GEOSCIENCES TESTING AND RESEARCH INC.

GEOTECHNICAL ENGINEERING REPORT-REV-2
PLUMMER SPRING ROAD OVER ARTICHOKE RIVER
BRIDGE REPLACEMENT N-11-007=W-20-001
NEWBURYPORT/WEST NEWBURY, MASSACHUSETTS

December 9, 2022
Project 19.107

Prepared by:

Geosciences Testing and Research, Inc.
North Chelmsford, MA

Prepared for:

Mr. Micah Morrison, P.E.
BSC Group
803 Summer Street
Boston, MA 02127

December 9, 2022
GTR Project #19.107

Mr. Micah Morrison, P.E.
BSC Group
803 Summer Street
Boston, MA 02127

Re: **Geotechnical Engineering Report – Rev-2**
Plummer Spring Rd over Artichoke River
Bridge Replacement N-11-007=W-20-001
Newburyport/West Newbury, Massachusetts

Dear Micah:

Geosciences Testing and Research, Inc. (GTR) is pleased to present this report summarizing the results of our geotechnical engineering study for the above-referenced project. This study was carried out in general accordance with our proposal dated June 8, 2018. This report is subject to the limitations presented in Appendix A.

We trust this satisfies your current requirements and have appreciated working with you on this project. Please contact the undersigned if you have any questions.

Sincerely,
Geosciences Testing and Research, Inc.

Paul D. Dion
Geotechnical Engineer

Curtis A. George, P.E.
Principal

COMMONWEALTH OF MASSACHUSETTS
LES R. CHERNAUSKAS
CIVIL
No. 39934
REGISTERED PROFESSIONAL ENGINEER

Les R. Chernauskas
Reviewer

Attachments: Appendices A- D
19.107 Plummer St Newburyport - Geotech Report

TABLE OF CONTENTS

1.0 SUMMARY

This report summarizes Geosciences Testing and Research, Inc. (GTR's) geotechnical study to evaluate the subsurface conditions at the site and develop recommendations for the proposed replacement of the Plummer Spring Road Bridge spanning the Artichoke Reservoir. GTR carried out this study in general accordance with our proposal dated June 8, 2018. Our design was performed based on AASHTO 2020 9th Edition Specifications. This report is subject to the limitations in Appendix A.

2.0 INTRODUCTION

2.1 Scope of Study

This report provides recommendations for the design and construction of the new foundations for the proposed bridge replacement. The subsurface investigation and soil profile are described herein. Based on the subsurface conditions, soil design parameters, seismic design parameters, foundation recommendations and construction recommendations are provided.

The scope of this study included the following tasks:

1. Perform a subsurface exploration program consisting of two (2) borings for the bridge replacement.
2. Perform a subsurface exploration program consisting of eight (8) borings and 2 probes for the retaining wall.
3. Evaluate the soil conditions, liquefaction potential, pile capacity, settlement, and other soil properties under or in the vicinity of the proposed abutments.
4. Summarize the results and recommendations in this geotechnical report.

The information provided to us to prepare this report included the following:

1. An undated Preliminary Design plan set with existing conditions entitled "Bridge Replacement Newburyport/West Newbury" prepared by BSC Group. (Attached in Appendix B)
2. An Inspection Report labeled under structure N11007-8BC-MUN-BRI, dated June 21, 2016

Our scope of services did not include an environmental assessment to evaluate the subsurface conditions related to hazardous or toxic materials in the soil, bedrock, surface water, or groundwater around the site. Any statement in this report or on the boring logs regarding odors, suspicious items or conditions is strictly for the information of the client. We recommend engaging a qualified environmental professional, if necessary, to perform environmental services prior to/during construction.

2.2 Existing Conditions

The bridge is located where Plummer Spring Road crosses over the Artichoke Reservoir (see Locus Plan in Figure 1). The existing bridge structure consists of a granite block arch bridge with granite block wingwalls. The bridge is currently closed to vehicle traffic due to the excessive movement observed in the granite block wingwalls. The elevation of the road is around +17 to +18 feet. The existing bridge clear span is around 14.3 feet. The existing structure is approximately 24 feet from stone arch out to out. The existing road width curb to curb is approximately 20 feet wide at the bridge. The bottom of the riverbed elevation is around +2 feet (15 feet below grade). The water in the reservoir at the crossing location is around elevation +12.6 feet and is controlled by a dam downstream. See Appendix B for the existing bridge plans.

2.3 Proposed Construction

We understand that the proposed construction involves demolishing the existing bridge and wingwalls and replacing them with a new single span, Spread Prestressed Box Beam bridge structure. The bridge will be supported on integral abutment foundations. H-piles driven to the dense glacial till and/or bedrock are proposed for the support of the integral abutment. The proposed bridge will have an increased clear span of 41.5 feet. The roadway/bridge width will also be increased to 32.5 feet out to out. The elevation of the roadway will also be increased 1.5 to 2 feet. A Prefabricated Concrete Modular Block Wall (PMB Wall) with geogrid reinforcing with an exposed wall height of 4 to 10 feet is also proposed for the roadway widening. The preliminary bridge and construction plans are presented in Appendix B.

3.0 SUBSURFACE INFORMATION

3.1 Subsurface Exploration Program

The subsurface exploration program consisted of two primary borings designated as BB-1 and BB-2A&C. The subsurface investigation program was completed between February 4, 2019 and February 6, 2019 by Carr-dee Corporation of Medford, MA. A truck mounted Deidrich D50 rotary drill rig with an automatic hammer was used to perform the borings. Hollow stem augers were used to advance the borings to 10 to 20 feet below grade. HW casing (4”-ID) was then used to advance the borings to the final depths. The borings were advanced to depths of 42 and 55 feet below grade, including a 10-foot rock core for BB-1. The additional subsurface exploration program for the retaining wall consisted of eight (8) borings designated as RW-1 through RW-8. The subsurface investigation program was completed between July 7, 2022 and July 8, 2022 by Carr-dee Corporation of Medford, MA. A Mobile Drill B-61 AutoHammer drill rig was used to perform the borings. HW casing (4”-ID) was used to advance the borings were used to advance the borings to 15 to 20 feet below grade. Refer to Figure 2 for the approximate location of the borings with respect to the existing bridge features.

The drilling techniques and sampling methods are noted on the logs. Soil sampling was performed typically in five-foot intervals for the bridge borings and continuous within the zone of influence of the retaining wall. The soil samples were collected using a 2-inch outside diameter, 24-inch long, split-spoon sampler in accordance with ASTM D1586 procedures. The sampler was inserted into the borehole and then advanced 24 inches into undisturbed materials using a 140-pound hammer and a 30-inch drop height. The total number of blows required to advance the sampler the second and third 6-inch intervals is referred to as the Standard Penetration Test (SPT) N-value, which can be correlated to the shear strength and density of the soil. The rock cores were taken with an NX core barrel.

A GTR field representative was on-site during the boring program to observe the drilling activities and log the soil and rock samples. The soil samples were classified according to the Mass DOT Soil Classification Method and subsequently collected in glass jars for further testing and/or identification. Appendix C contains copies of the boring logs prepared by GTR.

3.2 Subsurface Profile

The subsurface conditions below the asphalt pavement typically consist of granular fill, overlying a small pocket of clay or peat, overlying sand, overlying very dense till overlying bedrock.

3.2.1 Granular Fill

The soil immediately beneath the road grade is typical composed of loose to dense, brown, fine to medium sand with varying amounts of gravel, trace wood fibers and trace clayey silt. The SPT-N values ranged between weight of hammer (WOH) and 50 blows for three inches and typically were around 2 to 24 blows per foot (bpf). The granular fill in the boring locations extended to approximately 8 to 18 feet below ground surface (bgs).

3.2.2 Sand

A loose to dense, fine to medium sand with trace to little amounts of silt and gravel underlies the granular fill in borings BB-1, BB-6 and BB-6. The SPT-N values range between 9 and 44 bpf.

3.2.3 Peat

Below the granular fill a layer of amorphous and fibrous peat was encountered in the East Abutment based on cuttings observed on the augers at 18 to 20 feet below road grade and BB-5 at 15 to 19 feet below road grade and the West Abutment in probe P1 at 13 to 15 feet below road grade.

3.2.4 Clay

A gray, medium stiff to very stiff, clay and silt layer exist below the granular fill, sand or peat layer starting at a depth of around 12 to 18.5 feet and extending to 23.5 feet bgs in the West Approach Way and the West Abutment. The SPT-N values ranged between 5 bpf and 37 bpf.

3.2.5 Sand

An approximate 8-foot-thick layer of loose to medium dense, fine to medium sand with trace to little amounts of silt and gravel underlies the clay in the West Abutment in BB-1. The SPT-N values range between 9 and 24 bpf.

3.2.6 Glacial Till

A medium dense to very dense glacial till layer was encountered at around 20 to 31 feet bgs (Elevation -2 ft to -13 ft) in borings BB-1 and BB-2. The glacial till is composed primarily of fine to medium sand and various amounts of gravel and inorganic clayey silt. The SPT N-value was typically between 24 and 100+ in this layer. Based on drilling action, cobbles/boulders were encountered in this layer.

3.2.7 Bedrock

Competent bedrock was cored in boring BB-1 at 44 feet below existing ground surface (Elevation -27.3 ft). The cored bedrock consisted of gray, slightly to moderately weathered, moderately to highly fractured, medium grained, moderately hard, TONALITE/ GRANODIORITE. The RQD ranged from 7% to 14% for the rock cores.

3.2.8 Groundwater

Groundwater was measured in the borings at 5.5 feet to 9 feet below ground surface elevation. The groundwater levels represent conditions during field activities at the time of drilling and, therefore, different levels due to storm events and/or seasonal fluctuations should be anticipated.

3.3 Soil Design Parameters

Table 1 lists the soil parameters recommended for design based on our review of the boring logs and core results. Representative SPT N-values of the soil layers were used to estimate the shear strength.

Table 1. Recommended Soil Design Parameters

Soil Description	Unit Weight (lb/ft^3)	Friction Angle (º)	Su (psf)	Active Earth Pressure , Ka	At Rest Earth Pressure , Ko	Passive Earth Pressure, Kp
Existing Fill	120	32	-	.30	.50	4
New Structural Fill	125	37	-	.27	.50	7
Peat	105	-	250	-	-	-
Clay and Silt	115	-	1000	-	-	-
Glacial Till	135	38	-	.27	.50	7

3.4 Seismic Design Parameters

The recommended seismic design parameters are shown in Table 2 based on the Mass DOT LRFD Bridge Manual and AASHTO Bridge Specifications for LRFD Seismic Bridge Design. The bridge is assumed to be non-critical non-essential. The site soils are not susceptible to liquefaction. Liquefaction is the sudden, temporary loss of soil shear strength due to earthquake motion for soils below the water table. The bridge is single span and is located in seismic design category (SDC) A based on the SD1 < 0.15. Table 3.5-1 - AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition.

Table 2. Recommended Seismic Design Parameters

Parameter	**Value**
Site Class	D
Peak seismic ground acceleration (PGA) coefficient on rock for site class B	0.093g
Horiz rock response spectral acceleration coefficient at .2 sec period (Ss) for site class B	0.181g
Horiz rock response spectral acceleration coefficient at 1 sec period (S_1) for site class B	0.042g
Site factor for converting PGA from site class B to site class D	1.6
Site factor for converting Ss from site class B to site class D	1.6
Site factor for converting S1 from site class B to site class D	2.4
Peak seismic ground acceleration (PGA) coefficient on rock for site class D	0.149 g
Horiz rock response spectral acceleration coefficient at .2 sec period (Ss) for site class D	0.29 g
Horiz rock response spectral acceleration coefficient at 1 sec period (S_1) for site class D	0.101 g

4.0 RECOMMENDED FOUNDATION SYSTEM

4.1 Deep Foundation Recommendations

For integral abutment bridges, slender deep foundation elements are required. We recommend H-pile foundations driven into the dense glacial till and/or near the top of bedrock in accordance with Mass DOT standards. The ability to drive the piles to the required minimum depth depends on several factors such as factored axial load, lateral performance, and soil profile. We understand the preliminary factored axial load per pile is around 207 kips. The allowable H-piles sections for integral abutments in accordance with Mass DOT integral abutment design are HP10x57 and HP12x84 sections. Refer to Appendix D for the associated calculations. A summary of our findings and recommendations are presented below.

1. For the project, we recommend that HP12x84 H-piles be driven into the dense glacial till and/or near the top of rock. Based on static pile calculations, the nominal axial compressive geotechnical resistance is 687 kips when the pile is driven into the dense glacial till and/or near the top of rock. The applicable resistance factor is 0.45 for the method resulting in a factored geotechnical resistance of 306 kips. Reinforced points should be used to protect the pile tips. The estimated pile tip elevation is approximately -27 feet.

2. Sacrificial steel of $1/16^{th}$ of an inch should be incorporated into the design to account for long term corrosion.

3. Based on the additional 1.5 to 2 feet of fill required to raise the road grade, a down drag load will be imposed on the piles from the settlement of the anticipated peat layer. The factored down drag load is 10 kips based on a load factor of 1.4 for the HP12x84 piles and should be added to the above factored axial load stated above.

4. The lateral support of the piles provided by the site soils is sufficient to assume that the piles are fully braced against Euler buckling, assuming appropriate pile installation techniques are employed.

5. The piles and cap should be designed in accordance with Section 3.10 of the Mass DOT LRFD Bridge Manual. Some important considerations include reducing the passive resistance for the cap, displacement, piles embedded a minimum of 2 feet into cap, and a 2.5 feet wide by 3 feet deep trench filled with crushed stone is required.

6. Based on L-pile analyses for the HP12x84, the required minimum penetration below ground surface is 25 feet. The minimum penetration includes the depth to point of fixity and the additional 5 feet penetration required by Mass DOT.

7. Pile spacing is recommended to be a minimum of 3.5 feet to avoid group effects on the lateral performance. The maximum spacing is 10 feet. One pile per beam should be used

8. Pile splicing is not anticipated. Any pile splicing shall be performed in accordance with Mass DOT Standard Specifications. Splices shall not be permitted in the upper 20 feet of the pile.

9. Total and differential settlements for the piles are expected to be less than ½ inch.

10. At this time, we understand that there are no tension loads on the piles. If uplift is needed at a later stage, we can evaluate the uplift performance of the selected pile at that time.

11. Dynamic testing should be performed on at least one pile in each abutment to assess hammer performance, pile integrity, capacity and develop the driving criteria. The required resistance factor of 0.65 (dynamic testing) should be used in conjunction with the factored axial load. Restrike of the test piles should be performed at minimum of 24 hours after end of driving to determine time dependent changes in pile capacity.

12. A Wave Equation Analysis (WEAP) was performed for drivability to establish if the piles can be driven using a commonly available pile driving hammer (Delmag D19-32) and achieve the necessary depths and capacity at a reasonable blow count. A factored axial load of 217 kips and a nominal geotechnical resistance of approximately 334 kips (resistance factor 0.65 dynamic testing) was used to evaluate the hammer. The hammer is capable of installing the piles to the aforementioned required nominal geotechnical resistance. A new WEAP should be performed by the contractor for the hammer proposed to drive the piles.

13. The piles may need to be overdriven (greater than the required nominal resistance stated above) to meet the required minimum penetration and should be accounted for by the contractor when selecting a hammer for the project.

4.2 Retaining Wall Recommendations

1. A Prefabricated Concrete Modular Block Wall (PMB Wall) with geogrid reinforcing is proposed to be used to retain the soil along the roadway. The PMB walls are flexible, can tolerate larger settlements practically for the earthquake conditions, are easily constructed and are generally more cost effective. These walls are typically a delegated design item by the wall manufacturer. The contractor or manufacturer should submit their chosen wall design for review. The submittal should include the assumptions made regarding soil properties, geometry of excavation, lateral earth pressures and surcharge loads, staging and sequencing and wall design calculations. The submittal should be prepared and stamped by a professional engineer licensed in the Commonwealth of Massachusetts and designed in accordance with Mass DOT and AASHTO requirements.

2. Unsuitable soils (peat and loose granular fills) were identified in the soil borings within the zone of influence of the retaining wall. We recommend excavation and replacement with structural fill of any unsuitable bearing material within the zone of influence of the retaining wall.

3. Ground improvement consisting of Rigid inclusions (unreinforced concrete columns, timber piles, pipe piles, etc) can also be performed to support the proposed retaining wall in areas that peat is present. Densification of the existing fill can also be performed by proof rolling (see below) within the existing fill. Test pits during construction should be performed to ensure the peat has been fully removed under the wall.

4. The footings of the walls should be founded a minimum of 4 feet below grade. If ground improvement is used the footing can be founded a minimum of 2 feet below grade based on the wall designer's requirements.

5. Post construction settlement should be limited to 1-inch for the retaining wall system.

6. For resistance to sliding, a friction factor (i.e. coefficient of friction) of 0.5 is recommended for cast-in-place concrete on existing fill. A resistance factor of 0.8 (cast concrete) should be applied to the sliding resistance. The passive pressure in front of the proposed foundations below grade can only be used in the analysis of the sliding resistance if the embedment footing depth is considered permanent

7. For the existing fill or any other compacted backfill acting on the abutment walls, wing walls, an equivalent fluid unit weight of 60 lb/ft^3 (at rest conditions) is recommended. For retaining walls we recommend an equivalent fluid unit weight of 40 lb/ft^3 (active conditions). This assumes that the walls are allowed to rotate. If the walls are restrained from movement, the at-rest value recommended above should be used. These values assume that there is free drainage of water behind the walls. Hydrostatic pressure must be included below the water table.

8. Where the equivalent fluid pressure is less than 300 psf behind the walls, use a pressure of 300 psf to account for compaction induced stresses. Within 4 feet behind the walls, we recommend limiting compaction effort to hand-operated plate compactors. Additional surcharge loads from sloped backfill, vehicle traffic, etc. should also be applied when located within a line extending from the bottom heel of the footing at a slope of 1:1 and extending to the ground surface. To determine the lateral pressure associated with the vertical soil and surcharge loads above, multiply the vertical pressure by 0.5 for at rest conditions and 0.3 for active conditions.

9. A global slope stability analysis was performed based on the final configuration of the retaining wall and roadway. Based on excavation replacement of the unsuitable soils, our analysis of the PMB wall indicates acceptable Factor of Safety during service loading conditions and extreme seismic events.

5.0 CONSTRUCTION CONSIDERATIONS

1. The pile driving contractor should submit the equipment (hammer, crane, etc.) and procedure intended for use on the project along with a wave equation analysis. The wave equation

analysis is performed using the soil information, pile properties, and hammer properties to predict the driving stresses/hammer performance and develop preliminary driving criteria. This will facilitate in sizing the appropriate hammer for the project conditions. The wave equation submittal should be prepared and stamped by a professional engineer licensed in the Commonwealth of Massachusetts. The procedure for performing the dynamic pile testing should also be submitted for review.

2. Pre-construction survey, post-construction survey and vibration monitoring are not anticipated at adjacent properties. No structures are within a 200-foot radius of the project site boundaries.

3. In accordance with OSHA regulations, excavation support is required for any excavation greater than 4 feet. We understand that the project will be completed in one stage. A cofferdam consisting of steel sheeting will be required for demolition of the existing bridge and roadway, construction of the proposed bridge abutments and aid in water control. Excavation depths of around 10 to 19 feet are anticipated depending on bottom of the proposed footing, existing grades, and proposed grades. Any sloping of excavations should be performed at a 1.5H:1V angle or shallower.

4. The water levels are expected to be above the bottom of the abutment excavations. Dewatering of the abutment excavations can most likely be accomplished using sumps. Any water removed from the excavations should be evaluated and, if necessary, disposed of in accordance with local, state and federal regulations. Consideration should be given to the lead-time necessary to test the water and obtain the EPA permit for discharging back into the local storm drains.

5. The contractor should submit their chosen construction staging, excavation support system and dewatering/water control plan for review. The submittal should include the assumptions made regarding soil properties, geometry of excavation, lateral earth pressures and surcharge loads, staging and sequencing, wall design calculations, and control of water procedure. The submittal should be prepared and stamped by a professional engineer licensed in the Commonwealth of Massachusetts and designed in accordance with Mass DOT and AASHTO requirements.

6. The abutments are proposed to be pile supported. A 3 foot deep by 2.5 foot wide trench along the entire length of the abutments is required at the pile locations. The hole should be filled with crushed stone (M2.01.6) after the piles are installed. Refer to Section 3.10 of Mass DOT LRFD Bridge manual for further details. All subgrades should be protected from frost during construction. Compaction and backfill should be performed in accordance with Mass DOT Standard Specifications.

7. The exposed granular sub grades for the retaining wall should be proof-rolled to densify the subgrade soils and detect any areas that may be unsuitable or soft. The proof rolling is also intended for pavement areas, sidewalks, and other locations that may support surface loads.

The proof rolling activities should be observed by a geotechnical engineer to determine the acceptability of the subgrade. Proof rolling should not be performed in wet areas. A base of ¾ inch crushed stone should be used in wet areas to create "dry" conditions. Wet conditions are expected to be worse in the winter/spring periods, where extra precautions should be made during these times. Proof rolling under retaining wall areas and pavement areas should be performed using a minimum of 6 passes with a vibratory drum roller (min 10,000-pound static weight) operating at maximum energy. All utility subgrade soils should be proof-rolled with at least 6 passes of an 8,000 pound (minimum weight) vibratory drum roller or 8 passes with a vibratory plate compactor for small or confined areas.

