RM

COMMONWEALTH OF MASSACHUSETTS

CONTRACT DOCUMENTS AND SPECIAL PROVISIONS

PROPOSAL NO.	609185-129075
P.V. =	$17,939,000.00
PLANS	YES

FOR

Federal Aid Project No. STP(BR-OFF)-003S(815)X
Bridge Reconstruction of W-44-083, Harrison Street over I-290 &
W-44-093, Laurel Street over I-290

in the City of

WORCESTER

In accordance with the STANDARD SPECIFICATIONS
for HIGHWAYS and BRIDGES dated 2024

This Proposal to be opened and read: **TUESDAY, FEBRUARY 25, 2025 at 2:00 P.M.**

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DOCUMENT 00010

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DOCUMENT 00104

NOTICE TO CONTRACTORS

Electronic proposals for the following project will be received through the internet using www.bidx.com until the date and time stated below and will be posted on www.bidx.com forthwith after the bid submission deadline. No paper copies of bids will be accepted. All Bidders must have a valid vendor code issued by MassDOT in order to bid on projects. Bidders need to apply for a Digital ID at least 14 days prior to a scheduled bid opening date with www.bidx.com.

TUESDAY, FEBRUARY 25, 2025 at 2:00 P.M. **
WORCESTER

Federal Aid Project No. STP(BR-OFF)-003S(815)X
Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290

****Date Subject to Change**

PROJECT VALUE = $17,939,000.00

Bidders must be pre-qualified by the Department in the BRIDGE - CONSTRUCTION category to bid on the above project. An award will not be made to a Contractor who is not pre-qualified by the Department prior to the opening of Proposals.

All prospective Bidders who intend to bid on this project must obtain "Request Proposal Form (R109)". The blank "Request Proposal Form (R109)" can be obtained at: https://www.mass.gov/prequalification-of-horizontal-construction-firms.

All prospective Bidders must complete and e-mail an electronic copy of "Request Proposal Form (R109)" to the MassDOT Director of Prequalification for approval: prequal.r109@dot.state.ma.us.

Proposal documents for official bidders are posted on www.bidx.com. Other interested parties may receive informational Contract Documents containing the Plans and Special Provisions, free of charge.

Bids will be considered, and the contract awarded in accordance with statutes governing such contracts in accordance with Massachusetts General Laws Chapter 30 § 39M.

The Project Bids File Attachments folder for proposals at www.bidx.com shall be used for submitting at the time of bid required information such as the Bid Bond required document, and other documents that may be requested in the proposal.

NOTICE TO CONTRACTORS (Continued)

All parties who wish to have access to information plans and specification must send a "Request for Informational Documents" to MassDOTBidDocuments@dot.state.ma.us.

A Proposal Guaranty in the amount of 5% of the value of the bid is required.

This project is subject to the schedule of prevailing wage rates as determined by the Commissioner of the Massachusetts Department of Labor and Workforce Development, and the Division of Occupational Safety, and the United States Department of Labor.

The Massachusetts Department of Transportation, in accordance with Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby affirmatively ensures that for any contract entered into pursuant to this advertisement, all bidders, including disadvantaged business enterprises, will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration for an Award.

This Proposal contains the "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)". The goals and timetables applicable to this proposal for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all work, are contained in Appendices A and B-80 of the above specifications.

The Contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this Contract as contained in Appendices C and D of the above specifications.

NOTICE TO CONTRACTORS (Continued)

PRICE ADJUSTMENTS

This Contract contains price adjustments for hot mix asphalt and Portland cement mixtures, diesel fuel, and gasoline. For reference the base prices are as follows: liquid asphalt $560.00 per ton, Portland cement $425.53 per ton, diesel fuel $2.694 per gallon, and gasoline $2.329 per gallon, and Steel Base Price Index 369.8. MassDOT posts the **Price Adjustments** on their Highway Division's website at
https://www.mass.gov/massdot-contract-price-adjustments

This Contract contains Price Adjustments for steel. See Document 00813 - PRICE ADJUSTMENT FOR STRUCTURAL STEEL AND REINFORCING STEEL for their application and base prices.

MassDOT projects are subject to the rules and regulations of the Architectural Access Board (521 CMR 1.00 et seq.)

Prospective bidders and interested parties can access this information and more via the internet at WWW.COMMBUYS.COM.

BY: Monica G. Tibbits-Nutt, Secretary and CEO, MassDOT
Jonathan L. Gulliver, Administrator, MassDOT Highway Division
SATURDAY, DECEMBER 28, 2024

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DOCUMENT 00210

REQUIREMENTS OF MASSACHUSETTS GENERAL LAWS
CHAPTER 30, SECTION 39R;
CHAPTER 30, SECTION 39O

July 1, 1981, updated October 2016

M.G.L. c. 30, § 39R. Award of Contracts; Accounting Statements; Annual Financial Statements; Definitions.

(a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) “Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

(3) “Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

(4) “Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

(5) “Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

(7) “Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

(b) Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

(1) The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

(2) Until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

(3) If the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and

(4) If the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) If the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and

ii. to maintain accountability for assets;

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he has examined the statement of management on internal accounting controls, and expressing an opinion as to:

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the awarding authority upon request.

(e) The office of inspector general, the commissioner of capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

(f) Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b).

M.G.L. c. 30, § 39O: Suspension, Delay, or Interruption or Failure to Act by Awarding Authority; Adjustment in Contract Price; Submission of Claims.

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

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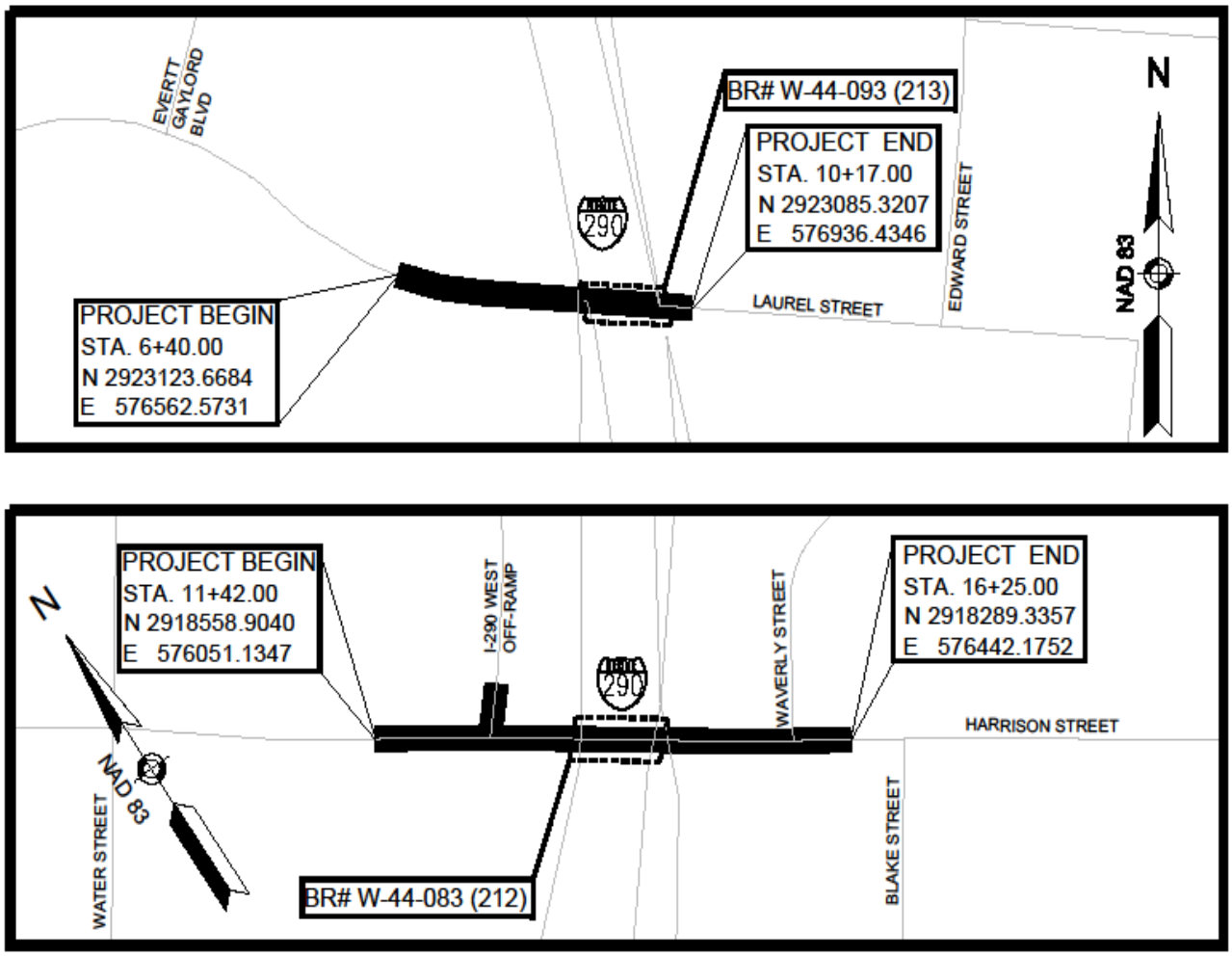
DOCUMENT 00331

LOCUS MAP

WORCESTER

Federal Aid Project No. STP(BR-OFF)-003S(815)X
Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290



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DOCUMENT 00439

Final Report ☐

Interim Report ☐

CONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Contractor: _____

Project: _____ Address: _____

F.A. No. _____ Contract Number: _____

Bid Price: _____ Notice to Proceed: _____

Funds: State: _____ Fed Aid: _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Contractor's Superintendent: _____

Division: (indicates class of work) Highway: _____ Bridge: _____ Maintenance: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1=
5. Subcontractors Performance								x 1=
6. Field Supervision/ Superintendent								x 1=
7. Contract Compliance								x 0.5=
8. Equipment								x 0.5=
9. Payment of Accounts								x 0.5=
(use back for additional comments)						**Overall Rating:**		

(Give explanation of items 1 through 9 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____

Contractor's Signature Acknowledging Report/Date

Contractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held: _____

Contractor's Comments/Meeting Notes (extra sheets may be added to this form and noted here if needed): _____

_____

_____

CONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number: _____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late: _____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 9: _____

WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

Revised: 04/28/17

*** END OF DOCUMENT ***

DOCUMENT 00440

Final Report ☐

Interim Report ☐

SUBCONTRACTOR PROJECT EVALUATION FORM

For instructions on using this form, see Engineering Directive E-10-002, Dated 4/20/2010

Date: _____

City/Town: _____ Subcontractor: _____

Project: _____ Address: _____

F.A. No.: _____ Contract Number: _____

Prime Contractor _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Subcontractor's Superintendent: _____

Type of Work Performed by Subcontractor: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1.5=
5. Field Supervision/ Superintendent								x 1=
6. Contract Compliance								x 1=
7. Equipment								x 0.5=
8. Payment of Accounts								x 0.5=
(use back for additional comments)							**Overall Rating:**	

(Give explanation of items 1 through 8 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

_____ _____

District Construction Engineer's Signature/Date Resident Engineer's Signature/Date

_____ _____

Contractor Signature Acknowledging Report/Date Subcontractor Signature Acknowledging Report/Date

Subcontractor Requests Meeting with the District: No ☐ Yes ☐ Date Meeting Held: _____

Subcontractor's Comments / Meeting Notes (extra sheets may be added to this form and noted here if needed):

_____

_____

Contractor's Comments: _____

_____

SUBCONTRACTOR PROJECT EVALUATION FORM (Continued)

Date: _____ Contract Number:_____

INFORMATION FOR DISTRICT HIGHWAY DIRECTORS RELATING TO PREQUALIFICATION

A deduction shall be recommended for unsatisfactory performance if computed overall rating is under 80%.
A deduction may be recommended for this project being completed late due to the Contractor's fault.

RECOMMENDATIONS FOR DEDUCTIONS FROM CONTRACTORS' ASSIGNED FACTOR
(*Write Yes or No in space provided*)

I recommend a deduction for Contractor's unsatisfactory performance: _____

I recommend a deduction for project completed late:_____

Signed: _____
District Highway Director

EXPLANATION OF RATINGS 1 – 8: _____

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WORK NOT COMPLETED WITHIN SPECIFIED TIME: _____

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Revised: 04/28/17

*** END OF DOCUMENT ***

DOCUMENT 00710
GENERAL CONTRACT PROVISIONS
Revised: 05/06/24

NOTICE OF AVAILABILITY

The STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES dated 2024, the SUPPLEMENTAL SPECIFICATIONS, the 1996 METRIC CONSTRUCTION AND TRAFFIC STANDARD DETAILS, the 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS; the 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING and the 2017 CONSTRUCTION STANDARD DETAILS are available online at https://www.mass.gov/massdot-highway-division-manuals-and-publications

SPECIAL PROVISIONS FOR RIGHT-TO-KNOW ACT REQUIREMENTS

The Contractor's attention is directed to Massachusetts General Laws, Chapter 111F, commonly known as the Right-To-Know Act, and to the regulations promulgated pursuant thereto. Among the provisions of the Right-To-Know Act is a requirement that employers make available to employees Materials Safety Data Sheets (MSDS) for any substance on the Massachusetts Substance List (MSL) to which employees are, have been, or may be exposed.

To ensure prompt compliance with these regulations and legislation, the Contractor shall:

1. Deliver to the Department, prior to the start of any work under this contract, copies of MSDS for all MSL substances to be used, stored, processed or manufactured at the worksite by the Contractor.

2. Train employees of the Department, who may be exposed to MSL substances as a result of the Contractor's work under this contract, with regard to those specific substances in accordance with requirements of the Right-To-Know Act.

3. Observe all safety precautions recommended on the MSDS for any MSL substance to be used, stored, processed, or manufactured at the worksite by the Contractor.

4. Inform the Department in writing regarding specific protective equipment recommended in the MSDS for MSL substances to which employees of the Department may be exposed as a result of the Contractor's work under this contract.

The Department shall not be liable for any delay or suspension of work caused by the refusal of its employees to perform any work due to the Contractor's failure to comply with the Right-To-Know Act. The Contractor agrees to hold the Department or the Commissioner of the Department harmless and fully indemnified for any and all claims, demands, fines, actions, complaints, and causes of action resulting from or arising out of the Contractor's failure to comply with the requirements of the Right-To-Know Act.

ALTERNATIVE DISPUTE RESOLUTION
Forum, Choice of Law and Mediations:

Any actions arising out of a contract shall be governed by the laws of Massachusetts and shall be brought and maintained in a State or federal court in Massachusetts which shall have exclusive jurisdiction thereof. MassDOT and the Contractor may both agree to mediation of any claim and will share the costs of such mediation pro rata based on the number of parties involved.

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DOCUMENT 00713

Subsection 701

Cement Concrete Sidewalks, Pedestrian Curb Ramps, and Driveways
and
Guide to the Interim Subsection 701
Cement Concrete Sidewalk Specification

(March 31, 2022)

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SUBSECTION 701: CEMENT CONCRETE SIDEWALKS, PEDESTRIAN CURB RAMPS, AND DRIVEWAYS
Replace this Subsection with the following:

INTERIM SUBSECTION 701: CEMENT CONCRETE SIDEWALKS, PEDESTRIAN CURB RAMPS, AND DRIVEWAYS

DESCRIPTION

701.20: General

This work shall consist of the construction of cement concrete sidewalks, pedestrian curb ramps, and driveways in accordance with the specifications and within the tolerances established on the plans.

MATERIALS

701.30: General

Materials shall meet the requirements specified in the following Subsections of Division III, Materials except as noted herein:

Gravel Borrow, Type b.....M1.03.0
Cement Concrete (≥ 4,000 psi).....M4.02.00
Preformed Expansion Joint Filler.....M9.14.0[1]

[1] Preformed expansion joint filler shall conform to Subsection M9.14.0 or ASTM D8139.

The following best practices may be incorporated into the cement concrete mix design at no additional cost to the Department as identified herein.

A. Combined Aggregate System.

The combined aggregate system for the mix design may be analyzed using the Tarantula Curve, Shilstone Chart, fineness modulus, and coarse aggregate content to enhance the properties of the concrete.

1. Tarantula Curve.

The combined aggregate system for the mix design may be analyzed using the Tarantula Curve to evaluate potential properties of the concrete, including workability, segregation, edge slumping, surface finishing, and cohesion.

Table 701.30-1: Tarantula Curve Particle Size Distribution

Sieve Opening	Percent by Mass Targets (%)		Percent by Mass Retained (%)		
	Passing	Retained			
1-1/2 in.	100	–	–	–	–
1 in.	92	8	0 – 16	–	–
3/4 in.	82	10	0 – 20	–	–
1/2 in.	69	13	4 – 20	–	–
3/8 in.	56	13	4 – 20	–	–
No. 4	43	13	4 – 20	–	–
No. 8	37	6	0 – 12	Coarse Sand 20 – 40	–
No. 16	31	6	0 – 12		–
No. 30	18	13	4 – 20		Fine Sand 24 – 34
No. 50	5	13	4 – 20	–	
No. 100	0	5	0 – 10	–	
No. 200	0	0	0 – 2	–	

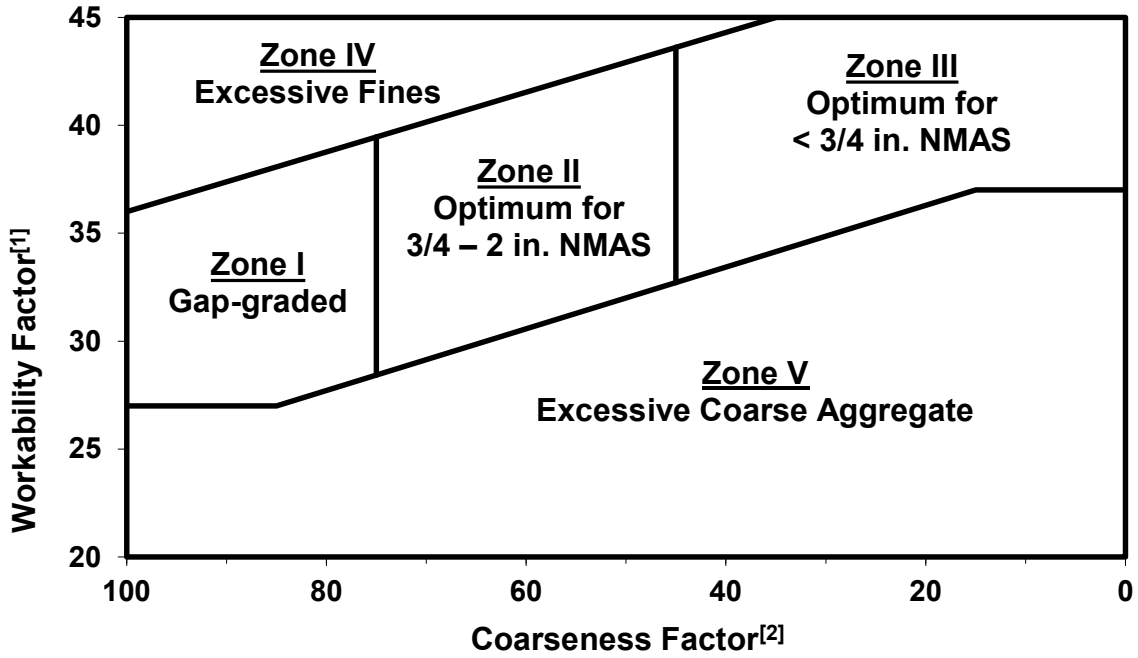
2. Shilstone Workability-Coarseness Chart.

The combined aggregate system for the mix design may be analyzed using the Shilstone Workability-Coarseness Chart, to evaluate potential properties of the concrete, including workability.

Table 701.30-2: Shilstone Workability-Coarseness

Zone	Property	Cause
Zone I	Gap-graded; High potential for segregation during placement and consolidation; Cracking, blistering, spalling, and scaling	Deficiency in intermediate particles; Non-cohesive
Zone II	Optimum mixture for nominal maximum aggregate size from 2 in. – ¾ in.	Optimized workability factor and coarseness factor
Zone III	Optimum mixture for nominal maximum aggregate size < ¾ in.	Optimized workability factor and coarseness factor
Zone IV	Sticky; High potential for segregation during consolidation and finishing; Variable strength, high shrinkage, cracking, curling, spalling, and scaling	Excessive fines
Zone V	Rocky; Lacking plasticity	Excessive amount of coarse and intermediate aggregate

Figure 701.30-1: Shilstone Workability-Coarseness Chart



[1] The workability factor is determined by the equation WF = W + (C - 564) / 38, where WF = workability factor, W = percent passing No. 8 sieve and C = total cementitious materials content.

[2] The coarseness factor is determined by the equation CF = (Q/R) / 100, where CF = coarseness factor, Q = cumulative percent retained on 3/8 in. sieve and R = cumulative percent retained on No. 8 sieve.

3. Fineness Modulus.

The combined aggregate system for the mix design may be analyzed using the fineness modulus, to evaluate potential properties of the concrete, including the fineness or coarseness of the mix design and estimating the design proportions of fine and coarse aggregates. The coarseness of the mix design increases as the fineness modulus increasers. The fineness modulus is determined by calculating the total cumulative percentages by mass retained on each designated sieve and dividing by 100.

4. Coarse Aggregate Content.

The combined aggregate system for the mix design may be analyzed using the coarse aggregate content. The coarse aggregate content is determined by calculating the total cumulative percentages by mass retained on the No. 4 sieve.

B. Paste System.

The quality of the paste system is determined by the water-cementitious ratio, air content, cementitious materials, and chemical admixtures incorporated into the mix design.

1. Water-Cementitious Ratio.

The water-cementitious ratio for the mix design may be analyzed to evaluate potential properties of the concrete, including strength, concrete and reinforcement bonding, and resistance to freezing, thawing, de-icing, sulfate reaction, corrosion of steel reinforcement, drying shrinkage, cracking, and

volume change from wetting and drying. The water-cementitious ratio is determined by calculating the total water content by mass and dividing by the total cement and supplementary cementitious material (SCM) content by mass. The recommended water-cementitious ratio design target is identified in Table 701.30-3. The water-cementitious ratio shall be less than or equal to 0.45.

Table 701.30-3: Freezing, Thawing, and De-icing Resistance

Exposure Class	Severity	Condition	Water-Cementitious Ratio Requirement
F3	Very Severe	Exposed to freezing and thawing cycles and accumulation of snow, ice, and de-icing chemicals; Frequent exposure to water	≤ 0.45

2. Air Content.

The air content for the mix design may be analyzed to evaluate potential properties of the concrete, including strength and resistance to freezing, thawing, de-icing, and sulfate reaction. The recommended air content design targets are identified in Table 701.30-4.

Table 701.30-4: Freezing, Thawing, and De-icing Resistance

Exposure Class	Severity	Condition	Nominal Maximum Aggregate Size (in.)	Air Content Target Recommendation (%)
F3	Very Severe	Exposed to freezing and thawing cycles and accumulation of snow, ice, and de-icing chemicals; Frequent exposure to water	3/8	7.5
			1/2	7.0
			3/4	7.0
			1	6.5
			1 1/2	6.5

3. Cement and Supplementary Cementitious Materials Content.

The cement and supplementary cementitious materials content incorporated into the mix design shall promote quality properties of the cement concrete, including resistance to alkali silica reaction, freezing, thawing, de-icing, and sulfate reaction. Incorporation of supplementary cementitious materials (SCM) in cement concrete may affect workmanship properties, including workability, bleed rate, setting time, and other properties. Adequate adjustments in Contractor workmanship practices, including placement, finishing, curing, and other construction practices shall be required to account for these changes in properties and to prevent scaling due to freezing, thawing, and de-icing cycles. The cement and supplementary cementitious materials content shall meet the design criteria identified in Table 701.30-5.

Table 701.30-5: Alkali Silica Reaction and Freezing, Thawing, and De-icing Resistance[1][2]

Exposure Class	Severity	Condition	Material	Replacement by Weight of Cement (%)
F3	Very Severe	Exposed to freezing and thawing cycles and accumulation of snow, ice, and de-icing chemicals; Frequent exposure to water	Low Alkali Cement (≤ 0.60% Alkalinity)	–
			Blended Hydraulic Cement[3]	–
			Fly Ash (Class F)	15 – 30
			Slag (Grade 100 or 120)	25 – 50
			Silica Fume	5 – 10
			Total SCM	≤ 50
			Total Fly Ash and Silica Fume	≤ 35

[1] Acceptable replacement by weight of cement for alkali silica reaction resistance shall be determined by the alkali silica reaction resistance performance test results and the criteria identified in Table 701.73-1: Minimum Acceptance Sampling and Testing Requirements.

[2] Test results meeting the alkali silica reaction resistance performance criteria of Table 701.30-6: Alternative Performance Evaluation to Alkali Silica Reaction Resistance Design Criteria may supersede the replacement by weight of cement design criteria.

[3] SCMs in blended hydraulic cement shall meet the criteria identified for fly ash, slag, and silica fume.

Table 701.30-6: Alternative Performance Evaluation to Alkali Silica Reaction Resistance Design Criteria

Method	Quality Characteristic	Criteria
C295	Petrographic Examination for Potential Alkali Aggregate Reactive Constituents and Deleterious Materials in Aggregate[1]	–
	Optically Strained, Microfractured or Microcrystalline Quartz (%)	≤ 5.0
	Chert or Chalcedony (%)	≤ 3.0
	Trydimite or Cristobalite (%)	≤ 1.0
	Opal (%)	≤ 0.5
	Natural Volcanic Glass (%)	≤ 3.0
T 380	Alkali Silica Reaction Resistance: Expansion of Miniature Concrete Prisms at 56 days (%)	≤ 0.03[2]

[1] Examination of aggregate shall be performed and reported to identify and quantify potential alkali-aggregate reactive constituents and deleterious materials in aggregate, as defined in ASTM C294 Standard Descriptive Nomenclature for Constituents of Concrete Aggregates and ASTM C295 Standard Guide for Petrographic Examination of Aggregates for Concrete.

[2] 56-day expansion results greater than 0.03 but less than or equal to 0.04 shall be considered non-reactive if the average two-week rate of expansion from day 56 to day 84 is less than or equal to 0.01%, otherwise, expansion results shall be considered reactive.

4. Chemical Admixtures.

Chemical admixtures may be incorporated into the mix design to enhance the properties of the concrete.

Table 701.30-7: Chemical Admixtures

Spec.	Type	Chemical Admixture	Properties
M 194	A	Water-Reducing	Increases Workability and Air Content; Decreases Water Demand (5 – 10%, 3 – 6 in. Slump)
	B	Retarding	Increases Initial and Final Setting Time, Air Content, Long-Term Strength; Offsetting of Accelerating Effect of Hot Weather; Decreases Early-Age Strength
	C	Accelerating	Increases Early-Age Strength; Decreases Initial and Final Setting Time
	D	Water-Reducing and Retarding	Type A and Type B Admixture Properties
	E	Water-Reducing and Accelerating	Type A and Type C Admixture Properties
	F	High Range Water-Reducing	Increases Workability (More Effective than Type A), Air Content, Early-Age Strength, and Ultimate Strength; Decreases Water Demand (12 – 40%, > 6 in. Slump) and Permeability
	G	High Range Water-Reducing and Retarding	Type F and Type B Admixture Properties
	S-SRA	Shrinkage Reducing	Increases Setting Time; Decreases Drying Shrinkage Cracking and Bleed Rate
	S-CRA	Crack Reducing	Decreases Cracking (More Effective than SRAs) and Crack Width
M 154	AEA	Air-Entraining	Increases Cohesion, Workability, Stabilization of Air Bubbles, Resistance to Freezing, Thawing, and De-icing, Resistance to Alkali-Reactive Environment, and Resistance to Sulfate Reaction
M 194[1]	MRWRA	Mid Range Water-Reducing	Type A and Type F Admixture Properties; Increases Workability (Especially Concrete with SCMs); Decreases Water Demand (6 – 12 %, 5 – 8 in. Slump)
C1622	CWA	Cold Weather	Increases Hydration Rate; Decreases Freezing Point of Mixing Water

[1] Mid range water-reducing admixtures (MRWRA) may meet either water-reducing (A) or high range water-reducing (F) admixture criteria.

5. Paste Content.

The paste content for the mix design may be optimized to enhance potential properties of the concrete, including workability, strength, permeability, and resistance to drying shrinkage and cracking and volume change from wetting and drying. The volume of paste should adequately fill the voids and provide sufficient separation between the aggregate particles to promote workability and effective bonding of particles.

Table 701.30-8: Paste Content

Mix Design Characteristic	Recommendation
Volume of Cement Concrete (cf)[1]	27
Paste Content (%)[2]	≤ 28[3]
Paste Content to Aggregate Void Content Ratio[4]	1.25 – 1.75
Excess Volume of Paste for Workability (%)[5]	–

[1] The volume of cement concrete is determined by the following equation, where W = Weight (lbs.), SG = Specific Gravity, D = Density (pcf), and V = Volume (cf).

$V_{CEMENT} = W_{CEMENT} / SG_{CEMENT} * D_{WATER}$

$V_{SCM} = W_{SCM} / SG_{SCM} * D_{WATER}$

$V_{ADMIXTURE} = V_{ADMIXTURE}$ in oz. / 957.5 oz. per cf

$V_{WATER} = V_{WATER}$ in gal. / 7.48 gal. per cf

$V_{COARSE} = W_{COARSE} / SG_{COARSE} * D_{WATER}$

$V_{FINE} = W_{FINE} / SG_{FINE} * D_{WATER}$

$V_{CONCRETE} = V_{CEMENT} + V_{SCM} + V_{ADMIXTURE} + V_{WATER} + V_{COARSE} + V_{FINE} + V_{AIR}$

[2] The paste content by volume of cement concrete is determined by the following equation, where V = Volume (cf) and PC = Paste Content (%).

$V_{PASTE} = V_{CEMENT} + V_{SCM} + V_{ADMIXTURE} + V_{WATER}$

$PC_{CONCRETE} = V_{PASTE} / V_{CONCRETE}$

[3] The cracking tendency of structural concrete is significantly reduced when the paste content by volume is less than or equal to 28 percent.

[4] The paste content to aggregate void content ratio is determined by the following equation, where D = Density (pcf), SG = Specific Gravity, BD = Bulk Density (pcf), VC = Void Content (%), V = Volume (cf), AVC = Aggregate Void Content (%), PC = Paste Content (%), and R = Ratio. Workability increases as the paste content to aggregate void content ratio increases. Decreased paste content to aggregate void content ratios will result in decreased workability, where water-reducing admixtures provide no benefit.

$VC_{COARSE} = SG_{COARSE} * D_{WATER} - BD_{COARSE} / D_{COARSE}$

$VC_{FINE} = SG_{FINE} * D_{WATER} - BD_{FINE} / D_{FINE}$

$VC_{AGGREGATE} = [(V_{COARSE} / (V_{COARSE} + V_{FINE})) * VC_{COARSE} + (V_{FINE} / (V_{COARSE} + V_{FINE})) * VC_{FINE}]$

$AVC_{CONCRETE} = [VC_{AGGREGATE} * ((V_{COARSE} + V_{FINE}) / V_{CONCRETE})]$

$R_{PC\text{-}AVC} = PC_{CONCRETE} / AVC_{CONCRETE}$

[5] The excess paste content for workability is determined by the following equation, where PC = Paste Content (%), AC = Air Content (%), AVC = Aggregate Void Content (%), and EPC = Excess Paste Content for Workability (%).

$EPC_{CONCRETE} = PC_{CONCRETE} + AC_{CONCRETE} - AVC_{CONCRETE}$

C. Initial Curing Materials.

The materials and procedures used for initial curing methods of cement concrete shall meet the Manufacturer's instructions and recommendations and the requirements specified herein.

Cement concrete with a low to negligible bleeding rate, exposure to highly evaporative environments, high content of silica fume, fine cement, or other fine cementitious material, low water to cementitious ratio, high air content, or water-reducing admixtures have an increased susceptibility to surface drying and plastic shrinkage between placement and finishing operations. Initial curing materials and procedures shall be applied immediately after the bleed water sheen has disappeared from the surface of the concrete or the concrete surface exhibits loss of moisture and surface drying, between placement and finishing operations. Initial curing materials shall not be worked into the surface in subsequent finishing operations.

1. Liquid-Applied Evaporation Reducers.

Liquid-applied evaporation reducers used for initial curing methods shall produce an effective monomolecular film over the bleed water layer, to reduce the rate of evaporation of the bleed water from the surface and plastic shrinkage when the evaporation rate equals or exceeds the bleeding rate.

D. Intermediate Curing Materials.

The materials and procedures used for intermediate curing methods of cement concrete shall meet the Manufacturer's instructions and recommendations and the requirements specified herein.

In instances where finishing operations have been completed prior to the concrete achieving final set and the concrete surface exhibits loss of moisture and surface drying, the following curing materials and procedures shall be applied immediately to the concrete surface prior to the application of final curing materials, to prevent the loss of moisture without damaging the concrete surface, until final set of the concrete has been achieved and final curing materials have been applied to the concrete surface.

- 701.30.C.1: Liquid-Applied Evaporation Reducers
- 701.30.E.3.a: Liquid Membrane-Forming Compounds for Curing
- 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing

E. Final Curing Materials.

The materials and procedures used for final curing methods of cement concrete shall meet the Manufacturer's instructions and recommendations and the requirements specified herein.

Curing water shall be free of deleterious impurities, causing staining and deterioration. The potential staining ability of curing water shall be evaluated by means of CRD-C401 (US Army Corps

of Engineers 1975) for instances where curing water quality is questioned. Curing water shall not exceed a temperature differential of more than 20°F from the internal concrete temperature, to prevent cracking due to temperature gradients causing strain that exceeds the strain capacity of concrete. Curing water shall remain above freezing temperatures throughout the duration of the curing cycle.

Final curing materials and procedures shall be applied to the concrete surface immediately after application of initial and intermediate curing materials, finishing operations, and final set of cement concrete, to prevent the loss of moisture and surface drying.

Materials used for final curing methods of cement concrete shall accommodate all exposed cement concrete surfaces with a continuous application of moisture throughout the entire duration of the final curing method cycle and provide controlled and gradual termination of the final curing method cycle.

Final curing materials applied to the concrete shall allow the concrete to mature sufficiently to achieve its designed and desired properties, including strength, volume stability, permeability, durability, and resistance to freezing, thawing, and de-icing cycles. Insufficient application of final curing materials results in decreased strength and durability of the top surface of concrete.

Protection to the concrete surface and curing materials shall be required in instances where adverse weather conditions are present, until curing operations can be initiated without damaging the surface of the concrete.

Final curing materials and procedures shall be applied to the concrete surface throughout the entire duration of the curing cycle and meet minimum sustained temperature, duration, and strength requirements, as specified in applicable Division II: Construction Details and herein. Controlled and gradual termination of the final curing method cycle shall begin only after all specified conditions are met, until the concrete gradually cools to within 20°F of the ambient temperature.

1. Saturated Covers.

Saturated covers used for final curing methods shall meet AASHTO M 182, Class 3. Saturated covers shall be in good condition, free from holes, tears, or other defects that would render it unsuitable for curing cement concrete and cementitious materials. Saturated covers shall be dried to prevent mildew when storing. Prior to application, saturated covers shall be thoroughly rinsed in water and free of harmful substances that are deleterious or cause discoloration to cement concrete and cementitious materials. Saturated covers shall have sufficient thickness and proper positioning onto the surface to maximize moisture retention. Saturated covers shall contain a sufficient amount of moisture to prevent moisture loss from the surface of cement concrete and cementitious materials. Saturated covers shall have the ability to retain sufficient moisture from continuous watering so that a film of water remains on the surface of cement concrete and cementitious materials throughout the entire duration of the final curing method cycle. Saturated covers shall not absorb water from cement concrete and cementitious materials. Polyethylene film may be applied over the saturated cover to limit the amount of continuous watering required for sufficient moisture retainage. Saturated covers shall accommodate uniform and slow drying of cement concrete and cementitious materials surfaces immediately prior to removal.

2. Sheet Materials.

Sheet materials, including polyethylene film, white burlap-polyethylene sheeting, and reinforced paper, used for final curing methods shall meet ASTM C171 and the requirements specified herein. Sheet materials shall inhibit moisture loss and reduce temperature rise in concrete exposed to radiation from the sun during the final curing method cycle. Adjoining covers shall overlap not less than 12 inches. All edges of the sheet materials shall be secured to maintain a moist environment.

a. Polyethylene Film.

Polyethylene film shall be clear, white, or black in color and consist of a single sheet manufactured from polyethylene resins, be free of visible defects, including tears, wrinkles, and discontinuity. The film shall prohibit mottling and uneven spots from appearing on the surface of concrete, due to variations in temperature, moisture content, or both. Application of additional curing water under the film or application of a polyethylene film bonded to absorbent fabric to the concrete surface may be required to prevent mottling and to retain and evenly distribute the moisture. Polyethylene film shall accommodate concrete surfaces with constant contact without damage. The film shall be sufficient in length to extend beyond the edges of the concrete surface. Edges of adjacent polyethylene film shall overlap a minimum of 6 inches and be tightly sealed with the use of sand, wood planks, pressure-sensitive tape, mastic, or glue to maintain close contact with the concrete surface, retain moisture, and prevent the formation of air pockets throughout the entire duration of the final curing method cycle.

i. White Polyethylene Film.

White polyethylene film shall minimize heat gain caused by absorption of solar radiation and shall be exclusively used during warm weather applications.

ii. Clear and Black Polyethylene Films.

Clear and black polyethylene films shall inhibit absorption of solar radiation for cold weather applications.

b. White Burlap-Polyethylene Sheeting.

White burlap-polyethylene sheeting shall be securely bonded to the burlap so to avoid separation of the materials during handling and curing of the concrete.

c. Reinforced Impervious Paper.

Reinforced impervious paper shall be white in color, consist of two sheets of kraft paper cemented together with a bituminous adhesive, and reinforced with embedded cords or strands of fiber running in both directions. Reinforced impervious paper shall be free of holes, tears, and pin holes from deterioration of the paper through repeated use. Reinforced impervious paper shall be treated to prevent tearing when wetted and dried. Reuse of reinforced impervious paper shall be permitted so long as it is able to retain moisture on the surface of concrete. The paper shall be discarded and prohibited from use when moisture is no longer retained in the material.

3. Liquid Membrane-Forming Compounds.

Compounds shall form a continuous, non-yellowing, and durable film with quality moisture-retention properties. Compounds shall maintain the relative humidity of the concrete surface

above 80% for seven days to sustain cement hydration. Compounds shall not affect the original color of the concrete surface. Compounds shall not degrade due to exposure to ultraviolet light from direct sunlight. Compounds shall meet the local and federal allowable Volatile Organic Compound (VOC) content limits.

White-pigmented compounds shall be used in instances where solar-heat gain is concern to the concrete surface. White-pigmented compounds shall be agitated in the container prior to application to prevent pigment from settling out resulting in non-uniform overage and ineffective curing.

Careful considerations shall be made by the Contractor to determine if the evaporation rate is exceeding the rate of bleeding, thus causing the surface to appear dry even though bleeding is still occurring. To diagnose and prevent this condition, the Contractor may place a transparent plastic sheet over a test area of the uncured and unfinished concrete surface and shall determine if any bleed water accumulates under the plastic. Under such conditions, the application of liquid membrane-forming compounds to the concrete surface shall be delayed to prevent bleed water from being sealed below the concrete surface, map cracking of the membrane films, reduction in moisture-retention capability, and the need for reapplication of the compound.

Prior to use, compounds shall be thoroughly mixed, stirred, and agitated per the Manufacturer's instructions and recommendations.

Compounds shall be applied continuously and uniformly to the surface of the concrete per the Manufacturer's instructions and recommendations. Compounds shall be applied immediately after the disappearance of the surface water sheen following final finishing. Applicating of the compound immediately after final finishing and before all free water on the surface has evaporated will help prevent the formation of cracks. When using compounds to reduce moisture loss from formed surfaces, the exposed surface shall be wetted immediately after form removal and kept moist until the curing compound is applied. The concrete shall be allowed to reach a uniformly damp appearance with no free water on the surface, and then application of the compound shall begin at once. Delayed application will result in surface drying, absorption of the compound into the concrete, and no forming of a continuous membrane.

The concrete surface shall be damp when the compound is applied. Power-driven spray equipment shall be used for uniform application of compounds on large paving projects. Spray nozzles recommended by the compound Manufacturer and use of windshields shall be arranged by the Contractor to prevent wind-blown loss of compound and to ensure proper coverage application rates are achieved. The compound shall be applied by power sprayer, using appropriate wands and nozzles with pressures between 25 and 100 psi. The Contractor shall fill the power sprayer with curing compound from the Manufacturer's original container in the presence of the Engineer. Any dilution as recommended by the Manufacturer shall take place in the presence of the Engineer. For very small areas such as repairs, the compound shall be applied with a wide, soft-bristled brush or paint roller.

The Contractor shall verify the application rate and procedures are in accordance with the Manufacturer's instructions and recommendations. At least one uniform coat shall be applied at a rate of 150 to 200 ft2/gallon. On very deeply textured surfaces, the surface area to be treated shall be at least twice the surface area of the surface. In such cases, two separate applications may be needed, each at 200 ft2/gallon or greater if specified by the Manufacturer to achieve the desired

moisture retention rate, with the first being allowed to become tacky before the second is applied. If two coats are necessary to ensure complete coverage, for effective protection the second coat should be applied at right angles to the first. Complete coverage of the surface shall be attained due to the potential for formation of small pinholes in the membrane, which will result in loss of moisture from the concrete. Compounds shall not sag, run off peaks, or collect in grooves.

Compounds and procedures shall be compatible with concrete surfaces receiving subsequent applications or placements of concrete, overlays, coatings, paints, sealers, finishes or other toppings to ensure acceptable bonding to the concrete. Testing to establish compatibility among the curing compound, subsequent surface treatments, concrete moisture content and the actual finished surface texture of the concrete shall be conducted when compatibility is not known. The compound Manufacturer shall be consulted by the Contractor to determine the compatibility of the application. Compounds shall not be applied to concrete surfaces where bonding of subsequent applications or placements is incompatible or is of concern. The use of wax-based curing compounds shall be prohibited in instances where concrete surfaces are subject to additional toppings and vehicular, pedestrian, or other traffic. Deliberate removal of compounds in the presence of the Engineer and in accordance with Manufacturer's instructions and recommendations shall be conducted as an alternative to compatibility testing, incompatibility, or in instances where bonding is of concern. Bonding of subsequent materials may still be inhibited by the presence of the compound even after the moisture retention characteristics of the compound have diminished.

a. Liquid Membrane-Forming Compounds for Curing.

Liquid membrane-forming compounds for curing shall meet ASTM C309, the Manufacturer's instructions and recommendations, and the requirements specified herein.

Table 701.30-1: Types of Compounds for Curing

Type	Description
Type 1	Clear or translucent without dye
Type 1-D	Clear or translucent with fugitive dye
Type 2	White pigmented

Table 701.30-2: Composition Class of Compounds for Curing

Type	Description
Class A	Unrestricted composition, generally wax-based products
Class B	ASTM D883 resin-based products

b. Liquid Membrane-Forming Compounds for Curing and Sealing.

Liquid membrane-forming compounds for curing and sealing shall meet ASTM C 1315, the Manufacturer's instructions and recommendations, and the requirements specified herein.

In addition to moisture-retention capabilities compounds shall exhibit specific properties, including alkali resistance, acid resistance, adhesion-promoting quality, and resistance to degradation by ultraviolet light.

Table 701.30-3: Types of Compounds for Curing and Sealing

Type	Description
Type I	Clear or translucent
Type II	White pigmented

Table 701.30-4: Class of Compounds for Curing and Sealing

Type	Description
Class A	Non-yellowing

F. Protective Sealing Compounds.

Protective sealing compounds shall maintain valid listing on the Department Qualified Construction Materials List (QCML) and meet AASHTO M 224, NCHRP Report 244 and the requirements specified herein.

Protective sealing compounds shall sufficiently penetrate the concrete to seal the surface pores and fill the capillaries of the concrete by chemically reacting with the concrete and forming a hydrophobic layer. Protective sealing compounds shall limit the penetration of liquids, gases, and harmful substances into hardened concrete, including water, de-icing agents, and carbon dioxide to protect concrete from freezing, thawing, and de-icing cycles, corrosion of reinforcing steel, and acid attack. Protective sealing compounds shall limit the buildup of vapor pressure between the concrete and the applied sealer. Protective sealing compounds shall retard the penetration of harmful substances into hardened concrete. Protective sealing compounds shall maintain their protective properties during environmental exposure to freezing, thawing, and de-icing cycles. Protective sealing compounds shall not reduce the frictional properties of the concrete. Protective sealing compounds shall not affect the original color of the concrete surface if maintaining the original color is desired by the Department. Protective sealers shall meet the local and federal allowable Volatile Organic Compound (VOC) content limits.

Curing methods conforming to Department specifications shall be applied to the concrete prior to the application of protective sealers. Protective sealers shall not be applied to the concrete for a minimum of 28 days after placement and the surface shall be sufficiently prepared, clean, and dry for at least 24 hours with ambient temperatures exceeding 60°F. Protective sealers shall not be applied to concrete placed where freezing, thawing, and de-icing cycles are expected immediately after, due to the retainage of water in the concrete. Periodic re-application shall be required for protective penetrants requiring multiple applications and for concrete surfaces exhibiting wear to ensure long-term protection of the concrete surface.

G. Cold Weather Concreting Materials.

Cold weather concreting shall be defined as the procedures, operations, materials, and equipment required for the mixing, delivery, placement, finishing, curing, and protection of concrete during cold weather conditions, while exposed to air temperatures falling below, or expected to fall below 40°F.

The protection period shall be defined as the minimum duration required to prevent concrete from the negative effects of cold weather exposure. The protection period shall remain in place while

cold weather conditions exist. Controlled and gradual termination of the protection period shall be conducted only after 100% f'c is attained and all specified conditions are met.

The procedures, operations, materials, and equipment selected for cold weather concreting shall adequately maintain specified temperature ranges by addressing all variables, including ambient weather conditions, geometry of the structure, and mix design proportions. Concrete temperatures for cold weather concreting shall meet Table 701.30-5.

Table 701.30-5: Concrete Temperature Requirements for Cold Weather Concreting

Phase	Cold Weather Temperature (°F)	Concrete Temperature (°F)
Mixing	30-39	60-75
	0-30	65-80
	< 0	70-85
Placement	< 40	55-75
Protection Period	< 40	55-75
Termination of Protection Period – Allowable Rate of Decrease in 24 Hours	< 40	≤ 50

Cold weather concreting procedures, operations, materials, and equipment shall be developed and performed to prevent damage to concrete due to freezing at early ages, to ensure that the concrete develops the recommended strength for safe removal of forms, to maintain curing conditions that promote quality strength and durability development, to limit rapid temperature fluctuation, and to provide protection consistent with intended serviceability of the structure. The Contractor shall develop and submit to the Department for review and approval, cold weather concreting procedures for the mixing, delivery, placement, finishing, curing, and protection of concrete during cold weather, including:

- Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement or forms prior to placement
- Methods and requirements for cold weather protection and temperature control of constituent materials incorporated into the mix design
- Chemical admixtures incorporated into the mix design for cold weather protection and temperature control
- Methods and requirements for cold weather protection and temperature control during mixing, delivery, placement, finishing, curing, and protection period
- Curing methods to be used during and following the protection period
- Types of covering, insulation, heating, or enclosures to be provided
- Methods for verification of in-place strength
- Procedures for measuring and recording concrete temperatures
- Procedures for preventing drying during dry, windy conditions

All procedures, operations, materials, and equipment required for adequate protection and curing shall be present and ready for use prior to concrete production.

1. Insulating Materials.

Insulating materials used for cold weather concreting shall meet the requirements specified herein. The thermal resistance of the proposed insulation system shall be determined to meet the concrete temperature range requirements specified herein. Supplemental heat, including hydronic heating systems, shall be applied in instances where insulating materials cannot achieve the concrete temperature requirements.

2. Heaters.

Heaters used for cold weather concreting including direct fired, indirect fired, and hydronic heaters shall meet ANSI A10.10 carbon monoxide limits, safety regulations for ventilation, and the stability, operation, fueling, and maintenance of heaters and the requirements specified herein.

a. Direct Fired Heaters.

Direct fired heaters generate heat to an enclosed space through the combustion of fossil fuels, including oil, kerosene, propane, gasoline, and natural gas. Hot air comprised of carbon dioxide and carbon monoxide combustion products, is discharged into the enclosed space. Direct fired heaters shall be prohibited from heating the air directly surrounding the concrete surface due to calcium carbonate formation interfering with the hydration reaction, from the reaction between the carbon dioxide generated from the combustion of fossil fuels and the calcium hydroxide on the surface of freshly placed concrete, resulting in a soft, chalky, and nondurable concrete surface. Direct fired heaters shall only be used on concrete surfaces protected from fossil fuel combustion products.

b. Indirect Fired Heaters.

Indirect fired heaters generate heat to an enclosed space through the combustion of fossil fuels, including oil, kerosene, propane, gasoline, and natural gas. The carbon dioxide and carbon monoxide combustion products are expelled through venting, resulting in clean heated air discharged into the enclosed space. Indirect fired heaters are suitable for heating the air directly surrounding the concrete surface.

c. Hydronic Heaters.

Hydronic heaters generate heat to an enclosed space through the circulation of the heat-transfer fluid in a closed system of pipes or hoses. The heat-transfer fluid is comprised of a propylene glycol water solution and is heated through the combustion of fossil fuels, including diesel fuel and kerosene. The combustion of fossil fuel occurs outside of the enclosed space and does not expose the concrete surface to the deleterious effects of carbon dioxide.

After the concrete placement achieves final set, polyethylene film or other suitable material shall sufficiently serve as a vapor barrier. The heat-transfer hoses shall be placed on top of the vapor barrier and covered with insulating materials meeting 701.30.G.1. Hydronic heaters shall be used to thaw or preheat subgrades prior to concrete placement and provide supplementary heat to insulating materials. Hydronic heaters shall provide an even distribution of heat to prevent curling and cracking induced by temperature gradients within concrete.

3. Enclosures.

Enclosures shall be made of wood, canvas tarpaulins, polyethylene film, or prefabricated rigid plastic. Enclosures shall be airtight, block wind, prevent admittance of cold air, conserve heat, and withstand wind and snow loads. Enclosures shall provide adequate headroom for craftsmen and sufficient space between the concrete and the enclosure to permit free circulation of warm air. Supplementary heat shall be supplied to enclosures by hydronic heaters, live steam, hot forced air, or indirect fired combustion heaters. Icing along the perimeter of the enclosure shall be prevented when live steam is utilized. Heaters and ducts shall be positioned to prevent the hot, dry air from overheating or drying the concrete surface. Insulating materials meeting 701.30.G.1 shall be applied as a vapor barrier to the concrete surface immediate after final set is attained.

H. Hot Weather Concreting Materials.

Hot weather concreting shall be defined as the procedures, operations, materials, and equipment required for the mixing, delivery, placement, finishing, bleed water evaporation, curing, and protection of concrete during hot weather conditions, while exposed to air temperatures exceeding, or expected to exceed 80°F; concrete temperatures approaching, or expected to approach 90°F; evaporation rates of surface water approaching, or expected to approach the bleeding rate of the concrete; high solar radiation; low relative humidity; and high wind speed.

The protection period shall be defined as the minimum duration required to prevent concrete from the negative effects of hot weather exposure, including the acceleration of rate of moisture loss and rate of cement hydration, difficulties in curing, increased concrete temperature, increased water demand, accelerated slump loss, increased rate of setting, increased tendency for plastic shrinkage and thermal cracking, increased potential for cold joints, and difficulties in controlling entrained air content. The protection period shall remain in place while hot weather conditions exist. Controlled and gradual termination of the protection period shall be conducted when conditions permit. The allowable rate of temperature decrease shall not exceed 5°F per hour and meet the allowable rate of temperature decrease specified in 701.30.G: Cold Weather Concreting Materials.

The procedures, operations, materials, and equipment selected for hot weather concreting shall adequately maintain specified temperature ranges and evaporation rates by addressing all variables, including ambient weather conditions, geometry of the structure, and mix design proportions. Initial materials meeting 701.30.C: Initial Curing Materials shall be applied to the concrete surface while the concrete and air temperatures, relative humidity of the air, and the wind speed have the capacity to evaporate free water from the fresh concrete surface at a rate that is equal to or greater than bleeding rate of the concrete. The evaporation rate of surface water shall be determined by the following equation:

$$E = (T_c^{2.5} - r * T_a^{2.5})(1 + 0.4V) \times 10^{-6}$$

where E = evaporation rate of water-covered surface ($lb/ft^2/hr$), T_c = concrete temperature of the evaporating surface (°F), r = relative humidity of air surrounding the evaporating surface (%), T_a = temperature of the air surrounding the evaporative surface (°F), and V = average wind speed 20 inches above the evaporating surface. The air surrounding the evaporating surface shall be defined as the air approximately 4 to 6 feet above the evaporating surface on the windward side and shielded from the sun's rays.

Hot weather concreting procedures, operations, materials, and equipment shall be developed and performed to prevent damage to concrete and promote long-term durability. The Contractor shall develop and submit to the Department for review and approval, hot weather concreting procedures for the mixing, delivery, placement, finishing, curing, and protection of concrete during hot weather, including:

- Procedures for preparing the subgrade prior to placement
- Methods and requirements for hot weather protection and temperature control of constituent materials incorporated into the mix design
- Chemical admixtures incorporated into the mix design for hot weather protection and temperature control
- Methods and requirements for hot weather protection and temperature control during mixing, delivery, placement, finishing, curing, and protection period
- Initial curing methods to be used to reduce surface evaporation
- Curing methods to be used during and following the protection period
- Types of covering, insulation, cooling, or enclosures to be provided
- Evaporation rate and bleeding rate of concrete calculations
- Procedures for measuring and recording concrete temperatures
- Procedures for preventing drying during dry, windy conditions

All procedures, operations, materials, and equipment required for adequate protection and curing shall be present and ready for use prior to concrete production.

CONSTRUCTION METHODS

701.40: Pre-Placement

A. Excavation.

Excavation of the area shall be in accordance with the applicable portions of Subsection 120: Excavation.

B. Subgrade and Subbase.

The subgrade for the sidewalks and driveways shall be shaped parallel to the proposed surface of the sidewalks and driveways and thoroughly compacted. All depressions in the subgrade shall be filled with suitable material and again compacted until the surface is smooth and hard. Prior to the placement of the subbase, the Contractor shall inspect the prepared subgrade to ensure that it is in conformance with the required grade and cross-section. Subgrade shall be fine graded to meet the applicable requirements of Subsection 170: Grading.

After the subgrade has been prepared, a gravel subbase shall be placed upon it. After being compacted thoroughly, the subbase shall be at least 8 inches thick and parallel to the proposed surface of the sidewalk. Prior to the placement of the cement concrete, the Contractor shall inspect the prepared subbase material to ensure that it is in conformance with the required grade and cross-section. Subbase material that is not in accordance with the plans or specifications shall be reworked or replaced to meet the applicable requirements of Subsection 170: Grading before the start of cement concrete placement. When placing cement concrete, the compacted subbase shall not be frozen or have standing water.

C. Forms.

Side forms and transverse forms shall be smooth, free from warp, of sufficient strength to resist springing out of shape, of a depth to conform to the thickness of the proposed sidewalk or pedestrian curb ramp and of a type satisfactory to the Engineer.

All mortar or dirt from previously used forms shall be completely removed prior to use. The forms shall be well staked and thoroughly graded and set to the established lines with their upper edge conforming to the grade of the finished sidewalk or pedestrian curb ramp which shall have sufficient pitch to the roadside edge to provide for surface drainage.

All pedestrian curb ramp joints and transition sections which define grade changes shall be formed staked and checked for dimension, grade and slope conformance prior to placing cement concrete.

All forms shall be oiled before placing concrete.

701.41: Placement

The concrete shall be placed in alternate slabs 30 ft long except as otherwise ordered. The slabs shall be separated by transverse preformed expansion joint filler ½ in. thick.

Preformed expansion joint filler shall be placed adjacent to or around existing structures as directed.

Detectable warning panels conforming to the plans shall be securely incorporated into the work by means acceptable to the Engineer.

On the foundation as specified above, the concrete shall be placed in such quantity that after being thoroughly consolidated in place it shall be 4 in. deep. At driveways, the sidewalks shall be 6 in. deep.

In conveying the concrete from the place of mixing to the place of deposit, the operation shall be conducted in such a manner that no mortar will be lost, and the concrete shall be so handled that the concrete will be of uniform composition throughout, showing neither excess nor lack of mortar in any one place.

The surface of all concrete sidewalks shall be uniformly scored into block units of areas not more than 36 ft². The depth of the scoring shall be at least ½ in. deep and no more than ½ in. wide.

701.42: Initial Curing

In instances where the bleed water sheen has disappeared from the surface of the concrete or the concrete surface exhibits loss of moisture and surface drying between placement and finishing operations, the Contractor shall apply one of the following initial curing materials and procedures meeting 701.30.C: Initial Curing Materials until finishing operations occur.

- 701.30.C.1: Liquid-Applied Evaporation Reducers

Initial curing materials shall not be worked into the surface in subsequent finishing operations.

701.43: Finishing

The finishing of concrete surface shall be done by experienced and competent cement finishers. No finishing operation shall be performed while free water is present. Finishing operations shall be delayed until all bleed water and water sheen has left the surface and the concrete has started to stiffen. After water sheen has disappeared, edging operations, where required, shall be completed. After edging and joining operations, the surface shall be floated. Magnesium floats shall be used for all finishing operations. If necessary tooled joints and edges shall be rerun before and after floating to maintain uniformity. After floating, the surface shall be brushed by drawing a soft-bristled push broom with a long handle over the surface of the concrete to produce a nonslip surface.

701.44: Intermediate Curing

In instances where finishing operations have been completed prior to the concrete achieving final set and the concrete surface exhibits loss of moisture and surface drying, the Contractor shall apply one of the following intermediate curing materials and procedures meeting 701.30.D: Intermediate Curing Materials immediately to the concrete surface prior to the application of final curing materials, to prevent the loss of moisture without damaging the concrete surface, until final set of the concrete has been achieved and final curing materials have been applied to the concrete surface.

- 701.30.C.1: Liquid-Applied Evaporation Reducers
- 701.30.E.3.a: Liquid Membrane-Forming Compounds for Curing
- 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing

701.45: Final Curing

The Contractor shall apply one of the following final curing materials and procedures meeting 701.30.E: Final Curing Materials to the concrete surface immediately after application of initial and intermediate curing materials, finishing operations, and final set of cement concrete, to prevent the loss of moisture and surface drying.

- 701.30.E.1: Saturated Covers
- 701.30.E.2: Sheet Materials
- 701.30.E.3.a: Liquid Membrane-Forming Compounds for Curing
- 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing

The Contractor shall apply final curing materials and procedures to the concrete surface throughout the entire duration of the curing cycle and meet minimum sustained temperature, duration, and strength requirements, as specified in in Table 701.45-1. Controlled and gradual termination of the curing cycle shall begin after all specified conditions are met.

Table 701.45-1: Termination of Curing Cycle

Sustained Concrete Temperature	Final Curing Cycle Duration	Compressive Strength[1]
50°F ≤ °F ≤ 90°F	≥ Seven (7) days	≥ 70% f'_c

[1] Compressive strength cylinders for termination of curing cycle shall be cast and field cured with the same environmental conditions that the sidewalk is subjected to throughout the entire duration of the final curing cycle, per 701.73: Acceptance Sampling and Testing.

701.46: Protective Sealing

The Contractor shall apply sealing materials and procedures meeting 701.30.F: Protective Sealing Compounds only if one or more of the following final curing materials and procedures were applied:

- 701.30.E.1: Saturated Covers
- 701.30.E.2: Sheet Materials
- 701.30.E.3.a: Liquid Membrane-Forming Compounds for Curing

Protective sealing compounds shall not be applied to concrete surfaces applied with a final curing material and procedure meeting 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing.

701.47: Cold Weather Concreting

The Contractor shall conduct cold weather concreting procedures, operations, materials, and equipment required for the mixing, delivery, placement, finishing, curing, and protection of concrete, while surfaces are exposed to air temperatures falling below, or expected to fall below 40°F in accordance with 701.30.G: Cold Weather Concreting Materials. All procedures, operations, materials, and equipment required for adequate protection and curing shall be present and ready for use prior to concrete production.

701.48: Hot Weather Concreting

The Contractor shall conduct hot weather concreting procedures, operations, materials, and equipment required for the mixing, delivery, placement, finishing, curing, and protection of concrete, while surfaces are exposed to air temperatures exceeding, or expected to exceed 80°F; concrete temperatures approaching, or expected to approach 90°F; evaporation rates of surface water approaching, or expected to approach the bleeding rate of the concrete; high solar radiation; low relative humidity; and high wind speed in accordance with 701.30.H: Hot Weather Concreting Materials. All procedures, operations, materials, and equipment required for adequate protection and curing shall be present and ready for use prior to concrete production

CONTRACTOR QUALITY CONTROL

701.60: General

The Contractor shall provide adequate Quality Control (QC) to ensure that all materials and workmanship conform with the specification requirements. The Contractor shall perform QC activities as outlined further below.

701.61: Contractor Quality Control Plan

The Contractor shall provide and maintain a Quality Control Plan (QC Plan). The QC Plan should sufficiently document the QC processes of all Contractor parties (i.e. Prime Contractor, Subcontractors, Producers) performing work required under this specification.

701.62: Production Personnel

A. Foreman.

A foreman shall be present throughout the entire duration of the construction operation with at least one of the following personnel certifications.

- NRMCA Concrete Exterior Finisher Certification
- ACI Concrete Flatwork Technician and Flatwork Finisher

The foreman is responsible for the oversight of the construction operation per the requirements specified in Table 701.62-1.

Table 701.62-1: Minimum Foreman Activities

Operation	Foreman	Activity
Oversight	One (1)	Review and compare batch ticket quantities and sources to approved mix design
		Monitors conformance to AASHTO M 157 Standard Specification for Ready-Mixed Concrete
		Monitors conformance to Department specifications
		Monitors Production Personnel activities
		Verifies proper equipment is on hand prior to start of construction
		Monitors equipment, environmental conditions, materials, and workmanship
		Prohibits the use of prohibited equipment and practices
		Acknowledges sampling, testing, and inspection results

B. Operators.

Concrete sidewalk shall be constructed by sufficiently staffed, trained, experienced, and qualified equipment operators and craftsmen, who are presently involved in sidewalk construction, throughout the entire duration of the construction operation, per the requirements specified in Table 701.62-2.

Table 701.62-2: Minimum Operator Activities

Operation	Operators[1]	Activity
701.40: Pre-Placement	Two (2)	Apply sufficient base compaction
		Moisten sub-base, free of standing water
		Secure forms, straight and level
		Mark expansion locations
		Prohibited Practices: Placement on frozen sub-grade
701.41: Placement (Concrete Discharging)	Two (2)	Direct concrete trucks
		Handle chute discharge and truck movement
		Assist in preparing concrete for testing
		Direct trucks to washout area
		Provide general help
		Prohibited Practices: Adding constituent materials not in conformance with AASHTO M 157 or without Department consent
701.41: Placement	Two (2)	Localize placement to minimize moving material
		Level concrete in front of the screed
		Operate come-alongs or flat headed shovel to move concrete in form
		Consolidate concrete along form edge to avoid honeycombing
		Operate screed over top of forms in sawing action for surface leveling
		Operate magnesium bull float to push coarse aggregate below the surface and fill in the low spots or depressions
		Prohibited Practices: Toothed raking, dragging of internal vibrator, and internal vibrator to move concrete; steel troweling or floating
701.42: Initial Curing	Apply an initial curing material and procedure per 701.42	
	One (1)	701.30.C.1: Liquid-Applied Evaporation Reducers
701.43: Finishing	Two (2)	Permit bleed water to dissipate and concrete to set
		Operate a hose drag or squeegee to remove water from the surface
		Check surface for flatness, fill/cut as necessary
		Finish surface with magnesium float
		Apply pulled broom finish at proper time to acceptable texture
		Clean broom when excessive mortar adheres
		Remove excess water from broom before use
		Finish edges and joints
		Finish well formed, properly spaced joints to sufficient depth
		Prohibited Practices: Steel troweling or floating; adding water to the surface; excessive working of surface; pushing broom across surface

[1] Recommended number of operators.

Table 701.62-2: Minimum Operator Activities (Continued)

Operation	Operators[1]	Activity
701.44: Intermediate Curing	If applicable, apply an intermediate curing material and procedure per 701.44	
	One (1)	701.30.C.1: Liquid-Applied Evaporation Reducers
	One (1)	701.30.E.3.a: Liquid Membrane-Forming Compounds
	One (1)	701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing
701.45: Final Curing	Apply a final curing material and procedure meeting 701.45	
	Four (4)	701.30.E.1: Saturated Covers
	Four (4)	701.30.E.2: Sheet Materials
	One (1)	701.30.E.3.a: Liquid Membrane-Forming Compounds
	One (1)	701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing
701.46: Protective Sealing	One (1)	If applicable, apply a protective sealing material and procedure per 701.46
701.47: Cold Weather Concreting	Four (4)	If applicable, apply cold weather concreting materials and procedures per 701.47 and the Department approved Contractor cold weather concreting plan
701.48: Hot Weather Concreting	Four (4)	If applicable, apply hot weather concreting materials and procedures per 701.48 and the Department approved Contractor hot weather concreting plan

[1] Recommended number of operators.

701.63: Quality Control Inspection

Quality Control inspection shall be performed and reported on inspection report forms by qualified Quality Control Technicians, to confirm conformance to specifications and to visually inspect equipment, environmental conditions, materials, and workmanship. Quality Control Technicians shall obtain at least one of the following personnel certifications.

- NRMCA Concrete Exterior Finisher Certification
- ACI Concrete Flatwork Technician and Flatwork Finisher

Quality Control inspection report forms shall be completed by the Contractor and submitted to the Department for review.

DEPARTMENT ACCEPTANCE

701.70: General

Acceptance shall be performed by the Department, including consultants under direct contract with the Department independent of the Contractor, to evaluate the degree of compliance with contract requirements, to monitor each Contractor entity's Quality Control activities, to determine the

corresponding value for a given product, and to determine the acceptability of all material produced and placed.

701.71: Acceptance of Contractor Quality Control Plan

The Department will review the Contractor Quality Control Plan. Department approval shall be subject to conformance with the requirements specified herein.

701.72: Acceptance Inspection

Acceptance inspection will be performed and reported by qualified Department (or designee) Acceptance Technicians, to confirm conformance to specifications and to visually inspect equipment, environmental conditions, materials, and workmanship.

701.73: Acceptance Sampling and Testing

Acceptance sampling and testing will be performed and reported by qualified Department (or designee) Acceptance Technicians, to provide quality characteristic data used for Department Acceptance determination, per the requirements specified herein.

Table 701.73-1: Minimum Acceptance Sampling and Testing Requirements

Property	Method	Quality Characteristic	Sublot Size	Minimum Test Frequency	Point of Sampling	Criteria
Uniformity	T 119	Slump Allowable Tolerance (in.)[1]	100 cy	1 per Sublot	Point of Discharge	Target ± 1.5
Workability	T 119	Segregation Resistance[2]	100 cy	1 per Sublot	Point of Discharge	Pass
Thermal	T 309	Concrete Temperature (°F)	100 cy	1 per Sublot	Point of Discharge	50 – 90
Strength	T 22	Compressive Strength at 7 Days for Curing Termination (psi)[3]	100 cy	1 per Sublot	Point of Discharge	≥ 70% f'_c
		Compressive Strength at 28 Days (psi)[3]	100 cy	1 per Sublot	Point of Discharge	≥ 100% f'_c
		Compressive Strength at 56 Days (psi)[3][4]	100 cy	1 per Sublot	Point of Discharge	≥ 100% f'_c
Durability	T 121 T 152 T 196	Freezing and Thawing Resistance: Air Content (%)	100 cy	1 per Sublot	Point of Discharge	5.5 – 8.5
	T 303 or C1567	Alkali Silica Reaction Resistance: Expansion at 14 Days (%)	–	1 per Annual Mix Design Submission Cycle	–	≤ 0.08

[1] Test result and the Producer's mix design target shall be within the specified allowable tolerances. Slump shall be reported on the Producer's mix design batch ticket for each delivery.

[2] Testing for segregation resistance shall be performed while the concrete is being discharged and during AASHTO T 119 Standard Method of Test for Slump of Hydraulic Cement Concrete. Visual signs of segregation include coarse particles advancing in front of or behind the fine particles and mortar and a tendency for coarse aggregate to separate from the mortar, particularly when the mixture is being consolidated.

[3] Three (3) 4 x 8 in. compressive strength cylinders shall be cast and tested for each age per sublot.

[4] Testing only required if compressive strength results at 28 days do not conform with specifications.

COMPENSATION

701.80: Method of Measurement

Cement Concrete Sidewalks, Pedestrian Curb Ramps, and Driveways will be measured in square yards.

Excavation will be measured by the cubic yard as specified in 120.80: Method of Measurement.

Gravel Borrow will be measured by the cubic yard as specified in 150.80: Method of Measurement.

Fine grading and compacting will be measured by the square yard as specified in 170.88: Method of Measurement.

701.81: Basis of Payment

Cement Concrete Sidewalk, Cement Concrete Pedestrian Curb Ramp, and Cement Concrete Driveway will be paid for at the contract unit price per square yard complete in place, including detectable warning panels and all incidental materials, labor, and equipment necessary to complete the work to the satisfaction of the Engineer.

Gravel will be paid for at the contract unit price per cubic yard under Item 151: Gravel Borrow.

Fine grading and compacting will be paid for at the contract unit price per square yard under Item 170: Fine Grading and Compacting – Subgrade Areas.

Excavation will be paid for at the contract unit price per cubic yard under the excavation items.

701.82: Payment Items

701.	Cement Concrete Sidewalk	Square Yard
701.1	Cement Concrete Sidewalk Driveways	Square Yard
701.2	Cement Concrete Pedestrian Curb Ramp	Square Yard

GUIDE TO THE INTERIM SUBSECTION 701 CEMENT CONCRETE SIDEWALK SPECIFICATION

MATERIALS ACTIVITIES

Section	Activity	
701.30.A	**Combined Aggregate System**	
701.30.A.1	The mix design's combined aggregate system should meet Table 701.30-1: Tarantula Curve Particle Size Distribution.	Recommendation
701.30.A.2	The mix design's combined aggregate system should meet Table 701.30-2 / Figure 701.30-1: Shilstone Workability-Coarseness.	Recommendation
701.30.A.3	The mix design's combined aggregate system should be analyzed using the Fineness Modulus.	Recommendation
701.30.A.4	The mix design's combined aggregate system should be analyzed using the Coarse Aggregate Content.	Recommendation
701.30.B	**Paste System**	
701.30.B.1	The mix design's Water-Cementitious Ratio should be ≤ 0.40 (Table 701.30-3: Freezing, Thawing, and De-icing Resistance).	Recommendation
701.30.B.1	The mix design's Water-Cementitious Ratio shall be ≤ 0.45 (Table 701.30-3: Freezing, Thawing, and De-icing Resistance).	Required
701.30.B.2	The mix design's Air Content should approach the recommended Air Content Targets identified in Table 701.30-4: Freezing, Thawing, and De-icing Resistance.	Recommendation
701.30.B.3	The mix design's Cement and Supplementary Cementitious Materials (SCM) Content shall meet Table 701.30-5: Alkali Silica Reaction and Freezing, Thawing, and De-icing Resistance requirements.	Requirement
701.30.B.3	Test results meeting Table 701.30-6: Alternative Performance Evaluation to Alkali Silica Reaction Resistance requirements may be used in lieu of the mix design requirements identified in Table 701.30-5: Alkali Silica Reaction and Freezing, Thawing, and De-icing Resistance requirements.	Optional
701.30.B.4	The mix design should incorporate Chemical Admixtures identified in Table 701.30-7: Chemical Admixtures to enhance the properties of the concrete.	Recommendation
701.30.B.5	The mix design's Paste Content should approach the recommended targets identified in Table 701.30-8: Paste Content.	Recommendation

701.73	Acceptance Sampling and Testing	
T 119	The Slump shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements (± 1.5 from Slump Target identified by the Concrete Producer on the Batch Ticket).	Requirement
T 119	The Segregation Resistance shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements.	Requirement
T 309	The Concrete Temperature shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements.	Requirement
T 22	The Compressive Strength (7, 28, and 56 days) shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements.	Requirement
T 121 T 152 T 196	The Air Content shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements (5.5 – 8.5%).	Requirement
T 303 or C1567	The resistance to Alkali Silica Reaction shall meet Table 701.71-1: Minimum Acceptance Sampling and Testing Requirements (One per year for mix design verification).	Requirement

CONTRACTOR ACTIVITIES

Section	Activity	
701.40	Pre-Placement	
	The Contractor should have a minimum of two (2) Operators.	Recommendation
	The Contractor shall apply sufficient base compaction.	Requirement
	The Contractor shall moisten sub-base, free of standing water.	Requirement
	The Contractor shall secure forms, straight and level.	Requirement
	The Contractor shall mark expansion locations.	Requirement
	The Contractor shall be prohibited from performing the following practices: Placement on frozen sub-grade.	Requirement
701.41	Placement (Concrete Discharging)	
	The Contractor should have a minimum of two (2) Operators.	Recommendation
	The Contractor shall direct concrete trucks.	Requirement
	The Contractor shall handle chute discharge and truck movement.	Requirement
	The Contractor shall assist in preparing concrete for testing.	Requirement
	The Contractor shall direct trucks to washout area.	Requirement
	The Contractor shall provide general help.	Requirement

	The Contractor / Concrete Producer shall be prohibited from performing the following practices: Adding constituent materials not in conformance with AASHTO M 157 or without Department consent.	Requirement
701.41	**Placement**	
	The Contractor should have a minimum of two (2) Operators.	Recommendation
	The Contractor shall localize placement to minimize moving material.	Requirement
	The Contractor shall level concrete in front of the screed.	Requirement
	The Contractor shall operate come-alongs or flat headed shovel to move concrete in form.	Requirement
	The Contractor shall consolidate concrete along form edge to avoid honeycombing.	Requirement
	The Contractor shall operate screed over top of forms in sawing action for surface leveling.	Requirement
	The Contractor shall operate magnesium bull float to push coarse aggregate below the surface and fill in the low spots or depressions.	Requirement
	The Contractor shall be prohibited from performing the following practices: Toothed raking, dragging of internal vibrator, and internal vibrator to move concrete; steel troweling or floating.	Requirement
701.42	**Initial Curing (When Applicable)**	
	The Contractor should have a minimum of one (1) Operator.	Recommendation
	The Contractor shall apply 701.30.C.1: Liquid-Applied Evaporation Reducers when applicable.	Required when applicable
701.43	**Finishing**	
	The Contractor should have a minimum of two (2) Operators.	Recommendation
	The Contractor shall permit bleed water to dissipate and concrete to set.	Requirement
	The Contractor shall operate a hose drag or squeegee to remove water from the surface.	Requirement
	The Contractor shall check surface for flatness, fill/cut as necessary.	Requirement
	The Contractor shall finish surface with magnesium float.	Requirement
	The Contractor shall apply pulled broom finish at proper time to acceptable texture.	Requirement
	The Contractor shall clean broom when excessive mortar adheres.	Requirement
	The Contractor shall remove excess water from broom before use.	Requirement

	The Contractor shall finish edges and joints.	Requirement
	The Contractor shall finish well formed, properly spaced joints to sufficient depth.	Requirement
	The Contractor shall be prohibited from performing the following practices: Steel troweling or floating; adding water to the surface; excessive working of surface; pushing broom across surface.	Requirement
701.44	**Intermediate Curing (When Applicable, Apply One of the Methods)**	
	The Contractor should have a minimum of one (1) Operator.	Recommendation
	The Contractor shall apply 701.30.C.1: Liquid-Applied Evaporation Reducers when applicable and if selected.	Required when applicable
	The Contractor shall apply 701.30.E.3.a: Liquid Membrane-Forming Compounds when applicable and if selected.	Required when applicable
	The Contractor shall apply 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing when applicable and if selected.	Required when applicable
701.45	**Final Curing (Apply One of the Methods)**	
	The Contractor should meet the minimum number of operators identified in Table 701.62-2: Minimum Operator Activities.	Recommendation
	The Contractor shall apply 701.30.E.1: Saturated Covers if selected.	Requirement
	The Contractor shall apply 701.30.E.2: Sheet Materials if selected.	Requirement
	The Contractor shall apply 701.30.E.3.a: Liquid Membrane-Forming Compounds if selected.	Requirement
	The Contractor shall apply 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing if selected.	Requirement
701.46	**Protective Sealing (If Required)**	
	The Contractor should have a minimum of one (1) Operator.	Recommendation
	The Contractor shall apply 701.30.F: Protective Sealing Compounds at least 28 days after placement. Application of 701.30.F: Protective Sealing Compounds is **NOT REQUIRED IF 701.30.E.3.b: Liquid Membrane-Forming Compounds for Curing and Sealing was applied**.	Required if 701.30.E.3.b Curing and Sealing Compound was Not Applied
701.47	**Cold Weather Concreting (When Applicable)**	
	The Contractor should have a minimum of four (4) Operators.	Recommendation
	The Contractor shall submit a Cold Weather Concreting Plan meeting 701.47.	Required when applicable

	The Contractor shall apply cold weather concreting materials and procedures meeting 701.47 and the Department approved Contractor cold weather concreting plan.	Required when applicable
701.48	**Hot Weather Concreting (When Applicable)**	
	The Contractor should have a minimum of four (4) Operators.	Recommendation
	The Contractor shall submit a Hot Weather Concreting Plan meeting 701.48.	Required when applicable
	The Contractor shall apply hot weather concreting materials and procedures meeting 701.47 and the Department approved Contractor hot weather concreting plan.	Required when applicable
701.61	**Contractor Quality Control Plan**	
	The Contractor shall prepare and submit a Quality Control Plan (QC Plan) to the Department for review.	Requirement
701.62	**Production Personnel**	
701.62.A	Foreman	
	The Contractor shall have a minimum of One (1) Foreman.	Requirement
	A Foreman shall be present throughout the entire duration of the construction operation with at least one of the following personnel certifications. • NRMCA Concrete Exterior Finisher Certification • ACI Concrete Flatwork Technician and Flatwork Finisher	Requirement
	The Contractor's Foreman shall review and compare batch ticket quantities and sources to approved mix design.	Requirement
	The Contractor's Foreman shall monitor conformance to AASHTO M 157 Standard Specification for Ready-Mixed Concrete.	Requirement
	The Contractor's Foreman shall monitor conformance to Department specifications.	Requirement
	The Contractor's Foreman shall monitor Production Personnel activities.	Requirement
	The Contractor's Foreman shall verify that proper equipment is on hand prior to start of construction.	Requirement
	The Contractor's Foreman shall monitors equipment, environmental conditions, materials, and workmanship.	Requirement
	The Contractor's Foreman shall prohibit the use of prohibited equipment and practices.	Requirement
	The Contractor's Foreman shall acknowledge sampling, testing, and inspection results.	Requirement

701.62.B	**Operators**	
	Concrete sidewalk shall be constructed by sufficiently staffed, trained, experienced, and qualified equipment operators and craftsmen, who are presently involved in sidewalk construction, throughout the entire duration of the construction operation, per the requirements specified in Sections 701.40 to 701.48.	Requirement
701.63	**Quality Control Inspection**	
	Quality Control inspection shall be performed and reported on inspection report forms by qualified Quality Control Technicians, to confirm conformance to specifications and to visually inspect equipment, environmental conditions, materials, and workmanship. Quality Control Technicians shall obtain at least one of the following personnel certifications. • NRMCA Concrete Exterior Finisher Certification • ACI Concrete Flatwork Technician and Flatwork Finisher Quality Control inspection report forms shall be completed by the Contractor and submitted to the Department for review	Requirement

DOCUMENT 00715

SUPPLEMENTAL SPECIFICATIONS

SEPTEMBER 30, 2024

The 2024 *Standard Specifications for Highways and Bridges* are amended by the following modifications, additions and deletions. These Supplemental Specifications prevail over those published in the Standard Specifications.

The Specifications Committee has issued these Supplemental Specifications for inclusion into each proposal until such time as they are updated or incorporated into the next Standard Specifications.

Contractors are cautioned that these Supplemental Specifications are dated and will change as they are updated.

DIVISION I

GENERAL REQUIREMENTS AND COVENANTS

SECTION 1: DEFINITON OF TERMS

Subsection 1.03: Defined Terms
Under Party of the First Part replace the words Chapter 90 of the General Laws with MGL Chapter 6C, Section 4[b].

SECTION 2: PROPOSAL REQUIREMENTS AND CONDITIONS

Subsection 2.01: Proposal Forms and Plans
Replace the first paragraph under A. Prequalification Prior to Requesting Proposal Forms with the following:

Subject to the requirements of M.G.L. Chapter 81, Section 8B, each prospective Bidder proposing to bid on any work, excepting the construction, reconstruction, repair or alteration of buildings, to be awarded by the Department or by a municipality under the provisions of M.G.L. Chapter 6C, Section 4(b) must be prequalified in accordance with 700 CMR 14.00 Prequalification of contractors and subcontractors, if the amount of the proposal added to the value of the uncompleted work already under contract with the Department will aggregate $50,000 or more.

Replace the second paragraph under B. Issuance of Proposal Forms and Plans with the following:

For projects to be awarded under the provisions of M.G.L. Chapter 6C, Section 4(b), bidders may obtain plans and specifications from the applicable municipality at the place specified in the Notice to Contractors.

SECTION 4: SCOPE OF WORK

Subsection 4.04: Changed Conditions
Replace the last paragraph with the following.

The provisions of Section 39N of Chapter 30 of the General Laws, as amended, do not apply to construction contracts entered into on behalf of a municipality under the provisions of M.G.L. Chapter 6C, Section 4(b).

Subsection 4.06: Increased or Decreased Contract Quantities
Replace the second paragraph with the following.

Where the actual quantity of a pay item varies by more than 25% above or below the estimated quantity stated in the Contract, an equitable adjustment in the Contract Price for that pay item shall be negotiated upon demand of either party regardless of the cause of the variation in quantity. A demand for an equitable adjustment must be submitted to the other party within 30 days after beginning the work of the affected item that is greater than 25% above the bid quantity or within 30 days after completing the work when the actual quantity is 25% less than the bid quantity.

SECTION 9: MEASUREMENT AND PAYMENT

Subsection 9.03: Payment for Extra Work
Replace paragraph B., (2) with the following.

(2) Plus 13 percent of direct labor, for the actual costs of Federal Insurance Contribution Act (FICA) including Medicare; Federal Unemployment Tax Act (FUTA); State Unemployment Tax Act (SUTA), which includes Unemployment Insurance, the Workforce Training Fund Program, ~~and~~ Employer Medical Assistance Contribution, and COVID-19 Recovery Assessment; Earned Sick Time (EST) Law (940 CMR 33.00); and Paid Family and Medical Leave (PFML) Act (458 CMR 2.00); or, as an alternative to the above 13 percent, the Contractor may elect to use actual rates for FICA, FUTA, SUTA, EST and PFML provided the actual rates are supported with verifiable documentation and shall be subject to review by MassDOT Audit Operations.

Subsection 9.04: Partial Payments
Replace the last sentence of the first paragraph with the following;.

No such estimates or payment shall be required to be made when, in the Engineer's judgment, the work is not proceeding in accordance with the provisions of the Contract, or when in their judgment the total value of the work completed since the last estimate amounts to less than $5,000.00.

DIVISION II

CONSTRUCTION DETAILS

DIVISION II: Construction Details
Replace M4.02.15 Cement Mortar with M4.04.0 Grout, Mortar, and Concrete Products where encountered, including in Subsections 230.40, 485.40, 501.40, 685.40, 940.40A and 983.40.

SECTION 100: EARTHWORK, GRADING, DEMOLITION, RODENT CONTROL AND BORINGS

SUBSECTION 150: EMBANKMENT

Subsection 150.62: Embankment Construction with Materials Other Than Rock
Replace the fourth paragraph with the following.

The embankment materials shall be compacted to not less than 95% of the maximum dry density of the embankment material as determined by AASHTO T 99, Method C. If required, a correction for oversized particles shall be in accordance with Annex A of AASHTO T 99. If the material retained on the ¾-in. sieve is 30% or more of the total sample, this test shall not apply and the material shall be compacted to the target density. The target density shall be established by determining the number of passes of a roller required to produce a constant and uniform density, after conducting a series of tests using either AASHTO T 310, *In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*, AASHTO T 191, *Density of Soil In-Place by the Sand-Cone Method*, or *ASTM D 8167 Standard Test Method for In-Place Bulk Density of Soil and Soil-Aggregate by a Low-Activity Nuclear Method (Shallow Depth)*. The Contractor shall, without additional compensation, employ whatever measures may be necessary to adjust the natural water content of the suitable embankment material to permit the placement and compaction as hereinbefore specified.

SUBSECTION 160: CONTROLLED LOW-STRENGTH MATERIAL

Subsection 160: Controlled Low-Strength Material
Add this new subsection.

DESCRIPTION

160.20: General

Controlled Low-Strength Material shall be installed in accordance with the relevant provisions of Subsection 150: Embankment, Section 901: Cement Concrete and in accordance with the procedures described herein.

Controlled Low Strength Materials (CLSM) shall be a self-compacting, self-leveling, flowable, excavatable or non-excavatable, low strength, rigid setting, and unshrinkable material, used as an alternative to compacted granular fills, including backfill, structural fill, utility fill, pavement base, subgrade, subbase, base course, conduit bedding, erosion control, and void filling.

MATERIALS

160.40: General

Material for controlled low-strength material shall meet the requirement specified of M4.08.0 Controlled Low-Strength Material. The material shall be specified by the Engineer as one of the following types;

CLSM – Manual Excavatable (≤100 psi)
CLSM – Mechanical Excavatable (101-300 psi)
CLSM – Structural Non Excavatable (> 300 psi)

Permeability testing as specified in Table M4.08.0-2 shall be required when the material is placed outside of roadway areas or footings for concrete structures, or as directed by the Engineer.

CONSTRUCTION METHODS

160.60: General

The Contractor shall submit a placement plan for Controlled Low-Strength Material (CLSM). The plan shall include the type of CLSM, detailed descriptions of methods used for placing and containing the controlled density fill and the set time to strength.

The Contractor shall remove all debris prior to placing the fill. Fill shall not be placed against any structural elements or utilities unless approved by the Engineer.

CLSM shall be poured in lifts not exceeding 4 feet to insure stability under the fluid effects of the pour. Care shall be taken to ensure the integrity of the forms or other means of supporting the material until the material sets up.

COMPENSATION

160.80: Method of Measurement

Controlled Low-Strength Material shall be measured by the cubic yard in place to the neat lines established on the plans or specified by the Engineer. When backfilling pipes the horizontal neat lines shall be not greater than 3.0 ft. greater than the rated inside diameter of the pipe and vertically from the top of the crushed stone foundation material, if any, or 6 in. below the pipe invert whichever is less to the specified top elevation. A deduction shall be made for the volume of the pipe or conduit encased.

160.81: Basis of Payment

Payment under this item shall constitute full compensation for the placement, testing, and all material, equipment and labor to complete the work.

160.82: Payment Items

160.1	Controlled Low-Strength Material - Manual Excavatable (≤ 100 PSI)	Cubic Yard
160.2	Controlled Low-Strength Material – Mechanical Excavatable (101-300 PSI)	Cubic Yard
160.3	Controlled Low-Strength Material (>300 PSI)	Cubic Yard

SECTION 200: DRAINAGE

SUBSECTION 201: BASINS, MANHOLES AND INLETS

Subsection 201.40: General
Replace "Cement Mortar ..... M4.02.15" with "Mortar ..... M4.04.0".

SECTION 400: SUB-BASE, BASE COURSES, SHOULDERS, PAVEMENTS AND BERMS

SUBSECTION 401: GRAVEL SUB-BASE

Subsection 401.60: Gravel Sub-base
Replace the last sentence of the first paragraph with the following.

The specific density of the Gravel Sub-base shall be maintained by determining the number of passes of a roller required to produce a constant and uniform density, after conducting a series of tests using a nuclear device or the sand/volume method in accordance with AASHTO T310, AASHTO T 191, or ASTM D 8167.

SUBSECTION 402: DENSE GRADED CRUSHED STONE FOR SUB-BASE

Subsection 402.61: Spreading and Compacting
Replace the last sentence of the first paragraph with the following.

The specified density of the Dense Graded Crushed Stone shall be maintained by determining the number of passes of a roller are required to produce a constant and uniform density, after conducting a series of tests using a nuclear device or the sand/volume method in accordance with AASHTO T310, AASHTO T 191, or ASTM D 8167.

SUBSECTION 403: RECLAIMED PAVEMENT FOR BASE COURSE AND/OR SUB-BASE

Subsection 403.64: Compaction and Dust Control
Replace the second paragraph with the following.

The reclaimed base course shall be tested for compaction and smoothness and accuracy of grade in accordance with the applicable provisions of 401.60: Gravel Sub-base. The required density shall be measured by using a nuclear device or the sand/volume method in accordance with AASHTO T310, AASHTO T 191, or ASTM D 8167. If any portions are found to be unacceptable by the Engineer, such portions shall be reprocessed, regraded, and recompacted until the required smoothness and accuracy are obtained.

SUBSECTION 404: RECLAIMED PAVEMENT BORROW MATERIAL

Subsection 404.60: General
Replace the second sentence with the following.

The specified density of the Reclaimed Pavement Borrow Material shall be maintained by determining the number of passes of a roller that are required to produce a constant and uniform density, after conducting a series of tests using a nuclear device or the sand/volume method in accordance with AASHTO T310, AASHTO T 191, or ASTM D 8167

SUBSECTION 450: HOT MIX ASPHALT PAVEMENT

Subsection 450.40: General
Add the following paragraph to the end of this subsection.

Prior to placing hot mix asphalt the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, HMA tonnage, the type of mix, the mix provider and plant location.

SUBSECTION 460: HOT MIX ASPHALT PAVEMENT FOR LOCAL ROADS

Subsection 460.40: General
Add the following paragraph to the end of this subsection.

Prior to placing hot mix asphalt the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, HMA tonnage, the type of mix, the mix provider and plant location.

SUBSECTION 466: STRESS ABSORBING MEMBRANE & STRESS ABSORBING MEMBRANE INTERLAYER

Subsection 466.40: General
Replace this subsection with the following.

Prior to placing stress absorbing membrane the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, tonnage, the type of mix, the mix provider and plant location. Stress absorbing membrane and stress absorbing membrane interlayer shall be constructed as specified herein.

SUBSECTION 470: HOT MIX ASPHALT PAVEMENT BERM

Subsection 470.40: General
Replace this subsection with the following.

Prior to placing hot mix asphalt the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, HMA tonnage, the type of mix, the mix provider and plant location. The Contractor shall obtain HMA berm material of the type specified.

SUBSECTION 472: TEMPORARY ASPHALT PATCHING

Subsection 472.40: General
Add the following paragraph to the beginning of this subsection.

Prior to placing hot mix asphalt the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, HMA tonnage, the type of mix, the mix provider and plant location.

SUBSECTION 486: ULTRATHIN BONDED OVERLAY

Subsection 486.40: General
Add the following paragraph to the end of this subsection.

Prior to placing ultrathin bonded overlay the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, tonnage, the type of mix, the mix provider and plant location.

SECTION 600: HIGHWAY GUARD, FENCES AND WALLS

SUBSECTION 690: WALLS REMOVED AND RESET

Subsection 690.40: General
Replace the last sentence with the following.

Mortar shall meet the requirement of M4.04.0: Grout, Mortar, and Concrete Products.

SECTION 700: INCIDENTAL WORK

SUBSECTION 702: HOT MIX ASPHALT SIDEWALKS AND DRIVEWAYS

Subsection 702.40: General
Add the following paragraph to the end of this subsection.

Prior to placing hot mix asphalt the contractor shall provide notice to the Engineer at least 48 hours in advance of the work. The notice shall include the anticipated schedule, HMA tonnage, the type of mix, the mix provider and plant location.

SECTION 800: TRAFFIC CONTROL DEVICES

SUBSECTION 825: RECTANGULAR RAPID FLASHING BEACONS

Subsection 825: Rectangular Rapid Flashing Beacons
Add this new subsection.

DESCRIPTION

825.20: General

This work shall consist of furnishing and installing a solar-powered, actuated, Rectangular Rapid Flashing Beacon (RRFB) system at the location(s) shown in the Plans.

MATERIALS

825.40: General

Rectangular Rapid-Flashing Beacons shall meet the requirements specified in the following Subsections of Division III, Materials:

Cement Concrete.....M4.02.00
Signal Posts and Bases M10.05.1
APS Pushbuttons.....M10.09.1
RRFB Assemblies.....M10.11.0

An RRFB system shall include the following items (quantities shown in the Major Items List found in the Plans):

- Cement Concrete Foundation
- Signal Post and Pedestal Base
- APS Pushbutton
- Light Bar
- Signage
- Enclosure for Controller, Activation Unit, and Battery System
- Solar Panel
- All mounting and supporting hardware and wiring necessary to complete a working system

The Contractor shall supply cement concrete foundations per the Plans.

The Contractor shall supply Schedule 80 aluminum signal posts with a brushed or spun finish and square, pedestal aluminum bases with a natural finish unless otherwise shown in the Plans or Special Provisions.

Each Light Bar shall have a pair of yellow beacons facing one or both directions of traffic, as shown in the Plans.

All sign designs shall conform to the MUTCD. Sign panel information, including dimensions, shall be per the Plans.

The warning signs (MUTCD code W11-2, W11-15, or S1-1 signs – see Plans for sign type), and the diagonal downward arrow sign (W16-7P) signs shall be on Type A substrate, conforming to 828.42: Panels. The sign sheeting shall be fluorescent yellow-green, conforming to ASTM D4956 Type IX.

An R10-25 sign, conforming to the MUTCD, shall be mounted above the APS Pushbutton on a Type A substrate or may be integral to the button assembly.

The solar panel and battery system may be integrated into a single unit or housed separately, per the manufacturer's design. These may also be co-housed with the Light Bar and/or the Controller and Activation Unit.

The solar panel and battery system shall be sized appropriately to accommodate 300 actuations per day, 365 days a year, for the duration of the repeating flashing sequence shown in the Plans. The sizing calculations shall be based upon solar and temperature conditions for a typical December-January in Massachusetts. The system shall have a minimum autonomy of 5 days.

Each assembly shall be rated for wind speeds of up to 90 mph.

Any proprietary software required for the programming and/or operation of the system during its lifetime shall be included at no additional cost.

825.41: Shop Drawings

Within 30 days from the Notice to Proceed the Contractor shall submit shop drawings for the RRFB system, including cutsheets for all components to show conformance with M10.05, M10.09.1, and M10.11.0 and these specifications.

Shop drawings shall include all solar and battery sizing calculations. These calculations shall have Contractor- or manufacturer-supplied, site-specific shading factors applied.

825.42: Material Warranties

All RRFB components shall include a minimum 1-year manufacturer's replacement warranty for manufacturing or installation defects starting at the date of acceptance by the Engineer. A battery shall be considered defective should it not retain 80% of its original capacity within the warranty period.

CONSTRUCTION METHODS

825.60: General

RRFBs shall be installed on new foundations at the locations as shown in the Plans. Bases shall be secured to the foundation in accordance with the manufacturer's specifications.

All systems shall be installed per the manufacturer's instructions.

The location and orientation of the system shall be per the Plans.

The arrow on each APS pushbutton shall be aligned parallel to the direction of travel of the crosswalk.

The Light Bar(s) shall be oriented towards the incoming lane(s).

Solar panels shall be oriented to maximize sunlight gain.

SYSTEM OPERATION

825.70: APS Pushbuttons

APS Pushbuttons shall actuate the RRFB system. Upon actuation, an audible speech message shall be broadcast from each pushbutton in the system that says, "Warning lights are flashing," shall be stated twice. This message shall be repeated upon each actuation. No other messages shall be allowed.

While the system is in dark mode, the APS Pushbuttons shall broadcast a locator tone. The locator tone shall have a duration of 0.15 seconds or less and shall repeat at 1-second intervals at all times that the system is in dark mode. The locator tone shall be set 2 to 5 dBA above ambient sound, shall automatically adjust intensity, but cap at a maximum volume of 100 dBA.

APS Pushbuttons shall have all other vibrotactile and percussive indications disabled.

825.71: Light Bar

The Light Bar shall remain dark until actuated.

Upon actuation, all Light Bars in the system shall be activated simultaneously for a predetermined repeating flash sequence. The flashing rate shall be 75 flashing sequences per minute.

The left and right yellow beacons shall operate using the following sequence:

A. The yellow beacon on the left-hand side shall be illuminated for approximately 50 milliseconds.
B. Both yellow beacons shall be dark for approximately 50 milliseconds.
C. The yellow beacon on the right-hand side shall be illuminated for approximately 50 milliseconds.
D. Both yellow beacons shall be dark for approximately 50 milliseconds.
E. The yellow beacon on the left-hand side shall be illuminated for approximately 50 milliseconds.
F. Both yellow beacons shall be dark for approximately 50 milliseconds.
G. The yellow beacon on the right-hand side shall be illuminated for approximately 50 milliseconds.
H. Both yellow beacons shall be dark for approximately 50 milliseconds.
I. Both yellow beacons shall be illuminated for approximately 50 milliseconds.
J. Both yellow beacons shall be dark for approximately 50 milliseconds.
K. Both yellow beacons shall be illuminated for approximately 50 milliseconds.
L. Both yellow beacons shall be dark for approximately 250 milliseconds.

The flash rate of each individual RRFB indication, as applied over the full flashing sequence, shall not be more than 5 flashes per second, to avoid frequencies that might cause seizures.

The sequence shall then be repeated until the duration time has been met and then all yellow beacons shall return to dark mode simultaneously. The duration time shall be per the Plans.

The predetermined repeating flash sequence shall be immediately initiated every time a pushbutton detector is actuated. If the RRFBs are already flashing and an actuation is received, it shall restart the duration time. There shall be no delay time programmed between actuations.

COMPENSATION

825.80: Method of Measurement

RRFBs will be measured as a single system, 2-Post Assembly or 3-Post Assembly, furnished and installed.

825.81: Basis of Payment

The work will be paid for at the contract price each under the respective item for a 2-Post Assembly System or 3-Post Assembly System. Any additional wiring, mounting equipment, or other materials or labor required to for an operating system per the Plans and Specifications shall be considered as incidental to the construction and be included in the contract price.

825.82: Payment Item

825.2	RRFB (2-Post Assembly System)	Each
825.3	RRFB (3-Post Assembly System)	Each

SECTION 900: STRUCTURES

Subsection 922: Elastomeric Bearing Pads
Add this new subsection.

SUBSECTION 922: ELASTOMERIC BEARING PADS

DESCRIPTION

922.20: General
This specification consists of the construction requirements for elastomeric bearing pads. Elastomeric bearing pads shall consist of plain or laminated bearings consisting of layers of elastomers restrained at their interfaces by bonded steel laminates.

MATERIALS

922.40: General

Elastomeric bearing pads shall meet the following requirements:

Elastomeric Bearing Pads M9.14.5

Anchor bolts M8.01.5

CONSTRUCTION METHODS

922.50: Submittals

The Contractor shall submit the following to the Engineer for approval:

1. Prior to fabrication:
    a. Written notification 30 days prior to the start of bearing production. The notification shall include the contract number, quantity, type, and size of bearing being produced, manufacturer's name, and the name of the independent testing lab.
    b. Shop drawings for approval in accordance with Subsection 5.02, 14 days prior to the start of bearing production.
2. At the time of bearing pad delivery:
    a. A certificate of compliance (COC) certifying that the elastomeric bearing pads meet the requirements of the contract specifications. The COC shall be accompanied by:
        - A mill certificate for steel laminates used in bearings, where applicable.
        - Fabricator QC test reports.
    b. Independent test results as required under Subsection 922.62.

922.51: Fabricators

Fabricators shall be in accordance with Subsection M9.14.5D.

922.52: Fabrication

Fabrication shall be in accordance with Subsection M9.14.5E.

In addition to the number of bearing pads required for the contract the Contractor shall order additional bearing pads as defined in Subsection M9.14.5G, in order to allow the Engineer to randomly select a bearing pad for testing in accordance with 922.72.

922.53: Packaging, Handling, & Storage

The bearing pads shall be packaged, handled, and stored in accordance with Subsection M9.14.5F.

All bearing devices and components shall be stored on the project in an area that provides protection from environmental and physical damage. When installed, bearings shall be clean and free of all foreign substances.

922.54 Installation

Bearing pads shall be installed only on concrete bridge seat bearing areas that have been prepared in accordance with Subsection 901.65A(3).

Bearing pads shall be installed by qualified personnel to the positions, elevations, and slopes shown on the plans and to the dimensions and offsets prescribed by the manufacturer. The bearing pads shall be adjusted, as necessary, to take into account the ambient temperature at installation and future movements of the bridge due to temperature changes, release of falsework, and shortening due to post-tensioning.

Elastomeric bearings shall be placed directly on the concrete surface provided that it is flat within the bearing area to within a tolerance of 0.005 times the smallest nominal dimension of the bearing as measured by a straight edge from peak to valley. Bearings shall be placed on surfaces that do not deviate from the specified bridge seat slope in any direction by more than 0.01 rad.

Any bearing areas that exceed these tolerances shall be brought into compliance by grouting or use of shims as directed by the Engineer before the weight of the structure acts on the bearing.

Bearings that have an internal tapered load plates shall be marked with an arrow that points up-station in order to properly align the slope of the internal tapered load plate with the centerline of the bridge.

Sole plates that sit on the bearing shall not be welded to the beam flange in the field unless at least 1.5 in. of the steel exists between the weld and the elastomer. In no case shall the elastomer or the bond be subjected to temperatures higher than 400°F.

No beams shall be erected until the bearings have been accepted by the Engineer.

CONTRACTOR QUALITY CONTROL

922.60: General

The Contractor shall provide a Quality Control System (QC System) to ensure that all materials and workmanship meet the required specifications.

922.61: Quality Control Inspection

The Contractor shall perform QC inspection of all work items addressed under this specification. Inspection activities during placement may be performed by qualified production personnel. The Contractor's QC personnel shall have overall responsibility for the QC inspection. The Contractor shall not rely on the results of the Engineer's Acceptance inspection for QC purposes. The Engineer shall be provided with the opportunity to monitor and witness all QC inspections.

QC inspection activities must address the following three primary components:

a. Materials
b. Environmental Conditions
c. Workmanship

The minimum frequency of QC inspection activity shall be in accordance with the requirements below.

Table 922.61-1 - Minimum QC Inspection of Elastomeric Bearing Pads

Inspection Component	Inspection Attribute	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Materials	Bearing Pad	Each Delivery	Bearing Pad	Check COC
	Geometry and Surface	Each Bearing Pad	Bearing Pad Surface	Visual Check & Check Measurement
Environmental Conditions	Temperature of Air	1 per Day	At Project Site	Check Measurement
Workmanship	Bridge Seat	Each Bearing Location	Bearing Pad Location	Visual Check
	Elevation	Each Bearing Pad	Bearing Pad Location	Check Measurement
	Orientation	Each Bearing Pad	Bearing Pad Location	Check Measurement

922.62: Quality Control Sampling and Testing Requirements

The Contractor shall have each Lot of bearing pads sampled and tested in accordance with Subsection M9.14.5G. This shall include both QC and compliant independent laboratory test results.

DEPARTMENT ACCEPTANCE

922.70: General

The Department shall sample and test bearing pads as part of its Acceptance activities. Independent testing shall also be used to supplement its testing.

922.71: Acceptance Inspection

The Engineer will perform Acceptance inspection to ensure that materials and completed work are in conformance with the contract requirements. Acceptance inspection is intended to visually assess the quality of each Lot produced and placed and will address only the inspection components of materials and workmanship in support of the Department's final Acceptance determination. All Acceptance inspection activities by the Department will be performed independent of the Contractor's QC inspection.

Table 922.71-1 – Department Acceptance Inspection of Elastomeric Bearing Pads

Inspection Component	Inspection Attribute	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Materials	Bearing Pad	1 Per Bearing Pad	Bearing Pad Surface	Check COC
	Geometry and Surface	1 Per Bearing Pad	Bearing Pad Surface	Visual Check & Check Measurement
Workmanship	Elevation	1 per Bearing Pad	Bearing Pad Location	Check Measurement
	Orientation	1 per Bearing Pad	Bearing Pad Location	Check Measurement

922.72: Acceptance Sampling and Testing Requirements

For Acceptance samples taken by the Engineer at the project, the sampling rate shall be in accordance with Subsection M9.14.5G. Bearing pads shall be tested by the Department in accordance with Table M9.14.5-1.

922.73: Lot Acceptance Determination Based on Inspection Results

The Engineer's Acceptance inspection results will be used in the final Acceptance determination for all Lots. Prior to final Acceptance of each Lot produced and placed, the Engineer will evaluate all Acceptance inspection information for the Lot. The materials and product workmanship for the completed work will be evaluated for conformance with the plans and the requirements specified in Subsections 922.60, 922.61, and 922.62.

When the Acceptance information identifies deficiencies in either material quality or product workmanship, the location will be isolated and further evaluated by the Engineer through additional Acceptance inspection. Depending upon the findings of the additional Acceptance inspection activity, the Engineer will determine the disposition of the nonconforming work in accordance with Division I, Subsection 5.03, Conformity with Plans and Specifications.

922.74: Lot Acceptance Determination Based on Testing Data

Prior to final Acceptance of each Lot, the Engineer will evaluate all available QC, independent, and Acceptance testing data for the Lot to determine conformance with the minimum requirements in Subsection M9.14.5G and Table M9.14.5-1.

If a test result does not meet the minimum requirement, the Contractor and Engineer will further assess the quality to determine whether the material can remain in place.

If the Engineer's assessment determines that the material quality is not sufficient to permit the bearing pad to remain in place, the pad shall be removed and replaced. When a nonconforming bearing pad is corrected or replaced, the Engineer will perform Acceptance testing of the replacement bearing pad and evaluate the test results for conformance with the minimum requirements.

922.75: Final Lot Acceptance Determination

For each Lot produced and placed, the Engineer will evaluate all Acceptance inspection and testing data for the Lot. The final review and visual inspection shall be conducted jointly by the Contractor and Engineer. Any items that do not meet the requirements of the specifications and plans shall be addressed at this time, at no additional cost to the Department.

After each Lot is complete, including any corrective action, the Engineer will perform a final evaluation of all Acceptance data for the Lot. The Engineer will accept the Lot if the evaluation of all inspection and testing data for the Lot is in conformance with this specification and the contract documents.

When the above requirements have been met, the Engineer will accept all completed bearing pads.

COMPENSATION

922.80: Method of Measurement

Laminated Elastomeric Bearing Pads will be measured by each pad installed. Plain Elastomeric Bearing Pads will be measured by the square foot installed. The measured quantities do not include the additional bearings required for conformance and destructive testing.

922.81: Basis of Payment

Payment under this item shall be at the contract unit price. This price will include all materials, equipment, tools and labor, additional bearing pads for testing and all required testing necessary to complete the work.

922.82: Payment Items

921.	Laminated Elastomeric Bearing Pad with Anchor Bolts	Each
922.	Laminated Elastomeric Bearing Pad without Anchor Bolts	Each
923.	Laminated Sliding Elastomeric Bearing Pad with Anchor Bolts	Each
933.	Plain Elastomeric Bearing Pad	Square Foot

SECTION 970: DAMP-PROOFING

Subsection 970.30: General
Add the following material to this subsection.

Mortar..... M4.04.0

Subsection 970.40: General
Replace the second sentence in the second paragraph with the following.

All holes in concrete surfaces shall be satisfactorily filled with mortar before damp-proofing is applied.

SUBSECTION 983: REVETMENT

Subsection 983.64 Special Slope Paving Under Bridges
Replace the last sentence under B. Quarry Stone or Precast Concrete Blocks. with the following.

Mortar shall then be placed in the joints to the top of the paved surface.

Subsection 983.65 Channel Paving and Grouted Channel Paving
Replace the last sentence with the following.

The grout shall conform to M4.04.0: Grout, Mortar, and Concrete Products.

DIVISION III

MATERIALS SPECIFICATIONS

SECTION M4: CEMENT AND CEMENT CONCRETE MATERIALS

Subsection M4.02.00 Cement Concrete
Add the following to the end of this subsection.

Alkali Silica Reactivity - Resistant Portland Cement Concrete

All cement concrete and precast/prestressed concrete products shall be alkali silica reactivity-resistant. Proportion Portland cement concrete mixes to include materials that meet either the aggregate requirement or Alkali-Silica Reactivity (ASR) mitigation criteria listed below. Provide cement mill test reports from certified laboratories that show the materials' source, composition and the cement alkali content expressed as sodium oxide equivalent(s) not to exceed 1.4%. Certified test reports according to test procedures as specified in Table A will be required to be submitted with the trial batch submission to RMS for approval every year or whenever the source of material is changed.

Select non-reactive aggregates that meet all the criteria of Table M4.02.00-2. Mitigate the mix as described below when nonreactive aggregates are unavailable. If non-reactive aggregates are used for portland cement concrete mix, 15% by weight of the cementitious content shall be fly ash meeting AASHTO M 295, Type F.

Select a material or a combination of materials that meet the criteria shown in Table M4.02.00-3 to mitigate ASR when concrete mixes must be proportioned with reactive aggregates. Perform verification test according to AASHTO T 303 and ASTM C295 to determine the effectiveness of the resulting mix design against ASR. Use the same proportion of cement and pozzolan for each test mixture as that proposed for the actual mix design. Provide the Department with certified documentation of the mixtures' effectiveness to control ASR.

Table M4.02.00-2: Tests and Criteria for Proposed Aggregates

Procedure	Description	Limits
AASHTO T 303: Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	Mean mortar bar expansion at 14 days. Perform a polynomial fit (1) of 4, 7, 11, and 14 days to determine reliability of results	0.08% maximum metamorphic aggregate; 0.10% maximum all other aggregates. Repeat AASHTO T 303 if r^2 is less than 0.95.
ASTM C295: Petrographic Examination of Aggregates for Concrete	Optically strained, microfractured, or microcrystalline quartz	5.0% maximum (2)
	Chert or chalcedony	3.0% maximum (2)
	Tridymite or cristobolite	1.0% maximum (2)
	Opal	0.5% maximum (2)
	Natural volcanic glass	3.0% maximum (2)

(1) Use a second order polynomial of $\%Exp = A^o + A^1 SQRT(t) + A^2t$. See publication SD92-04-F.
(2) Based on the total aggregate sample.

Table M4.02.00-3: Mitigation Methods for ASR in Portland Cement Concrete

Material	Specification	Cementitious Material Percentage (1)
Low alkali cement (2)	AASHTO M 85	100%
Fly ash - Class F	AASHTO M 295	15% minimum to 30% (4) maximum
Silica Fume (5)	AASHTO M 307	6% ± 1% (6)
Slag Grade 100 and 120	AASHTO M 302	25% minimum to 50% maximum

(1) Measure this minimum content of cementitious material as percent by weight of cement plus pozzolan.
(2) This single criterion is not effective in all cases in remediating ASR. Low alkali cement (0.60% maximum (3)) must be used in combination with other pozzolanic materials in Table B.
(3) Na_2O equivalent = $\%Na_2O + 0.658 (\%K_2O)$
(4) Fly ash, Type F, shall replace 15% by weight of the design cement content, and any additional fly ash will be considered as fine aggregate.
(5) Silica fume shall only be used in silica fume cement concrete.
(6) The total amount of Type F fly ash and silica fume shall constitute 20% by weight of the design cement content, and any additional fly ash shall be considered as fine aggregate.

Subsection M4.02.15 Cement Mortar
Delete this subsection.

Subsection M4.04.0: Grout, Mortar and Concrete Products
Replace this subection with the following.

M4.04.0: Grout, Mortar, and Concrete Products

Grout, cementitious mortar, and concrete products shall be packaged, dry, and preblended with preformulated constituent materials (excluding mixing water) to produce a material with acceptable quality characteristics and material properties, including time of set, compressive strength, flexural strength, slant shear bond strength, resistance to alkali silica reaction, freezing/thawing, and de-icing cycles, shrinkage, expansion, and sulfate reaction.

Mortar products shall be defined as products containing aggregate of which less than 5% by mass of the total mixture is retained on the 3/8 in. sieve. Mortar products for concrete repairs shall be used only on repair depths of 2 in. or less. Concrete products shall be defined as products containing aggregate of which 5% or more by mass of the total mixture is retained on the 3/8 in. sieve. Concrete products for concrete repairs shall be used only on repair depths greater than 2 in.

The aggregate sources included in the prepackaged product or extended into the product shall meet Section M4.02.02: Aggregates. Grout, cementitious mortar, and concrete products shall only be applied per the requirements provided on the product's technical data sheet. Grout, cementitious mortar, and concrete products shall maintain valid listing on the MassDOT Qualified Construction Materials List (QCML). Grout, cementitious mortar, and concrete products shall meet requirements specified herein.

A. Technical Data Sheet.

The Manufacturer shall submit the product's technical data sheet to the Department for review. At a minimum, the product's technical data sheets shall include:

(a) Product Name
(b) Manufacturer, including address and contact information
(c) Packaging
(d) Yield
(e) Product Description, including an overview of the product and its intended application(s) and use(s).

(f) Technical Data, including quality characteristics and corresponding performance criteria with the AASHTO and/or ASTM standard test methods identified.
(g) Recommended Equipment
(h) Instructions, including surface preparation, mixing, forming, placing, finishing, curing, and protection from adverse conditions, such as precipitation, cold conditions, and hot conditions.
(i) Limitations
(j) Storage and Shelf Life
(k) Safety

B. Mix Design Formulation.

Products that are extended with aggregate not included in the original product packaging shall be formulated per the product's technical data sheet and evaluated through Department mix design evaluation and verification testing. Producers shall report and submit proposed mix design formulations onto the Department issued mix design sheet. The Producer shall select an AASHTO accredited independent laboratory to conduct verification testing. The sampling and testing conducted by the independent laboratory shall be witnessed by the Department.

C. Product Verification Testing.

Verification test results shall be within the limits specified herein.

M4.04.1: Conventional Grout, Cementitious Mortar, and Concrete Products

Conventional grout, cementitious mortar, and concrete products shall meet the requirements of Section M4: Cement and Cement Concrete Materials, performance criteria of the product's technical data sheet, and the requirements specified herein.

M4.04.2: Rapid Hardening Cementitious Mortar and Concrete Products

Rapid hardening cementitious mortar and concrete products shall meet the requirements and performance criteria of the product's technical data sheet, ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs, and Table M4.04.2-2.

Table M4.04.2-1: Types of Rapid Hardening Cementitious Products for Concrete Repairs

Type	Description	Application
R1	General Rapid Hardening	Vertical and Overhead Repairs
R2	Medium Rapid Hardening	Vertical and Overhead Repairs
R3	Very Rapid Hardening	Horizontal, Vertical, and Overhead Repairs

Table M4.04.2-2: Verification Testing Requirements

Property	Method	Quality Characteristic		Limits					
				R1		R2		R3	
				Min.	Max.	Min.	Max.	Min.	Max.
Setting	T 197	Initial Set (min.)		Technical Data Sheet					
		Final Set (min.)		Technical Data Sheet					
Strength	T 97[1]	Flexural Strength (psi)	24 Hours	–	–	–	–	650	–
			7 Days	–	–	–	–	–	–
Durability	T 358	Surface Chloride Ion Penetration Resistance (kΩ-cm)	28 Days	21	–	21	–	21	–
	T 161 (A)	Relative Durability Factor		90	–	90	–	90	–
		Mass Loss (%)		–	6.0	–	6.0	–	6.0
[1] Not applicable to vertical and overhead repair applications.									

M4.04.3: Mortar Products for Unit Masonry

Mortar products for unit masonry shall meet the requirements and performance criteria of the product's technical data sheet and Type M specified in ASTM C270 Standard Specification for Mortar for Unit Masonry. Field proportioned cement mortar for laying brick and block shall be composed of 1 part Portland cement and 2 parts of fine aggregate by volume with a sufficient amount of water to form a workable mixture, while still achieving the properties specified herein.

M4.04.4: Grout Products for Unit Masonry

Grout products for unit masonry shall meet the requirements and performance criteria of the product's technical data sheet and ASTM C476 Standard Specification for Grout for Masonry.

M4.04.5: Non-Shrink Grout Products

Non-shrink grout products are intended for use under applied load, including supporting a structure, transfer medium between load-bearing members, shear keys, and other non-shrink applications, where a change in height below initial placement height is to be avoided. Non-shrink grout products shall meet the requirements and performance criteria of the product's technical data sheet and ASTM C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

SECTION M5: PIPE, CULVERT SECTIONS AND CONDUIT

Subsection M5.01.0: Joint Material for Pipe
Replace M4.02.15 Cement Mortar with M4.04.0 Grout, Mortar, and Concrete Products in paragraph B.

SECTION M8: METALS AND RELATED MATERIALS

Subsection M8.18.1: Traffic Signal Supports
Delete the heading Posts and the two paragraphs under it. Delete the heading Bases and the three paragraphs under it.

SECTION M9: MISELLANEOUS MATERIALS

Subsection M9.14.5: Elastomeric Bridge Bearing Pads
Replace this subsection with the following:

M9.14.5: Elastomeric Bearing Pads

A. General Requirements

Elastomeric bearing pads shall be plain or laminated. They shall meet the applicable requirements of AASHTO M 251, the MassDOT Bridge Manual, and the AASHTO LRFD Bridge Design and Construction Specifications. The type of bearing will be specified on the plans.

Laminated elastomeric bearing pads consist of layers of elastomers restrained at their interfaces by bonded metal laminates.

B. Material Requirements

Plain elastomeric bearing pads shall consist of elastomer.

Laminated elastomeric bearing pad shall consist of:

- Elastomer
- Internal Steel Laminates
- Tapered Internal Load Plates (if used)

The components of the elastomeric bearing pad shall conform to AASHTO M 251 and the following:

- The elastomer compound shall be 100% virgin neoprene and classified as being of low-temperature grade 3.
- The steel laminates shall meet the requirements of ASTM A 1011 Grade 36 or higher

C. Material Qualification

Elastomeric bearing pads shall be approved on a project basis. The Contractor shall furnish to the Research and Materials Section certified independent test reports demonstrating conformance. All testing shall be performed by the same independent lab in accordance with Subsection M9.14.5G.

D. Fabricators

Bearing shall be fabricated by a fabricator listed on the MassDOT Qualified Construction Materials List (QCML).

E. Fabrication

Fabrication shall not begin until the shop drawings have been approved and the Department has an inspector at the fabricator's facility.

The shop drawings shall specify bearing dimensions as shown on the plans and, where applicable, shall include:

- Elastomer thickness and edge cover,
- Number and thickness of steel reinforcing laminates,
- Dimensions of load plates (if any),
- Design shear modulus of the elastomer shall be as shown on the Plans.

Plain elastomeric bearing pads shall be fabricated and tested in accordance with the "Method A" design outlined in the AASHTO LRFD Bridge Design Specifications.

Laminated elastomeric bearing pads shall be fabricated and tested in accordance with the "Method B" design outlined in the AASHTO LRFD Bridge Design Specifications.

The manufacturer shall designate the bearings in each Lot, as described in Subsection M9.14.5G, and certify that each bearing in the Lot was manufactured in a reasonably continuous manner from the same batch of elastomer and cured under the same conditions. In addition, the manufacturer shall certify that each bearing in the Lot satisfies the requirements of this specification, AASHTO M 251, the AASHTO LRFD Bridge Construction Specifications, and the contract plans and documents.

The tolerances on the overall dimensions for the bearings shall be according to Table 2 of AASHTO M 251, except that the tolerance on the overall vertical dimension shall be limited to 0, +1/8" regardless of the design thickness.

All steel included in the final bearing product must conform to Buy America Requirements.

F. Packaging, Handling, & Storage

The bearing pads shall be packaged, handled, and stored as specified below:

Prior to shipment from the point of manufacture, bearings shall be packaged in such a manner to ensure that during shipment and storage the bearings will be protected against damage from handling, weather, or any normal hazard. Each completed bearing shall have its components clearly identified, be securely bolted, strapped, or otherwise fastened to prevent any relative movement, and be marked on it top as to location and orientation in each structure in the project in conformity with the contract documents.

Each elastomeric bearing shall be marked in indelible ink or flexible paint. The marking shall consist of the order number, lot number, bearing identification number, and elastomer type and grade per AASHTO M 251. For bearing pads fabricated with a tapered internal load plate, a 1/32" deep direction arrow shall be inscribed into the bearing which will allow the bearing to be aligned with the up-station direction. All marks shall be permanent and be visible after the bearing is installed.

G. Testing Requirements

Quality Control System

Fabricators shall perform Quality Control (QC) testing in accordance with their quality system. QC test reports shall accompany the bearing pads when delivered to the project.

Acceptance System

MassDOT will evaluate the fabricator's quality system and QC test reports. It will also perform its own testing and verify the independent laboratory's test reports, if applicable.

Lot Sizes

Sampling of bearing pads for testing shall be random and performed on a Lot basis. A Lot of bearings shall be a group of 100 or fewer bearings that are:

- For a single contract,
- Cured under the same conditions,
- The same size and configuration,
- Manufactured in a reasonably continuous manner from the same batch of elastomer.

Testing of Plain Bearings

Testing Laboratory

Plain elastomeric bearing pads shall be tested by both an independent laboratory and MassDOT:

- Independent testing shall be performed by a nationally recognized third-party laboratory approved by the Research & Materials Section.
- Acceptance testing shall be performed by the Research and Materials.

Sampling Frequency

Each Lot of plain bearings shall be randomly sampled for testing. The Contractor shall ensure that the fabricator produces the additional bearings required for testing.

Samples for independent testing shall be selected by the fabricator. The sampling rate for the independent

testing shall be as follows:

- Lot sizes less than 10 bearings – One full-size bearing per Lot.
- Lot sizes greater than or equal to 10 bearings – Two full-size bearings per lot.

Samples for Acceptance testing shall be selected by the Engineer. The sampling rate for Acceptance testing shall be one bearing pad per lot.

Testing Requirements

The laboratory shall test the bearings in accordance with Sections 8 and 9 of AASHTO M 251 as specified below:

1. Dimensions per Section 8.4.
2. Elastomer per Section 8.6.
    - The hardness, tensile strength, and ultimate elongation shall be in accordance with Table 1 of AASHTO M 251.
3. Test procedures per Section 8.9.
    - Heat resistance per Section 8.9.3.

Testing of Laminated Bearings

Testing Laboratory

Laminated elastomeric bearing pads shall be tested by both an independent laboratory and MassDOT:

- Independent testing shall be performed by a nationally recognized third-party laboratory approved by the Research & Materials Section.
- Acceptance testing shall be performed by the Research and Materials.

Sampling Frequency

Each Lot of laminated bearings shall be randomly sampled for testing. The Contractor shall ensure that the fabricator produces the additional bearings required for testing.

Samples for independent testing shall be selected by the fabricator. The sampling rate for the independent testing shall be as follows:

- Lot sizes less than 10 bearings – One full-size bearing per Lot.
- Lots sizes greater than or equal to 10 bearings:
    - One full-size bearing per every twenty per lot, or a minimum of two bearings.
    - The number of laminated bearings to sample shall be determined by taking the Lot size divided by 20. If the integer part of this calculation is 0 or 1, then two bearings shall be sampled. For example, if the lot size is 58 laminated bearings, two bearings shall be sampled; if the lot size is 65, three bearings shall be sampled; and if the lot size is 22, two bearings shall be sampled.

Samples for Acceptance testing shall be selected by the Engineer. The sampling rate for Acceptance testing shall be one bearing pad per lot.

Testing Requirements

Testing of the bearings shall be in accordance with Sections 8 and 9 of AASHTO M 251 as specified below:

1. Dimensions per Section 8.4.
2. Elastomer per Section 8.6.
    - The hardness, tensile strength, and ultimate elongation shall be in accordance with Table 1 of AASHTO M 251.
3. Compressive strain at the maximum design dead plus live service compressive load per Section 8.8.1.1.

- The compressive deflection, as determined per Section 9.1., between the two loadings for each bearing tested shall not exceed 10%.

4. Bond via Compressive Load per Section 8.8.2.2.
5. Shear Modulus of the elastomer per Section 8.8.3.
    - Shear modulus shall meet the requirements on the plans.
6. Test procedures per Section 8.9.
    a. Additional Low Temperature Shear Modulus testing per Section 8.9.1.
    b. Heat resistance per Section 8.9.3.
    c. Compression set per Section 8.9.4.
    d. Creep per Section 8.9.5.
        - The percent creep shall be less than 35%.
    e. Long Term Compression per Section 8.9.6.

Table M9.14.5-1: Department Acceptance Testing of Elastomeric Bearing Pads

Quality Characteristic	**Test Method**	**Requirement**
Hardness	ASTM D2240	From Independent Test Results ± 5 Pts
Tensile Strength	ASTM D412	≥ 2250 psi
Ultimate Elongation	ASTM D412	Minimum Elongation Based on Durometer according to AASHTO M 251 Table 1
Shear Modulus (see Note 1)	ASTM D4014	Specified Value ± 15%
After Heat Aging for 70 Hours at 100°C (Maximum Change from Unaged Testing)		
Hardness	ASTM D573	Hardness + 15 Pts
Tensile Strength	ASTM D573	Tensile Strength - 15%
Ultimate Elongation	ASTM D573	Ultimate Elongation - 40%
Note 1: Test is only required for laminated elastomeric bearing pads.		

SECTION M10: TRAFFIC CONTROL DEVICES

Subsection M10.05.0: Traffic Signal Structures (General)
Add this new subsection.

M10.05.0: Traffic Signal Structures (General)

The bases of all Traffic Signal Structures shall be supplied with a bonding lug.

Subsection M10.05.1: Signal Posts and Bases
Add this new subsection.

M10.05.1: Signal Posts and Bases

All Signal Posts shall be one-piece 4-in. diameter, Schedule 40 or Schedule 80, and machine-threaded.

Signal Posts may be fabricated from aluminum with a brushed or spun finish or from steel with a galvanized finish.

The interior of Signal Posts shall be coated as specified in Underwriters Laboratories UL-6 for enameled conduit, or aluminum conduit conforming to M5.07.1: Electrical Conduit-Rigid Metallic (Type RM), Paragraph C.

Signal Posts Bases shall be fabricated to accept the threads from the Signal Post and locked into place with set screws.

Signal Post Bases shall be fabricated from aluminum with a natural or anodized finish or galvanized cast iron.

Signal Post Bases shall be square or octagonal.

Signal Posts and Bases conform to Table M10.05.1-1.

Table M10.05.1-1: Signal Post and Base Material Requirements

Component	Material	Specification
Signal Post	Aluminum	6063-T6 (ASTM B221, B429 or B241)
Signal Post	Steel	ASTM A53, Grade A or B
Signal Post Base	Aluminum	356.0-T6 (ASTM B26, B108)
Signal Post Base	Cast Iron	AASHTO M 105

Subsection M10.11.0: RRFB Assemblies
Add this new subsection.

M10.11.0: RRFB Assemblies

Rectangular Rapid Flashing Beacon (RRFB) Assemblies shall consist of a Light Bar and an enclosure for the Controller and Activation Unit.

Light Bar

The Light Bar shall consist of two rapidly-flashed rectangular-shaped yellow indications, each with an LED-array based pulsing light source. The size of each RRFB indication shall conform to the Construction Standard Details.

The light intensity of the yellow indications during daytime conditions shall meet the minimum specifications for Class 1 yellow peak luminous intensity in the publication "Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles J595," 2005, Society of Automotive Engineers (SAE). A photocell or equivalent device shall be included to reduce the brilliance of the LED beacons during nighttime conditions.

Controller and Activation Unit

The enclosure for the Controller and Activation Unit shall be NEMA rated for outdoor use and protection against rain and sleet.

The Controller and Activation Unit shall be powered by a DC battery/solar array system or a 120 VAC service connection.

The Controller and Activation Unit shall be actuated by a pedestrian pushbutton, a passive pedestrian detection device, or both.

Communications between multiple units within the same system shall be via a 900MHz or 2.4 GHz frequency hopping spread spectrum with a minimum range of 200 ft. Multiple channels shall be available to prevent cross-communication between multiple systems located close to each other.

The Controller shall be programmable via an on-board user interface or a no-fee wireless (Wi-Fi, Bluetooth®, etc.) connection and application.

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END OF SUPPLEMENTAL SPECIFICATIONS

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DOCUMENT 00719

(Revised September 14, 2023 – for all Federally Aided Projects)

SPECIAL PROVISIONS FOR PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES

(IMPLEMENTING TITLE 49 OF THE CODE OF FEDERAL REGULATIONS, PART 26)

Section: Page 00719-

POLICY

The Massachusetts Department of Transportation (MassDOT) receives Federal financial assistance from the Federal Highway Administration (FHWA), United States Department of Transportation (U.S. DOT), and as a condition of receiving this assistance, has signed an assurance that it will comply with 49 CFR Part 26 (Participation By Disadvantaged Business Enterprises In Department Of Transportation Financial Assistance Programs). The U.S. DOT Disadvantaged Business Enterprise Program is authorized by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users ("SAFETEA-LU"), as amended, at Title 23, United States Code, § 1101.

Accordingly, MassDOT has established a Disadvantaged Business Enterprise (DBE) Program in accordance with 49 CFR Part 26. It is the policy of MassDOT to ensure that DBEs have an equal opportunity to receive and participate in U.S. DOT assisted Contracts, without regard to race, color, national origin, or sex. To this end, MassDOT shall not directly, or through contractual or other arrangements, use criteria or methods of administration that have the effect of defeating or substantially impairing accomplishment of the program objectives stated below:

- To ensure nondiscrimination in the award and administration of U.S. DOT assisted Contracts;
- To create a level playing field on which DBEs can compete fairly for U.S. DOT assisted Contracts;
- To ensure that the DBE Program is narrowly tailored in accordance with applicable law;
- To ensure that only firms that fully meet 49 CFR Part 26 eligibility standards are permitted to participate as DBEs;
- To help remove barriers to the participation of DBEs in U.S. DOT assisted Contracts; and
- To assist the development of firms that can compete successfully in the market place outside the DBE Program.

The Director of Civil Rights of MassDOT has been designated as the DBE Liaison Officer. The DBE Liaison Officer is responsible for implementing all aspects of the DBE Program. Other MassDOT employees are responsible for assisting the Office of Civil Rights in carrying out this obligation. Implementation of the DBE Program is accorded the same priority as compliance with all other legal obligations incurred by MassDOT in its financial assistance agreements with each operating administration of the U.S. DOT. Information on the Federal requirements and MassDOT's policies and information can be found at:

Type of Info	***Website***	***Description***
MassDOT Highway Division Policies and Info	https://www.mass.gov/disadvantaged-business-enterprise-goals-2019-2022	*MassDOT–Highway Div'n Page*
For copies of the Code of Federal Regulations	http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR	FDsys – US Gov't Printing Office
For information about the U.S.DOT DBE Program	https://www.transportation.gov/civil-rights/disadvantaged-business-enterprise	U.S. DOT/ FHWA page

1. DEFINITIONS

As used in these provisions, the terms set out below are defined as follows:

"Broker", for purposes of these provisions, shall mean a DBE Entity that has entered into a legally binding relationship to provide goods or services delivered or performed by a third party. A broker may be a DBE Entity that arranges or expedites transactions but performs no work or installation services.

"Contractor", "General" or "Prime" Contractor, "Bidder," and "DB Entity" shall mean a person, firm, or other entity that has contracted directly with MassDOT to provide contracted work or services.

"Contract" shall mean the Contract for work between the Contractor and MassDOT.

"DBB" or "Design-Bid-Build" shall mean the traditional design, bid and project delivery method consisting of separate contracts between awarding authority and a designer resulting in a fully designed project; and a separate bidding process and Contract with a construction Contractor or Bidder.

"DB" or "Design-Build" shall mean an accelerated design, bid and project delivery method consisting of a single contract between the awarding authority and a DB Entity, consisting of design and construction companies that will bring a project to full design and construction.

"Disadvantaged Business Enterprise" or "DBE" shall mean a for-profit, small business concern:

(a) that is at least fifty-one (51%) percent owned by one or more individuals who are both socially and economically disadvantaged, or, in the case of any corporation, in which at least fifty-one (51%) percent of the stock is owned by one or more such individuals; and

(b) where the management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

"FHWA" shall mean the Federal Highway Administration," an agency within U.S. DOT that supports State and local governments in the design, and maintenance of the Nation's highway system (Federal Aid Highway Program).

"Good faith efforts" shall mean efforts to achieve a DBE participation goal or other requirement of these Special Provisions that, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement. Such efforts must be deemed acceptable by MassDOT.

"Joint Venture" shall mean an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which the parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the Contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

"Approved Joint Venture" shall mean a joint venture, as defined above, which has been approved by MassDOT's Prequalification Office and Office of Civil Rights for DBE participation on a particular Contract.

"Manufacturer" shall mean a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles or equipment required under the contract and of the general character described by the specifications.

"Regular Dealer" shall mean a DBE firm that owns, operates, or maintains a store, warehouse, or other establishment in which materials, supplies, articles or equipment of the general character described by the specifications and required under the Contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.

(a) To be a regular dealer, the firm must be an established, regular business that engages, as its principal business, and under its own name, in the purchase and sale of the products in question.

(b) A person may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business as provided above if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by long term lease agreement and not on an ad hoc or contract by contract basis.

(c) Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not regular dealers within the meaning of this definition.

"Responsive" and "Responsible" refers to the bidder's submittal meeting all of the requirements of the advertised request for proposal. The term responsible refers to the ability of the Contractor to perform the work. This ability can be determined prior to bid invitations.

"Small Business or Small Business Concern" shall mean a small business concern or company as defined in Section 3 of the Small Business Act and SBA regulations implementing it (13 CFR Part 121); and is a business that does not exceed the cap on annual average gross receipts established by the U.S. Secretary of Transportation pursuant to 49 CFR Part 26.65; see also 49 CFR Part 26.39.

"SDO" shall mean the Massachusetts Supplier Diversity Office, formerly known as the State Office of Minority and Women Business Assistance (SOMWBA). In 2010, SOMWBA was abolished and the SDO was established. *See* St. 2010, c. 56. The SDO has assumed all the functions of SOWMBA. SDO is an agency within the Commonwealth of Massachusetts Executive office of Administration and Finance (ANF) Operational Services Division (OSD). The SDO mandate is to help promote the development of business enterprises and non-profit organizations owned and operated by minorities and women.

"Socially and economically disadvantaged individuals" shall mean individuals who are citizens of the United States (or lawfully admitted permanent residents) and who are:

(a) Individuals found by SDO to be socially and economically disadvantaged individuals on a case by case basis.

(b) Individuals in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

(1) "Black Americans" which includes persons having origin in any of the Black racial groups of Africa; (2) "Hispanic Americans" which include persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race; (3) "Native Americans" which include persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians; (4) "Asian Pacific Americans" which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Tuvalu, Nauru, Federated States of Micronesia, or Hong Kong; (5) "Subcontinent Asian Americans" which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka; (6) Women; or (7) Any additional groups whose members are designated as socially and economically disadvantaged by the Small Business Administration (SBA), at such time as the SBA designation becomes effective.

Other terms and definitions applicable to the U.S. DOT DBE Program may be found at 49 CFR Part 26 and related appendices and guidance pages.

2. DBE PARTICIPATION

a. Goal

On this Contract, MassDOT has established the following goal(s) for participation by firms owned and controlled by socially and economically disadvantaged persons. At least half of the goal must be met in the form of DBE Subcontractor construction activity as opposed to material supplies or other services. The applicable goal remains in effect throughout the life of the contract regardless of whether pre-identified DBE Subcontractors remain on the Project or under Contract.

☒ Design-Bid-Build Projects: DBE Participation Goal **12 %**
(*One half of this goal shall be met in the form of Subcontractor construction activity*)

☐ Design-Build Projects: DBE Design Participation Goal ____**%** and DBE Construction Participation Goal **%**
(One half of the Construction Goal shall be met in the form of Subcontractor construction activity)

b. Bidders List

Pursuant to the provisions of 49 CFR Part 26.11(c), Recipients such as MassDOT, must collect from all Bidders who seek work on Federally assisted Contracts the firm full company name(s), addresses and telephone numbers of all firms that have submitted bids or quotes to the Bidders in connection with this Project. All bidders should refer to the Special Provision Document "A00801" of the Project proposal for this requirement.

In addition, MassDOT must provide to U.S. DOT, information concerning contractors firm status as a DBE or non-DBE, the age of the firm, and the annual gross receipts of the firm within a series of brackets (e.g., less than $500,000; $500,000–$1 million; $1–2 million; $2–5 million, etc.). The status, firm age, and annual gross receipt information will be sought by MassDOT regularly prior to setting its DBE participation goal for submission to U.S. DOT. MassDOT will survey each individual firm for this information directly.

Failure to comply with a written request for this information within fifteen (15) business days may result in the suspension of bidding privileges or other such sanctions, as provided for in Section 9 of this provision, until the information is received.

3. CONTRACTOR ASSURANCES

No Contractor or any Subcontractor shall discriminate on the basis of race color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in all respects and as applicable prior to, or subsequent to, award of U.S. DOT assisted Contracts. The Contractor agrees to affirmatively seek out and consider DBE firms as Contractors, Subcontractors, and/or suppliers of materials and services for this Contract. No Contract will be approved until MassDOT has reviewed Bidders'/Contractors' affirmative actions concerning DBEs. Failure to carry out these requirements is a material breach of this Contract which may result in the termination of the Contract or such other remedy as MassDOT or FHWA deem appropriate.

4. REQUIRED SUBCONTRACT PROVISIONS

The Prime Contractor shall include the provisions of Section 3 above in every subcontract, making those provisions binding on each Subcontractor; in addition, the Prime Contractor shall include a copy of this Special Provision, in its entirety, in every subcontract with a DBE firm which is, or may be, submitted for credit toward the Contract participation goal.

5. ELIGIBILITY OF DBES

Only firms that have been certified by SDO and confirmed by MassDOT as eligible in accordance with 49 CFR Part 26 to participate as DBEs on federally aided MassDOT Contracts may be used on this Contract for credit toward the DBE participation goal.

a. Massachusetts DBE Directory

MassDOT makes available to all bidders the most current Massachusetts Disadvantaged Business Enterprise Directory. This directory is made available for Contractors' convenience and is informational only. The Directory lists those firms that have been certified as eligible in accordance with the criteria of 49 CFR Part 26 to participate as DBEs on federally aided MassDOT contracts. The Directory also lists the kinds of work each firm is certified to perform but does not constitute an endorsement of the quality of performance of any business and does not represent MassDOT Subcontractor approval.

Contractors are encouraged to make use of the DBE Directory maintained by SDO on the Internet. This listing is updated daily and may be accessed at the SDO's website at:
https://www.diversitycertification.mass.gov/BusinessDirectory/BusinessDirectorySearch.aspx

b. DBE Certification

A firm must apply to SDO, currently acting as certification agent for MassDOT, for DBE certification to participate on federally aided MassDOT Contracts. A DBE application may be made in conjunction with a firm's application to SDO for certification to participate in state-funded minority and women business enterprise programs or may be for DBE certification only. An applicant for DBE certification must identify the area(s) of work it seeks to perform on U.S. DOT funded projects.

c. Joint Venture Approval

To obtain recognition as an approved DBE Joint Venture, the parties to the joint venture must provide to MassDOT's Office of Civil Rights and Prequalification Office, at least fourteen (14) business days before the bid opening date, an Affidavit of DBE/Non-DBE Joint Venture in the form attached hereto, and including, but not limited to the following:

1. a copy of the Joint Venture Agreement;
2. a description of the distinct, clearly defined portion of the contract work that the DBE will perform with its own forces; and,
3. all such additional information as may be requested by MassDOT for the purpose of determining whether the joint venture is eligible.

6. COUNTING DBE PARTICIPATION TOWARDS DBE PARTICIPATION GOALS

In order for DBE participation to count toward the Contract participation goal, the DBE(s) must have served a commercially useful function in the performance of the Contract and must have been paid in full for acceptable performance.

a. Commercially Useful Function

(1) In general, a DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. With respect to materials and supplies used on the Contract, the DBE must be responsible for negotiating price, determining quality and quantity, ordering the material, installing (where applicable) and paying for the material itself.

(2) To determine whether a DBE is performing a commercially useful function, MassDOT will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the Contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and other relevant factors.

(3) A DBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation. In determining whether a DBE is such an extra participant, MassDOT will examine similar transactions, particularly those in which DBEs do not participate.

b. Counting Participation Toward The Contract Participation Goal

DBE participation which serves a commercially useful function shall be counted toward the DBE participation goal in accordance with the Provisions of 49 CFR Part 26.55(a) to (h), as follows:

(1) When a DBE participates in a construction Contract, MassDOT will count the value of the work performed by the DBE's own forces. MassDOT will count the cost of supplies and materials obtained by the DBE for the work of its contract, including supplies purchased or equipment leased by the DBE. Supplies, labor, or equipment the DBE Subcontractor uses, purchases, or leases from the Prime Contractor or any affiliate of the Prime Contractor will not be counted.

(2) MassDOT will count the entire amount of fees or commissions charged by a DBE firm for providing bona fide services, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a U.S. DOT assisted Contract, toward DBE participation goals, provided it is determined that the fee is reasonable and not excessive as compared with fees customarily allowed for similar services.

(3) When a DBE performs as a participant in a joint venture, MassDOT will count toward DBE participation goals a portion of the total dollar value of the contract that is equal to the distinct, clearly defined portion of the work of the Contract that the DBE performs with its own forces.

(4) MassDOT will use the following factors in determining whether a DBE trucking company is performing a commercially useful function:

(i) the DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract; there cannot be a contrived arrangement for the purpose of meeting DBE participation goals.

(ii) the DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the Contract.

(iii) the Contractor will receive DBE credit for the total value of the transportation services the DBE provides on the Contract using trucks owned, insured, and operated by the DBE itself and using drivers the DBE employs alone.

(iv) the DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The Contractor who has a contract with a DBE who leases trucks from another DBE will receive credit for the total value of the transportation services of the lease.

(v) the DBE may also lease trucks from a non-DBE firm, including an owner-operator. The Contractor who has a Contract with a DBE who leases trucks from a non-DBE is entitled to credit for the total value of the transportation services provided by non-DBE lessees not to the exceed the value of transportation services provided by DBE-owned trucks on the Contract. Additional participation by non-DBE lessees receives credit only for the fee or commission it receives as a result of the lease arrangement, fee or commission it receives as a result of the lease arrangement. The DBE does not receive credit for the total value of the transportation services provided by the lessee, since these services are not provided by a DBE.

(vi) the lease must indicate that the DBE has exclusive use of, and control over, the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

(5) MassDOT will count the Prime Contractor's expenditures with DBEs for materials or supplies toward DBE participation goals as follows:

(i) if the materials or supplies are obtained from a DBE manufacturer, as defined in Section 1 above, MassDOT will count one hundred (100%) percent of the cost of the materials or supplies toward DBE participation goals, provided the DBE meets the other requirements of the regulations.

(ii) if the materials or supplies are purchased from a DBE regular dealer, as defined in Section 1 above, MassDOT will count sixty (60%) percent of the cost of the materials or supplies toward the Contract participation goal, provided the DBE meets the other requirements of the regulations.

(iii) for materials or supplies purchased from a DBE which is neither a manufacturer nor a regular dealer, MassDOT will count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site toward the Contract participation goal, provided that MassDOT determines the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services; the cost of the materials and supplies themselves will not be counted; and provided the DBE meets the other requirements of the regulations.

c. Joint Check Policy

MassDOT recognizes that the use of joint checks may be a business practice required by material suppliers and vendors in the construction industry. A joint check is a two-party check issued by a/the Prime Contractor to a DBE third party such as a regular dealer of material or supplies. The Prime Contractor issues the check as payor to the DBE and the third party jointly as payees to guarantee payment to the third party for materials or supplies obtained or to be used by the DBE. FHWA has established criteria to ensure that DBEs are in fact performing a commercially useful function ("CUF") while using a joint check arrangement. Contractors and DBEs must meet and conform to these conditions and criteria governing the use of joint checks.

In the event that a Contractor or DBE Subcontractor desires to a use joint check, MassDOT will require prior notice and will closely monitor the arrangement for compliance with FHWA regulations and guidance. MassDOT may allow a joint check arrangement and give credit to a Contractor for use of the DBE where one or more of the following conditions exist:

- The use of a joint check is in fact required by this type of vendor or supplier as a standard industry practice that applies to all Contractors (DBEs and non-DBEs); or is required by a specific vendor or supplier;
- Payment for supplies or materials would be delayed for an unreasonably extended period without the joint check arrangement;
- The DBE (or any of its Subcontractors) has a pattern or history of not paying a vendor or supplier within a reasonable time or has not established enough of a credit history with the supplier or vendor; and/or
- The presence of severe adverse economic conditions, where credit resources may be limited and such practices may be necessary or required to effect timely payments.

Other factors MassDOT may consider:

- Whether there is a requirement by the Prime Contractor that a DBE should use a specific vendor or supplier to meet their Subcontractor specifications;
- Whether there is a requirement that a DBE use the Prime Contractor's negotiated price;
- The independence of the DBE;
- Whether approval has been sought prior to use of a joint check arrangement; and
- Whether any approved joint check arrangement has exceeded a reasonable period of use;
- The operation of the joint check arrangement; and
- Whether the DBE has made an effort to establish alternate arrangements for following periods (i.e., the DBE must show it can, or has, or why it has not, established or increased a credit line with the vendor or supplier).

Even with the use of a Joint Check, both the Contractor and DBE remain responsible for compliance with all other elements under 49 CFR § 26.55 (c) (1), and must still be able to prove that a commercially useful function is being performed for the Contractor.

d. Joint Check Procedure(s)

- The DBE advises its General or Prime Contractor that it will have to use a Joint Check and provide proof of such requirement.
- The General or the Prime Contractor submits a request for approval to MassDOT, using MassDOT's approved Joint Check Request form (Document B00855) and by notification on the DBE Letter of Intent (Document B00854), and any other relevant documents. Requests that are not initiated during the bid process should be made in writing and comply with the procedure.
- The MassDOT Office of Civil Rights will review the request and render a decision as part of the approval process for DBE Schedules and Letters of Intent.
- Review and Approval will be project specific and relevant documents will be made part of the project Contract file.
- Payments should be made in the name of both the DBE and vendor or supplier. Payments should be issued and signed by the Contractor as only the guarantor for prompt payment of purchases to the vendor or supplier. The payment to the vendor or supplier should be handled by the DBE (i.e. if possible, funds or the joint check should be processed by the DBE and sent by the DBE to the vendor or supplier).
- MassDOT may request copies of cancelled checks (front and back) and transmittal information to verify any payments made to the DBE and vendor or supplier.
- MassDOT may request other information and documents, and may ask questions of the Contractor, Subcontractor and vendor or supplier prior to, during, and after the project performance to ascertain whether the Subcontractor is performing a commercially useful function and all parties are complying with DBE Program policies and procedures as part of the Subcontractor approval process.

7. AWARD DOCUMENTATION AND PROCEDURES

a. The two lowest bidders/the two bidders with the lowest price per quality score point, shall submit, by the close of business on the third (3rd) business day after the bid opening, a completed Schedule of Participation by DBEs (Document B00853) which shall list:

(1) The full company name, address and telephone number of each DBE with whom the bidder intends to make a commitment.

(2) The contract item(s), by number(s) and quantity(ies), if applicable, or specific description of other business activity to be performed by each DBE as set forth in the Letters of Intent. The Bidder shall list only firms which have the capacity to perform, manage and supervise the work proposed in accordance with the requirements of 49 CFR Part 26 and Section **6.b** of these Special Provisions.

(3) The total dollar amount to be paid to each DBE. (Bidders are cautioned that at least one half of the participation goal must be met with construction activity work.)

(4) The total dollar amount to be paid to each DBE that is eligible for credit toward the DBE participation goal under the counting rules set out in Section **6.b**.

(5) The total creditable DBE participation as a percentage of the total bid price.

b. All firms listed on the Schedule must be currently certified.

c. The two lowest bidders/the two bidders with the lowest price per quality score point, shall each submit, with their Schedules of Participation, fully completed, signed Letters of Intent (Document B00854) from each of the DBEs listed on the Schedule. The Letters of Intent shall be in the form attached and shall identify specifically the contract activity the DBE proposes to perform, expressed as contract item number, if applicable, description of the activity, NAICS code, quantity, unit price and total price. In the event of discrepancy between the Schedule and the Letter of Intent, the Letter of Intent shall govern.

d. Evidence of good faith efforts will be evaluated by MassDOT in the selection of the lowest responsible bidder.

All information requested by MassDOT for the purpose of evaluating the Contractor's efforts to achieve the participation goal must be provided within three (3) calendar days and must be accurate and complete in every detail. The apparent low bidder's attainment of the DBE participation goal or a satisfactory demonstration of good faith efforts is a prerequisite for award of the Contract.

e. Failure to meet, or to demonstrate good faith efforts to meet, the requirements of these Special Provisions shall render a bid non-responsive. Therefore, in order to be eligible for award, the bidder (1) must list all DBE's it plans to employ on the Schedule of Participation; and provide the required Letters of Intent for, DBE participation which meets or exceeds the Contract goal in accordance with the terms of these Special Provisions or (2) must demonstrate, to the satisfaction of MassDOT, that good faith efforts were made to achieve the participation goal. MassDOT will adhere to the guidance provided in Appendix A to 49 CFR Part 26 on the determination of a Contractor's good faith efforts to meet the DBE participation goal(s) set forth in Section 2 herein.

f. If MassDOT finds that the percentage of DBE participation submitted by the bidder on its Schedule does not meet the Contract participation goal, or that Schedule and Letters of Intent were not timely filed, and that the bidder has not demonstrated good faith efforts to comply with these requirements, it shall propose that the bidder be declared ineligible for award. In that case, the bidder may request administrative reconsideration. Such requests must be sent in writing within three (3) calendar days of receiving notice of proposed ineligibility to: The Office of the General Counsel, Massachusetts Department of Transportation, 10 Park Plaza, Boston, MA, 02116.

g. If, after administrative reconsideration, MassDOT finds that the bidder has not shown that sufficient good faith efforts were made to comply with the requirements of these Special Provisions, it shall reject the bidder's proposal and may retain the proposal guaranty.

h. Actions which constitute evidence of good faith efforts to meet a DBE participation goal include, but are not limited to, the following examples, which are set forth in 49 CFR Part 26, Appendix A:

(1) Soliciting through all reasonable and available means (e.g., attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the Contract. The bidder must solicit this interest within sufficient time to allow the DBEs to respond to the solicitation. The bidder must determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.

(2) Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE participation goal will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Prime Contractor might otherwise prefer to perform these work items with its own forces.

(3) Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

(4) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE Subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE Subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone number of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.

A bidder using good business judgment would consider a number of factors in negotiating with Subcontractors, including DBE Subcontractors, and would take a firm's price and capabilities as well as Contract participation goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the Contract DBE participation goal, as long as such costs are reasonable. Also, the ability or desire of a Prime Contractor to perform the work of a Contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Prime Contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

(5) Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. Contractors should be careful of adding additional requirements of performance that would in effect limit participation by DBEs or any small business. The Contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. nonunion employee status) are not legitimate causes for the rejection or non-solicitation of bids in the Contractor's efforts to meet the Contract participation goal.

(6) Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

(7) Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.

(8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case by case basis to provide assistance in the recruitment and placement of DBEs.

8. COMPLIANCE

a. All activity performed by a DBE for credit toward the Contract participation goal must be performed, managed and supervised by the DBE in accordance with all commercially useful function requirements of 49 CFR Part 26. The Prime Contractor shall not enter into, or condone, any other arrangement.

b. The Prime Contractor shall not perform with its own organization, or assign to any other business, an activity designated for the DBE(s) named on the Schedule(s) submitted by the Prime Contractor under Section 7 or under paragraph **8.f** of this section, without the approval of MassDOT in accordance with the requirements of paragraphs **8.f** and **8.j** of this section.

c. MassDOT may suspend payment for any activity that was not performed by the DBE to whom the activity was committed on the approved Schedule of Participation, or that was not performed in accordance with the requirements of Section 6.

d. MassDOT retains the right to approve or disapprove of any or all Subcontractors. Requests by the Prime Contractor for approval of participation by a DBE Subcontractor for credit toward the Contract participation goal must include, in addition to any other requirements for Subcontractor approval, the following:

(1) A copy of the proposed subcontract. The subcontract must be for at least the dollar amount, and for the work described, in the Bidder's Schedule of Participation.

(2) A resume stating the qualifications and experience of the DBE Superintendent and/or foreperson who will supervise the on-site work. A new resume will be required for any change in supervisory personnel during the progress of the work.

(3) A Schedule of Operations indicating when the DBE is expected to perform the work.

(4) A list of (1) equipment owned by the DBE to be used on the Project, and (2) equipment to be leased by the DBE for use on the Project.

(5) A list of: (1) all projects (public and private) which the DBE is currently performing; (2) all projects (public and private) to which the DBE is committed; and (3) all projects (public and private) to which the DBE intends to make a commitment. For each Contract, list the contracting organization, the name and telephone number of a contact person for the contracting organization, the dollar value of the work, a description of the work, and the DBE's work schedule for each project.

e. If, pursuant to the Subcontractor approval process, MassDOT finds that a DBE Subcontractor does not have sufficient experience or resources to perform, manage and supervise work of the kind proposed in accordance with the requirements of 49 CFR Part 26, approval of the DBE Subcontractor may be denied. In the event of such denial, the Prime Contractor shall proceed in accordance with the requirements paragraphs **8.f** and **8.j** of this section.

f. If, for reasons beyond its control, the Prime Contractor cannot comply with its DBE participation commitment in accordance with the Schedule of Participation submitted under Section 7, the Prime Contractor shall submit to MassDOT the reasons for its inability to comply with its obligations and shall submit, and request approval for, a revised Schedule of Participation. If approved by MassDOT, the revised Schedule shall govern the Prime Contractor's performance in meeting its obligations under these Special Provisions.

g. A Prime Contractor's compliance with the participation goal in Section 2 shall be determined by reference to the established percentage of the total contract price, provided, however, that no decrease in the dollar amount of a bidder's commitment to any DBE shall be allowed without the approval of MassDOT.

h. If the contract amount is increased, the Prime Contractor may be required to submit a revised Schedule of Participation in accordance with paragraphs **8.f** and **8.j** of this section.

i. In the event of the decertification of a DBE scheduled to participate on the Contract for credit toward the participation goal, but not under subcontract, the Contractor shall proceed in accordance with paragraphs **8.f** and **8.j** of this section.

j. The Prime Contractor shall notify MassDOT immediately of any facts that come to its attention indicating that it may or will be unable to comply with any aspect of its DBE obligation under this Contract.

k. Any notice required by these Special Provisions shall be given in writing to: (1) the Resident Engineer; (2) the District designated Compliance Officer; and (3) the DBE Liaison Officer, MassDOT Office of Civil Rights, 10 Park Plaza, – 3rd Floor - West, Boston, MA, 02116 and cc'd to the Deputy Chief of External Programs.

l. The Prime Contractor and its Subcontractors shall comply with MassDOT's Electronic Reporting System Requirements (MassDOT Document 00821) and submit all information required by MassDOT related to the DBE Special Provisions through the Equitable Business Opportunity Solution ("EBO"). MassDOT reserves the right to request reports in the format it deems necessary anytime during the performance of the Contract.

m. Termination of DBE by Prime Contractor

(1) A Prime Contractor shall not terminate a DBE Subcontractor or an approved substitute DBE firm without the prior written consent of MassDOT. This includes, but is not limited to, instances in which a Prime Contractor seeks to perform work originally designated for a DBE Subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm.

(2) MassDOT may provide such written consent only if MassDOT agrees, for reasons stated in its concurrence document, that the Prime Contractor has good cause to terminate the DBE firm.

(3) For purposes of this paragraph, good cause includes the following circumstances:

(i) The DBE Subcontractor fails or refuses to execute a written contract;

(ii) The DBE Subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Good cause, however, does not exist if the failure or refusal of the DBE Subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the Prime Contractor;

(iii) The DBE Subcontractor fails or refuses to meet the Prime Contractor's reasonable, nondiscriminatory bond requirements.

(iv) The DBE Subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;

(v) The DBE Subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1,200 or applicable State law;

(vi) (vii) MassDOT has determined that the listed DBE Subcontractor is not a responsible contractor;

(vii) The listed DBE Subcontractor voluntarily withdraws from the Project and provides written notice of its withdrawal;

(viii) The listed DBE is ineligible to receive DBE credit for the type of work required;

(ix) A DBE owner dies or becomes disabled with the result that the listed DBE Contractor is unable to complete its work on the Contract;

(x) Other documented good cause that MassDOT determines compels the termination of the DBE Subcontractor. Good cause, however, does not exist if the Prime Contractor seeks to terminate a DBE it relied upon to obtain the Contract so that the Prime Contractor can self-perform the DBE work or substitute another DBE or non-DBE Contractor after Contract Award.

(4) Before transmitting to MassDOT a request to terminate and/or substitute a DBE Subcontractor, the Prime Contractor must give notice in writing to the DBE Subcontractor, with a copy to MassDOT, of its intent to request to terminate and/or substitute, and the reason for the request.

(5) The Prime Contractor must give the DBE five (5) business days to respond to the Prime Contractor's notice. The DBE must advise MassDOT and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why MassDOT should not approve the Prime Contractor's action. If required in a particular case as a matter of public necessity (e.g., safety), MassDOT may provide a response period shorter than five (5) business days.

(6) In addition to post-award terminations, the provisions of this section apply to pre-award deletions of or substitutions for DBE firms.

n. Prompt Payment.

Contractors are required to promptly pay Subcontractors under this Prime Contract within ten (10) business days from the receipt of each payment the Prime Contractor receives from MassDOT. Failure to comply with this requirement may result in the withholding of payment to the Prime Contractor until such time as all payments due under this provision have been received by the Subcontractor(s) and/or referral to the Prequalification Committee for action which may affect the Contractor's prequalification status.

9. SANCTIONS

If the Prime Contractor does not comply with the terms of these Special Provisions and cannot demonstrate to the satisfaction of MassDOT that good faith efforts were made to achieve such compliance, MassDOT may, in addition to any other remedy provided for in the Contract, and notwithstanding any other provision in the Contract:

a. Retain, in connection with final acceptance and final payment processing, an amount determined by multiplying the total contract amount by the percentage in Section 2, less the amount paid to approved DBE(s) for work performed under the Contract in accordance with the provisions of Section 8.

b. Suspend, terminate or cancel this Contract, in whole or in part, and call upon the Prime Contractor's surety to perform all terms and conditions in the Contract.

c. In accordance with 720 CMR 5.05(1)(f), modify or revoke the Prime Contractor's Prequalification status or recommend that the Prime Contractor not receive award of a pending Contract. The Prime Contractor may appeal the determination of the Prequalification Committee in accordance with the provisions of 720 CMR 5.06.

d. Initiate debarment proceedings pursuant to M.G.L. c. 29 §29F and, as applicable, 2 CFR Parts 180, 215 and 1,200.

e. Refer the matter to the Massachusetts Attorney General for review and prosecution, if appropriate, of any false claim or pursuant to M.G.L. c. 12, §§ 5A to 5O (the Massachusetts False Claim Act).

f. Refer the matter to the U.S. DOT's Office of the Inspector General or other agencies for prosecution under Title 18, U.S.C. § 1001, 49 CFR Parts 29 and 31, and other applicable laws and regulations.

10. FURTHER INFORMATION; ENFORCEMENT, COOPERATION AND CONFIDENTIALITY.

a. Any proposed DBE, bidder, or Contractor shall provide such information as is necessary in the judgment of MassDOT to ascertain its compliance with the terms of this Special Provision. Further, pursuant to 49 CFR, Part 26.107:

(1) If you are a firm that does not meet the eligibility criteria of 49 CFR, Parts 26.61 to 26.73 ("subpart D"), that attempts to participate in a DOT- assisted program as a DBE on the basis of false, fraudulent, or deceitful statements or representations or under circumstances indicating a serious lack of business integrity or honesty, MassDOT or FHWA may initiate suspension or debarment proceedings against you under 49 CFR Part 29.

(2) If you are a firm that, in order to meet DBE Contract participation goals or other DBE Program requirements, uses or attempts to use, on the basis of false, fraudulent or deceitful statements or representations or under circumstances indicating a serious lack of business integrity or honesty, another firm that does not meet the eligibility criteria of subpart D, FHWA may initiate suspension or debarment proceedings against you under 49 CFR Part 29.

(3) In a suspension or debarment proceeding brought either under subparagraph a.(1) or b.(2) of this section, the concerned operating administration may consider the fact that a purported DBE has been certified by a recipient. Such certification does not preclude FHWA from determining that the purported DBE, or another firm that has used or attempted to use it to meet DBE participation goals, should be suspended or debarred.

(4) FHWA may take enforcement action under 49 CFR Part 31, Program Fraud and Civil Remedies, against any participant in the DBE Program whose conduct is subject to such action under 49 CFR Part 31.

(5) FHWA may refer to the Department of Justice, for prosecution under 18 U.S.C. 1001 or other applicable provisions of law, any person who makes a false or fraudulent statement in connection with participation of a DBE in any DOT-assisted program or otherwise violates applicable Federal statutes.

b. Pursuant to 49 CFR Part 26.109, the rules governing information, confidentiality, cooperation, and intimidation or retaliation are as follows:

(1) Availability of records.

(i) In responding to requests for information concerning any aspect of the DBE Program, FHWA complies with provisions of the Federal Freedom of Information and Privacy Acts (5 U.S.C. 552 and 552a). FHWA may make available to the public any information concerning the DBE Program release of which is not prohibited by Federal law.

(ii) MassDOT shall safeguard from disclosure to unauthorized persons information that may reasonably be considered as confidential business information, consistent with Federal and Massachusetts General Law (M.G.L. c. 66, § 10, M.G.L. c. 4, §7 (26), 950 CMR 32.00).

(2) Confidentiality of information on complainants. Notwithstanding the provisions of subparagraph b.(1) of this section, the identity of complainants shall be kept confidential, at their election. If such confidentiality will hinder the investigation, proceeding or hearing, or result in a denial of appropriate administrative due process to other parties, the complainant must be advised for the purpose of waiving the privilege. Complainants are advised that, in some circumstances, failure to waive the privilege may result in the closure of the investigation or dismissal of the proceeding or hearing.

(3) Cooperation. All participants in FHWA's DBE Program (including, but not limited to, recipients, DBE firms and applicants for DBE certification, complainants and appellants, and Contractors using DBE firms to meet Contract participation goals) are required to cooperate fully and promptly with U.S. DOT and recipient compliance reviews, certification reviews, investigations, and other requests for information. Failure to do so shall be a ground for appropriate action against the party involved (e.g., with respect to recipients, a finding of noncompliance; with respect to DBE firms, denial of certification or removal of eligibility and/or suspension and debarment; with respect to a complainant or appellant, dismissal of the complaint or appeal; with respect to a Contractor which uses DBE firms to meet participation goals, findings of non-responsibility for future Contracts and/or suspension and debarment).

(4) Intimidation and retaliation. No recipient, Contractor, or any other participant in the program, may intimidate, threaten, coerce, or discriminate against any individual or firm for the purpose of interfering with any right or privilege secured by this part or because the individual or firm has made a complaint, testified, assisted, or participated in any manner in an investigation, proceeding, or hearing under this part. If any recipient or contractor violates this prohibition, that entity is in noncompliance with this 49 CFR Part 26.

11. LIST OF ADDITIONAL DOCUMENTS.

a. The following documents shall be completed and signed by the bidder and designated DBEs in accordance with Section 7 - Award Documentation and Procedures. These documents must be returned by the bidder to MassDOT's Bid Document Distribution Center:

- □ Schedule of DBE Participation (Document B00853)
- □ Letter of Intent (Document B00854)
- □ DBE Joint Check Arrangement Approval Form (Document B00855), if Contractor and DBE plan, or if DBE is required to use a Joint Check

b. The following document shall be signed and returned by Contractor and Subcontractors/DBEs to the MassDOT District Office overseeing the Project, as applicable:

- □ Contractor/Subcontractor Certification Form (Document No. 00859) (a checklist of other documents to be included with every subcontract (DBEs and non-DBEs alike)).

c. The following document shall be provided to MassDOT's Office of Civil Rights and Prequalification Office at least fourteen (14) business days before the bid opening date, if applicable:

- □ Affidavit of DBE/Non-DBE Joint Venture (Document B00856)

d. The following document shall be provided to MassDOT's District Office of Civil Rights within 30 calendar days after the work of the DBE is completed, or no later than 30 calendar days after the work of the DBE is on a completed and processed CQE. This document shall be completed and submitted by the Prime Contractor:

- □ Certificate of Completion by a Minority/Women or Disadvantaged Business Enterprise (M/W/DBE) (Form No. CSD-100)

*** END OF DOCUMENT ***

DOCUMENT 00760

FHWA-1273 – Revised October 23, 2023

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the “Statement of Compliance” required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily

excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B) This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

DOCUMENT 00811

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR HOT MIX ASPHALT (HMA) MIXTURES
Revised: 02/03/2023

This provision applies to all projects using greater than 100 tons of hot mix asphalt (HMA) mixtures containing liquid asphalt cement as stipulated in the Notice to Contractors section of the bid documents.

Price Adjustments will be based on the variance in price, for the liquid asphalt component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis.

Base Price
The Base Price of liquid asphalt on a project as listed in the Notice to Contractors section of the bid documents is a fixed price determined by the Department at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

Period Price
The Period Price is the price of liquid asphalt for each monthly period as determined by the Department using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The Department will post this Period Price on its website at https://www.mass.gov/service-details/massdot-current-contract-price-adjustments following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the Department the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor.

Price Adjustment Determination, Calculation and Payment
The Contract Price of the HMA mixture will be paid under the respective item in the Contract. Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed.

Price Adjustments will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the approved Job Mix Formula.

Price Adjustments will be separate payment items. The pay item numbers are 999.401 for a positive price adjustment (a payment) and 999.402 for a negative price adjustment (a deduction). Price Adjustments will be calculated using the following equation:

Price Adjustment = Tons of HMA Placed X Liquid Asphalt Content % X RAP Factor X (Period Price - Base Price)

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

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DOCUMENT 00812

SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE –
ENGLISH UNITS
Revised: 02/01/2021

This monthly fuel price adjustment is inserted in this contract because the national and worldwide energy situation has made the future cost of fuel unpredictable. This adjustment will provide for either additional compensation to the Contractor or repayment to the Commonwealth, depending on an increase or decrease in the average price of diesel fuel or gasoline.

This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price.

The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department's web site https://www.mass.gov/service-details/massdot-current-contract-price-adjustments for the month in which the contract was bid, which includes State Tax.

The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

This adjustment will be effected only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No adjustment will be paid for work done beyond the extended completion date of any contract.

Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity.

The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

ITEMS COVERED	FUEL FACTORS	
	Diesel	Gasoline
Excavation: and Borrow Work: Items 120, 120.1, 121, 123, 124, 125, 127, 129.3, 140, 140.1, 141, 142, 143, 144, 150, 150.1, 151 and 151.1 (Both Factors used)	0.29 Gallons / CY.	0.15 Gallons / CY
Surfacing Work: All Items containing Hot Mix Asphalt	2.90 Gallons / Ton	Does Not Apply

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DOCUMENT 00813

SPECIAL PROVISIONS

PRICE ADJUSTMENTS FOR STRUCTURAL STEEL AND REINFORCING STEEL

January 15, 2025

This special provision applies to all projects containing the use of structural steel and/or reinforcing steel as specified elsewhere in the Contract work. It applies to all structural steel and all reinforcing steel, as defined below, on the project. Compliance with this provision is mandatory, i.e., there are no "opt-in" or "opt-out" clauses. Price adjustments will be handled as described below and shall only apply to unfabricated reinforcing steel bars and unfabricated structural steel material, consisting of rolled shapes, plate steel, sheet piling, pipe piles, steel castings and steel forgings.

Price adjustments will be variances between Base Prices and Period Prices. Base Prices and Period Prices are defined below.

Price adjustments will only be made if the variances between Base Prices and Period Prices are 5% or more. A variance can result in the Period Price being either higher or lower than the Base Price. Once the 5% threshold has been achieved, the adjustment will apply to the full variance between the Base Price and the Period Price.

Price adjustments will be calculated by multiplying the number of pounds of unfabricated structural steel material or unfabricated reinforcing steel bars on a project by the index factor calculated as shown below under Example of a Period Price Calculation.

Price adjustments will ***not*** include guardrail panels or the costs of shop drawing preparation, handling, fabrication, coatings, transportation, storage, installation, profit, overhead, fuel costs, fuel surcharges, or other such charges not related to the cost of the unfabricated structural steel and unfabricated reinforcing steel.

The weight of steel subject to a price adjustment shall not exceed the final shipping weight of the fabricated part by more than 10%.

Base Prices and Period Prices are defined as follows:

Base Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are fixed prices determined by the Department and found in the table below. While it is the intention of the Department to make this table comprehensive, some of a project's unfabricated structural steel and/or unfabricated reinforcing steel may be inadvertently omitted. Should this occur, the Contractor shall bring the omission to the Department's attention so that a contract alteration may be processed that adds the missing steel to the table and its price adjustments to the Contract.

The Base Price Date is the month and year of the most recent finalized period price index at the time that MassDOT opened bids for the project. The Base Price Index for this contract is the Steel PPI listed in the Notice to Contractors.

Period Prices of unfabricated structural steel and unfabricated reinforcing steel on a project are variable prices that have been calculated using the Period Price Date and an index of steel prices to adjust the Base Price.

The Period Price Date is the date the steel was delivered to the fabricator as evidenced by an official bill of lading submitted to the Department containing a description of the shipped materials, weights of the shipped materials and the date of shipment. This date is used to select the Period Price Index.

The index used for the calculation of Period Prices is the U.S. Department of Labor Bureau of Labor Statistics Producer Price Index (PPI) Series ID WPU101702 (Not Seasonally Adjusted, Group: Metals and Metal Products, Item: Semi-finished Steel Mill Products.) As this index is subject to revision for a period of up to four (4) months after its original publication, no price adjustments will be made until the index for the period is finalized, i.e., the index is no longer suffixed with a "(P)".

Period Prices are determined as follows:

Period Price = Base Price X Index Factor
Index Factor = Period Price Index / Base Price Index

Example of a Period Price Calculation:

Calculate the Period Price for December 2009 using a Base Price from March 2009 of $0.82/Pound for 1,000 Pounds of ASTM A709 (AASHTO M270) Grade A36 Structural Steel Plate.

The Period Price Date is December 2009. From the PPI website*, the Period Price Index = 218.0.

The Base Price Date is March 2009. From the PPI website*, the Base Price Index = 229.4.

Index Factor = Period Price Index / Base Price Index = 218.0 / 229.4 = 0.950
Period Price = Base Price X Index Factor = $0.82/Pound X 0.950 = $0.78/Pound

Since $0.82 - $0.78 = $0.04 is less than 5% of $0.82, no price adjustment is required.

If the $0.04 difference shown above was greater than 5% of the Base Price, then the price adjustment would be 1,000 Pounds X $0.04/Pound = $40.00. Since the Period Price of $0.78/Pound is less than the Base Price of $0.82/Pound, indicating a drop in the price of steel between the bid and the delivery of material, a credit of $40.00 would be owed to MassDOT. When the Period Price is higher than the Base Price, the price adjustment is owed to the Contractor.

* To access the PPI website and obtain a Base Price Index or a Period Price Index, go to http://data.bls.gov/cgi-bin/srgate

End of example.

The Contractor will be paid for unfabricated structural steel and unfabricated reinforcing steel under the respective contract pay items for all components constructed of either structural steel or reinforced Portland cement concrete under their respective Contract Pay Items.

Price adjustments, as herein provided for, will be paid separately as follows:

Structural Steel
Pay Item Number 999.449 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.457 for negative (-) pay adjustments (credits to MassDOT Highway Division)

Reinforcing Steel
Pay Item Number 999.466 for positive (+) pay adjustments (payments to the Contractor)

Pay Item Number 999.467 for negative (-) pay adjustments (credits to MassDOT Highway Division)

No price adjustment will be made for price changes after the Contract Completion Date, unless the MassDOT Highway Division has approved an extension of Contract Time for the Contract.

TABLE

Steel Type		Price per Pound
1	ASTM A615/A615M Grade 60 (AASHTO M31 Grade 60 or 420) Reinforcing Steel	$0.57
2	ASTM A27 (AASHTO M103) Steel Castings, H-Pile Points & Pipe Pile Shoes (See Note below.)	$0.79
3	ASTM A668 / A668M (AASHTO M102) Steel Forgings	$0.79
4	ASTM A108 (AASHTO M169) Steel Forgings for Shear Studs	$0.82
5	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Plate	$0.87
6	ASTM A709/A709M Grade 36 / AASHTO M270M/M270 Grade 36 or 250 Structural Steel Shapes	$0.81
7	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Plate	$0.87
8	ASTM A709/A709M Grade 50 / AASHTO M270M/M270 Grade 50 or 345 Structural Steel Shapes	$0.81
9	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Plate	$0.90
10	ASTM A709/A709M Grade 50WT / AASHTO M270M/M270 Grade 50WT or 345WT Structural Steel Shapes	$0.82
11	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W 345W Structural Steel Plate	$0.90
12	ASTM A709/A709M Grade 50W / AASHTO M270M/M270 Grade 50W or 345W Structural Steel Shapes	$0.82
13	ASTM A709/A709M Grade HPS 50W / AASHTO M270M/M270 Grade HPS 50W or 345W Structural Steel Plate	$0.94
14	ASTM A709/A709M Grade HPS 70W / AASHTO M270M/M270 Grade HPS 70W or 485W Structural Steel Plate	$1.01
15	ASTM A514/A514M-05 Grade HPS 100W / AASHTO M270M/M270 Grade HPS 100W or 690W Structural Steel Plate	$1.54
16	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Plate	$0.90
17	ASTM A992/A992M Grade 50S / AASHTO M270M/M270 Grade 50S or 345S Structural Steel Shapes	$0.82
18	ASTM A276 Type 316 Stainless Steel	$4.61
19	ASTM A240 Type 316 Stainless Steel	$4.61
20	ASTM A148 Grade 80/50 Steel Castings (See Note below.)	$1.58
21	ASTM A53 Grade B Structural Steel Pipe	$1.01
22	ASTM A500 Grades A, B, 36 & 50 Structural Steel Pipe	$1.01
23	ASTM A252, Grades 240 (36 KSI) & 414 (60 KSI) Pipe Pile	$0.80
24	ASTM 252, Grade 2 Permanent Steel Casing	$0.80
25	ASTM A36 (AASHTO M183) for H-piles, steel supports and sign supports	$0.85
26	ASTM A328 / A328M, Grade 50 (AASHTO M202) Steel Sheetpiling	$1.52
27	ASTM A572 / A572M, Grade 50 Sheetpiling	$1.52
28	ASTM A36/36M, Grade 50	$0.87
29	ASTM A570, Grade 50	$0.85
30	ASTM A572 (AASHTO M223), Grade 50 H-Piles	$0.87
31	ASTM A1085 Grade A (50 KSI) Steel Hollow Structural Sections (HSS), heat-treated per ASTM A1085 Supplement S1	$1.01
32	AREA 140 LB Rail and Track Accessories	$0.52

NOTE: Steel Castings are generally used only on moveable bridges. Cast iron frames, grates and pipe are not “steel” castings and will not be considered for price adjustments.

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DOCUMENT 00814

SPECIAL PROVISIONS
PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES

January 12, 2009

This provision applies to all projects using greater than 100 Cubic Yards (76 Cubic Meters) of Portland cement concrete containing Portland cement as stipulated in the Notice to Contractors section of the Bid Documents. This Price Adjustment will occur on a monthly basis.

The Price Adjustment will be based on the variance in price for the Portland cement component only from the Base Price to the Period Price. It shall not include transportation or other charges.

The Base Price of Portland cement on a project is a fixed price determined at the time of bid by the Department by using the same method as for the determination of the Period Price (see below) and found in the Notice to Contractors.

The Period Price of Portland cement will be determined by using the latest published price, in dollars per ton (U.S.), for Portland cement (Type I) quoted for Boston, U.S.A. in the **Construction Economics** section of *ENR Engineering News-Record* magazine or at the ENR website http://www.enr.com under **Construction Economics**. The Period Price will be posted on the MassDOT website the Wednesday immediately following the publishing of the monthly price in ENR, which is normally the first week of the month.

The Contract Price of the Portland cement concrete mix will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The price adjustment applies only to the actual Portland cement content in the mix placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of cubic yards of Portland cement concrete placed during each monthly period times the Portland cement content percentage times the variance in price between the Base Price and Period Price of Portland cement.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

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DOCUMENT 00820

THE COMMONWEALTH OF MASSACHUSETTS SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY, NON-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM

I. Definitions

For purposes of this contract,

"Minority" means a person who meets one or more of the following definitions:

(a) American Indian or Native American means: all persons having origins in any of the original peoples of North America and who are recognized as an Indian by a tribe or tribal organization.
(b) Asian means: All persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian sub-continent, or the Pacific Islands, including, but Not limited to China, Japan, Korea, Samoa, India, and the Philippine Islands.
(c) Black means: All persons having origins in any of the Black racial groups of Africa, including, but not limited to, African-Americans, and all persons having origins in any of the original peoples of the Cape Verdean Islands.
(d) Eskimo or Aleut means: All persons having origins in any of the peoples of Northern Canada, Greenland, Alaska, and Eastern Siberia.
(e) Hispanic means: All persons having their origins in any of the Spanish-speaking peoples of Mexico, Puerto Rico, Cuba, Central or South America, or the Caribbean Islands.

"State construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility, or a contract for the construction, reconstruction, alteration, remodeling or repair of a public work undertaken by a department, agency, board, or commission of the commonwealth.

"State assisted construction contract" means a contract for the construction, reconstruction, installation, demolition, maintenance or repair of a building or capital facility undertaken by a political subdivision of the commonwealth, or two or more political subdivisions thereof, an authority, or other instrumentality and whose costs of the contract are paid for, reimbursed, grant funded, or otherwise supported, in whole or in part, by the commonwealth.

II. Equal Opportunity, Non-Discrimination and Affirmative Action

During the performance of this Contract, the Contractor and all subcontractors (hereinafter collectively referred to as "the Contractor") for a state construction contract or a state assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

In connection with the performance of work under this contract, the Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability, shall not discriminate in the selection or retention of subcontractors, and shall not discriminate in the procurement of materials and rentals of equipment.

The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion, or transfer; recruitment advertising, layoff or termination; rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship or on-the-job training opportunity. The Contractor shall comply with the provisions of chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this Contract.

The Contractor shall post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the Massachusetts Commission Against Discrimination setting forth the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter l51 B).

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. Such affirmative action measures shall entail positive and aggressive measures to ensure nondiscrimination and to promote equal opportunity in the areas of hiring, upgrading, demotion or transfer, recruitment, layoff or termination, rate of compensation, apprenticeship and on-the-job training programs. A list of positive and aggressive measures shall include, but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority, women and other community-based organizations of employment opportunities; validating all job specifications, selection requirements, and tests; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying the administering agency in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker. These and other affirmative action measures shall include all actions required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, sex, sexual orientation, genetic information, military service, age, ancestry or disability. One purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for this and future Commonwealth public construction projects.

III. Minority and Women Workforce Participation

Pursuant to his/her obligations under the preceding section, the Contractor shall strive to achieve on this project the labor participation goals contained herein. Said participation goals shall apply in each job category on this project including but not limited to bricklayers, carpenters, cement masons, electricians, ironworkers, operating engineers and those classes of work enumerated in Section 44F of Chapter 149 of the Massachusetts General Laws. The participation goals for this project shall be 15.3% for minorities and 6.9% for women. The participation goals, as set forth herein, shall not be construed as quotas or set-asides; rather, such participation goals will be used to measure the progress of the Commonwealth's equal opportunity, non-discrimination and affirmative action program. Additionally, the participation goals contained herein should not be seen or treated as a floor or as a ceiling for the employment of particular individuals or group of individuals.

IV. Liaison Committee

At the discretion of the agency that administers the contract for the construction project there may be established for the life of the contract a body to be known as the Liaison Committee. The Liaison Committee shall be composed of one representative each from the agency or agencies administering the contract for the construction project, hereinafter called the administering agency, a representative from the Office of Affirmative action, and such other representatives as may be designated by the administering agency. The Contractor (or his/her agent, if any, designated by him/her as the on-site equal employment opportunity officer) shall recognize the Liaison Committee as an affirmative action body, and shall establish a continuing working relationship with the Liaison Committee, consulting with the Liaison Committee on all matters related to minority recruitment, referral, employment and training.

V. Reports and Records

The Contractor shall prepare projected workforce tables on a quarterly basis when required by the administering agency. These shall be broken down into projections, by week, of workers required in each trade. Copies shall be furnished one week in advance of the commencement of the period covered, and also, when updated, to the administering agency and the Liaison Committee when required.

The Contractor shall prepare weekly reports in a form approved by the administering agency, unless information required is required to be reported electronically by the administering agency, the number of hours worked in each trade by each employee, identified as woman, minority, or non-minority. Copies of these shall be provided at the end of each such week to the administering agency and the Liaison Committee.

Records of employment referral orders, prepared by the Contractor, shall be made available to the administering agency on request.

The Contractor will provide all information and reports required by the administering agency on instructions issued by the administering agency and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the administering agency to effect the employment of personnel. This provision shall apply only to information pertinent to the Commonwealth's supplementary non-discrimination, equal opportunity and access and opportunity contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the administering agency and shall set forth what efforts he has made to obtain the information.

VI. Access to Work Site

A designee of the administering agency and a designee of the Liaison Committee shall each have a right to access the work site.

VII. Solicitations for Subcontracts, and for the Procurement of Materials and Equipment

In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this contract relative to non-discrimination and equal opportunity.

VIII. Sanctions

Whenever the administering agency believes the General or Prime Contractor or any subcontractor may not be operating in compliance with the provisions of the Fair Employment Practices Law of the Commonwealth (Massachusetts General Laws Chapter 151B), the administering agency may refer the matter to the Massachusetts Commission Against Discrimination ("Commission") for investigation.

Following the referral of a matter by the administering agency to the Massachusetts Commission Against Discrimination, and while the matter is pending before the MCAD, the administering agency may withhold payments from contractors and subcontractors when it has documentation that the contractor or subcontractor has violated the Fair Employment Practices Law with respect to its activities on the Project, or if the administering agency determines that the contractor has materially failed to comply with its obligations and the requirements of this Section. The amount withheld shall not exceed a withhold of payment to the General or Prime Contractor of 1/100 or 1% of the contract award price or $5,000, whichever sum is greater, or, if a subcontractor is in non-compliance, a withhold by the administering agency from the General Contractor, to be assessed by the General Contractor as a charge against the subcontractor, of 1/100 or 1% of the subcontractor price, or $1,000 whichever sum is greater, for each violation of the applicable law or contract requirements. The total withheld from anyone General or Prime Contractor or subcontractor on a Project shall not exceed $20,000 overall. No withhold of payments or investigation by the Commission or its agent shall be initiated without the administering agency providing prior notice to the Contractor.

If, after investigation, the Massachusetts Commission Against Discrimination finds that a General or Prime Contractor or subcontractor, in commission of a state construction contract or state-assisted construction contract, violated the provisions of the Fair Employment Practices Law, the administering agency may convert the amount withheld as set forth above into a permanent sanction, as a permanent deduct from payments to the General or Prime Contractor or subcontractor, which sanction will be in addition to any such sanctions, fines or penalties imposed by the Massachusetts Commission Against Discrimination.

No sanction enumerated under this Section shall be imposed by the administering agency except after notice to the General or Prime Contractor or subcontractor and an adjudicatory proceeding, as that term is used, under Massachusetts General Laws Chapter 30A, has been conducted.

IX. Severability

The provisions of this section are severable, and if any of these provisions shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

X. Contractor's Certification

After award and prior to the execution of any contract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall certify that it will comply with all provisions of this Document 00820 Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, by executing Document 00859 Contractor/Subcontractor Certification Form.

XI. Subcontractor Requirements

Prior to the award of any subcontract for a state construction contract or a state assisted construction contract, the Prime or General Contractor shall provide all prospective subcontractors with a complete copy of this Document 00820 entitled "Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program" and will incorporate the provisions of this Document 00820 into any and all contracts or work orders for all subcontractors providing work on the Project. In order to ensure that the said subcontractor's certification becomes a part of all subcontracts under the prime contract, the Prime or General Contractor shall certify in writing to the administering agency that it has complied with the requirements as set forth in the preceeding paragraph by executing Document 00859 Contractor/Subcontractor Certification Form.

Rev'd 03/07/14

*** END OF DOCUMENT ***

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DOCUMENT 00821

ELECTRONIC REPORTING REQUIREMENTS
CIVIL RIGHTS PROGRAMS AND CERTIFIED PAYROLL

Implemented on March 2, 2009 Revised June 04, 2019

The Massachusetts Department Of Transportation (MassDOT) has replaced the CHAMP reporting system with Equitable Business Opportunity Solution (EBO), a new web-based civil rights reporting software system. This system is capable of handling both civil rights reporting requirements and certified payrolls. The program's functions include the administration of Equal Employment Opportunity (EEO) requirements, On-The-Job Training requirements (OJT), Disadvantage Business Enterprise (DBE) and/or Minority / Women's Business Enterprise (M/WBE) subcontracting requirements, and the electronic collection of certified payrolls associated with MassDOT projects. In addition, this system is used to generate various data required as part of the American Recovery and Reinvestment Act (ARRA). Contractors are responsible for all coordination with all sub-contractors to ensure timely and accurate electronic submission of all required data.

Contractor and Sub-Contractor EBO User Certification

All contractors and sub-contractors must use the EBO software system. The software vendor, Internet Government Solutions (IGS), has developed an online EBO Training Module that is available to contractors and sub-contractors. This module is a self-tutorial which allows all users in the company to access the training, complete the tutorial, and become certified as EBO users for a one time fee of $75.00. This is the only cost to contractors and sub-contractors associated with the EBO software system. The online EBO Training Module can be accessed at www.ebotraining.com. Click the "Register My Company" button on the login page to begin your training registration. Questions regarding EBO online training should be directed to Gerry Anguilano, IGS at (440) 238-1684.

MassDOT will track contractors and sub-contractors who have successfully completed the on-line training module. All persons performing civil rights program and/or certified payroll functions should be EBO certified.

Vetting of Firms and Designated Firm Individuals

Contractors must authorize a Primary Log-In ID Holder who has completed EBO on-line training to have access to the EBO system by completing and submitting the "Request For EBO System Log-In/Password Form" located on the MassDOT website at: https://www.mass.gov/how-to/how-to-get-an-ebo-login
Contractors must also agree to comply with the EBO system user agreement located on the MassDOT website.

All subcontracts entered into on a project must include language that identifies the submission and training requirements that the sub-contractor must perform. Sub-contractors will be approved by the respective District Office of MassDOT through the existing approval process. When new sub-contractors, who have not previously worked for MassDOT, are initially selected by a general contractor, the new sub-contractor must be approved by the District before taking the EBO on-line training module.

Interim Reporting Requirements

Until MassDOT is satisfied that the EBO system is fully operational and functioning as designed, contractors and sub-contractors will be required to submit certified payrolls manually. There will be a transition period where dual reporting, through manual and electronic submission, will be required. MassDOT, however, will notify contractors and sub-contractors when they may cease manual submission of certified payrolls.

*** END OF DOCUMENT ***

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DOCUMENT 00859

CONTRACTOR/SUBCONTRACTOR CERTIFICATION FORM ‡

The contractor shall submit this completed document 00859 to MassDOT for each subcontract.

_____ **(Contractor)** **Date:**_____

_____**(Subcontractor)** ☐ District Approved Subcontractor

Contract No: 129075 **Project No.** 609185 **Federal Aid No.:** **STP(BR-OFF)-003S(815)X**

Location: WORCESTER

Project Description: Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290

PART 1 CONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that to the best of my knowledge, information and belief, the company is in compliance with all applicable federal and state laws, rules, and regulations governing fair labor and employment practices, that the company will not discriminate in their employment practices, that the company will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals and specific affirmative action steps contained in Contract Document 00820 The Commonwealth of Massachusetts Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, and that the company will comply with the special provisions and documentation indicated below (as checked).

I further hereby certify, as an authorized official of this company, that the special provisions and documentation indicated below (as checked) have been or are included in, and made part of, the Subcontractor Agreement entered into with the firm named above.

☐ **This is not a Federally-aided construction project**

Document #

☐ 00718 –Participation By Minority Or Women's Business Enterprises and SDVOBE†
☐ 00761 –Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination, and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs, and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00861 – Applicable State Wage Rates in the Contract Proposal**
☐ B00842 – MA Schedule of Participation By Minority or Women Business Enterprises (M/WBEs)†
☐ B00843 – MA Letter of Intent – M/WBEs†

** Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a M/WBE; only include these forms for the particular M/WBE Entity

☐ B00844 - Schedule of Participation By SDVOBE
☐ B00845 - Letter of Intent – SDVOBE
☐ B00846 – M/WBE or SDVOBE Joint Check Arrangement Approval Form
☐ B00847 – Joint Venture Affidavit

☐ **This is a Federally-aided construction project (Federal Aid Number is present)**

Document #

☐ 00719 – Special Provisions for Participation by Disadvantaged Business Enterprises†
☐ 00760 - Form FHWA 1273 - Required Contract Provisions for Federal-Aid Construction Contracts
☐ 00820 – MA Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program
☐ 00821 – Electronic Reporting Requirements, Civil Rights Programs and Certified Payroll
☐ 00859 – Contractor/Subcontractor Certification Form (this document)
☐ 00860 – MA Employment Laws
☐ 00870 – Standard Federal Equal Employment Opportunity Construction Contract Specifications Executive Order 11246, (41 CFR Parts 60-4.2 and 60-4.3 (Solicitations and Equal Opportunity Clauses)*
☐ 00875 – Federal Trainee Special Provisions

☐ B00853 – Schedule of Participation by Disadvantaged Business Enterprise†
☐ B00854 – Letter of Intent – DBEs†
☐ B00855 – DBE Joint Check Arrangement Approval Form
☐ B00856 – Joint Venture Affidavit
☐ 00861/00880 - Applicable state and federal wage rates from Contract Proposal**

*Applicable only to Contracts or Subcontracts in excess of $10,000
**Does not apply to Material Suppliers, unless performing work on-site
† Applies only if Subcontractor is a DBE; only include these forms for the particular DBE Entity

Signed this _____ Day of _____, 20_____ Under The Pains And Penalties Of Perjury.

_____ _____
(Print Name and Title) (Authorized Signature)

PART 2

PART 2 SUBCONTRACTOR CERTIFICATION: I hereby certify, as an authorized official of this company, that the required documents in Part 1 above were physically incorporated in our Agreement/Subcontract with the Contractor and give assurance that this company will fully comply or make every good faith effort to comply with the same. I further certify that:

1. This company recognizes that if this is a Federal-Aid Project, then this Contract is covered by the equal employment opportunity laws administered and enforced by the United States Department of Labor ("USDOL"), Office of Federal Contract Compliance Programs ('OFCCP"). By signing below, we acknowledge that this company has certain reporting obligations to the OFCCP, as specified by 41 CFR Part 60-4.2.
2. This company further acknowledges that any contractor with fifty (50) or more employees on a Federal-aid Contract with a value of fifty-thousand ($50,000) dollars or more must annually file an EEO-1 Report (SF 100) to the EEOC, Joint Reporting Committee, on or before September 30th, each year, as specified by 41 CFR Part 60-1.7a.
3. For more information regarding the federal reporting requirements, please contact the USDOL, OFCCP Regional Office, at 1-646-264-3170 or EEO-1, Joint Reporting Committee at 1-866-286-6440. You may also find guidance at: http://www.dol.gov/ofccp/TAguides/consttag.pdf or http://www.wdol.gov/dba.aspx#0.
4. This company ☐ has, ☐ has not, participated in a previous contract or subcontract subject to the Equal Opportunity clauses set forth in 41 CFR Part 60-4 and Executive Order 11246, and where required, has filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance Programs or the EEO Commission all reports due under the applicable filing requirements.
5. This company is in full compliance with applicable Federal and Commonwealth of Massachusetts laws, rules, and regulations and is not currently debarred or disqualified from bidding on or participating in construction contracts in any jurisdiction of the United States. See : https://www.mass.gov/service-details/contractors-and-vendors-suspended-or-debarred-by-massdot
6. This company is properly registered and in good standing with the Office of the Secretary of the Commonwealth.

Signed this _____ Day of _____, 20_____, Under The Pains And Penalties Of Perjury.

Firm: _____
Address: _____
_____
_____
Telephone Number:_____
Federal I.D. Number:_____
Estimated Start Date:_____
Estimated Completion Date:_____
Estimated Dollar Amount:_____

_____
(Print Name and Title)

_____
(Authorized Signature)

_____
(Date)

Rev'd 09/02/22

*** END OF DOCUMENT ***

DOCUMENT 00860

COMMONWEALTH OF MASSACHUSETTS PUBLIC EMPLOYMENT LAWS

Revised February 20, 2019

The Contractor's attention is directed to Massachusetts General Laws, Chapter 149, Sections 26 through 27H, and 150A. This contract is considered to fall within the ambit of that law, which provides that in general, the Prevailing Rate or Total Rate must be paid to employees working on projects funded by the Commonwealth of Massachusetts or any political subdivision including Massachusetts Department of Transportation (MassDOT).