8. If any footing subgrades are disturbed or unsuitable, a minimum of 12 inches of compacted Gravel Borrow fill (M1.03 Type b specifications) or ¾-inch crushed stone should be placed below the footing immediately after excavation to act as a cover and improve drainage. All subgrades should be protected from frost during construction. Compaction and backfill should be performed in accordance with Mass DOT Standard Specifications.

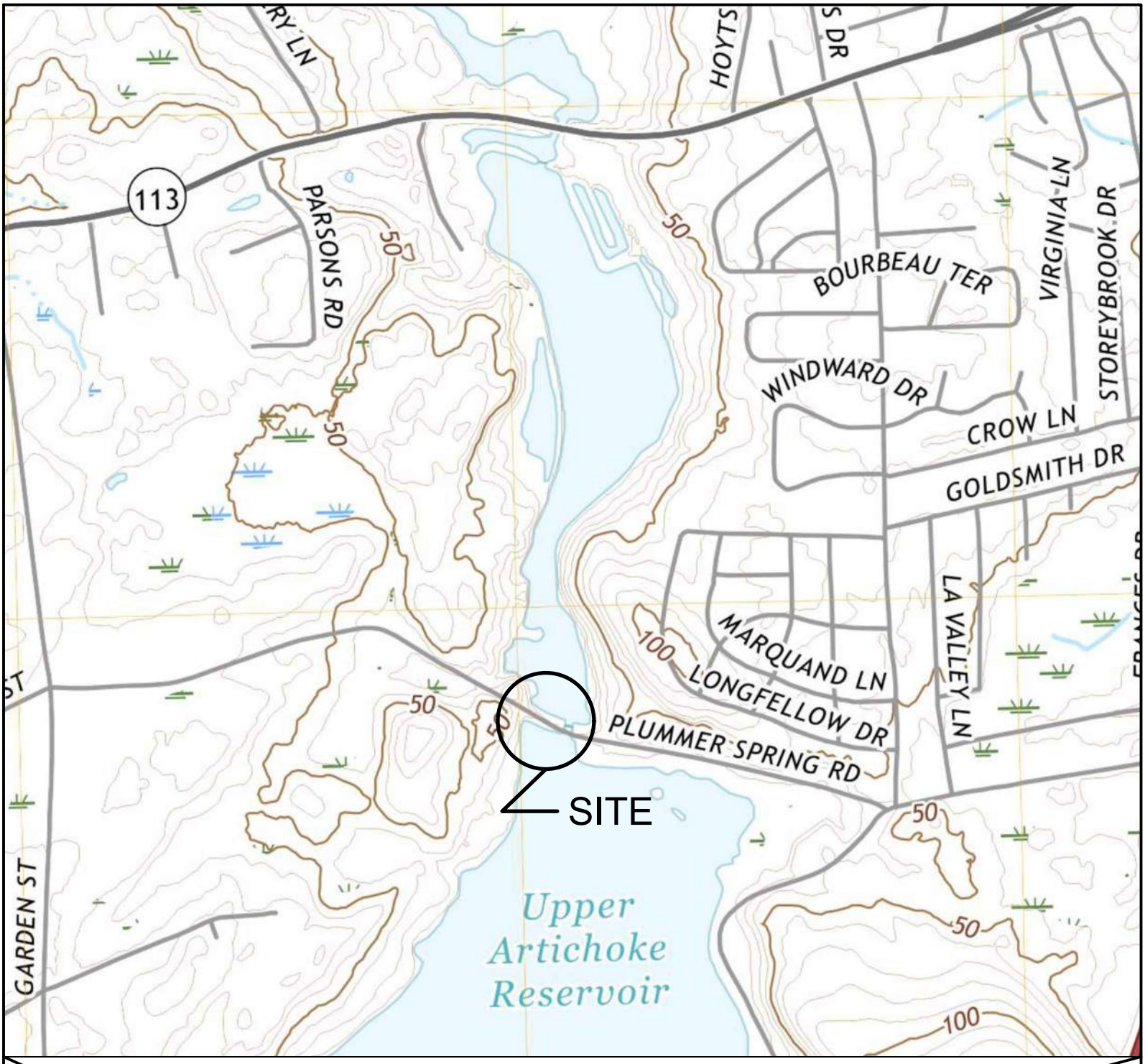
9. Any structural fill material behind any retaining walls should satisfy Mass DOT Gravel Borrow M1.03 Type B specifications. The Gravel Borrow should be placed in layers less than 12 inches in thickness and compacted to not less than 95% of its maximum dry density as determined by ASTM D1557, Method C. The Gravel Borrow should be free of organic material, trash, ice, frozen soil, and other deleterious material.

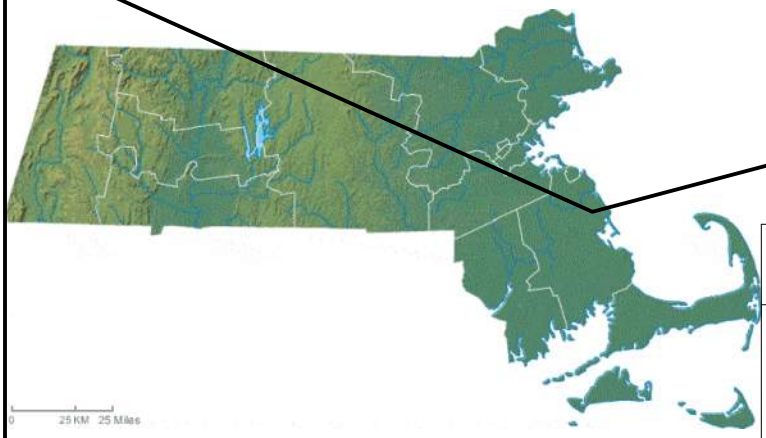
10. Excavated on-site fill meeting the requirements of compacted Gravel Borrow as described above may be re-used. Screening equipment may be necessary to allow the re-use of some of the excavated fill as acceptable backfill. The contractor will need to confirm this by performing selected grain size distribution analyses on the excavated and/or screened material. The results should be submitted to the engineer for review and assessment of suitability for on-site re-use. Any soil removed from the site should be evaluated, and if necessary, disposed of in accordance with local and federal regulations.

11. It is recommended that a geotechnical engineer or qualified technician be present during construction to observe pile driving activities and test pile foundations, observe and confirm that the soils used as fill and backfill and materials proposed for re-use are in accordance with the contract specifications, and observe and test the placement and compaction of Compacted Gravel Borrow and other compacted fills.

12. GTR should be given the opportunity to review final plans and specifications for the foundations systems, piles, earthwork, and other items related to our scope to confirm that the recommendations contained in our report are interpreted and implemented as intended.

FIGURES





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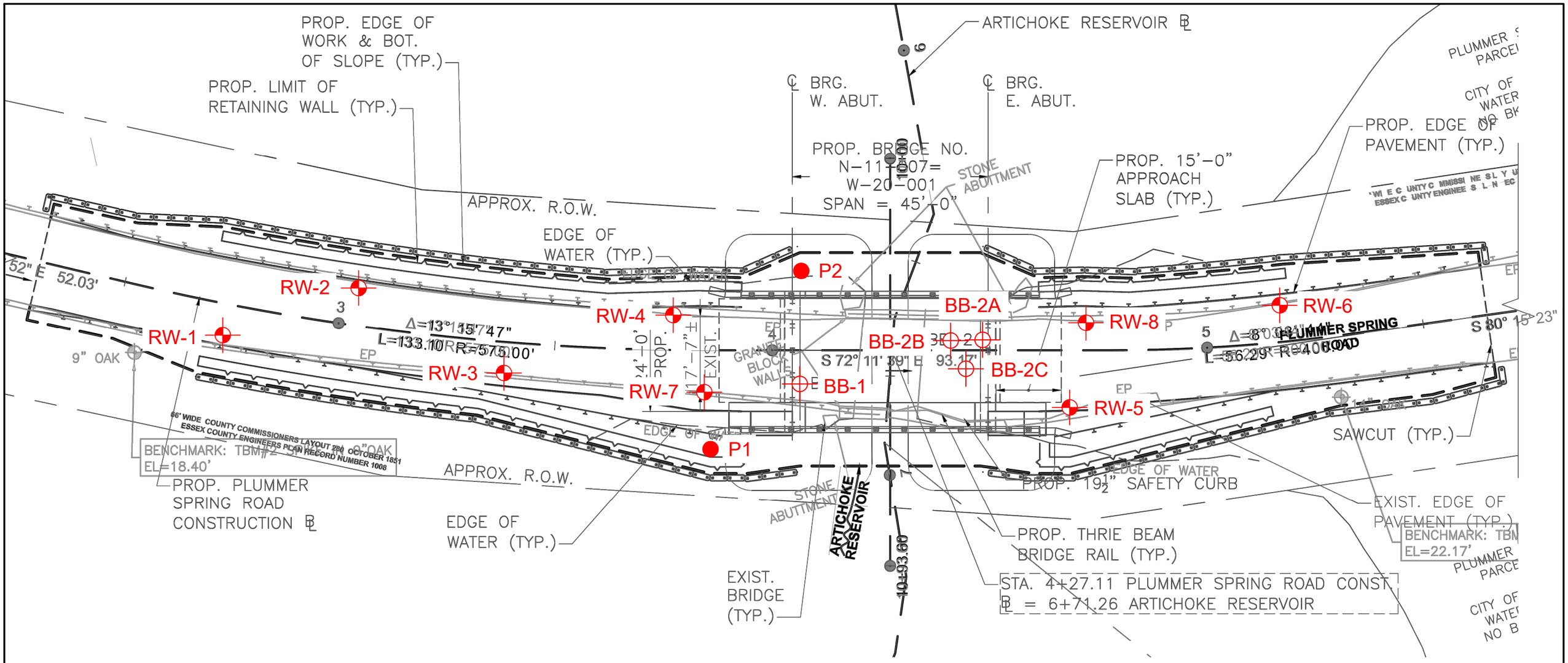
PLUMMER SPRING ROAD OVER ARTICHOKE RIVER - BRIDGE NO. N-11-007=W-20-001
NEWBURYPORT, MASSACHUSETTS

LOCUS PLAN

GEOSCIENCES TESTING AND RESEARCH, INC.
55 MIDDLESEX STREET, SUITE 225
NORTH CHELMSFORD, MA. 01863
(TEL) 978-251-9395
(FAX) 978-251-9396

GTR ENGINEERING SINCE 1995

DRAWN BY:	AJC	SCALE:	N/A	DESIGN BY:
CHK BY:	CAG	PROJECT NO.:	19.107	
DATE:	08/29/2022	SHEET NO.:	1 OF 4	



BB-1 = Location and designation of boring performed by Carr-dee Test Boring & Construction on February 4th, 2019 through February 6th, 2019 and observed by GTR personnel.

RW-1 = Location and designation of boring performed by Carr-dee Test Boring & Construction on July 7th, 2022 through July 8th, 2022 and observed by GTR personnel.

P1 = Location and designation of probes performed by GTR Personnel on July 7th, 2022 and July 8th, 2022.

NOTE:

The locations of borings and probes should be considered approximate to the degree implied by the method used to locate them. Location determined by tape and measure from existing site features.

Boring Locations Plummer Spring Road Over Artichoke Reservoir

Name	Northing	Easting
BB-1	3118162.0652	808856.6015
BB-2A	3118158.1099	808899.4990
BB-2B	3118158.9561	808896.8646
BB-2C	3118155.8558	808897.8503
RW-1	3118213.1986	808734.0596
RW-2	3118213.9304	808767.0992
RW-3	3118185.1840	808792.8998
RW-4	3118185.8987	808834.0589
RW-5	3118137.8732	808914.2393
RW-6	3118145.4665	808967.4360
RW-7	3118166.9332	808835.4063
RW-8	3118155.1964	808923.7848
P1	3118154.0275	808832.8056
P2	3118186.6325	808865.1528

PLUMMER SPRING ROAD OVER ARTICHOKE RIVER - BRIDGE NO. N-11-007=W-20-001 NEWBURYPORT, MASSACHUSETTS

SOIL PROFILE

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55 MIDDLESEX STREET, SUITE 225
NORTH CHELMSFORD, MA. 01863
(TEL) 978-251-9395
(FAX) 978-251-9396
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CHK BY:	CAG	PROJECT NO.:	19.107	
DATE:	08/29/2022	SHEET NO.:	2 OF 4	

NOTE:
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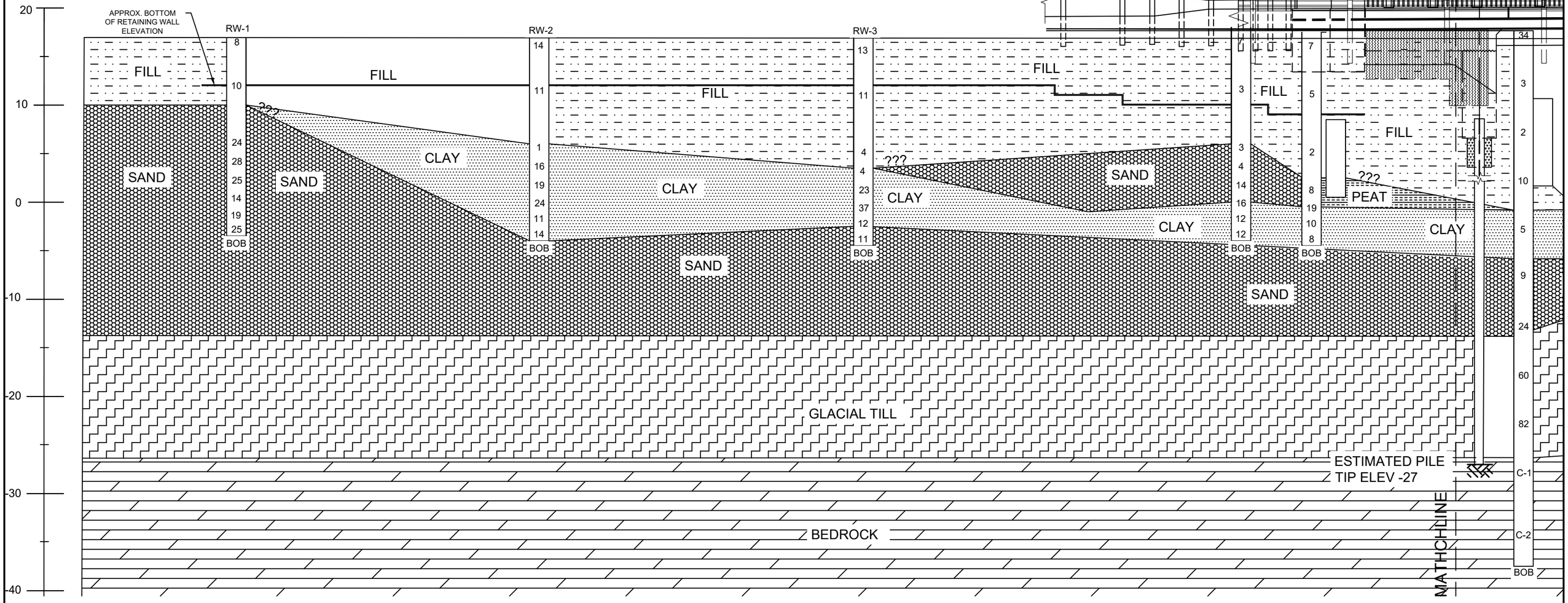

GENERAL NOTES

1. BASE DRAWING ARE BASED ON INFORMATION PROVIDED TO GEOSCIENCES TESTING & RESEARCH, INC. (GTR).
2. THE LOCATION OF BORINGS SHOULD BE CONSIDERED APPROXIMATE.

PLUMMER SPRING ROAD OVER ARTICHOKE RIVER - BRIDGE NO. N-11-007=W-20-001 NEWBURYPORT, MASSACHUSETTS	SOIL PROFILE

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55 MIDDLESEX STREET, SUITE 225
NORTH CHELMSFORD, MA. 01863
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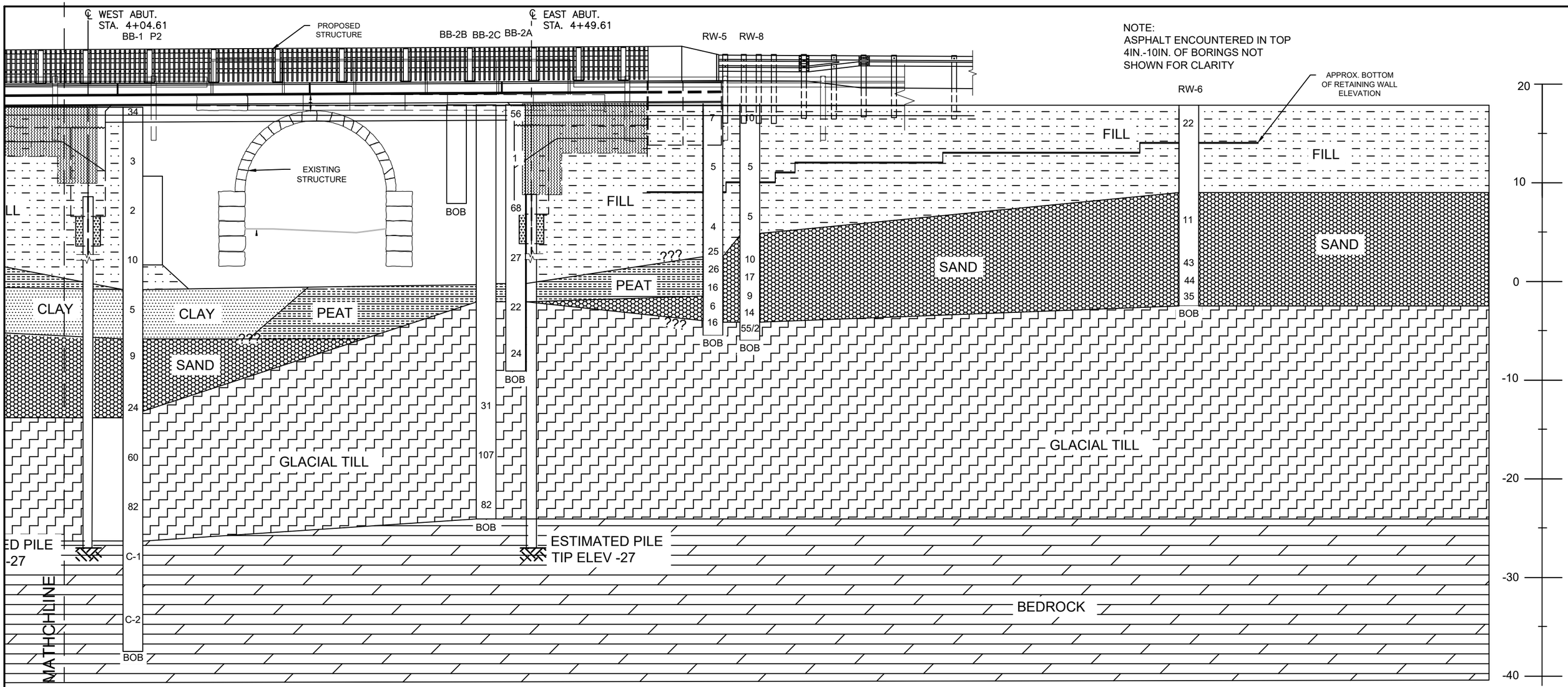

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(FAX) 978-251-9396
GTR ENGINEERING SINCE 1995

DRAWN BY:	SCALE:	DESIGN BY:
ANS	N/A	
CHK BY:	PROJECT NO.:	
CAG	19.107	
DATE:	SHEET NO.:	
08/29/2022	4 OF 4	

APPENDIX A
GEOTECHNICAL LIMITATIONS

GEOTECHNICAL LIMITATIONS

1. The analyses and recommendations in this report are based in part upon the data obtained from the subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations become evident, we will need to re-assess our recommendations provided in this report.
2. The simplified soil profile described in this report is intended to convey trends in subsurface conditions. Limited data was available. The boundaries between the strata are approximate and are idealized to convey trends in the subsurface information. The actual soil transitions are most likely more erratic than presented.
3. Water level readings from the borings are representative at the time of drilling. The data have been reviewed and interpretations have been made in the report. It must be noted, however, that fluctuations in the groundwater level does occur due to variations in rainfall, temperature, and other factors occurring since the measurements were made.
4. In the event that any changes in the nature, function, design, or location of the proposed construction are planned, then the conclusions of this report may become invalid. Geosciences Testing and Research, Inc. (GTR) personnel must review these changes so that they may be incorporated into our report. It is recommended that GTR be provided the opportunity for a general review of the final design and specifications so that our recommendations are properly interpreted and incorporated in the project documents.
5. It is recommended that GTR be retained to provide soil engineering services during the final design and/or construction phases of the project. This will enable compliance with our recommendations and to allow design changes as they become evident during construction as needed.
6. This report has been prepared for the exclusive use of client as related to this project. The report has been carried out in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
7. This geotechnical engineering report has been prepared for this project by GTR, is for design purposes only, and is not intended for bidding purposes. Contractors wishing a copy of this report may do so with the understanding that the scope is limited to design issues only.

APPENDIX B
CONTRACT DOCUMENTS

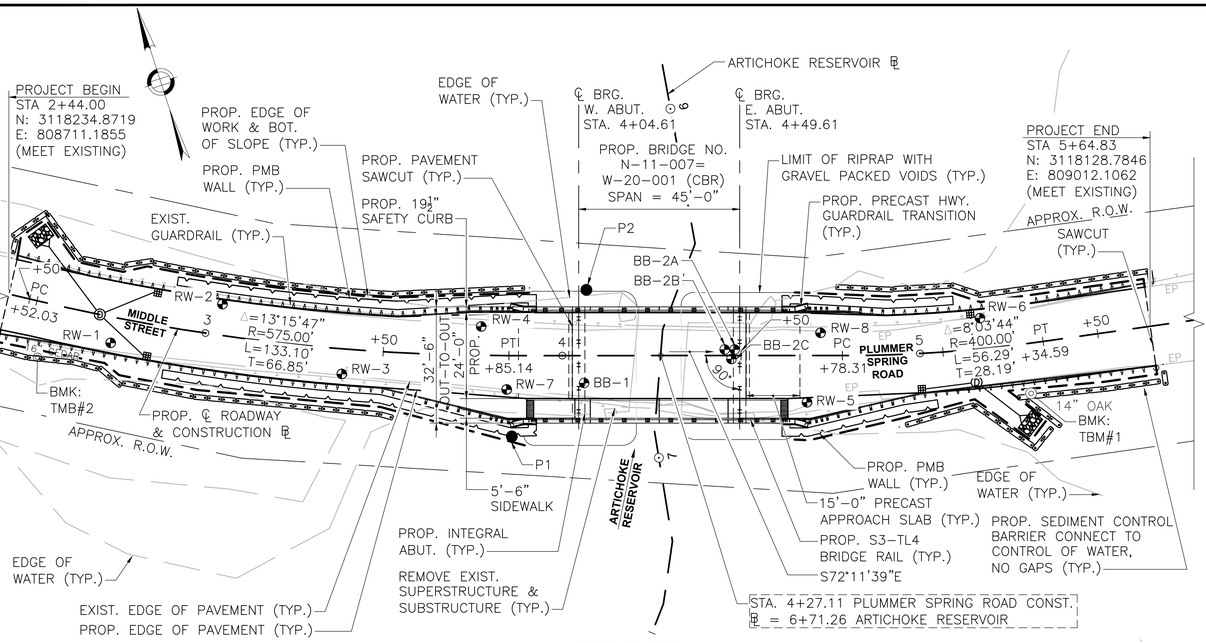
AND

2016 INSPECTION REPORT

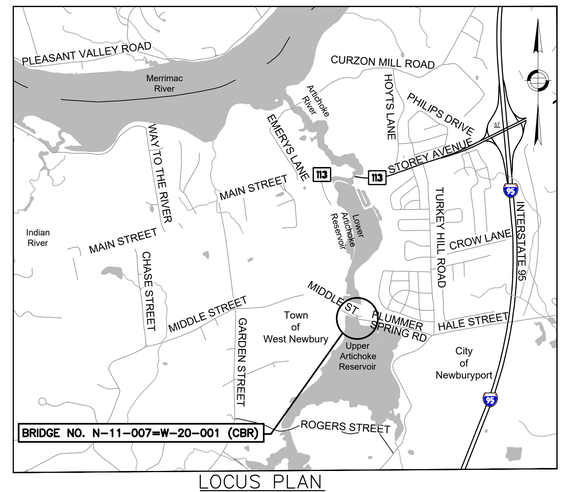
NEWBURYPORT=WEST NEWBURY
PLUMMER SPRING ROAD/MIDDLE STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	15	38
PROJECT FILE NO.		N/A	

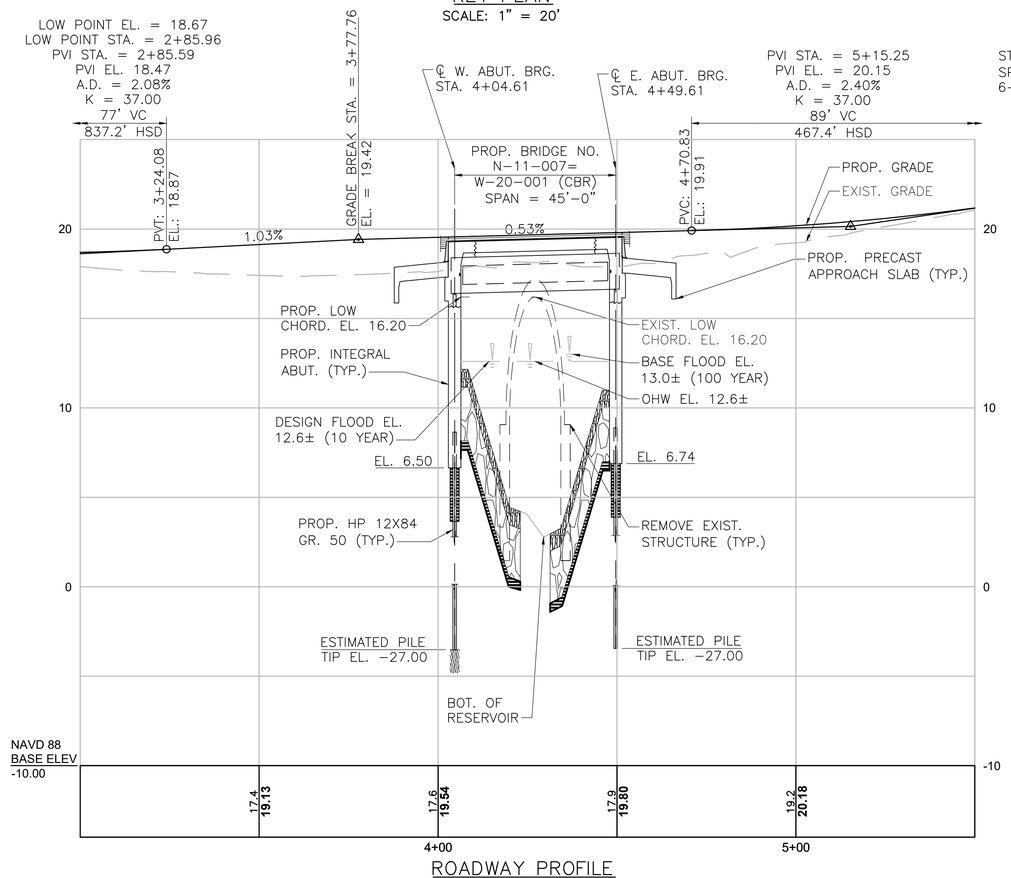
KEY PLAN, LOCUS AND PROFILE



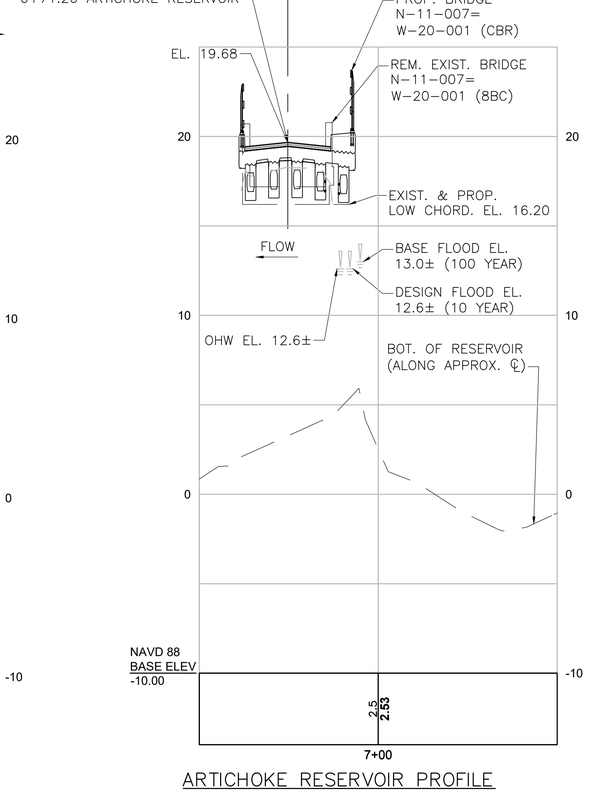
KEY PLAN
SCALE: 1" = 20'



LOCUS PLAN
SCALE: 1" = 2000'



ROADWAY PROFILE
1" = 20' HORIZONTAL
1" = 4' VERTICAL



ARTICHOKE RESERVOIR PROFILE
1" = 20' HORIZONTAL
1" = 4' VERTICAL

INDEX

NOTE:

CONTRACTOR TO REFER TO HIGHWAY PLAN 4 OF 38 AND GEOTECHNICAL REPORT FOR BORING LOCATIONS/BORING LOGS/PROBES (RW-1 – RW-8 AND P1 & P2) AND DESIGN PARAMETERS RELATED TO THE PMB WALLS

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION

PROPOSED BRIDGE
NEWBURYPORT/WEST NEWBURY
PLUMMER SPRING RD./MIDDLE ST.
OVER ARTICHOKE RESERVOIR

BSC GROUP
803 SUMMER STREET
BOSTON, MA 02127
(617) 896-4300
www.bscgroup.com

GENERAL NOTES:

DESIGN:

IN ACCORDANCE WITH THE 2020 (9TH EDITION) AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS FOR HL-93 LOADING.

BENCH MARK:

BENCH MARK 1: TBM#1
NAIL IN 14" OAK
N=3118121.019, E=808974.433, EL.=22.17

BENCH MARK 2: TBM#2
SPIKE IN 9" OAK
N=3118215.642, E=808713.356, EL.=18.40

ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

SURVEY:

AN INSTRUMENT FIELD SURVEY WAS PERFORMED BY BSC GROUP IN SEPTEMBER 2018.
THE COORDINATES, IN FEET, ARE BASED UPON THE NORTH AMERICAN DATUM OF 1983 (NAD 83)

DATE:

TO BE PLACED ON THE INSIDE FACE OF THE NORTHEASTERLY AND SOUTHWESTERLY HIGHWAY GUARDRAIL TRANSITIONS. A SHEET SHOWING THE SIZE AND CHARACTER OF NUMERALS WILL BE FURNISHED. THE DATE USED SHALL BE THE LATEST YEAR OF THE CONTRACT COMPLETION AS OF THE DATE THE BRIDGE IS CONSTRUCTED. BOTH ENDS OF THE BRIDGE SHALL FEATURE THE SAME DATE. SEE SHEET 6 OF 20.

SCALES:

SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR HALF-SIZED PRINTS (A3).

FOUNDATIONS:

FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

UNSUITABLE MATERIAL:

ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

ANCHOR BOLTS:

ALL ANCHOR BOLTS SHALL BE SET BY A TEMPLATE BEFORE THE CONCRETE IS PLACED.
(SEE SHEETS 19 & 20)

REINFORCEMENT:

REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS	#7 BARS	#8 BARS
1. NONE	16"	19"	23"	33"	38"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"	43"	49"
3. COATED BARS, COVER < $3d_b$, OR CLEAR SPACING < $6d_b$	23"	29"	34"	50"	57"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"	40"	46"
5. CONDITION 2. AND 3.	26"	32"	39"	56"	64"
6. CONDITION 2. AND 4.	24"	30"	36"	52"	59"

ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS.
ALL REINFORCEMENT SHALL BE EPOXY COATED.

MEMBRANE WATERPROOFING:

ALL MEMBRANE WATERPROOFING USED ON BRIDGE DECKS SHALL BE MEMBRANE WATERPROOFING (SPRAY-APPLIED) FOR NEW BRIDGE DECKS.

CONCRETE:

CONCRETE TYPE	APPLICATION
CAST IN PLACE	
4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE	LOWER INTEGRAL ABUTMENTS & WINGWALLS
4000 PSI, ¾ INCH, 585 HP CEMENT CONCRETE	DECK SLAB, UPPER INTEGRAL ABUTMENTS & WINGWALLS
4000 PSI, ¾ INCH, 610 CEMENT CONCRETE	BEAM PEDESTALS
5000 PSI, ¾ INCH, 685 HP CEMENT CONCRETE	SAFETY CURB & SIDEWALK
PRECAST	
5000 PSI, ¾ INCH, 685 HP CEMENT CONCRETE	GUARDRAIL TRANSITIONS
4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE	APPROACH SLABS

* SEE SHEET 11 OF 20 FOR PRESTRESSED B36-24 BEAM DETAILS.

CONTRACTOR MUST BE MASSDOT PRE-QUALIFIED IN BRIDGE CONSTRUCTION

STRUCTURAL STEEL:

PILES SHALL CONFORM TO AASHTO M270 GRADE 50.

EXISTING CONDITIONS:

ALL DIMENSIONS AND DETAILS SHOWN FOR THE EXISTING STRUCTURE ARE NOT GUARANTEED TO BE CORRECT. MASSDOT, THE CITY OF NEWBURYPORT AND TOWN OF WEST NEWBURY DO NOT HAVE ANY EXISTING PLANS OF THE STRUCTURE. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR THE COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURACY AND ADEQUACY THEREOF AND SHALL NOT COMMENCE ANY FABRICATION UNTIL THEY HAVE MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE SUBMITTED SHOP DRAWINGS HAVE BEEN APPROVED BY THE ENGINEER. SHOP DRAWINGS SHALL STATE THAT THE EXISTING DIMENSIONS, ANGLES, ELEVATIONS AND FIELD CONDITIONS HAVE BEEN FIELD VERIFIED BY THE CONTRACTOR.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS REQUIRED FOR THE PROPER PERFORMANCE OF THE WORK. FIELD CONDITIONS MAY EXIST, WHICH DEVIATE FROM THE TYPICAL WORK AND THEORETICAL DIMENSION SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR FABRICATION AND FIT OF THEIR WORK.

TRAFFIC NOTES:

THE BRIDGE IS CURRENTLY CLOSED WITH A DETOUR IN PLACE. THE BRIDGE WILL REMAIN CLOSED FOR THE DURATION OF BRIDGE CONSTRUCTION.

UTILITIES:

THE CONTRACTOR SHALL PROTECT THE RESERVOIR FROM DAMAGE/CONTAMINATION. THE CONTRACTOR SHALL COORDINATE AND COOPERATE WITH THE WATER DEPARTMENT. THERE ARE NO KNOWN UTILITIES ABOVE GROUND OR BELOW AT THE SITE LOCATION. THE CONTRACTOR SHALL CONTACT DIG-SAFE BEFORE WORK BEGINS.

CONSTRUCTION:

ANY PERMIT MODIFICATIONS REQUIRED DUE TO THE CONTRACTOR'S MEANS AND METHODS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL MODIFY ALL REQUIRED PERMITS AND LICENSES AND PAY ALL CHARGES AND FEES INCURRED. THE CONTRACTOR SHALL GIVE ALL NOTICES NECESSARY AND INCIDENT TO THE DUE AND LAWFUL PROSECUTION OF THE WORK, AND SHALL COMPLY WITH ALL LAWS, ORDINANCES, RULES, AND REGULATIONS OF THE FEDERAL GOVERNMENT, THE STATE, THE TOWN/CITY, AND OTHER BODIES HAVING JURISDICTION OVER THE WORK AND ENCOMPASSED BY THE CONTRACT. THE COMPLETION DATE WILL REMAIN AS STATED IN THE CONTRACT DOCUMENTS.

AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.

CONSTRUCTION JOINTS:

CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT THE APPROVAL OF BSC GROUP.

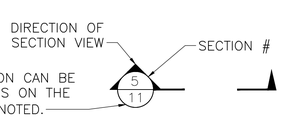
ESTIMATED QUANTITIES
(NOT GUARANTEED)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT
115.1	DEMOLITION OF BRIDGE NO. N-11-007 = W-20-001	1	LS
140.	BRIDGE EXCAVATION	570	CY
143.	CHANNEL EXCAVATION	505	CY
144.	CLASS B ROCK EXCAVATION	90	CY
151.1	GRAVEL BORROW FOR BRIDGE FOUNDATION	290	CY
151.2	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES	35	CY
153.1	CONTROLLED DENSITY FILL - NON-EXCAVATABLE	14	CY
156.13	CRUSHED STONE FOR INTEGRAL ABUTMENT PILES	35	TON
156.5	CRUSHED STONE FOR FILTER BLANKET	105	CY
450.60	SUPERPAVE BRIDGE SURFACE COURSE - 9.5 (SSC-B-9.5)	15	TON
450.70	SUPERPAVE BRIDGE PROTECTIVE COURSE - 9.5 (SPC-B-9.5)	20	TON
698.4	GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL	315	SY
942.124	STEEL PILE HP 12 X 84	360	FT
948.41	DYNAMIC LOAD TEST BY CONTRACTOR	2	EA
948.5	PILE SHOES	10	EA
983.12	RIPRAP WITH GRAVEL PACKED VOIDS	555	TON
983.521	STREAMBED/BANK RESTORATION	110	CY
991.1	CONTROL OF WATER - STRUCTURE NO. N-11-001 = W-20-001	1	LS
994.01	TEMPORARY PROTECTIVE SHIELDING BRIDGE NO. N-11-001 = W-20-001	1	LS
995.01	BRIDGE STRUCTURE, BRIDGE NO. N-11-001 = W-20-001	1	LS

GENERAL NOTE:

THE CONTRACTOR MUST COORDINATE ALL WORK WITH THE CITY OF NEWBURYPORT, THE TOWN OF WEST NEWBURY, THE WATER DEPARTMENT, THE ENGINEER, AND ANY AFFECTED ABUTTERS. WORK SHALL NOT PROCEED WITHOUT WRITTEN APPROVAL FROM THE CITY OF NEWBURYPORT AND THE TOWN OF WEST NEWBURY.

SECTION MARK:



SHEET NUMBER WHERE THE SECTION CAN BE FOUND, NO SHEET NUMBER IF IT IS ON THE SAME SHEET. INSTEAD "-" IS DENOTED.

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	16	38
PROJECT FILE NO.		N/A	

GENERAL NOTES

TRAFFIC DATA

	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2039	
AVERAGE DAILY TRAFFIC - PRESENT	920	
AVERAGE DAILY TRAFFIC - DESIGN YEAR	1120	
DESIGN HOURLY VOLUME	125	
DIRECTIONAL DISTRIBUTION	53% WB	
TRUCK PERCENTAGE - AVERAGE DAY	2.9%	
TRUCK PERCENTAGE - PEAK HOUR	1.6%	
DESIGN SPEED	30 MPH	
DIRECTIONAL DESIGN HOURLY VOLUME	65	

SEISMIC DESIGN CRITERIA

DESIGN RETURN PERIOD:	1000 YEARS
DESIGN SPECTRA	
A_S	0.149
SD_S	0.290
SD1	0.101
SITE CLASS	D
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA

DRAINAGE AREA:	5.60	SQ. MILES
DESIGN FLOOD DISCHARGE:	80.0	C.F.S.
DESIGN FLOOD FREQUENCY:	10	YEARS
DESIGN FLOOD VELOCITY:	0.32	F.P.S.
DESIGN FLOOD ELEVATION:	12.60	FEET, NAVD
BASE (100-YEAR) FLOOD DATA		
BASE FLOOD DISCHARGE:	240	C.F.S.
BASE FLOOD ELEVATION:	13.00	FEET, NAVD
DESIGN AND CHECK SCOUR DATA		
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	25	YEARS
DESIGN FLOOD ABUTMENT SCOUR DEPTH:	0.00	FEET
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY:	50	YEARS
CHECK FLOOD ABUTMENT SCOUR DEPTH:	0.00	FEET
FLOOD OF RECORD		
DISCHARGE:	N/A	C.F.S.
FREQUENCY:	N/A	YEARS
MAXIMUM ELEVATION:	N/A	FEET, NAVD
DATE:	N/A	MONTH, YEAR
HISTORY OF ICE FLOES:	N/A	N.A.
EVIDENCE OF SCOUR AND EROSION:	N/A	N.A.
TEMPORARY WATER CONTROL DESIGN DATA		
DESIGN FLOOD DISCHARGE:	50	C.F.S.
DESIGN FLOOD FREQUENCY:	5	YEARS
DESIGN FLOOD VELOCITY:	0.93	(F.P.S.)
DESIGN FLOOD ELEVATION:	12.63	FEET, NAVD

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

CHAPTER 85 REVIEW 06-24-2021

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	17	38
PROJECT FILE NO.		N/A	

BORING LOG BB-1

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

GTR ENGINEERING SINCE 1995

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB-1
Page: 1 of 2
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Joe/Frank
Start Date: 2/4/2019 End Date: 2/5/2019
Gnd Surface Elev (ft): ~ 17.7'
Location: 808857.91 E , 3118163.09 N
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core
Type	HW	SS	NX
Size I.D.	4"	1.75"	2.16"
Hammer Wt.	300 lb	140 lb	-
Hammer Fall	30 in	30 in	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
2/5	7am	5.5'	45'	

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
		SS-1A	24/16	0.7-1.7	59-20		S-1A,Dry, brown, dense, fine SAND, little Silt, trace Gravel	ASPHALT 8"		1,2
		SS-1B		1.7-2.7	14-8		S-1B, Dry, brown, Hard, Clayey SILT, trace fine Sand			
5		S-2	24/15	5-7	2-3		Wet, Brown, very loose, fine to medium SAND, little Clayey Silt, trace Gravel			
					1 for 12"					
10		SS-3	24/14	10-12	3-2		Wet, Brown, very loose, fine to medium SAND, trace Silt, trace Gravel	FILL		
					1 for 12"					
15		SS-4	24/12	15-17	20-7		Wet, Brown, loose, fine to medium SAND, some Gravel			
					3-7			18.5'		
20		SS-5	24/20	20-22	3-2		Gray, medium stiff, CLAY & SILT	CLAY		
					3-3			23.5'		
25		SS-6	24/12	25-27	4-4		Gray, loose, fine to medium SAND, little Silt, trace Gravel	SAND		
					5-7					

ELEVATION (FEET): 15.00, 10.00, 5.00, 00.00, −5.00, −10.00

OBSERVED GROUND WATER EL. 12.2± FEBRUARY 5, 2019

BOT. OF WEST INTEGRAL ABUT. EL. 6.50

NOTES:
1. Water level checked prior to starting the second day of drilling.
2. The upper 15 feet of the boring was completed with 4-inch hollow stem augers.