A Federal Aid project is also subject to the Federal Minimum Wage Rate law for construction. When comparing a state minimum wage rate, monitored by the Massachusetts Attorney General, versus federal minimum wage rate, monitored by the U.S. Department of Labor Wage and Hour Division, for a particular job classification the higher wage is at all times to be paid to the affected employee.

Every contractor or subcontractor engaged in this contract to which sections twenty-seven and twenty-seven A apply will keep a true and accurate record of all mechanics and apprentices, teamsters, chauffeurs and laborers employed thereon, showing the name, address and occupational classification of each such employee on this contract, and the hours worked by, and the wages paid to, each such employee, and shall furnish to the MassDOT's Resident Engineer, on a weekly basis, a copy of said record, in a form approved by MassDOT and in accordance with M.G.L. c. 149, § 27B, signed by the employer or his/her authorized agent under the penalties of perjury.

Each such contractor or subcontractor shall preserve its payroll records for a period of three years from the date of completion of the contract.

The Prevailing Wage Rate generally includes the following:

> Minimum Hourly Wage + Employer Contributions to Benefit Plans = Prevailing Wage Rate or Total Rate
>
> Any employer who does not make contributions to Benefit Plans must pay the total Prevailing Wage Rate directly to the employee.

Any deduction from the Prevailing Wage Rate or Total Rate for contributions to benefit plans can only be for a Health & Welfare, Pension, or Supplementary Unemployment plan meeting the requirements of the Employee Retirement Income Security Act (ERISA) of 1974. The maximum allowable deduction for these benefits from the prevailing wage rate cannot be greater than the amount allowed by Executive Office of Labor (EOL) for the specified benefits. Any additional expense of providing benefits to the employees is to be borne by the employer and cannot be deducted from the Minimum Hourly Wage. If the employer's benefit expense is less than that so provided by EOL the difference will be paid directly to the employee. The rate established must be paid to all employees who perform work on the project.

When an employer makes deductions from the Minimum Hourly Wage for an employee's contribution to social security, state taxes, federal taxes, and/or other contribution programs, allowed by law, the employer shall furnish each employee a suitable pay slip, check stub or envelope notifying the employee of the amount of the deductions.

No contractor or subcontractor contracting for any part of the contract week shall require or permit any laborer or mechanic to be employed on such work in excess of forty hours in any workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

Apprentice Rates are permitted only when there is an Apprentice Agreement registered with the Massachusetts Division of Apprentice Training in accordance with M.G.L. c. 23, § 11E-11L.

The Prevailing Wage Rates issued for each project shall be the rates paid for the entire project. The Prevailing Wage Rates must be posted on the job site at all times and be visible from a public way.

In addition, each such contractor and subcontractor shall furnish to the MassDOT's Resident Engineer, within fifteen days after completion of its portion of the work, a statement, executed by the contractor or subcontractor or by any authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE

Date: _____

I , _____do hereby state:
(Name of signatory party) (Title)

That I pay or supervise the payment of the persons employed by:

_____
(Contractor or Subcontractor)

on the _____
(MassDOT Project Location and Contract Number)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____

The above-mentioned copies of payroll records and statements of compliance shall be available for inspection by any interested party filing a written request to the MassDOT's Resident Engineer for such inspection and copying.

Massachusetts General Laws c. 149, §27, requires annual updates to prevailing wage schedules for all public construction contracts lasting longer than one year. MassDOT will request the required updates and furnish them to the Contractor. The Contractor is required to pay no less than the wage rates indicated on the annual updated wage schedules.

MassDOT will request the updates no later that two week before the anniversary of the Notice to Proceed date of the contract to allow for adequate processing by the Department of Labor Standards (DLS). The effective date for the new rates will be the anniversary date of the contract (i.e. the notice to proceed date), regardless of the date of issuance on the schedule from DLS.

All bidders are cautioned that the aforementioned laws require that employers pay to covered employees no less than the applicable minimum wages. In addition, the same laws require that the applicable prevailing wages become incorporated as part of this contract. The prevailing minimum wage law establishes serious civil and criminal penalties for violations, including imprisonment and exclusion from future public contracts. Bidders are cautioned to carefully read the relevant sections of the Massachusetts General Laws.

*** END OF DOCUMENT ***

DOCUMENT 00861

STATE PREVAILING WAGE RATES

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Proposal No. 609185-129075

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

MAURA HEALEY
Governor

KIM DRISCOLL
Lt. Governor

LAUREN JONES
Secretary

MICHAEL FLANAGAN
Director

Awarding Authority: MassDOT Highway

Contract Number: 129075 **City/Town:** WORCESTER

Description of Work: WORCESTER: Federal Aid Project No. STP (BR-OFF)-003S (815) X00 Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290

Job Location: Harrison St and Laurel St over I-290

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, the awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. The updated wage schedule must be provided to all contractors, including general and sub-contractors, working on the construction project.
- This annual update requirement is generally not applicable to 27F "rental of equipment" contracts. For such contracts, the prevailing wage rates issued by DLS shall remain in effect for the duration of the contract term. However, if the prevailing wage rate sheet issued does not contain wage rates for each year covered by the contract term, the Awarding Authority must request updated rate sheets from DLS and provide them to the contractor to ensure the correct rates are being paid throughout the duration of the contract. Additionally, if an Awarding Authority exercises an option to renew or extend the contract term, they must request updated rate sheets form DLS and provide them to the contractor.
- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule if it has not opened bids or selected a contractor within90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27.The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or a sub-contractor.
- Apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (DAS). Apprentices must keep their apprentice identification card on their persons during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DAS regardless of whether they are registered with another federal, state, local, or private agency must be paid the journeyworker's rate.**
- Every contractor or subcontractor working on the construction project must submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. For a sample payroll reporting form go to http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Contractors must obtain the wage schedules from awarding authorities. Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may file a complaint with the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

Issue Date: 12/31/2024 **Wage Request Number:** 20241230-033

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$39.95	$15.07	$20.17	$0.00	$75.19
	01/01/2025	$39.95	$15.57	$20.17	$0.00	$75.69
	06/01/2025	$40.95	$15.57	$20.17	$0.00	$76.69
	12/01/2025	$40.95	$15.57	$21.78	$0.00	$78.30
	01/01/2026	$40.95	$16.17	$21.78	$0.00	$78.90
	06/01/2026	$41.95	$16.17	$21.78	$0.00	$79.90
	12/01/2026	$41.95	$16.17	$23.52	$0.00	$81.64
	01/01/2027	$41.95	$16.77	$23.52	$0.00	$82.24
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.02	$15.07	$20.17	$0.00	$75.26
	01/01/2025	$40.02	$15.57	$20.17	$0.00	$75.76
	06/01/2025	$41.02	$15.57	$20.17	$0.00	$76.76
	12/01/2025	$41.02	$15.57	$21.78	$0.00	$78.37
	01/01/2026	$41.02	$16.17	$21.78	$0.00	$78.97
	06/01/2026	$42.02	$16.17	$21.78	$0.00	$79.97
	12/01/2026	$42.02	$16.17	$23.52	$0.00	$81.71
	01/01/2027	$42.02	$16.77	$23.52	$0.00	$82.31
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.14	$15.07	$20.17	$0.00	$75.38
	01/01/2025	$40.14	$15.57	$20.17	$0.00	$75.88
	06/01/2025	$41.14	$15.57	$20.17	$0.00	$76.88
	12/01/2025	$41.14	$15.57	$21.78	$0.00	$78.49
	01/01/2026	$41.14	$16.17	$21.78	$0.00	$79.09
	06/01/2026	$42.14	$16.17	$21.78	$0.00	$80.09
	12/01/2026	$42.14	$16.17	$23.52	$0.00	$81.83
	01/01/2027	$42.14	$16.77	$23.52	$0.00	$82.43
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$117.16	$10.08	$24.29	$0.00	$151.53
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.61	$9.65	$17.70	$0.00	$67.96
	06/01/2025	$42.00	$9.65	$17.70	$0.00	$69.35
	12/01/2025	$43.38	$9.65	$17.70	$0.00	$70.73
	06/01/2026	$44.82	$9.65	$17.70	$0.00	$72.17
	12/01/2026	$46.26	$9.65	$17.70	$0.00	$73.61
	06/01/2027	$47.71	$9.65	$17.70	$0.00	$75.06
	12/01/2027	$49.16	$9.65	$17.70	$0.00	$76.51
	06/01/2028	$50.66	$9.65	$17.70	$0.00	$78.01
	12/01/2028	$52.16	$9.65	$17.70	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"						
AIR TRACK OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.61	$9.65	$17.80	$0.00	$68.06
	06/01/2025	$42.00	$9.65	$17.80	$0.00	$69.45
	12/01/2025	$43.38	$9.65	$17.80	$0.00	$70.83
	06/01/2026	$44.82	$9.65	$17.80	$0.00	$72.27
	12/01/2026	$46.26	$9.65	$17.80	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ASBESTOS WORKER (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (WORCESTER)*	12/01/2024	$42.80	$14.50	$11.05	$0.00	$68.35
	06/01/2025	$43.80	$14.50	$11.05	$0.00	$69.35
	12/01/2025	$44.80	$14.50	$11.05	$0.00	$70.35
ASPHALT RAKER *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
ASPHALT RAKER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	12/01/2024	$40.61	$9.65	$17.70	$0.00	$67.96
	06/01/2025	$42.00	$9.65	$17.70	$0.00	$69.35
	12/01/2025	$43.38	$9.65	$17.70	$0.00	$70.73
	06/01/2026	$44.82	$9.65	$17.70	$0.00	$72.17
	12/01/2026	$46.26	$9.65	$17.70	$0.00	$73.61
	06/01/2027	$47.71	$9.65	$17.70	$0.00	$75.06
	12/01/2027	$49.16	$9.65	$17.70	$0.00	$76.51
	06/01/2028	$50.66	$9.65	$17.70	$0.00	$78.01
	12/01/2028	$52.16	$9.65	$17.70	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.61	$9.65	$17.80	$0.00	$68.06
	06/01/2025	$42.00	$9.65	$17.80	$0.00	$69.45
	12/01/2025	$43.38	$9.65	$17.80	$0.00	$70.83
	06/01/2026	$44.82	$9.65	$17.80	$0.00	$72.27
	12/01/2026	$46.26	$9.65	$17.80	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2024	$48.12	$7.07	$20.60	$0.00	$75.79

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$31.28	$7.07	$13.22	$0.00	$51.57
2	65	$31.28	$7.07	$13.22	$0.00	$51.57
3	70	$33.68	$7.07	$14.23	$0.00	$54.98
4	75	$36.09	$7.07	$15.24	$0.00	$58.40
5	80	$38.50	$7.07	$16.25	$0.00	$61.82
6	85	$40.90	$7.07	$17.28	$0.00	$65.25
7	90	$43.31	$7.07	$18.28	$0.00	$68.66
8	95	$45.71	$7.07	$19.32	$0.00	$72.10

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (WORCESTER)*	08/01/2024	$62.36	$11.49	$22.90	$0.00	$96.75
	02/01/2025	$63.66	$11.49	$22.90	$0.00	$98.05
	08/01/2025	$65.81	$11.49	$22.90	$0.00	$100.20
	02/01/2026	$67.16	$11.49	$22.90	$0.00	$101.55
	08/01/2026	$69.36	$11.49	$22.90	$0.00	$103.75
	02/01/2027	$70.76	$11.49	$22.90	$0.00	$105.15

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Worcester*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.18	$11.49	$22.90	$0.00	$65.57
2	60	$37.42	$11.49	$22.90	$0.00	$71.81
3	70	$43.65	$11.49	$22.90	$0.00	$78.04
4	80	$49.89	$11.49	$22.90	$0.00	$84.28
5	90	$56.12	$11.49	$22.90	$0.00	$90.51

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.83	$11.49	$22.90	$0.00	$66.22
2	60	$38.20	$11.49	$22.90	$0.00	$72.59
3	70	$44.56	$11.49	$22.90	$0.00	$78.95
4	80	$50.93	$11.49	$22.90	$0.00	$85.32
5	90	$57.29	$11.49	$22.90	$0.00	$91.68

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$48.10	$9.65	$18.22	$0.00	$75.97
	06/01/2025	$49.60	$9.65	$18.22	$0.00	$77.47
	12/01/2025	$51.10	$9.65	$18.22	$0.00	$78.97
	06/01/2026	$52.65	$9.65	$18.22	$0.00	$80.52
	12/01/2026	$54.15	$9.65	$18.22	$0.00	$82.02
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$46.95	$9.65	$18.22	$0.00	$74.82
	06/01/2025	$48.45	$9.65	$18.22	$0.00	$76.32
	12/01/2025	$49.95	$9.65	$18.22	$0.00	$77.82
	06/01/2026	$51.50	$9.65	$18.22	$0.00	$79.37
	12/01/2026	$53.00	$9.65	$18.22	$0.00	$80.87
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$47.28	$9.65	$18.22	$0.00	$75.15
	06/01/2025	$48.78	$9.65	$18.22	$0.00	$76.65
	12/01/2025	$50.28	$9.65	$18.22	$0.00	$78.15
	06/01/2026	$51.83	$9.65	$18.22	$0.00	$79.70
	12/01/2026	$53.33	$9.65	$18.22	$0.00	$81.20
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARBIDE CORE DRILL OPERATOR	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
LABORERS - ZONE 2	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
CARPENTER	09/01/2024	$48.37	$9.83	$19.97	$0.00	$78.17
CARPENTERS -ZONE 2 (Eastern Massachusetts)	03/01/2025	$49.62	$9.83	$19.97	$0.00	$79.42
	09/01/2025	$50.87	$9.83	$19.97	$0.00	$80.67
	03/01/2026	$52.12	$9.83	$19.97	$0.00	$81.92
	09/01/2026	$53.37	$9.83	$19.97	$0.00	$83.17
	03/01/2027	$54.62	$9.83	$19.97	$0.00	$84.42

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$21.77	$9.83	$1.73	$0.00	$33.33
2	45	$21.77	$9.83	$1.73	$0.00	$33.33
3	55	$26.60	$9.83	$3.40	$0.00	$39.83
4	55	$26.60	$9.83	$3.40	$0.00	$39.83
5	70	$33.86	$9.83	$16.51	$0.00	$60.20
6	70	$33.86	$9.83	$16.51	$0.00	$60.20
7	80	$38.70	$9.83	$18.24	$0.00	$66.77
8	80	$38.70	$9.83	$18.24	$0.00	$66.77

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$22.33	$9.83	$1.73	$0.00	$33.89
2	45	$22.33	$9.83	$1.73	$0.00	$33.89
3	55	$27.29	$9.83	$3.40	$0.00	$40.52
4	55	$27.29	$9.83	$3.40	$0.00	$40.52
5	70	$34.73	$9.83	$16.51	$0.00	$61.07
6	70	$34.73	$9.83	$16.51	$0.00	$61.07
7	80	$39.70	$9.83	$18.24	$0.00	$67.77
8	80	$39.70	$9.83	$18.24	$0.00	$67.77

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARPENTER WOOD FRAME *CARPENTERS-ZONE 3 (Wood Frame)*	10/01/2024	$26.65	$7.02	$4.80	$0.00	$38.47
	10/01/2025	$27.75	$7.02	$4.80	$0.00	$39.57
	10/01/2026	$28.85	$7.02	$4.80	$0.00	$40.67

All Aspects of New Wood Frame Work

Apprentice - *CARPENTER (Wood Frame) - Zone 3*

Effective Date - 10/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$15.99	$7.02	$0.00	$0.00	$23.01
2	60	$15.99	$7.02	$0.00	$0.00	$23.01
3	65	$17.32	$7.02	$1.00	$0.00	$25.34
4	70	$18.66	$7.02	$1.00	$0.00	$26.68
5	75	$19.99	$7.02	$4.80	$0.00	$31.81
6	80	$21.32	$7.02	$4.80	$0.00	$33.14
7	85	$22.65	$7.02	$4.80	$0.00	$34.47
8	90	$23.99	$7.02	$4.80	$0.00	$35.81

Effective Date - 10/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.65	$7.02	$0.00	$0.00	$23.67
2	60	$16.65	$7.02	$0.00	$0.00	$23.67
3	65	$18.04	$7.02	$1.00	$0.00	$26.06
4	70	$19.43	$7.02	$1.00	$0.00	$27.45
5	75	$20.81	$7.02	$4.80	$0.00	$32.63
6	80	$22.20	$7.02	$4.80	$0.00	$34.02
7	85	$23.59	$7.02	$4.80	$0.00	$35.41
8	90	$24.98	$7.02	$4.80	$0.00	$36.80

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (WORCESTER)*	01/01/2024	$49.33	$13.00	$23.57	$1.30	$87.20

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CEMENT MASONRY/PLASTERING - Worcester*

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.67	$13.00	$15.93	$0.00	$53.60
2	60	$29.60	$13.00	$18.57	$1.30	$62.47
3	65	$32.06	$13.00	$19.57	$1.30	$65.93
4	70	$34.53	$13.00	$20.57	$1.30	$69.40
5	75	$37.00	$13.00	$21.57	$1.30	$72.87
6	80	$39.46	$13.00	$22.57	$1.30	$76.33
7	90	$44.40	$13.00	$23.57	$1.30	$82.27

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$58.18	$15.55	$16.50	$0.00	$90.23
	06/01/2025	$59.51	$15.55	$16.50	$0.00	$91.56
	12/01/2025	$60.98	$15.55	$16.50	$0.00	$93.03
	06/01/2026	$62.31	$15.55	$16.50	$0.00	$94.36
	12/01/2026	$63.79	$15.55	$16.50	$0.00	$95.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$36.67	$15.55	$16.50	$0.00	$68.72
	06/01/2025	$37.52	$15.55	$16.50	$0.00	$69.57
	12/01/2025	$38.47	$15.55	$16.50	$0.00	$70.52
	06/01/2026	$39.33	$15.55	$16.50	$0.00	$71.38
	12/01/2026	$40.28	$15.55	$16.50	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	07/01/2024	$57.26	$9.95	$23.95	$0.00	$91.16
	01/01/2025	$58.46	$9.95	$23.95	$0.00	$92.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$28.63	$9.95	$0.00	$0.00	$38.58
2	55	$31.49	$9.95	$6.66	$0.00	$48.10
3	60	$34.36	$9.95	$7.26	$0.00	$51.57
4	65	$37.22	$9.95	$7.87	$0.00	$55.04
5	70	$40.08	$9.95	$20.32	$0.00	$70.35
6	75	$42.95	$9.95	$20.93	$0.00	$73.83
7	80	$45.81	$9.95	$21.53	$0.00	$77.29
8	90	$51.53	$9.95	$22.74	$0.00	$84.22

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$29.23	$9.95	$0.00	$0.00	$39.18
2	55	$32.15	$9.95	$6.66	$0.00	$48.76
3	60	$35.08	$9.95	$7.26	$0.00	$52.29
4	65	$38.00	$9.95	$7.87	$0.00	$55.82
5	70	$40.92	$9.95	$20.32	$0.00	$71.19
6	75	$43.85	$9.95	$20.93	$0.00	$74.73
7	80	$46.77	$9.95	$21.53	$0.00	$78.25
8	90	$52.61	$9.95	$22.74	$0.00	$85.30

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/02/2024	$47.00	$9.65	$18.40	$0.00	$75.05
	06/02/2025	$48.50	$9.65	$18.40	$0.00	$76.55
	12/01/2025	$50.00	$9.65	$18.40	$0.00	$78.05
	06/01/2026	$51.55	$9.65	$18.40	$0.00	$79.60
	12/07/2026	$53.05	$9.65	$18.40	$0.00	$81.10
	06/07/2027	$54.65	$9.65	$18.40	$0.00	$82.70
	12/06/2027	$56.25	$9.65	$18.40	$0.00	$84.30
	06/05/2028	$57.93	$9.65	$18.40	$0.00	$85.98
	12/04/2028	$59.60	$9.65	$18.40	$0.00	$87.65

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/02/2024	$48.00	$9.65	$18.40	$0.00	$76.05
	06/02/2025	$49.50	$9.65	$18.40	$0.00	$77.55
	12/01/2025	$51.00	$9.65	$18.40	$0.00	$79.05
	06/01/2026	$52.55	$9.65	$18.40	$0.00	$80.60
	12/07/2026	$54.05	$9.65	$18.40	$0.00	$82.10
	06/07/2027	$55.65	$9.65	$18.40	$0.00	$83.70
	12/06/2027	$57.25	$9.65	$18.40	$0.00	$85.30
	06/05/2028	$58.93	$9.65	$18.40	$0.00	$86.98
	12/04/2028	$60.60	$9.65	$18.40	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/02/2024	$47.75	$9.65	$18.40	$0.00	$75.80
	06/02/2025	$49.25	$9.65	$18.40	$0.00	$77.30
	12/01/2025	$50.75	$9.65	$18.40	$0.00	$78.80
	06/01/2026	$52.30	$9.65	$18.40	$0.00	$80.35
	12/07/2026	$53.80	$9.65	$18.40	$0.00	$81.85
	06/07/2027	$55.40	$9.65	$18.40	$0.00	$83.45
	12/06/2027	$57.00	$9.65	$18.40	$0.00	$85.05
	06/05/2028	$58.68	$9.65	$18.40	$0.00	$86.73
	12/04/2028	$60.35	$9.65	$18.40	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 2*	12/02/2024	$48.00	$9.65	$18.40	$0.00	$76.05
	06/02/2025	$49.50	$9.65	$18.40	$0.00	$77.55
	12/01/2025	$51.00	$9.65	$18.40	$0.00	$79.05
	06/01/2026	$52.55	$9.65	$18.40	$0.00	$80.60
	12/07/2026	$54.05	$9.65	$18.40	$0.00	$82.10
	06/07/2027	$55.65	$9.65	$18.40	$0.00	$83.70
	12/06/2027	$57.25	$9.65	$18.40	$0.00	$85.30
	06/05/2028	$58.93	$9.65	$18.40	$0.00	$86.98
	12/04/2028	$60.60	$9.65	$18.40	$0.00	$88.65
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/02/2024	$47.75	$9.65	$18.40	$0.00	$75.80
	06/02/2025	$49.25	$9.65	$18.40	$0.00	$77.30
	12/01/2025	$50.75	$9.65	$18.40	$0.00	$78.80
	06/01/2026	$52.30	$9.65	$18.40	$0.00	$80.35
	12/07/2026	$53.80	$9.65	$18.40	$0.00	$81.85
	06/07/2027	$55.40	$9.65	$18.40	$0.00	$83.45
	12/06/2027	$57.00	$9.65	$18.40	$0.00	$85.05
	06/05/2028	$58.68	$9.65	$18.40	$0.00	$86.73
	12/04/2028	$60.35	$9.65	$18.40	$0.00	$88.40
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/02/2024	$47.00	$9.65	$18.40	$0.00	$75.05
	06/02/2025	$48.50	$9.65	$18.40	$0.00	$76.55
	12/01/2025	$50.00	$9.65	$18.40	$0.00	$78.05
	06/01/2026	$51.55	$9.65	$18.40	$0.00	$79.60
	12/07/2026	$53.05	$9.65	$18.40	$0.00	$81.10
	06/07/2027	$54.65	$9.65	$18.40	$0.00	$82.70
	12/06/2027	$56.25	$9.65	$18.40	$0.00	$84.30
	06/05/2028	$57.93	$9.65	$18.40	$0.00	$85.98
	12/04/2028	$59.60	$9.65	$18.40	$0.00	$87.65
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$78.11	$10.08	$24.29	$0.00	$112.48
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Diver wage 70/80/90 2A $69.83, 3A $91.79,4A $102.14 Total Rate						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$51.97	$10.08	$24.29	$0.00	$86.34
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Piledriver wage 70/80/90 2A $54.20, 3A $73.93,4A $82.05 Total Rate						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$83.69	$10.08	$24.29	$0.00	$118.06
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$117.16	$10.08	$24.29	$0.00	$151.53
For apprentice rates see "Apprentice- PILE DRIVER"						
DRAWBRIDGE OPERATOR (Construction) *DRAWBRIDGE - SEIU LOCAL 888*	07/01/2020	$26.77	$6.67	$3.93	$0.16	$37.53
ELECTRICIAN *ELECTRICIANS LOCAL 96*	09/01/2024	$47.05	$13.99	$19.22	$0.00	$80.26
	09/07/2025	$48.16	$14.98	$19.60	$0.00	$82.74
	09/06/2026	$49.38	$15.96	$20.00	$0.00	$85.34

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 96*

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$18.82	$13.99	$0.56	$0.00	$33.37
2	45	$21.17	$13.99	$0.64	$0.00	$35.80
3	48	$22.58	$13.99	$15.79	$0.00	$52.36
4	55	$25.88	$13.99	$16.26	$0.00	$56.13
5	65	$30.58	$13.99	$16.91	$0.00	$61.48
6	80	$37.64	$13.99	$17.90	$0.00	$69.53

Effective Date - 09/07/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$19.26	$14.98	$0.58	$0.00	$34.82
2	45	$21.67	$14.98	$0.65	$0.00	$37.30
3	48	$23.12	$14.98	$16.09	$0.00	$54.19
4	55	$26.49	$14.98	$16.57	$0.00	$58.04
5	65	$31.30	$14.98	$17.25	$0.00	$63.53
6	80	$38.53	$14.98	$18.26	$0.00	$71.77

Notes:
Steps 1-2 are 1000 hrs; Steps 3-6 are 1500 hrs.

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 41*	01/01/2024	$61.98	$16.18	$20.96	$0.00	$99.12
	01/01/2025	$62.83	$16.28	$21.36	$0.00	$100.47
	01/01/2026	$63.68	$16.38	$21.76	$0.00	$101.82
	01/01/2027	$64.53	$16.48	$22.16	$0.00	$103.17

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 41*

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$30.99	$16.18	$0.00	$0.00	$47.17
2	55	$34.09	$16.18	$20.96	$0.00	$71.23
3	65	$40.29	$16.18	$20.96	$0.00	$77.43
4	70	$43.39	$16.18	$20.96	$0.00	$80.53
5	80	$49.58	$16.18	$20.96	$0.00	$86.72

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.42	$16.28	$0.00	$0.00	$47.70
2	55	$34.56	$16.28	$21.36	$0.00	$72.20
3	65	$40.84	$16.28	$21.36	$0.00	$78.48
4	70	$43.98	$16.28	$21.36	$0.00	$81.62
5	80	$50.26	$16.28	$21.36	$0.00	$87.90

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 41*	01/01/2024	$43.39	$16.18	$20.96	$0.00	$80.53
	01/01/2025	$43.98	$16.28	$21.36	$0.00	$81.62
	01/01/2026	$44.58	$16.38	$21.76	$0.00	$82.72
	01/01/2027	$45.17	$16.48	$22.16	$0.00	$83.81
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2024	$51.78	$15.30	$16.40	$0.00	$83.48
	05/01/2025	$53.22	$15.30	$16.40	$0.00	$84.92
	11/01/2025	$54.51	$15.30	$16.40	$0.00	$86.21
	05/01/2026	$55.95	$15.30	$16.40	$0.00	$87.65
	11/01/2026	$57.24	$15.30	$16.40	$0.00	$88.94
	05/01/2027	$58.67	$15.30	$16.40	$0.00	$90.37
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2024	$53.37	$15.30	$16.40	$0.00	$85.07
	05/01/2025	$54.82	$15.30	$16.40	$0.00	$86.52
	11/01/2025	$56.12	$15.30	$16.40	$0.00	$87.82
	05/01/2026	$57.57	$15.30	$16.40	$0.00	$89.27
	11/01/2026	$58.87	$15.30	$16.40	$0.00	$90.57
	05/01/2027	$60.32	$15.30	$16.40	$0.00	$92.02
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2024	$25.37	$15.30	$16.40	$0.00	$57.07
	05/01/2025	$26.22	$15.30	$16.40	$0.00	$57.92
	11/01/2025	$26.98	$15.30	$16.40	$0.00	$58.68
	05/01/2026	$27.83	$15.30	$16.40	$0.00	$59.53
	11/01/2026	$28.59	$15.30	$16.40	$0.00	$60.29
	05/01/2027	$29.44	$15.30	$16.40	$0.00	$61.14
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 96*	09/01/2024	$47.05	$13.99	$19.22	$0.00	$80.26
	09/07/2025	$48.16	$14.98	$19.60	$0.00	$82.74
	09/06/2026	$49.38	$15.96	$20.00	$0.00	$85.34
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINT/COMMISSIONING *ELECTRICIANS LOCAL 96*	09/01/2024	$47.05	$13.99	$19.22	$0.00	$80.26
	09/07/2025	$48.16	$14.98	$19.60	$0.00	$82.74
	09/06/2026	$49.38	$15.96	$20.00	$0.00	$85.34
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$45.96	$15.55	$16.50	$0.00	$78.01
	06/01/2025	$47.02	$15.55	$16.50	$0.00	$79.07
	12/01/2025	$48.19	$15.55	$16.50	$0.00	$80.24
	06/01/2026	$49.25	$15.55	$16.50	$0.00	$81.30
	12/01/2026	$50.43	$15.55	$16.50	$0.00	$82.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$27.01	$9.65	$17.80	$0.00	$54.46
	06/01/2025	$28.09	$9.65	$17.80	$0.00	$55.54
	12/01/2025	$28.09	$9.65	$17.80	$0.00	$55.54
	06/01/2026	$29.21	$9.65	$17.80	$0.00	$56.66
	12/01/2026	$29.21	$9.65	$17.80	$0.00	$56.66
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE II*	03/01/2024	$49.47	$8.83	$20.27	$0.00	$78.57

Apprentice - *FLOORCOVERER - Local 2168 Zone II*

Effective Date - 03/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.74	$8.83	$1.76	$0.00	$35.33
2	55	$27.21	$8.83	$1.76	$0.00	$37.80
3	60	$29.68	$8.83	$3.52	$0.00	$42.03
4	65	$32.16	$8.83	$3.52	$0.00	$44.51
5	70	$34.63	$8.83	$16.75	$0.00	$60.21
6	75	$37.10	$8.83	$16.75	$0.00	$62.68
7	80	$39.58	$8.83	$18.51	$0.00	$66.92
8	85	$42.05	$8.83	$18.51	$0.00	$69.39

Notes: Steps are 750 hrs.
% After 10/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
Step 1&2 $32.63/ 3&4 $39.28/ 5&6 $59.86/ 7&8 $66.52

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$36.67	$15.55	$16.50	$0.00	$68.72
	06/01/2025	$37.52	$15.55	$16.50	$0.00	$69.57
	12/01/2025	$38.47	$15.55	$16.50	$0.00	$70.52
	06/01/2026	$39.33	$15.55	$16.50	$0.00	$71.38
	12/01/2026	$40.28	$15.55	$16.50	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	07/01/2024	$46.76	$9.95	$23.95	$0.00	$80.66
	01/01/2025	$47.96	$9.95	$23.95	$0.00	$81.86

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.38	$9.95	$0.00	$0.00	$33.33
2	55	$25.72	$9.95	$6.66	$0.00	$42.33
3	60	$28.06	$9.95	$7.26	$0.00	$45.27
4	65	$30.39	$9.95	$7.87	$0.00	$48.21
5	70	$32.73	$9.95	$20.32	$0.00	$63.00
6	75	$35.07	$9.95	$20.93	$0.00	$65.95
7	80	$37.41	$9.95	$21.53	$0.00	$68.89
8	90	$42.08	$9.95	$22.74	$0.00	$74.77

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.98	$9.95	$0.00	$0.00	$33.93
2	55	$26.38	$9.95	$6.66	$0.00	$42.99
3	60	$28.78	$9.95	$7.26	$0.00	$45.99
4	65	$31.17	$9.95	$7.87	$0.00	$48.99
5	70	$33.57	$9.95	$20.32	$0.00	$63.84
6	75	$35.97	$9.95	$20.93	$0.00	$66.85
7	80	$38.37	$9.95	$21.53	$0.00	$69.85
8	90	$43.16	$9.95	$22.74	$0.00	$75.85

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$31.37	$0.00	$0.00	$0.00	$31.37
2	60	$34.22	$15.55	$16.50	$0.00	$66.27
3	65	$37.07	$15.55	$16.50	$0.00	$69.12
4	70	$39.92	$15.55	$16.50	$0.00	$71.97
5	75	$42.77	$15.55	$16.50	$0.00	$74.82
6	80	$45.62	$15.55	$16.50	$0.00	$77.67
7	85	$48.48	$15.55	$16.50	$0.00	$80.53
8	90	$51.33	$15.55	$16.50	$0.00	$83.38

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$32.08	$0.00	$0.00	$0.00	$32.08
2	60	$35.00	$15.55	$16.50	$0.00	$67.05
3	65	$37.91	$15.55	$16.50	$0.00	$69.96
4	70	$40.83	$15.55	$16.50	$0.00	$72.88
5	75	$43.75	$15.55	$16.50	$0.00	$75.80
6	80	$46.66	$15.55	$16.50	$0.00	$78.71
7	85	$49.58	$15.55	$16.50	$0.00	$81.63
8	90	$52.50	$15.55	$16.50	$0.00	$84.55

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 63*	07/01/2024	$40.98	$12.20	$18.74	$2.13	$74.05
	01/01/2025	$42.23	$12.20	$18.74	$2.13	$75.30
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 96*	09/01/2024	$47.05	$13.99	$19.22	$0.00	$80.26
	09/07/2025	$48.16	$14.98	$19.60	$0.00	$82.74
	09/06/2026	$49.38	$15.96	$20.00	$0.00	$85.34
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 63*	07/01/2024	$40.98	$12.20	$18.74	$2.13	$74.05
	01/01/2025	$42.23	$12.20	$18.74	$2.13	$75.30
For apprentice rates see "Apprentice- SHEET METAL WORKER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (TESTING AND BALANCING -WATER) *PLUMBERS LOCAL 4*	09/01/2024	$55.00	$9.90	$17.77	$0.00	$82.67
	03/01/2025	$56.40	$9.90	$17.77	$0.00	$84.07
	09/01/2025	$57.80	$9.90	$17.77	$0.00	$85.47
	03/01/2026	$59.20	$9.90	$17.77	$0.00	$86.87
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PLUMBERS LOCAL 4*	09/01/2024	$55.00	$9.90	$17.77	$0.00	$82.67
	03/01/2025	$56.40	$9.90	$17.77	$0.00	$84.07
	09/01/2025	$57.80	$9.90	$17.77	$0.00	$85.47
	03/01/2026	$59.20	$9.90	$17.77	$0.00	$86.87
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 2*	12/01/2024	$40.61	$9.65	$17.70	$0.00	$67.96
	06/01/2025	$42.00	$9.65	$17.70	$0.00	$69.35
	12/01/2025	$43.38	$9.65	$17.70	$0.00	$70.73
	06/01/2026	$44.82	$9.65	$17.70	$0.00	$72.17
	12/01/2026	$46.26	$9.65	$17.70	$0.00	$73.61
	06/01/2027	$47.71	$9.65	$17.70	$0.00	$75.06
	12/01/2027	$49.16	$9.65	$17.70	$0.00	$76.51
	06/01/2028	$50.66	$9.65	$17.70	$0.00	$78.01
	12/01/2028	$52.16	$9.65	$17.70	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"						
HYDRAULIC DRILLS (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.61	$9.65	$17.80	$0.00	$68.06
	06/01/2025	$42.00	$9.65	$17.80	$0.00	$69.45
	12/01/2025	$43.38	$9.65	$17.80	$0.00	$70.83
	06/01/2026	$44.82	$9.65	$17.80	$0.00	$72.27
	12/01/2026	$46.26	$9.65	$17.80	$0.00	$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (WORCESTER)*	09/01/2024	$51.23	$14.75	$19.61	$0.00	$85.59
	09/01/2025	$54.31	$14.75	$19.61	$0.00	$88.67
	09/01/2026	$57.38	$14.75	$19.61	$0.00	$91.74

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Worcester*

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.62	$14.75	$14.32	$0.00	$54.69
2	60	$30.74	$14.75	$15.37	$0.00	$60.86
3	70	$35.86	$14.75	$16.43	$0.00	$67.04
4	80	$40.98	$14.75	$17.49	$0.00	$73.22

Effective Date - 09/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.16	$14.75	$14.32	$0.00	$56.23
2	60	$32.59	$14.75	$15.37	$0.00	$62.71
3	70	$38.02	$14.75	$16.43	$0.00	$69.20
4	80	$43.45	$14.75	$17.49	$0.00	$75.69

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (WORCESTER AREA)*	03/16/2024	$53.67	$8.35	$26.70	$0.00	$88.72

Apprentice - *IRONWORKER - Local 7 Worcester*

Effective Date - 03/16/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$32.20	$8.35	$26.70	$0.00	$67.25
2	70	$37.57	$8.35	$26.70	$0.00	$72.62
3	75	$40.25	$8.35	$26.70	$0.00	$75.30
4	80	$42.94	$8.35	$26.70	$0.00	$77.99
5	85	$45.62	$8.35	$26.70	$0.00	$80.67
6	90	$48.30	$8.35	$26.70	$0.00	$83.35

Notes:

Apprentice to Journeyworker Ratio:1:4

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 2*	12/01/2024	$39.86	$9.65	$17.70	$0.00	$67.21
	06/01/2025	$41.25	$9.65	$17.70	$0.00	$68.60
	12/01/2025	$42.63	$9.65	$17.70	$0.00	$69.98
	06/01/2026	$44.07	$9.65	$17.70	$0.00	$71.42
	12/01/2026	$45.51	$9.65	$17.70	$0.00	$72.86
	06/01/2027	$46.96	$9.65	$17.70	$0.00	$74.31
	12/01/2027	$48.41	$9.65	$17.70	$0.00	$75.76
	06/01/2028	$49.91	$9.65	$17.70	$0.00	$77.26
	12/01/2028	$51.41	$9.65	$17.70	$0.00	$78.76

Apprentice - *LABORER - Zone 2*

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.92	$9.65	$17.70	$0.00	$51.27
2	70	$27.90	$9.65	$17.70	$0.00	$55.25
3	80	$31.89	$9.65	$17.70	$0.00	$59.24
4	90	$35.87	$9.65	$17.70	$0.00	$63.22

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.75	$9.65	$17.70	$0.00	$52.10
2	70	$28.88	$9.65	$17.70	$0.00	$56.23
3	80	$33.00	$9.65	$17.70	$0.00	$60.35
4	90	$37.13	$9.65	$17.70	$0.00	$64.48

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$39.86	$9.65	$17.80	$0.00	$67.31
	06/01/2025	$41.25	$9.65	$17.80	$0.00	$68.70
	12/01/2025	$42.63	$9.65	$17.80	$0.00	$70.08
	06/01/2026	$44.07	$9.65	$17.80	$0.00	$71.52
	12/01/2026	$45.51	$9.65	$17.80	$0.00	$72.96

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER (Heavy & Highway) - Zone 2*

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$23.92	$9.65	$17.80	$0.00	$51.37
2	70	$27.90	$9.65	$17.80	$0.00	$55.35
3	80	$31.89	$9.65	$17.80	$0.00	$59.34
4	90	$35.87	$9.65	$17.80	$0.00	$63.32

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.75	$9.65	$17.80	$0.00	$52.20
2	70	$28.88	$9.65	$17.80	$0.00	$56.33
3	80	$33.00	$9.65	$17.80	$0.00	$60.45
4	90	$37.13	$9.65	$17.80	$0.00	$64.58

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	12/01/2024	$39.86	$9.65	$17.70	$0.00	$67.21
	06/01/2025	$41.25	$9.65	$17.70	$0.00	$68.60
	12/01/2025	$42.63	$9.65	$17.70	$0.00	$69.98
	06/01/2026	$44.07	$9.65	$17.70	$0.00	$71.42
	12/01/2026	$45.51	$9.65	$17.70	$0.00	$72.86
	06/01/2027	$46.96	$9.65	$17.70	$0.00	$74.31
	12/01/2027	$48.41	$9.65	$17.70	$0.00	$75.76
	06/01/2028	$49.91	$9.65	$17.70	$0.00	$77.26
	12/01/2028	$51.41	$9.65	$17.70	$0.00	$78.76

For apprentice rates see "Apprentice- LABORER"

LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	12/01/2024	$39.86	$9.65	$17.70	$0.00	$67.21
	06/01/2025	$41.25	$9.65	$17.70	$0.00	$68.60
	12/01/2025	$42.63	$9.65	$17.70	$0.00	$69.98
	06/01/2026	$44.07	$9.65	$17.70	$0.00	$71.42
	12/01/2026	$45.51	$9.65	$17.70	$0.00	$72.86
	06/01/2027	$46.96	$9.65	$17.70	$0.00	$74.31
	12/01/2027	$48.41	$9.65	$17.70	$0.00	$75.76
	06/01/2028	$49.91	$9.65	$17.70	$0.00	$77.26
	12/01/2028	$51.41	$9.65	$17.70	$0.00	$78.76

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/02/2024	$39.95	$9.65	$17.76	$0.00	$67.36
	06/02/2025	$41.34	$9.65	$17.76	$0.00	$68.75
	12/01/2025	$42.72	$9.65	$17.76	$0.00	$70.13
	06/01/2026	$44.16	$9.65	$17.76	$0.00	$71.57
	12/07/2026	$45.60	$9.65	$17.76	$0.00	$73.01
	06/07/2027	$47.05	$9.65	$17.76	$0.00	$74.46
	12/06/2027	$48.50	$9.65	$17.76	$0.00	$75.91
	06/05/2028	$50.00	$9.65	$17.76	$0.00	$77.41
	12/04/2028	$51.50	$9.65	$17.76	$0.00	$78.91
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	12/01/2024	$39.86	$9.65	$17.70	$0.00	$67.21
	06/01/2025	$41.25	$9.65	$17.70	$0.00	$68.60
	12/01/2025	$42.63	$9.65	$17.70	$0.00	$69.98
	06/01/2026	$44.07	$9.65	$17.70	$0.00	$71.42
	12/01/2026	$45.51	$9.65	$17.70	$0.00	$72.86
	06/01/2027	$46.96	$9.65	$17.70	$0.00	$74.31
	12/01/2027	$48.41	$9.65	$17.70	$0.00	$75.76
	06/01/2028	$49.91	$9.65	$17.70	$0.00	$77.26
	12/01/2028	$51.41	$9.65	$17.70	$0.00	$78.76
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 2*	12/01/2024	$39.86	$9.65	$17.70	$0.00	$67.21
	06/01/2025	$41.25	$9.65	$17.70	$0.00	$68.60
	12/01/2025	$42.63	$9.65	$17.70	$0.00	$69.98
	06/01/2026	$44.07	$9.65	$17.70	$0.00	$71.42
	12/01/2026	$45.51	$9.65	$17.70	$0.00	$72.86
	06/01/2027	$46.96	$9.65	$17.70	$0.00	$74.31
	12/01/2027	$48.41	$9.65	$17.70	$0.00	$75.76
	06/01/2028	$49.91	$9.65	$17.70	$0.00	$77.26
	12/01/2028	$51.41	$9.65	$17.70	$0.00	$78.76
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LASER BEAM OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2024	$49.32	$11.49	$21.62	$0.00	$82.43
	02/01/2025	$50.36	$11.49	$21.62	$0.00	$83.47
	08/01/2025	$52.08	$11.49	$21.62	$0.00	$85.19
	02/01/2026	$53.16	$11.49	$21.62	$0.00	$86.27
	08/01/2026	$54.92	$11.49	$21.62	$0.00	$88.03
	02/01/2027	$56.04	$11.49	$21.62	$0.00	$89.15

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.66	$11.49	$21.62	$0.00	$57.77
2	60	$29.59	$11.49	$21.62	$0.00	$62.70
3	70	$34.52	$11.49	$21.62	$0.00	$67.63
4	80	$39.46	$11.49	$21.62	$0.00	$72.57
5	90	$44.39	$11.49	$21.62	$0.00	$77.50

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.18	$11.49	$21.62	$0.00	$58.29
2	60	$30.22	$11.49	$21.62	$0.00	$63.33
3	70	$35.25	$11.49	$21.62	$0.00	$68.36
4	80	$40.29	$11.49	$21.62	$0.00	$73.40
5	90	$45.32	$11.49	$21.62	$0.00	$78.43

Notes:

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2024	$64.52	$11.49	$23.56	$0.00	$99.57
	02/01/2025	$65.82	$11.49	$23.56	$0.00	$100.87
	08/01/2025	$67.97	$11.49	$23.56	$0.00	$103.02
	02/01/2026	$69.32	$11.49	$23.56	$0.00	$104.37
	08/01/2026	$71.52	$11.49	$23.56	$0.00	$106.57
	02/01/2027	$72.92	$11.49	$23.56	$0.00	$107.97

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$32.26	$11.49	$23.56	$0.00	$67.31
2	60	$38.71	$11.49	$23.56	$0.00	$73.76
3	70	$45.16	$11.49	$23.56	$0.00	$80.21
4	80	$51.62	$11.49	$23.56	$0.00	$86.67
5	90	$58.07	$11.49	$23.56	$0.00	$93.12

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$32.91	$11.49	$23.56	$0.00	$67.96
2	60	$39.49	$11.49	$23.56	$0.00	$74.54
3	70	$46.07	$11.49	$23.56	$0.00	$81.12
4	80	$52.66	$11.49	$23.56	$0.00	$87.71
5	90	$59.24	$11.49	$23.56	$0.00	$94.29

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 3) *MILLWRIGHTS LOCAL 1121 - Zone 3*	01/01/2024	$41.20	$10.08	$21.22	$0.00	$72.50
	01/06/2025	$43.48	$10.08	$21.22	$0.00	$74.78
	01/05/2026	$45.76	$10.08	$21.22	$0.00	$77.06

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 3*

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$22.66	$10.08	$5.36	$0.00	$38.10
2	65	$26.78	$10.08	$6.34	$0.00	$43.20
3	75	$30.90	$10.08	$18.78	$0.00	$59.76
4	85	$35.02	$10.08	$19.76	$0.00	$64.86

Effective Date - 01/06/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$23.91	$10.08	$5.36	$0.00	$39.35
2	65	$28.26	$10.08	$6.34	$0.00	$44.68
3	75	$32.61	$10.08	$18.78	$0.00	$61.47
4	85	$36.96	$10.08	$19.76	$0.00	$66.80

Notes: Step 1&2 Appr. indentured after 1/6/2020 receive no pension, but do receive annuity. (Step 1 $5.72, Step 2 $6.66)
Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:4

MORTAR MIXER *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$25.37	$15.30	$16.40	$0.00	$57.07
	06/01/2025	$25.97	$15.30	$16.40	$0.00	$57.67
	12/01/2025	$26.63	$15.30	$16.40	$0.00	$58.33
	06/01/2026	$27.22	$15.30	$16.40	$0.00	$58.92
	12/01/2026	$27.89	$15.30	$16.40	$0.00	$59.59
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$31.08	$15.30	$16.40	$0.00	$62.78
	06/01/2025	$31.80	$15.30	$16.40	$0.00	$63.50
	12/01/2025	$32.60	$15.30	$16.40	$0.00	$64.30
	06/01/2026	$33.32	$15.30	$16.40	$0.00	$65.02
	12/01/2026	$34.12	$15.30	$16.40	$0.00	$65.82
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	07/01/2024	$57.26	$9.95	$23.95	$0.00	$91.16
	01/01/2025	$58.46	$9.95	$23.95	$0.00	$92.36

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$28.63	$9.95	$0.00	$0.00	$38.58
2	55	$31.49	$9.95	$6.66	$0.00	$48.10
3	60	$34.36	$9.95	$7.26	$0.00	$51.57
4	65	$37.22	$9.95	$7.87	$0.00	$55.04
5	70	$40.08	$9.95	$20.32	$0.00	$70.35
6	75	$42.95	$9.95	$20.93	$0.00	$73.83
7	80	$45.81	$9.95	$21.53	$0.00	$77.29
8	90	$51.53	$9.95	$22.74	$0.00	$84.22

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$29.23	$9.95	$0.00	$0.00	$39.18
2	55	$32.15	$9.95	$6.66	$0.00	$48.76
3	60	$35.08	$9.95	$7.26	$0.00	$52.29
4	65	$38.00	$9.95	$7.87	$0.00	$55.82
5	70	$40.92	$9.95	$20.32	$0.00	$71.19
6	75	$43.85	$9.95	$20.93	$0.00	$74.73
7	80	$46.77	$9.95	$21.53	$0.00	$78.25
8	90	$52.61	$9.95	$22.74	$0.00	$85.30

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	07/01/2024	$48.16	$9.95	$23.95	$0.00	$82.06
	01/01/2025	$49.36	$9.95	$23.95	$0.00	$83.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.08	$9.95	$0.00	$0.00	$34.03
2	55	$26.49	$9.95	$6.66	$0.00	$43.10
3	60	$28.90	$9.95	$7.26	$0.00	$46.11
4	65	$31.30	$9.95	$7.87	$0.00	$49.12
5	70	$33.71	$9.95	$20.32	$0.00	$63.98
6	75	$36.12	$9.95	$20.93	$0.00	$67.00
7	80	$38.53	$9.95	$21.53	$0.00	$70.01
8	90	$43.34	$9.95	$22.74	$0.00	$76.03

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.68	$9.95	$0.00	$0.00	$34.63
2	55	$27.15	$9.95	$6.66	$0.00	$43.76
3	60	$29.62	$9.95	$7.26	$0.00	$46.83
4	65	$32.08	$9.95	$7.87	$0.00	$49.90
5	70	$34.55	$9.95	$20.32	$0.00	$64.82
6	75	$37.02	$9.95	$20.93	$0.00	$67.90
7	80	$39.49	$9.95	$21.53	$0.00	$70.97
8	90	$44.42	$9.95	$22.74	$0.00	$77.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	07/01/2024	$46.22	$9.95	$23.95	$0.00	$80.12
	01/01/2025	$47.42	$9.95	$23.95	$0.00	$81.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.11	$9.95	$0.00	$0.00	$33.06
2	55	$25.42	$9.95	$6.66	$0.00	$42.03
3	60	$27.73	$9.95	$7.26	$0.00	$44.94
4	65	$30.04	$9.95	$7.87	$0.00	$47.86
5	70	$32.35	$9.95	$20.32	$0.00	$62.62
6	75	$34.67	$9.95	$20.93	$0.00	$65.55
7	80	$36.98	$9.95	$21.53	$0.00	$68.46
8	90	$41.60	$9.95	$22.74	$0.00	$74.29

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.71	$9.95	$0.00	$0.00	$33.66
2	55	$26.08	$9.95	$6.66	$0.00	$42.69
3	60	$28.45	$9.95	$7.26	$0.00	$45.66
4	65	$30.82	$9.95	$7.87	$0.00	$48.64
5	70	$33.19	$9.95	$20.32	$0.00	$63.46
6	75	$35.57	$9.95	$20.93	$0.00	$66.45
7	80	$37.94	$9.95	$21.53	$0.00	$69.42
8	90	$42.68	$9.95	$22.74	$0.00	$75.37

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, NEW) *	07/01/2024	$46.76	$9.95	$23.95	$0.00	$80.66
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2025	$47.96	$9.95	$23.95	$0.00	$81.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.38	$9.95	$0.00	$0.00	$33.33
2	55	$25.72	$9.95	$6.66	$0.00	$42.33
3	60	$28.06	$9.95	$7.26	$0.00	$45.27
4	65	$30.39	$9.95	$7.87	$0.00	$48.21
5	70	$32.73	$9.95	$20.32	$0.00	$63.00
6	75	$35.07	$9.95	$20.93	$0.00	$65.95
7	80	$37.41	$9.95	$21.53	$0.00	$68.89
8	90	$42.08	$9.95	$22.74	$0.00	$74.77

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.98	$9.95	$0.00	$0.00	$33.93
2	55	$26.38	$9.95	$6.66	$0.00	$42.99
3	60	$28.78	$9.95	$7.26	$0.00	$45.99
4	65	$31.17	$9.95	$7.87	$0.00	$48.99
5	70	$33.57	$9.95	$20.32	$0.00	$63.84
6	75	$35.97	$9.95	$20.93	$0.00	$66.85
7	80	$38.37	$9.95	$21.53	$0.00	$69.85
8	90	$43.16	$9.95	$22.74	$0.00	$75.85

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	07/01/2024	$44.82	$9.95	$23.95	$0.00	$78.72
	01/01/2025	$46.02	$9.95	$23.95	$0.00	$79.92

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.41	$9.95	$0.00	$0.00	$32.36
2	55	$24.65	$9.95	$6.66	$0.00	$41.26
3	60	$26.89	$9.95	$7.26	$0.00	$44.10
4	65	$29.13	$9.95	$7.87	$0.00	$46.95
5	70	$31.37	$9.95	$20.32	$0.00	$61.64
6	75	$33.62	$9.95	$20.93	$0.00	$64.50
7	80	$35.86	$9.95	$21.53	$0.00	$67.34
8	90	$40.34	$9.95	$22.74	$0.00	$73.03

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.01	$9.95	$0.00	$0.00	$32.96
2	55	$25.31	$9.95	$6.66	$0.00	$41.92
3	60	$27.61	$9.95	$7.26	$0.00	$44.82
4	65	$29.91	$9.95	$7.87	$0.00	$47.73
5	70	$32.21	$9.95	$20.32	$0.00	$62.48
6	75	$34.52	$9.95	$20.93	$0.00	$65.40
7	80	$36.82	$9.95	$21.53	$0.00	$68.30
8	90	$41.42	$9.95	$22.74	$0.00	$74.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$39.86	$9.65	$17.80	$0.00	$67.31
	06/01/2025	$41.25	$9.65	$17.80	$0.00	$68.70
	12/01/2025	$42.63	$9.65	$17.80	$0.00	$70.08
	06/01/2026	$44.07	$9.65	$17.80	$0.00	$71.52
	12/01/2026	$45.51	$9.65	$17.80	$0.00	$72.96
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$39.78	$15.07	$20.17	$0.00	$75.02
	01/01/2025	$39.78	$15.57	$20.17	$0.00	$75.52
	06/01/2025	$40.78	$15.57	$20.17	$0.00	$76.52
	12/01/2025	$40.78	$15.57	$21.78	$0.00	$78.13
	01/01/2026	$40.78	$16.17	$21.78	$0.00	$78.73
	06/01/2026	$41.78	$16.17	$21.78	$0.00	$79.73
	12/01/2026	$41.78	$16.17	$23.52	$0.00	$81.47
	01/01/2027	$41.78	$16.77	$23.52	$0.00	$82.07
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$51.97	$10.08	$24.29	$0.00	$86.34
For apprentice rates see "Apprentice- PILE DRIVER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2024	$51.97	$10.08	$24.29	$0.00	$86.34

Apprentice - *PILE DRIVER - Local 56 Zone 2*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$23.39	$10.08	$2.53	$0.00	$36.00
2	55	$28.58	$10.08	$5.07	$0.00	$43.73
3	70	$36.38	$10.08	$19.22	$0.00	$65.68
4	80	$41.58	$10.08	$21.76	$0.00	$73.42

Notes:

% Indentured BEFORE 8/1/2020, 50/60/70/75/80/80/90/90

Step 1 $60.36/2 $65.75/3 $70.75/4 $73.35/5&6 $75.95/7&8 81.14

Apprentice to Journeyworker Ratio:1:5

PIPELAYER *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
PIPELAYER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
PLUMBER & PIPEFITTER *PLUMBERS LOCAL 4*	09/01/2024	$55.00	$9.90	$17.77	$0.00	$82.67
	03/01/2025	$56.40	$9.90	$17.77	$0.00	$84.07
	09/01/2025	$57.80	$9.90	$17.77	$0.00	$85.47
	03/01/2026	$59.20	$9.90	$17.77	$0.00	$86.87

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PLUMBER/PIPEFITTER - Local 4*

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$22.00	$9.90	$0.00	$0.00	$31.90
2	50	$27.50	$9.90	$0.00	$0.00	$37.40
3	60	$33.00	$9.90	$0.00	$0.00	$42.90
4	70	$38.50	$9.90	$8.06	$0.00	$56.46
5	80	$44.00	$9.90	$8.06	$0.00	$61.96

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$22.56	$9.90	$0.00	$0.00	$32.46
2	50	$28.20	$9.90	$0.00	$0.00	$38.10
3	60	$33.84	$9.90	$0.00	$0.00	$43.74
4	70	$39.48	$9.90	$8.06	$0.00	$57.44
5	80	$45.12	$9.90	$8.06	$0.00	$63.08

Notes:
Steps - 2000 hrs; Step 4 w/lic 75%, Step 5 w/lic 85%
Step 4 w/lic $52.59, Step 5 w/lic $57.44

Apprentice to Journeyworker Ratio:1:3

PNEUMATIC CONTROLS (TEMP.) *PLUMBERS LOCAL 4*	09/01/2024	$55.00	$9.90	$17.77	$0.00	$82.67
	03/01/2025	$56.40	$9.90	$17.77	$0.00	$84.07
	09/01/2025	$57.80	$9.90	$17.77	$0.00	$85.47
	03/01/2026	$59.20	$9.90	$17.77	$0.00	$86.87
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.61	$9.65	$17.70	$0.00	$67.96
	06/01/2025	$42.00	$9.65	$17.70	$0.00	$69.35
	12/01/2025	$43.38	$9.65	$17.70	$0.00	$70.73
	06/01/2026	$44.82	$9.65	$17.70	$0.00	$72.17
	12/01/2026	$46.26	$9.65	$17.70	$0.00	$73.61
	06/01/2027	$47.71	$9.65	$17.70	$0.00	$75.06
	12/01/2027	$49.16	$9.65	$17.70	$0.00	$76.51
	06/01/2028	$50.66	$9.65	$17.70	$0.00	$78.01
	12/01/2028	$52.16	$9.65	$17.70	$0.00	$79.51
For apprentice rates see "Apprentice- LABORER"						
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWDERMAN & BLASTER *LABORERS - ZONE 2*	12/01/2024	$40.86	$9.65	$17.70	$0.00	$68.21
	06/01/2025	$42.25	$9.65	$17.70	$0.00	$69.60
	12/01/2025	$43.63	$9.65	$17.70	$0.00	$70.98
	06/01/2026	$45.07	$9.65	$17.70	$0.00	$72.42
	12/01/2026	$46.51	$9.65	$17.70	$0.00	$73.86
	06/01/2027	$47.96	$9.65	$17.70	$0.00	$75.31
	12/01/2027	$49.41	$9.65	$17.70	$0.00	$76.76
	06/01/2028	$50.91	$9.65	$17.70	$0.00	$78.26
	12/01/2028	$52.41	$9.65	$17.70	$0.00	$79.76
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.86	$9.40	$17.55	$0.00	$67.81
	06/01/2025	$42.25	$9.40	$17.55	$0.00	$69.20
	12/01/2025	$43.63	$9.40	$17.55	$0.00	$70.58
	06/01/2026	$45.07	$9.40	$17.55	$0.00	$72.02
	12/01/2026	$46.51	$9.40	$17.55	$0.00	$73.46
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$36.67	$15.55	$16.50	$0.00	$68.72
	06/01/2025	$37.52	$15.55	$16.50	$0.00	$69.57
	12/01/2025	$38.47	$15.55	$16.50	$0.00	$70.52
	06/01/2026	$39.33	$15.55	$16.50	$0.00	$71.38
	12/01/2026	$40.28	$15.55	$16.50	$0.00	$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS 170 - Dauphinais (Bellingham)*	12/01/2024	$27.60	$11.26	$6.15	$0.00	$45.01
	01/01/2025	$27.60	$11.26	$6.15	$0.00	$45.01
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.11	$9.65	$17.70	$0.00	$67.46
	06/01/2025	$41.50	$9.65	$17.70	$0.00	$68.85
	12/01/2025	$42.88	$9.65	$17.70	$0.00	$70.23
	06/01/2026	$44.32	$9.65	$17.70	$0.00	$71.67
	12/01/2026	$45.76	$9.65	$17.70	$0.00	$73.11
	06/01/2027	$47.21	$9.65	$17.70	$0.00	$74.56
	12/01/2027	$48.66	$9.65	$17.70	$0.00	$76.01
	06/01/2028	$50.16	$9.65	$17.70	$0.00	$77.51
	12/01/2028	$51.66	$9.65	$17.70	$0.00	$79.01
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	08/01/2024	$51.03	$13.03	$21.70	$0.00	$85.76
	02/01/2025	$52.28	$13.03	$21.70	$0.00	$87.01
	08/01/2025	$53.78	$13.03	$21.70	$0.00	$88.51
	02/01/2026	$55.03	$13.03	$21.70	$0.00	$89.76

Apprentice - *ROOFER - Local 33*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.52	$13.03	$6.52	$0.00	$45.07
2	60	$30.62	$13.03	$21.70	$0.00	$65.35
3	65	$33.17	$13.03	$21.70	$0.00	$67.90
4	75	$38.27	$13.03	$21.70	$0.00	$73.00
5	85	$43.38	$13.03	$21.70	$0.00	$78.11

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.14	$13.03	$6.52	$0.00	$45.69
2	60	$31.37	$13.03	$21.70	$0.00	$66.10
3	65	$33.98	$13.03	$21.70	$0.00	$68.71
4	75	$39.21	$13.03	$21.70	$0.00	$73.94
5	85	$44.44	$13.03	$21.70	$0.00	$79.17

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
(Hot Pitch Mechanics' receive $1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	08/01/2024	$51.28	$13.03	$21.70	$0.00	$86.01
	02/01/2025	$52.53	$13.03	$21.70	$0.00	$87.26
	08/01/2025	$54.03	$13.03	$21.70	$0.00	$88.76
	02/01/2026	$55.28	$13.03	$21.70	$0.00	$90.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 63*	07/01/2024	$40.98	$12.20	$18.74	$2.13	$74.05
	01/01/2025	$42.23	$12.20	$18.74	$2.13	$75.30

Apprentice - *SHEET METAL WORKER - Local 63*

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.44	$5.49	$4.86	$0.85	$29.64
2	50	$20.49	$6.10	$5.40	$0.94	$32.93
3	55	$22.54	$6.71	$9.71	$1.15	$40.11
4	60	$24.59	$7.32	$9.71	$1.23	$42.85
5	65	$26.64	$7.93	$9.71	$1.31	$45.59
6	70	$28.69	$8.54	$9.71	$1.39	$48.33
7	75	$30.74	$9.15	$9.71	$1.47	$51.07
8	80	$32.78	$9.76	$17.66	$1.78	$61.98
9	85	$34.83	$10.37	$17.66	$1.86	$64.72
10	90	$36.88	$10.98	$17.66	$1.94	$67.46

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$19.00	$5.49	$4.86	$0.85	$30.20
2	50	$21.12	$6.10	$5.40	$0.94	$33.56
3	55	$23.23	$6.71	$9.71	$1.15	$40.80
4	60	$25.34	$7.32	$9.71	$1.23	$43.60
5	65	$27.45	$7.93	$9.71	$1.31	$46.40
6	70	$29.56	$8.54	$9.71	$1.39	$49.20
7	75	$31.67	$9.15	$9.71	$1.47	$52.00
8	80	$33.78	$9.76	$17.66	$1.78	$62.98
9	85	$35.90	$10.37	$17.66	$1.86	$65.79
10	90	$38.01	$10.98	$17.66	$1.94	$68.59

Notes:

Apprentice to Journeyworker Ratio:1:3

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.24	$15.07	$20.17	$0.00	$75.48
	01/01/2025	$40.24	$15.57	$20.17	$0.00	$75.98
	06/01/2025	$41.24	$15.57	$20.17	$0.00	$76.98
	12/01/2025	$41.24	$15.57	$21.78	$0.00	$78.59
	01/01/2026	$41.24	$16.17	$21.78	$0.00	$79.19
	06/01/2026	$42.24	$16.17	$21.78	$0.00	$80.19
	12/01/2026	$42.24	$16.17	$23.52	$0.00	$81.93
	01/01/2027	$42.24	$16.77	$23.52	$0.00	$82.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.53	$15.07	$20.17	$0.00	$75.77
	01/01/2025	$40.53	$15.57	$20.17	$0.00	$76.27
	06/01/2025	$41.53	$15.57	$20.17	$0.00	$77.27
	12/01/2025	$41.53	$15.57	$21.78	$0.00	$78.88
	01/01/2026	$41.53	$16.17	$21.78	$0.00	$79.48
	06/01/2026	$42.53	$16.17	$21.78	$0.00	$80.48
	12/01/2026	$42.53	$16.17	$23.52	$0.00	$82.22
	01/01/2027	$42.53	$16.77	$23.52	$0.00	$82.82
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 669*	04/01/2023	$47.43	$11.45	$16.61	$0.00	$75.49

Apprentice - *SPRINKLER FITTER - Local 669*

Effective Date - 04/01/2023

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$21.34	$8.22	$0.00	$0.00	$29.56
2	50	$23.72	$8.22	$0.00	$0.00	$31.94
3	55	$26.09	$11.45	$7.20	$0.00	$44.74
4	60	$28.46	$11.45	$8.35	$0.00	$48.26
5	65	$30.83	$11.45	$8.35	$0.00	$50.63
6	70	$33.20	$11.45	$8.60	$0.00	$53.25
7	75	$35.57	$11.45	$8.60	$0.00	$55.62
8	80	$37.94	$11.45	$8.60	$0.00	$57.99
9	85	$40.32	$11.45	$8.60	$0.00	$60.37
10	90	$42.69	$11.45	$8.60	$0.00	$62.74

Notes:

Apprentice to Journeyworker Ratio:1:1

STEAM BOILER OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2024	$63.44	$11.49	$23.59	$0.00	$98.52
	02/01/2025	$64.74	$11.49	$23.59	$0.00	$99.82
	08/01/2025	$66.89	$11.49	$23.59	$0.00	$101.97
	02/01/2026	$68.24	$11.49	$23.59	$0.00	$103.32
	08/01/2026	$70.44	$11.49	$23.59	$0.00	$105.52
	02/01/2027	$71.84	$11.49	$23.59	$0.00	$106.92

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.72	$11.49	$23.59	$0.00	$66.80
2	60	$38.06	$11.49	$23.59	$0.00	$73.14
3	70	$44.41	$11.49	$23.59	$0.00	$79.49
4	80	$50.75	$11.49	$23.59	$0.00	$85.83
5	90	$57.10	$11.49	$23.59	$0.00	$92.18

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$32.37	$11.49	$23.59	$0.00	$67.45
2	60	$38.84	$11.49	$23.59	$0.00	$73.92
3	70	$45.32	$11.49	$23.59	$0.00	$80.40
4	80	$51.79	$11.49	$23.59	$0.00	$86.87
5	90	$58.27	$11.49	$23.59	$0.00	$93.35

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$51.28	$9.65	$18.22	$0.00	$79.15
	06/01/2025	$52.78	$9.65	$18.22	$0.00	$80.65
	12/01/2025	$54.28	$9.65	$18.22	$0.00	$82.15
	06/01/2026	$55.83	$9.65	$18.22	$0.00	$83.70
	12/01/2026	$57.33	$9.65	$18.22	$0.00	$85.20
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$47.07	$9.65	$18.22	$0.00	$74.94
	06/01/2025	$48.57	$9.65	$18.22	$0.00	$76.44
	12/01/2025	$50.07	$9.65	$18.22	$0.00	$77.94
	06/01/2026	$51.62	$9.65	$18.22	$0.00	$79.49
	12/01/2026	$53.12	$9.65	$18.22	$0.00	$80.99
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2024	$46.95	$9.65	$18.22	$0.00	$74.82
	06/01/2025	$48.45	$9.65	$18.22	$0.00	$76.32
	12/01/2025	$49.95	$9.65	$18.22	$0.00	$77.82
	06/01/2026	$51.50	$9.65	$18.22	$0.00	$79.37
	12/01/2026	$53.00	$9.65	$18.22	$0.00	$80.87
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$56.40	$15.55	$16.50	$0.00	$88.45
	06/01/2025	$57.68	$15.55	$16.50	$0.00	$89.73
	12/01/2025	$59.12	$15.55	$16.50	$0.00	$91.17
	06/01/2026	$60.40	$15.55	$16.50	$0.00	$92.45
	12/01/2026	$61.84	$15.55	$16.50	$0.00	$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.82	$15.07	$20.17	$0.00	$76.06
	01/01/2025	$40.82	$15.57	$20.17	$0.00	$76.56
	06/01/2025	$41.82	$15.57	$20.17	$0.00	$77.56
	12/01/2025	$41.82	$15.57	$21.78	$0.00	$79.17
	01/01/2026	$41.82	$16.17	$21.78	$0.00	$79.77
	06/01/2026	$42.82	$16.17	$21.78	$0.00	$80.77
	12/01/2026	$42.82	$16.17	$23.52	$0.00	$82.51
	01/01/2027	$42.82	$16.77	$23.52	$0.00	$83.11
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2024	$59.18	$9.65	$19.00	$0.00	$87.83
	06/01/2025	$60.68	$9.65	$19.00	$0.00	$89.33
	12/01/2025	$62.18	$9.65	$19.00	$0.00	$90.83
	06/01/2026	$63.73	$9.65	$19.00	$0.00	$92.38
	12/01/2026	$65.23	$9.65	$19.00	$0.00	$93.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2024	$61.18	$9.65	$19.00	$0.00	$89.83
	06/01/2025	$62.68	$9.65	$19.00	$0.00	$91.33
	12/01/2025	$64.18	$9.65	$19.00	$0.00	$92.83
	06/01/2026	$65.73	$9.65	$19.00	$0.00	$94.38
	12/01/2026	$67.23	$9.65	$19.00	$0.00	$95.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2024	$51.25	$9.65	$19.00	$0.00	$79.90
	06/01/2025	$52.75	$9.65	$19.00	$0.00	$81.40
	12/01/2025	$54.25	$9.65	$19.00	$0.00	$82.90
	06/01/2026	$55.80	$9.65	$19.00	$0.00	$84.45
	12/01/2026	$57.30	$9.65	$19.00	$0.00	$85.95
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2024	$53.25	$9.65	$19.00	$0.00	$81.90
	06/01/2025	$54.75	$9.65	$19.00	$0.00	$83.40
	12/01/2025	$56.25	$9.65	$19.00	$0.00	$84.90
	06/01/2026	$57.80	$9.65	$19.00	$0.00	$86.45
	12/01/2026	$59.30	$9.65	$19.00	$0.00	$87.95
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2024	$40.24	$15.07	$20.17	$0.00	$75.48
	01/01/2025	$40.24	$15.57	$20.17	$0.00	$75.98
	06/01/2025	$41.24	$15.57	$20.17	$0.00	$76.98
	12/01/2025	$41.24	$15.57	$21.78	$0.00	$78.59
	01/01/2026	$41.24	$16.17	$21.78	$0.00	$79.19
	06/01/2026	$42.24	$16.17	$21.78	$0.00	$80.19
	12/01/2026	$42.24	$16.17	$23.52	$0.00	$81.93
	01/01/2027	$42.24	$16.77	$23.52	$0.00	$82.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
VOICE-DATA-VIDEO TECHNICIAN *ELECTRICIANS LOCAL 96*	09/01/2024	$35.29	$13.99	$17.57	$0.00	$66.85
	09/07/2025	$36.12	$14.98	$17.91	$0.00	$69.01
	09/06/2026	$37.04	$15.96	$18.27	$0.00	$71.27

Apprentice - *VOICE-DATA-VIDEO TECHNICIAN - Local 96*

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.65	$13.99	$4.41	$0.00	$36.05
2	55	$19.41	$13.99	$4.46	$0.00	$37.86
3	60	$21.17	$13.99	$17.15	$0.00	$52.31
4	65	$22.94	$13.99	$17.20	$0.00	$54.13
5	70	$24.70	$13.99	$17.25	$0.00	$55.94
6	75	$26.47	$13.99	$17.30	$0.00	$57.76
7	80	$28.23	$13.99	$17.36	$0.00	$59.58
8	85	$30.00	$13.99	$17.41	$0.00	$61.40

Effective Date - 09/07/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.06	$14.98	$4.51	$0.00	$37.55
2	55	$19.87	$14.98	$4.57	$0.00	$39.42
3	60	$21.67	$14.98	$17.48	$0.00	$54.13
4	65	$23.48	$14.98	$17.53	$0.00	$55.99
5	70	$25.28	$14.98	$17.59	$0.00	$57.85
6	75	$27.09	$14.98	$17.64	$0.00	$59.71
7	80	$28.90	$14.98	$17.70	$0.00	$61.58
8	85	$30.70	$14.98	$17.75	$0.00	$63.43

Notes:

Apprentice to Journeyworker Ratio:1:1

WAGON DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2024	$40.61	$9.65	$17.70	$0.00	$67.96
	06/01/2025	$42.00	$9.65	$17.70	$0.00	$69.35
	12/01/2025	$43.38	$9.65	$17.70	$0.00	$70.73
	06/01/2026	$44.82	$9.65	$17.70	$0.00	$72.17
	12/01/2026	$46.26	$9.65	$17.70	$0.00	$73.61
	06/01/2027	$47.71	$9.65	$17.70	$0.00	$75.06
	12/01/2027	$49.16	$9.65	$17.70	$0.00	$76.51
	06/01/2028	$50.66	$9.65	$17.70	$0.00	$78.01
	12/01/2028	$52.16	$9.65	$17.70	$0.00	$79.51

For apprentice rates see "Apprentice- LABORER"

WAGON DRILL OPERATOR (HEAVY & HIGHWAY) *LABORERS - ZONE 2 (HEAVY & HIGHWAY)*	12/01/2024	$40.11	$9.65	$17.80	$0.00	$67.56
	06/01/2025	$41.50	$9.65	$17.80	$0.00	$68.95
	12/01/2025	$42.88	$9.65	$17.80	$0.00	$70.33
	06/01/2026	$44.32	$9.65	$17.80	$0.00	$71.77
	12/01/2026	$45.76	$9.65	$17.80	$0.00	$73.21

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2024	$57.03	$15.55	$16.50	$0.00	$89.08
	06/01/2025	$58.33	$15.55	$16.50	$0.00	$90.38
	12/01/2025	$59.78	$15.55	$16.50	$0.00	$91.83
	06/01/2026	$61.08	$15.55	$16.50	$0.00	$93.13
	12/01/2026	$62.53	$15.55	$16.50	$0.00	$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS LOCAL 4*	09/01/2024	$55.00	$9.90	$17.77	$0.00	$82.67
	03/01/2025	$56.40	$9.90	$17.77	$0.00	$84.07
	09/01/2025	$57.80	$9.90	$17.77	$0.00	$85.47
	03/01/2026	$59.20	$9.90	$17.77	$0.00	$86.87
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$29.67	$9.25	$1.89	$0.00	$40.81
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$42.03	$9.25	$10.27	$0.00	$61.55
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$34.62	$9.25	$10.07	$0.00	$53.94
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$42.03	$9.25	$14.35	$0.00	$65.63
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$37.09	$9.25	$10.87	$0.00	$57.21
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$22.25	$9.25	$1.82	$0.00	$33.32
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2020	$49.45	$9.25	$17.48	$0.00	$76.18

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 08/30/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.67	$9.25	$3.39	$0.00	$42.31
2	65	$32.14	$9.25	$3.46	$0.00	$44.85
3	70	$34.62	$9.25	$3.54	$0.00	$47.41
4	75	$37.09	$9.25	$5.11	$0.00	$51.45
5	80	$39.56	$9.25	$5.19	$0.00	$54.00
6	85	$42.03	$9.25	$5.26	$0.00	$56.54
7	90	$44.51	$9.25	$7.34	$0.00	$61.10

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$30.73	$4.70	$3.17	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77

Additional Apprentice Information:

All apprentices must be registered with the Division of Apprenticeship Training (DAS) in accordance with M.G.L. c. 23, §§ 11E-11L. Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the hourly prevailing wage rate established by the Commissioner under the provisions of M.G.L. c. 149, §§ 26-27D. Apprentice ratios are established by DAS pursuant to M.G.L. c. 23, §§ 11E-11L. Ratios are expressed as the allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified. The ratios listed herein have been taken from relevant private collective bargaining agreements (CBAs) and are provided for illustrative purposes only. They have not been independently verified as being accurate or continuing to be accurate. Parties having questions regarding what ratio to use should contact DAS.

DOCUMENT 00870

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)
Revised April 9, 2019

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted:

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority.

   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   d. "Minority" includes:

      (i) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $ 10,000 the provisions of the specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

   b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

   c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

   d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

   e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

   f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

   g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

   h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables of affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11 The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as many be required by the Government and keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

APPENDIX A

The following goals and timetables for female utilization shall be included in all Federal and federally assisted construction contracts and subcontracts in excess of $ 10,000. The goals are applicable to the Contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a Federal or federally-assisted construction contract or subcontract.

Area covered: Goal for Women apply nationwide

Goals and Timetables

Timetable	Goals (percent)
From Apr. 1, 1980 until further notice	6.9

APPENDIX B-80

Until further notice, the following goals for minority utilization in each construction craft and trade shall included in all Federal or federally assisted construction contracts and subcontracts in excess of $ 10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total on- site construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or nonfederally related project, contract or subcontract.

Construction contractors participating in an approved Hometown Plan (see 41 CFR 6-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix B-80.

Economic Areas

STATE:	Goals (percent)
MASSACHUSETTS	
004 Boston MA: SMSA Counties: 1123 Boston-Lowell-Brockton-Lawrence-Haverhill, MA-NH	4.0
MA Essex, MA Middlesex, MA Norfolk, MA Plymouth, MA Suffolk, NH Rockingham.	
5403 Fall River- New Bedford MA, Bristol	1.6
9243 Worcester-Fitchburg-Leominster, MA	1.6
6323 Springfield-Chicopee-Holyoke MA-CT MA Hampden, MA Hampshire	4.8
Non-SMSA Counties: MA Barnstable, MA Dukes, MA Nantucket	3.6
Non-SMSA Counties: MA Franklin	5.9

APPENDIX C

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Acts and Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. **Solicitations for Subcontractors, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to nondiscrimination on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto, and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Massachusetts Department of Transportation (MassDOT) or FHWA to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor will so certify to MassDOT or FHWA, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Nondiscrimination provisions of this contract, MassDOT will impose such contract sanctions as it or FHWA may determine to be appropriate, including, but not limited to:

    a. withholding payments to the contractor under the contract until the contractor complies; and/or
    b. cancelling, terminating, or suspending a control, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as MassDOT or FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request MassDOT to enter into any litigation to protect the interests of MassDOT. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

APPENDIX D

During the performance of this contact, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor," which includes consultants) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

PERTINENT NON-DISCRIMINATION AUTHORITIES:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21

- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-Aid programs and projects)

- Federal-Aid Highway Act of 1973 (23 U.S.C. § 324 *et seq.*) (prohibits discrimination on the basis of sex)

- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability) and 49 CFR Part 27

- The Age Discrimination Act of 1975, as amended (42 U.S.C. § 6101 *et seq.*) (prohibits discrimination on the basis of age)

- Airport and Airway Improvement Act of 1982 (49 U.S.C. § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex)

- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage, and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975, and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of Federal-Aid recipients, sub-recipients, and contractors, whether such programs or activities are Federally funded or not)

- Titles II and III of the Americans with Disabilities Act (42 U.S.C. §§ 12131-12189), as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38 (prohibits discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities)

- The Federal Aviation Administration's Non-Discrimination Statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex)

- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations)

- Executive Order 13166, Improving Access to Services for People with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100)

- Title IX of the Education Amendments Act of 1972, as amended (20 U.S.C. 1681 *et seq*.) (prohibits discrimination on the basis of sex in education programs or activities)

*** END OF DOCUMENT ***

DOCUMENT 00875
TRAINEE SPECIAL PROVISIONS
Revised October, 2016

THE REQUIRED NUMBER OF TRAINEES TO BE TRAINED UNDER THIS CONTRACT WILL BE **5**

The contractor shall provide on-the job training aimed at developing full journeyworkers in the type of trade of job classification involved.

In the event that a contractor subcontracts a portion of the contract work, the General Contractor shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this training special provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeyworkers in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to the Massachusetts Department Of Transportation (MassDOT) for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyworker status is a primary objective of the Training Special Provision. Accordingly, the contractor shall make every effort to enroll minority and women trainees (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that have been taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training.

No employee shall be trained under this Special Provision in any classification in which he or she has successfully completed a training course leading to journeyworker status or in which he or she has been employed as a journeyworker. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the finding in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Massachusetts Department Of Transportation and the Federal Highway Administration. The Massachusetts Department Of Transportation and the Federal Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyworker status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather that clerk-typist or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc. where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Federal Highway Administration division office. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Reimbursement

Under these Training Special Provisions, reimbursement will be as follows:

The Contractor will only be reimbursed 80 cents for each hour of on the job training as specified in the approved Training Program.

The Contractor is advised and encouraged that it may train additional persons in excess of the number specified and will be reimbursed as stated above. Reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement.

If less than full training specified in the approved training programs is provided, payment to the contractor will be made at a rate of 80 cents for each hour of training completed under this contract. However, no payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyworker, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision.

Payment

Trainees will be paid:

1. Percentage (%) of the journeyworker's rate as provided in the existing programs approved by the Department of Labor or Transportation as of September 15, 1970.

2. For journeyworker programs submitted by the Contractor and approved by Massachusetts Department Of Transportation and the Federal Highway Administration at least 60 percent of the appropriate minimum journeyworker's rate specified in the contract for the first half of the training period, 75 percent for the third quarter if the training period, and 90 percent for the last quarter of the training period.

3. For skilled laborer programs, the minimum starting wage rate of unskilled laborer. At the conclusion of training, he or she will be paid the minimum wage rate of the Classification for programs submitted by the Contractor and approved by the Massachusetts Department Of Transportation and the Federal Highway Administration.

4. For the purposes of meeting the legal requirements of State Prevailing Wage Law, please be advised that no person may be paid the Apprentice wage rate as listed on a MA Prevailing Wage Rates schedule, unless that person and program is registered with the Department of Labor Standards/Division of Apprentice Standards (DLS/DAS). Any person or program not registered with DLS/DAS, regardless of whether or not they are registered with any other federal, state, local, or private entity must be paid the journeyworker’s rate for the trade.

The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

Form FHWA-1409, Federal-aid Highway Construction Contracting Semi Annual Training Report, shall be submitted as per instructions on the Form.

*** END OF DOCUMENT ***

DOCUMENT 00880

Revised January 12, 2022

DEPARTMENT OF LABOR

Employment Standards Administration

MINIMUM WAGES FOR FEDERAL AND FEDERALLY ASSISTED CONTRACTS

"General Decision Number: MA20250025 01/03/2025

Superseded General Decision Number: MA20240025

State: Massachusetts

Construction Type: Highway

County: Worcester County in Massachusetts.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally
required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658.
Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours

	spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/03/2025

CARP0336-004 03/01/2024

	Rates	Fringes
CARPENTER (Includes Form Work)	$ 46.86	30.94

ELEC0103-007 09/01/2024

	Rates	Fringes
ELECTRICIAN	$ 63.78	36.22

ENGI0004-030 12/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
Group 1	$ 57.03	33.20
Group 2	$ 56.40	33.20

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. PAID HOLIDAYS: New Year's Day, Washington's Birthday, Labor Day, Memorial Day, Independence Day, Patriot's Day, Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

POWER EQUIPMENT OPERATORS CLASSIFICATIONS
Group 1: Backhoe/Excavator/Trackhoe; Bobcat/Skid Steer/Skid Loader; Broom/Sweeper; Gradall; Loader; Paver (Asphalt, Aggregate, and Concrete); Post Driver (Guardrail/Fences)
Group 2: Bulldozer; Grader/Blade; Roller

ENGI0004-031 12/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		

(Milling Machine).....$ 57.03 33.20

FOOTNOTE FOR POWER EQUIPMENT OPERATORS:
A. PAID HOLIDAYS: New Year's Day, Washington's Birthday,
Labor Day, Memorial Day, Independence Day, Patriot's Day,
Columbus Day, Veteran's Day, Thanksgiving Day, Christmas Day

IRON0007-028 03/16/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 54.38	36.48

IRON0007-029 03/16/2024

	Rates	Fringes
IRONWORKER, ORNAMENTAL	$ 54.68	36.48

LABO0039-003 06/01/2018

	Rates	Fringes
LABORER		
Asphalt, Includes Raker, Shoveler, Spreader and Distributor	$ 33.50	22.92
Common or General	$ 33.25	22.92
Guardrail Installation	$ 33.50	22.92

PAIN0035-023 07/01/2024

	Rates	Fringes
PAINTER (Steel)	$ 56.76	36.00

SUMA2014-015 01/11/2017

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 56.70	21.08
IRONWORKER, REINFORCING	$ 56.48	20.62
LABORER: Concrete Saw (Hand Held/Walk Behind)	$ 41.78	18.37
LABORER: Landscape	$ 40.39	17.68
OPERATOR: Crane	$ 52.14	21.08
OPERATOR: Forklift	$ 64.67	0.00
OPERATOR: Mechanic	$ 48.14	17.02
OPERATOR: Piledriver	$ 44.46	16.94
PAINTER: Spray (Linestriping)	$ 48.00	0.00
PILEDRIVERMAN	$ 45.65	23.33
TRAFFIC CONTROL: Flagger	$ 23.00	20.44
TRAFFIC CONTROL: Laborer-Cones/ Barricades/Barrels - Setter/Mover/Sweeper	$ 44.49	12.41
TRUCK DRIVER: Concrete Truck	$ 33.69	15.79
TRUCK DRIVER: Dump Truck	$ 30.38	7.20
TRUCK DRIVER: Flatbed Truck	$ 48.53	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave

for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage

determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a

weighted union average rate. OH indicates the State of Ohio.
The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024
in the example, indicates the date the wage determination was
updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to
reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union
rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by
computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted
average rate includes all rates reported in the survey, it may
include both union and non-union rates. Example: SUFL2022-007
6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that
classification. FL indicates the State of Florida. 2022 is the
year of the survey on which these classifications and rates are
based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date
for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey
is conducted. However, the Wage and Hour Division (WHD) has the

discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to

davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that

the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an
interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

DOCUMENT A00801
SPECIAL PROVISIONS

WORCESTER

Federal Aid Project No. STP(BR-OFF)-003S(815)X

**Bridge Reconstruction of W-44-083, Harrison Street over I-290 &
W-44-093, Laurel Street over I-290**

Labor participation goals for this Project shall be 15.3% for minorities and 6.9% for women for each job category. The goals are applicable to both Contractor's and Subcontractor's on-site construction workforce. Refer to Document 00820 for details.

SCOPE OF WORK

All work under this Contract shall be done in conformance with the *2024 Standard Specifications for Highways and Bridges*, the *Supplemental Specifications* contained in this book, the *2017 Construction Standard Details*, the *Traffic Management Plans and Detail Drawings*, *MassDOT Work Zone Safety Temporary Traffic Control,* the *1990 Standard Drawings for Signs and Supports*; the *2015 Overhead Signal Structure and Foundation Standard Drawings*, the *2009 Manual on Uniform Traffic Control Devices (MUTCD) with Revisions 1, 2, and 3 and the November 2022 Massachusetts Amendments to the MUTCD*; the *1968 Standard Drawings for Traffic Signals and Highway Lighting*; *The American Standard for Nursery Stock*; the Plans and these Special Provisions.

The work under this Contract consists of replacing the existing bridge superstructures carrying Harrison Street and Laurel Street over I-290, substructure rehabilitation, and the reconstruction of a portion of each approach in the City of Worcester. The substructure rehabilitation consists of demolition and construction of abutment backwalls, top of the abutment and wingwalls stems, pier caps, and top of pier columns for both the bridges and refacing of the West Abutment for the Harrison Street bridge.

The Harrison Street existing bridge is a two-span structure with an overall length of approximately 141 feet and out-to-out width of 45'-0". The bridge superstructure will be replaced with a two-span continuous steel plate girder structure with an approximate length of 137 feet and an exposed cement concrete deck and the substructure will be rehabilitated. The out-to-out width will be 50'-0" with two 11-foot travel lanes, two 5-foot shoulders, two 7'-10" sidewalks and a CP-PL2 barrier with Type II protective screening. The structure will be supported by rehabilitated existing abutments and a multi-column pier.

The Laurel Street existing bridge is a two-span structure with an overall length of approximately 138 feet and an out-to-out width of 50'-0". The bridge superstructure will be replaced with a two-span continuous steel plate girder structure with an approximate length of 134 feet and an exposed cement concrete deck and the substructure will be rehabilitated. The out-to-out width will be 45'-4" with two 11-foot lanes, two 5-foot shoulders, two 5'-6" sidewalks, and a CP-PL2 barrier with Type II protective screening. The structure will be supported by rehabilitated existing abutments and a multi-column pier.

SCOPE OF WORK (Continued)

The project provides improvements to both approach roadways and the median portion of I-290. It also includes the replacement of the existing guardrail with new barriers in front of the abutments and construction of appropriate transitions back to the existing guardrail. The work includes full-depth pavement reconstruction; excavation; pavement milling; pavement resurfacing; installing new ductile iron water pipe and fittings; installing new drainage structures and pipe; installing new granite curb; constructing cement concrete sidewalks and pedestrian ramps; installing guardrail; furnishing and spreading loam and seed; installing signs and pavement markings; providing traffic control; and all other incidental work listed on the plans and as described in these special provisions.

The structure shall always remain open to one lane of traffic Eastbound during construction in accordance with the Temporary Traffic Control Plans.

SUBSECTION 7.05 INSURANCE REQUIREMENTS
B. Public Liability Insurance

The insurance requirements set forth in this subsection are in addition to the requirements of the Standard Specifications and supersede all other requirements.

Paragraphs 1 and 2

The Massachusetts Department of Transportation and applicable railroads shall be named as additional insureds.

Paragraph 4

Asbestos Liability Insurance shall be obtained for this project. The Contractor and the Massachusetts Department of Transportation shall be named as additional insureds.

CONTRACTOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS

Prospective bidders are required to submit all questions to the Construction Contracts Engineer by 3:00 P.M. on the Tuesday of the previous week before the scheduled bid opening date. Any questions received after this time will not be considered for review by the Department.

Contractors should email questions and addendum acknowledgements to the following email address massdotspecifications@dot.state.ma.us The MassDOT project file number and municipality is to be placed in the subject line.

WORK SCHEDULE
(Supplementing Subsection 8.02)

Typical daytime work hours on Harrison Street and Laurel Street are from 7:00 AM to 3:00 PM on weekdays. Work shall not be performed the day before or the day after a holiday weekend, unless otherwise permitted by MassDOT Highway Division. All work schedules shall be pre-approved by the Department prior to beginning work.

RAMP WORK AND NIGHTTIME WORK RESTRICTIONS
(Supplementing Subsection 7.09)

Allowable ramp closures or partial closures to/from I-290 as shown on the plans with associated detours. Work setups or abutment barrier curing setups requiring ramp closures shall be expedited. Closure of an individual ramp shall not occur longer than six weeks. Multiple ramps shall not be closed simultaneously.

Work stated in the plans to occur during nighttime shall be restricted to only between the hours of 10 PM – 5 AM.

Work occurring on I-290 and associated I-290 ramp detours shall occur outside of the Polar Park / WooSox baseball season.

HOLIDAY WORK RESTRICTIONS

(Supplementing Subsection 7.09)

The District Highway Director (DHD) may authorize work to continue during these specified time periods if it is determined by the District that the work will not negatively impact the traveling public. DHD may allow work in those areas on a case by case basis and where work is behind barrier and will not impact traffic

Below are the holiday work restrictions:

New Years Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

Martin Luther King's Birthday (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

President's Day (Federal Holiday)
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Evacuation Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

Patriot's Day (State Holiday)
Work restrictions will be in place for Districts 3 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as to not to impact the marathon. All other districts work restrictions will be as per DHD.

Mother’s Day
No work on Western Turnpike and Metropolitan Highway System from 5:00 AM on the Friday before, until the normal start of business on the following day.

HOLIDAY WORK RESTRICTIONS (Continued)

Memorial Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Bunker Hill Day (Suffolk County State Holiday)
No work restrictions due to traffic concerns.

Juneteenth
No work restrictions due to traffic concerns, however work on local roadways requires permission by the DHD and local police chief.

Independence Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day. No work on local roadways on the holiday without permission by the DHD and the local police chief.

Labor Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the Friday before, until the normal start of business on the following day.

Columbus Day (Federal Holiday)
No work on major arterials from 5:00 AM on the Friday before, until the normal start of business on the following day

Veterans' Day (Federal Holiday)
No work restrictions due to traffic concerns.

Thanksgiving Day (Federal Holiday)
No work on major arterials from 5:00 AM two days before until the normal start of business on the following Monday.

Christmas Day (Federal Holiday)
No work on major arterial roadways from 5:00 AM on the day before until the normal start of business on the next subsequent business day.

SOIL STOCKPILING DIRECTIVE P-22-001

Any stockpiling of soil must be performed in compliance with Policy Directive P-22-001, Off-Site Stockpiling of Soil from MassDOT Construction Projects. This directive limits the allowable locations for off-site stockpiling of soil generated during MassDOT projects and includes various requirements that must be satisfied by the contractor prior to off-site stockpiling.

SUBSECTION 8.02 SCHEDULE OF OPERATIONS

Replace this subsection with the following:

An integrated cost and schedule controls program shall be implemented by the Contractor to track and document the progress of the Work from Notice to Proceed (NTP) through the Contractor Field Completion (CFC) Milestone. The Contractor's schedules will be used by the Engineer to monitor project progress, plan the level-of-effort required by the Department's work force and consultants and as a critical decision-making tool. Accordingly, the Contractor shall ensure that it complies fully with the requirements specified herein and that its schedules are both accurate and updated as required by the specification throughout the life of the project. Detailed requirements are provided in Division II, Section 722 Construction Scheduling.

SUBSECTION 8.14 UTILITY COORDINATION, DOCUMENTATION, AND MONITORING RESPONSIBILITIES

A. GENERAL

In accordance with the provisions of Section 8.00 Prosecution and Progress, utility coordination is a critical aspect to this Contract. This section defines the responsibility of the Contractor and MassDOT, with regard to the initial utility relocation plan and changes that occur as the prosecution of the Work progresses. The Engineer, with assistance from the Contractor shall coordinate with Utility companies that are impacted by the Contractor's operations. To support this effort, the Contractor shall provide routine and accurate schedule updates, provide notification of delays, and provide documentation of the steps taken to resolve any conflicts for the temporary and/or permanent relocations of the impacted utilities. The Contractor shall provide copies to the Engineer of the Contractor communication with the Utility companies, including but not limited to:

- Providing advanced notice, for all utility-related meetings initiated by the Contractor.
- Providing meeting minutes for all utility-related meetings that the Contractor attends.
- Providing all test pit records.
- Request for Early Utility work requirements of this section (see below).
- Notification letters for any proposed changes to Utility start dates and/or sequencing.
- Written notification to the Engineer of all apparent utility delays within seven (7) Calendar Days after a recognized delay to actual work in the field – either caused by a Utility or the Contractor.
- Any communication, initiated by the Contractor, associated with additional Right-of-Way needs in support of utility work.
- Submission of completed Utility Completion Forms.

B. PROJECT UTILITY COORDINATION (PUC) FORM

The utility schedule and sequence information provided in the Project Utility Coordination Form (if applicable) is the best available information at the time of the bid and has been considered in setting the contract duration. The Contractor shall use all of this information in developing the bid price and the Baseline Schedule Submission, inclusive of the individual utility durations sequencing requirements, and any work that has been noted as potentially concurrent utility installations.

C. INITIATION OF UTILITY WORK

The Engineer will issue all initial notice-to-proceed dates to each Utility company based on either the:

1) Contractor's accepted Baseline Schedule
2) An approved Early Utility Request in the form of an Early Utility sub-net schedule (in accordance with the requirements of this Subsection)
3) An approved Proposal Schedule

C.1 - BASELINE SCHEDULE – UTILITY BASIS

The Contractor shall provide a Baseline Schedule submission in accordance with the requirements of Subsection 8.02 and inclusive of all of the information provided in the PUC Form that has been issued in the Contract documents. This is to include the utility durations, sequencing of work, allowable concurrent work, and all applicable considerations that have been depicted on the PUC Form.

SUBSECTION 8.14 (Continued)

C.2 – EARLY UTILITY REQUEST – (aka SUBNET SCHEDULE) PRIOR TO THE BASELINE
All early utility work is defined as any anticipated/required utility relocations that need to occur prior to the Baseline Schedule acceptance. In all cases of proposed early utility relocation, the Contractor shall present all known information at the pre-construction conference in the form of a 'sub-net' schedule showing when each early utility activity needs to be issued a notice-to-proceed. The Contractor shall provide advance notification of this intent to request early utility work in writing at or prior to the Pre-Construction meeting. Prior to officially requesting approval for early utility work, the Contractor shall also coordinate with MassDOT and all utility companies (private, state or municipal) which may be impacted by the Contract. If this request is acceptable to the Utilities and to MassDOT, the Engineer will issue a notice-to-proceed to the affected Utilities, based on these accepted dates.

C.3 – PROPOSAL SCHEDULE - CHANGES TO THE PUC FORM
If the Contractor intends to submit a schedule (in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02) that contains durations or sequencing that vary from those provided in the Project Utility Coordination (PUC) Form, the Contactor must submit this as an intended change, in the form of a Proposal Schedule and in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02. These proposed changes are subject to the approval of the Engineer and the impacted utilities, in the form of this Proposal Schedule and a proposed revision to the PUC form. The Contractor shall not proceed with any changes of this type without written authorization from the Engineer, that references the approved Proposal Schedule and PUC form changes. The submission of the Baseline Schedule should not include any of these types of proposed utility changes and should not delay the submission of the Baseline Schedule. As a prerequisite to the Proposal Schedule submission, and in advance of the utility notification(s) period, the Contractor shall coordinate the proposed utility changes with the Engineer and the utility companies, to develop a mutually agreed upon schedule, prior to the start of construction.

D. UTILITY DELAYS
The Contractor shall notify the Engineer upon becoming aware that a Utility owner is not advancing the work in accordance with the approved utility schedule. Such notice shall be provided to the Engineer no later than seven (7) calendar days after the occurrence of the event that the Contractor believes to be a utility delay. After such notice, the Engineer and the Contractor shall continue to diligently seek the Utility Owner's cooperation in performing their scope of Work.

In order to demonstrate that a critical path delay has been caused by a third-party Utility, the Contractor must demonstrate, through the requirements of the monthly Progress Schedule submissions and the supporting contract records associated with Subsection 8.02, 8.10 and 8.14, that the delays were beyond the control of the Contractor.

SUBSECTION 8.14 (Continued)

All documentation provided in this section is subject to the review and verification of the Engineer and, if required, the Utility Owner. In accordance with MassDOT Specifications, Division I, Subsection 8.10, a Time Extension will be granted for a delay caused by a Utility, only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form, and only if;

1) proper Notification of Delay was provided to MassDOT in accordance with the time requirements that are specified in this Section
2) the utility delay is a critical path impact to the Baseline Schedule (or most recently approved Progress Schedule)

E. LOCATION OF UTILITIES

The locations of existing utilities are shown on the Contract drawings as an approximation only. The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the affected area.

F. POST UTILITY SURVEY – NOTIFICATION

Following completion of a utility survey of existing locations, the Contractor will be responsible to notify the Engineer of any known conflicts associated with the actual location of utilities prior to the start of the work. The Engineer and the Contractor will coordinate with any utility whose assets are to be affected by the Work of this Contract. A partial list of utility contact information is provided in the Project Utility Coordination Form.

G. MEETINGS AND COOPERATION WITH UTILITY OWNERS

The Contractor shall notify the Engineer in advance of any meeting they initiate with a Utility Owner's representative to allow MassDOT to participate in the meeting if needed.

Prior to the Pre-Construction Meeting, the Contractor should meet with all Utility Owners who will be required to perform utility relocations within the first 6 months of the project, to update the affected utilities of the Project Utility Coordination Form and all other applicable Contract requirements that impact the Utilities. The Contractor shall copy the Engineer on any correspondence between the Utility Owner and the Contractor.

H. FORCE ACCOUNT / UTILITY MONITORING REQUIREMENTS

The Engineer will be responsible for recording daily Utility work force reports. The start, suspension, re-start, and completion dates of each of the Utilities, within each phase of the utility relocation work, will be monitored and agreed to by the Engineer and the Contractor as the work progresses.

I. ACCESS AND INSPECTION

The Contractor shall be responsible for allowing Utility owners access to their own utilities to perform the relocations and/or inspections. The Contractor shall schedule their work accordingly so as not to delay or prevent each utility from maintaining their relocation schedule.

COMPLIANCE WITH THE NATIONAL DEFENSE AUTHORIZATION ACT

(Supplementing Subsection 7.01)

On all projects, the "Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment" Regulation (2 CFR 200.216) prohibits the Contractor from using or furnishing the following telecommunications equipment or services:

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- Telecommunications or video surveillance services provided by such entities or using such equipment.
- Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

This prohibition applies to all products manufactured by the aforementioned companies, including any individual components or parts.

By submitting a bid on a project, the Contractor certifies that all work will be in compliance with the terms of 2 CFR 200.216. The Contractor shall submit a COC indicating compliance with the above provisions for all telecommunications equipment or services included in the Contract.

Payment for the item in which the materials are incorporated may be withheld until these COCs are received. Any cost involved in furnishing the certificate(s) shall be borne by the Contractor

BIDDERS LIST

Pursuant to the provisions of 49 CFR Part 26.11 all official bidders will be required to report the names, addresses and telephone numbers of all firms that submitted bids or quotes in connection with this project. Failure to comply with a written request for this information within 15 business days may result in a recommendation to the Prequalification Committee that prequalification status be suspended until the information is received.

The Department will survey all firms that have submitted bids or quotes during the previous year prior to setting the annual goal and shall request that each firm report its age and gross receipts for the year.

BUILD AMERICA BUY AMERICA PREFERENCE

On Federally-aid projects the Buy America (23.CFR § 635.410) and Build America, Buy America Act (Pub. L. No. 117-58, §§ 70901-52). requires the following,

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, must occur in the United States. Foreign steel and iron can be used if the cost of the materials does not exceed 0.1% of the total Contract cost or $2,500, whichever is greater. The action of applying a coating to a covered material (i.e., steel and iron) is deemed a manufacturing process subject to Buy America. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of a material subject to requirements of Build America, Buy America. Steel used for temporary support of excavation, including H piles, soldier piles, and sheeting when the steel is required to be left in place is subject to requirements of Build America, Buy America. Temporary steel, shall remain in place when it falls within the influence zone of the soil supporting any structure or railroad tracks.

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

BUILD AMERICA BUY AMERICA PREFERENCE (Continued)

(3) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. "Construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of:

- non-ferrous metals,
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables),
- glass (including optic glass),
- lumber; or
- drywall.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

NOTE: The requirements for manufactured products indicated in paragraph (2) above are not in effect for this contract.

ENVIRONMENTAL PERMITTING

The proposed work does not occur in jurisdictional wetland resources subject to section 401 or section 404 of the Clean Water Act; therefore, the project does not require a Water Quality Certification from the Massachusetts Department of Environmental Protection or authorization from the US Army Corps of Engineers. The proposed work qualifies for the bridge exemption authorized in the Transportation Bond Bill and is therefore not subject to the Massachusetts Wetlands Protection Act, the Massachusetts Public Waterfront Act (Chapter 91), or the Massachusetts Environmental Policy Act.

If field conditions and/or Contractor-proposed erection, demolition, staging, or other procedures require work to occur in or otherwise impact water or wetland resource areas, the Contractor is advised that no associated work can occur until all required environmental permits have been obtained allowing such work. The Contractor must notify the District 3 Highway Director and Resident Engineer in writing at least 60 days prior to desire commencement of the proposed activity. All environmental submittals, including any Contract with Local, State, or Federal environmental agencies, must be coordinated with the District 3 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that the Department will not entertain a delay claim due to the time required to obtain the environmental permits.

NATIONAL GRID EMERGENCY TELEPHONE NUMBERS

ELECTRIC:
Outage/ Emergency: 1-800-465-1212
New Service: 1-800-375-7405
Customer Support: 1-800-322-3223

EVERSOURCE EMERGENCY TELEPHONE NUMBERS

GAS:
Outage/ Emergency: 800-592-2000
New Service: 866-678-2744
Customer Support: 800-592-2000

GENERAL REQUIREMENTS FOR DEMOLITION AND WORK INVOLVING PAINTED STEEL

(02/06/2020)

Demolition and work involving painted steel shall conform to the requirements of Subsection 961 of the Standard Specifications.

Work Involving Painted Steel.

Hazardous materials shall be removed in the immediate area of any intended welding, heating, saw cutting or burning of steel. Hazardous material removal is required to allow the demolition of structural steel, railings, drainage systems, utility supports, steel lamp posts, etc.

The contractor shall assume that the coatings on the steel contain lead (Pb), unless otherwise determined by testing. The contractor shall certify in writing to the Engineer the results of all testing, and shall also certify that any lead (Pb) coated steel removed from the project was not reused or buried, but was sent to a scrap metal recycling facility.

Implement and maintain programs and procedures, which comply with the requirements of this specification and all applicable standards and regulations. Comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the regulation of this specification, follow the more restrictive requirements.

This requirement is intended only for the demolition and preparation prior to repair and does not include provisions for recoating of steel.

Environmental

All applicable portions of Subsections 961.65 “Worker Protection” and 961.66 “Environmental Protection and Monitoring” shall be followed when performing this work.

During chemical stripping a hand washing facility may be used in lieu of a decontamination/changing facility.

Hazardous material shall be collected during the disassembly and disposed of as outlined in Subsection 961.68 “Handling of Hazardous Waste and Reporting Release Programs”.

The applicable submittals shall be according to Subsection 961.69 “Submittals”.

GENERAL REQUIREMENTS FOR DEMOLITION AND WORK INVOLVING PAINTED STEEL (Continued)

Cleaning/Removal

Cutting Or Burning Of Steel

All surfaces to be welded, heated, saw cut or burned shall be cleaned so as to remove all contaminants and/or hazardous materials, which could be discharged to the environment as a function of the subsequent operations.

Lead paint shall be removed in its entirety in an area prescribed by a 6 inch (15 cm) minimum offset from the required work. The paint removal operation may be dry abrasive blasting, wet abrasive blasting or chemical stripping.

Proper level of containment shall be used when performing this work in accordance with Subsection 961.67 "Containment". Full containment is not required during chemical stripping operation however; the Contractor shall install proper shielding and/or tarpaulins under the chemical stripping operations in order to catch all debris generated during this procedure. A cleaned area must be inspected and approved before the demolition operations are started.

During cleaning operations the Contractor shall be required to furnish and erect temporary floodlights illuminating the steel surface at a minimum of 30-foot candles. This lighting shall be used in areas where there is insufficient lighting for proper cleaning operations and inspection. The Contractor shall supply electrical power.

The Contractor shall provide support for interim and final inspection of the bridge during cleaning operations. This support shall include the necessary traffic controls and safe access to the work.

Mechanical Disassembly Of Steel

All surfaces to be mechanically disassembled by shear cutting or removing bolts or rivets shall not require deleading. When shear cutting or removing bolts or rivets, the Contractor shall not use any method that will cause dust and/or particles to be emitted and/or dispersed into the environment to an extent that would expose the workers above the Action Levels of 30µg/m3.

For purposes of limiting the lead (Pb) dust, the Contractor will be required to dampen the lead paint work areas.

The contractor shall install a proper shielding and/or tarpaulins under all lead-paint-coated surfaces to be shear cut or bolts or rivets ordered removed in order to catch any loose lead paint chips, dust or particles.

PIGEON WASTE

The Contractor shall remove and dispose of the pigeon waste and any other debris accumulated on the steel members and bridge seats in areas where work is being performed. Pigeon waste and debris material contaminants will require special handling and disposal in accordance with all Federal, state, and local requirements. No separate payment will be made for removal and disposal of pigeon waste. Cost shall be incidental to the contract pay items.

NOTIFICATION OF FUNDING SOURCES FOR WORK TO BE PAID BY OTHERS

This contract contains work that shall be paid by the City of Worcester. The said City of Worcester shall be responsible for construction costs associated with a Non-Participating Agreement with MassDOT.

COORDINATION WITH CITY OF WORCESTER DPWP

All work within the City Right-of-Way shall comply with all City requirement and Standards. Additionally, the City requires the following:

- 24 hours advance notice to coordinate work on the water mains.
- The Contractor is responsible for filing all required construction permits with the City.
- Pipe laying work within the City Right-of-Way shall be performed by a licensed pipe layer.

NORTHERN LONG-EARED BAT PROTECTION

The U.S. Fish and Wildlife Service (USFWS) has listed the northern long-eared bat (NLEB) as endangered under the Endangered Species Act (ESA) and the following requirements exist to protect the bat and its habitat. This project has been consulted with the USFWS through the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and Federal Transit Administration (FTA) Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat revised February 5, 2018 and amended March 31, 2023.

On behalf of FHWA, the lead federal agency for Section 7 consultation, MassDOT submitted a Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bat to the USFWS through the Information for Planning and Consultation (IPaC) webpage and generated a USFWS No Effect Consistency Letter (see Document A00855 included herein), whereby it was determined that this Project will have "No Effect" to the NLEB. Therefore, the project has completed Section 7 consultation through the Endangered Species Act, and no AMMs apply to the project.

If the project scope changes (i.e., tree clearing, bridge work), additional review is required by the MassDOT Highway Division's Environmental Services Section. Contact MassDOT Environmental Services - Wildlife & Endangered Species Unit Supervisor (David Paulson, david.j.paulson@dot.state.ma.us, 857-262-3378).

CONTAMINATED SOIL

Soil to be removed from the project area shall not be assumed to be uncontaminated and must be evaluated prior to off-site management for potential contamination with hazardous materials. No soil may be disposed of off-site without proper assessment by the contractor and approval from the Resident Engineer (RE), District Environmental Engineer (DEE), or the project designee.

EMERALD ASH BORER ADVISORY

To the extent possible, all trees and brush shall be disposed on site, typically chipped and spread in place. When trees or brush must be removed, such as in urban, or otherwise populated areas, Contractor shall identify proposed location for disposal, and provide written notification to the Engineer for approval. Disposal shall be in city or town of project, or at minimum, within county, of construction operations.

EQUIVALENT SINGLE AXLE LOADS (ESALS)

The estimated traffic level to be used for SUPERPAVE HMA mixture designs for this contract, expressed in Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period, is 0.9 Million 18-kip (80-kn) ESALs.

2026 FIFA WORLD CUP – BOSTON, MASSACHUSETTS

The 2026 FIFA World Cup will be held at Gillette Stadium in Foxborough and related events will be held throughout the region. Matches and Fan Fest activities are scheduled from June 11, 2026 through July 19, 2026. MassDOT will impose work restrictions as necessary to minimize traffic impacts during FIFA events when the Contractor's operations could impact vehicular traffic, particularly on interstate highways and major arterials throughout the region and local roads near the event site. No additional compensation will be allowed for work restrictions except as determined under Subsection 8.10

GUNSHOT DETECTOR EQUIPMENT

The City will remove and reset the gunshot detector equipment attached to light pole #2 located at approximately STA 12+36 RT on Harrison Street prior to the light pole being removed. The Contractor shall notify the Worcester Police Department a minimum of 7 days prior to the pole being removed. The contact for the police department is Jacquelyn Burmeister (tel, 508-799-8600).

CONTROL OF STORMWATER RUNOFF

The Contractor shall prevent stormwater from Harrison Street and Laurel Street from falling onto I-290 during construction. The Contractor shall provide his method of preventing the runoff from falling onto I-290 to the Engineer prior to removing the bridge structures.

CITY CONSTRUCTION STANDARDS AND SPECIFICATIONS

For installation of utilities owned by the City, see Document A00825 for "The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details", dated March 1, 2023.

MassDOT specifications and these special provisions take precedent over the City's specifications where there are conflicts between the specifications.

UTILITY CONSTRUCTION STANDARDS AND SPECIFICATIONS

See Document A00826 for "Charter Communications/Spectrum Cable City of Worcester Standards." See Document A00827 for "National Grid Bridge and Overpass Conduit Support System Guidelines."

MATERIAL OPTIONS

The Contractor shall inform the Engineer of his option prior to the installation of the material. Once the option is designated, all material for the option item(s) shall remain the same throughout the job.

OPTIONS

Item Number	Item Description	Unit
234.12	12 Inch Drainage Pipe - Option	Foot
234.15	15 Inch Drainage Pipe - Option	Foot
234.18	18 Inch Drainage Pipe – Option	Foot

Pipe Options

Reinforced Concrete Pipe
Corrugated Plastic (Polyethylene) Pipe
Corrugated Plastic (Polypropylene) Pipe

NON-RESPONSE DAMAGES

This provision is intended to ensure prompt response to Emergency Response Work Orders. MassDOT may waive these Non-Response Damages when, in the opinion of the Engineer, it is in the best interest of MassDOT to do so.

If the Contractor has not met the complexity milestones as outlined in the Work Order, the contractor will be notified regarding Non-Response Damages that will be assessed. The Engineer shall assess damages in the amount of $1,000 per day (or portion thereof) for each day beyond the milestone due date that the milestone is not met.

Emergency Repairs: If the Contractor has not started Physical Work on an assigned Emergency Repair within four (4) hours of receiving the notification, payment under Item 748.1 will only be made at the discretion of the Engineer. Furthermore, the Contractor will be assessed damages in the amount of $1,000 per hour for each hour Physical Work is delayed.

“Physical Work” shall refer to the physical implementation of the required repair at the bridge site. For repairs with no additional complexities, Physical Work will be measured from the issuance of the Work Order. In no case will Physical Work include any of the following: ordering materials, fabrication of materials, organizing labor forces, coordinating with subcontractors, or other operations needed to be performed in advance of the required repairs.

SECTION 722
CONSTRUCTION SCHEDULING
DESCRIPTION

722.20 General

The Contractor's approach to prosecution of the Work shall be disclosed to the Department by submission of a Critical Path Method (CPM) schedule and a cost/resource loaded Construction Schedule as defined by the schedule type set forth below. These requirements are in addition to any requirements imposed in other sections.

This section establishes the requirement for scheduling submissions. There are four schedule types identified as types A, B, C and D. The schedule type applicable to this project is established in the project special provisions.

All schedules shall be prepared and submitted in accordance with this specification and the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit.

Type A –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Cost-loaded & Resource Loaded CPM
- Resources Graphic Reporting
- Cash Flow Projections from the CPM
- Cash Flow Charts
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type B –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Cost-loaded & Resource Loaded CPM
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

Type C –

- Schedule Planning Session
- Baseline CPM Schedule
- Monthly Update CPM Schedule
- Short-term Construction Schedule
- Contract Schedule Update Meeting
- Monthly Projected Spending Report (PSR)
- Contractor-furnished CPM software and computer

SECTION 722 (Continued)

Type D -

- Bar chart schedule updated monthly or at the request of the Engineer
- Short-term Construction Schedule
- Monthly Projected Spending Report (PSR)

EQUIPMENT, PERSONNEL

722.40 General

A. **Software Requirements**

The Contractor shall use Primavera P6 computer scheduling software.

In addition to the requirements of Section 740 – Engineer's Field Office and Equipment, the Contractor shall provide to the Department one (1) copy of the scheduling software, one (1) software license and one (1) computer capable of running the scheduling software for the duration of the Contract. This computer and software shall be installed in the Engineer's Field Office. The computer and software shall be maintained and serviced at no additional cost to the Department.

B. Scheduler Requirements

The Scheduler shall be approved by the Engineer.

For Type A, B and C Schedules the name of the Contractor's Project Scheduler together with his/her qualifications shall be submitted to the Department for approval by the Engineer within seven (7) Calendar Days after NTP. The Project Scheduler shall have a minimum of five (5) years of project CPM scheduling experience, three (3) years of which shall be on projects of similar scope and value as the project for which the Project Scheduler is being proposed. References shall be provided from past projects that can attest to the capabilities of the Project Scheduler.

SCHEDULING METHODS

722.60 General

A. **Schedule Planning Session**

The Contractor shall conduct a schedule planning session prior to submission of the Baseline Schedule. This session will be attended by the Department and its consultants. During this session, the Contractor shall present its planned approach to the project including, but not limited to:

1. the Work to be performed by the Contractor and its subcontractors;
2. the planned construction sequence and phasing; planned crew sizes;
3. summary of equipment types, sizes, and numbers to be used for each work activity;
4. all early work related to third party utilities;
5. identification of the most critical submittals and projected submission timelines;
6. estimated durations of major work activities;
7. the anticipated Critical Path of the project and a summary of the activities on that Critical Path;
8. a summary of the most difficult schedule challenges the Contractor is anticipating and how it plans to manage and control those challenges;

SECTION 722 (Continued)

9. a summary of the anticipated quarterly cash flow over the life of the project.

This will be an interactive session and the Contractor shall answer all questions that the Department and its consultants may have. The Contractor shall provide a written summary of the information presented and discussed during the session to the Engineer. The Contractor's Baseline Schedule and accompanying Schedule Narrative shall incorporate the information discussed at this Schedule Planning Session.

B. **Schedule Reviews by the Department**

1. Baseline Schedule Reviews
   The Engineer will respond to the Baseline Schedule Submission within thirty (30) Calendar Days of receipt providing comments, questions and/or disposition that either accepts the schedule or requires revision and resubmittal. Rejected Baseline Schedules shall be resubmitted within fifteen (15) Calendar Days after receipt of the Engineer's comments.
2. Contract Progress Schedule / Monthly Update Reviews / Recovery Schedules
   The Engineer will respond to each submittal within twenty-one (21) Calendar Days. Rejected schedules shall be resubmitted by the Contractor within five (5) Calendar Days after receipt of the Engineer's comments.

The Engineer's review comments shall not be construed as direction to change the Contractor's means and methods. The review and acceptance of the CPM schedule does not relieve the Contractor of the responsibility for accomplishing the work within the contract required completion dates. Omissions and errors in the accepted CPM schedule shall not excuse performance less than that required by the Contract.

722.61 Schedule Content and Preparation Requirements

All schedules shall be prepared and submitted in accordance with the instructions contained in the Construction Schedule Toolkit located on the MassDOT-Highway Division website at:
https://www.mass.gov/info-details/massdot-highway-contractors-schedule-toolkit
and the following:

A. **LOGIC**

The schedules shall divide the Work into activities with appropriate logic ties to show:

1. conformance with the requirements of this Section and Division I, Subsection 8.02 - Schedule of Operations
2. the Contractor's overall approach to the planning, scheduling, and execution of the Work
3. conformance with any additional sequences of Work required by the Contract Documents, including, but not limited to, Subsection 8.03 - Prosecution of Work and Subsection 8.06 – Limitations of Operations.

SECTION 722 (Continued)

B. **ACTIVITIES**

The schedule shall clearly define the progression of the Work from the Notice to Proceed (NTP) to Contractor Field Completion (CFC) by using separate activities, or including attributes within appropriate activities, to address each of the following:

1. Notice to Proceed
2. Work Breakdown Structure
3. The Critical Path is clearly defined and organized.
4. Float shall be clearly identified.
5. Detailed activities to satisfy permit requirements.
6. Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
7. The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
8. The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be thirty (30) Calendar Days, unless otherwise specified or as approved by the Engineer.
9. Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
10. Each component of the Work defined by specific activities.
11. Right-of-Way (ROW) takings that have been identified in the Contract.
12. Early Utility Relocation (by others) that has been identified in the Contract.
13. Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
14. Utility work to be performed in accordance with the Project Utility Coordination (PUC) Form as provided in Section 8.14 - Utilities Coordination, Documentation and Monitoring Responsibilities
15. Access Restraints – restrictions on access to areas of the Work that are defined by the Department in the bid package, in Subsection 8.06 – Limitations of Operations or elsewhere in the Contract
16. Limitations of Work – time of year restrictions and any other limitations identified in the contract
17. Traffic work zone set-up and removal, night work and phasing
18. Material Certifications
19. Milestones listed in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents
20. For Type A and B Contracts only: All items to be paid for, including all Unit Price and Lump Sum pay items, shall be identified by activity. This shall include all non-construction activities such as engineering work; purchase of permanent materials and equipment, purchase of structural steel stock, equipment procurement, equipment delivery to the site or storage location and the representative amount of overhead/indirect costs that was included in the Contractor's Bid Prices.

SECTION 722 (Continued)

21. Contractor's request for validation of FBU (ready to open to traffic)
22. Full Beneficial Use (FBU) Contract Milestone per the following requirements: The majority of contract Work has been completed and the asset(s) has been opened for full multi-modal transportation use, except for limited contract work items that do not materially impair or hinder the intended public use of the transportation facility. All anticipated lane takings have been completed, except for minor, short term work items and as defined in Subsection 8.03 - Prosecution of Work
23. The Department's confirmation of completed work to allow for FBU.
24. Contractor's request for validation of Substantial Completion
25. Department generated punch list of twenty-one (21) Calendar Days
26. Substantial Completion Contract Milestone as defined in the standard specifications.
27. Punch list Completion Period of at least thirty (30) Calendar Days per the requirements of Subsections 5.11 - Final Acceptance, 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes
28. Contractor confirmation that all punchlist work and documentation has been completed.
29. Physical Completion of the Work Contract Milestone per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
30. Documentation Completion per the requirements of Subsections 5.11 - Final Acceptance and 8.03 - Prosecution of Work
31. Contractor Field Completion Contract Milestone (which can also be considered the completion date) per the following requirements: All physical contract Work is complete including punchlist. The Contractor has fully de-mobilized from field operations and as defined in Subsection 5.11

C. **EARLY AND LATE DATES**

Early Dates shall be based on proceeding with the Work or a designated part of the Work exactly on the date when the corresponding Contract Time commences. Late Dates shall be based on completing the Work or a designated part of the Work exactly on the corresponding Contract Time, even if the Contractor anticipates early completion.

D. **DURATIONS**

Activity durations shall be in Work Days. Planned Original Durations shall be established with consideration of resources and production rates that correspond to the Contractor's Bid Price. Within all of the Department-required schedules, the Contractor shall plan the Work using durations for all physical construction activities of no less than one (1) Work Day and no greater than fourteen (14) Work Days, unless approved by the Engineer as part of the Baseline Schedule Review.

SECTION 722 (Continued)

Should there be an activity with a duration that is determined by the Engineer to be unreasonable, the Contractor will be asked to provide a basis of the duration using bid documents, historic production rates for similar work, or other form of validation that is acceptable to the Engineer. Should the Contractor and the Engineer be unable to agree on reasonable activity durations, the Engineer will, at a minimum, note the disagreement in the Baseline Schedule Review along with a duration the Engineer considers reasonable and the basis for that duration. A schedule that contains a substantial number of activities with durations that are deemed unreasonable by the Engineer will not be accepted.

E. **MATERIALS ON HAND**

The Contractor shall identify in the Baseline Schedule all items of permanent materials (Materials On Hand) for which the Contractor intends to request payment prior to the incorporation of such items into the Work.

F. **ACTIVITY DESCRIPTIONS**

The Contractor shall use activity descriptions in all schedules that clearly describe the work to be performed using a combination of words, structure numbers, station numbers, bid item numbers, work breakdown structure (WBS) and/or elevations in a concise and compact label.

G. **ACTIVITY IDENTIFICATION NUMBERS**

The Contractor shall use the activity identification numbering system specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

H. **ACTIVITY CODES**

The Contractor shall use the activity codes specified in the MassDOT Highway Division Contractor Construction Schedule Toolkit.

I. **CALENDARS**

Different calendars may be created and assigned to all activities or to individual activities. Calendars define the available hours of work in each Calendar Day, holidays and general or project-specific non-Work Days such as Fish Migration Periods, time-of-year (TOY) restrictions and/or area roadway restrictions. All calendars shall extend two years beyond the current project completion date.

Project Special Provisions identify specific calendar restrictions some examples of special calendars include, but are not limited to:

- Winter Shutdown Period, specific work is required by separate special provision to be performed during the winter. See Special Provision 8.03 (if applicable)
- Peak traffic hours on heavily traveled roadways. This shall be from 6:30 am to 9:30 am and from 3:30 pm to 7:00 pm, unless specified differently elsewhere in the Contract.
- Special requirements by sensitive abutters, railroads, utilities and/or other state agencies as defined in the Contract.
- Planting seasons for trees, shrubs and grasses and wetlands mitigation work.

SECTION 722 (Continued)

- Cape Cod and the Islands Summer Roadway Work Restrictions: A general restriction against highway and bridge construction is enforced between Memorial Day and Labor Day, unless otherwise directed by the Engineer. Cape Ann Summer Roadway Work Restrictions: While there are no general restrictions for Cape Ann as there are for Cape Cod and the Islands, project-specific restrictions may be enforced.
- Turtle and/or Fish Migration Periods and/or other in-water work restrictions: Refer to the Project Special Provisions for specific restrictions.
- Working over Waterways Restricted Periods.
- Night-time paving and striping operations, traffic, and temperature restrictions.
- Utility Restrictions shall be as specified within the Contract.

J. **FLOAT**

For the calculation of float in the CPM schedule, the setting for *Retained Logic* is required for all schedule submissions, starting with the Baseline Schedule Submission. Should the Contractor have a reason to propose that an alternative calculation setting such as *Progress Override* be used, the Contractor shall obtain the Engineer's approval prior to modifying to this setting.

K. **COST AND RESOURCE LOADING (Types A and B only)**

For all Type A and B Schedules, the Contractor shall provide a cost and resource-loaded schedule with an accurate allocation of the costs and resources necessary to complete the Work. The costs and resources shall be assigned to all schedule activities in order to enable the Contractor to efficiently execute the Contract requirements and the Engineer to validate the original plan, monitor progress, provide cash flow projections, and analyze delays.

1. Each schedule activity shall have an assigned cost that accurately represents the value of the Work. Each schedule activity shall have its resources assigned to it by craft and the anticipated hours to accomplish the work. Each schedule activity's equipment resources shall be assigned to it by equipment type and hours operated. Front-loading or other unbalancing of the cost distribution will not be permitted.
2. The sum of the cost of all schedule activities shall be equal to the Contractor's Bid Price.
3. Indicating the labor hours per individual, per day, by craft and equipment hours/day will be acceptable.
4. The Engineer reserves the right to use the cost-loading as a means to resolve changes, disputes, time entitlement evaluations, increases or decreases in the scope of Work, unit price renegotiations and/or claims.
5. For all Type A and B Schedules, all subnets, fragnets, Proposal Schedules, and Recovery Schedules shall be cost and resource- loaded to help to quickly validate and monitor the duration of the Work to be performed.
6. For Type A Schedules, cost-loading of the schedule will also be used for cash flow projection purposes.
7. The cost-loading of each activity shall indicate the portion of the cost for that activity that is applicable to a specific bid item (cost account.) The total cost for each cost account must equal the bid item price.

SECTION 722 (Continued)

L. **NOT TO BE USED IN THE CONTRACTOR'S CPM SCHEDULE**

1. Milestones or constraint dates not specified in the Contract.
2. Scheduled work not required for the accomplishment of a Contract Milestone
3. Use of activity durations, logic ties and/or sequences deemed unreasonable by the Engineer.
4. Delayed starts of follow-on trades.
5. Float suppression techniques.
6. Leads such as leads, lags, SS, SF, & FF relationships without the expressed permission of the Department.

722.62 Submittal Requirements

All schedules shall be prepared and submitted in accordance with the requirements listed below.

Each monthly Contract Progress Schedule submittal shall be uniquely identified.

Each Submission shall, at a minimum, include the following:

a. Narrative
b. Schedule submittals shall be signed by the Scheduler
c. Schedule Printout - All Activities
d. Schedule Printout - Critical Path Layout
e. Schedule Printout - Remaining Work
f. Schedule Printout - Top 3 Float Path
g. Work Breakdown Structure (WBS) Summary
h. Project Spending Report (PSR) in Portable Document Format (.PDF)
i. Project Spending Report (PSR) in Microsoft Excel spreadsheet (.XLS)
j. Oracle Primavera P6 Schedule File (.XER)

All digital file submittals will be labeled with the following information.

- Contract Number
- Project Number
- Project locations (i.e., town(s))
- Brief description
- Submittal description (i.e., UP07)
- Data Date (MM-DD-YY)
- File Description (i.e., Critical Path)

Example: C110464 (P606309) - Orange Route 2 over 202 – UP23 (07-15-22) - Critical Path

A. **Narratives**

A written narrative shall be submitted with every schedule submittal. The narrative shall:

1. itemize and describe the flow of work for all activities on the Critical Path in a format that includes any changes made to the schedule since the previous Contract Progress Schedule / Monthly Update or the Baseline Schedule, whichever is most recent.
2. provide a description of any specification requirements that are not being followed. Identify those that are improvements and those that are not considered to be meeting the requirements.

SECTION 722 (Continued)

3. provide all references to any Notice of Delay that has been issued, within the time period of the Contract Progress Schedule Update, by letter to the Engineer. Note that any Notice of Delay that is not issued by letter will not be recognized by the Engineer. See Subsection 722.64.A – Notice of Delay.
4. provide a description of each third-party utility's planned vs. actual progress and note any that are trending late or are late per the durations and commitments as provided in the PUC Form; provide a description of the five (5) most important responses needed from the Department and the need date for the responses in order to maintain the current Schedule of Record.
5. provide a description of all critical issues that are not within the control of the Contractor or the Department (third party) and any impact they had or may have on the Critical Path.
6. provide a description of any possible considerations to improve the probability of completing the project early or on time.
7. compare Early and Late Dates for activities on the Critical Path and describe reasons for changes in the top three (3) most critical paths.
8. describe the Contractor's plan, approach, methodologies, and resources to be employed for completing the various operations and elements of the Work for the top three (3) most critical paths. For update schedules, describe and propose changes to those plans and verify that a Proposal Schedule is not required.
9. describe, in general, the need for shifts that are not 5 days/week, 8 hours/day, the holidays that are inserted into each calendar and a tabulation of each calendar that has been used in the schedule.
10. describe any out-of-sequence logic and provide an explanation of why each out-of-sequence activity does not require a correction, if one has not been provided, and an adequate demonstration that these changes represent the basis of how these activities will be built, including considerations for resources, dependencies, and previously approved production rates.
11. identify any possible duration increases resulting from actual or anticipated unit price item quantity overruns as compared to the baseline duration, with a corresponding suggestion to mitigate any possible delays to the Critical Path. If the delay is anticipated to impact the Critical Path, refer to Subsections 4.06 – Increased or Decreased Contract Quantities and 8.10 – Determination and Extension of Contract Time for Completion and submit a letter to the Engineer notifying of a potential delay.
12. include a schedule log consisting of the name of the schedule, the data date and the date submitted.
13. include and describe any notifications, communications and coordination meetings with third-parties such as utility companies that occurred from the last update including personnel names, job titles and contact information, date of meeting(s)/correspondence(s), topics discussed, and reasons the third party provided for deviations from the PUC form.

SECTION 722 (Continued)

B. **CPM Bar Charts**

One (1) timescaled bar chart containing all activities shall be prepared and submitted using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements Activities shall be linked by logic ties and shown on their Early Dates. Critical Paths shall be highlighted, and Total Float shall be shown for all activities.

A second timescaled bar chart shall also be prepared containing only the Critical Path or, if the Critical Path is not the longest path, the Longest Path using a scale that yields readable plots and that meets the requirements of Subsection 722.61 – Schedule Content and Preparation Requirements. Activities shall be linked by logic ties and shown on their Early Dates. Total Float shall be shown for all activities.

C. Detailed Activity Schedule Comparisons

A Detailed Activity Schedule Comparison (DASC) is a simple reporting tool in the format of a graphical report that will provide Resident Engineers with immediate, timely and up-to-date information. The DASC consists of an updated bar chart that overlays the current time period's bar chart onto the previous time period's bar chart for an easily read comparison of progress during the present and previous reporting periods.

D. Activity Cost Report and Monthly Cash Flow Projections (Type A only)

With each Contractor Quantity Estimate (CQE), the Contractor shall submit an Activity Cost Report and Cash Flow Projection that includes all activities grouped by Contract Bid Item.

The Activity Cost Report shall be generated from the Schedule of Record and shall be the basis of the Monthly Cash Flow Projection. Within each contract Bid Item, activities shall be sequenced by ascending activity identification number and shall show:

1. activity ID and description,
2. forecast start and finish dates for each activity and,
3. when submitted as a revised schedule, actual start, and finish dates for each completed activity.
4. any variance to the estimated contract quantity shall be shown.

E. Resource Graphs (Type A only)

Monthly and cumulative resource graphs for the remaining Contract period using the Early Dates and Late Dates in the Contract Progress Schedule shall be included as part of each schedule submittal.

SECTION 722 (Continued)

F. Projected Spending Reports

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF.

722.63. Progress Schedule Requirements

A. Baseline Schedule

The Baseline Schedule shall be due thirty (30) Calendar Days after Notice to Proceed (NTP). The Baseline Schedule shall only reflect the Work awarded to the Contractor and shall not include any additional work involving Extra Work Orders or any other type of alleged delay. The Baseline Schedule shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements. Once the Baseline Schedule has been accepted by the Engineer, with or without comments, it shall represent the as-planned schedule for the Work and become the Contract Progress Schedule of Record until such time as the schedule is updated or revised under Subsections 722.63.C - Contract Progress Schedules / Monthly Updates, 722.64.C - Recovery Schedules and 722.64.D - Proposal Schedules.

The Cost and Resource-Loading information (Types A and B only) shall be provided by the Contractor within forty-five (45) Calendar Days after NTP.

The Engineer's review comments on the Baseline Schedule and the Contractor's responses to them will be maintained for the duration of the Contract and will be used by the Engineer to monitor the Contractor's work progress by comparing it to the Contract Progress Schedule / Monthly Update.

B. Interim Progress-Only Schedule Submissions

The first monthly update of the Contract Progress Schedule/Monthly Update is due within seventy (70) Calendar Days after Notice to Proceed (NTP.) The Baseline Schedule review period ends at sixty (60) Calendar Days after NTP, see Subsection 722.60.B - Schedule Reviews by the Department. If the Baseline Schedule has not been accepted within sixty (60) Calendar Days after NTP, an Interim Progress-Only Schedule shall be due within seventy (70) Calendar Days after NTP. The purpose of the Interim Progress-Only Schedule is to document the actual progress of all activities, including non-construction activities, from NTP until the Baseline Schedule is accepted.

SECTION 722 (Continued)

C. Contract Progress Schedules / Monthly Updates

The first Contract Progress Schedule shall be submitted by the Contractor no later than seventy (70) Calendar Days after NTP. The data date for this first Progress Schedule shall be two months (approximately sixty (60) Calendar Days) after NTP. Subsequent Progress Schedules shall be submitted monthly.

Each Contract Progress Schedule shall reflect progress up to the data date. Updated progress shall be limited to asbuilt sequencing and asbuilt dates for completed and inprogress activities. Asbuilt data shall include actual start dates, remaining Work Days and actual finish dates for each activity, but shall not change any activity descriptions, the Original Durations, or the Original Resources (as planned at the time of bid), without the acceptance of the Engineer. If any activities have been completed out-of-sequence, the Contractor shall propose new logic ties for affected in-progress and future activities that accurately reflect the previously approved sequencing. Alternatively, the Contractor may submit to the Engineer for approval an explanation of why an out-of-sequence activity does not require a correction and an adequate demonstration that the changes accurately represent how the activities will be built, including considerations for resources, dependencies, and previously approved production rates. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

No revisions to logic ties, sequence, description, or duration of future activities; or planned resource costs shall be made without prior approval by the Engineer.

Any proposed logic changes for in-progress or future activities shall be submitted to the Engineer for approval before being incorporated into a Contract Progress Schedule. The logic changes must be submitted using a Proposal Schedule or a schedule fragnet submission. Once approved by the Engineer, the Contractor may incorporate the logic in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

For any proposed changes to the original sequence, description or duration of future activities, the Contractor shall submit to the Engineer for approval an explanation of how the proposed description or duration change reflects how the activity will be progressed, including considerations for resources and previously approved production rates. Any description or duration change that does not accurately reflect how the activity will be progressed will not be approved by the Engineer. Once approved by the Engineer, the Contractor may incorporate the changes in the next Contract Progress Schedule/Monthly Update with the affected activities clearly identified and explained in the Schedule Narrative.

Contract Progress Schedules that extend performance beyond the Contract Time or beyond any Contract Milestone shall not be approved by the Engineer. The Contractor shall submit a Recovery Schedule, or a Time Entitlement Analysis, if any Contract Progress Schedule/Monthly Update indicates a failure to meet the Contract Dates.

SECTION 722 (Continued)

D. Short-Term Construction Schedule

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work for the two (2) week period prior and all planned work for the following three (3) week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities. Short-Term Construction Schedules shall be prepared and submitted in accordance with Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements.

722.64 Impacted Schedule Requirements

A. Notice of Delay

The Contractor shall notify the Engineer in writing, with copies to the District and State Construction Engineers, within fifteen (15) of the start of any delays to the Critical Path that are caused by actions or inactions that were not within the control of the Contractor. Delay notifications that are not provided in a letter to the Engineer, such as a delay notification in the schedule narrative, will not be recognized as contractual notice in the determination of any Time Extension related to the impacts to the work associated with this specific alleged delay. Should such a delay continue for more than one (1) week, the Contractor shall note it in the Schedule Narrative until the delay is no longer impacting the Critical Path for the completion of the Contract Milestones. The Engineer will evaluate the alleged delay and its impact and will respond to the Contractor within ten (10) Calendar Days after receipt of a notice of delay.

B. Time Entitlement Analysis

A Time Entitlement Analysis (TEA) shall consist of a descriptive narrative, prepared in accordance with Subsection 722.62.A - Narratives, and an as-built CPM schedule, which may be in the form of a schedule fragnet that has been developed from the project's Contract Progress Schedule of Record, and illustrates the impact of a delay to the Critical Path, Contract Milestones and/or Contract Completion Date as required in Subsection 8.10 - Determination and Extension of Contract Time for Completion. TEAs shall also be used to determine the schedule impact of proposed Extra Work Orders (EWO) as also required in Subsection 8.10.

TEAs shall be prepared and submitted in accordance with the requirements of Subsections 722.61 - Schedule Content and Preparation Requirements and 722.62 - Submittal Requirements and shall be based on the Contract Progress Schedule of Record applicable at the start of the delay or impact from an EWO. A TEA fragnet must start with a specific new activity describing the work contained in either a Notice of Delay previously submitted to the Department per Subsection 722.64.A - Notice of Delay or an EWO.

SECTION 722 (Continued)

TEAs shall be submitted:

1. as part of any Extra Work Order that may impact Contract Time,
2. with a request for a Time Extension,
3. within fifteen (15) Calendar Days after a request for a TEA by the Engineer for any other reason.

A TEA shall be submitted to the Engineer before any Time Extension is granted to the Contractor. Time Extensions will not be granted unless the TEA accurately reflects an evaluation of all past delays and the actual events that occurred that impacted the Critical Path. The TEA must also demonstrate a plan for the efficient completion of all of the remaining work through an optimized CPM Schedule. The analysis shall include all delays, including Contractor-caused delays, and shall be subdivided into timeframes and causes of delays.

TEAs shall incorporate any proposed activities, logic ties, resource considerations, and activity costs required to demonstrate the schedule impacts most efficiently in addition to detailing all impacts to existing activities, logic ties, the Critical Path, Contract Milestones, and the Contract Completion Date. In addition, TEAs shall accurately reflect any changes made to activities, logic ties, restraints, and activity costs, necessitated by an Extra Work Order or other schedule impact, for the completion of the remaining work. The Contractor shall provide TEAs that demonstrate that all delays have been mitigated to the fullest extent possible without requiring an Equitable Adjustment to the original bid basis.

All TEAs shall clearly indicate any overtime hours, additional shifts and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. The Engineer shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of Time Extensions if it is determined to be in the best interest of the Department to do so.

When accepted, the changes included in a TEA shall be incorporated into the next Contract Progress Schedule per the requirements of Subsection 722.63.C - Contract Progress Schedules / Monthly Updates. During the review of any TEA, all Contract Progress Schedules shall continue to be submitted as required.

The Engineer may request that the Contractor prepare a Proposal Schedule or a Recovery Schedule to further mitigate any delays that are shown in the accepted TEA or Contract Progress Schedule.

C. Recovery Schedules

The Contractor shall promptly report to the Engineer all schedule delays during the prosecution of the Work. Contract Progress Schedules that predict performance extended beyond the Contract Time or beyond any Contract Milestone shall not be approved as the schedule of record. This requirement is critical to the Department's ability to make informed decisions regarding Contract Time and costs.

The Contractor shall submit a Recovery Schedule within fifteen (15) Calendar Days of a Contract Progress Schedule submission that shows failure to meet the Contract Dates unless a recovery schedule is waived by the Department. Waiving the recovery schedule does not relieve the contractor of the responsibility for the delay. The Department may revoke the waiver of a Recovery Schedule, at which time a Recovery Schedule shall be submitted within fifteen (15) Calendar Days of the Contractor being notified.

Changes represented in accepted Recovery Schedules shall be incorporated into the next Contract Progress Schedule.

SECTION 722 (Continued)

D. Proposal Schedules

A Proposal Schedule is an alternative schedule used to evaluate proposed changes to the Contract scope or significant alternatives to previously approved approaches to complete the Work, which may include changes to activity durations, logic, and sequence. For Types A and B Schedules, the Proposal Schedule shall be cost and resource loaded.

A Proposal Schedule may be requested by the Department at any time or may be offered by the Contractor. The Engineer may request that the Contractor prepare a Proposal Schedule to further mitigate any delays that are shown in an accepted TEA or Contract Progress Schedule.

The Contractor shall submit the Proposal Schedule within thirty (30) Calendar Days of a request from the Department.

The Proposal Schedule shall not be considered a Schedule of Record until the logic, durations, narrative, and basis of the Proposal Schedule have been accepted by the Engineer. If the Proposal Schedule took the form of a fragnet, it must be incorporated into the Contract Progress Schedule of Record showing the current progress of all other activities and the impacts/results of the changes made by the Proposal Schedule before the Proposal Schedule is accepted by the Department.

Proposal Schedules shall clearly indicate any proposed acceleration including overtime hours, additional shifts, and the resources that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts. Proposal Schedules that contain a cost element shall be submitted with a separate Cost Proposal.

Changes represented in the accepted Proposal Schedules shall be incorporated into the next Contract Progress Schedule. During the review of any Proposal Schedule, all Contract Progress Schedules shall continue to be required every month.

E. Disputes

All schedules shall be submitted, reviewed, dispositioned, and accepted in the timely manner specified herein so as to provide the greatest possible benefit to the execution of this Contract.

The Contractor may dispute a decision by the Engineer by filing a claim notice within seven (7) days after the Contractor's request for additional time has been denied or if the Contractor does not accept the number of days granted in a time extension. The Contractor's claim notice shall include a revised time entitlement analysis that sufficiently explains the basis of the time-related claim. Failure to submit the required time entitlement analysis with the claim notice shall result in denial of the Contractor's claim. A determination on the Contractor’s claim shall be in accordance with Subsection 7.16 Claims of Contractor for Compensation. Pending resolution of any dispute, the last schedule accepted by the Engineer will remain the Contract Schedule of Record.

SECTION 722 (Continued)

722.65 Schedule Type D Requirements

This section is to detail the requirements for Type D Schedules and is separate from the requirements listed above. These schedules are intended for a project in which a more formal schedule would not be practical.

Schedules for Type D projects shall be submitted for each work assignment. The Schedule Type D shall be submitted electronically in .XLS and .PDF format and meet the following requirements.

The schedule requirements for work assignments that are anticipated to last three weeks or less shall conform to the requirements for Short-term Construction Schedules below.

Work assignments that are anticipated to last longer than three weeks shall submit a bar chart baseline and provided update schedules upon request of the engineer as required under Bar Chart Schedule below in addition to meeting the Short-term Construction schedule requirements.

A. **Bar Chart Schedule**

A Bar Chart that shall include the following:

- Work Assignment start date.
- Activities to identify.
  - Major work operations broken down to be no longer than 14 days.
  - Procurement of fabricated materials and equipment with long lead times, including time for review and approval of submittals required before procuring and fabricating.
  - The preparation and submission of shop drawings, procedures, and other required submittals, with a planned duration that is to be demonstrated to the Engineer as reasonable.
  - The review and return of shop drawings, procedures, and other required submittals, approved or with comments, the duration of which shall be shown as thirty (30) Calendar Days,
  - Detailed activities to satisfy permit requirements.
  - Subcontractor approvals at fifteen (15) Calendar Days from submittal to response
  - Project Close out activities including a 21-calendar day creation of a punchlist activity and 30 calendar day minimum completion of punchlist activity.
- Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third-party work affecting the Contract.
- Access Restraints – restrictions on access to areas of the Work
- Traffic work zone set-up and removal, night work and phasing
- Contract Milestones including Full beneficial Use, Substantial Completion and Contractor Field Completion

The Bar Char Schedule shall be provided at the beginning of the project and updated with each work order created for the project.

SECTION 722 (Continued)

B. **Short-Term Construction Schedule**

The Contractor shall provide a Short-Term Construction Schedule that details daily work activities, including any multiple shift work that the Contractor intends to conduct, in a spreadsheet format. The daily activities shall directly correspond to the Contract Progress Schedule activities, with a matching reference to the activity identification number in the Contract Progress Schedule and may be at a greater level of detail. See schedule toolkit for suggested format.

The Short-Term Construction Schedule shall be submitted every two weeks. It shall display all work for a thirty-five (35) Calendar Day period consisting of completed work on the assignment for the two week period prior and all planned work for the following three week period. The initial submission shall be provided no later than thirty (30) Calendar Days after NTP or as required by the Engineer.

The Contractor shall be prepared to discuss the Short-Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, the schedule of work affecting abutters and any corresponding work with affected utilities.

C. **Project Spending Report (PSR)**

A Projected Spending Report (PSR) shall be prepared and submitted monthly. The PSR shall be for all active work assignments, broken down by work assignment. The PSR shall indicate the monthly spending (cash flow) projection for each month from NTP to Contractor Field Completion (CFC). Each month's actual spending shall be calculated using all CQEs paid during that month. The Projected Spending Report (PSR) shall be depicted in a tabular format and provided in both an .XLS and .PDF

SECTION 722 (Continued)

COMPENSATION

722.80 Method of Measurement

Schedule of Operations (Type A, B and C)

The project bid documents specify the fixed-price amounts to be paid to the Contractor for the Project Schedule requirements contained herein. Each bidder shall include this fixed price bid item amounts in their bid. Failure to do so may be grounds for the rejection of the bid.

This fixed price amount is for payment purposes only and is separate from what the Department considers to be the Contractor's General Condition costs. If the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs shall be included in the Contractor's overall bid price.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals will be paid for under the fixed price amount.

Twenty percent (20%) of this pay item will be paid upon the Engineer's acceptance of the Contractor's Baseline Schedule, prepared and submitted in accordance with Subsection 722.63.A.

The remaining eighty percent (80%) of this pay item will be paid in equal monthly installments distributed across the Contract Duration from Notice to Proceed (NTP) to Contractor Field Completion (CFC), less the 2 months required for the submittal and review of the Baseline Schedule in accordance with the following formula:

$$\text{Monthly Payment} = \frac{\text{Remaining Fixed Price amount (80\% of the Item Cost.)}}{\text{Contract Duration in whole months} - 2 \text{ months}}$$

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section.

Should there be a Time Extension granted to the Contractor, the Engineer may provide an Equitable Adjustment for additional Contract Progress Schedule Updates at intervals directed by the Engineer. The monthly payment will be the basis for this Equitable Adjustment.

Schedule of Operations (Type D)

For projects assigned with Type D schedule requirements, all scheduling work shall be considered incidental to the project with no separate payment under this section.

SECTION 722 (Continued)

722.81 Basis of Payment

The timely and accurate submission of the Baseline Schedule is critical to the Contract and the Department's ability to make informed decisions. Only payments under Item 740 - Engineer's Field Office and Item 748 – Mobilization will be made until the Baseline Schedule is accepted by the Engineer.

All required schedule-related work, including, but not limited to computers, computer software, the planning and coordination with utilities, training, schedule preparation and schedule submittals (including monthly progress schedules, short-term schedules, project spending reports, TEAs, recovery schedules or impacted schedules) shall be included in this work.

No payment for any other pay item will be processed beyond seventy-five (75) Calendar Days from Notice to Proceed (NTP) until the Baseline Schedule is accepted by the Engineer. Until the Engineer's acceptance of the Baseline Schedule, the combined total of all payments made to the Contractor will be limited to an amount no greater than the total price for Item 748 - Mobilization or 3% of the contract price, whichever is less.

All Contract Progress Schedule Updates submitted later than ten (10) Calendar Days after the CQE (Contract Quantity Estimate) completion date, or greater than forty (40) Calendar Days from the Data Date of the previous submission, will be deemed to be no longer useful and will not qualify for payment. The late submission of Impacted schedules, including TEAs, recovery schedules and proposal schedules will result in the forfeiture of the monthly payment for the month in which they were due and subsequent months until the submission is made. Late submission of missed submittals will not result in recovery of the previously forfeited portion of the Schedule of Operations Fixed Price Payment Item.

Failure to submit schedules as and when required may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

Failure to submit schedules that are acceptable to the Engineer may result in the forfeiture of that portion of the Schedule of Operations Fixed Price Payment and/or the withholding of the full or partial CQE payments by the Engineer.

The Schedule of Operations pay item will be adjusted to pay for only the actual quantity of schedules that have been submitted in accordance with this section.

The Contractor's failure or refusal to comply with the requirements of this Section shall be reasonable evidence that the Contractor is not prosecuting the Work with due diligence and may result in the Engineer withholding of full or partial payments of all work performed.

722.82 Payment Items

722.1	SCHEDULE OF OPERATIONS (TYPE A) - FIXED PRICE $_____	LUMP SUM
722.2	SCHEDULE OF OPERATIONS (TYPE B) - FIXED PRICE $_____	LUMP SUM
722.3	SCHEDULE OF OPERATIONS (TYPE C) - FIXED PRICE $_____	LUMP SUM

ITEM 100.5 ELECTRICAL WORK LUMP SUM

The work under this Item shall conform to the relevant provisions of Section 100 and Subsections 801, 813, and 820 of the Standard Specifications and the following:

Construction Methods

The work under this Item shall consist of all work required to maintain the lighting on I-290 throughout construction. The electrical conduits and equipment shall be temporarily relocated off the abutment face prior to its demolition and supported under the bridge. The Contractor shall submit a work plan showing the configuration and materials to the Engineer, and MassDOT for approval prior to the work. The work under this Item shall include the installation, maintenance, and removal of the temporary lighting configuration.

The lighting on I-290 may only be temporarily taken out of service during daylight hours, and as approved by MassDOT, in order to temporarily relocate the electrical conduits and equipment impacted by the proposed bridge work. The Contractor shall be responsible for maintaining service to the lighting system on I-290 during the bridge demolition and construction work for the full duration of construction.

Any equipment damaged or stolen through carelessness or lack of protection by the Contractor shall be replaced at no additional cost.

Work shall be in accordance with the latest edition of the National Electrical Code, Massachusetts Electrical Code, local codes and as required by the Engineer. All work shall be performed by an experienced licensed electrician licensed in the Commonwealth of Massachusetts, and qualified to perform work on utility poles in the Electrical Space.

The Contractor shall notify MassDOT and MassDOT Lighting a minimum of 7 days prior to the work commencing.

BASIS OF PAYMENT

Item 100.5 will be paid for at the Contract unit price per LUMP SUM, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 100.91 PRE AND POST CONSTRUCTION SURVEY AND SETTLEMENT/DISPLACEMENT MONITORING AT BRIDGE NO. W-44-083 LUMP SUM

ITEM 100.92 PRE AND POST CONSTRUCTION SURVEY AND SETTLEMENT/DISPLACEMENT MONITORING AT BRIDGE NO. W-44-093 LUMP SUM

The work under these Items consists of performing pre-construction and post-construction surveys of the existing substructure components that includes both existing abutments and pier for both bridges as well as retaining wall located at southwest corner of the bridge on Harrison Street, preparation of a photographic log, field survey, furnishing, installing, monitoring, reporting data from, and maintaining settlement/displacement monitoring points including all materials, equipment, labor and professional services required to install, protect, replace, monitor, and report.

Materials

The optical level or total station unit used for settlement/displacement monitoring shall provide an accuracy of 0.005 foot (1/16 inch) or better. Readings shall be repeatable within 0.005 feet (1/16 inch).

Settlement/displacement monitoring points shall be reflective prisms suitable for use with the total station unit or optical scales graduated in units of 0.005 feet (1/16 inch).

Construction Methods

Pre-Construction Survey

The Contractor shall retain and pay an experienced Professional Engineer registered in the Commonwealth of Massachusetts to perform a pre-construction survey of the existing substructure components for both bridges and retaining wall at southwest corner of Harrison Street bridge to document the existing condition of the structure prior to the start of any construction activities near the bridge. This survey, as a minimum, shall locate, measure, photograph and otherwise document any visible cracks, defects, distortion, settlement, and other signs of distress on the existing components to the greatest extent possible. The product shall be an original written report stamped and signed by the Professional Engineer performing the survey and four (4) copies, including photographs, CD's, plans, sketches and attachments, which shall be submitted to the Engineer a minimum of five (5) days prior to commencement of any construction activity. Two copies of the report shall be distributed to both the MassDOT Engineer and the City of Worcester Department of Public Works Director. The Contractor shall submit a structure and geotechnical monitoring plan listing all required equipment and showing its proposed location on the structure. The plan shall also describe the monitoring procedures to be followed.

ITEMS 100.91 and 100.92 (Continued)

As part of this submittal, a mitigation plan shall be provided to indicate the Contractor's course of action if any of the established criteria are exceeded. The Geotechnical Monitoring Consultant shall provide the Engineer with the baseline readings three days prior to starting demolition. Subsequent reports shall be provided to the Engineer prior to starting work the day following the day the readings were taken. In this case, payment shall also include all costs associated with the professional services provided by the Geotechnical Monitoring Consultant and the collection and processing of all data and reporting this data to the Engineer.

Settlement Surveying

The Contractor shall establish a minimum of six (6) deformation monitoring points along the existing substructure components including the retaining wall at Harrison Street bridge. Survey points shall be located at approximately equivalent intervals along the structure.

The survey points shall be attached using masonry anchors or other methods that provide a secure and stable attachment.

Settlement surveys shall be referenced to the project benchmark to be provided by the Department and maintained by the Contractor in accordance with Standard Specification Subsection 5.07.

The Contractor shall perform a minimum of three (3) initial surveys of the settlement points prior to start of any construction activities within 50 feet of the structure. During periods when any construction activities are occurring within 50 feet of the structure, settlement surveys shall be taken by the Contractor at least once per week as long as the total measured settlement is less than the threshold value. If the measured settlement exceeds the threshold value, the frequency of the settlement survey shall be a minimum of twice per week. Settlement surveys shall continue at a frequency of once per week for two weeks after all work near the existing structure is complete.

Survey measurements shall be submitted to the Engineer within 24 hours after the survey is taken. The survey report shall highlight any survey point and data that exceed the threshold value.

If any settlement point measurement exceeds the threshold value, the Contractor shall immediately evaluate the cause of the settlement. Based on the evaluation, the Contractor shall submit to the Engineer within five (5) days a proposed plan of action to modify the construction procedures so that the settlement will not exceed the limiting value during the completion of construction.

If any settlement point measurement exceeds the limiting value, the Contractor shall immediately stop work near the existing structure and further evaluate the cause of the settlement. Based on the evaluation, the Contractor shall submit to the Engineer within five (5) days a proposed plan of action to modify the construction procedures so that any additional settlement will be prevented or minimized during the completion of construction. Work in the area where the "limiting" values have been reached shall not be permitted until the results of surveys can be reviewed and evaluated by the Engineer.

ITEMS 100.91 and 100.92 (Continued)

The response values for vertical movement at all settlement/deformation points located on the structure are as follows:

Threshold Value:	0.25 inches (1/4 inch)
Limiting Value:	0.50 inches (1/2 inch)

The response values for horizontal movement at all settlement/deformation points located on the structure are as follows:

Threshold Value:	0.50 inches (1/2 inch)
Limiting Value:	0.75 inches (3/4 inch)

These criteria are intended to establish a minimum basis for the Contractor's design and procedures and does not relieve the Contractor of its responsibility for preventing detrimental movements and damage to adjacent structures, utilities or other work. In the event the Contractor does not comply with the approved mitigation plan or continues work in violation of "threshold" or "limiting" values being reached or exceeded, the Contractor shall not be allowed to continue work until proper mitigation procedures and corrections have been made as determined by the Engineer. No claims for schedule delays will be allowed due to the Contractor's failure to comply with these requirements.

The Contractor shall retain a Geotechnical Monitoring Consultant to install, monitor, maintain, and report on the monitoring points. This proposed subconsultant must be preapproved by the Engineer. The subconsultant shall have the demonstrated experience to perform the work and shall provide reference to at least three (3) similar past projects.

Post-Construction Survey

The Contractor shall retain and pay an experienced Professional Engineer registered in the Commonwealth of Massachusetts to perform a post-construction survey of the existing substructure to document the condition of the structure prior to the completion of construction activities. The purpose of the post-construction survey is to document any changes in the structures condition that may have occurred during the construction period. This survey, as a minimum, shall locate, measure, photograph and otherwise document any visible cracks, defects, distortion, settlement, and other signs of distress on existing structure, including the post-construction condition of items noted during the pre-construction survey to the greatest extent possible. The product shall be an original written report stamped and signed by the Engineer performing the survey and four (4) copies, including photographs, CD's, plans, sketches and attachments, which shall be submitted to the Engineer no later than two weeks after pavement and finishes are installed on the new roadway. Two copies of the report shall be distributed to both the MassDOT Engineer and the City of Worcester Department of Public Works Director.

ITEMS 100.91 and 100.92 (Continued)

BASIS OF PAYMENT

Item 100.91 and Item 100.92 will be paid for at the respective Contract unit prices per LUMP SUM, which prices shall include all labor, materials, equipment, disposal fees if necessary, and all incidental costs required to complete the work.

Partial payment shall be made upon the following percentages: 50% upon completion of the pre-construction survey, installation of the monitoring points and approval by the Engineer; 25% in equal monthly amounts based on the anticipated schedule of monitoring in accordance with the Contractor's approved schedule; and the remaining 25% will be paid upon satisfactory completion of the post-construction survey, removal of all monitoring points and Engineer's acceptance of final report.

ITEM 102.511 TREE PROTECTION – ARMORING AND PRUNING EACH

The work under this Item shall conform to the relevant provisions of Subsection 771 of the Standard Specifications and the following:

Tree protection – armoring and pruning shall be used for instances where construction activity (the use of heavy equipment), comes within proximity to potentially damage tree trunk(s) or limbs.

The work shall include the furnishing and installing of temporary tree trunk protection, minor limb pruning, or removal of lower tree limbs to prevent injury to the tree from construction equipment and activities; as shown on the Drawings; and/or as required by the Engineer.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the latest edition of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance: Part 1-Pruning and Part 5-Construction Management Standard. Provision of reference shall be incidental to this Item.

MATERIALS

Trunk armoring shall be such that it prevents damage to the trunk from construction equipment. Material used for trunk armoring or mounting shall be such that installation and removal shall not damage the trunk.

Acceptable trunk armoring materials shall include two by four (2x4) wood cladding, mounted with wire or metal strapping, or when duration of construction activities is less than three months, slotted corrugated plastic pipe, mounted with duct tape. Eight (8) once untreated burlap shall be used to wrap the tree trunk prior to installation of cladding.

Alternative armoring methods or materials may be acceptable if approved by the Engineer.

The height of tree trunk cladding shall be measured from the base of the tree (including root flare) to the bottom of the first branch, or to a height of eight (8) feet, or as may be required by the Engineer.

METHODS OF WORK

Prior to construction activities, the Engineer, Contractor, and the Arborist (if item is included in the contract), shall review trees noted on the Drawings to be protected. Final decision and selection of trees to be armored and/or pruned shall be per the Engineer.

ITEM 102.511 (Continued)

Care shall be taken to avoid damage to the bark during installation and removal of armoring. Trunk armoring shall be maintained such that it is effective for as long as required or replaced when materials are found to be damaged or ineffective, as determined by the Engineer. Replacement, if required, shall be incidental to the work. Armoring shall be removed immediately upon completion of work activities adjacent to the protected tree(s).

Pruning of limbs shall conform to the techniques and standards of the most recent ANSI A300 standards.

DAMAGES OR LOSS

If trees designated for protection under this item are damaged, including root damage from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist, described in Item 102.55. The Arborist shall be approved by MassDOT.

If, based on the recommendation of the Arborist, the Engineer determines that damages can be remedied by corrective measures, such as repairing trunk or limb injury; soil compaction remediation; pruning; soil injection fertilization; and/or watering; the damage shall be repaired as soon as possible, within the appropriate season for such work and according to industry standards.

If, based on the recommendation of the Arborist, the Engineer determines that damages are irreparable, or that the damages are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and topsoil filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate tree protection shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

ITEM 102.511 (Continued)

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.511 will be measured and paid at the Contract unit price per EACH tree to be armored and pruned. This will include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work and the subsequent removal and satisfactory disposal of the protective materials upon completion of the Contract or as required by the Engineer.

Payment for work under this Item will be scheduled as follows:

- 40% of the value shall be paid upon installation of trunk armoring and completion of pruning work, if required.

- 60% of the value shall be paid at the end of construction operations that would potentially damage the tree and after protection materials have been removed and properly disposed of by the Contractor. In the event of repairable damages, payment shall be made after the completion of remediation measures.

No separate payment will be made for costs of remedial actions, including Arborist services, tree removal, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the Contract price of the work.

ITEM 102.521 TREE AND PLANT PROTECTION FENCE FOOT

The work under this Item shall conform to the relevant provisions of Subsections 644 and 771 of the Standard Specifications and the following:

Work under this Item shall consist of furnishing, installing, and maintaining tree and plant protection fence(s) in a vertical and taut position; removing and resetting fencing as may be required; and final removal of protection fence(s) at the completion of construction activities, or as otherwise required by the Engineer.

The purpose of the fencing is to signify a construction work-free zone and physical barrier, thereby preventing damage to tree roots, tree trunks, soil, and all other vegetation within this delineated Tree and Plant Protection Zone (TPPZ), as shown on the Drawings, as required by the Engineer, and as described herein.

Protection shall be for the duration of the construction activities unless otherwise required by the Engineer.

MATERIALS

Tree and plant protection fence(s) shall provide a minimum forty-eight (48) inch tall barrier, that remains vertical and taut. The Fence shall be orange plastic safety fence (recommended where high visibility is necessary), or wooden snow fencing, or other approved material. Posts and anchoring materials shall be incidental to the work.

Per requirements of the Engineer, additional posts, deeper post depths, and/or additional attachments shall be used if the fabric or fence sags, leans or otherwise is not providing visible or physical protection to the TPPZ.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 1, Pruning and Part 5, Construction Management Standard. Provision of reference shall be incidental to this Item.

ESTABLISHMENT OF THE TPPZ

Fencing shall be used to delineate and establish the TPPZ, adjacent to construction areas, staging areas, stockpile areas, as shown on the Drawings, and/or as required by the Engineer.

Fencing shall be located as close to the work zone limit and as far from tree trunk(s) and plants as possible to maximize the area to be protected. Fence shall run parallel and adjacent to construction activity to create a barrier between the work zone and the root zone or designated limit of plants and soils to be protected.

ITEM 102.521 (Continued)

When construction activities surround (or have the potential to surround) trees or plants to be protected, a circular enclosure shall be used. In these instances, the TPPZ limit shall be the drip line of each tree or as close as possible to the drip line, and/or as shown on the Drawings. The drip line is defined as the outermost limit of tree canopy.

The Contractor shall not engage in any construction activity within the TPPZ without the approval of the Engineer. Activities may including operating, moving, or storing equipment, supplies, or materials; and locating temporary facilities, including trailers or portable toilets, Accessing or traversing the TPPZ shall not be permitted.

METHOD OF WORK

TPPZ fencing shall be installed prior to any construction work or staging activities. Fence(s) shall be repositioned where and as necessary for optimum tree and plant protection. Repositioning shall be incidental to this item. TPPZ fencing shall not be moved without prior approval by the Engineer.

The TPPZ shall be protected at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves, and roots of all plants; and contamination of the soil with construction materials, debris, silt, fuels, oils, and any chemicals substance.

After construction activities are completed, or when required by the Engineer, fencing, stakes, and other anchoring materials, if any, shall be removed and disposed off-site by the Contractor.

REQUIRED WORK WITHIN THE TPPZ

In the event that grading, trenching, utility work, or storage is unavoidable within the TPPZ, the Engineer shall be notified. Measures may be required for tree protection and preservations, including air spading; the use of six (6) inch depth of wood chips or approved matting for root protection; pruning of branches; and/or trunk protection. These protection measures shall be paid under applicable contract items.

Landscaping work specified within the TPPZ shall be accomplished by hand tools. Where handwork is not feasible, with permission of the Engineer, work shall be conducted with the smallest mechanized equipment necessary.

TREE AND PLANT INJURY OR LOSS

If the TPPZ is encroached by construction activity without approval, at the discretion of the Engineer, the Contractor may be required to provide a more durable barrier (e.g., Jersey Barriers, chain link fence (if not already in use) to secure the area. Costs of furnishing and installing additional or more durable barrier(s) shall be borne by the Contractor.

In such cases of encroachment, soils shall be considered compacted and tree root injury will be assumed. Action shall be taken as specified below.

ITEM 102.521 (Continued)

In the event that trees designated for protection under this Item are injured, including root injury from unapproved trespassing onto the root zone, the Contractor shall, at his own expense, secure the services of an Arborist, described under Item 102.55. The Arborist shall be approved by MassDOT.

In the event of spills, compaction or injury, the Contractor shall take corrective action immediately using methods approved by the Engineer, in coordination with the Arborist.

If, based on the recommendations of the Arborist, the Engineer determines that injuries can be remedied by corrective measures, such as repairing trunk or limb injury, soil compaction remediation, pruning, and/or watering; the injury shall be repaired as soon as possible, within the appropriate season for such work, and according to industry standards.

If, based on the recommendations of the Arborist, the Engineer determines that injuries are irreparable, or that the injuries are such that the tree is sufficiently compromised to pose a future safety hazard, the tree shall be removed. Tree removal shall include cleanup of all wood, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil. Such tree removal(s), grinding, debris removal, and filling, shall be at the Contractor's expense.

Tree removal from improper or inadequate protection of the TPPZ shall result in the Engineer assessing the Contractor monetary damages consistent with industry standards for assessed value and/or replacement.

Shrubs removals from improper or inadequate protection of the TPPZ shall be replaced with plants of similar species and equal size or the largest size plants reasonably available. The Engineer shall approve the size, quality, and quantity of the replacement plant(s). Each replacement shall include a minimum of one year of watering and establishment care, specified under Subsection 771.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Tree and Plant Protection Fence will be measured by the FOOT, complete in place, by the length along the top of the fence.

Tree and plant protection fence will be paid for under the contract unit price per FOOT, complete in place and shall include all materials, labor, and equipment required to furnish, install, anchor, maintain, and remove the fence upon completion, as described herein. Posts, temporary footings, anchoring and removal upon completion, shall be incidental to this item.

No separate payment will be made for costs of remedial actions, including addition of more durable barriers, Arborist services, tree or plant removal, shrub replacement and establishment, but all costs in connection therewith shall be included in the Contract unit price bid.

Tree damages assessed, due to lack of or improper tree and plant protective measures being taken, shall be deducted from the contract price of the work.

ITEM 102.521 (Continued)

Payment for work under this Item will be scheduled as follows:

- Forty (40) percent of the value payment will be made upon installation of fencing.

- Sixty (60) percent of the value payment will be made when fencing materials have been maintained to function as specified, for the intended duration, and removed and disposed off-site at the completion of protection measure requirement.

ITEM 114.1	**DEMOLITION OF SUPERSTRUCTURE OF BRIDGE NO. W-44-083**	**LUMP SUM**
ITEM 114.2	**DEMOLITION OF SUPERSTRUCTURE OF BRIDGE NO. W-44-093**	**LUMP SUM**

The work under these Items shall conform to the relevant provisions of Subsections 112 and 960 of the Standard Specifications and the following:

The work under these Items includes furnishing all material, labor, equipment, and tools necessary to perform the removal and satisfactory disposal of the entire superstructure of the existing bridges as shown on the Plans or as required by the Engineer. Except as specified, all materials and debris shall become property of the Contractor, and shall be recycled, reused or disposed of in accordance with applicable local, state and federal requirements.

The partial demolition of the substructure of the existing bridge is specified and paid for separately under Item No. 127.1 Reinforced Concrete Excavation.

The Contractor shall be responsible for providing a temporary protective shielding system to prevent any debris from falling onto I-290 as a result of their operation.

The Department makes no assurances regarding the presented conditions, dimensions, and materials of the existing structure as shown on the Contract Drawings. The Contractor shall verify all the existing conditions and construction features of the bridges to be demolished, as necessary, for the proper planning and completion of the work. The Contractor shall base his/her bid on his/her own findings without any additional compensation for variances from the Plans or these Special Provisions regarding actual conditions for the items to be removed.

Refer to the utility plans and coordinate with the utility companies for the relocation of utilities during the stage construction.

The following is a description of elements to be demolished:

Superstructure

Elements of the superstructure to be removed and disposed of under these Items include but are not limited to:

1. Metal bridge railing and chain link fence
2. Concrete deck slab, sidewalks and granite curbs
3. Steel beams and diaphragm members
4. Steel bearing assemblies
5. All existing utilities on Bridge Nos. W-44-083 and W-44-093.
6. Partial demolition of north sidewalk on Bridge No. W-44-093
7. Miscellaneous debris encountered with the demolition.

ITEMS 114.1 and 114.2 (Continued)

Demolition work for the existing bridge superstructure shall conform to the construction staging sequence outlined in the Construction Drawings. The Contractor shall schedule demolition operations subject to the compliance with the general construction phasing scheme and subject to approval of the Engineer. Means and methods of performing the demolition work are the responsibility of the Contractor.

The Contractor shall prepare and submit a plan indicating his/her proposed demolition procedures and methods to be used, including equipment, tools, devices, crane capacity and location(s), radii of movements, schedule of operations, etc. to the Engineer for approval for all stages of construction. The requirements for equipment and all procedures utilized shall be in conformance with the intent of Subsection 960.61, Erection, of the Standard Specifications for Highway and Bridges and the Supplemental Specifications. The demolition procedure and any necessary calculations of all loads, including all factors of safety, and selection of crane and lifting hardware, and drawings shall be stamped by a Professional Engineer registered in the Commonwealth of Massachusetts, certifying that all existing structural members are suitably braced and supported throughout the demolition process. Work under these Items may not commence until the Engineer has given written approval of the method of demolition. The Contractor is also required to submit the required temporary traffic control/detours to MassDOT for approval for work involving lifts over I-290.

The Contractor shall not damage existing reinforcing on the pier column and it is Contractor's responsibility to provide repair procedure in case of any damage to the existing reinforcing at the pier location.

All materials removed in this demolition shall become the property of the Contractor and shall be recycled, reused, or disposed of in accordance with all applicable Local, State, and Federal requirements. Any damage to any bridge components that are designated to remain or newly constructed bridge section during staged construction that are damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer and at no additional expense. The Contractor shall be responsible for protecting from any damage the existing utilities that pass over, under and/or are attached to the bridge. During the prosecution of the work under Items. 114.1 and 114.2, the Engineer may reject the use of any method or equipment which causes undue vibration or possible damage to the remaining structure or any part thereof. The noise and dust created by demolition operations must be reduced to the maximum extent possible.

ITEMS 114.1 and 114.2 (Continued)

BASIS OF PAYMENT

Items 114.1 and 114.2 will be paid for at the respective Contract unit price per LUMP SUM, which prices shall include all labor, tools, equipment, materials, testing, loading, transportation, disposal, approvals, and permits necessary for the completion of the work including all costs associated with hazardous material and compliance with the Endangered Species Act requirements, and all incidental costs required to complete the work.

The Contractor will make his/her own investigation of the structure to be demolished including the materials that are a part of, or may be stored in the structure. No increase will be made to the bid price due to the nature of the materials involved in the demolition. All costs for permits, dump fees, taxes, special handling of hazardous materials, etcetera, shall be included in the bid price of the demolition item.

The Contractor shall submit in duplicate for approval, by the Engineer, a cost schedule for the "Demolition of Superstructure of Bridge No. W-44-083" and a cost schedule for the "Demolition of Superstructure of Bridge No. W-44-093". The approval of the cost schedule by the Engineer shall not be considered as a guarantee to the Contractor of the quantities assumed in developing any part of the submittal cost schedule. The schedule is only for the purpose of estimating partial payments, and it shall not affect the Contract terms in any way.

The Engineer shall make partial payments in proportion as the demolition work progresses with the final 10 percent (10%) paid upon the satisfactory removal of demolition material from the site, and site restored to its original condition.

The cost of providing, installing and removing the temporary protective shielding will be paid for under Item No. 994.01 Temporary Protective Shielding for Bridge No. W-44-083 and Item No. 994.02 Temporary Protective Shielding for Bridge No. W-44-093.

ITEM 127.1 REINFORCED CONCRETE EXCAVATION CUBIC YARD

The work under this Item shall conform to the relevant provisions of Subsections 112, 120, and 140 of the Standard Specifications and the following:

The work under this Item shall include furnishing all labor, materials and equipment necessary to demolish and remove elements of the substructure of the existing bridges as indicated on the Contract Drawings and as required by the Engineer. In addition, the Contractor is required to remove all dust, loose concrete and debris encountered as part of the excavation and prior to installation of the new reinforcement and placement of the new concrete. Except as specified, all materials and debris shall become the property of the Contractor, and shall be recycled, reused or disposed of in accordance with applicable local, state and federal requirements. The edges of the final surfaces where concrete is to be removed under this Item be saw cut, and all costs in connection with such work shall be considered as incidental to this Item.

The following is a description of elements to be demolished:

Elements of the substructure for Bridge Nos. W-44-083 and W-44-093 to be removed and disposed of under this Item include but are not limited to:

a. Abutment backwalls in their entirety
b. Top of the abutment stems as indicated on plans
c. Top of wingwalls stems as indicated on plans
d. Pier caps in their entirety
e. Top of the pier columns as indicated on plans
f. Approach slabs in their entirety
g. End posts in their entirety

A suggested sequence of construction is shown on the construction drawings. The Contractor shall schedule concrete excavation operations subject to compliance with the general construction phasing scheme and subject to the approval of the Engineer. The Engineer may reject the use of any method or equipment that may cause damage to the existing substructure which is to remain. Means and methods of performing the concrete excavation work are the responsibility of the Contactor. Upon completion of the excavation the Contractor shall inspect the final surface for any cracks or other damage.

No material shall be disposed of onsite, and the Contractor shall take all necessary precautions to prevent debris from falling onto the I-290.

Four (4) weeks prior to the start of demolition, the Contractor shall submit to the Engineer, for review and approval, a detailed method of demolition and dust control, including all equipment to be used at each location, and the method of preventing falling debris. Any material that falls into such areas shall be removed immediately, and at the Contractor's expense. Legal documentation indicating an approved disposal location for all waste material resulting from the demolition shall be submitted.

ITEM 127.1 (Continued)

The Contractor's operations shall not result in any damage to adjacent structures or foundations. Any damage to adjacent structures that are to remain that are damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer and at no additional expense.

METHOD OF MEASUREMENT

Item 127.1 will be measured for payment by the CUBIC YARD of reinforced concrete excavated.

BASIS OF PAYMENT

Item 127.1 will be paid for at the Contract unit price per CUBIC YARD, which price shall include all labor, equipment, materials, tools, temporary support systems, sawcutting, scaffolding, transportation, disposal fees, dust control, and all incidental costs required to complete the work.

ITEM 127.12 REINFORCED CONCRETE SUBSTRUCTURE EXCAVATION CUBIC YARD

The work under this Item shall conform to the relevant Provisions of Subsection 120 of the Standard Specifications and the following:

The work under this Item consists of the removal and disposal of all deteriorated, spalled, and scaled concrete as required to repair the existing concrete substructure elements to the general lines identified on the drawings and as required by the Engineer. All the deterioration mappings shown on the plans for existing abutments, wingwalls, and pier columns were observed during field visits in April, 2021 and more deterioration shall be expected. The Contractor shall immediately report to the Engineer any deterioration that significantly exceeds the limits shown on the Contract plans and shall not continue work without direction from the Engineer.

During the prosecution of the Work, the Engineer may reject the use of any method or equipment which causes undue vibration or possible damage to the structure or any part thereof. Pneumatic hammers heavier than the nominal 25 pounds mass shall not be used unless approved by the Engineer. The Contractor shall submit a repair schedule for approval prior to commencing any work.

Minimum depth of excavation to sound concrete shall be one inch (1") beyond the inner most layer of reinforcing steel, but not less than four inches (4") from the original surface. The Contractor shall stop excavating deteriorated concrete when the depth of excavation reaches six inches (6") and shall notify the Engineer immediately. The edges of the patch shall be cut to neat lines by saw cutting or by methods approved by the Engineer, and the patch areas shall be made rectangular in shape, if possible, with horizontal and vertical edges and avoid overcutting square corners.

The Contractor shall limit extent of excavation of the pier caps and columns as shown on the Contract drawings. If the Contractor exceeds the limits of excavation as shown on the Contract drawings, then temporary shoring shall be installed to alleviate loading on the substructure, at no additional cost to the Department. The Contractor may submit an alternate method of reinforced concrete excavation to be approved by the Engineer. The alternate method, if approved by the Engineer, shall not incur any additional costs to the Department, and Item 127.12 Reinforced Concrete Substructure Excavation will be paid at the Contract unit price regardless of the method used to complete the work.

The Contractor shall take all precautions necessary so as not to damage those portions of the bridge including reinforcing steel that are to remain. This includes determining the concrete cover to the steel bars at the edge of each patch prior to excavating concrete. Any steel that is unsuitable for further use through no fault of the Contractor shall be replaced under Item 910. Steel Reinforcement for Structures. All reinforcing steel that is loose shall be tied tightly together using epoxy coated wire ties.

Also, included under this Item are all costs in connection with the cleaning, cutting, and bending of the existing reinforcing steel designated to be retained in the proposed repair. Immediately before preparation for placement of new concrete, the exposed reinforcing steel and concrete area to be patched shall be free of all oil, grease, rust or other foreign materials. These materials shall be removed by abrasive blasting or other methods approved by the Engineer.

ITEM 127.12 (Continued)

PREPARATION FOR PLACEMENT OF NEW CONCRETE

Before placing new concrete, the existing surface must be cleaned with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface and all porous surfaces to be in contact with new concrete for 24 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene, etc., where moisture can be maintained. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water. Preparation of concrete surfaces is to be paid by Item 905.

The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry (SSD) condition until placement of the new concrete.

The Contractor shall take all measures necessary to protect pedestrian and vehicular traffic from the construction operations. No debris, tools, or incidental equipment of any kind will be permitted to fall where vehicular or pedestrian traffic exists. Any material that accidentally falls into such areas shall be removed immediately.

DISPOSAL OF EXCAVATED MATERIALS AND SITE CLEANING

Surplus materials obtained from reinforced concrete excavation and not needed for further use, as determined by the Engineer, shall become the property of the Contractor and shall be properly disposed of by the Contractor outside the location at no additional compensation.

The Contractor is required to broom clean all work site areas after the removal of excavated debris regardless of preexisting conditions. Removal of debris, site cleaning, and disposal of debris are incidental to the Contract and no additional payment will be made.

METHOD OF MEASUREMENT

Item 127.12 will be measured for payment by the CUBIC YARD of substructure concrete excavated, removed, and properly disposed of.

BASIS OF PAYMENT

Item 127.12 will be paid for at the Contract unit price per CUBIC YARD, which price shall include all labor, tools, equipment, sawcutting, and all incidental costs required to complete the work including final disposal of the excavated material.

New reinforcing steel will be paid for under Item 910.

Temporary protective shielding will be paid for under the respective Contract items.

ITEM 127.4 REINFORCED CONCRETE DECK EXCAVATION (FULL DEPTH) SQUARE YARD

ITEM 127.41 REINFORCED CONCRETE DECK EXCAVATION (PARTIAL DEPTH) CUBIC YARD

The Work under these Items shall conform to the relevant provisions of Subsections 120 and 482 of the Standard Specifications and the following:

The work under these Items shall consist of full and partial depth removal and disposal of all disintegrated or otherwise unsatisfactory reinforced concrete from the bridge deck as required by the Engineer during construction to perform emergency repairs.

Note: Some of the bridges, due to their height (vertical clearance), will require special lifting equipment to place shielding for the assigned bridge repair work. Any equipment necessary to erect forms shall be incidental to the relevant Items: 127.4 and 127.41.

Prior to excavation, the Contractor shall cover all drainage structures that may be affected by the work. The structures shall remain covered until the new concrete has set and the area has been cleaned.

The Contractor shall take all precautions necessary not to damage that portion of the deck, including reinforcing steel, which is to remain. This includes determining the concrete cover to the steel bars at the edge of each patch prior to excavating concrete.

The edges of all areas where concrete is removed under Items 127.4 and 127.41 shall be cut to neat lines by saw cutting or by methods approved by the Engineer, to a depth of 1 inch, and all costs in connection with such work shall be incidental to the pertinent item. Excavated areas shall be made rectangular in shape [as much as possible], with horizontal and vertical edges and square corners.

In case the reinforcing bars are exposed, the minimum depth of all cement concrete areas to be excavated shall be one (1) inch below the bottom of the top layer of longitudinal reinforcing steel throughout the entire excavated area.

Concrete removal equipment shall be of the following types:

Pneumatic and Power-Driven Chipping Hammers: In no event shall any pneumatic or power hammer weighing in excess of twenty-five (25) pounds be used for the removal of concrete. The Contractor will be restricted to fifteen (15) pound chipping hammers when work involves repairs when removing concrete from below any reinforcing bar.

Abrasive Blasting Equipment: Abrasive blasting equipment shall be capable of removing rust and old concrete from exposed reinforcing steel when deemed necessary by the Engineer.

During the prosecution of this work, the Engineer may reject the use of any method or equipment which causes undue vibration or possible damage to the structure or any part thereof.

ITEMS 127.4 and 127.41 (Continued)

Bobcats/Skid Steers will be allowed only to collect debris from the deck surface and will not be allowed to remove concrete from the patch area. All concrete debris shall be removed by hand or by using hand tools. The smaller pieces may be blown out using an oil free compressed air after first being wetted with water to control airborne particulates.

Also, included under these Items are all costs in connection with the cleaning, cutting, and bending of the existing reinforcing steel designated to be retained in the proposed construction. Any existing reinforcing steel damaged or otherwise made unsatisfactory for continued use as a result of the Contractor's operations shall be replaced at the Contractor's expense. All reinforcing steel with active rusting encountered in the excavation shall be thoroughly cleaned by abrasive blasting and coated with a zinc-rich primer conforming to MassDOT Spec. No. M7.04.11 or as required by the Engineer. Any reinforcing steel that is unsuitable for further use through no fault of the Contractor shall be replaced under Item 910. All reinforcing steel that is loose shall be tied tightly together using wire ties. Ties are required at every other intersection of transverse and longitudinal reinforcing.

Temporary Protective Shielding must be used on bridges over the roadway during full depth excavation and when, in the opinion of the Engineer, there is the possibility of dislodging concrete from the bottom of the deck.

The Contractor shall take all measures necessary to protect vehicular traffic from the construction operations. No debris, tools or incidental equipment of any kind will be permitted to fall into areas where vehicular traffic exists. Any material that accidentally falls into such areas shall be removed immediately.

ITEMS 127.4 and 127.41 (Continued)

METHOD OF MEASUREMENT

Item 127.4 will be measured for payment by the SQUARE YARD of reinforced concrete deck excavation (Full Depth).

Item 127.41 will be measured for payment by the CUBIC YARD of reinforced concrete deck excavation (Partial Depth).

BASIS OF PAYMENT

Items 127.40 will be paid for at the Contract unit price per SQUARE YARD, which price shall include all labor, materials, equipment, sawcutting, removal of any bituminous concrete, waterproof membrane, cleaning, cutting, and bending of the existing reinforcing steel designated to be retained, and all incidental costs required to complete the work.

Item 127.41 will be paid for at the Contract unit price per CUBIC YARD, which price shall include all labor, materials, equipment, sawcutting, removal of any bituminous concrete, waterproof

membrane, cleaning, cutting, and bending of the existing reinforcing steel designated to be retained, and all incidental costs required to complete the work.

Items 127.4 and 127.41 will compensate the Contractor for excavation performed on the bridge deck (full depth and partial).

The Contractor will be paid under either Item 127.4 or 127.41 for excavated concrete. In no case the Contractor shall be paid under more than one Item for the same excavated material.

New reinforcing steel will be paid under Item 910.

Temporary protective shielding will be paid under Items 994.01 and 994.02.

ITEM 180.01 ENVIRONMENTAL HEALTH AND SAFETY PROGRAM LUMP SUM

The work shall consist of ensuring the health and safety of the Contractor's employees and subcontracting personnel, the Engineer, their representatives, the environment, and public welfare from any on-site chemical contamination present in air, soil, water and sediment.

The Contractor shall prepare and implement a site-specific Environmental Health and Safety Plan (EHASP) which has been approved and stamped by a Certified Industrial Hygienist (CIH) and includes the preparer's name and work experience. The EHASP shall include appropriate components required by OSHA Standard 29 CFR 1910.120(b) and the Massachusetts Contingency plan (MCP) 310 CMR 40.0018 and must comply with all applicable state and federal laws, regulations, standards and guidelines, and provide a degree of protection and training appropriate for implementation on the project. The EHASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. The EHASP shall be developed and implemented independently from the standard construction HASP required to work on all MassDOT construction projects.

Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions, including but not limited to standards established by OSHA and National Institute for Occupational Safety and Health (NIOSH). Equipment used for the purpose of health and safety shall be approved by and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the most up-to-date version of the EHASP shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the MassDOT, Contractor, and Subcontractors involved with on-site activities. The employee's signature on the EHASP shall be deemed prima facie evidence that the employee has read and understands the plan. Updated copies of signature sheets shall be submitted to the Engineer.

The EHASP shall specify a Contractor Site Safety and Health Officer responsible for implementation of the EHASP and to oversee all construction activities, including handling, storage, sampling and transport, which require contact with or exposure to potentially hazardous materials.

The level of protection, required to ensure the health and safety of on-site personnel will be stipulated in the EHASP. The Site Safety and Health Officer shall implement the EHASP based on changing site and weather conditions, type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, air monitoring data, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and type of equipment to be utilized.

ITEM 180.01 (Continued)

During implementation of the EHASP, a daily log shall be kept by the Site Safety and Health Officer and a copy shall be provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personal protection being employed, screening data and any other information relevant to on-site environmental safety conditions. The Site Safety and Health Officer shall sign and date the daily log.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Preparation and implementation of the Environmental Health and Safety Program, including the monitoring, protection and storage of all contaminated materials, as well as subsequent modifications to the EHASP, will be measured and paid for at the Lump Sum Bid Price.

Payment of 50% of the Environmental Health and Safety Program contract price will be made upon the initial acceptance of the EHASP by the Engineer. Payment of the remaining 50% of the Environmental Health and Safety Program contract price will be made upon completion of the work. The bid price shall include preparation and implementation of the EHASP as well as the cost for its enforcement by the Site Safety and Health Officer along with any necessary revisions and updates. The work of implementing the Environmental Health and Safety Program includes work involving, but not limited to, the monitoring, protection, and storage of all contaminated materials.

ITEM 180.02 PERSONAL PROTECTION LEVEL C UPGRADE HOUR

The work shall consist of providing appropriate personal protective equipment (PPE) for all personnel in an area either containing or suspected of containing a hazardous environment.

Contingencies for upgrading the level of protection for on-site workers will be identified in the EHASP and the Contractor shall have the capability to implement the personal protection upgrade in a timely manner. The protective equipment and its use shall be in compliance with the EHASP and all appropriate regulations and/or standards for employee working conditions.

Personal Protection Level C Upgrade will be measured and paid only upon upgrade to Level C and will be at the contract unit price, per hour, per worker, required in Level C personal protection. No payment will be made to the Contractor to provide Level D PPE.

ITEM 180.03 LICENSED SITE PROFESSIONAL SERVICES HOUR

Within limited areas of the project site, media (i.e. soils, sediments, surface water and/or groundwater) requiring evaluation and/or management under the Massachusetts Contingency Plan (MCP) may be encountered. A Licensed Site Professional (LSP) shall be required to provide the services necessary to comply with the requirements of the MCP. These services may include a site walk, field screening, sampling, analysis and characterization of potentially contaminated media, preparation and implementation of Immediate Response Action (IRA) Plans, Utility-Related Abatement Measure (URAM) and Release Abatement Measure (RAM) Plans, Imminent Hazard Evaluations, status reports, transmittal forms, release notification forms, risk assessments, completion statements, and related documents required pursuant to the MCP. LSP services shall also be necessary to temporarily move material generated on the project to an off-site storage location.

The name and qualifications of the LSP and all environmental technicians to be assigned to the project shall be submitted to the Engineer for approval at least four weeks prior to initial site activities. The LSP shall have a current, valid license issued by the Massachusetts Board of Registration of Hazardous Waste Site Cleanup Professionals. The LSP shall have significant experience in the oversight of MCP activities at active construction sites. Qualification packages for the LSP and each technician shall include a resume, all recent work assignments with responsibilities identified (previous 5 years), and applicable training and certifications. A list of all Notices of Noncompliance, Notice of Audit Findings and Enforcement Orders issued by the Massachusetts Department of Environmental Protection (DEP) shall be submitted for all work assignments listed for the LSP and environmental technicians. Upon approval of the LSP Qualifications, the LSP will be designated as the LSP of Record unless MassDOT designates in writing otherwise. The LSP of Record will serve as the primary point of contact for all hazardous material matters on the project.

The LSP shall evaluate soil and/or sediment with discoloration, odor, elevated field screening results, presence of petroleum liquid or sheen on the groundwater surface, or any abnormal gas or materials in the ground which are known or suspected to be oil or hazardous materials. Excavated soil and sediment which is suspected of petroleum contamination shall be field screened using the jar headspace procedures according to established DEP Guidance. All field screening equipment must be pre-approved by the Engineer. The LSP shall ensure proper on-site calibration of all field screening instrumentation.

The Engineer shall be contacted immediately when observations or any field screening results verify contamination requiring further analysis, and/or enhanced management of suspect media. Any enhanced management of contaminated soil to ensure proper stockpiling and storage is incidental to the LSP Services item. The LSP shall evaluate the need for confirmatory sampling prior to backfill in areas where contaminated material has been excavated and disposed off-site for compliance with applicable regulatory requirements. The Engineer shall approve the locations of the testing sites prior to the sampling.

ITEM 180.03 (Continued)

Contaminated media shall be handled in accordance with all applicable state and federal statutes, regulations, and policies. The LSP shall adequately evaluate contaminated media for compliance with the requirements of the MCP and Department Policies.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and both shall be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations. The LSP shall maintain written records in a clear and concise tabular format which tracks the excavation, stockpiling, analysis and reuse/disposal of all known/suspect contaminated media. These records shall be up-to-date and submitted to the Engineer on a bi-weekly basis. The LSP shall review and summarize the laboratory data from any analyses performed on contaminated media in a tabular format and compare the results to applicable reporting thresholds. A report shall be delivered to the Engineer outlining the material sampling methods, laboratory analysis results, evaluation of applicable regulatory exemptions, reporting obligations, and proposed course of action. The laboratory report together with Chain of Custody forms for all analytical results shall be submitted to the Engineer within 14 days after completion of such analyses.

The LSP and Contractor shall be held responsible for the submission of all MCP-related documents to the Engineer at least 14 days in advance of any timeframe specified in the MCP and for the timely submission of data and tracking information as noted within this Item. All documents prepared under this Item must be reviewed and signed by the approved LSP. The Contractor and LSP shall be responsible for all fines, penalties and enforcement requirements imposed by applicable regulatory agencies for failure to meet regulatory and contract timeframes. No compensation will be provided for such fines, penalties, and enforcement actions.

The Contractor and the LSP shall be aware of the reporting requirements for releases of oil and/or other hazardous material (OHM) as set forth in federal and state laws and regulations and shall both be held responsible for performing the work in accordance with all applicable Federal and State laws and regulations.

If the Contractor causes a release of OHM, the Contractor shall be responsible for assessing and remediating the release in accordance with all pertinent State and Federal regulations, including securing the services of a LSP, at his own expense.

The LSP shall coordinate all activities involving both MassDOT and the DEP through the Engineer. Any notification of release shall be approved by the Engineer before submittal to the DEP, except if an imminent hazard condition exists as defined in 309 CMR 4.03(4)(b).

ITEM 180.03 (Continued)

LABORATORY TESTING IN SUPPORT OF LSP SERVICES

Laboratory testing provides for analytical testing in support of LSP services related to maintaining MCP compliance, such as delineating the extent and type of contamination present. Sampling and testing for disposal purposes are not included and are incidental to Items 181.11-181.14.

In order to maintain compliance with the MCP and Department Policies or other regulatory requirements, the LSP shall request approval from the Engineer to obtain samples from various locations and depths within the project area and to perform laboratory analyses on those samples. No sampling shall be conducted without prior approval from the Engineer. The samples shall be delivered to a DEP-certified laboratory using proper chain-of-custody documentation for analyses which, depending upon site conditions and suspected and/or identified contaminants of concern, may include, but are not limited to, metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbons (EPHs) and volatile petroleum hydrocarbons (VPHs). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (EPA Method 1311) for metals.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

LSP Services for work under this item will be measured per person, per hour of service provided by LSP, Environmental Technicians and other approved personnel. Travel time shall not be included in the billable hours.

The quantity and type of laboratory tests must be approved by the Engineer beforehand. The Contractor will be reimbursed upon satisfactory written evidence of payment. The Contractor may be required to obtain cost estimates from three DEP certified laboratories for the Engineer to choose the service provider.

LSP Services will be paid at the Contractor bid price for each hour, or fraction thereof, spent to perform the work as described above. The bid price shall be a blended rate that includes the cost of the LSP, environmental technicians and other personnel, the performance of all work tasks and field screening, including required equipment, materials and instrumentation, and production of all documentation described above. All requests for payment must be accompanied by the following information: the names of the personnel associated with the work charged under LSP Services, dates and hours worked, work conducted, including, where appropriate, locations as identified on the construction plans, and a copy of the field diary for the dates submitted.

Laboratory testing will be reimbursed upon receipt of paid invoices for testing approved by the Engineer.

This item is for LSP work for compliance with the MCP and Department Policies. LSP hours and any laboratory testing related to off-site disposal of excess soil and sediment is incidental to Items 181.11-181.14 (including, but not limited to, disposal characterization, disposal package preparation, landfill acceptance, shipment paperwork preparation, field screening, and tracking).

ITEM 181.11 DISPOSAL OF UNREGULATED SOIL TON
ITEM 181.12 DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY TON
ITEM 181.13 DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY TON
ITEM 181.14 DISPOSAL OF HAZARDOUS WASTE TON

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as "disposal" for the purposes of this specification. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying disposal facility (ies) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

CLASSES OF CONTAMINATED SOILS

The Contractor and its LSP shall determine if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the MCP. Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

ITEMS 181.11 through 181.14 (Continued)

UNREGULATED SOIL consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas. Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to MassDOT the proposed disposal location for unregulated soils for approval. If such a disposal location is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the MassDOT construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal location that they have been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

ITEMS 181.11 through 181.14 (Continued)

REGULATED SOIL consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form. This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

HAZARDOUS WASTE consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.

MONITORING/SAMPLING/TESTING REQUIREMENTS

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Item 180.03 – LSP Services. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

ITEMS 181.11 through 181.14 (Continued)

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

WASTE TRACKING:

Copies of the fully executed Weight Slips/Bills of Lading/ Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with MassDOT to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

DECONTAMINATION OF EQUIPMENT

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item.

ITEMS 181.11 through 181.14 (Continued)

REGULATORY REQUIREMENTS

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts DEP, the U.S. Environmental Protection Agency (EPA), Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions shall apply. The Contractor shall reimburse MassDOT for all costs it incurs, including penalties and/or for fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

SUBMITTALS

I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option.

The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to MassDOT.

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis program. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a baseplan to record this information.

The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and, all analytical results.

ITEMS 181.11 through 181.14 (Continued)

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

II. Stockpiling, Transport, and Disposal.

At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to MassDOT.

Excavation and Stockpiling Protocol:
Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material.

Disposal and Recycling Facilities:

1. Provide the name, address, applicable licenses and approved waste profile for disposal and/or recycling location(s) where contaminated soil will be disposed. Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.

2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. MassDOT reserves the right to reject any facility on the basis of poor compliance history.

Transportation:
The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

III. Material Tracking and Analytical Documentation for Reuse/Disposal.

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to MassDOT.

ITEMS 181.11 through 181.14 (Continued)

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

Demolition Debris:
Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station-offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on-site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation range, quantity, and finish grade for said location. For demolition debris which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.

Soil/Sediment:
Soil excavation will be identified based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material off-site using the same categories identified for demolition debris above.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used. The work of the LSP for disposal under all of these items shall be incidental to the work with no additional compensation.

ITEM 181.11 Measurement for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in tons, of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 181.12 Measurement for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEMS 181.11 through 181.14 (Continued)

ITEM 181.13 Measurement for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight in tons of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 181.14 Measurement for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight in tons of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

ITEM 182.1 INSPECTION AND TESTING FOR ASBESTOS LUMP SUM

The work shall include the inspecting and testing of all materials suspected of containing asbestos. When any demolition is required to enable the inspection and testing of the suspected material it will be considered incidental to this Item and the Contractor must perform all asbestos handling and testing in accordance with the regulations stated below.

Dust suppression in the form of light water sprays, foams, dust suppressants and calcium chloride will be implemented as required to control dusting during any disturbance of asbestos suspected material. Alternatively, intrusive activities may be reduced or curtailed under high wind or heavy rain conditions, which in the opinion of the Health and Safety Plan (HASP) may pose a safety hazard to the workers.

The Contractor shall employ the services of a Massachusetts licensed "Asbestos Inspector" to inspect the material to determine whether or not "ITEM 182.2 REMOVAL OF ASBESTOS" is required. Should the asbestos inspector determine laboratory testing is required, a state certified laboratory shall be used to perform all necessary tests.

REGULATIONS

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) including but not limited to:

29 CFR 1910 Section 1001 and 29 CFR 1926 Section 58 Occupational exposure to Asbestos, Tremolite, Anthophyllite and Actinolite, Final Rule
29 CFR 1910 Section 134 Respiration Protection
29 CFR 1926 Construction Industry
29 CFR 1910 Section 2 Access to Employee Exposure and Medical Records
29 CFR 1910 Section 1200 Hazard Communication
29 CFR 1910 Section 145 Specifications for Accident Prevention Signs and Tags

U.S. Environmental Protection Agency, (EPA) including but not limited to:

40 CFR 762, CPTS 62044, FRL 2843-9, Federal Register Vol. 50 no.134, July 12, 1985 p.28530 - 28540 Asbestos Abatement Projects Rule
40 CFR 61 Subpart A Regulation for Asbestos
40 CFR 61 Subpart M (Revised Subpart B) National Emission Standard for Asbestos

ITEM 182.1 (Continued)

U.S. Department of Transportation 49 CFR 172 and 173

Massachusetts Department of Labor Standards Regulations, (DLS) including but not limited to:

454 CMR 28.00 Removal, Containment and Encapsulation of Asbestos

Massachusetts Department of Environmental Protection (DEP) including but not limited to (supplementing subsection 7.01):

310 CMR 7.00, Section 7.09 Odor and Dust, Section 7.10 Noise, Section 7.15 Air Pollution Control Regulations
310 CMR 18.00 and 19.00 Solid Waste Regulations

Massachusetts Division of Industrial Safety 45 CMR 10.00

Local Requirements including but not limited to those of Health Departments, Fire Departments and Inspection Services Departments

Wherever there is a conflict or overlap of the above references, the most stringent provision shall apply.

BASIS OF PAYMENT

Item 182.1 will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work as described and as required by the Engineer.

No separate payment will be made for the protection of general public, private property, the proper inspecting and testing of the material, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 182.2 REMOVAL OF ASBESTOS FOOT

The work shall include the removal and satisfactory disposal of existing asbestos. The Contractor's attention is directed to the fact that existing asbestos shall be inspected and tested prior to removal, to determine if special removal and disposal is required. The Contractor shall follow all the rules and regulations stated in "ITEM 182.1 INSPECTION AND TESTING FOR ASBESTOS". If asbestos is present, the Contractor shall follow all the rules and regulations stated in the section "REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS", under this item. The Contractor should notify and coordinate his/her efforts with the proper utility accordingly.

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS
This section specifies the requirements for the handling and removal of asbestos containing material. The Contractor must perform all asbestos handling and removal work in accordance with these specifications and the following additional requirements.

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) including but not limited to:

29 CFR 1910 Section 1001 and 29 CFR 1926 Section 58 Occupational exposure to Asbestos, Tremolite, Anthophyllite and Actinolite, Final Rule
29 CFR 1910 Section 134 Respiration Protection
29 CFR 1926 Construction Industry
29 CFR 1910 Section 2 Access to Employee Exposure and Medical Records
29 CFR 1910 Section 1200 Hazard Communication
29 CFR 1910 Section 145 Specifications for Accident Prevention Signs and Tags

U.S. Environmental Protection Agency, (EPA) including but not limited to:

40 CFR 762, CPTS 62044, FRL 2843-9, Federal Register Vol. 50 no.134, July 12, 1985 p.28530 - 28540 Asbestos Abatement Projects Rule
40 CFR 61 Subpart A Regulation for Asbestos
40 CFR 61 Subpart M (Revised Subpart B) National Emission Standard for Asbestos

ITEM 182.2 (Continued)

U.S. Department of Transportation 49 CFR 172 and 173

Massachusetts Department of Labor Standards, (DLS) including but not limited to:

454 CMR 28.00 Removal, Containment and Encapsulation of Asbestos

Massachusetts Department of Environmental Protection (DEP) including but not limited to (supplementing subsection 7.01):

310 CMR 7.00, Section 7.09 Odor and Dust, Section 7.10 Noise, Section 7.15 Air Pollution Control Regulations
310 CMR 18.00 and 19.00 Solid Waste Regulations

Massachusetts Division of Industrial Safety 45 CMR 10.00

Local Requirements including but not limited to those of Health Departments, Fire Departments and Inspection Services Departments

Wherever there is a conflict or overlap of the above references, the most stringent provision shall apply.

All asbestos material shall be removed and properly disposed of by a contractor or subcontractor with a current Massachusetts Abatement Contractors License issued by the Department of Labor Standards. Work shall be supervised by a competent person as required by OSHA in 29 CFR 1926 to ensure regulatory compliance. This person must have completed a course at an EPA Training Center or equivalent course in asbestos abatement procedures, have had a minimum of four years on-the-job training and meet any additional requirements set forth in 29 CFR 1926 for a Competent Person. This person must also be certified by the Commonwealth as an Asbestos Supervisor and Asbestos Project Designer as required by 454 CMR 28.00.

Asbestos removal work shall be coordinated with all other work under the contract and shall be completed prior to performing any activities which could disturb the asbestos material or produce airborne asbestos fibers.

Dust suppression in the form of light water sprays, foams, dust suppressants and calcium chloride will be implemented as required to control dusting during trenching and excavation. Alternatively, intrusive activities may be reduced or curtailed under high wind or heavy rain conditions, which in the opinion of the Health and Safety Plan (HASP) may pose a safety hazard to the workers.

ITEM 182.2 (Continued)

NOTIFICATION AND PERMITS

The Contractor shall prepare a formal pre-notification form at least ten (10) days prior to the start of asbestos removal work. This form must be submitted to the appropriate Regional Office of the Massachusetts Department of Environmental Protection and to the U.S. Environmental Protection Agency Region I Air and Hazardous Material Division. A copy of the submitted forms must be provided to the Engineer and kept at the work site.

Prior to starting any work, the Contractor shall also obtain any required asbestos removal permit(s) from the city/town. A copy of the permit(s) must be provided to the Engineer and posted at the work site.

The Contractor shall also obtain and pay all other applicable asbestos waste transportation and disposal permits, licenses and fees.

STANDARD OPERATING PROCEDURES

The standard operating procedure shall ensure the following:

1. Proper site security including posting of warning signs and restricting access to prevent unauthorized entry into the work spaces.

2. Proper protective clothing and respiratory protection prior to entering the work spaces.

3. Safe work practices including provisions for communications; exclusion of eating, drinking, smoking, or use of procedures or equipment that would in any way reduce the effectiveness of respiratory protection or other engineering controls.

4. Proper exit practices from the work space though the showering and decontamination facilities.

5. Removing asbestos containing material in ways that minimize release of fibers.

6. Packing, labeling, loading, transporting and disposing of contaminated material in a way that minimizes or prevents exposure and contamination.

7. Emergency evacuation of personnel, for medical or safety (fire and smoke) so that exposure will be minimized.

8. Safety from accidents in the work space, especially from electrical shocks, slippery surfaces and entanglements in loose hoses and equipment.

9. Provisions for effective supervision and OSHA - specified personnel air monitoring for exposure during work.

ITEM 182.2 (Continued)

REQUIRED SUBMITTALS

The Contractor shall submit to the Engineer the following listed items at least ten (10) calendar days prior to the start of asbestos work. No asbestos removal work activities shall commence until these items are reviewed by the Engineer, unless otherwise waived. Submittals shall be clearly labeled and in sufficient detail to enable the Engineer to form an opinion as to its conformity to the specifications.

1. Name, experience and DLS certification of proposed Supervisors and Foreman responsible for asbestos work.

2. Summary of workforce by disciplines and a notarized statement documenting that all proposed workers, by name, have received all required medical exams and have been properly trained and certified for asbestos removal work, respirator use and appropriate Massachusetts DLS, EPA and OSHA standards.

3. Notarized statement that workers are physically fit and able to wear and use the type of respiratory protection proposed for the project. Notarized certification signed by an officer of the abatement contracting firm that exposure measurements, medical surveillance and worker training records are being kept in conformance with 29 CFR 1926.

4. Written plan of action and standard operating procedures (HASP) to include: location and layout of decontamination areas; sequencing of asbestos work; detailed schedule of work activities by date and interface with other project activities which affect work performance; methods used to assure safety and security; worker protection and exposure monitoring; contingency and emergency evacuation procedures; detailed description of methods to be employed to control pollution; waste handling procedures.

5. Written respiratory protection program specifying level of protection intended for each operation required by the project and details of daily inspection and maintenance elements.

6. Copies of the U.S. EPA, State and local asbestos removal pre-notification forms. If applicable, lists and copies of all permits, licenses, or manifests which will be applied for and used.

7. Name, location and applicable approval certificates for primary and secondary landfill for disposal of asbestos-containing or asbestos contaminated waste. Name, address and licenses number(s) of hauler permitted to transport waste. (Submit copies of completed manifests upon disposal).

The Contractor must provide copies of daily inspection and record logs upon request of the Engineer, at any time during project. This information will include but is not limited to work area entry data, respirator inspections and maintenance, HEPA-exhaust inspections and maintenance and other work applicable activities or reports of accidents or unusual events.

ITEM 182.2 (Continued)

METHOD OF MEASUREMENT

ITEM 182.2 will be measured for payment by the FOOT for the complete removal and disposal of the asbestos containing material.

BASIS OF PAYMENT

Item 182.2 will be paid for at the Contract unit price per FOOT, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work specified above and as required by the Engineer.

No separate payment will be made for the protection of general public, private property, the proper inspecting and testing of the material, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 201.01	**DROP INLET – MUNICIPAL STANDARD**	**EACH**
ITEM 201.5	**CATCH BASIN – MUNICIPAL STANDARD**	**EACH**
ITEM 201.51	**ALTERNATIVE CATCH BASIN – MUNICIPAL STANDARD**	**EACH**
ITEM 202.01	**MANHOLE – MUNICIPAL STANDARD**	**EACH**
ITEM 222.3	**FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD**	**EACH**

The work under these Items shall conform to the relevant provisions of Subsection 201 of the Standard Specifications and the relevant provisions of Section 200 of the City of Worcester standards as described in the "The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details", dated March 1, 2023(included herein as Document A00825); the Construction Details; and the following:

Materials

Catch Basins and Manholes shall conform with the City of Worcester standards, except as otherwise noted in the Contract Drawings and for structures on I-290. The structures on I-290 shall be in accordance with the MassDOT Standard Construction Details.

Units shall be precast concrete.

Flat top sections shall be rated for HS-20 loading, produced by manufacturers on the MassDOT approved list and shop drawings shall be submitted for approval.

Frame and Grate or Frame and Cover shall conform with the City of Worcester standards, except as otherwise noted in the Contract Drawings.

Sediment trap shall be in accordance with City of Worcester Standards.

Construction Methods

All storm and sanitary structures shall be installed in accordance with City of Worcester standards and as shown in the Contract Document details except on I-290. The structures on I-290 shall be in accordance with the MassDOT Standard Construction Details.

The cone sections shall be replaced with flat tops sections as needed at no additional cost.

Sediment trap shall be installed in accordance with City of Worcester Standards in all Catch Bain – Municipal Standard and Alternative Catch Basin – Municipal Standard.

ITEMS 201.01, 201.5, 201.51, 202.01, and 222.3 (Continued)

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Items 201.01, 201.5, 201.51, 202.01, and 222.3 will be measured and paid for in accordance with the relevant provisions of Subsection 201 of the Standard Specifications and the following:

The cone sections of catch basins and manholes shall be replaced with flat tops sections as needed at no additional cost.

Gravel Borrow shall be paid for under Item 151.2 Gravel Borrow for Backfilling Structures and Pipes.

¾" stone for bedding shall be paid for under Item 156. Crushed Stone.

Sediment traps shall be incidental to the work and included in the price.

ITEM 202.02 DROP MANHOLE – MUNICIPAL STANDARD EACH

The work under this Item shall conform to the relevant provisions of Subsection 201 of the Standard Specifications, the City of Worcester Standards, the Construction Details, and the following:

Materials

Units shall be precast concrete.

Cone and flat top sections shall be rated for HS-20 loading, produced by manufacturers on the MassDOT approved list and shop drawings shall be submitted for approval.

Frame and Cover shall conform with the City of Worcester standards, except as otherwise noted in the Contract Drawings.

Construction Methods

All storm and sanitary structures shall be installed in accordance with City of Worcester standards and as shown in the Contract Document details except on I-290. The structures on I-290 shall be in accordance with the MassDOT Standard Construction Details.

METHOD OF MEASUREMENT

Item 202.02 will be measured for payment by the EACH, regardless of depth, drop manhole – municipal standard installed, complete in place.

BASIS OF PAYMENT

Item 202.02 will be for at the Contract unit price per EACH, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

Frame and grate (or cover) will be paid for under Item 222.3 Frame and Grate (or Cover) Municipal Standard.

Gravel Borrow will be paid for under Item 151.2 Gravel Borrow for Backfilling Structures and Pipes.

¾" stone for bedding will be paid for under Item 156. Crushed Stone.

ITEM 202.5 MANHOLE WITH RISER EACH

The work under this Item shall conform to the relevant provisions of Subsection 201 of the Standard Specifications; the Construction Details; and the following:

Construction Methods

Manhole With Riser shall be constructed of precast concrete conforming to the latest ASTM Specifications for precast reinforced concrete sections (ASTM C478). Concrete shall have a minimum compressive strength of 4,000 psi. Reinforcing steel shall conform to the latest ASTM A1064 Specifications. The manhole shall be capable of supporting an HS 20-44 live load. The joints of the precast manhole sections shall be sealed with either a round rubber "O"-ring gasket or a flexible joint sealant. The "O"-ring shall conform to ASTM C443.

¾" crushed stone shall be placed under the structure to a depth of 6-inches.

METHOD OF MEASUREMENT

Item 202.5 will be measured for payment by the EACH manhole with riser installed, regardless of depth, complete in place.

BASIS OF PAYMENT

Item 202.5 will be paid for at the Contract unit price per EACH, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

Castings for manholes will be paid for under Item 221.1 Frame and Cover - Secured.

Gravel Borrow will be paid for under Item 151.2 Gravel Borrow for Backfilling Structures and Pipes.

Crushed stone for bedding will be paid for under Item 156. Crushed Stone.

ITEM 210.02 SANITARY SEWER MANHOLE REMOVED EACH

The work under this Item shall conform to the relevant provisions of Subsection 140 of the Standard Specifications and the following:

Construction Methods

The work under this Item shall consist of the removal and stacking of iron castings. The plugging of inlets and outlets and the filling of all sanitary structures designated to be abandoned and the removal and proper disposal of all masonry and filling the cavity of the structures designated to be removed.

Upper portions of the masonry shall be removed to a depth of 3 ft below the finished grade at the location designated by the Engineer, and the structures shall be completely filled with selected excavated material placed in 6-in. layers and thoroughly compacted. The existing masonry of structures to be removed shall be completely removed. The cavity shall be completely filled with selected excavated materials placed in 6-in. layers and thoroughly compacted.

METHOD OF MEASUREMENT

Item 210.02 will be measured for payment by the EACH sanitary structure removed,, complete in place.

BASIS OF PAYMENT

Item 210.02 will be paid for at the Contract unit price EACH, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work. Masonry plugs shall be incidental to the work.

ITEM 220.8 SANITARY STRUCTURE REMODELED EACH

The work under this Item shall conform to the relevant provisions of Subsection 220 of the Standard Specifications and the following:

Construction Methods

All sanitary structures which are the property of the municipality shall be remodeled to meet the proposed grade when the adjustment of the structure to line or grade or both line and grade is greater than 6 inches. Existing castings shall be retained.

Work shall include remodeling existing sanitary structures, including brick and mortar, concrete collar and frames to allow the frame to be set to proposed line and grade. All associated work shall conform to the Municipality's requirements.

METHOD OF MEASUREMENT

Item 220.8 will be measured for payment by the EACH sanitary structure remodeled, complete in place.

BASIS OF PAYMENT

Item 220.8 will be paid for at the Contract unit price per EACH, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 221.1 FRAME AND COVER - SECURED EACH

The work under this Item shall conform to the relevant provisions of Subsections 201, 220 of the Standard Specifications and the following:

The work to be done under this Item consists of the furnishing and delivering Frame and Cover – Secured to the site as shown on the Plans, and as required by the Engineer.

Frame and Cover - Secured assemblies shall consist of covers and frames that conform to the nominal size, weight, material and load-carrying requirements in MassDOT Construction Standard Details E 202.6.0, E 202.7.0 and E 202.8.0, and are on the relevant MassDOT Qualified Construction Materials list. Some dimensions of secured manhole covers and frames may vary slightly from those shown on the standard details to account for necessary fastening components. The Contractor shall submit shop drawings of all drainage castings for approval prior to ordering.

Covers and frames shall be held securely together by bolting to threaded holes in the frame or to nuts or tumbler devices secured by the frame, by use of hooks attached to the cover or by any other means approved by MassDOT, to prevent being dislodged under traffic loading. Gaskets and other sealing devices will not be allowed.

METHOD OF MEASUREMENT

Item 221.1 will be measured per EACH Frame and Cover – Secured furnished and delivered to the site.

BASIS OF PAYMENT

Item 221.1 will be paid for at the Contract unit price EACH Frame and Cover – Secured furnished and delivered.

ITEM 223.1 FRAME AND GRATE (OR COVER) REMOVED AND STACKED EACH

The work under this Item shall conform to the relevant provisions of Subsection 220 of the Standard Specifications and the following:

Construction Methods

The existing frames and grates or covers from existing structures shown on the Plans to be abandoned, removed, or changed in type, shall be removed and stacked unless, in the judgment of the Engineer, they are unsuitable for salvage. Unsuitable frames, grates and covers shall become the property of the Contractor and shall be legally disposed of off the site at no additional cost to the Owner in accordance with all state and local requirements. New frames, grates, and covers shall be furnished and installed for new structures and change in type structures, and paid for under their respective items.

Existing frames and grates or covers owned by the City of Worcester shall be removed, transported, unloaded, and stacked at the City of Worcester Department of Public Works Yard.

Existing frames and grates or covers owned by MassDOT shall be removed, transported, unloaded, and stacked at the MassDOT Depot located at 8 Depot Road, Oxford, MA. The Contractor shall coordinate removal and delivery with the MassDOT Resident Engineer.

METHOD OF MEASUREMENT

Item 223.1 will be measured for payment by the EACH frame and grate or cover removed and stacked (or discarded).

BASIS OF PAYMENT

Item 223.1 will be paid for at the Contract unit price per EACH, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 250.08 8 INCH POLYVINYL CHLORIDE SANITARY SEWER PIPE FOOT
ITEM 250.12 12 INCH POLYVINYL CHLORIDE SANITARY SEWER PIPE FOOT

The work under these Items shall conform to the relevant provisions of Subsection 230 of the Standard Specifications and the relevant provisions of Section 200of the City of Worcester standards as described in the "The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details", dated March 1, 2023(included herein as Document A00825); the Construction Details; and the following:

Materials

All PVC pipe shall conform with Section 200 of the City of Worcester standards.

Construction Methods

All PVC pipe shall be installed in accordance with Sections 200 of the City of Worcester standards.

All pipes shall be bedded in crushed stone and uniformly supported over its full length. Crushed stone shall be as specified under Item 156.

All cutting of pipe shall be done with a machine suitable for cutting PVC pipe.

METHOD OF MEASUREMENT

Items 250.08 and 250.12 will be respectively measured for payment by the FOOT in accordance with the provisions of Subsection 230.80 of the Standard Specifications.

BASIS OF PAYMENT

Items 250.08 and 250.12 will be paid for at the respective Contract unit price per FOOT in accordance with the provisions of Subsection 230.81 of the Standard Specifications.

Pipe bedding will be paid for under Item 156.

ITEM 251.12 12 INCH DUCTILE IRON SEWER PIPE (MECHANICAL JOINT) FOOT

The work under this Item shall conform to the relevant provisions of Subsection 230 of the Standard Specifications, the City of Worcester Standards, and the following:

Materials

Ductile Iron Pipe

All mechanical joint ductile iron sewer pipe shall conform with Section 200 of the City of Worcester Standards(Document A00825).

Joints

Joints shall be furnished with mechanical joint restraint that conforms to the City of Worcester Standards(Document A00825).

Lining

Ductile iron sewer pipes shall be lined in accordance with Section 200 of the City of Worcester Standards(Document A00825).

Polywrap

All ductile iron sewer pipe shall be encased in a Polyethylene sleeve (polywrap) that shall meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.

Construction Methods

All ductile iron sewer pipe shall be installed in accordance with Section 200 of the City of Worcester standards.

All pipes, fittings and appurtenances to be laid in open trench excavations shall be bedded in and uniformly supported over its full length as shown on the Contract Drawings.

End seals for pipe sleeves through abutment walls shall be flexible and able to withstand settlement and expansion and contraction.

ITEM 251.12 (Continued)

METHOD OF MEASUREMENT

Item 251.12 will be measured for payment by the FOOT of 12 Inch ductile iron sewer pipe (mechanical joint) installed, complete in place.

BASIS OF PAYMENT

Item 251.12 will be paid for at the Contract unit price per FOOT, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

Insulation will be paid for at the Contract unit price per foot under Item 254.12, complete in place.

Fittings for Ductile Iron Sewer Pipe shall be paid for under Item 251.91.

ITEM 251.91 DUCTILE IRON FITTINGS FOR SEWER PIPE POUND

The work under this Item shall conform to the relevant provisions of Subsections 230, 301, and M5.05.3 of the Standard Specifications and the following:

Materials

Ductile Iron Fittings

All mechanical joint ductile iron sewer fittings shall conform with Subsections 230 and M5.05.3 of the Standard Specifications.

Lining

Ductile iron sewer fittings shall be lined in accordance with Subsection 230 of the Standard Specifications.

Construction Methods

All ductile iron sewer fittings shall be installed in accordance with Subsection 230 of the Standard Specifications.

All pipes, fittings and appurtenances to be laid in open trench excavations shall be bedded in and uniformly supported over its full length as shown on the Contract Drawings.

METHOD OF MEASUREMENT

Item 251.91 will be measured for payment by the POUND of ductile iron fitting for sewer pipe installed, complete in place.

BASIS OF PAYMENT

Item 251.91 will be paid for at the Contract unit price per POUND, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 251.92 12 INCH EXPANSION JOINT FOR SEWER EACH

The work under this Item shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

The work under this Item shall consist of furnishing and installing expansion couplings for open-air gravity sewer main installation across the bridge as indicated on the Plans and as herein specified.

Materials

Expansion couplings for sewer pipe shall be installed in the locations indicated on the drawings and shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. All expansion couplings shall be capable of expanding or contracting to the amounts shown on the drawings, or indicated in the specifications, but in no case shall there be less than 4" total axial movement. Separation beyond the maximum extension of the expansion couplings shall be prevented without the use of external tie rods. Each expansion couplings shall be pressure tested against its own restraint to a minimum of 350 psi. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61.

Expansion couplings shall be approved by the Worcester DPW. Couplings shall be provided with mechanical joint connections conforming to the dimensional requirements of ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53. Seals shall conform to the applicable requirements of ANSI/AWWA C111/A21.11.

Gasket joints shall be furnished with mechanical joint restraint in accordance with Items 303.12 and 309.

METHOD OF MEASUREMENT

Item 251.92 will be measured for payment by the EACH 12 inch expansion joint for sewer installed, complete in place.

BASIS OF PAYMENT

Item 251.92 will be paid for at the Contract unit price per EACH, which price shall include all labor, material, equipment, joint restraining devices, and all incidental costs required to complete the work.

ITEM 254.12 12 INCH SEWER PIPE INSULATION FOOT

The work under this Item shall conform to the relevant provisions of Subsection 301.60 of the Standard Specifications and the following:

The work under this Item consists of all work required to furnish and install insulation for 12-inch sewer, when the pipes cannot be installed at or below the required burial depth of five (5) feet below grade.

Material

Pipe Insulation shall be extruded polystyrene conforming to ASTM C-552 or ASTM C-578. Buried pipe insulation shall be high-density, moisture resistant, and suitable for underground insulation.

Insulation shall be installed where required, in accordance with Section 300 of the Standard Specifications, as required by the Engineer, and the manufacturer's instructions.

METHOD OF MEASUREMENT

Item 254.12 will be measured for payment by the FOOT of 12 inch sewer pipe insulation installed, complete in place.

BASIS OF PAYMENT

Item 254.12 will be paid for at the Contract unit price per FOOT, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 286.1 TEMPORARY COMBINED SEWER BYPASS LUMP SUM

The work under this Item shall consist of all required labor, materials, coordination, operation and maintenance, and equipment to satisfactorily design, install, protect, maintain, and remove a temporary bypass system of the gravity combined sewer which will be installed and supported on the deck of the bridge, as shown on the bridge plans.

The work under this Item shall meet the requirements of all codes and regulatory agencies having jurisdiction and shall conform to the relevant provisions of Section 200 of the MassDOT Standard Specifications and the relevant provisions of the City of Worcester standards as described in the "The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details", dated March 1, 2023; and the following:

The temporary combined sewer bypass system shall provide, at a minimum, the existing system's capacity when flowing full over the bridge, 13.57 cubic feet per second.

Additionally, the Contractor shall control stormwater on site and prevent stormwater runoff from exiting the project limits. The Contractor shall install stormwater control measures to prevent runoff from entering I-290 below the bridge and no discharge shall be directed to I-290. The Contractor shall provide plans for stormwater control to the Engineer, MassDOT, and the City of Worcester for approval, which shall be incidental to the work done under this Item.

The Contract documents include one conceptual option for the temporary combined sewer bypass system. The Contractor shall provide a temporary combined sewer bypass plan and bypass pump sizing calculations stamped by a Professional Engineer licensed in the State of Massachusetts for the approval of the Engineer, MassDOT, and the City of Worcester.

Materials

Pumps

All pumps used shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot-valves, diaphragm pumps, isolation valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods to accommodate the cyclical nature of bypass flows. The pumps shall not be hydraulic submersible type.

The Contractor shall provide the necessary stop/start controls for each pump. The Contractor shall include one stand-by pump system (including suction and discharge piping) of each size to be maintained on site. Additional back-up pumps shall be on-line, isolated from the primary system by a valve.

Discharge Piping

In order to prevent the accidental spillage of flows, all temporary discharge systems shall be constructed in such a manner to avoid leakage and as appropriate for the materials and pressures that the systems selected by the Contractor will produce for the design peak flow rate. Aluminum "irrigation" type piping or glued PVC pipe will not be allowed under any circumstances. Discharge hoses will only be allowed in short sections and with specific permission of the Engineer.

ITEM 286.1 (Continued)

Construction Methods

Submittals

For all pumping systems, the Contractor or its vendor shall provide at least five references of project experience of similar size and complexity to the combined sewer bypass system work contained within this project.

The Contractor shall submit a detailed description of the proposed bypass system stamped by a Professional Engineer in the State of Massachusetts and submit it and the vendor's references.

The Contractor shall submit to the Engineer detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater and stormwater flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

The plan shall include but not be limited to the following: Staging areas for pumps; Flow diversion method and types of materials; Number, size, material, location and method of installation of suction piping; Number, size, material, method of installation and location of discharge piping; Bypass pump sizes, capacity, number of each size to be on site and the related power requirements; Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted); Standby power generator size, location; Downstream discharge plan; Method of protecting suction and discharge areas from erosion and damage; Thrust and restraint block sizes and locations; Sections showing suction and discharge pipe depth, embedment, select backfill; Method of noise control for each pump and/or generator, with external dB valve; Any temporary pipe supports and anchoring required; Design plans and computation for access to bypass pumping locations indicated on the drawings; Calculations for selection of bypass pumping pipe size; Schedule for installation of and maintenance of bypass pumping lines; Plan indicating proposed location of bypass pumping lines.

System Design Requirements

Bypass pumping systems shall have sufficient capacity to pump peak flow. The Contractor shall provide all pipeline, plugs, pumps of adequate size to handle peak flow, and discharge piping to ensure that the total flow can be safely diverted around the area of work. Bypass pumping system will be required to operate 24 hours per day.

The Contractor shall have adequate standby power and pumping equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

ITEM 286.1 (Continued)

Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performance of work.

System Performance Requirements
It is essential for the protection of the public safety and private property that there be no interruption in the flow throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the wastewater flow before it reaches the point where it would interfere with their work, carry it past his work and return it to the existing combined sewers downstream of their work.

The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

The Contractor shall provide all necessary means to safely convey the flow past the work area. The Contractor will not be permitted to stop or impede the flows under any circumstances.

The Contractor shall maintain flow around the work area in a manner that will not cause surcharging or significant level variations in the existing pipe, and that will protect public and private property from damage and flooding.

The Contractor shall protect water resources, wetlands and other natural resources.

The Contractor shall be responsible to meet noise requirements (73dbA @ 30'). In addition, the Contractor shall meet the City Noise Ordinance. All diesel driven primary and standby pumps shall be sound attenuated. The use of Critical Silenced Canopy Pumps or acoustical Whisper Pac enclosures for sound attenuation is required.

Sewage Flow Control
The Contractor shall coordinate with the City of Worcester for bypass the flow around the sections of combined sewer pipe under the Harrison Street Bridge and throughout the work zone as needed to perform the work. The Contractor shall construct temporary bypass pumping structures and may be required to provide adequate suction conduit. The bypass is to be protected from vehicle traffic by being placed in a shallow trench beneath anchored steel plates when placed within or across driveway and roadway locations.

ITEM 286.1 (Continued)

Diverting or blocking of flows shall incorporate primary and secondary devices. A line plug shall be inserted into the combined sewer pipe upstream of the section to be bypassed. The plug shall be so designed that all or any portion of the sewage can be released. After the work has been completed and diversion or blocking is no longer needed for performance and acceptance or work, the primary and secondary devices shall be removed in a manner that permits the flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream. The bypass shall be made by plugging an existing upstream manhole and diverting the sewage into a downstream manhole or adjacent system. The Contractor shall exercise caution and comply with OSHA requirements when working in the presence of gases, combustible or oxygen-deficient atmospheres, and confined spaces. When pumping and bypassing is required, the Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the sewer piping sections within the Harrison Street Bridge work zone which could be affected by the proposed Harrison Street Bridge work. The bypass system shall be of sufficient capacity to handle existing full pipe flow capacity within the sewer system to be bypassed.

The Contractor shall also pay close attention to weather reports for potential precipitation events and coordinate with the City of Worcester regarding the operation of the temporary bypass system.

The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and by-pass system. All bypass systems shall be approved by the Engineer and the City of Worcester Engineer. Approval of the bypass system by the Engineers shall in no way be construed as relieving the Contractor of any responsibility under this Contract as related to protection of the interests of MassDOT, the City of Worcester and the general public.

The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer shall be given 24 hours notice prior to testing.

The Contractor shall inspect bypass pumping system every two hours to ensure that the system is working correctly. The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating. The Contractor shall designate an onsite responsible operator charged to be responsible for the system.

Spare parts for pumps and piping shall be kept on site as required. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

When flow in a sewer line is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from MassDOT, the Engineer and the City of Worcester. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

ITEM 286.1 (Continued)

During all bypass pumping operation, the Contractor shall protect the work area and all local utilities from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to public and private property caused by human or mechanical failure. Under no circumstances will the dumping of raw sewage on private property or in city streets be allowed.

The pipeline must be located off streets and sidewalks and on shoulders of the roads unless otherwise directed on the plans and approved by MassDOT and the City of Worcester. When the bypass pipeline crosses local streets and private driveways, the Contractor must place the bypass pipelines in trenches and cover with temporary backfill and pavement and protected with steel plates. Upon completion of the bypass pumping operations, and after the receipt of written permission from MassDOT, the Engineer and the City of Worcester, the Contractor shall remove all the piping, restore all property to pre-construction conditions and restore all roadway, driveway and sidewalk pavements, curbing and striping. The Contractor is responsible for obtaining any and all approvals from the MassDOT and the City of Worcester for placement of the temporary pipeline within public ways.

BASIS OF PAYMENT

Item 286.1 will be paid for at the Contract unit price per LUMP SUM, which price shall include all labor, material, equipment, and all incidental costs required to complete the work. All costs in connection with the protection of the general public, private property, and all costs associated with the combined sewer temporary bypass installation, protection, maintenance, removal and restoration, including driveway and roadway trenching with anchored steel plate protection, and driveway and roadway reconstruction after bypass removal, shall be considered as included in the price. The cost shall also include the preparation and submittal of the stamped temporary combined sewer bypass plans and the preparation and submittal of the stormwater control plans by the Contractor.

No payment will be made for flow control of sewerage associated with repairing damage to existing pipes or structures caused by the Contractor’s activities.

ITEM 303.06	**6 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)**	**FOOT**
ITEM 303.08	**8 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)**	**FOOT**
ITEM 303.12	**12 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)**	**FOOT**
ITEM 309.	**DUCTILE IRON FITTINGS FOR WATER PIPE**	**POUND**

Under these Items, the Contractor shall furnish, lay, joint, test, and disinfect all water pipe and fittings, as indicated on the Contract Drawings and in accordance with the relevant provisions of Subsection 301 of the Standard Specifications, the American Water Works Association (AWWA) C-600 Standards, and in accordance with the current requirements of the Worcester Department of Public Works (DPW).

The Contractor shall be responsible for notifying the Worcester DPW and the Engineer of service shutdown at least 48 hours prior to the actual shutdown. The shutdown of the water services will be performed only by personnel of the Worcester DPW. Valves, hydrants, corporations and curb stops will be operated by the Worcester DPW personnel only. Shutdown of fire service(s) requires prior notification to, and approval of, the Worcester Fire Department.

The new water mains are to be installed as shown on the plans. The existing water mains shall remain in service until all water services and hydrants are connected to the new mains and tested. The existing main shall be abandoned in place or removed where required to complete the construction work. The existing main shall be cut and plugged where shown or as required.

No water main or service supplying any home, place of business or fire hydrant shall be shut down for more than eight (8) hours unless prior approval is granted by MassDOT, affected abutters, City of Worcester DPW and City of Worcester Fire Department. Notice shall be given to owners of properties affected by proposed shutdowns of water mains and services at least 48 hours prior to shutdown.

The Contractor shall notify and coordinate with owners of business and commercial establishments of any disruptions to, or shutdowns of, water service to their facilities. The Contractor shall schedule service disruptions or shutdowns such that operations of business and commercial establishments are not impacted, and furthermore shall coincide with periods of minimal water usage by these properties.

Data relative to existing water mains, services, etc. shown on the plans has been compiled from plans and field information but such data is not guaranteed as to exact location or elevation.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

Materials

Ductile Iron Pipe and Fittings

All material mechanically restrained and shall be new and shall be of the type currently used by the Worcester DPW.

Mechanical joint water mains shall conform to AWWA C151 (thickness class 52). Pipe joints and gaskets shall be of the mechanical joint type in accordance with ANSI A21.11/AWWA C111. Pipes shall be lined with cement in accordance with ANSI A21.4/AWWA C104 and City of Worcester Standards.

End seals for pipe sleeves through abutment walls shall be flexible and able to withstand settlement and expansion and contraction.

Joints

Gasket joints shall be furnished with mechanical joint restraint in accordance with Item 309.

Ductile iron fittings shall be Thickness Class 52, Pressure Class 350, cement lined, and shall meet the requirements of ANSI A21.54/AWWA C104. All fittings are required to be equipped with mechanical joints and retainer glands. Mechanical joint fittings in sizes 6 inch through 12 inch shall be ductile iron compact fittings conforming to AWWA C153. All nuts and bolts shall be of a type equal to ductile iron or KOR-10 T-bolts and nuts. Mechanical joints shall be furnished with suitable appliances for insuring electrical conductivity, in accordance with the recommendations of the manufacturer.

Tees for hydrant branches and for stubs for future use shall have mechanical joints on the run with a plain end and having an integral rotating gland on the branch. The gland will anchor mechanical joint pipe or valve ends to the plain end of the tee.

Lining and Coating

The inside of ductile iron pipe and fittings shall be given a cement lining and bituminous seal coat in accordance with AWWA C104/ANSI A21.4. Cement lining shall be double thickness.

The outside of ductile iron pipe and fittings shall be coated with bituminous varnish as required by AWWA C104/ANSI A21.4.

Machined surfaces shall be cleaned and coated with a suitable rust preventive coating at the shop immediately after being machined.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

Anchor Harness Rods, Tie Rods and Clamps

Anchor harness rods, tie rods and clamps shall be furnished and installed in accordance with the Standard Construction Details or as required by the Engineer.

Anchor harness rods and tie rods shall have minimum diameter of ¾ inch. Tie rods as clamps shall be as manufactured by Carpenter Paterson, Inc., Woburn, Mass.; Star National Products of Columbus, Ohio; or Metcalfe Industries, Palm Beach, Florida; or approved equal.

Anchor harness rod, tie rod and clamp assemblies incorporated in the work shall be thoroughly coated with two coats of a heavy duty protective coating conforming to "Coal Tar Protective Coating P-101," Subsection M7.04.01 of the Standard Specifications.

Polywrap

All ductile iron pipe shall be encased in a Polyethylene sleeve (polywrap) that shall meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.

Sand Borrow

Sand borrow shall conform to Subsection M1.04.0 of the Standard Specifications and shall be M1.04.0 Type b, 3/8 inch.

Construction Methods

Lines and Grades

Piping shall be installed at the locations indicated on the Contract Drawings and as designated in these Specifications. Unless otherwise shown or stated, the minimum total finished cover over the top of the barrel of all installed pipe shall be 5 feet. All excavation necessary for the pipe installation, excluding Class B Trench Excavation and Class B Rock Excavation, shall be included in the cost of the pipe. The location of the pipe is to be marked with an identification tape buried 2 feet below finish grade. The tape shall be 3 inches in width by 0.004 inches in thickness, polyethylene plastic, solid blue in color and shall read "Caution - Water Line Buried Below" on a continuously printed caption in black letters.

Pipe Foundations

All pipes, fittings and appurtenances to be laid in open trench excavations shall be bedded in and uniformly supported over its full length as shown on the Contract Drawings.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

Inspection of Pipe Before Installation

All pipe fittings and appurtenances shall be carefully inspected in the field by the Engineer before lowering into the trench. All pieces found to be defective as determined by the Engineer, shall be pulled out and not installed. Such rejected pipe shall be clearly tagged in such a manner as not to deface or damage it, and the rejected pipe shall be removed from the job site.

Installation of Pipe and Fittings

All pipe and fittings shall be carefully handled by equipment of sufficient capacity and proper design to avoid damage to the pipe and fittings. No defective pipe or fittings shall be laid or placed in the piping. Any piece discovered to be defective after having been laid shall be removed and replaced by a sound and satisfactory piece at the expense of the Contractor.

Each pipe joint shall be covered with an 8 mil thick polyethylene sleeve that is 2 feet longer than the pipe joint. The sleeve shall cover the full length of the pipe joint, lap over 1 foot on each end of the adjoining pipe joints, and be secured with a minimum of two circumferential turns of pressure sensitive polyvinyl tape. Excess material should be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe, and held in place by means of pieces of pressure sensitive tape at approximately 5 foot intervals. After assembling the joint, the polywrap tube from the previously installed pipe shall be pulled over the joint and secured by the Contractor. The polywrap tube from the new joint shall be pulled over the first tube and secured by the Contractor to provide a double seal. This polyethylene wrap shall also be used for all point repairs or cut-in valves and shall include all couplings used for this work Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the completed work.

Pipe and fittings shall be laid accurately to the lines and grade indicated on the drawings or as required. Care shall be taken to ensure alignment both horizontally and vertically, and to give buried pipe a firm bearing along its entire length. Pipes shall not be laid in water or frozen ground; nor shall water be allowed to flow through them. The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench.

Backfilling of the pipe trench shall be done as specified under Subsection 150 of the Standard Specifications.

Reaction or thrust blocks of concrete shall be constructed at all tees, plugs, hydrant, and bends, as directed or as detailed on the drawings. The blocks shall be poured against undisturbed original ground and shall be so placed that pipe joints will be accessible for any possible future repairs. Method of restraint may be either locking joint or mechanical restraint as approved by the Worcester DPW.

Connection to Other Facilities

The water pipe shall be connected to existing or new structures and/or piping by the Contractor as shown on the Contract Drawings. Test pits shall be dug as required by the Engineer to verify the size and the type of existing pipe where connections are to be made. The Contractor shall furnish and install all such fittings and appurtenances as are necessary to make the connections shown whether all such fittings are detailed or not. Couplings, where required, shall be as specified under Items 371.06, 371.08, and 371.12.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

All concrete for thrust blocks shall be as specified under Item 903. The other means of restraint (method of restraining may either be of an interlocking type or mechanical joint with retainer gland as specified by the Worcester DPW) shall be installed in addition to or in lieu of thrust blocks as directed by the Worcester DPW. Pipe anchors and thrust collars shall be used when and as directed.

Laying Pipe and Fittings

Gasket type joints shall be made up by first inserting the gasket into the groove of the bell and applying a thin film of special non-toxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. The end of the plain pipe shall be chamfered to facilitate assembly. The end shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket. A metal feeler shall then be used to make certain the gasket is properly located.

A minimum of two brass wedges shall be installed per pipe joint and fitting to maintain conductivity and facilitate locating pipe in the future.

Restrained type joints shall be used where straight pipe joints are deflected to bend pipe line on a curve. The method of restraining may either be of an interlocking type or mechanical joint with retainer gland as specified by the Worcester DPW.

Hydrant connections are to be restrained for the full length of the pipe from the main to the hydrant.

Handling and Cutting Pipe

The Contractor's attention is directed to the fact that the cement lining is comparatively brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.

Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

If any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the Engineer, may be cut off before the pipe is laid so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. The cracked portion shall not be included as part of the measurement for payment under this section.

Deflection of Pipe

In laying ductile iron pipe, the manufacturer’s allowable deflection shall not be exceeded.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

Field Testing

The testing shall conform to AWWA Standard C600, and all equipment shall be approved by the Worcester DPW. The water pipe shall be given pressure and leakage tests in sections of approved length. For these tests, the Contractor shall furnish a water measuring device and a pressure gage. The Contractor shall also furnish and install suitable temporary testing plugs or caps for the pipeline; all necessary pressure pumping equipment, pipe connections, and other similar equipment; water; and all labor required; all without additional compensation. Compensation for testing shall be included in the unit price for pipe and fittings. The meter and gage shall be installed by the Contractor in such a manner that all water entering the section under test will be measured and the pressure in the section indicated, and equipment shall be kept in use during both tests. Meters, gages, and other test equipment shall be approved by the Engineer.

The scheduling of pressure and leakage tests shall be as approved by the Engineer.

Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If air release assemblies are not available at high points for releasing air, the Contractor shall make the necessary excavations and do the necessary backfilling and shall make the necessary taps at such points and install corporation stops. Corporation stops shall be capped with brass or bronze caps upon completion of the test and left in place.

The pressure and leakage tests shall be as specified in Subsection 301.60 of the Standard Specifications, and the American Water Works Association Standard C600, Section 5.2.

Tests for strength and leakage shall be made with all hydrants in place with branch gate valves and all required corporation stops installed and in the closed position. Before testing pipelines having flexible joints, the Contractor must make certain that the pipelines are securely held to prevent their movement.

The newly laid pipe shall be tested in valved or plugged sections as determined by the Engineer in the field. Water shall be slowly introduced into the section being tested by means of an approved power-driven high pressure test pump.

The lengths of joint to be used in determining the allowable leakage shall be based on the nominal diameter of the pipe.

All pipe shall be subjected to a hydrostatic pressure of at least 225 psi. The pressure for the tests shall be maintained by pumping additional water as required into the pipeline and shall not vary by more than 5 psi for the duration of the test. The test pressure shall be maintained for at least two hours. Temporary plugs and fittings may be required by the Engineer.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

The pressure shall be raised to the test pressure required for each section being tested as determined by the Engineer. When the test pressure is reached, the time shall be recorded and the test shall begin. The duration of each pressure test shall be a minimum of two hours. During the test, pressure shall be maintained in the section of pipeline being tested by means of a recirculating by-pass type test pump. Water shall be added in measured amounts from a container of known volume if required to maintain pressure. The addition of excessive amounts of water shall constitute immediate test failure. The Engineer will approve all gauges and test equipment.

If the section shall fail to pass the pressure test, the leakage test, or both, the Contractor shall do everything necessary to locate, uncover, even to the extent of uncovering the entire section, and repair or replace the defective pipe, fitting, or joint, all at no additional cost to the owner and without extension of time for completion of the work.

If, in the judgment of the Engineer, it is impracticable to follow the foregoing procedure exactly for any reason, modification in the procedures shall be made as required or approved, but in any event the Contractor shall be responsible for the ultimate tightness of the line within the above leakage requirements.

The City, at its own expense, may test the water pipe independent of or in place of the Contractor's test. The City, or its agent, shall schedule such test so as to minimize any delay to the Contractor. The Contractor is notified that this test may cause delay in his work and he shall not receive reimbursement for costs incurred during a reasonable delay. Should any section of pipe fail, the Contractor shall have no claim for any expenses incurred during the delay required to schedule and complete a new test.

Disinfection and Flushing

After a section of the main has been tested and found acceptable, it shall be flushed free of all the heavily treated water by the Contractor. After completion of the flushing operation, the Contractor shall disinfect the water mains with a solution consisting of 50 ppm of chlorine in accordance with the AWWA C651 Specifications for Disinfecting Water Mains. The preferable point of chlorine application shall be at the source of the water for the section being sterilized. The chlorine solution shall be fed into the pipe through a corporation stop, using a gas chlorinator or a hypochlorinator. This work shall be done with the attendance of a representative of the Worcester DPW.

The Contractor shall provide caps or plugs at ends of branches of water mains at intersections to allow for disinfection of all portions of newly installed water mains.

The water shall be tested chemically for residual chlorine and bacteriologically for coliform group bacteria. Testing must be done by a Massachusetts State Certified Laboratory and the results of all tests must be submitted to the Worcester DPW. The Contractor shall be solely responsible for all costs associated by the aforesaid test.

The contact period for the disinfection shall be at least 24 hours and a longer period will be required if tests of residual chlorine show it to be necessary for proper disinfection.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

Following chlorination, the mains shall be flushed again with clean water to remove any evidence of contamination, as determined by the bacteriological analysis. Flushing with clean water shall continue until testing shows a residual chlorine concentration of less than 0.2 mg/liter. Water used in disinfecting and flushing pipes shall be disposed of in an approved manner.

Bacteriological sampling and testing shall be done in accordance with AWWA C651 for each main and each branch. Sampling shall be accomplished with sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater. No hose or fire hydrants shall be used in the collection of samples. A corporation stop installed on the main, with a removable copper tube gooseneck assembly, is the recommended method.

Testing shall be done by a laboratory approved by the Engineer, in accordance with Standard Methods, and shall show the absence of coliform organisms. A standard plate count may be required at the option of the Engineer.

A report describing amounts of water flushed, amounts of chlorine used and chlorine residuals after the test period must be submitted to the Worcester DPW. If the initial treatment fails to produce the desired result, the chlorination procedure must be repeated.

For this work, the Contractor shall furnish all equipment, materials, and labor required.

METHOD OF MEASUREMENT

Items 303.06, 303.08, and 303.12 will be respectively measured for payment by the FOOT of water pipe installed, complete in place. Water pipe will be measured in place along the axis of the pipe without deduction for the space occupied by valves, excluding however, the length occupied by new fittings. Where two pipes join, measurement will be made to the intersection of the axes, excluding the length occupied by new cast iron fittings.

Item 309. Will be measured for payment by the POUND of ductile iron fittings for water pipe installed. Fittings, consisting of bends, tees, caps, wyes, sleeves, reducers, increasers, blow-off fittings and other specials, applies only when new materials are necessary and which are not specifically provided for under other items in the Proposal. Fittings other than new will not be paid separately but only under the applicable foot items. When new fittings are measured for payment under the pound price for Item 309, the length occupied by the fittings will not be measured for payment under the foot items.

The fittings (excluding accessories comprising of Rings, Gaskets, Bolts, Nuts, Washers and Clamps) will be measured by the pound and the quantity to be paid for shall be the weight stated on the invoice of the supplier or the manufacturer's rated weight as listed in the catalog whichever is the lesser.

ITEMS 303.06, 303.08, 303.12, and 309. (Continued)

BASIS OF PAYMENT

Items 303.06, 303.08, and 303.12 will be paid for at the respective Contract unit price per FOOT, which prices shall be full compensation for the removal and disposal of existing water pipe and appurtenances encountered during construction, cutting and plugging the existing water pipe, and furnishing all materials, preparation and installation, including all excavation, compaction and backfilling of ordinary borrow backfill above initial backfill, water line testing and disinfecting, brass caps and wedges, buried pipe identification tape, cement lining, abutment sleeve end seals, support of excavation, dewatering, all hardware necessary to secure the pipe to the thrust blocks, and for all labor, equipment, tools and incidentals required to complete the work.

Payment for Ductile Iron Water Pipe (Mechanical Joint) with mechanical restraint devices shall be made at the Contract unit price, which shall be full compensation for all labor, material, tools and equipment necessary or incidental to complete the required work including the mechanical restraint devices.

Item 309. will be paid for at the Contract unit price per POUND, which price shall include all labor, material, equipment, and all incidental costs required to complete the work. Payment for anchor harness rods, tie rods and clamps shall be at the Contract unit price for Item 309, which shall be full compensation for all labor, materials, equipment and tools required to complete this work, and for furnishing and installing anchor rods, ties rods and clamps.

Sand borrow used for pipe bedding in trench sections will be paid for under Item 154.

Additional excavation to remove unsuitable bottom material for water main bedding will be paid for under Item 142, Class B Trench Excavation.

Rock excavation when encountered in the trenching operation will be paid for under Item 144.

All above grade pipe and pipe within 5 feet of the ground surface shall be insulated in accordance with M9.11.0 of the Standard Specifications. The insulation shall be attached to the pipe by the manufacturer and shall be covered with a polyethylene wrap prior to installation on the bridge (pre-insulated pipe). Insulation for water main will be paid under Item 373.12.

Gravel borrow required to replace existing material obtained from the trench excavation that is determined to be unsuitable for reuse, as shown in the Drawings, will be paid for under Item 151.2.

Concrete for thrust blocks will be paid for under Item 903.

Reinforcing for thrust blocks will be paid under Item 910.1.

ITEM 310.08 8 INCH EXPANSION JOINT EACH
ITEM 310.12 12 INCH EXPANSION JOINT EACH

The work under these Items shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

The work under these Items consists of furnishing and installing expansion couplings for open-air water main installation across the bridge as indicated on the Plans and as herein specified.

Materials

Expansion couplings for water and sewer pipe shall be installed in the locations indicated on the drawings and shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. All expansion couplings shall be capable of expanding or contracting to the amounts shown on the drawings, or indicated in the specifications, but in no case shall there be less than 4" total axial movement. Separation beyond the maximum extension of the expansion couplings shall be prevented without the use of external tie rods. Each expansion couplings shall be pressure tested against its own restraint to a minimum of 350 psi. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61.

Expansion couplings shall be approved by the Worcester DPW. Couplings shall be provided with mechanical joint connections conforming to the dimensional requirements of ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53. Seals shall conform to the applicable requirements of ANSI/AWWA C111/A21.11.

Gasket joints shall be furnished with mechanical joint restraint in accordance with Items 303.12 and 309.

METHOD OF MEASUREMENT

Items 310.08 and 310.12 will be respectively measured for payment by the EACH expansion joint installed, complete in place.

BASIS OF PAYMENT

Items 310.08 and 310.12 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, material, equipment, and all incidental costs required to complete the work including all joint restraint devices.

ITEM 350.06	**6 INCH GATE AND GATE BOX**	**EACH**
ITEM 350.08	**8 INCH GATE AND GATE BOX**	**EACH**
ITEM 350.12	**12 INCH GATE AND GATE BOX**	**EACH**

The work under these Items shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

Under these Items, the Contractor shall furnish and install new valves, valve boxes, and appurtenant materials and equipment, all as indicated in the Drawings and as specified herein. Valves shall be applicable for a design working pressure of 250 psi.

Materials

4-inch through 12-inch gate valves shall be Resilient Seated, full-bodied ductile iron, encapsulated with rubber and having dual sealing systems which seal on the upstream and downstream side of the gates, and with a non-rising stem in accordance with AWWA C509.

Gate valves shall have an unobstructed waterway when fully opened equal in diameter to at least ¼-inch greater than the nominal valve size.

They shall be of resilient seat, wedge type with ductile iron body and shall have a non-rising high strength bronze stem mounted with a thermoplastic cartridge stem seal incorporating "O" rings packed and ready for use. The sealing mechanism shall provide a dual seal with zero leakage at the water working pressure when installed with the line flow in either direction, and shall consist of a cast iron gate having a vulcanized synthetic rubber coating with no rubber metal seams or edges in the waterway when in the fully closed position.

Valves shall be designed for vertical setting and shall be equipped with operating nuts. Operating nuts shall be 2 inches square at the base and shall be loosely fitted on the stem. The Contractor shall verify which direction the valves open with the City.

All gate valves shall be suitable for working water pressure of 250 psi and shall be tested under a hydrostatic pressure of 400 psi and show no leak.

All ferrous surfaces of the valve body waterway and vane shall be given a fusion-bonded epoxy coating in compliance with AWWA C550. This coating shall be applied prior to assembly to ensure that all exposed interior and exterior surfaces receive the epoxy coating.

All surfaces of the cast iron gate, including stem hole, shall be encapsulated in rubber tightly bonded to the gate. Design and machining of valves shall permit packing of valves without undue leakage while they are wide open and in service.

ITEMS 350.06, 350.08, and 350.12 (Continued)

Valves shall be equipped with mechanical joint ends and mechanical joint restraints as specified for Items 309 unless otherwise specified by the Worcester Department of Public Works, Water Division. Gate boxes shall be extra grade grey iron and of the adjustable sliding, heavy-pattern type and shall be provided at main valves, branch-line valves, and at other locations, as specified. The gate boxes shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valves and shall be centered and plumb over the wrench nut of the valves with the box cover flush with the surface of the finished pavement or such other level as may be directed.

The top section shall be 24 inches in height and the bottom shall be 36 inches in height. The upper or sliding section of the box shall be provided with a top flange having sufficient bearing area to prevent undue settlement. The top section of the box shall have a plain bottom.

The lower section of the box shall have a bell-shaped bottom to enclose the operating nut and stuffing box of the valve and fit over the valve bonnet, without bearing on the valve bonnet, and rest on the backfill.

The boxes shall be adjustable through at least 6 inches vertically without reduction of lap between sections to less than 4 inches. The length shall be as necessary to suit ground elevation. The inside diameter of the boxes shall be at least 5 1/8-inches for the bottom section and 6 1/8-inches for the top section.

Covers shall be close fitting and substantially soil-tight. The top of the cover shall be flush with the top of the box rim. The word "WATER" and the word "OPEN", and an arrow indicating the direction of opening valve shall be prominently cast in the top of the cover. The gate box extension shall be 12 inches to 15 inches in length. The extension shall be extra grade grey iron and shall fit on the top of the bottom section of the gate box.

Castings for gate boxes shall be strong, tough, even grained, and without defects. The gate boxes shall be manufactured in the United States. Gate boxes shall be completely and thoroughly coated with bitumastic paint.

METHODS OF MEASUREMENT

Items 350.06, 350.08, and 350.12 will be respectively measured for payment by the EACH 6 inch, 8 inch, or 12 inch gate and gate box installed, complete in place.

BASIS PAYMENT

Items 350.06, 350.08, and 350.12 will be paid for at the respective Contract unit price, which prices shall include all labor, material, equipment, excavation, backfill, and all incidental costs required to complete the work.

ITEM 352.06	**6 INCH GATE AND GATE BOX REMOVE AND DISPOSE**	**EACH**
ITEM 352.08	**8 INCH GATE AND GATE BOX REMOVE AND DISPOSE**	**EACH**
ITEM 352.12	**12 INCH GATE AND GATE BOX REMOVE AND DISPOSE**	**EACH**

Under these Items, the Contractor shall remove and dispose old valves, valve boxes, and appurtenant materials and equipment, all as indicated in the Drawings and the following.

Construction Methods

All existing gates and gate boxes designated to be removed and disposed of shall be disconnected and removed from the water main. The removed gates and gate boxes shall be disposed of by the Contractor.

The Contractor shall coordinate the work with the City. The Contractor shall give at least 48 hours written notice to the Fire Department and the Department of Public Works prior to removing any gates and gat boxes.

MEASUREMENT AND PAYMENT

Items 352.06, 352.08, and 352.12 will be respectively measured for payment by the EACH 6 inch, 8 inch, or 12 inch gate and gate box removed and disposed.
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BASIS OF PAYMENT

Items 352.06, 352.08, and 352.12 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 371.06	**6 INCH COUPLING**	**EACH**
ITEM 371.08	**8 INCH COUPLING**	**EACH**
ITEM 371.12	**12 INCH COUPLING**	**EACH**
ITEM 372.08	**8 INCH SOLID SLEEVE**	**EACH**

The work under these Items shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

The work under these Items consists of furnishing and installing insulating mechanically restrained transition couplings and mechanically restrained solid sleeves for water pipe to connect the proposed ductile iron pipe to the existing water mains.

Construction Methods

These Items shall be installed according to the City of Worcester's requirements, as shown in the plans and described in the City's Standard Construction Specifications and Details(Document A00825).

The Contractor shall coordinate the work with the City. The Contractor shall give at least 48 hours written notice to the Fire Department and the Department of Public Works prior to installing any water pipes and fittings.

Materials

All cast components shall be ductile iron meeting or exceeding the requirements of ASTM A536, grade 65-45-12.

Grippers shall be ductile iron, meeting or exceeding ASTM A536, Grade 65-45-12, with corrosion resistant fastener coating, capable of withstanding a minimum 1,500 hours of salt fog, per ASTM B117.

Gaskets shall be either SBR or NBR compounded, per ASTM D2000, classified by UL to meet NSF61.

Draw hooks shall be uncoated 304 stainless steel.

Ramp Runners shall be nylon 66, 14% glass filled.

Bolts and nuts shall be stainless steel with heavy hex nuts.

Center ring shall have fusion bonded epoxy, NSF 61 certified coating.

METHOD OF MEASUREMENT

Items 371.06, 371.08, 371.12, and 372.08 will be respectively measured for payment by the EACH 6 inch, 8 inch, or 12 inch coupling, or 8 inch solid sleeve installed, complete in place.

BASIS OF PAYMENT

Items 371.06, 371.08, 371.12, and 372.08 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 375.08 8 INCH INSERTION VALVE AND BOX EACH
ITEM 375.12 12 INCH INSERTION VALVE AND BOX EACH

The work under these Items shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following.

The work under these Items shall consist of furnishing and installing new insertion valves, valve boxes, and appurtenant materials and equipment, as required and specified herein.

Insertion valves shall have an EPDM-molded resilient wedge seal. The resilient wedge seal will be affixed into a reinforced nylon composite polymer valve cartridge. The entire assembly shall be inert and impervious to corrosion and designed for use in potable water. Insertion valves shall have a stainless steel body with a working pressure of 250 psi. Insertion valve must be capable of working on cast iron or ductile iron pipe. The design will allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. All insertion valves must be hydrostatically pressure tested to 1.25 times of the system operating pressure (minimum) or 1.5 times of the insertion valves 250 psig maximum pressure rating. The test shall be sustained for a minimum of 15 minutes. Once the pressure test is effectively achieved the insertion valve body must not be moved in accordance with AWWA Standards. If the insertion valve body is moved the pressure test must be completed again. Any movement, repositioning, loosening, and/or re-tightening must be retested before the pipe is tapped.

Traditional line tapping methods shall be used for the installation of all insertion valves to allow removal of a single coupon for system evaluation. Reaming the pipe, complete removal of a section of pipe (top and bottom), or milling a slot in the pipe shall be prohibited.

Gate box shall be as specified under Items 350.08 and 350.12.

METHOD OF MEASUREMENT

Items 375.08 and 375.12 will be respectively measured for payment by the EACH 8 inch or 12 inch insertion valve and box installed, complete in place.

BASIS OF PAYMENT

Items 375.08 and 375.12 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 376.1 HYDRANT – EXCLUDING COST OF HYDRANT EACH

The work under this Item shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

The work under this Item consists of installing a hydrant furnished by the City of Worcester.

Construction Methods

All proposed hydrants shall be installed according to the City of Worcester's requirements, as shown in the plans and described in the City's Standard Construction Specifications and Details(Document A00825).

The Contractor shall coordinate the work with the City. The Contractor shall give at least 48 hours written notice to the Fire Department and the Department of Public Works prior to installing any hydrant.

MEASUREMENT AND PAYMENT

Item 376.1 will be measured for payment by the EACH hydrant – excluding the cost of hydrant installed, complete in place.

BASIS OF PAYMENT.

Item 376.1 will be paid for at the Contract unit price per EACH, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 376.4 HYDRANT – REMOVED AND DISPOSED EACH

The work under this Item shall conform to the relevant provisions of Subsection 301 of the Standard Specifications and the following:

Construction Methods

All existing hydrants designated to be removed and disposed shall be first be disconnected from the active water main by closing the connected shutoff valve. The hydrant shall be carefully removed and set on blocks to avoid damage to the hydrant. The hydrant shall be disposed of by the Contractor.

The Contractor shall coordinate the work with the City. The Contractor shall give at least 48 hours written notice to the Fire Department and the Department of Public Works prior to removing any hydrants.

MEASUREMENT AND PAYMENT

Item 376.4 will be measured for payment by the EACH hydrant – removed and disposed.

BASIS OF PAYMENT

Item 376.4 will be paid for at the Contract unit price per EACH, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

ITEM 386.	**TEMPORARY WATER MAIN BY-PASS SYSTEM - HARRISON**	**LUMP SUM**
ITEM 386.01	**TEMPORARY WATER MAIN BY-PASS SYSTEM - LAUREL**	**LUMP SUM**

Under these Items, the Contractor shall furnish, install, chlorinate, maintain, and remove bypass and temporary service pipe of the size required to adequately service water customers.

The Contractor shall locate all services to be fed by the by-pass system. The Contractor shall coordinate the work with the City. The Contractor shall give at least 48 hours written notice to the Fire Department, the Department of Public Works, and the customers impacted prior to interrupting water service.

The Contractor shall submit a plan showing the proposed temporary by-pass system and point of connections for review and approval by the Engineer, the City Engineer, and City Fire Department.

Materials

All by-pass shall be galvanized steel, H.D.P.E. or polyvinylchloride (PVC) pipe. All plastic pipe or hose shall bear the imprint of the National Sanitary Foundation approval for potable water NSF-PW or shall be capable of meeting the standards established by the NSF for this use. All pipe, valves, and other appurtenances shall be NSF approved for potable water.

The materials selected shall be adequate to operate at the pressure to which they will be subject to and adequate to withstand whatever forces, such as traffic loading, they will encounter. Joints for all pipes shall be watertight.

The owner reserves the right to reject at any time materials that do not meet the requirements set forth herein.

Construction Methods

In general, by-pass piping shall be laid along the side of the roadway adjacent to the curb line or protective barriers at edge of pavement line.

For bypass connection to hydrant, the Contractor shall install a NST, double-valved tee directly on 4 ½ inch hydrant nozzle, with approved double check valve assembly and flow meter. One branch of tee shall be used for temporary bypass connection, and other shall be left without bypass attachments for fire department use.

At locations where the pipe is subject to minimal traffic, such as at driveways, the pipe shall be adequately protected by excavating and setting the pipe below grade or "ramping" it with stone dust or other suitable material.

All by-pass pipes that cross handicapped ramps, intersections, or extends around the radius of an intersecting street shall be installed below the surface grade.

ITEMS 386. and 386.01 (Continued)

Where necessary to feed large services, the Contractor may be required to excavate the sidewalk or other areas adjacent to a building to cut into the existing service or fire pipe. The cost of this work will be included in the bid price for Temporary By-pass Pipe including backfill and paving.

In addition, the Contractor will be required, where necessary, to ramp over all by-pass piping to provide for wheelchair access on affected sidewalks. Ramping shall be in accordance with ADA (Americans with Disabilities Act) regulations.

The Contractor shall coordinate service connections with the City and abutters. Above ground connections may be acceptable contingent on approval from the City and abutters.

The interior of all by-pass pipe, temporary service pipe (hard connections) and service hoses (above ground connections) shall be flushed to remove any dirt or other objects and shall be disinfected in accordance with AWWA C651-86 "AWWA Standard for Disinfecting Water Mains". The appropriate section of the Pressure Testing and Disinfection Report in the Appendix of these specifications shall be completed by the Contractor and approved by both the City Engineer and Inspector prior to any payments being made for by-pass piping.

At all locations where hydrants are out of service due to work under this contract, the contractor shall provide temporary hydrants. A hydrant being used to feed temporary hydrants must be fed by 6-inch by-pass pipe including whip connections and must be fitted with a valve manufactured for water service that shall be coordinated with the Town Engineer and fire department.

Adequate precautions shall be taken to protect all vehicular and pedestrian traffic from injury due to by-pass piping and temporary service lines. These precautions shall include, but are not limited to "ramping", barricades and other devices.

All by-pass pipe and service hoses shall be bubble tight at all times. No leakage shall be acceptable.

No by-pass pipe shall remain in place after November first, and none shall be put in service prior to April first.

BASIS OF PAYMENT

Items 386. and 386.01 will be paid for at the respective Contract unit price per LUMP SUM, which prices shall include preparing a plan and sequence of work for approval, furnishing all pipes, fittings, valves, hoses, stone-dust, cold patch, barricades, chlorine, and other materials necessary to install, maintain, and remove the by-pass system. This payment shall also include all labor, tools and equipment necessary to adequately temporarily serve all water customers with domestic and fire service lines, including the removal of all meters as required, and all incidental costs required to complete the work.

When by-pass is bid under this Item, partial payments shall be made in accordance with the following procedure:

a) 60% of the bid price shall be paid upon completion of the installation of the by-pass and the remaining 40% shall be paid upon removal of the by-pass.
b) Each street being rehabilitated shall be considered one location.
c) Where the existing main is used for the temporary by-pass, the Contractor will be required to maintain this pipe the Contractor will be compensated for the proportion of the main replaced.

ITEM 508. GRANITE TRANSITION – VERTICAL TO SLOPED CURB FOOT

The work under this Item includes furnishing and installing Granite Transition – Vertical to Sloped Curb as shown on the Contract Drawings and shall conform to the relevant provisions of Subsection 501 of the Standard Specifications and the following:

Materials
Materials shall meet Materials Specification for VA-4 curb and be in accordance with Subsections M9.04.0, M9.04.01, and M9.04.02 of the Standard Specifications. Curb shall be as shown on the Plans. Standard length shall be 6 feet.

Construction Methods
Granite Transition – Vertical to Sloped Curb shall be installed at the final grades as shown on the Plans.

METHOD OF MEASUREMENT

Item 508. will be measured for payment by the FOOT of granite transition – vertical to sloped curb installed, complete in place.

BASIS OF PAYMENT

Item 508. will be paid for at the Contract unit price per FOOT, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 514.2 GRANITE CURB INLET – STRAIGHT – MUNICIPAL STANDARD EACH

The work under this Item shall conform to the relevant provisions of Subsection 501 of the Standard Specifications, the Construction Details, and the following:

The work under this Item includes furnishing and installing Granite Curb Inlet – Straight – Municipal Standard as shown on the Contract Drawings.

Materials
Materials shall meet Materials Specification for curb inlet and be in accordance with Subsection M9.04.5 of the Standard Specifications. Curb inlets shall be as shown on the Plans.

Construction Methods
Granite Curb Inlet – Straight – Municipal Standard shall be installed at the final grades as shown on the Plans.

METHOD OF MEASUREMENT

Item 514.2 will be measured for payment in accordance with the provisions of Subsection 501.80 of the Standard Specifications.

BASIS OF PAYMENT

Item 514.2 will be paid for at the Contract unit price in accordance with the provisions of Subsection 501.81 of the Standard Specifications.

ITEM 628.241 SPECIAL TRANSITION TO BRIDGE RAIL LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsection 601 of the Standard Specifications and the following.

The work under this Item consists of furnishing and installing the special transition to bridge rail as required by the Engineer.

Materials

Materials shall meet the requirements specified in Subsection 601.40 of the Standard Specifications.

Construction Methods

The Contractor shall furnish and install the special transition to bridge rail which shall consist of thrie beam, posts, terminal connector, and end section as shown on the plans. Post spacing should be as called for on the plans.

BASIS OF PAYMENT

Item 628.241 will be paid for at the Contract unit price per LUMP SUM, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 629.1 PRECAST CONCRETE BARRIER - SINGLE FACED FOOT

The work under this Item shall conform to the relevant provisions Subsection 629 of the Standard Specifications and the following.

The cost for sawcut and for furnishing and installing the concrete in front of the barrier for pavement restoration will be incidental for the cost of the barrier.

METHOD OF MEASUREMENT

Method of measurement will be per Subsection 629.80 of the Standard Specifications.

BASIS OF PAYMENT

Payment will be per Subsection 629.81 of the Standard Specifications.

ITEM 657. TEMPORARY FENCE FOOT
ITEM 657.5 TEMPORARY FENCE REMOVED AND RESET FOOT

The work under these Items shall be in accordance with Subsections 644 and 665 of the Standard Specifications and the following

The work under these Items consist of furnishing, installing removing, resetting and final removal of temporary fence to protect the safety of the general public or as required by the Engineer:

Materials

Temporary fence for pedestrian protection shall be a minimum of 6 feet in height and shall be any type specified in Subsection 644. All end, corner and intermediate posts shall be driven into the ground and properly supported as outlined in Subsection 644. Fence post shall not be inserted into the bridge deck. Where temporary chain link fence is required on the bridge, the fence posts shall be 2 3/8 inches O.D., galvanized Schedule 40, and have a standard base that does not require embedment into existing or proposed deck.

Construction Methods

The Contractor shall furnish and install all end, corner and intermediate brace posts and all other incidental materials, labor and equipment required for the installation, including concrete foundations if required, relocation and final removal from the site. Material need not be new, but shall not be deteriorated, nor in any way jeopardize the protection purposes intended. All fencing shall meet the approval of the Engineer.

The Contractor shall be responsible for maintenance of the temporary fence and shall be responsible and cognizant that it remains secure at all times. Fence fabric shall be placed on the face of the post away from the work area. The top edge of the fabric shall be finished with a “knuckled” selvage.

During construction it will be necessary to remove and reset the temporary fence at different locations to accommodate the stage construction.

Any removing and resetting of the Temporary Fence by the Contractor to facilitate his/her construction operations or site access shall be done at no additional cost to the Department.

The Contractor shall furnish and install all end, corner and intermediate brace posts, gates and gate post, brackets and hardware and all other incidental materials, labor and equipment required for the installation, including concrete foundations if required, relocation and final removal from the site. Material need not be new, but shall not be deteriorated, nor in any way jeopardize the protection purposes intended. All fencing shall meet the approval of the Engineer.

Upon completion of the work, or as required by the Engineer, the fencing and supports shall be removed and disposed off-site by the Contractor at no additional cost.

ITEMS 657. and 657.5 (Continued)

METHOD OF MEASUREMENT

Items 657. and 657.5 will be respectively measured for payment by the FOOT of temporary fence or temporary fence removed and reset, complete in place.

BASIS OF PAYMENT

Item 657. will be paid for at the Contract unit price per FOOT, which price shall include all labor, material, equipment, and all incidental costs required to complete the work.

Twenty (20) percent of the Contract unit price will be held until the fence is removed.

Item 657.5 will be paid for at the Contract unit price per FOOT, which price shall include all labor, material, equipment and incidental costs to remove and reset the chain link fence as required to relocate the temporary fence to the locations shown on the plans for Stage II construction.

The removal and proper disposal of the Temporary Fence shall be considered incidental.

The Contractor shall replace and/or restore sections of fence damaged due to accidents, vandalism or in any other manner for the duration of the project. Damage due to construction activities or the Contractor’s operation shall be replaced at no additional cost to the Department.

ITEM 665.2 REMOVE AND DISPOSE CHAIN LINK FENCE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 665 of the Standard Specifications and the following.

Construction Methods

The Contractor shall remove the existing link fence, gates, posts, bracing, hardware and footings and legally dispose of all material away from the site.

METHOD OF MEASUREMENT

Item 665.2 will be measured for payment by the FOOT of chain link fence removed and disposed. Chain link fence will be measured in its original location before removing.

BASIS OF PAYMENT

Item 665.2 will be paid for at the Contract unit price per FOOT, which price shall include all labor, materials, equipment and incidental costs required to complete this work.

ITEM 697.1 SILT SACK EACH

Work under this Item shall conform to the relevant provisions of Subsections 227 and 670 of the Standard Specifications and the following:

The work under this Item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in retained existing and proposed catch basins and drop inlets within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as required by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the Contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as specified in Subsection 227 of the Standard Specifications

ITEM 697.1 (Continued)

COMPENSATION

Silt sacks will be measured and paid at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 740. ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH

The work under this Item shall conform to the relevant provisions of Subsection 740 of the Standard Specifications and the following:

Three computer systems and a printer system meeting minimum requirements set forth below including installation, maintenance, power, paper, disks, and other supplies shall be provided at the Resident Engineer's Office:

All equipment shall be UL approved and Energy Star compliant.

The Computer System shall meet the following minimum criteria or better:

Processor:	Intel, 3.5 GHz
System Memory (RAM):	12 GB
Hard Drive:	500 GB
Optical Drive:	DVD-RW/DVD+RW/CD-RW/CD+RW
Graphics Card:	8 GB
Network Adapter:	10/100 Mbit/s
USB Ports:	6 USB 3.0 ports
Keyboard:	Generic
Mouse:	Optical mouse with scroll, MS-Mouse compliant
Video/Audio	the computer system shall be capable of allow video calling and recording:
Video camera	shall be High Definition 1080p widescreen capable video calling and recording with built in microphone. The microphone system shall capture natural audio while filtering out background noise.
Audio	shall be stereo multimedia speaker system delivering premium sound.
OS:	Latest Windows Professional with all security updates
Web Browser:	Latest Internet Explorer with all security updates
Applications:	Latest MS Office Professional with all security updates Latest Adobe Acrobat Professional with all security updates Latest Autodesk AutoCAD LT Antivirus software with all current security updates maintained through the life of the contract.
Monitors:	Two 27" LED with Full HD resolution. Max. resolution 1920 x 1080
Flash drives:	2 (two) - 128GB USB 3.0
Internet access:	High Speed (min. 24 mbps) internet access with wireless router.

ITEM 740. (Continued)

The Multifunction Printer System shall meet the following minimum criteria or better:

Color laser printer, fax, scanner, email and copier all in one with the following minimum capabilities:

- Estimated volume 8,000 pages per month
- LCD touch panel display
- 50 page reversing automatic document feeder (RADF)
- Reduction/enlargement capability
- Ability to copy and print 11” x 17” paper size
- email and network pc connectivity
- Microsoft and Apple compatibility
- ability to overwrite latent images on hard drive
- 600 x 600 dpi capability
- 30 pages per minute print speed (color),
- 4 Paper Trays Standard (not including the bypass tray)
- Automatic duplexing
- Finisher with staple functions
- Standard Ethernet. Print Controller
- Scan documents to PDF, PC and USB
- ability to print with authenticated access protection

The Contractor shall supply a maintenance contract for next day service, and all supplies (toner, staples, paper) necessary to meet estimated monthly usage.

The Engineer's Field Office and the equipment included herein including the computer system, and printer shall remain the property of the Contractor at the completion of the project. Disks, flash drives, and card readers with cards shall become the property of the Department.

Compensation for this work will be made at the contract unit price per month which price includes full compensation for all services and equipment, and incidentals necessary to provide equipment, maintenance, insurance as specified and as directed by the Engineer.

ITEM 748.1 EMERGENCY RESPONSE EACH

The work under this Item shall conform to the relevant Provisions of Subsection 748 of the Standard Specifications and is intended to be used as a means of providing payment to the Contractor for mobilization and maintenance of traffic costs associated with emergency repairs to areas of deteriorated cement concrete in the existing reinforced concrete deck during construction as directed by the Engineer.

Note: The Contractor is required to commence emergency repair work within (4) four hours of notification.

METHOD OF MEASUREMENT

Item 748.1 will be measured for payment by the EACH notified emergency Work Order under which the Contractor meets the response requirements outlined.

In the event that another emergency occurs during the period that the Contractor's forces have been notified and are mobilizing or working, all additional responses performed by a different emergency response crew at a different work site during that period will be considered an additional emergency response in accordance to the requirements specified herein.

The Engineer will determine if conditions require another crew to be mobilized as a separate emergency response.

The Emergency Response item is not applicable if the emergency occurs during scheduled working hours.

BASIS OF PAYMENT

Item 748.1 will be paid at the Contract unit price per EACH, which shall include full compensation for all costs associated with ensuring a prompt response, including all labor, materials, and equipment required for mobilization and maintenance of traffic measures to perform the emergency repairs. Costs specific to the repair shall be paid under the respective Contract bid items included in this Contract, as required by the Engineer.

Damages will be assessed in the amount specified under NON-RESPONSE DAMAGES for each notified emergency Work Order the Contractor fails to report as required.

ITEM 805.41 4 INCH ELECTRICAL CONDUIT - RTRC FOOT

The work under this Item shall conform to the relevant provisions of Subsection 801 of the Standard Specification and the following:

The work under this Item consists of providing single and multiple exposed bullet-resistant Reinforced Thermosetting Resin Conduit (RTRC) utility conduits mounted to bridge structures as shown on the plans. This includes all vertical conduit sections attached to bridge structures. The plans are diagrammatic, and the Contractor shall determine the best location and means and methods of installation. The Contractor shall locate the steel reinforcement prior to coring.

Materials

RTRC type conduit shall be used where raceway system is above ground only at multiple bridge locations. Use of this type of conduit system shall be limited to short runs and above ground runs only; locations to be coordinated with field conditions.

The conduit shall be filament wound fiberglass reinforced epoxy as manufactured to comply with specifications outlined in NEMA TC-14. Conduit shall be free from defects including, but not limited to, delamination and foreign inclusions.

Conduit shall be uniform in color, density, and physical properties. It shall be straight with ends cut square to inside diameter. Conduit shall be pigmented black and be supplied with an ultraviolet inhibitor. Conduit shall have a wall thickness of 0.25", clear inside dimension of either 2" or 4" as specified on the plans and meet or exceed the following properties:

Ultimate Tensile Strength	11,000 PSI Min.
Ultimate Elongation	2%
Modulus of Elasticity	1,475,000 PSI
Thermal Expansion	1.5" Max/150'/100o F. Temp. CHG.
Dielectric Strength	500 Volts/MIL
Water Absorption	Less Than 1%
Specific Gravity	1.9-2.0
Glass Content	68% + 2%
Barcol Hardness	50
Operating Temp. Range	-50°F to 235°F

Fire Resistance

Vertical specimens of the finish conduit shall not flame for longer than 30 seconds following any of three 60-second applications of flame, the period between applications being thirty seconds. The conduit shall not be capable of igniting combustible materials in its vicinity during, between, or after the three applications of the test flame, when tested in accordance with Section 12 of UL 651.

ITEM 805.41 (Continued)

Construction Methods

Conduits shall be installed in accordance with applicable provisions of Subsection 801 of the Standard Specifications.

Jointing Method
Conduit shall be supplied with an integrally wound tapered bell and ground tapered spigot to be used with an adhesive. The joint shall be capable of withstanding a joint pullout force of 1,000 lb.

Fittings and Support Elements
Conduit shall be supplied with all fittings, elbows, expansion fittings (double expansion joints with o-rings), deflection fittings, adapters, and bends (sweeps) manufactured from the same materials as the conduit. Expansion fittings shall be furnished as required by the manufacturer and the National Electrical Code, Article 355.44, to allow for thermal expansion. Expansion fittings to be provided at all bridge deck expansion joints and locations shown on the Plans. Additional locations shall be coordinated with field conditions. Materials for bridge hanger attachment assemblies and wall mounted supports shall be as listed and detailed on the plans.

Cable being installed in RTRC conduit shall not exceed a maximum pulling force of 2,678lbs, or maximum sidewall pressure of 1,000lbs. As part of the shop drawing review Contractor shall provide cable pulling calculation for conductors being installed on bridge portion of the project only.

METHOD OF MEASUREMENT

Item 805.41 will be measured for payment by the FOOT of 4 inch electrical conduit – RTRC installed, complete in place.

BASIS OF PAYMENT

Item 805.41 will be paid for at the Contract unit price per Foot, which price shall include all labor, materials, equipment, and all incidental costs for fittings, elbows, expansion fittings, deflection fittings, utility hangers—which includes the bolts, top plate, and any other required materials, conduit installation, and minor repair of the bridge backwalls as needed.

ITEM 805.42 4 INCH TELEPHONE CONDUIT - RTRC FOOT
ITEM 805.51 5 INCH ELECTRICAL CONDUIT - RTRC FOOT

The work under Item 805.42 shall conform to the relevant provisions of Subsection 801 of the Standard Specifications, "Charter Communications/Spectrum Cable City of Worcester Standards," Verizon's standards and requirements(included herein as Document A00826), and the following:

Work under Item 805.51 shall conform to the relevant provisions of Subsection 801 of the Standard Specifications, the "National Grid Bridge and Overpass Conduit Support System Guidelines", and the following:

Materials

Conduits shall be Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) in conformance with NEMA TC-14. Conduits, expansion/deflection fittings, and other fittings shall conform to National Grid standards.

Construction Methods

Electrical Conduits shall be installed in accordance with National Grid standards and as shown in the Contract Documents. Telephone Conduits shall be installed in accordance with the utility owners'—Charter and Verizon—standards and as shown in the Contract Documents. The plans are diagrammatic and the Contractor shall determine the best location and means and methods of installation. The Contractor shall locate the steel reinforcement prior to coring.

METHOD OF MEASUREMENT

Items 805.42 and 805.51 will be respectively measured for payment by the FOOT of 4 inch telephone conduit – RTRC or 5 inch electrical conduit – RTRC installed, complete in place.

BASIS OF PAYMENT

Items 805.42 and 805.51 will be paid for at the respective Contract unit price per FOOT, which prices shall include all labor, materials, equipment and incidental costs for fittings, elbows, expansion fittings, deflection fittings, caps, utility hangers, bolts, top plate, conduit installation, and minor repair of the bridge backwalls as needed, and all incidental costs required to complete the work.

ITEM 816.81	**TEMPORARY TRAFFIC CONTROL SIGNAL**	**LUMP SUM**
ITEM 816.82	**TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 2**	**LUMP SUM**
ITEM 816.83	**TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 3**	**LUMP SUM**
ITEM 816.84	**TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 4**	**LUMP SUM**

The work under these Items shall consist of retiming each of the indicated signalized intersections to the timings indicated in the plans at the following locations for the duration of the detour route, and to restore the existing timings following completion of the detour route.

Item 816.81 Location No. 1: Vernon Street at I-290 Westbound Ramps
Item 816.82 Location No. 2: Vernon Street at I-290 Eastbound Ramps
Item 816.83 Location No. 3: Grafton Street at Water Street at Winter Street
Item 816.84 Location No. 4: Summer Street at Prospect Street at Thomas Street

Construction Methods

Existing signal installations shall be maintained in operation throughout the construction period and until the new signal timings are ready for operation. If an existing signal is to be turned off temporarily to allow for controller changes, a police detail shall be used to control traffic at the intersection until stop-and-go operation is restored. The Contractor shall minimize the amount of time that traffic control equipment is not operational and actively controlling traffic at the intersection, and the Contractor shall plan for and schedule the work accordingly. Unless called out to be adjusted in the Plans, existing signal equipment and settings shall be retained.

Documentation

Before implementation of the detour route, the Contractor shall record the existing traffic signal timings, phase/ring progression, and timing patterns and provide copies of the timing settings to the City of Worcester and MassDOT. The Contractor shall restore these existing traffic signal timings following completion of the detour route.

BASIS OF PAYMENT

Items 816.81, 816.82, 816.83, and 816.84 will be paid for at the respective Contract unit price per LUMP SUM, which prices shall include all labor, material, equipment, and all incidental costs required to complete the work to provide a working traffic control signal system at each location both for/during and following implementation of the detour route.

ITEM 816.89 TEMPORARY TRAFFIC CONTROL SIGNAL RECONSTRUCTION I-290 RAMP DETOURS LUMP SUM

The work under this Item shall consist of retiming up to 33 signalized intersections along the detour routes for the closures of the I-290 on-ramps asrequired by the Engineer. The traffic signals to be retimed shall be determined by direction of the Engineer, MassDOT, and the City of Worcester during construction. The anticipated number of intersections requiring traffic signal retiming per on-ramp closure are as follows:

- I-290 Eastbound On-Ramp from Vernon Street: Up to 5 intersections
- I-290 Eastbound On-Ramp from Mulberry Street: Up to 14 intersections
- I-290 Westbound On-Ramp from Belmont Street: Up to 14 intersections

The traffic signals shall be retimed per direction from the Engineer using timings provided by the Engineer, for the duration of the detour routes covering the affected traffic signals. Existing timings shall be restored following completion of the detour route covering the affected traffic signals. The Engineer will provide temporary traffic signal timings for each intersection in advance of implementation of the associated detour routes.

Construction Methods

Existing signal installations shall be maintained in operation throughout the construction period and until the new signal timings are ready for operation. If an existing signal is to be turned off temporarily to allow for controller changes, a police detail shall be used to control traffic at the intersection until stop-and-go operation is restored. The Contractor shall minimize the amount of time that traffic control equipment is not operational and actively controlling traffic at any given intersection, and the Contractor shall plan for and schedule the work accordingly. Unless called out to be adjusted in the Plans, existing signal equipment and settings shall be retained. The Contractor shall expedite work along I-290 requiring on-ramp closures to the extent possible in order to minimize the duration of closures and associated detour routes.

Documentation

Before implementation of the detour route, the Contractor shall record the existing traffic signal timings, phase/ring progression, and timing patterns and provide copies of the timing settings to the City of Worcester and MassDOT. The Contractor shall restore these existing traffic signal timings following completion of the detour route.

BASIS OF PAYMENT

Item 816.89 will be paid for at the Contract unit price per LIMP SUM, which price shall include all labor, material, equipment, and all incidental costs required to complete the work to provide a working traffic control signal system at all locations determined to require retiming during the ramp closures. It is assumed that up to thirty-three (33) signalized intersections will require temporary retimings and restoration to original traffic signal timings.

ITEM 823.70 HIGHWAY LIGHTING POLE AND LUMINAIRE REMOVED AND RESET EACH

The work under this Item shall conform to the relevant provisions of Subsections 801 and 820 of the Standard Specifications and the relevant provisions of Section 800 of the City of Worcester standards as described in the "The City of Worcester Department of Public Works & Parks Standard Construction Specifications and Details", dated March 1, 2023(Document A00825); the Construction Details; and the following:

Construction Methods

The work under this Item shall consist of removing and resetting the existing light poles, as shown on the plans. This work includes removing and stacking the existing light pole, removing the existing light pole base, installing the new light pole base and resetting the existing light pole in its new location, as shown on the plans. This work includes all fees and coordinating with the City of Worcester and National Grid to discontinue service, provide new pig tails at the new pole locations and re-energize. The State Contractor shall not be paying for any power usage billings, after an immediate inspection, all payment for power as well as new billing for new arm and luminaire will continue to the city payments.

The Contractor shall exercise extreme care in the dismantling, removal, transporting, storage, and resetting of the existing light poles, luminaires, and arms. Any equipment damaged or stolen through carelessness or lack of protection by the Contractor shall be replaced at no additional cost.

Work shall be in accordance with the latest edition of the National Electrical Code, Massachusetts Electrical Code, local codes and as required by the Engineer. All work shall be performed by an experienced licensed electrician licensed in the Commonwealth of Massachusetts, and qualified to perform work on utility poles in the Electrical Space.

The Contractor shall notify the Worcester Department of Public Works & Parks a minimum of 7 days prior to the light poles being removed and reset.

If the Town decides to abandon part or all the light pole, arm, and luminaire, said materials shall become the property of the Contractor and shall be legally disposed of.

METHOD OF MEASUREMENT

Item 823.70 will be measured for payment by the EACH highway lighting pole and luminaire removed and reset, complete in place.

BASIS OF PAYMENT

Item 823.70 will be paid for at the Contract unit price per EACH, which price shall include all labor, equipment, materials, and all incidental costs required to complete the work.

ITEM 852.11 TEMPORARY PEDESTRIAN BARRICADE FOOT
ITEM 852.12 TEMPORARY PEDESTRIAN CURB RAMP EACH

Description

Work under these Items consist of furnishing, deploying, maintaining in proper operating conditions, and removing temporary pedestrian barricades and temporary pedestrian ramps as part of a Temporary Pedestrian Access Route (TPAR) in order to guide pedestrians around a fully- or partially-closed sidewalk. These devices are intended to prevent pedestrians from entering the work area and to prevent pedestrians from inadvertently entering the vehicle travel lane by providing visual and physical separation between each space.

Materials

The Temporary Pedestrian Barricade shall have a continuous bottom rail or edge no more than two (2) inches above the ground and eight (8) inches in height (minimum) to accommodate cane users, have a smooth and continuous hand railing along the top edge no less than 32 inches above the ground and not obstruct or project into the pedestrian path of travel. Barricade walls shall be nearly vertical and generally within the same plane.

If exposed to traffic, Temporary Pedestrian Barricades shall be crashworthy.

The Temporary Pedestrian Curb Ramp shall provide a 48 inch minimum width, with a firm, stable, and non-slip surface. Protective edging with a two (2) inch minimum height shall be installed when the curb ramp or landing platform has a vertical drop of six (6) inches or greater.

The Temporary Pedestrian Curb Ramp walkway and landing area surface shall be of a solid, continuous, contrasting color abutting up to the existing sidewalk.

If a Temporary Pedestrian Curb Ramp leads to a crosswalk, a detectable warning pad must be used at the base of the ramp; if it leads to a protected path that does not conflict with vehicular traffic then a detectable pad shall not be used.

Construction Methods

The Temporary Pedestrian Barricade shall be placed in an area that will provide pedestrians with a TPAR on a smooth, continuous hard surface for its entirety. The geometry and alignment of the facility shall meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities" and the Massachusetts Architectural Access Board.

The recommended width of the TPAR is 60 inches, but if constraints exist a minimum clear width of 48 inches shall be provided along its entirety. If a 60 inch width cannot be accommodated in full, a 60 inch by 60 inch passing space shall be provided every 200 feet or less along the TPAR.

Turning areas shall be 60 inches by 60 inches minimum.

Lateral joints between any surfaces shall not exceed 0.5 inches. Lateral edges may be vertical up to 0.25 inches high and shall be beveled at 1V:2H between 0.25 inches and 0.5 inches.

The TPAR shall be kept clear of debris, snow, and ice and the Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall not obstruct drainage.

ITEMS 852.11 and 852.12 (Continued)

Removal and/or resetting of Temporary Pedestrian Barricades and Temporary Pedestrian Curb Ramps shall be considered incidental.

COMPENSATION

Payment for Temporary Pedestrian Barricades will be made at the Contract price per foot installed in place, including all incidental items. This price shall include the cost of furnishing, installing, resetting, removal, and maintaining in good working condition.

Payment for Temporary Pedestrian Curb Ramps will be made at the Contract price per each unit installed in place, including all incidental items. This price shall include the cost of furnishing, installing, resetting, removal, and maintaining in good working condition.

ITEM 853.21 TEMPORARY BARRIER REMOVED AND RESET FOOT

Work under this Item shall conform to the relevant provisions of Subsection 850 of the Standard Specifications and shall consist of removing, transporting and resetting temporary barrier systems from alignments established along the roadway to new alignments in accordance with the details shown on the plans, as required by the construction and staged construction operations and as required by the Engineer for the channelization of traffic and/or work zone protection.

The work shall also include furnishing and installing all hardware and associated materials per the details and/or manufacturer's specifications. The work shall also include necessary patches and repairs caused by the temporary barrier system to damaged pavement surfaces or any adjacent longitudinal barrier once the system has been removed.

Temporary barrier systems shall be removed from existing locations and reset in accordance to the construction methods stated in the respective barrier items.

Damage to the pavement surface or adjacent permanent barriers caused by removing or resetting temporary barrier shall be repaired as directed by the Engineer at the Contractor's expense.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 853.21 will be measured and paid by the FOOT, in place which shall provide full compensation for removing, relocating, resetting, realigning, and transporting maintaining the temporary barrier system. The Contractor will be paid for this Item each time the barrier is relocated either to a new work zone, to off-season storage, or back to the project from storage. The Contractor will not be separately compensated for any work necessary to maintain or re-align units or replace damaged units. No payment will be made for removing and resetting barriers for the purpose of gaining access to the construction work zone. No payment will be made for removing, relocating and resetting any barriers moved for the convenience of the Contractor.

For temporary barrier systems that require anchorage systems, the cost of furnishing, installing and removing the anchorage and hardware and the restoration of pavement surfaces or adjacent permanent barrier systems to facilitate anchorage shall be considered incidental to the cost of this Item.

ITEM 853.23 TEMPORARY BARRIER (TL-3) FOOT

Work under this Item shall conform to the relevant provisions of Subsection 850 and shall consist of furnishing, installing, maintaining and final removal of TL-3 temporary barrier systems for channelization of traffic and/or work zone protection.

Materials

The Contractor shall use a temporary barrier system that is listed on the Qualified Traffic Control Equipment List.

The Contractor may submit alternate materials to the Engineer for approval if the temporary barrier system meets the following criteria:

1. The system has been tested by an independent laboratory that is accredited by FHWA to crash test roadside hardware;
2. The system meets the minimum requirements of the AASHTO *Manual on Assessing Safety Hardware* (MASH) at Test Level (TL) 3 or higher; and
3. The system has a federal-aid eligibility letter from FHWA.

Copies of the testing results and the federal-aid eligibility letter shall be submitted and approved by the Engineer prior to procurement of an alternate temporary barrier system.

The Contractor shall supply shop drawings to confirm the available clear area behind the barrier equals or exceeds the maximum dynamic deflection of MASH Test 3-11 during testing procedures taken at an independent laboratory that is accredited by FHWA to crash test roadside hardware.

Delineators shall be installed on all temporary barrier systems in conformance with the relevant provisions of Subsection 850.69 and shall be incidental to the temporary barrier systems.

Temporary impact attenuators that are listed on the Qualified Traffic Control Equipment List shall be used whenever a blunt end of the temporary barrier system is facing traffic within the clear zone unless it is protected by a second barrier system or secured to a separate barrier system or bridge railing by a method approved by the manufacturer.

Construction Methods

Temporary barrier systems shall be placed in line with the drawings. Installation shall be per the manufacturer's specifications, details, and the approved shop drawings.

The Contractor shall not place any breaks in the temporary barrier system that will result in sections that are shorter than the stated minimum length-of-need (LON) under MASH Test 3-11. Exceptions shall be allowed for gate systems or changeable length segments placed over expansion joints if those barrier segment types have been tested and meet the minimum requirements of MASH Test 3-11 with the adjoining barrier system.

Within the LON section, temporary barrier systems shall only be placed on paved surfaces unless otherwise tested and certified under MASH TL-3 for those conditions.

ITEM 853.23 (Continued)

Damage to the pavement surface caused by the temporary barrier during installation, while in service, and/or during removal shall be repaired as required by the Engineer at the Contractor's expense.

METHOD OF MEASUREMENT

Items 853.23 will be measured by the FOOT, in place.

BASIS OF PAYMENT

Payment for work under this Item will be made at the Contract price per FOOT for temporary barrier installed in place, including all incidental items. This price shall include the cost of furnishing, installing, maintaining and final removal of all temporary barrier systems.

For temporary barrier systems that require anchorage systems, the cost of furnishing and installing the anchorage and hardware and the restoration of pavement surfaces or adjacent permanent barrier systems to facilitate anchorage shall be considered incidental to the cost of the item.

Payment for temporary barrier removed and reset will be made under Item 853.21.

ITEM 853.33 TEMPORARY BARRIER – LIMITED DEFLECTION (TL-3) FOOT

Description

Work under this Item shall conform to the relevant provisions of Subsection 850 and shall consist of furnishing, installing, maintaining and final removal of limited deflection TL-3 temporary barrier systems for channelization of traffic and/or work zone protection. Limited deflection temporary barrier systems shall have a maximum combined working width of 36 inches on Harrison Street and I-290 and 33 inches on Laurel Street which includes the width of the barrier plus the dynamic deflection and in all cases the clear area available behind the barrier shall be greater than the dynamic deflection of the barrier system. The barriers shall be used in areas where the available clear area behind the barrier systems to obstructions or vertical drop-offs is greater than the dynamic deflection of the barrier system.

Materials

The Contractor shall use a temporary barrier system that is listed on the Qualified Traffic Control Equipment List.

The Contractor may submit alternate materials to the Engineer for approval if the limited deflection temporary barrier system meets the following criteria:

1. The system has been tested by an independent laboratory that is accredited by FHWA to crash test roadside hardware;
2. The system meets the minimum requirements of the AASHTO *Manual on Assessing Safety Hardware* (MASH) at Test Level (TL) 3 or higher; and
3. The system has a federal-aid eligibility letter from FHWA.
4. The system meets the above envelope criteria.

Copies of the testing results and the federal-aid eligibility letter shall be submitted and approved by the Engineer prior to procurement of an alternate temporary barrier system.

The Contractor shall supply shop drawings to confirm the available clear area behind the barrier equals or exceeds the maximum dynamic deflection of MASH Test 3-11 during testing procedures taken at an independent laboratory that is accredited by FHWA to crash test roadside hardware.

Delineators shall be installed on all limited deflection temporary barrier systems in conformance with the relevant provisions of Subsection 850.69 and shall be incidental to the temporary barrier systems.

Temporary impact attenuators paid under Item 628.305 that are listed on the Qualified Traffic Control Equipment List shall be used whenever a blunt end of the limited deflection temporary barrier system is facing traffic within the clear zone unless it is protected by a second barrier system or secured to a separate barrier system or bridge railing by a method approved by the manufacturer.

ITEM 853.33 (Continued)

Construction Methods

Limited deflection temporary barrier systems shall be placed in line with the drawings. Installation shall be per the manufacturer's specifications, details, and the approved shop drawings.

The Contractor shall not place any breaks in the limited deflection temporary barrier system that will result in sections that are shorter than the stated minimum length-of-need (LON) under MASH Test 3-11. Exceptions shall be allowed for gate systems or changeable length segments placed over expansion joints if those barrier segment types have been tested and meet the minimum requirements of MASH Test 3-11 with the adjoining limited deflection barrier system.

Within the LON section, limited deflection temporary barrier systems shall only be placed on paved surfaces unless otherwise tested and certified under MASH TL-3 for those conditions.

Damage to the pavement surface caused by the limited deflection temporary barrier during installation, while in service, and/or during removal shall be repaired as required by the Engineer at the Contractor's expense.

METHOD OF MEASUREMENT

Item 853.33 shall be measured for payment by the FOOT complete in place.

BASIS OF PAYMENT

Payment for work under this Item will be made at the Contract price per FOOT for limited deflection temporary barrier installed in place, including all incidental items. This price shall include the cost of furnishing, installing, maintaining and final removal of all limited deflection temporary barrier systems.

For limited deflection temporary barrier systems that require anchorage systems, the cost of furnishing and installing the anchorage and hardware and the restoration of the proposed bridge deck, pavement surfaces or adjacent permanent barrier systems to facilitate anchorage shall be considered incidental to the cost of the item.

Payment for limited deflection temporary barrier removed and reset will be made under Item 853.331.

ITEM 853.331 TEMPORARY BARRIER – LIMITED DEFLECTION (TL-3) REMOVED AND RESET FOOT

Description

Work under this Item shall conform to the relevant provisions of Subsection 850 of the Standard Specifications and shall consist of removing, transporting and resetting temporary barrier (TL-3) systems from alignments established along the roadway to new alignments in accordance with the details shown on the plans, as required by the construction and staged construction operations and as required by the Engineer for the channelization of traffic and/or work zone protection.

The work shall also include furnishing and installing all hardware and associated materials per the details and/or manufacturer's specifications. The work shall also include necessary patches and repairs caused by the temporary barrier system for the damaged pavement surfaces or any adjacent longitudinal barrier once the system has been removed.

Temporary barrier – Limited Deflection (TL-3) systems shall be removed from existing locations and reset in accordance to the construction methods stated in the respective barrier items.

METHOD OF MEASUREMENT

Item 853.331 will be measured for payment by the FOOT of temporary barrier – limited deflection(TL-3) removed and reset.

BASIS OF PAYMENT

Item 853.331 will be paid for at the Contract unit price per FOOT, which price shall include full compensation for removing, relocating, resetting, realigning, transporting and maintaining the temporary barrier – limited deflection (TL-3) system. The Contractor will be paid for this Item each time the barrier is relocated either to a new work zone, or to off-season storage, and back to the project from storage. The Contractor will not be separately compensated for any work necessary to maintain or re-align units or replace damaged units. No payment will be made for removing and resetting barriers for the purpose of gaining access to the construction work zone. No payment will be made for removing, relocating and resetting any barriers moved for the convenience of the Contractor.

For temporary barrier systems– limited deflection that require anchorage systems, the cost of furnishing, installing and removing the anchorage and hardware and the restoration of pavement surfaces or adjacent barrier systems to facilitate anchorage shall be considered incidental to the cost of this Item.

ITEM 853.8 TEMPORARY ILLUMINATION FOR WORK ZONE DAY

The work under this Item shall conform to the relevant provisions of Subsection 850 of the Standard Specification and the following:

The work under this Item shall include furnishing, deploying and maintaining in proper operating condition a LED balloon diffuser lighting system. These portable light towers shall be used throughout the project area for temporary work zone lighting. The use of unshielded high wattage flood lights shall not be permitted.

These towers shall be used, relocated and adjusted to meet the criteria in Subsection 850 of the Standard Specifications and the following:

The Contractor shall illuminate the following work zone areas:

- Change in direction (i.e., work zone entrances and exits, crossovers, etc.)
- Tapered areas
- Actual area where the construction is being performed

Light measurement shall be based on the illuminance method and the lighting levels shall be based on the classification of construction activity that is taking place. At no time shall the light level be below 5 fc and the uniformity shall not exceed 6:1. Task Classifications and recommended illumination levels is shown in Table 1.

Task Classifications	Illuminatio n Level	Average Minimum Maintained Illuminance
All work operations areas, setup of lane or road closures, lane closure tapers, and flagging stations, such as: Excavation (all types), Embankment Fill and Compaction, Reworking Shoulders, Asphalt Pavement Rolling, Subgrade, Stabilization and Construction, Base Course Rolling, Sweeping, Cleaning and Landscaping.	Level I	5 foot-candles
Areas on or around construction equipment; asphalt paving, milling, and concrete placement and/or removal, such as, Milling, Removal of Pavement, Asphalt Paving and Resurfacing, Concrete Pavement, Waterproofing and Sealing, Sidewalk Construction, Base Course Grading and Shaping, Surface Treatment, Bridge Decks, Drainage Structures and Drainage Piping, Other Concrete Structures, Barrier Wall and Traffic Separators, Guardrails and Fencing, Striping and Pavement Markings, Repair of Concrete Pavement, Highway Signs, Hole Filling and Repair of Guardrails and Fencing.	Level II	10 foot-candles
Pavement or structural crack/ pothole filling; joint repair, pavement patching and/or repairs, installation of signal/electrical/mechanical equipment, such as, Traffic Signals, Highway Lighting Systems and Crack Filling	Level III	20 foot-candles

TABLE 1
TASK CLASSIFICATIONS AND ILLUMINATION LEVELS

ITEM 853.8 (Continued)

Prior to commencement of work the Contractor shall submit to MassDOT for approval a description of illumination equipment that is proposed to be used on this project, and shall include photometrics that detail the light levels that are to be provided for the particular operation for the type of equipment, level of luminance and height to be installed.

Any potential glare from the lighting system should be considered from each direction and on all approaching roadways and opposing lanes of traffic. Glare from the illumination system should be minimized as much as possible for both workers and motorists in adjacent active travel lanes. If necessary, the Contractor shall provide supplemental hardware, such as, visors, louvers, shields, glare screen and barrier to reduce glare in adjacent active travel lanes.
Equipment mounted lighting may be used to supplement light towers to achieve the required lighting levels for the activity involved per Table 1.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 853.8 will be measured and paid for at the Contract unit price per DAY. The cost shall include all labor, materials, equipment, tools and all incidentals required for the design and installation of the work zone lighting system. This shall include, but not be limited to lighting submission preparation, wiring connections, equipment relocations, and include all material and labor incidental for a complete, functional and operational work zone illumination system.

The price of this Item shall include the material and labor necessary to install any supplemental hardware required to reduce glare on all adjacent active travel lanes.

The per day price shall be full compensation for all “Temporary Illumination for Work Zone” regardless of the number of concurrent work areas, amount of equipment concurrently in use or the durations of or changes of the work shifts per day.

Furnishing, Installing, resetting, modifying and removing equipment for work zone illumination shall be incidental to Item 853.8.

ITEM 854.6 TEMPORARY PORTABLE RUMBLE STRIP DAY

Work under this Item consists of furnishing, deploying, maintaining in proper operating conditions, and removing temporary portable rumble strips (TPRS) for temporary lane closures of 24 hours or less.

MATERIALS

The TPRS shall be 10’ to 11’ wide, measured perpendicular to the path of travel, 12” to 16” long, measured parallel to the path of travel, and 0.5” to 0.75” tall. All edges shall be beveled. The surfaces shall be grooved to limit potential hydroplaning.

The TPRS shall lay flat on the road surface without the use of nails, anchors, or adhesives, and shall be flexible so as to conform to the surface profile.

The TPRS shall be able to withstand vehicle weights of up to 80,000 lbs. and operate in temperatures between 0° to 120° F.

The manufacturer shall certify the TPRS to be safe for use on roads with speed limits of at least 70 mph.

TPRS that appear damaged or functioning in an unsafe manner may be order removed by the Engineer and replaced at no additional cost.

CONSTRUCTION METHODS

The TPRS shall be installed per the plans or at the discretion of the Engineer.

The Contractor shall conform to the manufacturer’s specifications for installation and the following:

A. The road surface shall be cleared of all gravel, sand, and debris.

B. If RoadQuake 2™ model is used, the modular pieces shall be assembled into 11-foot strips per the manufacturer’s instructions in advance of deployment. The interconnected segments shall form a smooth and flat, continuous section.

C. A Truck-Mounted Attenuator, conforming to Subsection 850, shall be used as shadow vehicle protection during the deployment and removal of TPRS on any roadway with speeds of 45 mph or greater.

D. TPRS shall be deployed in conjunction with all other temporary traffic control devices. MA-W28-1 (Rumble Strips Ahead) sign(s) shall be installed per the Temporary Traffic Control Plan.

ITEM 854.6 (Continued)

E. TPRS deployment:

1. TPRS shall be placed perpendicular to the direction of travel, centered in the lane.
2. Three (3) individual strips are required for a single array.
3. Refer to the Temporary Traffic Control Plan for the location of the array respective to the lane closure.
4. The spacing of the individual strips within the array shall conform to the following table:

Speed Limit	Distance Between Rumble Strips (measured center-to-center)
>55 mph	20 feet
40 mph to 55 mph	15 feet
<40 mph	10 feet

5. The TPRS shall be placed without the use of nails, adhesives, or other methods of affixing them to the road surface.

F. All TPRS shall be maintained in proper condition, alignment, spacing, and location throughout the duration of the lane closure, at no additional cost.

G. The TPRS shall be removed prior to the removal of the traffic control devices used to close the travel lane.

H. TPRS shall not be used during snow events.

METHOD OF MEASUREMENT

An array of three (3) temporary portable rumble strips is considered one (1) unit and will be measured by the day. Each period of up to 24 hours during which this unit is in use will be measured as one day regardless of the number of times the array is deployed, repositioned, or removed.

BASIS OF PAYMENT

Temporary Portable Rumble Strips will be paid for at the Contract unit price per day, which shall include full compensation for furnishing, deploying, repositioning, and removing the array of three (3) individual strips as required by the Engineer.

ITEM 864.33	**SLOTTED PAVEMENT MARKER TWO-WAY WHITE/RED**	**EACH**
ITEM 864.34	**SLOTTED PAVEMENT MARKER TWO-WAY YELLOW/RED**	**EACH**

Description

Work to be done under these Items shall consist of furnishing and installing two-way white and red and two-way yellow and red reflectorized slotted pavement markers in the pavement surface on I-290 and associated ramps in accordance with the Sign and Pavement Marking Plans, the relevant provisions of Subsection 860 of the Standard Specifications, Traffic Standards TR.6.2 "Raised Pavement Markings for Freeways" in the 1996 Construction and Traffic Standard Details and the following:

White/Red markers shall be installed along the broken white lines (skip lines) at the midway point between successive skip lines at 80-foot intervals on the mainline.

White/Red markers and Yellow/Red markers shall be installed at 20-foot intervals along the solid lines along the I-290 ramps where the existing striping is to be restored following implementation of temporary striping during work setups on I-290. The choice of yellow or white shall match the existing stripe color that the marker is installed along or as designated in the plans.

Materials

Slotted pavement marker material must be listed in the MassDOT Qualified Traffic Control Equipment for Reflectorized Pavement Markings provided on the website below:

https://www.mass.gov/doc/section-860-reflectorized-pavement-markings/download

Construction Methods

Reflectorized markers shall be installed along the pavement marking lines as described above. (Typical locations shown per the Traffic Standards TR.6.3 in the 1996 Construction and Traffic Standard Details)

The work shall include cutting the tapered pavement slot, application of the manufacturer's recommended epoxy adhesive and placing the reflectorized pavement marker in the proper position within the slot so that the white or yellow reflectorized face is visible and perpendicular to oncoming traffic and so that the top of the marker is set 1/4 to 1/8 inch below the top of the adjacent pavement. The red reflectorized face shall be visible from the opposite direction as visibility of the white reflectorized face. Surface preparation and installation shall be strictly in accordance with the manufacturer's instructions.

ITEMS 864.33 and 864.34 (Continued)

METHOD OF MEASUREMENT

Items 864.33 and 864.34 will be respectively measured for payment by the EACH slotted pavement marker two-way white/red or slotted pavement marker two-way yellow/red installed.

BASIS OF PAYMENT

Items 864.33 and 864.34 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, materials, equipment for cutting the tapered pavement slot, furnishing and installation of the reflectorized markers, and all incidental costs required to complete the work.

ITEM 864.41 GREEN COLORIZED PAVEMENT MARKINGS SQUARE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 860 of the Standard Specifications and the following. The work under this Item consists of furnishing and installing Colorized Pavement Markings at the locations shown on the plans or as required by the Engineer.

Materials

Colorized Pavement Markings are composed of Epoxy, Methyl Methacrylate (MMA), or Preformed Thermoplastic Materials.

The initial daytime chromaticity coordinates for green colorized pavement shall fall within the area created by the following coordinates:

Initial Daytime Chromaticity Coordinates (Corner Points) for Green Colorized Pavement Markings				
	1	2	3	4
x	0.230	0.266	0.367	0.367
y	0.714	0.460	0.480	0.583

The surface of the Colorized Pavement Markings shall provide a minimum skid resistance value of 55 British Pendulum Number (BPN) when tested in accordance with ASTM E303.

The Contractor shall provide a Certificate of Compliance verifying the product supplied meets the specified daytime chromaticity requirements and friction requirements prior to installation.

Construction Methods

The Contractor shall supply Shop Drawings to the Engineer for approval a minimum of 30 days in advance of installation. Shop Drawings shall include the product manufacturer's instructions, material safety data sheets (MSDS) for all components including any primers and sealers, and all tools, equipment, and procedures to be used for the installation. No work shall commence until the Shop Drawings have been approved.

It shall be the responsibility of the Contractor to prepare the surface prior to the installation of any Colorized Pavement Markings. Any joints or cracks in the pavement shall be pre-treated per the manufacturer's recommendation. The surface shall be clean and dry prior to installation of the system. If additional surface preparation is recommended by the manufacturer, such as the installation of a primer or preheating, it shall be completed per the manufacturer's specifications. All surface preparation shall be considered incidental to the cost of the item.

Any existing pavement markings that conflict with the Colorized Pavement Markings shall be removed by the Contractor in advance of installation; installation of colorized pavement over pavement markings shall not be allowed. All existing pavement markings that are to remain, castings, curbs, and rumble strips within the vicinity of the colorized pavement application shall be covered and protected by the Contractor. Existing pavement markings damaged by the Colorized Pavement Markings installation shall be removed and replaced by the Contractor at no additional cost.

The Contractor shall follow all installation instructions from the manufacturer, including allowable ranges of temperature and humidity for installation, unless otherwise approved by the Engineer.

ITEM 864.41 (Continued)

Upon completion of installation, a sealer shall be applied if recommended by the manufacturer. The sealer shall be installed per the manufacturer's specification. The application of a sealer shall be considered incidental to the cost of the item.

The Contractor shall maintain protection of the Colorized Pavement Markings installation from vehicle and foot traffic throughout the minimum cure time recommended by the manufacturer.

METHOD OF MEASUREMENT

Item 864.41 will be measured for payment by the SQUARE FOOT of Colorized Pavement Markings installed, complete in place.

BASIS OF PAYMENT

Item 864.41 will be paid for at the Contract unit price per SQUARE FOOT, which price shall include all material, labor, equipment, and all incidental costs required to complete the work.

ITEM 864.906 PERMANENT PAVING MARKING – 6 INCH (TAPE) FOOT

The work under this Item consists of furnishing materials and the applications of reflectorized pavement markings on the bridge deck in accordance with the MUTCD and Subsection 860 of the Standard Specifications.

Materials

General
All paving marking tape used on this project shall be lead-free.

The preformed patterned markings shall consist of white or yellow films with pigments selected and blended to conform to standard highway colors. Glass beads shall be incorporated to provide immediate and continuing retroreflection.

Preformed words and symbols shall conform to the applicable shapes and sizes as outlined in the "Manual on Uniform Traffic Control Devices for Streets and Highways."

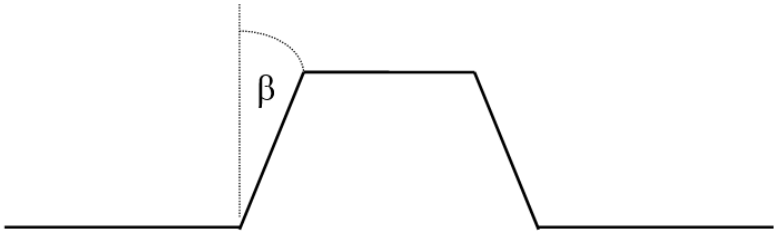
The Contractor shall supply Shop Drawings to the Engineer for approval a minimum of 30 days in advance of installation. Shop Drawings shall include the product manufacturer's instructions, material safety data sheets (MSDS) for all components including any primers and sealers, and all tools, equipment, and procedures to be used for the installation. No work shall commence until the Shop Drawings have been approved.

The preformed markings shall be capable of being adhered to asphalt cement concrete and Portland cement concrete by a pre-coated pressure sensitive adhesive. A surface preparation adhesive may be used to precondition the pavement surface. The preformed markings shall conform to pavement contours by the action of traffic. After application, the markings shall be immediately ready for traffic. The bidder shall identify proper surface preparation adhesives (where necessary) to be applied at the time of application, all equipment necessary for proper application, and recommendations for application that will assure effective product performance. The preformed markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

The marking shall be a general purpose pliant polymer material for preformed longitudinal, transverse, and symbol and legend markings.

Composition
The retroreflective pliant polymer pavement markings shall consist of a mixture of high-quality polymeric materials, pigments and glass beads distributed throughout its base cross-sectional area, with a reflective layer of glass beads bonded to a durable polyurethane topcoat surface. The patterned surface shall have approximately 50% ± 15% of the surface area raised and presenting a near vertical face (ß angle of 0° to 60°) to traffic from any direction. (See diagram below.) The channels between the raised areas shall be substantially free of exposed beads or particles.

ITEM 864.906 (Continued)



Reflectance

The white and yellow markings should be no less than the following expected initial average retroreflectance values as measured in accordance with the testing procedures of ASTM D4061. The photometric quantity to be measured shall be coefficient of retroreflected luminance (R_L) and shall be expressed as millicandelas per square foot per foot-candle [(mcd • ft^{-2}) • fc^{-1}]. The metric equivalent shall be expressed as millicandelas per square meter per lux [(mcd • m^{-2}) • lx^{-1}]. The test distance shall be 100 feet (30 m).

EXPECTED INITIAL AVERAGE REFLECTANCE

	White	Yellow
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retroreflected Luminance R_L (mcd • ft^{-2}) • fc^{-1})	300	250

*These retroreflectance values are based on dark room photometric readings per ASTM D4061, and a test instrument using an Entrance Angle of 88.76° and Observation Angle of 1.05° which represent a simulated driver viewing geometry at a 30 meter distance.

Beads

The size, quality and refractive index of the glass beads shall be such that the performance requirements for the markings shall be met. The bead adhesion shall be such that beads are not easily removed when the material surface is scratched.

Color

The preformed markings shall consist of white and yellow films with pigments selected and blended to conform to standard highway colors. The color of each section of tape shall conform with the color specified on the plans.

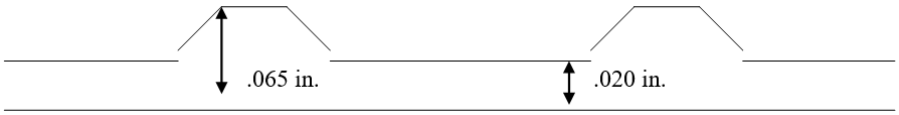
Skid Resistance

The patterned surface of the retroreflective pliant polymer shall provide an initial average skid resistance value of at least 45 BPN when tested according to ASTM E303 except values shall be taken in one direction and then at a 45° angle from that direction. These two values shall then be averaged to find the skid resistance of the patterned surface.

ITEM 864.906 (Continued)

Patchability
The pavement marking material shall be capable of use for patching worn areas of the same type in accordance with manufacturer's instructions.

Thickness
The patterned material without adhesive shall have a minimum caliper of 0.065 inch (1.651mm) at the thickest portion of the patterned cross-section and a minimum caliper of 0.02 inch (.508mm) at the thinnest portion of the cross-section.



Construction Methods

All equipment used for the application of paving markings shall be approved by the Engineer and shall be of standard commercial manufacture. All equipment and devices necessary for the protection of the paving marking and the traveling public shall be approved by the Engineer.

Marking configurations shall be in accordance with the "Manual on Uniform Traffic Control Devices." The markings shall be applied during the final pavement marking striping of the project, following removal of all temporary markings. These markings shall be overlaid on existing pavement surfaces in accordance with the manufacturer's installation instructions. The paving marking equipment shall be operated in accordance with the manufacturer's recommendations.

The paving marking equipment shall be operated in accordance with the manufacturer's recommendations.

The pavement marking, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The film shall be weather-resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of the marking and shall show no significant tearing, roll back or other signs of poor adhesion.

ITEM 864.906 (Continued)

METHOD OF MEASUREMENT

Item 864.906 will be measured for payment by the FOOT of the actual length of lines applied, complete in place.

The lengths of solid lines will be obtained by:

1. Calculation from established base line stations; or
2. Use of a measuring wheel; or
3. Vehicle odometer readings.

The length of broken lines (except for broken lines less than 10 ft, the actual length shall be used) will be obtained by using 25% of the results obtained above for solid lines. Patterns, other than lines, are to be paid for by the square foot area under the item in the Contract.

BASIS OF PAYMENT

Item 864.906 will be paid for at the Contract unit price per FOOT, which price shall include all material, labor, equipment, and all incidental costs required to complete the work.

ITEM 866.206	**6 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED)**	**FOOT**
ITEM 866.212	**12 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED)**	**FOOT**
ITEM 867.206	**6 INCH REFLECTORIZED YELLOW LINE (POLYUREA) (RECESSED)**	**FOOT**

The work under these Items shall conform to the relevant provisions of Subsection 860 of the Standard Specifications and the following:

Work shall consist of the following major activities:

- Cutting or grinding recessed grooves or slots in the pavement, and
- Installing white or yellow pavement markings in the recessed grooves, and
- Periodically measuring and reporting the performance of the pavement markings.

Materials

All work shall be done in accordance with the Material Supplier's specifications and the following:

Polyurea shall be one of the following products, or approved equivalent:

1. 3M Series 5000 Liquid Pavement Markings; or
2. Ennis-Flint HPS-5; or
3. Epoplex LS90.

All Liquid Pavement Marking Materials shall have 'no-track times' of 10 minutes or less. Material certification shall be submitted to the resident engineer before all applications.

All Pavement Marking shall conform to ASTM D6628 (*Standard Specification for Color of Pavement Marking Materials*).

Wet Reflective Element products for Liquid Pavement Markings shall be specified by the Material Supplier in order to meet the Pavement Marking Performance subsection of this specification.

All Pavement Marking Materials including reflective elements shall be free of heavy metals.

Construction Methods for Installation of Groove

The Contractor shall not cut the recessed grooves without the approval of the Engineer. Prior to cutting the recessed grooves for any lines, the Contractor shall layout the proposed lines on the pavement surface. The Contractor shall use a chalk line or other suitable method to mark the proposed layout. The Contractor may cut the recessed grooves upon approval of the proposed layout by the Engineer.

ITEMS 866.206, 866.212 and 867.206 (Continued)

Grooves shall be positioned so that there shall be a minimum of 4 inches from the edge of the pavement marking to any longitudinal pavement joints. Grooves shall not be installed on bridge joints, at drainage structures, or in other areas identified by the Engineer. For intermittent pavement markings (ie: broken or dotted lane lines), grooves shall be cut in the same intermittent pattern. Grooves for such pavement markings shall not be cut as a single continuous groove, but shall be cut only where markings will be applied.

The Contractor shall cut or grind each groove to the correct depth, width, and length as specified and in proper alignment. For use with Liquid Pavement markings, grooves for 6 inch lines shall be 7 inches ±¼ inch wide, and grooves for 12 inch lines shall be 13 inches ± ¼ inch wide. Grooves may extend no more than 1 inch beyond the length of the marking on either end.

Groove depth and tolerance shall be determined by the pavement marking material supplier. Where no depth or tolerance is specified, the following will apply:

Material	Groove Depth	Tolerance
Polyurea	80 mils	± 5 mils

The Engineer will inspect all recessed grooves prior to installing any marking material. The depth of the groove will be taken at the center line of the proposed marking. The Contractor shall provide depth plates to the Engineer for such inspection.

The Contractor shall use a gang-stacked diamond cutting blade device to cut or grind flat, smooth, and square grooves, to the depth and tolerance specified. Blades and spacers in the cutting head shall be configured such that the bottom of the cut shall be smooth and uniform, with no more than a 10 mil difference between the bottom and top of the cut surface. The acceptability of the surface texture will be determined by the Engineer and/or Material Supplier's Technical Representative.

The diamond grinder shall be equipped with an articulated cutting head so that the recessed grooves are cut correctly on grades and super elevated sections. The diamond grinder shall be equipped with shrouds and a vacuum apparatus to remove the spoil from the grinding operation. The Contractor shall dispose of all spoil material off-site.

The Contractor shall repair any grooves that are deeper or wider than the specified allowable limits, using the Department's approved repair procedure at no additional cost to the Department. The Contractor shall repair any grooves that are out of alignment using the same procedure. Grooves that are too shallow or too narrow shall be reground to the specification limits at no additional cost to the Department.

The Contractor shall clean the recessed grooves prior to the application of pavement markings. Grooves shall be clean, dry and free of any contaminants. The Contractor shall prevent traffic from traversing the grooves, and re-clean grooves where necessary or where directed.

ITEMS 866.206, 866.212 and 867.206 (Continued)

Construction Methods for Installation of Durable Pavement Markings

Application of liquid pavement markings and reflective elements shall be per the Material Supplier's specifications in order to meet the minimum initial retroreflectance levels described herein. A Technical Representative from the Material Supplier shall be present for the first liquid pavement marking installation shift to provide quality assurance/quality control.

Prior to the first application of liquid pavement markings, one or more test strips shall be constructed at a location designated by the Engineer. Each test strip shall consist of approximately 500 linear feet each of white and yellow liquid pavement markings. Pavement markings shall be surface applied; no groove is required for the test strip.

The purpose of the test strip(s) is to demonstrate the capability of the proposed liquid pavement marking material, equipment, and installation procedures to comply with the specifications for uniform wet thickness, dry time, reflective element application and retention, marking width, and overall appearance (color uniformity and clean, well-defined edges).

A test strip shall be required for each applicator unit used. Additional test strips may be required when major equipment repairs or adjustments are made or if the application of the liquid pavement markings fails to comply with these specifications.

The cost of applying the test strip(s) shall be considered incidental to the cost of the item.

Upon acceptance of the test strip(s) by the Engineer, the Contractor will be permitted to proceed with the application of the liquid pavement markings.

The Contractor shall install pavement marking material in accordance with the Material Supplier's specifications. Where no minimum uniform wet thickness is specified, the following will apply:

Material	Uniform Wet Thickness	Tolerance
Polyurea	25 mils	± 2 mils

The Line Thickness for all materials shall be met across at least the middle ⅔ of the pavement marking width. The Contractor shall provide depth plates to the Engineer for such inspection.

The Contractor shall apply/install reflective elements in liquid pavement markings as per the Material Supplier's specifications.

Newly installed markings shall be protected from tracking during the setting period per Subsection 860.63 of the Standard Specifications.

ITEMS 866.206, 866.212 and 867.206 (Continued)

Pavement Marking Performance

Incidental to the cost of these items, the Contractor shall measure the average retroreflectance of the pavement markings, and report the results to the Engineer. The Contractor shall take retroreflectance measurements at the following three times:

1. Initial (between 7 and 14 days from date of application); and
2. 6 Months (182 days, ± 14 days from initial application); and
3. 1 Year (365 days, ± 14 days from initial application).

The Contractor shall provide temporary traffic control setups for the retroreflectance measurements. Traffic control items under Subsection 850 of the Standard Specifications will be measured and paid for normally as part of the Contract. Should the 6-month or 1-year measurement fall beyond the physical completion date, the Department will provide temporary traffic control setups for those measurements at no cost to the Contractor.

The Contractor shall measure and report the retroreflectance of the pavement markings in accordance with the following testing methods and procedures:

1. ASTM D7585 *Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments*; and
2. ASTM E2177 *Standard Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Wetness*; and
3. ASTM E2832 *Standard Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Continuous Wetting*.

The Contractor shall use properly calibrated measuring devices to perform the required measurements and provide evidence of such calibration to the Engineer along with the results of the measurements.

The average Initial retroreflectance readings shall meet or exceed the following minimum values for all pavement marking materials installed under these items:

	White Markings	Yellow Markings
Observation Angle	1.05º	1.05º
Entrance Angle	88.8º	88.8º
ASTM D7585 (Dry)	600 mcd/lux/m^2	400 mcd/lux/m^2
ASTM E2177 (Wet Recovery)	400 mcd/lux/m^2	300 mcd/lux/m^2

During the Initial testing, if the average of the three readings for a line within the one mile segment falls below the specified minimum values, additional readings following the same methodology shall be taken in an adjacent one mile segment. If the average retroreflectance values in the adjacent mile segment also fall below the specified minimum values, the pavement marking shall be removed by an approved method and reapplied at no cost to the Department.

ITEMS 866.206, 866.212 and 867.206 (Continued)

Readings taken at the 6 Month and 1 Year intervals are for MassDOT Highway informational purposes only. Average readings that fall below the specified minimum values will not require additional testing or pavement marking removal and reinstallation.

Pavement Marking Asset Management

Upon completion of the pavement marking installation, the following data shall be tabulated by the Contractor:

1. Date(s), time(s), and location(s) of test strip installation;
2. Retroreflectance readings from test strip(s), by ASTM test method;
3. Liquid binder type(s) and application rate;
4. Reflective element type and drop rate;
5. Date of groove installation;
6. Depth of groove;
7. Date and time of final pavement marking installation;
8. Highway location (including direction) of installation;
9. Air and pavement temperature during application;
10. Measured material application thickness, depth of groove; and
11. Any other pertinent information that may assist MassDOT with Quality Control.

Results for all readings shall be provided within 10 business days of testing to the Engineer, with a second copy sent to:

State Traffic Engineer
Attention: Pavement Marking Retroreflectivity Testing
10 Park Plaza, Room 7210
Boston, MA 02116

METHOD OF MEASUREMENT

Items 866.206, 866.212, and 867.206 will be respectively measured in accordance with Subsection 860.80 of the Standard Specifications.

BASIS OF PAYMENT

Items 866.206, 866.212, and 867.206 will be paid for at the respective Contract unit price per FOOT, which prices shall include all labor, materials, equipment, and all incidental costs required to complete the work.

No separate payment will be made for measuring the pavement marking performance, but all costs in connection therewith shall be included in the Contract unit price bid for the respective item.

ITEM 871.9 MOTORIZED TRAFFIC DATA MONITORING PROGRAM LUMP SUM

The work under this Item shall conform to the relevant provisions of Subsection 871 of the Standard Specifications and the following:

The Contractor's traffic signal technician shall periodically monitor motor vehicle traffic volumes and intersections using portable traffic data collection devices, and provide recommendations for mitigative retiming and/or temporary lane reconfigurations based on the results of the Contractor's review of traffic operations during construction. The Contractor's traffic signal technician shall provide a traffic monitoring plan prior to the start of construction outlining intended study locations and methodology.

BASIS OF PAYMENT

Item 871.9 will be paid for at the Contract unit price per LUMP SUM, which price shall include all labor including design efforts and agency coordination efforts, materials, documentation including distributed reports and plans, equipment including traffic monitoring devices, data processing, and all incidental costs required to complete the work throughout the project duration.

ITEM 874.1 STREET SIGN REMOVED AND RESET EACH
ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET EACH

The work under these Items shall conform to the relevant provisions of Subsection 840 of the Standard Specifications and the following:

The work under Item 874.1 consists of removing, dismantling, transporting, and resetting the existing street name signs and their supports to new locations as shown on the Plans or as required by the Engineer.

The work under Item 874.2 consists of removing, dismantling, transporting, and resetting the existing street, warning, regulatory and miscellaneous signs and their supports to new locations as shown on the Plans or as required by the Engineer.

The sign panels shall be stored at an appropriate location to prevent damage until ready to be installed in the new locations.

The Contractor shall replace at their own expense, all sign panels and supports that are damaged or lost either directly or indirectly as a result of his actions.

If the Engineer determines the existing sign panel is unsuitable for reuse, a new sign panel equal to the existing sign panel, shall be furnished by the Contractor.

Materials

Materials for traffic signs, street name signs, and miscellaneous signs removed and reset shall be the existing signs. If in the opinion of the Engineer, the existing sign panel is unsuitable for reuse, a new sign panel of a size and composition equal to the existing sign panel, shall be furnished, as required by the Engineer.

Construction Method

The sign shall be mounted in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the 1990 Standard Drawings for Signs and Supports.

When the visibility of the relocated sign panels and/or street name panels is obstructed by trees and other vegetation, the Contractor shall clear the obstruction for proper sight distance. All clearing shall be done within the roadway layout, as approved by the Engineer. This work shall be incidental to these Items.

Sign panels and street name sign panels to be removed and reset shall be cleaned before being reset. Damage during removal or resetting to any sign panel designated for reuse by the Engineer shall be repaired or replaced by the Contractor at their own expense.

Any excavation made for removal of the existing sign or foundation and any resulting depression shall be backfilled with selected excavated material and the surface restored to match the adjacent materials.

ITEMS 874.1 and 874.2 (Continued)

The Contractor shall furnish and install all necessary mounting fixtures (nuts, bolts and other miscellaneous items) required to complete the work.

METHOD OF MEASUREMENT

Items 874.1 and 874.2 will be respectively measured for payment by the EACH street sign or traffic sign removed and reset, complete in place.

BASIS OF PAYMENT

Items 874.1 and 874.2 will be paid for at the respective Contract unit price per EACH, which prices shall include all labor, tools, materials, equipment, and all incidental costs, for doing all the work including excavation, backfill, removal and stacking of posts, stacking or disposal of existing sign foundations involved in removing and resetting signs, and gravel compaction and the restoration or replacement in kind of disturbed surfaces. The price shall also include all necessary mounting fixtures (nuts, bolts and other miscellaneous items) to complete the work.

If required by the Engineer, new sign posts for Traffic Signs shall be paid for separately under Item 847.1.

If required by the Engineer, new Traffic Sign panels shall be furnished, installed and paid for under Item 832, and new Street Name Sign panels shall be furnished, installed, and paid under Item 874.

The cost of any work or materials required, due to the Contractor's operation, for either Item shall be paidby the Contractor without additional compensation.

ITEM 874.4 TRAFFIC SIGN REMOVED AND STACKED EACH

The work under this Item shall conform to the relevant provisions of Subsection 850 of the Standard Specifications and the following:

The work under this Item consists of dismantling, removing, and stacking existing warning and regulatory sign panels and guide signs, including their supports and all mounting hardware, designated to be removed and stacked on the plans or as required by the Engineer.

Construction Methods

Signs and attached hardware shall be carefully removed from their supports. The supports and existing foundations shall be completely removed and the holes backfilled with gravel borrow. The surface shall be patched with a material to match the existing ground or as required by the Engineer.

The Contractor shall backfill all holes resulting from removal of existing signs and their foundations with compacted gravel and restore the area to match the existing conditions of adjacent areas.

Sign panels, posts and foundations shall be returned to the City of Worcester Department of Public Works, 20 East Worcester Street, Worcester, MA 01604, in a manner that meets all applicable local, state and federal requirements.

If signs are attached to existing light poles, utility poles or traffic poles, only the sign and attached hardware shall be removed and stacked.

Sign posts that are observed to no longer have mounted signage that are called out to be stacked in the plans shall be removed under this Item.

The Contractor shall be responsible for the signs, and shall replace or repair any damage due to his operations with no additional compensation.

The existing signs shall not be removed and stacked without the prior approval of the Engineer.

METHOD OF MEASUREMENT

Item 874.4 will be measured for payment by the EACH traffic sign removed and stacked. One unit shall include the sign panel, sign post(s), appurtenances, and foundation(s).

BASIS OF PAYMENT

Item 874.4 will be paid for at the Contract unit price per EACH, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work for dismantling, loading, transporting and stacking of the signs and supports as designated above, and for the excavating and disposal of the existing foundations if present. Backfilling and removed sign area restoration shall be considered incidental to the cost of this Item.

ITEM 904.12 RAPID SET CONCRETE CUBIC FOOT

The work under this Item shall conform to the relevant Provisions of Subsection 901 of the Standard Specifications and the following:

The work under this Item shall consist of furnishing and placing rapid setting cementitious material that is suitable to repair concrete and pavement surfaces on bridges as required by the Engineer.

The rapid setting cementitious product shall be qualified rapid set material that shall have completed testing through AASHTO's National Transportation Program (NTPEP) and is included on the MassDOT Qualified Construction Material List.

The rapid setting cementitious material shall be expanded with aggregate for placements that are two (2) inches or more in depth and must be formulated to develop a minimum compressive strength of 2000 psi within two (2) hours.

The product shall be expanded using clean non-reactive aggregates from a MassDOT approved source according to a formulation acceptable to the manufacturer. Submit certified test reports showing the aggregate is non-reactive. Aggregate specified, labeled, and furnished by the rapid set patching material manufacturer may be used with approval of the Engineer. The mixing process for expanding the rapid setting patching material shall be performed per the Manufacturer's recommendations.

The Contractor will be required to cast twelve (12) cylinders from trial batch for compressive strength testing, in accordance with AASHTO T 161. The trial batch production shall use the same materials and processes as those to be used to produce the rapid setting patching material for the Contract.

Trial batching shall be conducted in the presence of the Engineer. The concrete cylinders shall be cast by a certified technician for testing at an independent laboratory approved by MassDOT. Acceptance shall be based on the average compressive strength of three (3) cylinder breaks. The cylinders shall be tested at two (2) hours and seven (7) days. The minimum average compressive strength of the specimens (including 20% overdesign requirement) shall be 2400 psi at two (2) hours and 5000 psi at seven (7) days. Two sets of three (3) cylinders shall be reserved for quality assurance testing by MassDOT Research and Material Section. The Contractor shall coordinate delivery of the concrete cylinders to a MassDOT facility so that they may be tested for compressive strength at two hours. No cylinders shall be handled or transported until they have cured for a minimum of 1 hour. Retesting through trial batching will be required if the rapid setting cementitious product, aggregate source, or the process to produce the patching material changes.

The Contractor shall give the Engineer a 10-day minimum advance notification of trial batch production.

ITEM 904.12 (Continued)

Construction Method

The surface to receive the rapid setting repair material shall be properly prepared and free from frost, ice, mud, water, grease, dirt, and any other materials that will hamper the bond.

Prior to placing the rapid setting repair material, the patch area shall be flushed with clean potable water to remove all dust and then blasted with oil free compressed air to remove all standing water.

The ambient temperature must be 35 degrees F and rising for placement of the rapid set repair material. Placement of this material, when the temperature is below 35 degrees F, will require the following:

1. Heating the mixing water.
2. Heating the aggregate.
3. Using warm cement
4. Pre-heating the excavated area to be patched using a method approved by the Engineer.
5. Protecting the mixture from freezing after placement (using a method approved by the Engineer) until after hydration takes place.

If approved by the Engineer, gypsum-based concrete may be used on exposed concrete deck repairs when ambient, surface and adjacent concrete temperature is 35 degrees Fahrenheit and falling. This product should not be used below 32 degrees Fahrenheit without taking additional steps to ensure proper curing.

NOTE: Gypsum based concrete shall NOT BE USED when it will be covered by a hot mix asphalt product.

The rapid setting repair material shall be cured and protected until the minimum compressive strength is achieved.

The Contractor shall be required to mix and place the cement by using an eight (8) cubic foot minimum rubber-blade mobile mixer. Two (2) mixers will be required to be on site, of which one mixer can be used as a back-up. Sufficient mixing and placing equipment shall be provided on the construction site by the Contractor to ensure that a breakdown of equipment will not cause significant delays in completing the scheduled work in the shift.

Approval by the Engineer for all formwork shall be required prior to placement of any concrete.

The Engineer may require the Contractor to vibrate and/or power screed the patched area.

Payment for such equipment shall be considered incidental to this Item.

ITEM 904.12 (Continued)

Rapid setting concrete placements shall be completed no later than 2:00 AM for nighttime operations so that the required compressive strength of 2000 psi is attained before the area is opened to traffic no later than 5:00 A.M.

Formwork shall be maintained and remain in place a minimum of seventy-two (72) hours after placement.

All formwork placed under this Contract must be removed no later than forty-five (45) days after it was initially placed. Failure to remove formwork within forty-five (45) days may result in its removal by others, with the associated costs being assessed to the Contractor.

METHOD OF MEASUREMENT

Item 904.12 will be measured for payment by the CUBIC FOOT of rapid-setting concrete installed, complete in place.

BASIS OF PAYMENT

Item 904.12 will be paid at the Contract unit price per CUBIC FOOT, which price shall include all labor, materials, tools, equipment, trial batching, testing, and all incidental costs required to complete the work.

It is understood that the cold weather steps listed above come at an additional cost to the Contractor. When temperatures during the repair of a bridge deck will generally be less than 35 degrees F during mixing, placement, and hydration the Contractor will be compensated an additional 10% of the unit bid price under non-bid Items.

Where formwork is installed for concrete placement, payment of seventy percent (70%) of the Cubic Feet price of this Item will be made upon complete concrete installation.

The remaining thirty (30%) of the Cubic Feet price of this Item will be paid only after complete form work is removed by the Contractor.

Payment for replacing and installing new reinforcing steel in the bridge deck repairs shall be paid under Item 910. Payment for replacing and installing new reinforcing bar splicers in the bridge deck repairs shall be paid under Item 910.4.

ITEM 905. 4000 PSI, 3/8 INCH, 660 CEMENT CONCRETE CUBIC YARD

The work under this Item shall conform to the relevant provisions of Subsection 901 of Standard Specifications and as follows:

The work under this Item shall consist of furnishing and placing 4000 PSI, 3/8 INCH, 660 Cement Concrete. This Item shall be used for patching after all deteriorated and/or unsound concrete is removed under Item 127.12 and for resurface of the West Abutment at Harrison Street Bridge as shown in the Contract Documents.

The Engineer shall determine whether to use this Item or to direct the use of a Hi-Early mix. All cost(s) associated with the addition of any approved admixture to the cement concrete shall be considered incidental to this Item.

Approval by the Engineer of all formwork shall be required prior to placement of any concrete.

All formwork placed under this Item must be removed no later than forty-five (45) days after the repair is completed. Failure to remove the formwork within forty-five (45) days may result in its removal by others, with the associated costs being assessed to the Contractor.

PREPARATION OF CONCRETE SURFACES:

All concrete surfaces to be patched shall be roughened, cleaned of all laitance, dirt, grease, oil, other contaminants and all standing water. All reinforcing steel encountered in the excavation shall be thoroughly cleaned by abrasive blasting and coated with a zinc-rich primer conforming to MassDOT Standard Specification M7.04.11 before being covered with new concrete.

METHOD OF MEASUREMENT

Item 905. will be measured for payment by the CUBIC YARD of 4000 psi, 3/8 Inch, 660 cement concrete placed, complete in place.

BASIS OF PAYMENT

Item 905. will be paid for at the Contract unit price per CUBIC YARD, which price shall include full compensation for materials, tools, equipment, labor, oversight services and all incidentals required to complete the work, including the installation and subsequent removal of any formwork, placement of anodes for cathodic protection, and coating of the reinforcing steel.

The use of Hi-Early concrete when required by the Engineer, shall be incidental to this Item.

ITEM 909.2 CEMENTITIOUS MORTAR FOR PATCHING SQUARE FOOT

The work under this Item shall conform to the relevant provisions of Subsection 901 of the Standard Specifications and the following:

The work under this Item consists of furnishing and placing a polymer-modified, cementitious, fast setting, trowel grade patching mortar to patch vertical surfaces on the existing structures at areas of spalled, delaminated, or cracked concrete as shown on Contract Plans.

This Item does not include the repair of any vertical patch that exceeds two (2) inches in depth. The repairs to those patches shall be made using Item 905.

Material

The polymer modified cementitious patching mortar shall conform to the following requirements:

The mortar system shall not contain chlorides, nitrates, added lime, or high silica cements. The system shall be non-combustible, either before or after cure.

TYPICAL PROPERTIES OF CURED MATERIALS	
Finishing Time	20-60 minutes after combining components
Color	Concrete Gray
Abrasion Resistance	6 times that of controlled concrete
Bond Strength	100% concrete substrate failure (Pull off method)
Modulus of Elasticity	4.5×10^6 PSI
Surface Scaling	No Deterioration after 120 cycles (deicing salt solution and freeze/thaw)
Compressive Strength (2 hours, 50% RH)	150 PSI minimum
Compressive Strength (28 days, 50% RH)	5,500 PSI minimum
Flexural Strength (28 days, 50% RH)	1,300 PSI minimum

The system shall conform to the ECA/USPHS Standards for surface contact with potable water. The system shall not produce a vapor barrier. The system shall be thermally compatible with concrete.

ITEM 909.2 (Continued)

Certification

The Contractor shall furnish notarized certification that all materials conform to the above requirements. In addition, samples of all materials proposed for use shall be submitted to the Department's Research and Materials Section. To allow sufficient time for testing, these samples must be submitted at least six weeks prior to scheduled use.

Surface Preparation

The Contractor shall remove all deteriorated and spalled areas as designated by the Engineer. All costs to remove the deteriorated and spalled concrete shall be compensated for under Item 127.12.

The Contractor shall have the approval of the Engineer certifying that all spalled and deteriorated concrete has been removed prior to patching deteriorated areas. If the deterioration of the vertical surfaces is deeper than one (1) inch, then the repair will be made in maximum lifts of one (1) inch deep. The preceding lift shall be allowed to reach final set before applying fresh material. The fresh mortar must be scrubbed into the preceding lift.

Application Methods

Areas to be patched must be clean and sound. All loose and disintegrated concrete shall be removed by means of abrasive blasting, or an equivalent method, to a depth where sound concrete is exposed. Minimum patch depths at edges of patch shall be sawcut to one half (½) inch in depth. Abrasive blast existing concrete to remove all contaminants prior to applying mortar. Chipping methods are to be approved in advance by the Engineer.

At the time of application, surfaces should be damp (saturated surface dry) with no glistening water. Mortar must be worked into the substrate filling all pores and voids. Force the material against the edge of the repair, working towards the center. After filling, consolidate, then screed.

The maximum thickness of application in one pass shall be one (1) inch. If the depth of patch exceeds one (1) inch, the mortar shall be placed in two passes of approximate equal thickness, with a total thickness not to exceed two (2) inches. Before the first pass has achieved an initial set, the surface shall be prepared for the second pass by scratching with a trowel to form a grid of deformation on the surface.

Prime and work the mix into the substrate, filling all pores and voids. Avoid puddling of the primer on horizontal substrates.

Curing

Use a fine mist spray of water, wet burlap, or a non-solvent approved curing compound if ambient conditions might cause premature surface drying (high temperature, low humidity, strong winds, etc.). If necessary, protect the newly applied mortar from rain. To prevent freezing, cover with insulating material.

ITEM 909.2 (Continued)

Manufacturer's Field Representative

The Contractor shall arrange with the material's manufacturer or distributor to have the services of a competent field representative at the work site prior to any mixing of components to instruct the work crews in the proper mixing and application procedures.

The manufacturer's field representative must be fully qualified to instruct artisans or perform the work and shall be subject to the approval of the Engineer.

The Contractor shall be completely responsible for the expense and services of the required field representative, and the bid Contract price shall be full compensation for all cost in connection therewith.

METHOD OF MEASUREMENT

Item 909.2 will be measured for payment by the SQUARE FOOT of patch area, complete in place.

BASIS OF PAYMENT

Item 909.2 will be paid for at the Contract unit price per SQUARE FOOT, which price shall include all labor, materials, equipment, and all incidental costs required to complete the work.

ITEM 910.1 STEEL REINFORCEMENT FOR STRUCTURES - EPOXY COATED POUND

The work under this Item shall conform to the relevant Provisions of Subsection 901 of the Standard Specifications and the following:

All requirements of Subsection 901.62 of the Standard Specifications shall be adhered to, including but not limited to lapping at splices and ties at every other intersection.

The Contractor may be required to submit for approval, detail plans and schedule of bar reinforcement. The Contractor will replace reinforcing bars as required by the Engineer. Any reinforcing steel damaged by the Contractor's operations will be replaced by the Contractor at their own expense.

Should the Engineer direct the placement of MassDOT supplied anodes for cathodic protection at locations where such protection is warranted, the Contractor will be required to supply replacement reinforcing that is not epoxy coated (black bar). No additional compensation will be made for any such required substitution. The cost of anode installation and testing shall be considered incidental to this Item.

METHOD OF MEASUREMENT

Item 910.1 will be measured for payment by the POUND of steel reinforcement for structures – epoxy coated furnished and installed, complete in place.

BASIS OF PAYMENT

Item 910.1 will be paid for at the Contract unit price per POUND, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work.

ITEM 910.4 MECHANICAL REINFORCING BAR SPLICER EACH

The work under this Item shall conform to the relevant provisions of Subsection 901 of Standard Specifications and as follows:

The work consists of replacing deteriorated reinforcing that was previously excavated from the bridge deck under Items 127.4 and 127.41 with new reinforcing.

The Contractor shall adhere to the access and mobilization requirements outlined in the Special Provision for Item 748.1 Emergency Response.

All materials shall be from the MassDOT Qualified Construction Materials List.

METHOD OF MEASUREMENT

Item 910.4 will be measured for payment by the EACH mechanical reinforcing bar splicer furnished and installed, complete in place.

BASIS OF PAYMENT

Item 910.4 will be paid for at the Contract unit price per EACH, which price shall include all labor, materials, tools, forms, and equipment for installing new mechanical reinforcing bar splicers for bridge deck repairs.

Payment for Contractor mobilization and maintenance of traffic will be made under Item 748.1.

Payment of excavation, removal and satisfactory disposal of all reinforced concrete and corresponding bituminous concrete overlay for the bridge deck repairs will be made under Items 127.4 and 127.41.

Payment for placing rapid setting concrete in the bridge deck repairs will be paid under Item 904.12.

Payment for replacing and installing new steel reinforcing in the bridge deck repairs will be paid under Item 910.

ITEM 912. DRILLING AND GROUTING DOWELS EACH

The work under this Item shall consist of furnishing of all material, products, equipment, and labor for drilling and grouting rebars for the anchorage of new resurface concrete to the existing concrete facing for West Abutment at Harrison Street Bridge. The embedment length, edge distance, and core hole diameter shall conform to the minimum dimensions shown on the plans or the recommendations of the manufacturer. The method and equipment used to core the holes, the final embedment length, and diameter of the core hole shall be submitted to the Engineer for approval.

MATERIALS

The grout to be used for these rebars shall be "GaroniteTM HD" as manufactured by Garon Products, Inc. of Wall, New Jersey; "Quik-Rok®" as manufactured by Ameristar of Tulsa, Oklahoma; "FX-228®" as manufactured by Fox Industries, Inc. of Baltimore, Maryland; "Five Star® Grout" as manufactured by Five Star Products, Inc. of Fairfield, Connecticut; or an approved equal. Epoxy, vinyl, or polyester resin adhesives shall not be utilized. The Contractor shall confer with the Research & Materials Division regarding which products are approved for use on Massachusetts Department of Transportation bridge projects.

Reinforcing steel shall meet the requirements of AASHTO M31 Grade 60. All reinforcing steel dowels shall be epoxy coated in accordance with AASHTO M284.

CONSTRUCTION METHODS

All holes shall be diamond core drilled. No impact or percussion type drills will be allowed without prior approval of the Engineer. The inner surfaces of diamond core drilled dowel holes shall be scored to develop sufficient keying action. The method of scoring of the hole's inner surfaces shall be subject to the approval of the Engineer. The holes shall be blown clear of any debris and oil and shall have the approval of the Engineer prior to the placement of any grout material.

If loose cement or concrete spalling is encountered, the Contractor shall perform any necessary repairs before the installation of the dowels. This repair shall be considered incidental.

The drilling operation shall be performed without damage to any portion of the existing structure that is to remain in place. Any damage to any portion of the existing structure that is to remain in place shall be repaired to a condition equal to or better than that existing prior to the beginning of the Contractor's operations and shall be repaired at the Contractor's expense.

The Contractor shall strictly follow the recommendations of the manufacturer for mixing and placing the grout material prior to the placement of the dowels. The Contractor shall, at a minimum, adhere to the ACI code requirements regarding minimum and maximum temperatures while placing the grout. Any excessive grout around the hole after placement of the dowel or anchor bolt shall be struck off smooth while the grout is still fresh.

ITEM 912. (Continued)

METHOD OF MEASUREMENT

Item 912. will be measured for payment by the EACH drilled and grouted dowel installed, complete in place.

BASIS OF PAYMENT

Item 912. will be paid for at the Contract unit price per EACH, which price shall include all labor, tools, equipment, all materials including steel reinforcing bars regardless of length and size, and all incidental costs required to complete the work.

ITEM 950.51	**TEMPORARY SUPPORT OF EXCAVATION BRIDGE NO. W-44-083**	**LUMP SUM**
ITEM 950.511	**TEMPORARY SUPPORT OF EXCAVATION - LEFT IN PLACE BRIDGE NO. W-44-083**	**LUMP SUM**
ITEM 950.52	**TEMPORARY SUPPORT OF EXCAVATION BRIDGE NO. W-44-093**	**LUMP SUM**

The work under these Items shall conform to the relevant provisions of Subsections 140 and 950 of Standard Specifications and the following:

The Contractor shall design, furnish, install, maintain, relocate if necessary, and remove or cut-off a temporary support of excavation system and all associated other work to be used in the demolition and construction of the partial removal of the existing substructures as shown on the Contract Plans. The temporary earth support system shall be designed and constructed as required to allow the safe removal of existing structures, and construction of proposed structures and shall prevent damage to, or undermining of, the sides of excavations, roadways, driveways, and portions of existing structures to remain and/or be maintained. The Contractor is required to design and detail any required temporary earth support required for all stages of construction.

The temporary support of excavation system shall either consist of soldier pile and lagging, or any other system, which is approved by the Engineer. The approximate layout of the temporary support of excavation system is shown on the Plans. Steel sheeting shall conform to ASTM A328. Foreign source of supply may be submitted for approval if sufficient documentation is provided demonstrating that domestic material is unavailable and that ASTM A328 compatibility is achieved. All materials used for the temporary earth support systems shall be in good condition as determined by the Engineer.

The Contractor shall make his/her own evaluation of existing site conditions and facilities, and shall design and construct the proposed temporary support of excavation system at both abutments to be compatible with the Contractor's means and methods of construction including Bridge Demolition, Bridge Excavation and Bridge Construction.

The design of the temporary support of excavation system shall conform to industry standards and all OSHA requirements. The Contractor shall determine the final location and design of the support of excavation system to provide necessary clearance for demolition and construction. The temporary support of excavation system at locations on the plans shall be fully designed by the Contractor to carry all applicable AASHTO loads. It shall be designed in accordance with the AASHTO Guide Design Specifications for Bridge Temporary Works, 2nd Edition 2017, and all interims published as of the bid opening date. The support system shall be designed to prevent damage resulting from loss of ground and lateral movement and settlement of the ground and ground surface behind the wall.

ITEMS 950.51, 950.511, and 950.52 (Continued)

The Contractor is responsible for determining all geotechnical criteria associated with the temporary support of excavation system including, but not limited to, lateral earth pressures, live load surcharge, surcharge due to construction equipment operation, surcharge due to temporary traffic barriers, and/or surcharge due to material storage near the top of excavation. Maximum design stresses in steel members shall not exceed 125% of the allowable basic stresses specified in the current specifications of the American Institute of Steel Construction. The design shall provide for all anticipated load conditions that may occur during the entire construction period. The minimum factor of safety for each of the design conditions shall be 1.50.

The temporary support of excavation system must be designed and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts. Complete detailed drawings and calculations shall be submitted to the Engineer for approval. Written approval must be obtained prior to installation of temporary support of excavation system. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful completion of the project.

BASIS OF PAYMENT

Items 950.51, 950.511, and 950.52 will be paid for at the respective Contract unit price per LUMP SUM, which price shall include full compensation for all the Contractor's design, plans, and submittals, all material, labor, tools, equipment, and all incidental costs required to complete the work.

Partial payment shall be made upon the following percentages: 60% upon complete installation and 40% upon complete removal.

ITEM 964.3 ELASTOMERIC PROTECTIVE COATING SQUARE FOOT

The work under this Item shall consist of applying a minimum of two coats of an elastomeric acrylic protective coating to all exposed faces of the abutment, pier and wingwalls, after completion of the proposed substructure improvements for each stage of construction as shown on the Plans and other locations as required by the Engineer. Elastomeric acrylic protective coating shall also be applied to the existing portions of the abutment, wingwalls and pier not repaired or modified by the work, as well as areas of new concrete. A total dry film thickness (DFT) of 16 mils shall be required.

The acrylic protective coating shall be breathable, durable, flexible, and color retentive. It shall provide protection and be resistant to weathering, carbon dioxide, chlorides, UV light, wind driven rain, dirt pick up and mildew. It shall also bridge hairline cracks up to 1/32". The acrylic protective coating system shall be one of the following or an approved equal:

- SikaGard 550W Elastocolor by Sika Corp.
- Flexxide Elastomer by Carboline
- Colorlastic by ChemMasters.

The proposed coating product shall be submitted to the Engineer for approval. The Contractor shall submit the proposed application procedures and Manufacturer's Product Data Sheet(s) that completely describe the product. The color of the coating shall be "Gray" for the substructure. This color is from the SikaGard Color Chart. This color must be exactly reproduced as certified by the manufacturer in order to be allowed to use the Flexxide or Colorastic coatings (at this time Flexxide has matching color samples that have been pre-approved).

Preparation and Protection of Surfaces

All vegetation growing adjacent to or within the limits of the concrete surfaces to be coated shall be removed and properly discarded. All debris adjacent to or within the limits of the concrete surfaces to be coated shall be removed and properly discarded.

All surfaces to be coated must be dry, clean, sound and free of all contaminants that could interfere with adhesion of the coating. All loose material shall be removed. If required by the Engineer, the Contractor shall repair any holes and any spalled and damaged concrete prior to applying the coating. All concrete repair areas shall be cured for a minimum 28 days before application of coating.

The Contractor shall pressure wash all concrete surfaces to be coated. The pressure washer shall operate at a minimum of 3,000 psi. The protective coating shall not be applied until the surface is dry and the surface preparation has been approved by the Engineer. All concrete to be coated must be tested for the presence of moisture after the surface preparation has been completed and prior to application of coating. Testing shall be in accordance with ASTM D 4263.

ITEM 964.3 (Continued)

APPLICATION

Application shall be done by airless sprayer or roller or a combination of both and in accordance with the manufacture's recommendations. The use of a primer shall not be required unless stipulated for that particular coating by the manufacturer. The recommended minimum wet film thickness (WFT) must be maintained during each application. The manufacturer's specified temperature and weather limitations for the application shall be strictly adhered to.

METHOD OF MEASUREMENT

Item 964.3 will be measured for payment by the SQUARE FOOT of concrete surfaces to which the elastomeric protective coating is applied, complete in place.

BASIS OF PAYMENT

Item 964.3 will be paid for at the Contract unit price per SQUARE FOOT, which price shall include all labor, materials, tools, equipment, and all incidental costs required to complete the work, including all preparation and protection of surfaces.

The Contractor shall also supply a wet/dry film thickness gauge for the use of the Engineer, the cost of this device will be considered incidental to this Item. The Contractor will retain ownership of the gauge.

ITEM 992.33 TEMPORARY SUPPORT OF STRUCTURE LUMP SUM
BRIDGE NO. W-44-083

ITEM 992.34 TEMPORARY SUPPORT OF STRUCTURE LUMP SUM
BRIDGE NO. W-44-093

The work under these Items shall conform to the relevant provisions of Subsection 995 of the Standard Specifications and shall include: design, detail, construction, demolition and disposal of the temporary shoring structures supporting pier and existing concrete deck during stage 1 construction of Bridge No. W-44-083 and Bridge No. W-44-093 and its existing steel stringers during all stages of construction.

The Contractor shall propose a temporary support structure, subject to approval of the Engineer. The Contractor shall be solely responsible for the design and detailing of the proposed temporary support structure.

The temporary supports for the existing bridge are intended to support the existing pier, existing deck and steel stringers during stage 1 construction. The existing structure is expected to require based on the suggested sequence of construction presented on the plans, however approach to construction and temporary shoring will be determined by the Contractor.

The temporary supports shall be designed for all applicable loadings as described below and as specified on the plans. It is anticipated that the existing deck will be supported by utilizing existing stringers and supporting by a bracket system.

If coring in the existing deck is proposed by the Contractor, to allow for the passage of thread bar, the core holes shall be filled with a MassDOT approved repair mortar. All structural elements shall be verified for structural adequacy and overall stability. Temporary support of the overhangs may also be required within limits of demolition.

After removal of the temporary support system, the site shall be restored to its original condition.

The temporary supports shall be coordinated to meet the requirements of the construction staging, traffic control plans, and Contract work restrictions/work schedule.

Where design and detailing are required, as described above, the Contractor shall submit to the Engineer for approval, drawings and design calculations in accordance with AASHTO Guide Design Specifications for Bridge Temporary Works for HS-20 loading, stamped by a professional engineer licensed in the Commonwealth of Massachusetts and experienced in the design of bridges. The design shall include all applicable loading and geometric requirements. The design of the temporary supports shall limit the stress induced from the applied loading to Operating Stress levels. The Contractor shall submit detailed shop drawings for all shoring structures to the Engineer for review and approval. Elevations, plan dimensions, working points shall be included as part of this submittal.

ITEMS 992.33 and 992.34 (Continued)

The temporary support system at the piers for bridges must not interfere with or disturb the existing footing. The temporary support system for both bridges will need to be adequately anchored to the existing bedrock and shall include temporary support for the founding soil under the piers during Stage 1 demolition. Contractor may submit a system of his/her own design to the Engineer for approval and is incidental to these Items.

BASIS OF PAYMENT

Items 992.33 and 992.34 will be paid for at the respective Contract unit price per LUMP SUM, which prices shall include all design, detailing, submittals, labor, material, equipment, and all incidental costs required to complete the work.

The costs for design and/or evaluation of the temporary support structures shall be incidental to Item 992.33 and 992.34.

ITEM 994.01	**TEMPORARY PROTECTIVE SHIELDING BRIDGE NO. W-44-083**	**LUMP SUM**
ITEM 994.02	**TEMPORARY PROTECTIVE SHIELDING BRIDGE NO. W-44-093**	**LUMP SUM**

The work under these Items shall consist of designing, furnishing, installing, maintaining, removing and disposing of a temporary protective shielding system. The shielding shall protect the surrounding areas, including all personnel, vehicles and/or pedestrians below the bridge, from falling or flying debris during demolition and construction operations. The shielding shall prevent any debris, tools or incidental items from falling onto areas where vehicular or pedestrian traffic exists. The shielding shall also serve as a work platform for the personnel performing the demolition and construction operations, as well as any equipment required.

The shielding shall conform to the following:

1. Shielding shall be in place prior to the start of any demolition or removal to protect any debris from falling onto areas where vehicular or pedestrian traffic exists, and to aid in the construction procedures on the bridge.
2. Shielding shall extend the full length of the bridge and a sufficient distance above and beyond the deck overhang at the fascia.
3. Shielding shall function as a containment system during construction. All spaces along the perimeter and at the seams shall be sealed to prevent dust and debris from escaping and falling below the bridge. Containment measures shall conform to Subsection 961.67 of the Standard Specifications.
4. Shielding shall be designed to safely withstand all loads that it will be subjected to. The allowable design stresses shall be in accordance with AASHTO Standard Specifications for Highway Bridges. The design of the shielding for deck removal shall also include a complete description of the equipment and construction methods proposed for the superstructure removal and also the maximum superstructure segment being removed in one section. The shielding shall also be designed to withstand impact of the maximum segment or member should it fall inadvertently during demolition or removal.
5. The shielding shall be positively attached to the structure such that it cannot be dislodged or shifted during construction. The attachment methods shall be designed for all intended and errant loads anticipated by the Contractor based on the Contractor's means and methods of construction and shall be included in the design submittal.
6. The shielding shall not reduce the minimum vertical clearance over the active travel lanes of I-290 of both the structures.
7. Shielding shall be installed and removed only upon approval of the Engineer.

ITEMS 994.01 and 994.02 (Continued)

Prior to the start of demolition, the Contractor shall be required to submit the details of the temporary shielding to the Engineer for review and approval. The plans will be reviewed as to the methods of erection and as to whether or not the proposed installation will provide the required level of protection. It is the Contractor's responsibility to design the protective shielding to conform to all Federal, State and Local laws and regulations and the requirements contained in the Contract Documents. The protective shielding shall be designed by a Professional Engineer registered in the Commonwealth of Massachusetts. The drawings and calculations shall bear his/her seal when they are submitted to the Engineer. The drawings shall include details of all connections, brackets and fasteners and shall be submitted at the pre-construction conference.

The Contractor may utilize the bottom flanges of the existing steel beams and of the proposed steel beams as supports for the temporary protective shielding where feasible. However, the Contractor will not be permitted to weld onto, drill into, or cut any existing or proposed structural members without receiving prior approval of the Engineer.

After completion, the shielding shall be removed and disposed of properly. All materials used in the shielding system shall become the property of the Contractor and shall be completely removed from the site at the completion of the project.

BASIS OF PAYMENT

Items 994.01 and 994.02 will be paid for at the respective Contract unit price per LUMP SUM, which prices shall include full compensation for the design and submittal of the shielding scheme, all labor, equipment, materials, tools, and all incidental costs for the installation, maintenance, operation, removal and disposal of the protective shielding.

Payment of 50% of the Lump Sum Bid Price for these Items will be paid upon complete installation and removal of Stage 1 limits. The remaining 50% shall be paid upon complete installation and removal of Stage 2 limits. Payment for each stage shall be further broken down as follows: Payment of 75% will be paid upon complete installation and approval by the Engineer, and the remaining 25% will be paid following complete removal and disposal of the shielding.

ITEM 995.1	**BRIDGE SUPERSTRUCTURE, BRIDGE NO. W-44-083**	**LUMP SUM**
ITEM 995.2	**BRIDGE SUPERSTRUCTURE, BRIDGE NO. W-44-093**	**LUMP SUM**

The work under these Items shall conform to the relevant provisions of Subsection 995 of the Standard Specifications and the specific requirements stipulated below for the component parts of this Item. For those component parts where no specific requirement is stipulated, the Standard Specifications shall apply except for payment.

Work under this Item shall include all materials, equipment and labor needed to construct the following:

- Metalized and painted structural steel plate girders and shear connectors.
- Galvanized steel diaphragms and utility supports
- Cast-in-place concrete deck slab and sidewalks
- Laminated elastomeric bearing pads
- Pavement sawcut bridge joints
- CP-PL2 bridge rail and Type II protective screens
- Cast-in-place concrete abutment caps and backwalls including any steel sleeves
- Cast-in-place concrete pier cap, keeper blocks, and top of pier columns
- Cast-in-place concrete approach slabs
- Steel reinforcement
- Cast-in-place highway guardrail transitions and bases
- Nonstandard cast-in-place highway guardrail transitions and bases

The work does not include any items listed separately in the proposal. Payment for materials shown on the Plans as being part of this bridge structure or which may be incidental to its construction and are not specifically included for payment under another Item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component for which they are a part.

5000 PSI, 3/4 INCH, 685 HP CEMENT CONCRETE

The work to be done under this Heading shall conform to the relevant provisions of Subsection 901 of the Standard Specifications, supplemented and amended as follows:

All concrete shall be placed in the dry.

All concrete shall be 5000 PSI, 3/4 INCH, 685 HP CEMENT CONCRETE.

Included in the work are the furnishing and installing of preformed fillers and other items incidental to the furnishing and placing of concrete. All other work covered in the Schedule of Basis for Partial Payments or for which payment is not provided elsewhere in the Contract shall be considered as included in the unit price per cubic yard of concrete, as stated by the Contractor and approved by the Engineer, in the respective "Basis for Partial Payment".

ITEMS 995.1 and 995.2 (Continued)

SHEAR CONNECTORS

The work under this Heading shall conform to the applicable provisions of Subsections 901 and 960 of the Standard Specifications and the material requirements outlined in the following sections: Stud Shear Connectors shall meet the requirements in Subsection M8.04.1 of the Standard Specifications, and as shown on the Contract Plans.

STRUCTURAL STEEL – COATED STEEL

The work under this Heading shall conform to the applicable provisions of Subsection 960 of the Standard Specifications and the material requirements outlined in the following sections:

Grade AASHTO M270 Grade 36 (sole plates) and Grade 50 shall meet the requirements shown in Subsection M8.05.0, and as shown on the Contract Plans.

THERMAL SPRAYED COATING (METALIZING) SHOP APPLIED

PURPOSE

This section provides the requirements for shop performed surface preparation; the application of a thermal spray coating (TSC/metalizing); the application of a coating system; and includes field application of coatings and repairs and touch up of all coatings after site erection of the coated structure.

GENERAL INFORMATION

1. All fabrication shall be completed prior to the application of a thermal sprayed coating. (TSC)
2. All surfaces to be coated shall be cleaned in accordance with SSPC SP-5.
3. All TSC shall be sealed with an approved sealer, except for faying surfaces.
4. After site erection of the structure, perform field touch-up of any damaged coating.
5. All fasteners shall be galvanized and coated with the intermediate and topcoat if applicable.
6. The products of only one thermal spray wire manufacturer and one coating manufacturer shall be used on the entire project.
7. All field painting shall be in accordance with applicable sections of Item 961 of the MassDOT Standards and Specifications.

ITEMS 995.1 and 995.2 (Continued)

MATERIALS

Abrasives
Provide abrasives that are clean, dry, and sized properly to provide the specified surface profile. The profile shall be dense, uniform and of sufficient angularity to be acceptable for the application of TSC.
Abrasives shall conform to the following as applicable:

- SSPC-AB 1 for mineral slag abrasives
- SSPC-AB 2 for recycles ferrous metal abrasives
- SSPC-AB 3 for new steel abrasives

Thermal Spray Feedstock
The Contractor shall provide material certificates from the supplier that include the chemical composition and lot number of the wire. MassDOT will perform random sampling of wire from lots provided. Wire shall conform to ASTM A833. See table below for application and selection of wire type, thickness, and coating system.

Environmental Zone **3** shall be used for this project.

ENVIRONMENTAL ZONE*	**WIRE TYPE**	**THICKNESS** (mils)**	**COATING SYSTEM*****
1	Zinc-Aluminum	6-9	Three Coat
	Zinc-Aluminum	6-9	Sealer Only
2	Zinc- Aluminum	8-12	Three Coat
	Zinc-Aluminum	8-12	Sealer Only
3	Zinc Aluminum	10-14	Three Coat
	Zinc Aluminum	10-14	Sealer Only

***Zone 1** – Bridges in rural environments, not over waterways, and not over high speed state or interstate highways with potential for salt spray and heavy salt use and de-icing chemical use.
***Zone 2** – Bridges in urban environments, near industrial and manufacturing plants, power plants, or warehouses, over heavy road traffic, or over waterways.
***Zone 3** – Bridges in marine environments, over or close to saltwater waterways, or over high speed state or interstate highways with potential for salt spray and heavy salt use and de-icing chemical use.
** Mil thickness on faying surfaces shall meet the requirements of the slip certificate.
*** Coating systems shall consist of a three coat paint system applied over the metalized surface or a clear sealer applied over the metalized surface.

ITEMS 995.1 and 995.2 (Continued)

SUBMITTALS

Submit the following information to the MassDOT - Highway for approval a minimum of thirty days prior to beginning any coating operations:

A. Manufacturer's recommendation and field history for the coating system proposed. Include data sheets for all selected coatings to be applied.
B. Procedures for shop surface preparation, the application of the TSC and application of coatings.
C. Procedures for coating of field connections.
D. Procedures for field touch-up surface preparation, application of TSC and application of coating.
E. Proposed abrasive for use in the shop.
F. Proposed thermal spray wire to be used and product data sheets. Provide certification of Class B slip coefficient.
G. A copy of SSPC-QP3/AISC (SPE) certification. This certification must be in effect at the time of bid and must remain in effect throughout the duration of the project.
H. Quality Systems Manual
I. Work schedule. Contractor must notify the Engineer a minimum of seven days prior to starting work.

QUALITY CONTROL

A. The shop performing the application of TSC, and coating shall be certified by the American Institute of Steel Construction (AISC) Sophisticated Paint Endorsement (SPE) quality program, or under the Society for Protective Coatings (SSPC) QP3 program, "Standard Procedure for Evaluating Qualification of Shop Painting Applicators" and shall maintain certification throughout the project.
    1. The coating applicator shall have completed a minimum of three structural steel TSC projects that utilized the same coating system as that being specified on this project. Provide project locations, TSC/painting; name, e-mail address, and the telephone number of the owner or owner's representative.
B. Provide an on-site Quality Control Specialist (QCS) who shall function as a TSC inspector with a minimum of five years of each TSC and coating application experience; and possess SSPC BCI Level 1 or NACE Certified Level 3 or other related certification as accepted by the MassDOT - Highway. The QCS shall not be a foreman or a member of the Contractor's production staff. The QCS's sole purpose shall be quality control testing, inspection and reporting.

PRE-APPLICATION MEETING

A pre-application meeting will be held prior to any steel fabrication that includes the application of thermal spray applied coatings. This meeting is separate from the pre-construction meeting for the entire project.

The following parties are required to attend this meeting: TSC/applicator, QCS, and MassDOT – Highway Representatives. Other project personnel should attend as may be needed.

ITEMS 995.1 and 995.2 (Continued)

PERSONNEL QUALIFICATION

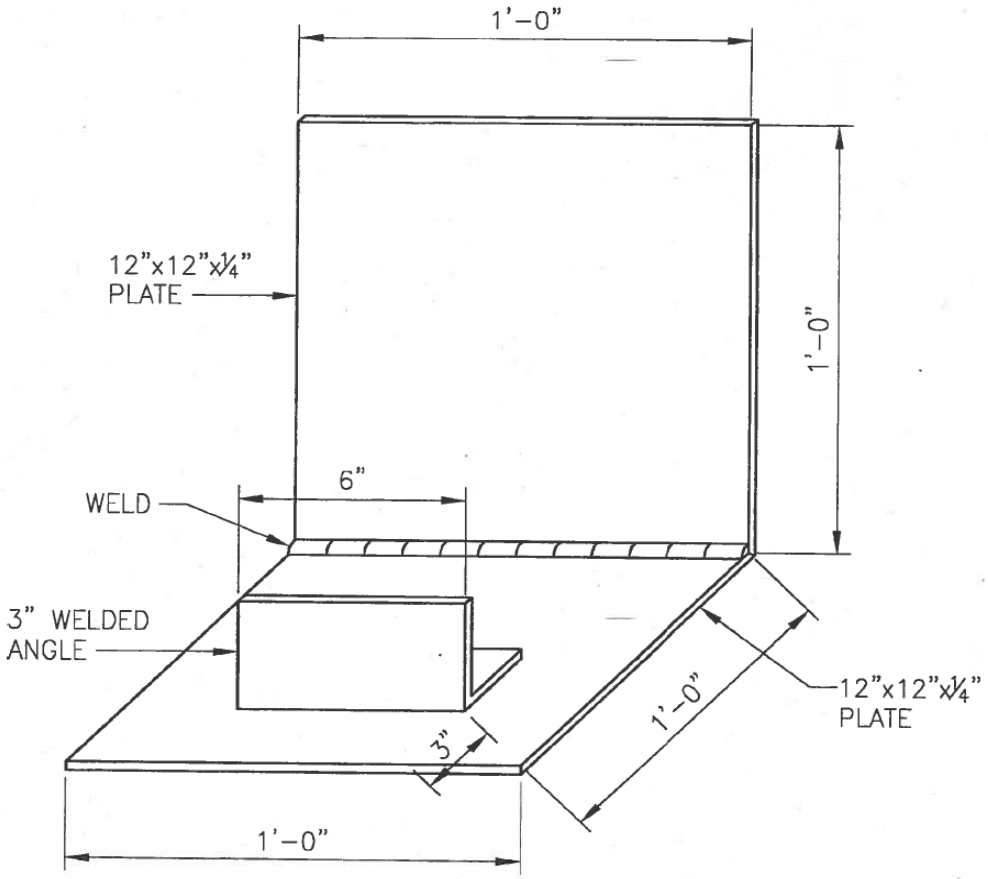
The applicators of the thermally applied material shall be individually qualified to apply the TSC as follows:

1. Each applicator must complete a practical test designed to demonstrate the ability to set up and operate the equipment to apply the material to the specified thicknesses to a minimum of 10 square feet of representative steel surfaces, and to successfully pass the surface preparation, bend, and cut tests specified herein. Administer the qualification testing, document the results in writing, and retain the bend test coupons for the duration of the project.
2. At the discretion of MassDOT - Highway, requalify the applicators at any time during the project to reconfirm the proficiency and the quality of the workmanship being provided. This may be required at any time due to unacceptable or failing results of the bend test, cut test, or poor workmanship.

SHOP QUALIFICATIONS

Prior to proceeding with the production blast cleaning operations prepare a minimum of five Job Reference Standards (JRS) test plates. Blast clean all surfaces of each test plate using the same equipment and abrasive that will be used for the production work. After acceptance of the surface cleanliness and profile, apply the TSC to all surfaces of each test plate. After acceptance of the TSC apply the sealer to be used with the three coat system to three test plates excluding the bottom surface of all test plates. After curing apply a coat of epoxy to two of the three test plates excluding the bottom surface. After curing apply a coat of the polyurethane topcoat to one test plates on all surfaces excluding the bottom surface. Apply the clear sealer to the last remaining TSC plate. Bottom surfaces of the prepared plates shall be used for cut testing as specified. Surface preparation and application shall be witnessed by a MassDOT representative. *See drawing below for dimensions and construction.*

ITEMS 995.1 and 995.2 (Continued)



Configuration of JRS Test Plates

SURFACE PREPARATION

For cleaning that utilizes compressed air, utilize only clean, dry air. Conduct blotter test(s) in accordance with ASTM D4285 a minimum of one time each shift for each compressor system in use to verify that the air supply is free of moisture and oil contamination. Conduct the tests in the presence of the MassDOT – Highway Representative.

Weld Spatter, Sharp Edges, Flame-Cut Steel, Holes, Fins, and Silvers
Remove slag, flux deposits, fins, slivers, burrs, and weld spatter from the steel. Grind any sharp edges around holes. Break all flame-cut and sheared edges. If blast profile is degraded by grinding restore profile by abrasive blasting.

ITEMS 995.1 and 995.2 (Continued)

Solvent Cleaning
Where oil and grease are present on the bare steel, remove by solvent cleaning to SSPC-SP 1 prior to blast cleaning. If contamination remains after blast cleaning, reclean with solvent prior to application of the TSC.

Cleaning of galvanized bolts prior to the application of paint to bolted connections in the shop or in the field all galvanized fasteners shall be cleaned of all lubricating wax. Cleaning shall be in accordance with SSPC-SP-1, Solvent Cleaning, method 4.1.1. The Contractor is responsible to identify the solvent and method needed to remove all lubricant. Cleanliness will be determined by the use of a white cloth wipe test. The test will be performed by the engineer using a clean white cloth and the same solvent used by the Contractor for cleaning. The cloth shall be wetted and rung to a damp condition, placed on selected fasteners and rubbed with a twisting motion around the entire exposed surface of the previously waxed surfaces of the fastener. A minimum of 3 alternating rotations shall be done. Acceptance of cleanliness is with no color transfer to the cloth. A minimum of 10% of the bolts at each bolted connection shall be tested for cleanliness.

Abrasive Blasting
Blast clean all steel to, SSPC-SP5 "White Metal Surface Cleanliness." Determine the SP5 condition by use of SSPC-Vis 1. In the event of a conflict between the pictorial standard and the written definition the written definition shall prevail. Abrasive blast cleaned surfaces shall have a dense, uniform pattern of sharp, angular depressions and ridges, between 3.5-5.0 mils.

Surface preparation is defined as complete when all remedial repairs have been performed and the piece is accepted by both QC and MassDOT QA.

Verification of the profile height will be performed in accordance with ASTM D 4417 Method C.

Manual Blasting shall have a minimum of one profile depth measurement every 10 to 20 ft², of blasted surface.

Automated Blasting shall have a minimum of two profile depth measurements every 100 ft². When acceptable results are obtained on three consecutive days in which testing is conducted, the test frequency may be reduced to two spot readings for every 1,000 ft² providing the preparation method remains unchanged. If unacceptable results are encountered during testing or the preparation method has changed in any way, testing will revert back to a frequency of two tests per every 100 ft², until acceptable results are once again achieved over a three day period.

Profile replica tape shall be filed with the project inspection records. The Engineer with the use of a surface profile comparator will randomly inspect angularity of the profile.

The use of steel shot is not permitted.

ITEMS 995.1 and 995.2 (Continued)

TSC AND COATING APPLICATION

Storage, Testing and Sampling

The Contractor shall provide protection from the elements and insure that the paint is not subjected to temperatures outside the manufacturer's recommended extremes.

Before the Contractor will be permitted to use any paint, the material provided for application shall have been sampled, tested and approved in accordance with Section M7. MassDOT's Research and Materials Laboratory needs a minimum of fourteen days after the receipt of samples to test and approve.

Mixing and Thinning

Before the paint is applied, each component shall be mechanically mixed to ensure the pigment is completely dispersed. Mixing of components shall be accomplished by mechanical mixing, boxing or hand mixing of components will not be allowed. Any special precautions or requirements for mixing by the manufacturer shall be followed. Paint shall be kept thoroughly mixed in spray pots or containers during application. The pot life shall not be exceeded or attempts made to extend pot life with the addition of solvent.

If it is necessary for any reason to thin paint it will be done in the presence of the Engineer, in accordance with the manufacturer's recommendations. Thinning must be performed using a measuring cup marked in ounces or milliliters. Other methods, such as eyeballing, are not acceptable. Thinner shall be supplied from and recommended by the same manufacturer as the paint system.

For multi component paints, the mixing of half or partial kits is not allowed. If the need for small quantities of paint is anticipated, the Contractor should order materials accordingly.

Application

Prior to the application of any coating material, the Engineer's approval must be obtained. All surfaces painted prior to the Engineer's approval, shall require the complete removal of the coating applied.

Thermal Sprayed Coating

Apply the TSC within six hours after the final abrasive blast cleaning is performed. If the steel is blast cleaned and remains unmetalized for longer than six hours, or if cleaned steel exhibits evidence of rustback, blast clean it again prior to metalizing. Remove abrasive residue and dust from the surface. Apply the metalizing only after the MassDOT – Highway Representative has accepted the prepared surface.

ITEMS 995.1 and 995.2 (Continued)

Bend Testing for Evaluation of the TSC

Conduct bend tests of applied TSC each day prior to production application. Unless otherwise directed by the MassDOT - Highway, each day that TSC will be applied, conduct bend testing before beginning the production work. For each TSC applicator, blast clean five carbon steel coupons measuring 0.05 inches in thickness, 2 inches width, and between 5 and 8 inches in length. Use the same equipment and abrasive used for the production work. Have each applicator apply the TSC to five coupons in accordance with the requirements of this Section to dry film thickness between 8 and 15 mils. Conduct 180º bend testing on all five coupons using the appropriate mandrel in accordance with the requirements and acceptance criteria of SSPC-CS 23. Minor cracks that cannot be lifted from the substrate with a knife blade are acceptable. If lifting on any of the coupons is possible, modify the surface preparation/TSC process until acceptable results are achieved before proceeding with the production work.

Apply the TSC in accordance with the requirements of the material supplier, this specification, approved procedures and SSPC-CS 23.

The completion of TSC is defined as after the spraying of TSC is complete and all remedial repairs have been performed and the piece is accepted by both QC and MassDOT QA.

Touch-up of bare steel and/or TSC damage shall be done with organic zinc rich primer. The total area subject to repair shall be no more than .50 % of the total square foot of the piece requiring repair. The dry film thickness of the applied coating shall be a minimum of 5 mils. Surface preparation for all repair areas shall be as specified in, “Surface Preparation and Abrasives” paragraph 3. The maximum individual repair shall be limited to 1 square foot. Areas larger than 1 square foot shall be re-blasted and the TSC applied in accordance with this document.

Sealer Coat

Apply the seal coat to the TSC after the MassDOT – Highway Representative has accepted the TSC. The seal coat shall be thin enough when applied to penetrate into the body of the TSC and seal the porosity. Added thickness to porous TSC should not be measurable. Typically, the seal coat is applied at a spreading rate resulting in a theoretical 1.5 mils dry film thickness. Apply the seal coat in accordance with the manufacturer’s instructions as soon as possible after the application of the TSC but in no case greater than 6 hours. Verify that the TSC surface is clean and dry prior to the application of the sealer. If grease, oil, or similar contaminants become deposited on the TSC, remove them in accordance with SSPC-SP 1 prior to the application of the seal coat.

Paint

Applied coatings shall not exhibit, runs, sags, holidays, wrinkling, pinholes, nap hair, topcoat gloss or color variations, or other film discontinuities.

Repair of unacceptable areas that involve removal of the coating system or part of it shall require surface preparation and coating equal to that specified. Repair procedures used for any unacceptable coating shall be those supplied by the contractor and approved by the Engineer.

ITEMS 995.1 and 995.2 (Continued)

Application of full coats of paint shall be accomplished by spray equipment. Spray equipment shall meet the requirements of the coating manufacturer and be in proper working order.

Application by brush and roller will be allowed for limited access areas. Brushes and roller cover recommended by the coating manufacturer shall be used. Areas brushed and rolled will have a uniform thickness and be free of defects and excessive coating thickness.

All coating shall be applied according to the latest manufacturer's data sheet or approved recommendations. The maximum recoat times of the primer, intermediate and finish coats shall not be exceeded.

Application of coatings shall not be done when the relative humidity is above 85% or when the surface temperature of the steel is less than 5°F above the Dew Point. Paint shall not be applied when the surface temperature is below 50°F or when the surface temperature is above 110°F.

If requested by the Engineer the Contractor shall provide written instructions from the coating manufacturer indicating the length of time that each coat must be protected from cold or inclement weather (e.g., exposure to rain) during its curing or drying period.

Paint shall not be applied when, in the Engineer's judgment, conditions are or will become unsatisfactory for application and proper cure. All changes as to the application parameters other than specified must be the manufacturer's and presented in writing and approved by the Engineer. Ambient conditions should be closely monitored so that proper cure/drying is achieved prior to recoat. In no case shall a succeeding coat of paint be applied before the previous coat has cured/dried sufficiently for recoat as per manufactured data sheet.

If required, contaminated surfaces shall be cleaned in accordance with SSPC- SP 1 Solvent Cleaning method 4.1.1.
Measurement of the ambient conditions shall be done in accordance with ASTM, E 337 Test Method for "Measuring Humidity with a Psychrometer" (the Measurement of Wet and Dry bulb Temperatures).

When the primer has cured sufficiently for recoat, all bridge components to be painted shall receive a full intermediate coat.

When the intermediate coat has cured sufficiently for recoat, all bridge components to be painted shall receive the finish coat.

ITEMS 995.1 and 995.2 (Continued)

Coating Thickness
Apply the shop and field coats to the dry film thicknesses as specified.

1. Determine the cumulative dry film thickness of each coat using a magnetic dry film thickness gage in accordance with SSPC-CS 23 and SSPC-PA 2 with the following exceptions:
    a. Take readings on each 100 square-foot increment of the surface.
    b. The minimum specified thickness of the TSC must be achieved at each individual spot measurement location (i.e., the 20 percent under run allowed by SSPC-PA 2 is not permitted for the metalizing).
2. If the thickness of any coat (TSC, seal coat, intermediate coat or top coat) is less than specified, apply additional material in accordance with the manufacturer's instructions and this Section before applying the next coat. Before applying additional TSC, visually confirm that there is no evidence of oxidation or contamination on the surface.

3. Thickness of applied TSC greater than the Contract specified shall be reported to the MassDOT-Highway QA inspector in writing prior to the end of the shift. The thickness of the applied TSC shall not be more than 120% of the specified range for the zone specified.

4. Application of TSC to faying surfaces that require a slip rating shall not be more than the maximum thickness specified in the environmental zone chart for each zone included in the materials section of this specification.

5. The minimum adhesion value of the unsealed TSC shall be the average of 3 spot reading resulting in an average of 700psi for each 500 sq/ft.

Access for MassDOT - Highway Inspection
Provide safe access and sufficient time for MassDOT - Highway inspections for any and all phases of the work, including but not limited to surface preparation, the application of each coat (including field coat), and for an inspection of the completed system.

Quality Control Documentation
Copies of Quality Control daily inspection and testing documents will be provided to the MassDOT – Highway Representative within 24 hours.

HOT DIP GALVANIZED COATING FOR NEW STRUCTURAL STEEL

A. GENERAL
Fabricated steel shall be galvanized as indicated on the plans. All fabrication shall be completed prior to surface preparation and the application of any coating.

The faying surfaces of all field bolted connections shall be coated based on the design of the connection. Class B connections shall be masked prior to galvanizing to allow for application of an approved class B slip coefficient primer. After galvanizing the masked surface will be cleaned in accordance with SSPC-SP11 and coated with the approved zinc rich primer. A galvanized connection will result in a faying surface meeting a class C slip coefficient.

ITEMS 995.1 and 995.2 (Continued)

When grinding, drilling or any other operation produces steel turnings, filings, shavings, etc. the Contractor shall completely clean all areas of all accumulation prior to the end of the work shift.

Locations of field applied studs shall require masking or removal of galvanizing and paint prior to welding.

The Engineer shall provisionally accept the shop coated items before shipment to the jobsite but final acceptance of the coating system will occur after erection of the coated items, and after all required repairs and coating application has been completed.

The Contractor shall be responsible for failure and damage of all applied coating. Failures include but are not limited to, visible corrosion, blistering, checking, cracking, or delamination (peeling) and loss of gloss and color of the coating system. Damage includes but is not limited to damage from installation or from external agents, such as scraping, vandalism, debris impacts, and collisions. The extent and method of repair must be approved by the Engineer.

B. GALVANIZING

The following shall be hot dipped galvanized in accordance with Section M7 of these Specifications:

1. Members identified on the Contract documents.
2. Diaphragms and utility support that are composed of non-weathering steels.
3. All sole plates.

Galvanized members requiring shop fabrication and assembly shall be cut, welded, and/or drilled prior to galvanizing. Bearing members to be milled shall be galvanized prior to milling. A thin layer of a rust inhibitor shall be applied to the milled surface. Material to be painted shall not be quenched after galvanizing.

Where material is required to be welded after galvanizing, the steel shall be masked 3 inches on each side of the weld center line. Prior to field welding the masked surface shall be cleaned in accordance with SSPC-SP11. After welding the area shall be repaired in accordance with ASTM A780 “Repair of Hot Dip Galvanizing” section 4.2.2, “Paints Containing Zinc Dust” and Annex 2. Repair paint shall meet M7.04.11 and application shall be in accordance with the manufacturer’s recommendations.

Damaged galvanized surfaces shall be repaired in accordance with ASTM A780 “Repair of Hot Dip Galvanizing” section 4.2.2 Paints Containing Zinc Dust “High Zinc Dust Content”. The paint shall be applied to achieve a minimum dry film thickness of 3 mils and not more than 5 mils. Repair paint shall meet M7.04.11 and application shall be in accordance with the manufacturer’s recommendations.