CONTINUATION

CONTINUATION

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test Results	Description and Classification	Stratum Description	Additional Data	Notes
30		SS-7A	24/14	30-31	10-7		SS-7A, Gray, medium dense, fine to medium SAND, little Gravel, trace Silt	SAND		
		SS-7B		31-32	17-12		SS-7B, Gray, medium dense, fine to medium SAND, some Clayey Silt, some Gravel	31'		
35		S-8	24/12	35-37	17-24		Gray, very dense, GRAVEL, some fine to coarse Sand, trace Clayey Silt			
					36-31			GLACIAL TILL		
40		SS-9	24/10	40-42	37-37		Gray, very dense, fine to medium SAND, little Gravel, little Silt			
					45-51					
45		SS-10	2/0	45-45.2	100 for 2"		No Recovery			3
		C-1	60/51	45.2-50.2	5:45 min		Gray, slightly to moderately weathered, moderately to highly fractured, medium grained, moderately hard, TONALITE/ GRANODIORITE	44'		
					6:30 min					
					6:45 min					
50					6:15 min					
					5:45 min					
		C-2	60/54	50.2-55.2	4:45 min		Gray, slightly to moderately weathered, moderately to highly fractured, medium grained, moderately hard, TONALITE/ GRANODIORITE	BEDROCK		
					4:00 min					
					6:00 min					
55					6:30 min					
					6:30 min					
							Bottom of boring at 55.2 feet below ground surface with 10 foot rock core.	55.2'		

ELEVATION (FEET): −15.00, −20.00, −25.00, −30.00, −35.00, −40.00

APPROX. PILE TIP EL. −27.00 (±)

NOTES:
3. Based on drilling action top of rock is at approximately 44 feet below ground surface.

Order of Sample Description (Modified Burmister)
1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size; "some" - 20% to 35% minor grain size; "little" - 10% to 20% minor grain size; "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)		Cohesive Soils (Clays)	
Relative Density / Blows per Foot		Consistency / Blows per Foot	
Very Loose	0 - 4	Very Soft	Below 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

NOTES:
1. LOCATION OF BORINGS FROM FEBRUARY 2019 ARE SHOWN ON THE PLAN THUS: BB−# ◔. LOCATION OF BORINGS FROM JULY 2022 ARE SHOWN ON THE PLANS AS THUS: RW−# ◔. LOCATIONS OF PROBES FROM JULY 2022 ARE SHOWN ON THE PLANS AS THUS: P# ●.
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORINGS LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1⅜" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. ALL BORINGS WERE MADE IN FEBRUARY, 2019 & JULY, 2022.
6. FEBRUARY 2019 & JULY 2022 BORINGS WERE MADE BY CAR−DEE TEST BORING & CONSTRUCTION, LOCATED AT 37 LINDEN ST., MEDFORD, MA 02155.
7. ALL PROBES FROM JULY 2022 WHERE MADE BY GEOSCIENCES TESTING AND RESEARCH INC. LOCATED AT 55 MIDDLESEX ST. NORTH CHELMSFORD, MA 01863
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.
9. BORING LOG FOR BORING BB−2B IS NOT AVAILABLE. BORING BB−2B ENCOUNTERED OBSTRUCTION AT 10 FEET BELOW GROUND SURFACE AND RELOCATED TO BB−2C.

BORING LOG BB−1
SCALE: 1/4" = 1'−0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER DATE

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

SHEET 3 OF 20 SHEETS BRIDGE NO. N−11−007 = W−20−001 (CBR)

CHAPTER 85 REVIEW 06-24-2021

2839500_BR2-5(N11007_W20001).DWG Plotted on 13-Dec-2022 10:31 AM

Drawing name: \\Docket\box\Projects-800\2839500\Structural\Drawings\Program\2839500_BR2-5(N11007_W20001).dwg
Plotted on: Tuesday, December 13, 2022 - 10:31am by 129858

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB-2A
Page: 1 of 2
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Frank
Start Date: 2/5/2019 End Date: 2/6/2019
Gnd Surface Elev (ft): ~ 17.9'
Location: 808900.72 E, 3118159.80 N
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Type	HW	SS	-	Date	Time	Water	Casing	Hole
Size I.D.	4"	1.75"	-	2/6	7am	6'	25'	
Hammer Wt.	300 lb	140 lb	-					
Hammer Fall	30 in	30 in	-					

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
		SS-1A	18/10	0.7-2.2	21-17		Dry, brown, dense, fine to medium SAND, little Silt, little Gravel	ASPHALT 8"		1,2
		SS-1B			39					
5		S-2	24/0	5-7	1-1		No Recovery			
					WOH for 12"					
		S-3	24/0	7-9	WOH for		No Recovery			
					24"					
10		SS-4	15/6	10-11.3	15-18		Wet, Brown, very dense, GRAVEL, little Sand, trace Silt	FILL		
					50 for 3"					3
15		SS-5	24/10	15-17	6-18		Wet, Brown, medium dense, fine to medium SAND, some Gravel, trace Clayey Silt, trace Wood Fibers			
					9-9			18' PEAT		4
20		SS-6	24/6	20-22	7-10		Gray, medium dense, GRAVEL, some fine Sand, trace Silt	20'		
					12-16			GLACIAL TILL		
25		SS-7	24/7	25-27	46-10		Gray, medium dense,GRAVEL and fine to medium Sand, trace Clayey Silt			
					14-14					5
							Bottom of boring at 27 feet below ground surface due to battered casing.	27'		

ELEVATION (FEET): 15.00, 10.00, 5.00, 00.00, −5.00, −10.00

OBSERVED GROUND WATER EL. 11.9± FEBRUARY 6, 2019

BOT. OF EAST INTEGRAL ABUT. EL. 6.74

NOTES:

1. Water level checked prior to starting the second day of drilling.
2. The upper 20 feet of the boring was completed with 4-inch hollow stem augers.
3. Boulder/Cobbles encountered at 10 to 15 feet below ground surface
4. Peat/Organic Silt observed on the augers at approximately 18 to 20 feet below ground surface.
5. Due to obstructions encountered casing was battered to much to continue drilling. Casing removed and rig moved ahead for BB-2B

Order of Sample Description (Modified Burmister)

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)		Cohesive Soils (Clays)	
Relative Density / Blows per Foot		Consistency / Blows per Foot	
Very Loose	>> 0 - 4	Very Soft	>> Below 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

NOTE:
FOR BORING NOTES SEE SHEET 3 OF 20.
SEE BORING LOG NOTE 5 (THIS SHEET) FOR INFORMATION ON BORING BB−2B.

BORING LOG BB−2A
SCALE: 1/4" = 1'−0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

CHAPTER 85 REVIEW 06-24-2021

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

GTR ENGINEERING SINCE 1995

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB -2C
Page: 1 of 1
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Frank
Start Date: 2/6/2019 End Date: 2/6/2019
Gnd Surface Elev (ft): ~ 17.9'
Location: 808897.04 E, 3118156.24 E
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	300 lb	140 lb	-
Hammer Fall	30 in	30 in	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
2/6	7am	6'	25'	
Results from boring BB-2A				

Depth	Case BPF	Sample Data: No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
15.00								ASPHALT 8"		1,2
5										
10.00								FILL		
10										
5.00										3
15										
00.00								18' PEAT 20'		
20										
-5.00										
25								GLACIAL TILL		
-10.00										

ELEVATION (FEET)

OBSERVED GROUND WATER EL. 11.9± FEBRUARY 6, 2019

BOT. OF EAST INTEGRAL ABUT. EL. 6.74

CONTINUATION

CONTINUATION

Depth	Case BPF	Sample Data: No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test Results	Description and Classification	Stratum Description	Additional Data	Notes
30		SS-8	24/10	30-32	15-14		Gray, dense, GRAVEL and fine to coarse Sand, trace Clayey Silt			
-15.00					17-19					4
35		S-9	24/8	35-37	27-36		Gray, very dense, GRAVEL, some fine to coarse Sand, trace Clayey Silt	GLACIAL TILL		
-20.00					71-45					
40		SS-10	24/10	40-42	37-37		Gray, very dense, fine to medium SAND, little Gravel, little Clayey Silt			
-25.00					45-51		Bottom of boring at 42 feet below ground surface with no refusal encountered.	42'		
45										
-30.00										
50										
-35.00										
55										
-40.00										

ELEVATION (FEET)

APPROX. PILE TIP EL. -27.00 (±)

NOTES:
1. Stratum description from boring BB-2A. Boring BB-2B encountered obstruction at 10 feet below ground surface and relocated to BB-2C.
2. The upper 10 feet of the boring was completed with 4-inch hollow stem augers.
3. Boulder/Cobbles encountered at 5 to 15 feet below ground surface

NOTES:
3. Based on drilling action a cobble/boulder was encountered at approximately 32 to 33 feet below ground surface.

Order of Sample Description (Modified Burmister)
1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

NOTE:
FOR BORING NOTES SEE SHEET 3 OF 20.
SEE BORING LOG NOTE 1 (THIS SHEET) FOR INFORMATION ON BORING BB-2B.

BORING LOG BB-2C
SCALE: 1/4" = 1'-0"

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MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

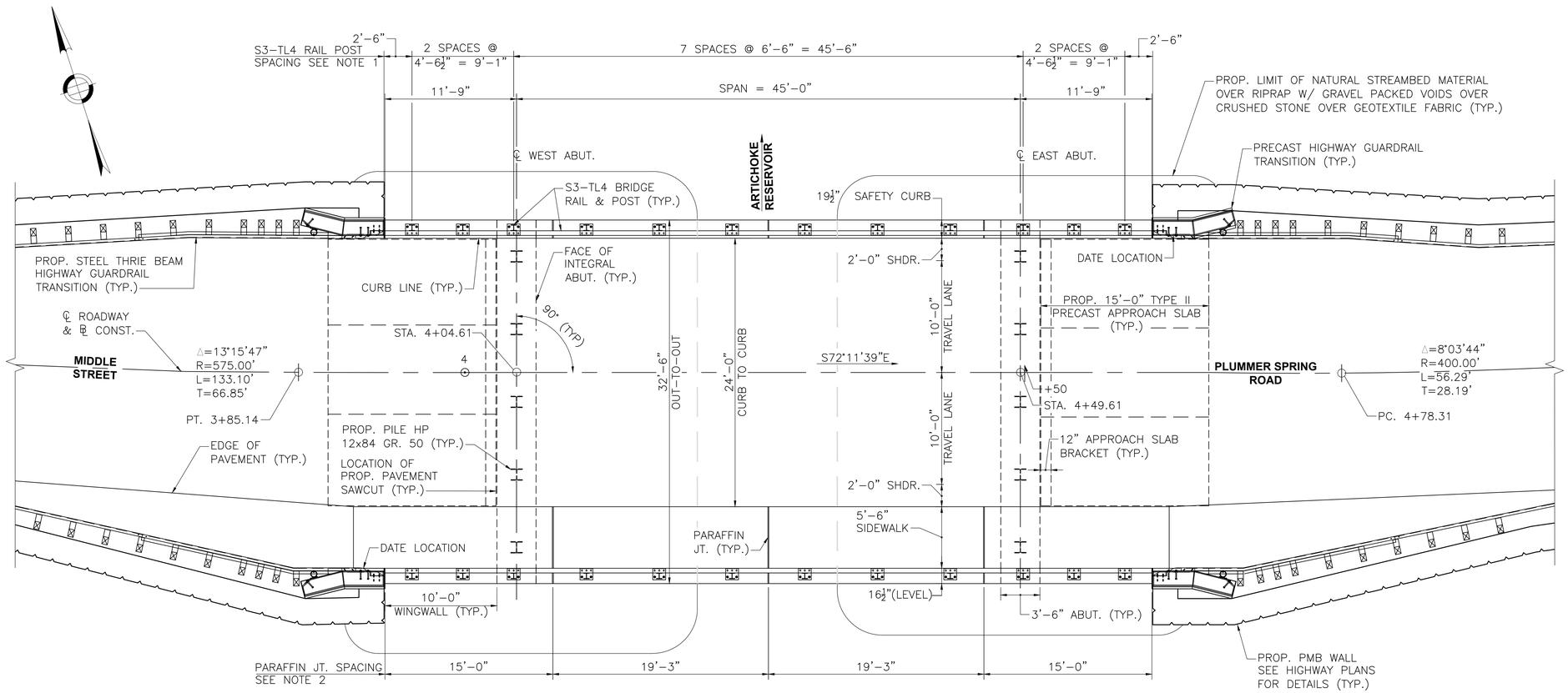
STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

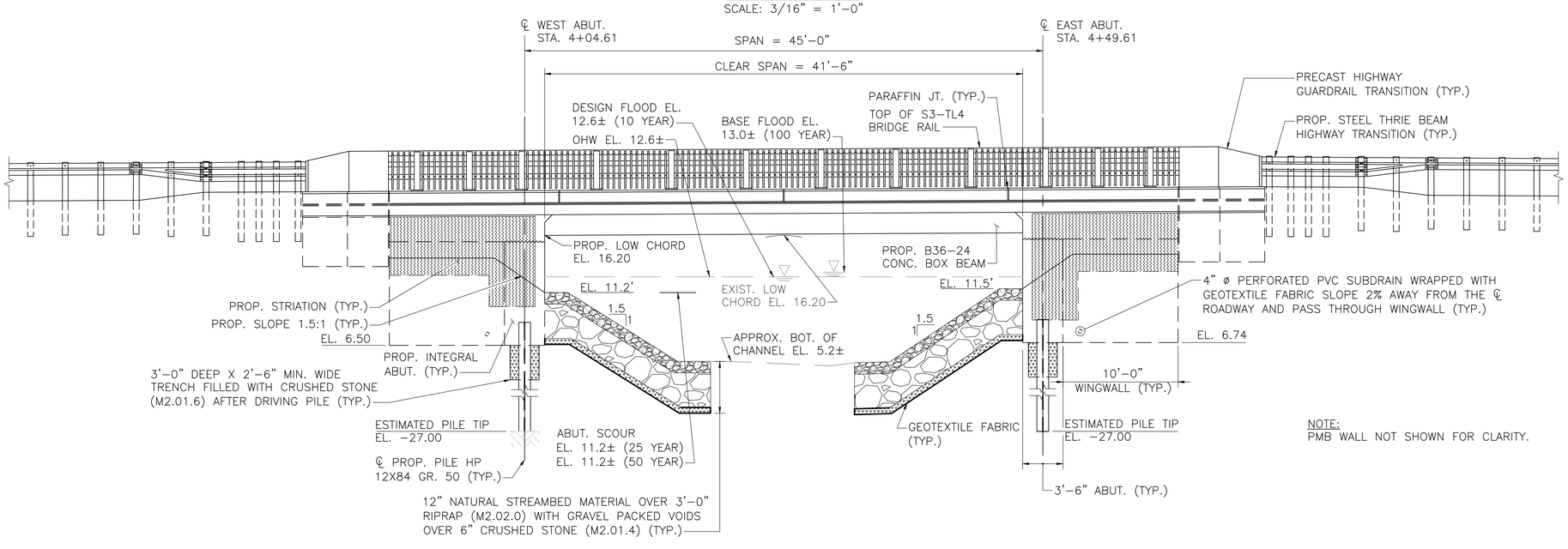
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	20	38
PROJECT FILE NO.		N/A	

PROPOSED PLAN & ELEVATION



GENERAL PLAN

SCALE: 3/16" = 1'-0"



PROPOSED SOUTH ELEVATION

SCALE: 3/16" = 1'-0"

NOTE:
PMB WALL NOT SHOWN FOR CLARITY.

NOTES:

1. BRIDGE RAIL POST SPACING IS DIMENSIONED FROM FACE OF PRECAST HIGHWAY TRANSITION TO CENTER LINE OF POST.
2. PARAFFIN JOINT IS DIMENSIONED FROM START OF BRIDGE SAFETY CURB TO CENTER LINE OF JOINT.
3. SEE SHEET 14 & 15 OF 20 FOR ADDITIONAL ELEVATIONS.
4. PMB WALLS NOT SHOWN IN ELEVATION FOR CLARITY.
5. CONTRACTOR TO REFER TO PERMIT DRAWINGS, WITHIN THE ISSUED PERMITS CONTAINED IN THE CONTRACT DOCUMENTS, FOR LIMITS OF THE PROPOSED CONTROL OF WATER SYSTEM.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
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STATE BRIDGE ENGINEER — DATE

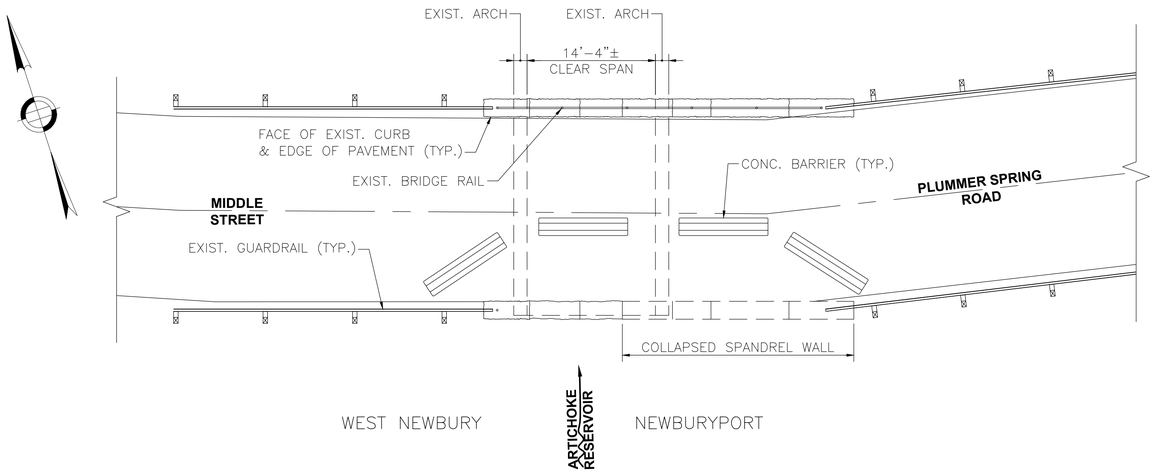
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

CHAPTER 85 REVIEW 06-24-2021

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	21	38
PROJECT FILE NO.		N/A	

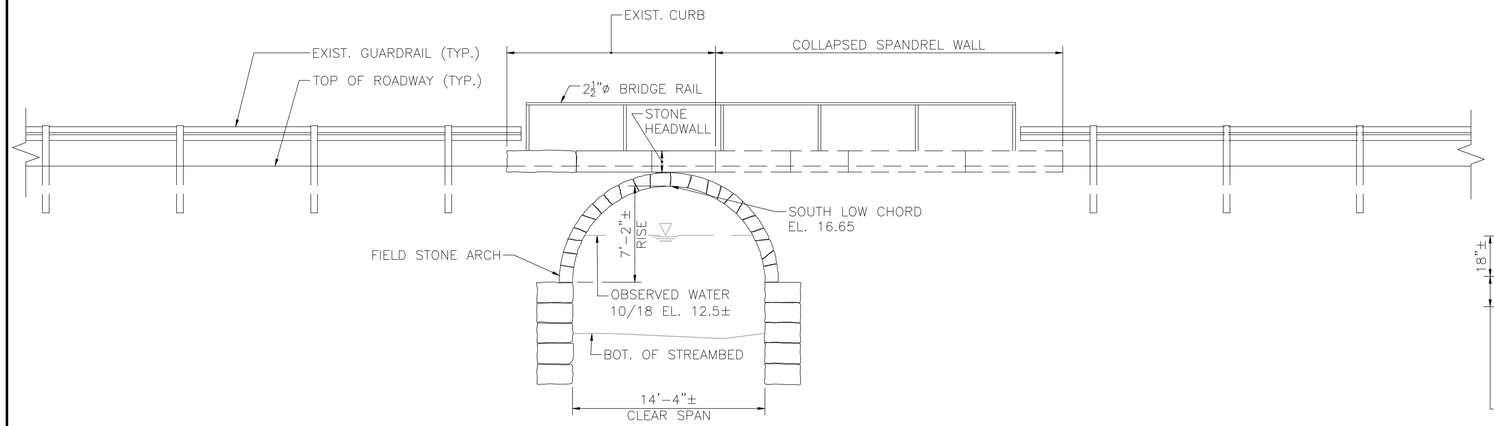
EXISTING CONDITIONS



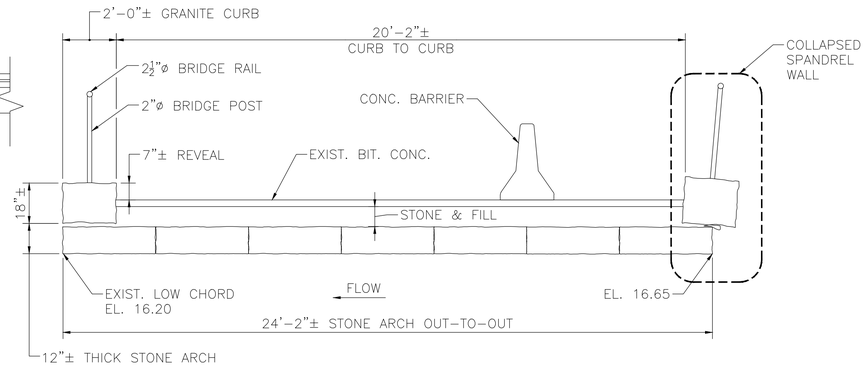
EXISTING PLAN
SCALE: 1/8" = 1'-0"