The Contractor shall provide protection of the adjacent coating in areas that will be field welded. After welding, the weld areas shall be prepared in accordance with SSPC-SP-11.

ITEMS 995.1 and 995.2 (Continued)

MECHANICAL REINFORCING BAR SPLICER

The work under this Heading shall conform to the applicable provisions of Subsections 901 and M8.01.9 of the Standard Specifications and shall be selected from the Qualified Construction Materials List.

Work shall include furnishing and installing Mechanical Reinforcing Bar Splicers at construction joints as shown on the Plans, and at the Contractor's option in lieu of lapped splices. Mechanical Reinforcing Bar Splicers shall be sleeve or coupler type with non-threaded coupler, sized to develop a minimum of 125% of the bar yield strength.

DRILLING AND GROUTING DOWELS

The work under this Heading shall conform to the relevant provisions of Subsection 901 of the Standard Specifications and the following:

The work to be done under this Heading shall consist of drilling holes, furnishing, installing, and grouting of steel dowel reinforcement for the anchorage of new concrete cap to existing concrete abutment, as shown on the Contract Plans, or as required by the Engineer.

Materials

The grout to be used for these dowels shall meet the requirements of MassDOT's Approved Products and shall be chosen from QCML

Reinforcing steel dowels shall meet the requirements of AASHTO M31 Grade 60. All reinforcing steel dowels shall be epoxy coated in accordance with ASTM A775. The Contractor shall follow the Manufacturer's recommendations for mixing, placing and curing the grout and placing the reinforcing dowels.

Submittals

The Contractor shall submit to the Engineer for review and approval, the methods and procedures for drilling and grouting, and dowel testing, including equipment and materials proposed for the work. The embedment length, the method and equipment used to drill the dowel holes and the diameter of the drilled hole shall, at a minimum, conform to the recommendations of the manufacturer and shall also be submitted to the Engineer for approval.

Construction Methods

The dowel embedment must be adequate to fully develop 125% of the yield strength of the bar and shall be a minimum of 12 inches in length.

ITEMS 995.1 and 995.2 (Continued)

The Contractor shall perform a field test on a minimum of 5% of the dowels for capacity in tension. This testing is incidental to the work under these Items.

The pullout force shall correspond to 90% of the yield strength of the bar. If any of the tested bars pull out or if the surrounding concrete shows signs of fracture, the Contractor shall adjust the hole diameter, embedment length and/or grouting material to meet this test requirement.

The method of applying the tension test load to the dowels shall conform to ASTM E488.

The details of the testing equipment used, and the locations and details of the test dowels shall be submitted to the Engineer for approval. The Contractor shall perform this test as soon as possible in order to eliminate delays in construction due to the approval process. Dowels shall not be ordered until the embedment lengths have been approved by the Engineer.

The diameter of the drilled dowel holes shall be in accordance with the recommendations of the grout manufacturer. The holes shall be blown clear of any debris and shall be approved by the Engineer prior to the placement of any grout materials.

The Contractor shall strictly follow the recommendations of the manufacturer for mixing and placing the grout material prior to the placement of the dowels. The Contractor shall adhere to the recommendations of the manufacturer regarding minimum and maximum temperatures while placing the grout. Any excessive grout around the hole after placement of the dowel shall be struck off smooth while the grout is still fresh.

All dowel holes shall be drilled at locations where impact or percussion type drills would be likely to damage adjacent concrete; however, the drill holes shall be intentionally roughened in these instances to ensure proper adhesion of the grout. No impact or percussion type drills will be allowed unless approved by the Engineer. The drilling operation shall be performed without damage to any existing reinforcing or portion of the structure that is to remain in place. All holes shall be blown clear of any foreign material prior to placement of the grout.

The Contractor shall have no claim for any variations in the diameter of the hole, the embedment length, the method of coring the holes or the type of grout used in anchoring the proposed dowels.

ITEMS 995.1 and 995.2 (Continued)

Manufacturer's Representative

The Contractor shall arrange with the materials manufacturer or distributor to have the services of a competent field representative at the work site prior to any drilling of the proposed dowel holes to instruct the work crews in proper dowel installation procedures.

The field representative shall remain at the job site after work commences and continue to instruct until the representative and the Contractor, Inspector and/or Engineer are satisfied that the crew has mastered the technique of installing the dowels successfully. The representative shall make periodic visits to the Project as the work progresses and shall confer on each visit with the Contractor, Inspector, and/or Engineer. The manufacturer's field representative must be fully qualified to perform the work and shall be subject to the approval of the Engineer.

The Contractor is responsible for the expense of the services of the required field representative and the Contract unit price shall be considered full compensation for all costs in connection therewith.

LAMINATED ELASTOMERIC BEARING W/O ANCHOR BOLTS (101-150)
LAMINATED ELASTOMERIC BEARING W/O ANCHOR BOLTS (>200)

DESCRIPTION OF WORK

The work to be performed under this item shall conform to the relevant provisions of Subsection M9.14.5 and the following:

SUBMITTALS

The Contractor shall submit to the Engineer for approval the following documents:

1. Prior to fabrication:
    a. Written notification in accordance with M9.14.5
    b. Shop drawings for approval in accordance with Section 5.02 of MassDOT's Supplemental Specifications to the Standard Specifications for Highways and Bridges.
        i. Fabrication shall not begin until the Contractor receives written approval from the Department that the submitted shop drawings have been received.
2. Upon delivery of the bearing pads:
    a. A Certificate of Compliance certifying that the elastomeric bearing pads meet the requirements of the contract specifications.
        i. A Mill certificate and certificate of compliance for the steel laminates shall accompany the bearing pads.
    b. Independent testing results as required below.
    c. Additional elastomeric bearing pads for MassDOT Acceptance testing as required below.

ITEMS 995.1 and 995.2 (Continued)

MATERIALS

Elastomer: The elastomeric compound shall be composed of 100% low temperature Grade 3 virgin crystallization resistant polychloroprene (neoprene).

Steel Laminates: The steel laminates shall meet the requirements of AASHTO M 251.

Internal Load Plates: The internal load plates shall conform to AASHTO M 270 Grade 36 or Grade 50.

FABRICATORS

The National Transportation Product Evaluation Program (NTPEP) shall find the bearing pad fabrication plant to be in compliance with the Elastomeric Bridge Bearing Pad Technical Committee Work Plan. Approved fabricators are listed on the MassDOT QCML.

FABRICATION

Bearing pads shall be fabricated in conformance with the "Method B" design method outlined in the AASHTO LRFD Bridge Design Specifications.

The bearing dimensions, including elastomer thickness and edge cover, number and thickness of steel reinforcing laminates, dimensions of load plates (if any), and the design shear modulus of the elastomer shall be as shown on the Plans.

The tolerances on the overall dimensions for the bearings shall be according to Table 2 of AASHTO M 251, except that the tolerance on the overall vertical dimension shall be limited to -0, +1/8" regardless of the design thickness.

SAMPLING

Sampling of bearing pads for testing shall be random and performed on a lot basis. Lots shall be divided into sublots of 10 bearings. Acceptance samples shall be independently tested as outlined below. For Verification samples taken by the Engineer at the project, the sampling rate shall be one randomly selected full size bearing pad of each size and type in accordance with Subsection M9.14.5. A lot shall be defined as the smallest number of bearings determined by the following criteria:

1. A lot shall not exceed a single contract quantity.
2. A lot shall consist of bearings of the same size and configuration.
3. A lot shall consist of bearings produced in a continuous manner from the same batch of elastomer and cured under the same conditions.

All pads required for testing purposes in accordance with Subsection M9.14.5 of the Standard Specifications shall be considered as incidental to these Items. The quantities listed in the Schedule of Basis for Partial Payment only include the number of bearings required for construction and do not include the additional bearings required for conformance and destructive testing as outlined herein.

ITEMS 995.1 and 995.2 (Continued)

INDEPENDENT TESTING

Independent testing shall be performed by a nationally recognized testing laboratory approved by the Engineer which shall provide certified test results. Each Lot of bearings as defined above shall be randomly sampled and tested at the frequency specified under Section 8.5 of AASHTO M 251. The minimum testing shall be in conformance with Sections 8 and 9 of M 251 as specified below:

1. Materials shall meet Section 4 of M 251.
2. Dimensions per Section 8.4 of M 251.
3. Elastomer per Section 8.6 of M 251.
4. Compressive Strain at maximum dead and live load (service) per Section 8.8.1 of M 251.
    a. The compressive deflection of each bearing shall not exceed 10% of the design effective rubber thickness at a compressive load equal to the maximum design load.
5. Short Duration Compression Test per Section 8.8.2 of M 251.
6. Shear Modulus of the Elastomer per Section 8.9.1 of M 251.
    a. The shear modulus shall be between 0.136 and 0.184 ksi.
7. Tensile Strength, Ultimate Elongation per ASTM D412.
8. Shear Bond Strength per ASTM D429.
9. Heat Resistance per ASTM D573.
10. Compression Set per ASTM D395.
11. Low Temperature Brittleness per ASTM D746 for Elastomer Grades 3.

PACKAGING, HANDLING, AND STORAGE

The bearing pads shall be packaged, handled and stored in accordance with Section 18.1.3 of the AASHTO LRFD Bridge Construction Specifications. On the top of each completed bearing it shall be clearly identified and marked in accordance with M 251 Section 7. In addition, a 1/32" deep direction arrow shall be inscribed into the bearing which will allow the bearing to be aligned with the up-station direction. All marks shall be permanent and be visible after the bearing is installed.

INSTALLATION

The bearing pads and bridge seat bearing areas shall conform to Subsection 901.65A(3).

ACCEPTANCE

Requirements for providing notification to the Department prior to the start of bearing pad production as well as the provisions for random sampling of the bearings by the Department at the job site for additional destructive testing shall be in accordance with M9.14.5 and this specification. The Department shall use the results of the Independent testing as well as their own testing in the Acceptance of the bearing pads.

ITEMS 995.1 and 995.2 (Continued)

SCHEDULE OF BASIS FOR PARTIAL PAYMENT

Within 10 days after notice to proceed, the Contractor shall submit on his/her proposal form a schedule of unit prices for the major component Sub-Items that make up Items 995.1 and 995.2 as well as his/her total Lump Sum cost for Bridge Superstructure, Bridge No. W-44-083 and Bridge Superstructure, Bridge No. W-44-093. The bridge structure Lump Sum breakdown quantities provided in the proposal form are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the Lump Sum Contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Items 995.1 and 995.2 and no further compensation will be allowed.

The schedule on the proposal form applies to Bridge Superstructure, Bridge No. W-44-083 and Bridge Superstructure, Bridge No. W-44-093. Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

BRIDGE STRUCTURE NO. W-44-083

Sub-Item	Description	Qty.	Unit	Unit Price	Total
904.3	5000 PSI, 3/4 IN., 685 HP CEMENT CONCRETE	560	CY		
910.1	STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	115000	LB		
*910.4	MECHANICAL REINFORCING BAR SPLICER	197	EA		
*911.1	SHEAR CONNECTORS	3885	EA		
*912.	DRILLING AND GROUTING DOWELS	369	EA		
*922.3	LAMINATED ELASTOMERIC BEARING PAD W/O ANCHOR BOLTS (101-150)	14	EA		
*922.5	LAMINATED ELASTOMERIC BEARING PAD W/O ANCHOR BOLTS (>200)	7	EA		
960.1	STRUCTURAL STEEL – COATED STEEL	212300	LB		
970.	DAMP-PROOFING	1370	SF		
975.4	PROTECTIVE SCREEN TYPE II	420	FT		
				TOTAL LUMP SUM FOR ITEM 995.1 =	

ITEMS 995.1 and 995.2 (Continued)

BRIDGE STRUCTURE NO. W-44-093

Sub-Item	Description	Qty.	Unit	Unit Price	Total
904.3	5000 PSI, 3/4 IN., 685 HP CEMENT CONCRETE	480	CY		
910.1	STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED	101000	LB		
*910.4	MECHANICAL REINFORCING BAR SPLICER	197	EA		
*911.1	SHEAR CONNECTORS	3780	EA		
*912.	DRILLING AND GROUTING DOWELS	400	EA		
*922.3	LAMINATED ELASTOMERIC BEARING PAD W/O ANCHOR BOLTS (101-150)	12	EA		
*922.5	LAMINATED ELASTOMERIC BEARING PAD W/O ANCHOR BOLTS (>200)	6	EA		
960.1	STRUCTURAL STEEL – COATED STEEL	198600	LB		
970.	DAMP-PROOFING	1260	SF		
975.4	PROTECTIVE SCREEN TYPE II	360	FT		
				TOTAL LUMP SUM FOR ITEM 995.2 =	

END OF SPECIAL PROVISIONS

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DOCUMENT A00802

DETAIL SHEETS

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THE COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
10 PARK PLAZA, BOSTON MA

-ESTIMATE OF QUANTITIES - DETAIL SHEET-

CITY/TOWN:
Worcester, MA

YEAR:
2024

STATION:
Harrison Street: 11+42.00 to 16+25.00
Laurel Street: 6+40.00 to 10+17.00

ROAD:
Harrison St and Laurel St

CLASS:
Local

DATE:
11/4/2024

Earth Excavation:	1840	CY	Gravel Borrow:	1700	CY
Class B Trench Excavation:	250	CY	Ordinary Borrow:	380	CY
Class B Rock Excavation;	50	CY	Gravel Borrow for backfilling		
Bridge Excavation:	85	CY	structures and pipes:	130	CY

PAVEMENT **NOTES:**

PROPOSED FULL DEPTH PAVEMENT AREA=1770 SY

SURFACE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER

INTERMEDIATE: 2" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER

BASE: 4" SUPERPAVE BASE COURSE - 37.5 (SBC-37.5) OVER
SUBBASE COURSE: 4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER 8" GRAVEL BORROW (TYPE B)

PROPOSED FULL DEPTH RECONSTRUCTION LESS THAN 4 FEET WIDE I-290

SURFACE COURSE:	1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
INTERMEDIATE COURSE:	2.5" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
BASE COURSE:	6" HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE OVER
SUB-BASE:	8" GRAVEL BORROW (TYPE B)

PROPOSED MEDIAN WITH BARRIER FULL DEPTH RECONSTRUCTION I-290 AREA=1770 SY

FRICTION COURSE:	1.5" ASPHALT RUBBER GAP GRADED - 12.5 (ARGG-12.5) OVER
SURFACE COURSE:	2.5" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
BASE COURSE:	4.25" SUPERPAVE BASE COURSE - 37.5 (SBC-37.5) OVER
SUB-BASE:	4" DENSE GRADED CRUSHED STONE FOR SUB-BASE OVER 8" GRAVEL BORROW (TYPE B)

PROPOSED MEDIAN WITH GUARDRAIL FULL DEPTH RECONSTRUCTION I-290

SURFACE COURSE:	1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
INTERMEDIATE COURSE:	2.5" SUPERPAVE INTERMEDIATE COURSE - 12.5 (SSC-12.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
BASE COURSE:	8" GRAVEL BORROW (TYPE B)

PROPOSED MICROMILLING & RESURFACING AREA=528 SY

SURFACE:	1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER ASPHALT EMULSION FOR TACK COAT OVER
MICROMILLING:	1.5" PAVEMENT MICROMILLING

PROPOSED CEMENT CONCRETE SIDEWALK/ PEDESTRIAN CURB RAMPS/ PAVEMENT BEHIND CONCRETE BARRIERS AREA=657 SY

SURFACE: 4" CEMENT CONCRETE (4000 PSI, 3/4", 610 CEMENT CONCRETE) OVER

FOUNDATION: 8" GRAVEL BORROW (TYPE B)

PROPOSED CEMENT CONCRETE SIDEWALK AT DRIVEWAYS AREA=143 SY

SURFACE: 6" CEMENT CONCRETE (4000 PSI, 3/4", 610 CEMENT CONCRETE) OVER

FOUNDATION: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA DRIVEWAY AREA=86 SY

SURFACE: 1.5" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
2.5" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) OVER

SUB-BASE: 8" GRAVEL BORROW (TYPE B)

PROPOSED HMA SIDEWALK AREA=12 SY

SURFACE: 1.25" SUPERPAVE SURFACE COURSE - 9.5 (SSC-9.5) OVER
1.75" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) OVER

SUB-BASE: 8" GRAVEL BORROW (TYPE B)

ITEM 102.1 TREE TRIMMING

Harrison Street

Sta. 12+70	RT	to	Sta. 12+95	RT
Sta. 14+85	RT	to	Sta. 15+10	RT
Sta. 30+35	LT	to	Sta. 31+40	LT

Laurel Street

Sta. 7+15	RT	to	Sta. 7+55	RT
Sta. 7+35	LT	to	Sta. 7+60	LT
Sta. 9+40	RT	to	Sta. 9+65	RT

ITEM 102.511 TREE PROTECTION – ARMORING AND PRUNING

Laurel Street

Sta. 6+74 LT Sta. 7+35 RT

ITEM 102.521 TREE AND PLANT PROTECTION FENCE

Harrison Street

Sta. 12+83	RT	to	Sta. 13+28	RT

Laurel Street

Sta. 9+51	LT	to	Sta. 9+75	LT

ITEM 103. TREE REMOVED - DIAMETER UNDER 24 INCHES

Harrison Street

Sta. 15+08	LT	Sta. 15+23	LT
Sta. 30+54	LT	Sta. 15+31	LT
Sta. 30+85	LT	Sta. 30+83	LT
Sta. 31+32	LT	Sta. 31+30	LT

ITEM 146. DRAINAGE STRUCTURE REMOVED

Harrison Street

Sta.	13+27	LT	Sta. 13+27	LT
Sta.	15+01	LT	Sta. 15+01	RT
Sta.	80+26	RT		

Laurel Street

Sta.	9+61	RT	Sta. 9+65	LT
Sta.	127+08	RT		

ITEM 201.01 DROP INLET - MUNICIPAL STANDARD

Harrison Street
Sta. 12+58 RT

ITEM 201.5 CATCH BASIN - MUNICIPAL STANDARD

Harrison Street

Sta. 15+20	RT	Sta. 15+05	LT
Sta. 15+45	LT	Sta. 13+16	LT

Laurel Street

Sta. 9+64	LT	Sta. 9+61	RT

ITEM 201.51 ALTERNATIVE CATCH BASIN - MUNICIPAL STANDARD

Harrison Street
Sta. 12+57 RT

ITEM 202. MANHOLE

Harrison Street
Sta. 80+26 RT

ITEM 202.01 MANHOLE - MUNICIPAL STANDARD

Harrison Street

Sta. 15+01	LT	Sta. 15+02	LT
Sta. 15+46	LT	Sta. 15+74	LT
Sta. 15+63	LT	Sta. 13+00	RT

ITEM 202.02 DROP MANHOLE - MUNICIPAL STANDARD

Harrison Street
Sta. 13+11 LT

ITEM 202.5 MANHOLE WITH RISER

I-290
Sta. 127+08

ITEM 210.02 SANITARY SEWER MANHOLE REMOVED

Harrison Street

Sta. 15+00	RT	Sta. 15+38	RT

ITEM 220. DRAINAGE STRUCTURE ADJUSTED

Laurel Street

Sta. 6+47	LT	Sta. 6+92	RT
Sta. 6+89	LT		

I-290 at Laurel Street

Sta. 127+02	RT	Sta. 129+03	RT
Sta. 127+08	LT	Sta. 129+05	LT

Harrison Street

Sta. 11+44	RT	Sta. 11+48	RT

I-290 at Harrison Street

Sta. 80+17	RT	Sta. 80+17	LT
Sta. 80+76	LT		

ITEM 220.5 DRAINAGE STRUCTURE REMODELED

Harrison Street

Sta. 12+57	RT		

ITEM 220.7 SANITARY STRUCTURE ADJUSTED

Harrison Street

Sta. 11+44	LT	Sta. 12+78	LT
Sta. 15+64	LT	Sta. 15+75	RT

Laurel Street

Sta. 6+43	LT	Sta. 6+64	LT
Sta. 6+66	LT	Sta. 9+73	RT

ITEM 220.8 SANITARY STRUCTURE REMODELED

Laurel Street

Sta. 7+35	LT		

ITEM 221.1 FRAME AND COVER - SECURED

Sta. SAME AS	MANHOLE
	MANHOLE WITH RISER

ITEM 222.3 FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD

Harrison Street

Sta. 15+15	RT	CB	Sta. 15+01	LT	CB
Sta. 15+45	LT	CB	Sta. 13+21	LT	DI
Sta. 15+01	LT	CSMH	Sta. 15+02	LT	CSMH
Sta. 15+46	LT	CSMH	Sta. 13+00	RT	CSMH
Sta. 15+63	LT	CSMH	Sta. 15+74	LT	CSMH
Sta. 12+58	RT	ALT CB	Sta. 13+11	LT	CSMH
Sta. 13+16	LT	CB F&C			

Laurel Street

Sta. 6+89	LT	CB	Sta. 6+92	RT	EXCB
Sta. 9+64	LT	CB	Sta. 9+61	RT	EXCB

And as required by the Engineer.

ITEM 223.1 FRAME AND GRATE (OR COVER) REMOVED AND STACKED

Harrison Street

Sta. 12+57	RT	CB	Sta. 13+00	RT	CSMH
Sta. 13+26	LT	DMH	Sta. 13+26	LT	CB
Sta. 15+01	LT	CB	Sta. 15+01	RT	CB
Sta. 15+00		CSMH	Sta. 15+38	RT	CSMH
Sta. 15+63	LT	CSMH	Sta. 15+74	LT	CSMH
Sta. 80+26	RT	DMH			

Laurel Street

Sta. 6+89	LT	CB	Sta. 9+61	RT	CB
Sta. 6+92	RT	CB	Sta. 127+08		DMH
Sta. 9+65	LT	CB			

ITEM 227.4 MASONRY PLUG

Harrison Street

Sta. 13+03	RT	Sta. 13+37	RT
Sta. 15+02	RT	Sta. 15+36	RT
Sta. 15+40	RT	Sta. 15+41	LT
Sta. 15+46	LT	Sta. 15+48	RT
Sta. 15+61	LT		

ITEM 234.12 12 INCH DRAINAGE PIPE - OPTION

Harrison Street and I-290 at Laurel Street

Sta. 80+26	RT	to	Sta. 80+27	LT
Sta. 80+16	RT	to	Sta. 80+26	RT
Sta. 80+24	RT	to	Sta. 80+26	RT
Sta. 127+07	RT	to	Sta. 127+08	RT
Sta. 127+05	RT	to	Sta. 127+08	RT

ITEM 234.15 15 INCH DRAINAGE PIPE - OPTION

Laurel Street

Sta. 127+01	to	127+08	

ITEM 234.18 18 INCH DRAINAGE PIPE - OPTION

Laurel Street

Sta. 127+08	LT	to	Sta. 127+14	LT

ITEM 250.08 8 INCH POLYVINYL CHLORIDE SANITARY SEWER PIPE

Harrison Street

Sta. 12+58	RT	to	Sta. 12+57	RT
Sta. 13+21	LT	to	Sta. 12+78	LT
Sta. 15+01	RT	to	Sta. 15+01	LT
Sta. 15+11	RT	to	Sta. 15+01	LT
Sta. 15+45	LT	to	Sta. 15+63	LT

Laurel Street

Sta. 9+71	LT	to	Sta. 9+73	RT
Sta. 9+61	RT	to	Sta. 9+73	RT

ITEM 250.12 12 INCH POLYVINYL CHLORIDE SANITARY SEWER PIPE

Harrison Street

Sta. 15+01	LT	to	Sta. 15+01	LT
Sta. 15+62	RT	to	Sta. 15+01	RT
Sta. 15+74	RT	to	Sta. 15+63	RT
Sta. 15+63	LT	to	Sta. 15+63	RT

ITEM 251.12 12 INCH DUCTILE IRON SEWER PIPE (MECHANICAL JOINT)

Harrison Street

Sta. 13+08	RT	to	Sta. 14+99	RT
Sta. 13+05	RT	to	Sta. 13+00	RT

ITEM 251.92 12 INCH EXPANSION JOINT FOR SEWER

Harrison Street

Sta. 14+73	RT		Sta. 13+44	RT

ITEM 254.12 12 INCH SEWER PIPE INSULATION

Harrison Street

Sta. 13+11	LT	to	Sta. 14+97	LT

ITEM 303.06 6 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)

Laurel Street

Sta. 9+80	RT	to	Sta. 9+80	RT

Harrison Street

Sta. 12+53	RT	to	Sta. 12+53	RT
Sta. 15+38	RT	to	Sta. 15+38	RT

ITEM 303.08 8 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)

Laurel Street

Sta. 6+49	LT	to	Sta. 9+99	RT

Harrison Street

Sta. 15+58	RT	to	Sta. 15+56	LT

ITEM 303.12 12 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)

Harrison Street

Sta. 12+60	RT	to	Sta. 15+65	RT

ITEM 310.08 8 INCH EXPANSION JOINT

Laurel Street

Sta. 9+08	LT
Sta. 7+82	LT

ITEM 310.12 12 INCH EXPANSION JOINT

Harrison Street

Sta. 14+73 LT

Sta. 13+45 LT

ITEM 347.075 3/4 INCH COPPER TUBING TYPE K

Laurel Street

Sta. 9+88 RT to Sta. 9+88 RT

ITEM 350.06 6 INCH GATE AND GATE BOX

Harrison Street

Sta. 15+49 RT Sta. 12+53 RT

Laurel Street

Sta. 9+80 RT

ITEM 350.08 8 INCH GATE AND GATE BOX

Laurel Street

Sta. 6+64 LT Sta. 9+61 RT

Sta. 9+77 RT

Harrison Street

Sta. 15+58 LT

ITEM 350.12 12 INCH GATE AND GATE BOX

Harrison Street

Sta. 15+53 RT Sta. 15+42 RT

Sta. 12+53 RT Sta. 12+82 LT

ITEM 352.06 6 INCH GATE AND GATE BOX REMOVE AND DISPOSE

Harrison Street

Sta. 12+52 RT Sta. 15+45 RT

And as required by the Engineer.

ITEM 352.08 8 INCH GATE AND GATE BOX REMOVE AND DISPOSE

Harrison Street

Sta. 15+56 RT

ITEM 352.12 12 INCH GATE AND GATE BOX REMOVE AND DISPOSE

Harrison Street

Sta. 12+85 RT Sta. 15+32 RT

Sta. 15+55 LT

ITEM 358. GATE BOX ADJUSTED

Harrison Street

Sta. 11+50 RT Sta. 11+92 RT

Laurel Street

Sta. 6+42 LT

ITEM 363.075 3/4 INCH CORPORATION COCK

Laurel Street

Sta. 9+98 RT

ITEM 371.06 6 INCH COUPLING

Harrison Street

Sta. 12+53 RT

ITEM 371.08 8 INCH COUPLING

Harrison Street

Sta. 15+56 LT

ITEM 371.12 12 INCH COUPLING

Harrison Street

Sta. 12+37 RT Sta. 15+66 RT

ITEM 372.08 8 INCH SOLID SLEEVE

Laurel Street

Sta. 6+45 LT Sta. 9+99 RT

ITEM 373.08 8 INCH WATER PIPE INSULATION

Laurel Street

Sta. 7+65 RT to Sta. 9+40 RT

ITEM 373.12 12 INCH WATER PIPE INSULATION
Harrison Street
Sta. 13+19 RT to Sta. 14+98 RT

ITEM 375.08 8 INCH INSERTION VALVE AND BOX
Laurel Street
Sta. 6+25 RT

ITEM 375.12 12 INCH INSERTION VALVE AND BOX
Harrison Street
Sta. 12+14 RT Sta. 15+91 RT

ITEM 376.1 HYDRANT - EXCLUDING COST OF HYDRANT
Harrison Street
Sta. 15+49 RT

ITEM 376.2 HYDRANT - REMOVED AND RESET
Laurel Street
Sta. 9+81 RT

ITEM 376.4 HYDRANT - REMOVED AND DISPOSED
Laurel Street
Sta. 15+45 RT

ITEM 381.3 SERVICE BOX ADJUSTED
Harrison Street
Sta. 11+93 RT

And as required by the Engineer

ITEM 451. HMA FOR PATCHING

Harrison Street

Sta. 80+20	to	Sta. 80+28
Sta. 15+63	to	Sta. 15+46
Sta. 15+74	to	Sta. 15+63
Sta. 15+45	to	Sta. 15+46
Sta. 80+25		Sta. 15+45
Sta. 15+46		Sta. 15+64
Sta. 15+74		Sta. 15+53

Laurel Street

Sta. 6+50	to	Sta. 6+65
Sta. 6+42		Sta. 6+46
Sta. 6+64		Sta. 6+66

ITEM 470. HOT MIX ASPHALT BERM

Harrison Street

Sta. 81+56	RT	to	Sta. 82+24	RT
Sta. 81+56	LT	to	Sta. 82+24	LT

Laurel Street

Sta. 125+28	RT	to	Sta. 125+94	RT
Sta. 125+28	LT	to	Sta. 125+94	LT
Sta. 129+48	RT	to	Sta. 130+17	RT
Sta. 129+48	LT	to	Sta. 130+17	LT

ITEM 472. TEMPORARY ASPHALT PATCHING

For patching utility trenches

ITEM 477. MILLED RUMBLE STRIP (TYPE A)

Harrison Street

Sta. 79+46	RT	to	Sta. 81+56	RT
Sta. 79+46	LT	to	Sta. 81+56	LT

Laurel Street

Sta. 125+94	RT	to	Sta. 129+48	RT
Sta. 125+94	LT	to	Sta. 129+48	LT

ITEM 504. GRANITE CURB TYPE VA4 - STRAIGHT

Laurel Street

Sta. 6+40	LT	to	Sta. 7+62	LT
Sta. 6+40	RT	to	Sta. 7+72	RT
Sta. 9+16	LT	to	Sta. 9+37	LT
Sta. 9+24	RT	to	Sta. 10+17	RT
Sta. 9+70	LT	to	Sta. 10+17	LT

Harrison Street

Sta. 11+50	LT	to	Sta. 12+44	LT
Sta. 11+50	RT	to	Sta. 11+98	RT
Sta. 12+44	RT	to	Sta. 12+59	RT
Sta. 12+97	RT	to	Sta. 13+07	RT
Sta. 13+34	RT	to	Sta. 13+37	RT
Sta. 14+81	LT	to	Sta. 15+29	LT
Sta. 14+81	RT	to	Sta. 15+55	RT
Sta. 15+85	RT	to	Sta. 15+89	RT
Sta. 15+87	LT	to	Sta. 15+90	LT
Sta. 16+13	RT	to	Sta. 16+25	RT
Sta. 16+21	LT	to	Sta. 16+25	LT
Sta. 30+31	RT	to	Sta. 30+35	RT
Sta. 30+33	LT	to	Sta. 30+37	LT
Sta. 60+33	RT	to	Sta. 60+38	RT

ITEM 504.1 GRANITE CURB TYPE VA4 - CURVED

Harrison Street

Sta. 12+44	LT	to	Sta. 12+68	LT
Sta. 12+84	LT	to	Sta. 60+64	LT
Sta. 16+13	LT	to	Sta. 16+21	LT

ITEM 508. GRANITE TRANSITION - VERTICAL TO SLOPED CURB

Harrison Street

Sta. 79+29	LT	to	Sta. 79+35	LT
Sta. 78+81	RT	to	Sta. 78+87	RT
Sta. 80+26	RT	to	Sta. 80+32	RT
Sta. 80+88	LT	to	Sta. 80+94	LT

Laurel Street

Sta. 126+68	RT	to	Sta. 126+74	RT
Sta. 127+10	LT	to	Sta. 127+16	LT
Sta. 127+90	RT	to	Sta. 127+96	RT
Sta. 128+81	LT	to	Sta. 128+87	LT

ITEM 509. GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT

Harrison Street

Sta. 11+98	RT	to	Sta. 12+04	RT
Sta. 12+29	RT	to	Sta. 12+44	RT
Sta. 12+59	RT	to	Sta. 12+66	RT
Sta. 12+82	RT	to	Sta. 12+97	RT
Sta. 13+07	RT	to	Sta. 13+14	RT
Sta. 13+19	RT	to	Sta. 13+34	RT
Sta. 13+29	LT	to	Sta. 13+39	LT
Sta. 15+29	LT	to	Sta. 15+35	LT
Sta. 15+90	LT	to	Sta. 15+93	LT
Sta. 15+89	RT	to	Sta. 15+93	RT
Sta. 15+98	LT	to	Sta. 16+08	LT
Sta. 15+98	RT	to	Sta. 16+13	RT
Sta. 30+24	LT	to	Sta. 30+33	LT
Sta. 30+24	RT	to	Sta. 30+31	RT

Laurel Street

Sta. 9+37	LT	to	Sta. 9+41	LT
Sta. 9+57	LT	to	Sta. 9+70	LT

ITEM 509.1 GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - CURVED

Harrison Street

Sta. 12+68	LT	to	Sta. 12+75	LT
Sta. 12+79	LT	to	Sta. 12+84	LT
Sta. 13+14	LT	to	Sta. 13+15	LT
Sta. 13+18	LT	to	Sta. 13+29	LT
Sta. 15+77	LT	to	Sta. 15+87	LT
Sta. 16+08	LT	to	Sta. 16+14	LT

ITEM 510. GRANITE EDGING TYPE SA

Laurel Street

Sta. 127+04	LT	to	Sta. 127+10	LT

ITEM 514.2 GRANITE CURB INLET - STRAIGHT- MUNICIPAL STANDARD

Laurel Street

Sta. 6+92	RT	Sta. 6+89	LT
Sta. 9+61	RT		

Harrison Street

Sta. 15+20	RT	Sta. 15+05	LT

ITEM 516. GRANITE CURB CORNER TYPE A

Laurel Street

Sta. 9+42	LT	Sta. 9+83	RT
Sta. 9+56	LT	Sta. 9+96	RT
Sta. 10+15	RT		

Harrison Street

Sta. 15+57	RT	Sta. 15+81	RT

ITEM 594. CURB REMOVED AND DISCARDED

Laurel Street

Sta. 6+40	LT	to	Sta. 7+62	LT
Sta. 6+40	RT	to	Sta. 7+68	RT
Sta. 9+17	LT	to	Sta. 9+41	LT
Sta. 9+23	RT	to	Sta. 10+17	RT
Sta. 9+55	LT	to	Sta. 10+17	LT

Harrison Street

Sta. 11+50	LT	to	Sta. 12+68	LT
Sta. 11+50	RT	to	Sta. 11+94	RT
Sta. 12+29	RT	to	Sta. 12+66	RT
Sta. 12+84	RT	to	Sta. 13+36	RT
Sta. 13+18	LT	to	Sta. 13+38	LT
Sta. 14+81	LT	to	Sta. 15+40	LT
Sta. 14+81	RT	to	Sta. 15+55	RT
Sta. 15+77	LT	to	Sta. 15+98	LT
Sta. 15+85	RT	to	Sta. 15+98	RT
Sta. 16+03	RT	to	Sta. 16+25	RT
Sta. 16+03	LT	to	Sta. 16+25	LT
Sta. 30+24	LT	to	Sta. 30+35	LT
Sta. 30+25	RT	to	Sta. 30+35	RT
Sta. 60+24	LT	to	Sta. 60+64	LT
Sta. 60+25	RT	to	Sta. 60+38	RT

ITEM 620.13 GUARDRAIL, TL-3 (SINGLE FACED)

Harrison Street

Sta. 30+64	LT	to	Sta. 31+12	LT
Sta. 78+05	RT	to	Sta. 78+15	RT

ITEM 627.1 TRAILING ANCHORAGE

Harrison Street

Sta. 15+43	RT	to	Sta. 15+54	RT

ITEM 628.21 TRANSITION TO NCHRP 350 GUARDRAIL

Harrison Street

Sta. 31+12	LT	to	Sta. 31+46	LT
Sta. 60+74	RT	to	Sta. 61+09	RT
Sta. 78+15	RT	to	Sta. 78+49	RT
Sta. 81+28	LT	to	Sta. 81+63	LT
Sta. 80+63	RT	to	Sta. 80+97	RT
Sta. 81+89	LT	to	Sta. 82+24	LT
Sta. 81+89	RT	to	Sta. 82+24	RT

Laurel Street

Sta. 125+93	RT	to	Sta. 126+36	RT
Sta. 126+42	LT	to	Sta. 126+77	LT
Sta. 128+27	RT	to	Sta. 128+61	RT
Sta. 129+20	LT	to	Sta. 129+56	LT
Sta. 129+83	LT	to	Sta. 130+17	LT
Sta. 129+83	RT	to	Sta. 130+17	RT
Sta. 125+28	LT	to	Sta. 125+63	LT
Sta. 125+28	RT	to	Sta. 125+63	RT

ITEM 628.22 TRANSITION TO RIGID BARRIER (SINGLE FACED)

Harrison Street

Sta. 78+49	RT	to	Sta. 78+92	RT
Sta. 80+88	LT	to	Sta. 81+28	LT
Sta. 80+26	RT	to	Sta. 80+63	RT

Laurel Street

Sta. 126+36	RT	to	Sta. 126+75	RT
Sta. 126+77	LT	to	Sta. 127+18	LT
Sta. 127+90	RT	to	Sta. 128+27	RT
Sta. 128+81	LT	to	Sta. 129+20	LT

ITEM 628.23 TRANSITION TO RIGID BARRIER (DOUBLE FACED)

Harrison Street

Sta. 81+56	to	Sta. 81+89

Laurel Street

Sta. 125+63	to	Sta. 125+93
Sta. 129+34	to	Sta. 129+79

ITEM 628.24 TRANSITION TO BRIDGE RAIL

Harrison Street

Sta. 30+30	LT	to	Sta. 30+64	LT
Sta. 60+41	RT	to	Sta. 60+74	RT

ITEM 628.241 SPECIAL TRANSITION TO BRIDGE RAIL

Harrison Street

Sta. 15+18	RT	to	Sta. 15+43	RT

ITEM 629.1 PRECAST CONCRETE BARRIER - SINGLE FACED

Harrison Street

Sta. 79+46	MEDIAN	to	Sta. 81+56	MEDIAN
Sta. 79+41	LT	to	Sta. 80+83	LT
Sta. 78+92	RT	to	Sta. 80+21	RT

Laurel Street

Sta. 125+93	MEDIAN	to	Sta. 129+53	MEDIAN
Sta. 127+21	LT	to	Sta. 128+76	LT
Sta. 126+78	RT	to	Sta. 127+86	RT

ITEM 629.3 CAST-IN-PLACE CONCRETE BARRIER - SINGLE FACED

Harrison Street

Sta. 79+34	LT	to	Sta. 79+41	LT
Sta. 80+83	LT	to	Sta. 80+90	LT
Sta. 78+85	RT	to	Sta. 78+92	RT
Sta. 80+21	RT	to	Sta. 80+28	RT

Laurel Street

Sta. 127+14	LT	to	Sta. 127+22	LT
Sta. 128+76	LT	to	Sta. 128+83	LT
Sta. 126+71	RT	to	Sta. 126+78	RT
Sta. 127+86	RT	to	Sta. 127+92	RT

ITEM 629.5 CAST-IN-PLACE MEDIAN BARRIER CAP

Harrison Street

Sta. 79+47	to	Sta. 81+43

Laurel Street

Sta. 126+08	to	Sta. 129+34

ITEM 630.2 HIGHWAY GUARD REMOVED AND DISCARDED

Harrison Street

Sta. 60+27	RT	to	Sta. 60+74	RT
Sta. 60+33	RT	to	Sta. 61+06	RT
Sta. 79+46	LT	to	Sta. 82+25	LT
Sta. 78+43	RT	to	Sta. 82+25	RT
Sta. 78+75	RT	to	Sta. 80+95	RT
Sta. 79+31	LT	to	Sta. 80+94	LT
Sta. 30+23	LT	to	Sta. 31+46	LT
Sta. 15+17	RT	to	Sta. 15+56	RT

Laurel Street

Sta. 126+41	LT	to	Sta. 128+94	LT
Sta. 126+21	RT	to	Sta. 128+56	RT
Sta. 125+28	LT	to	Sta. 130+20	LT
Sta. 125+28	RT	to	Sta. 130+20	RT

ITEM 644.060 60 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) (LINE POST OPTION)

Laurel Street

Sta. 9+42	LT	to	Sta. 9+43	LT

ITEM 644.072 72 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) (LINE POST OPTION)

Laurel Street

Sta. 9+59	RT	to	Sta. 9+81	RT
Sta. 9+73	RT	to	Sta. 9+74	RT

Harrison Street

Sta. 30+25	LT	to	Sta. 30+33	LT
Sta. 15+22	RT	to	Sta. 15+53	RT

ITEM 665. CHAIN LINK FENCE REMOVED AND STACKED

Harrison Street

Sta. 15+16	RT	to	Sta. 15+53	RT

ITEM 665.2 REMOVE AND DISPOSE CHAIN LINK FENCE

Laurel Street

Sta. 9+42	LT	to	Sta. 9+43	LT
Sta. 9+65	RT	to	Sta. 9+74	RT
Sta. 9+67	RT	to	Sta. 9+81	RT
Sta. 9+73	RT	to	Sta. 9+74	RT

Harrison Street

Sta. 15+13	LT	to	Sta. 15+32	LT
Sta. 15+53	RT	to	Sta. 15+53	RT
Sta. 30+25	LT	to	Sta. 30+33	LT

ITEM 666. CHAIN LINK FENCE REMOVED AND RESET

Laurel Street

Sta. 7+34	LT	to	Sta. 7+35	LT
Sta. 7+59	RT	to	Sta. 7+59	RT
Sta. 7+61	LT	to	Sta. 7+66	LT
Sta. 7+72	RT	to	Sta. 7+77	RT

Harrison Street

Sta. 12+84	RT	to	Sta. 12+84	RT
Sta. 12+84	RT	to	Sta. 13+20	RT
Sta. 13+39	LT	to	Sta. 61+05	LT

ITEM 668. CHAIN LINK FENCE GATE W/GATE POSTS REMOVED AND RESET

Laurel Street

Sta. 7+35	LT	to	Sta. 7+61	LT
Sta. 7+59	RT	to	Sta. 7+72	RT

Harrison Street

Sta. 12+84	RT	to	Sta. 12+93	RT

ITEM 697.1 SILT SACK

Proposed CATCH BASIN-MUNICIPAL STANDARD (201.5)

Existing Laurel Street

Sta. 6+89	LT	Sta. 6+91	RT
Sta. 9+61	RT	Sta. 9+65	LT

Harrison Street

Sta. 127+03	RT	Sta. 129+01	RT
Sta. 12+57	RT	Sta. 13+27	LT
Sta. 15+01	RT	Sta. 15+01	LT
Sta. 77+64	RT	Sta. 80+15	RT

ITEM 701. CEMENT CONCRETE SIDEWALK

Laurel Street

Sta. 6+65	LT	to	Sta. 7+76	LT
Sta. 6+64	RT	to	Sta. 7+85	RT
Sta. 9+15	LT	to	Sta. 9+39	LT
Sta. 9+24	RT	to	Sta. 9+77	RT
Sta. 9+70	LT	to	Sta. 9+90	LT

Harrison Street

Sta. 11+56	RT	to	Sta. 11+98	RT
Sta. 11+50	LT	to	Sta. 12+61	LT
Sta. 12+44	RT	to	Sta. 12+59	RT
Sta. 12+97	RT	to	Sta. 13+07	RT
Sta. 13+32	LT	to	Sta. 13+40	LT
Sta. 13+33	RT	to	Sta. 13+37	RT
Sta. 14+80	RT	to	Sta. 15+55	RT
Sta. 14+81	LT	to	Sta. 15+29	LT
Sta. 15+80	RT	to	Sta. 15+90	RT
Sta. 16+18	RT	to	Sta. 16+25	RT
Sta. 30+31	RT	to	Sta. 30+35	RT
Sta. 30+33	LT	to	Sta. 30+37	LT

ITEM 701. 1 CEMENT CONCRETE SIDEWALK AT DRIVEWAYS

Laurel Street

Sta. 9+37	LT	to	Sta. 9+70	LT
Sta. 9+77	RT	to	Sta. 10+10	RT

Harrison Street

Sta. 11+98	RT	to	Sta. 12+44	RT
Sta. 12+59	RT	to	Sta. 12+97	RT
Sta. 15+55	RT	to	Sta. 15+81	RT

ITEM 701. 2 CEMENT CONCRETE PEDESTRIAN CURB RAMP

Harrison Street

Sta. 12+61	LT	to	Sta. 12+84	LT
Sta. 13+07	RT	to	Sta. 13+33	RT
Sta. 13+16	LT	to	Sta. 13+40	LT
Sta. 15+29	LT	to	Sta. 15+43	LT
Sta. 15+78	LT	to	Sta. 16+19	LT
Sta. 15+81	LT	to	Sta. 16+17	RT

ITEM 702. HOT MIX ASPHALT SIDEWALK OR DRIVEWAY

Laurel Street

Sta. 9+43	LT	to	Sta. 9+55	LT	DRIVEWAY
Sta. 9+70	RT	to	Sta. 10+16	RT	SIDEWALK
Sta. 9+75	RT	to	Sta. 10+15	RT	DRIVEWAY
Sta. 9+85	LT	to	Sta. 9+90	LT	SIDEWALK

Harrison Street

Sta. 12+04	RT	to	Sta. 12+29	RT	DRIVEWAY
Sta. 12+66	RT	to	Sta. 12+82	RT	DRIVEWAY
Sta. 15+58	RT	to	Sta. 15+80	RT	DRIVEWAY
Sta. 30+33	LT	to	Sta. 30+37	LT	SIDEWALK

ITEM 823.70 HIGHWAY LIGHTING POLE AND LUMINAIRE REMOVED AND RESET

Laurel Street

Sta. 9+83 LT

Harrison Street

Sta. 12+48 RT

ITEM 864.04 PAVEMENT ARROWS AND LEGENDS REFLECTORIZED WHITE (THERMOPLASTIC)

Laurel Street

Sta. 7+37	LT	Sta. 7+41	RT

Harrison Street

Sta. 11+70	LT	Sta. 12+40	LT
Sta. 15+13	RT	Sta. 15+20	LT

ITEM 864.33 SLOTTED PAVEMENT MARKER TWO-WAY WHITE/RED

I-290 Westbound under Harrison Street Bridge

I-290 Eastbound under Harrison Street Bridge

I-290 Westbound under Laurel Street Bridge

I-290 Eastbound under Laurel Street Bridge

ITEM 864.34 SLOTTED PAVEMENT MARKER TWO-WAY YELLOW/RED

I-290 Westbound under Harrison Street Bridge
I-290 Eastbound under Harrison Street Bridge
I-290 Westbound under Laurel Street Bridge
I-290 Eastbound under Laurel Street Bridge

ITEM 864.41 GREEN COLORIZED PAVEMENT MARKINGS

Harrison Street

Sta.	12+44	to	Sta.	13+11

ITEM 864.906 PERMANENT PAVING MARKING – 6 INCH (TAPE)

Harrison Street Bridge Deck

Sta.	13+37 LT	to	Sta. 14+80	LT
Sta.	13+37 LT/RT	to	Sta. 14+80	LT/RT
Sta.	13+38 RT	to	Sta. 14+80	RT

Laurel Street Bridge Deck

Sta.	7+77 LT	to	Sta. 9+17	LT
Sta.	7+80 LT/RT	to	Sta. 9+20	LT/RT
Sta.	7+82 RT	to	Sta. 9+22	RT

ITEM 866.106 6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)

Laurel Street

Sta. 6+50	LT	to	Sta. 6+88	LT	DWLEx
Sta. 6+55	RT	to	Sta. 6+92	RT	DWLEx
Sta. 6+88	LT	to	Sta. 7+77	LT	SWL
Sta. 6+92	RT	to	Sta. 7+82	RT	SWL
Sta. 9+17	LT	to	Sta. 9+30	LT	SWL
Sta. 9+22	RT	to	Sta. 9+30	RT	SWL
Sta. 9+30	LT	to	Sta. 9+80	LT	DWLEx
Sta. 9+30	RT	to	Sta. 9+83	RT	DWLEx

Harrison Street

Sta. 11+46	LT	to	Sta. 12+42	LT	SWL
Sta. 11+46	RT	to	Sta. 13+07	RT	SWL
Sta. 12+42	LT	to	Sta. 13+10	LT	DWLEx
Sta. 12+42	LT	to	Sta. 13+10	LT	DWLEx
Sta. 13+26	LT	to	Sta. 13+37	LT	SWL
Sta. 13+26	RT	to	Sta. 13+38	RT	SWL
Sta. 12+85	LT	to	Sta. 12+95	LT	SWL
Sta. 14+80	LT	to	Sta. 15+35	LT	SWL
Sta. 14+80	RT	to	Sta. 15+35	RT	SWL
Sta. 15+35	LT	to	Sta. 15+83	LT	DWLEx
Sta. 15+35	RT	to	Sta. 15+85	RT	DWLEx

ITEM 866.112 12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)

Harrison Street

Sta. 15+35	CW	to	Sta. 15+80
Sta. 15+90	CW	to	Sta. 16+00
Sta. 13+12	CW	to	Sta. 13+22
Sta. 12+74	CW	to	Sta. 13+16
Sta. 15+44	SL	to	Sta. 15+60.5
Sta. 12+80	SL	to	Sta. 13+10
Sta. 11+46	SL	to	Sta. 11+46

ITEM 866.206 6 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED)

I-290 WB at Harrison Street Bridge (Travel Lanes)
I-290 WB at Harrison Street Bridge (Shoulder)
I-290 WB at Harrison Street Bridge (Ramp)
I-290 EB at Harrison Street Bridge (Travel Lanes)
I-290 EB at Harrison Street Bridge (Shoulder)
I-290 EB at Harrison Street Bridge (Ramp)
I-290 WB at Laurel Street Bridge (Travel Lanes)
I-290 WB at Laurel Street Bridge (Shoulder)
I-290 WB at Laurel Street Bridge (Ramp)
I-290 EB at Laurel Street Bridge (Travel Lanes)
I-290 EB at Laurel Street Bridge (Shoulder)
I-290 EB at Laurel Street Bridge (Ramp)

ITEM 866.212 12 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED)

I-290 WB Exit 20
I-290 WB Exit 18
I-290 WB Exit 17

ITEM 867.106 6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)

Laurel Street

Sta. 6+40		to	Sta. 7+80	DBYL
Sta. 9+20		to	Sta. 10+17	DBYL

Harrison Street

Sta. 11+46		to	Sta. 12+64	DBYL
Sta. 13+26		to	Sta. 13+37	DBYL
Sta. 14+80		to	Sta. 15+40	DBYL
Sta. 16+07		to	Sta. 16+25	DBYL
Sta. 13+13	LT	to	Sta. 13+15	SYL

ITEM 867.206 6 INCH REFLECTORIZED YELLOW LINE (POLYUREA) (RECESSED)

I-290 Westbound under Harrison Street Bridge
I-290 Eastbound under Harrison Street Bridge
I-290 Westbound under Laurel Street Bridge
I-290 Eastbound under Laurel Street Bridge

ITEM 874.1 STREET SIGN REMOVED AND RESET

Harrison Street
Sta. 15+41 LT
Sta. 15+41 LT

ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET

Laurel Street
Sta. 7+54 RT
Sta. 9+70 LT
Harrison Street
Sta. 12+15 LT
Sta. 15+40 LT
Sta. 15+40 LT
I-290 WB under Harrison St
OM3-R
OM3-L

I-290 EB under Harrison St
OM3-R
OM3-L

I-290 WB under Laurel St
130 Marker
OM3-R OM3-L

I-290 EB under Laurel St
10 Marker R2-
1

UMass Memorial Guide Sign
OM3-R
OM3-L

ITEM 874.4 TRAFFIC SIGN REMOVED AND STACKED

Laurel Street

Sta. 9+40 RT

Harrison Street

Sta. 12+78 LT
Sta. 12+78 LT
Sta. 12+78 LT
Sta. 12+78 LT
Sta. 12+78 LT
Sta. 12+83 LT
Sta. 12+05 LT
Sta. 12+45 LT
Sta. 13+03 RT
Sta. 13+03 LT
Sta. 13+30 LT
Sta. 13+16 LT
Sta. 13+16 LT
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Sta. 13+16 LT
Sta. 13+16 LT

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DOCUMENT A00808

PROJECT UTILITY COORDINATION FORM

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Project Utilities Coordination (PUC) Form

CONTACTS AND GENERAL UTILITY INFORMATION

Revision Date:
10/14/2022

City/Town:	Project File #:	PUC Completed by:	Utility Pole Set:		
Worcester	609185	C. Grygorcewicz	National Grid Electric		
Route/Street:	**Resident Engineer:**	**Mass DOT PM:**	**Scheduled Ad Date:**	**Total Poles Relocated:**	11/8/2024
Harrison Street & Laurel Street over I-290	*TBD*	Jacob Tanoglu	12/28/2024	0	PRINTED

Consultant:	Contact:	Office #	Cell #	Email
Green International Affiliates, Inc.	Michael Cruz	(978) 843-5266	(978) 505-0212	mcruz@greenintl.com

Utility Company	Contact	Office #	Cell #	Email	Scope, Budget, Duration Submitted		Reimbursement			Potential for District Initiated Early Relocation *		Utilities On Bridge/Structure		Utilities Underground (UG) /Aerial (OH)	
					Yes	No	Agreement	Non-Reimb'le	Notes	YES	NO	YES	NO	UG	OH
National Grid Electric	Manny Munoz		(401) 895-9726	manuel.munoz@nationalgrid.com	X		50%	X	Betterment to install (6) 5" conduit on Harrison Street. Existing duct bank on Laurel Street 50% reimbursable.		X	X	X	X	
Eversource Gas	Paul Better	(978) 895-8819		paul.better@eversource.com	X		50%				X	X		X	
Charter	Rick Molnar	(508) 328-5787	(774) 243-9789	rick.molnar@charter.com	X			X	No active Charter lines exist on either bridge, betterment to install (1) 4" conduit on each bridge.		X		X	X	
Verizon	Paul Styspeck	(413) 787-1845		paul.m.styspeck@verizon.com	X		50%		Verizon has utilities on Laurel Street, none on Harrison Street with no betterment.		X	X	X	X	
Worcester DPW	Jason Mello	(508) 929-1454		mellojk@worcesterma.gov			n/a		Contact Info Only						
Worcester Water	Michael Daigneault	(508) 929-1300 x 2105		daigneaultm@worcesterma.gov			n/a		Contact Info Only						

Utility Relocation Notes for MassDOT Contractor

Unless otherwise noted by Contract, the MassDOT Contractor is to provide the District Construction Office **with 7 Calendar Days advance** notification in order to validate the current progress and provide the required 30 Days advance notice-to-proceed for the first Utility - and each subsequent Utility. These advance notifications are to be identified in the Contractor's Schedules (Pre-Con preparation, Baseline, Subnets, and Updated/Monthly Schedules) as specified in Subsection 8.02. Note: The durations included below do not include these lead-times. See Additional 'Important Basis notes for Contractor' - on last PUC Form page.

Additional notes:

- MADOT contractor to provide utility bay diaphragms
- MADOT contractor to provide & install ductile iron water main, restrained pipe fittings, polyurethane insulation, aluminum jacketing, u-bolts, sleeve through abutments, end seals, casing and gate valves, connection shut-off and tying to existing water line.
- MADOT contractor to provide & install ductile iron sewer pipe & fittings, polyurethane insulation, aluminum jacketing, u-bolts, sleeve through abutments and tying to existing sewer line
- MADOT contractor to provide & install MADOT owned electrical lighting conduits & wire on Harrison Street in both temporary and permanent conditions. This feeds lighting on I-290 and must remain in service for entirety of project.
- MADOT Contractor to provide & install supports and conduit for National Grid electric & Charter cable on both bridges
- It is probable that the existing Verizon lines on Laurel Street and the drain lines on I-290 contain asbestos. MADOT Contractor is responsible for all asbestos testing & removal through items 182.1 & 182.2

Suggested Sequence of Relocation (Based on Consultant proposed construction staging)

The sequence as detailed on the following pages is based on the consultants proposed staging plan. This information was compiled through meetings that included all of the utilities listed below along with the designer and the City of Worcester. The information provided is the best available information prior to project advertisement.

Is 'enabling' (prep) work, by the Contractor, necessary prior to the start of the first series of utility relocations:	Yes	No
	X	

Has any of the Utility work been identified to work concurrently	Yes	No
		X

11/8/2024
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massDOT Massachusetts Department of Transportation Highway Division

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work. Contractor note: In planning and executing the work, the information in these 4 columns is intended to supplement any related Access Restraints that are described in the Special Provisions.				Access Restraint & Limitations of Operations Notes. Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site: Utility working with no other Utilities in vicinity	Concurrent Utilities: Utility working with other Utilities on site	Contractor Off-Site: No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent: Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
Harrison Street over I-290 W-44-083	C		Enabling' work by the Contractor - Install traffic control for Stage 1 as detailed on the plans. Temporarily relocate combined sewer. Remove south side of existing superstructure to limit shown on bridge plans. Existing 12" water line is inactive and can be removed from bridge. Construct the southern side of the proposed superstructure up to the Stage 1 limits, including installation of sewer main, and MassDOT owned (2) 4" electric conduits that feed lighting on I-290. Contractor is also responsible for installation of conduits and junction boxes along west abutment and connecting to I-290 lighting feed off the bridge. Lighting must remain in service throughout construction. For NGrid electric - The utility supports & pipe for NGrid's proposed (6) 5" conduits are to be supplied and installed by Contractor per NGrid's specifications to a termination point beyond the approach slabs, to be coordinated with NGrid. NGrid to install manhole and duct banks up to the Contractor supplied stubs. NGrid will pull wire. For Charter - Contractor to supply & install utility supports & conduit for Charter's proposed (1) 4" conduit, to a termination point beyond the approach slabs, to be coordinated with Charter and per Charter specifications. Charter is responsible for all work & materials beyond approach slabs. For Eversource gas - Contractor to install brackets & rollers (per Eversource specifications) for gas main. Eversource to install pipe with support of MassDOT contractor. Eversource gas to supply brackets, rollers, pipe & casing end seals. MassDOT contractor to provide & install steel sleeve through abutment.							
			UTILITY OPERATIONS - STAGE 1 - Harrison Street over I-290 W-44-083							
Task: 1			***Eversource Gas***							
	C		Required Notice to Eversource Gas (14 days prior to Mobilizing)							
		U	Gas Contractor Crew Mobilize, Project Planning and 8" Pipe & Materials Delivery & storage to on-site location	2	X		X		No	
		U	FORCED ACCOUNT. Install 8" LP Steel Gas Main in 140 ft long Permanent Bridge Crossing on Harrison St over Hwy I-290	15	X		X		No	
		U	FORCED ACCOUNT. Install 8" LP Coated Steel buried main, perform TD Williamson main connection on each side of bridge.	8	X		X		No	
		U	Install Cathodic Protection, 100% X-Ray, Jeep Test, Pressure Test and nitrogen purge main into service	4	X		X		No	
		U	Abandon/Retire old 8" Steel gas main with cut & end caps on each side of the bridge	4	X		X		No	
		U	Backfill & Site restoration and demobilize	2	X		X		No	
			Sub-Total	**35**						
Task: 2			***National Grid Electric***							
		U	Site Readiness: Dig-safe, pre-checks, etc.	5	X		X		No	
		U	Manhole Install	3	X		X		No	
		U	Conduit Install	4	X		X		No	
			Sub-Total	**12**						
Task: 3			***Charter***							
		U	Trench and place conduits	14	X		X		No	
			Sub-Total	**14**						
			UTILITY OPERATIONS - STAGE 2 - Harrison Street over I-290 W-44-083							
Harrison Street over I-290 W-44-083	C		Enabling' work by the Contractor - Install traffic control for Stage 2 & remove north side of bridge superstructure as detailed on the plans. Construct northern section of bridge as shown on plans, including the installation of the water main per the plans & specifications.							
			UTILITY OPERATIONS - PRE-STAGE 1 - Laurel Street over I-290 W-44-093							
Laurel Street over I-290 W-44-093	C		Enabling' work by the Contractor - Install traffic control for Stage 1 as detailed on the plans. Contractor to supply & install (2) 4" temporary Verizon conduits to underside of the existing northern bridge deck per contractor design and Verizon approval (conceptual design shown in bridge plans). Conduit is to be installed to a point beyond the approach slab to be coordinated with Verizon.							
Task: 1			***Verizon***							
	C		MADOT contractor to install 2-4" temporary conduits on bridge for VZ cables							
		U	Verizon contractor ties temporary conduits into MH6455 on west side, places temp ducts on east side from bridge to MH6456	4	X		X		No	
		U	Verizon places temporary copper & fiber cables in MDOT contractor & VZ contractor install temporary conduits	4	X		X		No	
		U	Verizon splices in temporary cables, trims out old cables	22	X		X		No	
		U	Verizon removes old cables from conduits and abandons all old conduits on bridge	2	X		X		No	
			Sub-Total	**32**						

	RESPONSIBLE PARTY		DESCRIPTION - Utility Relocation Phases, Tasks and Activities	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work Contractor note: In planning and executing the work, the information in these 4 columns is intended to supplement any related Access Restraints that are described in the Special Provisions.				Access Restraint & Limitations of Operations Notes Should an AR be considered for the Contractor ?	
	C = Contractor	U = Utility Co.			Exclusive Utility on site: Utility working with no other Utilities in vicinity	Concurrent Utilities: Utility working with other Utilities on site	Contractor Off-Site: No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent: Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No)	Reason/Note (optional)
			UTILITY OPERATIONS - STAGE 1 - Laurel Street over I-290 W-44-093							
Laurel Street over I-290 W-44-093	C		Enabling' work by the Contractor - Remove & construct southern portion of superstructure to Stage 1 limits as shown in plans. For NGrid electric - Contractor to supply & install utility supports, hangers and (6) 5" conduits per NGrid specifications. Stub electric duct bank to termination point just beyond approach slabs to be coordinated with NGrid. For Charter- Contractor to supply & install utility supports, hangers and (1) 4" conduit per Charter specifications. Stub conduit to termination point just beyond approach slabs to be coordinated with Charter. For Verizon - Contractor to install utiilty supports and Verizon supplied hangers & conduits along bridge and stub to termination point just beyond approach slabs to be coordinated with Verizon. For gas - Contractor to install brackets & rollers (per Eversource specifications) for gas main. Eversource to install pipe with support of MassDOT contractor. Eversource gas to supply brackets, rollers, pipe & casing end seals. MassDOT contractor to provide & install steel sleeve through abutment.							
Task: 2			***National Grid Electric***							
		U	Site Readiness: Dig-safe, pre-checks, etc.	10	X		X		No	
		U	Manhole Install	5	X		X		No	
		U	Conduit Install	5	X		X		No	
		U	Manhole dressing and framing	2	X		X		No	
		U	Cable pulling	6	X		X		No	
		U	Cable splicing	3	X		X		No	
		U	Circuit switching	1	X		X		No	
		U	Cable removal	3	X		X		No	
			Sub-Total	**35**						
Task: 3			***Verizon***							
	C		MDOT contractor to install 4-4" permanent fiberglass American U-Tel conduits supplied by Verizon on bridge							
		U	Verizon contractor ties U-Tel conduits into MH6455 on west side, ties in on east side and runs about 172' of conduit to MH6456	5	X		X		No	
		U	Verizon places permanent copper & fiber cables in permanent conduits	5	X		X		No	
		U	Verizon splices in permanent cables	19	X		X		No	
		U	Verizon removes temporary cables from temporary conduits and abandons 6-3 1/2" conduits	2	X		X		No	
	C		MDOT contractor removes temporary conduits on bridge							
			Sub-Total	**31**						
Task: 4			***Charter***							
		U	Trench and place conduits	14	X		X		No	
			Sub-Total	**14**						
Task: 5			***Eversource Gas***							
	C		Required Notice to Eversource Gas (14 days prior to Mobilizing)							
		U	Gas Contractor Crew Mobilize, Project Planning and 6" Pipe & Materials Delivery & storage to on-site location	2	X		X		No	
		U	FORCED ACCOUNT. Install 6" LP Steel Gas Main in 140 ft long Permanent Bridge Crossing on Laurel St over Hwy I-290	15	X		X		No	
		U	FORCED ACCOUNT. Install 6" LP Coated Steel buried main, perform TD Williamson main connection on each side of bridge.	8	X		X		No	
		U	Install Cathodic Protection, 100% X-Ray, Jeep Test, Pressure Test and nitrogen purge main into service	4	X		X		No	
		U	Abandon / Retire old 6" Steel gas main with cut & end caps on each side of the bridge	4	X		X		No	
		U	Backfill & Site restoration and demobilize	2	X		X		No	
			Sub-Total	**35**						
			UTILITY OPERATIONS - STAGE 2 - Laurel Street over I-290 W-44-093							
Laurel Street over I-290 W-44-093	C		Enabling' work by the Contractor - Install traffic control for Stage 2 and remove & construct northern portion of superstructure, including installation of 8" water line, as shown in plans. When installing water main at western approach, coordinate with Verizon for potential hold in place of the existing Verizon conduits going to the utility cabinet at 16 Laurel Street. If it is determined that Verizon conduits cannot be held in place during water line installation, Verizon must re-lay the conduits as shown on plans.							
Task: 6			***Verizon***							
		U	Verizon contractor relocates 4-4" ductbank going from MH6455 to XBOX LS pad	2	X		X		No	
			Sub-Total	**2**						

IMPORTANT BASIS NOTES - FOR CONTRACTOR

1. Unless otherwise specified in the MassDOT Construction Contract, or unless specifically noted within this PUC form, the Utility durations shown herein are to be planned (within the CTD and by the Contractor) as unimpeded access to the Utility company to perform Utility relocations.
2. "Concurrent Utilities" operations noted herein, are to signify those Utility Company operations that can be worked concurrently - MassDOT and the Contractor are to prepare NTPs to Utilities accordingly.
3. "Potential Access Restraints" noted within this PUC Form are for planning purposes. See MassDOT Contract for Contractual Access Restraints (refer to Subsections 8.02, 8.03, and/or 8.06 for Design Bid Build Contracts and Volume II Section 9 for Design Build Contracts).
4. Utility non-work periods - For planning purposes, the durations above contain some non work days (contingency) for New England conditions (precipitation, high temperatures, low temperatures, snow, ice). Gas line work however, typically has a seasonal restriction and can NOT be installed from 15-November to 15-March. Municipally Owned Electric and Gas Utilities are also restricted from proceeding from 15-November to 15-March. The Contractor shall (and the CTD plan) reflect this calendar restriction within the schedule (unless otherwise note).
5. Access - Unless otherwise noted in the Contract, and in addition to the 'enabling' notes above, the Contractor must provide safe and unimpeded access (for trucks, lifts, cranes, etc.) to the Utilities, to allow for the proposed relocation(s) - including but not limited to snow removal, clearing and grubbing, guard rail removal, barrier removal, tree removal, and grading.

DESCRIPTION - Utility Relocation Phases, Tasks and Activities

	RESPONSIBLE PARTY	Estimated Duration (Work Days) by Utilities (Lead time not included)	Concurrent / Exclusive Utility Work Contractor note: In planning and executing the work, the information in these 4 columns is intended to supplement any related Access Restraints that are described in the Special Provisions.				Access Restraint & Limitations of Operations Notes	
	C = Contractor U = Utility Co.		Exclusive Utility on site Utility working with no other Utilities in vicinity	Concurrent Utilities Utility working with other Utilities on site	Contractor Off-Site No Contractor physical construction operations on-site (while Utility is working)	Contractor Concurrent Contractor and Utility are working on-site - but NOT in the same vicinity	Potential Access Restraint (Yes/No) Should an AR be considered for the Contractor ?	Reason/Note (optional)
6		For all MassDOT construction contracts issued after January 2014, the new Utility Coordination/documentation specification is required. This is Section 8.14 in Design-Bid-Build Contracts (see Design-Build index reference for applicable section #).						
7		Prior to starting any and all enabling work for Utilities, the Contractor is to plan in advance with submittals and approved durations.						
8		* Potential District Initiated Early Utility Relocation - if noted herein, the District reserves the right to initiate early utility relocation in advance of the Contract NTP. In submitting a bid price and in the development/basis of the Baseline Schedule, the Contractor shall not plan the Work with the potential benefit of this early utility relocation. As a requirement of the Baseline submission, unless otherwise noted in this Specification, the earliest that the first Utility company is to receive the 30 days advance notification to mobilize to the site, will be 7 calendar days after the pre-construction meeting and never sooner than 7 days after the Contract NTP.						

ASIAN LONGHORNED BEETLE DOCUMENTS

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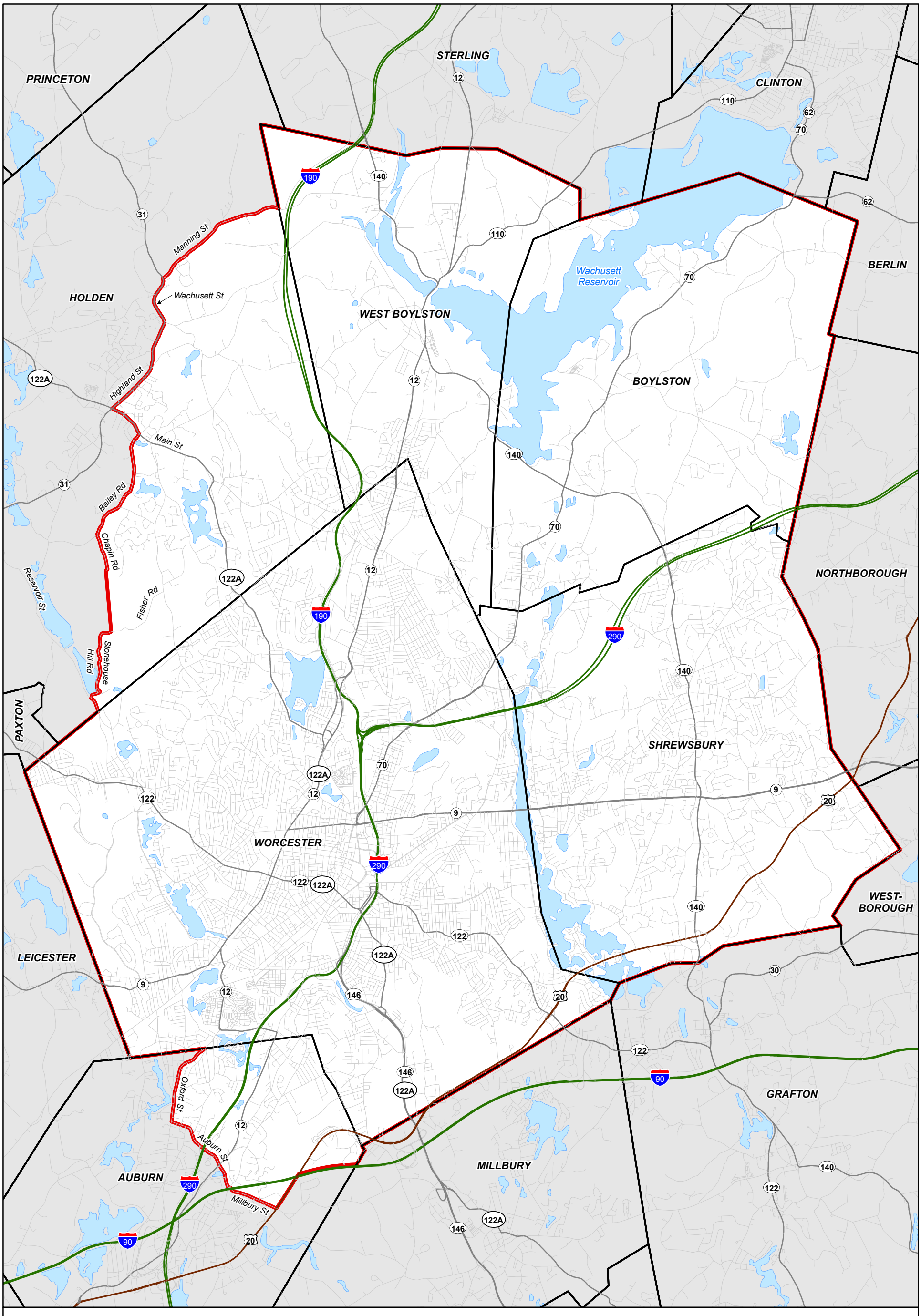
ASIAN LONGHORNED BEETLE ADVISORY

This project falls within the Asian Longhorned Beetle (ALB) Eradication Program Regulated Boundary. Bidders should familiarize themselves with the ALB Factsheet, Federal Regulations, and the Animal and Plant Health Inspection Service (APHIS)/USDA website www.aphis.usda.gov. The following contract bid items may be affected by this condition: Item 103. It is possible that certain additional training & certification requirements and special disposal requirements will be required at a minimum. Bidders shall include any additional costs of compliance with city, state and federal regulations within the above bid items at this time.

Working in Massachusetts' ALB Regulated Areas APHIS has partnered with the U.S. Forest Service, the Massachusetts Department of Conservation and Recreation, the Massachusetts Department of Agricultural Resources, and the City of Worcester. Together, these organizations form the ALB Cooperative Eradication Program in Massachusetts. Both Federal and State law establish regulated areas around ALB infestations. The regulated areas assist in beetle eradication by curtailing the movement of materials that could host populations of the ALB. This keeps infestations from spreading. Federal and State laws outline the conditions and requirements for moving regulated articles out of or within the infested area. The Federal regulation can be found at 7 CFR 301.51. Training sessions, workshops, and other outreach tools designed to assist businesses with compliance are offered in the Worcester area to explain the ALB and laws enacted to eradicate it.


PRINCETON
STERLING
CLINTON
HOLDEN
WEST BOYLSTON
BOYLSTON
BERLIN
Wachusett Reservoir
Manning St
Wachusett St
Highland St
Main St
Bailey Rd
Chapin Rd
Fisher Rd
Reservoir St
Hill Rd
Stonehouse
NORTHBOROUGH
PAXTON
SHREWSBURY
WORCESTER
LEICESTER
WEST-BOROUGH
Oxford St
Auburn St
AUBURN
MILLBURY
Millbury St
GRAFTON
Regulated Area
Lakes and Ponds
Town Boundary
Interstate
U.S. Highway
State Route
Non-numbered route
Regulated Area to Suppress and Control the Asian Longhorned Beetle
October 17, 2011
0 0.5 1 Mile
N
dcr
Massachusetts
Geographic data supplied by the Office of Geographic Information (MassGIS) and DCR GIS.

DOCUMENT A00811

WATERING LOG
for
MassDOT Plantings

Watering Log for MassDOT Plantings

Project Description:

Contract No:

Project No:

Plant Locations/s: (Attach planting plan/s as necessary)

Notes:

	Separate logs shall be kept to track areas or plants with different watering schedules. Trees shall receive a minimum of 10 gallons with each watering and shrubs a minimum of 5 gallons. Provide note that if watering is not performed as scheduled due to rain. Record date of rainfall and amount.												
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													
Date Watered													
Landscape Contractor Initial													
Prime Contractor Initial													

Each week, following watering, Log shall be submitted to the MassDOT Engineer.
6/15/2018

Temporary Traffic Control

Typical Details and
Massachusetts Guidelines
for MassDOT, Municipalities,
Utilities, and Contractors

SHEET INDEX (1 OF 3)

SHEET INDEX (2 OF 3)

STATIONARY OPERATIONS (CONT.) **PAGE**

MOBILE OPERATIONS

SHEET INDEX (3 OF 3)

INTRODUCTION

This guide has been prepared to assist in the planning and installing of temporary traffic controls in maintenance, utility, or short-term construction work areas (work lasting 10 hours or less). This guide serves to assist with the many decisions that must be made for each work site. Special planning for traffic control is necessary on a case by case basis because conditions can vary widely among work locations. **Since this guide cannot cover every situation, representative illustrations covering typical short-term construction, maintenance, and utility operations are presented**.

All typical traffic control device setups illustrated should be considered as guides. The traffic control devices that are shown, the arrangement or position of the devices, and the distances prescribed in the tables are based on the Federal Highway Administration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) and the Massachusetts Amendments to the MUTCD (MA Amendments), but these illustrations only present minimum standards. The provision of safe work zones for all roadway users and roadway workers affected by these activities is paramount. Traffic controls may be expanded or improved upon whenever deemed necessary. Traffic movement through the work site all traffic control devices shall be periodically observed and inspected at all locations.

If necessary, Part 6 of the MUTCD and the MA Amendments, Chapter 17 (Work Zone Management) of MassDOT's Project Development & Design Guide, and the “Traffic Engineering and Safety Section” of the MassDOT web site: (https://www.massdot.state.ma.us/highway/Departments/TrafficandSafetyEngineering.aspx), as well as MassDOT District offices can provide additional guidance, information, and suggestions for work zone setups.

RESPONSIBILITIES FOR TRAFFIC CONTROL

Short-term construction, maintenance, and utility work on or near the roadway creates a potentially hazardous situation, typically requiring the use of temporary traffic controls. These controls are important to protect both work crews and the road users. It is the responsibility of each maintenance foreman to establish and maintain safe and effective controls.

Usually the supervisor, working with the crew, plans the traffic control procedures for proposed work sites. The foreman is responsible for re-questing, storing, and maintaining all traffic control devices necessary for their crews.

The foreman is responsible for placing the devices according to these guidelines. They must inspect each installation and observe traffic flow through the area. The foreman is generally authorized to make adjustments to the original installations that, in their judgment, are necessary to improve the control of traffic and establish greater safety.

All necessary traffic control devices must be installed before work begins and properly maintained during the work period. They must also be removed as soon as they are no longer relevant to the roadway conditions.

In situations such as night time road or lane closures, detours, or other unusual conditions on state highways, the District Traffic Maintenance Engineer (DTME) should be advised. If the DTME is absent, the section foreman shall follow the instructions of the District Maintenance Engineer.

TRAFFIC CONTROL DEVICES

Traffic control devices regulate the movement of road users, warn of unexpected or unusual roadway conditions, and inform them how to maneuver safely through or around the work area. All signs, channelizing devices, barricades, and other miscellaneous traffic control devices should work together to guide traffic safely and efficiently. Common temporary traffic control devices are outlined and described below.

Signs

Temporary traffic control zone (TTCZ) signs are the primary means of providing information and directions to roadway users. All signs must be retroreflective per MassDOT's latest standard.

Warning signs call attention to unexpected conditions and to situations that might not be readily apparent to road users on or adjacent to a roadway. Warning signs alert road users to conditions that might call for a reduction of speed or an action in the interest of safety and efficient traffic operations. Nearly all warning signs for construction and work areas have black legends and borders on a fluorescent orange background.

Regulatory signs shall be used to inform road users of selected traffic laws or regulations and indicate the applicability of the legal requirements. Regulatory signs typically have black legends and borders on a white background.

Channelizing Devices

When used properly, traffic cones, reflectorized plastic drums, and barricades guide traffic through the work area along an appropriate travel path. It takes roadway users a certain distance along the roadway to safely move away from the upcoming active work site. These transition distances are based on the following taper length (L) formulas:

$L = WS^2/60$ for speeds of 40 mph or less; or

$L = WS$ for speeds of 45 mph or more; where

- L = minimum length of taper in feet,
- S = posted speed limit or typical travel speed in miles per hour prior to the work, and
- W = width of lane closure in feet.

The spacing of channelizing devices (in feet) is approximately equal to the existing speed of traffic (in mph).

Warning Lights

Rotating beacons and other flashing lights mounted on work vehicles, signs, or channelizing devices help alert roadway users to the work area. They may also be used to warn roadway users of hazards within the work area. The first 10 drums in any taper shall be equipped with sequential flashing lights.

Arrow Boards

Arrow boards are a special type of sign that are highly visible work zone warning devices. They are particularly effective on highways, where both speed and volume are high. Arrow boards in the non-directional, CAUTION, mode (four corner flashing) may be used to indicate that a shoulder is closed. Arrow boards in the arrow mode shall only be used when a travel lane is dropped on a multi-lane road and one lane of traffic must merge with another. All arrow boards should be located at the beginning of each lane or shoulder closure taper without extending outside of it. Arrow boards shall flash at a rate of 25 to 40 flashes per minute. Arrow boards shall not be used to indicate a lane shift.

BASIC REQUIREMENTS

In every work situation, the temporary traffic control setup must: Give roadway users sufficient advance warning of the work area; advise roadway users of the proper actions to take and travel paths to follow; and provide protection to roadway users, workers, and the work area. These three general requirements can be met as outlined below.

Provide Advance Warning

Warning devices along the approaches to a work area alert roadway Users to changes to road and operating conditions. Roadway users are usually alerted to these dangers via a sign or series of signs installed in the same order as the roadway user generally would expect to see them on long-term construction projects.

The initial project limit sign is usually a general warning such as “ROAD WORK 1500 FT”. Other operational warning signs then provide the roadway user with more specific information about the situation. A minimum of three advance warning signs (the initial project limit sign and two operational warning signs) is recommended when work is located on the traveled way. Warning lights and flags can be used to attract attention to the signs. A highly visible work area helps reinforce the advance warnings.

Advise and Direct Travelers

Operational warning signs provide information to the road-way user such as the type of work being performed, special conditions to watch for, or actions to take. These include signs such as, SHOULDER WORK, RIGHT LANE CLOSED, DETOUR 500 FT, ROAD CLOSED to THRU TRAFFIC, POLICE OFFICER AHEAD, etc. All of these signs must be located far enough in advance of the work area that the roadway user has sufficient time to react to them appropriately. For projects in Urban Areas, see detail: Typical Device Spacing for minimum sign spacing.

Protect Travelers, Workers, and the Work Area

The primary protection of any work area is its own visibility. Traffic cones, reflectorized plastic drums, portable breakaway barricades, etc. are used to make the work area visible and separate workers from traffic.

Other devices, such as flashing lights, flags, delineators, temporary lighting, and portable changeable message signs (PCMS) can be used to provide additional emphasis and visibility.

Workers must protect themselves by being alert to their work situation, wearing safety vests and hard hats, and by facing traffic whenever possible.

Work vehicles can also add protection when they are equipped with truck mounted attenuators, rotating beacons, flashing lights, flashing arrow boards, etc. and are parked between workers and oncoming traffic. However, workers should not position themselves between two closely parked vehicles. No private personal vehicles are allowed within the work site.

PLANNING GUIDELINES

Decisions regarding selection of work area traffic control devices require a knowledge and understanding of the specifics of each work zone. As there may be vast differences between situations, three main variables need to be considered prior to determining the need for, or the selection of, traffic control devices: 1) location of work, 2) type of roadway, and 3) speed of traffic.

Compiling information about these variables will help with planning a safe work area control. Each of these variables is explained below.

Location of Work

The choice of traffic controls needed for a short-term construction, maintenance, or utility operation depends upon the work zone's location. As a general rule, the closer the active work site is to the roadway, the more control devices are needed. Work can take place:

- Away from the shoulder or edge of pavement. No special devices are needed if work is confined to an area 15 or more feet from the edge of the shoulder. A general warning sign, such as ROAD WORK AHEAD, should be used if workers and equipment must occasionally move closer to the roadway.
- On or near the shoulder/ edge of pavement. This area should be signed as if work were on the road itself, since it is part of the roadway users' recovery area. Advance warning and operational signs are needed, as well as channelization devices to direct traffic and keep the work area visible to roadway users.
- On the median of a divided highway. Work in this location may require traffic control in both directions of traffic. Advance warning and channelization devices should be used if the median is narrow.
- On the roadway. This condition requires detailed protection for workers and sufficient warning to roadway users. Advance warning must provide a general message that work is taking place as well as information about specific hazards and specific actions the roadway user must take.

TYPE OF ROADWAY

The characteristics of the roadway also have an important influence on the selection of work area traffic control. The roadway, itself, may present special hazards. You should plan for maximum protection, using the worst hazard present as your guide to signing the work area. Some general considerations are described below for road conditions.

One-way roads: A one-way road requires signage on both sides of the road if it carries two or more lanes in one direction, ensuring roadway users in all lanes are alerted and informed.

Two-way roads:

- **Undivided:** Two-way, undivided roads will usually require controls for both directions of traffic. When the active work site is well off the roadway, controls for the opposite lane may be eliminated.
- **Divided:** Work on divided multi-lane roadways can often be handled as work along a one-way road (i.e. signs are provided along both sides of the roadway along the direction affected). If the work is in the median, both directions of traffic must be controlled, and both approaches should be double signed (i.e. have all 3 advance warning signs on both sides of each direction).

EFFECTS OF SPEED ON WORK ZONES

Speed is an important consideration in the use of work area traffic control devices. As a general rule, the greater the speed of traffic approaching a work area, the greater the size, number, and spacing of control devices.

Size. The standard size for most warning signs is 36 x 36 inches on conventional roadways and 48 x 48 inches on freeways and expressways. Signs larger than the standard 36 x 36 inches may be desirable on high-speed conventional roads.

Position. Install signs far enough in advance of the work area so the roadway users have time to react to them (see charts associated with diagrams for spacing).

OTHER FACTORS

Sight Obstructions. To ensure safety, work areas must be visible. Assess the placement of the temporary traffic control devices by driving through the area, and determine if the devices can be easily seen and provide sufficient time for roadway users to react in a safe manner. Extra precaution should be enacted in areas where horizontal or vertical curves may obstruct a roadway user's clear view of road activities ahead.

Police/Flaggers. It should be noted that the MUTCD does not require police/flaggers for stationary setups. If police/flaggers are used, a police/flagger ahead sign should be used in advance of any point where the police/flagger is stationed to control road users.

PROCEDURES FOR WORK AREA TRAFFIC CONTROL

1. PLAN YOUR WORK

Inspect location of work area and its surroundings.

Analyze:

- Location of work in relation to the traveled way, intersecting road-ways, driveways, and sight distances;
- Type of roadway and traffic involved; and
- Volume and speed of traffic.

Meet and discuss the work and necessary traffic control with the crew.

Study representative illustrations in this guide to develop a temporary traffic control plan (TTCP).

Other Considerations:

- Base your traffic control plan on the premise that all roadway users are unfamiliar with the area.
- The closer the work area location is to traffic, the more controls are needed.
- Plan for maximum protection.
- Select and inspect the temporary control devices needed (including all warning signs), if they are not in good condition, REPLACE THEM!
- Then collect and transport them to the work site.
- Determine their proper placement.
- Install signs and other traffic control devices prior to allowing personnel or equipment onto the roadway.
- Make sure signs are reflective, accurate, clean, and meet specifications. Completely cover any existing permanent signs that will conflict with the messages of the new work area control signs.

2. INSTALLING/REMOVING TEMP. TRAFFIC CONTROL DEVICES

Care must be exercised when installing and removing temporary traffic control (TTC) devices. The traffic control needed to perform the operation safely is dictated by the location on the roadway the operation will occur: in a shoulder or a lane, in the left lane or right, etc. In all cases, installing TTC begins and ends as a mobile operation.

A shadow vehicle with a truck mounted attenuator (TMA) shall be used to protect workers installing and removing TTC devices on all roadways with a posted speed limit of 45 MPH or greater as directed by the engineer. TTC devices shall not be installed or removed from a shadow vehicle with a TMA. TTC devices shall be installed or removed from a work operation vehicle only and a shadow vehicle with a TMA shall be used to protect the workers installing or removing the devices.

PROCEDURES FOR WORK AREA TRAFFIC CONTROL (CONT.)

3. INSTALL TRAFFIC CONTROL DEVICES AT WORK SITE

FOR LOWER SPEED (≤ 40 MPH) ROADWAYS:

1) All devices shall be installed in order with the flow of traffic.

2) Where one direction of traffic is being affected, the first sign installed should be the sign farthest from the work site, and on the same side as the work.

3) Where two directions of traffic are affected, install signs for opposing traffic first, starting with the sign farthest from the work area. When signs for opposing traffic have been installed, install signs on the same side as the work area, again beginning with the sign farthest from the active work site.

4) Once signs are in place, other traffic control devices shall be installed in the same manner as the signs.

FOR HIGHER SPEED (≥ 45 MPH) ROADWAYS:

1) All devices shall be installed in order with the flow of traffic.

2) Install all advance warning signs, beginning with the ROAD WORK XXX (W20-1) sign and ending with the END ROAD WORK/DOUBLE FINES END (MA-R2-10E) sign.

3) Install all signs beginning with the opposite side which will be closed (for a right lane closure; first, install all signs on the left side (shoulder) and then install all signs on the right side (shoulder). No signs shall be erected on the roadway unless delineated by traffic control devices.

4) If required, install shoulder taper as the mobile operation advances.

5) Install arrow board on the shoulder prior to the merging taper or as close to the beginning of the merging taper as possible.

6) Install channelizing devices to form a merging taper. Use of a shadow vehicle with a TMA during installation is required on roads with speed limits of 45 MPH or greater or as directed by the Engineer.

7) Install traffic control devices along the buffer space at the appropriate spacing.

8) Continue placing devices along the work space at the appropriate spacing.

9) Install devices for the termination area as necessary.

10) Place the shadow vehicle with a TMA in advance of the first work crew or hazard approached by motorists. Multiple shadow vehicles may be required based on the number of lane and shoulder closures implemented.

4. INSPECT WORK AREA SIGNING AND CONTROL DEVICES

1) Assess the placement of the temporary traffic control devices by driving through the work area. All approaches to the work zone should be checked.

2) Ensure roadway users will have sufficient time to read signs and react in a safe manner.

PROCEDURES FOR WORK AREA TRAFFIC CONTROL (CONT.)

3) Check visibility of entire work area. If approaching roadway users can't see the work area well, or if they can't see ahead to traffic that may already be queued on the approach because of the work, additional traffic control devices should be deployed.

4) Check to ensure the proper temporary traffic control devices are positioned to protect workers from traffic (where possible).

5) Ensure all workers wear safety vests, hard hats, and all other necessary safety equipment. All worker safety gear should be in good condition. All reflective gear should be clean and highly visible in the dark.

6) Record in the log book the number and location of all signs and devices.

Considerations:

- Work area signs should never be blocked from view or obscured by vegetation, existing signs, or other obstructions.
- Flags, flashing lights, and edge line traffic cones can be used to improve visibility.

5. REMOVE TRAFFIC CONTROL DEVICES AT WORK SITE

All workers and equipment should be clear from work site BEFORE removing signs and other devices.

FOR LOWER SPEED (≤ 40 MPH) ROADWAYS:

1) Remove signs and other devices within the delineated area when work is complete.

2) Remove other traffic control devices in the reverse order in which they were installed

3) Remove signs in the reverse order in which they were installed (i.e. sign closest to the work area to be removed first).

4) When the operation is complete, uncover any existing permanent signs covered in Step 2.

5) Record in the log book the time at which the signs were removed.

FOR HIGHER SPEED (≥ 45 MPH) ROADWAYS:

All TTC devices for a stationary lane closure on a multi-lane roadway, except advance warning signs, should be removed against the flow of traffic in the following sequence:

1) Remove the channelizing devices starting from the end of the activity area working back to the widest part of the merging taper.

2) A shadow vehicle with TMA shall be positioned to protect workers removing devices and work backwards as the setup is removed from the roadway.

PROCEDURES FOR WORK AREA TRAFFIC CONTROL (CONT.)

3) Place the removal vehicle on the shoulder, and remove the channelizing devices from the merging taper by hand onto the work vehicle.

4) Remove the arrow board once traffic is clear and it is safe to do so.

5) Circle back and moving with the flow of traffic, remove the advance warning signs starting with the opposite side from previous lane closure first.

6) At no time shall workers run across the multilane roadway to remove signs on both sides of the road simultaneously.

7) Record in the log book the time at which the signs were removed

RAMP FACILITIES

At all times it is necessary to control the on and off-ramp traffic during the installation and breakdown of traffic control devices. Use of temporary traffic slow-downs or rolling roadblocks is recommended to allow for the safety of workers handing temporary traffic control devices on ramp facilities. A shadow vehicle with a TMA shall be used to protect the workers installing or removing the devices. At no time shall the work operation vehicle be used as the shadow vehicle with the TMA.

USE OF THIS GUIDE

Illustrations showing minimum standards for short-term construction, maintenance, and utility operations are arranged in this guide by type of operation. The users of this guide should compare all illustrated examples and examine their differences. After gathering information about the work zones using the general guidelines as outlined, proceed as follows:

1) Turn to the Index. Consider the type of operations and the type of roadway upon which work will occur.

2) Select the figure that most closely matches the conditions where you plan to work. Remember that all diagrams represent minimum standards.

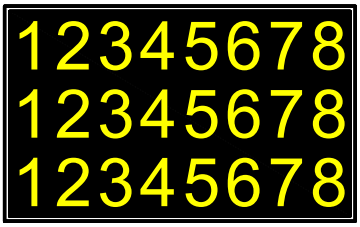
3) Read the title of the illustration to ensure that it is appropriate to your location. Study the layout of traffic control devices and read all notes.

4) Consult the appropriate tables, as directed on each illustration to determine taper length and proper spacing of signs. Notice that distances change when speeds change. Also note that these are guidelines, only, and they must be adapted to your specific work area.

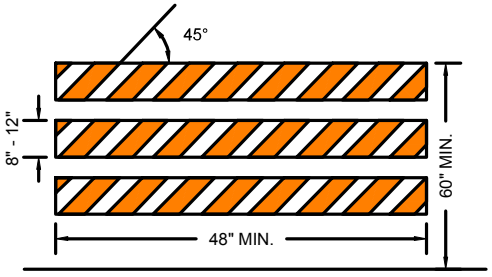
5) Use the **"PROCEDURES FOR WORK AREA TRAFFIC CONTROL"** for assistance in completing all necessary steps to provide effective and safe work area traffic control.

massDOT Massachusetts Department of Transportation Highway Division PAGE 10	Work Zone Safety Standard Details and Drawings	FIGURE 1 TYPICAL TRAFFIC CONTROL DEVICES NOT TO SCALE

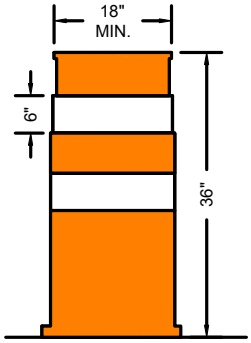
SIGN



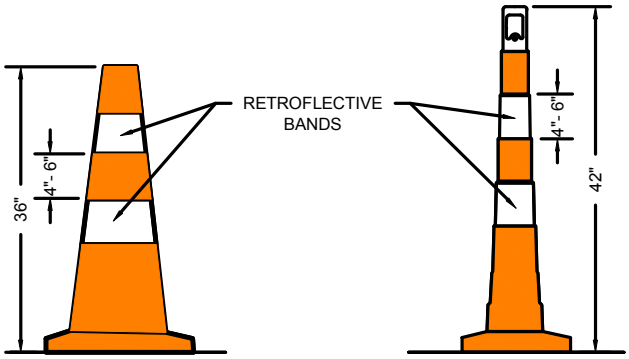
PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)



TYPE III BARRICADE

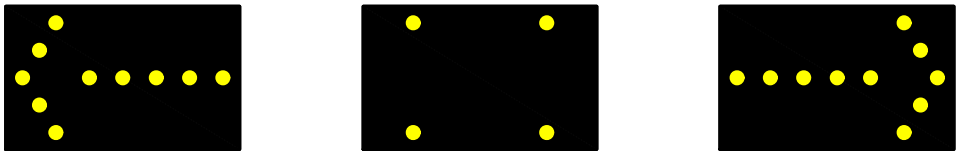


DRUM



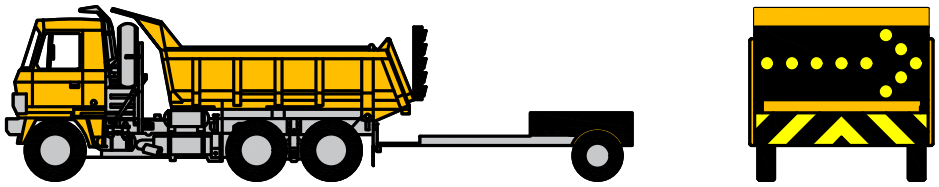
CONES

Cones may be used for all daytime operations. For night work, drums should be used to form the taper(s) and cones can be used along the tangent section of the work setup.



LEFT CAUTION RIGHT

ARROW BOARD (WITH MODE)



TRUCK MOUNTED ATTENUATORS

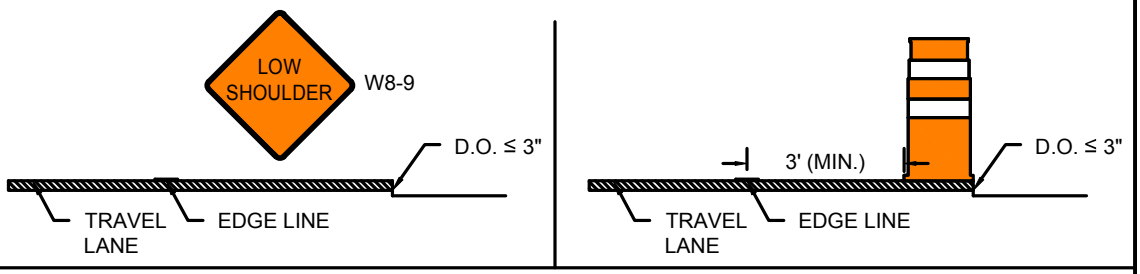
Truck Mounted Attenuators (TMA) shall be positioned between the start of the work area and the end of the designated buffer zone. The TMAs are to be positioned in each temporarily closed lane. This includes shoulders (≥8 feet) whether combined with a travel lane closure or being closed alone. These TMA conditions are required on roadways with speeds of 45 MPH or greater. TMAs can be used on other roadways at the discretion of the engineer. TMAs shall be used for the deployment and removal of all traffic control devices, including all advance warning signs.

SHORT-TERM PAVEMENT EDGE DROP-OFFS

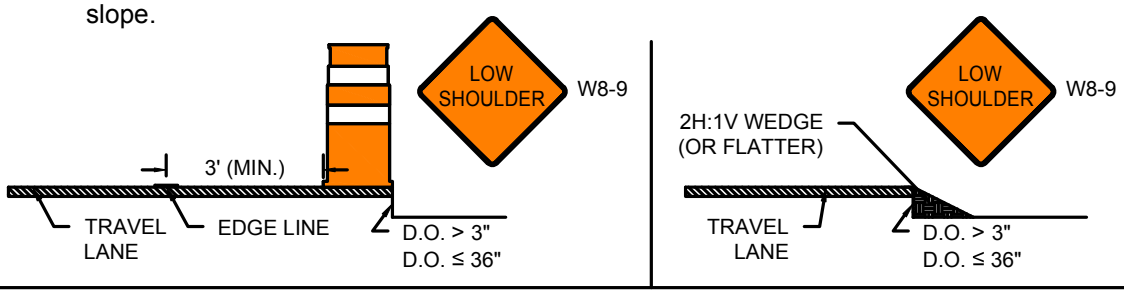
Note that this guidance is adopted from the Roadside Design Guide*, 4th Edition.*

Pavement drop-offs may occur during paving, excavation, and other construction activities. Drop-offs create hazards for vehicles if not properly mitigated. The following applies for all roads with speed limits greater than 30 mph; for roads with speed limits of 30 mph or less, treatments for pavement edge drop-offs are at the discretion of the Engineer. Drop-offs between adjacent, open travel lanes should not exceed 2", and any drop-off in excess of 3" should not be left unattended without one of these mitigation measures applied.

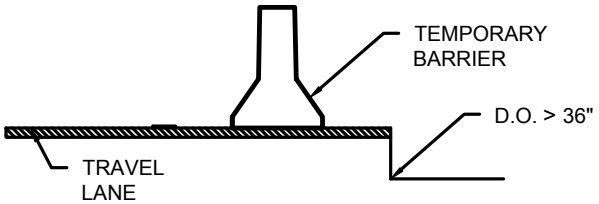
- Shoulder drop-offs 3" or less adjacent to a shoulder or active travel lane should be mitigated by:
  - ✓ A W8-9 (LOW SHOULDER) sign in advance of and at regular intervals throughout the treatment; or
  - ✓ The placement of drums on the traffic side of the drop-off.



- Shoulder drop-offs greater than 3" but less than or equal to 36" should be mitigated by:
  - ✓ A W8-9 (LOW SHOULDER) sign in advance of and at regular intervals throughout the treatment and the placement of drums on the traffic side off the drop-off, offset at least 3' from the travel lane; or
  - ✓ A W8-9 (LOW SHOULDER) sign in advance of and at regular intervals throughout the treatment and the placement of a temporary wedge of material along the face of the drop-off. The wedge should consist of stable material placed on a 2H:1V or flatter slope.



- Shoulder drop-offs greater than 36" must be protected by temporary barrier.



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PAGE 11

Work Zone Safety Standard Details and Drawings

FIGURE 2
PAVEMENT EDGE
DROP-OFF GUIDANCE
NOT TO SCALE

massDOT Massachusetts Department of Transportation Highway Division PAGE 12	Work Zone Safety Standard Details and Drawings	TYPICAL DEVICE SPACING

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	320	305	20	55
45-55	500 / 1000 / 1000	660	495	40	40
60-65	1000 / 1600 / 2600	780	645	40	50

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

MINIMUM SPACING OF ADVANCE WARNING SIGNS FOR URBAN ROADWAYS	
ROAD TYPE	DISTANCE BETWEEN SIGNS
URBAN (LOW SPEED)	100 FT
URBAN (HIGH SPEED)	350 FT

NOTES

1. 40 FT = 10 FT PAVEMENT MARKING + 30 FT SKIP

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

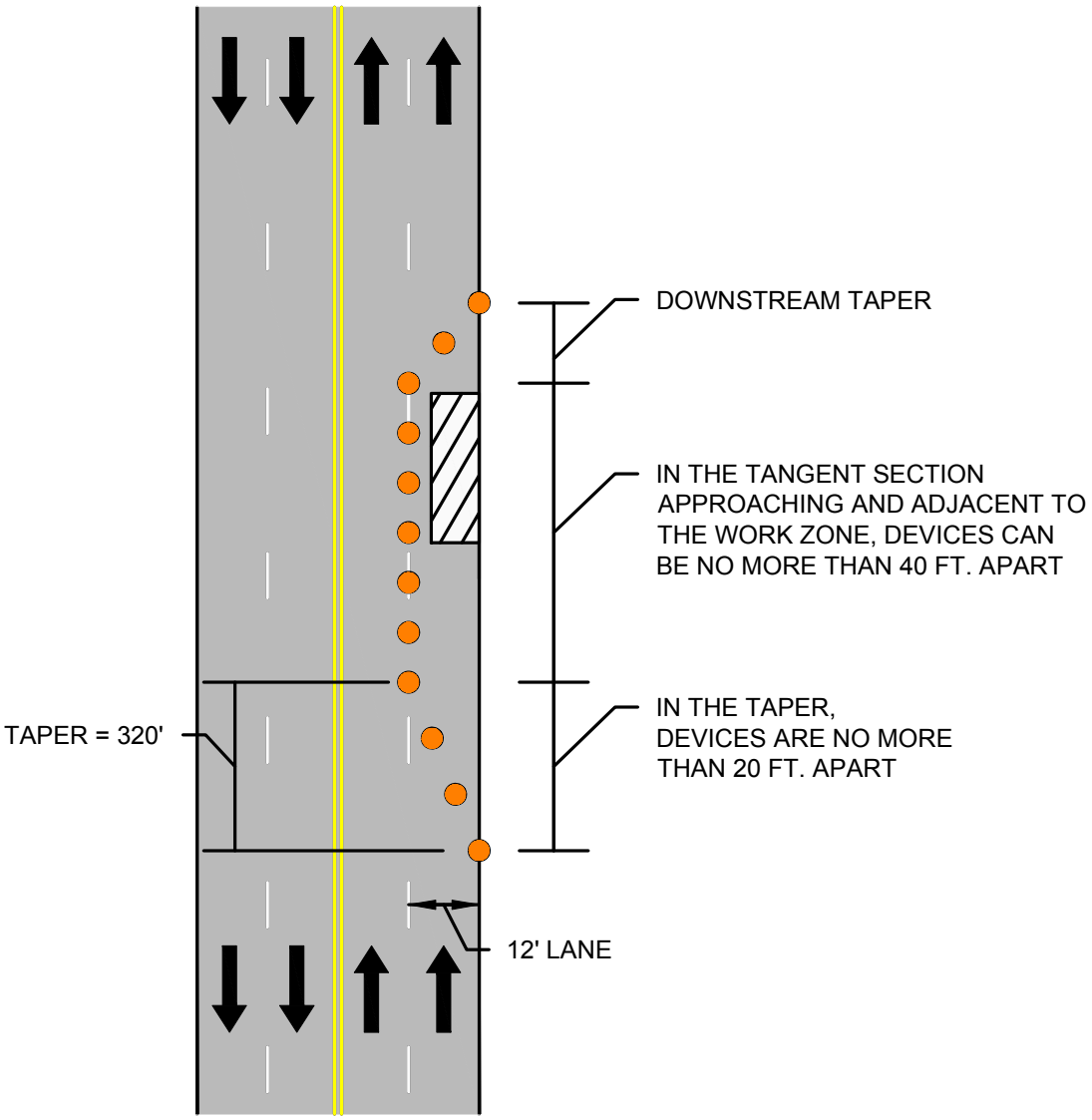
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 13	Work Zone Safety Standard Details and Drawings	FIGURE 3 TYPICAL DEVICE SPACING (AT 30 MPH)

Guidance for Flagging Operations

NOTE:
A flagger shall always be aware of their surroundings and have a good escape route. A flagger shall never be positioned directly beside or against construction equipment. When a flagger is required to direct traffic in an area where the escape route is partially blocked by a traversable obstruction such as a guardrail, the flagger shall be physically capable of traversing that obstruction. Prior to commencing a project, the supervisor in charge shall review the project, including guardrail areas, for safe flagging stations. The supervisor in charge shall clearly communicate with the flagger(s), indicating any locations where they cannot safely perform their duties.

Each flagger shall be equipped with the following high visibility clothing, signaling, and safety devices:

1) A white protective hard hat with a minimum level of reflectivity per the requirements of ANSI, Type I, Class E&G;
2) A clean, unfaded, untorn lime/yellow reflective safety vest and pants meeting the requirements of ANSI 107 Class 3 with the words "Traffic Control" on the front and rear panels in minimum two (2) inch (50 millimeter) high letters;
3) A 24 inch "STOP/SLOW" traffic paddle conforming to the requirements of Part 6E.03 of the Manual on Uniform Traffic Control Devices (MUTCD), a weighted, reflectorized red flag, flagger station advance warning signage, and two-way radios capable of providing clear communication within the work zone between flaggers, the Contractor, and the Engineer. The traffic paddle shall be mounted on a pole of sufficient length to be seven feet above the ground as measured from the bottom of the paddle;
4) A working flashlight with a minimum of 15,000 candlepower and a six inch red attachable wand, a whistle with a working lanyard, and a First Aid kit that complies with the requirements of ANSI Z308.1; and
5) An industrial/safety type portable air horn that complies with the requirements of the U.S. Coast Guard.

A "STOP/SLOW" paddle should be the primary hand-signaling device. It shall have an octagonal shape on a rigid handle. Flag use should be limited to emergency situations.

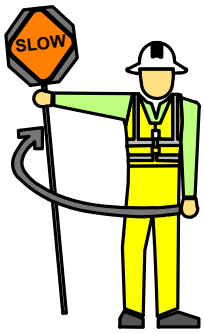
TO STOP TRAFFIC

Properly Trained Flaggers

- Give clear messages to drivers.
- Allow distance for drivers to react.
- Coordinate with other flaggers.
- Use standard signaling methods.

Properly Equipped Flaggers

- Use approved stop/slow paddles.
- Use approved safety apparel.
- Use retroreflective equipment.
- Use hand held radios, as needed.
- All flaggers shall wear safety apparel that meets ANSI Class 3 requirements. The combination of vest and pants is required.



TO LET TRAFFIC PROCEED

Proper Flagging Stations

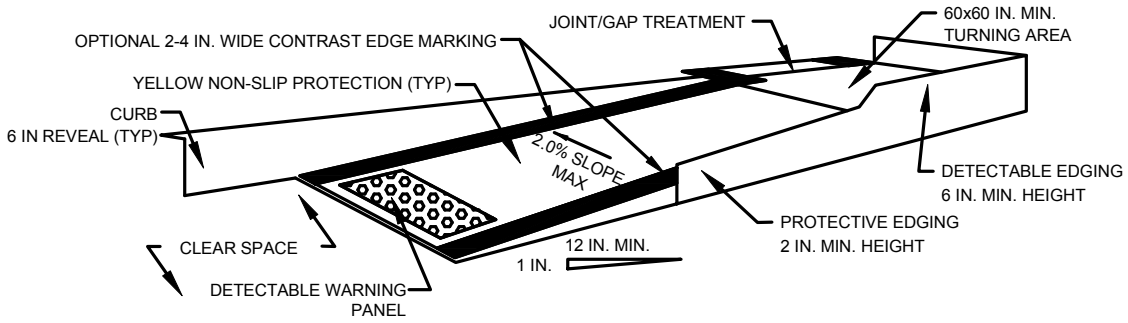
- Good approach sight distance.
- Highly visible to traffic.
- Stand alone away from other machinery and people.
- Stand on right edge of pavement or shoulder- proceed to centerline only when first vehicle has come to stop.
- Have a good escape route.

TO ALERT AND SLOW TRAFFIC

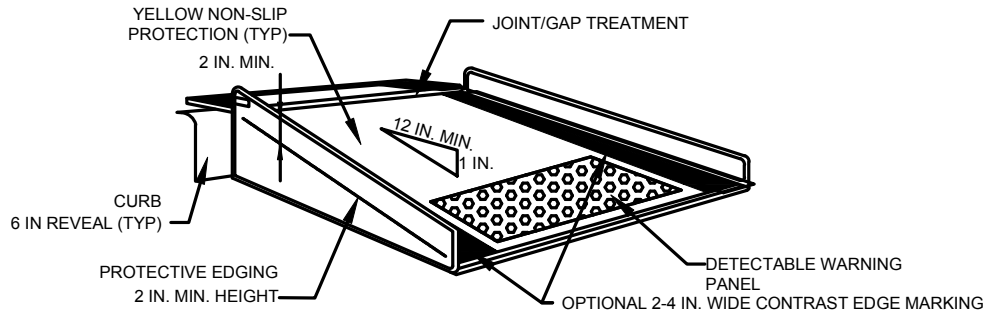
Proper Advance Warning Signs

- Always use warning signs.
- Allow for reaction distance from signs.
- Remove signs if no longer necessary or not flagging.
- Use free hand in up-and-down motion to help slow traffic.

massDOT Massachusetts Department of Transportation Highway Division PAGE 16	Work Zone Safety Standard Details and Drawings	FIGURE 4 TYPICAL PEDESTRIAN DEVICES (1 OF 2) NOT TO SCALE



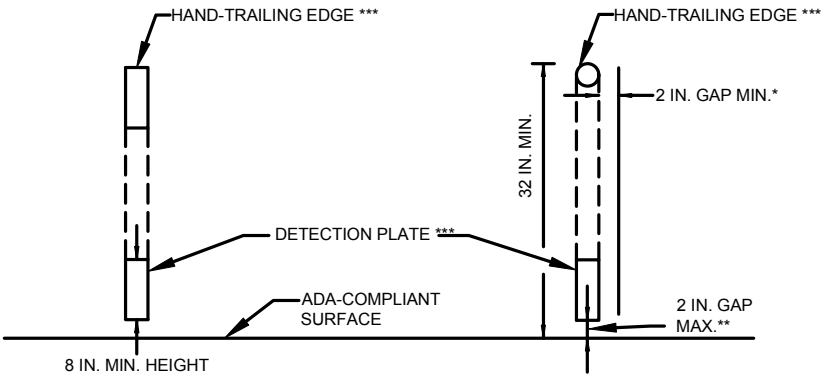
TEMPORARY CURB RAMP-PARALLEL TO CURB



TEMPORARY CURB RAMP-PERPENDICULAR TO CURB

NOTES:

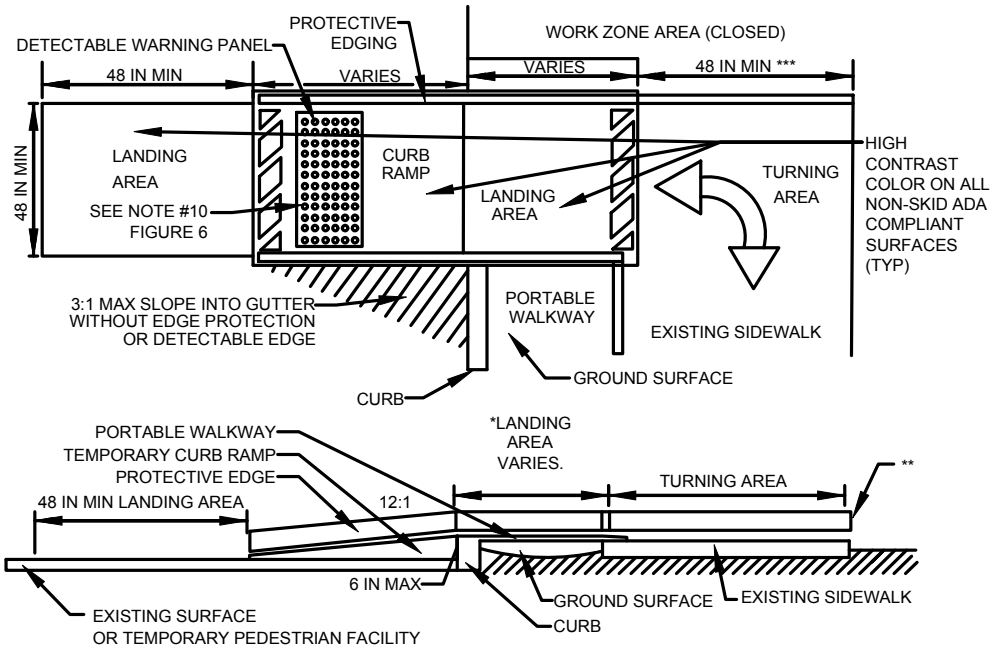
1. CURB RAMPS SHALL BE 60 IN. MINIMUM WIDTH WITH A FIRM, STABLE, AND NON-SLIP SURFACE.
2. PROTECTIVE EDGING WITH A 2 IN. MINIMUM HEIGHT SHALL BE INSTALLED WHEN THE CURB RAMP OR LANDING PLATFORM HAS A VERTICAL DROP OF 6 IN. OR GREATER OR HAS A SIDE APRON SLOP STEEPER THAN 1:3 (33%). PROTECTIVE EDGING SHOULD BE CONSIDERED WHEN THE CURB RAMPS OR LANDING PLATFORMS HAVE A VERTICAL DROP OF 3 IN. OR MORE.
3. PROTECTABLE EDGING WITH 6 IN. MINIMUM HEIGHT AND CONTRASTING COLOR SHALL BE INSTALLED ON ALL CURB RAMP LANDINGS WHERE THE WALKWAY CHANGES DIRECTION (TURNS).
4. THE CURB RAMP WALKWAY AND LANDING AREA SURFACE SHALL BE OF A SOLID CONTINUOUS CONTRASTING COLOR ABUTTING UP TO THE EXISTING SIDEWALK.
5. CURB RAMPS AND LANDINGS SHOULD HAVE A 1:50 (2%) MAX CROSS-SLOPE.
6. CLEAR SPACE OF 48x48 IN. MINIMUM SHALL BE PROVIDED ABOVE AND BELOW THE CURB RAMP.
7. WATER FLOW IN THE GUTTER SYSTEM SHALL HAVE MINIMAL RESTRICTION.
8. LATERAL JOINTS OR GAPS BETWEEN SURFACES SHALL BE LESS THAN 0.5 IN. WIDTH.
9. CHANGES BETWEEN SURFACE HEIGHTS SHOULD NOT EXCEED 0.5 IN. LATERAL EDGES SHOULD BE VERTICAL UP TO 0.25 IN. HIGH, AND BEVELED AT 1:2 BETWEEN 0.25 IN. AND 0.5 IN. HEIGHT.
10. IF A TEMPORARY PEDESTRIAN RAMP LEADS TO A CROSSWALK, THEN A DETECTABLE WARNING PAD MUST BE ADHERED TO THE BASE OF THE RAMP. IF IT LEADS TO A PROTECTED PEDESTRIAN BYPASS THAT DOES NOT CONFLICT WITH VEHICULAR TRAFFIC, THEN A PAD SHALL NOT BE INSTALLED ON THE RAMP.



CROSS SECTION VIEW

PEDESTRIAN CHANNELIZING DEVICE

* THERE SHALL BE A 2 INCH GAP BETWEEN THE HAND-TRAILING EDGE AND ITS SUPPORT.
** A MAXIMUM 2 INCH GAP BETWEEN THE BOTTOM OF THE BOTTOM RAIL AND THE SURFACE MAY BE USED TO PROVIDE DRAINAGE.
*** THE HAND-TRAILING EDGE AND DETECTION PLATE SHALL BE CONTINUOUS THROUGHOUT THE LENGTH OF THE PATH SUCH THAT A PEDESTRIAN USER WITH A LONG CANE CAN FOLLOW IT.



TEMPORARY CURB RAMP

* LANDING AREA USED TO OVERLAP NON-ADA COMPLIANT SURFACES.
** DETECTABLE EDGE REMOVED IF A CONTINUOUS SIDEWALK.
*** 60 IN. IF AN OBSTRUCTION IS AT BACK OF SIDEWALK.

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Work Zone Safety Standard Details and Drawings

FIGURE 5
TYPICAL PEDESTRIAN DEVICES
(2 OF 2)
NOT TO SCALE

massDOT Massachusetts Department of Transportation Highway Division PAGE 18	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED WORK NEAR CURVE

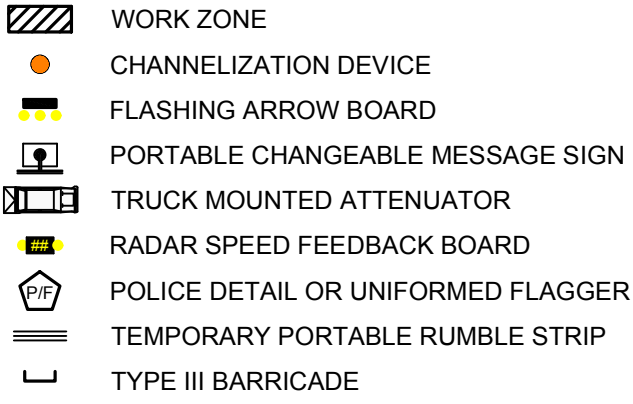
POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	50	100	20	30
45-55	500 / 1000 / 1000	100	150	40	20

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

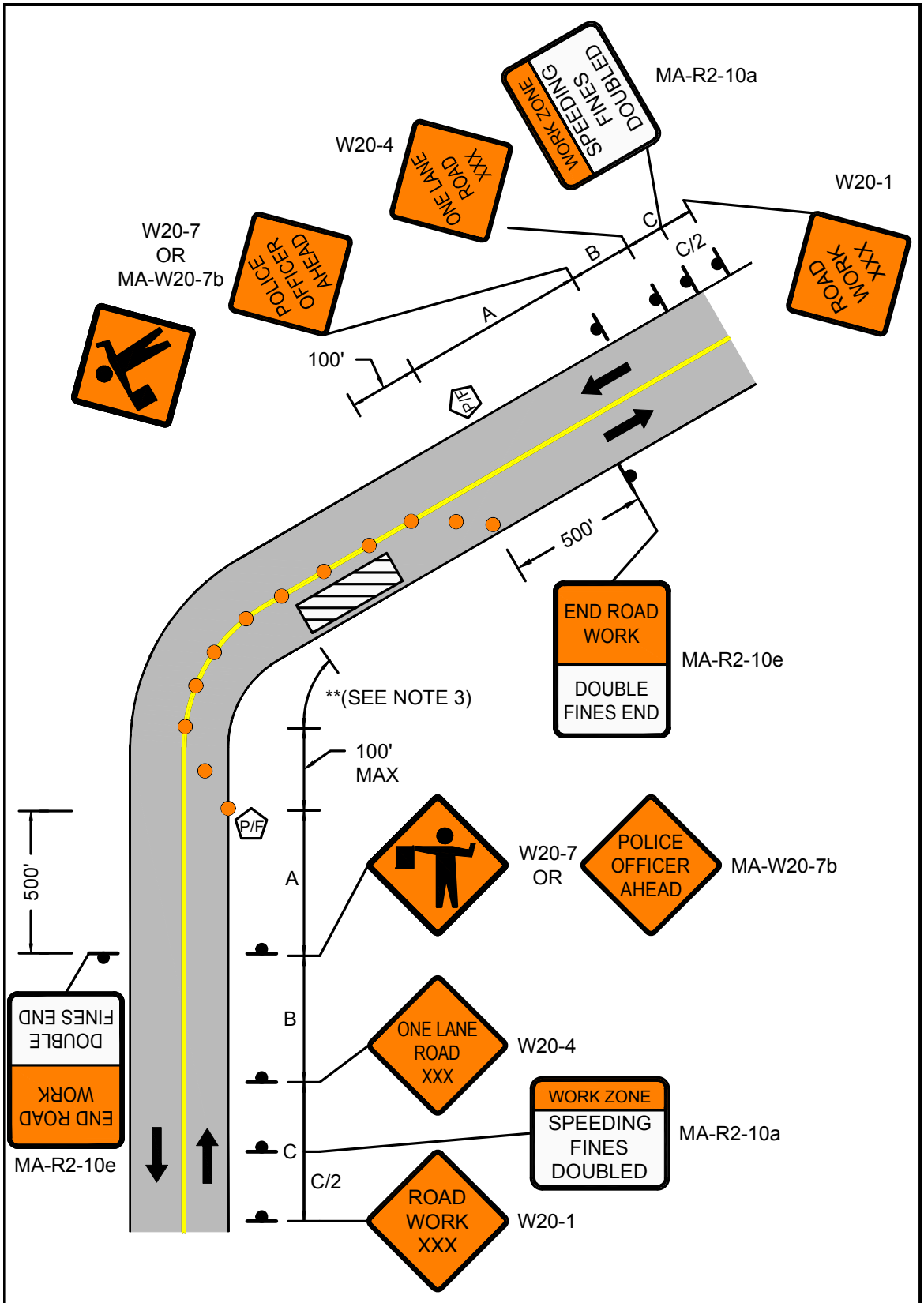
NOTES

1. IF POLICE DETAIL/UNIFORMED FLAGGER SUPPORT IS REQUIRED, PROVIDE TWO UNITS.
2. MA-R2-10a LOCATED AT C/2.
3. ** = EXTEND ENOUGH SO TAPER IS BEFORE CURVE

LEGEND



NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 19	Work Zone Safety Standard Details and Drawings	FIGURE 6 STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED WORK NEAR CURVE

massDOT Massachusetts Department of Transportation Highway Division PAGE 20	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	50	100	20	30
45-55	500 / 1000 / 1000	100	150	40	20

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED REGULATORY OR WORK ZONE SPEED	SEPARATION BETWEEN RUMBLE STRIPS
36-mph to 55-mph	15-feet
35-mph and under	10-feet

NOTES

1. IF POLICE DETAIL/UNIFORMED FLAGGER SUPPORT IS REQUIRED, PROVIDE TWO UNITS.
2. MA-R2-10a LOCATED AT C/2.
3. ** OPTIONAL AT THE ENGINEER'S DISCRETION.
4. *** SHALL BE DEPLOYED IF RUMBLE STRIPS ARE PRESENT.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

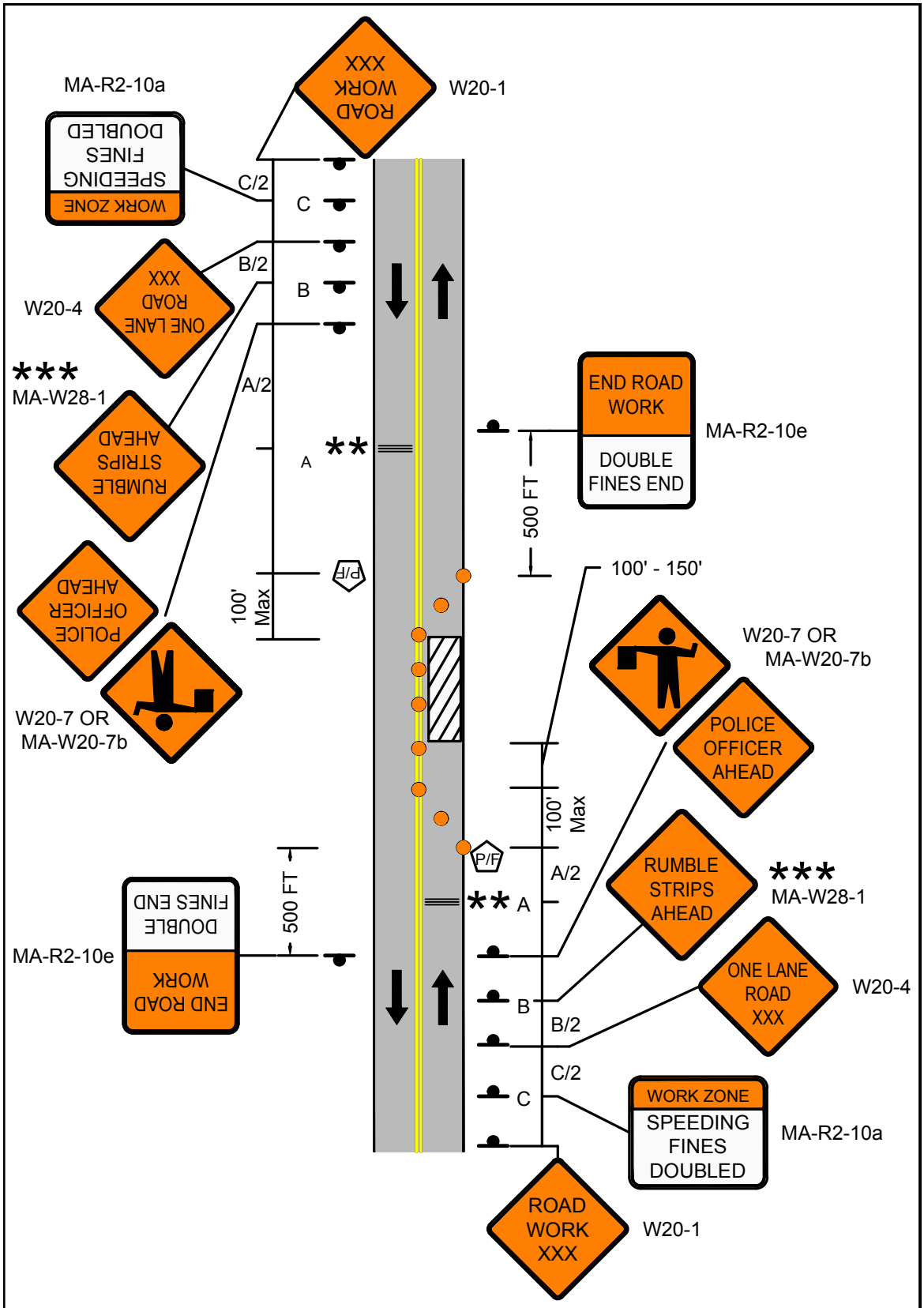
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 21	Work Zone Safety Standard Details and Drawings	FIGURE 7 STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 22	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY SHOULDER CLOSED

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		SHOULDER TAPER LENGTH (L/3) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	110	305	20	45
45-55	500 / 1000 / 1000	220	495	40	30
60-65	1000 / 1600 / 2600	260	645	40	35

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

NOTES
1. MA-R2-10a at C/2 and A/2.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

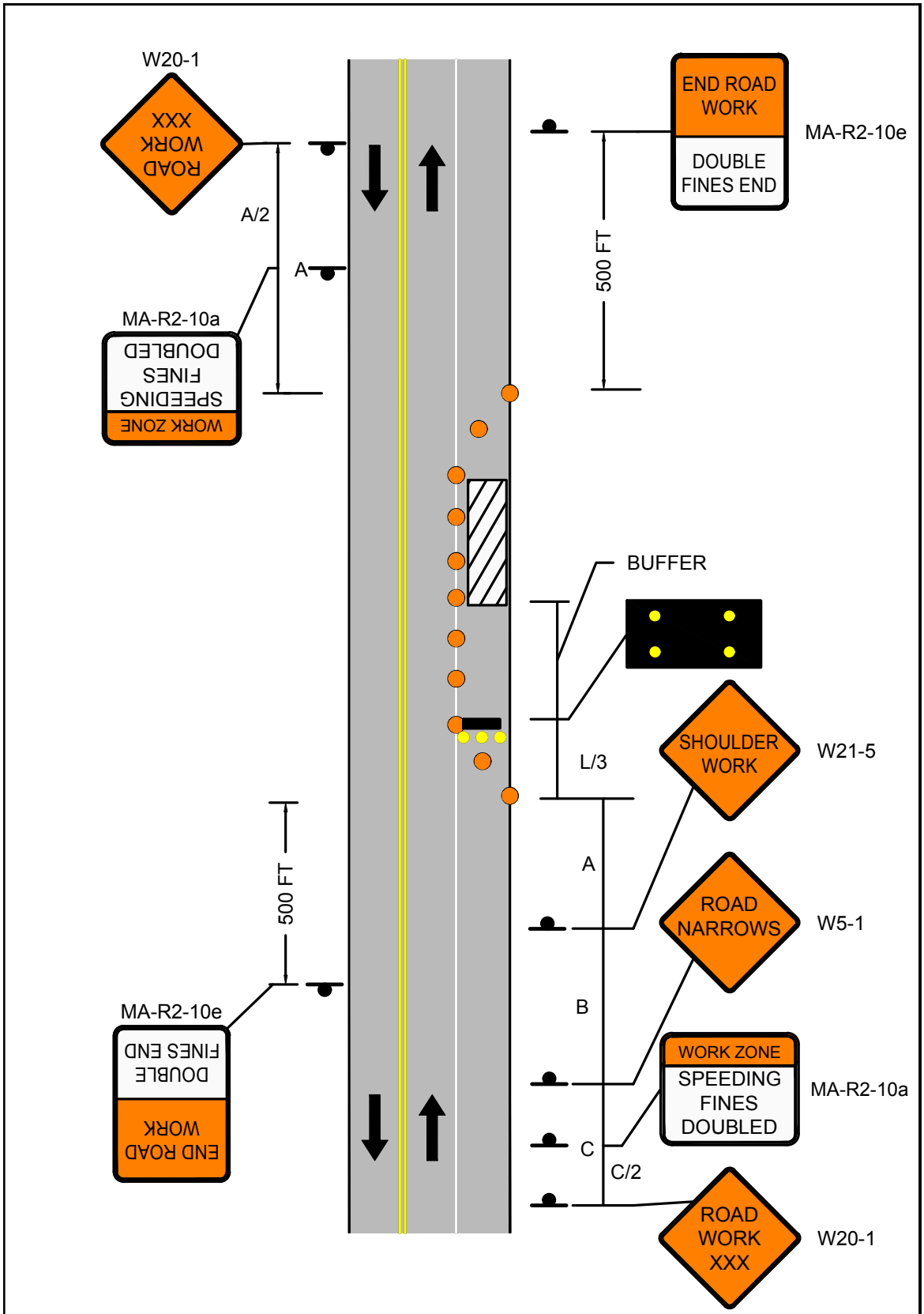
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 23	Work Zone Safety Standard Details and Drawings	FIGURE 8 STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY SHOULDER CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 24	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY WITH TRAVERSABLE SHOULDER HALF OF ROADWAY CLOSED MAINTAIN TWO-WAY TRAFFIC

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)				
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE SHIFT LENGTH (L/2) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	160	305	20	125
45-55	220	330	495	40	100
60-65	260	390	645	40	115

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

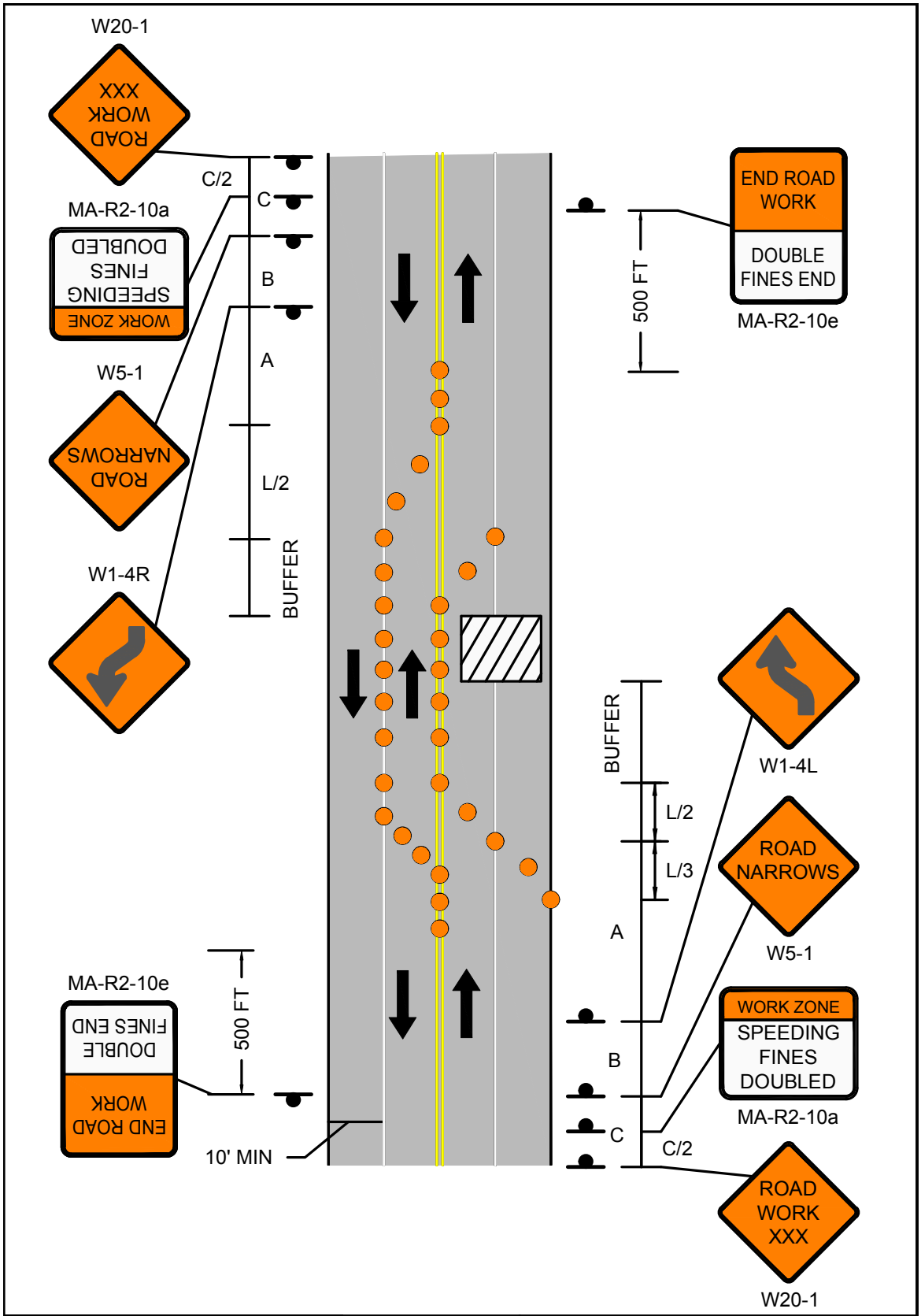
NOTES

1. MA-R2-10a LOCATED AT C/2.

LEGEND

- WORK ZONE
- CHANNELIZATION DEVICE
- FLASHING ARROW BOARD
- PORTABLE CHANGEABLE MESSAGE SIGN
- TRUCK MOUNTED ATTENUATOR
- RADAR SPEED FEEDBACK BOARD
- POLICE DETAIL OR UNIFORMED FLAGGER
- TEMPORARY PORTABLE RUMBLE STRIP
- TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 25	Work Zone Safety Standard Details and Drawings	FIGURE 9 STATIONARY OPERATIONS TWO LANE UNDIVIDED ROADWAY WITH TRAVERSABLE SHOULDER HALF OF ROADWAY CLOSED MAINTAIN TWO-WAY TRAFFIC

massDOT Massachusetts Department of Transportation Highway Division PAGE 26	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS FOUR LANE UNDIVIDED ROADWAY RIGHT LANE CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELATION DEVICES (DRUMS OR CONES)				
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	305	20	60
45-55	220	660	495	40	50
60-65	260	780	645	40	55

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT A/2 AND C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

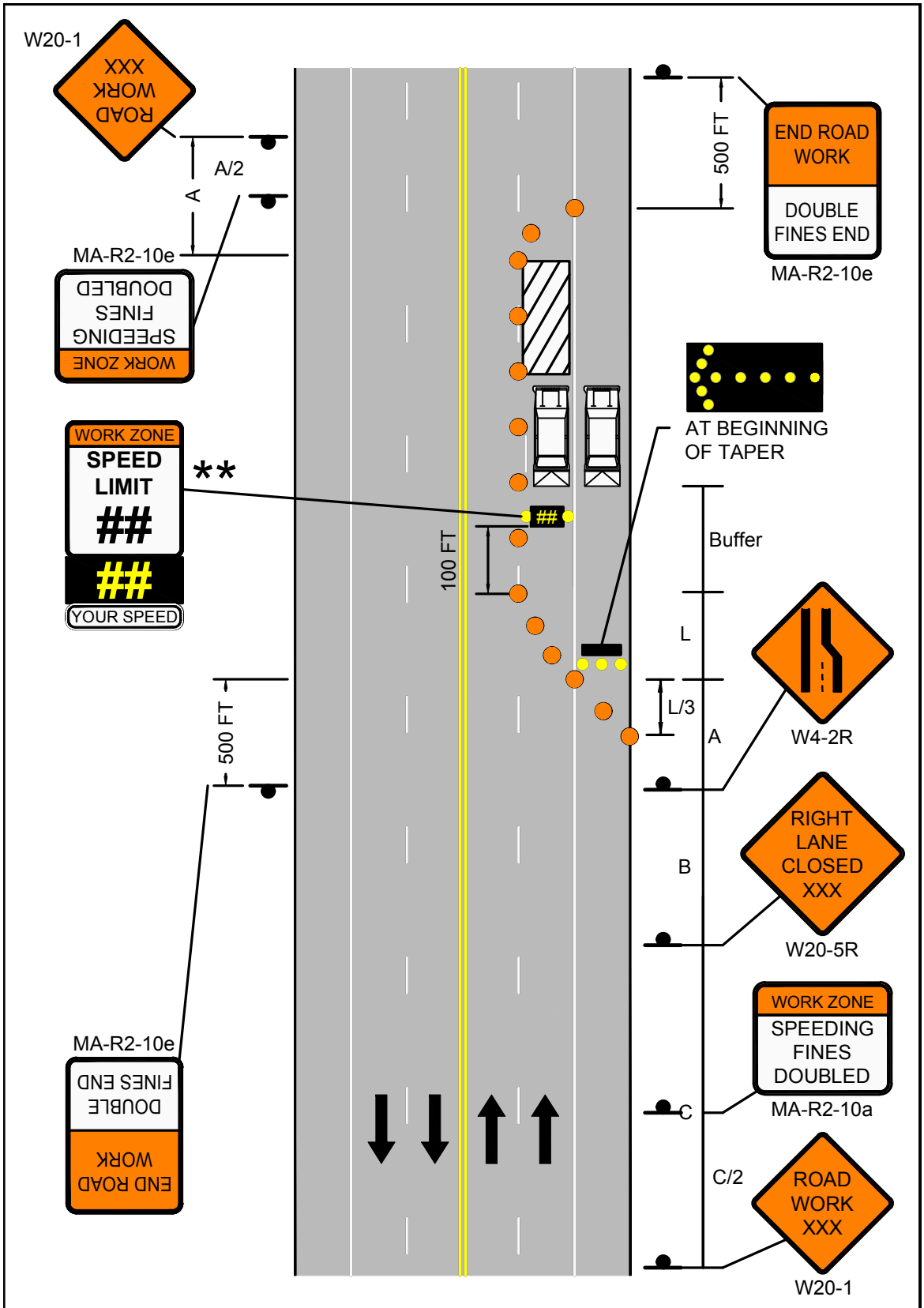
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 27	Work Zone Safety Standard Details and Drawings	FIGURE 10 STATIONARY OPERATIONS FOUR LANE UNDIVIDED ROADWAY RIGHT LANE CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 28	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS FOUR LANE UNDIVIDED ROADWAY LEFT LANE CLOSED

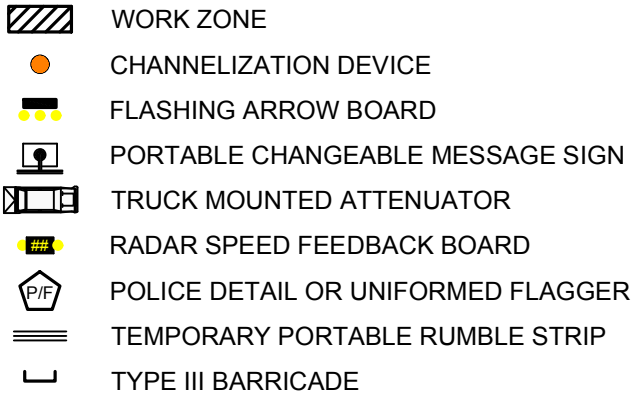
POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	320	305	20	105
45-55	500 / 1000 / 1000	660	495	40	80
60-65	1000 / 1600 / 2600	780	645	40	100

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

NOTES

1. MA-R2-10a LOCATED AT A/2 AND C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION. 2' OFFSET FROM EDGE OF TRAVEL LANE TO RADAR SPEED FEEDBACK BOARD IS REQUIRED. BOARD MAY BE MOVED FULLY OR PARTIALLY OFF PAVED SHOULDER, IF REQUIRED.

LEGEND



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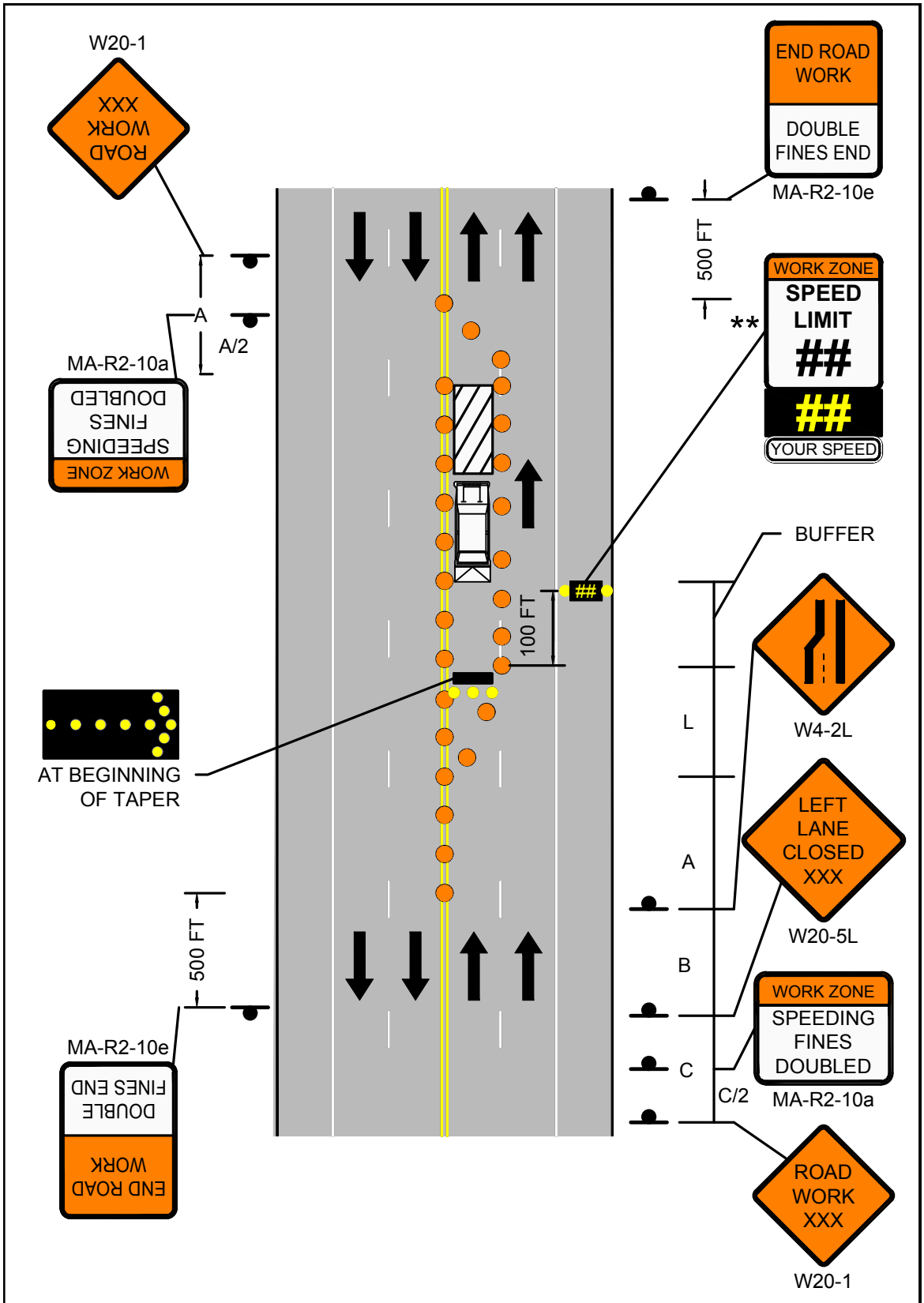

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Work Zone Safety Standard Details and Drawings

FIGURE 11
STATIONARY OPERATIONS
FOUR LANE UNDIVIDED ROADWAY
LEFT LANE CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 30	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS FOUR LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)					
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	TRAVEL LANE SHIFT LENGTH (L/2) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	160	305	20	140
45-55	220	660	330	495	40	120
60-65	260	780	390	645	40	140

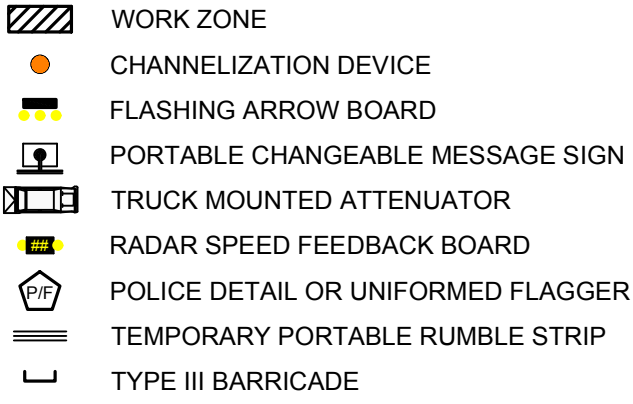
* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

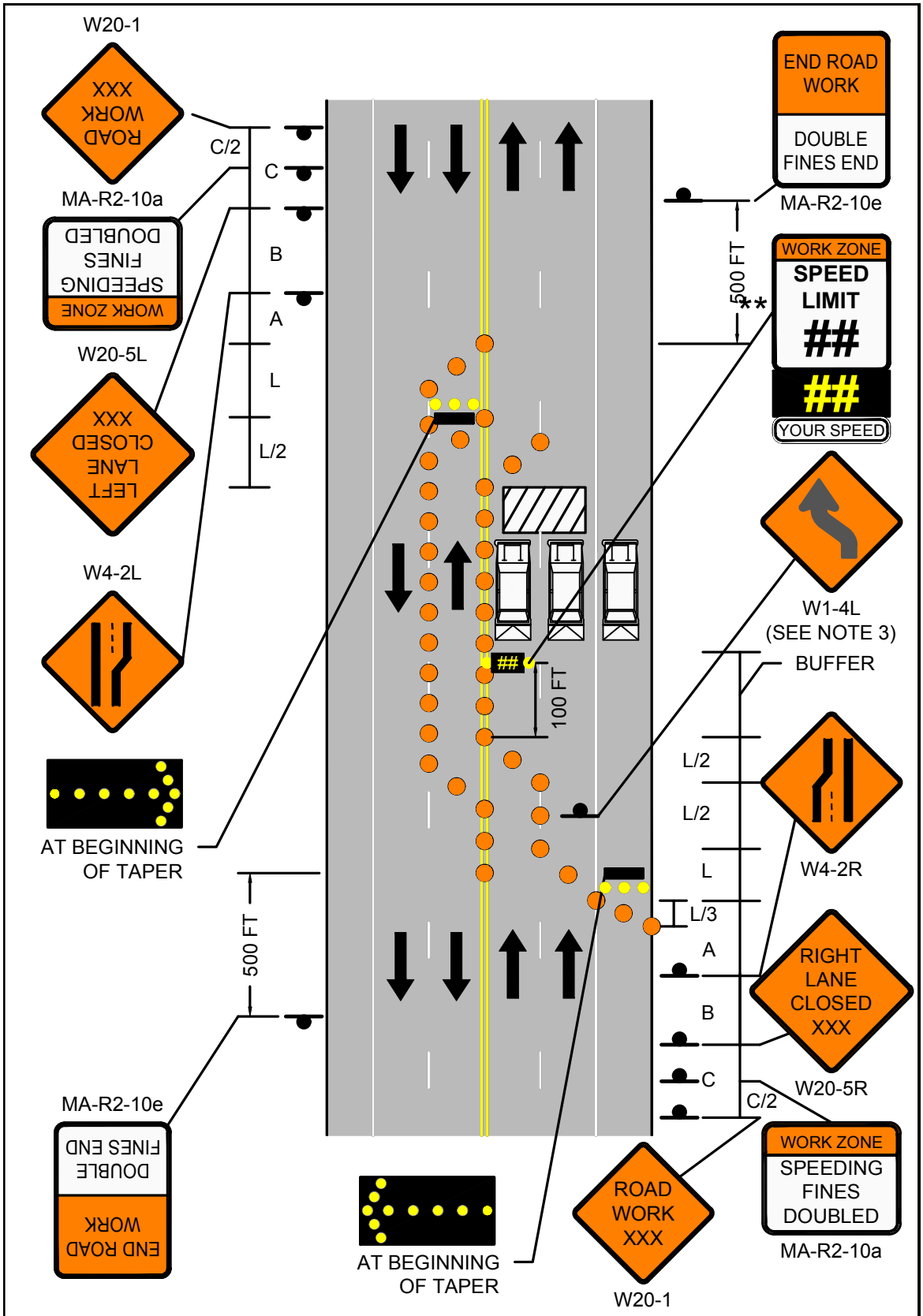
NOTES

1. MA-R2-10a LOCATED AT C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.
3. W1-4L SHALL BE PLACED AT THE MIDDLE OF THE TANGENT.

LEGEND



NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 31	Work Zone Safety Standard Details and Drawings	FIGURE 12 STATIONARY OPERATIONS FOUR LANE UNDIVIDED ROADWAY HALF OF ROADWAY CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 32	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY RIGHT LANE CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)				
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	305	20	60
45-55	220	660	495	40	50
60-65	260	780	645	40	55

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

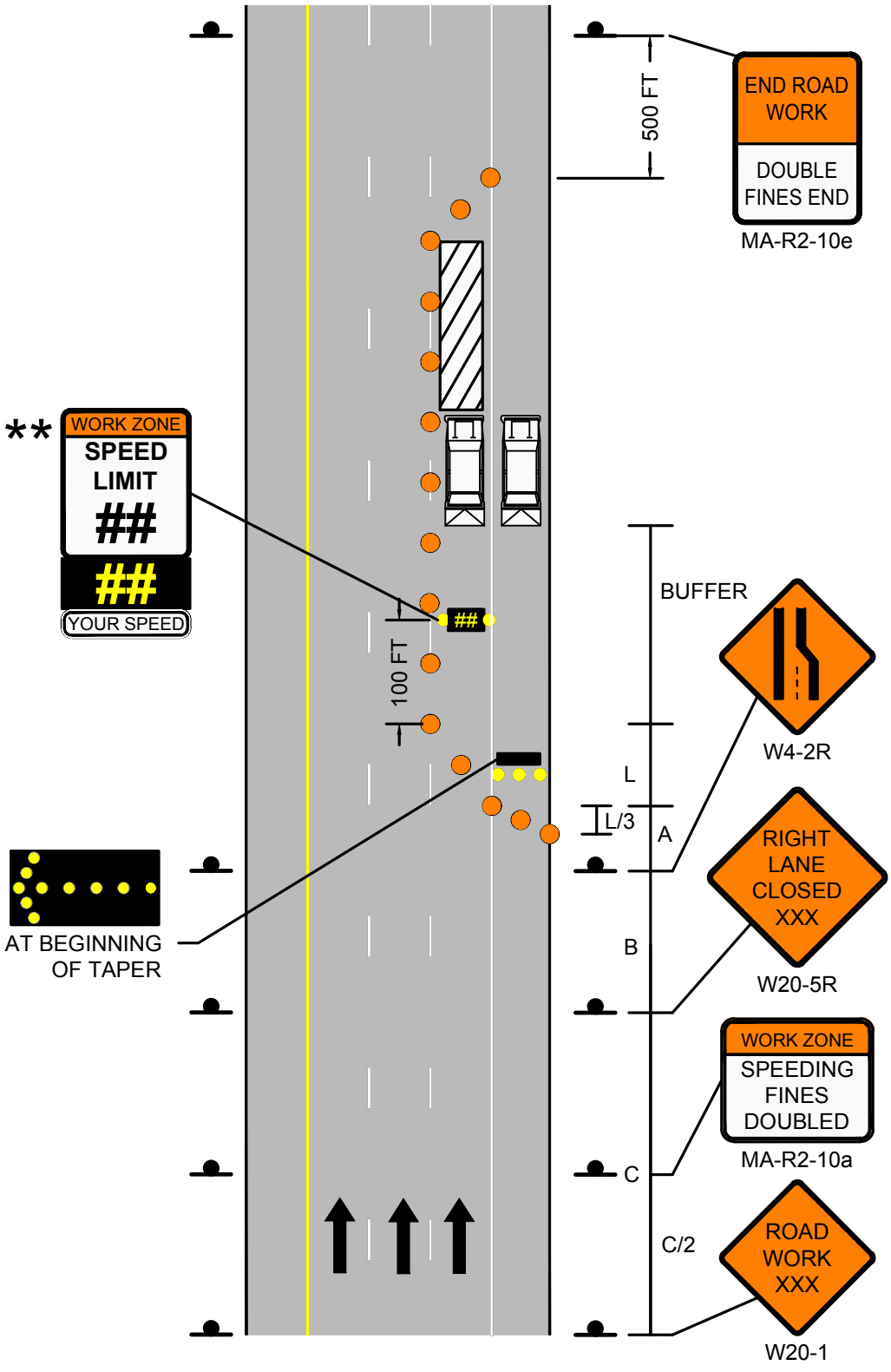
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 33	Work Zone Safety Standard Details and Drawings	FIGURE 13 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY RIGHT LANE CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 34	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY LEFT LANE CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)				
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	305	20	60
45-55	220	660	495	40	50
60-65	260	780	645	40	55

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

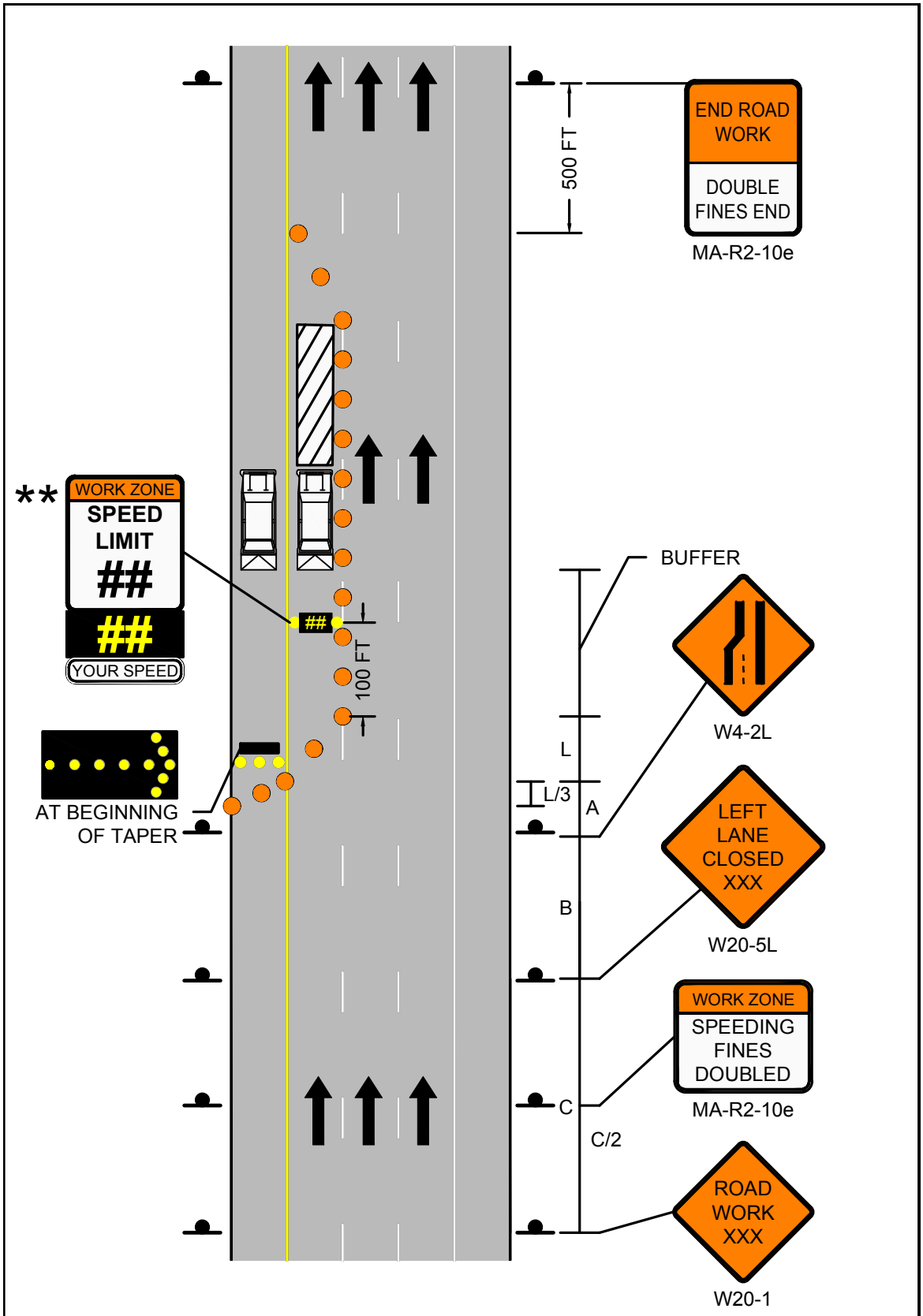
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 35	Work Zone Safety Standard Details and Drawings	FIGURE 14 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY LEFT LANE CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 36	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY CENTER LANE OR RIGHT/CENTER LANES CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)					
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	TANGENT LENGTH BETWEEN TAPERS T (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	640	305	20	110
45-55	220	660	1320	495	40	100
60-65	260	780	1560	645	40	115

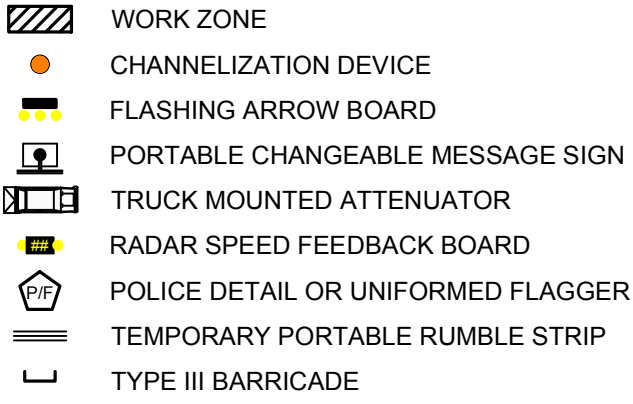
* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.
3. *** THIS SET OF SIGNS SHALL BE LOCATED AT T/2.

LEGEND



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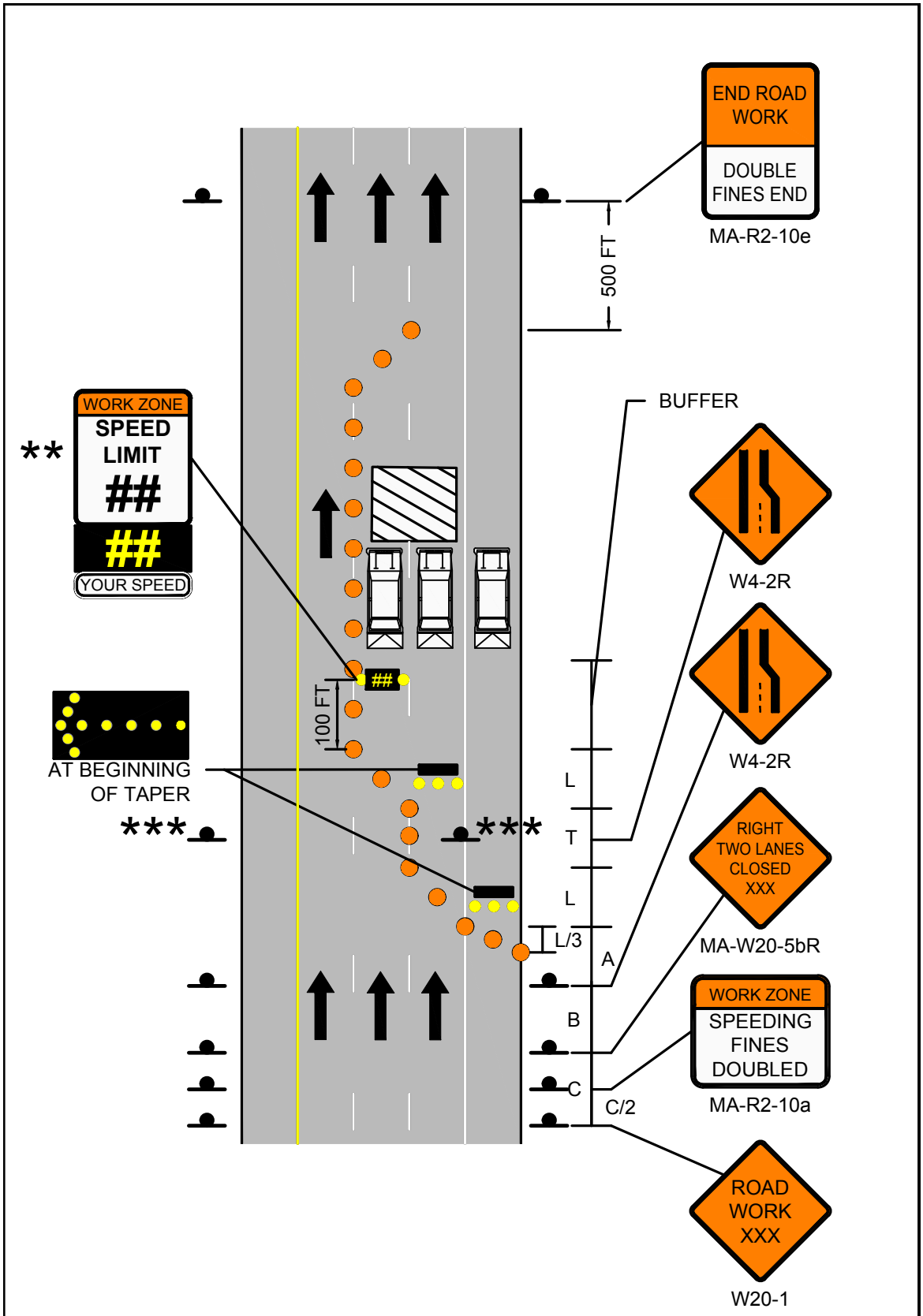


massDOT Massachusetts Department of Transportation Highway Division PAGE 37	Work Zone Safety Standard Details and Drawings	FIGURE 15 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY CENTER LANE OR RIGHT/CENTER LANES CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 38	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY CENTER LANE OR LEFT/CENTER LANES CLOSED

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)					
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	TANGENT LENGTH BETWEEN TAPERS T (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	640	305	20	110
45-55	220	660	1320	495	40	100
60-65	260	780	1560	645	40	115

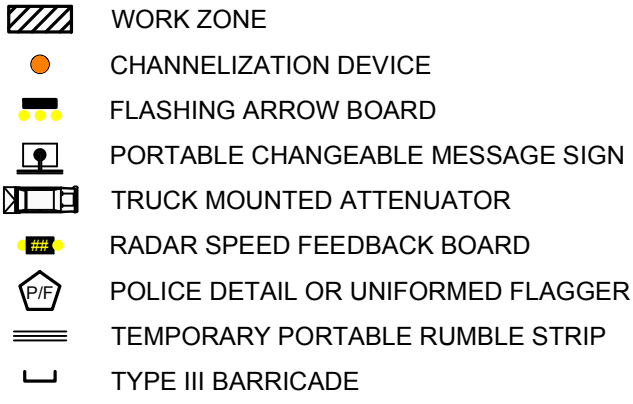
* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.
2. ** OPTIONAL AT THE ENGINEER'S DISCRETION.
3. *** THIS SET OF SIGNS SHALL BE LOCATED AT T/2.

LEGEND



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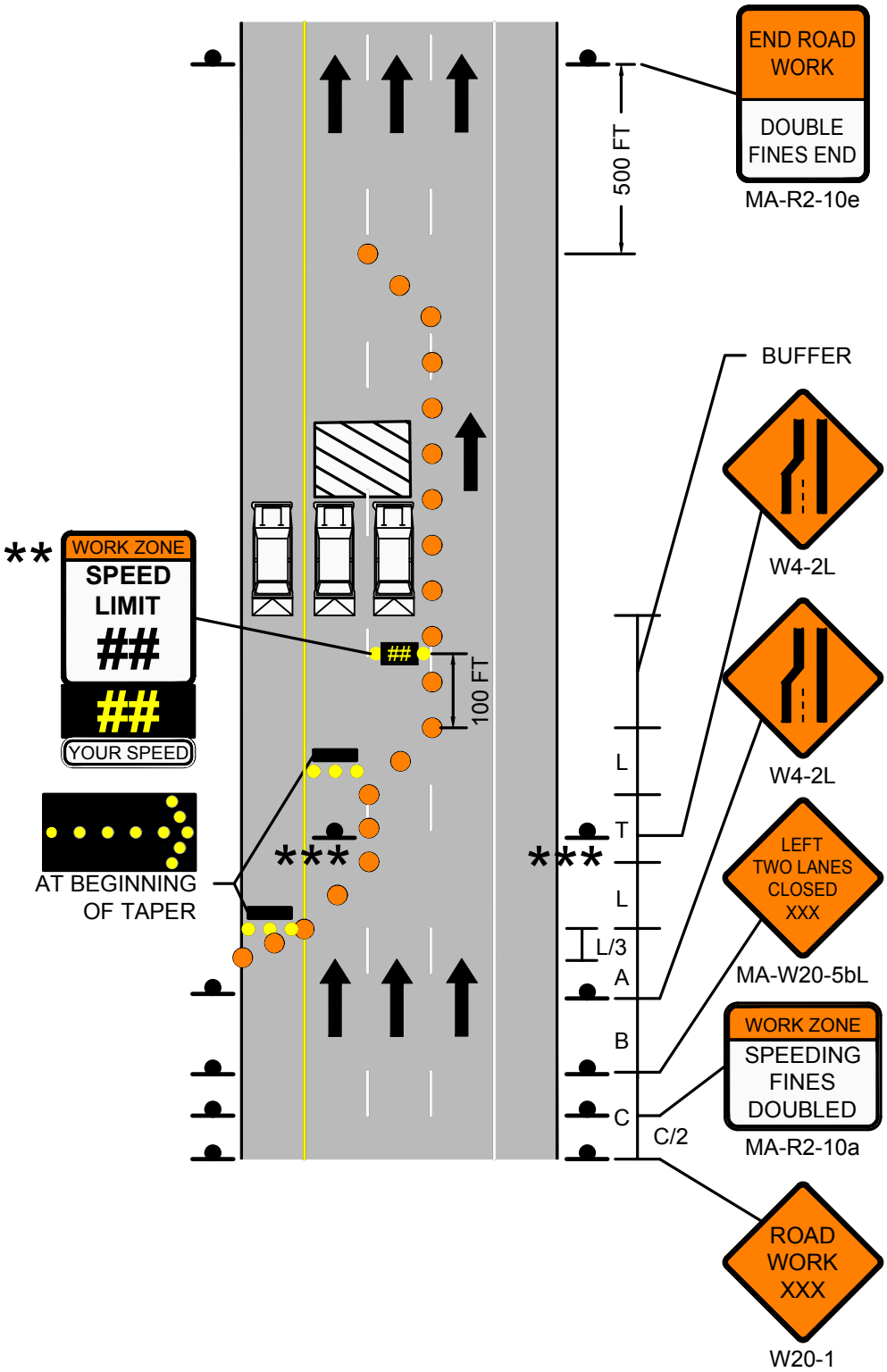


massDOT Massachusetts Department of Transportation Highway Division PAGE 39	Work Zone Safety Standard Details and Drawings	FIGURE 16 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY CENTER LANE OR LEFT/CENTER LANES CLOSED

massDOT Massachusetts Department of Transportation Highway Division PAGE 40	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY RIGHT SIDE OF OFF RAMP CLOSED

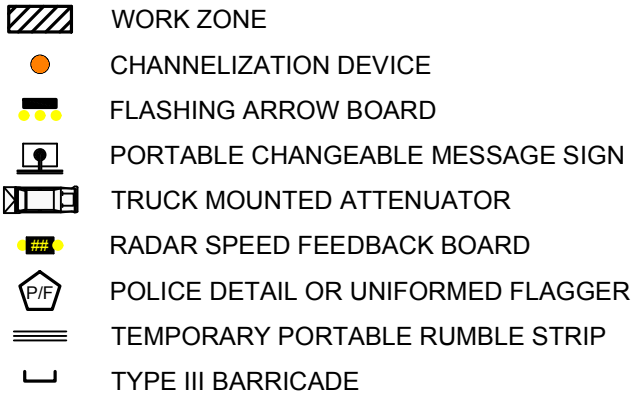
POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE SHIFT LENGTH (L/2) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	160	305	20	45
45-55	500 / 1000 / 1000	330	495	40	35

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

NOTES

1. MA-R2-10a LOCATED AT C/2.

LEGEND



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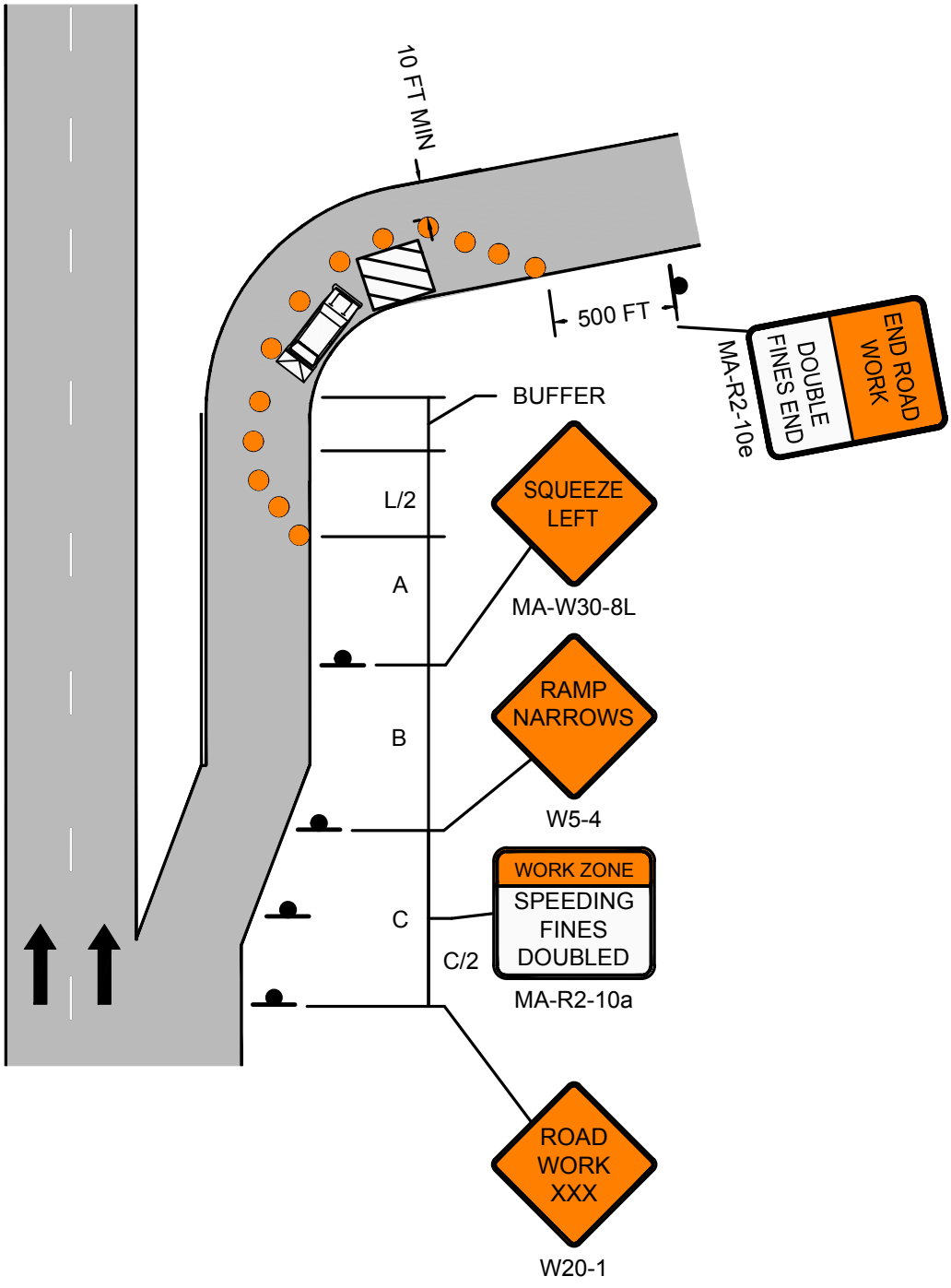


massDOT Massachusetts Department of Transportation Highway Division PAGE 41	Work Zone Safety Standard Details and Drawings	FIGURE 17 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY RIGHT SIDE OF OFF RAMP CLOSED

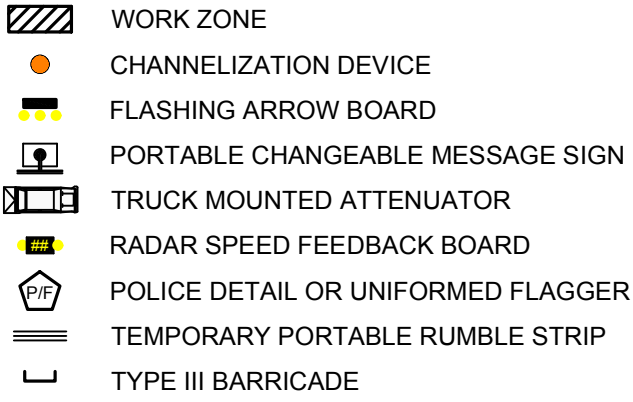
massDOT Massachusetts Department of Transportation Highway Division PAGE 42	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY LEFT SIDE OF OFF RAMP CLOSED

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRAVEL LANE SHIFT LENGTH (L/2) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	500 / 500 / 500	160	305	20	45
45-55	500 / 1000 / 1000	330	495	40	35

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

NOTES
1. MA-R2-10a LOCATED AT C/2.

LEGEND



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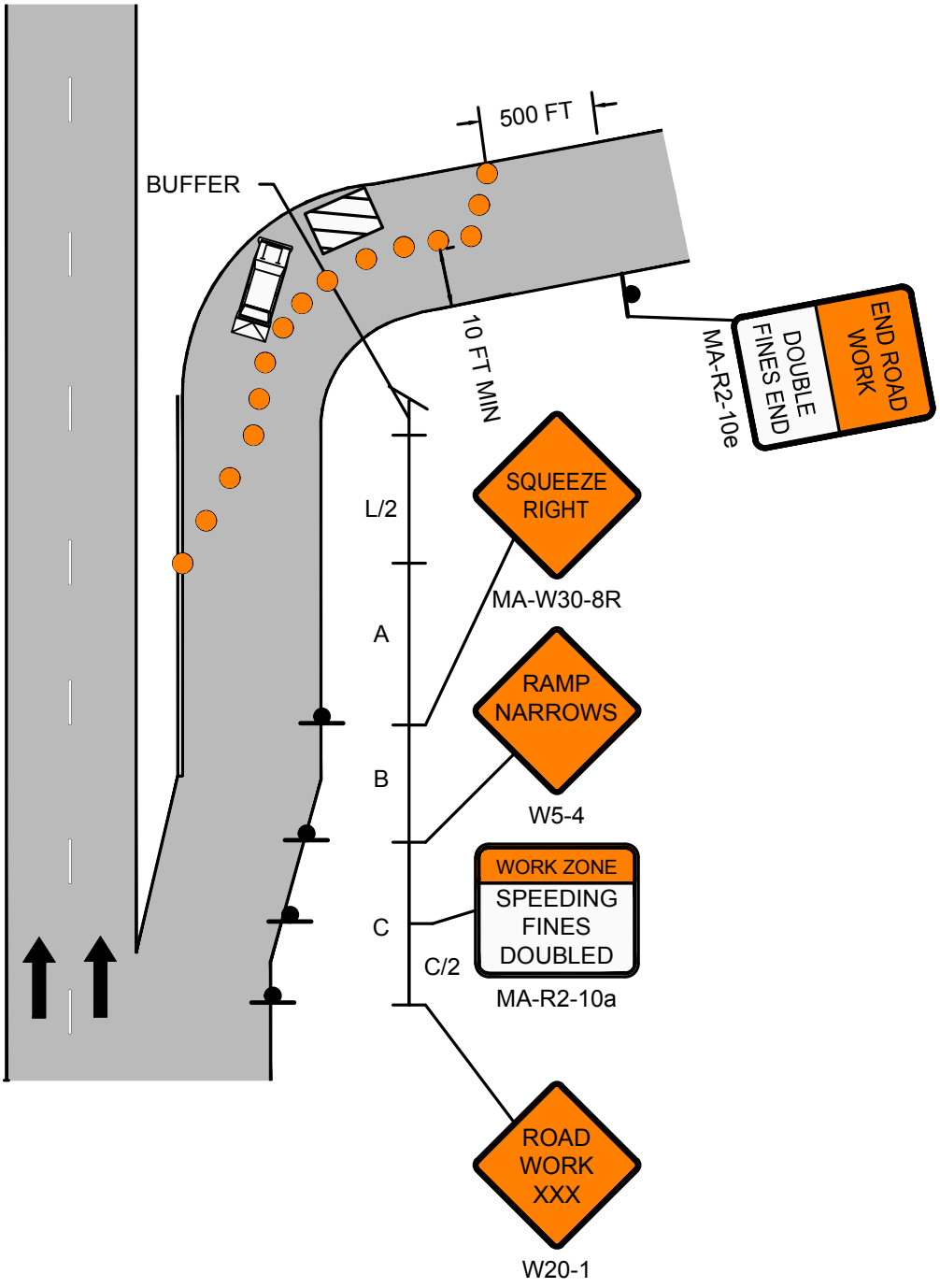


massDOT Massachusetts Department of Transportation Highway Division	Work Zone Safety Standard Details and Drawings	FIGURE 18 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY LEFT SIDE OF OFF RAMP CLOSED PAGE 43

massDOT Massachusetts Department of Transportation Highway Division PAGE 44	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY ROADWORK BEYOND ON RAMP

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)				
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	305	20	175
45-55	220	660	495	40	135
60-65	260	780	645	40	155

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

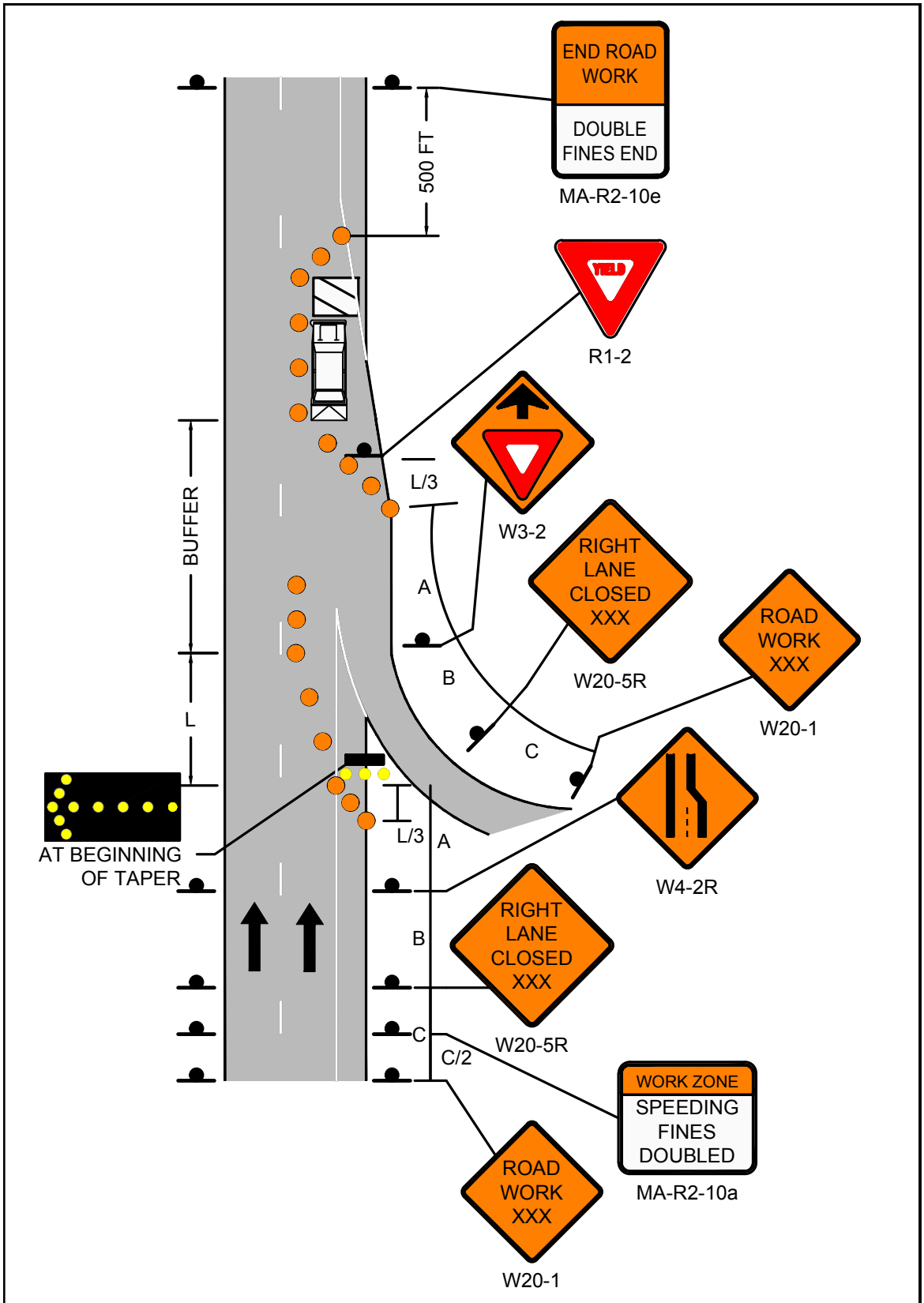
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 45	Work Zone Safety Standard Details and Drawings	FIGURE 19 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY ROADWORK BEYOND ON RAMP

massDOT Massachusetts Department of Transportation Highway Division PAGE 46	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY ROADWORK BEYOND OFF RAMP

POSTED SPEED LIMIT (MPH)	CHANNELIZATION DEVICES (DRUMS OR CONES)					
	SHOULDER TAPER LENGTH (L/3) (FT)	TRAVEL LANE CLOSURE LENGTH (L) (FT)	TRAVEL LANE SHIFT LENGTH (L/2) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	110	320	160	305	20	70
45-55	220	660	330	495	40	55
60-65	260	780	390	645	40	65

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)
25-40	500 / 500 / 500
45-55	500 / 1000 / 1000
60-65	1000 / 1600 / 2600

NOTES

1. MA-R2-10a LOCATED AT C/2.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

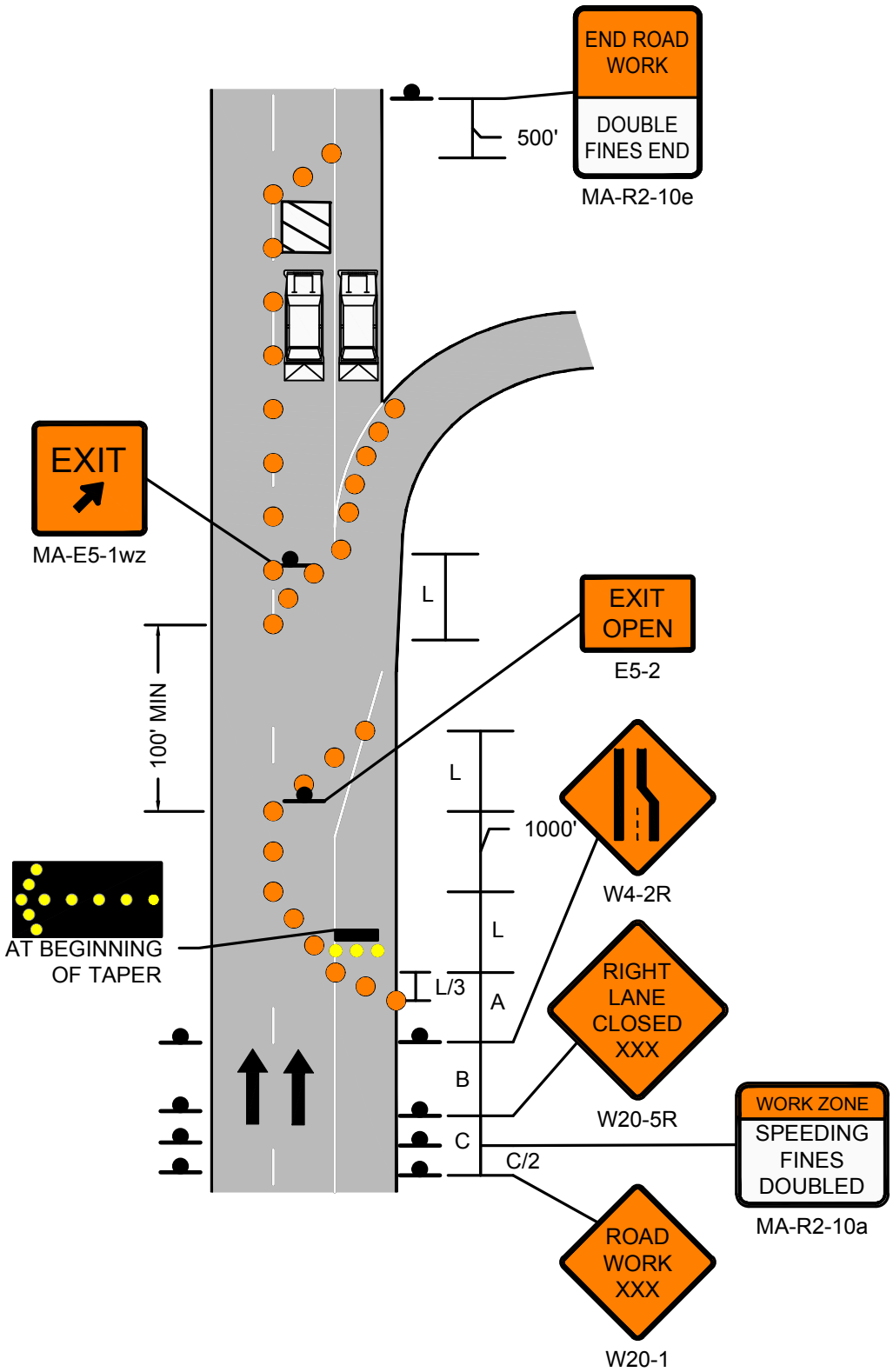
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE



massDOT Massachusetts Department of Transportation Highway Division PAGE 47	Work Zone Safety Standard Details and Drawings	FIGURE 20 STATIONARY OPERATIONS MULTILANE DIVIDED ROADWAY ROADWORK BEYOND OFF RAMP

massDOT Massachusetts Department of Transportation Highway Division PAGE 48	Work Zone Safety Standard Details and Drawings	MULTILANE DIVIDED ROADWAY TYPICAL RAMP CLOSURE

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		SHOULDER TAPER LENGTH (L/3) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES
25-40	500 / 500 / 500	110	305	20	45
45-55	500 / 1000 / 1000	220	495	40	30
60-65	1000 / 1600 / 2600	260	645	40	35

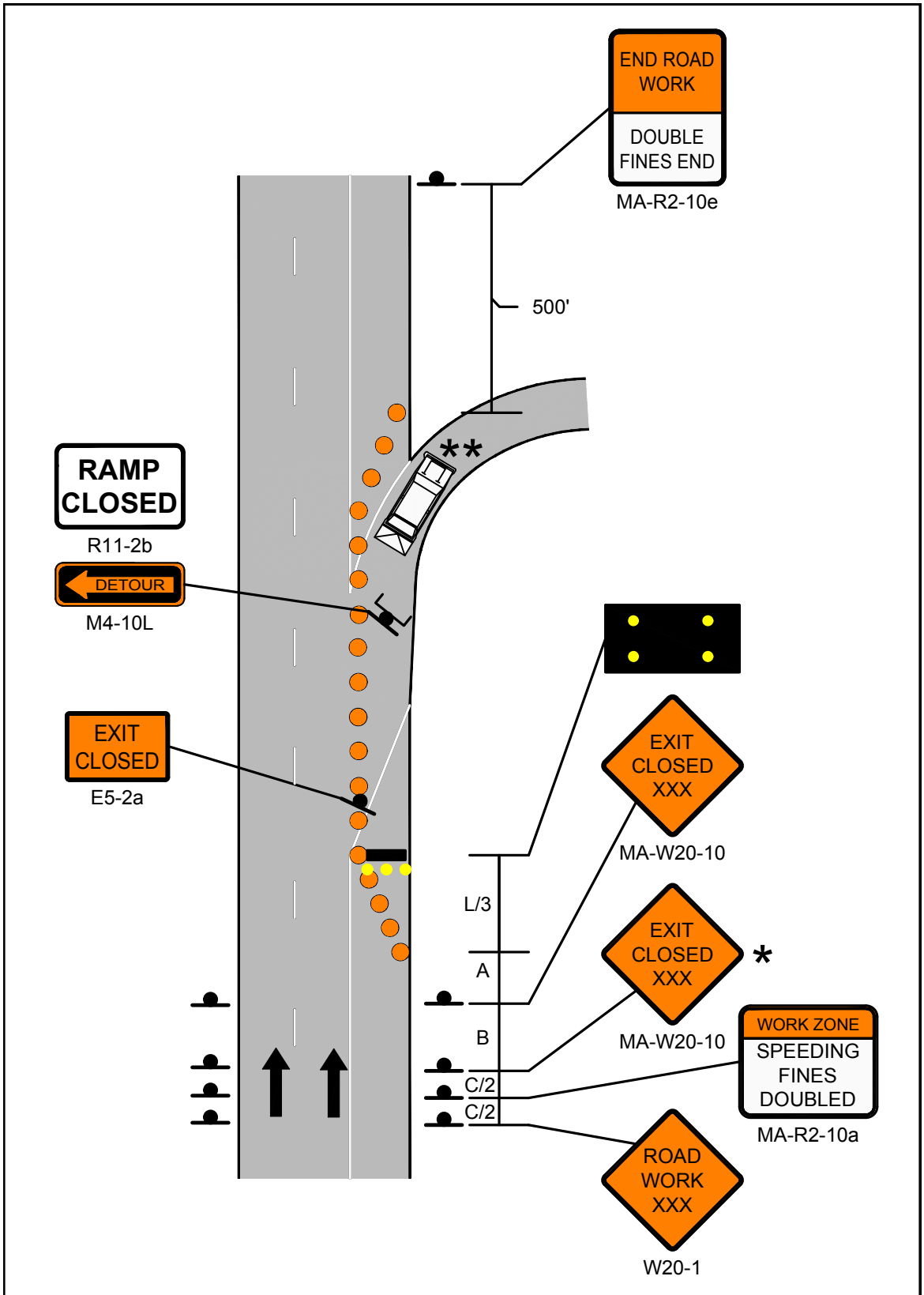
NOTES

1. MA-R2-10a LOCATED AT C/2.
2. * NOT REQUIRED IF RIGHT LANE IS CLOSED IN ADVANCE OF EXIT.
3. ** OPTIONAL AT ENGINEER'S DISCRETION.

LEGEND

- WORK ZONE
- CHANNELIZATION DEVICE
- FLASHING ARROW BOARD
- PORTABLE CHANGEABLE MESSAGE SIGN
- TRUCK MOUNTED ATTENUATOR
- RADAR SPEED FEEDBACK BOARD (##)
- POLICE DETAIL OR UNIFORMED FLAGGER (P/F)
- TEMPORARY PORTABLE RUMBLE STRIP
- TYPE III BARRICADE

NOT TO SCALE



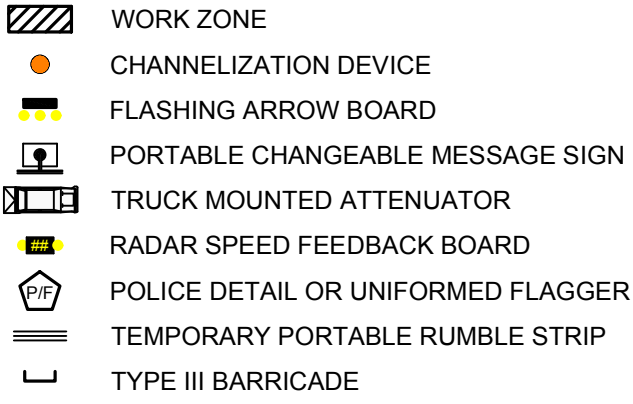
massDOT Massachusetts Department of Transportation Highway Division PAGE 49	Work Zone Safety Standard Details and Drawings	FIGURE 21 MULTILANE DIVIDED ROADWAY TYPICAL RAMP CLOSURE

massDOT Massachusetts Department of Transportation Highway Division PAGE 50	Work Zone Safety Standard Details and Drawings	MULTILANE DIVIDED ROADWAY TYPICAL CLOVERLEAF RAMP CLOSURE

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		SHOULDER TAPER LENGTH (L/3) (FT)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES
25-40	500 / 500 / 500	110	305	20	45
45-55	500 / 1000 / 1000	220	495	40	30
60-65	1000 / 1600 / 2600	260	645	40	35

NOTES
1. MA-R2-10a LOCATED AT C/2.
2. * NOT REQUIRED IF RIGHT LANE IS CLOSED IN ADVANCE OF EXIT.
3. ** OPTIONAL AT ENGINEER'S DISCRETION.