NOTES:

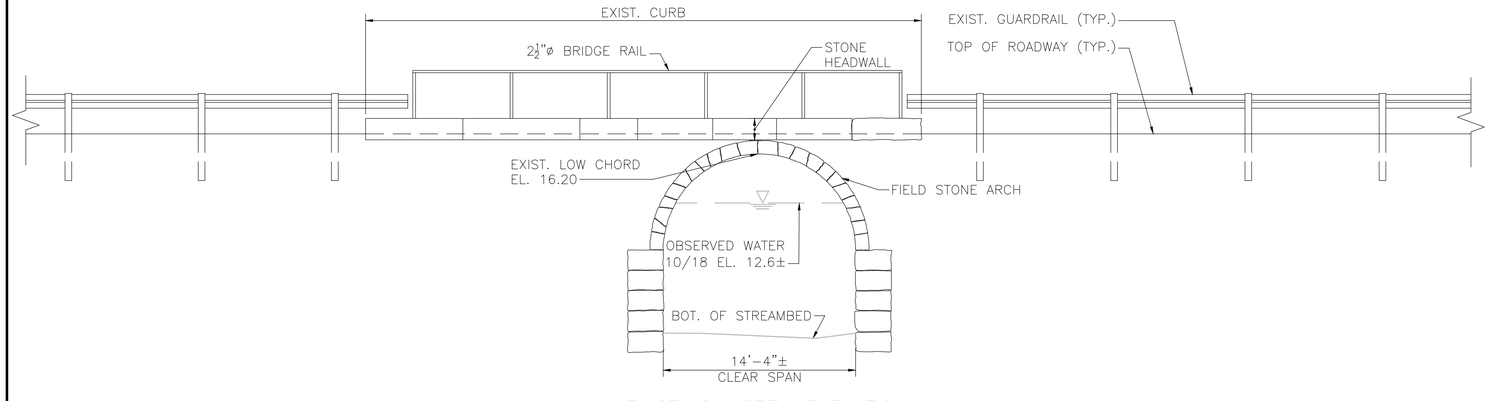
1. THE ENTIRE EXISTING BRIDGE AND SUBSTRUCTURE WILL BE DEMOLISHED INCLUDING ALL WINGWALLS, SPANDREL WALLS, ARCH AND FOOTINGS ETC.
2. SKETCHES WERE BASED OFF LIMITED EXPLORATORY INVESTIGATION AND ARE CONCEPTUAL ONLY. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENTS AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUACY AND ACCURACY THEREOF, AND SHALL NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.
3. ALL DEMOLITION ACTIVITIES SHALL OCCUR IN THE DRY.
4. CONTRACTOR SHALL SUBMIT A CONTROL OF WATER, TEMPORARY PROTECTIVE SHIELDING, DEMOLITION PLAN AND PROCEDURE BEFORE THE START OF DEMOLITION.
5. THE CONTRACTOR SHALL DISPOSE OF ANY DEMOLITION DEBRIS, CONSTRUCTION DEBRIS, WOOD WASTES, CONTAMINATED SOILS, HAZARDOUS MATERIALS AND OTHER MATERIALS OR SPECIAL WASTES IN STRICT ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS.
6. THE CONTRACTOR MUST COORDINATE ALL WORK WITH THE CITY OF NEWBURYPORT, THE WATER DEPARTMENT, THE TOWN OF WEST NEWBURY, THE ENGINEER AND ANY EFFECTED ABUTTERS. WORK SHALL NOT PROCEED WITHOUT WRITTEN APPROVAL FROM THE CITY OF NEWBURYPORT AND THE TOWN OF WEST NEWBURY.



EXISTING SOUTH ELEVATION
SCALE: 3/16" = 1'-0"



EXISTING TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"



EXISTING NORTH ELEVATION
SCALE: 3/16" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
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STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

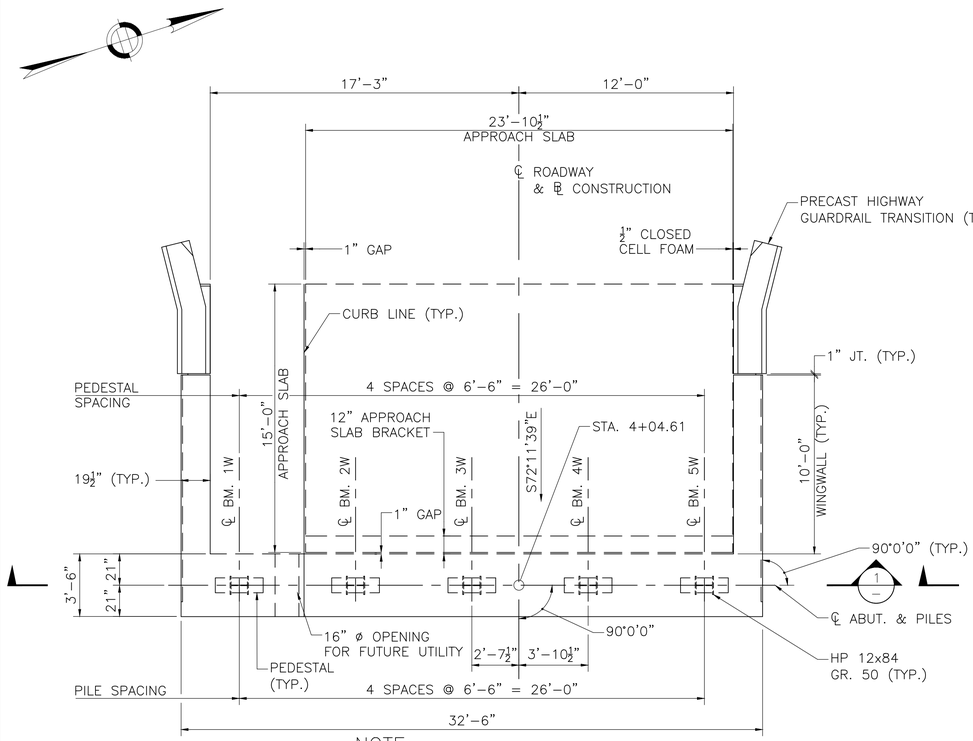
CHAPTER 85 REVIEW 06-24-2021

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	22	38
PROJECT FILE NO.		N/A	

ABUTMENT PLAN & SECTION

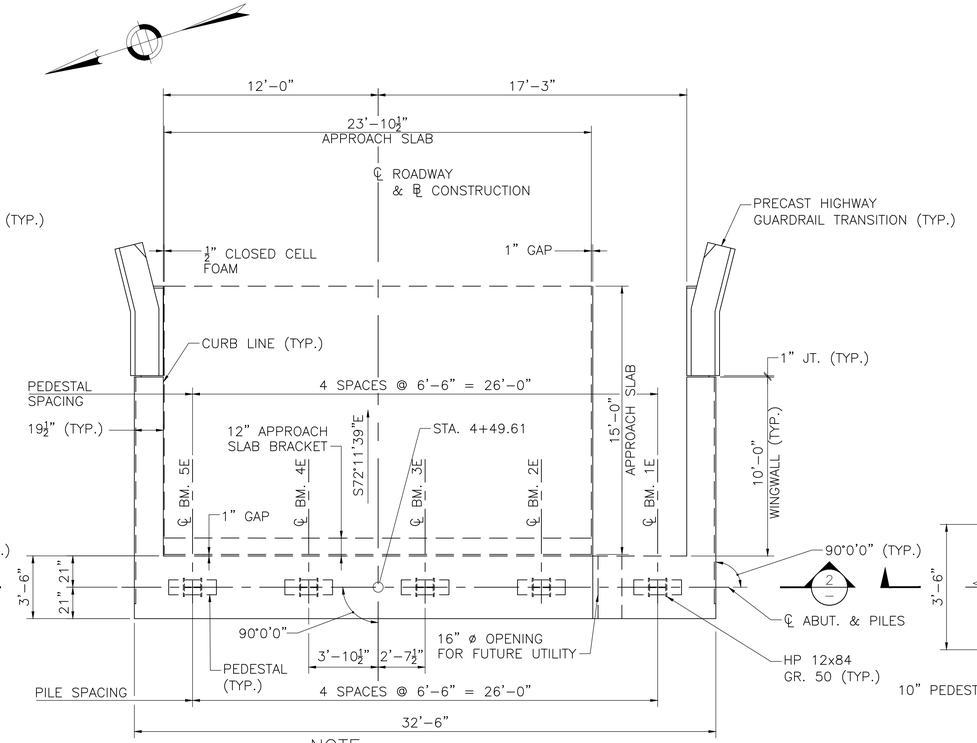
NOTES:
1. ALL ELEVATIONS ARE SHOWN AT ABUTMENT CENTERLINE.
2. DETAILS ABOVE DECK LEVEL ARE NOT SHOWN FOR CLARITY.
3. TOP OF PEDESTAL ELEVATIONS DO NOT INCLUDE ERECTION PAD THICKNESS.



NOTE:
BEAMS NOT SHOWN FOR CLARITY.

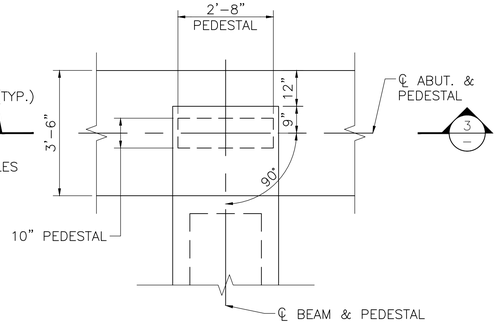
WEST ABUTMENT PLAN
SCALE: 1/4" = 1'–0"

TOP OF PEDESTAL ELEVATIONS			
BM. #1W	16.11	BM. #1E	16.35
BM. #2W	16.24	BM. #2E	16.48
BM. #3W	16.37	BM. #3E	16.61
BM. #4W	16.35	BM. #4E	16.58
BM. #5W	16.21	BM. #5E	16.45

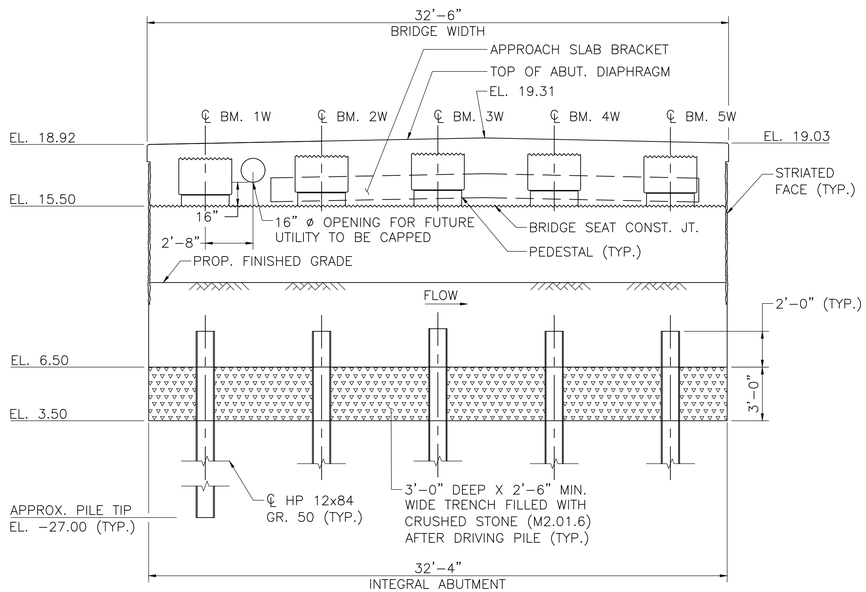


NOTE:
BEAMS NOT SHOWN FOR CLARITY.

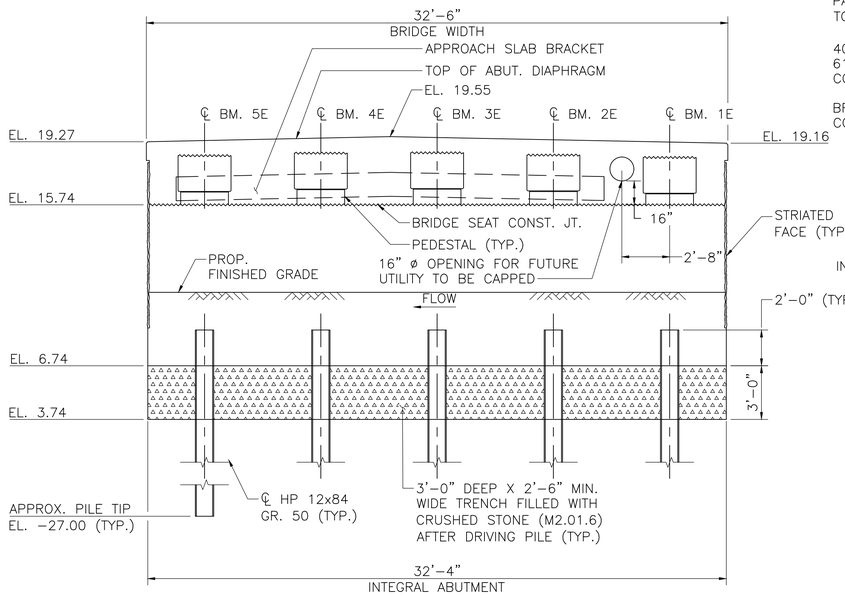
EAST ABUTMENT PLAN
SCALE: 1/4" = 1'–0"



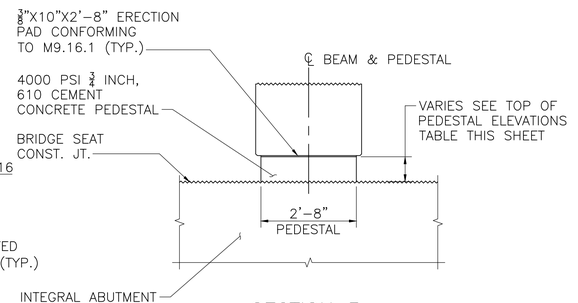
PEDESTAL PLAN
SCALE: 1/2" = 1'–0"



SECTION 1 – WEST ABUTMENT
SCALE: 1/4" = 1'–0"



SECTION 2 – EAST ABUTMENT
SCALE: 1/4" = 1'–0"



SECTION 3
SCALE: 1/2" = 1'–0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

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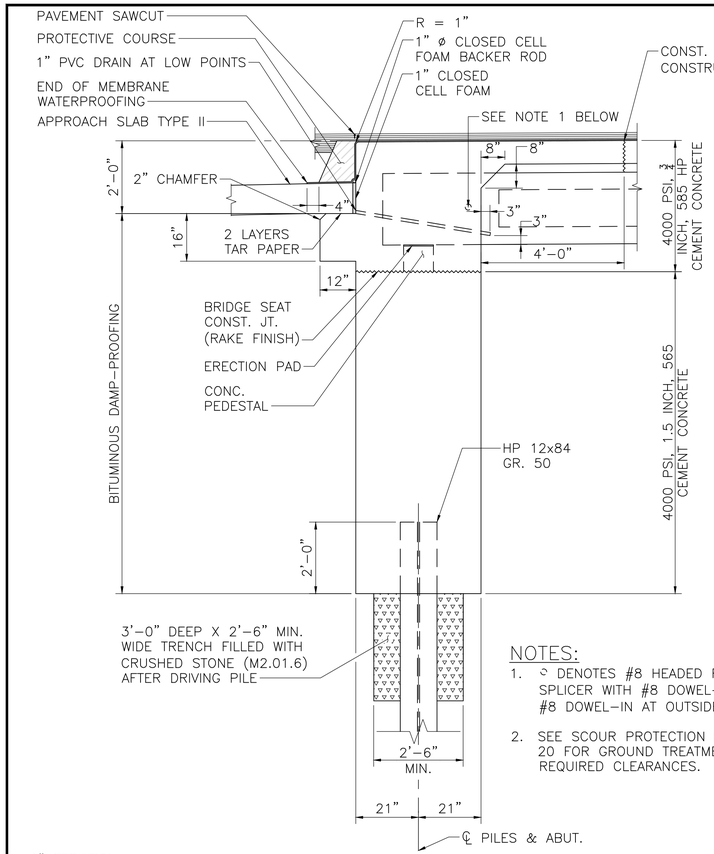
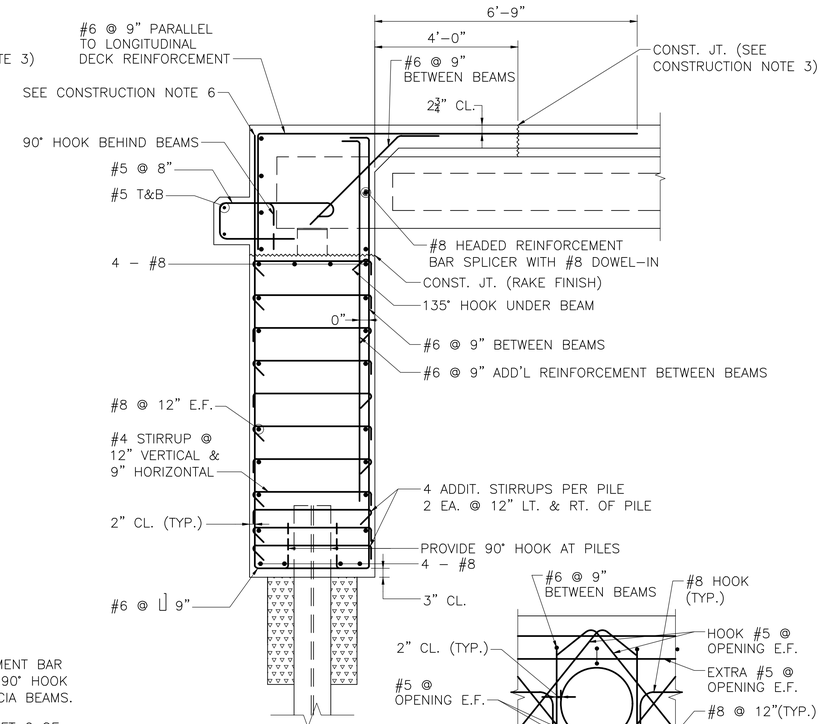
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	23	38
PROJECT FILE NO.		N/A	

ABUTMENT DETAILS

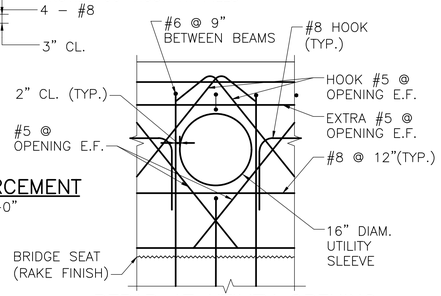


ABUTMENT SECTION
SCALE: 1/2" = 1'-0"

NOTES:
1. ○ DENOTES #8 HEADED REINFORCEMENT BAR SPLICER WITH #8 DOWEL-IN. USE 90° HOOK #8 DOWEL-IN AT OUTSIDES OF FASCIA BEAMS.
2. SEE SCOUR PROTECTION DETAIL SHEET 6 OF 20 FOR GROUND TREATMENT DETAILS AND REQUIRED CLEARANCES.



ABUTMENT REINFORCEMENT
SCALE: 1/2" = 1'-0"

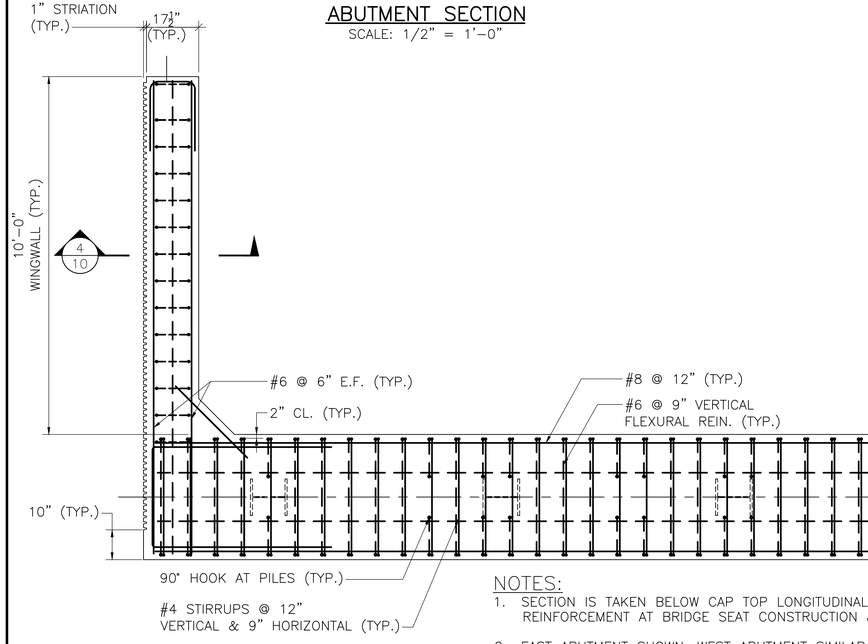


REBAR AT UTILITY OPENING
SCALE: 3/4" = 1'-0"

CONSTRUCTION NOTES:
1. ALL REINFORCEMENT SHALL BE COATED.
2. DECK SLAB REINFORCEMENT NOT SHOWN FOR CLARITY. CONTINUE DECK SLAB REINFORCEMENT TO BACK OF ABUTMENT.
3. THE CONTRACTOR SHALL FOLLOW THE DECK PLACEMENT SEQUENCE AS SHOWN ON THESE CONSTRUCTION DRAWINGS (SEE SHEET 13 OF 20).
4. ALL CONCRETE SHALL CONTAIN SUPERPLASTICIZER TO ENSURE ADEQUATE CONSOLIDATION.
5. BOTH ABUTMENTS SHALL BE BACKFILLED SIMULTANEOUSLY. NO MORE THAN TWO (2) FEET OF DIFFERENTIAL BACKFILL HEIGHT SHALL BE PERMITTED. BACKFILLING SHALL NOT BEGIN UNTIL THE ABUTMENT AND DECK CONSTRUCTION IS COMPLETE.
6. THE CONTRACTOR MAY USE MECHANICAL REINFORCING BAR SPLICERS IN LIEU OF TENSION LAP SPLICES TO FACILITATE CONSTRUCTION. HOWEVER, NO ADDITIONAL COMPENSATION WILL BE PROVIDED FOR THE USE OF MECHANICAL REINFORCING BAR SPLICERS.
7. THE TOP OF THE APPROACH SLAB WATERPROOFING PROTECTIVE COURSE SHALL MATCH THE TOP OF THE ABUTMENT DIAPHRAGM.

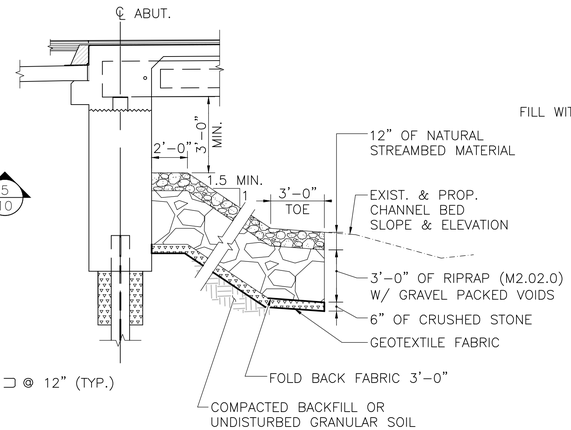
INTEGRAL ABUTMENT PILE NOTES:
1. A TRENCH WITH A DEPTH OF 3'-0" AND A MINIMUM WIDTH OF 2'-6" SHALL BE CONSTRUCTED DIRECTLY BELOW THE BOTTOM OF THE PILE CAP ELEVATION. AFTER THE PILES ARE DRIVEN, THE TRENCH SHALL BE FILLED WITH CRUSHED STONE (M2.01.6).
2. ALL SPLICES SHALL HAVE COMPLETE PENETRATION BUTT WELDS. THERE SHALL BE NO SPLICES WITHIN THE TOP 20 FEET OF PILE. SPLICE WELDS SHALL BE 100% UT.
3. THE FACTORED AXIAL DESIGN LOAD PER PILE IS 200 KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.
4. THE FACTORED STRUCTURAL RESISTANCE PER PILE IS 615 KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF 1230 KIPS AND A RESISTANCE FACTOR OF 0.50.
5. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS 306 KIPS. THE ESTIMATED TIP ELEVATION IS -27 FEET. HEAVY DUTY PILE SHOES SHALL BE INSTALLED ON THE TIPS OF ALL PILES. PREFABRICATED PILE SHOES MAY BE USED IF APPROVED BY THE ENGINEER.
6. DETERMINATION OF THE DRIVEN PILE RESISTANCE, PILE DRIVING CRITERIA, AND PILE INTEGRITY SHALL BE PERFORMED USING THE PDA DRIVING/TESTING METHOD WITH A RESISTANCE FACTOR OF 0.65. PILE SHALL BE INSTALLED TO ACHIEVE A FACTORED DRIVEN RESISTANCE EQUAL TO OR GREATER THAN THE FACTORED AXIAL DESIGN LOAD.
7. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND PILE DRIVING/TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER.
8. PILES SHALL CONFORM TO AASHTO M270 GRADE 50.
9. ONE (1) INDICATOR PILE AT EACH ABUTMENT SHALL BE TESTED DURING THE END OF INITIAL DRIVING AND DURING RESTRIKE A MINIMUM OF 24 HOURS AFTER INITIAL DRIVING WITH A PDA.
10. THE MINIMUM REQUIRED TIP ELEVATION TO THE POINT OF FIXITY IS APPROXIMATELY EL. -18.5. THE PILES MAY NEED TO BE DRIVEN GREATER THAN THE REQUIRED GEOTECHNICAL PILE RESISTANCE TO ACHIEVE THE MINIMUM TIP ELEVATION.

REQUIRED PILE LOCATION TOLERANCES:
1. CONFORMANCE TO THE FOLLOWING TOLERANCES IS OF EXTREME IMPORTANCE TO FOUNDATIONS OF THIS TYPE.
2. PRIOR TO DRIVING, EACH ABUTMENT PILE SHALL BE HELD BY A TEMPLATE WITHIN 1" OF PLAN LOCATION.
3. AFTER EACH ABUTMENT PILE IS DRIVEN, THE TOP OF THE PILE SHALL BE WITHIN 3" OF PLAN LOCATION

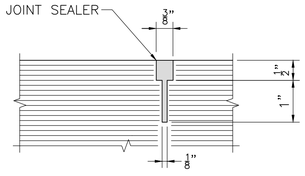


NOTES:
1. SECTION IS TAKEN BELOW CAP TOP LONGITUDINAL REINFORCEMENT AT BRIDGE SEAT CONSTRUCTION JOINT.
2. EAST ABUTMENT SHOWN, WEST ABUTMENT SIMILAR.

HORIZONTAL SECTION
SCALE: 1/2" = 1'-0"



SCOUR PROTECTION DETAIL
SCALE: 1/4" = 1'-0"

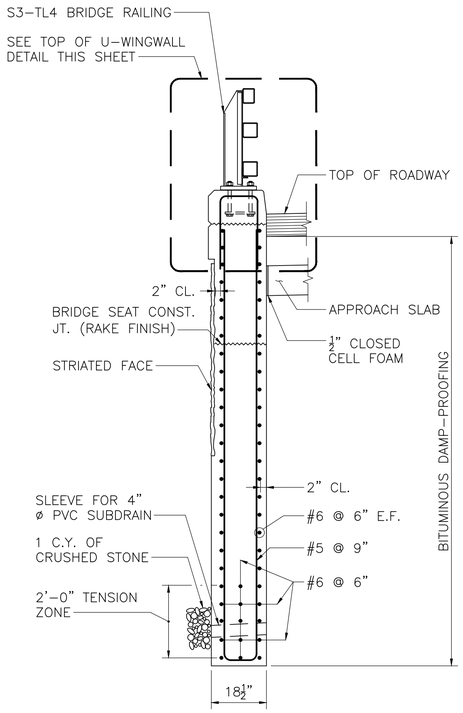


PAVEMENT SAWCUT DETAIL
NOT TO SCALE

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

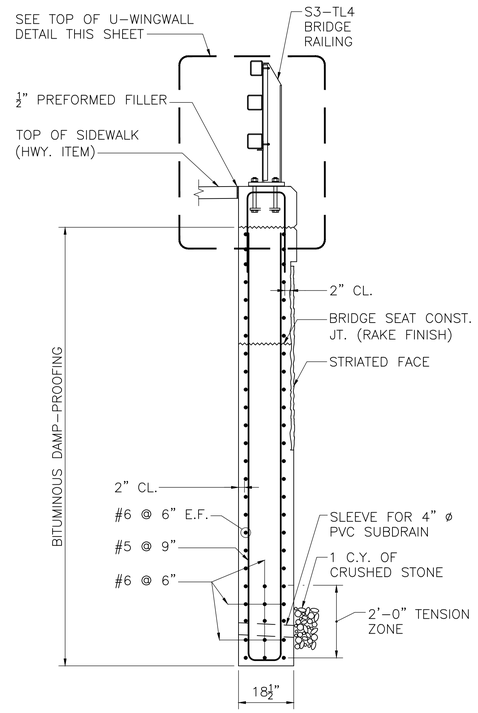
STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	



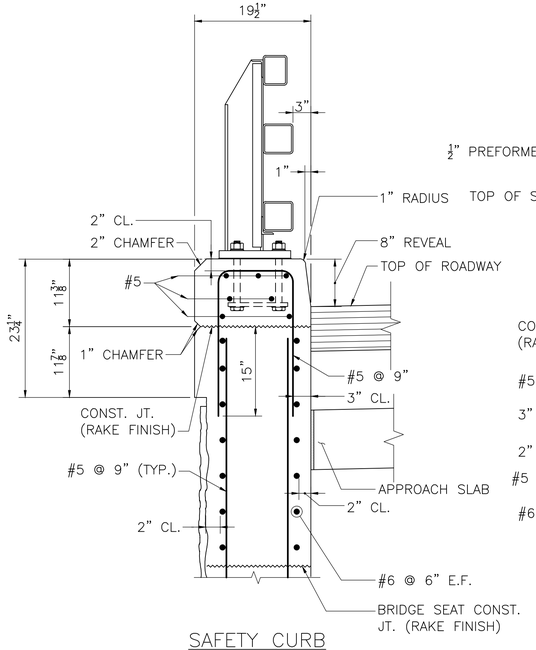
SECTION 4 – NORTH WINGWALL

SCALE: 1/2" = 1'–0"

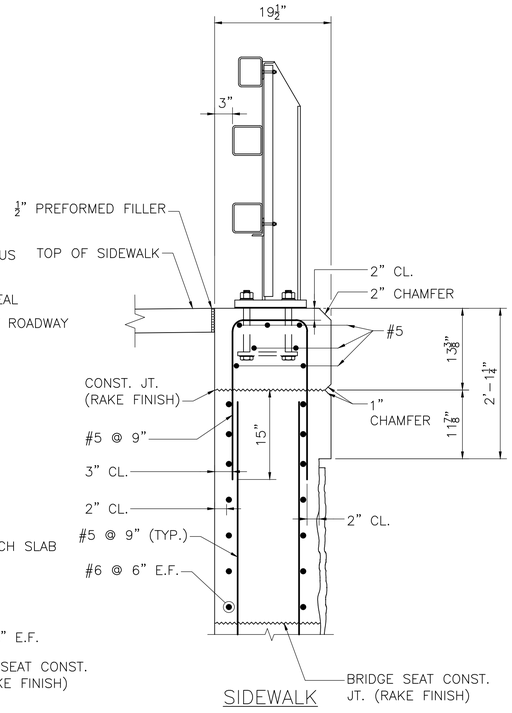


SECTION 5 – SOUTH WINGWALL

SCALE: 1/2" = 1'–0"



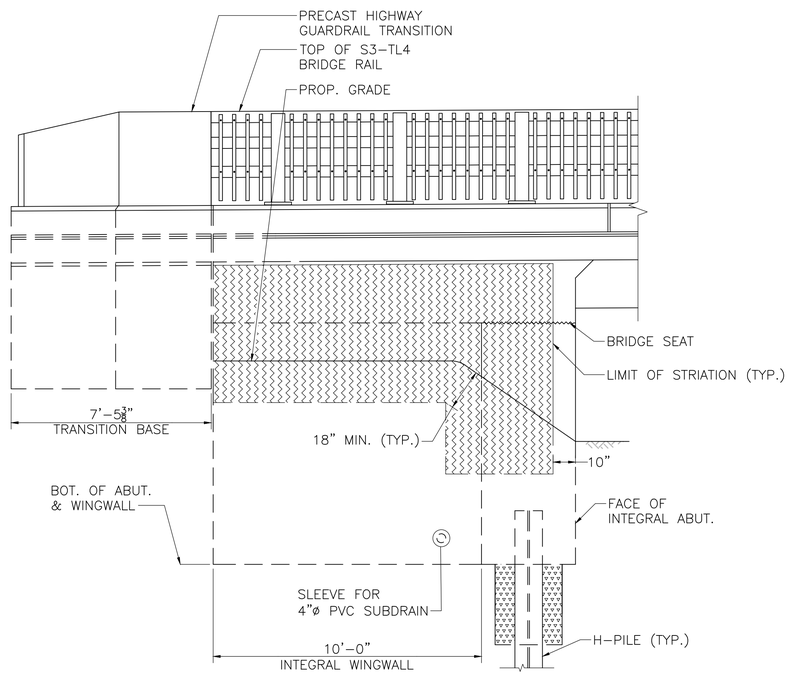
SAFETY CURB



SIDEWALK

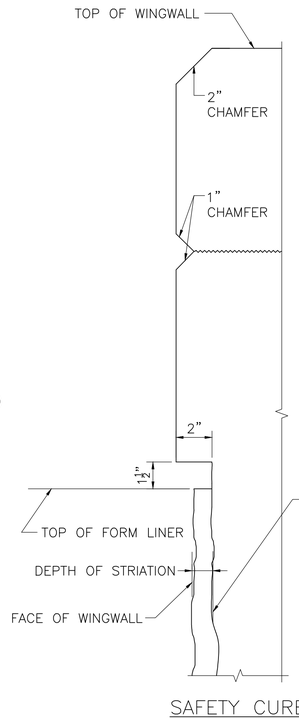
TOP OF U–WINGWALL

SCALE: 1" = 1'–0"

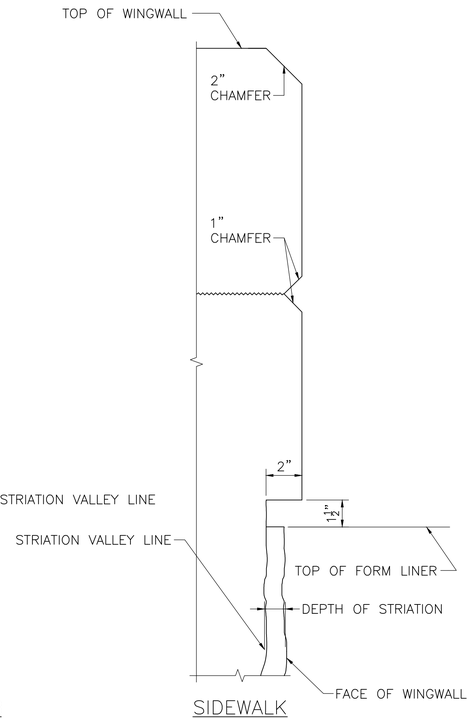


STRIATION ELEVATION

SCALE: 3/8" = 1'–0"



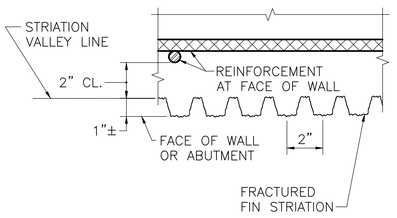
SAFETY CURB



SIDEWALK

STRIATION DETAIL AT TOP OF WINGWALL

SCALE: 3" = 1'–0"



STRIATION NOTE:

THE CONTRACTOR SHALL MAKE SURE THAT THE STRIATION FINS ARE PLUMB AND LINED UP VERTICALLY FROM PANEL TO PANEL FOR THE FULL HEIGHT OF THE WALL.

TYPICAL STRIATION DETAIL

SCALE: 3" = 1'–0"

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	24	38
PROJECT FILE NO.		N/A	

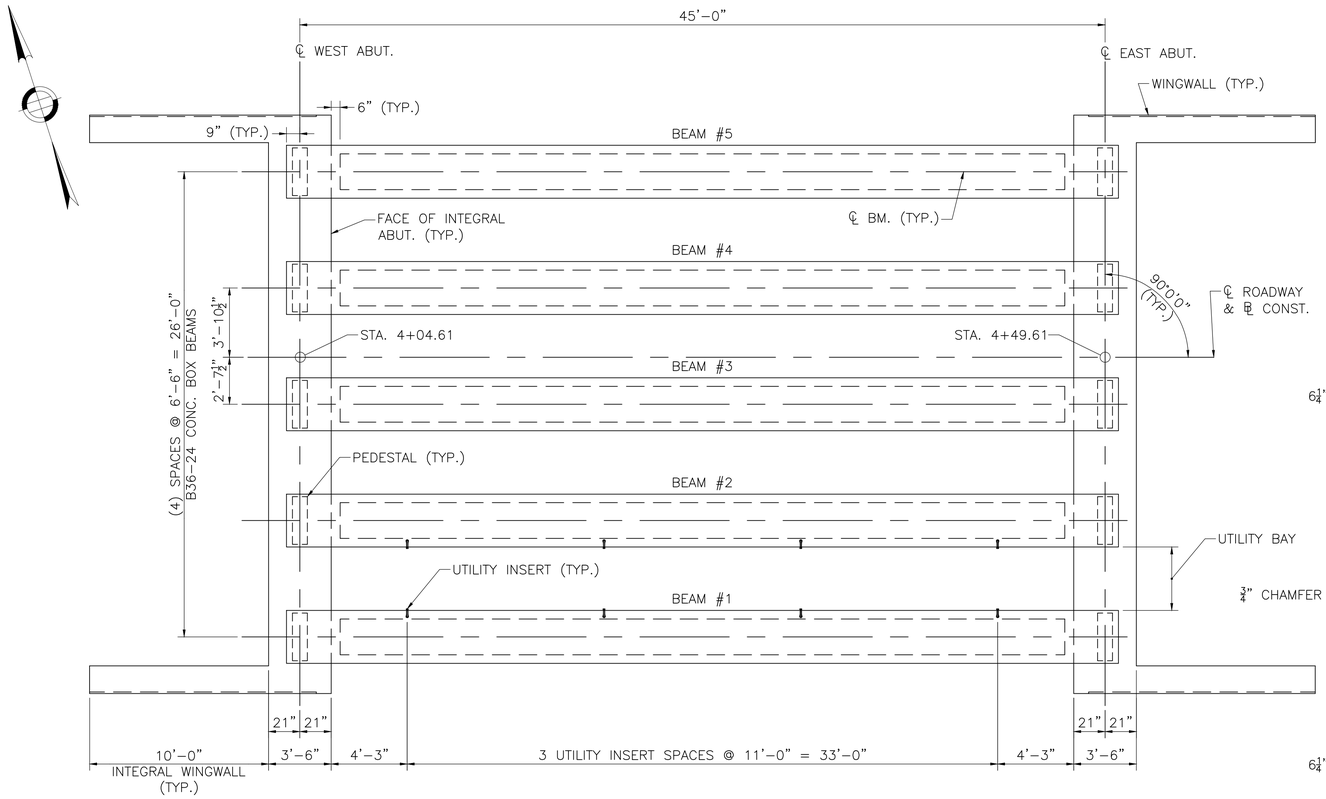
WINGWALL & STRIATION DETAILS

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

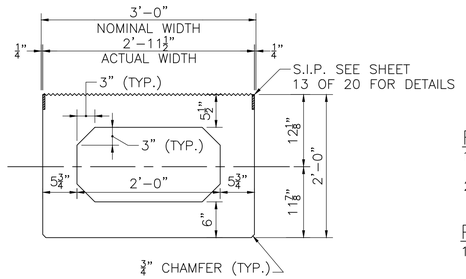
STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

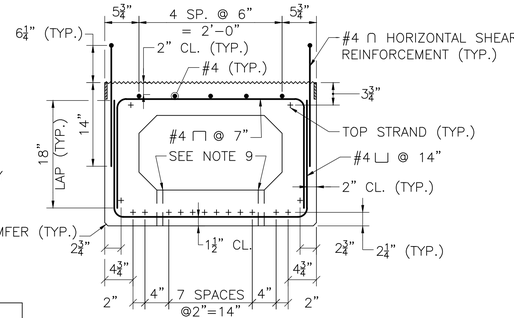
CHAPTER 85 REVIEW 06-24-2021



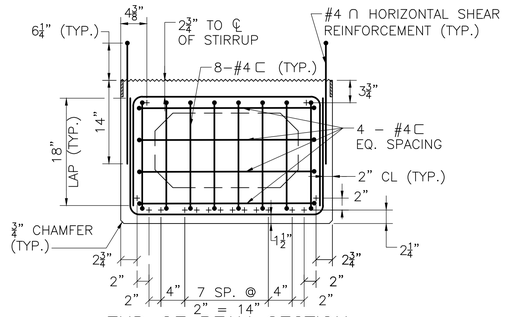
FRAMING PLAN
SCALE: 1/4" = 1'-0"