LEGEND



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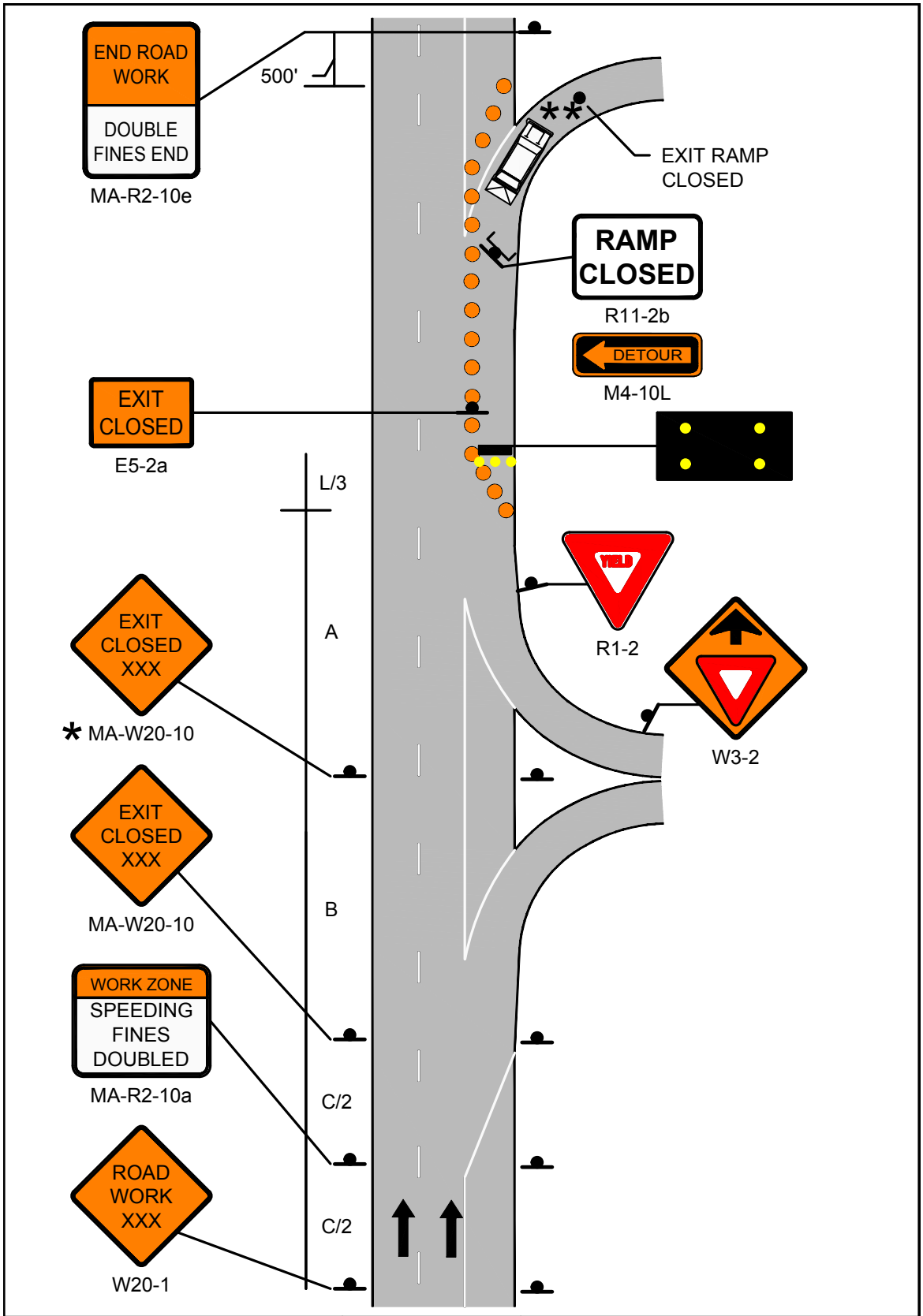


massDOT Massachusetts Department of Transportation Highway Division PAGE 51	Work Zone Safety Standard Details and Drawings	FIGURE 22 MULTILANE DIVIDED ROADWAY TYPICAL CLOVERLEAF RAMP CLOSURE

massDOT Massachusetts Department of Transportation Highway Division PAGE 52	Work Zone Safety Standard Details and Drawings	MULTILANE DIVIDED ROADWAY TYPICAL RAMP CLOSURE ADVANCE SIGNING

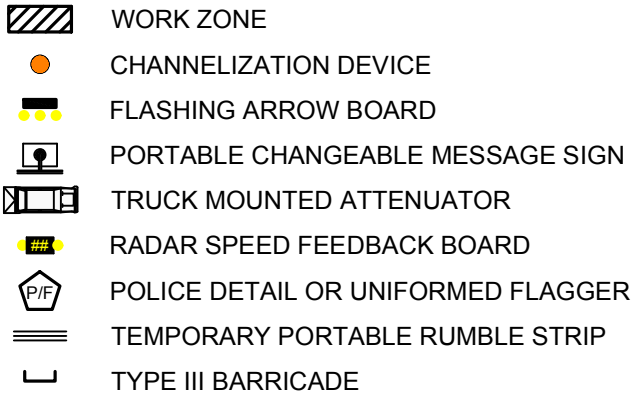
NOTES

1. IF THE CLOSED RAMP IS LOCATED DOWNSTREAM FROM THE PROPOSED DETOUR ROUTE/RAMP, A PCMS SHALL BE POSITIONED AT A SUFFICIENT DISTANCE IN ADVANCE OF THE DETOUR ROUTE/RAMP AND SHOULD STATE WHICH RAMP IS CLOSED AND WHICH SHALL BE USED FOR THE DETOUR.

2. IF THE CLOSED RAMP IS LOCATED UPSTREAM FROM THE PROPOSED DETOUR ROUTE/RAMP, A PCMS SHALL BE POSITIONED PRIOR TO THE CLOSED RAMP AND SHOULD STATE WHICH RAMP IS CLOSED AND WHICH SHALL BE USED FOR THE DETOUR.

3. A SUFFICIENT NUMBER OF DETOUR SIGNS (M4-9 SERIES) SHOULD BE DEPLOYED TO PROPERLY DIRECT DETOURED TRAFFIC. SIGN SPACING SHALL BE AT THE DIRECTION OF THE ENGINEER.

LEGEND



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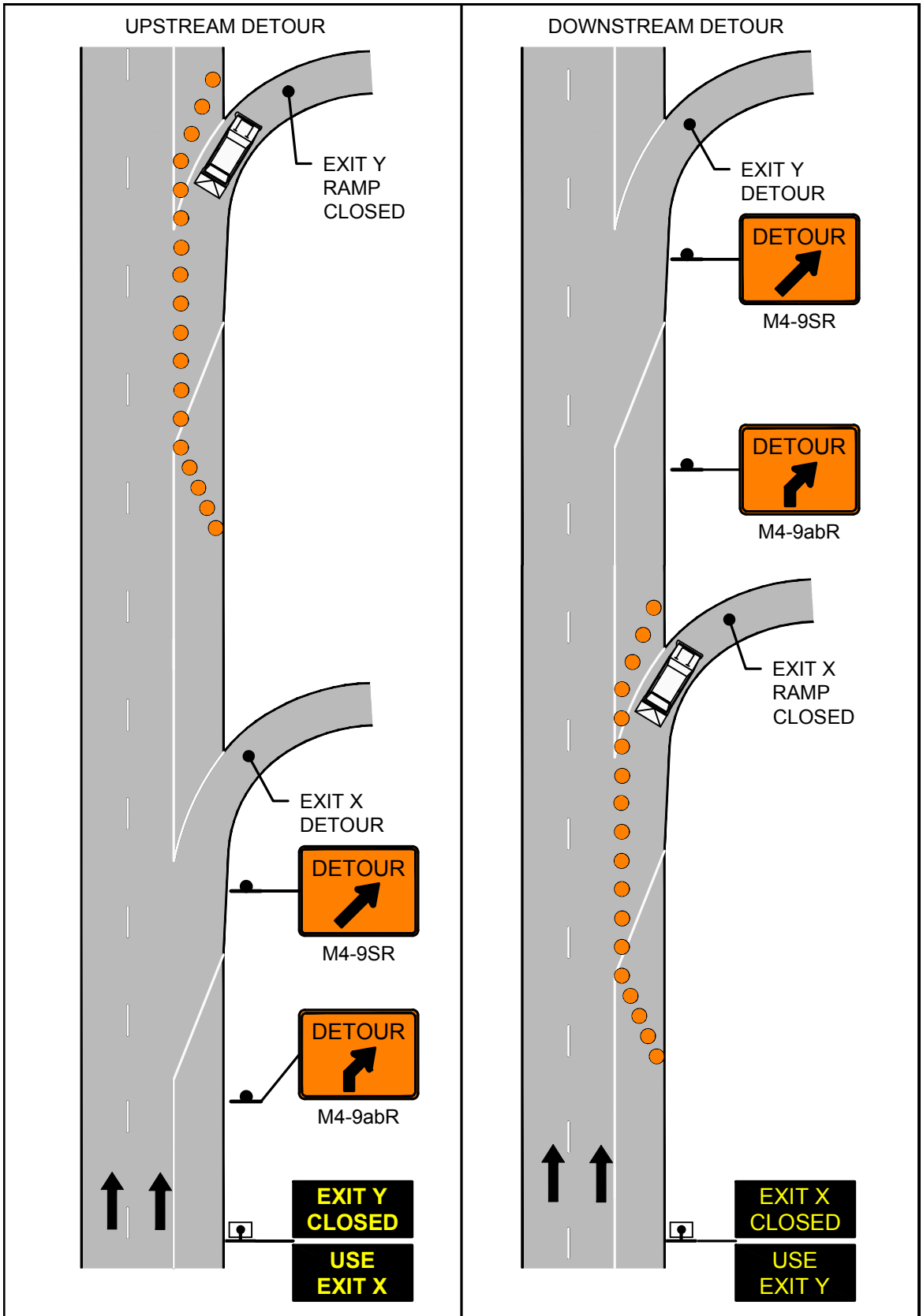

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PAGE 53

Work Zone Safety
Standard Details
and Drawings

FIGURE 23
MULTILANE DIVIDED ROADWAY
TYPICAL RAMP CLOSURE
ADVANCE SIGNING

massDOT Massachusetts Department of Transportation Highway Division PAGE 54	Work Zone Safety Standard Details and Drawings	FIGURE 24-1 MULTILANE DIVIDED ROADWAY PLACEMENT OF TEMPORARY PORTABLE RUMBLE STRIPS SHEET 1 OF 2

POSTED REGULATORY OR WORK ZONE SPEED	SEPARATION BETWEEN RUMBLE STRIPS
Above 55-mph	20-feet
36-mph to 55-mph	15-feet
35-mph and under	10-feet

POSTED SPEED LIMIT (MPH)	SPACING FOR ADVANCE WARNING SIGNS (FT) (A,B,C)	TANGENT LENGTH BETWEEN TAPERS (T) (FT)
25-40	500 / 500 / 500	640
45-55	500 / 1000 / 1000	1320
60-65	1000 / 1600 / 2600	1560

NOTES

1. THE INTENTION OF THESE DETAILS IS ONLY TO DEPICT THE PLACEMENT OF TEMPORARY PORTABLE RUMBLE STRIPS (TPRS) IN RELATIONSHIP TO THE TAPER AND THE BUFFER OF A SINGLE- OR MULTI-LANE CLOSURE. THE DEPICTION OF THE NUMBER AND SPACING OF ALL OTHER TRAFFIC CONTROL DEVICES IS NOT TO SCALE. REFER TO OTHER DETAILS FOR LANE CLOSURES FOR THE PLACEMENT AND NUMBER OF ALL OTHER TRAFFIC CONTROL DEVICES.
2. THESE DETAILS ONLY DEPICT RIGHT LANE CLOSURES. LEFT LANE CLOSURES SHOULD UTILIZE A MIRROR IMAGE OF THESE SETUPS, STARTING WITH CLOSURE OF THE LEFTMOST LANE.
3. * THIS TPRS ARRAY IS OPTIONAL AT THE ENGINEER'S DISCRETION. IF USED, IT SHOULD BE PLACED ADJACENT TO THE BUFFER.
4. DETAILS SHOW THE MINIMUM NUMBER OF TPRS REQUIRED. ADDITIONAL MAY BE USED IF CONDITIONS WARRANT.

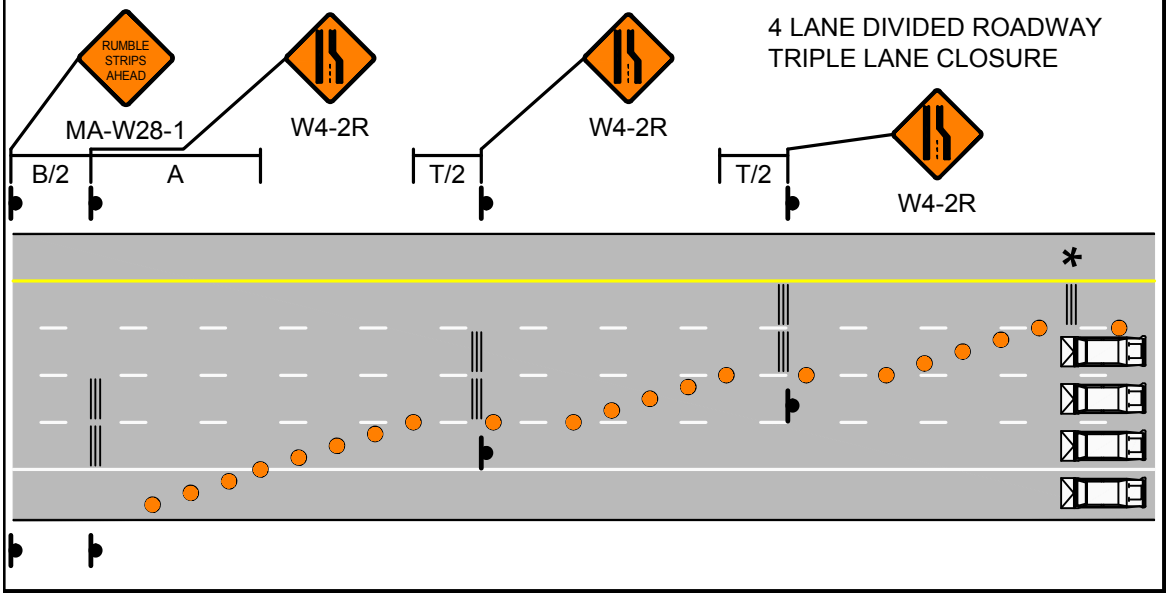
LEGEND

CHANNELIZATION DEVICE

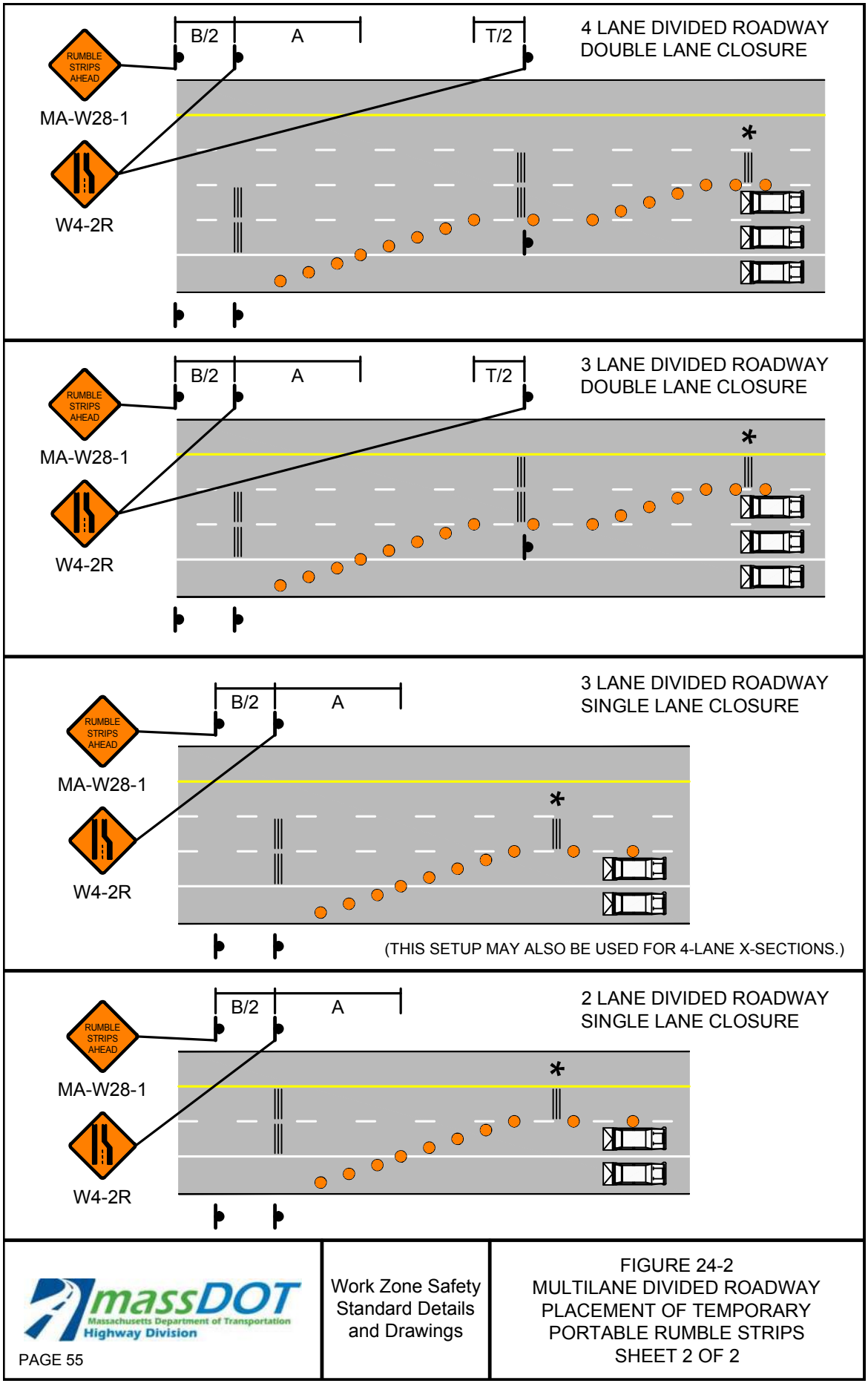
TRUCK MOUNTED ATTENUATOR

TEMPORARY PORTABLE RUMBLE STRIP

NOT TO SCALE



4 LANE DIVIDED ROADWAY
TRIPLE LANE CLOSURE



massDOT Massachusetts Department of Transportation Highway Division

PAGE 55

Work Zone Safety Standard Details and Drawings

FIGURE 24-2
MULTILANE DIVIDED ROADWAY
PLACEMENT OF TEMPORARY
PORTABLE RUMBLE STRIPS
SHEET 2 OF 2

Notes for Mobile Operations

- Unless otherwise stated, these notes shall apply to all Mobile Operation setups.
- Additional, setup-specific notes may be found on individual sheets.

1. The Supervisor shall travel the designated roadway prior to scheduling the work to ensure that sufficient and appropriate traffic control devices will be available. Special consideration shall be exercised to ensure that appropriate traffic controls be placed in areas that will have limited visibility of the work areas or any associated traffic queues.

2. Vehicles used for these operations shall be made highly visible with appropriate equipment such as flashing lights, rotating beacons, flags, signs, flashing arrow boards, and/or portable changeable message signs. Any signs mounted to these vehicles shall not obscure the visibility of other devices.

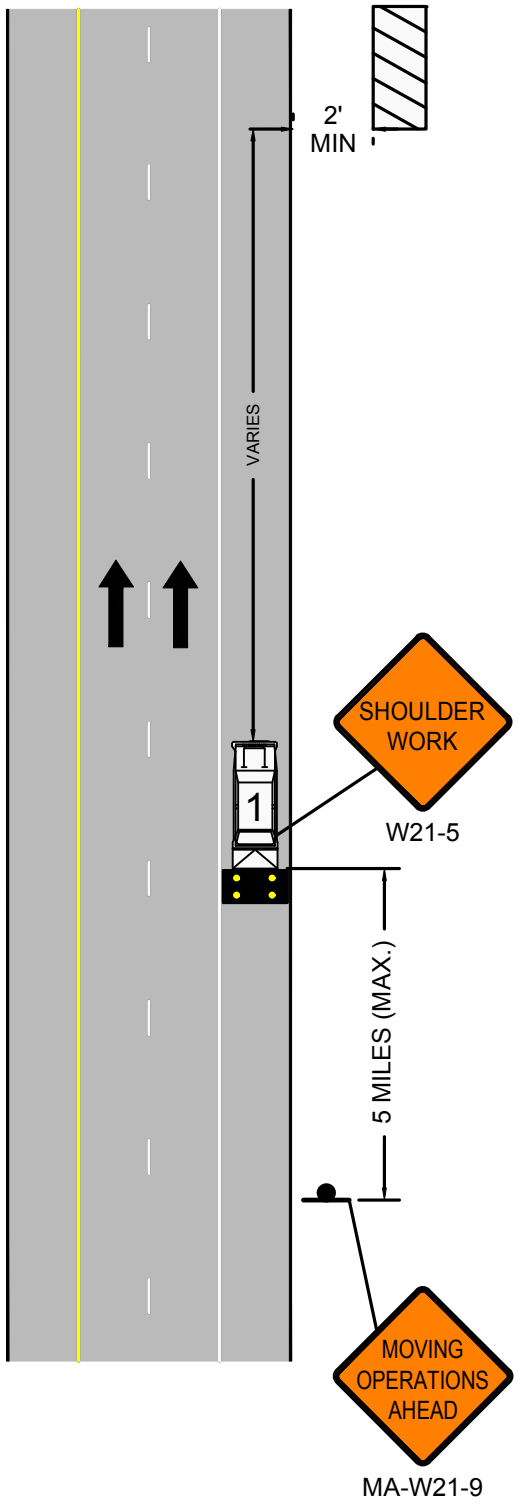
3. All vehicles shown may not be required based upon roadway conditions. However, when needed and practical, additional shadow vehicles and equipment to warn and protect motorists and workers should be used. Based upon roadway conditions, the addition of a police detail with cruiser may be used for additional protection or warning for the traveling public.

4. The distance between the work and shadow vehicle(s) may vary according to the terrain and other factors. Shadow vehicles are used to warn traffic of the operations ahead. Whenever adequate sight distance exists, the shadow vehicle(s) should maintain the minimum appropriate distance and maintain the same speed to prevent non-work related vehicles from entering the work convoy. If this formation cannot be maintained then additional traffic control devices should be deployed in advance of any vertical or horizontal curves that may restrict the sight distance of an oncoming vehicle to either the work vehicle or associated traffic queue.

5. All shadow vehicles shall be equipped with a truck or trailer mounted attenuator (TMA) and a flashing arrow board.

6. Signs should be covered or turned from view when work is not in progress.

7. Portable changeable message signs may be used in lieu of MA-W21-9 signs and any signs mounted directly to a shadow vehicle.



LEGEND

WORK ZONE

SHADOW VEHICLE

FLASHING ARROW BOARD
(WITH STATUS)

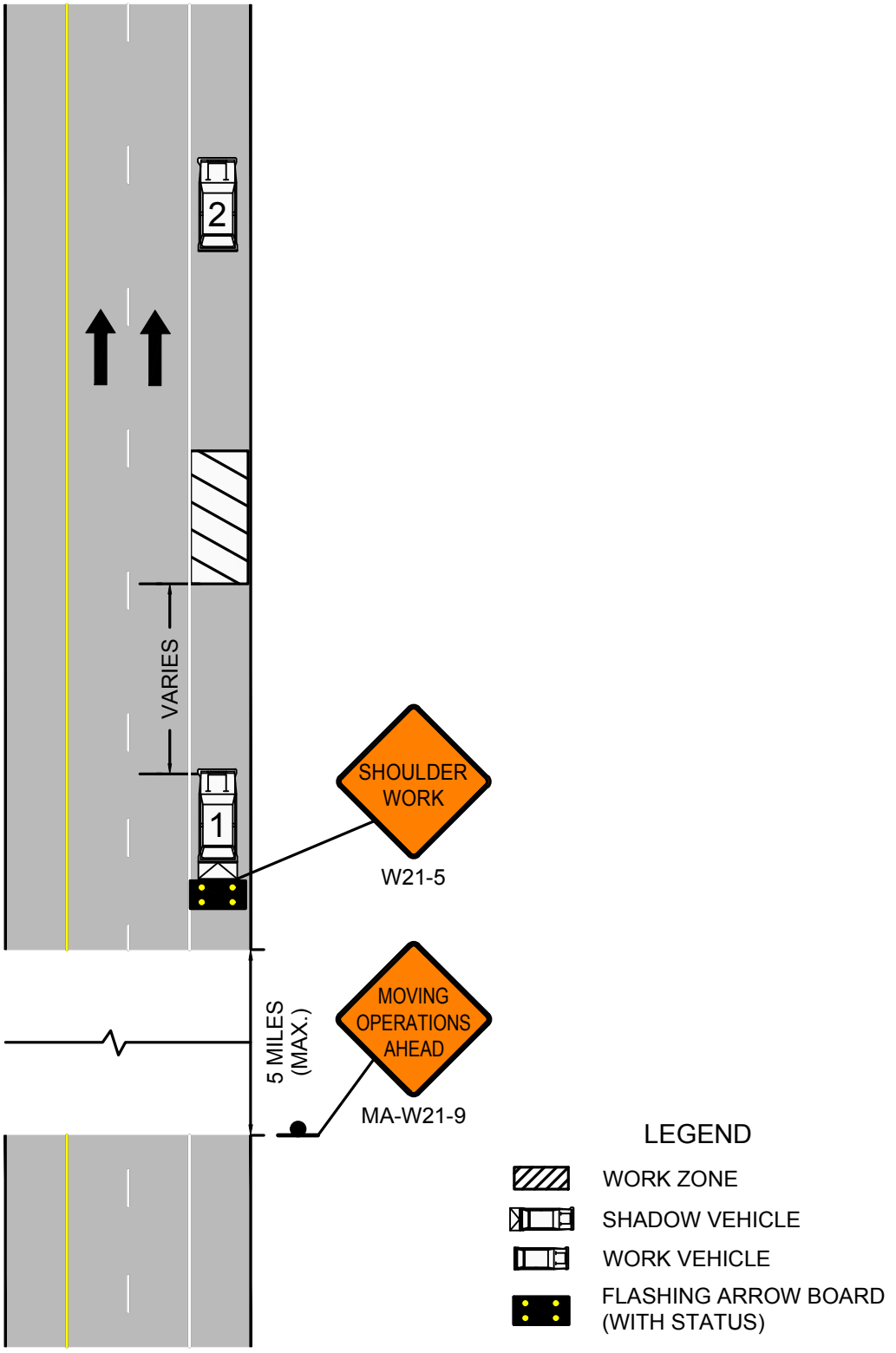
NOT TO SCALE

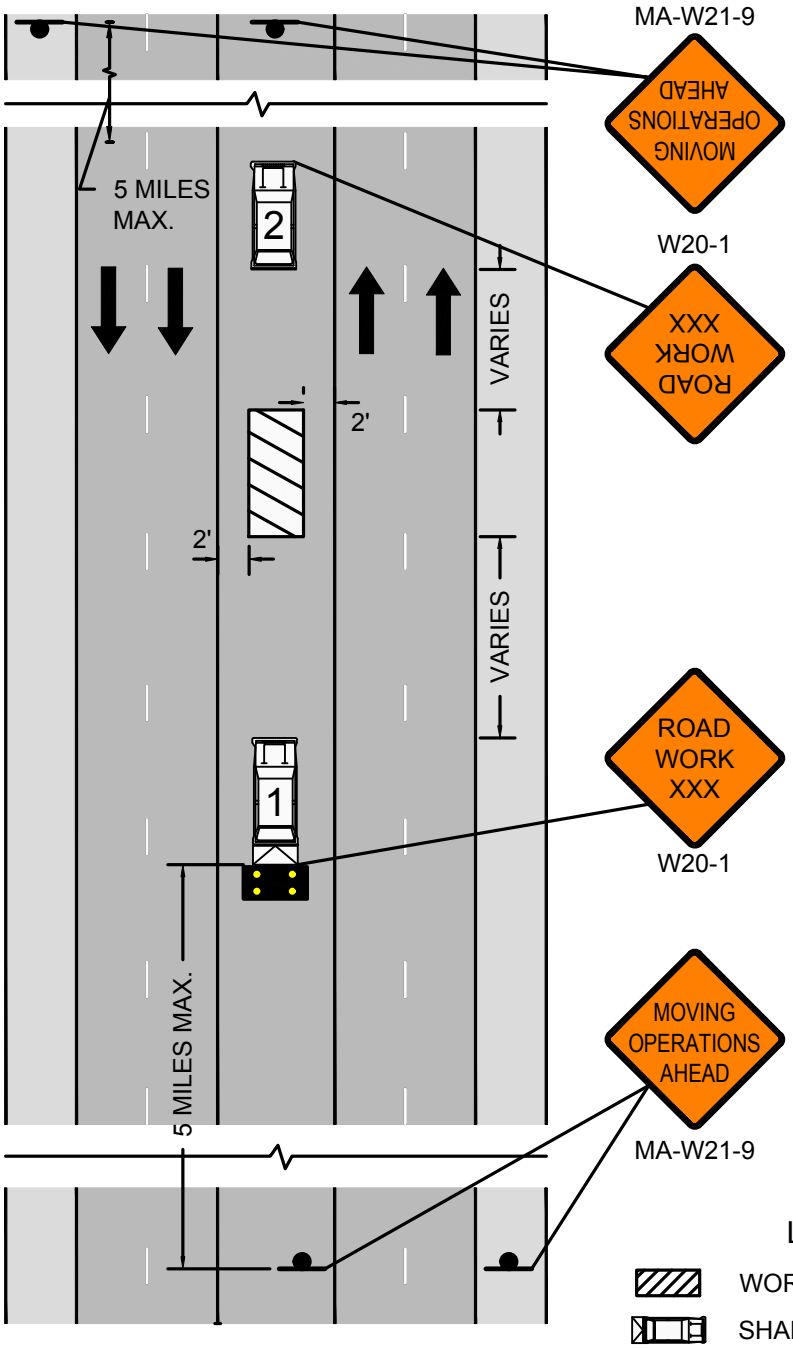
NOTES

1. IF THE WORK AREA IS SUFFICIENTLY AWAY FROM THE EDGE OF ROADWAY (20' MINIMUM) THEN SIGNS AND VEHICLES MAY NOT BE REQUIRED.

massDOT Massachusetts Department of Transportation Highway Division PAGE 57	Work Zone Safety Standard Details and Drawings	FIGURE 25 MOBILE OPERATIONS ANY ROADWAY BEYOND RIGHT SHOULDER

massDOT Massachusetts Department of Transportation Highway Division PAGE 58	Work Zone Safety Standard Details and Drawings	FIGURE 26 MOBILE OPERATIONS ANY ROADWAY SHOULDER





LEGEND

- WORK ZONE
- SHADOW VEHICLE
- WORK VEHICLE
- FLASHING ARROW BOARD (WITH STATUS)

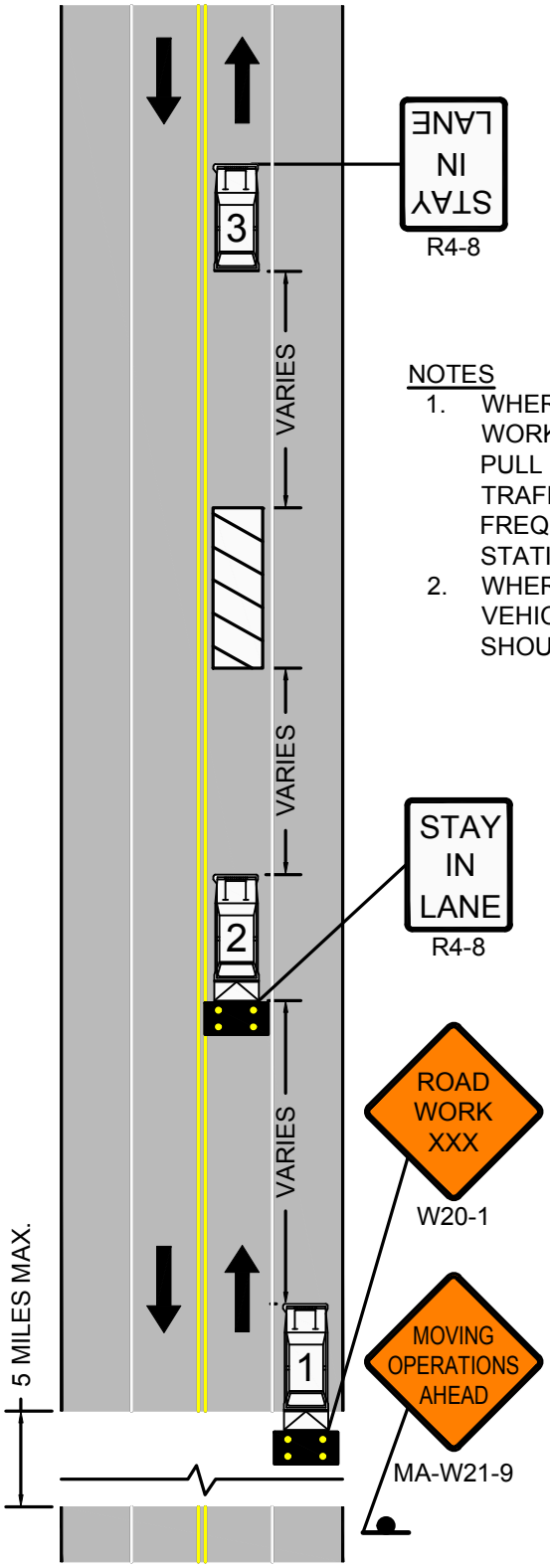
NOT TO SCALE

NOTES

1. IF THE 2' OFFSET CANNOT BE MAINTAINED, A SHORT-TERM STATIONARY SETUP SHOULD BE USED.

massDOT Massachusetts Department of Transportation Highway Division PAGE 59	Work Zone Safety Standard Details and Drawings	FIGURE 27 MOBILE OPERATIONS DIVIDED ROADWAY MEDIAN WORK

massDOT Massachusetts Department of Transportation Highway Division PAGE 60	Work Zone Safety Standard Details and Drawings	FIGURE 28 MOBILE OPERATIONS UNDIVIDED TWO LANE ROADWAY HALF OF ROADWAY CLOSED



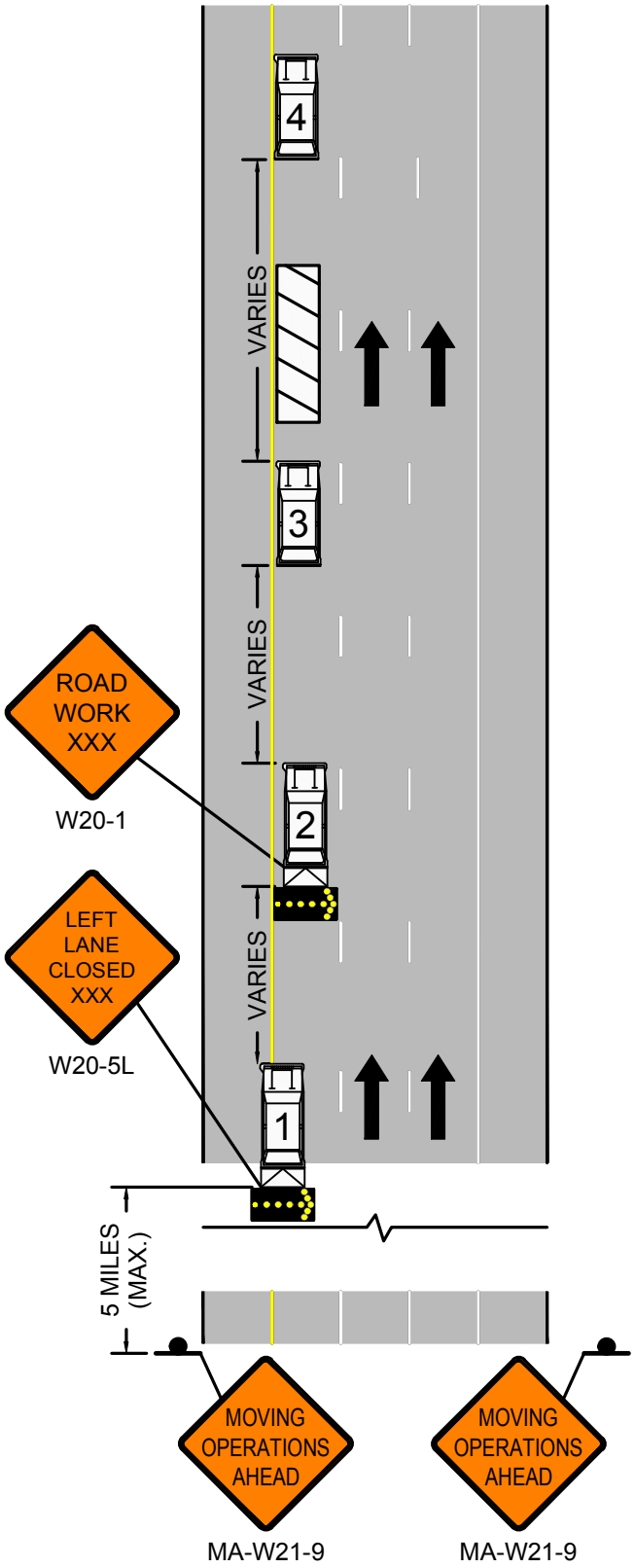
NOTES

1. WHERE PRACTICAL AND WHEN NEEDED, THE WORK AND SHADOW VEHICLE(S) SHOULD PULL OVER PERIODICALLY TO ALLOW TRAFFIC TO PASS. IF THIS CANNOT BE DONE FREQUENTLY, THEN AN ALTERNATE STATIONARY SETUP SHALL BE DEPLOYED.
2. WHERE A WIDE SHOULDER EXISTS, SHADOW VEHICLE #1 SHOULD DRIVE ON THE SHOULDER.

LEGEND

- WORK ZONE
- SHADOW VEHICLE
- WORK VEHICLE
- FLASHING ARROW BOARD (WITH STATUS)

NOT TO SCALE



LEGEND

- WORK ZONE
- SHADOW VEHICLE
- WORK VEHICLE
- FLASHING ARROW BOARD (WITH STATUS)

NOT TO SCALE

massDOT Massachusetts Department of Transportation Highway Division PAGE 61	Work Zone Safety Standard Details and Drawings	FIGURE 29 MOBILE OPERATIONS MULTILANE DIVIDED ROADWAY LEFT LANE

massDOT Massachusetts Department of Transportation Highway Division

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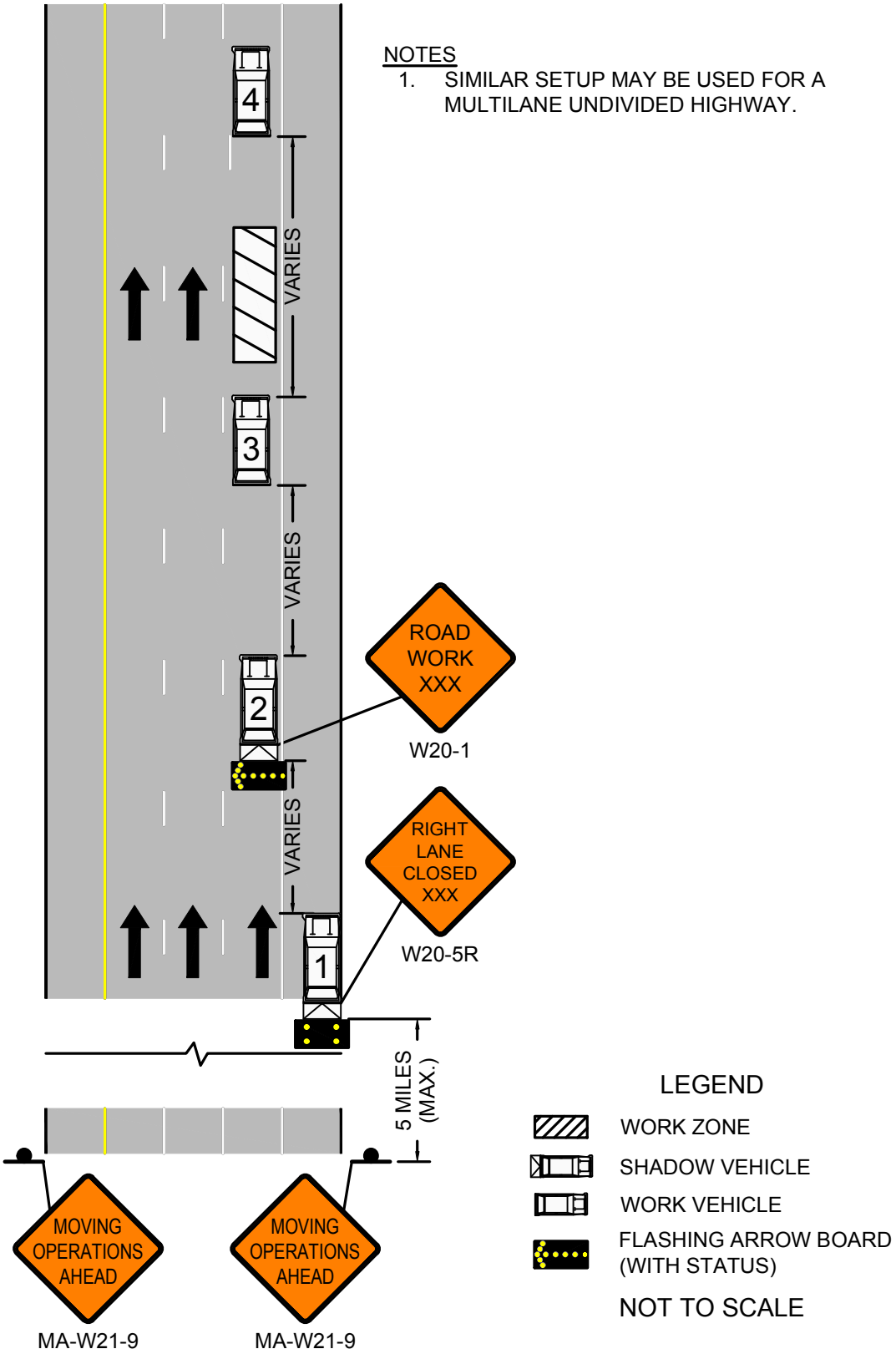
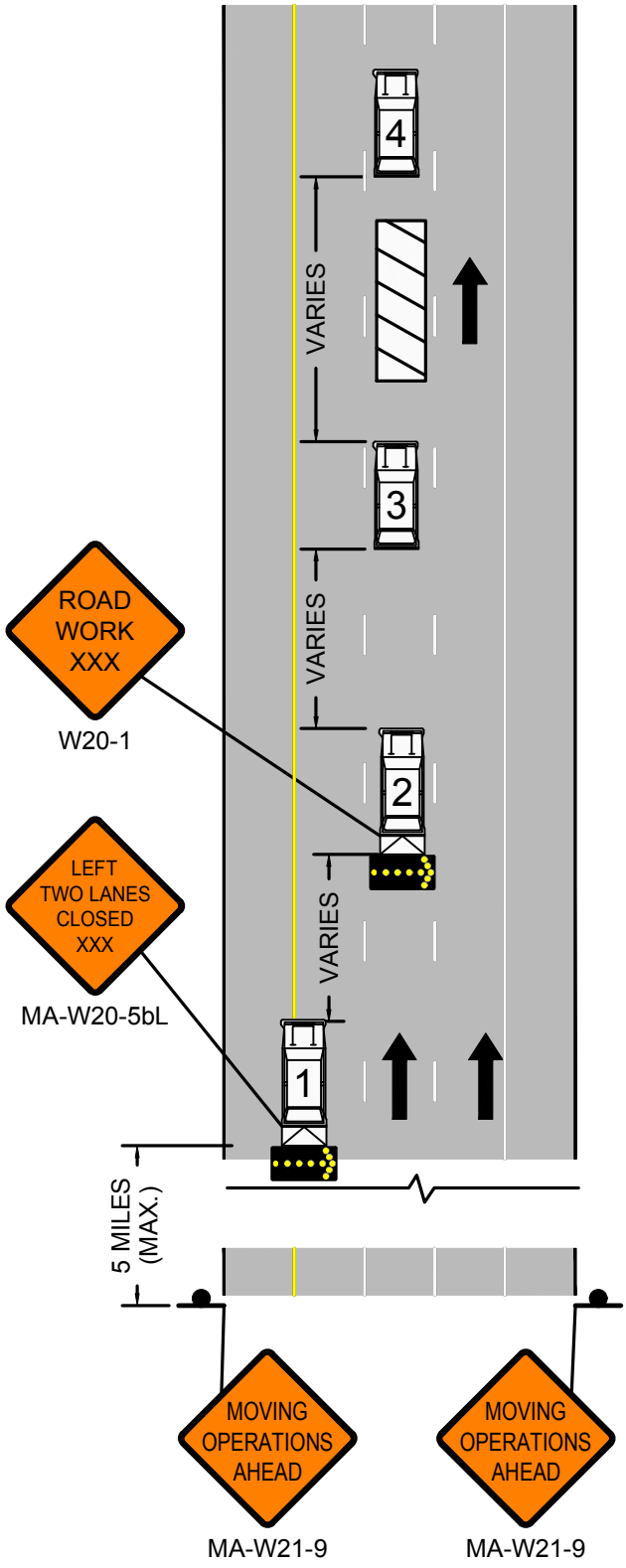
Work Zone Safety Standard Details and Drawings

FIGURE 30
MOBILE OPERATIONS
MULTILANE DIVIDED ROADWAY
RIGHT LANE





LEGEND

- WORK ZONE
- SHADOW VEHICLE
- WORK VEHICLE
- FLASHING ARROW BOARD (WITH STATUS)

NOT TO SCALE

massDOT Massachusetts Department of Transportation Highway Division PAGE 63	Work Zone Safety Standard Details and Drawings	FIGURE 31 MOBILE OPERATIONS MULTILANE DIVIDED ROADWAY CENTER LANE

massDOT Massachusetts Department of Transportation Highway Division

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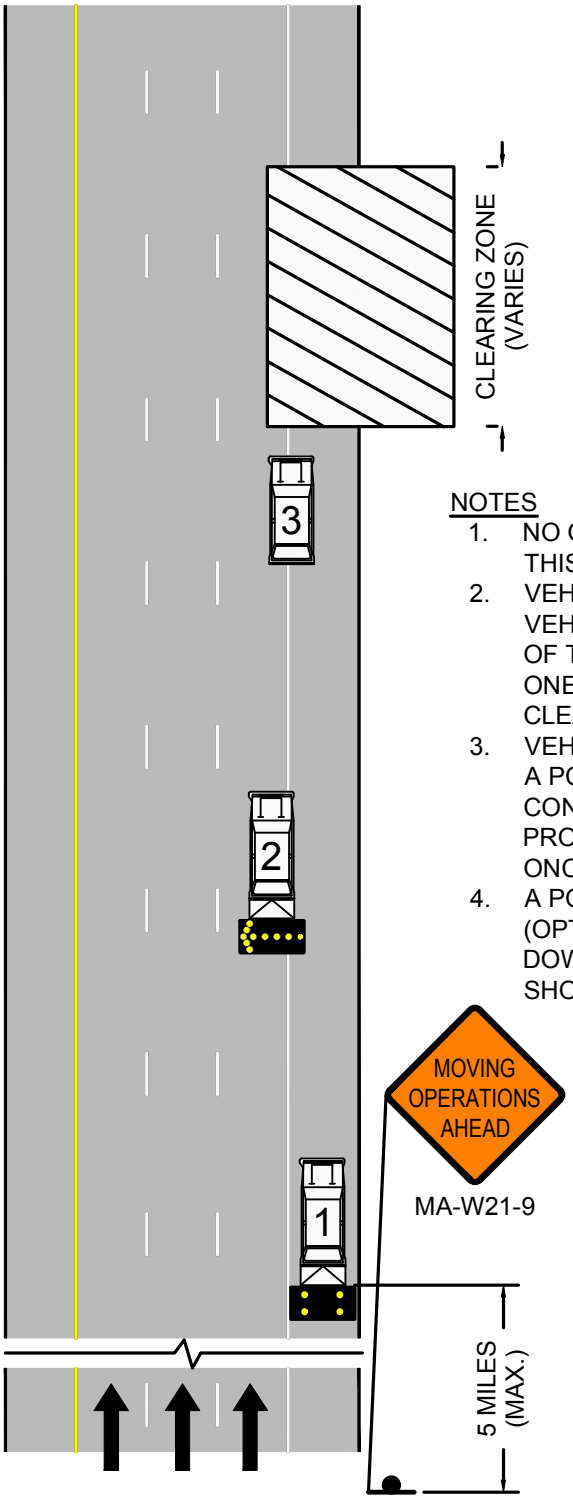
Work Zone Safety Standard Details and Drawings

FIGURE 32
MOBILE OPERATIONS
POST-STORM CLEANUP OPERATION



NOTES

1. NO OTHER NOTES ARE APPLICABLE TO THIS DETAIL.
2. VEHICLE #3 IS A SNOW/DEBRIS REMOVAL VEHICLE AND SHALL ALWAYS BE AWARE OF THE SURROUNDINGS. MORE THAN ONE VEHICLE MAY BE USED IN THE CLEARING ZONE.
3. VEHICLE #1 SHOULD BE EQUIPPED WITH A PCMS, A TMA, AND STAY IN VISUAL CONTACT WITH VEHICLE #3 WHILE PROVIDING AMPLE WARNING TO ONCOMING TRAFFIC.
4. A POLICE DETAIL WITH BLUE LIGHTS (OPTIONAL) SHALL REMAIN DOWNSTREAM OF VEHICLE #1 IN THE SHOULDER.

LEGEND

- WORK ZONE
- SHADOW VEHICLE
- WORK VEHICLE
- FLASHING ARROW BOARD (WITH STATUS)

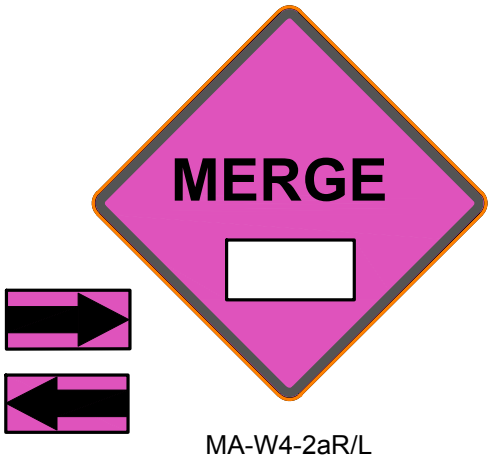
NOT TO SCALE

Notes for Traffic Emergency or Incident Operations

- The goal is to increase awareness of during traffic emergencies or incidents.
- These signs are to be used to differentiate from the traditional construction work zone and an emergency or incident.
- Upon arrival MassDOT First Responders shall assess the magnitude of the scene to determine if the incident is likely to last an hour or more in duration which would trigger the requirement to use these signs.
- Place the "Emergency Ahead" sign on the same side of the road as the incident, if possible, for up to an hour. Emergency response signs should be put up for all incidents and emergencies as soon as possible.
- Place the emergency sign 500 to 1000 feet before the first channelization devices.
- As an incident evolves this sign would be used as a secondary sign with all other emergency controls put in place.
- Only use "MERGE" signs where applicable (Not on 2 lane roads).
- Use MERGE signs on Multi-lane Roads to move traffic away from the incident and keep them in a safe lane.
- Place the MERGE sign about 500 feet before the closure.
- If additional signs are available, they should be placed accordingly as a sign informing people coming in the other direction or on the opposite side of the roadway.
- Use 12 emergency cones spaced 40 to 80 feet apart to form a taper and protect the scene.
- Sequential flashing lights/flares may be used in lieu of or to supplement cones.
- During a major incident that will last for a long duration, the EMERGENCY AHEAD sign should be moved back before an intersecting road or ramp to alert travelers and give them an option of using an alternate route. (Be sure all other devices are in place before moving this sign).

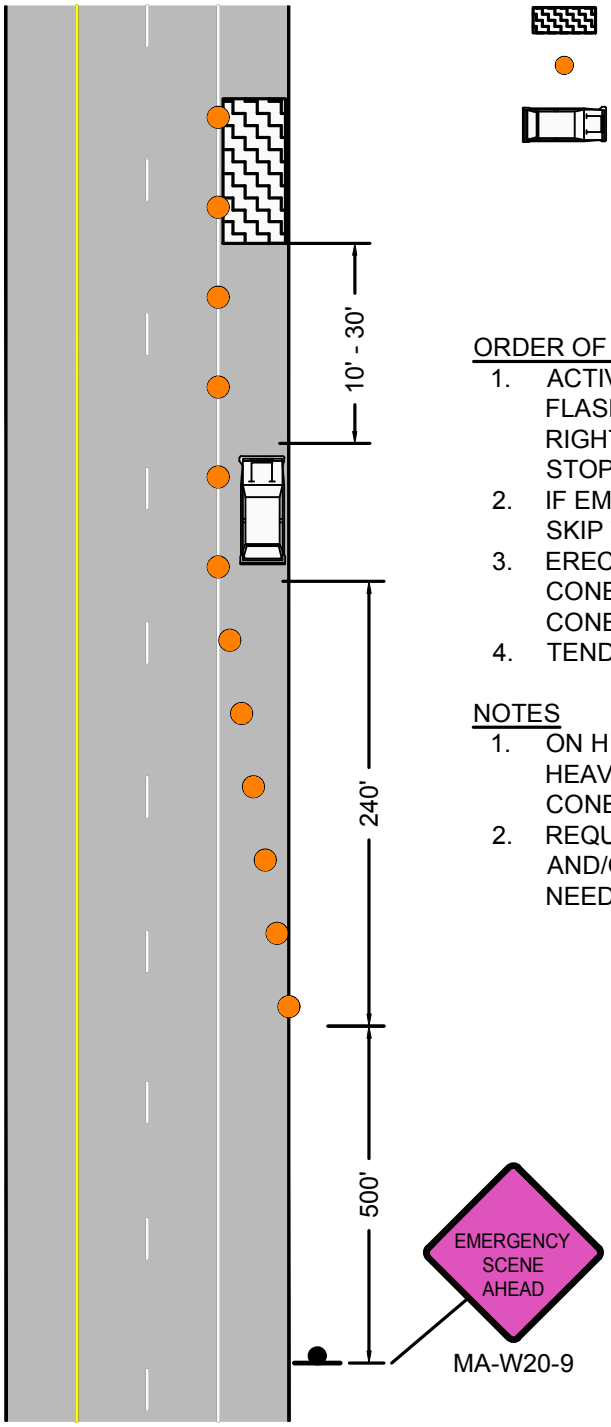
Standard Emergency Signs (36"x36" or 48"x48")

MA-W20-9



MA-W4-2aR/L

massDOT Massachusetts Department of Transportation Highway Division PAGE 66	Work Zone Safety Standard Details and Drawings	FIGURE 33 EMERGENCY RESPONSE ANY ROADWAY SHOULDER ENCROACHMENT



LEGEND

EMERGENCY AREA

CHANNELIZATION DEVICE

EMERGENCY RESPONSE VEHICLE

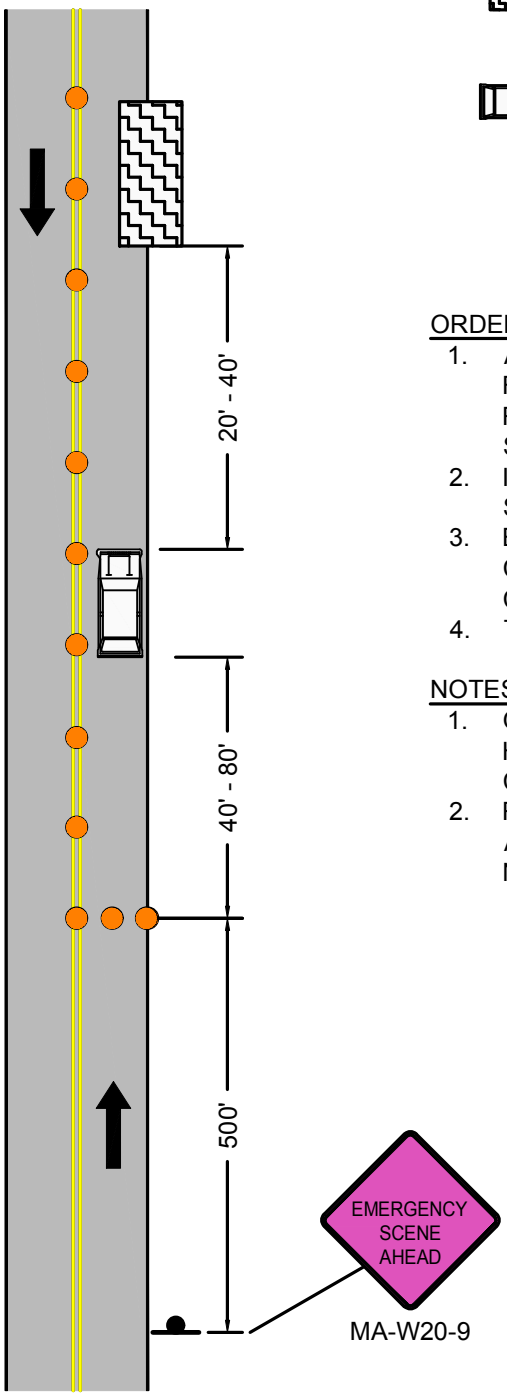
NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. PULL VEHICLE OVER TO THE RIGHT EDGE OF TRAVEL LANE BEFORE STOPPING.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 4 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.



LEGEND

EMERGENCY AREA

CHANNELIZATION DEVICE

EMERGENCY RESPONSE VEHICLE

NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

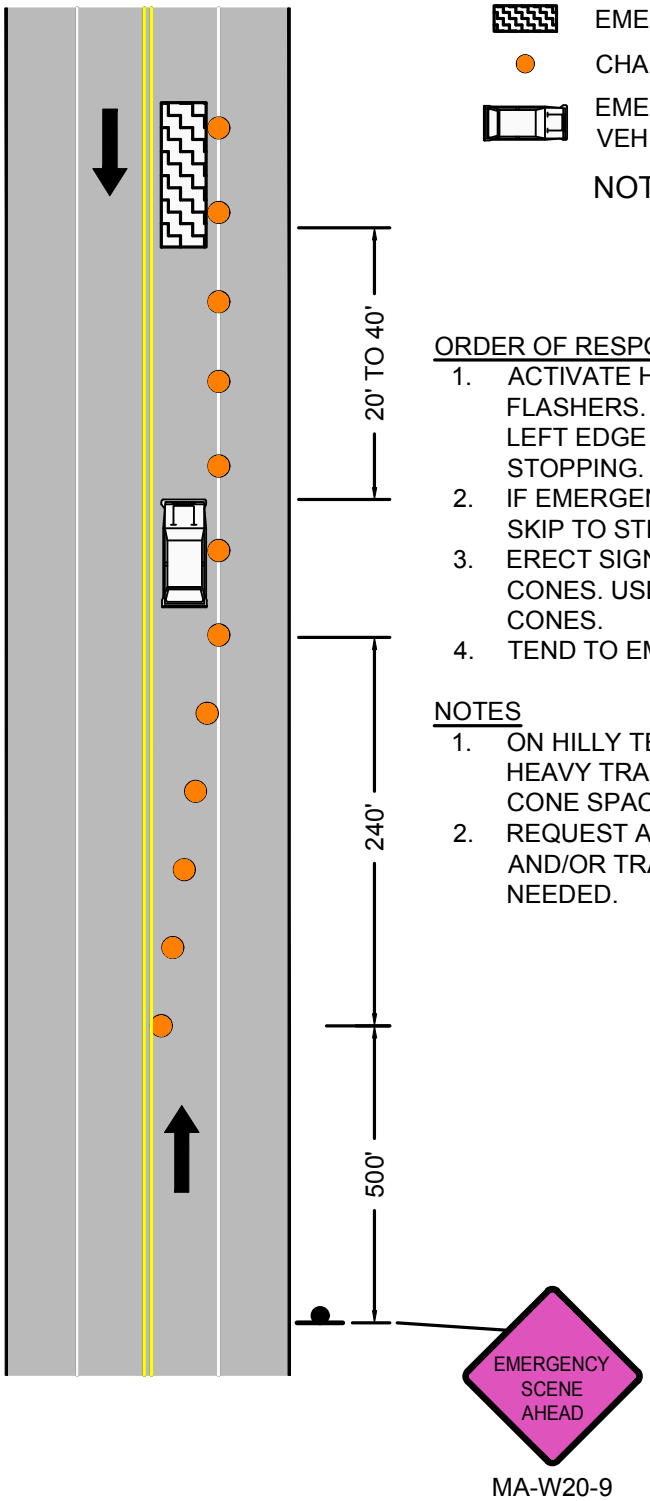
1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. PULL VEHICLE OVER TO THE RIGHT EDGE OF TRAVEL LANE BEFORE STOPPING.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 4 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.

massDOT Massachusetts Department of Transportation Highway Division PAGE 67	Work Zone Safety Standard Details and Drawings	FIGURE 34 EMERGENCY RESPONSE TWO LANE ROADWAY NO SHOULDER TRAVEL LANE ENCROACHMENT

massDOT Massachusetts Department of Transportation Highway Division PAGE 68	Work Zone Safety Standard Details and Drawings	FIGURE 35 EMERGENCY RESPONSE TWO LANE ROADWAY TRAVERSABLE SHOULDER SINGLE LANE ENCROACHMENT



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE

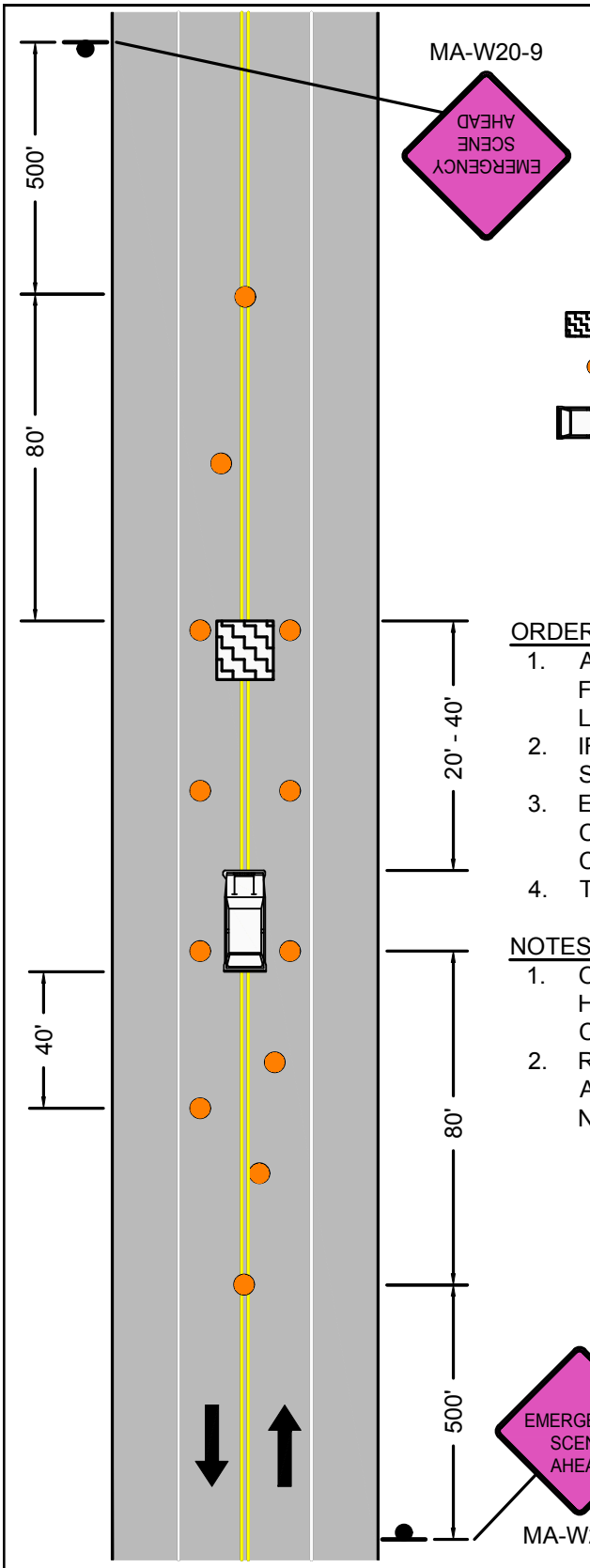
NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. PULL VEHICLE OVER TO THE LEFT EDGE OF TRAVEL LANE BEFORE STOPPING.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 4 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE

NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

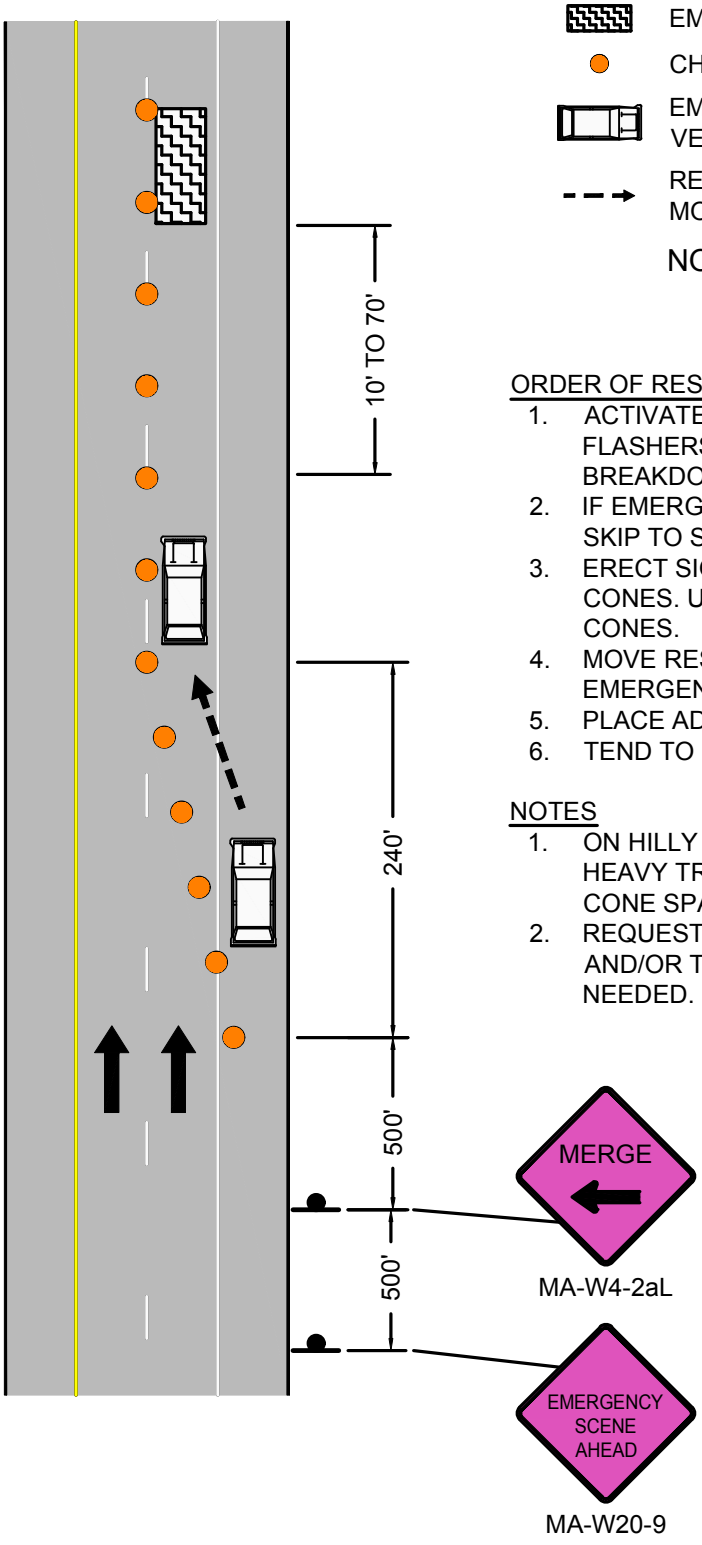
1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. STOP VEHICLE ON CENTER LINE.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 4 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.

massDOT Massachusetts Department of Transportation Highway Division PAGE 69	Work Zone Safety Standard Details and Drawings	FIGURE 36 EMERGENCY RESPONSE TWO LANE ROADWAY TRAVERSABLE SHOULDER CENTER OF ROADWAY

massDOT Massachusetts Department of Transportation Highway Division PAGE 70	Work Zone Safety Standard Details and Drawings	FIGURE 37 EMERGENCY RESPONSE MULTILANE DIVIDED ROADWAY RIGHT LANE



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE
- RESPONSE VEHICLE MOVEMENT

NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. STOP VEHICLE IN BREAKDOWN LANE.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 6 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. MOVE RESPONSE VEHICLE BEHIND EMERGENCY.
5. PLACE ADDITIONAL CONES.
6. TEND TO EMERGENCY.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.

LEGEND

EMERGENCY AREA

CHANNELIZATION DEVICE

EMERGENCY RESPONSE VEHICLE

RESPONSE VEHICLE MOVEMENT

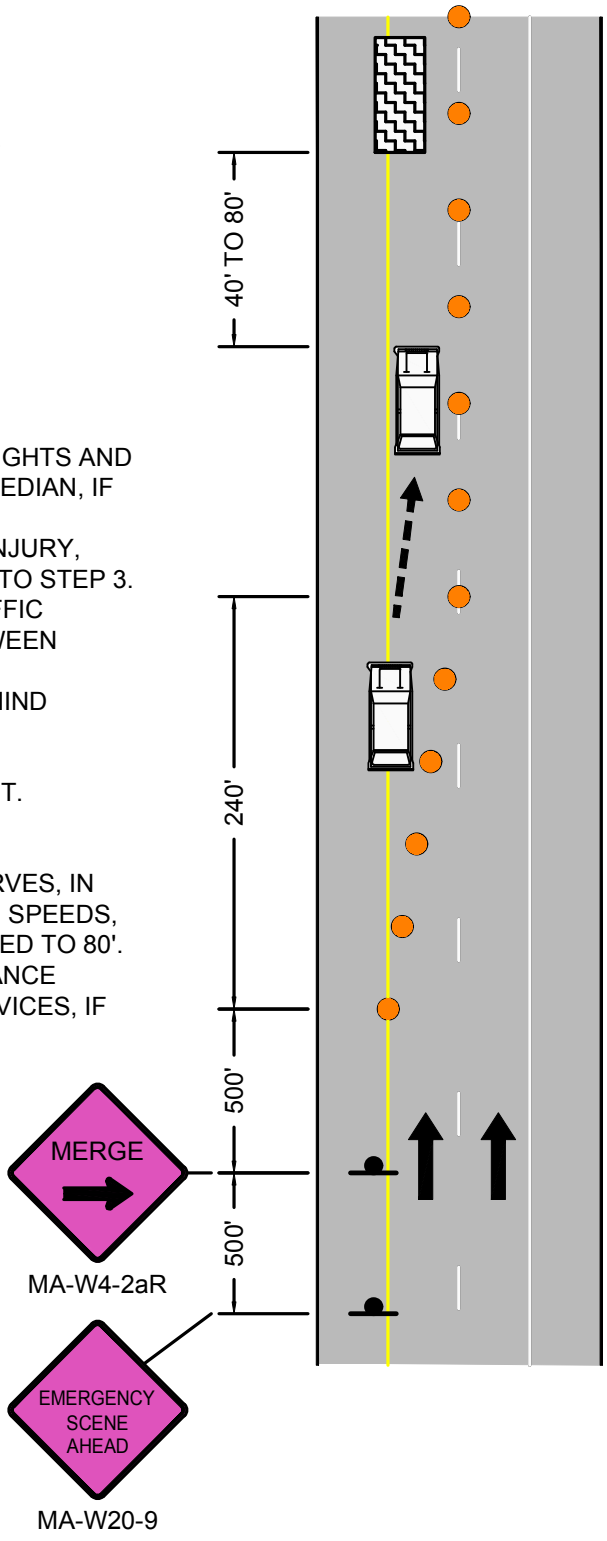
NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. STOP VEHICLE IN MEDIAN, IF PRESENT.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 6 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. MOVE RESPONSE VEHICLE BEHIND EMERGENCY.
5. PLACE ADDITIONAL CONES.
6. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.



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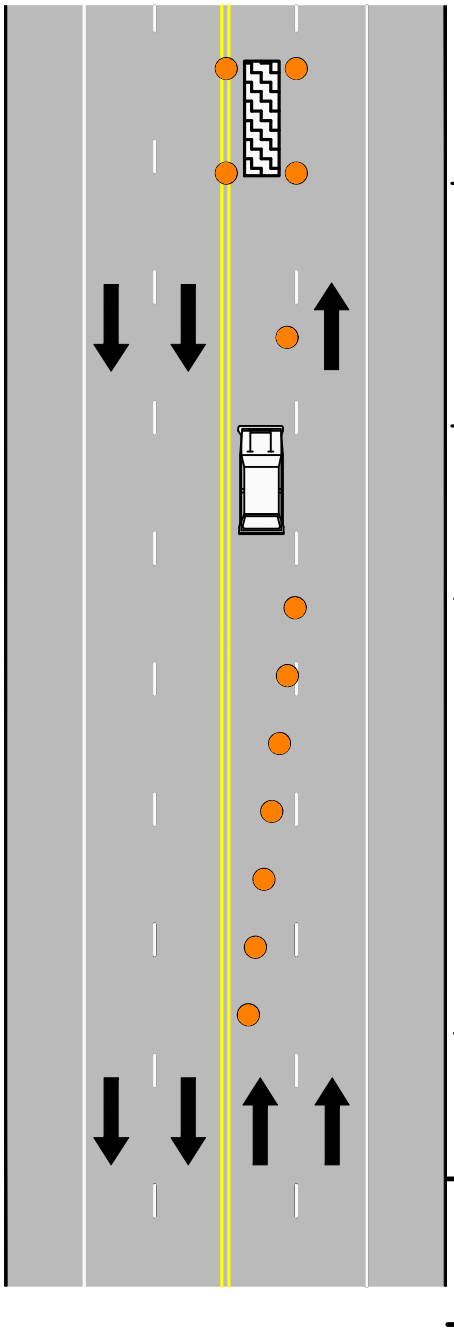
Work Zone Safety Standard Details and Drawings

FIGURE 38
EMERGENCY RESPONSE
MULTILANE DIVIDED ROADWAY
LEFT LANE

massDOT Massachusetts Department of Transportation Highway Division PAGE 72	Work Zone Safety Standard Details and Drawings	FIGURE 39 EMERGENCY RESPONSE MULTILANE UNDIVIDED ROADWAY LEFT LANE



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE

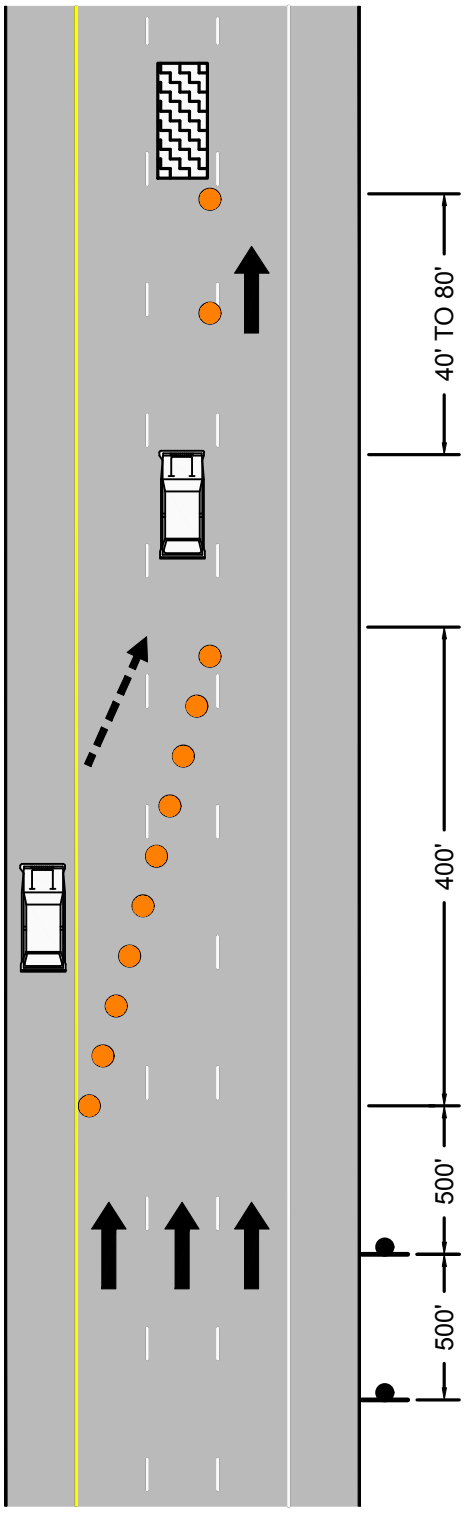
NOT TO SCALE

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. PULL VEHICLE OVER TO THE RIGHT EDGE OF BREAKDOWN LANE OR SHOULDER OR, IF NOT PRESENT, RIGHT EDGE OF TRAVEL LANE BEFORE STOPPING.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 4 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. TEND TO EMERGENCY/INCIDENT.



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE
- RESPONSE VEHICLE MOVEMENT

NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

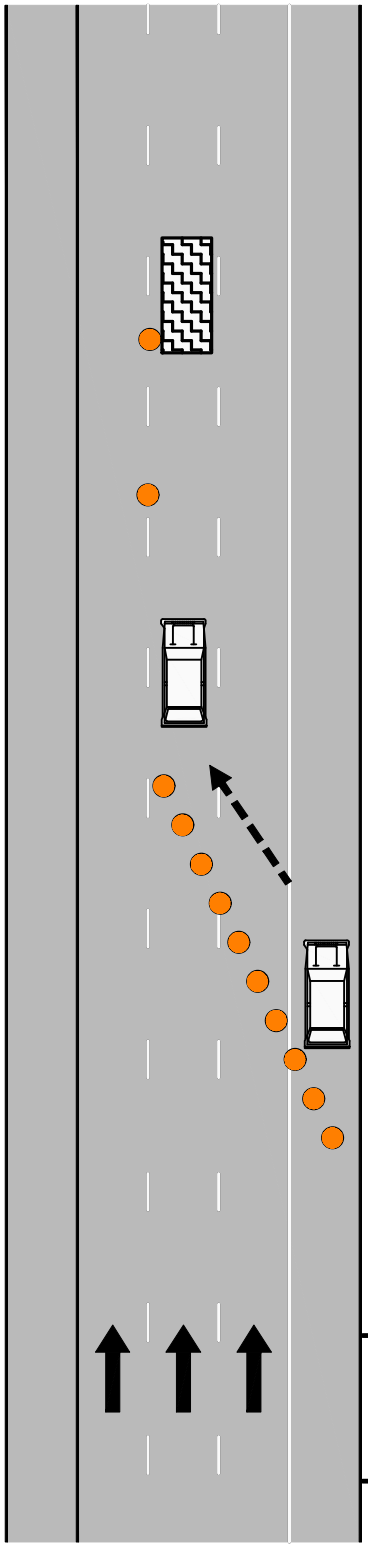
1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. STOP VEHICLE IN MEDIAN, IF PRESENT.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 6 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. MOVE RESPONSE VEHICLE BEHIND EMERGENCY.
5. PLACE ADDITIONAL CONES.
6. TEND TO EMERGENCY/INCIDENT.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.

massDOT Massachusetts Department of Transportation Highway Division PAGE 73	Work Zone Safety Standard Details and Drawings	FIGURE 40 EMERGENCY RESPONSE MULTILANE DIVIDED ROADWAY MIDDLE LANE APPROACH FROM LEFT

massDOT Massachusetts Department of Transportation Highway Division PAGE 74	Work Zone Safety Standard Details and Drawings	FIGURE 41 EMERGENCY RESPONSE MULTILANE DIVIDED ROADWAY MIDDLE LANE APPROACH FROM RIGHT



LEGEND

- EMERGENCY AREA
- CHANNELIZATION DEVICE
- EMERGENCY RESPONSE VEHICLE
- RESPONSE VEHICLE MOVEMENT

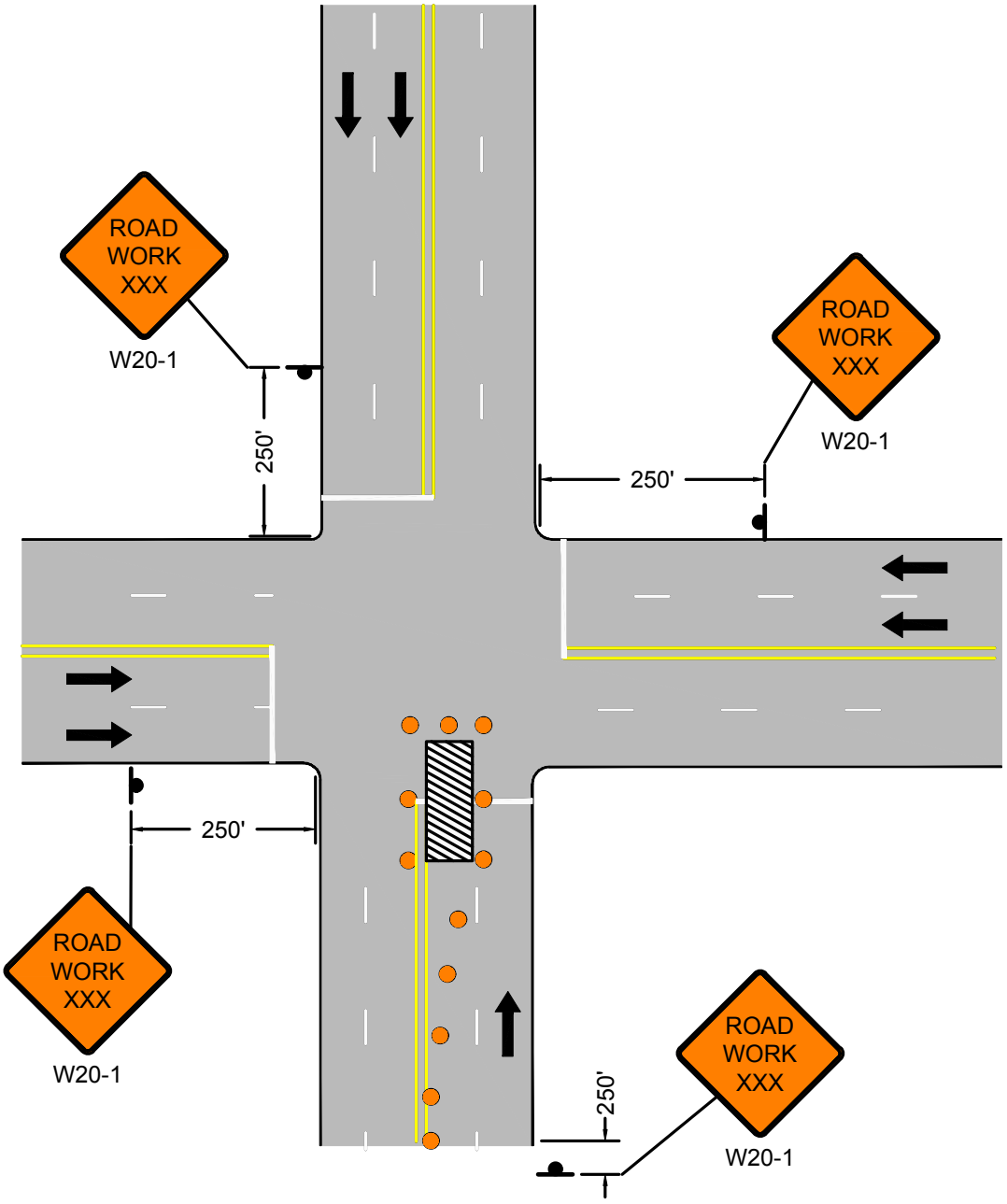
NOT TO SCALE

ORDER OF RESPONSE ACTIVITIES

1. ACTIVATE HAZARD WARNING LIGHTS AND FLASHERS. STOP VEHICLE IN BREAKDOWN LANE.
2. IF EMERGENCY INVOLVES AN INJURY, SKIP TO STEP 6 THEN RETURN TO STEP 3.
3. ERECT SIGNS AND PLACE TRAFFIC CONES. USE 40' SPACING BETWEEN CONES.
4. MOVE RESPONSE VEHICLE BEHIND EMERGENCY.
5. PLACE ADDITIONAL CONES.
6. TEND TO EMERGENCY.

NOTES

1. ON HILLY TERRAIN, SHARP CURVES, IN HEAVY TRAFFIC, OR WITH HIGH SPEEDS, CONE SPACING MAY BE DOUBLED TO 80'.
2. REQUEST ADDITIONAL ASSISTANCE AND/OR TRAFFIC CONTROL DEVICES, IF NEEDED.



LEGEND

WORK ZONE

CHANNELIZATION DEVICE

NOT TO SCALE

NOTES

1. DURATION OF WORK = 20 MINUTES OR LESS.
2. EQUIPMENT: 12 CONES + 4 PORTABLE SIGNS.
3. CONE SPACING IS 20 FEET.
4. SINGLE WORK VEHICLE PARKED/STOPPED.
5. POLICE DETAIL REQUIRED.

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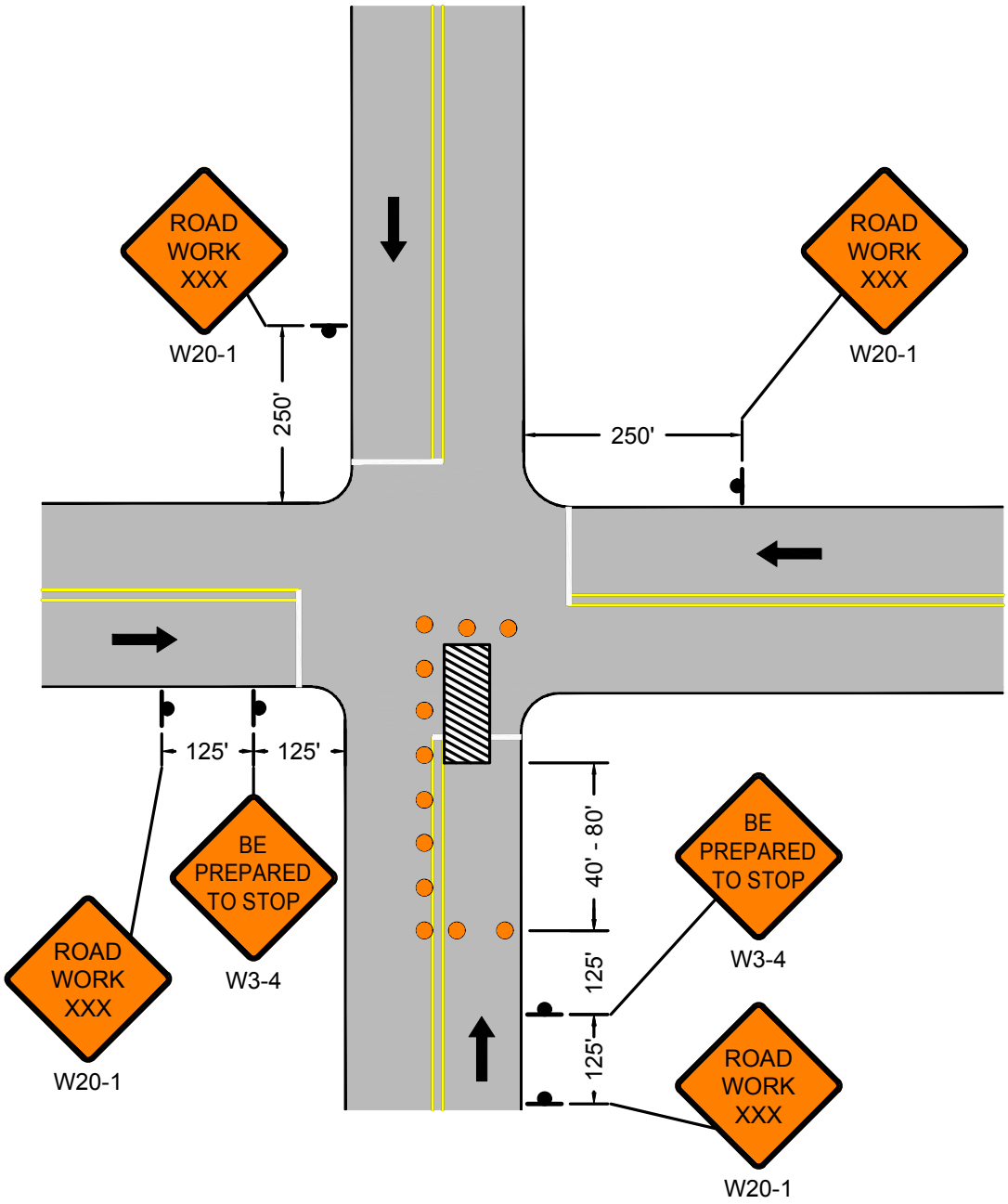
Work Zone Safety Standard Details and Drawings

FIGURE 42
TRAFFIC SIGNAL REPAIR WORK
MULTILANE UNDIVIDED ROADWAY
LEFTMOST OR LEFT TURNING LANE

massDOT Massachusetts Department of Transportation Highway Division PAGE 76	Work Zone Safety Standard Details and Drawings	FIGURE 43 TRAFFIC SIGNAL REPAIR WORK TWO LANE UNDIVIDED ROADWAY ONE LEG OF INTERSECTION



LEGEND

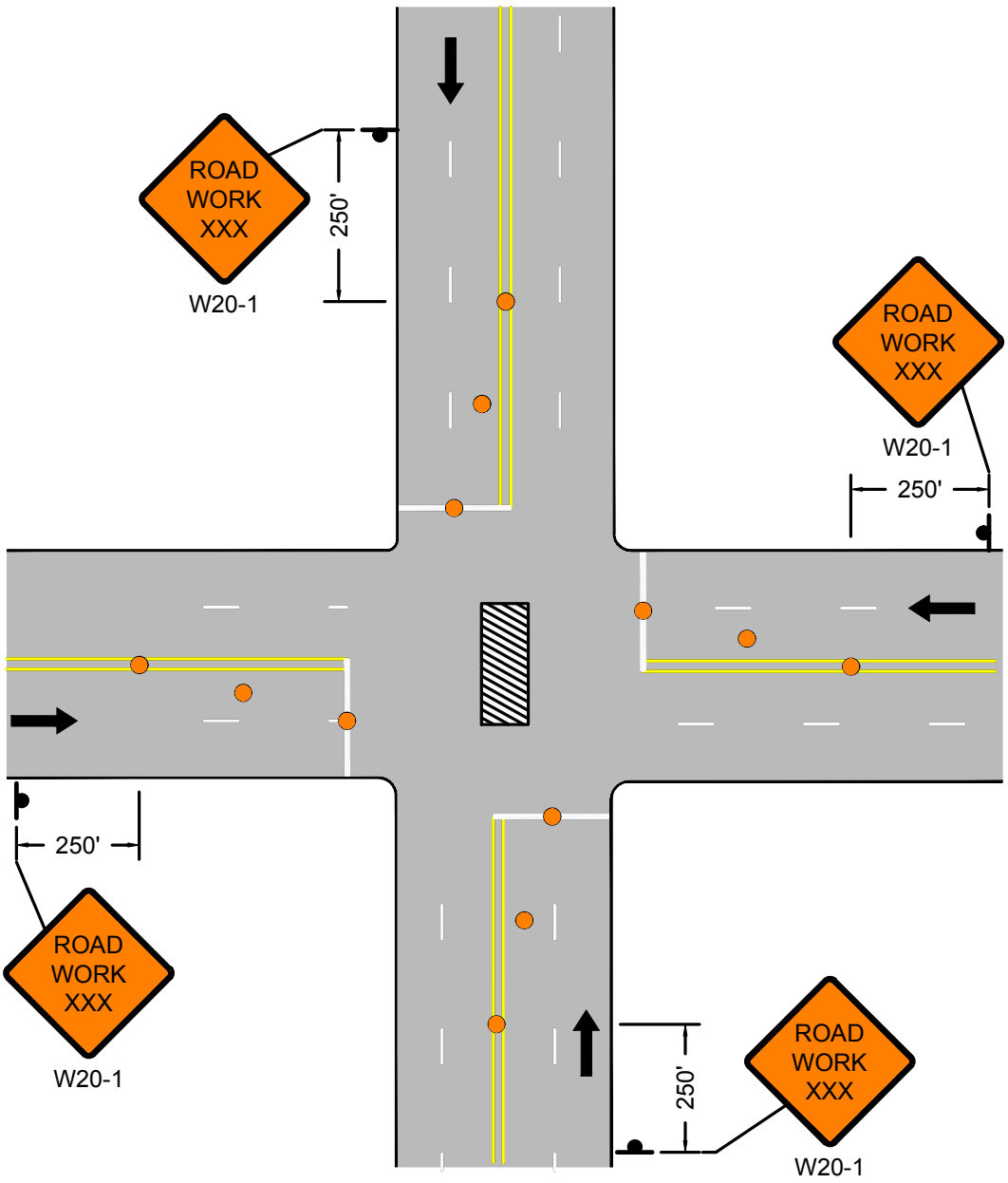
WORK ZONE

CHANNELIZATION DEVICE

NOT TO SCALE

NOTES

1. DURATION OF WORK = 20 MINUTES OR LESS.
2. EQUIPMENT: 12 CONES + 6 PORTABLE SIGNS.
3. CONE SPACING IS 20 FEET.
4. SINGLE WORK VEHICLE PARKED/STOPPED.
5. POLICE DETAIL REQUIRED.



LEGEND

WORK ZONE

CHANNELIZATION DEVICE

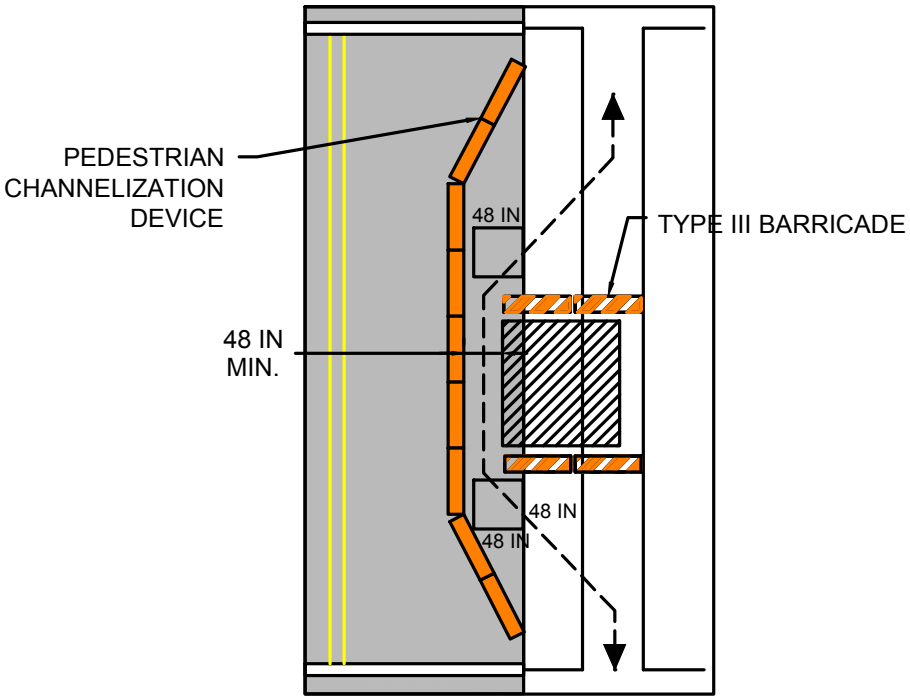
NOT TO SCALE

NOTES

1. DURATION OF WORK = 20 MINUTES OR LESS.
2. EQUIPMENT: 12 CONES + 4 PORTABLE SIGNS.
3. CONE SPACING IS 20 FEET.
4. SINGLE WORK VEHICLE PARKED/STOPPED.
5. POLICE DETAIL REQUIRED.

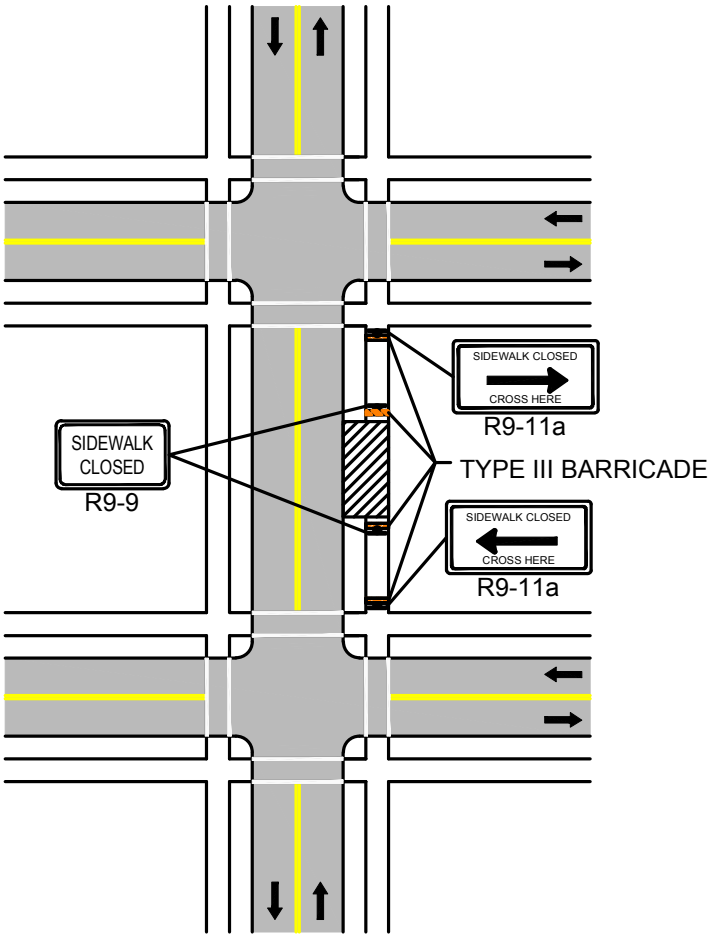
massDOT Massachusetts Department of Transportation Highway Division PAGE 77	Work Zone Safety Standard Details and Drawings	FIGURE 44 TRAFFIC SIGNAL REPAIR WORK MULTILANE UNDIVIDED ROADWAY CENTER OF INTERSECTION

massDOT Massachusetts Department of Transportation Highway Division PAGE 78	Work Zone Safety Standard Details and Drawings	FIGURE 45 PEDESTRIAN BYPASS



NOTES:

1. WHEN EXISTING PEDESTRIAN FACILITIES ARE DISRUPTED, CLOSED, OR RELOCATED IN A TTC ZONE, TEMPORARY FACILITIES SHALL BE PROVIDED AND THEY SHALL BE DETECTABLE AND INCLUDE ACCESSIBILITY FEATURES CONSISTENT WITH THE FEATURES PRESENT IN THE EXISTING PEDESTRIAN FACILITY.
2. A PEDESTRIAN CHANNELIZATION DEVICE THAT IS DETECTABLE BY A PERSON WITH A VISUAL DISABILITY TRAVELING WITH THE AID OF A LONG CANE SHALL BE PLACED ALONG THE FULL LENGTH OF THE TEMPORARY PEDESTRIAN ROUTE.
3. WHEN USED, TEMPORARY RAMPS SHALL COMPLY WITH AMERICANS WITH DISABILITIES ACT.
4. THE ALTERNATE PATHWAY SHOULD HAVE A SMOOTH CONTINUOUS HARD SURFACE FOR THE ENTIRE LENGTH OF THE TEMPORARY PEDESTRIAN FACILITY.
5. THE TEMPORARY SIDEWALK SHOULD BE A MINIMUM OF 4 FEET WIDE. IF THE SIDEWALK EXCEEDS 200 FEET THEN A 5 FOOT BY 5 FOOT PASSING ZONE SHALL BE PROVIDED NEAR THE MID-POINT OF THE CLOSURE.
6. THE PROTECTIVE REQUIREMENTS OF A TTC WORK ZONE MAY HAVE AN IMPACT IN DETERMINING THE NEED FOR TEMPORARY TRAFFIC BARRIERS AND THEIR USE IN PROVIDING PEDESTRIAN DELINEATION SHOULD BE BASED ON ENGINEERING JUDGMENT.
7. ON-DEMAND PEDESTRIAN ASSISTANCE PERSONNEL TO ASSIST WITH NAVIGATION AROUND THE CLOSURE/WORK AREA MAY BE CONSIDERED AS AN OPTION IN PLACE OF PROVIDING ADA/AAB DEVICES FOR WORK FOR CLOSURES LASTING 4 HOURS OR LESS.
8. CONTROLS ONLY FOR PEDESTRIAN TRAFFIC ARE SHOWN; VEHICULAR TRAFFIC SHOULD BE HANDLED AS SHOWN ELSEWHERE. THESE DETAILS ARE USED IN CONJUNCTION WITH THE PROPOSED LANE CLOSURE DETAILS AND DURING CONSTRUCTION STAGING, AS DETERMINED BY THE ENGINEER.



NOTES:

1. CLOSURE OF A SIDEWALK FACILITY SHALL CONSTITUTE THE PROVISION FOR MANAGING PEDESTRIAN TRAFFIC AND ACCOMMODATING ALL USERS. IF THE EXISTING PEDESTRIAN ACCESS ROUTE(S) CAN BE TEMPORARILY RELOCATED ALONG THE EXISTING SIDEWALK , AND SAID FACILITY PROVIDES A MINIMUM WIDTH OF 48-INCHES OF SOLID, SMOOTH UNOBSTRUCTED SURFACE, THEN NO DETOURING OF THE ROUTE SHALL BE REQUIRED. DELINEATION OF THE WORK AREA IS STILL REQUIRED.

2. IF IT IS NECESSARY TO DIVERT PEDESTRIAN TRAFFIC TO AN ALTERNATE ROUTE ACROSS THE ROADWAY FROM THE EXISTING FACILITY, THE FIGURE ABOVE SHALL BE FOLLOWED TO PROVIDE ADEQUATE DIRECTION TO PEDESTRIANS. ALTERNATE ROUTE SHALL PROVIDE THE SAME LEVEL OF ACCOMMODATION AS THE FACILITY THAT IS BEING DETOURED AND RETAIN ADA COMPLIANCE IN ITS ENTIRETY.

3. FOR EMERGENCY OR SHORT-DURATION SIDEWALK CLOSURES OF 4-HOURS OR LESS, IT IS OPTIONAL TO HAVE ON-DEMAND PEDESTRIAN ASSISTANCE PERSONNEL AVAILABLE AT ALL TIMES DURING THE CLOSURE TO ASSIST THOSE MOBILITY CHALLENGED PERSONS WHO REQUIRE ADDITIONAL ASSISTANCE TO SAFELY NAVIGATE AROUND THE WORK AREA IN LIEU OF A FULL DETOUR.

massDOT Massachusetts Department of Transportation Highway Division PAGE 80	Work Zone Safety Standard Details and Drawings	STATIONARY OPERATIONS BIKE LANE CLOSURE

POSTED SPEED LIMIT (MPH)	SPACING FOR BIKE ADVANCE WARNING SIGNS (FT) (A,B))	CHANNELIZATION DEVICES (DRUMS OR CONES)			
		TRANSITION LENGTH (L/3)	BUFFER ZONE LENGTH (FT)	DEVICE SPACING (FT)	MIN # OF DEVICES*
25-40	150 / 150	100	305	20	45
45-55	150 / 150	220	495	40	35
60-65	150 / 150	260	645	40	40

* NUMBER OF DEVICES BASED ON 400 FT WORK ZONE.

NOTES

1. DETAIL SHALL BE USED IN CONJUNCTION WITH THE PROPOSED LANE CLOSURE DETAILS. SIGNING SHOWN ONLY FOR BIKE TRAFFIC. FOLLOW ALL OTHER RELEVANT DETAILS FOR TTC DEVICES FOR VEHICULAR TRAFFIC.
2. ** SIGN SHALL BE USED ONLY IF THERE IS A MARKED BIKE LANE.
3. *** SIGN SHALL BE USED ONLY IF THERE IS NO MARKED BIKE LANE.

LEGEND


WORK ZONE


CHANNELIZATION DEVICE

FLASHING ARROW BOARD


PORTABLE CHANGEABLE MESSAGE SIGN


TRUCK MOUNTED ATTENUATOR

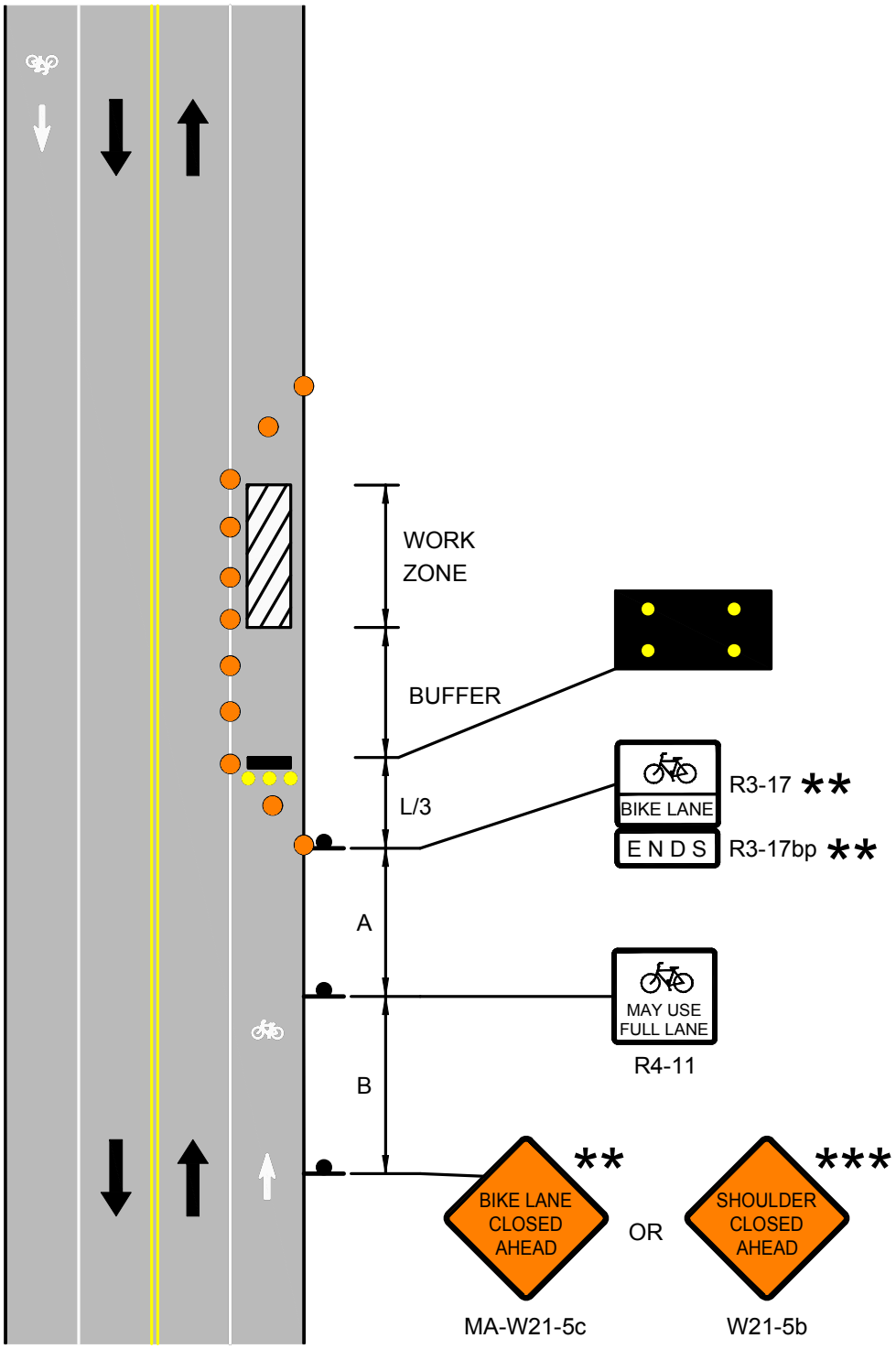
RADAR SPEED FEEDBACK BOARD

POLICE DETAIL OR UNIFORMED FLAGGER

TEMPORARY PORTABLE RUMBLE STRIP

TYPE III BARRICADE

NOT TO SCALE

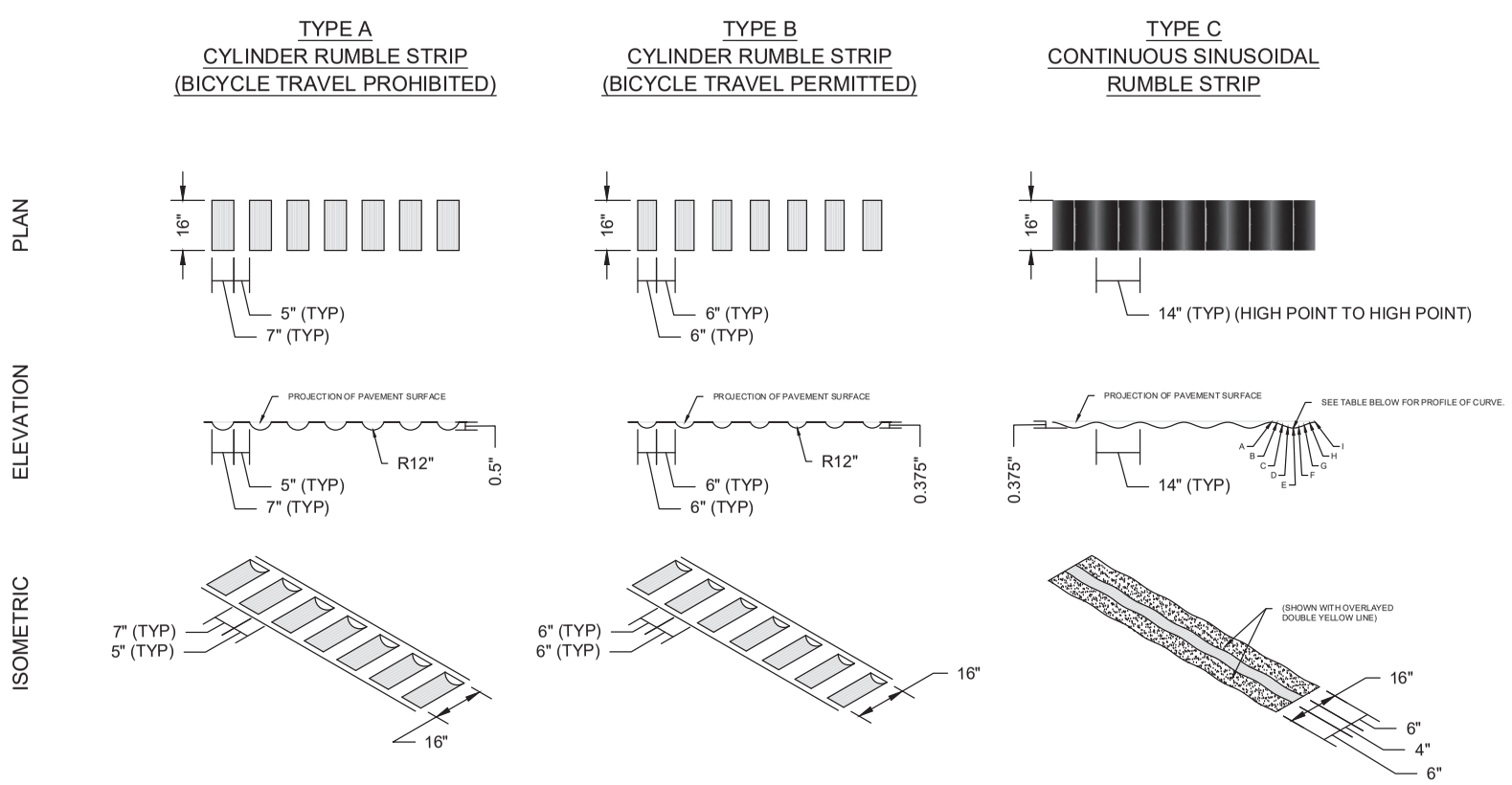


massDOT Massachusetts Department of Transportation Highway Division PAGE 81	Work Zone Safety Standard Details and Drawings	FIGURE 48 STATIONARY OPERATIONS BIKE LANE CLOSURE

Rev. June, 2017

DOCUMENT A00816

RUMBLE STRIP DETAILS



NOTES:

1. NOT TO SCALE. SOME LINE WORK EXAGGERATED FOR CLARITY.
2. SEE PLANS FOR LOCATION(S) AND START AND END STATIONS FOR ALL RUMBLE STRIP INSTALLATIONS.
3. HIGH POINT OF SINUSOIDAL RUMBLE STRIP LOCATED $\frac{1}{16}$" BELOW PAVEMENT SURFACE.

DESIGN OF CURVE PROFILE FOR SINUSOIDAL RUMBLE STRIP									
POINT	A	B	C	D	E	F	G	H	I
DEPTH FROM PAVEMENT SURFACE (IN.)	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{7}{32}$	$\frac{11}{32}$	$\frac{3}{8}$	$\frac{11}{32}$	$\frac{7}{32}$	$\frac{1}{8}$	$\frac{1}{16}$
DISTANCE FROM HIGH POINT "A" (IN.)	0	1.75	3.5	5.25	7	8.75	10.5	12.25	14

massDOT Massachusetts Department of Transportation Highway Division

TRAFFIC & SAFETY STANDARDS
SECTION 860

RUMBLE STRIP DETAILS

D-TE OF ISSUE
2020

DR- ING NUMBER
XXX.X.X

DOCUMENT A00817

STRUCTURES INSPECTION FIELD REPORT
BRIDGE NO. W-44-083

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MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

ROUTINE & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
03	212	W-44-083

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	41-STATUS	90-ROUTINE INSP. DATE
WORCESTER	W44083-212-DOT-NBI	000.000	D:OPEN	APR 18, 2023

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	YR REHAB'D (NON 106)
HWY HARRISON ST		1958	0000	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER	M. Azizi
I 290	Urban Local		

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER D. Simkhovich
302 : Steel Stringer/Girder	State Highway Agency	State Highway Agency	

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Cloudy	8°C	N. GAINES

ITEM 58 — DECK: 5

		DEF
1.Wearing Surface	5	M-P
2.Deck Condition	5	S-P
3.Stay in Place Forms	N	-
4.Curbs	6	M-P
5.Median	N	-
6.Sidewalks	5	S-P
7.Parapets	N	-
8.Railing	4	S-A
9.Anti Missile Fence	6	M-P
10.Drainage System	N	-
11.Lighting Standards	N	-
12.Utilties	5	S-P
13.Deck Joints	4	S-A
14.	N	-
15.	N	-
16.	N	-

CURB REVEAL (In millimeters)	N	S
	250	250

APPROACHES

		DEF
a. Appr. Pavement Condition	6	M-P
b. Appr. Roadway Settlement	7	-
c. Appr. Sidewalk Settlement	6	M-P
d.	N	-

OVERHEAD SIGNS (Attached to bridge) (Y/N): N

		DEF
a. Condition of Welds	N	-
b. Condition of Bolts	N	-
c. Condition of Signs	N	-

ITEM 59 — SUPERSTRUCTURE: 4

		DEF
1.Stringers	N	-
2.Floorbeams	N	-
3.Floor System Bracing	N	-
4.Girders or Beams	4	S-A
5.Trusses - General	N	-
a. Upper Chords	N	-
b. Lower Chords	N	-
c. Web Members	N	-
d. Lateral Bracing	N	-
e. Sway Bracings	N	-
f. Portals	N	-
g. End Posts	N	-
6.Pin & Hangers	N	-
7.Conn Plt's, Gussets & Angles	5	S-A
8.Cover Plates	6	M-P
9.Bearing Devices	5	M-P
10.Diaphragms/Cross Frames	5	S-P
11.Rivets & Bolts	7	-
12.Welds	7	-
13.Member Alignment	5	M-P
14.Paint/Coating	3	S-A
15.	N	-

Year Painted	1991

COLLISION DAMAGE: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD DEFLECTION: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

LOAD VIBRATION: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

Any Fracture Critical Member: (Y/N) N

Any Cracks: (Y/N) N

ITEM 60 — SUBSTRUCTURE: 6

	Dive	Cur		DEF
1. Abutments			6	
a. Pedestals	N	N		-
b. Bridge Seats	N	6		M-P
c. Backwalls	N	6		S-P
d. Breastwalls	N	6		M-P
e. Wingwalls	N	7		-
f. Slope Paving/Rip-Rap	N	N		-
g. Pointing	N	N		-
h. Footings	N	H		-
i. Piles	N	N		-
j. Scour	N	N		-
k. Settlement	N	6		M-P
l.	N	N		-
m.	N	N		-
2. Piers or Bents			6	
a. Pedestals	N	N		-
b. Caps	N	6		M-P
c. Columns	N	7		-
d. Stems/Webs/Pierwalls	N	N		-
e. Pointing	N	N		-
f. Footing	N	N		-
g. Piles	N	N		-
h. Scour	N	N		-
i. Settlement	N	N		-
j.	N	N		-
k.	N	N		-
3. Pile Bents			N	
a. Pile Caps	N	N		-
b. Piles	N	N		-
c. Diagonal Bracing	N	N		-
d. Horizontal Bracing	N	N		-
e. Fasteners	N	N		-

UNDERMINING (Y/N) If YES please explain: N

COLLISION DAMAGE:
None (X) Minor ( ) Moderate ( ) Severe ( )

SCOUR: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

I-60 (Dive Report): N *I-60 (This Report):* 6

93B-U/W (DIVE) Insp 00/00/0000

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

RTN(1)7-96

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**212**	**W-44-083**	**W44083-212-DOT-NBI**	**APR 18, 2023**

ITEM 61 — CHANNEL & CHANNEL PROTECTION

N

	Dive	Cur	DEF
1.Channel Scour	N	N	-
2.Embankment Erosion	N	N	-
3.Debris	N	N	-
4.Vegetation	N	N	-
5.Utilities	N	N	-
6.Rip-Rap/Slope Protection	N	N	-
7.Aggradation	N	N	-
8.Fender System	N	N	-

STREAM FLOW VELOCITY:

Tidal ( ) High ( ) Moderate ( ) Low ( ) None (**X**)

ITEM 61 (Dive Report): **N** ***ITEM 61 (This Report):*** **N**

93b-U/W INSP. DATE: 00/00/0000

ITEM 36 — *TRAFFIC SAFETY*

	36	COND	DEF
A. Bridge Railing	0	4	S-A
B. Transitions	0	6	M-P
C. Approach Guardrail	0	5	S-P
D. Approach Guardrail Ends	0	5	S-P

WEIGHT POSTING

Not Applicable **X**

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 07/01/1987 **EJDMT Date:** 00/00/0000

Signs In Place (Y=Yes,N=No, NR=NotRequired) **Legibility/ Visibility**	At bridge E	At bridge W	Other Advance E	Other Advance W

CLEARANCE POSTING

Not **X**

Actual Field Measurement

Posted Clearance

	N ft	N in	S ft	S in	meter
Actual Field Measurement	15	1	20	8	4.59
Posted Clearance		0		0	

Signs In Place (Y=Yes,N=No, NR=Not Required) **Legibility/ Visibility**	At bridge N	At bridge S	Advance N	Advance S

ACCESSIBILITY (Y/N/P)

	Needed	Used
Lift Bucket	Y	Y
Ladder	N	N
Boat	N	N
Waders	N	N
Inspector 50	N	N
Rigging	N	N
Staging	N	N
Traffic Control	Y	Y
RR Flagger	N	N
Police	Y	Y
Other:		
OVERTIME	Y	Y

TOTAL HOURS 8

PLANS (Y/N): **Y**

(V.C.R.) (Y/N): **N**

TAPE#: _____

List of field tests performed:

RATING

Rating Report (Y/N): **Y**

Date: 10/27/1986

Inspection data at time of existing rating

I 58: **6** I 59: **6** I 60: **6** Date : 06/11/1985

Recommend for Rating or Rerating (Y/N): **N**

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON: _____

CONDITION RATING GUIDE

(For Items 58, 59, 60 and 61)

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	
G	9	EXCELLENT	Excellent condition.
G	8	VERY GOOD	No problem noted.
G	7	GOOD	Some minor problems.
F	6	SATISFACTORY	Structural elements show some minor deterioration.
F	5	FAIR	All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
P	4	POOR	Advanced section loss, deterioration, spalling or scour.
P	3	SERIOUS	Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
C	2	CRITICAL	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stablility. Bridge is closed to traffic but corrective action may put it back in light service.
	0	FAILED	Out of service - beyond corrective action.

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

S= Severe/Major Deficiency - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, etc.

C-S= Critical Structural Deficiency - A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency - A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, etc.

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her].

A = ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) upon receipt of the Inspection Report].

P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

ROUTINE & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
03	212	W-44-083

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	90-ROUTINE INSP. DATE	93*-SPEC. MEMB. INSP. DATE
WORCESTER	W44083-212-DOT-NBI	000.000	Apr 18, 2023	Apr 18, 2023

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	*YR REHAB'D (NON 106)
HWY HARRISON ST		1958	0000	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER	
I 290	Urban Local		M. Azizi

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER
302 : Steel Stringer/Girder	State Highway Agency	State Highway Agency	D. Simkhovich

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Cloudy	8°C	N. GAINES

WEIGHT POSTING — *Not Applicable* X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 07/01/1987 EJDMT Date: 00/00/0000

Signs In Place (Y=Yes,N=No, NR=Not Required) / Legibility/ Visibility

	At bridge E	At bridge W	Advance E	Advance W
Signs In Place				
Legibility/ Visibility				

PLANS (Y/N): Y

(V.C.R.) (Y/N): N

TAPE#:

RATING

Rating Report (Y/N): Y Date: 10/27/1986

Recommend for Rating or Rerating (Y/N): N

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON:

Inspection data at time of existing rating

I 58: 6 I 59: 6 I 60: 6 I 62: - Date : 06/11/1985

SPECIAL MEMBER(S):

	MEMBER	CRACK (Y/N):	WELD'S CONDITION (0-9)	LOCATION OF CORROSION, SECTION LOSS (%), CRACKS, COLLISION DAMAGE, STRESS CONCENTRATION, ETC.	CONDITION PREVIOUS (0-9)	CONDITION PRESENT (0-9)	INV. RATING OF MEMBER FROM RATING ANALYSIS H-20	3	3S2	Deficiencies
A	Item 59.4 - Girders or Beams	N	N	See remarks in comments section.	4	4	15	17	23	S-A
B										
C										
D										
E										

List of field tests performed:

	I-58	I-59	I-60	I-62
(Overall Previous Condition)	5	4	6	-
(Overall Current Condition)	5	4	6	-

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

S= Severe/Major Deficiency - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, etc.

C-S= Critical Structural Deficiency - A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency - A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, etc.

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her].

A = ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) upon receipt of the Inspection Report].

P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

F.C.(1)7-96

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**212**	**W-44-083**	**W44083-212-DOT-NBI**	**APR 18, 2023**

REMARKS

BRIDGE ORIENTATION

According to the plans, the approaches are west and east and the elevations are south and north. **See sketch 1.** This structure is a two span steel beam bridge with seven beams and six bays in each span. The bays are numbered from north to south. The beams are numbered in accordance with the framing plan. **See sketch 2.** The spans are numbered east to west. There is one pier with three columns numbered from north to south. The abutments are labeled west and east.

GENERAL REMARKS

Underclearance note:

The low point measurements were found to be under beams 7 (EB) and 14 (WB). Route 290 eastbound was found to be on the left edge of road (when facing in the direction of travel) and Route 290 westbound was found to be on the right edge of road.

ITEM 58 - DECK

Item 58.1 - Wearing Surface

There are numerous concrete and Duracal repair patches in both spans. The Duracal patches have moderate scale. The rapid set concrete repair patches have full width x 1/16" wide shrinkage cracks, some with efflorescence. **See photos 1 and 2.**
In span 1 in the westbound lane, near the pier joint, there is a 4' long x 3' wide Duracal patch with heavy scale/spalls along the perimeter. **See photo 3.** The original wearing surface has minor cracking in many locations throughout, some of these are surface delamination cracks.

Item 58.2 - Deck Condition

The underside of the concrete deck has many areas of transverse and map cracking with efflorescence throughout. There are full depth repair patches in bays 4 and 5 of span 2 over the left and middle travel lanes and in bay 2 - 4 of span 1 over the left and middle travel lanes. **See photo 4.**

Both deck fascias have many transverse hairline cracks, some with efflorescence that extend into the rail bases. South deck fascia in span 2 over the left and middle travel lanes has two 1 foot long x 6 inch wide x 1 inch deep spalls with exposed rusted rebar. **See photo 5.**

Item 58.4 - Curbs

The granite curb pointing is deteriorated along the deck in many areas on both sides of the roadway. **See photo 6.**

Item 58.6 - Sidewalks

Both concrete sidewalks have minor transverse and longitudinal cracking throughout. Both sedewalks have several small, shallow spalls (up to 3 foot long x 6 inches wide x 1 inch deep in span #1 of the North sidewalk) some with exposed rusted rebar. **See photo 7.** There is a 2-1/2 inch diameter core hole through the North sidewalk in span 2 that is filled with debris and has shallow spalling around the perimeter.

Item 58.8 - Railing

The anchor studs on the base plates at the West end of both AL-3 rails have heavy corrosion. The remainder have moderate surface rust. There is a 6 inch diameter x 1 inch deep spall with exposed rusted shallow rebar to the top of the Northeast concrete end post.

Collision Damage Comments:

The west 20' of the South AL-3 railing has severe collision damage with two broken detached posts (2nd and 3rd from the west) at the base. The 1st post from the west has loose anchor studs on the north side of

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**212**	**W-44-083**	**W44083-212-DOT-NBI**	**APR 18, 2023**

REMARKS

the base plate. The top of the concrete wingwall at the 2nd post has a 2-1/2' long x 1' x 1' thick section separated/spalled with the railing post still attached. **See photo 8.**

Item 58.9 - Anti Missile Fence

There are small cut outs in the chain link anti missile fence on both sides of the bridge at the center of span 1. **See photo 9.** Both fences have several corroded frame couplings. Some of the couplings are cracked and broken. **See photo 10.** There is moderate vegetation growth at the West end of the South fence. The west 20 feet of the south fence is up to 1 foot out of alignment due to collision damage.

Item 58.12 - Utilties

There are utilities in bays 1, 2, 4 and 6.
The insulation around the utility in bay 6 is torn up to 2 feet out from both backwalls. **See photo 11.**
The insulation around the utility in bay 4 is torn at both backwalls and has heavy surface rust at the pier.
The conduit bank in bay 1 has disconnected/ broken conduits at the West backwall. **See photo 12.** The utility conduit attached to the West abutment at the Northwest corner has a broken junction box cover.

Item 58.13 - Deck Joints

The abutment deck joints have concrete repair patches on both sides of the joint with a 1" gap and foam filler. There is evidence of leakage through both joints. **See photos 13 and 14.** The strip seal joint at the pier has debris impaction full width of roadway. The pier joint has header damage and is open at the south curb allowing water infiltration onto the pier cap in bay #1. There is evidence of water infiltration at the North curb and sidewalk. The bottom of the pier joint steel has heavy rust flaking throughout. **See photo 15 - 17.**

APPROACHES

Approaches a - Appr. Pavement Condition

The east approach has moderate map cracking at the deck transition and areas of wheel line cracking in both travel lanes. **See photo 18.**

Approaches c - Appr. Sidewalk Settlement

Both east approach sidewalks have minor settlement, up to 1/2". **See photo 19.**

ITEM 59 - SUPERSTRUCTURE

Item 59.4 - Girders or Beams

Beam Properties

Span 1 beams 1 - 7: W36 x 150, original web thickness = 0.625", flange thickness = 0.94"
Span 2 beams 8 and 14: W36 x 182, original web thickness = 0.725", flange thickness = 1.18"
Span 2 beams 9 - 13: W36 x 194, original web thickness = 0.765", flange thickness = 1.26"

All beams have heavy paint peeling with rust flaking at the pier and abutments, up to 5' from the end. See Item 59.14. The bottom flange and the bottom 3" of the web on the outside face of all fascia beams have intermittent up to 1' long x 3" high/wide areas of moderate rust flaking with laminar rust buildup. There is section loss in these areas with as little as 0.42" remaining to the web as little as 0.70" remaining to the bottom flange. **See photos 20 - 25.**

Span 1:

Beam 1 at the west end has an 6' long x up to 2" high area of intermittent section loss with as little as 0.37" remaining to the web. **See photo 26.**

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REMARKS

Beam 1 at the east end the web bottom has a 3' long area of section loss with as little as 0.32" remaining. The bottom flange has as little as 0.95" remaining at the face of the bearing in this area. **See photo 27.**

Beam 2 at the west end has a 2' long x 3" high area of section loss with as little as 0.34" remaining to the bottom of the web. **See photo 28.**

Beam 3 web bottom at the west end has a 2' long x 3" high area with as little as 0.36" remaining. The bottom flange has as little as 0.67" in this area. **See photo 29.**

Beam 4 web bottom at the west end has 2' long x 3" high area with as little as 0.46" remaining with a 0.85" long x 0.38" high hole through the web at the center of the bearing. **See photo 30.**

Beam 5 web bottom at the east end has 3" long x 2" high area of as little as 0.38" remaining to the bottom of the web, behind the bearing. **See photo 31.**

Beam 5 at the west end has a 16" long x 4" high area of up to 0.24" remaining at the end of the web along the bottom. The bottom flange has 0.6" remaining thickness at the face of the bearing. **See photo 32.**

Beam 6 web bottom at the west end has a 2' long x 3" high area of as little as 0.25" remaining. There is as little as 0.67" remaining to the bottom flange in this area. **See photo 33.**

Beam 7 at the east end has as little as 0.65" remaining to the bottom flange along the web interface for length of 4' from the end. Section loss extends up to 2" out from the web. The bottom 2" of the web has a 2' long area with as little as 0.38" remaining. Section loss returns to original thickness at 4' out from the end of the beam. **See photo 34.**

Beam 7 at the west end has been shored with two screw jacks located on the bay 6 side of the beam. There is severe section loss to the end 3.5' and the web bottom has a 2' long x 3" high area of minor crippling with slight downward deformation to the bottom flange in front of the bearing indicating initiation of SHEAR YIELDING of the beam end. There is 0.34" remaining to the bottom flange at the bearing. The bottom of the web over the bearing has a 9.5" long x 1.5" high hole/crack in the web. At 2' from the end web section increases to 0.27" and section loss continues for an additional 16". The section loss also extends 18" up along the back of the web at the end diaphragm connection plate. The diaphragm connection plate over the bearing has severe rusting with 100% section loss. **See photos 35 - 37.**

Span 2:

Beam 8 at the east end has a 16" long area of moderate rust flaking to the bottom 3" of the web, with as little as 0.26" remaining. The bottom flange has 0.95" remaining at the face of the bearing. **See photo 38.**

Beam 8 in span 2, 5' from the west end, on the outside face has a 15' long area of rust flaking with laminar rust buildup with as little as 0.35" remaining to the web and 0.91" remaining to the flange. **See photo 39.**

Beam 9 at the east end has a 6' long x up to 3" high area of section loss to the bottom of the web with as little as 0.36" remaining. **See photo 40.**

Beam 12 at the west end has 0.44" remaining to the web end, behind bearing, at the bottom. **See photo 41.**

Beam 14 web bottom at the west end has as little as 0.28" remaining to the bottom 3" for a length of 65" from the end of the beam. **See photo 42.**

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REMARKS

Beam 14 web bottom at the east end has an 11' long x 2" high area with as little as 0.55" remaining. **See photo 43.**

Item 59.7 - Conn Plt's, Gussets & Angles
The bottom of the west abutment end diaphragm connection plate on beam 7 has severe section loss, with rust holes. The west abutment end diaphragm connection plates on beams 5 and 6 have moderate section loss below the concrete diaphragms (approximately 1/4 inch remaining thickness).

Item 59.8 - Cover Plates
See Item 59.4.

Item 59.9 - Bearing Devices
All bearings have heavy paint peeling and minor rust flaking, heaviest to all fascia bearings and West abutment bearings. Bearing to beam 14 on the East abutment has moderate pack rust, resulting in a bent keeper plate on the South side.

Item 59.10 - Diaphragms/Cross Frames
All the concrete end diaphragms over the west abutment and east abutment end diaphragms in bays 1-5 have heavy spalling and delamination cracking to the bottom exposing rusted rebar. **See photo 44.**

All utility support beams in bays 1, 2, 4 and 6 have heavy paint peeling and areas of minor rust flaking and minor section loss. **See photos 21 and 40.**

Item 59.13 - Member Alignment
See comments for beam 7 of span 1 under Item 59.4.

Item 59.14 - Paint/Coating
The superstructure paint system has widespread peeling throughout exposing structural steel. The worst areas are below the abutment and pier joints and on the bottom of all beams over the spans. The fascia beams on the sides facing traffic have heavy paint peeling to the webs.

SuperStructure Load Deflection Notes
Minor under heavy live loads.

SuperStructure Load Vibration Notes
Minor under heavy live loads.

ITEM 60 - SUBSTRUCTURE

Item 60.1 - Abutments
Item 60.1.b - Bridge Seats
All debris on the west bridge seat has been removed since the previous inspection. The east bridge seat has minor concrete debris from the spalled end diaphragms.

Item 60.1.c - Backwalls
Most of the bricks at utility cutouts in bays 1, 2, 4, and 6 have heavy scale and many have spalled. **See photo 45.** The west backwall has moderate scale along the horizontal cold joint at the bridge seat in all bays. **See photos 11, 12, and 46.**

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REMARKS

Item 60.1.d - Breastwalls

East breastwall:

The north face has an 7' high x up to 8" wide x up to 6" deep spall and delaminations at the vertical construction joint with the northeast wingwall.

The south face has two up to 4' high x 6" wide x 4" deep spalls and delaminations along the vertical wingwall joint, in the bottom half.

The south cheek wall at the top of the breastwall has a 3' long x 1/8" wide horizontal crack near the bottom.

Below bay 6 at the top there is a 3 foot diameter x 1.5 inch deep spall, at mid-height there is a 4' wide x 2' high delamination, and at the bottom there is a 2.5' high x 1' wide x 2" deep spall. **See photo 47.**

Item 60.1.e - Wingwalls

The southwest wingwall has areas of scale and efflorescence at the bottom. The northeast wingwall has areas of scale at the interface with ledge.

Item 60.1.k - Settlement

There is evidence of minor differential settlement with outward rotation at the top of the southeast wingwall at the vertical construction joints. The 1st section of the southeast wingwall adjacent to breastwall has 2" of outward rotation at the top and the 2nd section adjacent to the first has a displacement of approximately of 3.5". **See photo 48.**

Item 60.2 - Piers or Bents

Item 60.2.b - Caps

The concrete repair patches have minor full width shrinkage cracking. On the west side below beam 5 there is a 1.5' long horizontal 1/16" wide crack with efflorescence. On the west side at the top there is a 4' horizontal crack to the top under bay 2. On the west side of the cap under bay 1 there is a 40" x 6" x 4" deep spall which extends into the top by 25" exposing rusted rebar. Underside of the pier cap between columns 2 and 3 has a 1.5' x 1' area of delamination cracking. **See photos 49 and 50.**

Item 60.2.c - Columns

The concrete repair patches have minor shrinkage cracking. Column 2 top northeast corner has a 4' long 1/16" wide crack and bottom southeast corner has a 2' long x 4" wide area of cracking with rust staining.

TRAFFIC SAFETY

Item 36a - Bridge Railing

Both bridge rails consist of AL-3 rails with aluminum posts and concrete end posts. See Item 58.8.

Item 36b - Transitions

The Northwest transition is not properly stiffened and has minor surface rust.

Item 36c - Approach Guardrail

The Southeast and Northeast approach guardrail have improper post spacing and insufficient guardrail height. The Southeast approach guardrail has minor collision denting and areas of heavy surface rust where the end of the panel is disconnected. **See photo 51.**

Item 36d - Approach Guardrail Ends

The southeast boxing glove end has moderate collision damage and heavy rust with 100% section loss. The northeast guardrail end has moderate collision damage. **See photo 52.**

Sketch / Photo Log

Sketch 1 : Location map. North at the top of the page.

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Sketch 2 : Framing plan.
Photo 1 : View of the condition of the Duracal patches.
Photo 2 : Typical condition of the rapid set concrete patches.
Photo 3 : Scale to a repair patch in the westbound lane, span 1.
Photo 4 : Deck underside in span 1 looking east.
Photo 5 : South deck fascia in span 2, spall over I-290 EB.
Photo 6 : Curb pointing deterioration.
Photo 7 : Typical deterioration to the sidewalks. North sidewalk shown.
Photo 8 : Collision damage to the south AL-3 railing at the west end.
Photo 9 : Cutouts in the chain link fence. South fence shown.
Photo 10 : Typical broken couplings.
Photo 11 : Utility pipe in bay 6, west abutment.
Photo 12 : Utility conduit bank in bay 1 at the west abutment.
Photo 13 : West abutment joint repair.
Photo 14 : East abutment joint repair.
Photo 15 : Pier joint collision damage at the south sidwalk.
Photo 16 : Pier jont.
Photo 17 : Pier joint in bay 6, sidewalk bay.
Photo 18 : East approach pavement.
Photo 19 : Northeast approach sidewalk.
Photo 20 : Beams 6 and 13 at the pier.
Photo 21 : Bay 2 in span 2.
Photo 22 : Beam 8 in span 2 looking east.
Photo 23 : Beam 14 in span 2 looking east.
Photo 24 : Beam 1 in span 1 looking east.
Photo 25 : Beam 7 in span 1 at the pier.
Photo 26 : Beam 1 span 1 at the west end.
Photo 27 : Beam 1 span 1 at the east end.
Photo 28 : Beam 2 at the west end.
Photo 29 : Beam 3 at the west end.
Photo 30 : Beam 4 at the west end.
Photo 31 : Beam 5 at the east end.
Photo 32 : Beam 5 at the west end.
Photo 33 : Beam 6 at the west end.
Photo 34 : Beam 7 at the east end.
Photo 35 : Screw jacks at beam 7, west abutment.
Photo 36 : Beam 7 at the west abutment.
Photo 37 : Beam 7 at the west abutment.
Photo 38 : Beam 8 at the east abutment.
Photo 39 : Beam 8 at the pier.
Photo 40 : Beam 9 at the east abutment.
Photo 41 : Beam 12 at the pier.
Photo 42 : Beam 14 at the pier.
Photo 43 : Beam 14 at the east abutment.
Photo 44 : End diaphragm in bay 5, east abutment.
Photo 45 : Bay 2 west abutment.
Photo 46 : Bay 3, west abutment backwall.
Photo 47 : Spall to the east backwall below bay 6.
Photo 48 : Southeast wingwall minor rotation at construction joint with the breastwall.
Photo 49 : Pier on the west side.
Photo 50 : Spall on the underside of the pier cap between columns 2 and 3.

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REMARKS

Photo 51 : Southeast approach guardrail.
Photo 52 : Northeast guardrail end.

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SKETCHES

Sketch 1: Location map. North at the top of the page.

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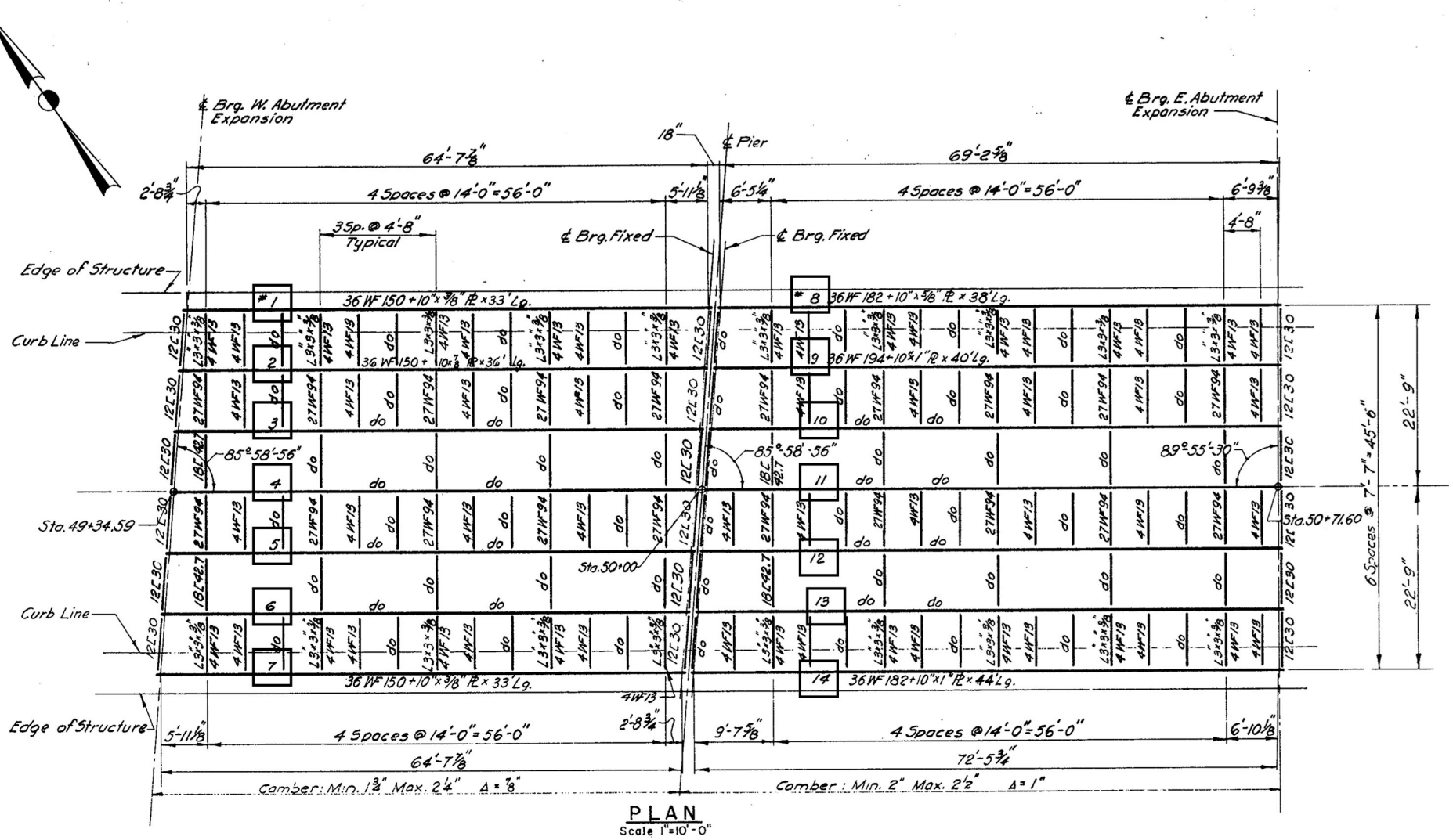
SKETCHES



PLAN
Scale 1" = 10'-0"

Sketch 2: Framing plan.

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PHOTOS

Photo 1: **View of the condition of the Duracal patches.**

Photo 2: **Typical condition of the rapid set concrete patches.**

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PHOTOS

Photo 3: Scale to a repair patch in the westbound lane, span 1.

Photo 4: Deck underside in span 1 looking east.

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PHOTOS

Photo 5: South deck fascia in span 2, spall over I-290 EB.

Photo 6: Curb pointing deterioration.

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PHOTOS

Photo 7: Typical deterioration to the sidewalks. North sidewalk shown.

Photo 8: Collision damage to the south AL-3 railing at the west end.

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PHOTOS

Photo 9: Cutouts in the chain link fence. South fence shown.

Photo 10: Typical broken couplings.

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PHOTOS

Photo 11: Utility pipe in bay 6, west abutment.

Photo 12: Utility conduit bank in bay 1 at the west abutment.

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PHOTOS

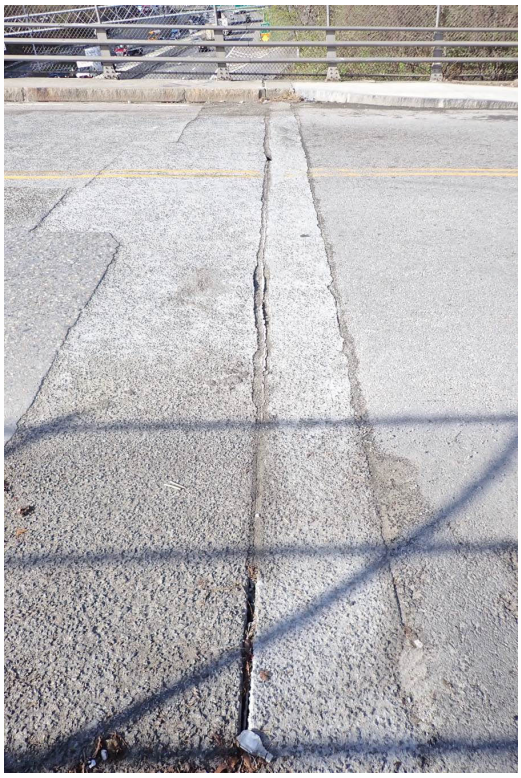

Photo 13: West abutment joint repair.

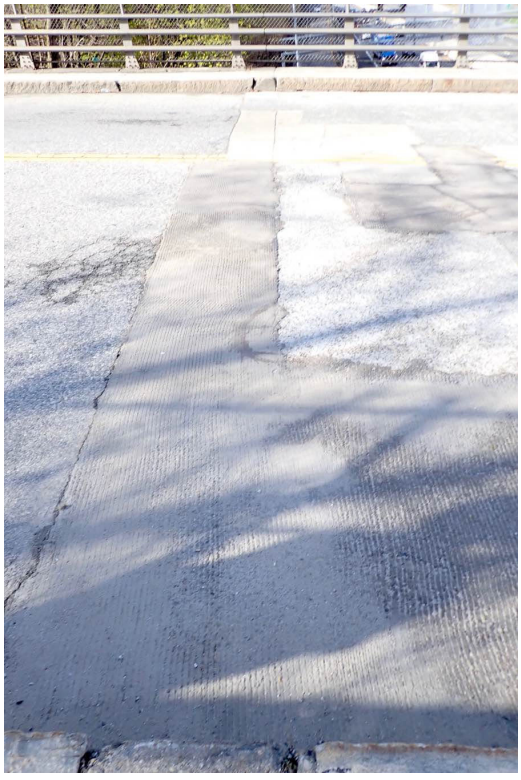

Photo 14: East abutment joint repair.

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PHOTOS

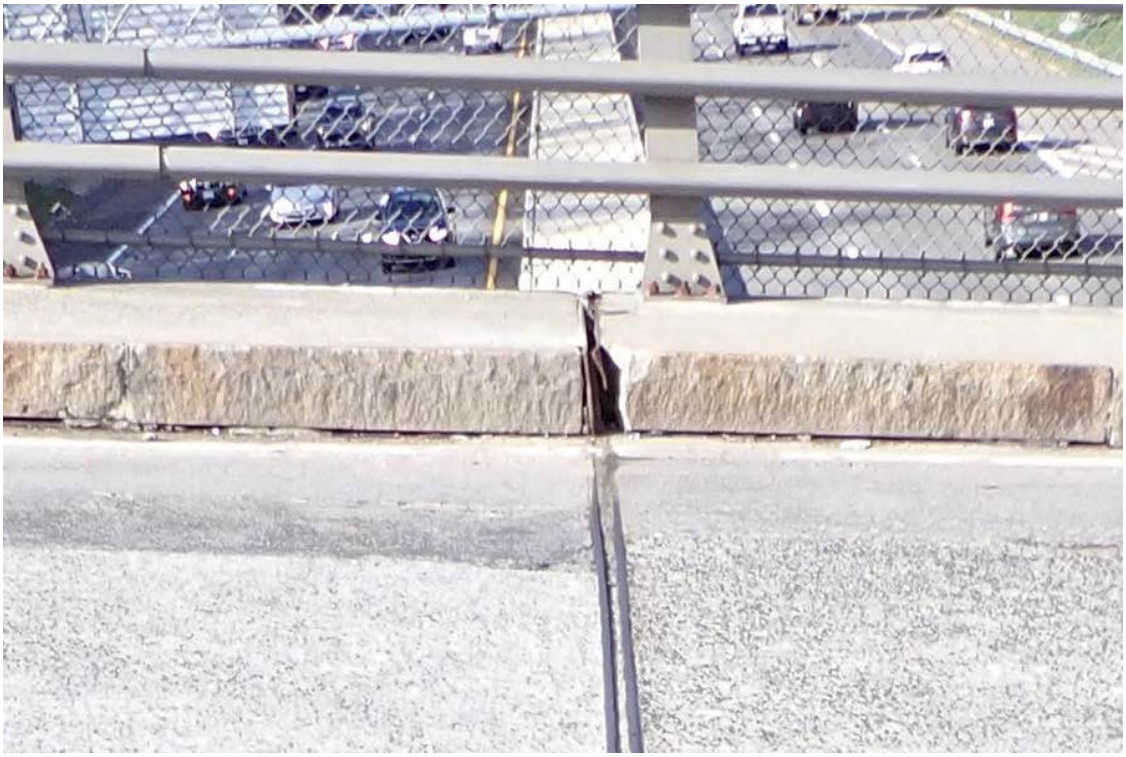

Photo 15: Pier joint collision damage at the south sidwalk.

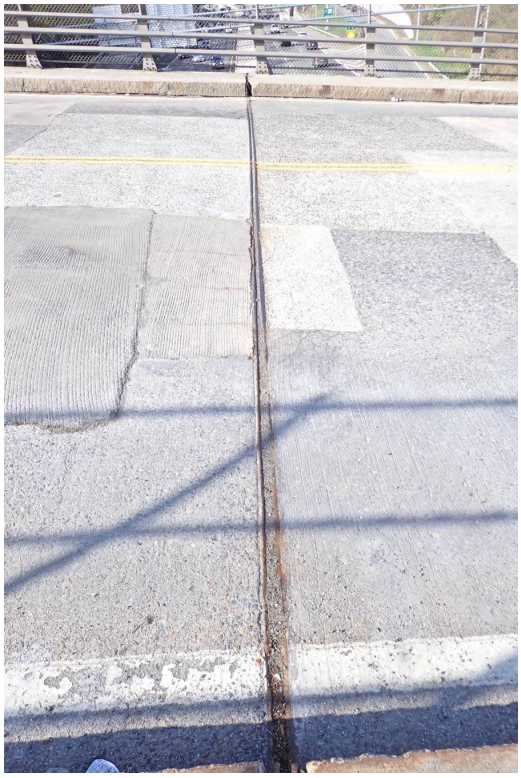

Photo 16: Pier jont.

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PHOTOS

Photo 17: Pier joint in bay 6, sidewalk bay.

Photo 18: East approach pavement.

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PHOTOS

Photo 19: Northeast approach sidewalk.

Photo 20: Beams 6 and 13 at the pier.

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PHOTOS

Photo 21: Bay 2 in span 2.

Photo 22: Beam 8 in span 2 looking east.

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PHOTOS

Photo 23: Beam 14 in span 2 looking east.

Photo 24: Beam 1 in span 1 looking east.

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PHOTOS

Photo 25: Beam 7 in span 1 at the pier.

Photo 26: Beam 1 span 1 at the west end.

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PHOTOS

Photo 27: Beam 1 span 1 at the east end.

Photo 28: Beam 2 at the west end.

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PHOTOS

Photo 29: Beam 3 at the west end.

Photo 30: Beam 4 at the west end.

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PHOTOS

Photo 31: Beam 5 at the east end.

Photo 32: Beam 5 at the west end.

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PHOTOS

Photo 33: Beam 6 at the west end.

Photo 34: Beam 7 at the east end.

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PHOTOS

Photo 35: Screw jacks at beam 7, west abutment.

Photo 36: Beam 7 at the west abutment.

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PHOTOS

Photo 37: Beam 7 at the west abutment.

Photo 38: Beam 8 at the east abutment.

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PHOTOS

Photo 39: Beam 8 at the pier.

Photo 40: Beam 9 at the east abutment.

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PHOTOS

Photo 41: Beam 12 at the pier.

Photo 42: Beam 14 at the pier.

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PHOTOS

Photo 43: Beam 14 at the east abutment.

Photo 44: End diaphragm in bay 5, east abutment.

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PHOTOS

Photo 45: Bay 2 west abutment.

Photo 46: Bay 3, west abutment backwall.

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PHOTOS

Photo 47: Spall to the east backwall below bay 6.

Photo 48: Southeast wingwall minor rotation at construction joint with the breastwall.

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PHOTOS

Photo 49: Pier on the west side.

Photo 50: Spall on the underside of the pier cap between columns 2 and 3.

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PHOTOS

Photo 51: Southeast approach guardrail.

Photo 52: Northeast guardrail end.

State Information

BDEPT#= W44083 Agency Br.No.
Town= Worcester L.O. MHD
B.I.N= 212 AASHTO= 042.9
RANK= 3112 H.I.= 77.4 % FHWA Select List= Y (6/21/2017)

Identification

(8) Structure Number	W44083212DOTNBI
(5) Inventory Route	151000000
(2) State Highway Department District	03
(3) County Code 027 (4) Place code	82000
(6) Features Intersected	**I 290**
(7) Facility Carried	**HWY HARRISON ST**
(9) Location	.1 MI. E. OF WATER ST.
(11) Kilometerpoint	0000.000
(12) Base Highway Network	N
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 15 MIN 21.20 SEC
(17) Longitude	71 DEG 47 MIN 42.64 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No. #	

Structure Type and Material

(43) Structure Type Main: Steel Code 302
Stringer/Girder Jointless bridge type: Not applicable
(44) Structure Type Appr:
Other Code 000
(45) Number of spans in main unit 002
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Concrete Code 1
B) Type of membrane - None Code 0
C) Type of deck protection - None Code 0

Age and Service

(27) Year Built	1958
(106) Year Reconstructed	0000
(42) Type of Service: On - Highway-Ped	
Under - Highway Code	51
(28) Lanes: On Structure 02 Under structure	07
(29) Average Daily Traffic	001000
(30) Year of ADT 2021 (109) Truck ADT	01 %
(19) Bypass, detour length	002 KM

Geometric Data

(48) Length of maximum span	0021.6 M
(49) Structure Length	00043.6 M
(50) Curb or sidewalk: Left 01.5 M Right	01.5 M
(51) Bridge Roadway Width Curb to Curb	012.2 M
(52) Deck Width Out to Out	015.2 M
(32) Approach Roadway Width (w/shoulders)	012.2 M
(33) Bridge Median - No median Code	0
(34) Skew 04 DEG (35) Structure Flared	N
(10) Inventory Route MIN Vert Clear	99.99 M
(47) Inventory Route Total Horiz Clear	12.2 M
(53) Min Vert Clear Over Bridge Rdwy	99.99 M
(54) Min Vert Underclear ref H	04.59 M
(55) Min Lat Underclear RT ref H	01.7 M
(56) Min Lat Underclear LT	00.0 M

Navigation Data

(38) Navigation Control - Not applicable, no waterway Code	N
(111) Pier Protection Code	
(39) Navigation Vertical Clearance	000.0 M
(116) Vert-lift Bridge Nav Min Vert Clear	M
(40) Navigation Horizontal Clearance	0000.0 M

Classification

	Code
(112) NBIS Bridge Length	Y
(104) Highway System	N
(26) Functional Class - Urban Local	19
(100) Defense Highway	0
(101) Parallel Structure	N
(102) Direction of Traffic - 2-way traffic	2
(103) Temporary Structure	Y
(105) Federal Lands Highways	0
(110) Designated National Network	N
(20) Toll - On free road	3
(21) Maintain - State Highway Agency	01
(22) Owner - State Highway Agency	01
(37) Historical Significance built after 1949 presumed to be not eligit	Z

Condition

	Code
(58) Deck	5
(59) Superstructure	4
(60) Substructure	6
(61) Channel & Channel Protection	N
(62) Culverts	N

Load Rating and Posting

	Code
(31) Design Load - HS 20=MS 18	5
(63) Operating Rating Method - Allowable Stress (AS)	2
(64) Operating Rating	32.7
(65) Inventory Rating Method - Allowable Stress (AS)	2
(66) Inventory Rating	14.4
(70) Bridge Posting	5
(41) Structure - Open with shoring	D

Appraisal

	Code
(67) Structural Evaluation	4
(68) Deck Geometry	8
(69) Underclearances, vert. and horiz.	2
(71) Waterway adequacy	N
(72) Approach Roadway Alignment	8
(36) Traffic Safety Features	0 0 0 0
(113) Scour Critical Bridges	N

Inspections

(90) Inspection Date 04/18/23 (91) Frequency 12 MO

(92) Critical Feature Inspection:				(93) CFI DATE
(A) Fracture Critical Detail	N	00	MO A)	00/00/00
(B) Underwater Inspection	N	00	MO B)	00/00/00
(C) Other Special Inspection	Y	12	MO C)	04/16/24
(*) Other Inspection (S1 BM7 west end)	Y	12	MO *)	10/16/24
(*) Closed Bridge	N	00	MO *)	00/00/00
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 10/27/86	H20	Type 3	Type 3S2	Type HS
Operating	32.0	39.0	52.0	0.0
Inventory	15.0	17.0	23.0	0.0

Field Posting

Status WAIVED Posting Date 07/01/87

	2 Axle	3 Axle	5 Axle	Single
Actual				
Recommended				

Missing Signs N

Misc.

Bridge Name
Y Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw 2 : Deteriorated concrete; No known problematic history
Stairs On/Adjacent 0 Stair Owner(s)

Accessibility (Needed/Used)

Y / Y Liftbucket	N / N Rigging	Y / Y Other
N / N Ladder	N / N Staging	OVERTIME
N / N Boat	Y / Y Traffic Control	
N / N Wader	N / N RR Flagperson	Inspection Hours: 008
N / N Inspector 50	Y / Y Police	

National Bridge Element Inspection

BDEPT# **W-44-083**
B.I.N. **212**
Item 8 **W44083-212-DOT-NBI**
Span Group **1**
Town **Worcester**
District **3**

Date **04/18/2023**
District Bridge Inspection Eng'r **Mahmood Azizi**
Inspecting Agency **Mass. Highway Dept.**
Team Leader **Dennis Simkhovich**
Team Member(s) **Nathaniel Gaines**

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
12	**Re Concrete Deck**	sq feet	2	7,400.000	☐ %	4,400.000	2,890.000	110.000	
Notes :									
> 1130	*Cracking (RC and Other)*	sq feet	2	3,700.000	☐ %	700.000	2,890.000	110.000	
Notes :									
> 510	Wearing Surfaces	sq feet	2	5,600.000	☐ %		5,570.000	30.000	
Notes :									
> > 3210	*Del/Spall/Patch/Pot(Wear Surf)*	sq feet	2	5,600.000	☐ %		5,570.000	30.000	
Notes :									
107	**Steel Opn Girder/Beam**	feet	2	840.000	☐ %	600.000		240.000	
Notes :									
> 1000	*Corrosion*	feet	2	240.000	☐ %			240.000	
Notes :									
> 515	Steel Protective Coating	sq feet	2	7,400.000	☐ %			4,440.000	2,960.000
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	2	7,400.000	☒ %			60.00	40.00
Notes :									
107	**Steel Opn Girder/Beam**	feet	3	140.000	☐ %		70.000	68.000	2.000
Notes :									
> 1000	*Corrosion*	feet	3	138.000	☐ %		70.000	66.000	2.000
Notes :									
> 1900	*Distortion*	feet	3	2.000	☐ %			2.000	
Notes :									
> 515	Steel Protective Coating	sq feet	3	1,240.000	☐ %			372.000	868.000
Notes :									

National Bridge Element Inspection

BDEPT#	**W-44-083**	Date	**04/18/2023**
B.I.N.	**212**	District Bridge Inspection Eng'r	**Mahmood Azizi**
Item 8	**W44083-212-DOT-NBI**	Inspecting Agency	**Mass. Highway Dept.**
Span Group	**1**	Team Leader	**Dennis Simkhovich**
Town	**Worcester**	Team Member(s)	**Nathaniel Gaines**
District	**3**		

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	1,240.000	☒ %			30.00	70.00
Notes :									
205	**Re Conc Column**	each	3	3	☐ %	2	1		
Notes :	Inspector does not think any columns warrent analysis to ascertain impact on strength or serviceability.								
> 1130	*Cracking (RC and Other)*	each	3	1	☐ %		1		
Notes :									
215	**Re Conc Abutment**	feet	3	132.000	☐ %	117.000		15.000	
Notes :									
> 1080	*Delamination/Spall/Patched Area*	feet	3	15.000	☐ %			15.000	
Notes :									
234	**Re Conc Pier Cap**	feet	3	50.000	☐ %	42.000	4.000	4.000	
Notes :									
> 1080	*Delamination/Spall/Patched Area*	feet	3	8.000	☐ %		4.000	4.000	
Notes :									
300	**Strip Seal Exp Joint**	feet	2	40.000	☐ %		18.000	17.000	5.000
Notes :									
> 2310	*Leakage*	feet	2	40.000	☐ %		18.000	17.000	5.000
Notes :									
301	**Pourable Joint Seal**	feet	2	80.000	☐ %			40.000	40.000
Notes :									
> 2310	*Leakage*	feet	2	80.000	☐ %			40.000	40.000
Notes :									
311	**Moveable Bearing**	each	3	14	☐ %		13	1	
Notes :									

National Bridge Element Inspection

BDEPT#	**W-44-083**	Date	**04/18/2023**
B.I.N.	**212**	District Bridge Inspection Eng'r	**Mahmood Azizi**
Item 8	**W44083-212-DOT-NBI**	Inspecting Agency	**Mass. Highway Dept.**
Span Group	**1**	Team Leader	**Dennis Simkhovich**
Town	**Worcester**	Team Member(s)	**Nathaniel Gaines**
District	**3**		

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
> 1000	*Corrosion*	each	3	14	☐ %		13	1	
Notes :									
> 515	Steel Protective Coating	sq feet	3	35.000	☐ %				35.000
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	35.000	☒ %				100.00
Notes :									
313	**Fixed Bearing**	each	3	14	☐ %		14		
Notes :									
> 1000	*Corrosion*	each	3	14	☐ %		14		
Notes :									
> 515	Steel Protective Coating	sq feet	3	35.000	☐ %				35.000
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	35.000	☒ %				100.00
Notes :									
330	**Metal Bridge Railing**	feet	2	408.000	☐ %	388.000			20.000
Notes :									
> 1020	*Connection*	feet	2	20.000	☐ %				20.000
Notes :									
> 7000	*Damage*	feet	2	20.000	☐ %				20.000
Notes :									

DOCUMENT A00818

STRUCTURES INSPECTION FIELD REPORT
BRIDGE NO. W-44-093

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MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

ROUTINE & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
03	213	W-44-093

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	41-STATUS	90-ROUTINE INSP. DATE
WORCESTER	W44093-213-DOT-NBI	000.322	P:POSTED	AUG 6, 2023

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	YR REHAB'D (NON 106)
HWY LAUREL ST	LEANORA MONROE	1958	0000	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER
I 290	Urban Local	M. Azizi

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER
302 : Steel Stringer/Girder	State Highway Agency	State Highway Agency	D. Simkhovich

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Clear	20°C	I. ABERMAGGER

ITEM 58 — DECK: 5

		DEF
1.Wearing Surface	5	S-A
2.Deck Condition	5	S-P
3.Stay in Place Forms	N	-
4.Curbs	7	-
5.Median	N	-
6.Sidewalks	5	M-P
7.Parapets	N	-
8.Railing	6	M-P
9.Anti Missile Fence	6	M-P
10.Drainage System	N	-
11.Lighting Standards	N	-
12.Utilities	6	M-P
13.Deck Joints	4	S-A
14.	N	-
15.	N	-
16.	N	-

CURB REVEAL (In millimeters)	N	S
	260	250

APPROACHES

		DEF
a. Appr. Pavement Condition	5	S-A
b. Appr. Roadway Settlement	7	-
c. Appr. Sidewalk Settlement	5	S-A
d.	N	-

OVERHEAD SIGNS (Attached to bridge) (Y/N): N

		DEF
a. Condition of Welds	N	-
b. Condition of Bolts	N	-
c. Condition of Signs	N	-

ITEM 59 — SUPERSTRUCTURE: 4

		DEF
1.Stringers	N	-
2.Floorbeams	N	-
3.Floor System Bracing	N	-
4.Girders or Beams	4	S-A
5.Trusses - General	N	-
a. Upper Chords	N	-
b. Lower Chords	N	-
c. Web Members	N	-
d. Lateral Bracing	N	-
e. Sway Bracings	N	-
f. Portals	N	-
g. End Posts	N	-
6.Pin & Hangers	N	-
7.Conn Plt's, Gussets & Angles	5	S-P
8.Cover Plates	7	-
9.Bearing Devices	5	S-P
10.Diaphragms/Cross Frames	4	S-A
11.Rivets & Bolts	6	M-P
12.Welds	7	-
13.Member Alignment	8	-
14.Paint/Coating	4	S-P
15.	N	-

Year Painted	1991

COLLISION DAMAGE: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD DEFLECTION: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

LOAD VIBRATION: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

Any Fracture Critical Member: (Y/N) N

Any Cracks: (Y/N) N

ITEM 60 — SUBSTRUCTURE: 6

	Dive	Cur		DEF
1. Abutments			6	
a. Pedestals	N	N		-
b. Bridge Seats	N	6		M-P
c. Backwalls	N	6		M-P
d. Breastwalls	N	6		M-P
e. Wingwalls	N	6		M-P
f. Slope Paving/Rip-Rap	N	N		-
g. Pointing	N	N		-
h. Footings	N	H		-
i. Piles	N	N		-
j. Scour	N	N		-
k. Settlement	N	7		-
l.	N	N		-
m.	N	N		-
2. Piers or Bents			6	
a. Pedestals	N	N		-
b. Caps	N	6		M-P
c. Columns	N	7		-
d. Stems/Webs/Pierwalls	N	N		-
e. Pointing	N	N		-
f. Footing	N	H		-
g. Piles	N	N		-
h. Scour	N	N		-
i. Settlement	N	7		-
j.	N	N		-
k.	N	N		-
3. Pile Bents			N	
a. Pile Caps	N	N		-
b. Piles	N	N		-
c. Diagonal Bracing	N	N		-
d. Horizontal Bracing	N	N		-
e. Fasteners	N	N		-

UNDERMINING (Y/N) If YES please explain: N

COLLISION DAMAGE:
None (X) Minor ( ) Moderate ( ) Severe ( )

SCOUR: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

I-60 (Dive Report): N *I-60 (This Report):* 6

93B-U/W (DIVE) Insp 00/00/0000

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

RTN(1)7-96

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

ITEM 61 — CHANNEL & CHANNEL PROTECTION

N

	Dive	Cur	DEF
1.Channel Scour	N	N	-
2.Embankment Erosion	N	N	-
3.Debris	N	N	-
4.Vegetation	N	N	-
5.Utilities	N	N	-
6.Rip-Rap/Slope Protection	N	N	-
7.Aggradation	N	N	-
8.Fender System	N	N	-

STREAM FLOW VELOCITY:

Tidal ( ) High ( ) Moderate ( ) Low ( ) None (**X**)

ITEM 61 (Dive Report): **N** ***ITEM 61 (This Report):*** **N**

93b-U/W INSP. DATE: 00/00/0000

ITEM 36 — *TRAFFIC SAFETY*

	36	COND	DEF
A. Bridge Railing	0	6	M-P
B. Transitions	N	N	-
C. Approach Guardrail	N	N	-
D. Approach Guardrail Ends	N	N	-

WEIGHT POSTING

Not Applicable ☐

	H	3	3S2	Single
Actual Posting	17	19	25	N
Recommended Posting	17	19	25	N

Waived Date: 00/00/0000 **EJDMT Date:** 00/00/0000

Signs In Place (Y=Yes,N=No, NR=NotRequired) **Legibility/ Visibility**	At bridge E	At bridge W	Other Advance E	Other Advance W
	Y	Y	NR	Y
	7 / 7	7 / 7	/	7 / 7

CLEARANCE POSTING

Not **X**

	N ft	N in	S ft	S in	meter
Actual Field Measurement	21	6	15	8	4.77
Posted Clearance		0		0	

Signs In Place (Y=Yes,N=No, NR=Not Required) **Legibility/ Visibility**	At bridge N	At bridge S	Advance N	Advance S
	/	/	/	/

ACCESSIBILITY (Y/N/P)

	Needed	Used
Lift Bucket	Y	Y
Ladder	N	N
Boat	N	N
Waders	N	N
Inspector 50	N	N
Rigging	N	N
Staging	N	N
Traffic Control	Y	Y
RR Flagger	N	N
Police	Y	Y
Other:		
OVERTIME	Y	Y

TOTAL HOURS 8

PLANS (Y/N): **Y**

(V.C.R.) (Y/N): **N**

TAPE#: _____

List of field tests performed:

RATING

Rating Report (Y/N): **Y**

Date: 08/01/1996

Inspection data at time of existing rating

I 58: **5** I 59: **6** I 60: **6** Date : 08/22/1995

Recommend for Rating or Rerating (Y/N): **N**

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON: _____

CONDITION RATING GUIDE

(For Items 58, 59, 60 and 61)

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	
G	9	EXCELLENT	Excellent condition.
G	8	VERY GOOD	No problem noted.
G	7	GOOD	Some minor problems.
F	6	SATISFACTORY	Structural elements show some minor deterioration.
F	5	FAIR	All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
P	4	POOR	Advanced section loss, deterioration, spalling or scour.
P	3	SERIOUS	Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
C	2	CRITICAL	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stablility. Bridge is closed to traffic but corrective action may put it back in light service.
	0	FAILED	Out of service - beyond corrective action.

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

S= Severe/Major Deficiency - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, etc.

C-S= Critical Structural Deficiency - A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency - A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, etc.

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her].

A = ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) upon receipt of the Inspection Report].

P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

ROUTINE & SPECIAL MEMBER INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
03	213	W-44-093

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	90-ROUTINE INSP. DATE	93*-SPEC. MEMB. INSP. DATE
WORCESTER	W44093-213-DOT-NBI	000.322	Aug 6, 2023	Aug 6, 2023

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	*YR REHAB'D (NON 106)
HWY LAUREL ST	LEANORA MONROE	1958	0000	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER	
I 290	Urban Local		M. Azizi

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER
302 : Steel Stringer/Girder	State Highway Agency	State Highway Agency	D. Simkhovich

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Clear	20°C	I. ABERMAGGER

WEIGHT POSTING — *Not Applicable* ☐

	H	3	3S2	Single
Actual Posting	17	19	25	N
Recommended Posting	17	19	25	N

Waived Date: 00/00/0000 EJDMT Date: 00/00/0000

Signs In Place (Y=Yes,N=No, NR=Not Required)

Legibility/ Visibility

	At bridge E	At bridge W	Advance E	Advance W
Signs In Place	Y	Y	NR	Y
Legibility/ Visibility	7/7	7/7		7/7

PLANS (Y/N): Y

(V.C.R.) (Y/N): N

TAPE#:

RATING

Rating Report (Y/N): Y Date: 08/01/1996

Recommend for Rating or Rerating (Y/N): N

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON:

Inspection data at time of existing rating

I 58: 5 I 59: 6 I 60: 6 I 62: - Date : 08/22/1995

SPECIAL MEMBER(S):

	MEMBER	CRACK (Y/N):	WELD'S CONDITION (0-9)	LOCATION OF CORROSION, SECTION LOSS (%), CRACKS, COLLISION DAMAGE, STRESS CONCENTRATION, ETC.	CONDITION PREVIOUS (0-9)	CONDITION PRESENT (0-9)	INV. RATING OF MEMBER FROM RATING ANALYSIS H-20	3	3S2	Deficiencies
A	Item 59.4 - Girders or Beams	N		See remarks in comments section.	5	4	17	19	25	S-A
B										
C										
D										
E										

List of field tests performed:

	I-58	I-59	I-60	I-62
(Overall Previous Condition)	5	5	6	-
(Overall Current Condition)	5	4	6	-

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

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P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

X=UNKNOWN **N=NOT APPLICABLE** **H=HIDDEN/INACCESSIBLE** **R=REMOVED**

F.C.(1)7-96

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

REMARKS

BRIDGE ORIENTATION

According to the plans, the approaches are west and east and the elevations are south and north. This is a two span steel beam bridge with six beams labeled (S1 - S12) and five bays in each span numbered from the north to the south. The spans are numbered from west to east. There is one pier with three columns numbered from north to south. **See sketches 1 and 2.**

GENERAL REMARKS

DBIE and ABE were notified via email regarding the changed condition of Item 59.4 and a new pothole in the wearing surface in span 1 exposing the top rebar mat.

Clearance posting note:

The low point measurement for Route 290 EB was found to be 21' - 6" on the left edge of road under beam #6.

The low point measurement for Route 290 WB was found to be 15' - 8" on the left edge of road under beam #6.

ITEM 58 - DECK

Item 58.1 - Wearing Surface

Almost the entire concrete wearing surface consists of partial depth repair patches. Many of these have moderate scaling and concrete deterioration along the edges. There are new concrete repair patches at the abutment ends of the wearing surface, at the east end of span 1, and in the eastbound lane of span 2. The new repair patches have minor hairline shrinkage cracks. **See photos 1 - 4.**

Span 1:

At 25' from the west end of the deck at the center of the roadway has a 2'x 2' x 5" deep pothole exposing the top rebar mat with adjacent heavy scale. There is a spall to the deck underside in the vicinity of this area in bay 3 of span 1. **See photo 5.**

There are several curb line patches that have moderate scale. located along the north curb have been patched with asphalt. **See photo 6.**

Item 58.2 - Deck Condition

The deck underside shows many areas of minor hairline transverse and map cracking. Some with efflorescence and soot staining. **See photos 7 - 9.**

Span 1:

The South deck fascia has three 2' x 1' areas of delamination cracking with spalls over the left and middle travel lanes and another over the ramp lane. There is a 1' wide x 10" high area of delamination cracking with rust staining to the south deck fascia at the pier joint. **See photo 10.**

Bay 2 over the ramp lane has a 1' diameter delamination with a 6" x 3" x 1" deep spall. **See photo 11.**

Bay 3 at 25' from west end of the deck (over the right and middle travel lanes) has a 3' long x 2' wide x 3" deep spall with exposed rusted rebar. **See photo 12.**

Bay 3 over the left travel lane has a 10' long x full width, full depth concrete repair patch with heavy efflorescence along the east end of the patch.

The north deck fascia underside has two spalls - one over the right lane and one over the middle travel lane - up to 1' diameter x 2" deep with exposed rusted rebar. **See photo 13.**

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Span 2:

The south deck fascia over the ramp lane has a 4' long x 18" wide x 2" deep spall with exposed rusted rebar and an adjacent 4' long delamination west of the spall. **See photo 14.**

Bay 4 over the middle travel lane has 12' x 4' delamination area with a 1' diameter x 1" deep spall adjacent to beam S10. **See photo 15.**

The north deck overhang over the ramp lane has an 8' long x full width x 2" deep spalled area with exposed rusted rebar. **See photo 16.**

Item 58.4 - Curbs
There is slight curb misalignment at all four corners.

Item 58.6 - Sidewalks
Both sidewalks have minor vegetation growth at the construction joints. There are several minor vertical hairline cracks with minor efflorescence throughout the outside faces of both sidewalks.

The south sidewalk has several small spalls up to 2' long x 6" wide x 2" deep, most patched with asphalt. The joint over the pier is open allowing moisture infiltration. **See photo 17.**

The north sidewalk has minor scaling and chip outs along the curb line.

Item 58.8 - Railing
The AL-3 bridge railing has several minor dents and scrapes (probably caused by snow equipment).

The south railing has anchor studs missing from at the 3rd post from east and another at the 6th post from the west. There is a backed off anchor nut at the 6th post from west. **See photo 18.**

The north railing has anchor studs missing/broken at the 4th and 13th post from the east and 3rd and 9th posts from the west. **See photo 19.**

Item 58.9 - Anti Missile Fence
There is heavy vegetation growth at the northwest and southeast corners of the bridge covering the anti missile fence and the railing. Several fence frame connection brackets are broken and missing bolts (the frame is still attached to the fence fabric with wire ties). **See photo 20.**

Item 58.12 - Utilities
Several electric utility conduits are broken/disconnected at the east end of bay #1. **See photo 21.**
The utility box and conduit at the north end of the west abutment has broken attachments and is laying on the ground. **See photo 22.**

Item 58.13 - Deck Joints
The abutment deck joints have full width concrete repair patches with pourable sealer over the joint opening. The sealer at both joints has cracking and separation with several sections dislodged and evidence of moisture infiltration. **See photos 3 and 4.**

APPROACHES

Approaches a - Appr. Pavement Condition
Both deck transitions have new asphalt repair patches. **See photos 3 and 4.**
The west approach pavement has heavy fatigue cracking and numerous asphalt patches. **See photo 23.**

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Approaches c - Appr. Sidewalk Settlement

The west approach sidewalks have raveling and scale adjacent to the bridge sidewalk. **See photos 24 and 25.**

ITEM 59 - SUPERSTRUCTURE

Item 59.4 - Girders or Beams

All beams are W36 x 150
Flange thickness: 0.940"
Web thickness: 0.625"

There is moderate to heavy paint blistering and peeling, with presence of rust flaking to all beam ends, up to 3' from the end due to joint leakage. Beams S1 and S7 on the outside have intermittent rust flaking and pitting to the bottom 3" of the web and top face of the bottom flange with as little as 0.42" remaining to the web and 0.69" remaining to the bottom flange. **See photos 26 and 27.**

West abutment:

Beam S6 (#1 in the prev. reports) bottom 3" of the web has as little as 0.55" remaining over the bearing, decreasing to 0.50" behind the bearing. The bottom flange has 0.77" remaining at the face of the bearing. **See photos 28 and 29.**

Beam S4 (#3 in the prev. reports) bottom 3" of the web has 0.50" remaining up to 2' from the end. The bottom flange has as little as 0.70" remaining in the same area. **See photo 30.**

Beams S2 and S3 (#4 and #5 in the prev. reports) bottom 3" has 0.60" remaining up to 2' from the end. **See photo 31.**

Beam S1 (#6 in the prev. reports) has as little as 0.32" remaining to bottom end of the web behind the bearing and 0.60" remaining over the bearing. The bottom flange has 0.50" remaining behind the bearing. **See photos 32 and 33.**

Span 1 at pier:

Beam S5 (#2 in the prev. reports) bottom 3" of the web has as little as 0.30" remaining up to 4' from the end. The bottom flange has 0.68" remaining in the same area. **See photo 34.**

Beam S4 (#3 in the prev. reports) the web end behind the diaphragm connection plate has as little as 0.40" remaining. Section loss extends along the bottom 3" of the web over the bearing. The bottom flange has as little as 0.65" remaining up to 10' from the end.

Beam S2 (#5 in the prev. reports) bottom 3" of the web has 0.50" remaining over the bearing (1' long area). The bottom flange has 0.78" remaining at the face of the bearing. **See photo 35.**

Beam S1 (#6 in the prev. reports) bottom 3" of the web has 0.30" remaining up to 2' from the end. The bottom flange has 0.68" remaining in the same area. **See photo 36.**

Span 2 at pier:

Beam S12 (#1 in the prev. reports) bottom 3' of the web has 0.30" remaining up to 4' from the end. The bottom flange has 0.68" remaining in the same area. **See photo 37.**

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Beam S11 (#2 in the prev. reports) web bottom has a12" long x up to 1-1/2" high area of section loss up to 100% over the bearing. There is minor crippling to the web in this area with deformation up to 1/2" to the north relative to the centerline of the beam. Web thickness increases to 0.25" at 1.5' from the end 0.58" at 2' from the end. The bottom flange has 0.60" up to 2' from the end. **See photos 38 and 39.**

Beam S10 (#3 in the prev. reports) behind the connection plate has a 6" long x full height area of severe section loss to the web with a 4" diameter rust hole at the top. The bottom 3" of the web over the bearing has 9" long area of severe section loss up to 100%. There is minor crippling to the web in this area with deformation up to 1/2" to the north relative to the centerline of the beam. Web thickness increases to 0.29" at the face of bearing. The bottom flange has 0.65" remaining up to 3' from the end. **See photos 40 and 41.**

Beam S9 (#4 in the prev. reports) web behind the end diaphragm connection plate has a 16" high x 5" wide area with 0.41" remaining. Within this area near top there is a 3" high x 1" wide rust hole. The bottom flange has 0.62 inches remaining at the face of bearing. **See photo 42.**

Beam S8 (#5 in the previous reports) bottom 3" of the web has as little as 0.25" remaining up to 9" from the end. The bottom flange has 0.65" remaining up to 1.5' from the end. **See photo 43.**

East abutment:

Beam S11 (#2 in the prev. reports) bottom 2" of the web has a 22" long area with 0.25" remaining to over the bearing. Web thickness increases to 0.52" at 2' from the end. **See photo 44.**

Item 59.7 - Conn Plt's, Gussets & Angles

The end diaphragm connection plates at the abutments and pier have heavy rusting with minor rust flaking. The connection plate to beam S1 at the pier has section loss up to 100% on the bottom. **See photo 45.** See Item 59.14.

Item 59.8 - Cover Plates

See Item 59.14.

Item 59.9 - Bearing Devices

All bearings have paint peeling with moderate to heavy rusting and rust flaking.

The pier fascia bearings have section loss to the anchor studs. The anchor nuts to pier bearings of beams S1 - S3, S7 - S9 are not torqued all the way down and there is one nut missing on the North side of bearing of beam S1 at the pier. **See photos 35, 36, 45.**

The abutment bearings have minor to moderate surface rusting, heaviest on the east abutment. All of the bearing nuts on the east abutment are not torqued all the way down and are missing on both sides of bearing of beam S11 and on the north side of bearing of beam S7. **See photo 46.**

Item 59.10 - Diaphragms/Cross Frames

The concrete end diaphragms at the pier and abutments have severe delamination cracking and spalling with exposed rusted rebar. **See photo 47.**

The steel utility support beams in bays #1 and #5 have moderate to heavy paint peeling, surface rusting and rust flaking.

The interior steel diaphragms in bays #2 - #4 show widespread paint peeling with moderate to heavy surface rusting.

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Item 59.11 - Rivets & Bolts
See Items 59.9 and 59.14.

Item 59.14 - Paint/Coating
The paint system is faded throughout, with intermittent areas of blistering and peeling throughout. There is heavy paint peeling to the ends at the abutments and at the pier with laminar rust on the beams and bearings.

SuperStructure Load Deflection Notes
Minor under live loads.

SuperStructure Load Vibration Notes
Minor under live loads.

ITEM 60 - SUBSTRUCTURE

Item 60.1 - Abutments
Item 60.1.b - Bridge Seats
East Bridge Seat:
Under bay #5 there is a 2.5' long delamination along the edge. **See photo 48.**
Under bay #4, there is a 6' long x 5" high x up to 1/2" wide area of delamination cracking.
Under bays #1 and #2, there is a 7' long x up to 6" high x up to 3" deep area of delamination and spalling, that extends up to the face of bearing #5. **See photo 49.**
There is minor concrete and pigeon debris in several areas throughout.

West Bridge Seat:
Under bay #3 there is a 6' long area of delamination with a 3' long x 8" wide x 5" deep spall with exposed rebar. **See photo 50.**
Under bay #2, there is a 2' long x 5" high x 2" deep spall.
Under bay #1, there is an 8" wide x 3' long x 4" deep spall with exposed rebar. **See photo 51.**

Item 60.1.c - Backwalls
Both backwalls have efflorescence and moisture staining. There is scale and several isolated minor vertical hairline cracks throughout.

West backwall:
Bay #5 at the utility cutout has a 4' long x full height x 8" deep area of deteriorated bricks. **See photo 52.**
Bay #1 most of the bricks at the utility cutout have heavy scale with many dislodged/missing. **See photo 53.**
There is heavy scale along the bottom of the wall and a 1.5' diameter x 5" deep area of concrete deterioration around the gas line.

East backwall:
In bay #1 there is a full height x 14" wide x 4" deep spall next to the gas line. **See photo 54.**

Item 60.1.d - Breastwalls
West Breastwall:
Bay #3, there is a 4' long horizontal crack with efflorescence.
Bay #2, there is a 5' high hairline vertical crack.
The south face has moderate map cracking with efflorescence and vegetation/vine growth.

East Breastwall:

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There are several diagonal and vertical hairline cracks throughout. **See photo 55.**
Under bay #3 there is a 10' high x up to 10" wide x up to 5" deep spall extending up from the bottom, at the north side of the center vertical construction joint.
Under bay #5 there are two core holes one near the top and one near the bottom, both filled with concrete.
The south cheek wall has 3 shallow rebar spalls up to 1' long x up to 3" wide.
The south face at the wingwall construction joint has a 5' high x up to 4" wide x 3" deep spall/delamination area at the top. **See photo 56.**
The north cheek wall has moderate scale at the top at the interface with the deck fascia. **See photo 57.**

Item 60.1.e - Wingwalls
The northeast wingwall has several diagonal hairline cracks with light efflorescence. The southwest wingwall cap has two full width 1/2" wide cracks.

Item 60.2 - Piers or Bents
Item 60.2.b - Caps
There is minor hairline to 1/16" wide cracking throughout. There is moderate concrete debris on the top of the cap spalled from the end diaphragms. **See photos 58, 59.**

East face under beam S9 has a 4' wide x 2.5' high delamination. **See photo 60.**

West face under between bays 1 and 2 has horizontal hairline cracking with rust staining. The concrete reapir patches on the bottom of the cap have hairline block cracking with moisture staining and minor efflorescence. **See photo 61.**

South face of the cap has at the top has horizontal cracking with rust staining.

Item 60.2.c - Columns
All columns have isolated vertical cracking heaviest to column #3 where cracks are full height. The concrete repair patches have intermittent hairline cracking with moisture staining.

TRAFFIC SAFETY

Item 36a - Bridge Railing
The bridge railing is type AL-3, with aluminum posts, and concrete end posts. See Item 58.8 for condition remarks.

Item 36b - Transitions
There are no approach traffic safety features at all four corners of bridge.

Sketch / Photo Log
Sketch 1 : Location map. North at the top of the page.
Sketch 2 : Framing plan.
Photo 1 : View of span 1.
Photo 2 : View of span 2.
Photo 3 : West end of the wearing surface in span 1 and approach to deck transition.
Photo 4 : East end of the deck in span 2 and approach to deck transition.
Photo 5 : Spall to the wearing surface in WB lane in span 1.
Photo 6 : Scale areas to the repair patches along the south curb in span 1 filled with dirt and vegetation.
Photo 7 : Deck underside in span 1.
Photo 8 : Deck underside span 2.
Photo 9 : Deck underside span 2 at the east abutment.

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Photo 10 : South deck fascia in span 1 over the left and middle travel lanes.
Photo 11 : Spall in bay 2 of span 1 over the ramp lane.
Photo 12 : Spall in bay 3 of span 1 over the middle travel lane.
Photo 13 : North deck fascia looking east from the ramp lane.
Photo 14 : The south deck fascia looking west from the ramp lane.
Photo 15 : Delamination cracking in bay 4 over the middle travel lane.
Photo 16 : North deck fascia looking west from the ramp lane.
Photo 17 : South sidewalk in span 1.
Photo 18 : South railing at the 6th post from the west.
Photo 19 : North railing at the 9th post from the west (pier joint location).
Photo 20 : Typical condition of some of the frame connections.
Photo 21 : East end of bay 1 in span 2.
Photo 22 : Utility box laying on the ground at the west abutment.
Photo 23 : West approach pavement.
Photo 24 : Northwest approach sidewalk.
Photo 25 : Southwest approach sidewalk.
Photo 26 : Beam S1 looking east.
Photo 27 : Beam S7 looking west.
Photo 28 : Beam S6 at the west abutment.
Photo 29 : Beam S6 at the west abutment opposite side.
Photo 30 : Beam S4 at the west abutment.
Photo 31 : Beam S2 at the west abutment.
Photo 32 : Beam S1 at the west abutment.
Photo 33 : Beam S1 opposite side.
Photo 34 : Beam S5 at the pier.
Photo 35 : Beam S2 at the pier.
Photo 36 : Beam S1 at the pier.
Photo 37 : Beam S12 at the pier.
Photo 38 : Beam S11 at the pier.
Photo 39 : Beam S11 at the pier.
Photo 40 : Beam S10 at the pier.
Photo 41 : Beam S10 at the pier.
Photo 42 : Beam S9 at the pier.
Photo 43 : Beam S8 at the pier.
Photo 44 : Beam S11 at the east abutment.
Photo 45 : End diaphragm connection plate at the west end of beam S1 (pier end).
Photo 46 : Typical condition of the abutment bearings, bearing to beam S11 shown.
Photo 47 : Typical condition of the end diaphragms over the pier.
Photo 48 : East bridge seat under bay #5.
Photo 49 : East bridge seat under bays #1 and #2.
Photo 50 : West bridge seat under bay #3.
Photo 51 : West bridge seat under bay #1.
Photo 52 : West backwall, bay #5.
Photo 53 : West backwall, bay #1.
Photo 54 : East backwall in bay #1.
Photo 55 : East breastwall.
Photo 56 : South cheek wall.
Photo 57 : North cheek wall.
Photo 58 : Debris on top of the pier cap in bay #5.
Photo 59 : Debris on top of the pier cap in bay #2.
Photo 60 : East face of the pier.

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Photo 61 : West face of the pier.

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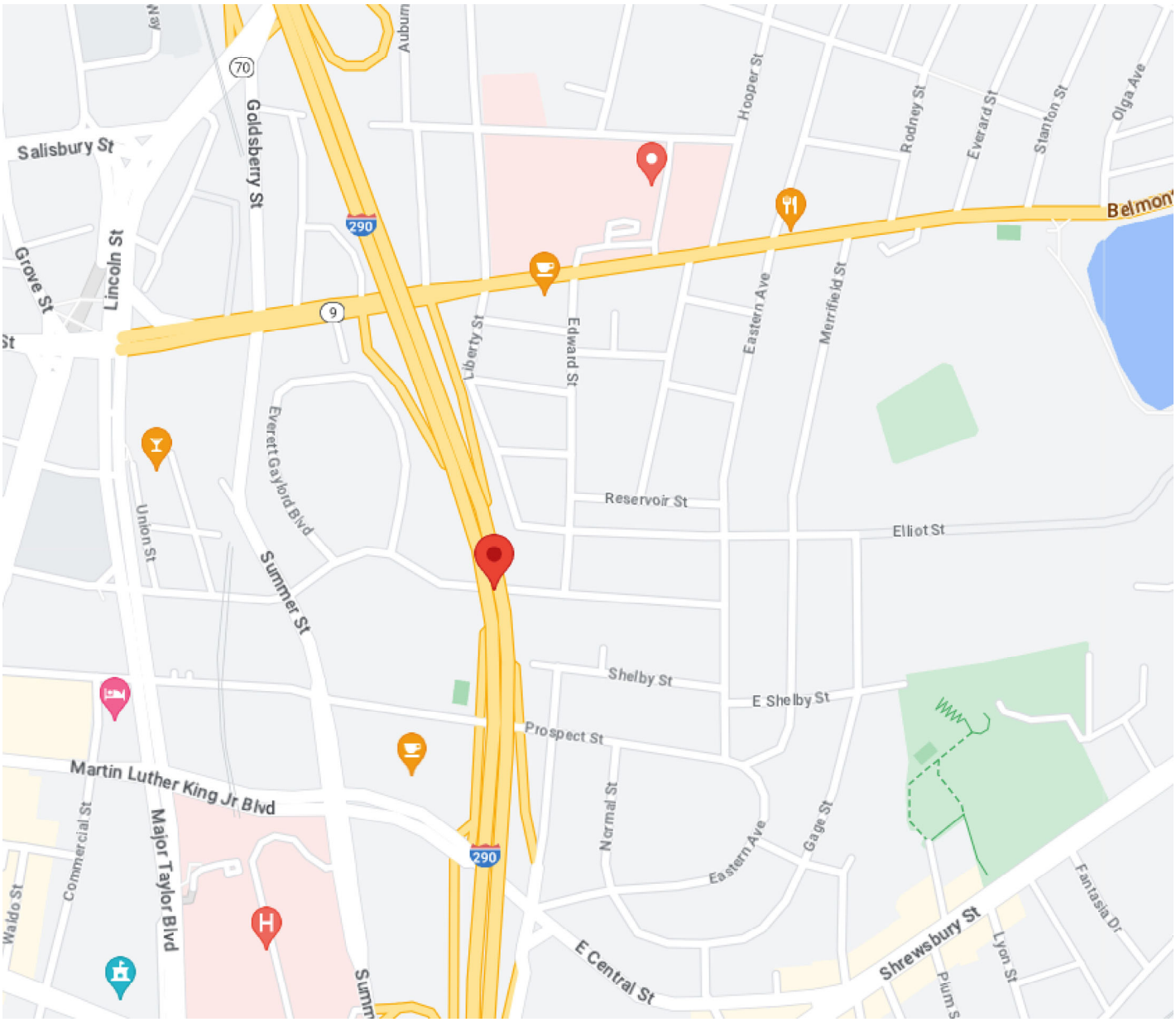
SKETCHES



Sketch 1: Location map. North at the top of the page.