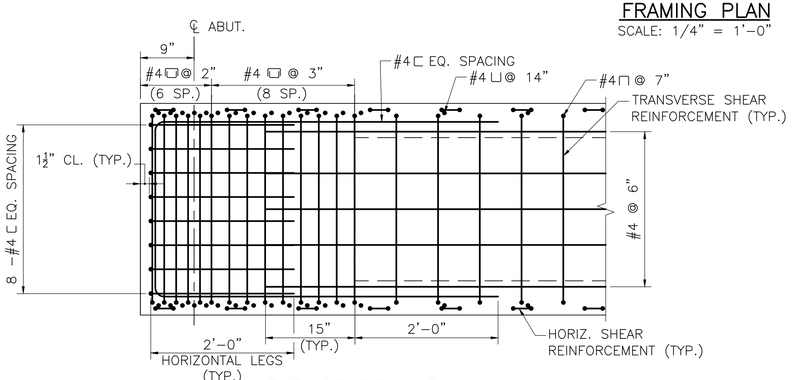
BOX BEAM PROPERTIES B36-24
SCALE: 1" = 1'-0"



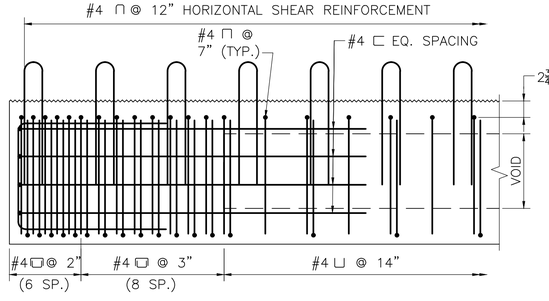
TYPICAL MIDSPAN SECTION
SCALE: 1" = 1'-0"



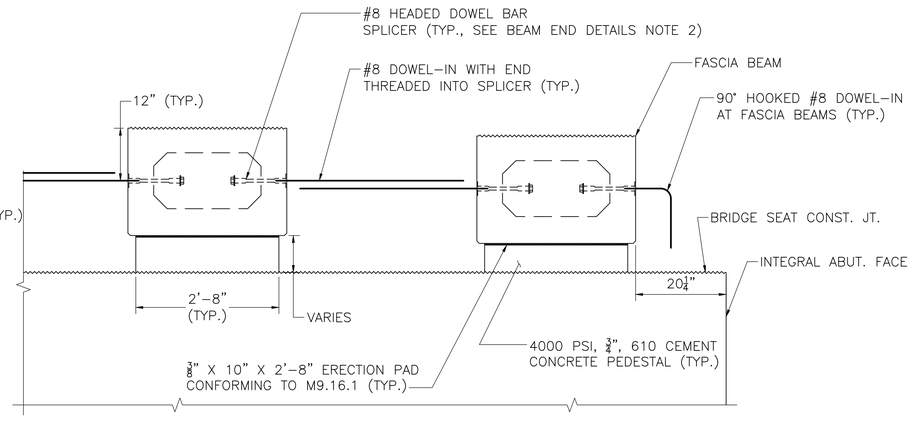
END OF BEAM SECTION
SCALE: 1" = 1'-0"



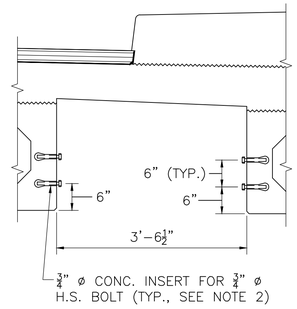
END OF BEAM PLAN
SCALE: 1" = 1'-0"



LONGITUDINAL SECTION
SCALE: 1" = 1'-0"



BEAM END DETAILS
SCALE: 3/4" = 1'-0"



UTILITY INSERT DETAIL
SCALE: 3/4" = 1'-0"

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	25	38
PROJECT FILE NO.		N/A	

FRAMING PLAN & BEAM DETAILS

FRAMING PLAN NOTES:
1. SEE STANDARD SPECIFICATIONS FOR BEAMS ERECTION AND LAYOUT.
2. THE MAIN LOAD CARRYING MEMBERS ARE B36-24 CONCRETE BOX BEAMS.

PRESTRESS NOTES:
1. ALL PRETENSIONING ELEMENTS SHALL BE 0.6" ø, UNCOATED, SEVEN-WIRE, LOW RELAXATION STEEL STRANDS AND SHALL CONFORM TO AASHTO M203.
2. THE NOMINAL TENSILE STRENGTH OF THE PRETENSIONING STRANDS SHALL BE 270 KSI.
3. THE INITIAL TENSION PER 0.6" ø STRAND SHALL BE 44 KIPS.
4. THE MINIMUM 28 DAY COMPRESSIVE STRENGTH SHALL BE 6500 PSI.
5. NO PRESTRESS SHALL BE TRANSFERRED TO THE CONCRETE UNTIL IT HAS ATTAINED A COMPRESSIVE STRENGTH, AS SHOWN BY CYLINDER TEST, OF AT LEAST 4500 PSI.
6. THE TOP OF ALL BEAMS SHALL BE GIVEN A RAKE FINISH (¼" AMPLITUDE) ACROSS THE WIDTH (PERPENDICULAR TO THE BEAM'S AXIS).
7. THE FABRICATOR IS FULLY RESPONSIBLE FOR THE DESIGN OF THE LIFTING DEVICES WHICH SHALL BE ADEQUATE FOR THE SAFETY FACTORS REQUIRED BY THE ERECTION PROCEDURE.
8. + DENOTES STRAIGHT STRANDS. (16 PRESTRESSED STRANDS)
9. 1" ø DRAIN, PLACED AT BOTH ENDS OF EACH VOID.

BEAM END DETAILS NOTES:
1. THE LATERAL STABILITY OF THE BEAMS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR DURING ERECTION AND CONSTRUCTION. A LATERAL SUPPORT SYSTEM SHALL BE DESIGNED BY THE CONTRACTOR IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN AND BRIDGE CONSTRUCTION SPECIFICATIONS.
2. #8 HEADED DOWEL BAR SPLICERS SHALL BE CAST-IN-PLACE IN THE PRECAST BEAMS BY THE FABRICATOR AND SHALL BE EMBEDDED AS REQUIRED TO PROVIDE A MINIMUM NOMINAL TENSILE RESISTANCE OF 71.0 KIPS AS SPECIFIED BY THE MANUFACTURER.

UTILITY INSERT DETAIL NOTES:
1. ¾" DIAMETER THREADED INSERTS FOR ¾" H.S. BOLTS SHALL BE CAST INTO THE PRECAST BEAMS BY THE FABRICATOR AND SHALL PROVIDE A MINIMUM NOMINAL TENSILE RESISTANCE OF 6.0 KIPS AND A MINIMUM NOMINAL SHEAR RESISTANCE OF 6.0 KIPS IN 3000 PSI CONCRETE.
2. INSERTS SHALL BE POSITIONED TO AVOID INTERFERENCE WITH PRESTRESSING STRANDS.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

DATE	DESCRIPTION
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
USE ONLY PRINTS OF LATEST DATE	

SHEET 11OF 20 SHEETS BRIDGE NO. N-11-007 = W-20-001 (CBR)

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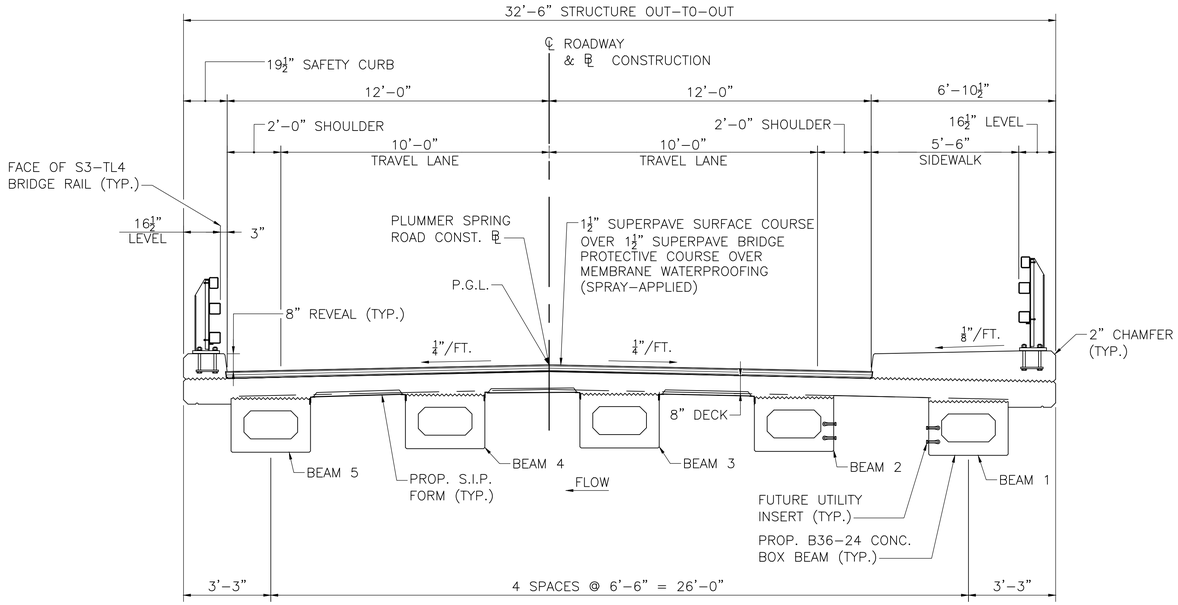
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	26	38
PROJECT FILE NO.		N/A	

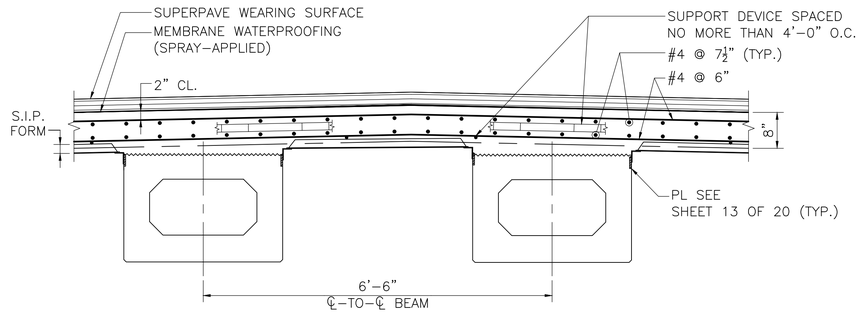
TRANSVERSE SECTION & DECK DETAILS



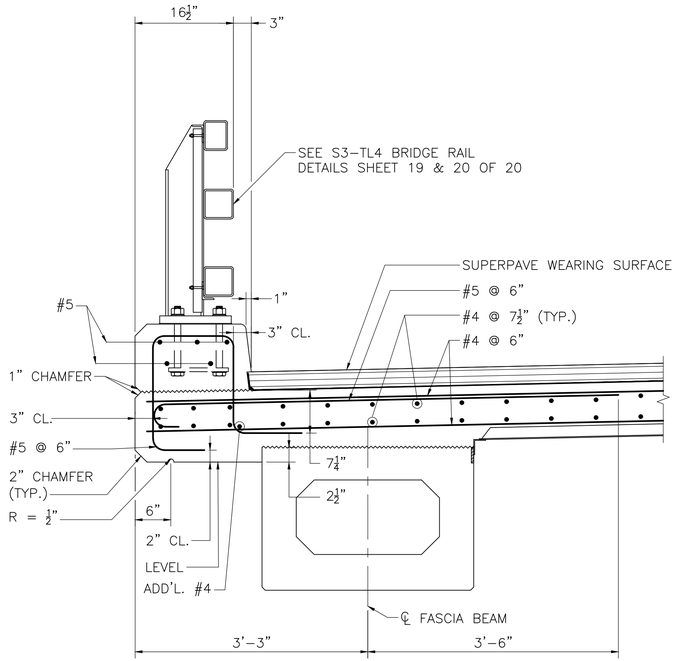
PROPOSED TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"

DECK NOTES:

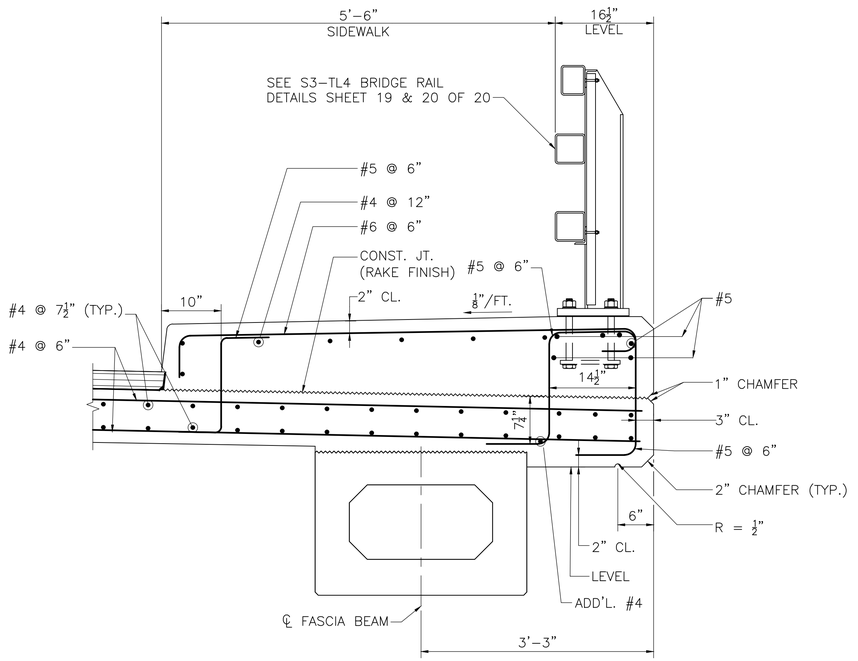
1. ROADWAY DECK SLAB SHALL BE 4000 PSI, ¾ INCH, 585 HP CEMENT CONCRETE.
2. LONGITUDINAL REINFORCEMENT SHALL BE PLACED PARALLEL TO THE ℄ OF CONSTRUCTION. TRANSVERSE (PRIMARY) REINFORCEMENT SHALL BE PLACED PERPENDICULAR TO THE ℄ OF CONSTRUCTION.
3. ALL REINFORCEMENT AND SUPPORT DEVICES SHALL BE COATED.
4. THE FINISHED SURFACE OF THE BRIDGE DECK SHALL BE SMOOTH AND WITHOUT ANY PROJECTIONS THAT COULD PUNCTURE THE MEMBRANE WATERPROOFING OR DEPRESSIONS THAT COULD RETAIN WATER.



TYPICAL DECK REINFORCEMENT
SCALE: 3/4" = 1'-0"



SECTION THRU SAFETY CURB
SCALE: 1" = 1'-0"

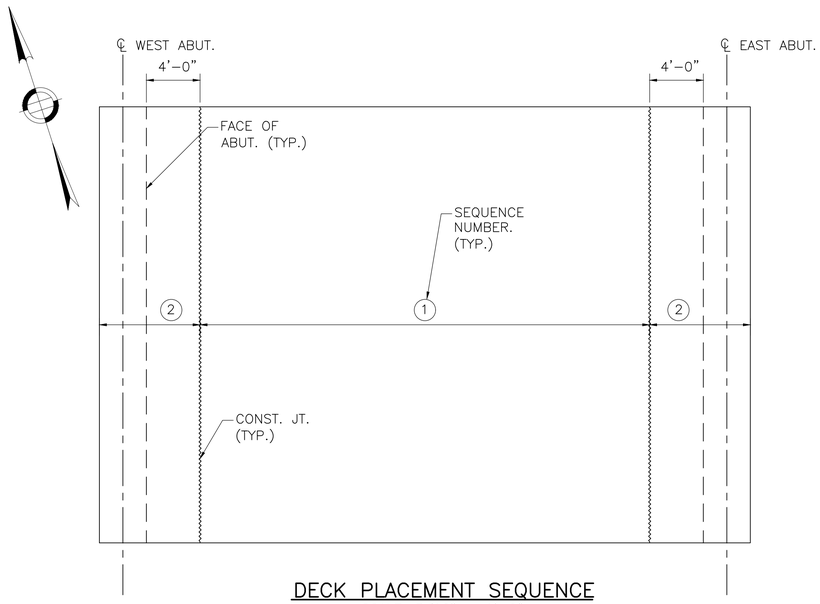


SECTION THRU SIDEWALK
SCALE: 1" = 1'-0"

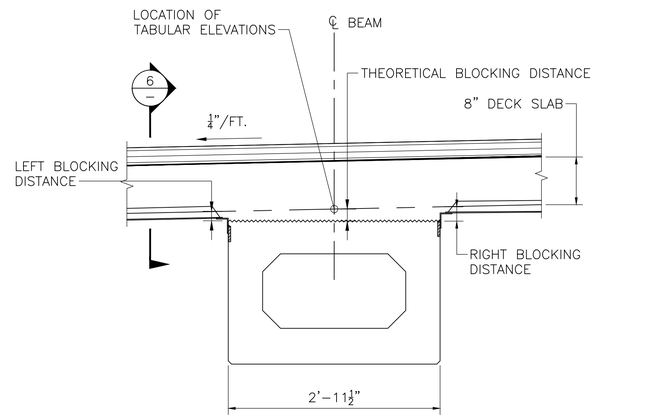
COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

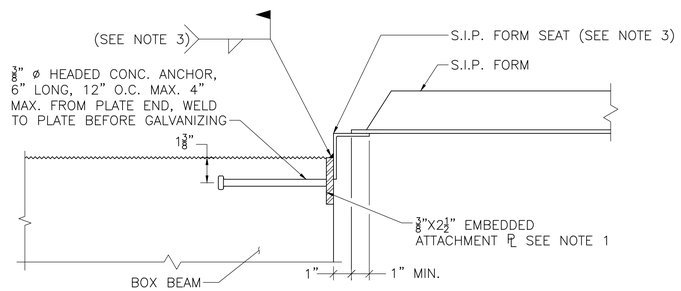


DECK PLACEMENT SEQUENCE
SCALE: 3/16" = 1'–0"



NOTES:
1. THE RIGHT AND LEFT ORIENTATION IS TAKEN LOOKING UPSTATION ALONG THE BEAM.
2. RIGHT BLOCKING DISTANCE = THEORETICAL BLOCKING DISTANCE + 0.375".
   LEFT BLOCKING DISTANCE = THEORETICAL BLOCKING DISTANCE – 0.375".

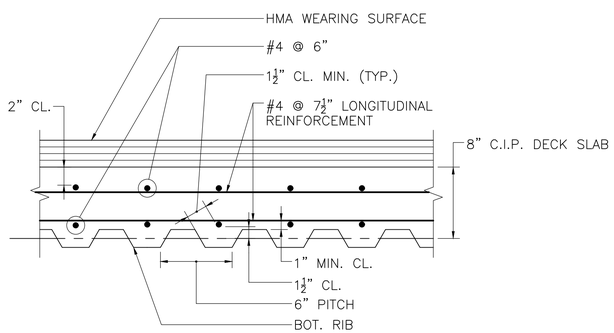
HAUNCH DETAIL
SCALE: 1" = 1'–0"



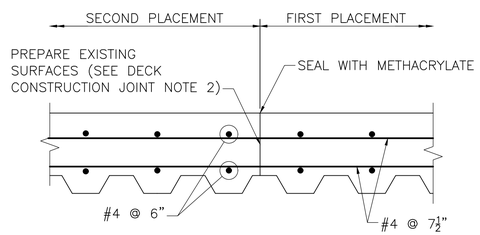
STAY–IN–PLACE FORM ATTACHMENT DETAIL
SCALE: 3" = 1'–0"

BEAM NO.	TOP OF FORM ELEVATIONS FOR DECK SLAB PRIOR TO PLACEMENT OF CONCRETE				
	INCREASING STATIONS →				
	℄ BRG.	1/4 PT.	1/2 PT.	3/4 PT.	℄ BRG.
1	18.32	18.41	18.48	18.53	18.56
2	18.46	18.54	18.61	18.66	18.69
3	18.59	18.67	18.74	18.79	18.83
4	18.56	18.65	18.72	18.77	18.80
5	18.43	18.51	18.58	18.63	18.67

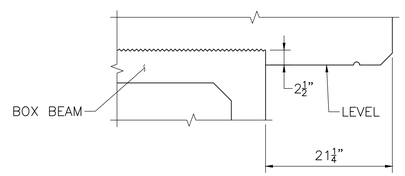
NOTE:
AFTER THE BEAMS ARE ERECTED BUT BEFORE THE FORMS ARE BUILT, ELEVATIONS ON TOP OF THE FLANGE OF THE BEAMS ARE TO BE OBTAINED AT THE POINTS INDICATED IN THE TABLE. THE DIFFERENCE BETWEEN THE ELEVATIONS OBTAINED AND THOSE SHOWN IN THE TABLE GIVES THE THEORETICAL BLOCKING DISTANCE FROM THE TOP OF BEAM TO THE BOTTOM OF THE SLAB AT CENTER LINE OF BEAM.