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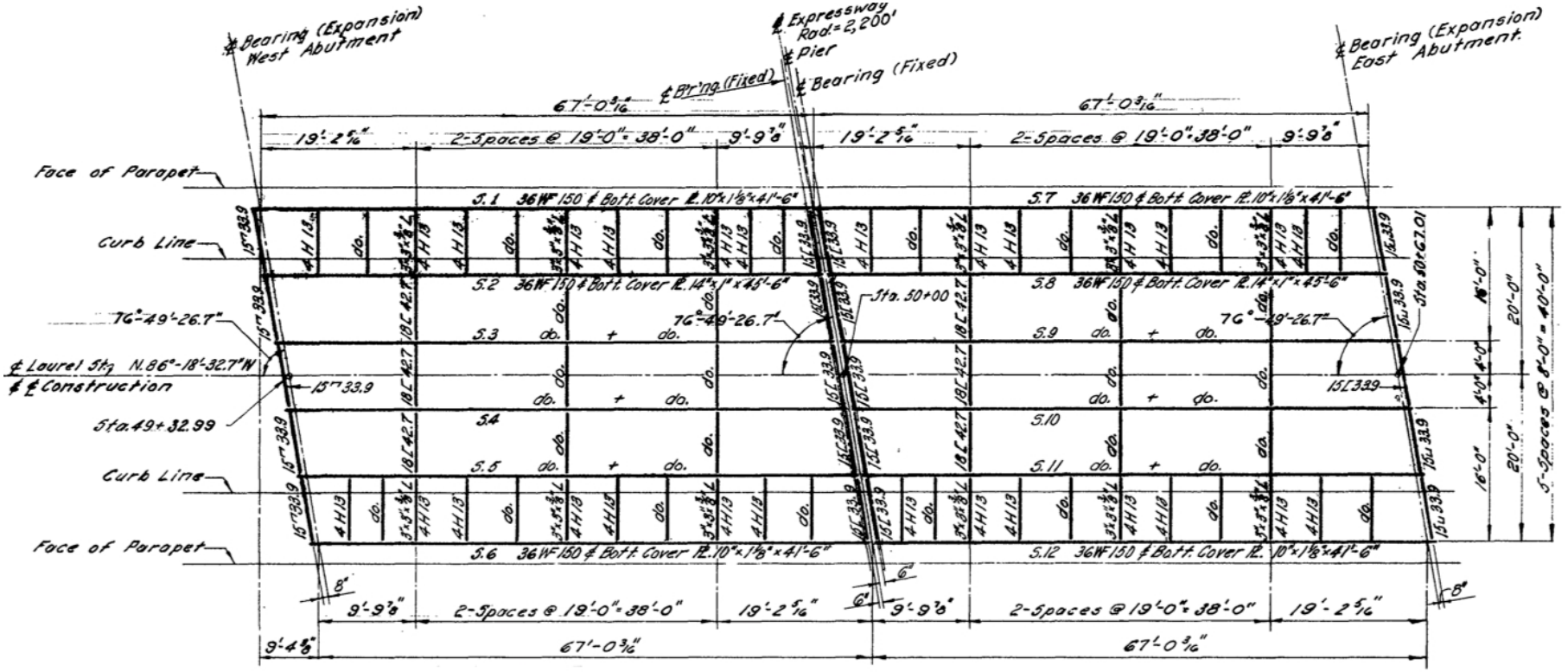
SKETCHES



FRAMING PLAN
Scale 1" = 10'

Sketch 2: Framing plan.

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PHOTOS

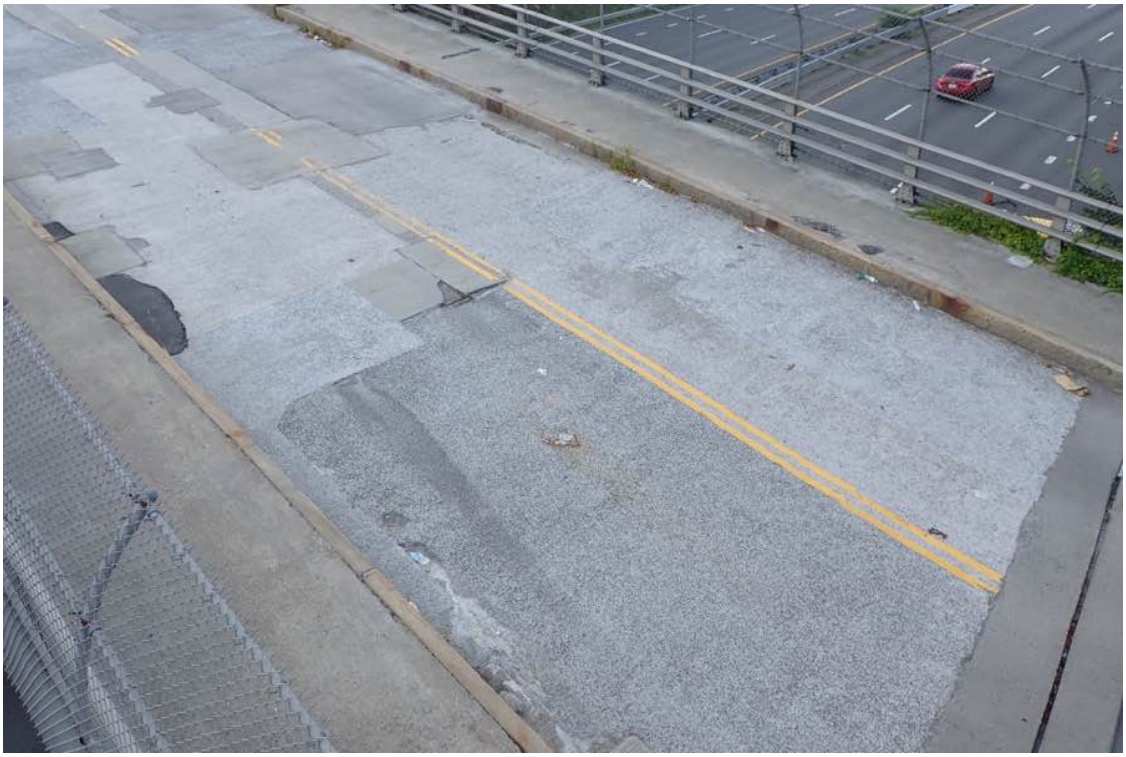

Photo 1: View of span 1.

Photo 2: View of span 2.

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PHOTOS

Photo 3: **West end of the wearing surface in span 1 and approach to deck transition.**

Photo 4: **East end of the deck in span 2 and approach to deck transition.**

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PHOTOS

Photo 5: **Spall to the wearing surface in WB lane in span 1.**

Photo 6: **Scale areas to the repair patches along the south curb in span 1 filled with dirt and vegetation.**

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PHOTOS

Photo 7: Deck underside in span 1.

Photo 8: Deck underside span 2.

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PHOTOS

Photo 9: Deck underside span 2 at the east abutment.

Photo 10: South deck fascia in span 1 over the left and middle travel lanes.

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PHOTOS

Photo 11: Spall in bay 2 of span 1 over the ramp lane.

Photo 12: Spall in bay 3 of span 1 over the middle travel lane.

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PHOTOS

Photo 13: North deck fascia looking east from the ramp lane.

Photo 14: The south deck fascia looking west from the ramp lane.

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PHOTOS

Photo 15: Delamination cracking in bay 4 over the middle travel lane.

Photo 16: North deck fascia looking west from the ramp lane.

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PHOTOS

Photo 17: South sidewalk in span 1.

Photo 18: South railing at the 6th post from the west.

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PHOTOS

Photo 19: North railing at the 9th post from the west (pier joint location).

Photo 20: Typical condition of some of the frame connections.

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PHOTOS

Photo 21: East end of bay 1 in span 2.

Photo 22: Utility box laying on the ground at the west abutment.

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PHOTOS

Photo 23: West approach pavement.

Photo 24: Northwest approach sidewalk.

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PHOTOS

Photo 25: Southwest approach sidewalk.

Photo 26: Beam S1 looking east.

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PHOTOS

Photo 27: Beam S7 looking west.

Photo 28: Beam S6 at the west abutment.

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PHOTOS

Photo 29: Beam S6 at the west abutment opposite side.

Photo 30: Beam S4 at the west abutment.

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PHOTOS

Photo 31: Beam S2 at the west abutment.

Photo 32: Beam S1 at the west abutment.

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PHOTOS

Photo 33: Beam S1 opposite side.

Photo 34: Beam S5 at the pier.

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PHOTOS

Photo 35: Beam S2 at the pier.

Photo 36: Beam S1 at the pier.

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PHOTOS

Photo 37: Beam S12 at the pier.

Photo 38: Beam S11 at the pier.

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PHOTOS

Photo 39: Beam S11 at the pier.

Photo 40: Beam S10 at the pier.

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WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 41: Beam S10 at the pier.

Photo 42: Beam S9 at the pier.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 43: Beam S8 at the pier.

Photo 44: Beam S11 at the east abutment.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 45: **End diaphragm connection plate at the west end of beam S1 (pier end).**

Photo 46: **Typical condition of the abutment bearings, bearing to beam S11 shown.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 47: Typical condition of the end diaphragms over the pier.

Photo 48: East bridge seat under bay #5.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 49: East bridge seat under bays #1 and #2.

Photo 50: West bridge seat under bay #3.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 51: West bridge seat under bay #1.

Photo 52: West backwall, bay #5.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 53: West backwall, bay #1.

Photo 54: East backwall in bay #1.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 55: East breastwall.

Photo 56: South cheek wall.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 57: North cheek wall.

Photo 58: Debris on top of the pier cap in bay #5.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 59: Debris on top of the pier cap in bay #2.

Photo 60: East face of the pier.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WORCESTER	**213**	**W-44-093**	**W44093-213-DOT-NBI**	**AUG 6, 2023**

PHOTOS

Photo 61: West face of the pier.

State Information

BDEPT#= W44093 Agency Br.No.
Town= Worcester L.O. MHD
B.I.N= 213 AASHTO= 047.4
RANK= 3061 H.I.= 79.3 % FHWA Select List= Y (6/21/2017)

Identification

(8) Structure Number	W44093213DOTNBI
(5) Inventory Route	151000000
(2) State Highway Department District	03
(3) County Code 027 (4) Place code	82000
(6) Features Intersected	**I 290**
(7) Facility Carried	**HWY LAUREL ST**
(9) Location	.2 MI E OF SUMMER ST
(11) Kilometerpoint	0000.322
(12) Base Highway Network	N
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 16 MIN 07.64 SEC
(17) Longitude	71 DEG 47 MIN 36.03 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No. #	

Structure Type and Material

(43) Structure Type Main: Steel Code 302
Stringer/Girder Jointless bridge type: Not applicable
(44) Structure Type Appr:
Other Code 000
(45) Number of spans in main unit 002
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Concrete Code 1
B) Type of membrane - None Code 0
C) Type of deck protection - None Code 0

Age and Service

(27) Year Built	1958
(106) Year Reconstructed	0000
(42) Type of Service: On - Highway-Ped	
Under - Highway Code	51
(28) Lanes: On Structure 02 Under structure	06
(29) Average Daily Traffic	000500
(30) Year of ADT 2023 (109) Truck ADT	01 %
(19) Bypass, detour length	002 KM

Geometric Data

(48) Length of maximum span	0021.3 M
(49) Structure Length	00042.1 M
(50) Curb or sidewalk: Left 02.2 M Right	02.2 M
(51) Bridge Roadway Width Curb to Curb	008.5 M
(52) Deck Width Out to Out	013.8 M
(32) Approach Roadway Width (w/shoulders)	008.5 M
(33) Bridge Median - No median Code	0
(34) Skew 13 DEG (35) Structure Flared	N
(10) Inventory Route MIN Vert Clear	99.99 M
(47) Inventory Route Total Horiz Clear	08.5 M
(53) Min Vert Clear Over Bridge Rdwy	99.99 M
(54) Min Vert Underclear ref H	04.77 M
(55) Min Lat Underclear RT ref H	00.2 M
(56) Min Lat Underclear LT	00.0 M

Navigation Data

(38) Navigation Control - Not applicable, no waterway Code	N
(111) Pier Protection Code	
(39) Navigation Vertical Clearance	000.0 M
(116) Vert-lift Bridge Nav Min Vert Clear	M
(40) Navigation Horizontal Clearance	0000.0 M

Classification

	Code
(112) NBIS Bridge Length	Y
(104) Highway System	N
(26) Functional Class - Urban Local	19
(100) Defense Highway	0
(101) Parallel Structure	N
(102) Direction of Traffic - 2-way traffic	2
(103) Temporary Structure	N
(105) Federal Lands Highways	0
(110) Designated National Network	N
(20) Toll - On free road	3
(21) Maintain - State Highway Agency	01
(22) Owner - State Highway Agency	01
(37) Historical Significance built after 1949 presumed to be not eligit	Z

Condition

	Code
(58) Deck	5
(59) Superstructure	4
(60) Substructure	6
(61) Channel & Channel Protection	N
(62) Culverts	N

Load Rating and Posting

	Code
(31) Design Load - H 20=M 18	4
(63) Operating Rating Method - Load Factor (LF)	1
(64) Operating Rating	39.6
(65) Inventory Rating Method - Load Factor (LF)	1
(66) Inventory Rating	17.1
(70) Bridge Posting	5
(41) Structure - Posted for load	P

Appraisal

	Code
(67) Structural Evaluation	4
(68) Deck Geometry	5
(69) Underclearances, vert. and horiz.	2
(71) Waterway adequacy	N
(72) Approach Roadway Alignment	8
(36) Traffic Safety Features	0 N N N
(113) Scour Critical Bridges	N

Inspections

(90) Inspection Date 08/06/23 (91) Frequency 12 MO

(92) Critical Feature Inspection:				(93) CFI DATE
(A) Fracture Critical Detail	N	00	MO A)	00/00/00
(B) Underwater Inspection	N	00	MO B)	00/00/00
(C) Other Special Inspection	Y	12	MO C)	08/18/24
(*) Other Inspection (freeze thaw)	Y	00	MO *)	09/18/22
(*) Closed Bridge	N	00	MO *)	00/00/00
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 08/01/96	H20	Type 3	Type 3S2	Type HS
Operating	35.0	43.0	56.0	44.0
Inventory	17.0	19.0	25.0	19.0

Field Posting

Status POSTED Posting Date 10/29/96

	2 Axle	3 Axle	5 Axle	Single
Actual	17	19	25	
Recommended	17	19	25	

Missing Signs N

Misc.

Bridge Name LEANORA MONROE
Y Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw 1 : Known problematic history of concrete deterioration
Stairs On/Adjacent 0 Stair Owner(s)

Accessibility (Needed/Used)

Y / Y Liftbucket	N / N Rigging	Y / Y Other
N / N Ladder	N / N Staging	OVERTIME
N / N Boat	Y / Y Traffic Control	
N / N Wader	N / N RR Flagperson	Inspection Hours: 008
N / N Inspector 50	Y / Y Police	

National Bridge Element Inspection

BDEPT#	**W-44-093**	Date	**08/06/2023**
B.I.N.	**213**	District Bridge Inspection Eng'r	**Mahmood Azizi**
Item 8	**W44093-213-DOT-NBI**	Inspecting Agency	**Mass. Highway Dept.**
Span Group	**1**	Team Leader	**Dennis Simkhovich**
Town	**Worcester**	Team Member(s)	**Ivan Abermagger**
District	**3**		

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
12	**Re Concrete Deck**	sq feet	2	7,830.000	☐ %	1,830.000	5,496.000	500.000	4.000
Notes :	Ditressed area is less than 2%.								
> 1080	*Delamination/Spall/Patched Area*	sq feet	2	6,000.000	☐ %		5,496.000	500.000	4.000
Notes :									
107	**Steel Opn Girder/Beam**	feet	2	984.000	☐ %	784.000		188.000	12.000
Notes :									
> 1000	*Corrosion*	feet	2	200.000	☐ %			188.000	12.000
Notes :									
> 515	Steel Protective Coating	sq feet	2	8,620.000	☐ %	4,120.000	1,500.000	1,500.000	1,500.000
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	2	8,620.000	☐ %	4,120.000	1,500.000	1,500.000	1,500.000
Notes :									
107	**Steel Opn Girder/Beam**	feet	3	60.000	☐ %	35.000		25.000	
Notes :									
> 1000	*Corrosion*	feet	3	25.000	☐ %			25.000	
Notes :									
> 515	Steel Protective Coating	sq feet	3	525.000	☐ %	35.000		465.000	25.000
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	525.000	☐ %	35.000		465.000	25.000
Notes :									
205	**Re Conc Column**	each	2	3	☐ %	3			
Notes :	All columns have been repaired since the last pontis inspection.								
> 1130	*Cracking (RC and Other)*	each	2	3	☐ %	3			
Notes :									

National Bridge Element Inspection

BDEPT#	**W-44-093**	Date	**08/06/2023**
B.I.N.	**213**	District Bridge Inspection Eng'r	**Mahmood Azizi**
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Span Group	**1**	Team Leader	**Dennis Simkhovich**
Town	**Worcester**	Team Member(s)	**Ivan Abermagger**
District	**3**		

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
215	**Re Conc Abutment**	feet	3	108.000	☐ %	85.000	18.000	5.000	
Notes :									
> 1080	*Delamination/Spall/Patched Area*	feet	3	20.000	☐ %		15.000	5.000	
Notes :									
> 1130	*Cracking (RC and Other)*	feet	3	3.000	☐ %		3.000		
Notes :									
234	**Re Conc Pier Cap**	feet	2	44.000	☐ %	38.000	6.000		
Notes :	The piercap has been repaired since the last pontis inspection.								
> 1080	*Delamination/Spall/Patched Area*	feet	2	6.000	☐ %		6.000		
Notes :									
301	**Pourable Joint Seal**	feet	3	90.000	☐ %	65.000	25.000		
Notes :	pourable joint seal has been replaced with concrete repair patches with styrofoam backer rod over the joint opening.								
> 2310	*Leakage*	feet	3	25.000	☐ %		25.000		
Notes :									
311	**Moveable Bearing**	each	3	12	☐ %		6	6	
Notes :									
> 1000	*Corrosion*	each	3	6	☐ %		6		
Notes :									
> 1020	*Connection*	each	3	6	☐ %			6	
Notes :									
> 515	Steel Protective Coating	sq feet	3	40.000	☐ %			40.000	
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	40.000	☐ %			40.000	
Notes :									

National Bridge Element Inspection

BDEPT#	**W-44-093**	Date	**08/06/2023**
B.I.N.	**213**	District Bridge Inspection Eng'r	**Mahmood Azizi**
Item 8	**W44093-213-DOT-NBI**	Inspecting Agency	**Mass. Highway Dept.**
Span Group	**1**	Team Leader	**Dennis Simkhovich**
Town	**Worcester**	Team Member(s)	**Ivan Abermagger**
District	**3**		

El #	Element Name	Units	Env.	Total Q.	% or Q	State 1	State 2	State 3	State 4
313	**Fixed Bearing**	each	3	12	☐ %		6	6	
Notes :									
> 1020	*Connection*	each	3	12	☐ %		6	6	
Notes :									
> 515	Steel Protective Coating	sq feet	3	40.000	☐ %			40.000	
Notes :									
> > 3440	*Eff (Stl Protect Coat)*	sq feet	3	40.000	☐ %			40.000	
Notes :									
330	**Metal Bridge Railing**	feet	2	348.000	☐ %	348.000			
Notes :									

DOCUMENT A00820

Massachusetts Department of Transportation
Conditions of Custody

REQUEST FOR RELEASE OF MASSDOT AUTOCAD FILES FORM
(Only to be used following award of contract)

City/Town: WORCESTER Project File Number: 609185

Contract Number: 129075

Project Description: Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290

All AutoCAD files are provided solely as a courtesy to facilitate public access to information. MassDOT attempts to provide current and accurate information but cannot guarantee so. MassDOT provides such documents, files or other data "as is" without any warranty of any kind, either expressed or implied, including but not limited to, accuracy, reliability, omissions, completeness and currentness. The Commonwealth of Massachusetts and its Consultants shall not be liable for any claim for damages, including lost profits or other consequential, exemplary, incidental, indirect or special damages, relating in any way to the documents, files or other data accessible from this file, including, but not limited to, claims arising out of or related to electronic access or transmission of data or viruses. Because data stored on electronic media can deteriorate undetected or be modified without our knowledge, MassDOT cannot be held liable for its completeness or correctness. MassDOT makes no representation as to the compatibility of these files beyond the version of the stated CAD software.

By signing this form, I agree that it shall be my responsibility to reconcile this electronic data with the conformed contract documents, and that only the conformed contract documents shall be regarded as legal documents for this Project. I understand that this authorization does not give me the right to distribute the files. I agree to the terms above and wish to receive the AutoCAD files.

This signed form shall be emailed to the Highway Design Engineer at the MassDOT -Highway Division at the following email address:

DOTHighwayDesign@dot.state.ma.us
Attn: AutoCAD Files

Name of person requesting AutoCAD files: _____

Affiliation/Company: _____

Address: _____

_____

Telephone number: _____

Email address: _____

Signature/Date: _____

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DOCUMENT A00825

THE CITY OF WORCESTER DEPARTMENT OF PUBLIC WORKS & PARKS STANDARD CONSTRUCTION SPECIFICATIONS AND DETAILS, DATED MARCH 1, 2023

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The City of Worcester Department of Public Works & Parks
Standard Construction Specifications and Details

Only relevant portions of the Worcester
Construction Specifications have been included

The City of
WORCESTER
Department of Public Works & Parks

STANDARD CONSTRUCTION SPECIFICATIONS AND DETAILS

MARCH 1, 2023

SECTION 200

B. *SANITARY SEWERS*

GENERAL

Under this item the Contractor shall furnish all labor, tools, equipment, pipe and fittings, adapters, couplings, stoppers and/or plugs, jointing materials and screened gravel required to handle, lay and joint pipe for sanitary sewers, including tee connections, Y-branches and pipe for chimneys. All house and/or building connections shall be required to maintain any flows in existing sewer lines that are affected by his work. The Contractor is responsible for locating, maintaining and connecting all existing connections that are affected by his work. The Contractor shall not discharge sewage onto roadways or into surface sewers during the progress of his work. Where applicable the connection shall be Kor-N-Tee as manufactured by NPC Systems, Inc., Milford N.H., or equal.

PIPES AND FITTINGS

The type of pipe and fittings to be used for sanitary sewers shall be as specified in the proposal and shall be made of (1) cast and ductile iron; (2) poly (vinyl chloride) plastic; and (3) pre-cast, reinforced concrete. Each type of pipe and fitting shall meet the standards specified herein. Other types of pipe and fittings may be used for sanitary sewers and will be designated under appropriate items in the specifications and proposal. Where specific standards are referred to in the specifications, it is understood and agreed that they shall include all the revisions and amendments thereto. The class and type of pipe and fittings shall be shown on the plans.

CAST AND DUCTILE IRON PIPE

Cast and ductile iron pipe and fittings shall conform to the following standards:

1. American National Standard ANSI A 21.1 (AWWA HI) for thickness design of Cast-Iron Pipe.
2. American National Standard ANSI 21.50 (AWWA H3) for thickness design of Ductile Iron Pipe.
3. American National Standard ANSI A 21.6 (AWWA C 106) for Cast-Iron Pipe centrifugally cast in Metal Molds, for water and other liquids with push-on, mechanical and/or bell-and-spigot joints.
4. American National Standard ANSI A 21.8 (AWWA C 108) for Cast-Iron Pipe centrifugally cast in Sand-lined Molds, for water and other liquids with push-on, mechanical and/or bell-and spigot joints.
5. American National Standard ANSI A 21.10 (AWWA C 111) for Gray-Iron and Ductile - Iron Fittings, 2 inches through 48 inches, for water and other liquids with mechanical, push-on, bell-and-spigot and flanged joints.
6. American National Standard ANSI A 21.11 (AWWA C 111) for Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings for push-on and mechanical joints.
7. American National Standard ANSI A 21.51 (AWWA C 151) for Ductile-Iron Pipe centrifugally cast in Metal Molds or Sand-lined molds for water or other liquids with push-on and mechanical joints.
8. Federal Specifications WW-P-421 c for pipe, Cast Iron and Ductile iron, pressure (for water and other liquids).
9. CIPRA Standard for Flanged Pipe with threaded flanges.
10. CIPRA - Special type of pipe and fittings.

POLY (VINYL CHLORIDE) PLASTIC PIPE

Poly (Vinyl Chloride) plastic pipe and fittings shall conform to the following standards:

1. ASTM Standard Specification for Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Schedules 40, 80 and 120 for Water and Force Mains, Designation D 1785
2. ASTM Standard Specification for Socket-Type Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40, Designation D 2466.
3. ASTM Standard Specification for Socket-Type Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80, Designation D 2467.
4. ASTM Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Fittings, Designation D 2729.
5. ASTM Standard Specification for Filled Poly (Vinyl Chloride) (PVC) Sewer Pipe, Designation D 2836.

6. ASTM Standard Specification for Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, Designation D 3033.

7. ASTM Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings for Gravity Sewers.

PRECAST REINFORCED CONCRETE PIPE

Pre-cast, reinforced concrete pipe and fittings for sanitary sewers shall be epoxy coated. The pipe shall conform to the requirements of ASTM Standard Specifications for Reinforced Concrete Culvert. Storm Drain and Sewer, Designation C 76 and to ASTM Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe, Designation C 655.

The epoxy coating shall conform to the specifications listed herewith.

Class and Wall Designations will be shown on the plans.

The groove of all tongue-and-groove pipes and the bell of all bell-and-spigot pipes shall contain circumferential reinforcement equal in area to that of a single line within the barrel of the pipe. Reinforcement for bell-and-spigot pipe, 12 to 24 inches in diameter, shall be extended into the bell.

The interior of pre-cast, reinforced concrete pipe for sanitary sewers shall be coated with two (2) coats of a green epoxy resin, specified as follows.

Internal coating of each piece of concrete sewer pipe shall be performed at the plant and under the control of the concrete pipe manufacturer in accordance with these specifications. A rigid inspection shall be maintained by the manufacturer of each length of pipe to determine that a thorough coating has been applied. If any portion of the coating is found to be thin or holidays are found, a second coat shall be applied to the deficient area. If bond between the pipe and coating is inadequate, the coating shall be thoroughly removed and a new application properly made.

PREPARATION OF PIPE

At the time the protective inner coating is applied, the pipe shall have a high, uniformly distributed moisture content (essentially saturated and surface damp) but shall be free of glistening or dripping water. The pipe may be prepared to meet this condition by one of the following methods:

1. For Pipe to be Prepared after Initial Kiln Curing.

Pipe, after initial kiln curing and removal of forms, shall be placed in an enclosure and shall be subjected to an atmosphere of approximately 100% relative humidity at a temperature of not less than 90 degrees F. for a period of not less than 12 hours.

2. For Pipe from Yard Storage.

Pipe from yard storage shall be placed in an enclosure and shall be subjected to an atmosphere of approximately 100% relative humidity at a temperature of not less than 90 degrees F. for a period of not less than 12 hours.

Dust, weak laitance, rich cement films not firmly bonded, irregular aggregate protuberances, and other objectionable conditions shall be removed from the inner surface of the pipe to a depth sufficient to assure firm bond of crating. This shall be accomplished by mechanical grinding or other approved method, followed by a strong air blast, wire brushing and/or generous water flushing to remove all detritus. This inner surface preparation may precede or follow the moisture conditioning of the pipe herein before described.

COATING APPLICATION

After the pipe has been properly prepared as specified, the pipe shall be coated immediately before any appreciable loss of moisture by evaporation takes place and before a significant change in color of the pipe takes place due to drying.

The coating shall be catalytic - setting modified type epoxy coating consisting of two approximately equal volume components of type J-151-75 as manufactured by the George W. Whitesides Company, Inc. Louisville, Kentucky or approved equal. The coating shall be distinctively pigmented to aid in inspection. Application must be made in full compliance with instructions of the manufacturer. The coating shall be applied as a uniform with no holidays or thin spots. Application shall be at a rate to produce a cured film thickness of not less than 5 mils, and shall be made by suitable proportioning in temperature-controlled spray equipment, in which intimate mixing is done in the nozzle. Alternate application at the same rate may be made by approved hand methods, but in this case, no more epoxy material than is necessary to coat one pipe shall be attained by mechanical stirring.

In addition to coating the entire internal surface of the pipe, the inside groove (bell) and the extreme end of the tongue or spigot face shall also be coated.

MISCELLANEOUS CONTROLS

Temperature of concrete shall be 60 degrees F. to 90 degrees F. at the time of coating application. The pipe, after coating, shall be promptly stored and protected at an initial curing temperature of 60 degrees F. to 90 degrees F. until the film attains set-hardness before stockpiling, shipping, etc. Forced curing, at temperatures not to exceed 115 degrees F. will be permitted.

Any damage or discontinuities in the coating film prior to installation may be repaired by spot brush application of the same material used in the original coating. The proper timing of spot application in relation to original application of coating shall be determined from the manufacturer of the epoxy material and shall be rigidly adhered to in order to prevent lamination at overlaps of coats.

Sealing materials shall conform to the following requirements:

Rubber gaskets for joints shall conform to the requirements of ASTM Standard Specification for circular concrete sewer and culvert for pipe, using rubber gaskets, Designation C 443 and shall be flexible and able to withstand expansion, contraction, and settlement.

Resilient joint materials shall consist of poly vinyl chloride, or fiberglass impregnated with epoxy resin, or other approved resilient joint materials.

Joint material for reinforced concrete sanitary sewer pipe shall be the rubber gasketed type.

LAYING AND JOINTING PIPE

Before being laid each pipe length shall be inspected and tested to verify that it is not cracked, permanently dented or deformed. Pipe of the required size shall be laid to conform to the lines and grades indicated on the drawings or given by the Contracting Officer. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to required grade. Each pipe shall be supported with compacted crushed stone, graded in size from 1/4 inch to 3/4 inch, to obtain a substantially unyielding bed.

Unless recommended by the ASTM standards and by the manufacturers of the various kinds and types of pipe, the Contractor shall not joint pairs of pipe before laying them.

The factory instructions for unloading, handling, and laying and jointing the various kinds and types of pipes and fittings shall be followed explicitly and shall also follow the standards below, providing that the listed standards do not conflict with the manufacturer's recommendations:

1. ASTM Standard Recommended Practice for Installing Vitrified Clay Pipe Sewers, Designation C 12.
2. ASTM Standard Specifications for Rubber Rings for Asbestos Cement Pipe, Designation D 1869.
3. AWWA Standard for Installation of Cast Iron Water Mains C 600.
4. ASTM Standard Specifications for the Underground Installation of Flexible Thermoplastic Sewer Pipe, Designation D 2321.
5. ASTM Standard Specifications for Butt Fusion of Polyethylene (PE) Plastic Pipe Fittings, Schedule 40, Designation D 2610.
6. ASTM Standard Specifications for Butt Fusion of Polyethylene (PE) Plastic Pipe Fittings, Schedule 80, Designation D 2611.
7. ASTM Recommended Practice for the Underground Installation of Thermoplastic Pressure Piping, Designation D 2774.
8. ASTM Standard Specifications for Plastic Pressure Pipe using Flexible Elastomeric Seals, Designation D 3139.
9. Tentative Specifications for Joints for Drain and Sewer Plastic Pipe using Flexible Elastomeric Seal, Designation D 3212-73T.
10. Standard Specifications for Butt Heat Fusion of Polyethylene (PE) Plastic Pipe and Tubing, Designation D 3261.

Where a concrete cradle is used, the pipe shall be laid on concrete saddles so constructed as to provide lateral support for the pipe while the cradle is being placed. The location, dimensions, and class concrete required for cradles are given on the drawings.

Branches and fittings shall be laid by the Contractor as and where directed. Open ends of pipe and branches shall be closed with the appropriate stoppers and/or plugs secured in place in an acceptable manner using an approved gasket for the stopper and/or plug. No walking on or working over the pipes after they are laid, except when necessary in tamping the earth and backfilling, will be permitted until they are covered with earth to a depth of one (1) foot. All openings to the pipe line shall be satisfactorily protected from the entrance of earth, water, or other material, and all necessary precautions shall be taken to prevent flotation of the pipe.

LEAKAGE

The sewers and appurtenant structures connected thereto shall be made as nearly watertight as practicable and leakage measurements shall be made wherever possible.

The leakage into the sewers, including manholes, constructed under contract shall not exceed an average of 500 gallons per twenty-four (24) hour per inch-diameter per mile of sewer pipeline. There shall be no gushing or spurting streams entering the sewer or manholes.

Where practicable, the leakage tests shall be made at a time when a head of water can be maintained at least one (1) foot above the top of the pipe of the highest section of work being tested.

The sewers will be tested before any building connections are made.

The Contractor shall construct such weirs or other means or measurement as may be required and shall do all necessary pumping to enable the tests to be properly made.

Testing will be required.

SPECIFICATION FOR FLEXIBLE WATERTIGHT PIPE-TO-PIPE TEE CONNECTORS

A flexible watertight pipe-to-pipe connector shall be employed when connecting laterals into trunk and other sanitary sewer pipelines.

The connector shall be Kor-N-Tee as manufactured by NPC Systems, Inc., Milford N.H. or approved equal.

The connector shall be the sole element relied on to assure a flexible watertight seal at the location where the two (2) pipes are connected. No adhesives or lubricants shall be employed in the installation of the connector. The rubber for the connector shall comply with ASTM C 443, be of molded one-piece construction, shall be 3/8" (9.4 mm) thick or greater and consist of EPDM and Neopreneor elastomers designed to be resistant to ozone, weather elements, chemicals including acids, alkalis, animal and vegetable fats, oils and petroleum products from spills.

The connector shall be installed in the wall of the pipe by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

All stainless steel elements of the connector shall be totally non-magnetic Series 304 stainless including the worm screw assembly for tightening the steel band around the pipe. The worm screw for tightening the stainless steel band shall be torqued by a break-away torque wrench available from the pre-cast manhole supplies, and set for 60-70 inch/lbs.

The connector shall be a size specifically designed so as not to protrude more than 1/8" inside the pipe. The connector shall also contain an internal shoulder that shall act as a stop for the incoming lateral.

Actual laboratory test results show that our material meets the requirements given in ASTM Specification C923, which covers rubber seals used in concrete sewer pipe and culvert joints.

	PHYSICAL PROPERTIES	ASTM C-923	ACTUAL
I.	**Original**		
	Tensile, psi., min.	1200	1550
	Elongation, % min.	350%	910
	Shore A. Durometer	35-65	40
II.	**Comp. Set, % max.**	19.6	25
III.	**Oven Aging: 96 hrs. @ 158 degrees F.**		
	Tensile Change, % max.	-15	10.40%
	Elongation Change, % max.	-20	-14.00%
IV.	**Water Absorption: 48 hrs. @ 158 degrees F.**		
	Weight increase, % max.	10	3.50%
V.	**Ozone Resistance**		
	120 hrs. @ 100 degrees (+-) 02 degrees F.	0	0

TESTING

1. GENERAL REQUIREMENTS

All sanitary and surface sewer lines shall be subject to the applicable tests described in this section and also subject to CCTV work as described under Item 210. The contractor shall furnish all materials, equipment, gauges, pumps, special temporary tappings in line and water or other things required for making the tests. He shall include in his price for furnishing and laying pipe an allowance for the costs of such tests. The pipes installed under this contract will be tested as specified by the contracting officer and according to the contract documents.

2. TELEVISION INSPECTION

On all City of Worcester pipe installation projects, including sanitary and surface sewer lines, new or replacement projects, the contractor will adhere to the work specified in Item 210.

3. PIPE DEFLECTION MEASUREMENT

In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the contractor shall test the pipeline for deflection using a “go/no-go” deflection mandrel having a minimum of nine evenly spaced arms or prongs. The “go/no-go” gauge shall be hand pulled through all sections of the pipeline by the contractor. The contractor shall submit drawings of the “go/no-go” gauge to the engineer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.

Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the contractor at his own expense.

4. LOW PRESSURE AIR TESTING

Unless otherwise approved, the section shall be tested using low-pressure air test procedures. If circumstances permit; the Engineer may allow testing in infiltration or exfiltration in lieu of air testing.

The air test procedures shall conform to the Uni-Bell Recommended Practice for Low pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psi. The minimum duration permitted for the prescribed low pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. The two tables are reproduced on the following pages:

TABLE 1

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSUER DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

PIPE DIAMETER (INCHES)	MINIMUM TIME (MIN:SEC)	LENGTH FOR MINIMUM TIME (FT)	LENGHT FOR LONGER LENGTH (SEC)	100 FEET	150 FEET	200 FEET	250 FEET	300 FEET	350 FEET	400 FEET	450 FEET
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.52L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15.49	17.48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22.47	25.38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	31:09	35:36
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.673L	22:47	34:11	45:34	56:58	68:22	79.46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172.21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179.29	205:07	230:46

SEPTEMBER 25, 2009		DEPARTMENT OF PUBLIC WORKS AND PARKS Engineering Division 20 East Worcester St, Worcester MA 01604	NO.	DATE	DESCRIPTION	BY
TABLE 1						
NOT TO SCALE						
SHEET 1 OF 1						

TABLE 2

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSUER DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

PIPE DIAMETER (INCHES)	MINIMUM TIME (MIN:SEC)	LENGTH FOR MINIMUM TIME (FT)	LENGHT FOR LONGER LENGTH (SEC)	100 FEET	150 FEET	200 FEET	250 FEET	300 FEET	350 FEET	400 FEET	450 FEET
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	26:26	25:38	28:51
21	9:55	114	5.235L	9:55	13.00	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17.57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683L	17:48	38:28	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	64:38	43:56	53:25	64:28	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	76:55	51:17	64:06	76:55	89.44	102:34	115:23

SEPTEMBER 25, 2009		DEPARTMENT OF PUBLIC WORKS AND PARKS Engineering Division 20 East Worcester St, Worcester MA 01604	NO.	DATE	DESCRIPTION	BY
TABLE 2						
NOT TO SCALE						
SHEET 1 OF 1						

If either infiltration or exfiltration is permitted by the Contracting Officer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch-diameter per mile of sewer per 24 hours.

The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, under drains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water, which may enter the sewer through pipe connections and inlets during the infiltration test.

Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections and chimneys.

When slopes between manholes are steep, the contractor shall insure that this test can be accomplished without danger of forcing stoppers from wyes or tee branches.

The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test.

The contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the test to be properly made.

The contractor shall be responsible for the satisfactory water tightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the contractor shall do all work of locating and repairing leaks and retesting as the Contracting Officer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.

Portions of sewers that fail to meet tests shall be repaired and retested as necessary until test requirements are compiled. All said tapes/dvd’s shall be submitted to the Contracting Officer.

The work to be done under Items 230 and 232 shall include furnishing and installing complete manhole bases and sections including hauling, excavation, placement of structures, backfilling and all labor, equipment and incidentals necessary to complete the work. All pre-cast manhole bases and sections shall conform to ASTM Specifications C 478. Installation of pre-cast manholes shall be as shown on a plan titled Typical Manhole and Step Manhole.

ITEM 230.4 4' MANHOLE BASE

ITEM 230.5 5' MANHOLE BASE

ITEM 230.6 6' MANHOLE BASE

ITEM 230.7 7' MANHOLE BASE

ITEM 230.8 8' MANHOLE BASE

ITEM 231.4 4' MANHOLE SECTION

ITEM 231.5 5' MANHOLE SECTION

ITEM 231.6 6' MANHOLE SECTION

ITEM 231.7 7' MANHOLE SECTION

ITEM 231.8 8' MANHOLE SECTION

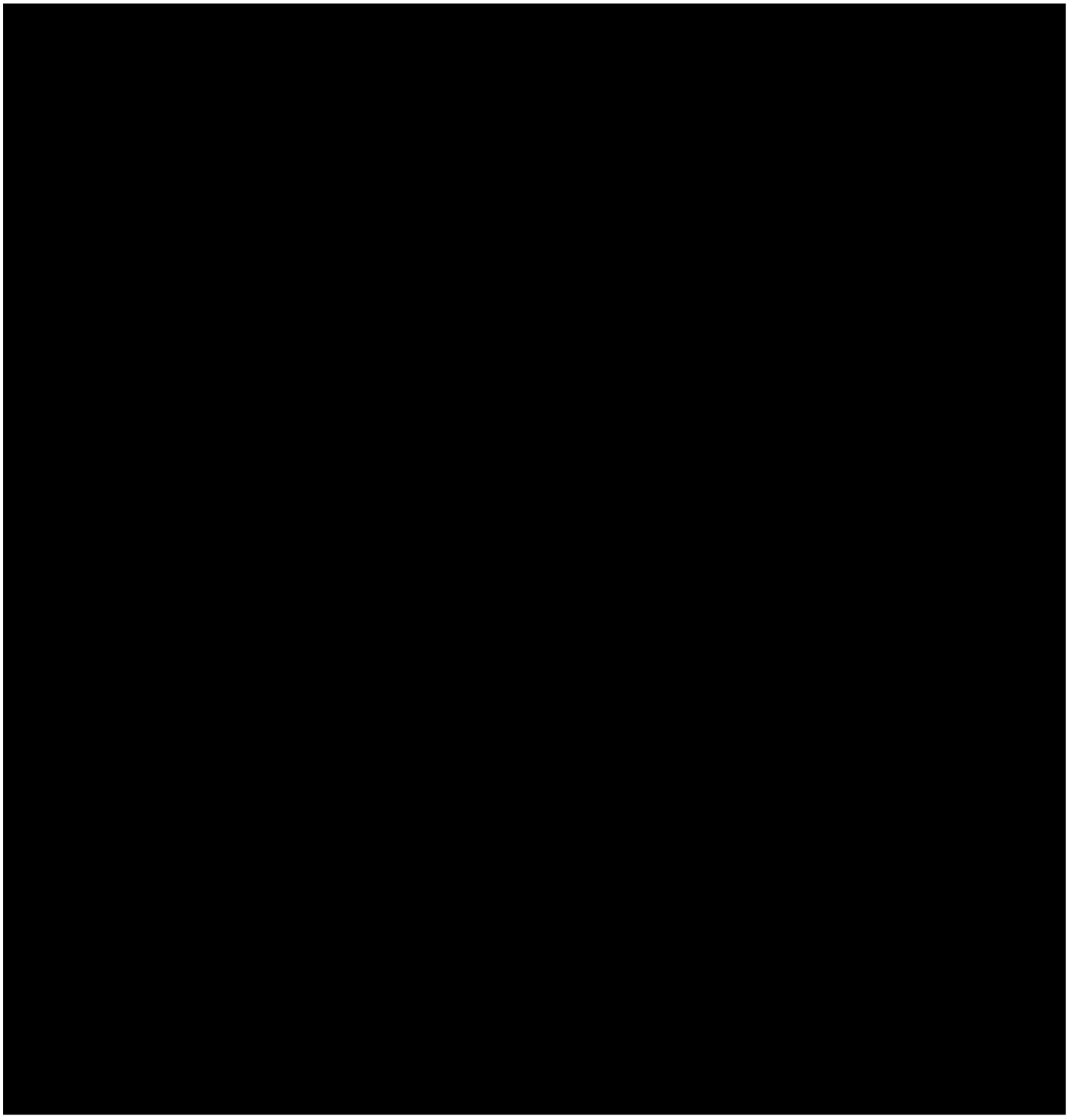
ITEM 232.1 MITER BEND MANHOLE TEE

ITEM 232.2 FLAT MANHOLE TEE

MANHOLES

A. ***DESCRIPTION***

Manholes shall conform in shape, size, dimensions, and in other respects to the details indicated on the drawings, or as ordered by the Contracting Officer. Manholes shall be two types: (1) manholes built over existing sewer pipes and (2) pre-cast reinforced concrete manholes to be installed along with sanitary and surface sewers. A minimum of 12 inches of red sewer brick, grade MS only, shall be used under the frame.



The joint at the base section between the manhole and the pipe shall be (1) "A-Lok" Seal Joint as manufactured by L and L Concrete Products Incorporated, Webster, Massachusetts (or an approved equal).

The "A-Lok" rubber gasket is a pipe to manhole seal cast integrally into the pipe opening of the manhole base to provide a water tight joint and 10 degree of omni directional deflection. The "A-Lok" rubber gasket is to be manufactured in accordance with ASTM Rubber Joint Specifications Designation C 425 for Compression Joints.

Q. ***KIND OF BRICK***

The brick shall be good, sound, hard, and uniformly burned brick, regular and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the Contracting Officer.

Brick shall be Grade MS conforming to the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C 32 for use under the frame and for all other uses with the exception of the invert and shelf.

Brick shall be Grade SS conforming to the ASTM Standard Specification for Sewer Brick (made from clay or shale), Designation C 32 for invert and shelf.

In case the Contracting Officer rejects any brick, the same shall be immediately removed from the work site and brick satisfactory to the Contracting Officer substituted. Brick shall be culled and completely piled as soon as possible.

R. ***LAYING BRICK***

Bricks shall be clean when laid. For best results, bricks should have a section rate, when laid, not in excess of 40 gpm., in accordance with the NBS test procedure.

Except in cold weather, all brick shall be set as directed by the Contracting Officer to approximate this condition.

Each brick shall be laid in full bed and joint of mortar without requiring subsequent grouting, flushing or filling and shall be thoroughly bonded as directed.

Brick work shall be protected against weather and frost as approved or required by the Contracting Officer.

S. ***PLASTERING***

Outside faces of brick masonry shall be plastered with mortar 1/2 inch thick. The masonry shall be properly wetted as above specified, before the plaster is applied.

The plaster shall be carefully spread and troweled so that all cracks are thoroughly worked out. After hardening, the plaster shall be carefully checked, by being tapped, for bond and soundness. Two coats of bituminous waterproofing material shall then be applied to the hardened plaster. The material shall be "Miniwax Fibrous Brush Coat" made by the Miniwax Company, New York, N.Y.; "Tremco 121 Foundation Coating" made by the Tremco Manufacturing Company, Cleveland, Ohio; "Inertol No. 7" made by Inertol Company, Newark, N.J.; or approval equal. The material shall be applied by brush or spray (using a primer if necessary) in accordance with the direction of the manufacturer.

The Contracting Officer, at his discretion, may require that two (2) coats of the above described bituminous waterproofing material be applied to the outside of pre-cast manholes installed in wet area.

T. ***STUBS IN MANHOLES***

The stubs shall be short pieces cut from the bell end of the pipe, sealed as specified under Items 230-232. The stubs shall be set to the required line and elevation and encased in the manhole masonry as shown on the drawings or as directed by the Contracting Officer.

U. ***MANHOLE VACUUM TESTING***

Vacuum Test: The work under this section shall be for new construction only, unless otherwise specified by the Contracting Officer. Testing required in this section shall be a subsidiary obligation of the contractor at no additional cost to the City of Worcester.

Vacuum Test: The vacuum test shall be conducted in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

TABLE 1 - Minimum test times for various manhole diameters.

Diameter (Inches)	**48**	**60**	**72**
Depth (Feet)		**Times (Seconds)**	
0 - 12	30	39	49
12 - 16	40	52	67
16 - 20	50	65	81
20 - 24	59	78	97
26 - 30	74	98	121

If the manhole fails the initial test, the Contractor shall locate the leaks and make proper repairs. Leaks may be filled with wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.

Water Exfiltration Test: After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.

The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily watertight. If the test, as described above, is unsatisfactory as determined by the Contracting Officer or if the manhole excavation had been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Contracting Officer to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3-gallon per vertical foot per day shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as directed by the Contracting Officer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.

If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Contracting Officer, such a test can serve to evaluate water-tightness of the manhole. However, if the Engineer is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

[redacted]

ITEM 235 CATCH BASIN FRAME & GRATE

ITEM 236 MANHOLE FRAME & COVER

A. ***INSTALLATION OF CASTING FRAMES***

Casting frames shall be set on a full bed of mortar, set to finish grade and concentric with the masonry. All voids beneath the bottom flange shall be completely filled to make a watertight fit. A ring of mortar at least 1 inch thick shall be placed around the outside of the bottom flange extending to the outer edge of the masonry all around the frame. A minimum 12 inches of red sewer brick, grade MS only, shall be used under casting.

B. ***TECHNICAL SPECIFICATIONS***

All construction castings shall meet the requirements of AASHTO M306 and shall be supplied by East Jordan Iron Works, Inc. – LeBaron Foundry or approved Equal. All manufacturers will need their drawings and weights reviewed by Worcester DPW – Engineering to determine if the proposed item is equal.

Catch Basin grate shall be EJIW 7288M or LeBaron L28SG1. Catch basin inlet frame shall be EJIW 7288Z (4-Flange), EJIW 7288Z1 (3-Flange) or LeBaron LF288, Type E.

Manhole frame and cover shall be EJIW 1056Z frame and EJIW 1056A cover or LeBaron LC239/L23C-1. Non-bolted casting manhole covers shall be supplied with a closed pickhole and shall show the wording ‘Worcester, A Town June 14, 1722: A City February 29, 1848” cast into said cover. Castings that are supplied bolted and watertight may have alternate lettering.

ITEM 246 8 INCH GREEN TRAPS

A. ***GENERAL***

The work to be done under this item shall include furnishing, handling and installing Worcester standard green traps in catch basins. Green traps shall be as supplied by Tolman Manufacturing Company of Boston, MA., or approved equal. Green traps are to be installed as shown on a plan titled Body and Collar for 8" Trap.

SECTION 300 - WATER

ITEM 301 WATER MAINS

ITEM 301.01 1" POLYETHYLENE TUBING

ITEM 301.015 1" COPPER TUBING

ITEM 301.02 2" COPPER TUBING

[redacted]

ITEM 301.50 POLYETHYLENE WRAP FOR DI PIPE

A. *SCOPE OF WORK*

The work under this section shall consist of furnishing and installing new water pipe of various sizes, complete with gaskets, accessories, appurtenances, coatings for installing or making alterations in existing water main systems. The work shall also include excavating, backfilling, chlorinating, testing for leakage and other steps as may be necessary for the construction of new sections of existing water main systems as specified herein, as shown on the plans, or as directed by the Contracting Officer.

B. *MATERIALS*

1. Ductile Iron Pipe

Standards: Ductile iron pipe shall conform to AWWA C150 and C151, subject to the following supplemental requirements. The pipe shall be of the diameter as shown, AWWA C151 Class 52 for all sizes and Class 53 for all sizes of flanged pipe with threaded flanges. Pipe shall be supplied complete with rubber gaskets, follower rings and/or flanges as indicated in the Contract Documents. Any specials or other fittings shall be provided as specified under the contract plans. Joints shall conform to AWWA C111, cement linings to AWWA C104, fittings to AWWA C153 or C110.

Markings: All pipes shall be clearly marked with Manufacturer, Class, Date, Size, standard and zinc coating designation. Any other cast marks and other marks shall be in accordance with applicable Standards.

Laying Lengths: Pipe laying lengths shall be provided in standard pre-approved lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

Joint Design: Ductile iron pipe shall be furnished with push-on joints or push-on restrained joints. Restrained joints shall be AMERICAN Fast-Grip, Flex-Ring, Mega-Lug, Lok-Ring or per-approved equal. All shall conform to AWWA C111.

Lining: Interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined at the pipe casting facility with a standard thickness cement mortar lining applied in conformity with AWWA C104. A thin asphaltic coating shall be applied over the cement lining as per ANSI/AWWA C104/A21.4 to assist in curing of the cement and prevent altering of water PH.

Coating: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer of asphaltic topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The zinc coating system shall conform to ISO 8179-1 “Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01."

Polyethylene Wrap: All ductile iron pipe shall be encased in a Polyethylene sleeve (polywrap) that shall meet all the requirements for ANSI/AWWA C105/A21.5, *Polyethylene Encasement for Ductile Iron Pipe Systems*. Each pipe joint shall be covered with an 8 mil thick polyethylene sleeve that is 2 feet longer than the pipe joint. The sleeve shall cover the full length of the pipe joint, lap over 1 foot on each end of the adjoining pipe joints, and be secured with a minimum of two circumferential turns of pressure sensitive polyvinyl tape. Excess material should be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe, and held in place by means of pieces of pressure sensitive tape at approximately 5 foot intervals. After assembling the joint, the polywrap tube from the previously installed pipe shall be pulled over the joint and secured by the Contractor. The polywrap tube from the new joint shall be pulled over the first tube and secured by the Contractor to provide a double seal. This polyethylene wrap shall also be used for all point repairs or cut-in valves and shall include all couplings used for this work

Cast iron and ductile iron fittings and valves shall be completely wrapped in 8 mil thick polyethylene film with a minimum of a 1 foot overlap on each end and appropriately taped. Laps shall cover joints of adjoining pipe or fittings when installed. Also, the fire hydrant barrel, from the surface to the valve, shall be wrapped as specified herein. Any damaged areas in the polyethylene film shall be repaired by covering the area with a sheet of polyethylene film large enough to lap over the damaged area 1 foot minimum in any direction and appropriately taped. Extreme care shall be taken at service tap locations to insure that the tape extends beyond the corporation and onto the service line pipe by a minimum of 1 foot.

Prior to placing pipe in the trench, a cushion of approved materials shall be placed in the trench as required by, "Excavation, Trenching and Backfill." Backfill material shall be carefully placed on the pipe so as to avoid any damage to the polyethylene sleeve.

The Contractor shall use care to protect and preserve the polyethylene wrap around ductile iron water mains when installing service corporations. The required method is to wrap pipe tape around the pipe over the polywrap in the area to be tapped. The tap is to be made through the tape and polywrap. It is not necessary to remove and replace poly wrap. All exposed pipe, the corporation, and the first 3 feet of the service shall be wrapped and taped to achieve a complete seal. In addition, a sand envelope shall extend over and around the connection to a depth of 12 inches above the main.

2. Polyethylene Tubing:

Polyethylene tubing shall conform to the latest revision of AWWA Standard C901, have a working pressure of 250 psi and shall meet the nominal size as shown on the plan. All tubing shall be copper tube size, meeting ASTM specifications D-1248, D-2239, and D-2737 and shall meet PE 4710 requirements.

3. Copper Tubing:

Copper tubing shall conform to the requirements of ASTM-B88, Type K, “Annealed” (soft).

4. Inspection:

All pipe and tubing shall be thoroughly inspected before being installed. All cracked or otherwise defective pipe shall not be laid but shall be removed immediately from the work, and new materials of acceptable quality shall be furnished at the contractor's expense.

5. Bolts:

Bolts for all Flexible Couplings, Flanged and Mechanical Joints shall be high strength; low alloy steel bolts only, conforming to the latest revision of AWWA C111. Bolt manufacturers certification of compliance shall accompany each shipment.

C. *DESIGN AND CONSTRUCTION*

1. The minimum allowable size of any public water main shall be eight (8) inches in diameter unless otherwise approved by the Department of Public Works and Parks - Water Operations.

2. All water mains shall have a five (5) foot minimum and an eight (8) foot maximum depth of cover as measured from the top of the pipe to finish grade.

3. All pipes shall be thoroughly cleaned before being installed, and shall be kept clean until accepted in the finished work. The ends of all uncompleted lines shall be tightly closed with temporary plugs at all times when the pipe laying is not in progress, and no trench water or debris shall be permitted to enter the pipe.

4. The contractor shall furnish the necessary pumps and tools to handle any water encountered in the pipe trench, and shall maintain the trench in a satisfactory condition, free from water, during the laying of the pipe. The pipe, after being laid in place, shall not, under any circumstances, be used as a drainpipe for the trench. Pipe shall be set in accordance with manufacturer's recommendations. Pipe or fittings requiring cutting shall be beveled so that the cut end does not damage the gasket. Joint ends of pipe shall especially be kept clean.

5. All tees shall be three (3) way gated and all crosses shall be four (4) way gated, unless otherwise directed by the Contracting Officer.

6. Small depressions shall be excavated in the trench bottom to accommodate the pipe bells and to assure continuous support of the pipe.

7. When new mains are installed, the corporation stops shall be installed (dry tap) prior to the hydrostatic pressure test or as the Contracting Officer directs.

8. All work shall conform to Typical Trench Detail W-5 which is part of these specifications.

D. *EXCAVATION, TRENCING AND BACKFLIING*

1. Excavation for water main and water service trenches shall be wide enough to permit the pipe to be properly installed and the backfill to be placed and compacted. Depth of the trench shall be such as to provide five (5) feet minimum cover from the top of the pipe to finished grade. The City may prohibit heavy-duty pavement breakers when their use endangers existing substructures or other property. Unstable pavement shall be removed over cave-ins and breaks and the sub-grade shall be treated as the main trench. The contractor shall not be required to pay for the repair of any pavement damage existing prior to the excavation unless the contractor’s cut results in small floating sections that may be unstable. If this occurs, the contractor shall remove the unstable portion and the area shall be treated as part of the excavation. The maximum length of open trench permissible in the street or sidewalk, at any time, shall be two hundred (200) feet. No greater length shall be opened for pavement removal, excavation, construction, backfilling, patching or any other operation without written permission of the City.

2. The extent of excavation necessary to make tie-ins or taps between new and existing pipes shall be kept to a minimum consistent with room needed to accomplish the work.

3. Where existing bituminous concrete pavement is to be removed to allow for excavation, the pavement shall be precut in a neat, clean straight line with a pavement breaker or saw. The minimum width of any excavation shall be twenty four (24) inches. Pavement edges shall be trimmed to a vertical face and neatly aligned parallel and perpendicular to the center line of the trench. Pulverization of a trench shall be considered an acceptable procedure to remove the existing bituminous concrete pavement provided that the trench is cut in a neat, straight line with a pavement breaker or saw prior to permanent restoration.

4. Backfilling of trenches shall follow as soon as possible and/or practical after the installation of water mains and water service pipes. The purpose of the backfill material which shall be placed under, around and over the pipe is to:

   a. Provide support for the pipe

   b. Provide lateral stability between the pipe and the trench walls

   c. Form a cushioning layer over the pipe to prevent damage

   d. The first layer of backfill shall be placed under and around both sides of the pipe, joints, valves and fittings, up to the center line of the pipe, and thoroughly compacted with hand tampers or approved mechanical rammers which shall not come in contact with the pipe.

e. All water mains and/or water service pipes shall be properly bedded in a pipe envelop consisting of moist sand borrow. The pipe shall be set on six (6) inches of moist sand borrow and backfilled with such sand, well compacted to a level of one (1) foot above the pipe.

f. The backfill between the top of the pipe envelope and a point one (1) foot below the bottom of the existing or proposed pavement surface shall be selected common fill from the excavation suitable for proper compaction as the Field Engineer directs. It shall be the contractor's responsibility to adjust the moisture content of the soil in the field as necessary to achieve the specified compaction. If the excavation material is not suitable in the opinion of the Field Engineer, then gravel borrow, conforming to MHD Standard, Section M1.03.0, Type B shall be used.

g. In public streets, the top of the compacted backfill shall be left one (1) foot below the bottom of the existing pavement surface and the remainder of the trench backfilled with gravel borrow conforming to MHD Standard, Section M1.03.0, Type B. This layer of gravel borrow shall form the sub-base of the road.

h. All sand and gravel borrow shall be as specified in Section 100.

5. Prior to beginning backfill operations, the contractor shall be responsible for contacting the Field Engineer to obtain a soil sample. The soil sample will then be forwarded to an approved material testing agency to insure its compliance with the project's specifications. A maximum laboratory dry density of the soil will be determined in accordance with ASTM D698. It will benefit the contractor to provide a soil sample prior to the beginning of the project. This will allow field density test values to be calculated, as the excavation is being backfilled and allow for additional passes with compaction equipment, if necessary. It will also be the responsibility of the contractor to notify the Contracting Officer if any change in soil characteristics occurs. Approved backfill material shall be placed in lifts not to exceed ten (10) to twelve (12) inches and thoroughly compacted by mechanical or pneumatic compactors to at least ninety-five per cent (95%) of the soil's maximum laboratory dry density. Adequate moisture content in a backfill material is essential to achieve effective compaction. It will be the Contractor's responsibility to adjust the moisture content of the soil as necessary to achieve the specified compaction. An approved material testing agency or certified City Engineer will then perform field density testing. Density testing will be performed at intervals of one (1) test per one hundred (100) linear feet of the compacted lift. In the event that the project is of a short duration or begins prior to obtaining the soil's maximum laboratory dry density (which is necessary in determining field density test results), the contractor shall assume full responsibility for re-excavating and re-compacting areas of failed field density tests. Due to the hazardous nature of performing field density testing in deep excavations (6 feet or deeper), the contractor shall be responsible for establishing a method of compaction using mechanical or pneumatic compactors that assures each lift is compacted to at least 95% of the soil's maximum laboratory dry density. As the excavation is brought to grade and field density tests are taken, the Field Engineer, along with the contractor, shall establish a sufficient compaction method necessary to achieve at least ninety-five per cent (95%) of the material's maximum laboratory dry density based on the type of compaction equipment, number of passes and existing soil type and moisture content.

BUCKET WHACKING AND WATER JETTING WILL NOT BE PERMITTED.

6. Hand excavation may be required when mechanical equipment cannot gain access, or in the opinion of the Field Engineer is required, due to conflicts with underground structures.

7. When excavation of rock is necessary, all rock shall be removed to provide a clearance below and on each side of all pipe, valves and fittings of at least six (6) inches for nominal pipe sizes up to twenty four (24) inch. When excavation is completed, a minimum of six (6) inches of gravel borrow shall be placed between the rock and the bottom of the pipe envelope. This layer of gravel borrow shall be placed leveled and compacted prior to the installation of any pipe. This gravel borrow shall be **"Type B"** as specified in Section 100. These clearances and bedding procedures shall also be followed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers or foundations that may be encountered during excavation. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection or point of rock, boulder or stone of sufficient size and placement that could cause a fulcrum point or point load.

8. The Contractor will have adequate equipment, such as magnetic or electronic pipe locators so that he may pinpoint locations of water services in the event City personnel cannot furnish timely information on locations.

9. Streetcar rails will be occasionally encountered on some City streets. When they are, the Contractor may be directed by the Field Engineer to cut them with an acetylene torch or some other means, and dispose of them satisfactorily.

10. If tree roots are encountered and must be removed in order to facilitate the installation of the water pipe, the Contractor shall satisfactorily remove them. Care shall be taken so to minimize the damage to the trees.

11. Materials from all classes of excavation which are unsuitable and any surplus suitable materials remaining after the completion of backfilling shall be known as **waste** and shall be disposed of by the Contractor at no additional cost to the City.

12. Calcium Chloride shall be applied to any backfilled trench for dust control. The calcium chloride shall be placed at the discretion and direction of the Field Engineer. Calcium Chloride shall be uniformly applied at the rate of 1-1/2 pounds per square yard or at any other rate as directed by means of a mechanical spreader, or other approved means.

13. Whenever additional information is required regarding the location of existing sub-surface structures, the Field Engineer may direct the Contractor to excavate test pits of such dimensions as may be required. If the Field Engineer deems it necessary to dig a test pit, the Contractor shall cut the pavement, excavate and properly backfill the test hole as outlined in this section.

EXCAVATING AND BACKFILLING TRENCHES IN NEW STREETS LESS THAN FIVE (5) YEARS OLD

All applicable provisions of section 3.03 above shall apply to cutting through the existing pavement. The date used to determine the age of a street shall be the date of final paving. When excavating trenches in new streets less than five (5) years old, all material excavated shall be removed from the project site. No material shall be placed on the roadway. All excavated material shall be loaded directly into a dump truck for disposal off site. Upon completion of water, sewer and/or utility work, a one- (1) foot envelope of approved pipe bedding material shall be placed over installed lines. The trench shall then be backfilled using excavatable Controlled Density Fill (CDF), Type 2E. For rigid base roads, the trench shall be filled with CDF to the bottom of the rigid base. Prior to backfilling with CDF, the Contractor may be required to notify the Contracting Officer for the purpose of obtaining a sample for compressive strength testing.

E. ***DISINFECTION***

1. Disinfection shall be in accordance with the latest revision of AWWA Standard 651 Disinfecting Water Mains. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination during construction. The water main shall be flushed prior to disinfection except when the tablet method is used.

2. The disinfection shall be accomplished by pumping a chlorine solution into the pipes by using the continuous feed method of disinfection. The initial chlorine dose concentration shall be 25 mg/l with a free chlorine residual of not less than 10 mg/l after a 24-hour holding period. After the retention period, the chlorinated water shall be flushed from the main until chlorine concentrations in the water leaving the main are no higher than that generally prevailing in the distribution system.

3. The tablet method of disinfection shall not be used without the expressed approval of the Contracting Officer.

4. After final flushing and before the new water main is placed in service, two (2) consecutive sets of acceptable samples, taken at least 24 hours apart, and shall show the absence of coliform bacteria. At least one (1) set of samples shall be collected from the new main. All samples shall be tested for bacteriological quality and be collected from every 1,200 feet of new water main plus one (1) set from the end of the line and at least one (1) set from each branch. All samples shall be collected by DPW&P at no charge to the contractor. All plastic pipe and hose for bacteria sampling shall bear the imprint of the National Sanitary Foundation (NSF) approval for potable water, NSF-PW or shall be capable of meeting the standards established by the NSF for its use and shall have no threaded ends unless otherwise directed by the Field Engineer.

5. If initial disinfection fails to produce satisfactory bacteriological results, the new main shall be re-flushed and shall be re-sampled. If these check samples also fail to produce acceptable results, the main shall be re-chlorinated until satisfactory results are obtained. When check samples are taken, it is advisable to sample water entering the new main also.

6. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any question that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, Federal, State and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. The contractor shall be responsible for the proper disposal of all heavily chlorinated water at no cost to the City. Any temporary connection to the main or other facilities required to accomplish the chlorination as just described shall be at the contractor's expense. Any temporary connections shall be properly abandoned as determined by the Contracting Officer at no cost to the City.

F. *HYDROSTATIC TESTING*

1. Hydrostatic Testing shall be in accordance with the latest revision of AWWA Standard C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
2. Hydrostatic pressure test shall be made at 1.5 times the working pressure but not less than 150 psi for a period of not less than 2 hours (see exception for fire systems below and Section E paragraph 7 per NFPA 24). The working pressure shall be based on the static pressure at the lowest point of the line or section under test. The test pressure shall not vary by more than 5 psi plus or minus for the duration of the test.
3. If permanent air release valves are not located at all high points, the contractor shall install temporary connections as necessary to expel any air in the line. All temporary connections shall be removed and plugged as directed by the Contracting Officer at no cost to the City. When hydrants are in the test section, the test shall be made against the closed hydrant.
4. A leakage test shall be conducted concurrently with the pressure test. No pipe installation will be acceptable if the leakage is greater than the allowable leakage as determined by the formula listed in the above-referenced AWWA Standard. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
5. If any test of laid pipe discloses leakage greater than that specified, the contractor shall, at no cost to the City, locate and repair defective material until leakage is within the specified allowance.

G. *SPECIAL CONDITIONS*

1. If requested by the contracting officer the contractor shall return all existing valves and valve boxes removed under normal excavation to the Millbury Street Yard (formerly Ballard Street Yard) at no additional cost to the City.
2. Unless otherwise specified the existing pipe shall be removed and the new pipe installed within the same trench. The existing water pipe to be removed shall become the property of the contractor and shall be properly disposed of at **no** additional cost to the City.
3. Where a main is going to be abandoned in place, as specified on the plans, the service and valve boxes shall be removed and stacked at the 1065 Millbury Street at no cost to the City if requested by the contracting officer.
4. During the cutting of tees, crosses, valves; the installation of tapping sleeves and the repair of leaks and breaks, sanitary construction practices shall be followed so there is no contamination of the new or existing water main with foreign material or groundwater. Any and all pipe, valves, couplings, and fittings used as listed above shall be disinfected as outlined in the latest revision of ANSI/AWWA Standard C651 for Disinfecting Water Mains.
5. All dedicated fire protection/fire sprinkler pipes shall be hydrostatically pressure tested in accordance with the latest revision of National Fire Protection Association standard, NFPA 24. Hydrostatic test shall be made at not less than 200 psi or 50 psi above static pressures in excess of 150 psi for two (2) hours. A typical “Contractor’s Material and Test Certificate for Private Fire Service Mains” shall be submitted to the Worcester Fire Department upon successful completion of all work, inspections and tests.
6. Where CDF (controlled density fill) is used, care shall be taken to avoid any contact between the CDF and pipe or fitting surfaces either by the use of approved polywrap around the pipe, gravel fill encasing all metallic surfaces to a depth of at least 6” above pipe surfaces or a combination of these methods as directed by the contracting officer.

[redacted]

ITEM 305.02 2” BALL VALVE

ITEM 305.04 4” GATE VALVE

ITEM 305.06 6” GATE VALVE

ITEM 305.08 8” GATE VALVE

ITEM 305.10 10” GATE VALVE

ITEM 305.12 12” GATE VALVE

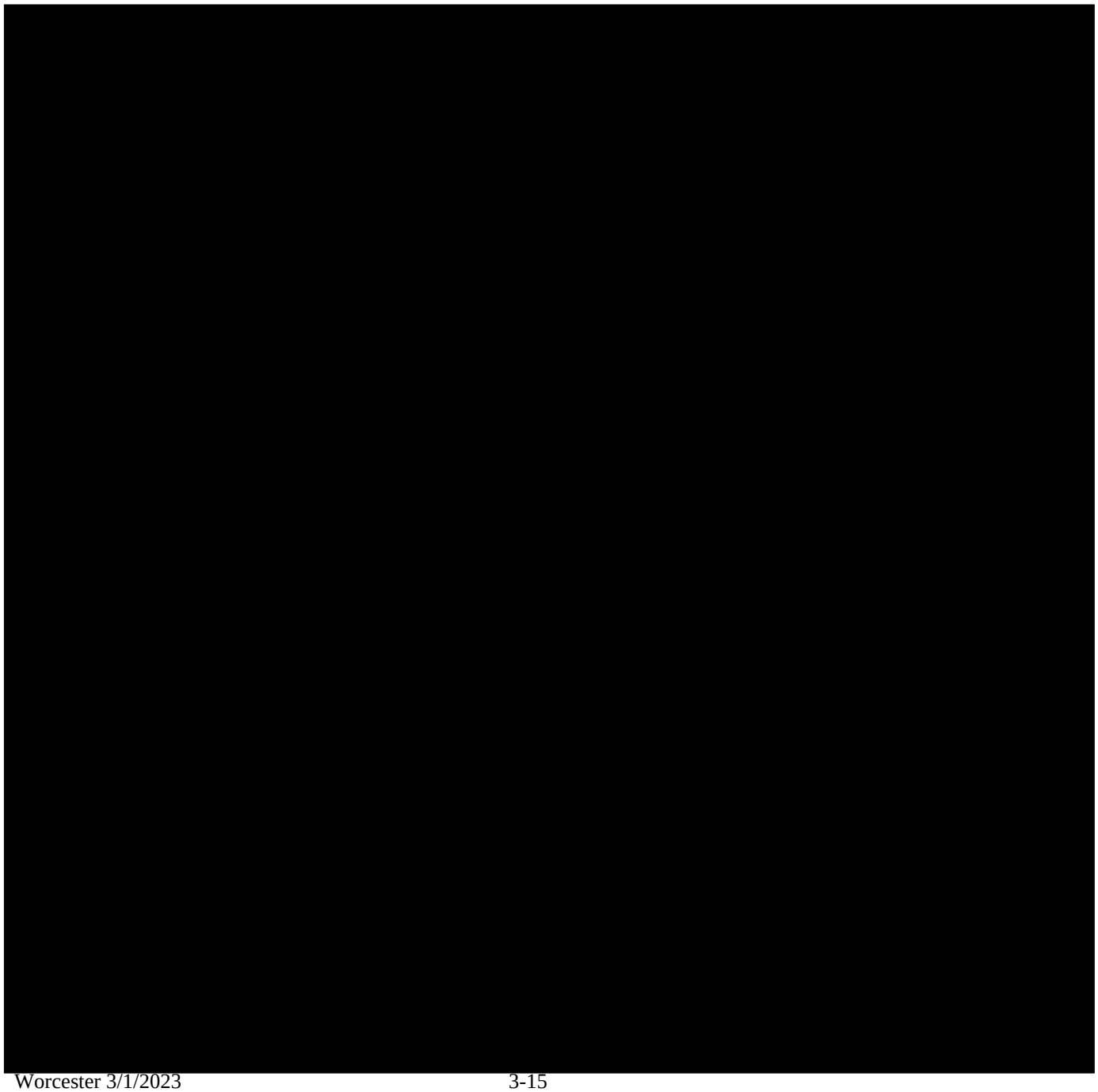
[redacted]

Resilient-Seated Disc Wedge: The resilient-seated disc wedge shall be fully (100%) encapsulated in rubber. The rubber shall be securely bonded to the wedge, including the part which houses the stem nut. The stem hole through the wedge shall be full opening top to bottom and shall also be covered with rubber. Disc wedges that are not 100% fully encapsulated shall not be acceptable.

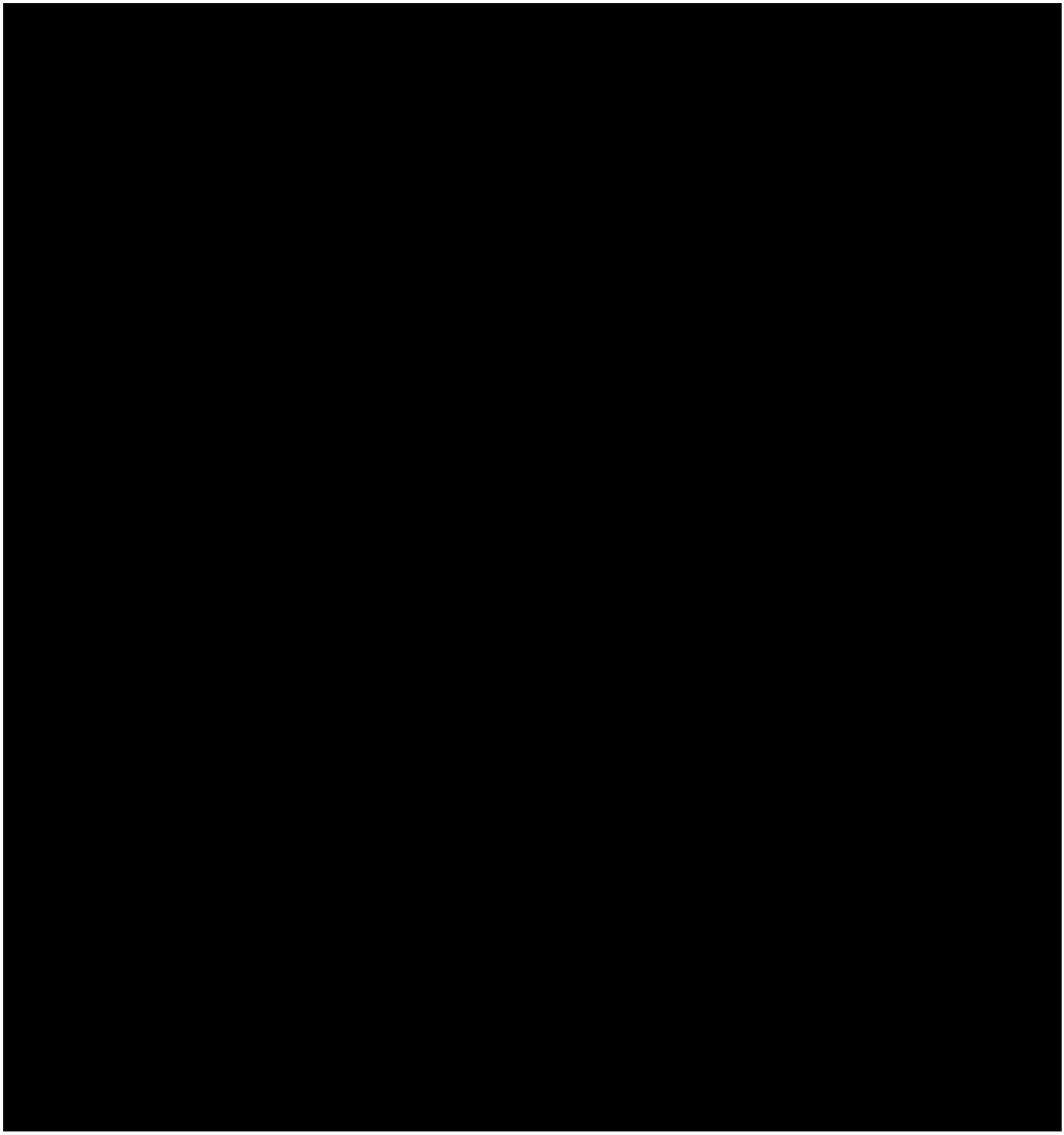
Bolting: All resilient-seated gate bonnet bolts, seal or gland plate bolts, stuffing box bolts or any other bolts with threads exposed to the environment shall be type either 304 stainless steel, everdur bronze, cadmium-plated (ASTM B766), or zinc-coated (ASTM A153 or ASTM B633).

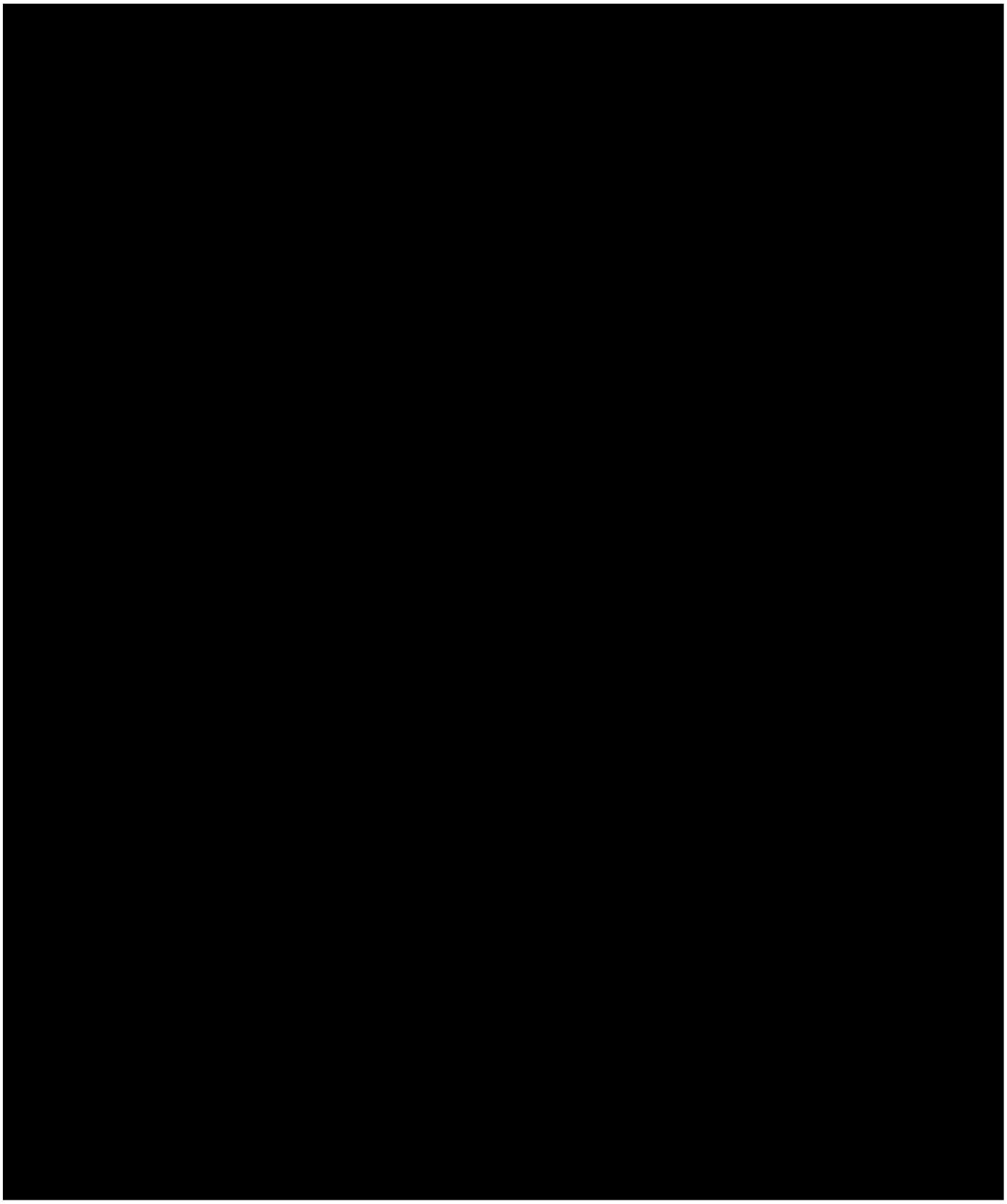
Tapping Valves: Tapping valves shall be furnished with the tapping flange on the inlet side shall have a raised face or lip designed to engage the corresponding recess in the tapping sleeve flange in accordance with MSS-SP60. Flanged tapping valves without the raised face shall not be allowed because they do not assure the proper alignment required to prevent damage by a misaligned shell cutter. The interior of the waterway in the valve body shall be a full opening capable of passing a full-sized shell cutter equal to the nominal diameter of the valve.

Country of Origin: To insure compliance with AWWA and other applicable standards, and access to manufacturing facilities for inspection purposes, and assure timely shipment and delivery, all gate type valves shall be manufactured, assembled, and tested in plants located within the continental United States.



All valves, except 2 inch, shall be fitted with a standard 2 inch square operating nut and shall **open right (clockwise)**.





Water Operations shall check and clean all main gates needed for a shutdown before the contractor starts the work.

ITEM 310 HYDRANTS

ITEM 310.1 NEW HYDRANT

ITEM 310.2 HYDRANT EXTENSION

ITEM 310.3 HYDRANT REMOVED AND STACKED

ITEM 310.4 HYDRANT REMOVED AND RESET

ITEM 310.5 INSTALL NEW CITY SUPPLIED HYDRANT

A. ***SCOPE OF WORK***

The work under this section shall consist of [redacted] installing new hydrants and removing and resetting existing hydrants, as specified herein, as shown on the plans, or as directed by the Contracting Officer.

B. ***MATERIALS***

[redacted]

[redacted]

C. ***DESIGN AND CONSTRUCTION***

The contractor shall be responsible for obtaining properly sized hydrants. There shall be no additional compensation to the contractor if an extension is required to raise the hydrant up to obtain the proper exposed hydrant height.

Hydrant heights shall be obtained by measuring the distance from finish grade to the bottom or invert of the connection pipe.

The centerline of the lowest nozzle of the hydrant shall be eighteen (18) inches above finish grade.

The hydrant shall have a set back of twelve (12) inches from the curb line to the point of the hydrant nearest the curb or as the Contracting Officer directs.

All hydrants shall be installed in the grass plot between the curb and the sidewalk wherever possible.

The pumper connection of the hydrant shall face the street.

In the event that a hydrant is borrowed from the Water Operations' yard, the contractor shall submit a Purchase Order for the exact hydrant height that was obtained.

Hydrants shall be properly supported and held plumb while the connections are being made, and during backfilling. One-half cubic yard of pea stone shall be placed as directed to drain each hydrant drip.

A layer of 8 mil. polyethylene shall cover the pea stone prior to backfilling to prevent clogging of the drainage area

Thrust blocks shall be placed in accordance with the details and as directed by the Contracting Officer.

Hydrants shall be located not more than 300 feet apart in high value areas, and shall not exceed 500 foot spacing in residential areas, and shall be located as directed by the Contracting Officer.

Abandoning any hydrant shall include the removing, transporting and unloading of the existing hydrant at 1065 Millbury Street. The cutting out of the hydrant tee and the installation of a section of appropriate sized CLDI pipe; the removal and stacking of the valve box; and the cutting and plugging of the old connecting pipe.

The contractor shall verify in the field that each hydrant drains in a reasonable amount of time and shall be approved by the Contracting Officer before acceptance.

The controlling valve for the hydrant shall be restrained to the water main by the use of an Anchor Tee.

The fire hydrant barrel, from the surface to the valve, shall be polywrapped as specified herein.

[redacted]

ITEM 812.2 LIGHT STANDARD FOUNDATION CONCRETE

A. ***GENERAL***

The work under this item shall conform to the relevant portions of Section 801 (MSSHB) and the following:

The work shall include the furnishing and the installation of concrete light standard foundation for street lighting system in accordance with the plans and as directed by the Engineer.

The quantity of light standard foundations estimated under this item is for the comparison of bids only and is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon the actual conditions encountered as provided for in Section 4.06 (MSSHB).

B. ***MATERIALS***

Refer to the plans for the details of the light standard foundations.

Light standard foundation concrete shall meet the requirements of Section 801.62 (MSSHB).

C. ***CONSTRUCTION METHODS***

All light standard foundations shall be constructed per Section 801.62 (MSSHB), except as deviations may be required based on field conditions. All deviations must be approved by the engineer prior to making any changes.

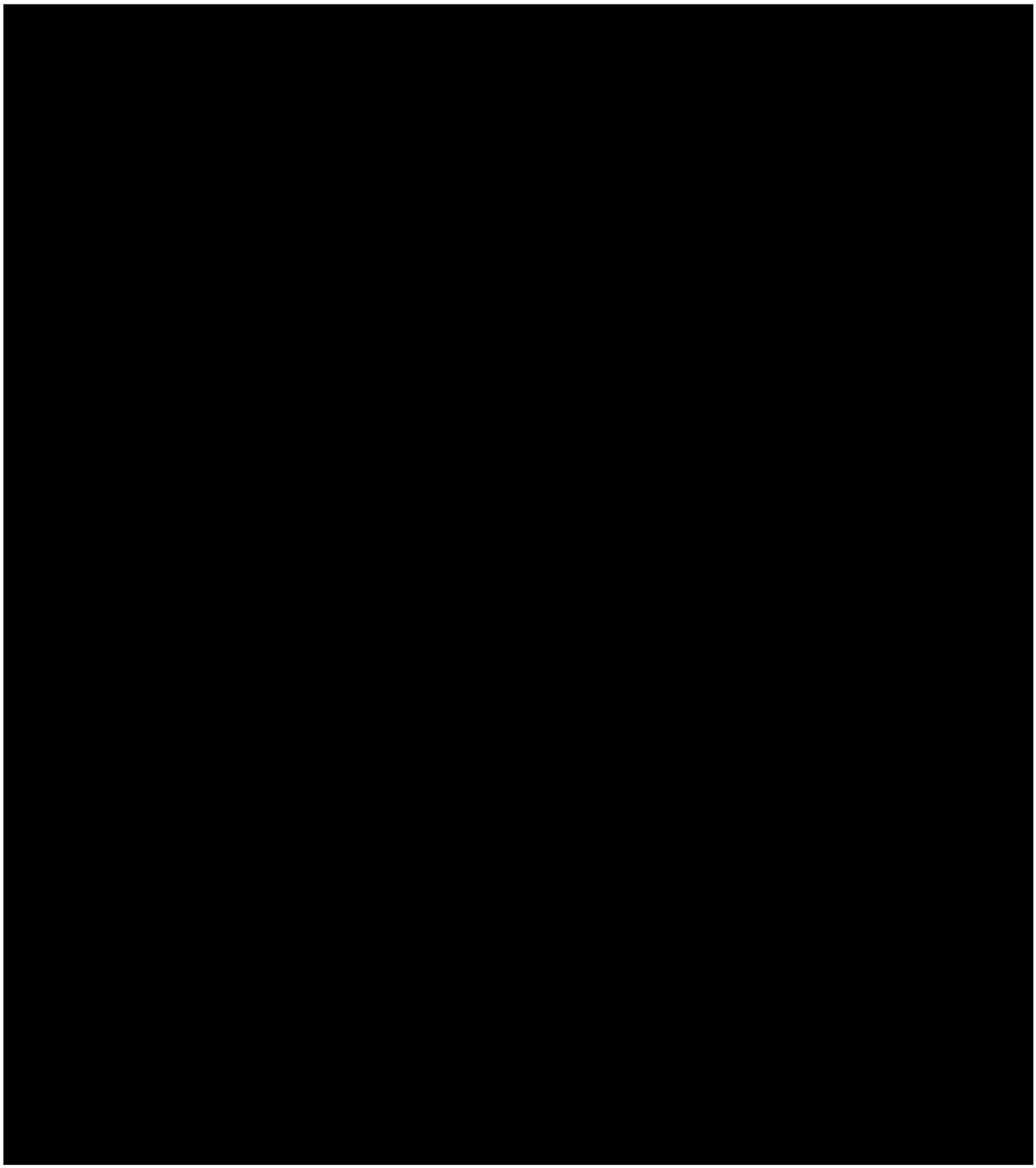
D. ***INSTALLATION***

Light standard foundations shall be placed per the plans and shall be positioned using an approved grade so that the top of the concrete is as indicated on the plans in comparison to finish grade.

Furnish and install 20 inch sonotube, reinforcing rods and hoops, as shown on the plans, and per the Structural Engineers recommendations. Confirm exact light fixture pole base anchor requirements with the manufacturer prior to furnish and installation and install accordingly.

Furnish and install a 5/8” X 10’ long copper clad ground rod, a grounding clamp, and #8 ribbon braid ground conductor.

Furnish and install 2” rigid steel conduit, stubbed out from base, as shown on the plans.



DOCUMENT A00826

CHARTER COMMUNICATIONS/SPECTRUM CABLE

CITY OF WORCESTER STANDARDS

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Charter Communications/Spectrum Cable City of Worcester Standards

Spectrum

Charter Communications / Spectrum Cable

City of Worcester Standards

March 21st, 2022

Spectrum

Table of Contents:

811 Know what's below. Call before you dig.

Permits:

- The Excavator will secure a permit for all work.
- The excavator is responsible for all drawings, engineering and fees associated with permits
- The Excavator is responsible for making sure their Bond is up to date with the municipality if not working under Charter/ Spectrum's Bond
- The excavator is responsible for maintaining Insurance and must notify Charter / Spectrum and The City of any Changes:
- Excavator Must Call Dig Safe before any project
- If Dig Safe is not called Contractor will be responsible for all fines

Excavation:

- The excavator shall give a minimum of one weeks' notice to the Permit's Dept. and charter of all work
- The excavator will follow all City Standards in Worcester DPW's latest version of Standards services book
- Charter Coordinator expected to be on-site and complete inspections daily
- The excavator is expected to take photos of each stage to be provided to Charter
- The excavator will wear all required PPE, for the job they are doing
- The excavator will use appropriate signage laid out by DOT's "Traffic Management plans"
- The excavator's equipment will be in good working order, and all safety devices and procedures will be followed for every piece of equipment

Restoration

- Contractor to follow all City Standards in Worcester DPW's latest version of Standards services book
- Contractor will guarantee Pavement work for a period of 6 years
- Contractor and Charter project coordinator inspections expectations:
    - Temporary patches every 30 days until permanent patch
    - Permian Repairs will be checked every 30 days for 2 cycles then @ coordinators discretion / Normal routes.
- All Grass and Loam will be guaranteed for 90 days
- And new or existing plants or bushes will be guaranteed for 1 year

Permits:

- The Excavator will secure a permit for all work.
- The excavator is responsible for all drawings and fees associated with permits

BOND:

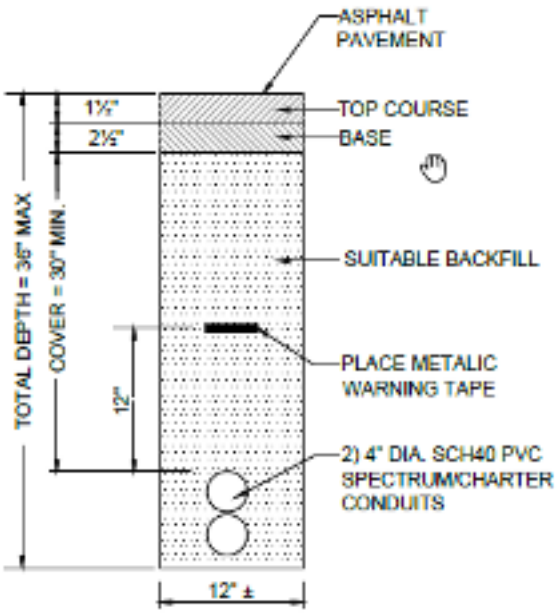
- The Excavator is responsible for making sure their Bond is up to date with the municipality if not working under Charter/ Spectrum's Bond

INSURANCE REQUIREMENTS

- The excavator is responsible for maintaining Insurance and must notify Charter / Spectrum and municipalities of any Changes:
- Examples:
    - General Liability:
    - Comprehensive Form Aggregate

Excavator Must Call Dig Safe before any project

- If Dig Safe is not called Contractor will be responsible for all fines



TRENCH DETAIL NOTES:
1.30" MINIMUM COVERAGE ON TOP OF CONDUIT PER CITY SPECS
2. 12" FROM TOP OF CONDUIT TO METALLIC WARNING TAPE
3. RESTORE SIDEWALKS AND WALKWAYS TO SAME OR BETTER CONDITIONS

EARTH EXCAVATION

GENERAL

- This section Reviews standards for cutting roads, the excavation, and backfilling of dirt. This does not cover pavement restoration that will be another section
- Excavator will call in Dig safe on all excavations
- All work will be completed by a properly licensed Hydraulics Operator

CUTTING THROUGH All PAVEMENT AND CONCRETE STREETS / SIDEWALKS

From city of Worcester permitting Handbook:

- When existing concrete or pavement is to be removed to allow for excavation, the pavement shall be precut in a neat, clean straight line with a pavement breaker or saw.
- The minimum width of any excavation shall be 24 inches.
- The maximum Width would be 24 Inches outside the limits of the pipe or structure
- Pavement edges shall be a vertical face and parallel
- Pulverization of a trench will be considered an acceptable procedure provided that the trench is cut in a neat straight line with a pavement breaker or saw prior to permanent restoration.
- Unstable pavement shall be removed over cave-ins and breaks and the subgrade shall be treated as the main trench.
- The Permittee shall not repair of any pavement damage existing prior to the excavation unless the Permittee's cuts results in small floating sections that may be unstable.
    - If this occurs, the permittee shall remove the unstable portion and the area shall be treated as part of the excavation.
- The maximum length to open trench permissible, at any time, shall be two hundred (200) feet
- Excavation should if possible be minimum of twenty-four (24) inches from the face of the curb.
    - If the excavation is less than five (5) feet from the face of the curb, then the repair must go to the curb

EXCAVATING TRENCHES IN NEW STREETS LESS THAN FIVE (5) YEARS OLD

From city of Worcester permitting Handbook:

- All applicable provisions of CUTTING THROUGH PAVEMENT – IN STREETS shall apply to new streets less than five (5) years old.
- All material excavated shall be removed from the project site.
- No material shall be placed on the roadway.
- All excavated material shall be loaded directly into a dump truck for disposal off site.

SHEETING AND BRACING

From city of Worcester permitting Handbook:

- The Contractor shall furnish, put in place, and maintain such sheeting and bracing, etc., as may be required to support the sides of the excavation and to prevent any movement of earth
- Sheeting will be required at all times when digging 5 feet or lower
- following all OSHA Safety Guidelines

BACKFILLING OF EXCAVATION

From city of Worcester permitting Handbook:

- If replacement fill is needed Backfill material is needed it shall be replacement gravel, Type B, with no stones larger than three (3) inches in diameter.
- It will be the Contractor's responsibility to adjust the moisture content of soil in the field as necessary to achieve compaction.
- Backfill materials shall be considered unsuitable when containing at least one of the following:
    - Material with a maximum unit dry weight per cubic foot less than 90 lbs.
    - Material containing visible organic matter, topsoil, organic silt, peat, construction debris, roots or stumps.
    - Material designated in the field by the coordinator
- Approved backfill material shall be placed in lifts not to exceed ten (10) to twelve (12) inches
- Lifts will be thoroughly compacted by mechanical or pneumatic
- **BUCKET WHACKING AND WATER JETTING WILL NOT BE PERMITTED**

BACKFILLING OF EXCAVATION IN NEW STREETS LESS THAN FIVE (5) YEARS OLD

From city of Worcester permitting Handbook:

- Backfill material within the streets shall be replacement gravel and comply, Type B, with no stones larger than 1 (1) inches in diameter.
- Fllowabale Fill is required on the main fill of all roads less than 5 years

NOISE, DUST, DEBRIS

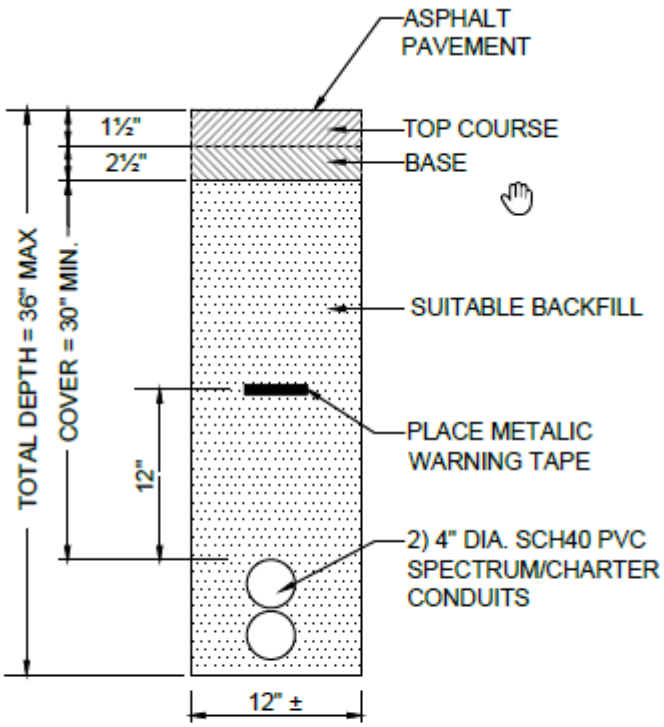
- The Excavator shall conduct work in such manner as to avoid unnecessary inconvenience and annoyance to the general public and occupants of the neighboring properties.
- The Excavator shall take appropriate measure to reduce, to the fullest extent practicable, noise, dust, and unsightly debris between the hours of 7:00 p.m. and 7:00 a.m.
- The Excavator, except with the express written permission of the municipality and Coordinator, or in case of an emergency, use any tool, appliance, or equipment producing noise of sufficient volume to disturb Sleep

EXCAVATION DURING WINTER:

- The Excavator will not excavate or open any street or sidewalk from November 15th of each year to April 15th of the next year unless an emergency or special permission is obtained.

Spectrum

Conduit Placement



TRENCH DETAIL NOTES:

1.30" MINIMUM COVERAGE ON TOP OF CONDUIT PER CITY SPECS
2. 12" FROM TOP OF CONDUIT TO METALLIC WARNING TAPE
3. RESTORE SIDEWALKS AND WALKWAYS TO SAME OR BETTER CONDITIONS

- The excavator, per Line Item, will install (2) SCHEDULE 40 PVC conduits while maintaining 30” of Cover at all times. Including sidewalk’s and utility easements
- 3” of lose base material required in any trench that was hammered or sitting on rock
- All joints will be glued and de-burred
- Large PVC sweeps are to be used, no street or hard 90s
- 2 Mule tapes should be left in the conduit at the end of construction

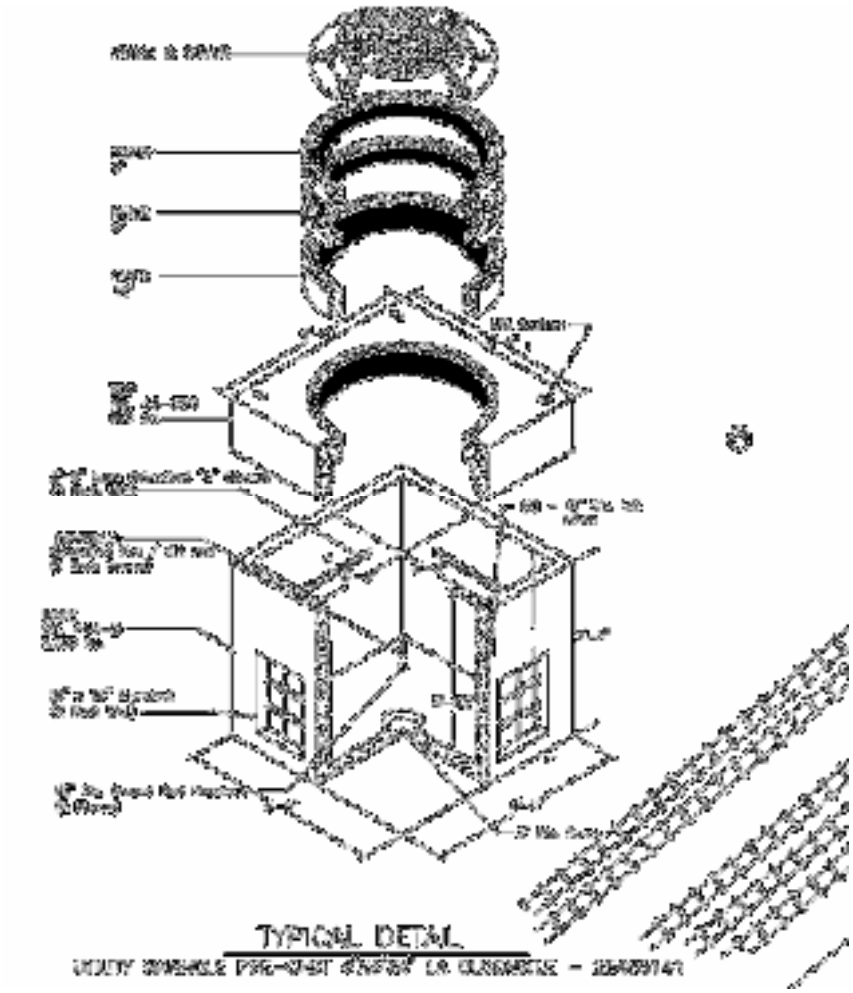
Vault and Manhole Placement

Manholes:

Locking Lid – Hex bolt

3 x 3 interior Minimum -

3” Gravel Base if Dirt Floor



Vaults:

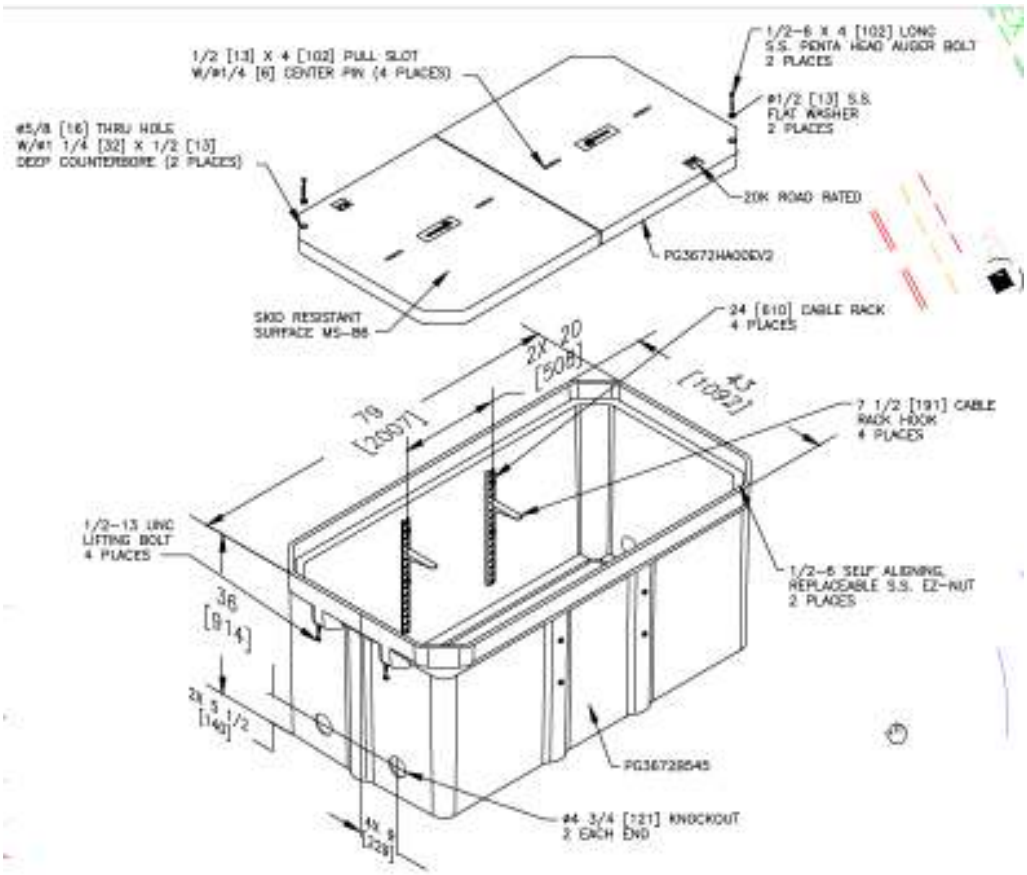
Must be Level

28” Depth minimum

3” crushed stone @ base

Support Bars in place and Cover Locked

20K pounds plus Rated.



TYPICAL DETAIL – VAULT

QUAZITE 36X72X36 ASSEMBLY
W/(4) 24 CABLE RACKS
& (4) 7/1/2 HOOKS

Greenery Standards:

From the City of Worcester Standards:

Trees:

GENERAL

- The Excavator: shall provide trees, hardware, materials, labor, tools, and equipment required to properly complete the work

METHOD OF PLANTING

- All trees required shall be transported, moved and installed with the fibrous root system as a solid mass of earth.
- All tree pits are to have the following minimum dimensions; 6 feet in length by 3 feet in width. This shall then be filled with approved loam

PLANT MATERIALS

- All trees shall be nursery grown and shall have a caliper of 2 - 2-1/2 inches.
- Tree type shall be London Plane Tree, Ginkgo Balboa (male only), Redmond Linden, Washington American Elm
- 18 feet in height.
- root shall be approximately 18 inches in diameter
- FERTILIZER: 16-8-16 (3) YEAR RELEASE
- Tree fertilizer packets shall be installed in the tree planting pit during tree planting installations. A minimum of two (2) fertilizer packets per tree, or as recommended by the manufacturer.

GUARANTEE PERIOD

- After the establishment period, the Contractor shall guarantee that all trees shall be in good health and flourishing condition two (2) years from date of acceptance (120 Days after planting)

Pine Bark Mulch

GENERAL

- Pine Bark Mulch shall be placed be loosely placed in the areas affected to meet current applications. Completed placement shall be no less than 3” in depth,

GUARANTEE PERIOD

- After Installation , the Contractor shall guarantee Color for 60 Days

BUSHES, HEDGE, REMOVE AND RESET

GENERAL

- Excavator will attempt to not disturb and bushes, hedges, and limbs when possible
- Where encountered within the limits of work, hedges shall be removed and reset
- This work shall consist of removing hedges, excavations of pits, placing of backfill mixture, mulching, watering, staking or guying, fertilizing
  - Any cutting of Branches, Limbs, or roots shall be smoothly and neatly done without splitting or crushing.

GUARANTEE PERIOD

- The excavator will be responsible for guaranteeing the health of any hedges / bushes or trees with limbs removed for a period of 1 year.

LOAM

From the City of Worcester Standards

- Loam shall be a “fine sandy loam” or a “sandy loam” Based on the “USDA classifications system”,
  - It shall be of uniform composition,
  - Without admixture of subsoil.
  - It shall be free of stones greater than two inches (2”),
  - It shall be free of lumps, plants and their roots, debris and other matter.

SEEDING

From the City of Worcester Standards:

- Under 150 Sq. Feet
  - Seed required will be @ rate of 50lbs per acre.
  - The contractor is responsible for the initial watering of the seed.
  - If the area does not become established after 90 days, the contractor will be responsible for a reapplication and repair of any erosion occurring due to the exposed loam.
- Over 150 sq. feet:
  - seeding shall be applied using the Hydro seeding method of spraying a combination of seed, mulch, and fertilizer, over properly loamed areas,
  - Hydroseed shall be applied in the following minimum quantities; 50lb seed per acre, 1500lb of hydromulch per acre, and 200lb of 10-20-10 fertilizer.
  - If the area does not become established after 90 days, the contractor will be responsible for a reapplication and repair of any erosion occurring due to the exposed loam

TEMPORARY SURFACE REPAIRS

- As soon as the excavation has been backfilled and compacted, a temporary repair shall be made.
- Temporary paving shall be hot laid binder course conforming to the City of Worcester specifications and shall be placed in a single, two (2) inch course.
- This course shall be compacted to match existing pavement so that it is hard enough and smooth enough to be safe for pedestrian travel over it
- It must be hard enough and smooth enough for vehicular traffic to pass safely over it at the legal rate of speed.
- The temporary patch shall be maintained by the excavator and kept safe for pedestrian and vehicular traffic until the permanent restoration is made
- IF any issues arise with the temporary patch
    - Repairs will be fixed within twenty-four (24) hours.
    - In emergency situations, the City will make immediate repairs and the excavator will be responsible for all fees
- The Permittee shall maintain the temporary paving for a period of not more than ninety (90) days after backfilling is completed.
    - Unless to conform to the schedule below:

SCHEDULE OF PERMANENT PATCHING

TEMPORARY PATCH PLACED	PERMANENT PATCH PLACED
April 1 – April 30	August 1
May 1 – May 31	September 1
June 1 – June 30	October 1
July 1 – July 31	November 1
August 1 – August 31	November 15
September 1 – September 30	November 15
October 1 – October 15	November 15
October 15 – December 30	May 15; following year
December 30 – April 1	May 15

- Water shall not be permitted to rise on concrete within twenty-four (24) hours after it is placed, or shall running water be allowed to flow over completed concrete within four (4) days after it has been placed.
- Not allowed to leave road base until temperature reaches 140 deg

GRINDING AND MILLING

From the city of Worcester handbook

- The depth of material removed should average approximately 1 1/2".
- Removal shall be done by a power operated planning machine or grinder capable of removing, in one pass,
    - 6 feet in width and 1-1/2 inches in depth.
    - The equipment shall also have an effective means for removing excess material from the surface and for preventing any dust resulting from the operations from escaping into the air.
    - The Contractor will be permitted to augment the large milling or grinding equipment with other more maneuverable machines for those areas inaccessible to the 6 foot grinder such as curb or casting cuts.
- All milling or grinding shall be done during daylight hours unless otherwise specified
- The Contractor shall exercise due care not to disturb or break existing manholes, valve boxes, catch basins, monument boxes, castings, etc. All castings broken shall be replaced or repaired at the Contractor's expense.
- The cutting blade shall be such that the irregularities of the roadway pavement are removed without gouging and the blade can cut to the curb and around all castings when necessary.

STANDARD 6 INCH STEEL BOLLARD (COMPLETE IN PLACE)

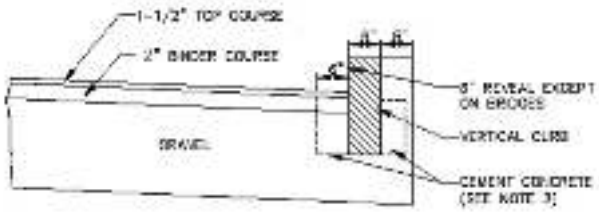
From the city of Worcester handbook:

- Bollard shall be a 6 inch galvanized iron pipe filled with cement concrete.
- Exposed length shall not be less than 4 feet from final grade, and shall be buried for not less than 4 feet. The base around the indicator post will be secured and centered in poured concrete no less than 12 inches in diameter.
- The bollard shall be painted black or yellow at the coordinator or municipality’s decision.
- Bollards shall be located at certain points to serve as a visual and physical barrier for protection from vehicle traffic.

Granite Curb Repair

From the city of Worcester handbook

- Granite curb requiring resetting shall be excavated so that the present curb can be removed without damage.
- When resetting, the length of any section of curb or edging shall be altered by cutting in order to fit closures as necessary.
- Class D = 4,000 p.s.i., 3/4" aggregate Concrete to be used
- **Settlement of curbing shall be repaired by the excavator at no cost to charter for a period of (5) years (charter Standard)**



NOTES:
1. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BINDER, BASE AND STONE. REPLACE WITH CEMENT CONCRETE.
2. ANY CLASS CEMENT CONCRETE THAT IS ACCEPTABLE TO THE DEPARTMENT UNDER SECTION 104 OF THE 1972 STANDARD SPECIFICATIONS, ALL TEST REQUIREMENTS ARE WAIVED. BITUMINOUS CONCRETE SHALL NOT BE USED AS A SUBSTITUTE.
3. PAYMENT FOR CLASS B CONCRETE WILL BE PAID FOR UNDER ITEM 4481.

METHOD OF SETTING VERTICAL CURB

DEPARTMENT OF PUBLIC WORKS AND PARKS
Engineering Division

CONCRETE AND PAVED SIDE WALK REPAIR

From the city of Worcester handbook:

- Where cement concrete or paving block is encountered in roadways it shall be replaced with binder at a thickness equal to the existing rigid road base
- Cement concrete shall be replaced at a minimum thickness of (6) inches in driveways and wheelchair ramps.
- All sidewalks shall be poured on an eight (8) inch gravel base.
- All cuts in concrete sidewalks shall be from the nearest joint or pour line for the full width of the sidewalk.
- The finished surface shall be brushed by drawing a soft-bristled push broom, perpendicular to pedestrian travel, to produce a non-slip surface.
- Joints shall be scored at like intervals but not to exceed five (5) feet; expansion joints every 30 linear feet. A 2-1/2" edge finish shall be required on each side of the joint.
- The broom finish shall extend from the curbing to the back of sidewalk.
- **The finished concrete surface shall be adequately protected for curing and defacement**
- Pavement Sidewalks shall be replaced at a minimum compacted thickness of one (1) inch of ¾" binder and one (1) inch of top course
- **Whenever sidewalks at crosswalks are disturbed for necessary excavations, those sidewalks and curbs shall be reinstalled per American Disabilities Act (ADA) specifications**.
- All work shall be in compliance with the Local municipality Standard Specifications.

PERMANENT SURFACE REPAIR ALL ROADS

From the city of Worcester handbook

- The permanent patch shall be extended one (1) foot on all sides of the temporary patch area.
- The pavement shall be cut in a neat, straight line with a pavement saw only.
- The cut shall be square or rectangular with edges parallel and perpendicular to the trench
- Cuts shall be straight and vertical.
- The permanent patch of bituminous concrete walks shall be the full width of the sidewalk with end cuts straight and perpendicular to the street line.
- A tack coat shall be applied to the vertical faces of the existing pavement before placing permanent patch.
- A permanent patch material shall be applied in two (2) courses in accordance with the following thickness chart:
- . The binder will be placed in courses NOT exceeding 2-1/2 inches. Multiple binder courses will be laid if the existing thickness conditions warrant.
- When two (2) or more openings are made in sequence with fifteen (15) feet or less between the adjacent openings,
    - the excavator shall neatly cut out and remove the area of pavement between these adjacent openings and shall patch the entire area as one trench.
- Not allowed to leave road base until temperature reaches 140 deg
- **The excavator shall be required to correct any trench settlements and/or faulty pavement patches for a period of three (5) years after the permanent patch is placed (charter standard)**
- In the event of a failed permanent patch, the excavator shall be responsible for fully removing the patch, re-grading the sub-grade and re-cutting the trench edges Spot repairs of permanent patches will not be acceptable.

Roads Less than 5 years of age

From the city of Worcester handbook

- Restoration Will Be CURB to CURB for all Trenches
- Trench must be backfilled with “flow Fill”
- After one (1) seasonal movement the permanent patch shall be infrared treated by a firm certified in the infrared process. (4-5-17 list per DPW)
    - Pavement Maintenance Systems, Inc
        - Phone: (978) 531-6182
    - Felix A. Marino Co., Inc
        - Phone: (978) 532-3838
    - **Firehouse Infrared Asphalt Repair**
        - **Phone: (508) 248-7387**
    - D.W.D. Construction
        - Phone: (508 541-4488)
- Not allowed to leave road base until temperature reaches 140 deg
- **After completion of the permanent repair excavator is responsible for all repairs for a minimum (5) years. (charter Standard)**

LONG TRENCHES OVER 100 FEET

- Two-way traffic must be maintained at all times.
  - Unless permission to detour local traffic is given by the DPW and Charter
- The roadway shall be cleared and swept of all debris at the end of each day.
- All sidewalks excavated must be replaced entirely in kind
- Trench will be Temporary patched as work is completed
- Ninety (90) days after work is completed the patch will be rebuilt Following these guidelines:
  - A minimum of 12" beyond each side of the trench,
  - With a minimum width of 8 feet.
  - Shall be milled to a depth of 1-1/2 inches.
  - A tack coat or CRS-1 of RG1 asphalt emulsion shall be applied
  - 1-1/2 inches hot mix top course shall be laid and rolled to meet pre-existing grades
  - Permanent paving shall be applied with a self-propelled mechanical spreader and rolled with a power driven steel wheeled roller. A minimum width of repair will be 8 feet.
  - Not allowed to leave road base until temperature reaches 140 deg
- **After completion of the permanent repair excavator is responsible for all repairs for a minimum (6) years. (charter Standard)**

PROMPT COMPLETION OF WORK

· After an excavation has commenced shall promptly complete All Work.

· The Excavator shall perform such work so as not to obstruct, impede, or create a safety hazard to either pedestrian or vehicular traffic

NOISE, DUST, DEBRIS

· The Excavator shall conduct work in such manner as to avoid unnecessary inconvenience and annoyance to the general public and occupants of the neighboring properties.

· The Excavator shall take appropriate measure to reduce, to the fullest extent practicable, noise, dust, and unsightly debris between the hours of 7:00 p.m. and 7:00 a.m.

· The Excavator, except with the express written permission of the municipality and Coordinator, or in case of an emergency, use any tool, appliance, or equipment producing noise of sufficient volume to disturb Sleep

EXCAVATION DURING WINTER:

· The Excavator will not excavate or open any street or sidewalk from November 15th of each year to April 15th of the next year unless an emergency or special written permission is obtained.

Charter Standards:

- Contractor to follow all City Standards in Worcester DPW's latest version of Standards services book
- Contractor will guarantee work for a period of 6 years
- Contractor and Charter project coordinator inspections expectations:
  - Temporary patches every 30 days until permanent patch
  - Permiant Repairs will be checked every 30 days for 2 cycles then @ coordinators discretion

Vacuum Trenching Standards:

- Use of vacuum trenching must be pre-approved
  - Use of A vacuum without approval will be paid at standard dig rate
  - Line items will be: ER04 + ER06 for every hour the Vacuum is working

- Safety:
  - All Proper PPE must be worn:
    - Hard Hat – Eye Protection – Hearing Protection – Steele toe Boots
    - Other PPE as required
  - Dig Safe All sights
    - If no dig safe Contractor will be liable for all damages
  - Follow all manufactures safety devices and procedures

- Operation:
  - Follow all manufactures safety devices and procedures
  - Average Trench should be only around 6” in width
  - Trenching to follow all items from section 5 (earth Removal) and any other restrictions put in place by the city or town, Vacuum manufacture, or contractor doing work.
  - Permits must be pulled when required
  - All material vacuumed will be properly disposed of or re-introduced into the trench if applicable.
  - Care will be used with debris, as using this equipment can send debris into the air
    - Barriers – to protect homes and vehicles

- Working around Vegetation
  - All items from the Landscaping section apply
  - Care should be used to park the Vacuum so the boom will not interfere with tree canopy.
  - Use water inserted at approx. 1500PSI to create the trench and not harm any roots
  - Fill Trench with Appropriate New Fill

DOCUMENT A00827

NATIONAL GRID BRIDGE AND OVERPASS

CONDUIT SUPPORT SYSTEM GUIDELINES

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National Grid Bridge and Overpass Conduit System Guidelines

32.17 BRIDGE AND OVERPASS CONDUIT SUPPORT SYSTEM GUIDELINES

This standard is intended as a guideline for the installation of National Grid conduits in or on bridges and overpasses. The final conduit support system design will be the responsibility of the Project Engineer.

32.17.10 Process

1. National Grid personnel need to coordinate with the regulating body of the bridge or overpass to secure occupancy rights on the structure, to assure that the proper load limits are designed for, and to meet the project construction timetable.
2. National Grid's Engineering Planning Department shall specify system requirements, e.g. size and number of conduits. Spare conduits shall be included in the design.
3. Design should have no sharp bend of conduits. Design should minimize cable pulling tension.
4. Final design shall be stamped by a professional engineer registered in the state where the construction is taking place.
5. National Grid design acceptance should include review by but not limited to Underground, Distribution Design, Construction Standards, Engineering Planning and Project Management Departments.

32.17.20 Type – Conduit Specification

1. Conduit material shall be type Heavy Wall (HW) Reinforced Thermosetting Resin Conduit (RTRC) in conformance with NEMA TC-14. The conduit and fittings shall have fire resistance properties in accordance with test procedures of Underwriters Laboratories UL 2515.
2. Conduits shall be joined by bell and spigots manufactured integrally as part of the conduit. Adhesive shall be recommended by the conduit manufacturer.
3. Field bending of the conduit shall be accomplished by use of fittings made of the same material as the conduit.
4. Conduit and fittings shall have an ultraviolet inhibitor.

32.17.30 Expansion/Deflection Fitting

1. Expansion/deflection fittings shall be installed in/at all structural expansion joints or at 200 feet maximum spacing, whichever is the lesser distance and on the bridge side of the abutments.
2. Expansion/deflection joints shall be located no closer than 12" from any support.
3. The expansion and deflection setting shall be determined by the Project Engineer.
4. Expansion/deflection fittings shall only be installed on straight portions of conduit runs.
5. Double bell (B-B) stop couplings shall be installed at bridge abutments.

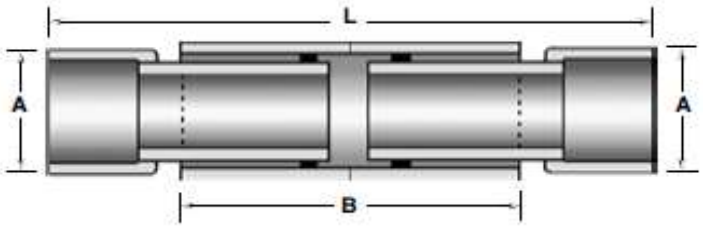

Figure 11 – Expansion / Deflection Joint

32.17.40 Hanger Supports

1. The conduit support system may be made up of anchor hangers and intermediate hangers. All conduit support hardware shall be fiberglass with the exception of bolts. All bolts shall be hot dipped galvanized in accordance with ASTM A153. Attachment of supports to bridge needs to be determined and designed by the Project Engineer.
2. Anchor hangers are required where more than one expansion joint is installed. Anchor hangers have adjustable braces and shall be installed at the midway point between expansion/deflection joints. Split stop rings restrict conduit movement and shall be installed at all anchor hangers.
3. Intermediate conduit hanger supports shall be at 10-12 foot maximum spacing.
4. Squares that enclose conduit in supports should be approximately ½" larger than the OD of the conduit.
5. Support shall permit conduit to expand and contract with temperature and bridge.
6. When needed, windows, sleeves and casings should be designed to permit the conduit to pass through bridge abutments in the same alignment as the hanger support. Such design will make rolling or bending the conduit unnecessary.

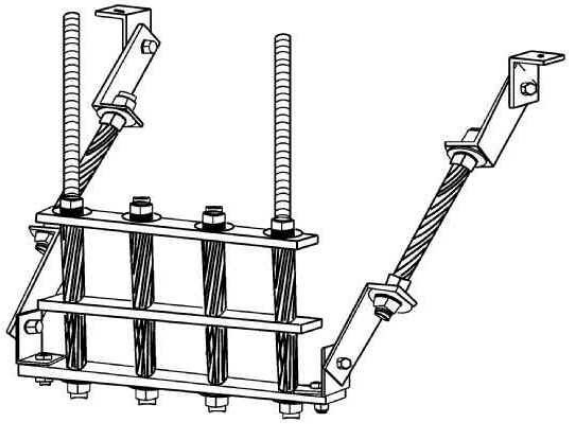

Figure 12 - Anchor Hanger

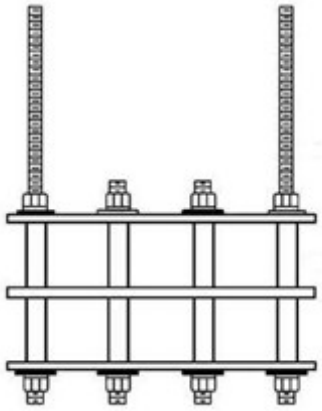

Figure 13 - Intermediate Hanger

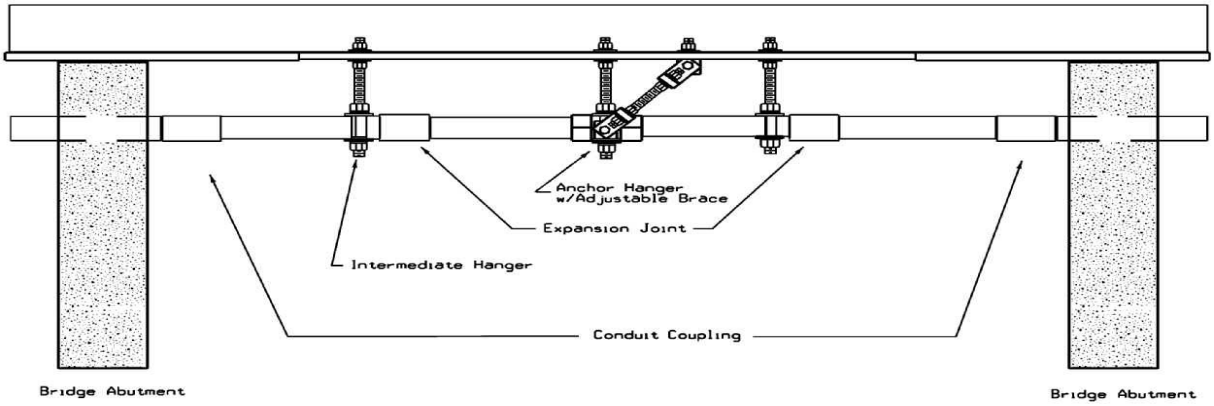

Figure 14 – Typical Bridge and Overpass Conduit Support System

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DOCUMENT A00834

HARRISON STREET OVER I-290
BRIDGE NO. W-44-083

GEOTECHNICAL REPORT

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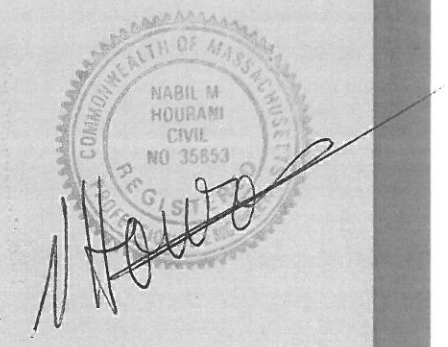
GEOTECHNICAL REPORT

DELIVERABLE: FINAL

HNTB NO: 78900

HARRISON STREET OVER I-290
BRIDGE REPLACEMENT
W-44-083 (212)
WORCESTER, MA
MASSDOT PROJ. #609185

V1.0A: March 2022
V2.0: March 2023



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2.0	3/9/2023	Jason Keohane, PE	Nabil Hourani, PE	Updated version

Note: Use minor 1.1 and major 2.0 versioning to denote changes. Letters denote draft versions (A, B, etc.)

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D – Design Calculations:

1. Seismic Design Calculation
2. Effective Friction Angle Calculation
3. Earth Coefficient Calculations
4. Bearing Resistance of Footings Calculation

1. EXECUTIVE SUMMARY

The Massachusetts Department of Transportation (MassDOT) is planning the superstructure replacement of the existing Harrison Street over I-290 Bridge in Worcester, Massachusetts. The MassDOT Bridge Number is W-44-083 (212). The existing two-span steel bridge was constructed in 1958 and is supported on two concrete abutments and concrete pier footings. According to as-built drawings, the abutment and pier footings are bearing on bedrock. The existing foundations will be reused to support the proposed superstructure replacement.

A subsurface exploration program was conducted by a drilling subcontractor and observed by an HNTB Engineer. One bridge boring was taken at each foundation location to sample the subsurface soils down to Bedrock, where about 10 feet of rock core was obtained. For bridge borings taken behind existing abutments, the concrete abutment was cored before bedrock cores were taken.

Subsurface conditions behind the existing abutments consist of medium dense Sand & Gravel Fill overlying abutment footings, with footings bearing on Bedrock. As-drilled bottom of footing elevations (El.) are 456.0 feet for the West Abutment, and El. 453.3 feet for the East Abutment. Bedrock below the abutments consist of soft to medium hard Slate which is slightly to moderately weathered and moderately to highly fractured.

Subsurface conditions below the existing I-290 roadway near the pier foundation consist of 0.7 feet of dense Gravel & Sand Fill underlain by 2.7 feet of Decomposed Rock, with top of Slate Bedrock encountered at 4.5 feet below top of roadway, or El. 456.5 feet. Bedrock near the pier consists of medium hard Slate which is slightly weathered and moderately to highly fractured.

Upon completion of borings, a non-stabilized depth to groundwater within the boreholes was measured. Based on this information, the groundwater table at the site is most nearly around El. 459 feet.

Based on as-built drawings and the results of the exploration program, the abutment and pier footings appear to be bearing on bedrock. **The Factored Bearing Resistance for all footings on bedrock shall be 14.4 ksf.**

This report will also include construction recommendations including reuse of existing fill, obstructions during excavation, support of excavation and utility protection, and a geotechnical monitoring program.

2. BACKGROUND

2.1. Introduction

GREEN International Affiliates, Inc. (GREEN) has been tasked with the final design for the replacement of the existing Harrison Street over I-290 Bridge in Worcester, Massachusetts. The MassDOT Bridge Number is W-44-083 (212). GREEN has hired HNTB to complete the geotechnical design for the subject bridge.

See **Figure 1 – Site Locus Plan** for the location of the subject bridge.

The geotechnical scope of work comprises a subsurface exploration program and design services associated with the proposed bridge's foundations. This report will be in accordance with the latest AASHTO LRFD Bridge Design Specifications (Reference 1) and MassDOT LRFD Bridge Manual (Reference 2).

Coordinates (Northing and Easting) are in feet and referenced to MA State Plane Coordinate System – Mass Mainland 2001 – NAD 83(07) Datum, and elevations are in feet and referenced to the North American Vertical Datum of 1988 (NAVD88), as used on the project plans.

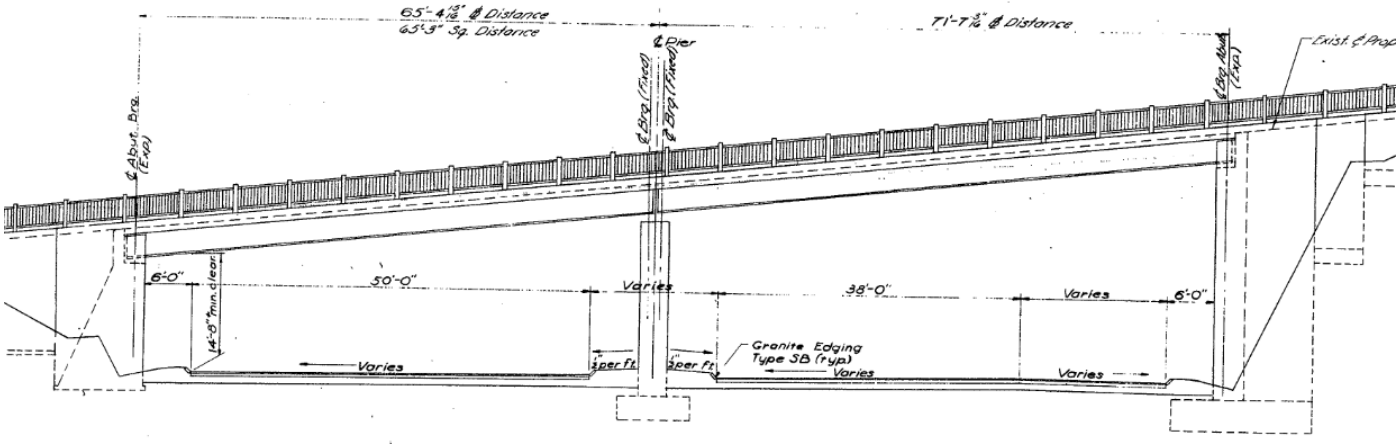
2.2. Existing Bridge

The existing bridge was constructed in 1958 and carries two lanes of traffic on Harrison Street over Interstate 290 (I-290). The bridge is a two-span structure with a length of 137 feet, width of 50 feet, and a skew angle of 4 degrees. The minimum vertical clearance from I-290 is approximately 15'-1" on the westbound side. The superstructure consists of seven (7) W36 girders supporting a concrete deck. The April 2019 Bridge Inspection Report shows that the girders are in "poor" shape with significant rusting and pitting, including areas of complete section loss.

The superstructure is supported by reinforced concrete abutments and wingwalls at the approaches, with the West Abutment being a gravity type and the East Abutment being cantilever shaped. The concrete pier consists of three (3) separate 9-foot square footings each supporting columns which are tied into the pier cap. According to as-built 1958 bridge plans, the pier and abutments are bearing on bedrock which was blasted to construct the existing I-290 roadway. The April 2019 Bridge Inspection Report indicates the substructure to be in "satisfactory" condition with locations of minor cracking and delamination as well as some spalls on the abutment backwalls.

The grade of Harrison Street is about 11% with the top of roadway at about El. 479 feet in the vicinity of the West Abutment, and at about El. 494 feet in the vicinity of the East Abutment. Below the surface of Harrison Street, existing plans show a 10-inch thick and 15-foot long concrete approach slab connected to the backwall of both abutments. The roadway surface of I-290 is at about El. 461 feet beneath the bridge. This section of I-290 consists of two 50-foot highways separated by a 16-foot wide median, with a total width of about 116 feet. Figure 2.1 below shows an elevation view from the south with the West Abutment on the left and East Abutment on the right.

Figure 2.1 – 1958 Bridge Plans South Elevation



The elevations shown in the 1958 Bridge Plans are in reference to the National Geodetic Vertical Datum of 1929 (NGVD29) which have been converted to NAVD88 by subtracting 0.62 feet. For more information on the existing bridge, see the attached **1958 Bridge Plans** in **Appendix A**.

1958 Bridge Plans include existing boring logs which show loose fills overlying natural dense sand and gravel material. Existing borings do not include rock cores of bedrock, but shallow refusals on bedrock were encountered in all explorations. Two borings, BH-W42 and BH-W49A were able to sample about 6-inches of "soft rock" with N-values of 93 and 83, respectively, before reaching refusal. These borings likely encountered thin layers of soft, highly weathered rock, which is also known as Decomposed Rock, overlying competent bedrock.

2.3. Proposed Bridge

The proposed bridge will be a full superstructure replacement with a similar length, width, and grade as the existing. The existing substructures will be repaired and reused to support the proposed superstructure replacement. The top of existing abutments will be cut, including the full backwall height and 12 to 18 inches of the bridge seat, and rebuilt with structural steel and concrete. The existing approach slabs on both abutments will be demolished and new approach slabs will be constructed. It is assumed that the existing pier bridge seat will be rebuilt and concrete patching will be done along the pier columns. It is anticipated that construction will be performed in stages, in order to maintain at least one lane of traffic over the bridge at all times.

According to GREEN, the proposed superstructure girders will be shallower than the existing girders, so the proposed dead weight will be less than or equal to the existing superstructure dead weight. For this reason, it is assumed that the existing bridge foundations will experience **no additional loading beyond existing conditions and therefore no settlement is expected.**

3. SUBSURFACE CONDITIONS

3.1. Local Geology

The area geology was influenced by the typical New-England glacial and post-glacial actions on subsurface soils. According to the USGS Surficial Materials Map of the Worcester North Quadrangle, Massachusetts (Reference 3) the site area contains thin Till with bedrock outcrops.

According to the USGS Bedrock Geologic Map of Massachusetts (Reference 3) the site is located in the Worcester Formation (Lower Devonian and Silurian period) which consists of carbonaceous slate and phyllite and minor metagraywacke.

Available geologic information shows that the Wekepeke Fault is located about a half mile northwest of the site.

3.2. Subsurface Explorations Program

Under the observation of an HNTB Engineer, three (3) test borings (BB-101 to BB-103) and three (3) probe explorations (PS-1A to PS-1C) were conducted on Harrison Street and I-290 by Terracon Consultants, Inc. (Terracon) between September 23, 2021 and February 24, 2022. The explorations were performed using a CME-45B drill rig which utilized an automatic hammer to conduct Standard Penetration Tests (SPT) with a standard 1-3/8 inch inside diameter (I.D.) split spoon. Samples were conducted nearly continuously for the first 10 feet, and then at standard 5-foot intervals after that.

For borings BB-101 and BB-103 behind existing abutments, 4-inch casing was advanced to the top of concrete before coring through the abutment and 10 to 13 feet of bedrock below. For boring BB-102 on I-290 Westbound (WB) next to the existing pier, 4-inch casing was driven to bedrock where 10 feet of rock core was taken. All concrete and rock coring was conducted using a 2.15-inch I.D. NX core bit.

The probe-series explorations were conducted with the same drill rig using a solid-stem auger with an outside flight diameter of 4-inches. Probes were conducted behind the West Abutment, moving sequentially away from the abutment to delineate geometry. Due to multiple site constraints, such as existing utilities and traffic control concerns, only three (3) probes could be conducted in the limited space available. Probe PS-1A hit a water main at a depth of 4.5 feet below top of roadway.

See attached **Figure 2 – As-Drilled Exploration Plan** for locations of all explorations conducted at the site, as well as **Appendix B** for boring logs.

3.3. Subsurface Conditions

3.3.1. Subsurface Layers

In general, the explorations encountered subsurface conditions which were similar to those shown on the 1958 Bridge Plans. From ground level, the site generally consists of granular Fill behind/overlying existing bridge foundations, which are founded on Bedrock. Each of the subsurface layers are described below:

Fill

Directly behind the existing abutments, Fill was encountered in tests borings to depths (below top of roadway) of approximately 20 feet at the West Abutment and 34 feet at the East Abutment. The Fill generally consisted of brown, fine to coarse sand containing around 40 percent gravel and 13 percent inorganic silt. The relative density of the Fill varied from loose to medium dense, with N-values (number of blows to advance the split-spoon from 6" to 18") between 7 and 26 blows-per-foot (bpf). Concrete abutment footings were encountered below the Fill.

Below the 9-inch thick asphalt and subbase layer of the I-290 WB roadway, about 0.7 feet of Fill was encountered. The Fill in the vicinity of the existing pier consisted of dense, brown, fine to coarse gravel and fine to coarse sand, with trace amounts of inorganic silt. The Fill resembled a sub-base layer which is commonly used below roadways.

Decomposed Rock

Boring BB-102 encountered decomposed slate bedrock from 1.7 to 4.5 feet below top of roadway. The decomposed rock was very dense and consisted of dark gray, fine gravel, some fine sand, some inorganic silt. The material was too soft to core, but too hard to sample with a split spoon, so a roller-bit was used to advance through the layer.

Bedrock

Bedrock was encountered directly underlying existing abutment and pier foundations. For bridge borings coring through abutments, top of bedrock (or bottom of footing) was encountered at El. 456.0 feet at the West Abutment (BB-101) and El. 453.3 feet at the East Abutment (BB-103). Boring BB-102 near the pier foundation encountered competent bedrock at El. 456.5 feet. Photographs of the concrete and rock cores are presented in **Appendix B** and a summary of cores is presented below:

Table 3.1 – Summary of Cores

Boring	Core	Top of Core Elev. (ft)	Penetration Length (in)	Recovery Length (in)	Recovery (%)	RQD (%)
BB-101	C-1	457.8	60	53	88	conc
	C-2	452.8	60	60	100	55
	C-3	447.8	60	55	93	65
BB-102	C-1	456.5	60	58	97	18
	C-2	451.5	60	59	98	52
BB-103	C-1	458.3	60	60	100	conc
	C-2	453.3	60	60	100	58
	C-3	448.3	60	59	98	27

The bedrock generally consisted of soft to medium hard, moderately fractured, slightly weathered, dark gray Slate (Carbonaceous) with joints dipping from approximately 30 degrees below horizontal to near horizontal. Rock core recovery of the bedrock cores ranged from 93 to 100 percent and Rock Quality Designation (RQD) values (the sum of all core pieces greater than 4 inches divided by the total length of penetration) ranged from 18 to 65 percent. The presence of fractures within the bedrock, and zones of moderate weathering, caused some loss of drilling fluid during coring.

After coring through the concrete West Abutment, boring BB-101 encountered about 12-inches of soft, moderately weathered slate bedrock directly underlying the footing. Below this was an 8-inch thick intrusion of very hard quartz, followed by competent slate bedrock. This was the only zone of soft and moderately weathered rock encountered during coring, as the majority of rock was medium hard and slightly weathered.

3.3.2. Groundwater

While coring bedrock during borings, moderate loss of drilling fluid into fractures of the bedrock was experienced. Upon completion of borings, a non-stabilized depth to groundwater table (GWT) within the boreholes was measured and a summary of these depths and elevations is provided below.

Table 3.2 – Observed Groundwater Table (GWT) Summary

Boring	Ground Elev. (ft)	Depth to GWT (ft)	Elev. of GWT (ft)
BB-101	477.3	18.0	459.3
BB-102	461.0	3.5	457.5
BB-103	494.3	36.0	458.3

Based on observed groundwater within the boreholes, a **GWT at El. 459 feet** may be used for the site.

3.3.3. Existing Abutments

The 1958 bridge plans show the proposed dimensions and bottom of footing elevations for both abutments. The West Abutment is a gravity-type abutment with a sloped backwall and 6-inch thick footing, with bottom of footing at El. 456.88 feet. Probes were conducted at the West Abutment to determine the angle of backwall slope and also find the edge of footing before conducting the bridge boring. The East Abutment is a cantilever-type abutment with a 4-foot thick footing and bottom of footing at El. 454.88 feet. Probes were not conducted at the East Abutment due to the 8-foot long heel of the footing.

Probes at the West Abutment were located by measuring the offset from the existing bridge joint and conducted moving sequentially away from the joint. Probes were advanced until reaching refusal on the concrete abutment or bedrock. Because bedrock consists of a soft to medium hard Slate which has a similar hardness to concrete, it could not be determined based on auger action if the refusal was encountered on bedrock or concrete.

Based on geometry of the abutment, it was determined that PS-1C reached refusal on bedrock and missed the edge of abutment. Boring BB-101 cored 21 inches of the concrete abutment and BB-103 cored 60 inches. Based on the results of the probes and borings, abutment sketches are provided in the attached **Figure 3 – Estimated Abutment Geometry** and compared to the 1958 Bridge Plans in the table below.

Table 3.3 – Abutment Geometry based on 1958 Bridge Plans and Explorations

West Abutment	1958 Bridge Plans	Based on Explorations	East Abutment	1958 Bridge Plans	Based on Explorations
Bott. of Footing El. (ft)	456.88	456.0	Bott. of Footing El. (ft)	454.88	453.3
Backslope Angle (deg)	68.9	70.8	Depth of Footing (ft)	4	5.5

Both as-drilled bottom of footing elevations are within about 1.5 feet of those given in the 1958 Bridge Plans. The backslope angle of the West Abutment is given in degrees above the horizontal and is used to calculate the active earth pressure behind the abutment. The East Abutment footing appears to be about 5.5 feet deep, 1.5 feet thicker than the dimensions provided in the 1958 Bridge Plans.

3.3.4. Existing Approach Slabs

The 1958 Bridge Plans show a 10-inch thick and 15-foot long concrete approach slab connected to the backwall of both abutments. It is anticipated that these approach slabs will be demolished and rebuilt. All explorations conducted from Harrison Street encountered the approach slab which was difficult to penetrate due to steel rebar encountered while augering through the slab. Depths to top and bottom of the slab were noted in borings BB-101 and BB-103 but should be considered approximate as they were estimated based on auger action during drilling.

According to explorations, the thickness of the approach slabs varied between about 10 to 12 inches. As-drilled information on existing approach slabs is summarized below.

Table 3.4 – Approach Slab Summary

Existing Approach Slab	West Abutment BB-101	East Abutment BB-103
Depth to Top (ft)	2	1.2
Depth to Bottom (ft)	2.8	2.2
Elev. of Top (ft)	475.3	493.1
Elev. of Bottom (ft)	474.5	492.1
Approx. Thickness (in)	10	12

Based on available information from existing plans and as-drilled depths provided above, it can be assumed that the **existing approach slab is about 10-inches thick**.

3.4. Laboratory Testing Program

Laboratory testing was conducted by GeoTesting of Acton, Massachusetts to evaluate physical properties of the soil and rock near the existing abutments and pier. Laboratory results are included in **Appendix C**.

3.4.1. Soil Testing

For calculations of horizontal earth pressure on the existing abutments, two (2) soil samples were tested for gradation (using ASTM D6913) and density (using ASTM D7263) and the results are presented below.

Table 3.5 – Soil Laboratory Testing Results

Boring	Sample	Bulk Density (pcf)	Water Content (%)	Dry Density (pcf)	Gravel (%)	Sand (%)	Fines (%)
BB-101	S-3	90.1	6.8	84.4	41.9	45.1	13.0
BB-103	S-3	84.2	4.4	80.7	38.9	47.8	13.3

Gradation results confirm soil classifications found in the boring logs, which generally show that the Fill located behind the abutment is a gravelly sand with about 13 percent fines. Bulk density results show a Fill with a unit weight around 90 pounds per cubic foot (pcf) which is low for gravelly sand, so a more conservative unit weight should be used for horizontal earth pressure calculations. We know this laboratory's testing is reliable but the data may indicate the material is loose or lightweight in-place.

3.4.2. Rock Testing

One rock core sample from boring BB-103 was tested for Peak Compressive Stress using ASTM D7012 – Method D. The intact slate rock core was found to have a Peak Compressive Stress, also known as **Unconfined Compressive Strength**, of **4,155 pounds per square inch (psi)**. Using the second stress range, the rock has a Young's Modulus of 362 kips per square inch (ksi) and a Poisson's Ratio of 0.43.

4. DESIGN AND ANALYSES

4.1. Design Criteria and Parameters

4.1.1. Seismic

Based on the results of the exploration program and laboratory testing which shows that all bridge footings are founded on soft to medium hard bedrock, this project site is representative of **Seismic Site Class B**. The MassDOT LRFD Bridge Manual (Reference 2) requires that all Critical/Essential bridges in Massachusetts shall be designed for a seismic hazard corresponding to a 2% probability of exceedance in 50 years, which is equal to a design earthquake with a return period of approximately 2,500 years.

Based on acceleration parameters from the USGS Seismic Hazard Map for the 2,500 year event and site parameters from AASHTO Section 3.10.3.2, the design response spectra are presented below (in units of gravity) and calculations are included in **Appendix D-1**.

Table 4.1 – Seismic Design Parameters

Horizontal Peak Ground Acceleration, PGA (g)	0.080
Horizontal Spectral Acceleration at Period 0.2S, S_S (g)	0.138
Horizontal Spectral Acceleration at Period 1.0S, S_1 (g)	0.055
Site Factor at Zero-Period Range of Acceleration, F_{pga}	1.0
Site Factor for Short-Period Range of Acceleration, F_a	1.0
Site Factor for Long-Period Range of Acceleration, F_v	1.0
Design Response Spectrum for Zero-Period, $A_S = F_{pga}PGA$	0.080
Design Response Spectrum for Short-Period, $S_{DS} = F_aS_S$	0.138
Design Response Spectrum for Long-Period, $S_{D1} = F_vS_1$	0.055

4.1.2. Liquefaction

Liquefaction assessment is not required for structures in Seismic Design Category A (SDC-A), also known as Seismic Zone 1, which is defined by AASHTO as having an S_{D1} less than 0.15. The proposed shallow foundations are supported on bedrock, therefore they are not susceptible to the seismic soil liquefaction effect which only occurs in loose sands.

4.1.3. Groundwater

As noted in Section 3.3.2. the groundwater table for this site is at El. 459 feet, which shall be used for design of the pier foundation. For abutments, the design shall consider a 100-year flood where water may build up behind abutments. Assuming that the existing 4-inch weep holes will be cleaned during construction, it is recommended that a groundwater table at the inlet elevations of the weep holes be conservatively used for abutment design.

4.2. Fill Behind Abutments

4.2.1. Soil Properties

Laboratory testing from Section 3.4.1. showed that the total unit weight of existing Fill behind the abutments was about 90 pcf, which is low for sand and gravel material. A more conservative (larger) total unit weight (γ_t) of 100 pcf (correlating with a loose in-situ existing fill condition) shall be used when calculating horizontal earth pressure and conducting stability analysis. Based on the N-values from borings behind the existing abutments, well-accepted correlations were used to estimate an effective friction angle (ϕ'_f) of 33 degrees. The calculation **Effective Friction Angle of Fill** is included in **Appendix D-2**. Soil properties of the existing Fill behind abutments are summarized below.

Table 4.2 – Properties of Fill Behind Abutments

Avg. N-value (bpf)	Avg. $(N_1)_{60}$ (bpf)	γ_t (pcf)	ϕ'_f (deg)
15	23	100	33

4.2.2. Earth Coefficients

In accordance with AASHTO Section 3.11.5.2 the at-rest lateral earth pressure coefficient (k_0) for normally consolidated soils shall be calculated with the following equation:

$$k_0 = 1 - \sin(\phi'_f) = 0.46$$

Using a ϕ'_f of 33 degrees, the at-rest lateral earth pressure coefficient for Fill in the vicinity of existing abutments shall be 0.46. According to the MassDOT Bridge Manual (Reference 2) Section 3.1.6 the at-rest earth pressure coefficient shall be used for the design of all cantilever or gravity walls that are founded on bedrock. This coefficient shall be used to calculate earth pressures of the Fill behind both abutments, for overturning and sliding analyses of the abutments. Passive pressure in front of the abutments shall not be considered in these calculations, as deflections will not be great enough to activate passive earth pressure of the soil.

As the MassDOT Bridge Manual requires, we recommend using at-rest coefficient Ko for the abutments / walls founded on bedrock. Active earth coefficients Ka are provided for the designer / contractor usage as needed (support-of-excavation, etc.). To calculate active earth coefficients at the West Abutment, an estimated backslope angle of 70.8° (above the horizontal) from Figure 3 was used and a level angle of backfill was conservatively used (due to negative roadway grade). Using the 1958 Bridge Plans, the East Abutment was assumed to be at a 90° angle and the angle of backfill was set equal to the proposed roadway grade of 11% behind the abutment, which is equal to 6.3° above the horizontal.

The static active earth pressure coefficient (k_a) was calculated in accordance with AASHTO Section 3.11.5.3 which is based on Coulomb earth pressure theories. The seismic active earth pressure coefficient (K_{AE}) was calculated in accordance with AASHTO Section A11.3.1 which utilitizes Mononobe-Okabe Method. **Earth Coefficient Calculations** are provided in **Appendix D-3** and the resulting coefficients are presented below.

Table 4.3 – Active Earth Coefficients

Abutment	k_0	k_a	K_{AE}
West	0.46	0.45	0.50
East		0.29	0.34

4.3. Fill at Pier

4.3.1. Soil Properties

Boring BB-102 encountered 0.7 feet of dense Fill underlying the roadway which consisted of a well graded gravel and sand with trace amounts of inorganic silt. Only one blow count of 16 was recorded for the first 6-inches of the sample, before the split-spoon encountered the underlying Decomposed Rock. To estimate N-value of the Fill, these 16 blows is doubled to get an Estimated (Est.) N-value of 32. Total unit weight (γ_t) and effective friction angle (ϕ'_f) will be estimated based on engineering experience with similar soils in the area, and the values are provided below.

Table 4.4 – Properties of Fill at Pier

Est. N-value (bpf)	Est. $(N_1)_{60}$ (bpf)	γ_t (pcf)	ϕ'_f (deg)
32	61	120	34

Although there was only a thin layer of Fill below the I-290 WB roadway, in the vicinity of the pier foundations it is expected that the same gravel and sand Fill was used to backfill above footings.

4.3.2. At-Rest Coefficient

In accordance with AASHTO Section 3.11.5.2 the at-rest lateral earth pressure coefficient (k_0) for normally consolidated soils shall be calculated with the following equation:

$$k_0 = 1 - \sin(\phi'_f) = 0.44$$

Using an effective friction angle of 34 degrees, the at-rest lateral earth pressure coefficient for fill in the vicinity of existing abutments shall be 0.44. Because shallow foundations are bearing on bedrock, it is anticipated that deflections will not be great enough to activate passive pressure of the surrounding soil.

4.4. Foundation Design

4.4.1. Bearing Material

Underlying the West Abutment, boring BB-101 encountered a 12-inch section of highly fractured, soft, slightly to moderately weathered Slate Bedrock above more competent bedrock. Boring BB-102 and BB-103 encountered a moderately fractured, medium hard, slightly weathered Slate Bedrock near the pier and below the East Abutment footing, respectively. The design of all abutment and pier foundations shall assume that the bearing material is a highly fractured, soft to medium hard, slightly weathered Slate.

4.4.2. Bearing Resistance

In accordance with AASHTO Article 10.6.2.6.2, bearing resistance on rock shall be determined using empirical correlations to the Geomechanics Rock Mass Rating System (RMR) as specified in Article 10.4.6.4 which uses geological strength index (GSI) and the Hoek-Brown failure criterion. Based on the GSI figure by Hoek and Marinos (2000) given in AASHTO Figure 10.4.6.-1 the bearing material can be conservatively described as having a "blocky" structure (fractured) and "good" surface conditions (slightly weathered) which results in a design GSI value of 65.

Hoek-Brown rock mass parameters were estimated per AASHTO Article 10.4.6.5. A disturbance factor "D" equal to one is used for footing construction, assuming bedrock was blasted which may have disturbed the rock mass. Effective overburden pressure was conservatively assumed to be zero at the bottom of footing. The resistance factor (φ_b) for footings on rock is 0.45 based on AASHTO Table 10.5.5.2.2-1. The **Bearing Resistance of Footings Calculation** is provided in **Appendix D-4** and the results are presented below.

Table 4.5 – Bearing Resistance Values

AASHTO LRFD Bearing Resistance Design	Value
Nominal Bearing Resistance, q_n	32.0
Bearing Resistance Factor, φ_b	0.45
Factored Bearing Resistance, $q_R = \varphi_b q_n$ (ksf)	14.4

4.4.3. Max Bearing Pressure

The maximum bearing pressures for each foundation, taken from 1958 Bridge Plans, are presented below.

Table 4.6 – Maximum Bearing Pressures from 1958 Bridge Plans

ASD Service Design	West Abutment	Pier	East Abutment
Max Bearing Pressure (ksf)	6.1	8.8	9.1

The maximum bearing pressures above are below the factored bearing resistance of 14.4 ksf. It is not known if eccentricity was considered when calculating these maximum bearing pressures, as these calculations are not available. It can be assumed that these service pressures were calculated using Allowable Stress Design (ASD) methodologies which are not up to date with current LRFD used by MassDOT and AASHTO. Bearing Capacity values using ASD are provided below for comparison, however it is recommended that LRFD resistances are used.

Table 4.7 – ASD Bearing Capacity Values

AASHTO ASD Bearing Capacity Design	Value
Ultimate Bearing Capacity, q_{ult} (ksf)	32.0
Factor of Safety, FS	3.0
Allowable Bearing Capacity, $q_{allow} = q_{ult} / FS$ (ksf)	10.7

For the proposed superstructure replacement, new values of maximum bearing pressure shall be calculated which consider eccentric loading and the resulting effective width of footing. We recommend using, for the West Abutment the as-drilled footing width of 11 feet, and for the East abutment the as-drilled width of 18 feet which is the same as on the existing plans (see Figure 3).

4.4.4. Sliding Resistance

In accordance with AASHTO Article 10.6.3.4, failure by sliding shall be investigated for all footings that support horizontal loads. Resistance to sliding shall be equal to the factored shear resistance (R_R) at the interface between the bottom of concrete footing and the underlying material, which is given by equation 10.6.3.4-1 below which ignores the passive resistance of the soil in front of the footing:

$$R_R = \varphi_\tau R_\tau$$

AASHTO Table 10.5.5.2.2-1 provides a **shear resistance factor (φ_τ) of 0.80** for cast-in-place (CIP) concrete on sand at the strength limit state. This resistance factor shall be conservatively used for CIP footings on bedrock, as no resistance factor is provided for footings on bedrock. Because some areas of fractured/weathered bedrock were encountered below footings, treating the bearing material as a cohesionless soil is appropriate. AASHTO Equation 10.6.3.4-2 provides the following equation for nominal sliding resistance (R_τ) between cohesionless soil and concrete foundation, with C being equal to 1.0 for CIP concrete against soil, and V being the total vertical force at the bottom of the footing:

$$R_\tau = CV \tan(\phi'_f) = 0.70\ V$$

For friction angle (ϕ'_f) the interface between concrete and bedrock shall be considered. AASHTO Table C3.11.5.3-1 provides friction angles between various dissimilar materials, with a ϕ'_f (given as δ) of 35 degrees for "mass concrete on clean sound rock." This value is reflected in the resultant equation provided above, with the nominal sliding resistance being equal to about 70% of the vertical force applied.

5. CONSTRUCTION CONSIDERATIONS

5.1. Reuse of Existing Fill

It is anticipated that the top of existing abutments will be cut, including the full backwall height and 12 to 18 inches of the bridge seat, and rebuilt with structural steel and concrete. This will require the removal of existing Fill behind the backwall during construction. Based on sieve analysis of this soil, the Fill behind the existing abutments is suitable to be reused for backfill provided that it is free of deleterious materials such as organics or other compressible soils.

It is anticipated that existing reinforced concrete approach slabs will also be demolished and rebuilt. Based on available soil information, the Fill excavated during this process may be reused provided that it is free of deleterious materials. When preparing the subgrade for the new approach slab, any compressible soils or cobbles above 3-inches in diameter shall be removed and replaced with reused Fill or another granular soil.

When backfilling behind the reconstructed backwalls, or above/below the new approach slab, the Fill shall be laid in loose lifts not exceeding 8 inches and then compacted to 95% relative density, as measured by a nuclear density gauge.

5.2. Obstructions During Excavation

No major obstructions were encountered while drilling behind existing abutments, besides the existing approach slab. However, these test borings are a small sample size and it is possible that cobbles (3 to 12 inches in diameter) or boulders (over 12 inches) could be encountered during excavation. Any cobbles or boulders encountered during excavation shall be removed from the site and not reused when backfilling behind rebuilt abutments or above/below the new approach slab.

5.3. Support of Excavation and Utility Protection

When removing soil behind the abutment for reconstruction of the backwall, temporary support of excavation (SOE) would most likely be needed for backwall and approach slab. This item will be coordinated with the bridge engineer to include a cost and spec for SOE in the final design. The system may consist of sheet piling with or without tiebacks, soldier piling and lagging, or other system that shall be capable of supporting all loads applied during stages of construction. The outline of the SOE system shall be such as to provide practical installation and removal, considering various stages of construction and potential natural obstructions and existing foundations. The SOE system shall be chosen by the contractor, signed and sealed by a MA Professional Engineer, and submitted to the design team for review.

There are various utilities carried by the bridge, including telephone, electrical and gas lines. It is anticipated that all utilities will be rebuilt as part of the superstructure replacement. The contractor shall coordinate with the utility subcontractor and shall work with all utility owners to make sure all lines are clearly marked out and protected during excavation.

5.4. Geotechnical Monitoring Program

It is anticipated that construction will be performed in stages, in order to maintain at least one lane of traffic over the bridge. Therefore, during staged construction the existing foundations will experience unequal loading as part of

the existing superstructure and substructure are rebuilt. Because foundations are bearing on competent bedrock and are in satisfactory condition, movement of foundations is unlikely. However, a geotechnical monitoring program shall be put in place to confirm that no movement occurs.

The geotechnical monitoring program shall consist of establishing a minimum of two (2) survey points on different ends of each substructure during a pre-construction survey. These survey points shall be checked frequently during and after each stage of construction to confirm that no movement has occurred. If movement is detected, then construction shall pause until corrective actions can be taken.

REFERENCES

1. AASHTO, 2020. "LRFD Bridge Design Specifications," American Association of State Highway and Transportation Officials (AASHTO), 9th Edition.

2. MassDOT, 2013. "LRFD Bridge Manual," Massachusetts Department of Transportation (MassDOT), with 2020 revisions.

3. USGS Maps:
    - Surficial Materials Map of the North Worcester Quadrangle, Massachusetts, 2018.
    - Bedrock Geologic Map of Massachusetts, 1983.

LIMITATIONS

Explorations

- The analyses and recommendations given in this report are based in part upon the data obtained from subsurface explorations performed by others.
- The soil description presented in this report is intended to convey trends in subsurface conditions and was developed by interpretations of spaced boreholes and samples; actual soil transitions could be more erratic.
- Water level readings have been made in the boreholes at times and under conditions stated in the boring logs. This information has been accordingly interpreted in this report. It must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

Review

- In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of this report are modified or verified in the field and made in writing.

Use of Report

- This Geotechnical Report has been prepared for the Harrison Street over I-290 Bridge Replacement Project by HNTB for GREEN International Affiliates, Inc.

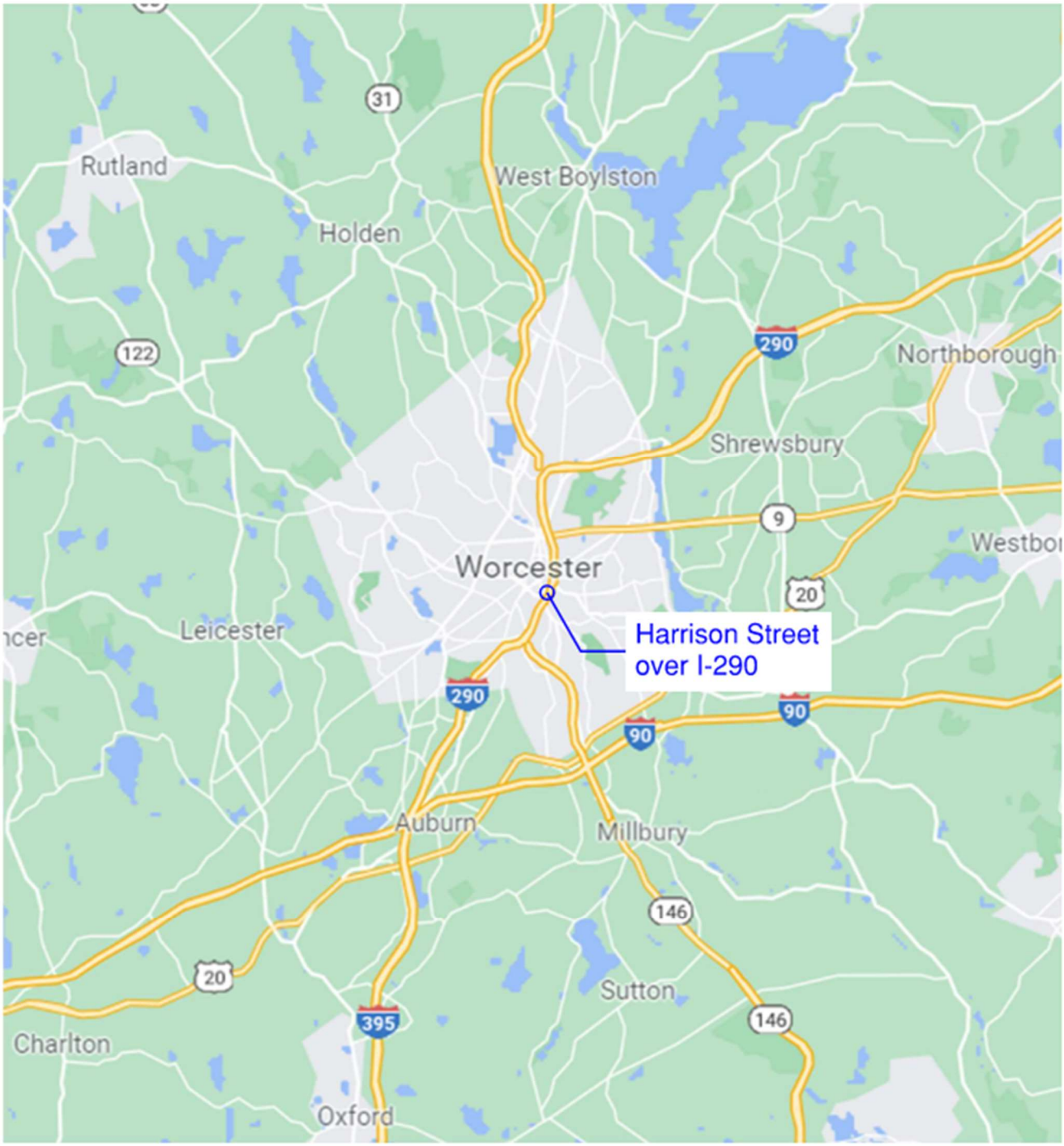
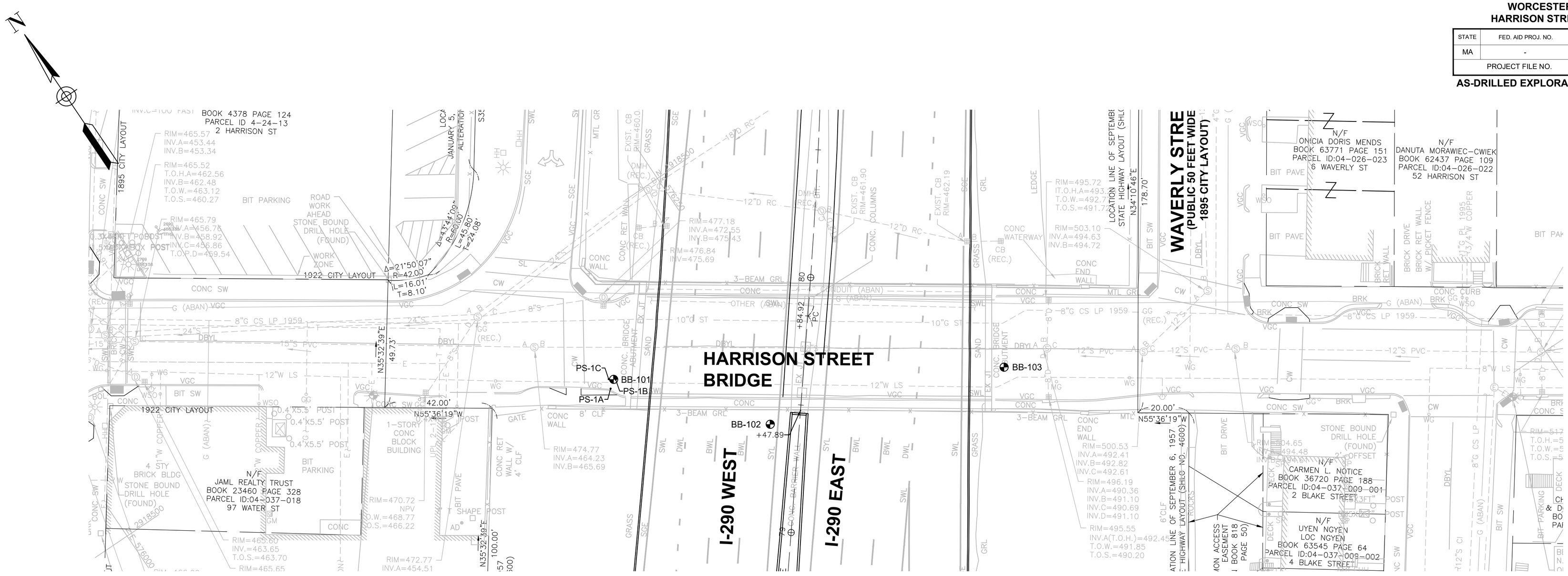


Figure 1 – Site Locus Plan

WORCESTER
HARRISON STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
	PROJECT FILE NO. 609185		

AS-DRILLED EXPLORATION PLAN



NOTES

1. THE EXISTING CONDITIONS SHOWN ON THIS BASE MAP ARE THE RESULT OF AN ON-THE- GROUND INSTRUMENT SURVEY PERFORMED BETWEEN MARCH 26, 2021 AND JULY 8, 2021 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN INTL.) AND A LASER SCAN SURVEY PERFORMED BY LANDTECH.
2. AS-DRILLED BORING LOCATIONS ARE SHOWN AS THUS: ◔ BB-101
3. AS-DRILLED PROBE SERIES BORINGS ARE SHOWN AS THUS: PS-1A
4. ELEVATIONS, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. HORIZONTAL COORDINATES, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD 83).
6. THE STATIONING AND OFFSETS OF EACH EXPLORATION LOCATION ARE GIVEN FROM THE BASELINE OF I-290.
7. EXPLORATION LOCATIONS AND ELEVATIONS ARE APPROXIMATE. EXPLORATIONS WERE MOVED FROM THEIR ORIGINAL LOCATIONS DUE TO UTILITIES, AND LOCATIONS ARE BASED ON APPROXIMATE MEASUREMENTS FROM EXISTING SITE FEATURES.
8. PROBE SERIES BORINGS WERE ADVANCED UNTIL REFUSAL ON CONCRETE ABUTMENT OR BEDROCK, TO DETERMINE THE APPROXIMATE GEOMETRY OF EXISTING ABUTMENTS. SEE DRAWING "FIGURE 3 - ESTIMATED ABUTMENT GEOMETRY" FOR MORE INFORMATION.
9. BOREHOLES WERE BACKFILLED WITH SOIL CUTTINGS AND/OR FILTER SAND, THEN THE ROADWAY SURFACE WAS RESTORED TO IT'S ORIGINAL CONDITION USING COLD-PATCH PAVEMENT.
10. SOIL JARS AND ROCK CORE BOXES ARE AVAILABLE FOR VIEWING AT THE MASSDOT STORAGE FACILITY IN LAWRENCE, MASSACHUSETTS.

AS-DRILLED EXPLORATION LOCATIONS (FEET)					
EXPLORATION	NORTHING	EASTING	STATION	OFFSET	SURFACE ELEVATION
BB-101	2918444.5	576191.9	79+54.4	73.8' L	477.3
BB-102	2918395.7	576232.8	79+41.6	11.4' L	461.0
BB-103	2918363.1	576321.1	79+70.9	78.0' R	494.3
PS-1A	2918442.1	576188.9	79+50.7	74.7' L	477.3
PS-1B	2918443.9	576192.5	79+54.4	73.0' L	477.3
PS-1C	2918445.6	576190.3	79+54.4	75.7' L	477.2

0 20 50 100
SCALE: 1" = 20'

JANUARY 2022 | PROJECT FILE NO. 609185

HNTB
31 SAINT JAMES AVE., SUITE 300
BOSTON, MA 02116

massDOT Massachusetts Department of Transportation Highway Division

FIGURE 2
AS–DRILLED EXPLORATION PLAN

WORCESTER
HARRISON STREET
OVER I–290

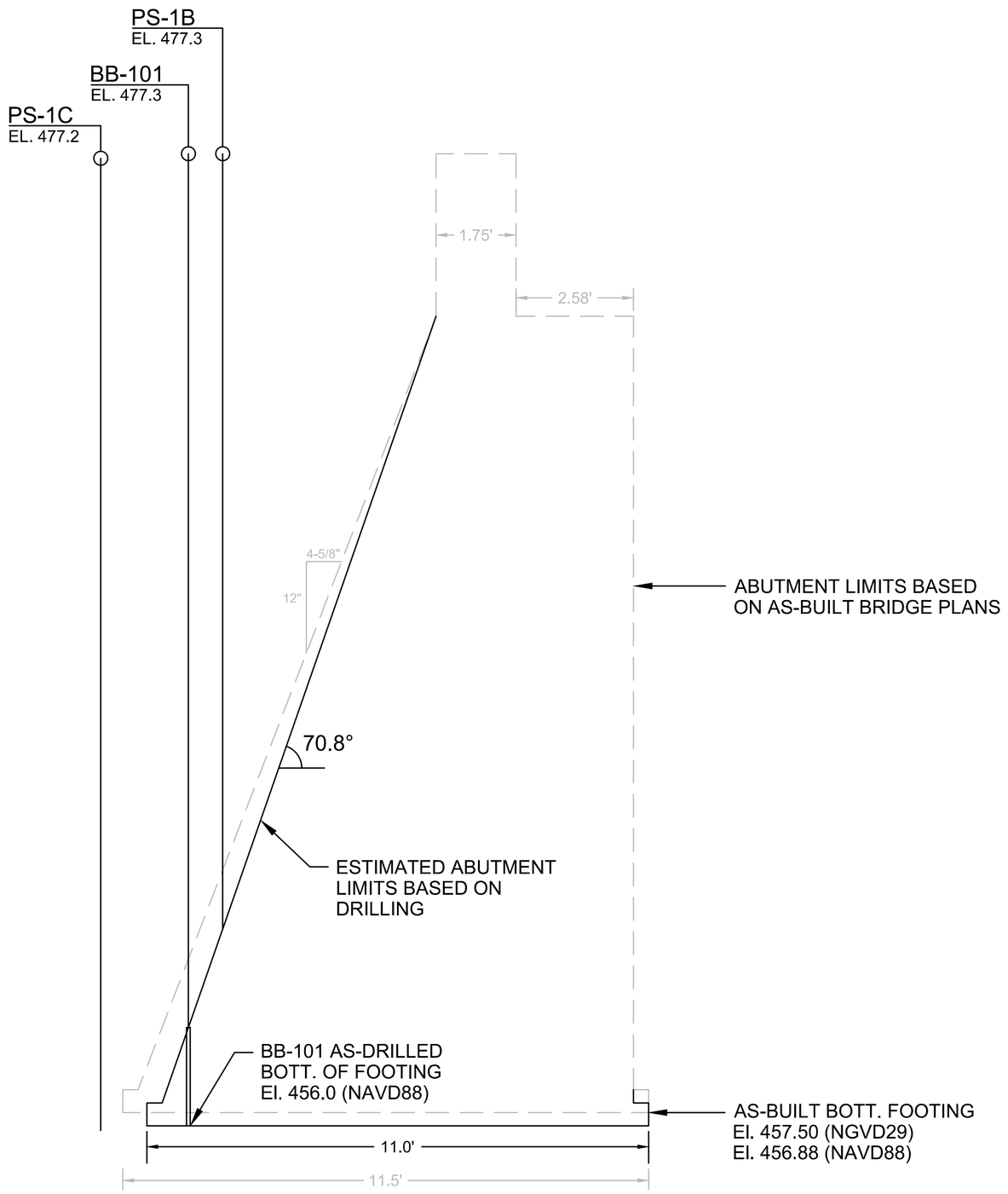
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

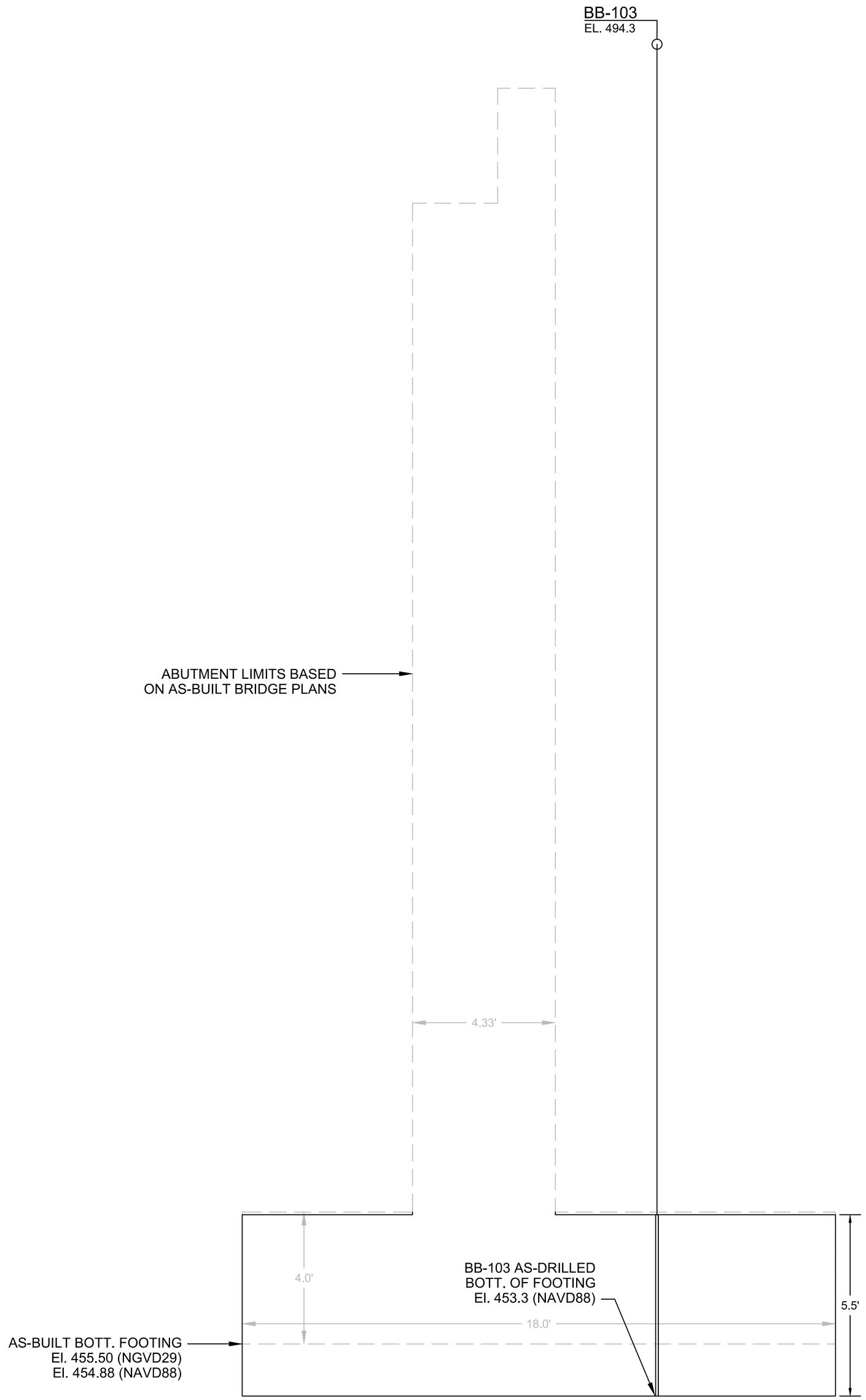
SHEET 1 OF 1 BRIDGE NO. W–44–83

WORCESTER
HARRISON STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609185		

ESTIMATED ABUTMENT GEOMETRY





NOTES

1. GROUND ELEVATIONS OF EXPLORATIONS WERE DETERMINED IN THE FIELD BASED ON ON SURVEY PLANS AND SHOULD BE CONSIDERED APPROXIMATE. SURVEY PLANS WERE DEVELOPED FROM AN ON-THE- GROUND INSTRUMENT SURVEY PERFORMED BETWEEN MARCH 26, 2021 AND JULY 8, 2021 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN INTL.) AND A LASER SCAN SURVEY PERFORMED BY LANDTECH.
2. DEPTHS OF EXPLORATIONS WERE ESTIMATED IN THE FIELD BASED ON DRILLING ACTION AND SHOULD BE CONSIDERED APPROXIMATE.
3. BOTH BRIDGE BORINGS CORED THROUGH THE CONCRETE ABUTMENT AND INTO GRANITE BEDROCK DIRECTLY UNDERLYING THE FOOTING. SEE THE BORING LOGS AND CORE PHOTOS IN THE GEOTECHNICAL REPORT FOR MORE INFORMATION.
4. ELEVATIONS, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). AS-BUILT BRIDGE PLANS GIVE ELEVATIONS IN NGVD29, WHICH HAVE BEEN CONVERTED TO NAVD88 BY SUBTRACTING 0.62 FEET.
5. AS-BUILT DIMENSIONS FROM THE BRIDGE PLANS ARE PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY AND MAY NOT ACCURATELY REPRESENT ACTUAL ABUTMENT DIMENSIONS.

0 2 5
SCALE: 1" = 2'

JANUARY 2022	PROJECT FILE NO. 609185

HNTB
31 SAINT JAMES AVE., SUITE 300
BOSTON, MA 02116

massDOT
Massachusetts Department of Transportation
Highway Division

FIGURE 3
ESTIMATED ABUTMENT GEOMETRY

WORCESTER

HARRISON STREET
OVER I–290

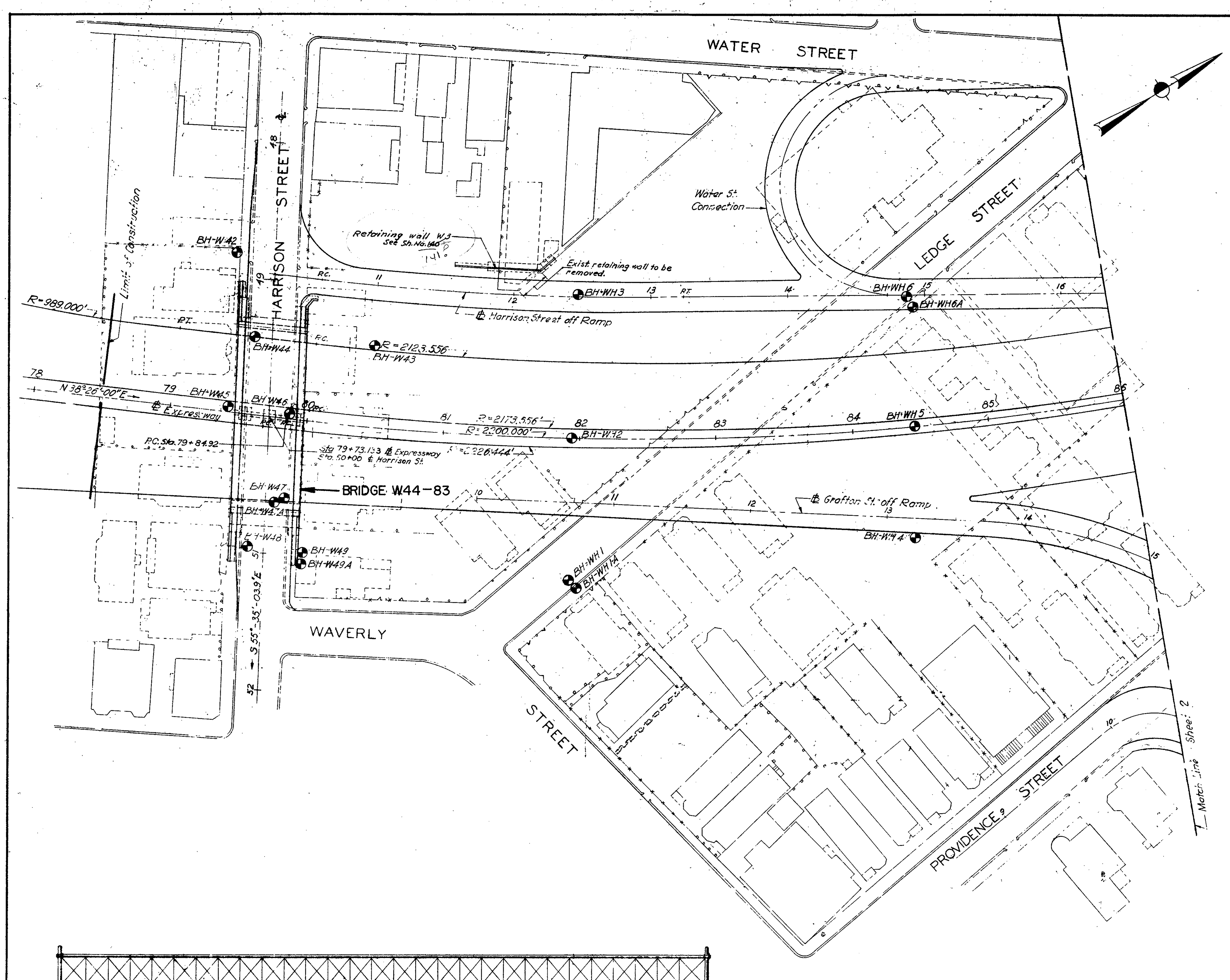
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

SHEET 1 OF 1 BRIDGE NO. W–44–83

Appendix A 1958 Bridge Plans

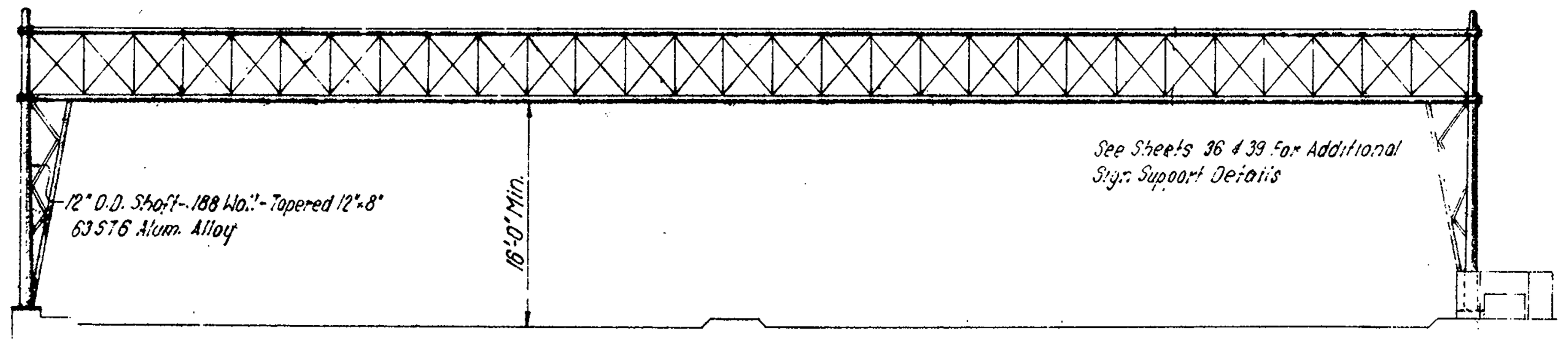
PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-53(3)	1958	142	194

I-W90-1 (3) 95 Contract B



PLAN

Scale 1"=40'-0"



OVERHEAD SIGN SUPPORT

Scale 1" = 10' - 0"

BRIDGE No. W-44-82
ESTIMATED QUANTITIES
(NOT GUARANTEED)

Description	Quantity	
Bridge Excavation	8,900	c.y.
Class "B" Rock Excavation	5	c.y.
Gravel Borrow	3,570	c.y.
Class I Bituminous Conc. Pavement Type I-1	3,100	Tons
Steel Sheeting	82,200	lb.
Class "B" Cement Conc. Masonry	5	c.y.
Steel Piles 14 BP 89	36,000	l.f.
Steel Piles 12 BP 53	9,500	l.f.
Steel Pile Splices 14 BP 89	55	Each
Steel Pile Splices 12 BP 53	10	Each
Bridge Structure (W-44-82)	1	L.S.
Electrical Substation (Structure Only)	1	L.S.
Overhead Destination Sign Support	1	L.S.
Bridge Lighting	1	L.S.

BRIDGE W-44-83
ESTIMATED QUANTITIES
(NOT GUARANTEED)

Description	Quantity	
Bridge Excavation	140	c.y.
Class "B" Rock Excavation	630	c.y.
Gravel Borrow	1,100	c.y.
Class I Bituminous Conc. Pavement Type I-1	100	Ton
Class "A" Cement Conc. Masonry	590	c.y.
Class "B" Cement Conc. Masonry	320	c.y.
Steel Reinforcement for Structure	57,000	lbs
Bridge Structure (W-44-83)	1	L.S.
Bituminous Dampproofing	600	s.y.

GENERAL NOTES

1. Design
In accordance with the current specifications of the A.A.S.H.O. 1953 as modified for:
a. Viaduct - H20-S16-44
b. Harrison Street over Expressway H20-44

2. Foundations
Foundations may be altered if necessary with approval of Engineer, to suit conditions encountered in construction, except those foundations which are designated to be placed on piles.

3. Date & Seal
Viaduct-to be placed on the Northwesterly and Southeasterly end posts. Harrison Street Over Expressway-to be placed on the Northeasterly and Southwesterly end posts. A sheet showing size and character of numerals will be furnished by the Commonwealth.

4. Reinforcement
All bars shall have deformations conforming to A.S.T.M. Designation A 305. Unless otherwise shown on the plans, reinforcing bars shall be lapped 20 diameters to make a splice, except that main reinforcing bars near top of slabs and beams having more than 12" of concrete under the bars shall be lapped 35 diameters to make a splice.

5. Structural Steel
℄ girder stringers, WF beams without cover ℞s or splices, diaphragms, rails, plates and all other material except as noted shall be Structural Carbon Steel A.S.T.M. Designation A-7. WF stringers with cover ℞s, the cover plates and stringers with splices shall be carbon steel A.S.T.M. Designation A-373.
All field connections except those designated as welded shall be riveted. High strength bolts may be used in lieu of rivets at the discretion of the Engineer where location warrants use of bolts.
All welding shall be in accordance with the specifications set forth be the American Welding Society for Welded Highway and Railway Bridges.

Field splices shall be riveted to develop 100% of the strength of the connected parts. Details & location of splices shall be submitted by Fabricator to Engineer for approval.
All rivets shall be 7/8"⌀; holes 15/16" diameter unless otherwise noted. Where no dead load deflection diagram or camber is shown beams shall have natural mill camber turned up.

6. Shear Connectors
The Contractor has the option of using stud reinforcement for shear connector as detailed on plans in lieu of spirals. Studs shall be automatically end welded. Spirals or studs may be either field or shop welded.

7. Bench Marks & Alignment Details
A-19 N.E. cor. Gas Gate Frame, in walk, W. side Water St. 40'± N of Harrison St. El. 465.252
For bridge No. W44-83
For additional Bench Marks & Alignment data see highway Dwgs.

8. Piles
All piles shall be driven to practical refusal.

9. Membrane Waterproofing (At Base of Cantilever Walls and Studs)
The cost of furnishing and installing waterproofing protective course as shown on plans shall be included in the cost of the membrane waterproofing.

SEPT. 3, 1958	SHEET #21 FOUNDATION PLAN-PIER V-10 REVISED
AUG. 18, 1958	SHEET #38 CROSS SLOPE REVISED
AUG. 18, 1958	SHEETS #10, 11, 12, 15, 16, 18, 19, 21, 22, 23, 24 & 25 ELEVATIONS REVISED
MAY 31, 1958	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION

USE ONLY PRINTS OF LATEST DATE

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
100 NASHUA STREET BOSTON, MASSACHUSETTS

WORCESTER EXPRESSWAY
SECTION I

STRUCTURAL PLANS

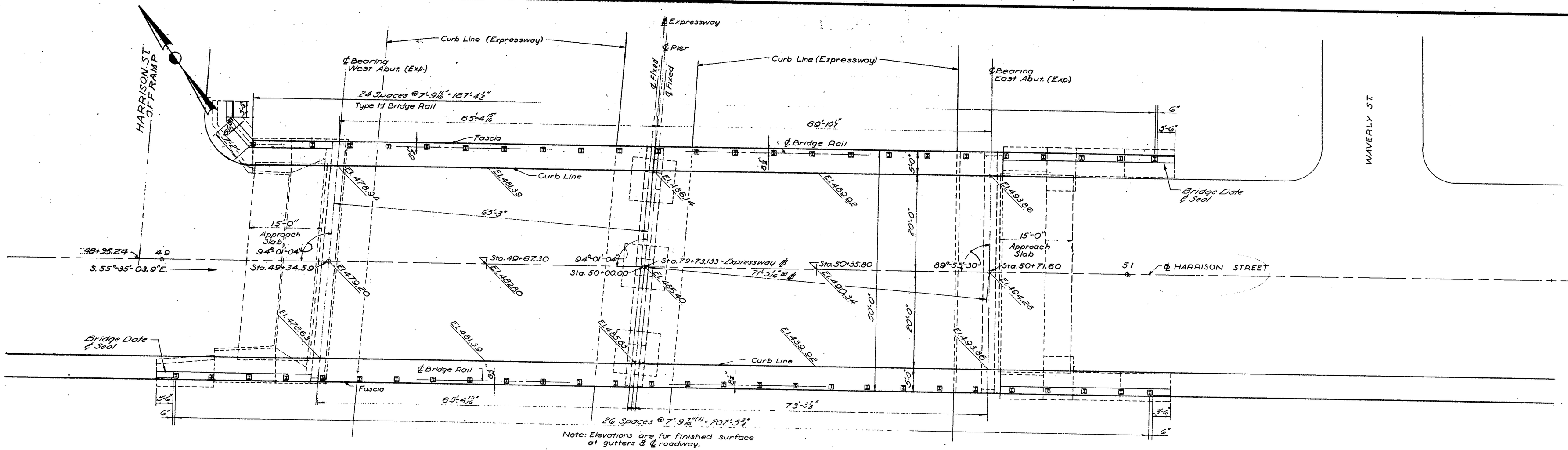
C. A. MAGUIRE & ASSOCIATES — ENGINEERS — BOSTON, MASSACHUSETTS

APPROVED DATE MAY 1958
ACT. BRIDGE ENGINEER
CHIEF ENGINEER

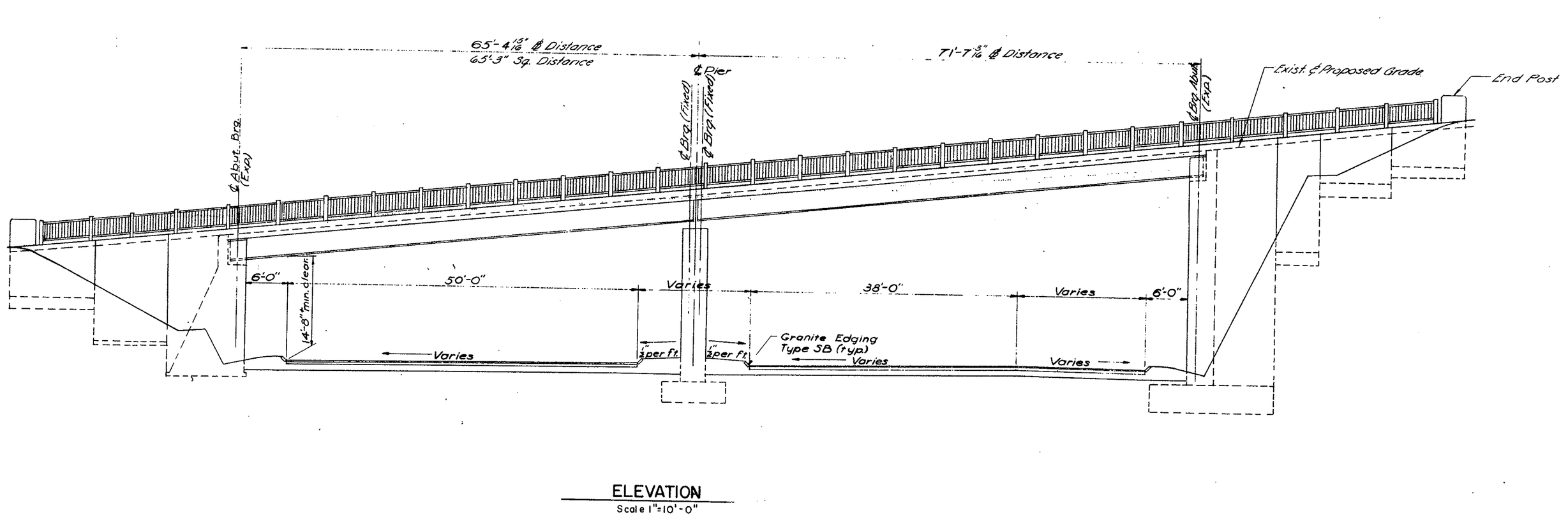
SHEET 1 OF 53 SHEETS BRIDGE NO. W-44-82 W-44-83

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-353(3)	1958	182	194

I-W90-1(3)95 Contract B



DECK PLAN
Scale 1"=10'-0"

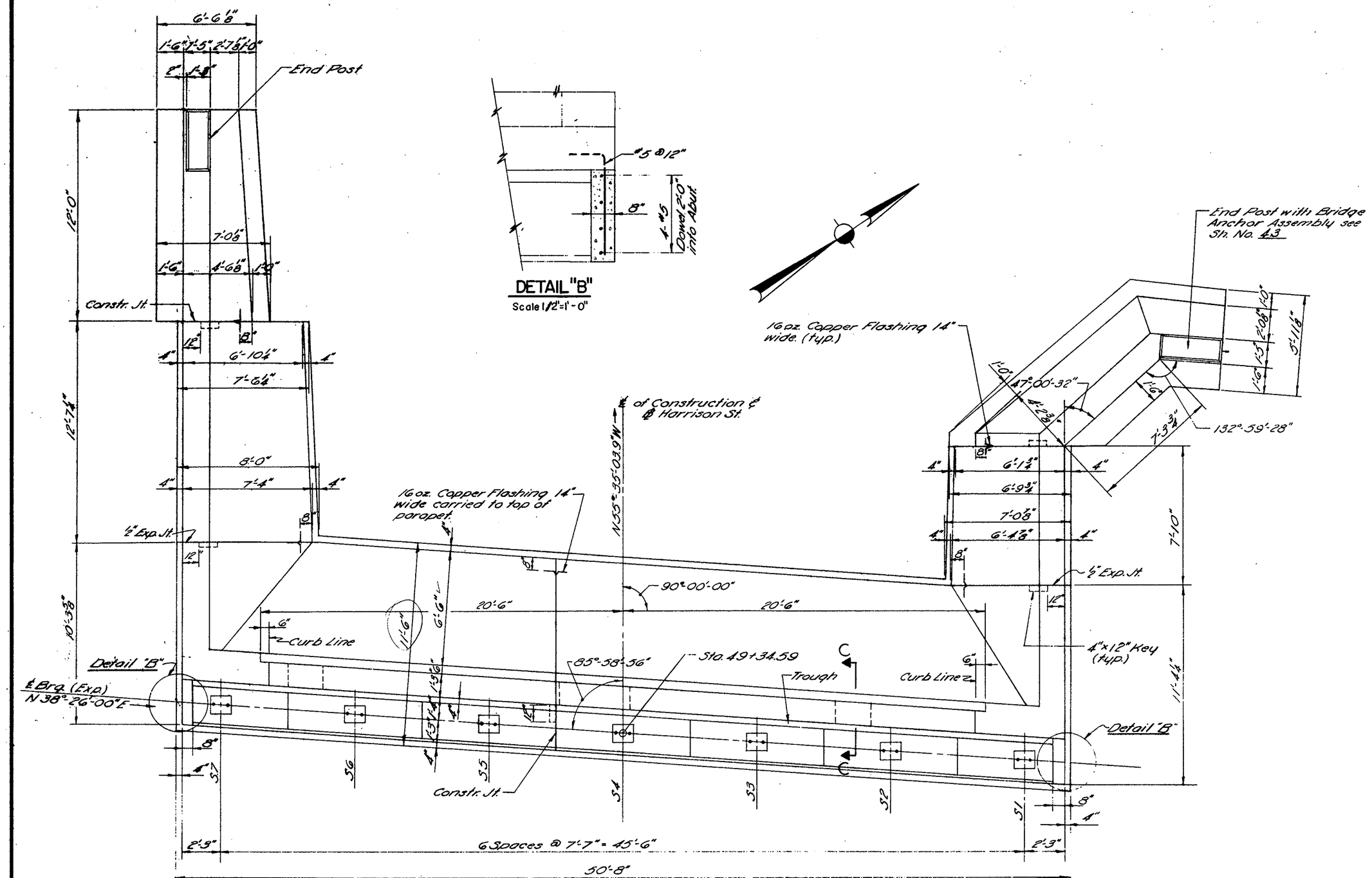


ELEVATION
Scale 1"=10'-0"

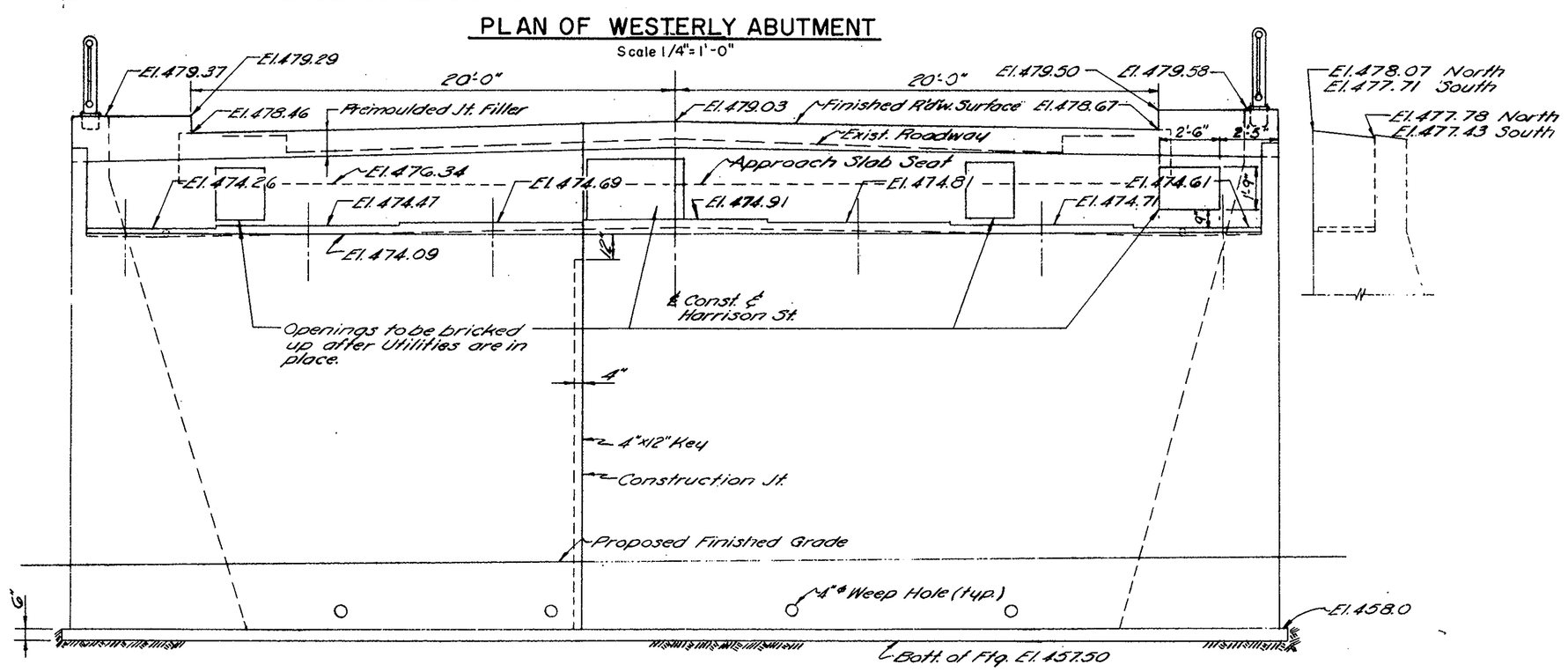
DATE	DESCRIPTION
MAY 31, 1958	• ISSUED FOR CONSTRUCTION •
	• USE ONLY PRINTS OF LATEST DATE •

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.		1958	183	194

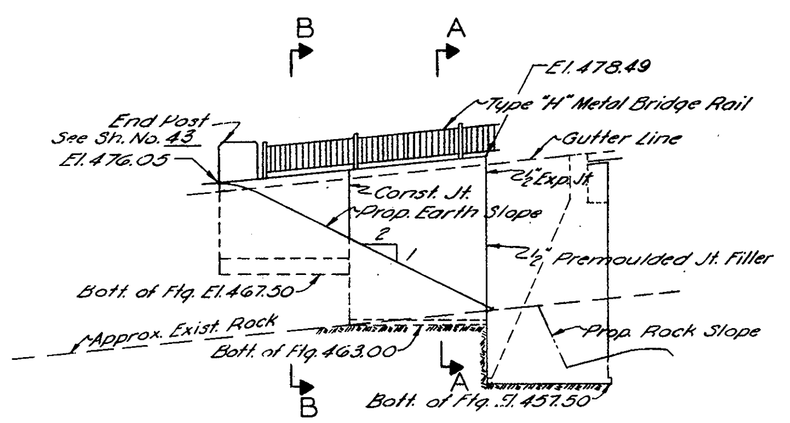
I-W90-1(3)95 Contract B



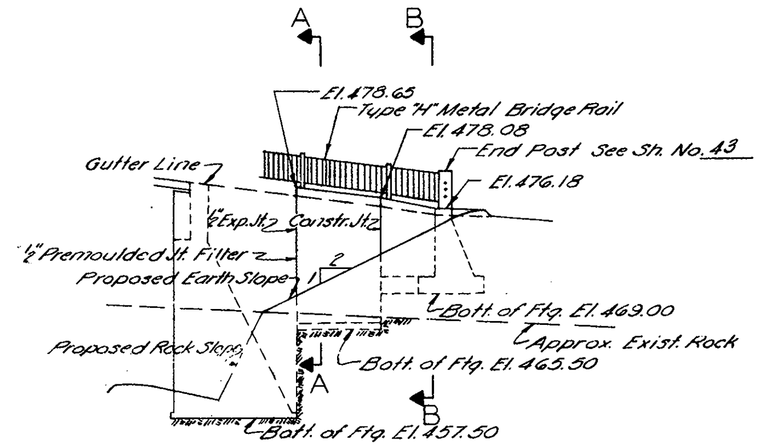
PLAN OF WESTERLY ABUTMENT
Scale 1/4"=1'-0"



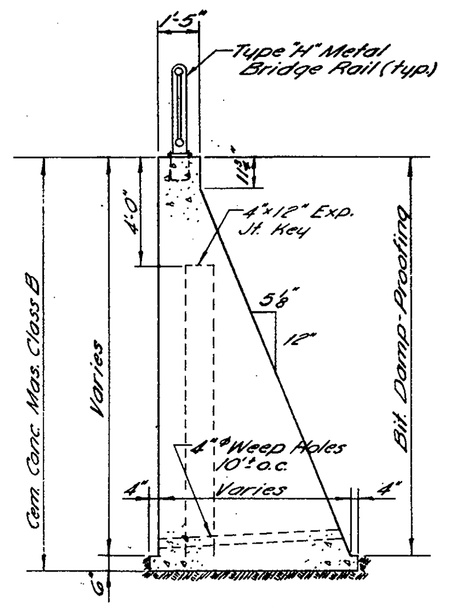
ELEVATION OF WESTERLY ABUTMENT
Scale 1/4"=1'-0"



ELEVATION SOUTH WING WALL
Scale 1"=10'-0"

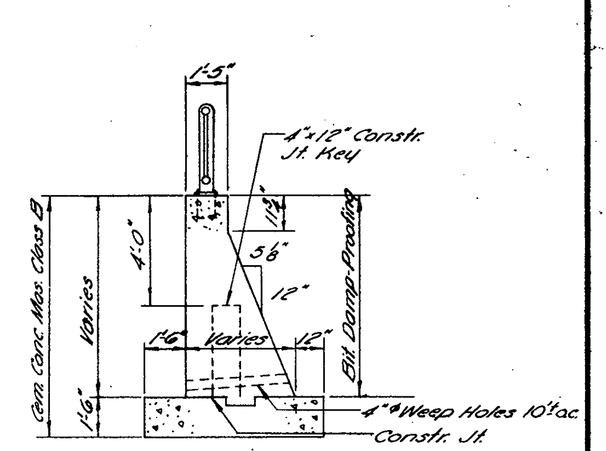


ELEVATION NORTH WING WALL
Scale 1"=10'-0"



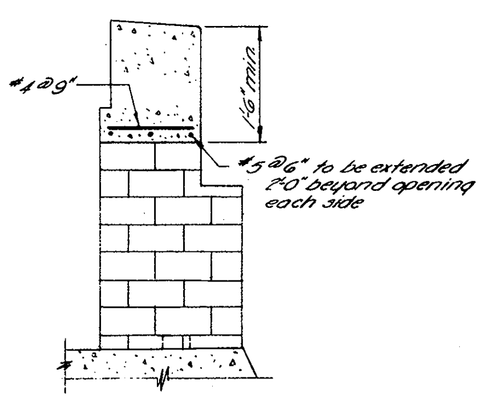
Max. Soil Pressure = 3920 lbs. per Sq. Ft.

SECTION A-A
Scale 1/4"=1'-0"

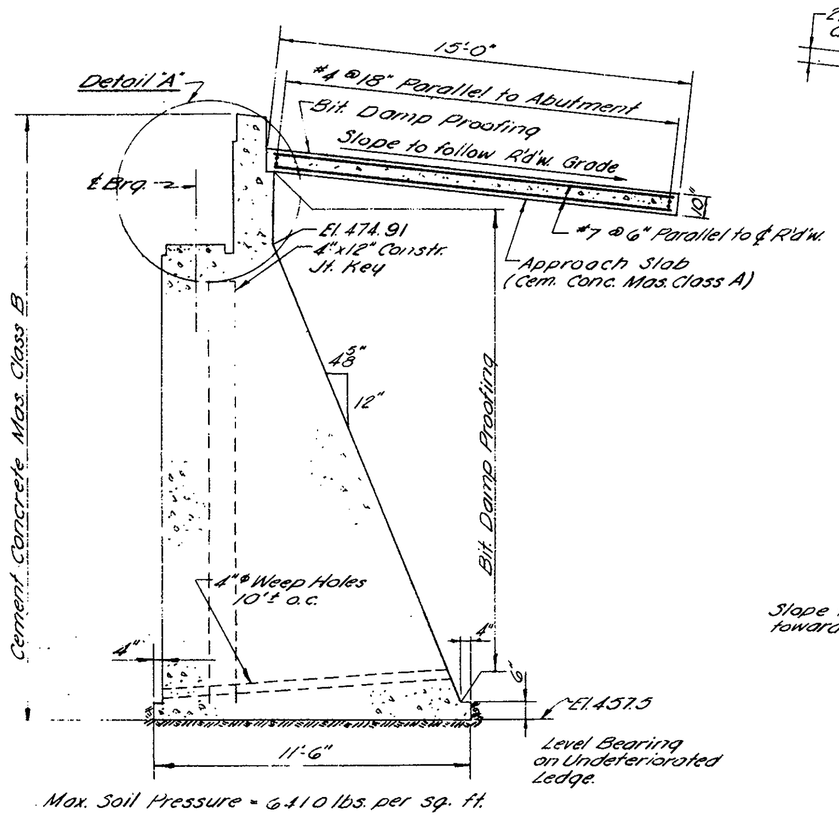


Max. Soil Pressure = 3580 lbs. per Sq. Ft.

SECTION B-B
Scale 1/4"=1'-0"

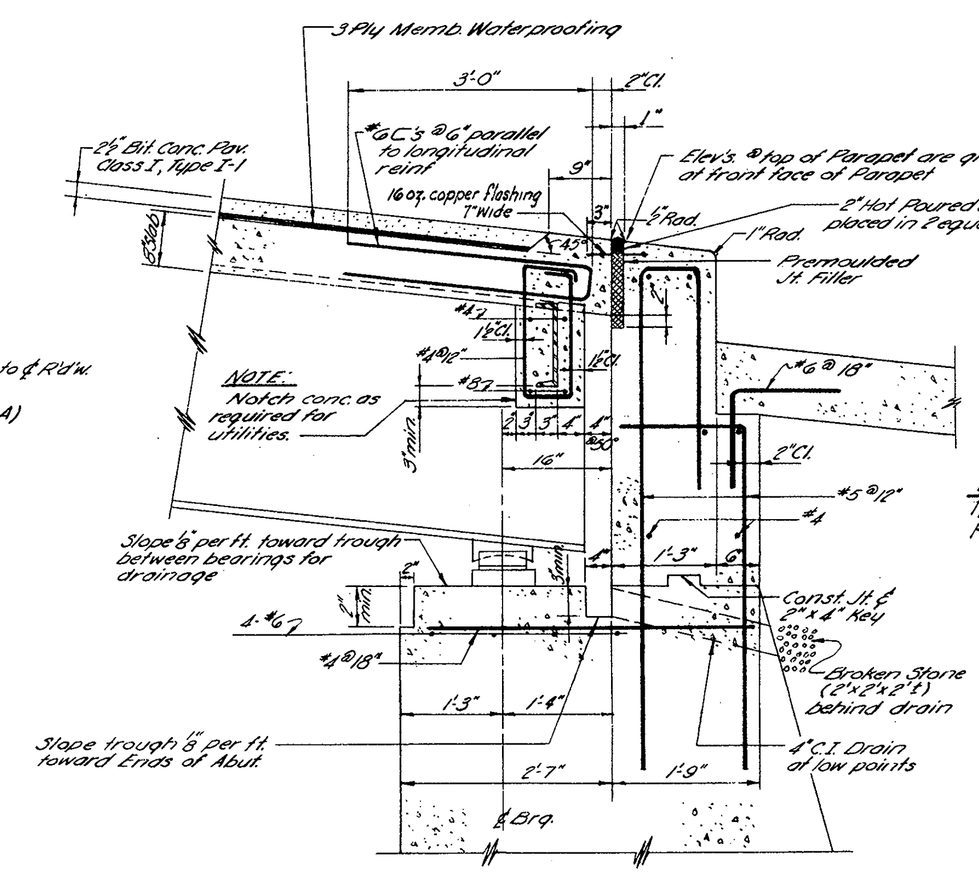


SECTION C-C
Scale 3/4"=1'-0"



Max. Soil Pressure = 6410 lbs. per sq. ft.

TYPICAL ABUTMENT SECTION
Scale 1/4"=1'-0"



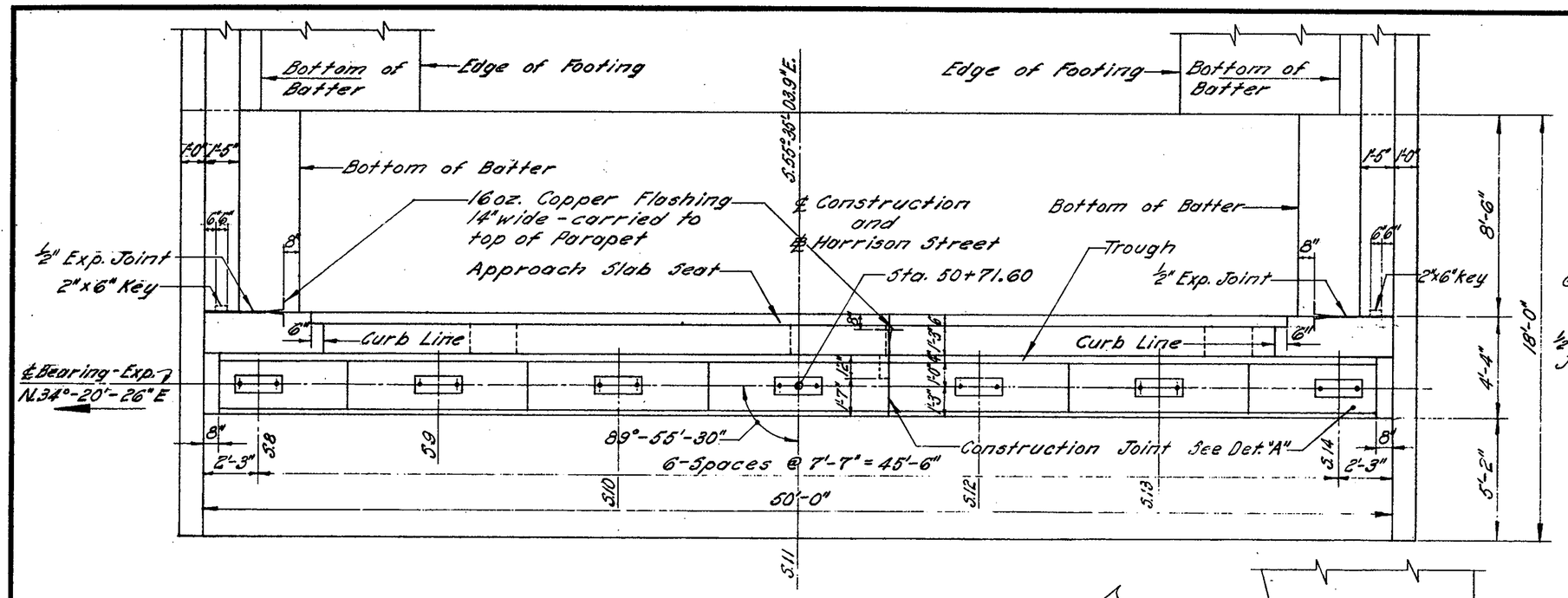
DETAIL "A"
Scale 3/4"=1'-0"

NOTE:
If Ledge is Cut More Than 12" Below Proposed Footing Grades, Reinf. Steel Should Be Redesigned.

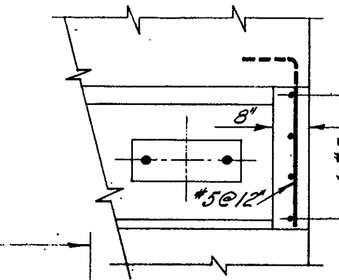
DATE	DESCRIPTION
MAY 31, 1958	· ISSUED FOR CONSTRUCTION ·
	· USE ONLY PRINTS OF LATEST DATE ·

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-359 (3)	1958	184	194

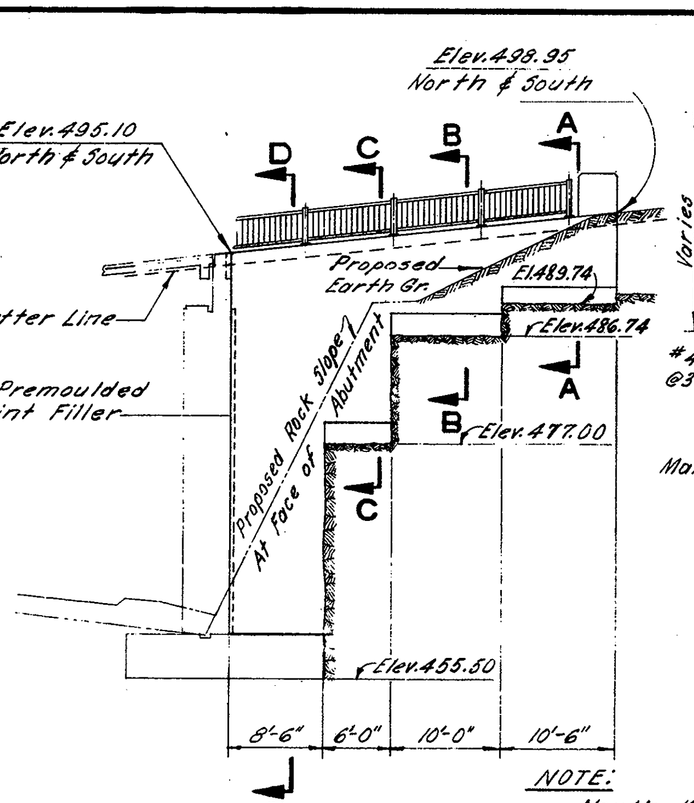
I-W190-1(3)95 Contract B



PLAN OF EASTERLY ABUTMENT
Scale 1/4"=1'-0"

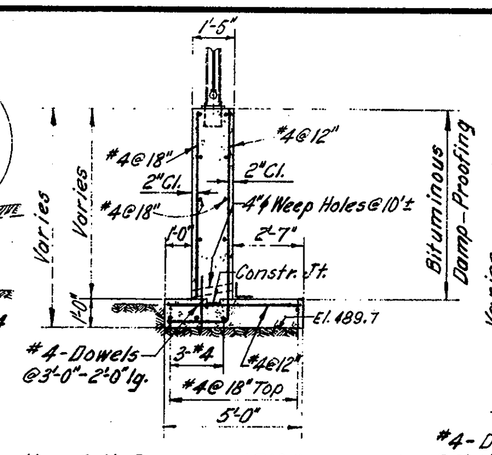


DETAIL "A"
Scale 1/2"=1'-0"



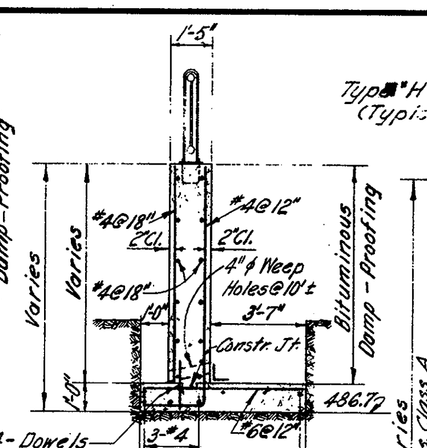
NOTE.
North Wing Wall similar but to opposite hand.

ELEVATION SOUTH WING-WALL
Scale 1"=10'-0"



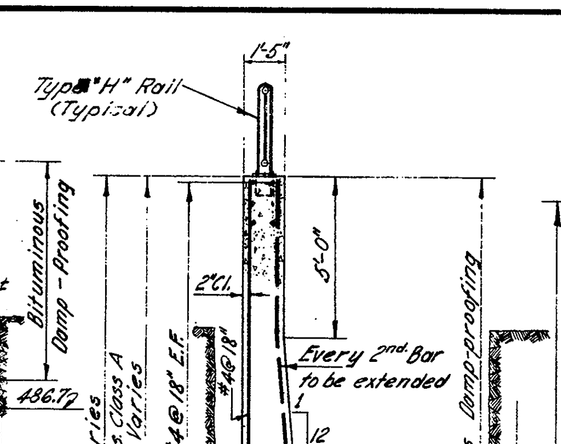
Max. Soil Pressure = 1,710 lbs. per sq. ft.

SECTION A-A
Scale 1/4"=1'-0"



Max. Soil Pressure = 2,450 lbs. per. sq. ft.

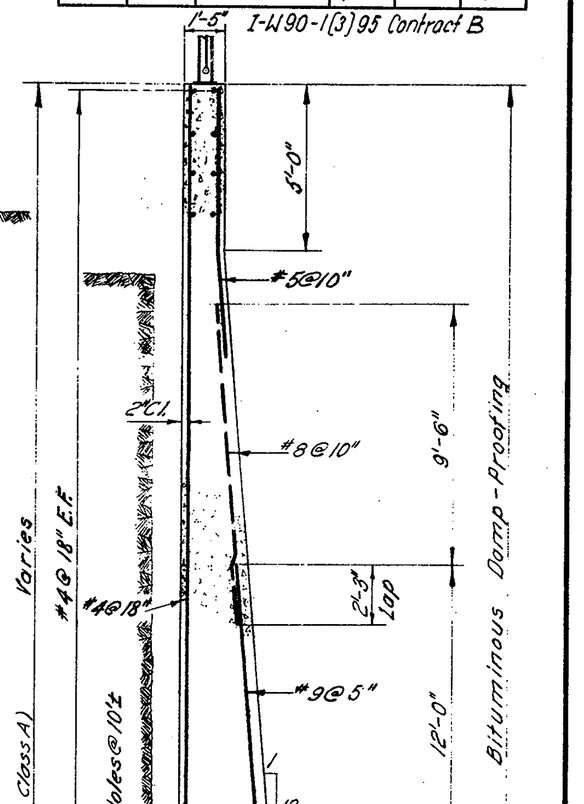
SECTION B-B
Scale 1/4"=1'-0"



PayLine for Rock Excavation. Typical at Abutment and Wing Walls.

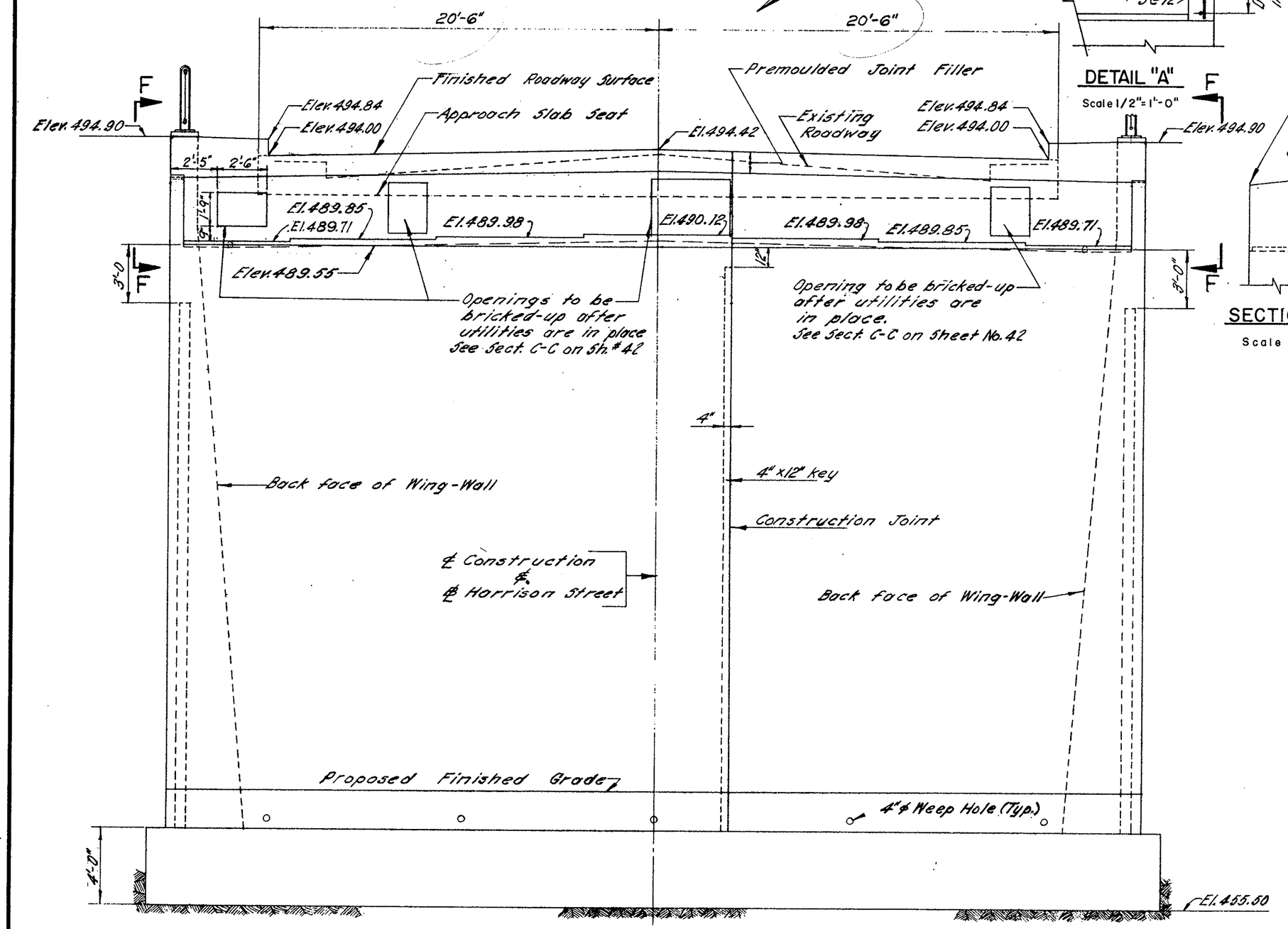
Max. Soil Pressure = 4,140 lbs. per. Sq. Ft.

SECTION C-C
Scale 1/4"=1'-0"

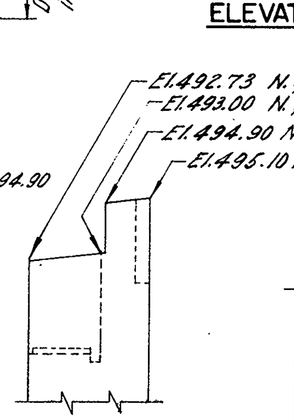


SECTION D-D
Scale 1/4"=1'-0"

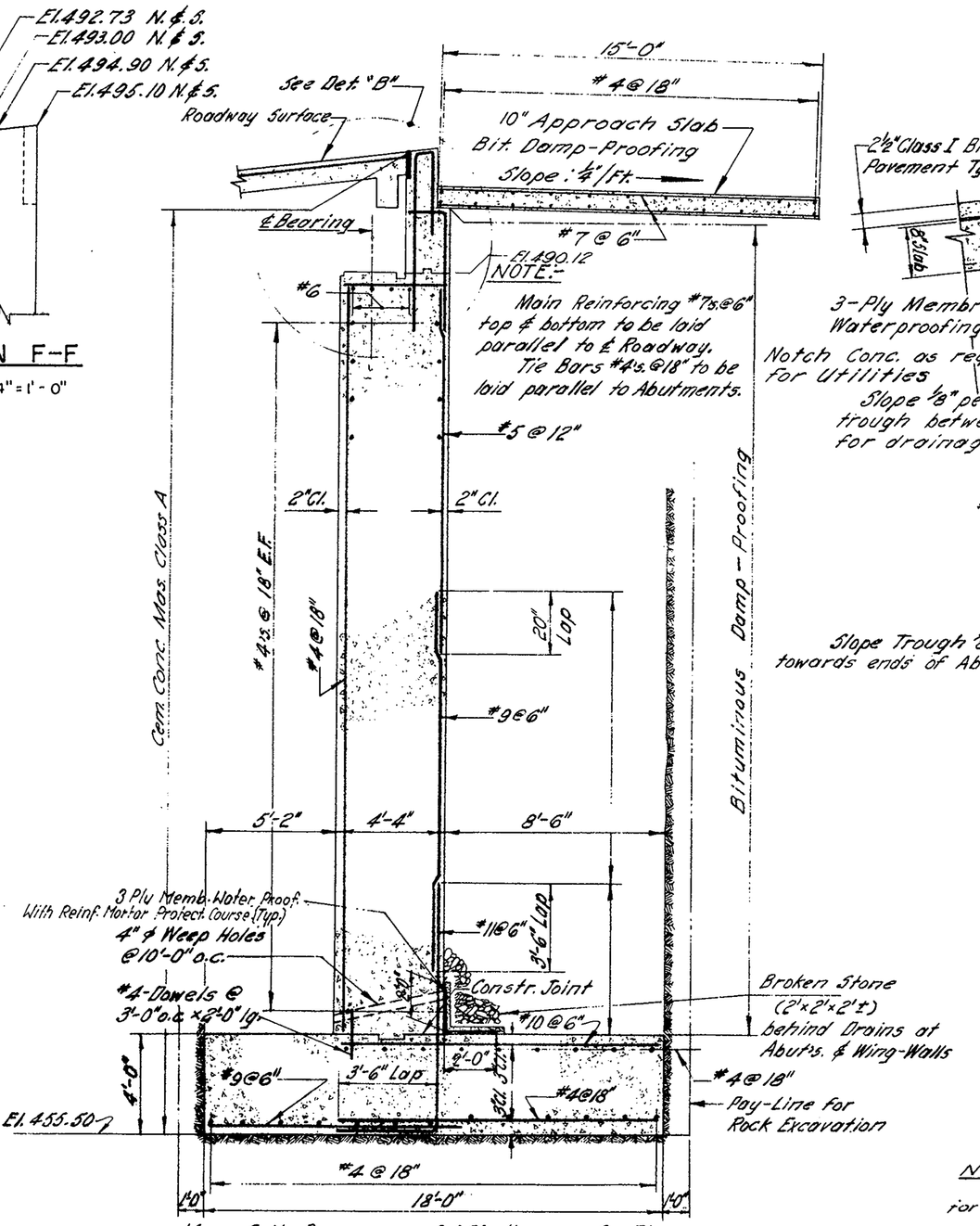
3 Ply Memb. W.P with reinf. mortar protective course. (Typ. for all Walls Shown on this Sheet)



ELEVATION OF EASTERLY ABUTMENT
Scale 1/4"=1'-0"

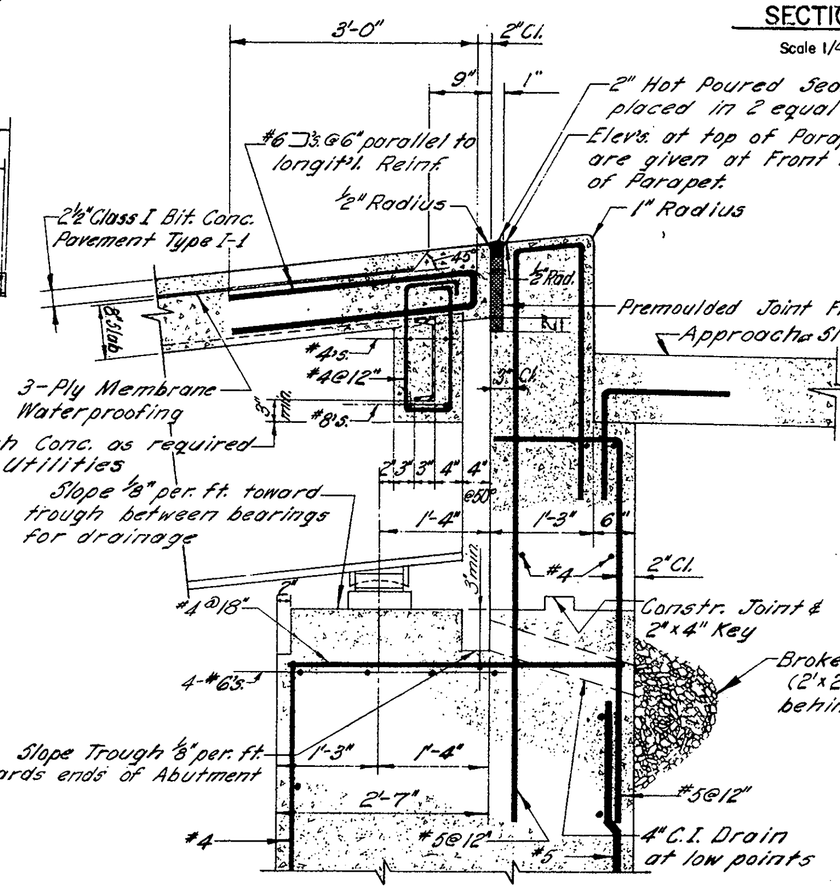


SECTION F-F
Scale 1/4"=1'-0"

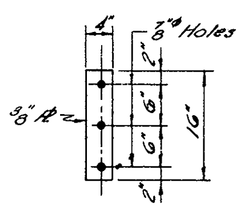


Max. Soil Pressure = 9,050 lbs. per Sq. Ft.

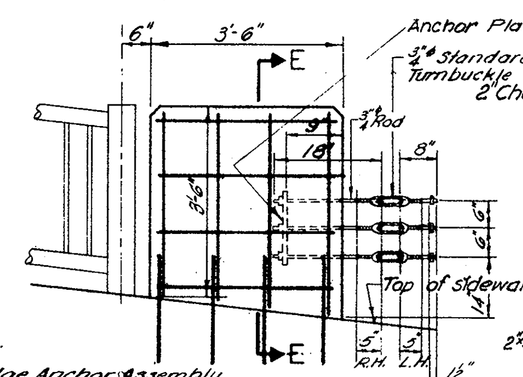
TYPICAL ABUTMENT SECTION
Scale 1/4"=1'-0"



DETAIL "B"
Scale 3/4"=1'-0"

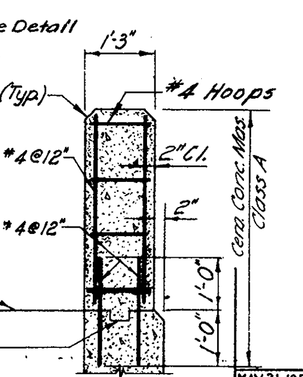


ANCHOR PLATE DETAIL
Scale 3/4"=1'-0"



NOTE:
Bridge Anchor Assembly for North West End Post only.

END POST DETAIL
Scale 1/2"=1'-0"

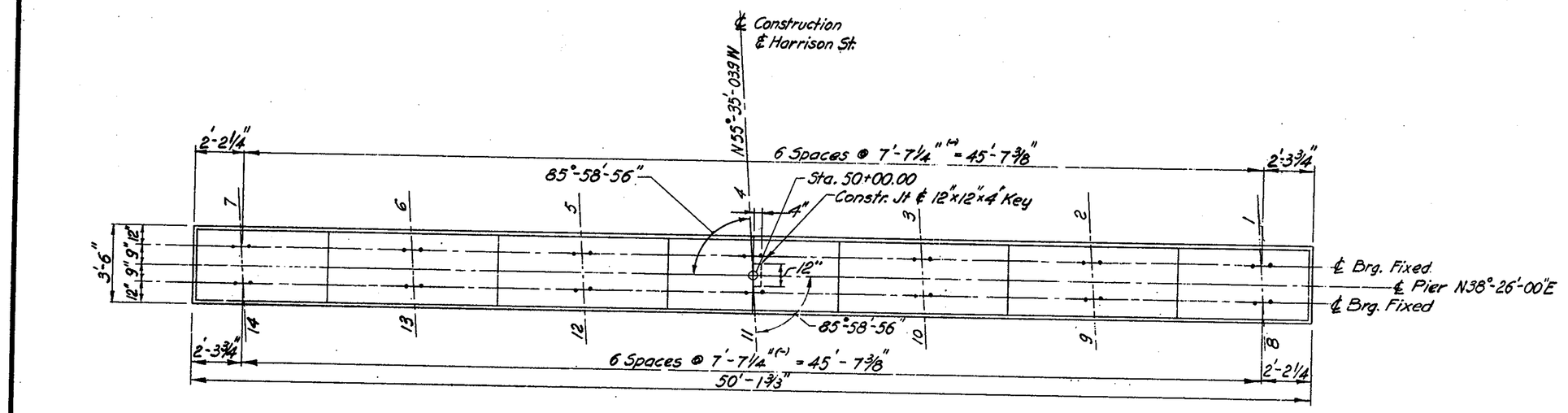


SECTION E—E
Scale 1/2"=1'-0"

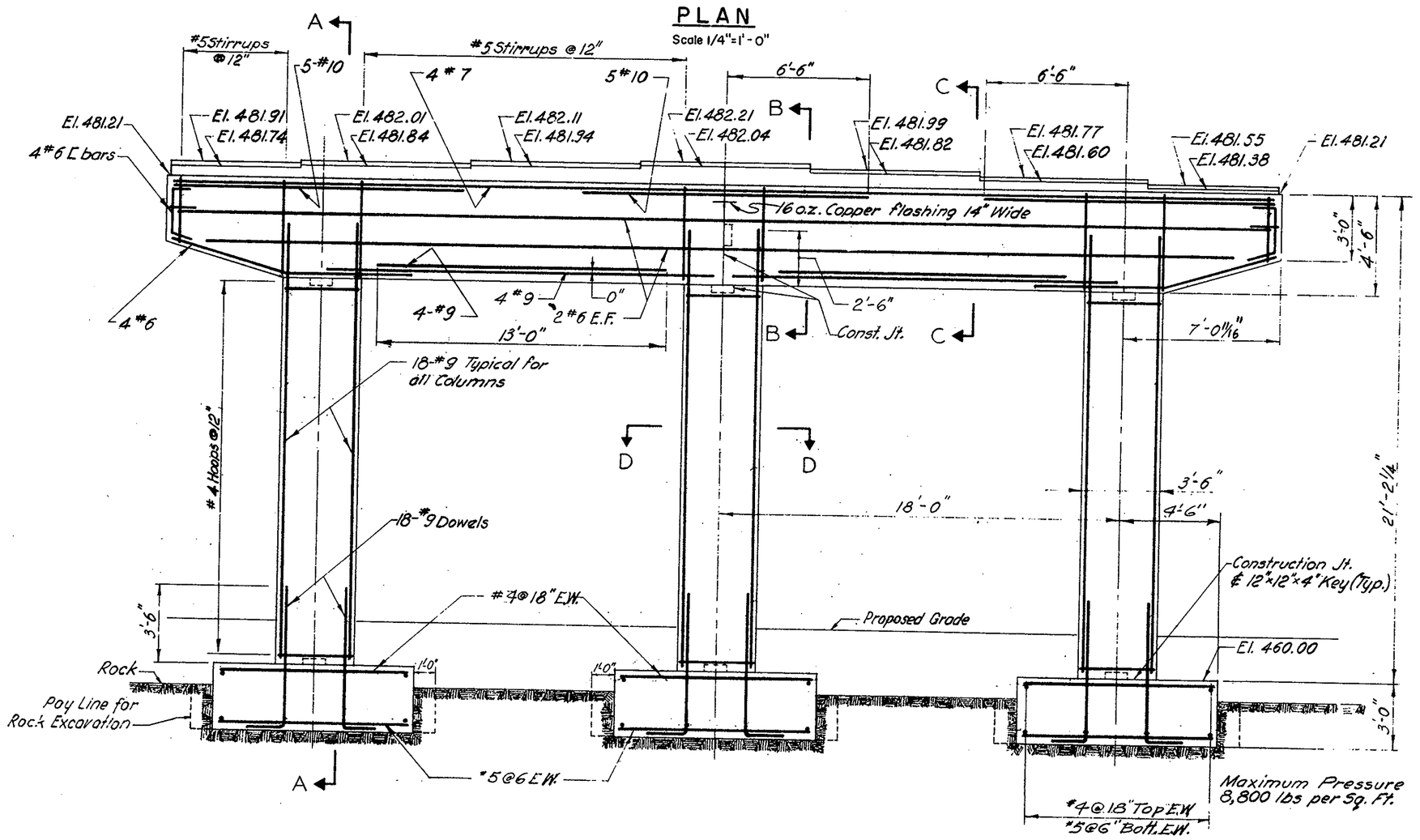
DATE	DESCRIPTION
MAY 31, 1958	· ISSUED FOR CONSTRUCTION ·
·	· USE ONLY PRINTS OF LATEST DATE ·

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-353(3)	1958	185	194

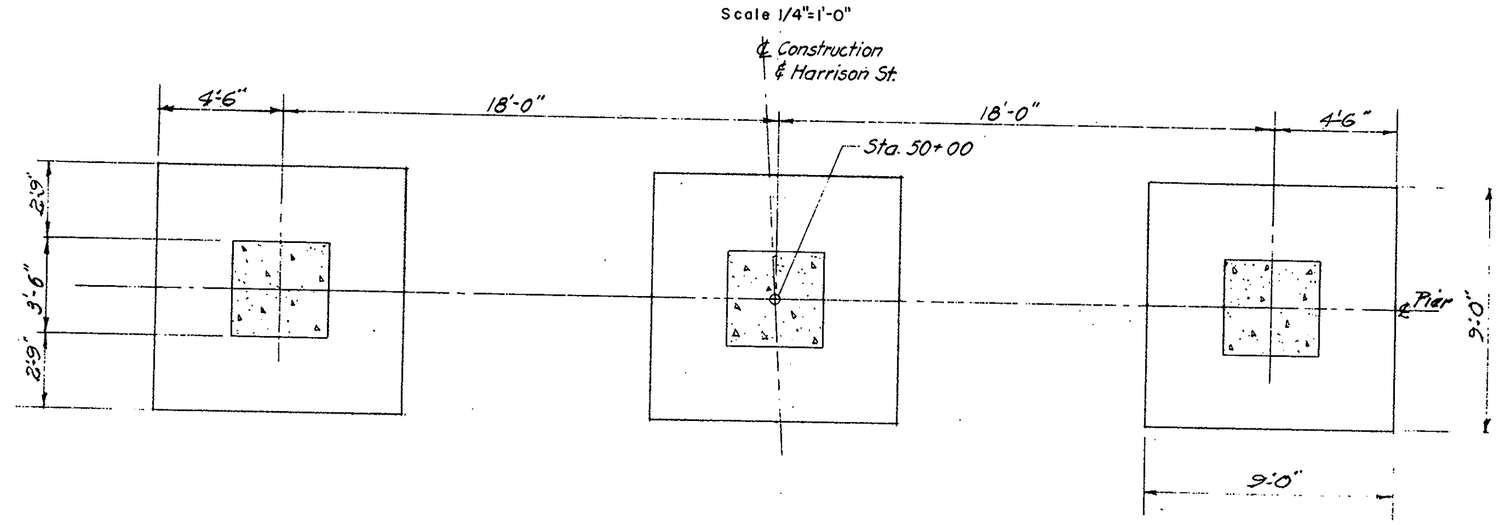
I-W90-1(3)95 Contract B



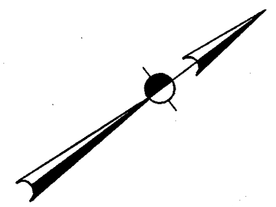
PLAN
Scale 1/4"=1'-0"

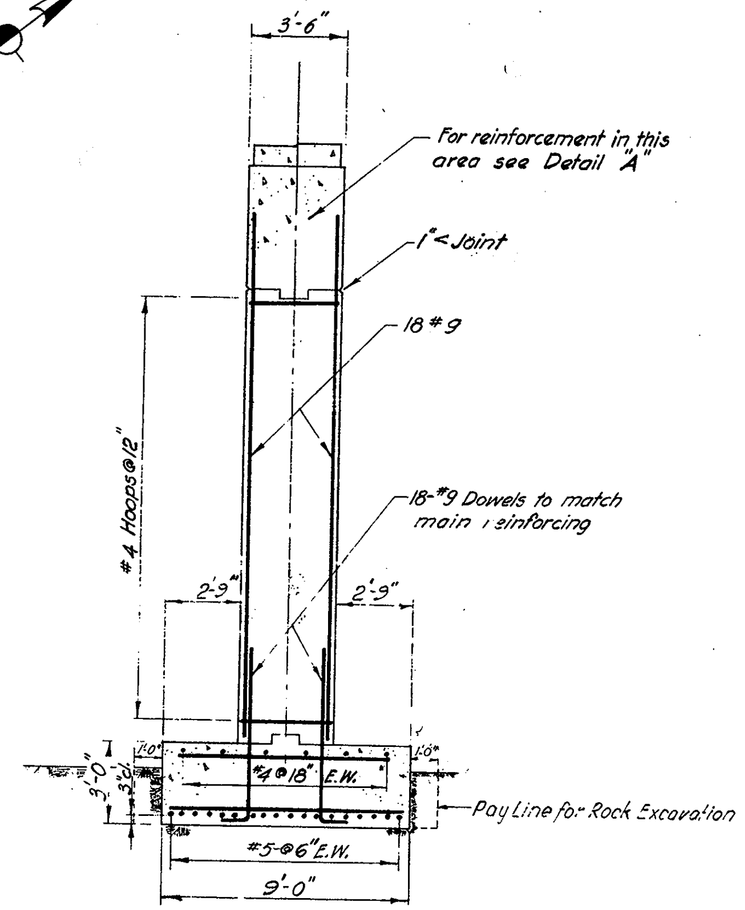


ELEVATION
Scale 1/4"=1'-0"

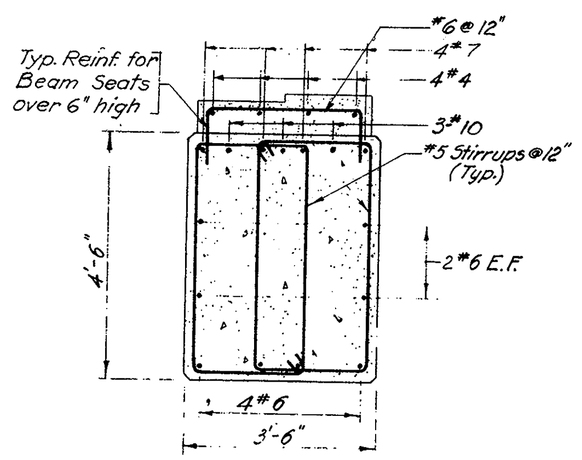


FOOTING
Scale 1/4"=1'-0"

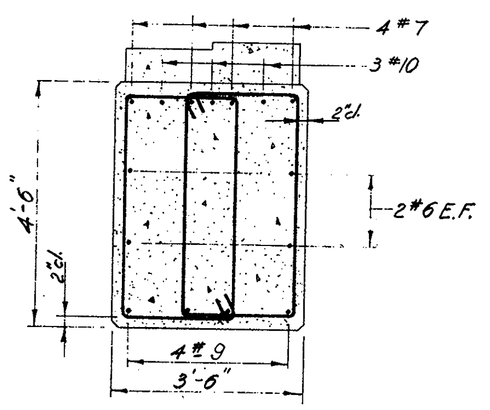




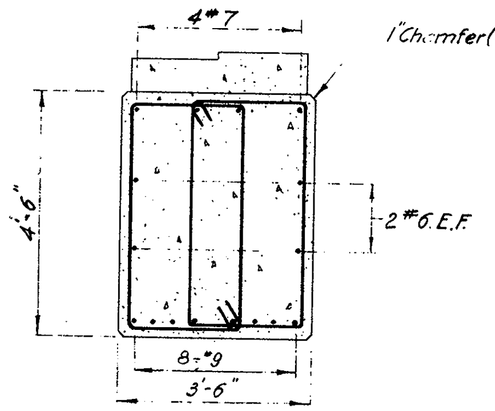
SECTION A-A
Scale 1/4"=1'-0"



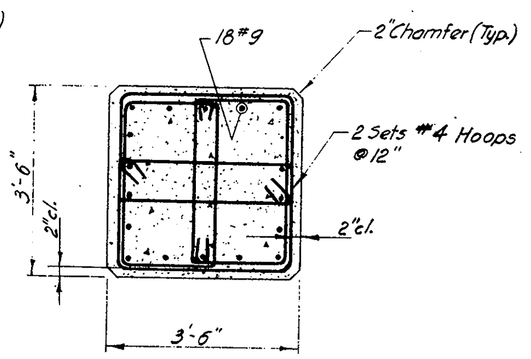
DETAIL "A"
Scale 1/2"=1'-0"



SECTION B-B
Scale 1/2"=1'-0"



SECTION C-C
Scale 1/2"=1'-0"



SECTION D-D
Scale 1/2"=1'-0"

DATE	DESCRIPTION
MAY 31, 1958	• ISSUED FOR CONSTRUCTION •
	• USE ONLY PRINTS OF LATEST DATE •

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-353(3)	1958	186	194

I-W90-1(3)95 CONTRACT B

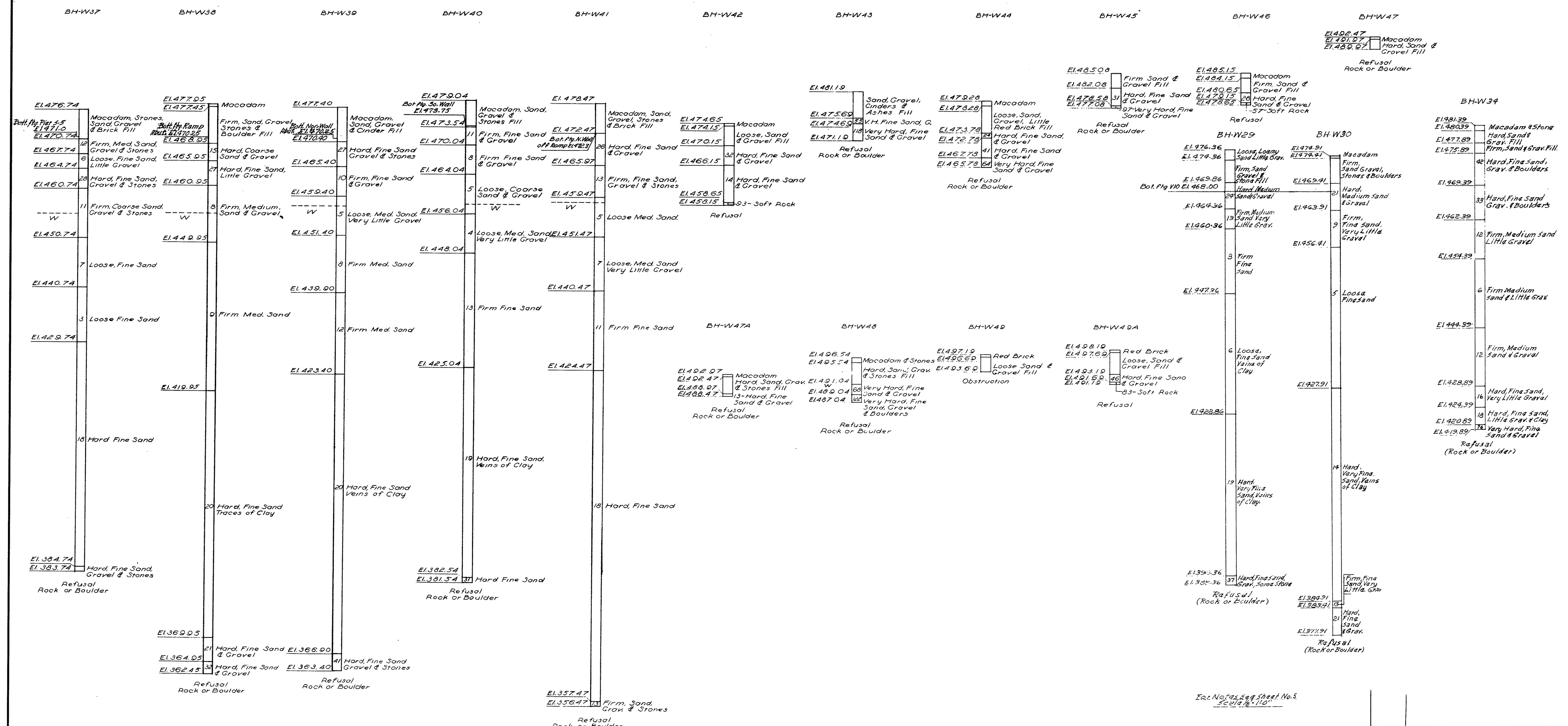
PLAN
Scale 1"=10'-0"
℄ Brg. W. Abutment Expansion
℄ Brg. E. Abutment Expansion
℄ Pier
℄ Brg. Fixed
Edge of Structure
Curb Line
Sta. 49+34.59
Sta. 50+00
Sta. 50+71.60
4 Spaces @ 14'-0"=56'-0"
35p. @ 4'-8" Typical
6 Spaces @ 7'-7"=45'-6"
36WF150+10"×⅜" ℞×33'Lg.
36WF182+10"×⅜" ℞×38'Lg.
36WF194+10"×1" ℞×40'Lg.
36WF182+10"×1" ℞×44'Lg.
Camber: Min. 1¾" Max. 2¼" Δ=⅞"
Camber: Min. 2" Max. 2½" Δ=1"
TYPICAL CROSS SECTION
Scale 3/8"=1'-0"
℄ Roadway
50'-0"
Mass. Standard Type "H" Metal Bridge Railing
Granite Curb, Type VA5, Str. #5 Anchors, @ 2 per piece of stone
8" Reinforced Conc. Slab, 2½" Bit. Conc. Class I, Type I-1 & 3 Ply Membrane Waterproofing
Lightweight Partition Tile: Downgrade ends of Tile to be left open for drainage. Upgrade ends to be filled with Concrete.
Longitudinal Constr. Jt.
Wire Mesh and Fabric Flashing
Slope ¼" per ft.
12" Sewer
12" Water
See Detail "A"
See Detail "B"
#4-7 Spaces @ 10" Bottom
4" ⌀ Gas. Support, similar to Detail "A"
EXPANSION BEARING DETAILS
Scale 1"=1'-0"
SIDE VIEW
END VIEW
Sole ℞ Beveled for Roadway Slope
2-1¼" ⌀ Swedged Anchor Bolts 1⅝" ⌀ Holes in Bed ℞ & 4" Ls, Hex. Nuts.
Curved Bronze ℞ with trepanned holes & Lubricant
L 4"×3"×⅝"×0'-7"
⅜ Fillet Welds on 3 sides
FIXED BEARING DETAILS
Scale 1"=1'-0"
2-1¼" ⌀ Swedged Anchor Bolts, 1⅜" ⌀ Holes in Sole ℞ & Bed ℞, 3"×⅛" ℞ Washer (beveled), Hex. Nuts.
SPIRAL DETAILS
No Scale
#5 Spiral Bar
⅝" ⌀ Rod
5" Mean Dia. Spiral
¾" ⌀ Studs
Weld
Pitch
Lap
Stringers No. 1, 7, 8, | Pitch = 6" | Pitch = 9" | Pitch = 15"
2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14 | 6" | 9" | 12"
℄ Bearing
℄ of Girder Symm. About
Conversion Table
Pitch for 2-⅝" ⌀ Spirals | Pitch for 4-¾" ⌀ Studs
6" | 7"
9" | 10"
12" | 14"
15" | 17"
COVER ℞ DETAIL
Scale 1"=1'-0"
Length of Cover ℞ as shown on Plan
¼ weld for ℞s under ¾" thick
DIAPHRAGM DETAILS
Scale 3/4"=1'-0"
ELEVATION
SECTION A–A
END DIAPHRAGM
ELEVATION
SECTION B–B
INTERMEDIATE DIAPHRAGM
Holes for Erection Bolts
Holes for erection bolts
LONGITUDINAL CONSTRUCTION JOINT
Scale 1"=1'-0"
Construction Joint 16 oz. Copper flashing, 8" wide
Main Reinf. bars to be continuous trough Joint
Note - 1. Δ = deflection due to wt. of conc. deck only.
ROADWAY FIXED JOINT
Scale 1"=1'-0"
1" Hot poured Joint Sealer
1" Premoulded Filler
2½"×½" Anchors 12" o.c. ⅜" Fillet all around
L 6"×4"×¾" Continuous
½" Stiffeners @ 12"
3 Ply membrane
Shim as required & weld
NOTES: Cut 12" Plates to clear Beam Flange. All welds are ⅜" continuous fillets, except as noted. Stringer flanges to be cut parallel to ℄ of Pier. Fixed Joint is continuous between exterior Stringers.
NOTE "A" Bar 7×1" Continuous, welded top & bottom to one ℞ only with ⅜"×2" Fillet welds @ 8", alternate @ 4"
SIDEWALK FIXED JOINT
Scale 1"=1'-0"
End of Lightweight Partition Tile, and Granite Curb
Fill with hot poured sealer for 1" at top of Joint
NOTE: Similar Joint to be carried down face of Curb.
1½"×⅜" Strap anchors, each @ 12" o.c. alternate @ 6"
DETAIL "A"
Scale 1/2"=1'-0"
19" Dia. Hole cut in web for 12" Pipe
27WF94 Level
Timber 3"×4"
DETAIL "B"
Scale 1/2"=1'-0"
12" C.I. Insulated water pipe
Timber 4"×4"
4WF13 (Level)
⅝" ⌀ Bolts

MAY 31, 1958	· ISSUED FOR CONSTRUCTION ·
DATE	· DESCRIPTION ·
	· USE ONLY PRINTS OF LATEST DATE ·

· SHEET 45 OF 53 SHEETS · BRIDGE NO. W-44-83

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-353(3)	1958	149	194

I-W90-1(3)95 CONTRACT B



Eqc. No. 95-549 Sheet No. 5 Scale 1/8" = 1'-0"

DATE	DESCRIPTION
MAY 31, 1958	· ISSUED FOR CONSTRUCTION ·
	· USE ONLY PRINTS OF LATEST DATE ·

Appendix B Boring Logs and Rock Core Photos

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-101

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 2
Location: Harrison St West Abut		Date & Time Started: 10/4/2021 10:15	Total Hours: 5.0
Groundwater Depth (Feet): 18	Date & Time: 11/11/2021 11:15	Date & Time Completed: 11/11/2021 11:15	
Coordinates (Feet): N 2918444.5 E 576191.9		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through about 5 inches of ASPHALT.	477
				0.4 - Auger through inferred FILL, cuttings show sand and gravel, trace silt.	
				2.0 - Auger through inferred CONCRETE approach slab, pop out around 2.8 feet.	
SS - 1	3 - 5	1 - 2 - 1 - 3	5	***3.0*** - SS-1: Wet, very loose, brown, FINE TO COARSE SAND, some fine gravel, trace inorganic silt (FILL).	
SS - 2	5 - 7	3 - 5 - 5 - 3	6	***5.0*** - SS-2: Wet, medium dense, brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL).	5 / 472
SS - 3	10 - 12	10 - 10 - 6 - 6	10	***10.0*** - SS-3: Moist to wet, medium dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, little inorganic silt (FILL). Angular gravel indicates blasted rock.	10 / 467
SS - 4	12 - 14	8 - 8 - 9 - 15	10	***12.0*** - SS-4: Moist to wet, medium dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, trace inorganic silt (FILL). Angular gravel indicates blasted rock.	
SS - 5	15 - 17	8 - 12 - 9 - 8	7	***15.0*** - SS-5: Wet, medium dense, brown and gray, FINE GRAVEL AND FINE TO COARSE SAND, trace inorganic silt, trace brick fragments (FILL). Angular gravel indicates blasted rock.	15 / 462
SS - 6	17 - 19	7 - 13 - 11 - 9	6	***17.0*** - SS-6: Wet, medium dense, brown and gray, FINE GRAVEL, some fine to coarse sand, trace inorganic silt (FILL).	
CORE - 1	19.5 - 24.5	2 - 2 - 2 - 3.5 - 3	53	***19.1*** - Spin 4" casing and hit inferred top of CONCRETE abutment at 19.1 feet depth. Spin casing to 19.5 feet then wash out.	

Remarks: Boring conducted 7'-2" from bridge joint and 6'-8" from edge of original (bridge) vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 19.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

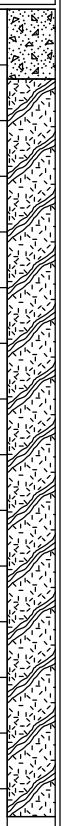
77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-101

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 2 of 2
Location: Harrison St West Abut		Date & Time Started: 10/4/2021 10:15	Total Hours: 5.0
Groundwater Depth (Feet): 18	Date & Time: 11/11/2021 11:15	Date & Time Completed: 11/11/2021 11:15	
Coordinates (Feet): N 2918444.5 E 576191.9		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
			RQD - 7%	***19.5*** - C-1 (0-21"): CONCRETE - Gray, high gravel content (less than 1" diameter).	457
CORE - 1	19.5 - 24.5	2 - 2 - 2 - 3.5 - 3	53 RQD - 7%	***21.3*** - C-1 (21-33"): SLATE (Carbonaceous) - Highly fractured, soft, slightly to moderately weathered, dark gray to black, fine grained. ***22.3*** - C-1 (33-41"): QUARTZ seam, very hard, highly fractured. ***22.9*** - C-1 (41-53"): SLATE (Carbonaceous) - Moderately fractured, medium hard, fresh, dark gray, fine grained.	
CORE - 2	24.5 - 29.5	2 - 2 - 2 - 2 - 2	60 RQD - 55%	***24.5*** - C-2: SLATE (Carbonaceous) - Highly fractured (first 1.5 feet) then slightly fractured (last 3.5 feet), medium hard, fresh, dark gray, fine grained, thin bedding, close joints dipping from approx. 30 degrees below horizontal to near horizontal.	25 452
CORE - 3	29.5 - 34.5	2 - 2 - 2 - 2 - 2	55 RQD - 65%	***29.5*** - C-3: SLATE (Carbonaceous) - Moderately to slightly fractured, medium hard, fresh, fine grained, thin bedding, close joints dipping approx. 30 degrees below horizontal.	30 447
				34.5 - Boring terminated at 34.5 feet below ground surface.	35 442



Remarks: Boring conducted 7'-2" from bridge joint and 6'-8" from edge of original (bridge) vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 19.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-102

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 1
Location: I-290 WB Left Lane		Date & Time Started: 2/24/2022 21:00	Total Hours: 2.0
Groundwater Depth (Feet): 3.5	Date & Time: 2/24/2022 23:00	Date & Time Completed: 2/24/2022 23:00	
Coordinates (Feet): N 2918395.7 E 576232.8		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 461	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through about 9 inches of ASPHALT.	461
SS - 1	1 - 2.4	16 - 30 - 50/5" -	13	***1.0*** - SS-1A (0-8"): Moist, dense, brown, FINE TO COARSE GRAVEL AND FINE TO COARSE SAND, trace inorganic silt (FILL). ***1.7*** - SS-1B (8-13"): Dry to moist, very dense, dark gray, FINE GRAVEL, some fine sand, some inorganic silt (DECOMPOSED ROCK).	
				3.0 - Drive casing to 3' depth, roller-bit through soft DECOMPOSED ROCK down to 4.5' depth where rock appears to get more hard.	
CORE - 1	4.5 - 9.5	2 - 1.5 - 2 - 2 - 2	58 RQD - 18%	***4.5*** - C-1: SLATE (Carbonaceous) - Highly to moderately fractured, medium hard, slightly weathered, fine grained, thin bedding, very close joints dipping approx. 30 degrees below horizontal.	5 456
CORE - 2	9.5 - 14.5	2 - 2 - 2 - 2 - 2	59 RQD - 52%	***9.5*** - C-2: SLATE (Carbonaceous) - Moderately to slightly fractured, medium hard, fresh, fine grained, thin bedding, close joints dipping approx. 30 degrees below horizontal.	10 451
				14.5 - Boring terminated at 14.5 feet below ground surface.	15 446

Remarks: Boring conducted in left (high-speed) lane of I-290 WB, about 3' from solid yellow line.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 3'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

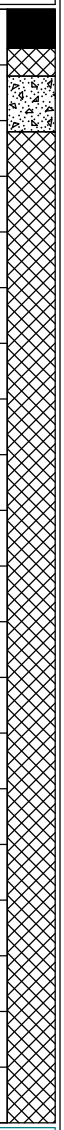
77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-103

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 3
Location: Harrison St East Abut		Date & Time Started: 9/30/2021 9:00	Total Hours: 4.5
Groundwater Depth (Feet): 36	Date & Time: 9/30/2021 13:30	Date & Time Completed: 9/30/2021 13:30	
Coordinates (Feet): N 2918363.1 E 576321.1		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 494.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through 8" of ASPHALT.	494
SS - 1	1 - 1.2	50/3" - - -	2	***1.0*** - SS-1: Moist, medium dense, black and brown, FINE TO COARSE SAND, some fine gravel, little inorganic silt, trace asphalt (FILL). ***1.2*** - Auger action indicates CONCRETE approach slab, heavy grinding then pop out around 2.2 feet depth. Auger action indicates possible rebar around 2 feet depth.	
SS - 2	3 - 5	4 - 4 - 3 - 3	5	***3.0*** - SS-2: Moist, loose, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
SS - 3	5 - 7	5 - 4 - 7 - 9	8	***5.0*** - SS-3: Moist, medium dense, light brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, little inorganic silt (FILL). Gravel is angular which indicates blasted rock.	5 489
SS - 4	7 - 9	7 - 8 - 5 - 5	6	***7.0*** - SS-4: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
SS - 5	10 - 12	7 - 5 - 8 - 9	7	***10.0*** - SS-5: Moist, medium dense, brown, FINE TO COARSE GRAVEL, some fine to coarse sand, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	10 484
SS - 6	15 - 17	12 - 9 - 8 - 13	4	***15.0*** - SS-6: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock. Coarse gravel in tip of spoon led to high blowcounts and low recovery.	15 479



Remarks: Boring conducted 4'-10" from bridge joint and 12'-6" from edge of vertical vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 35.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-103

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 2 of 3
Location: Harrison St East Abut		Date & Time Started: 9/30/2021 9:00	Total Hours: 4.5
Groundwater Depth (Feet): 36	Date & Time: 9/30/2021 13:30	Date & Time Completed: 9/30/2021 13:30	
Coordinates (Feet): N 2918363.1 E 576321.1		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 494.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
SS - 7	20 - 22	9 - 10 - 12 - 13	3	***20.0*** - SS-7: Wet, medium dense, brown, COARSE GRAVEL, some fine to coarse sand, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock. Coarse gravel stuck in tip of spoon led to high blowcounts and low recovery.	474
SS - 8	25 - 27	8 - 8 - 18 - 17	7	***25.0*** - SS-8: Wet, medium dense, brown, FINE TO COARSE SAND, some fine to medium gravel, little inorganic silt (FILL). Gravel is angular which indicates blasted rock.	25 / 469
SS - 9	30 - 32	5 - 6 - 6 - 6	5	***30.0*** - SS-9: Wet, medium dense, brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL).	30 / 464
					35 / 459
CORE - 1	36 - 41	7 - 3 - 3 - 3 - 4	60 RQD - N/A%	***35.5*** - Casing advance stops at 35.5 feet depth which indicates top of CONCRETE footing. Roller-bit through concrete to 36 feet depth. ***36.0*** - C-1: CONCRETE - Good condition, composed of gravel up to 1" diameter, first 18" of recovery has multiple joints but remaining recovery is sound. Rebar (#10) recovered at 6" of recovery. At end of recovery is 1" of dark gray slate bedrock.	

Remarks: Boring conducted 4'-10" from bridge joint and 12'-6" from edge of vertical vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 35.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-103

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 3 of 3
Location: Harrison St East Abut		Date & Time Started: 9/30/2021 9:00	Total Hours: 4.5
Groundwater Depth (Feet): 36	Date & Time: 9/30/2021 13:30	Date & Time Completed: 9/30/2021 13:30	
Coordinates (Feet): N 2918363.1 E 576321.1		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 494.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
CORE - 1	36 - 41	7 - 3 - 3 - 3 - 4	60 RQD - N/A%		454
CORE - 2	41 - 46	2 - 2 - 2 - 2 - 2	60 RQD - 58%	***41.0*** - C-2: SLATE (Carbonaceous) - Moderately fractured, medium hard, slightly weathered to fresh, dark gray, fine grained, thin bedding, close joints dipping from approx. 30 degrees below horizontal to near horizontal.	45 449
CORE - 3	46 - 51	3 - 2 - 2 - 2 - 2	59 RQD - 27%	***46.0*** - C-3: SLATE (Carbonaceous) - Highly to moderately fractured, medium hard, slightly weathered to fresh, dark gray, fine grained, thin bedding, very close to close joints dipping from approx. 30 degrees below horizontal to near horizontal.	50 444
				51.0 - Boring terminated at 51 feet below ground surface.	55 439

Remarks: Boring conducted 4'-10" from bridge joint and 12'-6" from edge of vertical vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4" OD
Hammer Weight: 140 lb
Fall: 30"
Depth: 35.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1A

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 1
Location: Harrison St West Abut		Date & Time Started: 10/1/2021 7:20	Total Hours: 0.2
Groundwater Depth (Feet): N/A	Date & Time: 10/1/21 7:30	Date & Time Completed: 10/1/2021 7:30	
Coordinates (Feet): N 2918442.1 E 576188.9		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through approach slab and fill, hit water main at 4.5 feet depth.	477
				4.5 - Exploration terminated at 4.5 feet below ground surface.	5 472
					10 467
					15 462

Remarks: Probe conducted 8'-4" from bridge joint and 3'-4" from edge of original (bridge) vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HSA Size 4" OD
Hammer Weight: -
Fall: -
Depth: 4.5'

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1B

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 1
Location: Harrison St West Abut		Date & Time Started: 10/4/2021 9:15	Total Hours: 0.3
Groundwater Depth (Feet): N/A	Date & Time: 10/4/21 9:30	Date & Time Completed: 10/4/2021 9:30	
Coordinates (Feet): N 2918445.3 E 576190.9		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.3	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through approach slab and fill, hit refusal at 16'-11" (16.9 feet) depth on inferred concrete abutment.	477
					5 / 472
					10 / 467
					15 / 462
				16.9 - Exploration terminated at 16.9 feet below ground surface.	

Remarks: Probe conducted 6'-5" from bridge joint and 6'-8" from original (bridge) vertical granite curb

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HSA Size 4" OD
Hammer Weight: -
Fall: -
Depth: 18.7'

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1C

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 1 of 2
Location: Harrison St West Abut		Date & Time Started: 10/4/2021 9:40	Total Hours: 0.4
Groundwater Depth (Feet): N/A	Date & Time: 10/4/21 10:00	Date & Time Completed: 10/4/2021 10:00	
Coordinates (Feet): N 2918445.6 E 576190.3		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.2	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through approach slab and fill, hit refusal at 21'-3" (21.25 feet) depth on inferred bedrock (missed footing).	477 5 472 10 467 15 462

Remarks: Probe conducted 9'-1" from bridge joint and 6'-8" from orginal (bridge) vertical granite curb

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HSA Size 4" OD
Hammer Weight: -
Fall: -
Depth: 22'

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1C

Scale:

City/Town: Worcester	Bridge Number: W-44-83	Project File Number: 601895	Page 2 of 2
Location: Harrison St West Abut		Date & Time Started: 10/4/2021 9:40	Total Hours: 0.4
Groundwater Depth (Feet): N/A	Date & Time: 10/4/21 10:00	Date & Time Completed: 10/4/2021 10:00	
Coordinates (Feet): N 2918445.6 E 576190.3		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 477.2	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
					457
				21.3 - Exploration terminated at 21.25 feet below ground surface.	25 452
					30 447
					35 442

Remarks: Probe conducted 9'-1" from bridge joint and 6'-8" from orginal (bridge) vertical granite curb

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

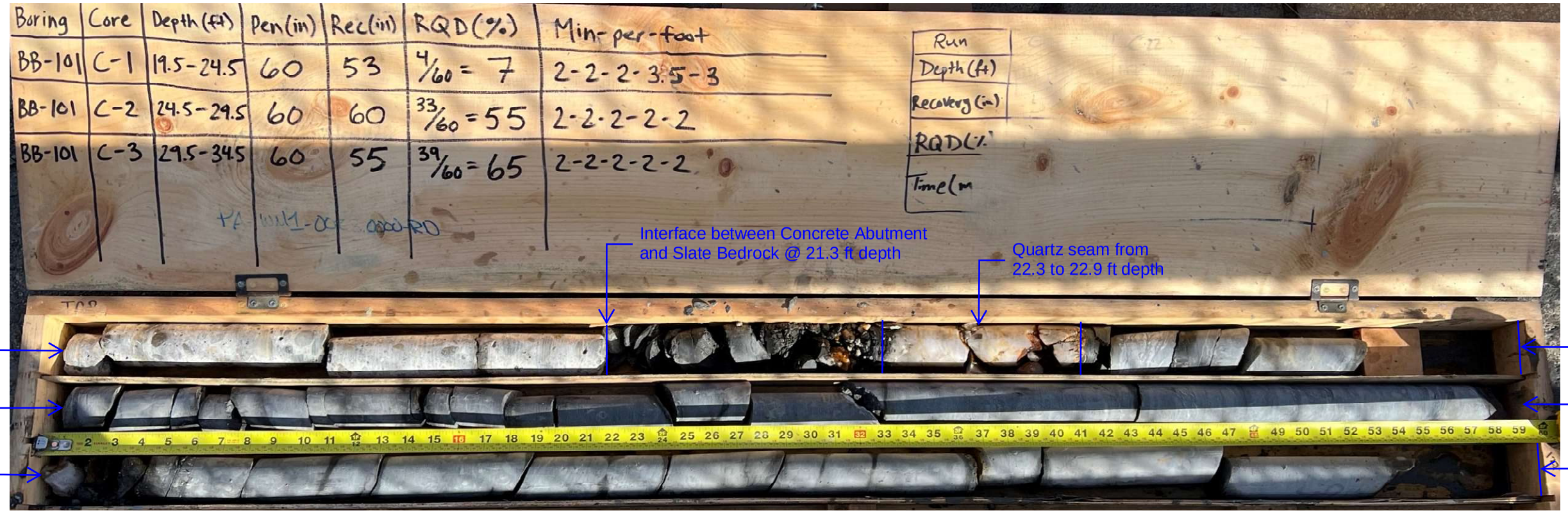
Casing Type: HSA Size 4" OD
Hammer Weight: -
Fall: -
Depth: 22'

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

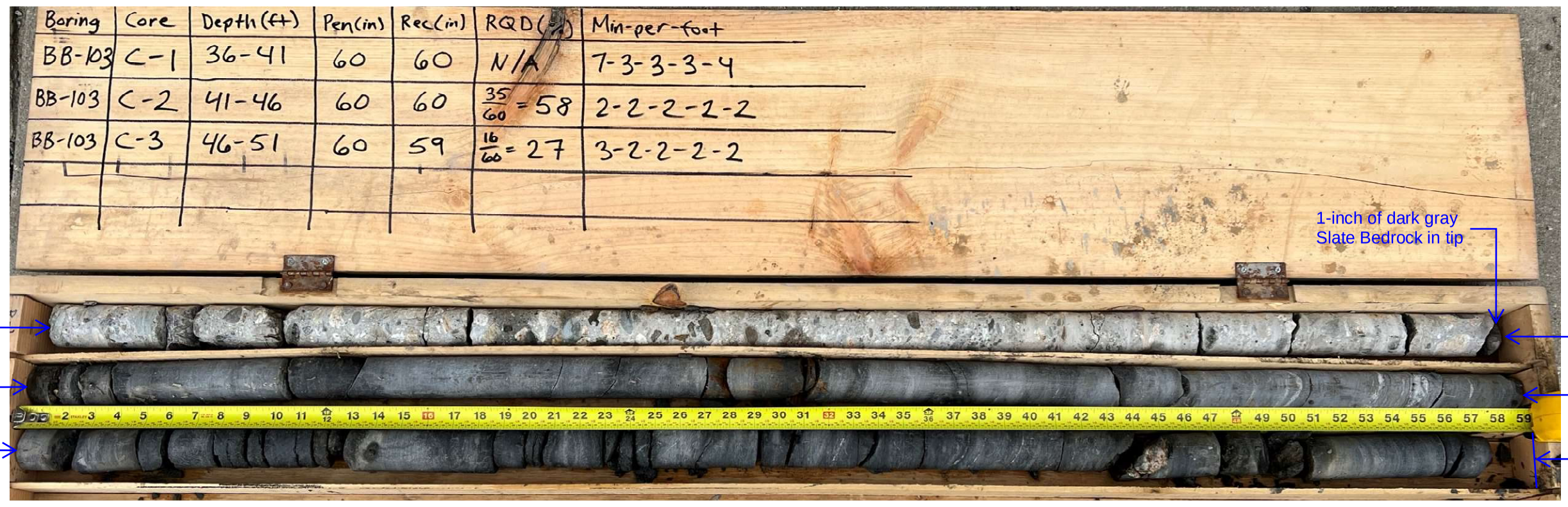
Core Barrel Type: - Size: -

ROCK CORE BOX PICTURES

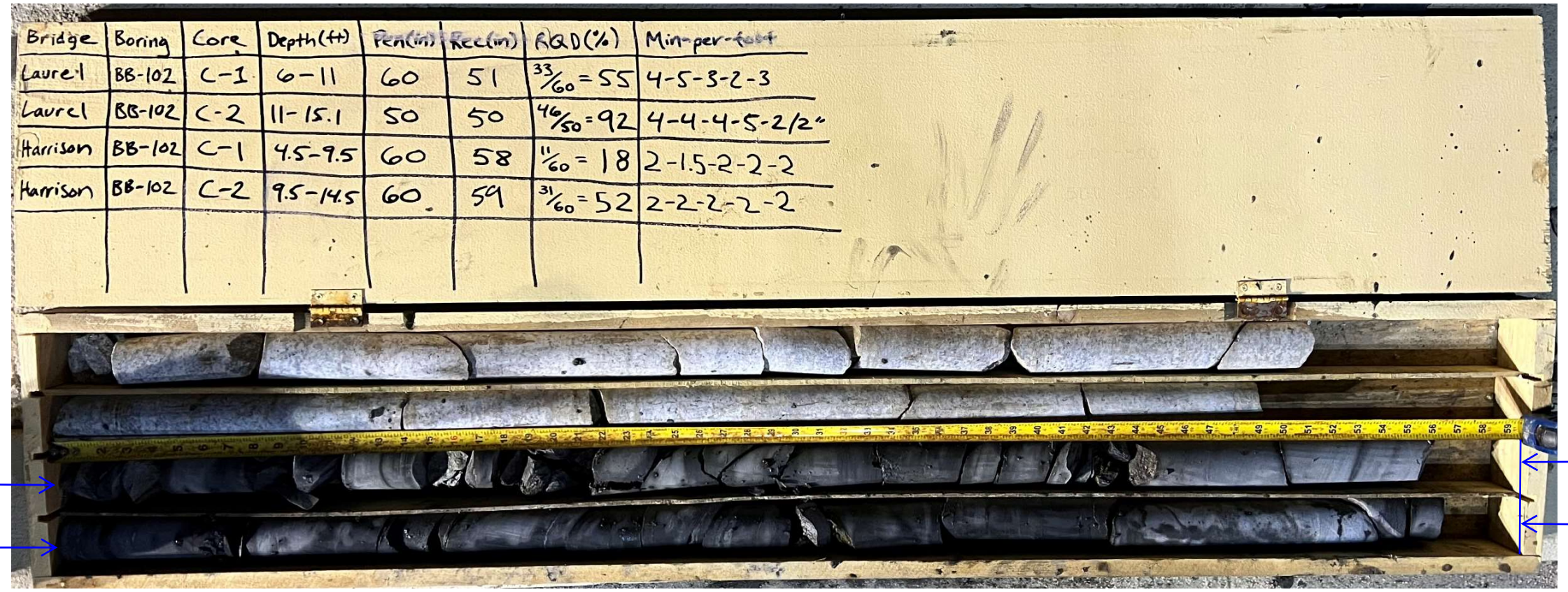
BB-101A



BB-103



BB-102



Top of C-1 @ 4.5 ft depth

Top of C-2 @ 9.5 ft depth

Bott. of C-1 @ 9.5 ft depth

Bott. of C-2 @ 14.5 ft depth

Appendix C Laboratory Testing Results

Client:	HNTB Corporation				
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	11/29/21	Checked By:	jdt
Depth :	---	Test Id:	641346		

Laboratory Determination of Density (Unit Weight) of Soil Specimens by ASTM D7263

Boring ID	Sample ID	Depth	Visual Description	Bulk Density pcf	Moisture Content %	Dry Density pcf	*
BB103	Harrison/ S- 3	5-7'	Moist, grayish brown silty sand with gravel	84.17	4.349	80.66	(1)
BB-101	Harrison/ S- 3	10-12'	Moist, grayish brown silty sand with gravel	90.08	6.769	84.37	(2)
BB-101	Laurel/ S- 4	7-9'	Moist, grayish brown sand with silt and gravel	81.79	5.849	77.27	(3)
BB-103	Laurel/ S- 3	10-12'	Moist, dark brown sand with silt and gravel	85.93	5.784	81.24	(4)

* Sample Comments

(1): Method B-Volumetric,

(2): Method B-Volumetric,

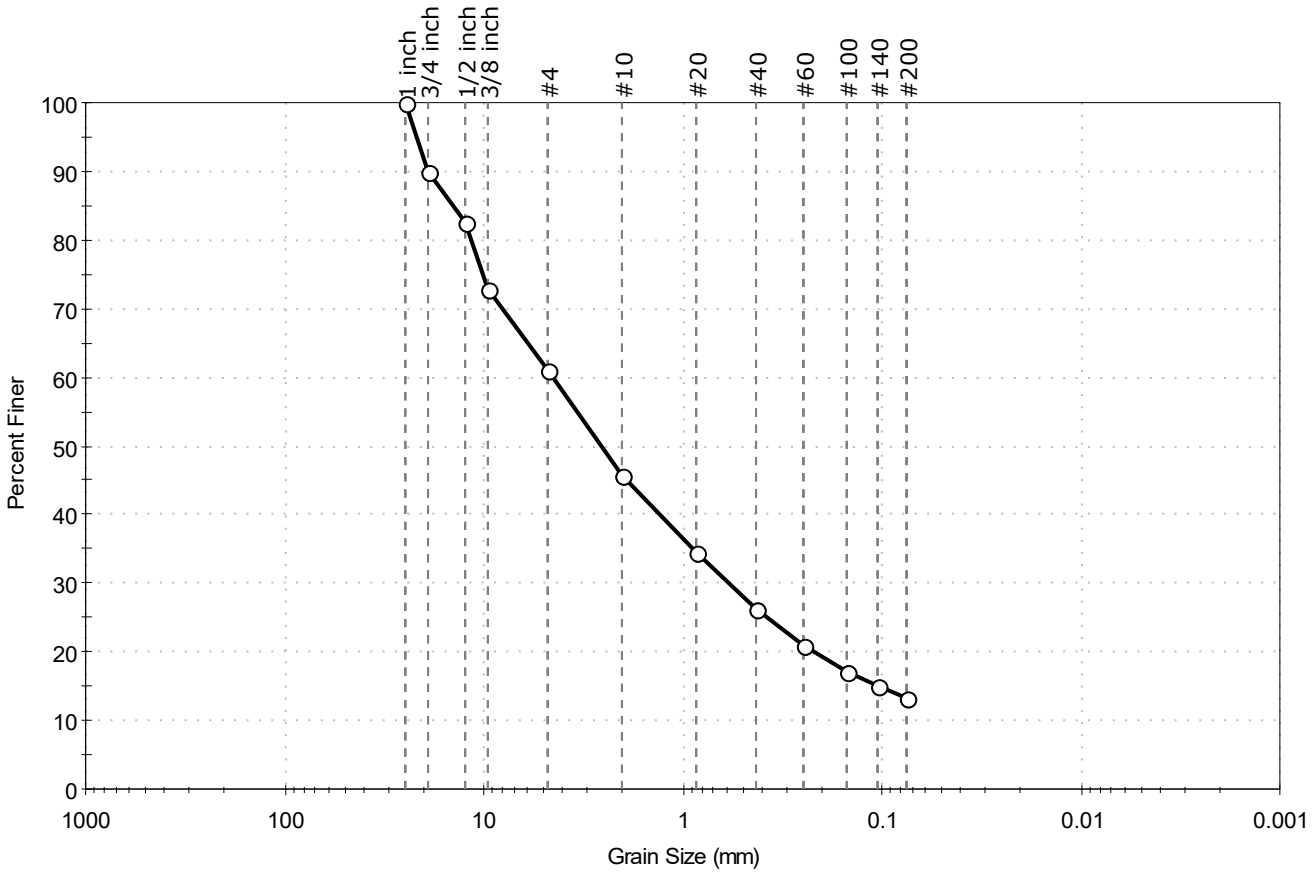
(3): Method B-Volumetric,

(4): Method B-Volumetric,

Notes: Moisture Content determined by ASTM D2216.

Client:	HNTB Corporation	Proposal No. 609185-129075			
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	BB103	Sample Type:	jar	Tested By:	ckg
Sample ID:	Harrison/S-3	Test Date:	11/23/21	Checked By:	jdt
Depth :	5-7'	Test Id:	641344		
Test Comment:	---				
Visual Description:	Moist, grayish brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	38.9	47.8	13.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.00	100		
3/4 inch	19.00	90		
1/2 inch	12.50	83		
3/8 inch	9.50	73		
#4	4.75	61		
#10	2.00	46		
#20	0.85	35		
#40	0.42	26		
#60	0.25	21		
#100	0.15	17		
#140	0.11	15		
#200	0.075	13		

Coefficients

D_{85} = 14.3668 mm	D_{30} = 0.5816 mm
D_{60} = 4.4669 mm	D_{15} = 0.1058 mm
D_{50} = 2.5467 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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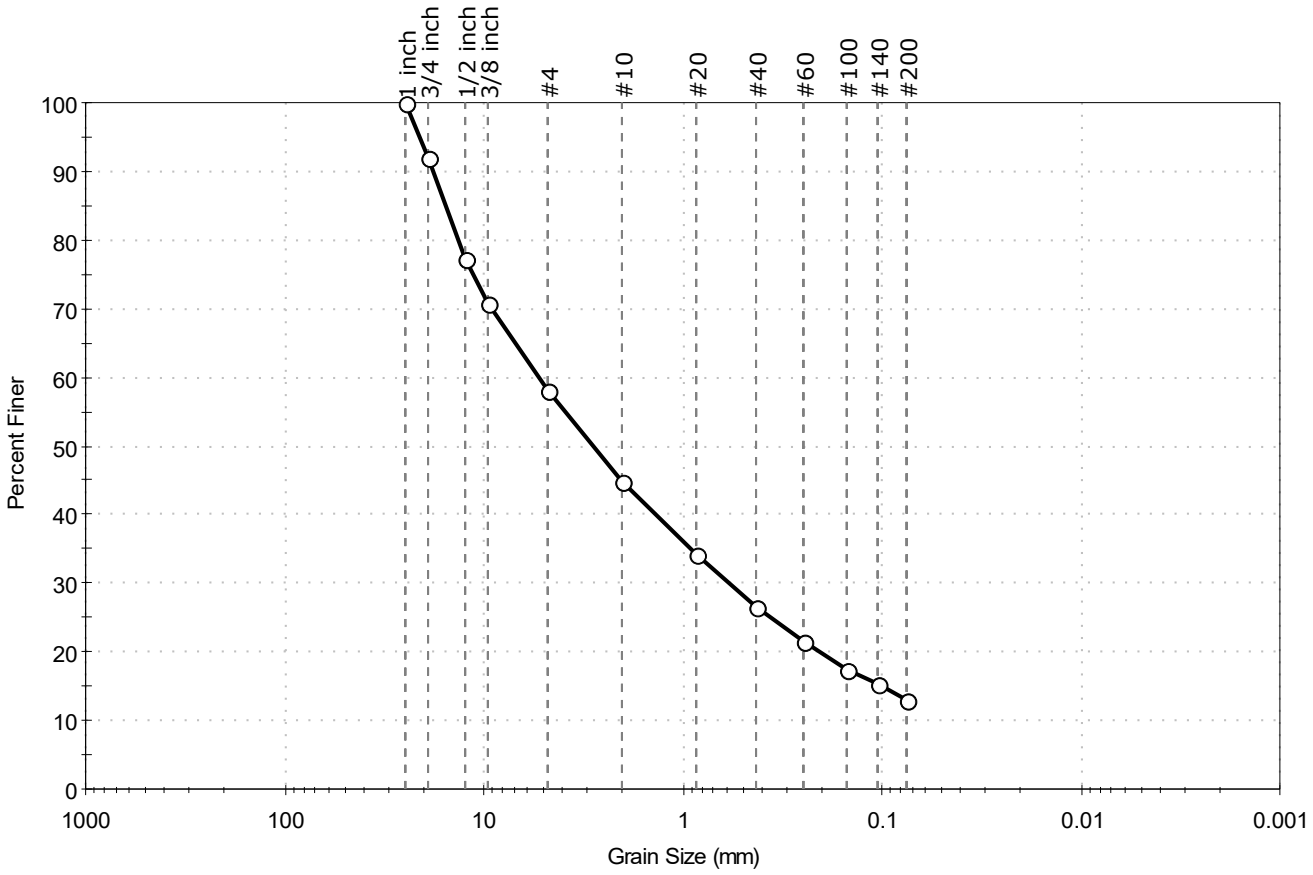
Client:	HNTB Corporation	Proposal No. 609185-129075			
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	BB-101	Sample Type:	jar	Tested By:	ckg
Sample ID:	Harrison/S-3	Test Date:	11/23/21	Checked By:	jdt
Depth :	10-12'	Test Id:	641343		
Test Comment:	---				
Visual Description:	Moist, grayish brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	41.9	45.1	13.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.00	100		
3/4 inch	19.00	92		
1/2 inch	12.50	77		
3/8 inch	9.50	71		
#4	4.75	58		
#10	2.00	45		
#20	0.85	34		
#40	0.42	26		
#60	0.25	22		
#100	0.15	17		
#140	0.11	15		
#200	0.075	13		

Coefficients

D_{85} = 15.5270 mm D_{30} = 0.5866 mm

D_{60} = 5.2578 mm D_{15} = 0.1008 mm

D_{50} = 2.8101 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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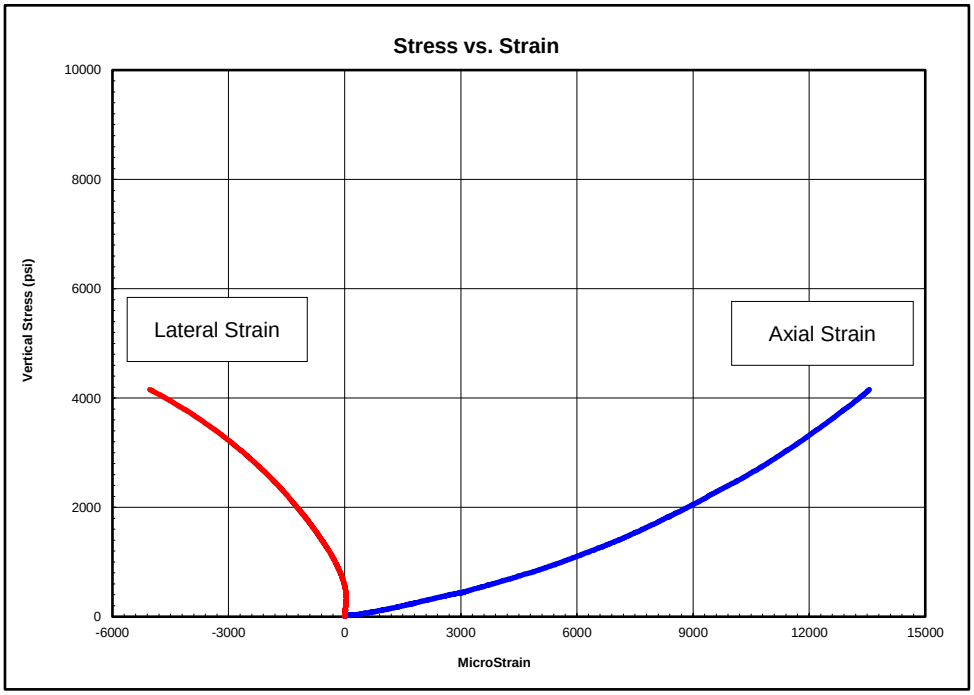
Client:	HNTB Corporation
Project Name:	Laurel & Harrison St over I-290
Project Location:	Worcester, MA
GTX #:	314613
Test Date:	11/17/2021
Tested By:	kdp
Checked By:	jsc
Boring ID:	BB-103
Sample ID:	Harrison/C-2
Depth, ft:	41.2-41.8
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 4,155 psi

The strain values recorded within the third stress range for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
400-1500	234,000	0.15
1500-2600	362,000	0.43
2600-3700	477,000	---

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	HNTB Corporation	Test Date:	11/15/2021
Project Name:	Laurel & Harrison St over I-290	Tested By:	ak
Project Location:	Worcester, MA	Checked By:	smd
GTX #:	314613		
Boring ID:	BB-103		
Sample ID:	Harrison/C-2		
Depth:	41.2-41.8 ft		
Visual Description:	See Photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.04	4.03	4.04
Specimen Diameter, in:	1.77	1.76	1.77
Specimen Mass, g:	434.39		
Bulk Density, lb/ft^3	167	**Minimum Diameter Tolerence Met?**	NO
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

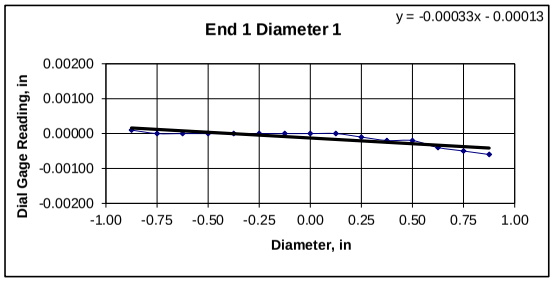
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00040	-0.00050	-0.00060
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010

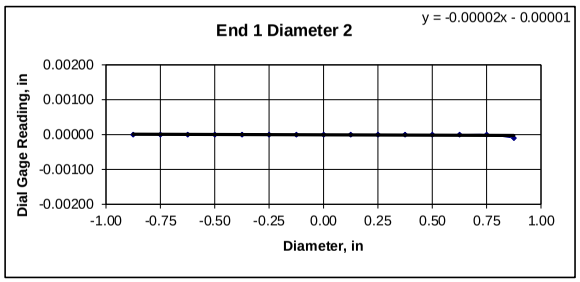
Difference between max and min readings, in:
0° = 0.00070 90° = 0.00010

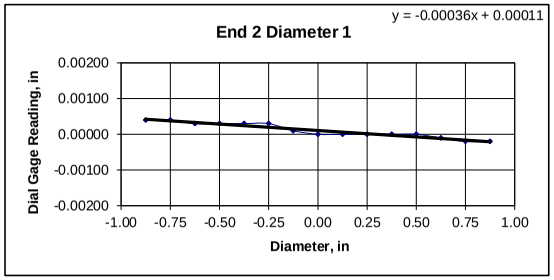
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00030	0.00030	0.00030	0.00030	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020
Diameter 2, in (rotated 90°)	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00010	0.00000	0.00010	0.00010	0.00010	0.00020	0.00020	0.00020	0.00020

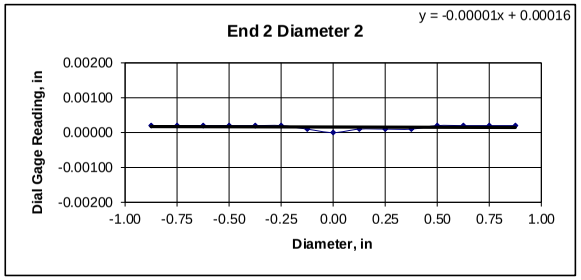
Difference between max and min readings, in:
0° = 0.0006 90° = 0.0002

Maximum difference must be < 0.0020 in. Difference = ± 0.00035
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00033
Angle of Best Fit Line: 0.01883

End 2:
Slope of Best Fit Line 0.00036
Angle of Best Fit Line: 0.02063

Maximum Angular Difference: 0.00180

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

End 2:
Slope of Best Fit Line 0.00001
Angle of Best Fit Line: 0.00082

Maximum Angular Difference: 0.00033

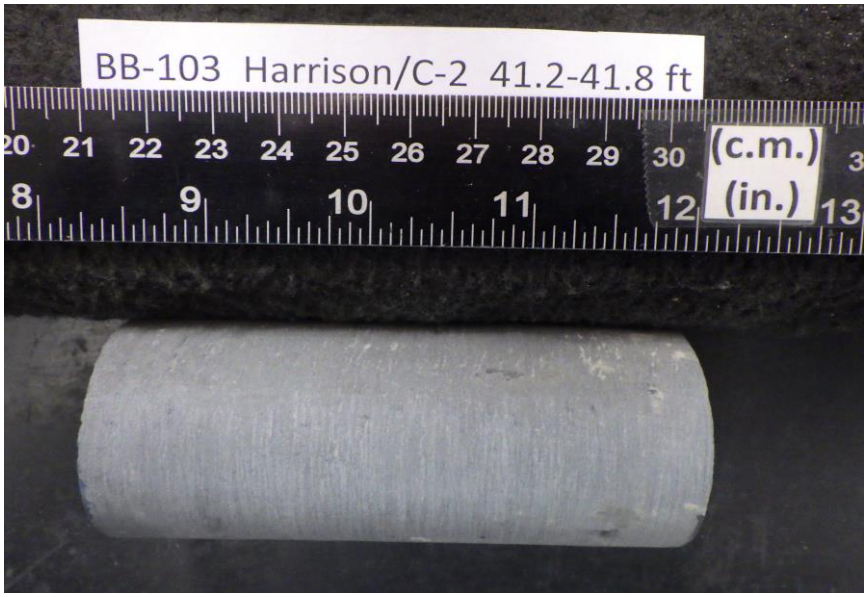
Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

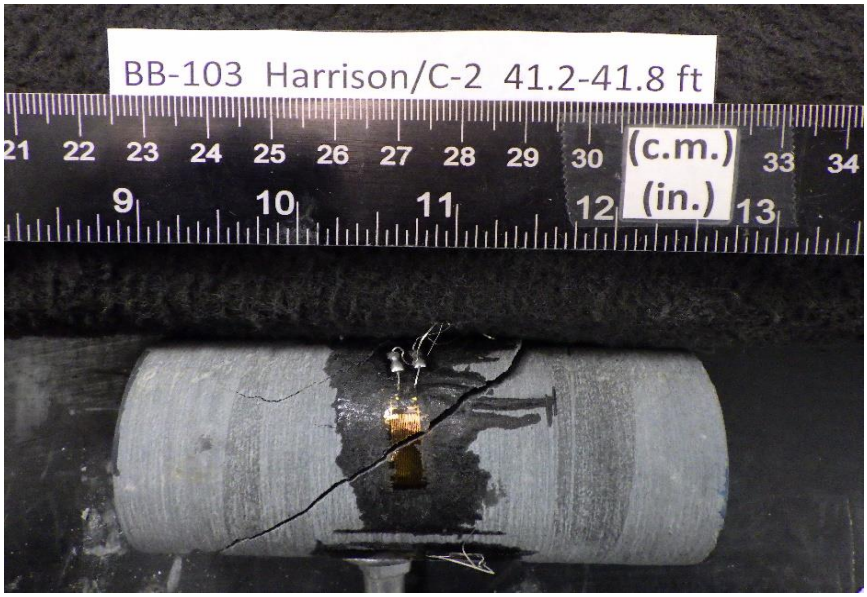
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00070	1.765	0.00040	0.023	YES
Diameter 2, in (rotated 90°)	0.00010	1.765	0.00006	0.003	YES
END 2					
Diameter 1, in	0.00060	1.765	0.00034	0.019	YES
Diameter 2, in (rotated 90°)	0.00020	1.765	0.00011	0.006	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	HNTB Corporation
Project Name:	Laurel & Harrison St over I-290
Project Location:	Worcester, MA
GTX #:	314613
Test Date:	11/17/2021
Tested By:	ak
Checked By:	smd
Boring ID:	BB-103
Sample ID:	Harrison/C-2
Depth, ft:	41.2-41.8 ft



After cutting and grinding



After break

Appendix D Design Calculations

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	2/9/2022	Job Number	78900
	Checked	NMH	Date	2/30/2022		
For Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/30/2022	Sheet No.	1 of 1

Seismic Design Calculation

REFERENCES

1. 2013 MassDOT LRFD Bridge Manual (with January 2020 Revisions)
2. 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition
3. 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design

ACCELERATION COEFFICIENTS See attached 2,500-yr USGS Seismic Hazard Maps (Reference 1)

PGA	0.080	*Horizontal Peak Ground Acceleration Coefficient*
S_1	0.055	*Horizontal Response Spectral Acceleration Coefficient At Period 1.0 S*
S_S	0.138	*Horizontal Response Spectral Acceleration Coefficient At Period 0.2 S*

SITE CLASS DEFINITION *See AASHTO Table 3.10.3.1-1 (Reference 2)*

Conservatively assume **Site Class B** (medium hard rock)

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s < 5{,}000$ ft/s

SITE FACTORS See AASHTO Figure 3.10.4.1-1 below (Reference 2)

F_{pga}	1.0	*Zero-Period on Acceleration Spectrum (Table 3.10.3.2-1)*
F_a	1.0	*Short-Period Range of Acceleration Spectrum (Table 3.10.3.2-2)*
F_v	1.0	*Long-Period Range of Acceleration Spectrum (Table 3.10.3.2-3)*

DESIGN RESPONSE SPECTRUM

A_S	0.080
S_{DS}	0.138
S_{D1}	0.055

SEISMIC DESIGN CATEGORY

From 2011 AASHTO (Reference 3):

Table 3.5-1—Partitions for Seismic Design Categories A, B, C, and D

Value of $S_{D1} = F_v S_1$	SDC
$S_{D1} < 0.15$	A
$0.15 \le S_{D1} < 0.30$	B
$0.30 \le S_{D1} < 0.50$	C
$0.50 \le S_{D1}$	D

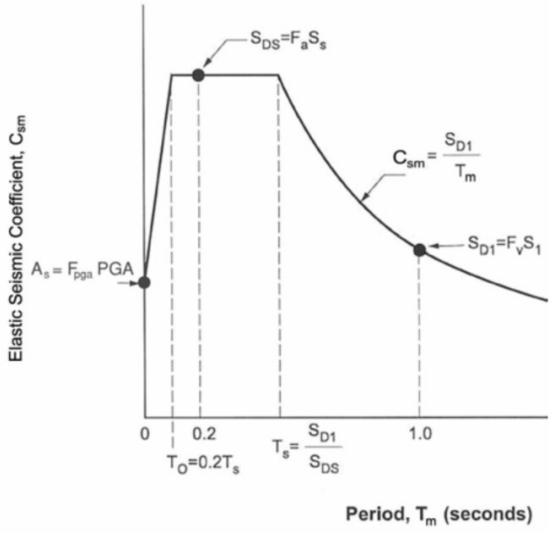
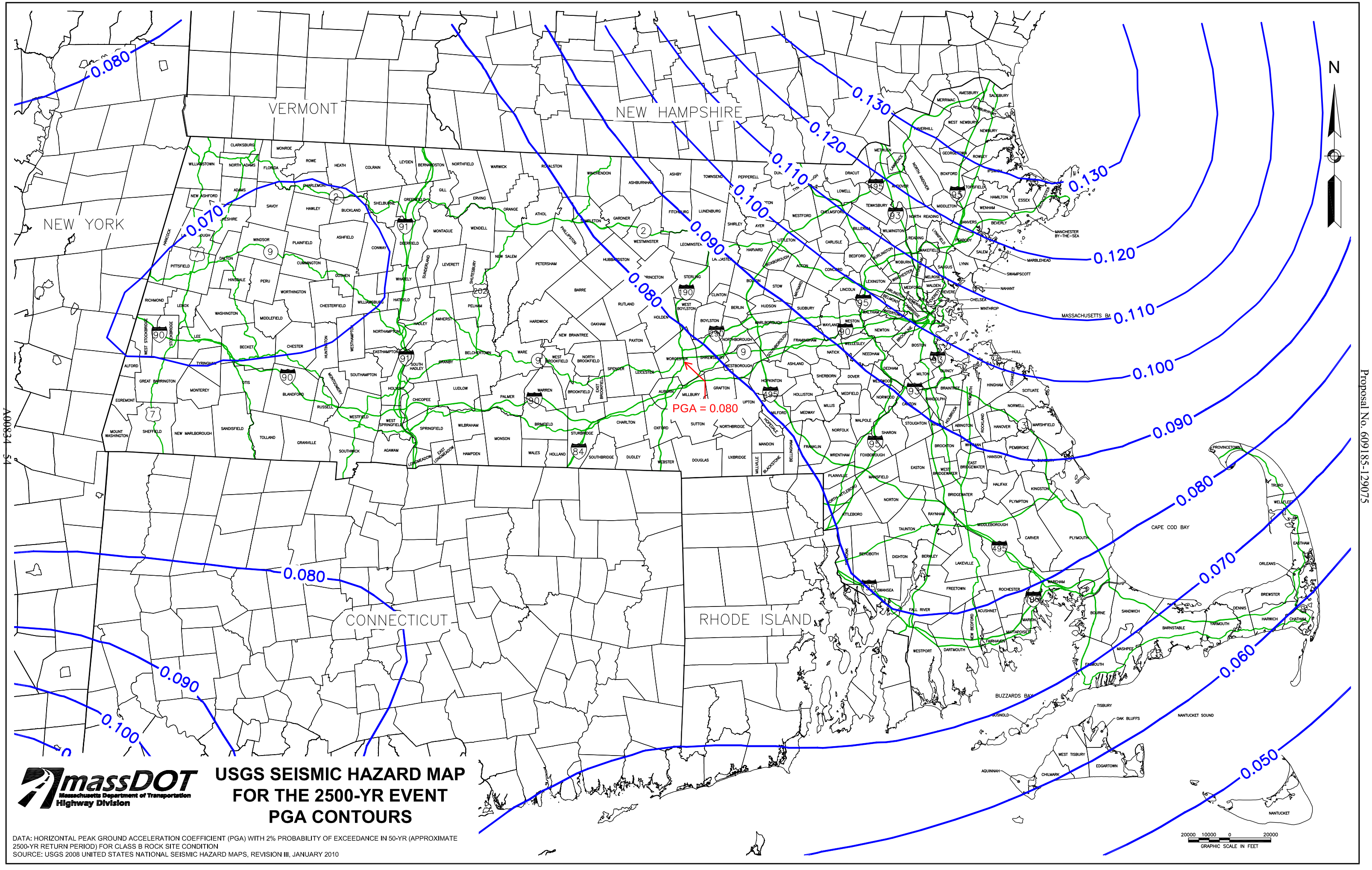


Figure 3.10.4.1-1—Design Response Spectrum

Seismic Design Category A

SDC A is also known as Seimsic Zone 1 in 2020 AASHTO (Reference 2)



USGS SEISMIC HAZARD MAP FOR THE 2500-YR EVENT PGA CONTOURS

massDOT Massachusetts Department of Transportation Highway Division

DATA: HORIZONTAL PEAK GROUND ACCELERATION COEFFICIENT (PGA) WITH 2% PROBABILITY OF EXCEEDANCE IN 50-YR (APPROXIMATE 2500-YR RETURN PERIOD) FOR CLASS B ROCK SITE CONDITION
SOURCE: USGS 2008 UNITED STATES NATIONAL SEISMIC HAZARD MAPS, REVISION III, JANUARY 2010

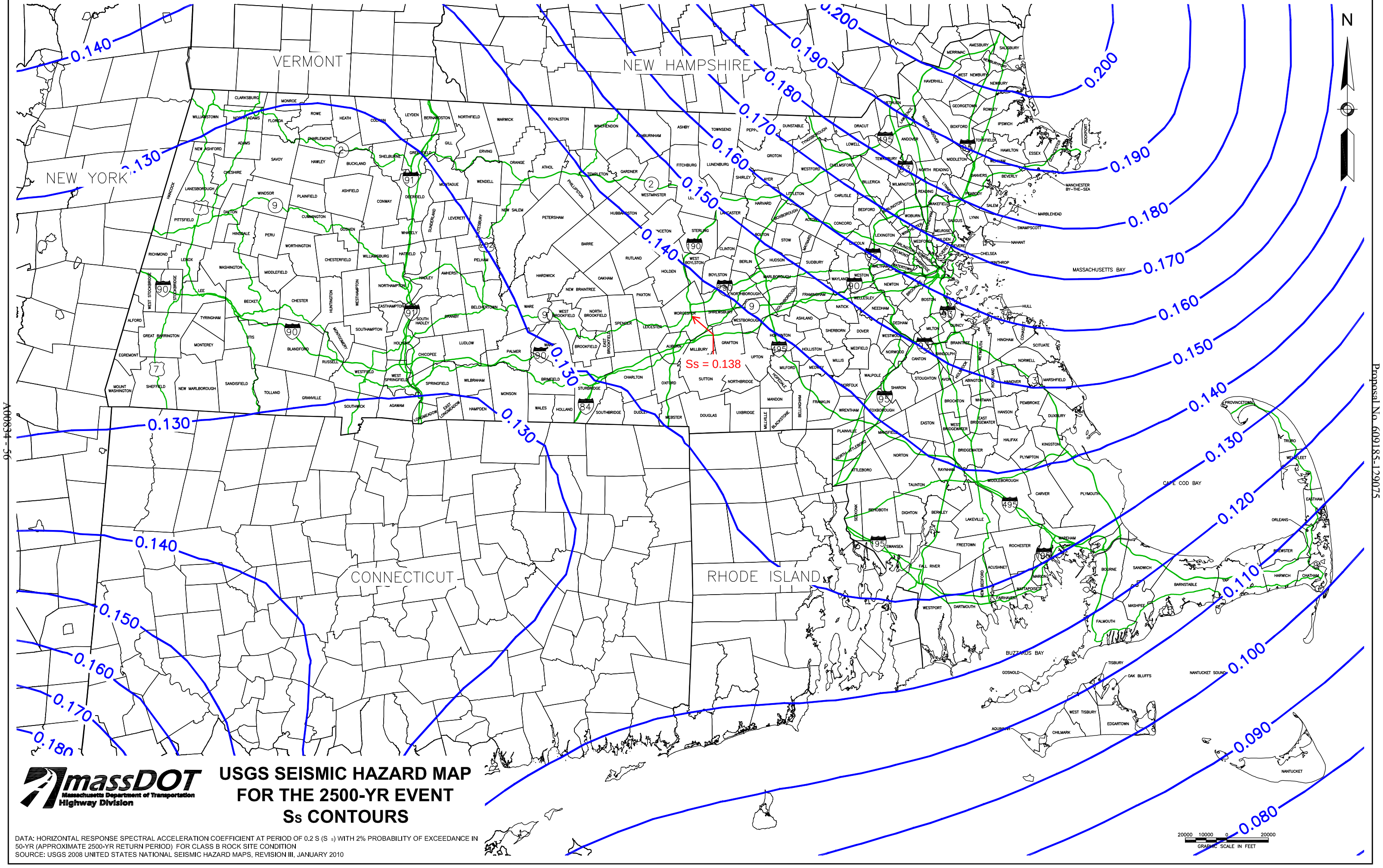
A00834 S4

Proposal No. 609185-129075

massDOT
Massachusetts Department of Transportation
Highway Division

USGS SEISMIC HAZARD MAP FOR THE 2500-YR EVENT S_1 CONTOURS

DATA: HORIZONTAL RESPONSE SPECTRAL ACCELERATION COEFFICIENT AT PERIOD OF 1.0 S (S_1) WITH 2% PROBABILITY OF EXCEEDANCE IN 50-YR (APPROXIMATE 2500-YR RETURN PERIOD) FOR CLASS B ROCK SITE CONDITION
SOURCE: USGS 2008 UNITED STATES NATIONAL SEISMIC HAZARD MAPS, REVISION III, JANUARY 2010



USGS SEISMIC HAZARD MAP FOR THE 2500-YR EVENT Ss CONTOURS

massDOT Massachusetts Department of Transportation Highway Division

DATA: HORIZONTAL RESPONSE SPECTRAL ACCELERATION COEFFICIENT AT PERIOD OF 0.2 S (S_a) WITH 2% PROBABILITY OF EXCEEDANCE IN 50-YR (APPROXIMATE 2500-YR RETURN PERIOD) FOR CLASS B ROCK SITE CONDITION
SOURCE: USGS 2008 UNITED STATES NATIONAL SEISMIC HAZARD MAPS, REVISION III, JANUARY 2010

A000834 - 56

Proposal No. 609185-129075

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	2/9/2022	Job Number	78900
	Checked	NMH	Date	2/30/2022		
For Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/30/2022		

Effective Friction Angle of Fill

PURPOSE

Calculate the Effective Friction Angle (ϕ') of the existing Fill behind the existing abutments using well accepted N-value correlations. Use N-values from boring BB-101 at the West Abutment and boring BB-103 at the East Abutment.

REFERENCES

1. Foundation Design - Principles and Practices, 2nd Edition, by Donald P. Coduto (2001)
2. Wolff (1989) correlation approximated from Peck, Hanson, and Thornburn (1974)
3. FHWA Soils and Foundations Reference Manual, Volume II (2006)

SOLUTION

N_{60} values below have been corrected for rod length (C_R) and hammer type (automatic hammer E_m = 0.9) using the following equation: $N_{60} = \frac{N\ C_R\ E_m}{0.60}$

For Depth of N_{60} values, use the depth at the midpoint of the SPT sample.

For calculating Vertical Effective Stress (σ'_z) use an effective unit weight (γ') of 100 pcf for Fill (see Geotechnical Report).

Correction factor C_N = (2000/σ'_z)^0.5 <= 1.7 so use maximum C_N of 1.7 when calculating $(N_1)_{60} = C_N N_{60}$

Reference 1 (attached) suggests using a correlation between SPT results and the effective friction angle of uncemented sands (ϕ') as shown in Figure 4.11.

Notes: This correlation should be used only at depths greater than 2 meters (6.5 feet), so N-values above this depth are ignored (in yellow).

When graphically determining ϕ' conservatively round down to closest 5 degree line.

Reference 2 gives a correlation between N_{60} and ϕ' in graphical form, which can be approximated as: $\phi'(\text{deg}) = 27.1 + 0.3N_{60} - 0.00054[N_{60}]^2$

Boring	Sample	N-value (bpf)	N_{60} (bpf)	Depth (ft)	σ'_z (psf)	C_N	$(N_1)_{60}$	Reference 1		Reference 2	
								ϕ' (deg)	Min. ϕ'	ϕ' (deg)	Avg. ϕ'
BB-101	SS-1	3	3	4.0	400	2.2	6	-	-	28	-
	SS-2	10	11	6.0	600	1.8	19	-		30	33
	SS-3	16	18	11.0	1,100	1.3	24	40	40	32	
	SS-4	17	19	13.0	1,300	1.2	24	40		33	
	SS-5	21	24	16.0	1,600	1.1	26	40		34	
	SS-6	24	31	18.0	1,800	1.1	32	45		36	
BB-103	SS-2	7	8	4.0	400	2.2	13	-	-	29	33
	SS-3	11	12	6.0	600	1.8	21	-	-	31	
	SS-4	13	15	8.0	800	1.6	23	40	35	31	
	SS-5	13	17	11.0	1,100	1.3	22	40		32	
	SS-6	17	24	16.0	1,600	1.1	27	45		34	
	SS-7	22	31	21.0	2,100	1.0	31	45		36	
	SS-8	26	37	26.0	2,600	0.9	32	45		37	
	SS-9	12	18	31.0	3,100	0.8	14	35		32	

Note: For all calculations BB-101, SS-1 is ignored when estimating ϕ' , because the blowcount of 3 is an outlier.

Reference 3 provides a table correlating $(N_1)_{60}$ with a range of friction angles:

Table 8-1
Estimation of friction angle of cohesionless soils from Standard Penetration Tests
(after AASHTO, 2004 with 2006 Interims; FHWA, 2002c)

Description	Very Loose	Loose	Medium	Dense	Very Dense
Corrected SPT $N1_{60}$	0	4	10	30	50
Approximate ϕ, degrees*	25 – 30	27 – 32	30 – 35	35 – 40	38 – 43
Approximate moist unit weight, (γ) pcf*	70 – 100	90 – 115	110 – 130	120 – 140	130 – 150

* Use larger values for granular material with 5% or less fine sand and silt.
Note: Correlations may be unreliable in gravelly soils due to sampling difficulties with split-spoon sampler as discussed in Chapter 3.

Use minimum $(N_1)_{60}$ values from both borings (ignoring BB-101, S-1):

BB-101 Min. $(N_1)_{60}$ 19 bpf correlates to: ϕ' = 35

BB-103 Min. $(N_1)_{60}$ 13 bpf correlates to: ϕ' = 35

All 3 References show that ϕ' of the Fill behind both abutments is at least 33 degrees **ϕ' = 33**

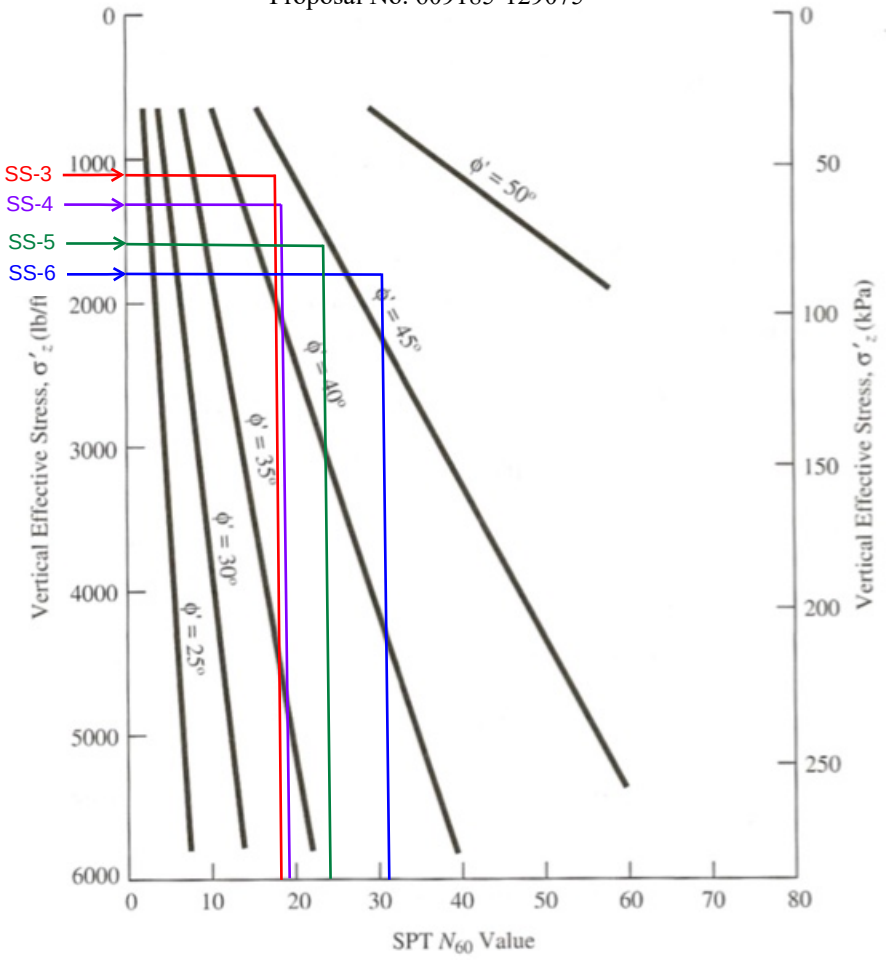


Figure 4.11 Empirical correlation between N_{60} and ϕ' for uncemented sands (Adapted from DeMello, 1971).

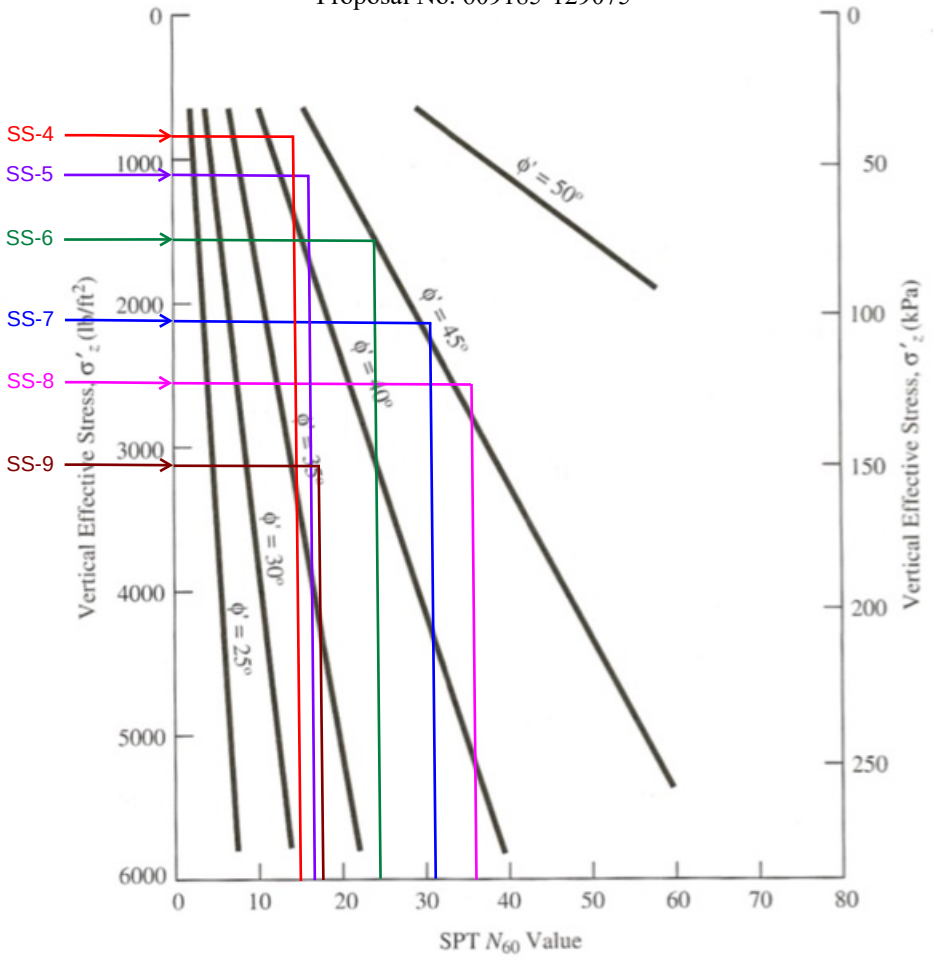


Figure 4.11 Empirical correlation between N_{60} and ϕ' for uncemented sands (Adapted from DeMello, 1971).

HNTB The HNTB Companies Engineers Architects Planners							
		Made	JLK	Date	12/22/2021	Job Number	72245
		Checked	NMH	Date	2/30/2022		
For	Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/30/2022		

Earth Coefficient Calculations

OBJECTIVE

Calculate the At-Rest Earth Coefficient (k_0), Static Active Earth Coefficient (k_a), and Seismic Active Earth Coefficient (K_{AE}) of backfill behind the existing abutments.

REFERENCES

1. Effective Friction Angle of Fill Behind Abutments (by HNTB)
2. AASHTO Bridge Design Specifications, 9th Edition (2020)
3. Figure 3 - Estimated Abutment Geometry (by HNTB)
4. Laurel Street over I-290 (W-44-93) As-Built Plans (1958)

SOLUTION

Reference 1: calculates the effective internal friction angle of Fill behind both abutments, based on N-value correlations:

ϕ'_f = 33 deg

Reference 2: use AASHTO Equation 3.11.5.2 to calculate k_0:

k_0 = 1 - sin(ϕ'_f) (3.11.5.2)

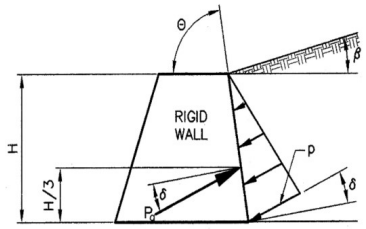
k_0 = 0.46 At-Rest Earth Coefficient for East and West Abutments

Reference 2: use AASHTO Equation 3.11.5.3-1 and -2 to calculate k_a:

$$k_a = \frac{\sin^2(\theta+\phi'_f)}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

in which:

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi'_f+\delta)\sin(\phi'_f-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$



where:

- δ = friction angle between fill and wall (degrees)
- β = angle of fill to the horizontal as shown in Figure 3.11.5.3-1 (degrees)
- θ = angle of back face of wall to the horizontal as shown in Figure 3.11.5.3-1 (degrees)
- ϕ'_f = effective angle of internal friction (degrees)

For δ, use "Clean gravel, gravel-sand mixtures, coarse sand" against "mass concrete" from AASHTO Table C3.11.5.3-1:

δ = 29 deg *Mostly sand with gravel, use lower end of range*

Reference 3: shows approximate angle of back face (above horizontal) of abutment wall, based on explorations:

θ_{west} = 70.8 deg *West Abutment*

θ_{east} = 90.0 deg *East Abutment*

Reference 4: shows that Laurel St has a positive 11% grade behind East Abut, and negative grade behind West Abut:

β_{west} = 0.0 deg *Negative grade, conservatively use zero*

β_{east} = 6.3 deg *Based on positive 11% grade*

Calculate k_a for West Abutment:

Γ_{west} = 3.51

$k_{a,west}$ = 0.452

Calculate k_a for East Abutment:

Γ_{east} = 2.81

$k_{a,east}$ = 0.286

HNTB The HNTB Companies Engineers Architects Planners							
		Made	JLK	Date	12/22/2021	Job Number	72245
		Checked	NMH	Date	2/30/2022		
For	Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/30/2022		

Earth Coefficient Calculations

Calculate K_{AE} in accordance with AASHTO Section A11.3.1 (Mononobe-Okabe Method):

$$K_{AE} = \frac{\cos^2(\phi - \theta_{MO} - \beta)}{\cos\theta_{MO}\cos^2\beta\cos(\delta + \beta + \theta_{MO})} \times \left[1 + \sqrt{\frac{\sin(\phi + \delta)\sin(\phi - \theta_{MO} - i)}{\cos(\delta + \beta + \theta_{MO})\cos(i - \beta)}}\right]^{-2}$$

where:

K_{AE} = seismic active earth pressure coefficient (dim)
γ = unit weight of soil (kcf)
H = height of wall (ft)
h = vertical distance between ground surface and wall base at the back of wall heel (ft)
ϕ_f = friction angle of soil (degrees)
θ_{MO} = arc tan $[k_h/(1 - k_v)]$ (degrees)
δ = wall backfill interface friction angle (degrees)
k_h = horizontal seismic acceleration coefficient (dim.)
k_v = vertical seismic acceleration coefficient (dim.)
i = backfill slope angle (degrees)
β = slope of wall to the vertical, negative as shown (degrees)

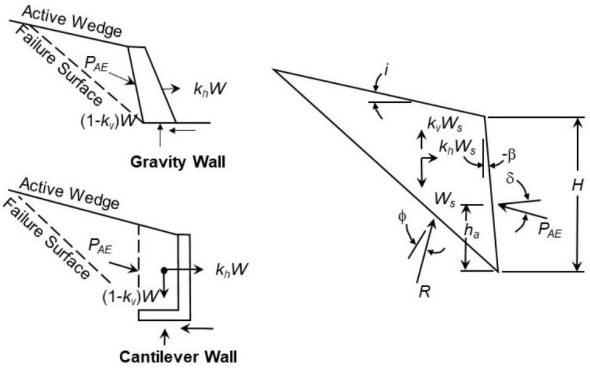


Figure A11.3.1-1—Mononobe–Okabe Method Force Diagrams

Reduce δ for Seismic case, use 0.67 of ϕ'$_f$ to calculate reduced value:

$\delta_{seismic}$ = 22 deg

Use same backfill slope angle as previous, and calculate slope of wall to vertical:

i_{west} = 0 deg i_{east} = 6.3 deg

β_{west} = 19.2 deg β_{east} = 0 deg

AASHTO Section 11.6.5.2.2 notes that for unrestrained walls with displacements of 1 to 2 inches, k_h = 0.5 * PGA

Foundations bearing on bedrock have small displacements (< 1 inch) so conservatively follow 11.6.5.2.1 for a restrained wall:

k_v = 0 g

k_h = F_{pga} PGA

PGA = 0.08 g From Geotech Report for 2,500-yr return period

F_{pga} = 1.0 Site Factor from AASHTO Table 3.10.3.2-1 for Site Class B

k_h = 0.08 g

θ_{MO} = $\tan^{-1}(k_h)$

θ_{MO} = 4.6 deg

Use the factors above to calculate K_{AE} for both abutments:

$K_{AE,west}$ = 0.502 **$K_{AE,east}$ = 0.343**

HNTB The HNTB Companies Engineers Architects Planners						
	Made	JLK	Date	11/5/2021	Job Number	78900
	Checked	NMH	Date	2/21/2022		
For Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Factored Bearing Resistance of Abutments

Purpose

The purpose of this calculation is to determine the Factored Bearing Resistance of the North and South Abutments bearing on Slate bedrock. This calculation will be in accordance with AASHTO LRFD Bridge Design Specification, 9th Edition (2020).

Laboratory Results

q_u =	4,155	psi	UCS of 4,155 psi for sample BB-103, C-3 (41.2 to 41.8 ft depth)
q_u =	598	ksf	Convert to kips per square foot
v =	0.43		Poisson's Ratio

Rock Mass Strength

AASHTO 10.6.2.6.2 notes that bearing resistance on rock should be determined using empirical correlation to the Geomechanic Rock Mass Rating System (RMR) as specified in Article 10.4.6.4 which uses geological strength index (GSI) and the Hoek-Brown failure criterion.

For GSI determination see boring log BB-101 and picture of rock core box which shows 12" section of weak rock underlying the abutment:

Boring BB-101, C-1 (21-33"): SLATE (Carbonaceous) - Highly fractured, soft, slightly to moderately weathered

Use Figure 10.4.6.4-1 to classify rock as: "Blocky" structure and "Good" (slightly weathered) surface condition

GSI = 65 *See Figure 10.4.6.4-1 on next page*

Use Hoek-Brown failure criterion (Sect. 10.4.6.4):

$$\sigma_1' = \sigma_3' + q_u\left(m_b\frac{\sigma_3'}{q_u} + s\right)^a \qquad (10.4.6.4\text{-}1)$$

in which:

$$s = e^{\left(\frac{GSI-100}{9-3D}\right)} \qquad (10.4.6.4\text{-}2)$$

$$a = \frac{1}{2} + \frac{1}{6}\left(e^{\frac{-GSI}{15}} - e^{\frac{-20}{3}}\right) \qquad (10.4.6.4\text{-}3)$$

Disturbance factor, D, ranges from zero (undisturbed) to 1 (highly disturbed). AASHTO recommends a factor approaching zero for rock coring, and a factor approaching 1.0 for rock blasting.

D =	1.0	*Conservative, assume rock was blasted when constructing I-290*
s =	0.00293	*Eqn. 10.4.6.4-2*
a =	0.502	*Eqn. 10.4.6.4-3*

The Nominal Bearing Resistance ($q_n = \sigma'_1$) can be obtained from Eqn. 10.4.6.4-1 by conservatively assuming that the horizontal effective stress (σ'_3) is equal to zero, which simplifies the equation to:

$$q_n = \sigma'_1 = q_u s^a$$

q_n =	32.0	ksf	Nominal Bearing Resistance
φ_b =	0.45		Resistance factor for footings on rock (Table 10.5.5.2.2-1)
$q_R = \varphi_b q_n$ =	**14.4**	**ksf**	**Factored Bearing Resistance (Eqn. 10.6.3.1.1-1)**

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	11/5/2021	Job Number	78900
	Checked	NMH	Date	2/21/2022		
For Harrison Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Factored Bearing Resistance of Abutments

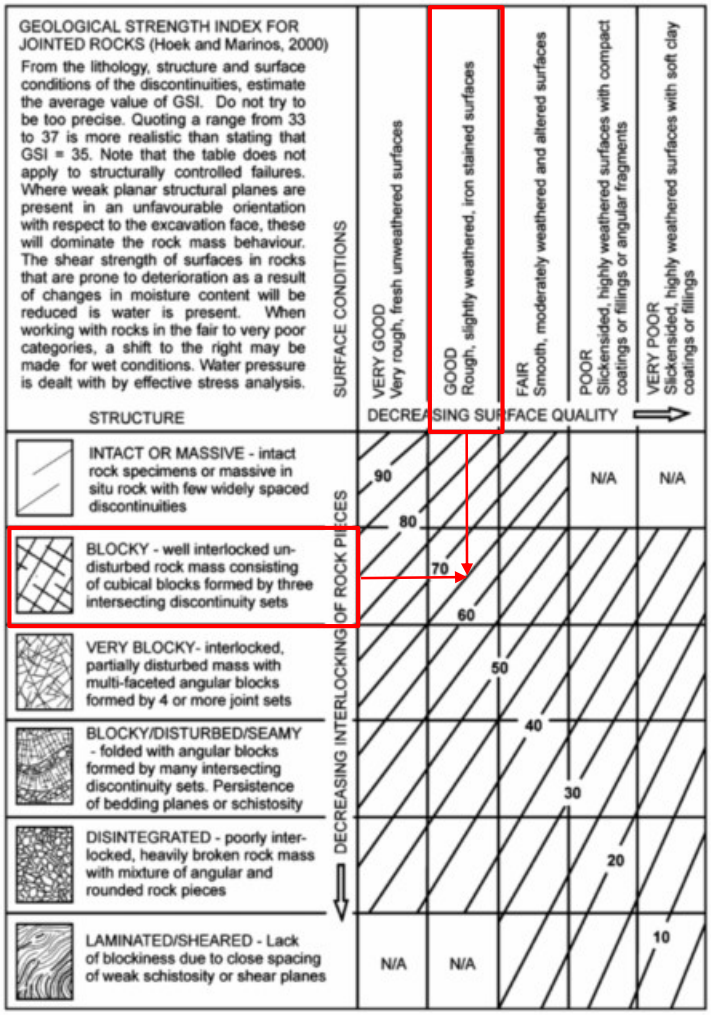


Figure 10.4.6.4-1—Determination of *GSI* for Jointed Rock Mass (Hoek and Marinos, 2000)

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DOCUMENT A00835

LAUREL STREET OVER I-290
BRIDGE NO. W-44-093

GEOTECHNICAL REPORT

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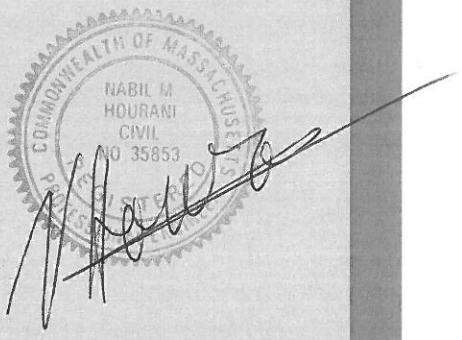
GEOTECHNICAL REPORT

DELIVERABLE: FINAL

HNTB NO: 78900

LAUREL STREET OVER I-290
BRIDGE REPLACEMENT
W-44-093 (213)
WORCESTER, MA
MASSDOT PROJ. #609185

V1.0A: February 2022
V1.1: March 2022
V2.0: March 2023



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Note: Use minor 1.1 and major 2.0 versioning to denote changes. Letters denote draft versions (A, B, etc.)

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1. EXECUTIVE SUMMARY

The Massachusetts Department of Transportation (MassDOT) is planning the superstructure replacement of the existing Laurel Street over I-290 Bridge in Worcester, Massachusetts. The MassDOT Bridge Number is W-44-093 (213). The existing two-span steel bridge was constructed in 1958 and is supported on two reinforced concrete abutments and pier footings. According to as-built drawings, the abutment and pier footings are bearing on bedrock. The existing foundations will be reused to support the proposed superstructure replacement.

A subsurface exploration program was conducted by a drilling subcontractor and observed by an HNTB Engineer. One bridge boring was taken at each foundation location to sample the subsurface soils down to Bedrock, where about 10 feet of rock core was obtained. For bridge borings taken behind existing abutments, the concrete abutment was cored before bedrock cores were taken.

Subsurface conditions behind the existing abutments consist of medium dense Sand & Gravel Fill overlying abutment footings, with footings bearing on Bedrock. As-drilled bottom of footing elevations (El.) are 501.9 feet for the West Abutment, and El. 502.5 feet for the East Abutment. Bedrock below the abutments consist of hard Granite which is slightly weathered and moderately fractured.

Subsurface conditions at the existing pier consist of dense Sand & Gravel Fill underlying the existing I-290 roadway, with top of Granite Bedrock encountered at 5.5 feet below top of roadway, or El. 500.5 feet. Bedrock near the pier consisted of hard Granite which is fresh and moderately fractured.

In general, groundwater was not encountered at the completion of borings due to all drilling fluid being lost inside the fractures of the Granite bedrock. The subject bridge is located on the side of a steep natural incline of bedrock, so it is likely that no observable groundwater table exists at the site.

Based on as-built drawings and the results of the exploration program, the abutment and pier footings appear to be bearing on bedrock. **The Factored Bearing Resistance for all footings on bedrock shall be 86.7 ksf.**

This report will also include construction recommendations including reuse of existing fill, obstructions during excavation, support of excavation and utility protection, and a geotechnical monitoring program.

2. BACKGROUND

2.1. Introduction

GREEN International Affiliates, Inc. (GREEN) has been tasked with the final design for the replacement of the existing Laurel Street over I-290 Bridge in Worcester, Massachusetts. The MassDOT Bridge Number is W-44-093 (213). GREEN has hired HNTB to complete the geotechnical design for the subject bridge.

See **Figure 1 – Site Locus Plan** for the location of the subject bridge.

The geotechnical scope of work comprises a subsurface exploration program and design services associated with the proposed bridge's foundations. This report will be in accordance with the latest AASHTO LRFD Bridge Design Specifications (Reference 1) and MassDOT LRFD Bridge Manual (Reference 2).

Coordinates (Northing and Easting) are in feet and referenced to MA State Plane Coordinate System – Mass Mainland 2001 – NAD 83(07) Datum, and elevations are in feet and referenced to the North American Vertical Datum of 1988 (NAVD88), as used on the project plans.

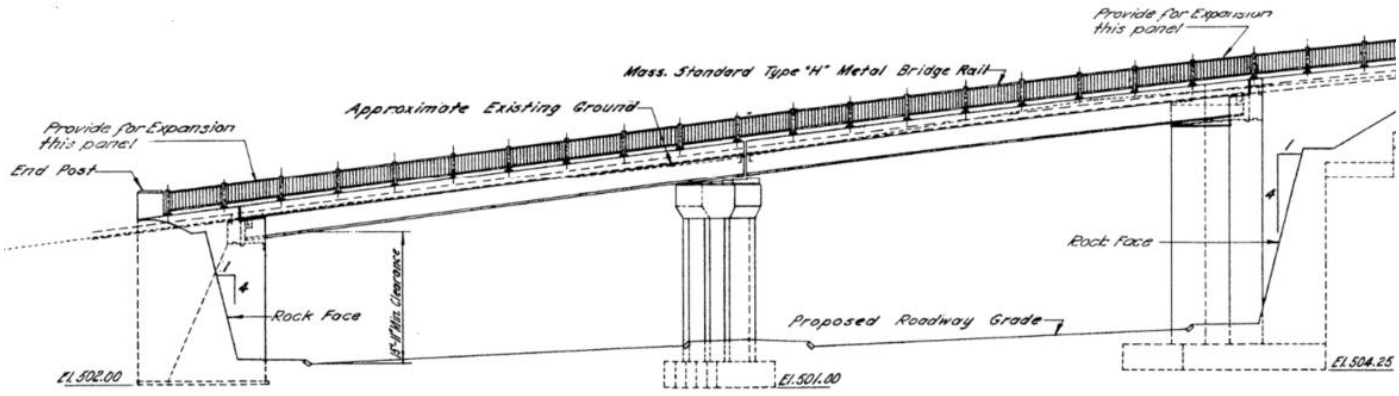
2.2. Existing Bridge

The existing bridge was constructed in 1958 and carries two lanes of traffic on Laurel Street over Interstate 290 (I-290). The bridge is a two-span structure with a length of 134 feet, width of 45 feet, and a skew angle of 13 degrees. The minimum vertical clearance from I-290 is approximately 15'-8" on the westbound side. The superstructure consists of six (6) W36x150 girders supporting a concrete deck. The August 2019 Bridge Inspection Report shows that the girders are in "fair" shape with significant rusting and pitting, including some areas of section loss.

The superstructure is supported by reinforced concrete abutments and wingwalls at the approaches, with the West Abutment being a gravity type and the East Abutment being cantilever shaped. The concrete pier consists of three (3) separate 8-foot square footings each supporting columns which are tied into the pier cap. According to as-built 1958 bridge plans, the pier and abutments are bearing on bedrock which was blasted to construct the existing I-290 roadway. The August 2019 Bridge Inspection Report indicates the substructure to be in "satisfactory" condition with locations of minor cracking and delamination as well as some spalls on the abutment backwalls.

The grade of Laurel Street is 12.5% with the top of roadway at about El. 523 feet in the vicinity of the West Abutment, and at about El. 540 feet in the vicinity of the East Abutment. Below the surface of Laurel Street, existing plans show a 10-inch thick and 15-foot long concrete approach slab connected to the backwall of both abutments. The roadway surface of I-290 is at about El. 506 feet beneath the bridge. This section of I-290 consists of two 50-foot highways separated by a 16-foot wide median, with a total width of about 116 feet. Figure 2.1 below shows an elevation view from the south with the West Abutment on the left and East Abutment on the right.

Figure 2.1 – 1958 Bridge Plans South Elevation



The elevations shown in the 1958 Bridge Plans above are in reference to the National Geodetic Vertical Datum of 1929 (NGVD29) which have been converted to NAVD88 by subtracting 0.62 feet. For more information on the existing bridge, see the attached **1958 Bridge Plans** in **Appendix A**.

1958 Bridge Plans include existing boring logs which show loose fills overlying natural dense sand and gravel material, with shallow bedrock. Most borings were terminated upon refusal on bedrock, however two (2) borings W3-20 and W3-25 cored 5 feet of Granite bedrock, and both recovered 46 inches. No information is provided on the quality of the granite recovered.

2.3. Proposed Bridge

The proposed bridge will be a full superstructure replacement with a similar length, width and grade as the existing. The existing substructures will be repaired and reused to support the proposed superstructure replacement. The top of existing abutments will be cut, including the full backwall height and 12 to 18 inches of the bridge seat, and rebuilt with structural steel and concrete. The existing approach slabs on both abutments will be demolished and new approach slabs will be constructed. It is assumed that the existing pier bridge seat will be rebuilt and concrete patching will be done along the pier columns. It is anticipated that construction will be performed in stages, in order to maintain at least one lane of traffic over the bridge at all times.

According to GREEN, the proposed superstructure girders will be shallower than the existing girders, so the proposed dead weight will be less than or equal to the existing superstructure dead weight. For this reason, it is assumed that the existing bridge foundations will experience **no additional loading beyond existing conditions and therefore no settlement is expected.**

3. SUBSURFACE CONDITIONS

3.1. Local Geology

The area geology was influenced by the typical New-England glacial and post-glacial actions on subsurface soils. According to the USGS Surficial Materials Map of the Worcester North Quadrangle, Massachusetts (Reference 3) the site area contains thin Till with bedrock outcrops.

According to the USGS Bedrock Geologic Map of Massachusetts (Reference 3) the site is located in the Merrimack Belt formation (Lower Devonian period) which consists of muscovite-biotite granite.

Available geologic information shows that the Wekepeke Fault is located about a half mile west of the site.

3.2. Subsurface Explorations Program

Under the observation of an HNTB Engineer, three (3) test borings (BB-101 to BB-103) and two probe explorations (PS-1A to PS-1B) were conducted on Laurel Street and I-290 by Terracon Consultants, Inc. (Terracon) between September 27, 2021 and February 2, 2022. The explorations were performed using a CME-45B drill rig which utilized an automatic hammer to conduct Standard Penetration Tests (SPT) with a standard 1-3/8 inch inside diameter (I.D.) split spoon. Samples were conducted nearly continuously for the first 10 feet, and then at standard 5-foot intervals after that. BB-101A was drilled as an offset boring, as the roller-bit action indicated concrete down to 19' depth and likely hit the sloped section of the wingwall foundation.

For borings BB-101 and BB-103 behind existing abutments, 4-inch casing was advanced to the top of concrete before coring through the abutment and about 11 feet of bedrock below. For boring BB-102 on I-290 Westbound (WB) next to the existing pier, 4-inch casing was driven to bedrock where 9.1 feet of core was taken. While coring bedrock, all water pumped into the borehole was lost into the fractures of the bedrock, which is why 10 feet of core could not be obtained at BB-102. All concrete and rock coring was conducted using a 2.15-inch I.D. NX core bit.

The probe-series explorations were conducted with the same drill rig using a solid-stem auger with an outside flight diameter of 4-inches. Probes were conducted behind the West Abutment, moving sequentially away from the abutment to delineate geometry. Due to multiple site constraints, such as existing utilities and traffic control concerns, only two (2) probes could be conducted in the limited space available.

See attached **Figure 2 – As-Drilled Exploration Plan** for locations of all explorations conducted at the site, as well as **Appendix B** for boring logs.

3.3. Subsurface Conditions

3.3.1. Subsurface Layers

In general, the explorations encountered subsurface conditions which were similar to those shown on the 1958 Bridge Plans. From ground level, the site generally consists of granular Fill behind/overlying existing bridge foundations, which are founded on Bedrock. Each of the subsurface layers are described below:

Fill

Directly behind the existing abutments, Fill was encountered in tests borings to depths (below top of roadway) of approximately 20 feet at the West Abutment and 34 feet at the East Abutment. The Fill generally consisted of brown, fine to coarse sand containing up to 50 percent gravel and around 10 percent inorganic silt. The relative density of the Fill varied from loose to medium dense, with N-values (number of blows to advance the SPT spoon from 6" to 18") between 5 and 15 blows-per-foot (bpf). Concrete abutment footings were encountered below the Fill.

Below the 1.8-foot thick asphalt and subbase layer of the I-290 WB roadway, about 3.7 feet of Fill was encountered overlying Bedrock. The Fill in the vicinity of the existing pier consisted of brown, fine to coarse sand and fine to medium gravel, with trace amounts of inorganic silt. The Fill was dense with an N-value of 37 bpf.

Bedrock

Bedrock was encountered directly underlying existing abutment and pier foundations. For bridge borings coring through abutments, top of bedrock (or bottom of footing) was encountered at El. 501.9 feet at the West Abutment (BB-101A) and El. 502.5 feet at the East Abutment (BB-103). Boring BB-102 near the pier foundation encountered bedrock at El. 500.5 feet. Photographs of the concrete and rock cores are presented in **Appendix B** and a summary of cores is presented below:

Table 3.1 – Summary of Cores

Boring	Core	Top of Core Elev. (ft)	Penetration Length (in)	Recovery Length (in)	Recovery (%)	RQD (%)
BB-101A	C-1	504.5	42	41	98	conc
	C-2	501.0	60	60	100	65
	C-3	496.0	60	56	93	77
BB-102	C-1	500.0	60	51	85	55
	C-2	495.0	50	50	100	92
BB-103	C-1	506.5	60	48	80	conc
	C-2	501.5	18	10	56	0
	C-3	500.0	48	47	98	46
	C-4	495.0	36	36	100	100

The bedrock generally consisted of hard, moderately fractured, slightly weathered to fresh, gray Granite with joints dipping from approximately 30 degrees below horizontal to near horizontal. Rock core recovery of the bedrock cores ranged from 56 to 100 percent and Rock Quality Designation (RQD) values (the sum of all core pieces greater than 4

inches divided by the total length of penetration) ranged from 0 to 100 percent. The presence of fractures within the bedrock caused complete loss of drilling fluid during coring, which also led to low recoveries and RQD values due to pulverization of the rock.

3.3.2. Groundwater

Due to complete loss of drilling fluid while coring bedrock, upon completion of all borings no groundwater was observed within the boreholes. In addition, the subject bridge is located on the side of a steep natural incline of bedrock, so it is likely that no observable groundwater table exists at the site. For BB-101A, as it appears that no observable groundwater table exists at the site, the exploration depth of 21' seems reasonable.

3.3.3. Existing Abutments

The 1958 bridge plans show the proposed dimensions and bottom of footing elevations for both abutments. The West Abutment is a gravity-type abutment with a sloped backwall and 6-inch thick footing, with bottom of footing at El. 501.38 feet. Probes were conducted at the West Abutment to determine the angle of backwall slope and also find the edge of footing before conducting the bridge boring. The East Abutment is a cantilever-type abutment with a 3.5-foot thick footing and bottom of footing at El. 503.63 feet. Probes were not conducted at the East Abutment due to the 8-foot long heel of the footing.

Probes at the West Abutment were located by measuring the offset from the existing bridge joint and conducted moving sequentially away from the joint. Probes were advanced until reaching refusal on the concrete abutment or bedrock, which was estimated based on auger action. After hitting refusal, if the auger was able to advance a few inches then it was estimated that the refusal occurred on concrete. When refusal was reached but the auger could not advance any further, then it was estimated that refusal was reached on bedrock, as Granite is significantly harder than concrete.

Once reaching refusal on bedrock, the bridge boring location was determined so the concrete abutment could be cored. Boring BB-101A cored 31 inches of the concrete abutment and BB-103 cored 48 inches. Based on the results of the probes and borings, abutment sketches are provided in the attached **Figure 3 – Estimated Abutment Geometry** and compared to the 1958 Bridge Plans in the table below.

Table 3.2 – Abutment Geometry based on 1958 Bridge Plans and Explorations

West Abutment	1958 Bridge Plans	Based on Explorations	East Abutment	1958 Bridge Plans	Based on Explorations
Bott. of Footing El. (ft)	501.38	501.9	Bott. of Footing El. (ft)	503.63	502.5
Backslope Angle (deg)	70.2	73.8	Depth of Footing (ft)	3.5	4

Both as-drilled bottom of footing elevations are within about a foot of those given in the 1958 Bridge Plans. The backslope angle of the West Abutment is given in degrees above the horizontal and is used to calculate the earth pressure behind the abutment. The East Abutment footing appears to be 4 feet deep, about 6 inches thicker than the dimensions provided in the 1958 Bridge Plans.

3.3.4. Existing Approach Slabs

The 1958 Bridge Plans show a 10-inch thick and 15-foot long concrete approach slab connected to the backwall of both abutments. It is anticipated that these approach slabs will be demolished and rebuilt. All explorations conducted from Laurel Street encountered the approach slab which was difficult to penetrate due to steel rebar encountered while augering through the slab. Depths to top and bottom of the slab were noted in borings BB-101/A and BB-103 but should be considered approximate as they were estimated based on auger action during drilling.

According to explorations, the thickness of the approach slabs varied between about 8 to 12 inches. As noted, these thicknesses are approximate and the 10-inch thickness provided in the 1958 Bridge Plans is within the margin of error for observed depths during drilling. As-drilled information on existing approach slabs is summarized below.

Table 3.3 – Approach Slab Summary

Existing Approach Slab	West Abutment BB-101/A	East Abutment BB-103
Depth to Top (ft)	1.8	2.5
Depth to Bottom (ft)	2.5	3.5
Elev. of Top (ft)	521.2	538.5
Elev. of Bottom (ft)	520.5	537.5
Approx. Thickness (in)	8	12

Based on available information from existing plans and as-drilled depths provided above, it can be assumed that the **existing approach slab is about 10-inches thick**.

3.4. Laboratory Testing Program

Laboratory testing was conducted by GeoTesting of Acton, Massachusetts to evaluate physical properties of the soil and rock near the existing abutments and pier. Laboratory results are included in **Appendix C**.

3.4.1. Soil Testing

For calculations of horizontal earth pressure on the existing abutments, two (2) soil samples were tested for gradation (using ASTM D6913) and density (using ASTM D7263) and the results are presented below.

Table 3.4 – Soil Laboratory Testing Results

Boring	Sample	Bulk Density (pcf)	Water Content (%)	Dry Density (pcf)	Gravel (%)	Sand (%)	Fines (%)
BB-101	S-4	81.8	5.9	77.3	36.4	53.2	10.4
BB-103	S-3	85.9	5.8	81.2	30.9	59.3	9.8

Gradation results confirm soil classifications found in the boring logs, which generally show that the Fill located behind the abutment is a gravelly sand with about 10 percent fines. Density results show a Fill with a unit weight less than 86 pounds per cubic foot (pcf) which is low for gravelly sand, so a more conservative unit weight should be used for horizontal earth pressure calculations. We know this laboratory's testing is reliable but the data may indicate the material is loose or lightweight in-place.

3.4.2. Rock Testing

One rock core sample from boring BB-101A was tested for Peak Compressive Stress using ASTM D7012 – Method D. The intact granite rock core was found to have a Peak Compressive Stress, also known as **Unconfined Compressive Strength**, of **25,764 pounds per square inch (psi)**. Using the second stress range, the rock has a Young's Modulus of 5,310 kips per square inch (ksi) and a Poisson's Ratio of 0.38.

4. DESIGN AND ANALYSES

4.1. Design Criteria and Parameters

4.1.1. Seismic

Based on the results of the exploration program which shows that all bridge footings are founded on bedrock, this project site is representative of **Seismic Site Class B**. Although laboratory testing revealed that intact bedrock cores are hard, which is indicative of Site Class A, boring logs show that the bedrock is highly fractured in some areas, so Site Class B is conservatively used.

The MassDOT LRFD Bridge Manual (Reference 2) requires that all Critical/Essential bridges in Massachusetts shall be designed for a seismic hazard corresponding to a 2% probability of exceedance in 50 years, which is equal to a design earthquake with a return period of approximately 2,500 years. Based on acceleration parameters from the USGS Seismic Hazard Map for the 2,500 year event and site parameters from AASHTO Section 3.10.3.2, the design response spectra are presented below (in units of gravity) and calculations are included in **Appendix D-1**.

Table 4.1 – Seismic Design Parameters

Horizontal Peak Ground Acceleration, PGA (g)	0.080
Horizontal Spectral Acceleration at Period 0.2S, S_S (g)	0.138
Horizontal Spectral Acceleration at Period 1.0S, S_1 (g)	0.055
Site Factor at Zero-Period Range of Acceleration, F_{pga}	1.0
Site Factor for Short-Period Range of Acceleration, F_a	1.0
Site Factor for Long-Period Range of Acceleration, F_v	1.0
Design Response Spectrum for Zero-Period, $A_S = F_{pga}PGA$	0.080
Design Response Spectrum for Short-Period, $S_{DS} = F_aS_S$	0.138
Design Response Spectrum for Long-Period, $S_{D1} = F_vS_1$	0.055

4.1.2. Liquefaction

Liquefaction assessment is not required for structures in Seismic Design Category A (SDC-A), also known as Seismic Zone 1, which is defined by AASHTO as having an S_{D1} less than 0.15. The proposed shallow foundations are supported on bedrock, therefore they are not susceptible to the seismic soil liquefaction effect which only occurs in loose sands.

4.1.3. Groundwater

No observable groundwater table was encountered at the site, and all drilling fluid was lost during coring which indicates groundwater is below top of bedrock. For BB-101A, in particular, no groundwater table was observed due to the site being on a steep natural incline of bedrock. .Due to the bridge being built on the side of a steep natural incline of bedrock, stormwater will likely drain downhill and off-site. However, the bridge should be designed to consider a 100-year storm flooding event where water may build up behind abutments and around the pier.

Assuming that the existing 4-inch weep holes will be cleaned during construction, it is recommended that a groundwater table at the inlet elevations of the weep holes be conservatively used for abutment design. For pier design, a 100-year storm should be assumed, with groundwater near the top of ground surface.

4.2. Fill Behind Abutments

4.2.1. Soil Properties

Laboratory testing from Section 3.4.1. showed that the total unit weight of existing Fill behind the abutments was less than 86 pcf, which is low for sand and gravel material. A more conservative (larger) total unit weight (γ_t) of 100 pcf (correlating with a loose in-situ existing fill condition) shall be used when calculating horizontal earth pressure and conducting stability analysis. Based on the N-values from borings behind the existing abutments, well-accepted correlations were used to estimate an effective friction angle (ϕ'_f) of 30 degrees. The calculation **Effective Friction Angle of Fill** is included in **Appendix D-2**. Soil properties of the existing Fill behind abutments are summarized below.

Table 4.2 – Properties of Fill Behind Abutments

Avg. N-value (bpf)	Avg. $(N_1)_{60}$ (bpf)	γ_t (pcf)	ϕ'_f (deg)
10	16	100	30

4.2.2. Earth Coefficients

In accordance with AASHTO Section 3.11.5.2 the at-rest lateral earth pressure coefficient (k_0) for normally consolidated soils shall be calculated with the following equation:

$$k_0 = 1 - \sin(\phi'_f) = 0.5$$

Using a ϕ'_f of 30 degrees, the at-rest lateral earth pressure coefficient for fill in the vicinity of existing abutments shall be 0.5. According to the MassDOT Bridge Manual (Reference 2) Section 3.1.6 the at-rest earth pressure coefficient shall be used for the design of all cantilever or gravity walls that are founded on bedrock. This coefficient shall be used to calculate earth pressures of the Fill behind both abutments, for overturning and sliding analyses of the abutments. Passive pressure in front of the abutments shall not be considered in these calculations, as deflections will not be great enough to activate passive earth pressure of the soil.

As the MassDOT Bridge Manual requires, we recommend using at-rest coefficient Ko for the abutments / walls founded on bedrock. Active earth coefficients Ka are provided for the designer / contractor usage as needed (support-of-excavation, etc.). To calculate active earth coefficients at the West Abutment, an estimated backslope angle of 73.8° (above the horizontal) from Figure 3 was used and a level angle of backfill was conservatively used (due to negative roadway grade). Using the 1958 Bridge Plans, the East Abutment was assumed to be at a 90° angle and the angle of backfill was set equal to the proposed roadway grade of 9.5% behind the abutment, which is equal to 5.4° above the horizontal.

The static active earth pressure coefficient (k_a) was calculated in accordance with AASHTO Section 3.11.5.3 which is based on Coulomb earth pressure theories. The seismic active earth pressure coefficient (K_{AE}) was calculated in accordance with AASHTO Section A11.3.1 which utilitizes Mononobe-Okabe Method. **Earth Coefficient Calculations** are provided in **Appendix D-3** and the resulting coefficients are presented below.

Table 4.3 – Earth Coefficients Summary

Abutment	k_0	k_a	K_{AE}
West	0.50	0.45	0.50
East		0.32	0.38

4.3. Fill at Pier

4.3.1. Soil Properties

Boring BB-102 encountered 3.7 feet of dense Fill underlying the roadway which consisted of a well graded sand and gravel with trace amounts of inorganic silt. Only one split-spoon sample was driven far enough to get an N-value, so recommended total unit weight (γ_t) and effective friction angle (ϕ'_f) will be estimated based on engineering experience with similar soils in the area. Soil properties of the existing Fill in the vicinity of the bridge pier are summarized below.

Table 4.4 – Properties of Fill at Pier

N-value (bpf)	$(N_1)_{60}$ (bpf)	γ_t (pcf)	ϕ'_f (deg)
37	70	120	34

Although there was only a thin layer of Fill below the I-290 WB roadway, in the vicinity of the pier foundations it is expected that the same sand and gravel Fill was used to backfill above footings.

4.3.2. At-Rest Coefficient

In accordance with AASHTO Section 3.11.5.2 the at-rest lateral earth pressure coefficient (k_0) for normally consolidated soils shall be calculated with the following equation:

$$k_0 = 1 - \sin(\phi'_f) = 0.44$$

Using an effective friction angle of 34 degrees, the at-rest lateral earth pressure coefficient for fill in the vicinity of existing abutments shall be 0.44. Because shallow foundations are bearing on bedrock, it is anticipated that deflections will not be great enough to activate passive pressure of the surrounding soil.

4.4. Foundation Design

4.4.1. Bearing Material

According to boring data and 1958 Bridge Plans, abutment and pier footings are bearing on Granite Bedrock. Boring BB-103 cored through the East Abutment but immediately upon reaching the bottom of footing, the core bit dropped quickly for the last foot. Core C-1 penetrated 5 feet and recovered 4 feet of concrete, but no bedrock was recovered. Boring BB-102 core C-1 also experienced two quick core bit drops of about 4 inches each, and only recovered 51 inches of the 60 inch penetration depth. All four (4) borings experienced total loss of drilling fluid while coring.

Based on experience with coring fractured bedrock, the rapid core bit drops and complete loss of drilling fluid while coring indicates zones of highly fractured and/or moderately weathered Granite Bedrock. Boring BB-103 encountered this zone of fractured/weathered bedrock directly below the East Abutment footing, which means that foundations are founded on this material. The design of all abutment and pier foundations shall conservatively assume that all bearing material is a fractured/weathered bedrock.

4.4.2. Bearing Resistance

In accordance with AASHTO Article 10.6.2.6.2, bearing resistance on rock shall be determined using empirical correlations to the Geomechanics Rock Mass Rating System (RMR) as specified in Article 10.4.6.4 which uses geological strength index (GSI) and the Hoek-Brown failure criterion. Based on the GSI figure by Hoek and Marinos (2000) given in AASHTO Figure 10.4.6.-1 the bearing material can be conservatively described as having a "blocky" structure (fractured) and "good" surface conditions (slightly weathered) which results in a design GSI value of 65.

Hoek-Brown rock mass parameters were estimated per AASHTO Article 10.4.6.5. A disturbance factor "D" equal to one is used for footing construction, assuming bedrock was blasted which may have disturbed the rock mass. Effective overburden pressure was conservatively assumed to be zero at the bottom of footing. The resistance factor (φ_b) for footings on rock is 0.45 based on AASHTO Table 10.5.5.2.2-1. The **Bearing Resistance of Footings Calculation** is provided in **Appendix D-4** and the results are presented below.

Table 4.5 – LRFD Bearing Resistance Values

AASHTO LRFD Bearing Resistance Design	Value
Nominal Bearing Resistance, q_n (ksf)	192.6
Bearing Resistance Factor, φ_b	0.45
Factored Bearing Resistance, $q_R = \varphi_b q_n$ (ksf)	86.7

The Bearing Resistance is high, but it is based on the lab test data, and it is in the acceptable range for Granite bedrock, as provided in AASHTO (Table C10.6.2.5.1-1—Presumptive Bearing Resistance for Spread Footing Foundations at the Service Limit State).

4.4.3. Maximum Service Bearing Pressure

The maximum service bearing pressures for each foundation, taken from 1958 Bridge Plans, are presented below.

Table 4.6 – Maximum Service Bearing Pressures from 1958 Bridge Plans

ASD Service Design	West Abutment	Pier	East Abutment
Max Bearing Pressure (ksf)	6.5	9.5	6.3

The maximum service bearing pressures above are well below the factored bearing resistance of 86.7 ksf. It is not known if eccentricity was considered when calculating these maximum bearing pressures, as these calculations are not available. It can be assumed that these service pressures were calculated using Allowable Stress Design (ASD) methodologies which are not up to date with current LRFD used by MassDOT and AASHTO. Bearing Capacity values using ASD are provided below for comparison, however it is recommended that LRFD resistances are used.

Table 4.7 – ASD Bearing Capacity Values

AASHTO ASD Bearing Capacity Design	Value
Ultimate Bearing Capacity, q_{ult} (ksf)	192.6
Factor of Safety, FS	3.0
Allowable Bearing Capacity, $q_{allow} = q_{ult} / FS$ (ksf)	64.2

For the proposed superstructure replacement, new values of maximum bearing pressure (using LRFD methodology) shall be calculated which consider eccentric loading and the resulting effective width of footing. We recommend using, for the West Abutment the as-drilled footing width of 9.8 feet, and for the East abutment the as-drilled width of 19 feet which is the same as on the existing plans (see Figure 3).

4.4.4. Sliding Resistance

In accordance with AASHTO Article 10.6.3.4, failure by sliding shall be investigated for all footings that support horizontal loads. Resistance to sliding shall be equal to the factored shear resistance (R_R) at the interface between the bottom of concrete footing and the underlying material, which is given by equation 10.6.3.4-1 below which ignores the passive resistance of the soil in front of the footing:

$$R_R = \varphi_\tau R_\tau$$

AASHTO Table 10.5.5.2.2-1 provides a **shear resistance factor (φ_τ) of 0.80** for cast-in-place (CIP) concrete on sand at the strength limit state. This resistance factor shall be conservatively used for CIP footings on bedrock, as no resistance factor is provided for footings on bedrock. Because some areas of fractured/weathered bedrock were encountered below footings, treating the bearing material as a cohesionless soil is appropriate. AASHTO Equation 10.6.3.4-2 provides the following equation for nominal sliding resistance (R_τ) between cohesionless soil and concrete foundation, with C being equal to 1.0 for CIP concrete against soil, and V being the total vertical force at the bottom of the footing:

$$R_\tau = CV \tan(\phi'_f) = 0.70\ V$$

For friction angle (ϕ'_f) the interface between concrete and bedrock shall be considered. AASHTO Table C3.11.5.3-1 provides friction angles between various dissimilar materials, with a ϕ'_f (given as δ) of 35 degrees for "mass concrete on clean sound rock." This value is reflected in the resultant equation provided above, with the nominal sliding resistance being equal to about 70% of the vertical force applied.

5. CONSTRUCTION CONSIDERATIONS

5.1. Reuse of Existing Fill

It is anticipated that the top of existing abutments will be cut, including the full backwall height and 12 to 18 inches of the bridge seat, and rebuilt with structural steel and concrete. This will require the removal of existing Fill behind the backwall during construction. Based on sieve analysis of this soil, the Fill behind the existing abutments is suitable to be reused for backfill provided that it is free of deleterious materials such as organics or other compressible soils.

It is anticipated that existing reinforced concrete approach slabs will also be demolished and rebuilt. Based on available soil information, the Fill excavated during this process may be reused provided that it is free of deleterious materials. When preparing the subgrade for the new approach slab, any compressible soils or cobbles above 3-inches in diameter shall be removed and replaced with reused Fill or another granular soil.

When backfilling behind the reconstructed backwalls, or above/below the new approach slab, the Fill shall be laid in loose lifts not exceeding 8 inches and then compacted to 95% relative density, as measured by a nuclear density gauge.

5.2. Obstructions During Excavation

No major obstructions were encountered while drilling behind existing abutments, besides the existing approach slab. However, these test borings are a small sample size and it is possible that cobbles (3 to 12 inches in diameter) or boulders (over 12 inches) could be encountered during excavation. Any cobbles or boulders encountered during excavation shall be removed from the site and not reused when backfilling behind rebuilt abutments or above/below the new approach slab.

5.3. Support of Excavation and Utility Protection

When removing soil behind the abutment for reconstruction of the backwall, temporary support of excavation (SOE) may be needed. The system may consist of sheet piling with or without tiebacks, soldier piling and lagging, or other system that shall be capable of supporting all loads applied during stages of construction. The outline of the SOE system shall be such as to provide practical installation and removal, considering various stages of construction and potential natural obstructions and existing foundations. The SOE system shall be chosen by the contractor, signed and sealed by a MA Professional Engineer, and submitted to the design team for review.

There are various utilities carried by the bridge, including telephone, electrical and gas lines. It is anticipated that all utilities will be rebuilt as part of the superstructure replacement. The contractor shall coordinate with the utility

subcontractor and shall work with all utility owners to make sure all lines are clearly marked out and protected during excavation.

5.4. Geotechnical Monitoring Program

It is anticipated that construction will be performed in stages, in order to maintain at least one lane of traffic over the bridge. Therefore, during staged construction the existing foundations will experience unequal loading as part of the existing superstructure and substructure are rebuilt. Because foundations are bearing on competent bedrock and are in satisfactory condition, movement of foundations is unlikely. However, a geotechnical monitoring program shall be put in place to confirm that no movement occurs.

The geotechnical monitoring program shall consist of establishing a minimum of two (2) survey points on different ends of each substructure during a pre-construction survey. These survey points shall be checked frequently during and after each stage of construction to confirm that no movement has occurred. If movement is detected, then construction shall pause until corrective actions can be taken.

REFERENCES

1. AASHTO, 2020. "LRFD Bridge Design Specifications," American Association of State Highway and Transportation Officials (AASHTO), 9th Edition.

2. MassDOT, 2013. "LRFD Bridge Manual," Massachusetts Department of Transportation (MassDOT), with 2020 revisions.

3. USGS Maps:
    - Surficial Materials Map of the North Worcester Quadrangle, Massachusetts, 2018.
    - Bedrock Geologic Map of Massachusetts, 1983.

LIMITATIONS

Explorations

- The analyses and recommendations given in this report are based in part upon the data obtained from subsurface explorations performed by others.
- The soil description presented in this report is intended to convey trends in subsurface conditions and was developed by interpretations of spaced boreholes and samples; actual soil transitions could be more erratic.
- Water level readings have been made in the boreholes at times and under conditions stated in the boring logs. This information has been accordingly interpreted in this report. It must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

Review

- In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of this report are modified or verified in the field and made in writing.

Use of Report

- This Geotechnical Report has been prepared for the Laurel Street over I-290 Bridge Replacement Project by HNTB for GREEN International Affiliates, Inc.

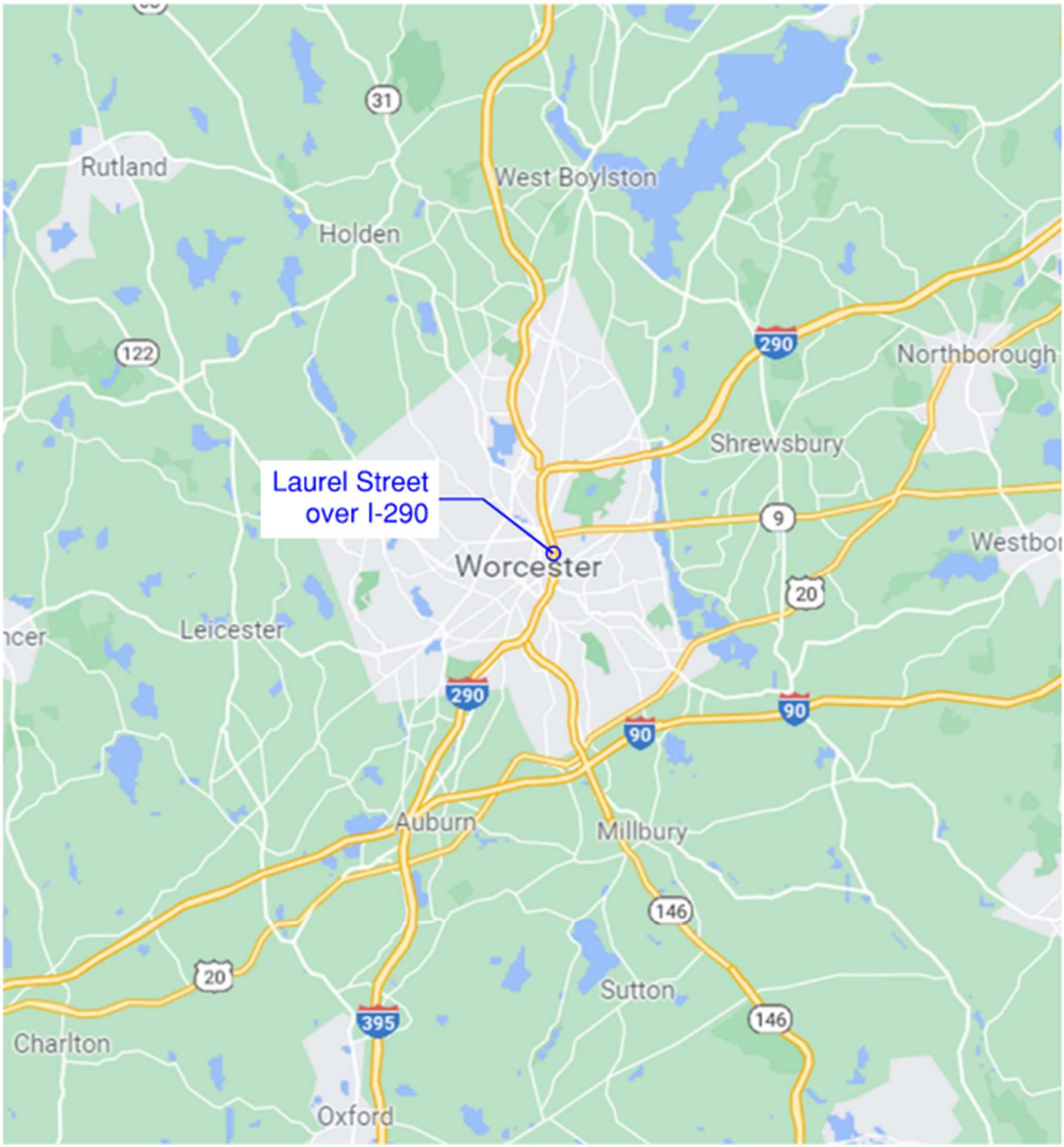
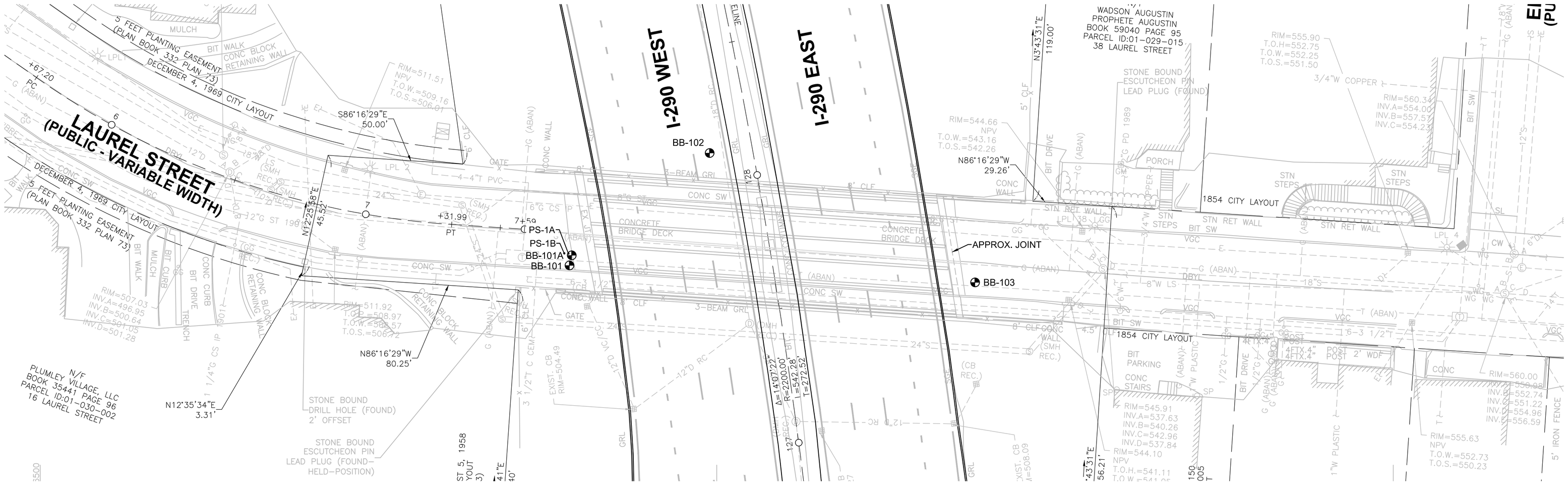


Figure 1 – Site Locus Plan

WORCESTER
LAUREL STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609185		

AS-DRILLED EXPLORATION PLAN



NOTES

1. THE EXISTING CONDITIONS SHOWN ON THIS BASE MAP ARE THE RESULT OF AN ON-THE- GROUND INSTRUMENT SURVEY PERFORMED BETWEEN MARCH 26, 2021 AND JULY 8, 2021 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN INTL.) AND A LASER SCAN SURVEY PERFORMED BY LANDTECH.
2. AS-DRILLED BORING LOCATIONS ARE SHOWN AS THUS: ◔ BB-101
3. AS-DRILLED PROBE SERIES BORINGS ARE SHOWN AS THUS: PS-1A
4. ELEVATIONS, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. HORIZONTAL COORDINATES, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD 83).
6. THE STATIONING AND OFFSETS OF EACH EXPLORATION LOCATION ARE GIVEN FROM THE BASELINE OF I-290.
7. EXPLORATION LOCATIONS AND ELEVATIONS ARE APPROXIMATE. EXPLORATIONS WERE MOVED FROM THEIR ORIGINAL LOCATIONS DUE TO UTILITIES, AND LOCATIONS ARE BASED ON APPROXIMATE MEASUREMENTS FROM EXISTING SITE FEATURES.
8. PROBE SERIES BORINGS WERE ADVANCED UNTIL REFUSAL ON CONCRETE ABUTMENT OR BEDROCK, TO DETERMINE THE APPROXIMATE GEOMETRY OF EXISTING ABUTMENTS. SEE DRAWING "FIGURE 3 - ESTIMATED ABUTMENT GEOMETRY" FOR MORE INFORMATION.
9. BOREHOLES WERE BACKFILLED WITH SOIL CUTTINGS AND/OR FILTER SAND, THEN THE ROADWAY SURFACE WAS RESTORED TO IT'S ORIGINAL CONDITION USING COLD-PATCH PAVEMENT.
10. SOIL JARS AND ROCK CORE BOXES ARE AVAILABLE FOR VIEWING AT THE MASSDOT STORAGE FACILITY IN LAWRENCE, MASSACHUSETTS.

AS-DRILLED EXPLORATION LOCATIONS (FEET)					
EXPLORATION	NORTHING	EASTING	STATION	OFFSET	SURFACE ELEVATION
BB-101	2923088.7	576695.6	127+78.1	74.1' L	523.0
BB-101A	2923092.4	576696.4	127+82.3	72.6' L	523.0
BB-102	2923130.2	576747.4	128+11.1	15.9' L	506.0
BB-103	2923082.4	576845.4	127+48.5	72.9' R	541.0
PS-1A	2923093.1	576695.2	127+83.1	73.7' L	523.0
PS-1B	2923093.2	576693.6	127+83.5	75.2' L	522.9

0 20 50 100
SCALE: 1" = 20'

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MassDOT Massachusetts Department of Transportation Highway Division

FIGURE 2
AS-DRILLED EXPLORATION PLAN

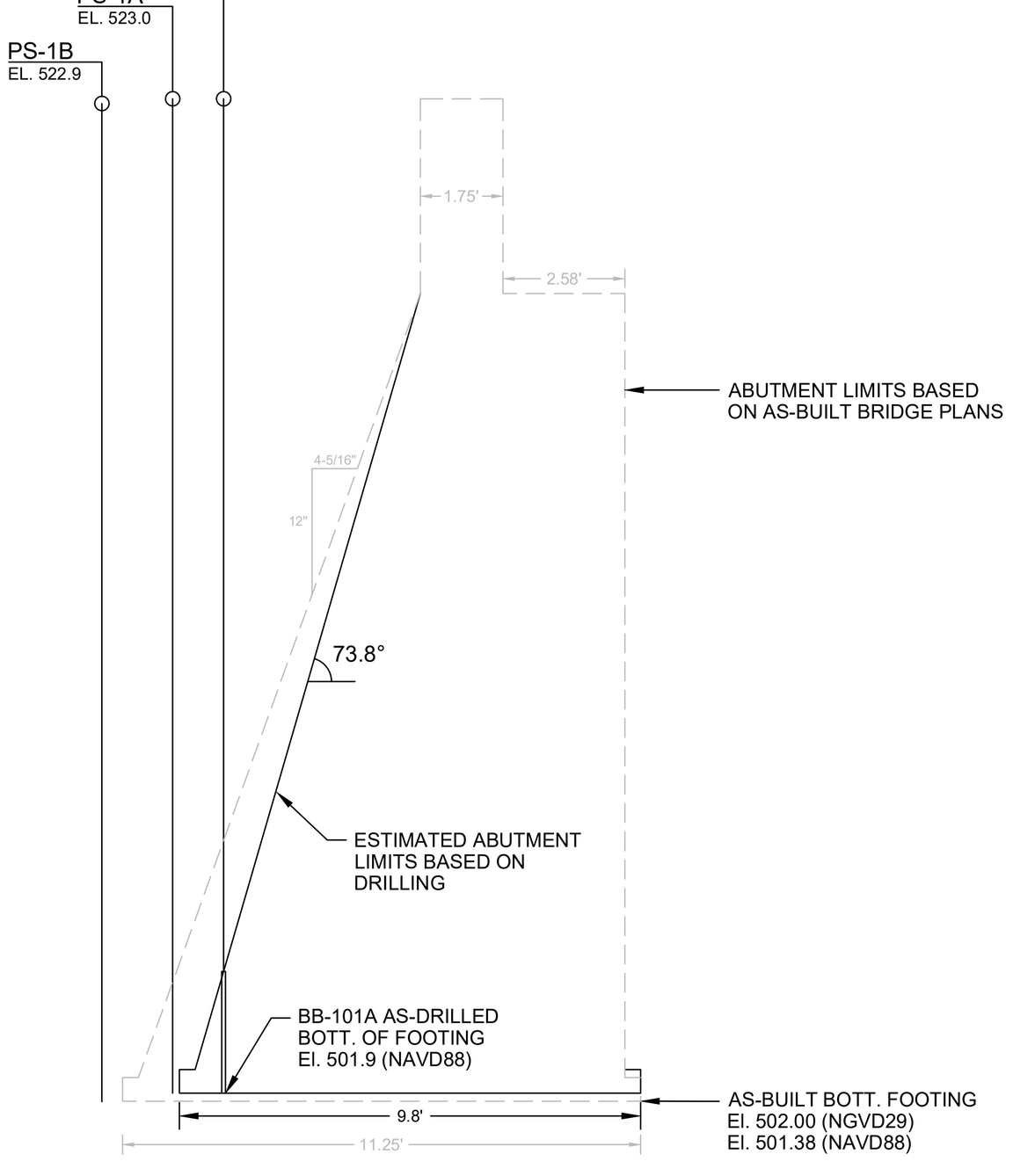
WORCESTER

LAUREL STREET
OVER I-290

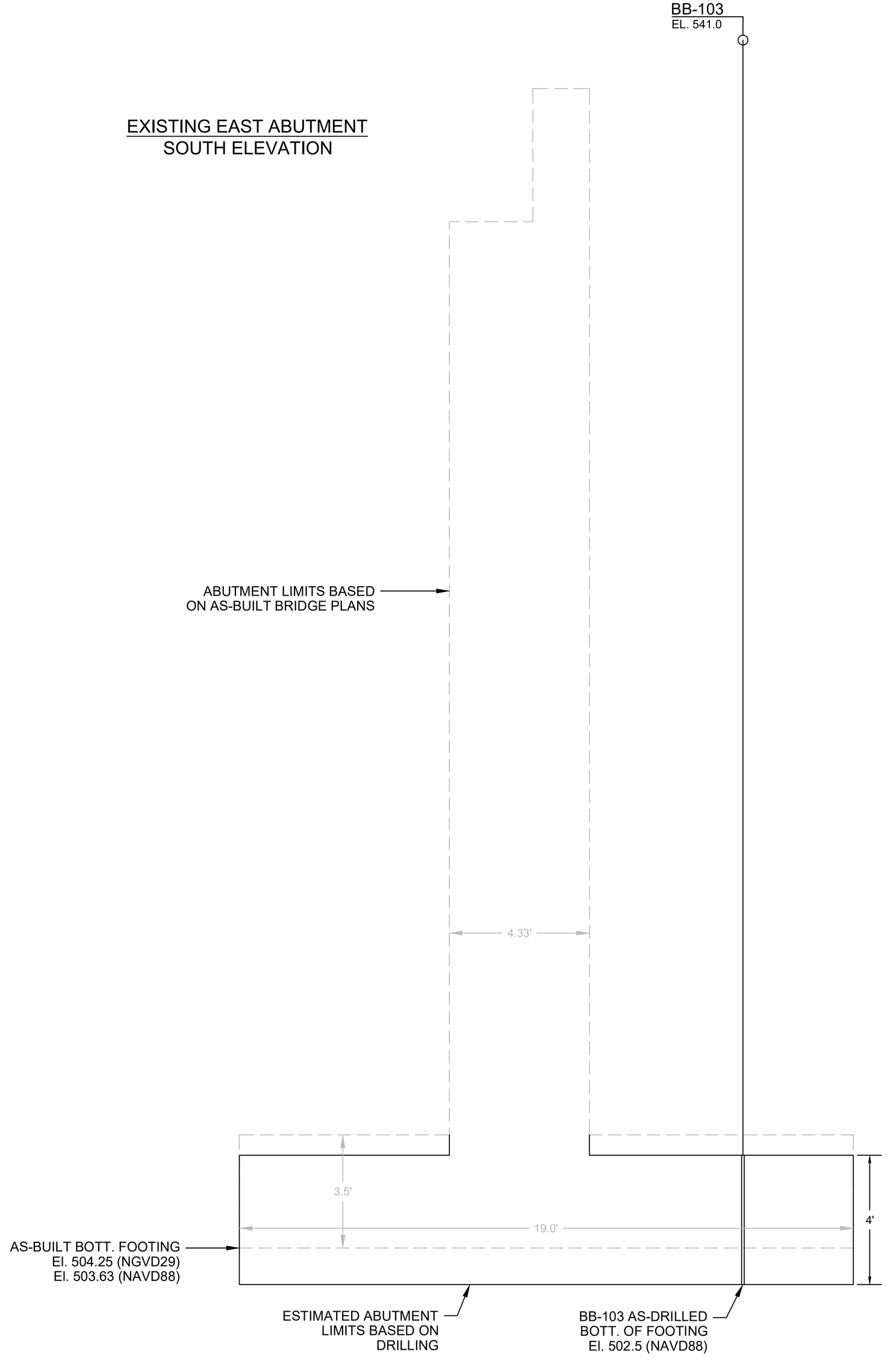
MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

SHEET 1 OF 1 BRIDGE NO. W-44-93

EXISTING WEST ABUTMENT
SOUTH ELEVATION



EXISTING EAST ABUTMENT
SOUTH ELEVATION



WORCESTER
LAUREL STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	1
PROJECT FILE NO.	609185		

ESTIMATED ABUTMENT GEOMETRY

NOTES

1. GROUND ELEVATIONS OF EXPLORATIONS WERE DETERMINED IN THE FIELD BASED ON ON SURVEY PLANS AND SHOULD BE CONSIDERED APPROXIMATE. SURVEY PLANS WERE DEVELOPED FROM AN ON-THE- GROUND INSTRUMENT SURVEY PERFORMED BETWEEN MARCH 26, 2021 AND JULY 8, 2021 BY GREEN INTERNATIONAL AFFILIATES, INC. (GREEN INTL.) AND A LASER SCAN SURVEY PERFORMED BY LANDTECH.
2. DEPTHS OF EXPLORATIONS WERE ESTIMATED IN THE FIELD BASED ON DRILLING ACTION AND SHOULD BE CONSIDERED APPROXIMATE.
3. BOTH BRIDGE BORINGS CORED THROUGH THE CONCRETE ABUTMENT AND INTO GRANITE BEDROCK DIRECTLY UNDERLYING THE FOOTING. SEE THE BORING LOGS AND CORE PHOTOS IN THE GEOTECHNICAL REPORT FOR MORE INFORMATION.
4. ELEVATIONS, IN U.S. SURVEY FEET, ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). AS-BUILT BRIDGE PLANS GIVE ELEVATIONS IN NGVD29, WHICH HAVE BEEN CONVERTED TO NAVD88 BY SUBTRACTING 0.62 FEET.
5. AS-BUILT DIMENSIONS FROM THE BRIDGE PLANS ARE PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY AND MAY NOT ACCURATELY REPRESENT ACTUAL ABUTMENT DIMENSIONS.

0 2 5
SCALE: 1" = 2'

JANUARY 2022 | PROJECT FILE NO. 609185

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BOSTON, MA 02116

massDOT Massachusetts Department of Transportation Highway Division

FIGURE 3
ESTIMATED ABUTMENT GEOMETRY

WORCESTER

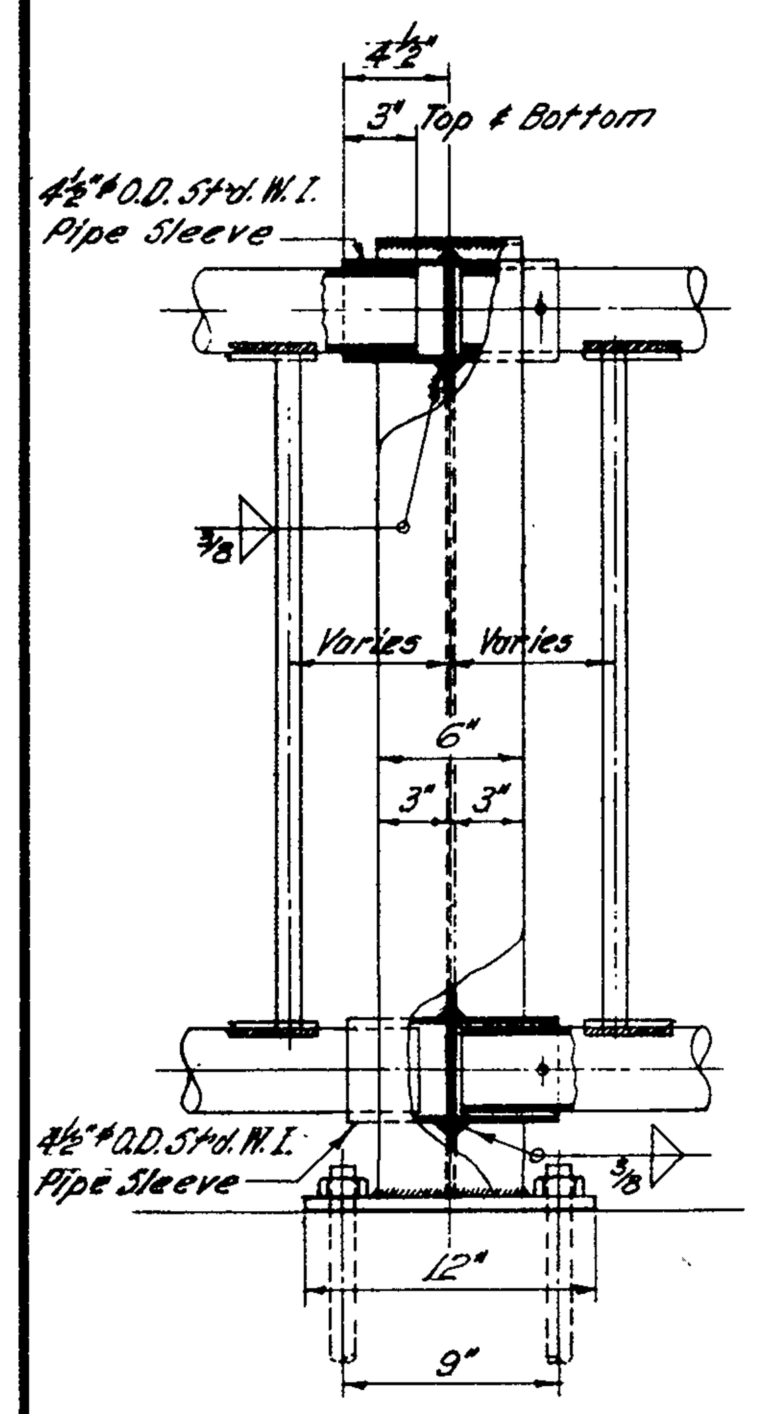
LAUREL STREET
OVER I–290

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

SHEET 1 OF 1 BRIDGE NO. W–44–93

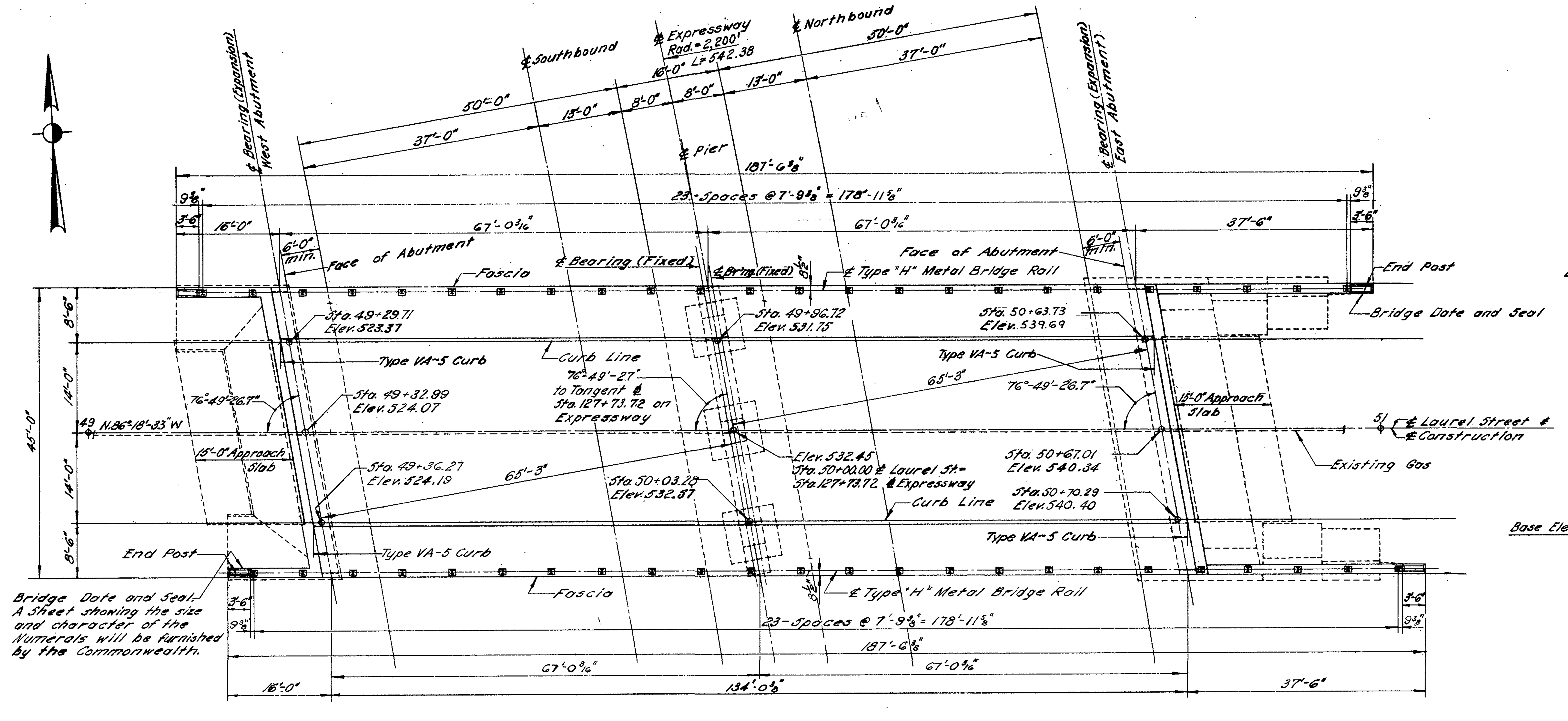
Appendix A 1958 Bridge Plans

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-N80-5(8)-97	1958	107	117



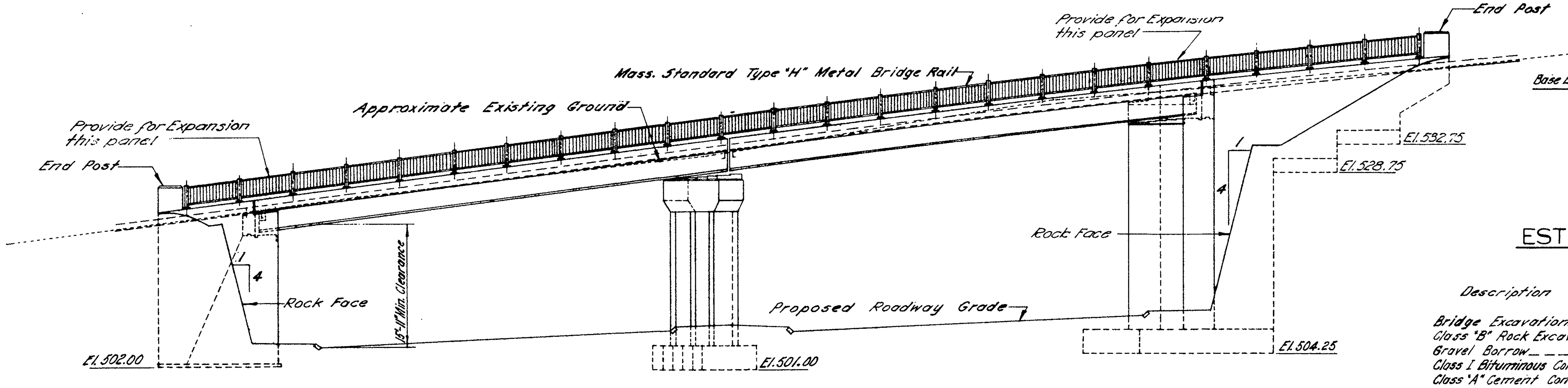
DETAIL FOR EXPANSION PANEL ONLY

Scale: 1½" = 1'-0"



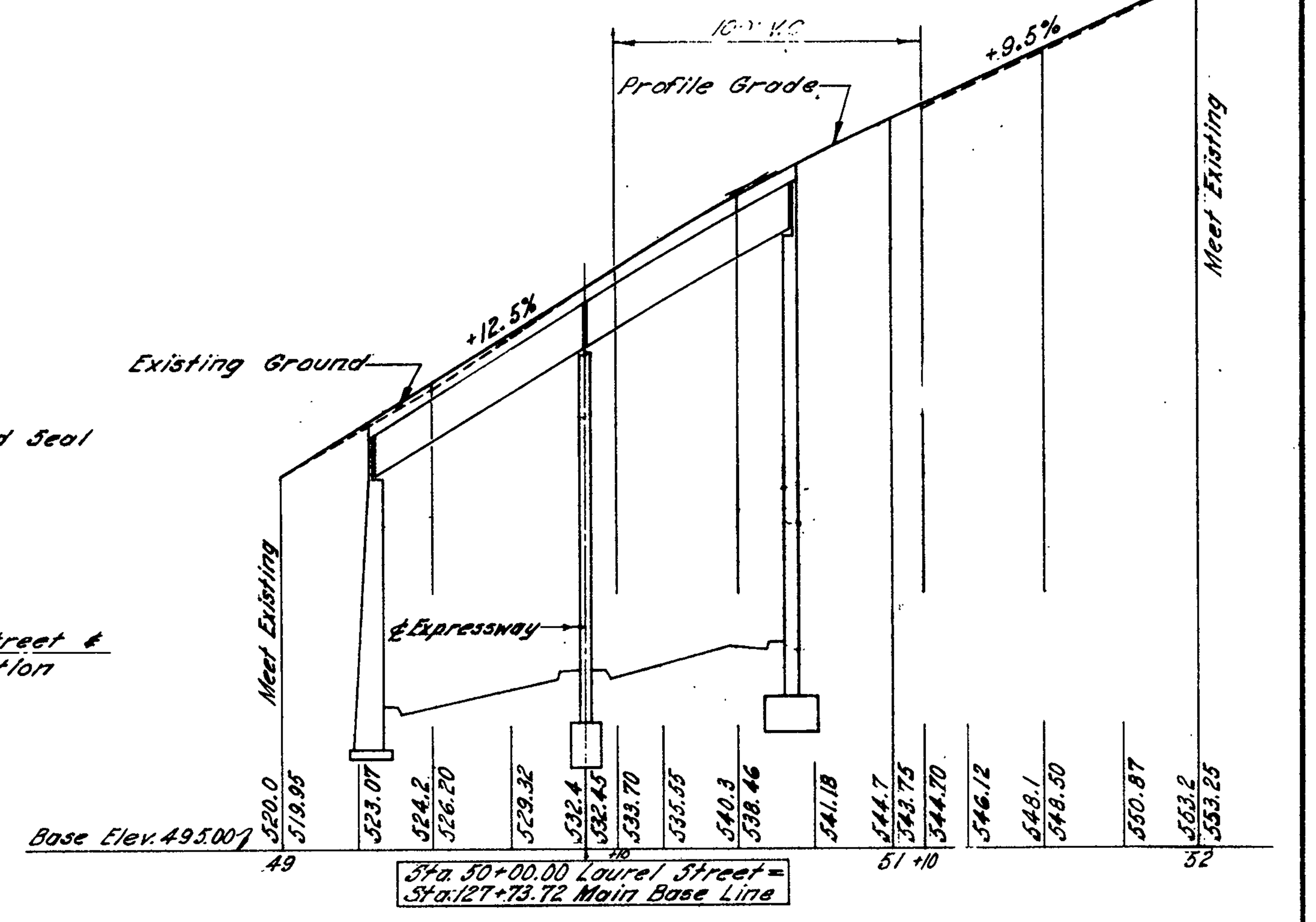
DECK PLAN

Scale 1" = 10'



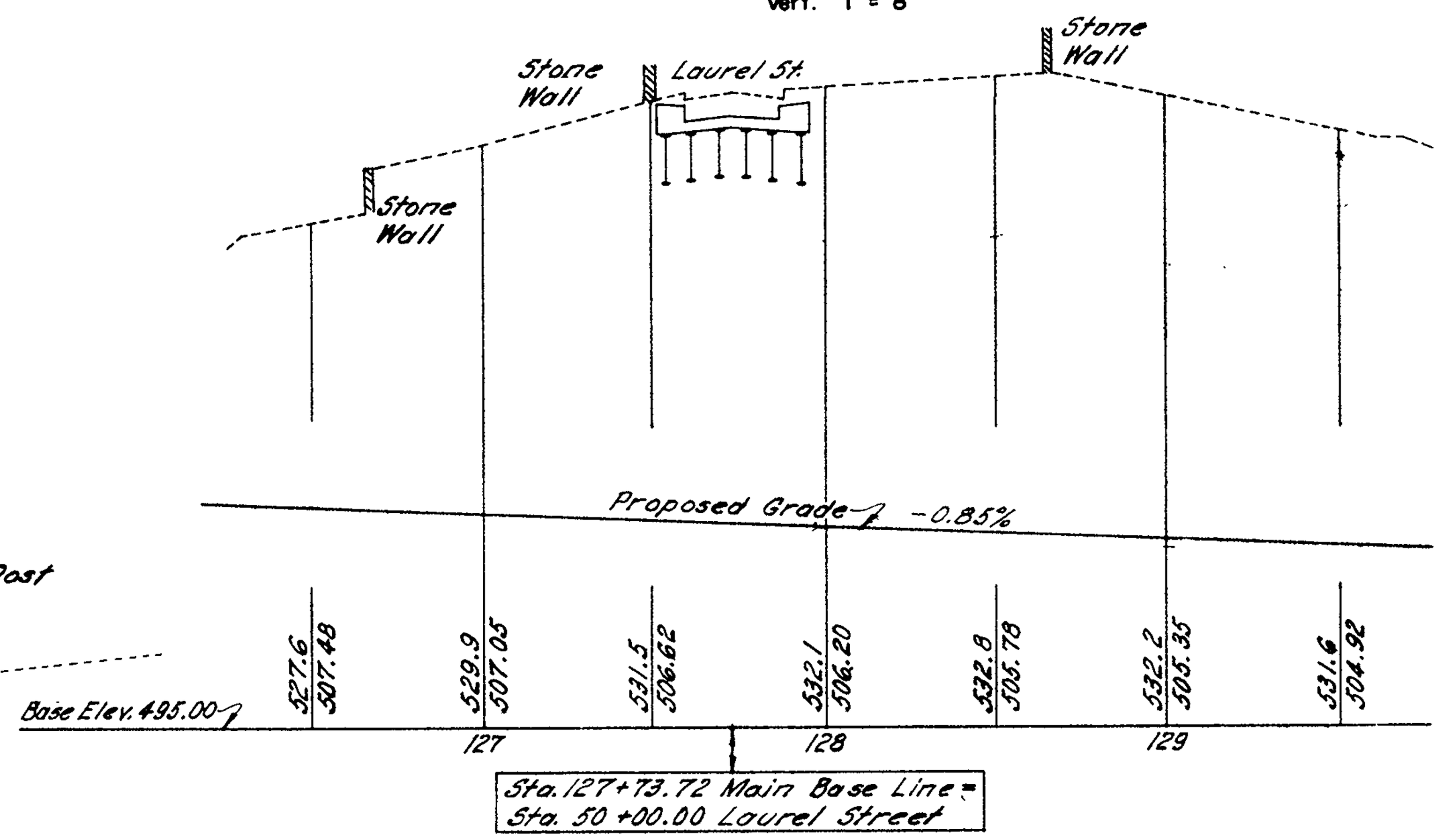
ELEVATION

Scale 1" = 10'



LAUREL STREET PROFILE

Scales Horz. 1" = 40' Vert. 1" = 8'



MAIN BASE LINE PROFILE

Scales: Horiz. 1" = 40' Vert. 1" = 8'

W-44-93 LAUREL ST. OVER EXPRESSWAY

- SH. 2 —— GEN. PLAN
- SH 4 —— BORINGS
- SH.16 —— DECK PLAN
- SH.17 —— WEST ABUT.
- SH.18 —— PIER
- SH.19 —— EAST ABUT.
- SH. 20 —— FRAMING PLAN

BRIDGE W-44-93

ESTIMATED QUANTITIES

(NOT GUARANTEED)

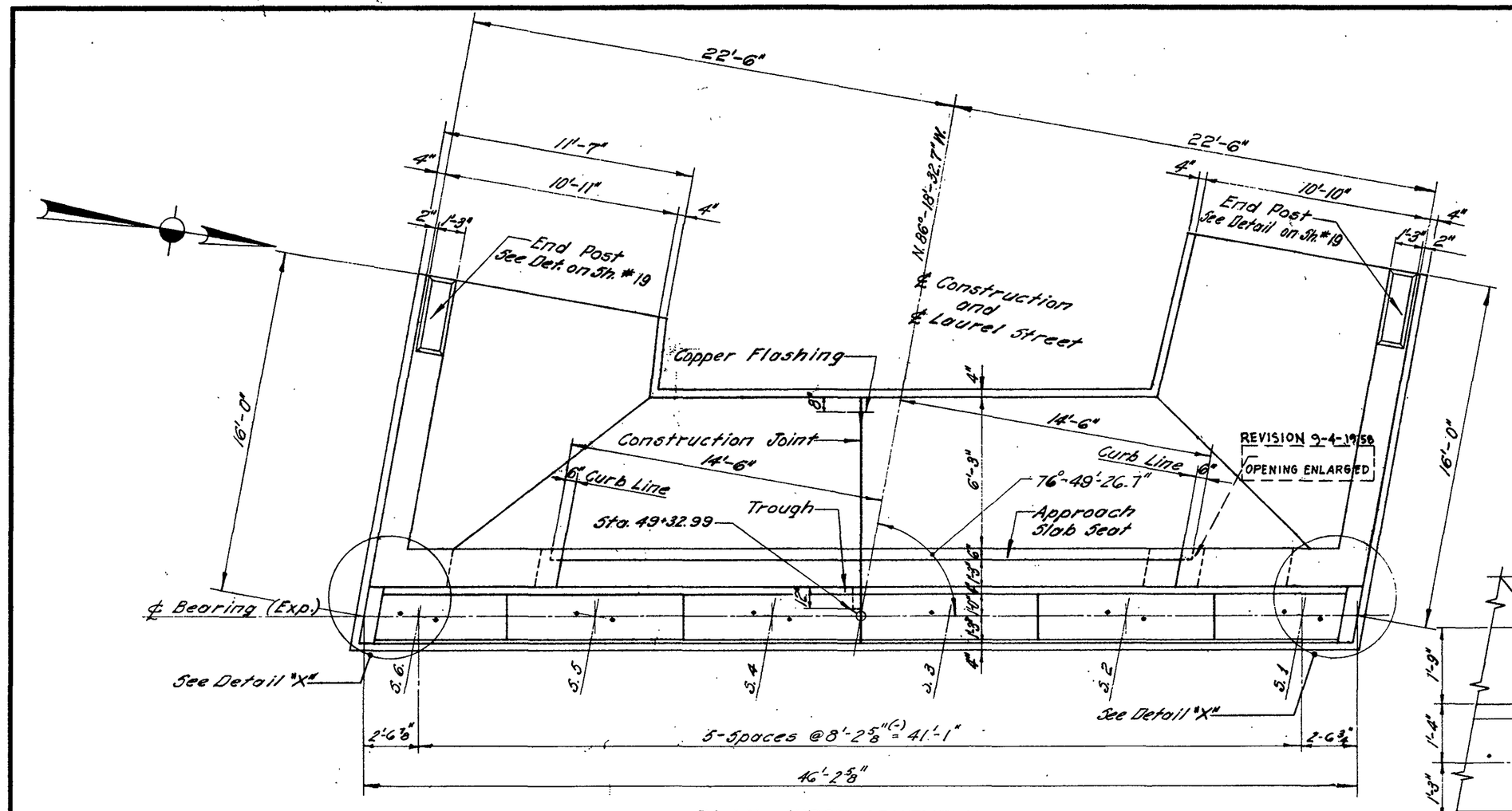
Description	Quantity
Bridge Excavation	95 C.Y.
Class "B" Rock Excavation	634 C.Y.
Gravel Borrow	958 C.Y.
Class I Bituminous Concrete Pavement Type I-1	65 Tons
Class "A" Cement Concrete Masonry	601 C.Y.
Class "B" Cement Concrete Masonry	309 C.Y.
Steel Reinforcing for Structure	54,000 Lbs.
Class "G" Cement Concrete Masonry	5 C.Y.
Bituminous Damp-proofing	493 S.Y.
Bridge Structure (W-44-93)	1 L.S.

DATE	DESCRIPTION
OCT. 14, 1958	REVISED SHEET: REPLACES SHEET NO. 16
JULY 31, 1958	ISSUED FOR CONSTRUCTION

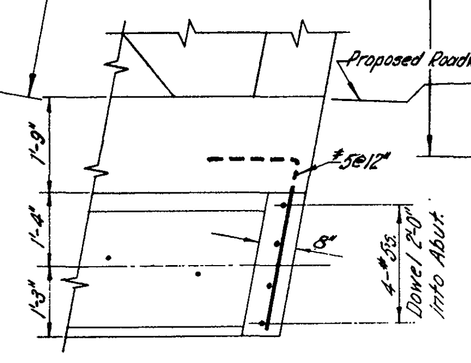
USE ONLY PRINTS OF LATEST DATE

SHEET 16A OF 26 SHEETS • BRIDGE NO. W-44-93

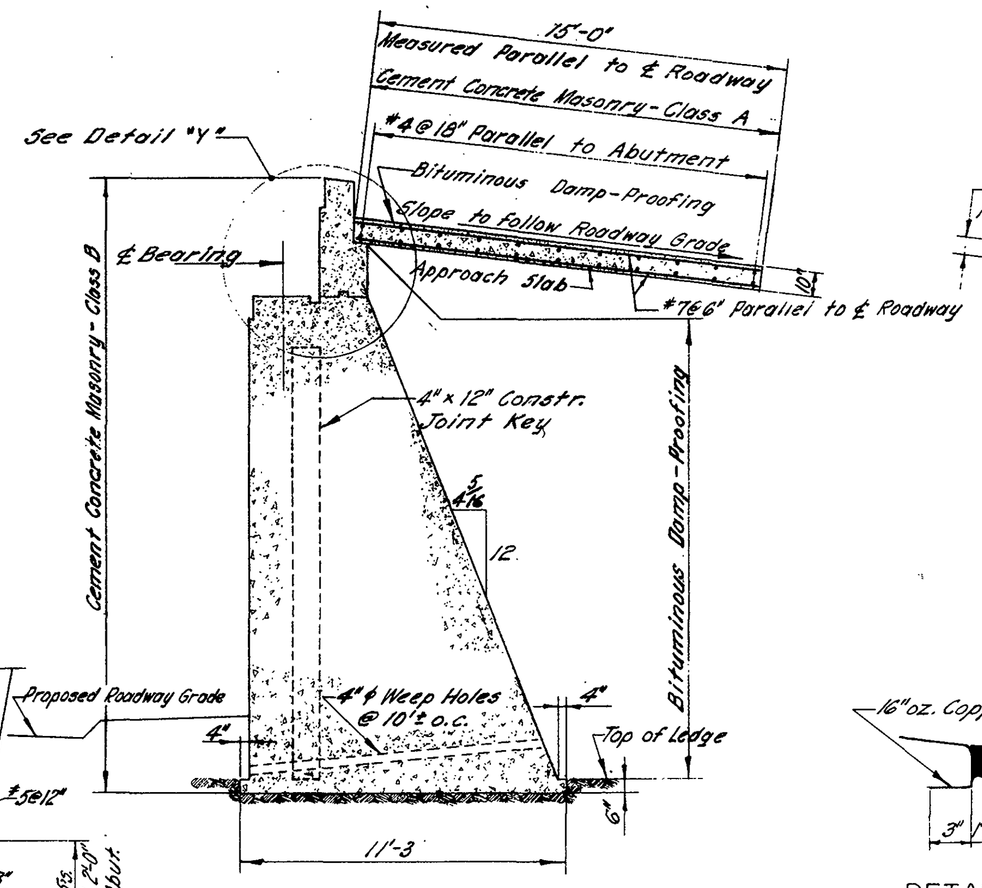
PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-N90-5(62)97	1958	108	117



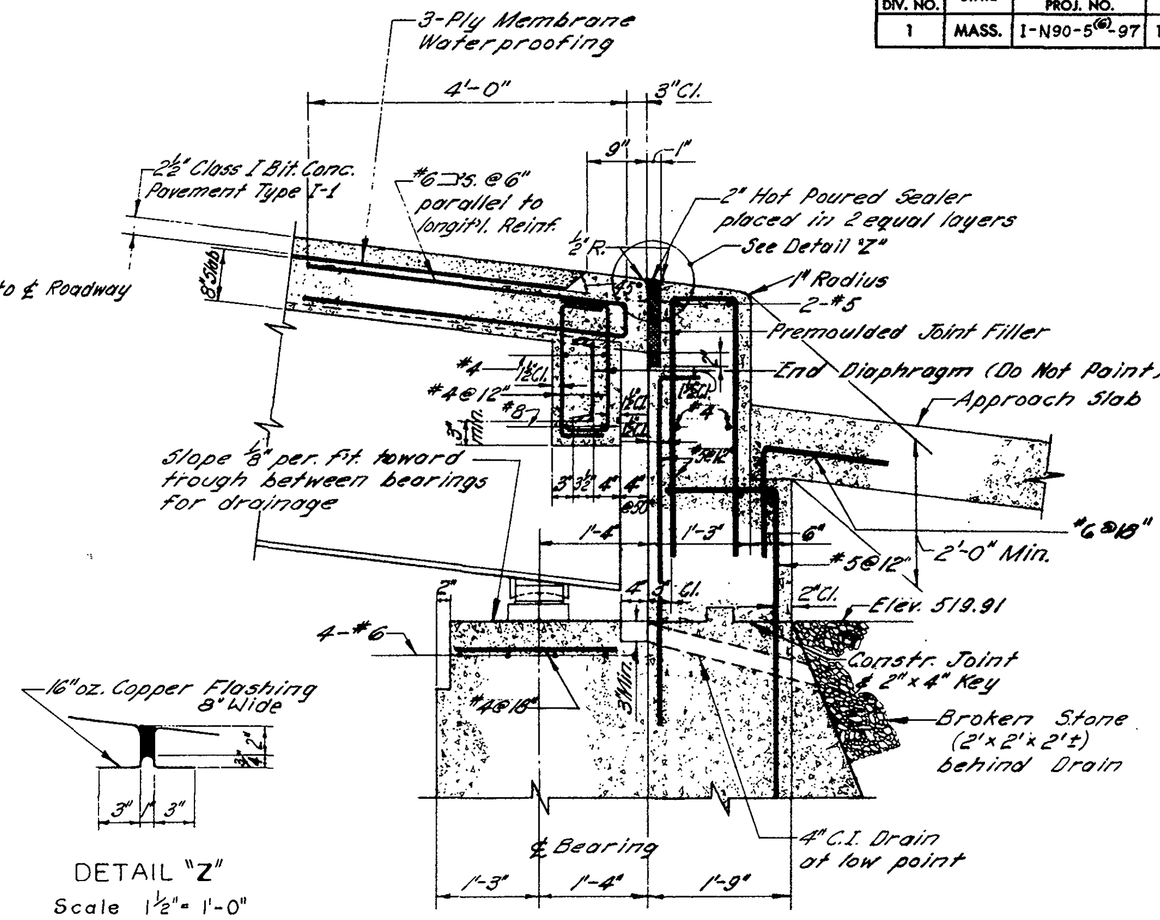
PLAN—WEST ABUTMENT
Scale 1/4" = 1'-0"



DETAIL "X"
Scale 1/2" = 1'-0"

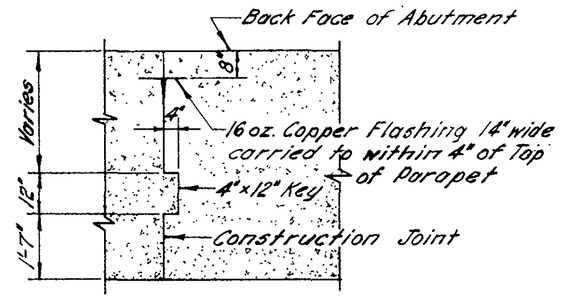


ABUTMENT SECTION
Scale 1/4" = 1'-0"

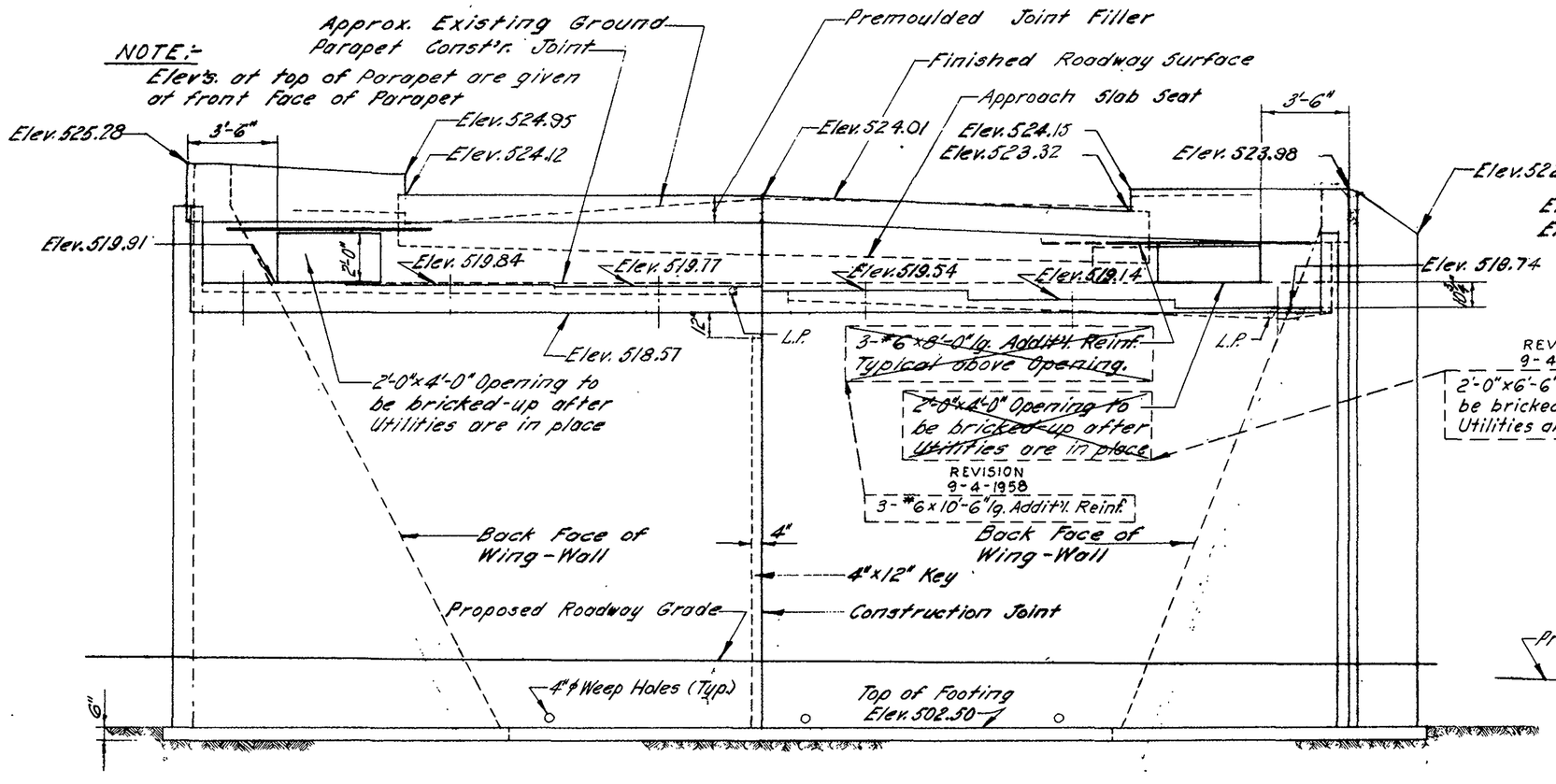


DETAIL "Z"
Scale 1½" = 1'-0"

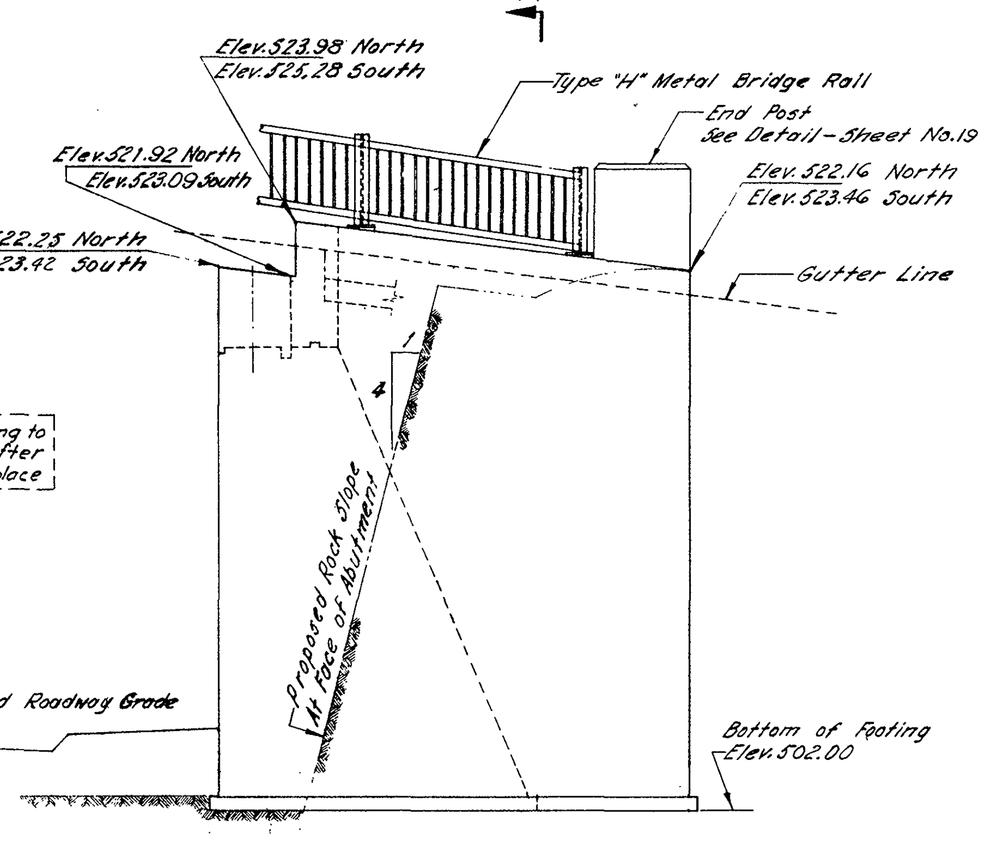
DETAIL "Y"
Scale 3/4" = 1'-0"



CONSTRUCTION JOINT DETAIL
Scale 3/8" = 1'-0"

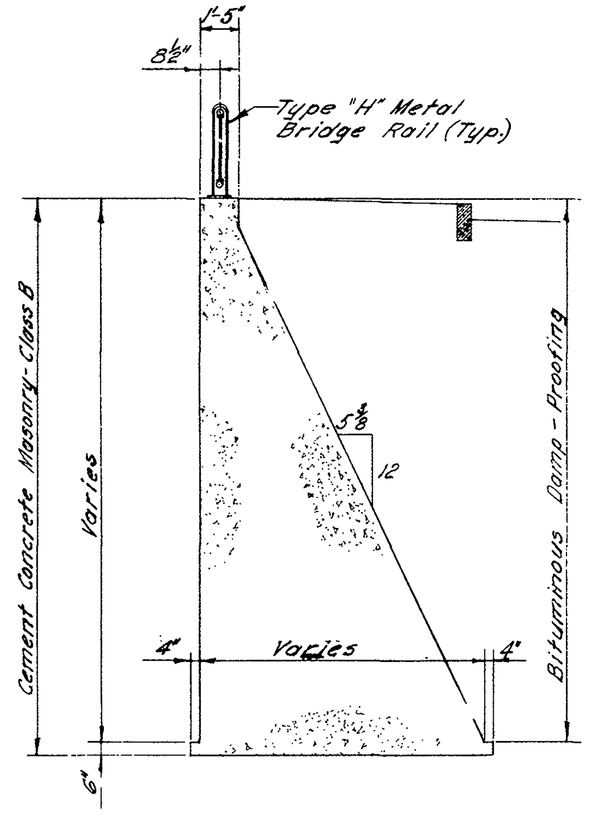


ELEVATION
Scale 1/4" = 1'-0"



NOTE:
South Wing-Wall similar except as noted.

NORTH WING WALL ELEVATION
Scale 1/4" = 1'-0"

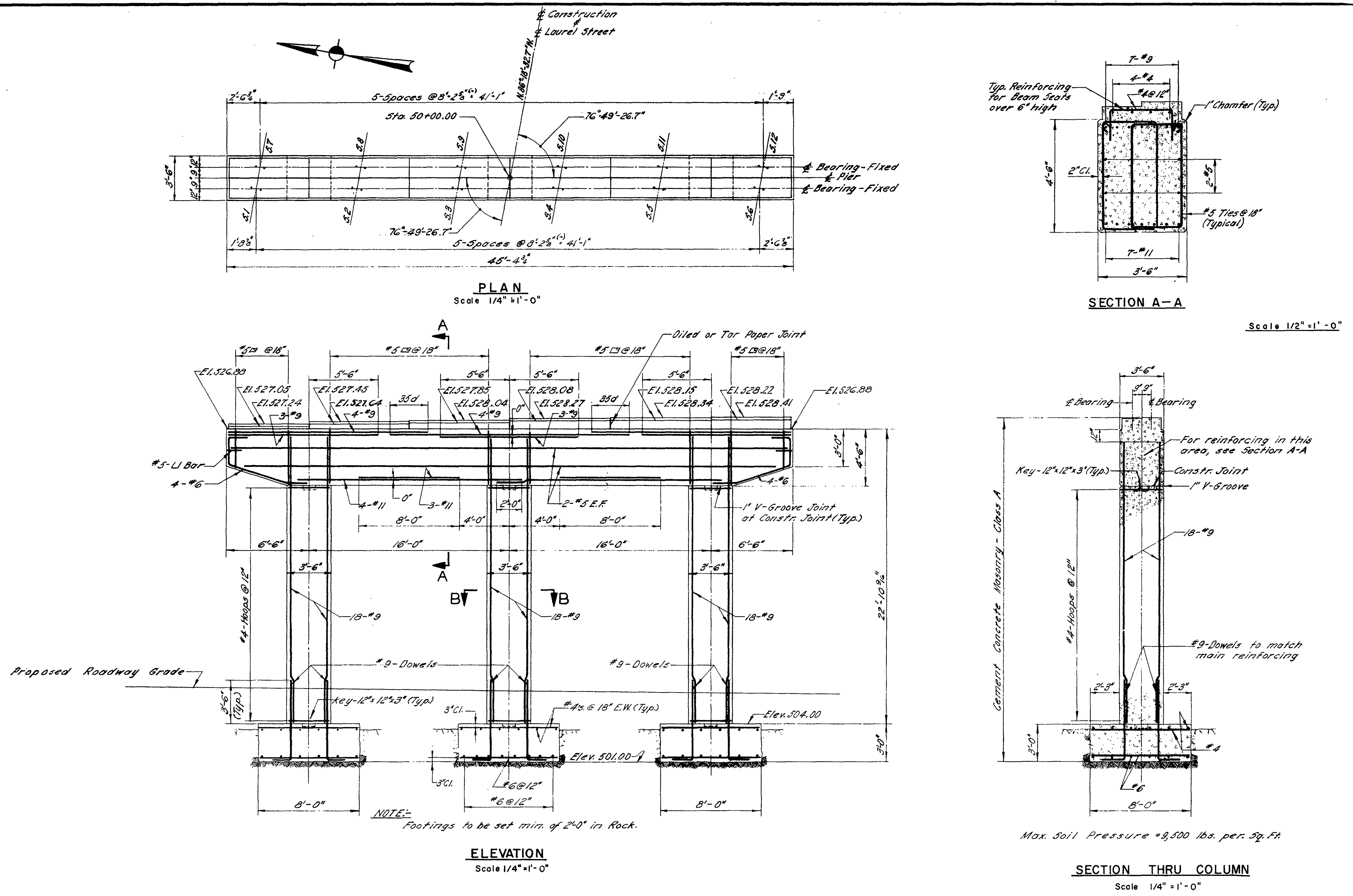


Max. Soil Pressure = 5,800 lbs. per Sq. Ft.

SECTION A-A
Scale 1/4" = 1'-0"

DATE	DESCRIPTION
OCT. 14, 1966	REVISED SHEET: REPLACES SHEET No. 17
SEPT. 4, 1958	REVISION - UTILITY OPENING ENLARGED - REVISED
JULY 31, 1958	• ISSUED FOR CONSTRUCTION •
	• USE ONLY PRINTS OF LATEST DATE •

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-N90-5(6)-97	1958	109	117

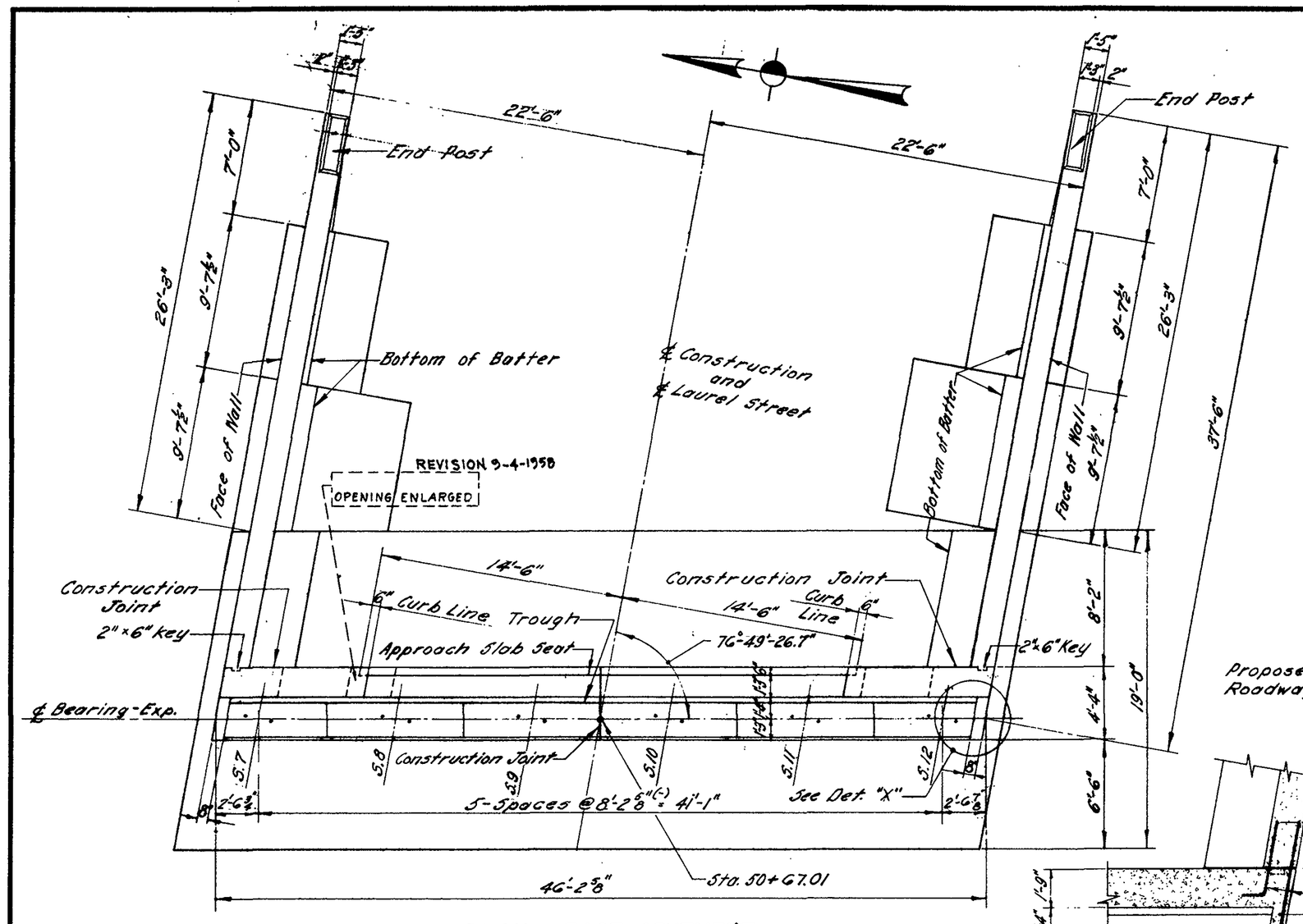


DATE	DESCRIPTION
OCT. 14, 1958	REVISED SHEET: REPLACES SHEET No. 18
JULY 31, 1958	ISSUED FOR CONSTRUCTION

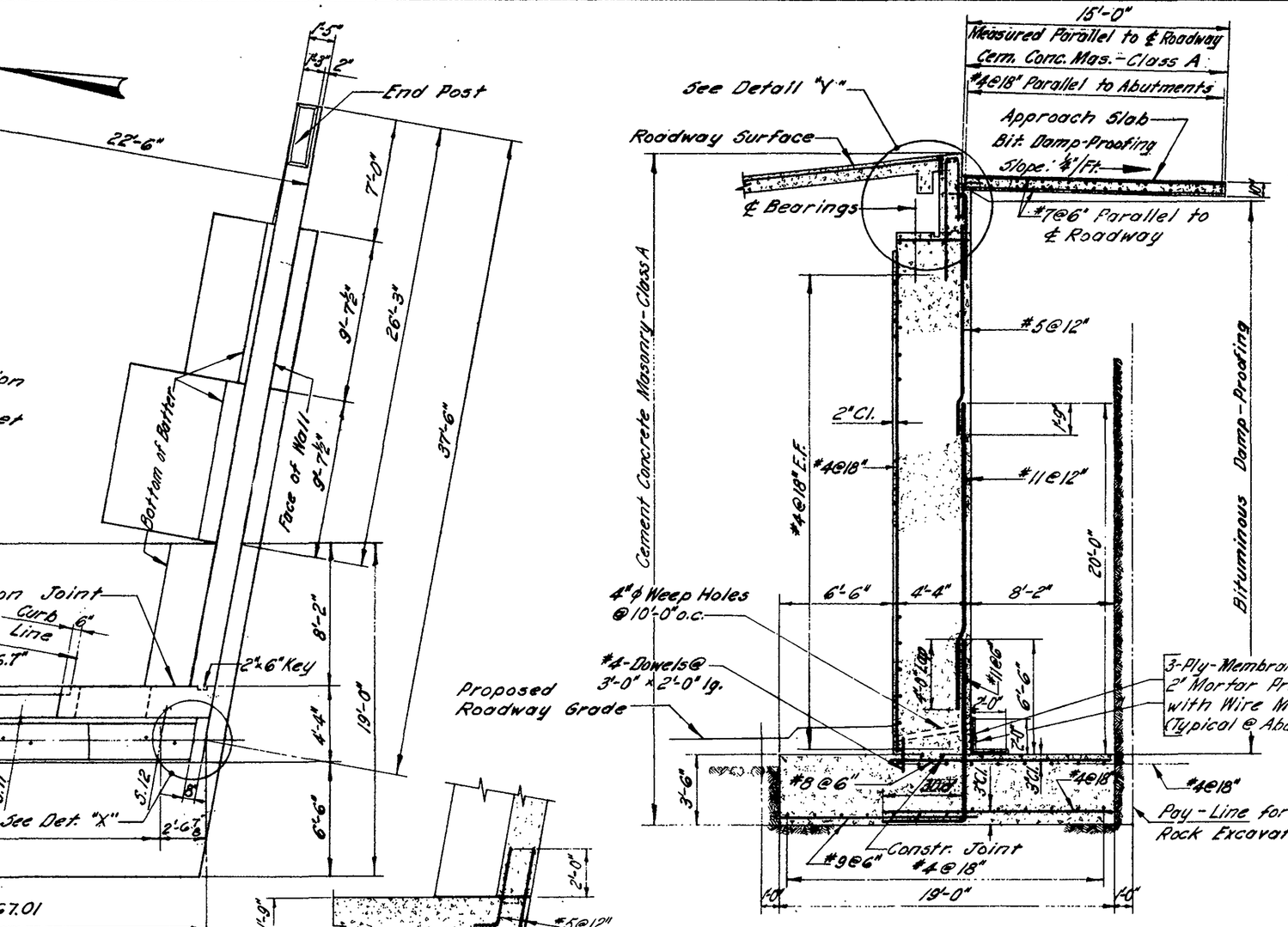
· USE ONLY PRINTS OF LATEST DATE ·

· SHEET 18A OF 26 SHEETS · BRIDGE NO. W-44-93

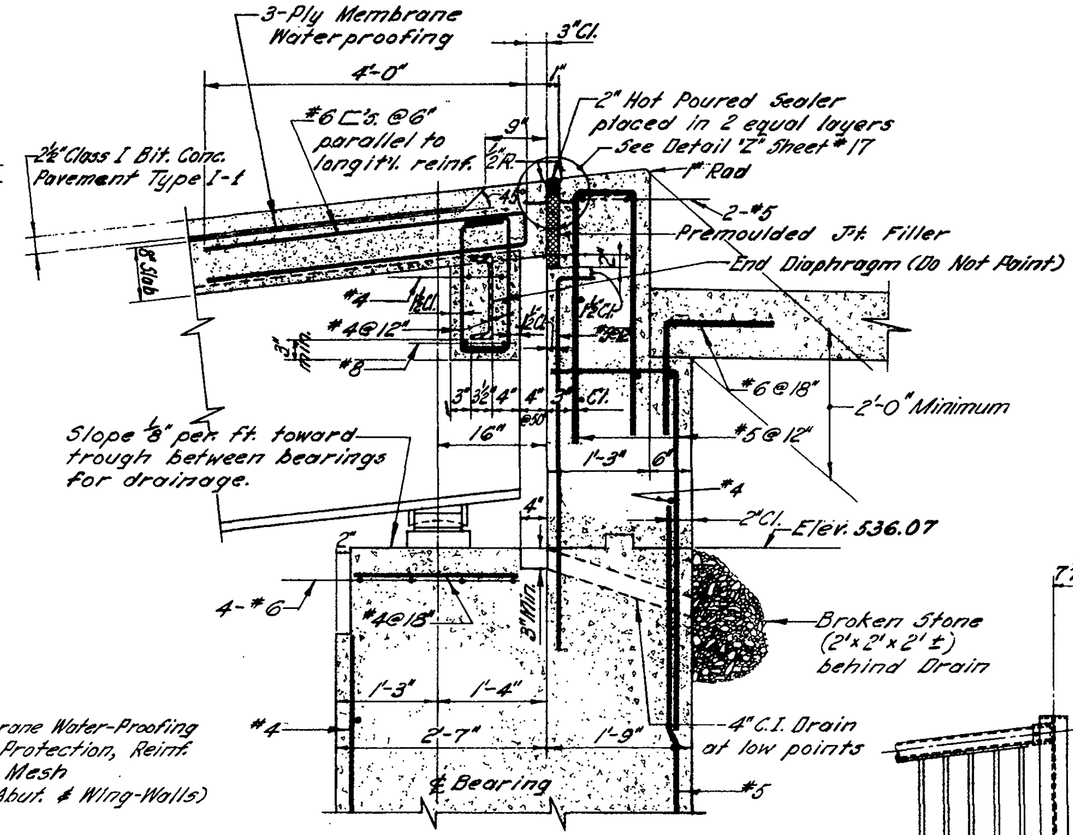
PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-N 90-5(82)-97	1958	110	117



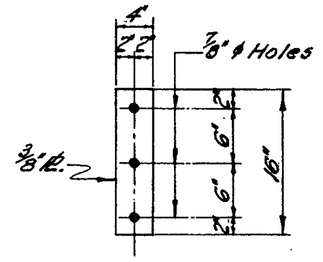
PLAN — EAST ABUTMENT
Scale 3/16"=1'-0"



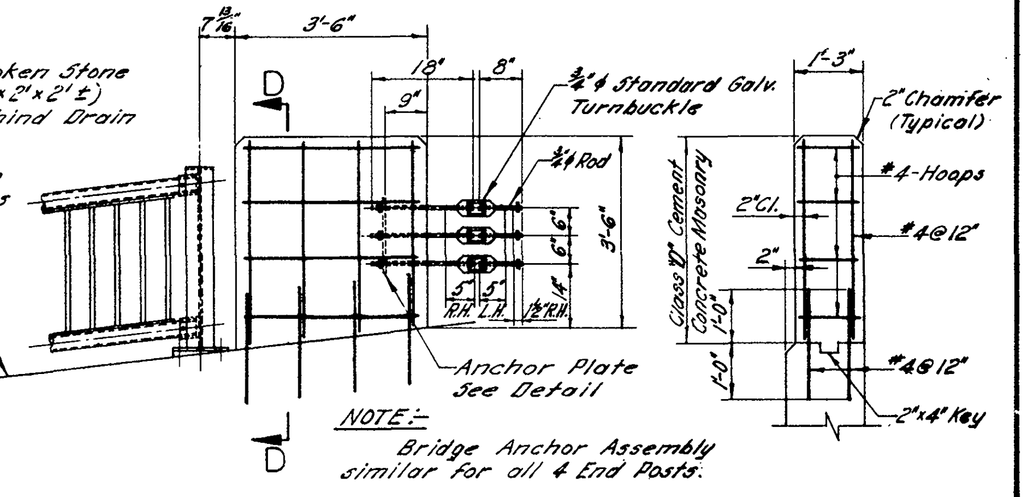
TYPICAL ABUTMENT SECTION
Scale 3/16"=1'-0"



DETAIL "Y"
Scale 3/4"=1'-0"



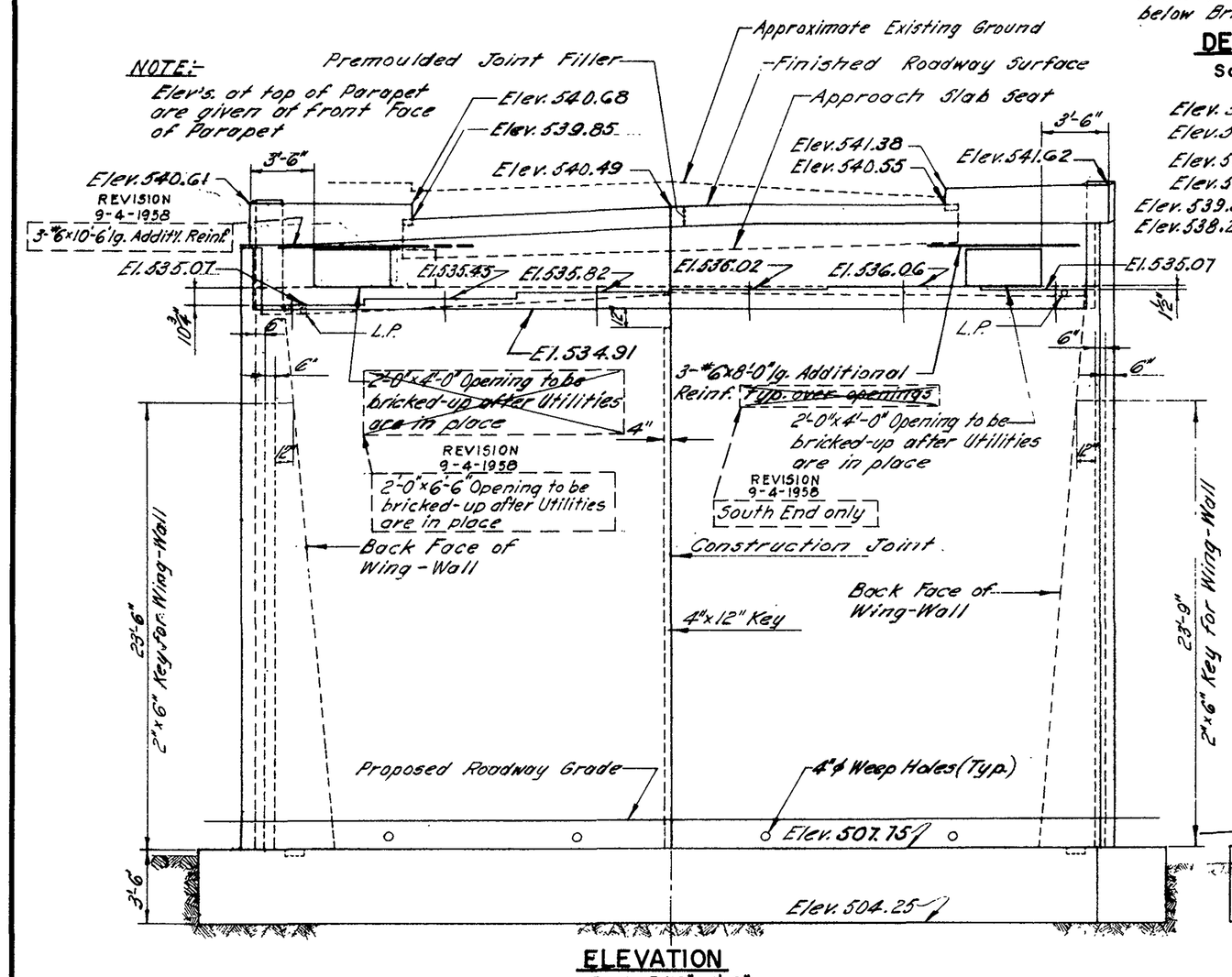
ANCHOR PLATE DETAIL
Scale 1"=1'-0"



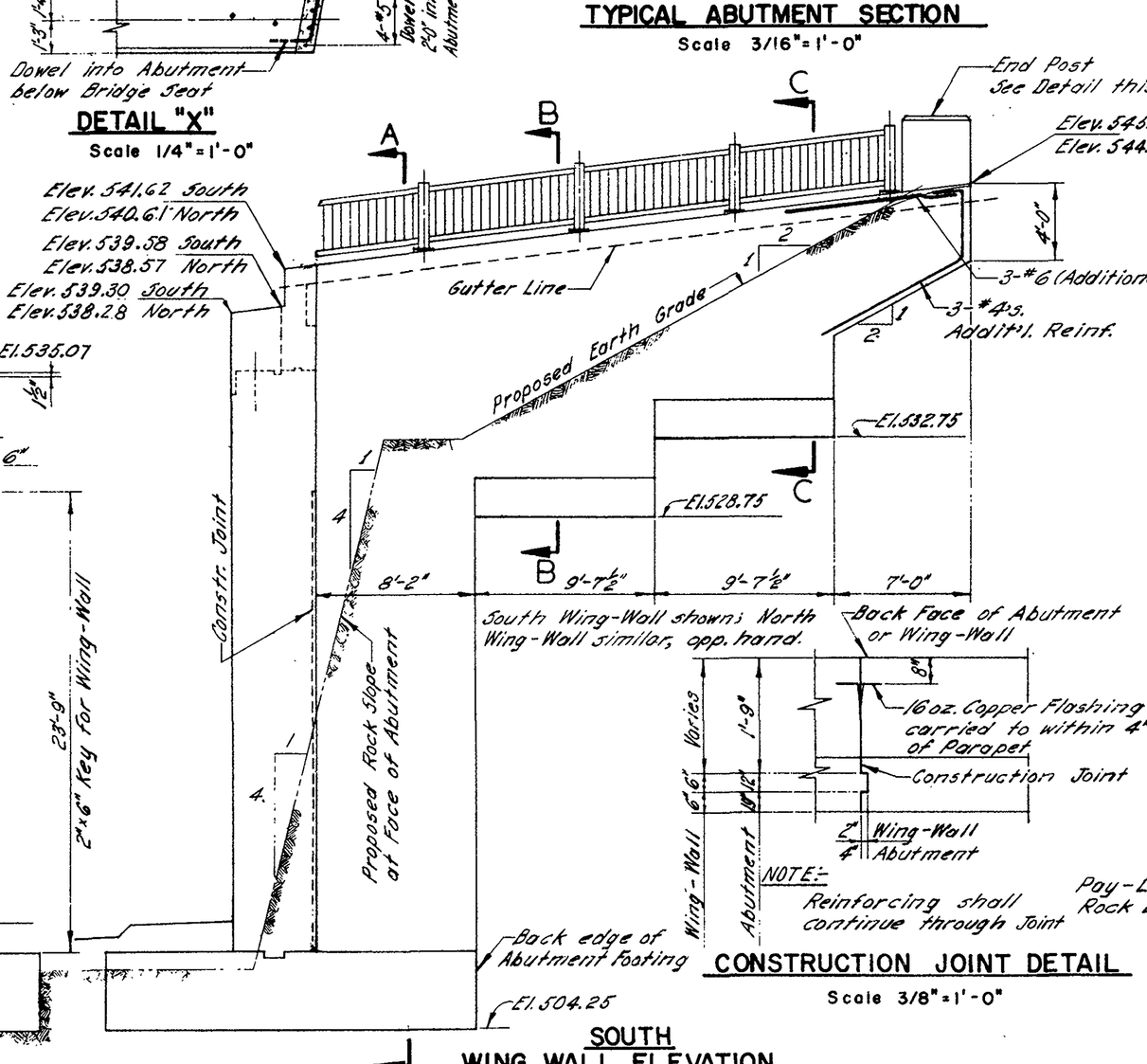
NOTE:-

END POST DETAIL
Scale 1/2"=1'-0"

SECTION D-D
Scale 1/2"=1'-0"

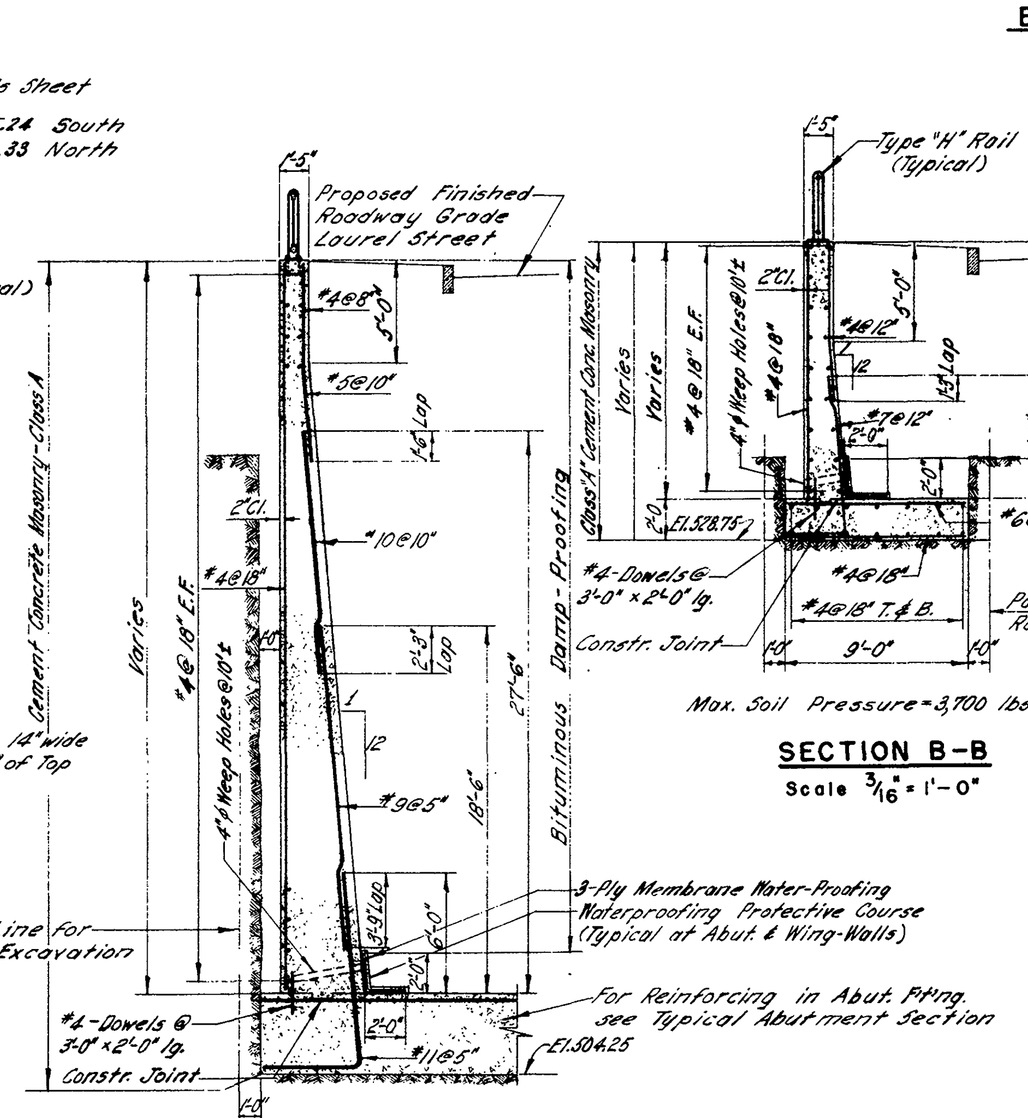


ELEVATION
Scale 3/16"=1'-0"

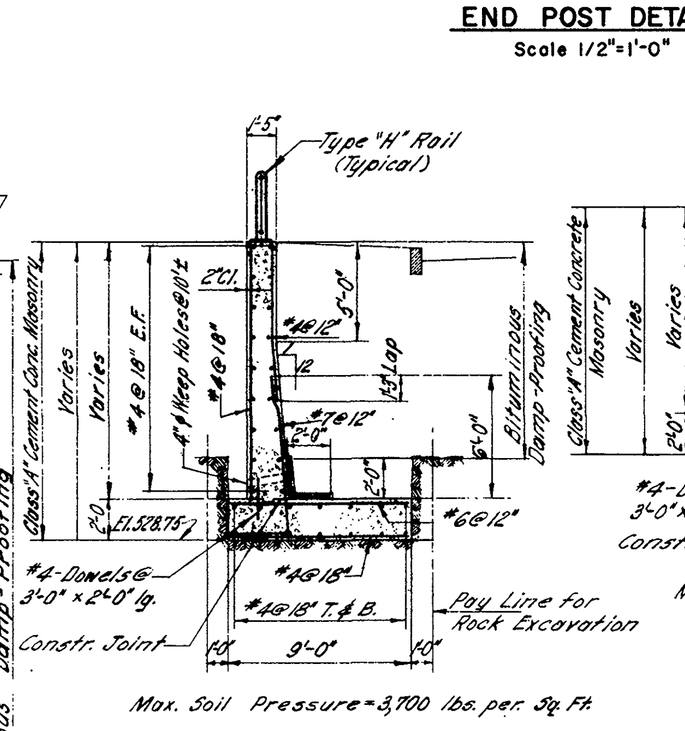


CONSTRUCTION JOINT DETAIL
Scale 3/8"=1'-0"

SOUTH WING WALL ELEVATION
Scale 3/16"=1'-0"

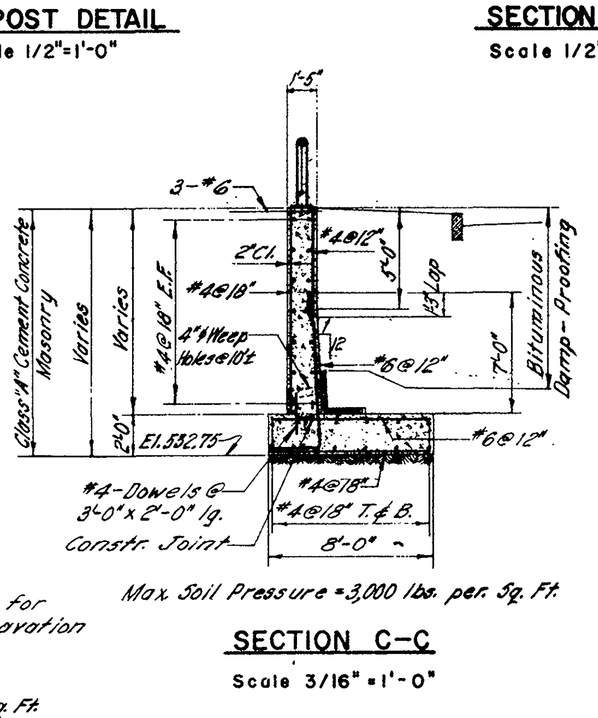


SECTION A-A
Scale 3/16"=1'-0"



Max. Soil Pressure = 3,700 lbs. per Sq. Ft.

SECTION B-B
Scale 3/16"=1'-0"



Max. Soil Pressure = 3,000 lbs. per Sq. Ft.

SECTION C-C
Scale 3/16"=1'-0"

DATE	DESCRIPTION
OCT. 14, 1958	REVISED SHEET: REPLACES SHEET No. 19
SEPT. 4, 1958	REVISION-UTILITY OPENING ENLARGED- REVISED
JULY 31, 1958	· ISSUED FOR CONSTRUCTION ·

· USE ONLY PRINTS OF LATEST DATE ·


BEARING DETAILS
Scale 1 1/2" = 1'-0"
EXPANSION
FIXED
COVER PL. DETAIL
STUDS
CONVERSION TABLE
STRINGER ELEVATION
SHEAR CONNECTOR DETAILS
No Scale
SPIRALS
FRAMING PLAN
Scale 1" = 10'
CAMBER DIAGRAM
DEFLECTION-CONC. SLAB ONLY
For use of Resident Engineer only
CROSS SECTION
Scale 3/8" = 1'-0"
END DIAPHRAGM
SECTION A-A
INTERMEDIATE DIAPHRAGM
SECTION B-B
DIAPHRAGM DETAILS
Scale 3/4" = 1'-0"
ROADWAY FIXED JOINT DETAIL
DETAIL "X"
DETAIL UNDER CURB
Scale 1 1/2" = 1'-0"
LONGITUDINAL CONSTRUCTION JOINT
Scale 3/4" = 1'-0"
SHEET 20A OF 26 SHEETS • BRIDGE NO. W-44-93
USE ONLY PRINTS OF LATEST DATE


PUB. RD. DIV. NO. 1
STATE MASS.
FED. AID PROJ. NO. I-N90-5(6)97
FISCAL YEAR 1958
SHEET NO. 93
TOTAL SHEETS 117
OCT. 14, 1958 REVISED SHEETS REPLACES SHEET No. 2
JULY 31, 1958 · ISSUED FOR CONSTRUCTION ·
DATE · DESCRIPTION ·
· USE ONLY PRINTS OF LATEST DATE ·
· SHEET 2A OF 26 SHEETS · BRIDGE NOS. W-44-91 to W-44-94
PLAN
Scale 1"=40'
Match Line See Sheet No. 3
Match Line See Sheet No. 1
LIBERTY ST.
ARCH ST.
ELLIOTT ST.
CARROLL
LAUREL STREET
SHELBY STREET
PROSPECT STREET
Proposed ℄
BRIDGE NO. W-44-93
BRIDGE NO. W-44-92
WALL W1 See Sheet 12 (Hgwy.)
WALL W2 See Sheet 12 (Hgwy)
WALL W3 See Sheet 13 (Hgwy)
Limit of Wall W1
Limit of Wall W2
Wall W3
EAST CENTRAL ST. OFF-RAMP SOUTH BOUND
MULBERRY ST. ON-RAMP NORTH BOUND
℄ Southbound Roadway
℄ Northbound Roadway
℄ Expressway
Sta. 127+73.72 ℄ Expressway
Sta. 50+00.00 ℄ Laurel St.
Sta. 122+58.10 ℄ Expressway
Sta. 50+00.00 ℄ Prospect St.
N 13°-12'-59"W
N 86°-18'-33"W
N 1°-37'-49"E
N 81°-34'-08"W
N 3°-39'-31"W
N 1°-16'-00E
76°-49'-27"
83°-55'-36"
R=902.26
R=3300
R=448.72'
R=2200
R=9222.33'
R=3300'
P.C.C. Sta. 129+83.04
P.C.C. Sta. 19+27.38
Sta. 20+11.41
Sta. 127+58.0
P.C.C. Sta. 124+40.16
P.T. Sta. 15+64.06
P.C. Sta. 13+87.67
P.C. Sta. 121+19.36
W3-11
W3-12
W3-13
W3-14
W3-15
W3-16
W3-17
W3-18
W3-18A
W3-19
W3-19A
W3-20
W3-21
W3-22
W3-22A
W3-23
W3-23A
W3-24
W3-24A
W3-25
W3-26
W3-27
W3-27A
W3-28

PUB. RD. DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-N90-5(62)97	1958	95	117

Bridge No. W-44-91

W3-1

El. 501.40
Bottom of Footing South Abut. El. 493.50
Pile Cutoff S. Abut. El. 494.0
8 Mixed Fill.
El. 489.40
12 Fine firm sand & gravel. Some clay.
El. 484.40
17 Fine, coars, firm sand & gravel. Some clay
El. 477.40
40 Fine, coarse, compact sand & gravel.
El. 474.90
75 Very compact, fine sand. Some gravel. Refusal at 33'
El. 468.40

W3-2

El. 500.30
Bottom of Footing South Abut. El. 493.50
Pile Cutoff S. Abut. El. 494.0
10 Mixed Fill
El. 490.30
15 Fine firm sand & some gravel.
El. 488.30
25 Fine hard sand & gravel.
El. 481.30
40 Fine compact sand & gravel. Some clay
El. 478.30
El. 477.30 80 Very compact fine sand & gravel. Trace of shale. Refusal at 23'

W3-3

El. 498.0
5 Mixed Fill.
El. 493.0
10 Mixed Fill
El. 486.0
12 Firm fine sand
El. 484.0
22 Fine hard sand & gravel
El. 480.0
El. 478.50 106 Hard pan Refusal at 19.6'

W3-4

Bottom Footing South Pier El. 481.0
El. 488.83
10 Mixed Fill
El. 484.83
30 Hard fine sand & gravel.
El. 477.83
75 Very compact, fine sand & gravel.
El. 475.83
100 Very compact, fine sand & gravel. Refusal at 15'
El. 473.83

W3-5

Bottom Footing South Pier El. 481.0
El. 489.36
12 Mixed Fill
El. 484.36
18 Fine, firm sand & some gravel.
El. 482.36
30 Hard, fine sand & gravel.
El. 478.86
70 Very compact, fine sand & gravel.
El. 475.36
El. 475.36 100 Very compact, fine sand & gravel. Refusal at 15'

W3-6

Bottom Footing South Pier El. 481.0
El. 489.34
9 Mixed Fill
El. 485.84
3 Loose, fine sand.
El. 483.84
18 Firm, fine sand.
El. 481.34
23 Hard, fine sand & gravel.
El. 479.84
55 Very compact, fine sand & gravel.
El. 476.34
El. 475.84 100 Very compact, fine sand & gravel. Refusal at 14'

W3-7

Bottom of Footing North Abut. El. 482.50
El. 486.10
3 Sandy loam.
El. 483.60
22 Hard, fine sand & gravel.
El. 480.60
85 Very compact fine sand, gravel & stone. Refusal at 8'
El. 478.10

W3-7A

El. 486.10
3 Sandy loam.
El. 483.60
20 Hard, fine sand & some gravel
El. 480.60
120 Very compact, fine sand & gravel stone. Refusal at 8'-6"
El. 477.60

W3-8

Pile Cutoff N. Abut. El. 496.0
El. 485.90
3 Sandy loam
El. 482.90
35 Hard, fine sand & gravel.
El. 479.90
40 Compact, fine sand & gravel.
El. 477.90
110 Very compact, fine sand, gravel & stones. Refusal at 9'-6"
El. 476.40

W3-9

Pile Cut off N. Abut. El. 496.0
El. 486.20
4 Sandy loam
El. 482.20
Refusal

Bridge No. W-44-91

W3-9A

Pile Cut off N. Abut. El. 496.0
El. 486.20
4 Sandy loam
El. 483.20
8 Loose, fine sand & some gravel.
El. 480.70
40 Compact fine sand & gravel.
El. 477.20
95 Very compact, medium sand & gravel. Refusal at 10'-6" Bent spoon at 10'-6"
El. 475.70

W3-10

El. 481.40
4 Sandy loam.
El. 476.40
20 Very fine, hard sand.
El. 470.40
85 Very compact fine sand & gravel. Refusal at 14'-6"
El. 466.90

W3-11

El. 478.90
3 Sandy loam
El. 473.90
6 Loose fine sand & some gravel.
El. 469.90
30 Hard fine sand & gravel.
El. 465.90
50 Very compact, fine sand & gravel.
El. 459.90
40 Compact fine & medium sand & gravel.
El. 452.90
El. 451.90 100 Very compact fine sand & gravel. Refusal at 27'

Bridge No. W-44-92

W3-12

Bott. Ftg. El. 472.0
El. 479.27
5 Mixed Fill.
El. 473.77
9 Firm fine sand. Some gravel.
El. 472.27
20 Hard fine sand.
El. 468.27
35 Hard fine sand & gravel.
El. 464.27
50 Compact fine sand & gravel.
El. 462.27
70 Very compact fine sand & gravel.
El. 455.27
45 Compact fine sand & gravel.
El. 453.27
120 Very compact fine sand & gravel: trace of blue shale. Refusal at 27'-6"
El. 451.77

W3-13

Bott. Ftg. El. 472.0
El. 479.45
8 Mixed Fill.
El. 476.45
10 Firm fine sand.
El. 470.45
30 Hard fine & coarse sand & gravel.
El. 465.45
45 Compact fine sand & gravel.
El. 461.45
25 Hard fine sand & gravel
El. 457.45
20 Hard fine sand & gravel.
El. 453.95
60 Very compact fine sand & gravel
El. 450.45
100 Very compact fine sand & gravel. Refusal at 31'
El. 448.45

W3-14

Bott. Ftg. El. 473.50
El. 481.64
6 Mixed Fill.
El. 475.64
6 Loose fine sand.
El. 473.64
20 Fine hard sand
El. 471.64
55 Compact fine sand & gravel.
El. 466.14
Hard pan.
El. 464.64

W3-15

Bott. Ftg. El. 477.0
El. 485.53
12 Mixed Fill.
El. 481.53
30 Fine hard sand & gravel.
El. 478.53
40 Fine hard sand & gravel.
El. 477.03
80 Very compact fine sand & gravel.
El. 475.53
55 Very compact fine sand & gravel.
El. 473.53
35 Fine hard sand.
El. 471.53
40 Hard fine sand.
El. 469.03
Refusal at 16'-6"

W3-16

Bott. Ftg. El. 482.50
El. 490.24
4 Mixed Fill.
El. 485.74
5 Firm fine sand.
El. 485.24
30 Hard fine sand & gravel.
El. 483.24
85 Very compact fine sand & gravel.
El. 480.24
100 Hard pan.
El. 478.24
Refusal at 12'

W3-17

Bott. Ftg. El. 482.50
El. 489.82
5 Mixed Fill.
El. 485.82
10 Firm fine sand.
El. 484.82
28 Hard fine sand & gravel.
El. 482.82
80 Very compact fine sand & gravel.
El. 479.82
100 Hard pan.
El. 478.32
Refusal at 10'-6"

W3-18

El. 496.38
5 Mixed Fill.
El. 493.38
12 Firm fine sand & gravel.
El. 491.38
30 Hard fine sand & gravel.
El. 488.88
El. 487.88 178 No sample recovered. Refusal at 8'-6"

W3-18A

El. 496.38
6 Mixed Fill.
El. 493.38
35 Hard fine sand & gravel.
El. 490.38
El. 489.98 85 Very compact fine sand & gravel. Refusal at 6'-6" Bent spoon.

W3-19

El. 500.15
20 Mixed Fill
El. 494.65
El. 493.15 90 Very compact fine sand, gravel. Refusal at 7'

W3-19A

El. 500.40
20 Mixed Fill. Refusal at 5' Bent spoon.
El. 495.40

W3-19B

El. 499.90
20 Mixed Fill.
El. 494.90
El. 493.90 100 Very compact fine sand & gravel. Refusal at 6'

Bridge No. W-44-93

W3-20

El. 525.37
El. 523.37 10 Mixed Fill
El. 522.37 65 Very Compact Fine Sand & Gravel. Refusal at 3' Cored 3' Granite Recovered 46"
Bott. Ftg. W. Abut. El. 501.25

W3-21

El. 525.35
El. 522.85 6 Mixed Fill. Refusal at 2'-6" Boulder or ledge.
Bott. Ftg. W. Abut. El. 501.25

W3-22

El. 530.40
El. 529.40 13 Mixed Fill.
El. 528.40 6 Sandy loam. Refusal at 2'
Bott. Ftg. Pier El. 500.50

W3-22A

El. 530.15
El. 527.15 6 Mixed Fill. Refusal at 3'
Bott. Ftg. Pier El. 500.50

W3-23

El. 532.29
El. 530.29 6 Mixed Fill.
El. 529.79 100 Sandy loam & gravel Refusal at 2'-6"
Bott. Ftg. Pier El. 500.50

W3-23A

El. 532.04
El. 529.54 5 Mixed Fill. Refusal at 2'-6" Boulder or ledge: Bent spoon.

W3-24

El. 539.0
El. 537.50 6 Mixed Fill
El. 534.0 25 Hard fine sand & gravel.
El. 533.50 40 Very compact fine sand & gravel. Refusal at 5'-6"
Bott. Ftg. E. Abut. El. 502.75

W3-24A

El. 538.75
4 Mixed Fill.
El. 535.75 20 Hard fine sand & gravel.
El. 532.75 42 Very compact fine sand & gravel. Refusal at 6'-3"
El. 532.50
Bott. Ftg. E. Abut. El. 502.75

W3-25

El. 538.37
El. 536.37 15 Mixed Fill Refusal at 2' Dug Hole: 2' Deep 2' Wide 3' Long Could not use Casing. Cored 3' Granite Recovered 46"
Bott. Ftg. E. Abut. El. 502.75

BORING NOTES

1. Location of Borings Show on Plan thus ⊕ W3-1
2. Borings Taken for Purposes of Design & show Conditions at Boaring Points Only but do not Necessarily Show Nature of Materials to be Encountered During Construction.
3. Figures in Columns Indicate Blows per Foot on 1" Pipe Produced by 30" Fall of 140 # Hammer.
4. Boring Samples May be Seen at the Dept's. Laboratory in the Maintenance Building on Route #9 in Wellesley, Mass.
5. "W" Indicates Water Table.
6. Borings Taken by John J. Boyle & Co. Martin Rd. Milton, Mass. Date: (11/57 - 3/58)

GENERAL NOTES

1. Unless otherwise specified, Water Tables shown were taken at completion of borings and are not necessarily permanent.
2. Level Datum: U.S.C. & G.S. Mean Sea Level Sea level datum of 1929.

Scale 1/8" = 1'-0"

DATE	DESCRIPTION
OCT. 14, 1958	REVISED SHEET: REPLACES SHEET No. 4
JULY 31, 1958	• ISSUED FOR CONSTRUCTION •
DATE	• DESCRIPTION •

• USE ONLY PRINTS OF LATEST DATE •

Appendix B Boring Logs and Rock Core Photos

massDOT Highway	**Terracon Consultants, Inc.** 77 Sundial Ave #401w, Manchester, New Hampshire, 03103	**No. BB-101** Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 1	
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 8:40		Total Hours: 1.5
Groundwater Depth (Feet): NE	Date & Time: 9/29/2021 10:10	Date & Time Completed: 9/29/2021 10:10		
Coordinates (Feet): N 2923088.7 E 576695.6		Driller's Name: P. Michaud	Helper's Name: T. Tetreault	
Ground Elevation (Feet): 523	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through 4" of ASPHALT.	523
SS - 1	0.5 - 1.8	5 - 6 - 50/4" -	8	***0.5*** - SS-1: Moist, medium dense, grayish brown, FINE TO COARSE SAND, some fine gravel, trace inorganic silt (FILL).	
				1.8 - Auger action indicates CONCRETE approach slab, heavy grinding then pop out around 2.5 feet depth.	
SS - 2	3 - 5	5 - 5 - 6 - 17	10	***3.0*** - SS-2: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
SS - 3	5 - 7	6 - 5 - 5 - 6	4	***5.0*** - SS-3: Moist, medium dense, brown, FINE TO COARSE SAND, some fine gravel, trace inorganic silt (FILL).	5 518
SS - 4	7 - 9	5 - 6 - 5 - 5	9	***7.0*** - SS-4: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, little inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
SS - 5	10 - 12	7 - 9 - 6 - 4	4	***10.0*** - SS-5: Moist, medium dense, brown, FINE TO COARSE SAND, some fine gravel, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	10 513
SS - 6	12 - 14	4 - 4 - 6 - 7	5	***12.0*** - SS-6: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
SS - 7	15 - 17	4 - 6 - 9 - 18	11	***15.0*** - SS-7: Moist, medium dense, brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL). Black fabric at 7" of recovery. Gravel is angular which indicates blasted rock.	15 508
				17.0 - Roller-bit action indicates concrete down to 19 feet depth. Likely hit sloped section of wingwall foundation, offset boring (see BB-101A).	
				19.0 - Boring terminated at 19 feet below ground surface.	

Remarks: Boring conducted about 7'-5" perpendicular from bridge joint and approx. 1'-6" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4"
Hammer Weight: 140 lb
Fall: 30"
Depth: 17'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-101A

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 10:45	Total Hours: 3.5
Groundwater Depth (Feet): 21	Date & Time: 9/29/2021 14:15	Date & Time Completed: 9/29/2021 14:15	
Coordinates (Feet): N 2923092.4 E 576696.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 523	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through 4" of ASPHALT. ***0.3*** - Auger through FILL, see boring BB-101 for soil info.	523
				1.8 - Auger action indicates CONCRETE approach slab, pop out at 2.5 feet.	
				2.5 - Auger through FILL down to 18.5 feet depth, see boring BB-101 for soil info.	5 / 518
					10 / 513
					15 / 508
CORE - 1	18.5 - 22	3 - 2 - 2 - 2/6" -	41 RQD - %	***18.5*** - C-1 (First 31" of recovery): CONCRETE - high coarse gravel content, good condition.	

Remarks: Boring conducted about 5'-11" perpendicular from bridge joint and 5'-4" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4"
Hammer Weight: 140 lb
Fall: 30"
Depth: 18.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-101A

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 2 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 10:45	Total Hours: 3.5
Groundwater Depth (Feet): 21	Date & Time: 9/29/2021 14:15	Date & Time Completed: 9/29/2021 14:15	
Coordinates (Feet): N 2923092.4 E 576696.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 523	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
CORE - 1	18.5 - 22	3 - 2 - 2 - 2/6" -	41 RQD - %	***21.1*** - C-1 (Last 10" of recovery): GRANITE - Moderately fractured, hard, slightly weathered, gray, fine grained, massive, close joints.	503
CORE - 2	22 - 27	3 - 4 - 4 - 4 - 4	60 RQD - 65%	***22.0*** - C-2: GRANITE - Moderately to slightly fractured, hard, fresh with slightly weathered joints, gray, fine grained, massive, close to moderately close joints dipping from approx. 30 degrees below horizontal to near horizontal.	25 498
CORE - 3	27 - 32	4 - 4 - 5 - 4 - 5	56 RQD - 77%	***27.0*** - C-3: GRANITE - Moderately to slightly fractured, hard, fresh, gray, fine grained, massive, close to moderately close joints dipping from approx. 30 degrees below horizontal to near horizontal.	30 493
				32.0 - Boring terminated at 32 feet below ground surface.	35 488

Remarks: Boring conducted about 5'-11" perpendicular from bridge joint and 5'-4" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4"
Hammer Weight: 140 lb
Fall: 30"
Depth: 18.5'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-102

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 1
Location: I-290 WB Left Lane		Date & Time Started: 2/1/2022 9:30	Total Hours: 3.0
Groundwater Depth (Feet): NE	Date & Time: 2/2/2022 00:30	Date & Time Completed: 2/2/2022 00:30	
Coordinates (Feet): N 2923130.2 E 576747.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 506	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through about 12" of ASPHALT.	506
				1.0 - Auger action indicates hard subbase with possible concrete down to 1.8 feet depth.	
SS - 1	2 - 3.8	19 - 17 - 20 - 50/3"	16	***2.0*** - SS-1: Moist, dense, brown, FINE TO COARSE SAND AND FINE TO MEDIUM GRAVEL, trace inorganic silt (FILL). After sample, drive 4" casing and start drive-and-wash.	
					5
SS - 2	5 - 5.3	50/4" - - -	2	***5.0*** - SS-2: Wet, dense, brown, FINE TO COARSE SAND, little fine gravel, trace inorganic silt (FILL).	501
				5.5 - Roller-bit action indicates top of bedrock, advance to 6 feet.	
CORE - 1	6 - 11	4 - 5 - 3 - 2 - 3	51 RQD - 55%	***6.0*** - C-1: GRANITE - Moderately fractured, hard, fresh, gray, fine grained, massive, close joints dipping from approx. 60 degrees below horizontal to 30 degrees below horizontal. RQD = 33/60 = 55% *No water return during coring and core bit drops quickly from 2.6 to 3 feet and again from 3.3 to 3.7 feet, which indicates fractured bedrock.*	10 496
CORE - 2	11 - 15.1	4 - 4 - 4 - 5 - 2/2"	50 RQD - 92%	***11.0*** - C-2: GRANITE - Slightly fractured, hard, fresh, gray, fine grained, massive, close joints dipping from approx. 60 degrees below horizontal to near horizontal. RQD = 46/50 = 92% *No water return during coring.*	15 491
				15.1 - Boring terminated at 15.1 feet below ground surface, due to losing all water (2 tanks full) during coring.	

Remarks: Probe conducted at center of left-hand high speed lane of I-290 WB.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW Size 4"
Hammer Weight: 140 lb
Fall: 30"
Depth: 6'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-103

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 3
Location: Laurel St East Abut		Date & Time Started: 9/27/2021 8:45	Total Hours: 9.0
Groundwater Depth (Feet): NE	Date & Time: 9/28/2021 11:30	Date & Time Completed: 9/28/2021 11:30	
Coordinates (Feet): N 2923082.4 E 576845.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 541	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger action indicates about 1 foot of ASPHALT.	541
				1.0 - Auger through sand and gravel FILL, hit inferred concrete at 2.5 feet depth.	
				2.5 - Auger action indicates CONCRETE approach slab, pop out at about 3.5 feet depth.	
				3.5 - Auger through sand and gravel FILL down to 5 feet depth.	
SS - 1	5 - 7	4 - 4 - 6 - 6	5	***5.0*** - SS-1: Moist, medium dense, dark brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	5 / 536
SS - 2	7 - 9	5 - 3 - 4 - 4	15	***7.0*** - SS-2: Moist, loose, dark brown, FINE TO MEDIUM GRAVEL AND FINE TO COARSE SAND, trace inorganic silt (FILL). Gravel is angular which indicates blasted rock.	
					10 / 531
SS - 3	10 - 12	4 - 3 - 2 - 3	10	***10.0*** - SS-3: Moist, loose, brown, FINE TO COARSE SAND, some fine gravel, little inorganic silt (FILL).	
SS - 4	15 - 17	4 - 3 - 4 - 5	3	***15.0*** - SS-4: Moist, loose, brown, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, trace inorganic silt (FILL).	15 / 526

Remarks: Boring conducted about 6'-6" perpendicular from bridge joints and approx. 5' from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW & NW Size 4" & 3"
Hammer Weight: 140 lb
Fall: 30"
Depth: 34.5' & 41'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

massDOT Highway	**Terracon Consultants, Inc.** 77 Sundial Ave #401w, Manchester, New Hampshire, 03103	**No. BB-103** Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 2 of 3	
Location: Laurel St East Abut		Date & Time Started: 9/27/2021 8:45		Total Hours: 9.0
Groundwater Depth (Feet): NE	Date & Time: 9/28/2021 11:30	Date & Time Completed: 9/28/2021 11:30		
Coordinates (Feet): N 2923082.4 E 576845.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault	
Ground Elevation (Feet): 541	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
SS - 5	20 - 22	5 - 4 - 3 - 4	16	***20.0*** - SS-5: Moist, loose, brown, FINE TO COARSE SAND, some fine to medium gravel, trace inorganic silt (FILL). After sample, switch from auger to drive-and-wash technique.	521
SS - 6	25 - 27	4 - 6 - 7 - 8	0	***25.0*** - SS-6: No recovery, inferred gravelly FILL.	25 516
SS - 7	30 - 32	11 - 6 - 4 - 4	5	***30.0*** - SS-7: Wet, medium dense, brown, FINE TO COARSE SAND, some fine gravel, little inorganic silt (FILL).	30 511
				33.0 - Casing advance slows, then speeds up at 33.5 feet depth.	
SS - 8	34 - 34.4	50/5" - - -	2	***34.0*** - SS-8: Wet, medium dense, grayish brown, FINE TO COARSE SAND, little fine gravel, little inorganic silt (FILL). After 5 blows hit concrete.	
CORE - 1	34.5 - 39.5	4 - 4 - 4 - 5 - 2	48 RQD - %	***34.5*** - C-1: CONCRETE - High coarse gravel content (some quartz gravel), good condition. *At 38.5 feet, core bit drops quickly and lose all water return. Assume bottom of abutment at 38.5 feet, and hit possible fracture in bedrock down to 39.5 feet. No recovery of bedrock, may have gotten washed out.*	35 506
CORE - 2	39.5 - 41	8 - 5/6" - - -	10	*39.5 - C-2: GRANITE - Highly fractured, hard, fresh to slightly weathered, gray, fine grained, massive, close joints. No water return while coring, advance 3" casing to 41 feet depth.*	

Remarks: Boring conducted about 6'-6" perpendicular from bridge joints and approx. 5' from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW & NW Size 4" & 3"
Hammer Weight: 140 lb
Fall: 30"
Depth: 34.5' & 41'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. BB-103

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 3 of 3
Location: Laurel St East Abut		Date & Time Started: 9/27/2021 8:45	Total Hours: 9.0
Groundwater Depth (Feet): NE	Date & Time: 9/28/2021 11:30	Date & Time Completed: 9/28/2021 11:30	
Coordinates (Feet): N 2923082.4 E 576845.4		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 541	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
CORE - 2	39.5 - 41	8 - 5/6" - - -	RQD - 0% 10 RQD - 0%		501
CORE - 3	41 - 45	4 - 5 - 4 - 4 -	47 RQD - 46%	***41.0*** - C-3: GRANITE - Moderately to highly fractured, hard, fresh, gray, fine grained, massive, close joints dipping from approx. 30 degrees below horizontal to near horizontal. Lose water return again at 43.5 feet depth.	
CORE - 4	45 - 48	4 - 6 - 9 - -	36 RQD - 100%	***45.0*** - C-4: GRANITE - Sound, hard, fresh, gray, fine grained, massive, moderately close joints. No water return during coring.	45 496
				48.0 - Boring terminated at 48 feet below ground surface.	50 491 55 486

Remarks: Boring conducted about 6'-6" perpendicular from bridge joints and approx. 5' from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: HW & NW Size 4" & 3"
Hammer Weight: 140 lb
Fall: 30"
Depth: 34.5' & 41'

Sampler Type: SS Size 1-3/8" ID
Automatic Hammer Weight: 140 lb
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: 30"

Core Barrel Type: NX Size: 2.15" ID

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1A

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 7:15	Total Hours: 0.5
Groundwater Depth (Feet): NE	Date & Time: 9/29/2021 7:45	Date & Time Completed: 9/29/2021 7:45	
Coordinates (Feet): N 2923093.1 E 576695.2		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 523	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through inferred approach slab and FILL. Hit refusal on hard material at 21'-1" (21.08 feet) and can't advance through with auger.	523 5 518 10 513 15 508

Remarks: Probe conducted about 7'-0" perpendicular from bridge joint, and at an elevation about 6" below that of the joint. Located about 5'-10" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: - Size -
Hammer Weight: -
Fall: -
Depth: -

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1A

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 2 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 7:15	Total Hours: 0.5
Groundwater Depth (Feet): NE	Date & Time: 9/29/2021 7:45	Date & Time Completed: 9/29/2021 7:45	
Coordinates (Feet): N 2923093.1 E 576695.2		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 523	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
					503
				21.1 - Probe terminated at 21.08 feet below ground surface. After pulling out auger, there is soft wood stuck in tip of auger, which is likely old formwork at the edge of abutment footing. May have hit refusal on bedrock.	25 / 498
					30 / 493
					35 / 488

Remarks: Probe conducted about 7'-0" perpendicular from bridge joint, and at an elevation about 6" below that of the joint. Located about 5'-10" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: - Size -
Hammer Weight: -
Fall: -
Depth: -

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1B

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 1 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 7:50	Total Hours: 0.3
Groundwater Depth (Feet): NE	Date & Time: 9/29/2021 8:10	Date & Time Completed: 9/29/2021 8:10	
Coordinates (Feet): N 2923093.2 E 576693.6		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 522.9	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				0.0 - Auger through inferred approach slab and FILL. Hit refusal on hard material at 21'-2" (21.16 feet) and can't advance through with auger. Possible bedrock.	523 5 518 10 513 15 508

Remarks: Probe conducted about 8'-6" perpendicular from bridge joint, and at a ground elevation about 0.1 feet below that of PS-1A. Located about 5'-10" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

Casing Type: - Size -
Hammer Weight: -
Fall: -
Depth: -

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

Terracon Consultants, Inc.

77 Sundial Ave #401w, Manchester, New Hampshire, 03103

No. PS-1B

Scale:

City/Town: Worcester	Bridge Number: W-44-93	Project File Number: 601895	Page 2 of 2
Location: Laurel St West Abut		Date & Time Started: 9/29/2021 7:50	Total Hours: 0.3
Groundwater Depth (Feet): NE	Date & Time: 9/29/2021 8:10	Date & Time Completed: 9/29/2021 8:10	
Coordinates (Feet): N 2923093.2 E 576693.6		Driller's Name: P. Michaud	Helper's Name: T. Tetreault
Ground Elevation (Feet): 522.9	Inspector's Name (PRINT): J. Keohane	Inspector's Signature: J. Keohane	Inspector's Company: HNTB

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches / Coring Times Minutes per Foot	Recovery (inches)	Field Description	Strata Changes
				21.2 - Probe terminated at 21.16 feet below ground surface.	503 25 498 30 493 35 488

Remarks: Probe conducted about 8'-6" perpendicular from bridge joint, and at a ground elevation about 0.1 feet below that of PS-1A. Located about 5'-10" from edge of vertical granite curb.

Arrow-Board: -
Signs: -
Cones: -

Protective Device - Stand: - Box: -
Well Depth: - Solid Pipe: -
Stick Up Pipe: - Screen Pipe: -

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 35-50%, some = 12-35%, little = 5-12%, trace = 5% or less

Type of Drill Rig: CME 45B

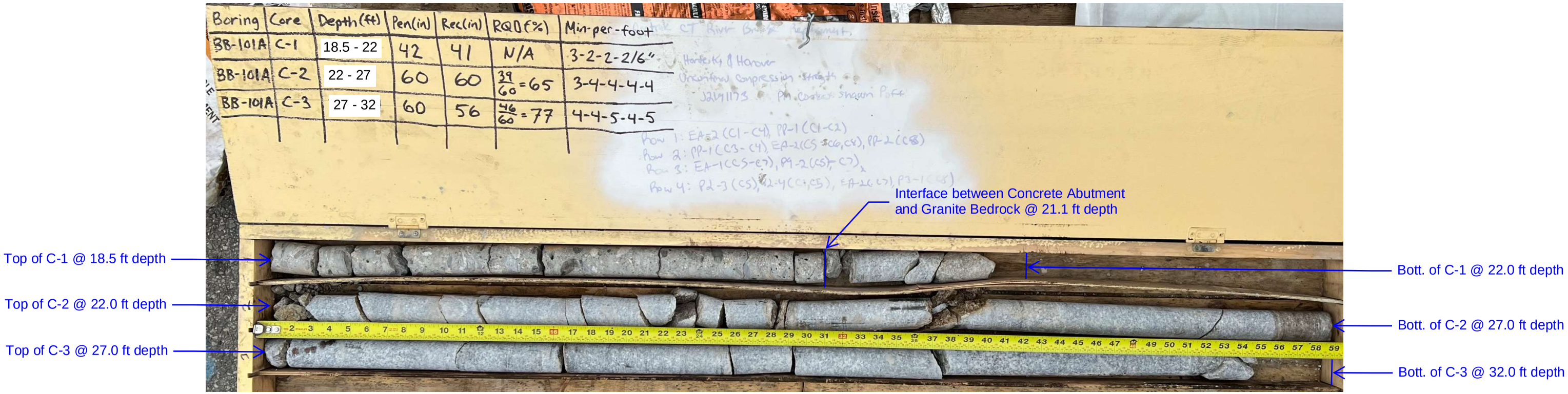
Casing Type: - Size -
Hammer Weight: -
Fall: -
Depth: -

Sampler Type: - Size -
Automatic Hammer Weight: -
Safety Hammer Weight: -
Donut Hammer Weight: -
Fall: -

Core Barrel Type: - Size: -

ROCK CORE BOX PICTURES

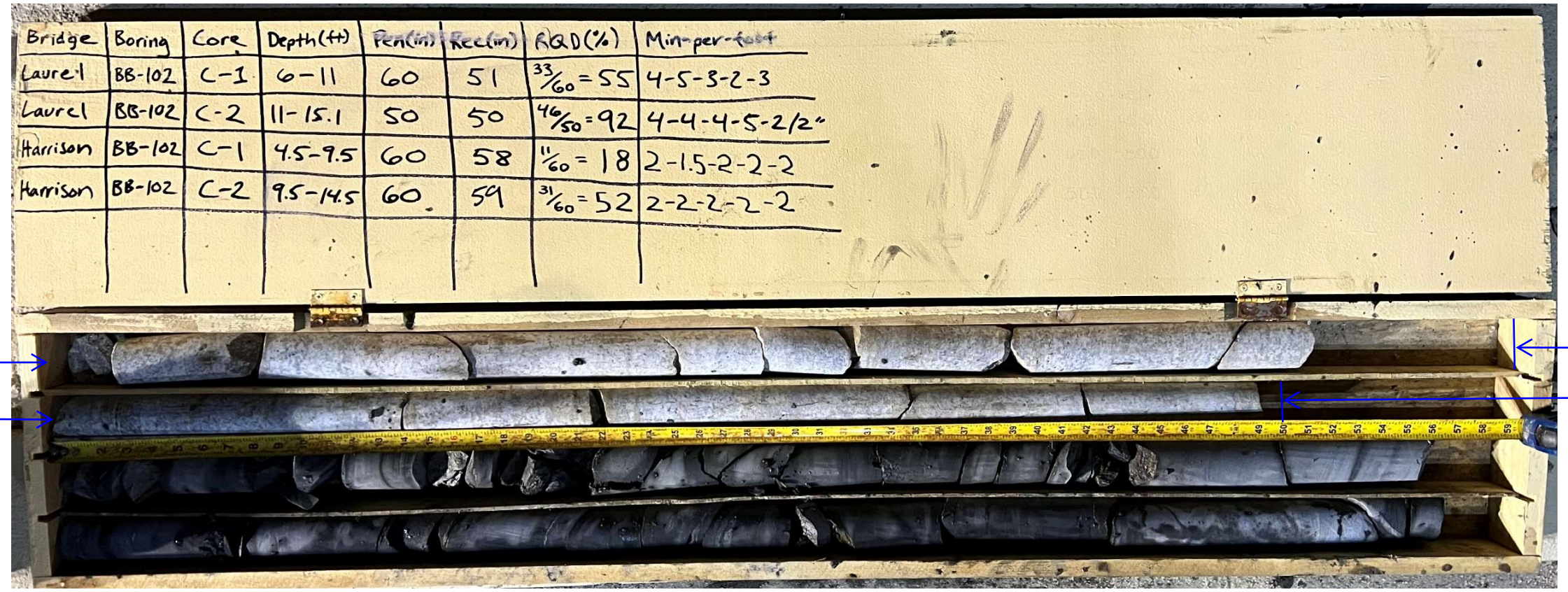
BB-101A



BB-103

BB-102

Bridge	Boring	Core	Depth (ft)	Pen (in)	Rec (in)	RQD (%)	Min-per-foot
Laurel	BB-102	C-1	6-11	60	51	33/60 = 55	4-5-3-2-3
Laurel	BB-102	C-2	11-15.1	50	50	46/50 = 92	4-4-4-5-2/2"
Harrison	BB-102	C-1	4.5-9.5	60	58	11/60 = 18	2-1.5-2-2-2
Harrison	BB-102	C-2	9.5-14.5	60	59	31/60 = 52	2-2-2-2-2



Top of C-1 @ 6 ft depth

Top of C-2 @ 11 ft depth

Bott. of C-1 @ 11 ft depth

Bott. of C-2 @ 15.1 ft depth

Appendix C Laboratory Testing Results

Client:	HNTB Corporation				
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	11/29/21	Checked By:	jdt
Depth :	---	Test Id:	641346		

Laboratory Determination of Density (Unit Weight) of Soil Specimens by ASTM D7263

Boring ID	Sample ID	Depth	Visual Description	Bulk Density pcf	Moisture Content %	Dry Density pcf	*
BB103	Harrison/ S- 3	5-7'	Moist, grayish brown silty sand with gravel	84.17	4.349	80.66	(1)
BB-101	Harrison/ S- 3	10-12'	Moist, grayish brown silty sand with gravel	90.08	6.769	84.37	(2)
BB-101	Laurel/ S- 4	7-9'	Moist, grayish brown sand with silt and gravel	81.79	5.849	77.27	(3)
BB-103	Laurel/ S- 3	10-12'	Moist, dark brown sand with silt and gravel	85.93	5.784	81.24	(4)

* Sample Comments

(1): Method B-Volumetric,

(2): Method B-Volumetric,

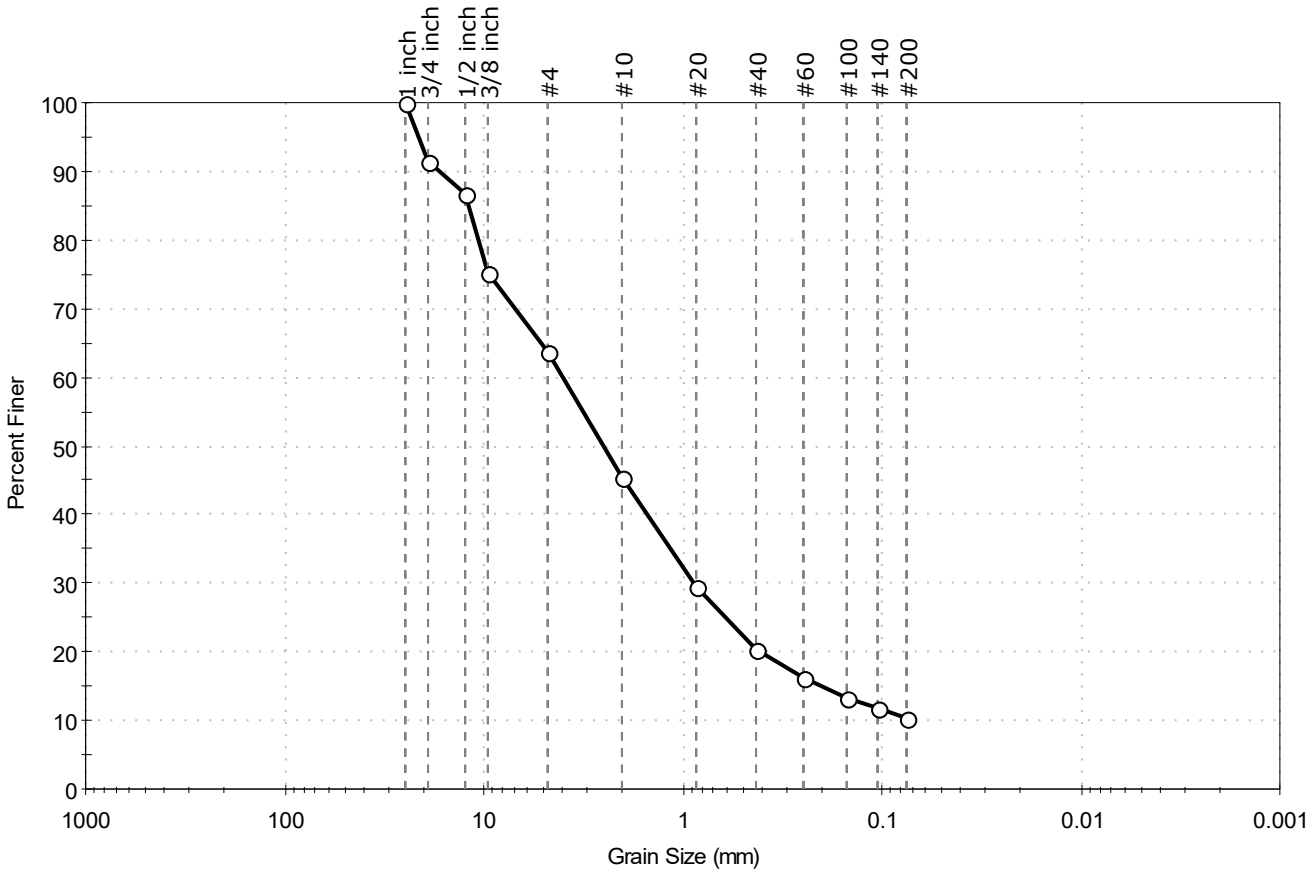
(3): Method B-Volumetric,

(4): Method B-Volumetric,

Notes: Moisture Content determined by ASTM D2216.

Client:	HNTB Corporation	Proposal No. 609185-129075			
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	BB-101	Sample Type:	jar	Tested By:	ckg
Sample ID:	Laurel /S-4	Test Date:	11/23/21	Checked By:	jdt
Depth :	7-9'	Test Id:	641341		
Test Comment:	---				
Visual Description:	Moist, grayish brown sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	36.4	53.2	10.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.00	100		
3/4 inch	19.00	91		
1/2 inch	12.50	87		
3/8 inch	9.50	75		
#4	4.75	64		
#10	2.00	45		
#20	0.85	29		
#40	0.42	20		
#60	0.25	16		
#100	0.15	13		
#140	0.11	12		
#200	0.075	10		

Coefficients

D_{85} = 11.9776 mm D_{30} = 0.8774 mm

D_{60} = 3.9990 mm D_{15} = 0.2047 mm

D_{50} = 2.4813 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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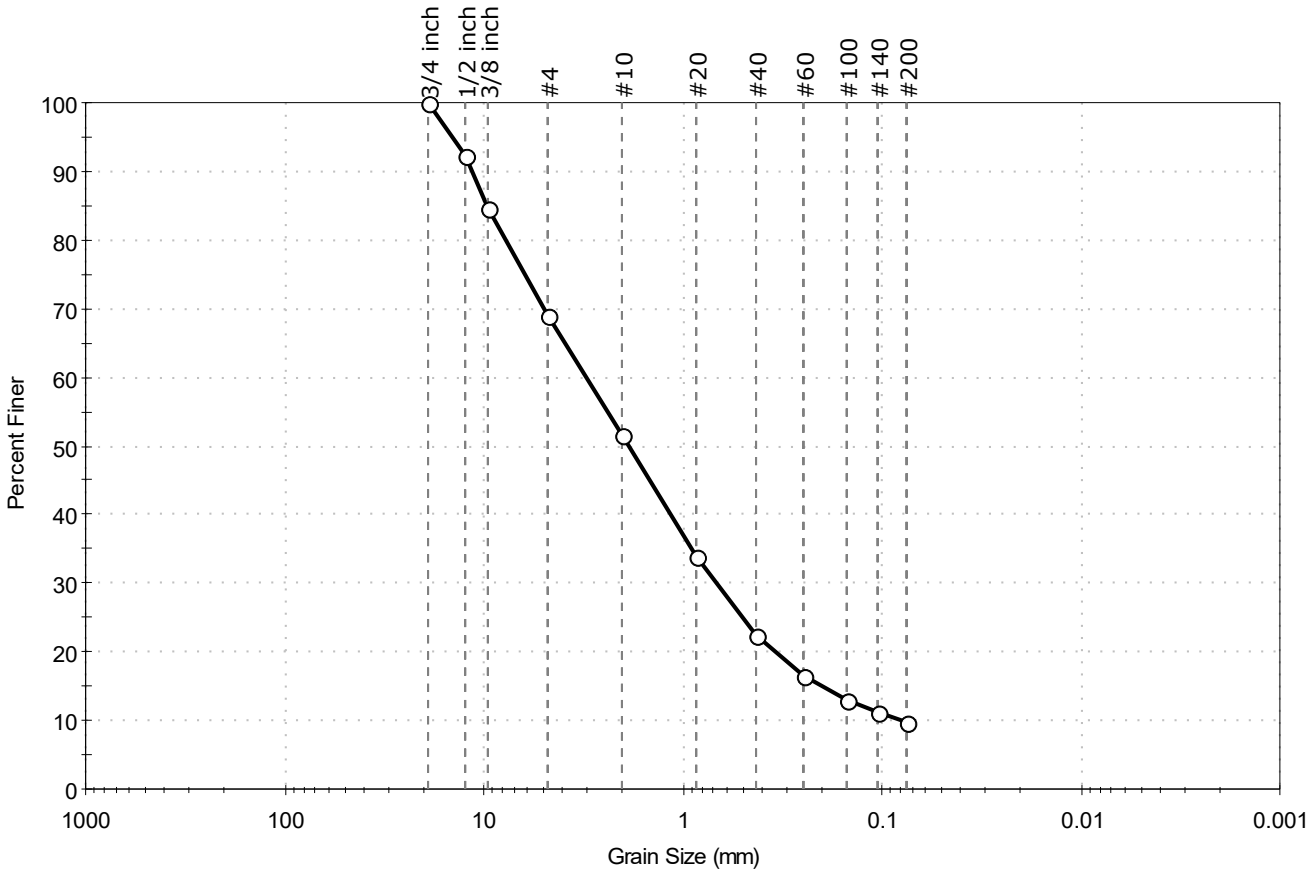
Client:	HNTB Corporation	Proposal No. 609185-129075			
Project:	Laurel & Harrison St over I-290				
Location:	Worcester, MA			Project No:	GTX-314613
Boring ID:	BB-103	Sample Type:	jar	Tested By:	ckg
Sample ID:	Laurel/S-3	Test Date:	11/23/21	Checked By:	jdt
Depth :	10-12'	Test Id:	641342		
Test Comment:	---				
Visual Description:	Moist, dark brown sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	30.9	59.3	9.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.50	92		
3/8 inch	9.50	85		
#4	4.75	69		
#10	2.00	52		
#20	0.85	34		
#40	0.42	23		
#60	0.25	17		
#100	0.15	13		
#140	0.11	11		
#200	0.075	9.8		

Coefficients

D_{85} = 9.5676 mm	D_{30} = 0.6727 mm
D_{60} = 3.0385 mm	D_{15} = 0.2014 mm
D_{50} = 1.8585 mm	D_{10} = 0.0788 mm
C_u = 38.560	C_c = 1.890

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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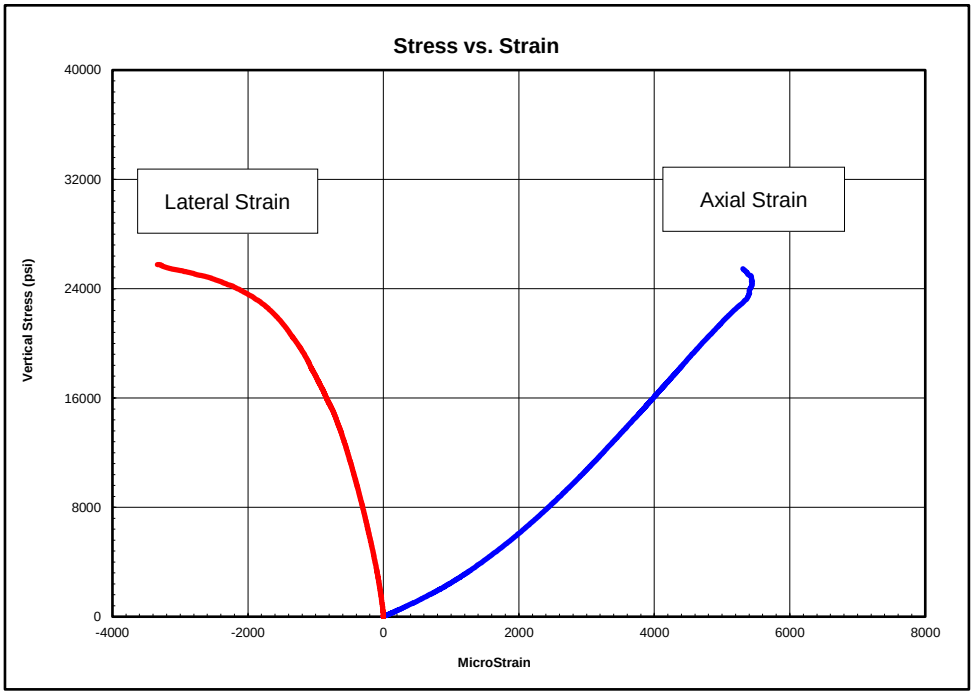
Client:	HNTB Corporation
Project Name:	Laurel & Harrison St over I-290
Project Location:	Worcester, MA
GTX #:	314613
Test Date:	11/17/2021
Tested By:	kdp
Checked By:	jsc
Boring ID:	BB-101A
Sample ID:	Laurel/C-3
Depth, ft:	29.9-30.3 ft
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 25,764 psi

The strain values recorded within the third stress range for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2600-9400	3,990,000	0.18
9400-16300	5,310,000	0.38
16300-23200	5,370,000	---

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	HNTB Corporation	Test Date:	11/15/2021
Project Name:	Laurel & Harrison St over I-290	Tested By:	ak
Project Location:	Worcester, MA	Checked By:	smd
GTX #:	314613		
Boring ID:	BB-101A		
Sample ID:	Laurel/C-3		
Depth:	29.9-30.3 ft		
Visual Description:	See Photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.01	4.01	4.01
Specimen Diameter, in:	1.77	1.77	1.77
Specimen Mass, g:	420.82		
Bulk Density, lb/ft^3	162	**Minimum Diameter Tolerence Met?**	NO
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

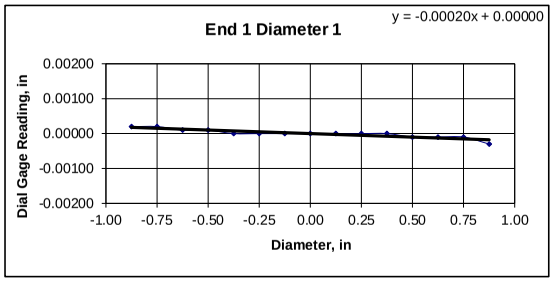
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00030
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

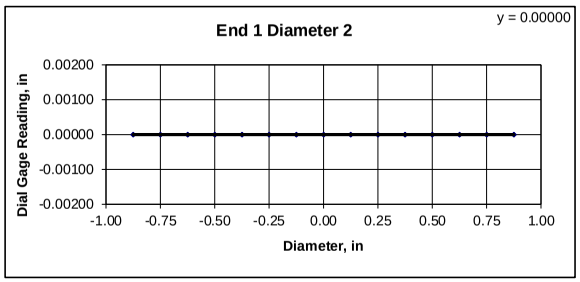
Difference between max and min readings, in:
0° = 0.00050 90° = 0.00000

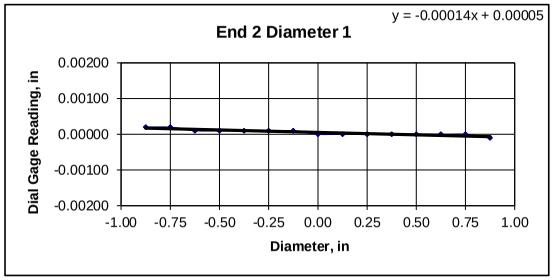
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

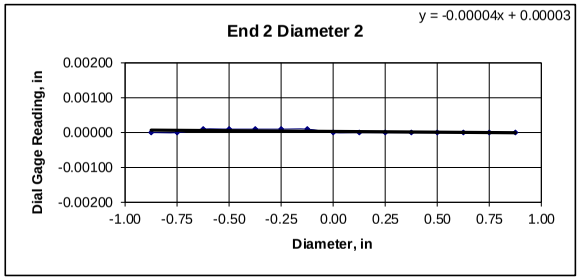
Difference between max and min readings, in:
0° = 0.0003 90° = 0.0001

Maximum difference must be < 0.0020 in. Difference = ± 0.00025
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00020
Angle of Best Fit Line: 0.01162

End 2:
Slope of Best Fit Line 0.00014
Angle of Best Fit Line: 0.00786

Maximum Angular Difference: 0.00377

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

End 2:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00246

Maximum Angular Difference: 0.00246

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00050	1.770	0.00028	0.016	YES
Diameter 2, in (rotated 90°)	0.00000	1.770	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00030	1.770	0.00017	0.010	YES
Diameter 2, in (rotated 90°)	0.00010	1.770	0.00006	0.003	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	HNTB Corporation
Project Name:	Laurel & Harrison St over I-290
Project Location:	Worcester, MA
GTX #:	314613
Test Date:	11/17/2021
Tested By:	ak
Checked By:	smd
Boring ID:	BB-101A
Sample ID:	Laurel/C-3
Depth, ft:	29.9-30.3 ft

After cutting and grinding

After break

Appendix D Design Calculations

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	12/1/2021	Job Number	78900
	Checked	NMH	Date	2/21/2022		
For Laurel Street over I-290 in Worcester	Backchk'd	JLK	Date	2/21/2022	Sheet No.	1 of 1

Seismic Design Calculation

REFERENCES

1. 2013 MassDOT LRFD Bridge Manual (with January 2020 Revisions)
2. 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition
3. 2011 AASHTO Guide Specifications for LRFD Seismic Bridge Design

ACCELERATION COEFFICIENTS See attached 2,500-yr USGS Seismic Hazard Maps (Reference 1)

PGA	0.080	*Horizontal Peak Ground Acceleration Coefficient*
S_S	0.138	*Horizontal Response Spectral Acceleration Coefficient At Period 0.2 S*
S_1	0.055	*Horizontal Response Spectral Acceleration Coefficient At Period 1.0 S*

SITE CLASS DEFINITION *See AASHTO Table 3.10.3.1-1 (Reference 2)*

Conservatively assume **Site Class B** due to fractured nature of bedrock

Site Class	Soil Type and Profile
A	Hard rock with measured shear wave velocity, $\bar{v}_s > 5{,}000$ ft/s
B	Rock with 2,500 ft/sec $< \bar{v}_s <$ 5,000 ft/s

SITE FACTORS See AASHTO Figure 3.10.4.1-1 below (Reference 2)

F_{pga}	1.0	*Zero-Period on Acceleration Spectrum (Table 3.10.3.2-1)*
F_a	1.0	*Short-Period Range of Acceleration Spectrum (Table 3.10.3.2-2)*
F_v	1.0	*Long-Period Range of Acceleration Spectrum (Table 3.10.3.2-3)*

DESIGN RESPONSE SPECTRUM

A_S	0.080
S_{DS}	0.138
S_{D1}	0.055

SEISMIC DESIGN CATEGORY

From 2011 AASHTO (Reference 3):

Table 3.5-1—Partitions for Seismic Design Categories A, B, C, and D

Value of $S_{D1} = F_v S_1$	SDC
$S_{D1} < 0.15$	A
$0.15 \le S_{D1} < 0.30$	B
$0.30 \le S_{D1} < 0.50$	C
$0.50 \le S_{D1}$	D

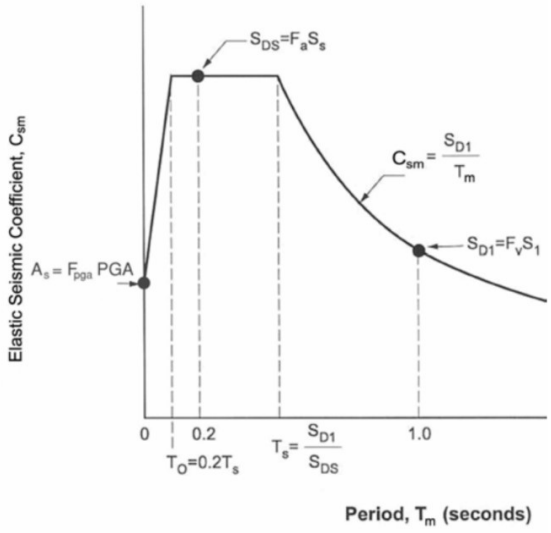


Figure 3.10.4.1-1—Design Response Spectrum

Seismic Design Category A

SDC A is also known as Seismic Zone 1 in 2020 AASHTO (Reference 2)

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	12/20/2021	Job Number	78900
	Checked	NMH	Date	2/21/2022		
For Laurel Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Effective Friction Angle of Fill

PURPOSE

Calculate the Effective Friction Angle (ϕ') of the existing Fill behind the existing abutments using well accepted N-value correlations. Use N-values from boring BB-101 at the West Abutment and boring BB-103 at the East Abutment.

REFERENCES

1. Foundation Design - Principles and Practices, 2nd Edition, by Donald P. Coduto (2001)
2. Wolff (1989) correlation approximated from Peck, Hanson, and Thornburn (1974)
3. FHWA Soils and Foundations Reference Manual, Volume II (2006)

SOLUTION

N_{60} values below have been corrected for rod length (C_R) and hammer type (automatic hammer E_m = 0.9) using the following equation: $N_{60} = \frac{N\ C_R\ E_m}{0.60}$

For Depth of N_{60} values, use the depth at the midpoint of the SPT sample.

For calculating Vertical Effective Stress (σ'_z) use an effective unit weight (γ') of 100 pcf for Fill (see Geotechnical Report).

Correction factor $C_N = (2000/\sigma'_z)^{0.5} <= 1.7$ so use maximum C_N of 1.7 when calculating $(N_1)_{60} = C_N N_{60}$

Reference 1 (attached) suggests using a correlation between SPT results and the effective friction angle of uncemented sands (ϕ') as shown in Figure 4.11.

Notes: This correlation should be used only at depths greater than 2 meters (6.5 feet), so N-values above this depth are ignored (in yellow).
When graphically determining ϕ' conservatively round down to closest 5 degree line.

Reference 2 gives a correlation between N_{60} and ϕ' in graphical form, which can be approximated as: $\phi'(\text{deg}) = 27.1 + 0.3N_{60} - 0.00054[N_{60}]^2$

Boring	Sample	N-value (bpf)	N_{60} (bpf)	Depth (ft)	σ'_z (psf)	C_N	$(N_1)_{60}$	Reference 1		Reference 2	
								ϕ' (deg)	Min. ϕ'	ϕ' (deg)	Avg. ϕ'
BB-101	SS-1	56	63	1.2	120	4.1	107	-	-	44	-
	SS-2	11	12	4.0	400	2.2	21	-		31	31
	SS-3	10	11	6.0	600	1.8	19	-		30	
	SS-4	11	12	8.0	800	1.6	20	40	35	31	
	SS-5	15	17	11.0	1,100	1.3	23	40		32	
	SS-6	10	13	13.0	1,300	1.2	16	35		31	
	SS-7	15	19	16.0	1,600	1.1	21	40		33	
BB-103	SS-1	10	11	6.0	600	1.8	19	-	-	30	30
	SS-2	7	8	8.0	800	1.6	12	35	30	29	
	SS-3	5	6	11.0	1,100	1.3	8	30		29	
	SS-4	7	9	16.0	1,600	1.1	10	30		30	
	SS-5	7	10	21.0	2,100	1.0	10	30		30	
	SS-6	13	19	26.0	2,600	0.9	16	35		32	
	SS-7	10	15	31.0	3,100	0.8	12	35		31	

Reference 3 provides a table correlating $(N_1)_{60}$ with a range of friction angles:

Table 8-1
Estimation of friction angle of cohesionless soils from Standard Penetration Tests (after AASHTO, 2004 with 2006 Interims; FHWA, 2002c)

Description	Very Loose	Loose	Medium	Dense	Very Dense
Corrected SPT $N1_{60}$	0	4	10	30	50
Approximate ϕ, degrees*	25 – 30	27 – 32	30 – 35	35 – 40	38 – 43
Approximate moist unit weight, (γ) pcf*	70 – 100	90 – 115	110 – 130	120 – 140	130 – 150

* Use larger values for granular material with 5% or less fine sand and silt.
Note: Correlations may be unreliable in gravelly soils due to sampling difficulties with split-spoon sampler as discussed in Chapter 3.

Use minimum $(N_1)_{60}$ values from both borings:

BB-101 Min. $(N_1)_{60}$ 16 bpf correlates to: ϕ' = 35

BB-103 Min. $(N_1)_{60}$ 8 bpf correlates to: ϕ' = 30

All 3 References show that ϕ' = 30 degrees best represents the effective friction angle of the Fill behind both abutments **ϕ' = 30**

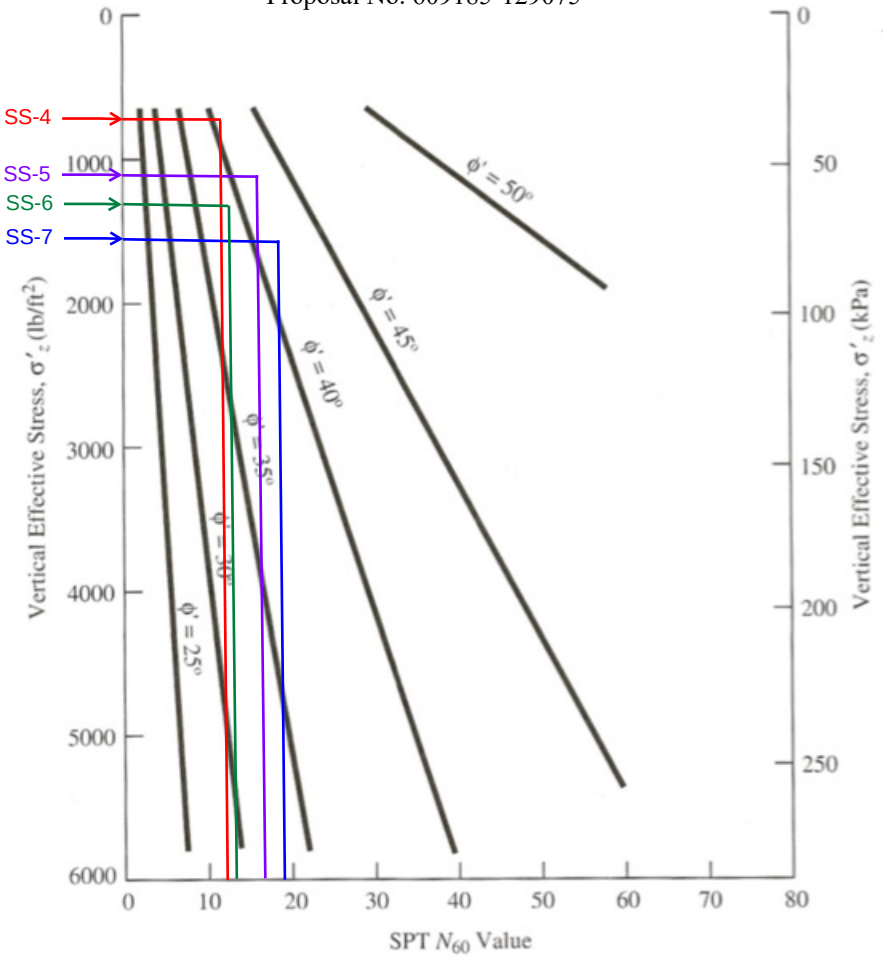


Figure 4.11 Empirical correlation between N_{60} and ϕ' for uncemented sands (Adapted from DeMello, 1971).

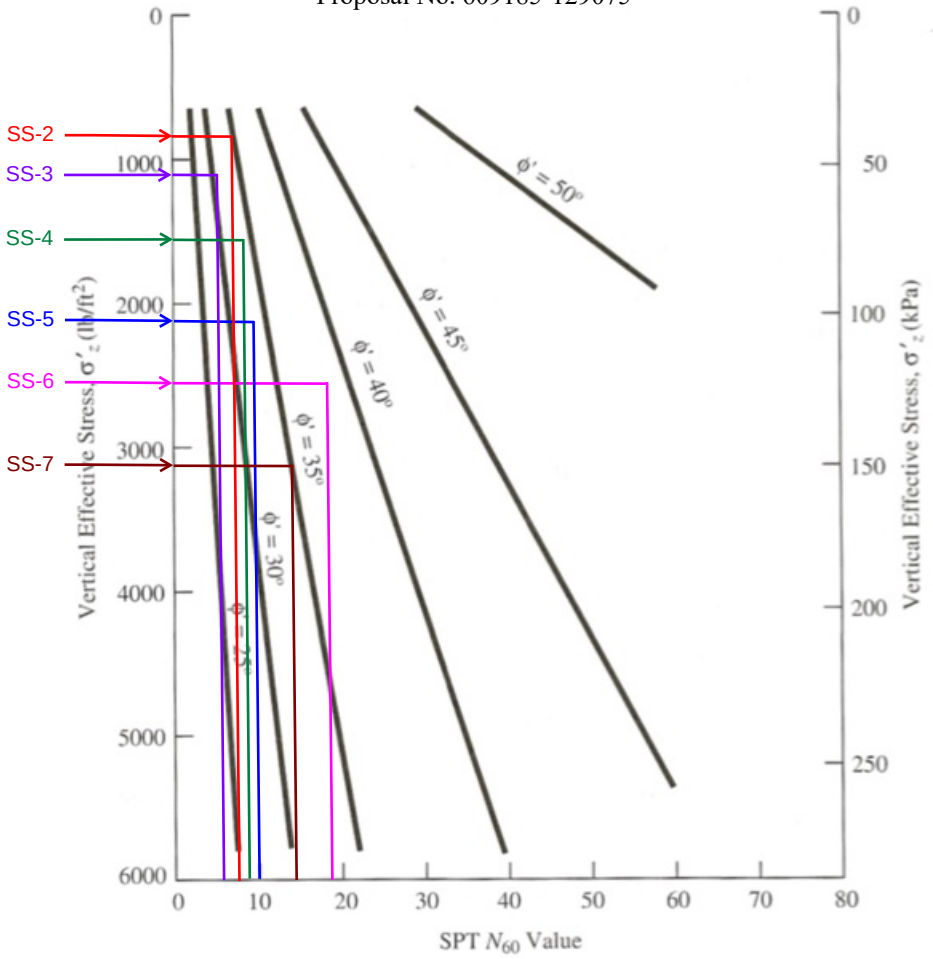


Figure 4.11 Empirical correlation between N_{60} and ϕ' for uncemented sands (Adapted from DeMello, 1971).

HNTB The HNTB Companies Engineers Architects Planners							
		Made	JLK	Date	12/22/2021	Job Number	72245
		Checked	NMH	Date	2/21/2022		
For	Laurel Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Earth Coefficient Calculations

OBJECTIVE

Calculate the At-Rest Earth Coefficient (k_0), Static Active Earth Coefficient (k_a), and Seismic Active Earth Coefficient (K_{AE}) of backfill behind the existing abutments.

REFERENCES

1. Effective Friction Angle of Fill Behind Abutments (by HNTB)
2. AASHTO Bridge Design Specifications, 9th Edition (2020)
3. Figure 3 - Estimated Abutment Geometry (by HNTB)
4. Laurel Street over I-290 (W-44-93) As-Built Plans (1958)

SOLUTION

Reference 1: calculates the effective internal friction angle of Fill behind both abutments, based on N-value correlations:

ϕ'_f = 30 deg

Reference 2: use AASHTO Equation 3.11.5.2 to calculate k_0:

$k_0 = 1 - \sin(\phi'_f)$ (3.11.5.2)

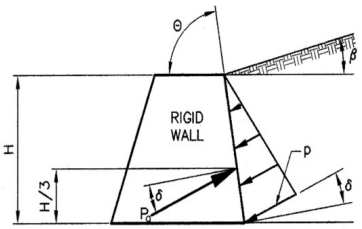
k_0 = 0.50 At-Rest Earth Coefficient for East and West Abutments

Reference 2: use AASHTO Equation 3.11.5.3-1 and -2 to calculate k_a:

$$k_a = \frac{\sin^2(\theta+\phi'_f)}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \quad (3.11.5.3\text{-}1)$$

in which:

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi'_f+\delta)\sin(\phi'_f-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \quad (3.11.5.3\text{-}2)$$



where:

- δ = friction angle between fill and wall (degrees)
- β = angle of fill to the horizontal as shown in Figure 3.11.5.3-1 (degrees)
- θ = angle of back face of wall to the horizontal as shown in Figure 3.11.5.3-1 (degrees)
- ϕ'_f = effective angle of internal friction (degrees)

For δ, use "Clean gravel, gravel-sand mixtures, coarse sand" against "mass concrete" from AASHTO Table C3.11.5.3-1:

δ = 29 deg *Mostly sand with gravel, use lower end of range*

Reference 3: shows approximate angle of back face (above horizontal) of abutment wall, based on explorations:

θ_{west} = 73.8 deg *West Abutment*

θ_{east} = 90.0 deg *East Abutment*

Reference 4: shows that Laurel St has a positive 9.5% grade behind East Abut, and negative grade behind West Abut:

β_{west} = 0.0 deg *Negative grade, conservatively use zero*

β_{east} = 5.4 deg *Based on positive 9.5% grade*

Calculate k_a for West Abutment:

Γ_{west} = 3.23

$k_{a,west}$ = 0.45

Calculate k_a for East Abutment:

Γ_{east} = 2.69

$k_{a,east}$ = 0.32

HNTB The HNTB Companies Engineers Architects Planners	Made	JLK	Date	12/22/2021	Job Number	72245
	Checked	NMH	Date	2/21/2022		
For Laurel Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Earth Coefficient Calculations

Calculate K_{AE} in accordance with AASHTO Section A11.3.1 (Mononobe-Okabe Method):

$$K_{AE} = \frac{\cos^2(\phi - \theta_{MO} - \beta)}{\cos\theta_{MO}\cos^2\beta\cos(\delta + \beta + \theta_{MO})} \times \left[1 + \sqrt{\frac{\sin(\phi + \delta)\sin(\phi - \theta_{MO} - i)}{\cos(\delta + \beta + \theta_{MO})\cos(i - \beta)}}\right]^{-2}$$

where:

K_{AE} = seismic active earth pressure coefficient (dim)
γ = unit weight of soil (kcf)
H = height of wall (ft)
h = vertical distance between ground surface and wall base at the back of wall heel (ft)
ϕ_f = friction angle of soil (degrees)
θ_{MO} = arc tan $[k_h/(1 - k_v)]$ (degrees)
δ = wall backfill interface friction angle (degrees)
k_h = horizontal seismic acceleration coefficient (dim.)
k_v = vertical seismic acceleration coefficient (dim.)
i = backfill slope angle (degrees)
β = slope of wall to the vertical, negative as shown (degrees)

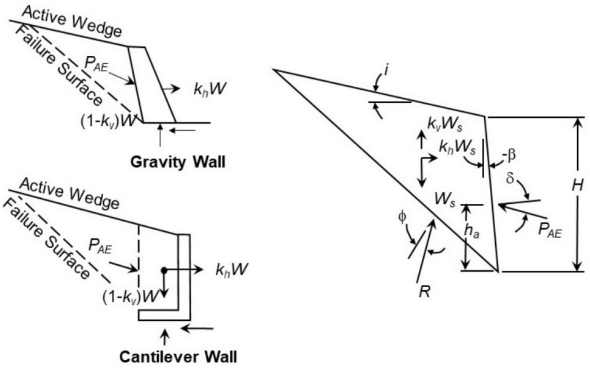


Figure A11.3.1-1—Mononobe–Okabe Method Force Diagrams

Reduce δ for Seismic case, use 0.67 of ϕ'$_f$ to calculate reduced value:

$\delta_{seismic}$ = 20 deg

Use same backfill slope angle as previous, and calculate slope of wall to vertical:

i_{west} = 0 deg i_{east} = 5.4 deg

β_{west} = 16.2 deg β_{east} = 0 deg

AASHTO Section 11.6.5.2.2 notes that for unrestrained walls with displacements of 1 to 2 inches, k_h = 0.5 * PGA

Foundations bearing on bedrock have small displacements (< 1 inch) so conservatively follow 11.6.5.2.1 for a restrained wall:

k_v = 0 g

k_h = F_{pga} PGA

PGA = 0.08 g From Geotech Report for 2,500-yr return period

F_{pga} = 1.0 Site Factor from AASHTO Table 3.10.3.2-1 for Site Class B

k_h = 0.08 g

θ_{MO} = $\tan^{-1}(k_h)$

θ_{MO} = 4.6 deg

Use the factors above to calculate K_{AE} for both abutments:

$K_{AE,west}$ = 0.50 **$K_{AE,east}$ = 0.38**

HNTB The HNTB Companies Engineers Architects Planners		Made	JLK	Date	12/29/2021	Job Number	78900
		Checked	NMH	Date	2/21/2022		
For	Laurel Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Bearing Resistance of Footings Calculation

Purpose

The purpose of this calculation is to determine the Bearing Resistance of the abutments and pier footings bearing on Granite Bedrock. This calculation will be in accordance with AASHTO LRFD Bridge Design Specification, 9th Edition (2020).

Laboratory Results

q_u =	25,000	psi	UCS of 25,764 psi for sample BB-101A, C-3 (29.9 to 30.3 ft depth)
q_u =	3,600	ksf	Convert to kips per square foot
v =	0.38		Poisson's Ratio

Rock Mass Strength

AASHTO 10.6.2.6.2 notes that bearing resistance on rock should be determined using empirical correlation to the Geomechanic Rock Mass Rating System (RMR) as specified in Article 10.4.6.4 which uses geological strength index (GSI) and the Hoek-Brown failure criterion.

For GSI, conservatively assume bedrock with a "Blocky" structure (fractured) and "Good" surface (slightly weathered):

GSI = 65 *See Figure 10.4.6.4-1 on next page*

Use Hoek-Brown failure criterion (Sect. 10.4.6.4):

$$\sigma_1' = \sigma_3' + q_u\left(m_b\frac{\sigma_3'}{q_u} + s\right)^a \qquad (10.4.6.4\text{-}1)$$

in which:

$$s = e^{\left(\frac{GSI-100}{9-3D}\right)} \qquad (10.4.6.4\text{-}2)$$

$$a = \frac{1}{2} + \frac{1}{6}\left(e^{\frac{-GSI}{15}} - e^{\frac{-20}{3}}\right) \qquad (10.4.6.4\text{-}3)$$

Disturbance factor, D, ranges from zero (undisturbed) to 1 (highly disturbed). AASHTO recommends a factor approaching zero for rock coring, and a factor approaching 1.0 for rock blasting.

D =	1.0	*Conservative, assume rock was blasted when constructing I-290*
s =	0.00293	*Eqn. 10.4.6.4-2*
a =	0.502	*Eqn. 10.4.6.4-3*

The Nominal Bearing Resistance ($q_n = \sigma'_1$) can be obtained from Eqn. 10.4.6.4-1 by conservatively assuming that the horizontal effective stress (σ'_3) is equal to zero, which simplifies the equation to:

$$q_n = \sigma'_1 = q_u s^a$$

q_n =	192.6	ksf	Nominal Bearing Resistance
φ_b =	0.45		Resistance factor for footings on rock (Table 10.5.5.2.2-1)
$q_R = \varphi_b q_n$ =	**86.7**	**ksf**	**Factored Bearing Resistance (Eqn. 10.6.3.1.1-1)**

HNTB The HNTB Companies Engineers Architects Planners		Made	JLK	Date	12/29/2021	Job Number	78900
		Checked	NMH	Date	2/21/2022		
For	Laurel Street over I-290 (Worcester)	Backchk'd	JLK	Date	2/21/2022		

Bearing Resistance of Footings Calculation

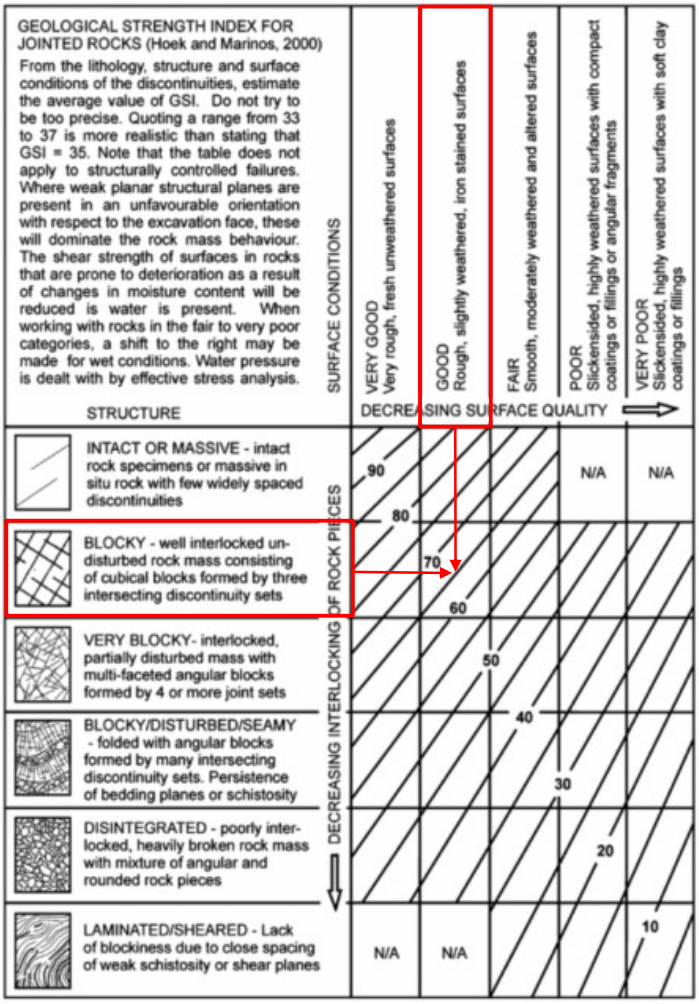


Figure 10.4.6.4-1—Determination of *GSI* for Jointed Rock Mass (Hoek and Marinos, 2000)

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DOCUMENT A00855

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

CONCURRENCE VERIFICATION LETTER

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: October 23, 2023
Project code: 2024-0007653
Project Name: 609185- WORCESTER BRIDGE RECONSTRUCTION OF W-44-083 & W-44-093

Subject: Consistency letter for the '609185- WORCESTER BRIDGE RECONSTRUCTION OF W-44-083 & W-44-093' project under the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (NLEB).

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated October 23, 2023 to verify that the **609185- WORCESTER BRIDGE RECONSTRUCTION OF W-44-083 & W-44-093** (Proposed Action) may rely on the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action will have no effect on the endangered Indiana bat (*Myotis sodalis*) or the endangered northern long-eared bat (*Myotis septentrionalis*). If the Proposed Action is not modified, **no consultation is required for these two species.** If the Proposed Action is modified, or new information reveals that it may affect the Indiana bat and/or northern long-eared bat in a manner or to an extent not considered in the PBO, further review to conclude the requirements of ESA section 7(a)(2) may be required.

For Proposed Actions that include bridge/culvert or structure removal, replacement, and/or maintenance activities:
If your initial bridge/culvert or structure assessment failed to detect Indiana bats and/or NLEBs use or occupancy, yet later detected prior to, or during construction, please submit the Post Assessment Discovery of Bats at Bridge/Culvert or Structure Form (User Guide Appendix E) to this Service Office within 2 working days of the incident. In these instances, potential incidental

take of Indiana bats and/or NLEBs may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species and/or designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please advise the lead Federal action agency accordingly.

The following species may occur in your project area and **are not** covered by this determination:

- Monarch Butterfly *Danaus plexippus* Candidate

PROJECT DESCRIPTION

The following project name and description was collected in IPaC as part of the endangered species review process.

NAME

609185- WORCESTER BRIDGE RECONSTRUCTION OF W-44-083 & W-44-093

DESCRIPTION

609185 - WORCESTER- BRIDGE RECONSTRUCTION OF W-44-083, HARRISON STREET OVER I-290 & W-44-093, LAUREL STREET OVER I-290

The project will consist of superstructure replacement and substructure repairs of the Harrison and Laurel Street bridges over I-290 in the City of Worcester.

Monarch Butterfly: Candidate Species only, no conservation measures at this time.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.26880575,-71.79358796159397,14z

DETERMINATION KEY RESULT

Based on the information you provided, you have determined that the Proposed Action will have no effect on the endangered Indiana bat and/or the endangered northern long-eared bat. Therefore, no consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required for these two species.

QUALIFICATION INTERVIEW

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No

2. Is the project within the range of the northern long-eared bat[1]?

   [1] See northern long-eared bat species profile

   Automatically answered
   Yes

3. [Semantic] Does your proposed action intersect an area where Indiana bats and northern long-eared bats are not likely to occur?

   Automatically answered
   Yes

DETERMINATION KEY DESCRIPTION: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

This key was last updated in IPaC on October 10, 2023. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which may require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the endangered **northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

IPAC USER CONTACT INFORMATION

Agency: Massachusetts Department of Transportation
Name: Julia Hoogeboom
Address: 10 Park Plaza
City: Boston
State: MA
Zip: 02116
Email julia.a.hoogeboom@dot.state.ma.us
Phone: 8574452880

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

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DOCUMENT A00875

POLICY DIRECTIVE P-22-001
AND
POLICY DIRECTIVE P-22-002

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Number: P-22-001
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Off-Site Stockpiling of Soil from MassDOT Construction Projects

Purpose

The purpose of this Policy Directive is to formally establish a policy and procedures for managing and stockpiling soil generated and transported from MassDOT construction projects. This Policy Directive does not supersede any Federal, State, or Local regulations.

Date of Effect

This Policy Directive is effective immediately for all projects, including active construction projects.

For active construction projects and for other projects advertised prior to October 15, 2022, changes to the contract documents needed to implement the requirements of this Policy Directive will be considered on a case-by-case basis and shall be approved by the District Highway Director, as necessary.

For projects advertised on or after October 15, 2022, MassDOT will include the requirements and implementation procedures of this Policy Directive in the construction contract documents.

Policy Requirements

This policy is intended to prevent the off-site relocation of excavated soil generated from MassDOT projects to areas near residential receptors and to control potential fugitive dusts and/or contaminants. To that end, excavated soil may not be moved from the project site without knowledge of the content of the material. Knowledge may include visual field observations for presence of staining, odor, and/or debris, screening with a photoionization detector (PID), laboratory analysis, and/or site history. Pavement millings and other non-soil materials are not subject to the requirements of this Policy Directive.

Moving soil from a MassDOT project site to a temporary off-site storage location must be approved in writing by the District Highway Director.

The Contractor must select a storage location that is at least 500 feet away from residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially

zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.

Temporary off-site storage of excavated soil from a MassDOT project is only permissible at a location approved and permitted by MassDOT. The temporary storage location should be located within the same municipality where the soil was excavated, where possible. Stockpiled soil must be securely covered, and appropriate measures must be taken to minimize fugitive dust and erosion.

Signs indicating the source of the soil, the date the soil was generated, and contact information must be erected and maintained until the stockpiled soils are transported to a disposal facility or reused on the project site.

Implementation Procedures

To ensure that off-site storage of excavated soils is managed properly on MassDOT projects, this policy requires the following:

1. **Off-Site Stockpile Storage Locations**
    a. The Contractor shall provide proposed off-site storage locations to the Engineer for approval at least 30 days prior to transporting soil off site. Off-site storage locations should be in the same municipality as the work site.
    b. The Contractor shall keep excavated soil on site until adequately characterized to the satisfaction of the Engineer.
    c. The Contractor shall provide notification of the approved off-site storage location to the local Board of Health and the Town Manager's/Mayor's Office at least 7-days prior to transporting soil off site.
    d. The Contractor shall provide the Engineer with at least 3-days' notice prior to transporting soil off site.
    e. For off-site storage locations on MassDOT property, the Contractor is required to obtain an Access Permit through the District Permits Office prior to storage of soil or other materials. MassDOT will issue these permits at no cost to the Contractor. Information to be submitted by the Contractor as part of the permit application shall include:
        i. A description of material to be stored off-site, including available analytical data;
        ii. A figure of the location with distances to residences and residential receptors; and
        iii. Anticipated duration of temporary storage.
    f. Stockpile locations should not be within 500 feet of residential receptors (e.g., residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities).
        i. If the stockpile location must be within 500 feet of residential receptors, then soil must be less than RCS-1 (per 310 CMR 40.1600) and free of potentially hazardous or regulated items.

g. For off-site storage locations on non-MassDOT property, the Contractor must notify the property owner(s) at least 7 days prior to transporting material.
h. Exceptions to these rules will be reviewed by MassDOT and may be approved by the District Highway Director on a case-by-case basis.

2. Off-Site Stockpile Management

a. The Contractor shall keep soil stockpiles on impermeable surfaces (e.g., asphalt or concrete) or on 10-mil polyethylene sheeting.
b. The Contractor shall cover soil stockpiles with 10-mil polyethylene sheeting and surround with a berm made of hay bales, straw wattles, or similar.
    i. Piles that are actively being worked on must be covered and re-secured at the end of the work shift.
c. The Contractor shall label stockpiles with signs, including:
    i. Location of origin (including any Release Tracking Numbers)
    ii. Stockpile ID number (including MassDOT District office-assigned tracking ID, if different)
    iii. Date of initial accumulation
    iv. Applicable telephone numbers for the Contractor and MassDOT.
d. The Contractor shall mitigate fugitive dust at storage locations under the direction of an appropriately trained/certified environmental professional.
e. The Contractor shall remedy noncompliance with this policy within 48 hours.
f. The Contractor shall remedy noncompliance with this policy on the SAME DAY for potentially hazardous material, as determined by the Engineer.
g. The Contractor shall handle excavated soil according to federal, state, and local regulations.
h. The Contractor shall use appropriate shipping documents for all movements of excavated soil on public roadways (e.g., Bill of Lading, Material Shipping Record, Manifest, Asbestos Waste Shipment Record, etc.).

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massDOT Massachusetts Department of Transportation Highway Division

Number: P-22-002
Date: 9/23/22

POLICY DIRECTIVE

Jonathan Gulliver (signature on original)
HIGHWAY ADMINISTRATOR

Use of MassDOT Property for Staging and other Construction-Related Operations

Purpose

This Policy Directive is intended to address the use of MassDOT property by MassDOT Contractors for construction staging and other construction-related operations that are not specifically defined in the construction contract. Such use of MassDOT property will only be allowed if permitted by the District Office in accordance with 700 CMR 13.00, Approval of Access to MassDOT Highways and Other Property. This includes the use of MassDOT property for staging, laydown, and storage of equipment and materials, including soil excavated from a project site.

This Policy Directive requires the Contractor/applicant to obtain a Non-Vehicular Access Permit from MassDOT to use MassDOT property for these purposes.

This Policy Directive is effective immediately and applies to all MassDOT construction projects.

General Permit Considerations and Conditions

In addition to other normal MassDOT Access Permit procedures, MassDOT shall consider the following during the application, review, implementation and monitoring processes of Access Permits required by this Policy Directive:

- Storage and placement of the Contractor's equipment and materials should not be allowed within the clear zone of the roadway.
- Stockpiled soils should not be located within 500 feet of residential receptors, as defined herein to include, but not be limited to, residential dwellings, residentially zoned property, schools, daycare facilities, playgrounds, parks, recreational areas, hospitals, elderly housing and convalescent facilities.
- The Contractor/applicant shall identify the access/egress locations of the proposed storage areas. MassDOT will only approve locations determined to be safe for roadway users, construction workers and the general public.
- The Contractor may be required to submit a Traffic Management Plan and/or Lighting Plan for MassDOT review and approval as part of the permit application, depending on the proposed use of the area.

- The Contractor shall submit the permit application through MassDOT's online State Highway Access Permit System (SHAPS).
- MassDOT will waive the permit application fee for any application received from a MassDOT Contractor for any permit required by this Policy Directive and will waive any subsequent amendment and extension fees that may otherwise be required.
- MassDOT will review the permit application in accordance with applicable standard procedures and will apply standard permit terms and conditions, as necessary.
- The Resident Engineer will verify that the permit is approved before allowing the Contractor to use the affected area for the requested purpose.
- Areas permitted are for use by the approved applicant only and are not to be shared with or used by other vendors. Subcontractors specifically engaged with the applicant working on the specific MassDOT project will be allowed to use the area in accordance with the terms of the permit.
- Permits are issued on an annual basis and will require the Contractor to file for an extension each year to continue use.

Exemptions from Permit Requirements

Equipment and materials being used for active construction operations and located within the work zone of the construction contract are exempt from this permit requirement, provided they do not interfere with the safety or operation of the roadway or the work zone. Examples of these types of exempt uses are:

- Equipment and materials parked or stored within a protected (barriered) work zone.
- Materials placed in the work zone prior to same-day installation or use.
- Soils excavated temporarily and scheduled to be replaced, such as for trenching operations or for installation of drainage structures.

DOCUMENT B00420

PROPOSAL

WORCESTER

For: **Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290**

COMMONWEALTH OF MASSACHUSETTS

LOCATION

The work referred to herein is in the City of WORCESTER in Worcester County, in the Commonwealth of Massachusetts, and is shown by the locus map (Document 00331) in the Proposal Pamphlet, the work locations extend as follows:

Bridge W-44-083 **Harrison Street over I-290**

Beginning – Station 11+42.00 +/-
Ending –Station 16+25.00 +/-

Bridge W-44-093 **Laurel Street over I-290**

Beginning – Station 6+40.00 +/-
Ending – Station 10+17.00 +/-

The contract prices shall include the furnishing of all materials (except as otherwise herein specified), the performing of all the labor requisite or proper, the providing of all necessary machinery, tools, apparatus and other means of construction, the doing of all the abovementioned work in the manner set forth, described and shown in the specifications and on the drawings for the work, and in the form of contract, and the completion thereof within **1000 CALENDAR DAYS** upon receipt of a Notice to Proceed, except that if the completion date falls between December 1 and March 15 then the same number of days beyond December 1st will be extended after March 15th.

The Work of this project is described by the following Items and quantities.

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Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
100.5	1	ELECTRICAL WORK AT _____ LUMP SUM		
100.91	1	PRE AND POST CONSTRUCTION SURVEY AND SEETLEMENT/DISPLACEMENT MONITORING AT BRIDGE NO. W-44-083 AT _____ LUMP SUM		
100.92	1	PRE AND POST CONSTRUCTION SURVEY AND SEETLEMENT/DISPLACEMENT MONITORING AT BRIDGE NO. W-44-093 AT _____ LUMP SUM		
102.1	265	TREE TRIMMING AT _____ PER FOOT		
102.511	2	TREE PROTECTION – ARMORING & PRUNING AT _____ EACH		
102.521	70	TREE AND PLANT PROTECTION FENCE AT _____ PER FOOT		
103.	8	TREE REMOVED - DIAMETER UNDER 24 INCHES AT _____ EACH		
114.1	1	DEMOLITION OF SUPERSTRUCTURE OF BRIDGE NO. W-44-083 AT _____ LUMP SUM		
114.2	1	DEMOLITION OF SUPERSTRUCTURE OF BRIDGE NO. W-44-093 AT _____ LUMP SUM		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
120.	1,840	EARTH EXCAVATION AT _____ PER CUBIC YARD		
127.1	225	REINFORCED CONCRETE EXCAVATION AT _____ PER CUBIC YARD		
127.12	10	REINFORCED CONCRETE SUBSTRUCTURE EXCAVATION AT _____ PER CUBIC YARD		
127.4	30	REINFORCED CONCRETE DECK EXCAVATION (FULL DEPTH) AT _____ PER SQUARE YARD		
127.41	10	REINFORCED CONCRETE DECK EXCAVATION (PARTIAL DEPTH) AT _____ PER CUBIC YARD		
140.	85	BRIDGE EXCAVATION AT _____ PER CUBIC YARD		
141.1	60	TEST PIT FOR EXPLORATION AT _____ PER CUBIC YARD		
142.	250	CLASS B TRENCH EXCAVATION AT _____ PER CUBIC YARD		
144.	50	CLASS B ROCK EXCAVATION AT _____ PER CUBIC YARD		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
146.	8	DRAINAGE STRUCTURE REMOVED AT _____ EACH		
150.	380	ORDINARY BORROW AT _____ PER CUBIC YARD		
151.	1,700	GRAVEL BORROW AT _____ PER CUBIC YARD		
151.1	15	GRAVEL BORROW FOR BRIDGE FOUNDATION AT _____ PER CUBIC YARD		
151.2	130	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES AT _____ PER CUBIC YARD		
154.	130	SAND BORROW AT _____ PER CUBIC YARD		
156.	190	CRUSHED STONE AT _____ PER TON		
170.	4,125	FINE GRADING AND COMPACTING - SUBGRADE AREA AT _____ PER SQUARE YARD		
180.01	1	ENVIRONMENTAL HEALTH AND SAFETY PROGRAM AT _____ LUMP SUM		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
180.02	100	PERSONAL PROTECTION LEVEL C UPGRADE AT _____ PER HOUR		
180.03	200	LICENSED SITE PROFESSIONAL SERVICES AT _____ PER HOUR		
181.11	758	DISPOSAL OF UNREGULATED SOIL AT _____ PER TON		
181.12	897	DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY AT _____ PER TON		
181.13	110	DISPOSAL OF REGULATED SOIL - OUT-OF-STATE FACILITY AT _____ PER TON		
181.14	479	DISPOSAL OF HAZARDOUS WASTE AT _____ PER TON		
182.1	1	INSPECTION AND TESTING FOR ASBESTOS AT _____ LUMP SUM		
182.2	1,800	REMOVAL OF ASBESTOS AT _____ PER FOOT		
201.01	1	DROP INLET - MUNICIPAL STANDARD AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
201.5	8	CATCH BASIN - MUNICIPAL STANDARD AT _____ EACH		
201.51	2	ALTERNATIVE CATCH BASIN - MUNICIPAL STANDARD AT _____ EACH		
202.	1	MANHOLE AT _____ EACH		
202.01	9	MANHOLE - MUNICIPAL STANDARD AT _____ EACH		
202.02	1	DROP MANHOLE - MUNICIPAL STANDARD AT _____ EACH		
202.5	1	MANHOLE WITH RISER AT _____ EACH		
210.02	2	SANITARY SEWER MANHOLE REMOVED AT _____ EACH		
220.	12	DRAINAGE STRUCTURE ADJUSTED AT _____ EACH		
220.5	1	DRAINAGE STRUCTURE REMODELED AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
220.7	8	SANITARY STRUCTURE ADJUSTED AT _____ EACH		
220.8	1	SANITARY STRUCTURE REMODELED AT _____ EACH		
221.1	2	FRAME AND COVER - SECURED AT _____ EACH		
222.3	18	FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD AT _____ EACH		
223.1	16	FRAME AND GRATE (OR COVER) REMOVED AND STACKED AT _____ EACH		
227.3	10	REMOVAL OF DRAINAGE STRUCTURE SEDIMENT AT _____ PER CUBIC YARD		
227.31	250	REMOVAL OF DRAINAGE PIPE SEDIMENT AT _____ PER FOOT		
227.4	8	MASONRY PLUG AT _____ PER SQUARE FOOT		
234.12	35	12 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
234.15	6	15 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		
234.18	6	18 INCH DRAINAGE PIPE - OPTION AT _____ PER FOOT		
250.08	110	8 INCH POLYVINYL CHLORIDE SANITARY SEWER PIPE AT _____ PER FOOT		
250.12	100	12 INCH POLYVINYLCHLORIDE SANITARY SEWER PIPE AT _____ PER FOOT		
251.12	220	12 INCH DUCTILE IRON SEWER PIPE (MECHANICAL JOINT) AT _____ PER FOOT		
251.91	560	DUCTILE IRON FITTINGS FOR SEWER PIPE AT _____ PER POUND		
251.92	2	12 INCH EXPANSION JOINT FOR SEWER AT _____ EACH		
254.12	200	12 INCH SEWER PIPE INSULATION AT _____ PER FOOT		
281.	10	CEMENT CONCRETE PAVING (WATERWAY) AT _____ PER SQUARE YARD		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
286.1	1	TEMPORARY COMBINED SEWER BYPASS AT _____ LUMP SUM		
303.06	30	6 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT) AT _____ PER FOOT		
303.08	400	8 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT) AT _____ PER FOOT		
303.12	360	12 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT) AT _____ PER FOOT		
309.	4,500	DUCTILE IRON FITTINGS FOR WATER PIPE AT _____ PER POUND		
310.08	2	8 INCH EXPANSION JOINT AT _____ EACH		
310.12	2	12 INCH EXPANSION JOINT AT _____ EACH		
347.075	4	3/4 INCH COPPER TUBING TYPE K AT _____ PER FOOT		
350.06	3	6 INCH GATE AND GATE BOX AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
350.08	4	8 INCH GATE AND GATE BOX AT _____ EACH		
350.12	4	12 INCH GATE AND GATE BOX AT _____ EACH		
352.06	3	6 INCH GATE AND GATE BOX REMOVE AND DISPOSE AT _____ EACH		
352.08	1	8 INCH GATE AND GATE BOX REMOVE AND DISPOSE AT _____ EACH		
352.12	3	12 INCH GATE AND GATE BOX REMOVE AND DISPOSE AT _____ EACH		
358.	3	GATE BOX ADJUSTED AT _____ EACH		
363.075	1	3/4 INCH CORPORATION COCK AT _____ EACH		
371.06	1	6 INCH COUPLING AT _____ EACH		
371.08	1	8 INCH COUPLING AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
371.12	2	12 INCH COUPLING AT _____ EACH		
372.08	2	8 INCH SOLID SLEEVE AT _____ EACH		
373.08	210	8 INCH WATER PIPE INSULATION AT _____ PER FOOT		
373.12	200	12 INCH WATER PIPE INSULATION AT _____ PER FOOT		
375.08	2	8 INCH INSERTION VALVE AND BOX AT _____ EACH		
375.12	2	12 INCH INSERTION VALVE AND BOX AT _____ EACH		
376.1	1	HYDRANT - EXCLUDING COST OF HYDRANT AT _____ EACH		
376.2	1	HYDRANT - REMOVED AND RESET AT _____ EACH		
376.4	1	HYDRANT - REMOVED AND DISPOSED AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
381.3	3	SERVICE BOX ADJUSTED AT _____ EACH		
386.	1	TEMPORARY WATER MAIN BY-PASS SYSTEM - HARRISON AT _____ LUMP SUM		
386.01	1	TEMPORARY WATER MAIN BY-PASS SYSTEM - LAUREL AT _____ LUMP SUM		
402.	265	DENSE GRADED CRUSHED STONE FOR SUB-BASE AT _____ PER CUBIC YARD		
415.3	600	PAVEMENT MICRO MILLING AT _____ PER SQUARE YARD		
440.	8,400	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL AT _____ PER POUND		
443.	9	WATER FOR ROADWAY DUST CONTROL AT _____ PER 1000 GALLONS		
450.22	230	SUPERPAVE SURFACE COURSE – 9.5 (SSC – 9.5) AT _____ PER TON		
450.23	87	SUPERPAVE SURFACE COURSE - 12.5 (SSC - 12.5) AT _____ PER TON		

Project # 609185 Contract # 129075				
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
450.31	245	SUPERPAVE INTERMEDIATE COURSE - 12.5 (SIC -12.5) AT _____ PER TON		
450.42	550	SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5) AT _____ PER TON		
450.80	52	ASPHALT RUBBER GAP GRADED - 12.5 (ARGG - 12.5) AT _____ PER TON		
451.	45	HMA FOR PATCHING AT _____ PER TON		
452.	470	ASPHALT EMULSION FOR TACK COAT AT _____ PER GALLON		
453.	1,550	HMA JOINT ADHESIVE AT _____ PER FOOT		
470.	31	HOT MIX ASPHALT BERM AT _____ PER TON		
472.	222	TEMPORARY ASPHALT PATCHING AT _____ PER TON		
477.	1,190	MILLED RUMBLE STRIP (TYPE A) AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
504.	765	GRANITE CURB TYPE VA4 - STRAIGHT AT _____ PER FOOT		
504.1	68	GRANITE CURB TYPE VA4 - CURVED AT _____ PER FOOT		
508.	50	GRANITE TRANSITION - VERTICAL TO SLOPED CURB AT _____ PER FOOT		
509.	147	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT AT _____ PER FOOT		
509.1	52	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - CURVED AT _____ PER FOOT		
510.	7	GRANITE EDGING TYPE SA AT _____ PER FOOT		
514.2	5	GRANITE CURB INLET - STRAIGHT- MUNICIPAL STANDARD AT _____ EACH		
516.	7	GRANITE CURB CORNER TYPE A AT _____ EACH		
594.	1,020	CURB REMOVED AND DISCARDED AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
620.13	60	GUARDRAIL, TL-3 (SINGLE FACED) AT _____ PER FOOT		
627.1	1	TRAILING ANCHORAGE AT _____ EACH		
628.21	15	TRANSITION TO NCHRP 350 GUARDRAIL AT _____ EACH		
628.22	7	TRANSITION TO RIGID BARRIER (SINGLE FACED) AT _____ EACH		
628.23	3	TRANSITION TO RIGID BARRIER (DOUBLE FACED) AT _____ EACH		
628.24	2	TRANSITION TO BRIDGE RAIL AT _____ EACH		
628.241	1	SPECIAL TRANSITION TO BRIDGE RAIL AT _____ LUMP SUM		
628.305	7	TEMPORARY IMPACT ATTENUATOR, NON-REDIRECTIVE, TL-3 AT _____ EACH		
628.4	13	TEMPORARY IMPACT ATTENUATOR, REMOVED AND RESET AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
629.1	1,750	PRECAST CONCRETE BARRIER - SINGLE FACED AT _____ PER FOOT		
629.3	84	CAST-IN-PLACE CONCRETE BARRIER - SINGLE FACED AT _____ PER FOOT		
629.5	31	CAST-IN-PLACE MEDIAN BARRIER CAP AT _____ PER CUBIC YARD		
630.2	2,850	HIGHWAY GUARD REMOVED AND DISCARDED AT _____ PER FOOT		
644.060	14	60 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) (LINE POST OPTION) AT _____ PER FOOT		
644.072	78	72 INCH CHAIN LINK FENCE (SPRING TENSION WIRE) (LINE POST OPTION) AT _____ PER FOOT		
657.	1,300	TEMPORARY FENCE AT _____ PER FOOT		
657.5	1,300	TEMPORARY FENCE REMOVED AND RESET AT _____ PER FOOT		
665.	38	CHAIN LINK FENCE REMOVED AND STACKED AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
665.2	80	REMOVE AND DISPOSE CHAIN LINK FENCE AT _____ PER FOOT		
666.	176	CHAIN LINK FENCE REMOVED AND RESET AT _____ PER FOOT		
668.	3	CHAIN LINK FENCE GATE W/GATE POSTS REMOVED & RESET AT _____ EACH		
697.1	32	SILT SACK AT _____ EACH		
701.	616	CEMENT CONCRETE SIDEWALK AT _____ PER SQUARE YARD		
701.1	150	CEMENT CONCRETE SIDEWALK AT DRIVEWAYS AT _____ PER SQUARE YARD		
701.2	160	CEMENT CONCRETE PEDESTRIAN CURB RAMP AT _____ PER SQUARE YARD		
702.	22	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY AT _____ PER TON		
722.2	1	SCHEDULE OF OPERATIONS (TYPE B) - FIXED PRICE $95,000 AT Ninety Five Thousand Dollars LUMP SUM	$95,000.00	$95,000.00

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
740.	33	ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) AT _____ PER MONTH		
748.	1	MOBILIZATION AT _____ LUMP SUM		
748.1	8	EMERGENCY RESPONSE AT _____ EACH		
751.	30	LOAM FOR ROADSIDES AT _____ PER CUBIC YARD		
765.	280	SEEDING AT _____ PER SQUARE YARD		
769.	1,080	PAVEMENT MILLING MULCH UNDER GUARD RAIL AT _____ PER FOOT		
804.2	40	2 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC (UL) AT _____ PER FOOT		
805.41	280	4 INCH ELECTRICAL CONDUIT - RTRC AT _____ PER FOOT		
805.42	900	4 INCH TELEPHONE CONDUIT - RTRC AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
805.51	2,200	5 INCH ELECTRICAL CONDUIT - RTRC AT _____ PER FOOT		
811.22	1	ELECTRIC HANDHOLE - SD2.022 AT _____ EACH		
811.87	4	JUNCTION BOX 24 X 24 X 10 INCHES AT _____ EACH		
813.33	1,600	WIRE TYPE 7 NO. 4 GENERAL PURPOSE AT _____ PER FOOT		
813.34	1,300	WIRE TYPE 7 NO. 2 GENERAL PURPOSE AT _____ PER FOOT		
816.81	1	TEMPORARY TRAFFIC CONTROL SIGNAL AT _____ LUMP SUM		
816.82	1	TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 2 AT _____ LUMP SUM		
816.83	1	TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 3 AT _____ LUMP SUM		
816.84	1	TEMPORARY TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 4 AT _____ LUMP SUM		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
816.89	1	TEMPORARY TRAFFIC CONTROL SIGNAL RECONSTRUCTION I-290 RAMP DETOURS AT _____ LUMP SUM		
823.70	2	HIGHWAY LIGHTING POLE AND LUMINAIRE REMOVED AND RESET AT _____ EACH		
832.	135	WARNING-REGULATORY AND ROUTE MARKER - ALUMINUM PANEL (TYPE A) AT _____ PER SQUARE FOOT		
847.1	26	SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL AT _____ EACH		
851.1	2,000	TRAFFIC CONES FOR TRAFFIC MANAGEMENT AT _____ PER DAY		
852.	2,750	SAFETY SIGNING FOR TRAFFIC MANAGEMENT AT _____ PER SQUARE FOOT		
852.11	420	TEMPORARY PEDESTRIAN BARRICADE AT _____ PER FOOT		
852.12	8	TEMPORARY PEDESTRIAN CURB RAMP AT _____ EACH		
853.1	38	PORTABLE BREAKAWAY BARRICADE TYPE III AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
853.21	2,400	TEMPORARY BARRIER REMOVED AND RESET AT _____ PER FOOT		
853.23	1,150	TEMPORARY BARRIER (TL-3) AT _____ PER FOOT		
853.33	1,200	TEMPORARY BARRIER - LIMITED DEFLECTION (TL-3) AT _____ PER FOOT		
853.331	3,600	TEMPORARY BARRIER - LIMITED DEFLECTION (TL-3) REMOVED AND RESET AT _____ PER FOOT		
853.403	360	TRUCK MOUNTED ATTENUATOR AT _____ PER DAY		
853.8	400	TEMPORARY ILLUMINATION FOR WORK ZONE AT _____ PER DAY		
854.016	46,750	TEMPORARY PAVING MARKINGS - 6 INCH (PAINTED) AT _____ PER FOOT		
854.036	13,750	TEMPORARY PAVING MARKINGS - 6 INCH (TAPE) AT _____ PER FOOT		
854.1	6,250	PAVEMENT MARKING REMOVAL AT _____ PER SQUARE FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
854.6	840	TEMPORARY PORTABLE RUMBLE STRIP AT _____ PER DAY		
856.	270	ARROW BOARD AT _____ PER DAY		
856.12	5,600	PORTABLE CHANGEABLE MESSAGE SIGN AT _____ PER DAY		
859.	93,000	REFLECTORIZED DRUM AT _____ PER DAY		
864.04	150	PAVEMENT ARROWS AND LEGENDS REFLECTORIZED WHITE (THERMOPLASTIC) AT _____ PER SQUARE FOOT		
864.33	160	SLOTTED PAVEMENT MARKER TWO-WAY WHITE/RED AT _____ EACH		
864.34	15	SLOTTED PAVEMENT MARKER TWO-WAY YELLOW/RED AT _____ EACH		
864.41	135	GREEN COLORIZED PAVEMENT MARKINGS AT _____ PER SQUARE FOOT		
864.906	300	PERMANENET PAVING MARKING - 6 INCH (TAPE) AT _____ PER FOOT		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
866.106	700	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		
866.112	700	12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT _____ PER FOOT		
866.206	6,500	6 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED) AT _____ PER FOOT		
866.212	2,100	12 INCH REFLECTORIZED WHITE LINE (POLYUREA) (RECESSED) AT _____ PER FOOT		
867.106	630	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT _____ PER FOOT		
867.206	4,400	6 INCH REFLECTORIZED YELLOW LINE (POLYUREA) (RECESSED) AT _____ PER FOOT		
871.9	1	MOTORIZED TRAFFIC DATA MONITORING PROGRAM AT _____ LUMP SUM		
874.	1	STREET NAME SIGN AT _____ EACH		
874.1	2	STREET SIGN REMOVED AND RESET AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
874.2	17	TRAFFIC SIGN REMOVED AND RESET AT _____ EACH		
874.4	17	TRAFFIC SIGN REMOVED AND STACKED AT _____ EACH		
903.	16	3000 PSI, 1.5 INCH, 470 CEMENT CONCRETE AT _____ PER CUBIC YARD		
904.12	450	RAPID SET CONCRETE AT _____ PER CUBIC FOOT		
905.	25	4000 PSI, 3/8 INCH, 660 CEMENT CONCRETE AT _____ PER CUBIC YARD		
909.2	725	CEMENTITIOUS MORTAR FOR PATCHING AT _____ PER SQUARE FOOT		
910.	2,740	STEEL REINFORCEMENT FOR STRUCTURES AT _____ PER POUND		
910.1	3,750	STEEL REINFORCEMENT FOR STRUCTURES - EPOXY COATED AT _____ PER POUND		
910.4	50	MECHANICAL REINFORCING BAR SPLICER AT _____ EACH		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
912.	244	DRILLING AND GROUTING DOWELS AT _____ EACH		
950.51	1	TEMPORARY SUPPORT OF EXCAVATION OF BRIDGE NO. W-44-083 AT _____ LUMP SUM		
950.511	1	TEMPORARY SUPPORT OF EXCAVATION - LEFT IN PLACE BRIDGE NO. W-44-083 AT _____ LUMP SUM		
950.52	1	TEMPORARY SUPPORT OF EXCAVATION OF BRIDGE NO. W-44-093 AT _____ LUMP SUM		
964.3	8,700	ELASTOMERIC PROTECTIVE COATING AT _____ PER SQUARE FOOT		
992.33	1	TEMPORARY SUPPORT OF STRUCTURE BRIDGE NO. W-44-083 AT _____ LUMP SUM		
992.34	1	TEMPORARY SUPPORT OF STRUCTURE BRIDGE NO. W-44-093 AT _____ LUMP SUM		
994.01	1	TEMPORARY PROTECTIVE SHIELDING BRIDGE NO. W-44-083 AT _____ LUMP SUM		
994.02	1	TEMPORARY PROTECTIVE SHIELDING BIRDGE NO. W-44-093 AT _____ LUMP SUM		

Project # 609185	Contract # 129075			
Location : WORCESTER				
Description : Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290				
ITEM #	**QUANTITY**	**ITEM WITH UNIT BID PRICE WRITTEN IN WORDS**	**UNIT PRICE**	**AMOUNT**
995.1	1	BRIDGE SUPERSTRUCTURE, BRIDGE NO. W-44-083 AT _____ LUMP SUM		
995.2	1	BRIDGE SUPERSTRUCTURE, BRIDGE NO. W-44-093 AT _____ LUMP SUM		
Total Qty:	267,392			

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DOCUMENT B00853

SCHEDULE OF PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES (DBES)

PRIME BIDDER: _____

DATE OF BID OPENING: _____ PROJECT NO.: 609185

FEDERAL AID PROJECT NO. STP(BR-OFF)-003S(815)X

PROJECT LOCATION: WORCESTER

Name, Address, and Phone Number(s) of DBE	Name of Activity	(a)† DBE Contractor Activity Amount *Construction Work*	(b) DBE Other Business Amount *Services, Supplies, Material*	(c) Total amount eligible for credit under rules in Section 6 of Document 00719 - DBE Special Provisions
Total Bid Amount	TOTALS:	$	$	$
$	DBE Percentage of Total Bid:	%	%	%

†*Column (a) must be at least one-half of the DBE participation goal. Attach additional sheets as necessary.*

Is MassDOT Document B00855 (Joint Check Approval) being submitted for any of the above? ☐ Yes ☐ No ☐ Not Known at This Time

Will any of the contractors listed above be using a third party (i.e. manufacturer) to deliver materials or perform any portion of work by a third party? ☐ Yes ☐ No

CERTIFICATION: I HEREBY DECLARE, TO THE BEST OF MY KNOWLEDGE, THAT **I HAVE READ THE SPECIAL PROVISIONS FOR PARTICIPATION BY DISADVANTAGED BUSINESS ENTERPRISES - DOCUMENT 00719.** BOTH THIS SCHEDULE AND THE RELEVANT AND ACCOMPANYING LETTER(S) OF INTENT ARE IN FULL COMPLIANCE WITH THE PROVISIONS OF, AND IN ACCORDANCE WITH, TITLE 49 CODE OF FEDERAL REGULATIONS, PART 26 (49 CFR Part 26).

SIGNATURE:_____ DATE_____

NAME AND TITLE (*PRINT*):_____

EMAIL ADDRESS: _____TEL NO.:_____

*** END OF DOCUMENT ***

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DOCUMENT B00854

DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION
LETTER OF INTENT
(To be completed by the DBE – Page 1 of 2)

TO: _____ (Prime Bidder)

FROM: _____ (DBE Firm)

RE: PROJECT NO.: 609185 FEDERAL AID PROJECT NO.: STP(BR-OFF)-003S(815)X

PROJECT LOCATION: WORCESTER

DATE OF BID OPENING: _____

I, _____, authorized signatory of the above-referenced DBE firm hereby declare:
Print Name

1. My company is currently certified as a Disadvantaged Business Enterprise (DBE) by the Massachusetts Supplier Diversity Office ("SDO"), formerly known as the State Office of Minority and Women Business Assistance (SOMWBA), as a: (check all applicable, see Section 1 of the Special Provisions For Participation By Disadvantaged Business Enterprises, MassDOT Document 00719 additional guidance is available at Title 49, Code of Federal Regulations, Part 26.55 (49 CFR Part 26.55)):

   ( ) CONTRACTOR ( ) REGULAR DEALER ( ) BROKER
   ( ) MANUFACTURER ( ) TRUCKING OPERATIONS ( ) PROFESSIONAL SERVICES

2. My firm has the ability to manage, supervise and perform the activity described on page 2 of this Letter of Intent. If you are awarded the contract, my company intends to enter into a contract with your firm to perform the items of work or other activity described on the following sheet for the prices indicated.

3. There have been no changes affecting the ownership, control or independence of my company since my last certification review on _____ ___, 20___. If any such change is planned or occurs prior to my company's completion of this proposed work, I will give prior written notification to your firm and to the Massachusetts Department of Transportation ("MassDOT") Office of Civil Rights and SDO.

4. I have read the MassDOT proposal for the Project which may be entitled "Project Contract Documents and Special Provisions" or the draft "Contract" which includes MassDOT Document 00719, and acknowledge that my company will comply with that document and the requirements of 49 CFR Part 26.

5. For the purpose of obtaining subcontractor approval from MassDOT, my firm will provide to you:

   A. ***The following construction work:***
      (i) a resume, stating the qualifications and experience, of the superintendent or foreperson who will supervise on site-work;
      (ii) a list of equipment owned or leased by my firm for use on this project; and
      (iii) a list of all projects (public or private) upon which my firm is currently performing, is committed to perform, or intends to make a commitment to perform. I shall also include, for each project: the name and telephone number of a contact person for the contracting authority, person, or organization; the dollar value of the work; a description of the work; and my firm's work schedule for the project.

   B. ***The following services, materials or supplies***:
      (i) a written agreement and invoices for the materials or supplies, and any other documents evidencing the terms of providing such items;
      (ii) information concerning brokers fees and commissions for providing services or materials; and
      (iii) a statement concerning whether my firm intends or will be required to use a joint check arrangement; and any other documents that may be required by MassDOT.

_____ Date_____
DBE Company Authorized Signature

DISADVANTAGED BUSINESS ENTERPRISES (DBE) PARTICIPATION
LETTER OF INTENT
(To be completed by the DBE – Page 2 of 2)

DATE OF BID OPENING: _____

PROJECT NUMBER: 609185

FEDERAL AID PROJECT NUMBER: STP(BR-OFF)-003S(815)X

PROJECT LOCATION: WORCESTER

PRIME BIDDER: _____

DBE COMPANY NAME: _____

Item number if applicable	NAICS Code	Description of Activity with notations such as Services, or Brokerage, Installation Only, Material Only, or Complete	Quantity	Unit Price	Amount
			TOTAL AMOUNT:		

Please give full explanations, attach additional sheets if necessary.

I HEREBY VERIFY THAT _____ WILL SOLELY
(DBE company name)
PERFORM THE WORK, OR PROVIDE THE SERVICES OR MATERIALS, AS DESCRIBED ABOVE.

DBE AUTHORIZED SIGNATURE: _____

NAME AND TITLE (PRINT):_____

TELEPHONE NUMBER: _____FAX NUMBER: _____

EMAIL ADDRESS: _____

Rev'd 9/20/19

*** END OF DOCUMENT ***

DOCUMENT B00855

DBE JOINT CHECK ARRANGEMENT APPROVAL FORM

(to be submitted by Prime Contractor)

Contract No: 129075 **Project No.** 609185 **Federal Aid No.:** STP(BR-OFF)-003S(815)X

Location: WORCESTER **Bid Opening Date:** _____

Project Description: Bridge Reconstruction of W-44-083, Harrison Street over I-290 & W-44-093, Laurel Street over I-290

We have received the attached request for the use of a joint check arrangement from _____ _____ , a DBE on the above- referenced Contract and _____ _____, a Material Supplier/Vendor for the subject Contract. The DBE has complied with the requirements of 49 CFR Part 26.55(c)(1). In particular, the DBE has:

- a written agreement with the material supplier/vendor;
- applied for credit with the subject material supplier and has supplied the vendor's response;
- shown that it will place all orders to the subject material supplier/vendor;
- made and retains all decision-making responsibilities concerning the materials; and
- provided a Joint Check Agreement that is acceptable to MassDOT;

As the Contractor for the Project, we agree to issue joint checks (made payable to the Material Supplier/Vendor and the DBE) for payment of sums due pursuant to invoices from the Supplier/Vendor and DBE.

Contractor:

_____ _____
Company Name Signature
Duly Authorized

_____
Printed Name

_____ _____
Date Title

SubContractor:

_____ _____
Company Name Signature –
Duly Authorized

_____
Printed Name

_____ _____
Date Title

*** END OF DOCUMENT ***

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DOCUMENT B00856

JOINT VENTURE AFFIDAVIT

(All Firms)

- All Information Requested By This Schedule Must Be Answered. Additional Sheets May Be Attached.
- If, there is any change in the information submitted, the Joint Venture parties must inform MassDOT Pre-Qualifications Office (and, if one of the companies is a DBE, the Director of Contract Compliance, Office of Civil Rights) *prior* to such change, in writing, either directly or through the Prime Contractor if the Joint Venture is a subcontractor.
- If the Joint Venture Entity will be the bidder on a prime Contract, it must bid and submit all required documents (insurance, worker's compensation, bonds, etc.) in the name of the Joint Venture Entity.

I. Name of Joint Venture: _____

Type of Entity if applicable (Corp., LLC):_____Filing State _____

Address of joint venture: _____

_____

Phone No(s) for JV Entity: _____E-mail:_____

Contact Person(s)_____

Tax ID/EIN of Joint Venture: _____Vendor Code:_____

II. Identify each firm or party to the Joint Venture:

Name of Firm: _____

Address: _____

Phone : _____E-mail:_____

Contact person(s) _____

Name of Firm: _____

Address: _____

Phone: _____E-mail:_____

Contact Person(s)_____

III. Describe the role(s) of the each party to the Joint Venture:

_____

_____

IV. Attach a copy of the Joint Venture Agreement. The proposed Joint Venture Agreement should include specific details including, but not limited to: (1) the contributions of capital and equipment; (2) work items to be performed by each company's forces, (3) work items to be performed under the supervision of any DBE Venturer; (4) the commitment of management, supervisory and operative personnel employed by the DBE to be dedicated to the performance of the Project; and (5) warranty, guaranty, and indemnification clauses.

V. Attach any applicable Corporate or LLC Votes, Authorizations, etc.

VI. Ownership of the Joint Venture:

A. What is the percentage(s) of each company's ownership in the Joint Venture?

ownership percentage(s): _____

ownership percentage(s): _____

B. Specify percentages for each of the following (provide narrative descriptions and other detail as applicable):

1. Sharing of profit and loss: _____

2. Capital contributions:

(a) Dollar amounts of initial contribution: _____

(b) Dollar amounts of anticipated on-going contributions: _____

(c) Contributions of equipment (specify types, quality and quantities of equipment to be provided by each firm): _____

_____

4. Other applicable ownership interests, including ownership options or other agreements, which restrict or limit ownership and/or control:

_____

_____

5. Provide copies of all other written agreements between firms concerning bidding and operation of this Project or projects or contracts.

6. Identify all current contracts and contracts completed during the past two (2) years by either of the Joint Venture partners to this Joint Venture:

_____

_____

VII. Control of and Participation in the Joint Venture. Identify by name and firm those individuals who are, or will be, responsible for and have the authority to engage in the following management functions and policy decisions. (Indicate any limitations to their authority such as dollar limits and co-signatory requirements.):

A. Joint Venture check signing:

_____

_____

B. Authority to enter Contracts on behalf of the Joint Venture:

_____

_____

C. Signing, co-signing and/or collateralizing loans:

_____

_____

D. Acquisition of lines of credit:

E. Acquisition and indemnification of payment and performance bonds:

F. Negotiating and signing labor agreements:

G. Management of contract performance. *(Identify by name and firm only)*:

1. Supervision of field operations:
2. Major purchases:
3. Estimating:
4. Engineering:

VIII. Financial Controls of Joint Venture:

A. Which firm and/or individual will be responsible for keeping the books of account?

B. Identify the "Managing Partner," if any, and describe the means and measure of their compensation:

C. What authority does each firm have to commit or obligate the other to insurance and bonding companies, financing institutions, suppliers, subcontractors, and/or other parties participating in the performance of this Contract or the work of this Project?

IX. Personnel of Joint Venture: State the approximate number of personnel (by trade) needed to perform the Joint Venture's work under this Contract. Indicate whether they will be employees of the majority firm, DBE firm, or the Joint Venture.

	Firm 1 (number)	Firm 2 (number)	Joint Venture (number)
Trade			
Professional			
Administrative/Clerical			
Unskilled Labor			

Will any personnel proposed for this Project be employees of the Joint Venture?: _____

If so, who: _____

A. Are any proposed Joint Venture employees currently employed by either firm?

Employed by Firm 1: _____ Employed by firm 2 _____

B. Identify by name and firm the individual who will be responsible for Joint Venture hiring: ____

_____

X. Additional Information. Please state any material facts and additional information pertinent to the control and structure of this Joint Venture.

_____

_____

XI. AFFIDAVIT OF JOINT VENTURE PARTIES. The undersigned affirm that the foregoing statements and attached documents are correct and include all material information necessary to identify and explain the terms and operations of our Joint Venture and the intended participation of each firm in the undertaking. Further, the undersigned covenant and agree to provide to MassDOT current, complete and accurate information regarding actual Joint Venture work, payments, and any proposed changes to any provisions of the Joint Venture, or the nature, character of each party to the Joint Venture. We understand that any material misrepresentation will be grounds for terminating any Contract awarded and for initiating action under Federal or State laws concerning false statements.

Firm 1	Firm 2
Signature Duly Authorized	Signature Duly Authorized
Printed Name and Title	Printed Name and Title
Date	Date

*** END OF DOCUMENT ***