SECTION 6
NOT TO SCALE



TRANSVERSE CONSTRUCTION JOINT DETAIL IN DECK SLAB
NOT TO SCALE



SLAB OVERHANG AT FASCIA BEAM
SCALE: 1" = 1'–0"

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	27	38
PROJECT FILE NO.		N/A	

DECK DETAILS

STAY–IN–PLACE FORM NOTES:
1. FOR 2" S.I.P. FORM, SET BOTTOM OF FORM 1" BELOW ELEVATION GIVEN IN TABLE. FOR 3" S.I.P. FORM, SET BOTTOM OF FORM 1½" BELOW TABLE ELEVATIONS.
2. FORM ENDS SHALL BE CRIMPED CLOSED IN A TAPERED MANNER. SEPARATE END CLOSURE PIECES WILL NOT BE ALLOWED.
3. SUPPORT ANGLES SHALL BE PLACED IN THE "LEG DOWN" POSITION WHERE POSSIBLE. WHERE "LEG UP" POSITION IS NECESSARY, THE UPPER MOST PORTION OF THE ANGLE SHALL NOT PROJECT MORE THAN 1" ABOVE THE TOP FLANGE. THE CONTRACTOR SHALL HAVE AN ASSORTMENT OF ANGLES OF VARIOUS SIZES AVAILABLE ON THE SITE TO CONFORM TO THIS REQUIREMENT.
4. ALL MAIN STEEL REINFORCEMENT IN THE LOWER MAT SHALL BE CENTERED OVER THE VALLEY OF THE S.I.P. FORM.
5. THE CONTRACTOR SHALL DESIGN AND DETAIL ALL ELEMENTS OF THE FORMING SYSTEM AND SHALL SUBMIT TO THE ENGINEER FOR APPROVAL.
6. IN CASES WHERE STANDARD 2" OR 3" DEEP S.I.P. FORMS DO NOT SATISFY DESIGN REQUIREMENTS AN ALTERNATIVE FORMING SYSTEM CONSISTING OF DEEPER S.I.P. FORMS OR REMOVABLE FORMS SHALL BE DESIGNED AND DETAILED BY THE CONTRACTOR AND SUBMITTED TO THE ENGINEER FOR APPROVAL. THE DESIGN THICKNESS OF THE SLAB SHALL NOT BE REDUCED.

STAY–IN–PLACE FORM ATTACHMENT NOTES:
1. EMBEDDED ATTACHMENT PLATES SHALL BE HOT–DIPPED GALVANIZED AASHTO M270 GRADE 36 STEEL. THE PLATES SHALL BE IN LENGTHS FROM 3' TO 12' WITH PIECES BUTTED TOGETHER WITHOUT END CONNECTIONS FOR FULL LENGTH OF BEAM. THE HEADED ANCHORS SHALL BE ATTACHED TO THE PLATES PRIOR TO GALVANIZING.
2. HEADED ANCHORS SHALL CONFORM TO M8.04.1 FOR MATERIAL REQUIREMENTS ONLY.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE S.I.P. FORM SEAT AND WELD.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING THE CONCRETE LAITANCE FROM THE ATTACHMENT PLATE BEFORE INSTALLING THE S.I.P. FORMS.

DECK CONSTRUCTION JOINT NOTES:
1. BRIDGE DECK SLAB SHALL BE PLACED IN ACCORDANCE WITH THE PLACEMENT SEQUENCE SHOWN ON THE PLANS.
2. THE SURFACE OF THE PREVIOUSLY CAST CONCRETE SHALL BE BLAST CLEANED, ROUGHENED, WETTED WITH CLEAN WATER, AND THEN FLUSHED WITH A MORTAR COMPOSED OF EQUAL PARTS OF THE CEMENT AND SAND SPECIFIED FOR THE NEW CONCRETE, BEFORE NEW CONCRETE IS PLACED ADJACENT THERETO. NEW CONCRETE SHALL BE PLACED BEFORE MORTAR HAS TAKEN INITIAL SET.
3. IN LIEU OF THE MORTAR, AN EPOXY ADHESIVE SUITABLE FOR BONDING FRESH CONCRETE TO HARDENED CONCRETE FOR LOAD BEARING APPLICATIONS MAY BE USED. THE EPOXY ADHESIVE SHALL CONFORM TO AASHTO M 235 TYPE V AND SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
4. DOWEL BAR SPLICERS SHALL BE USED WHERE USE OF LAP SPLICES IS NOT FEASIBLE.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

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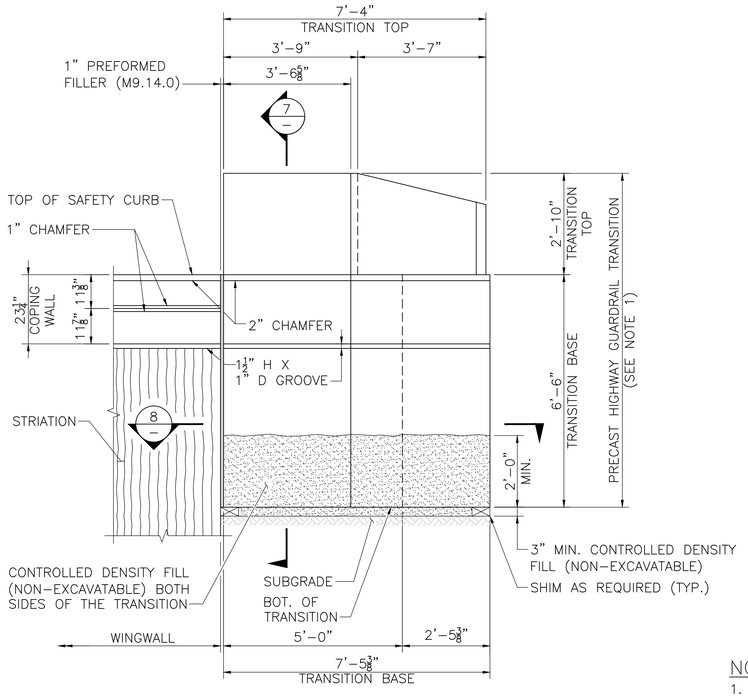
2839500_BR6 8-16(N11007_W20001).DWG Plotted on 13-Dec-2022 10:32 AM

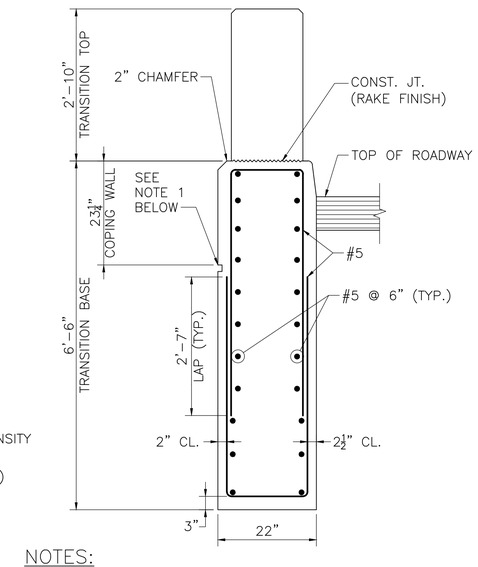
Drawing name: \\Vanbw\Ipw\Projects-800\839500\Structural\Drawings\Progress\839500_BR 8-16(N11007_W20001).dwg
Plotted on: Tuesday, December 13, 2022 - 10:32am by 239258



SAFETY CURB

PRECAST GUARDRAIL TRANSITION ELEVATION AT U-WINGWALL

SCALE: 1/2" = 1'-0"

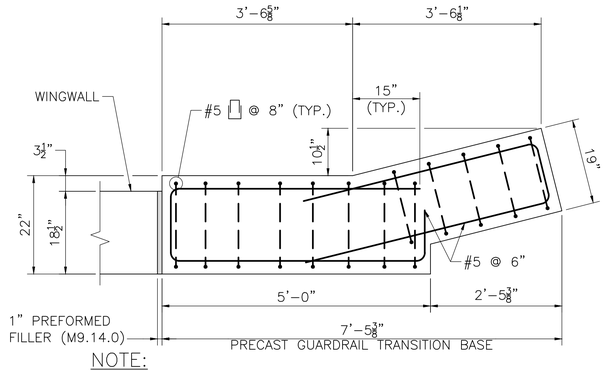


NOTES:

1. $1\frac{1}{2}$" H X 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 7

SCALE: 3/4" = 1'-0"



NOTE:
WINGWALL REINFORCEMENT AND STRIATIONS NOT SHOWN FOR CLARITY.

SECTION 8

SCALE: 3/4" = 1'-0"

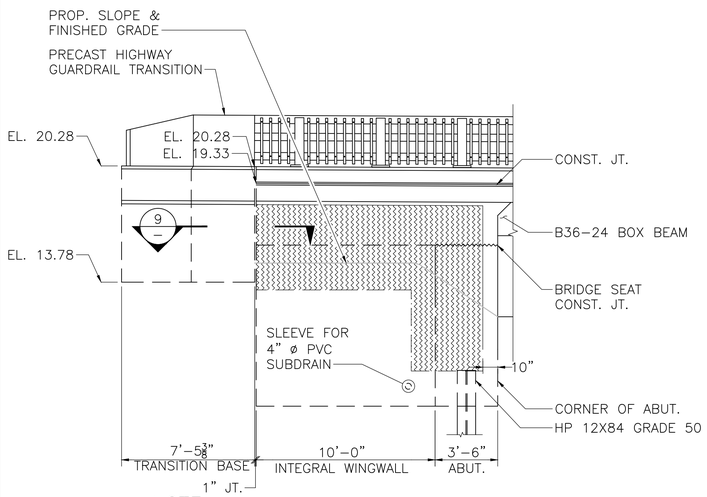
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	28	38
PROJECT FILE NO.		N/A	

PRECAST HIGHWAY GUARDRAIL TRANSITION BASE DETAIL AT SAFETY CURB

NOTES:

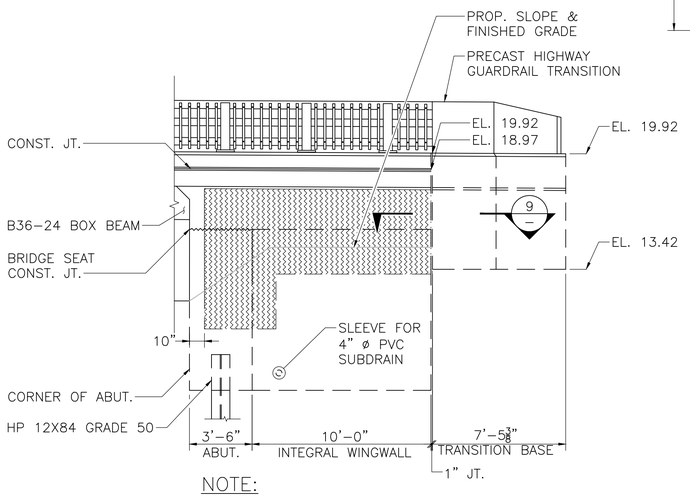
1. PRECAST GUARDRAIL TRANSITION SHALL BE 5000 PSI, $\frac{3}{4}$ INCH, 685 HP CEMENT CONCRETE.
2. GRAVEL BORROW SHALL BE PLACED AND THOROUGHLY COMPACTED TO THE GRADE OF 3" MINIMUM BELOW THE INTENDED BOTTOM OF THE PRECAST GUARDRAIL TRANSITION BASE AND TO A HEIGHT OF 2'-0" MINIMUM ON ALL SIDES OF THE TRANSITION BASE TO FORM A TRENCH IN WHICH TO SET THE TRANSITION. WHERE NO GRAVEL BORROW IS REQUIRED BELOW THE BASE, IT SHALL BE PLACED ON UNDISTURBED SOIL.
3. CONTRACTOR SHALL SET THE PRECAST GUARDRAIL TRANSITION TO THE REQUIRED ELEVATION AND ALIGNMENT, AND BACKFILL PRECAST GUARDRAIL TRANSITION WITH CONTROLLED DENSITY FILL (NON-EXCAVATABLE) TO THE ELEVATION SHOWN.
4. THE REST OF THE REINFORCEMENT IS NOT SHOWN FOR CLARITY.
5. PMB WALLS NOT SHOWN FOR CLARITY.



NOTE:
PMB WALL NOT SHOWN FOR CLARITY.

NORTHEAST GUARDRAIL ELEVATION

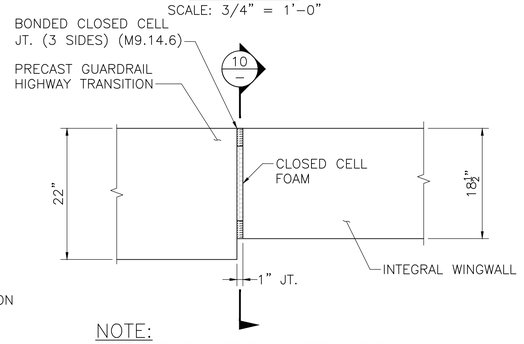
SCALE: 1/4" = 1'-0"



NOTE:
PMB WALL NOT SHOWN FOR CLARITY.

NORTHWEST GUARDRAIL ELEVATION

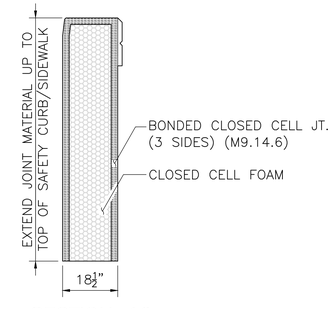
SCALE: 1/4" = 1'-0"



NOTE:
REINFORCEMENT NOT SHOWN FOR CLARITY.

SECTION 9

SCALE: 1" = 1'-0"



SECTION 10

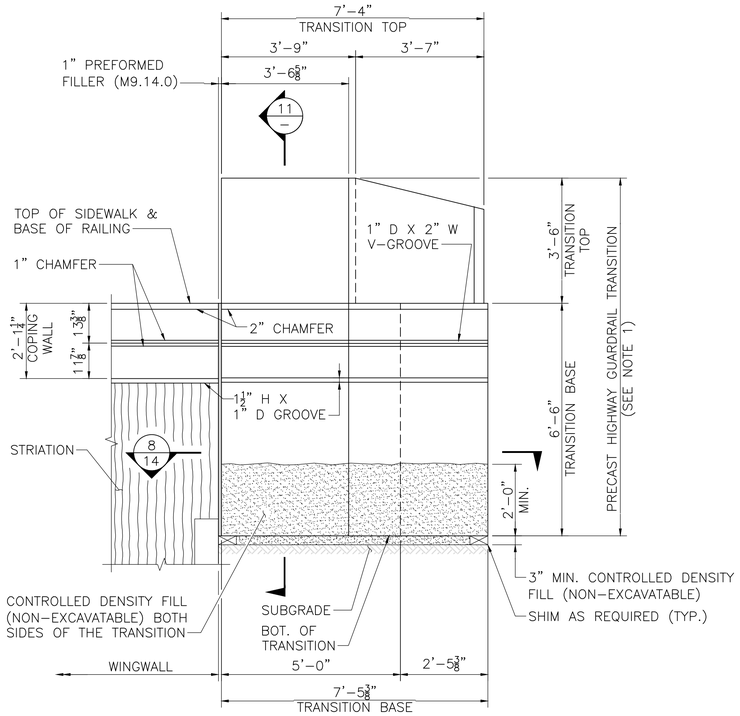
SCALE: 1/2" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

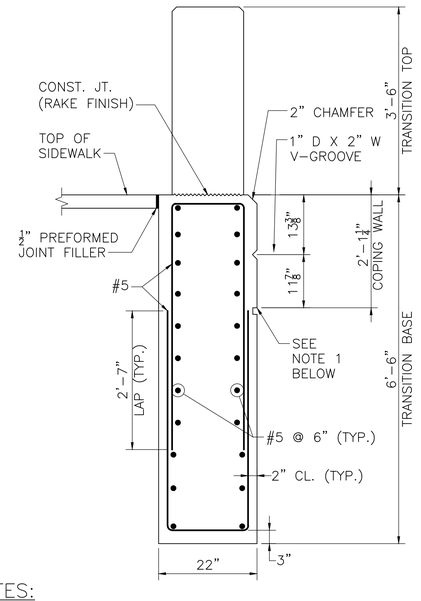
CHAPTER 85 REVIEW 06-24-2021



SIDEWALK

PRECAST GUARDRAIL TRANSITION ELEVATION AT U–WINGWALL

SCALE: 1/2" = 1'–0"

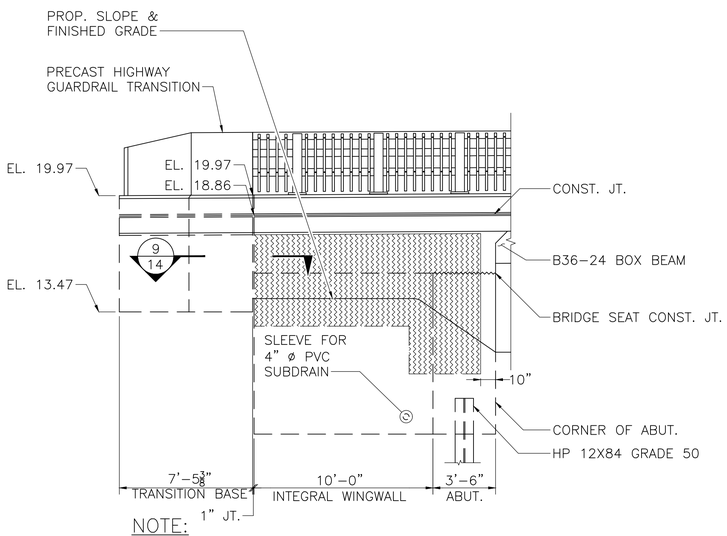


NOTES:

1. 1 1/2" H X 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 11

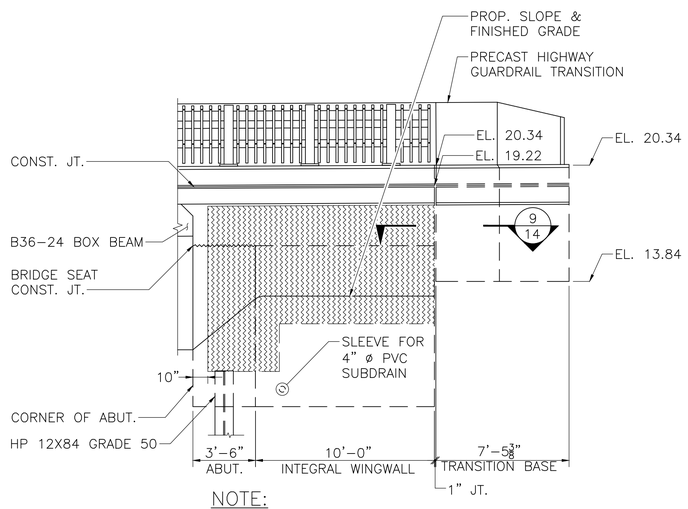
SCALE: 3/4" = 1'–0"



NOTE:
PMB WALL NOT SHOWN FOR CLARITY.

SOUTHWEST GUARDRAIL ELEVATION

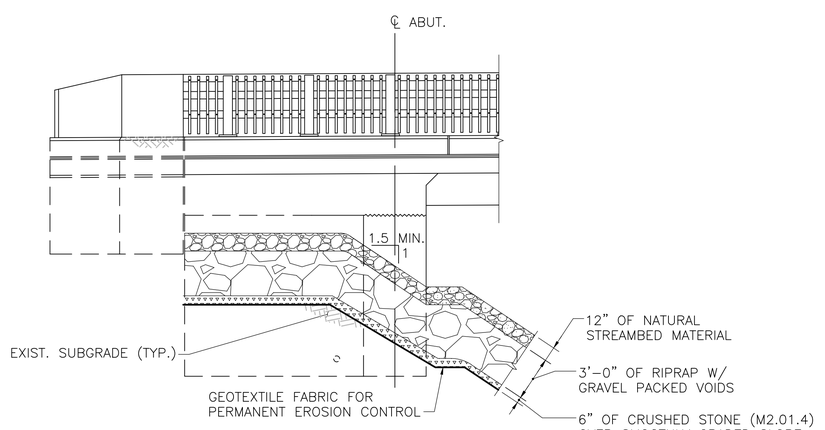
SCALE: 1/4" = 1'–0"



NOTE:
PMB WALL NOT SHOWN FOR CLARITY.

SOUTHEAST GUARDRAIL ELEVATION

SCALE: 1/4" = 1'–0"



NOTE:
STRIATIONS & PMB WALL NOT SHOWN FOR CLARITY.

SLOPE DETAIL

SCALE: 1/4" = 1"–0"

NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	29	38
PROJECT FILE NO.		N/A	

PRECAST HIGHWAY GUARDRAIL TRANSITION BASE DETAIL AT SIDEWALK

NOTES:

1. PRECAST GUARDRAIL TRANSITION SHALL BE 5000 PSI, ¾ INCH, 685 HP CEMENT CONCRETE.
2. GRAVEL BORROW SHALL BE PLACED AND THOROUGHLY COMPACTED TO THE GRADE OF 3" MINIMUM BELOW THE INTENDED BOTTOM OF THE PRECAST GUARDRAIL TRANSITION BASE AND TO A HEIGHT OF 2'–0" MINIMUM ON ALL SIDES OF THE TRANSITION BASE TO FORM A TRENCH IN WHICH TO SET THE TRANSITION. WHERE NO GRAVEL BORROW IS REQUIRED BELOW THE BASE, IT SHALL BE PLACED ON UNDISTURBED SOIL.
3. CONTRACTOR SHALL SET THE PRECAST GUARDRAIL TRANSITION TO THE REQUIRED ELEVATION AND ALIGNMENT, AND BACKFILL PRECAST GUARDRAIL TRANSITION WITH CONTROLLED DENSITY FILL (NON–EXCAVATABLE) TO THE ELEVATION SHOWN.
4. THE REST OF THE REINFORCEMENT IS NOT SHOWN FOR CLARITY.
5. PMB WALLS NOT SHOWN FOR CLARITY.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

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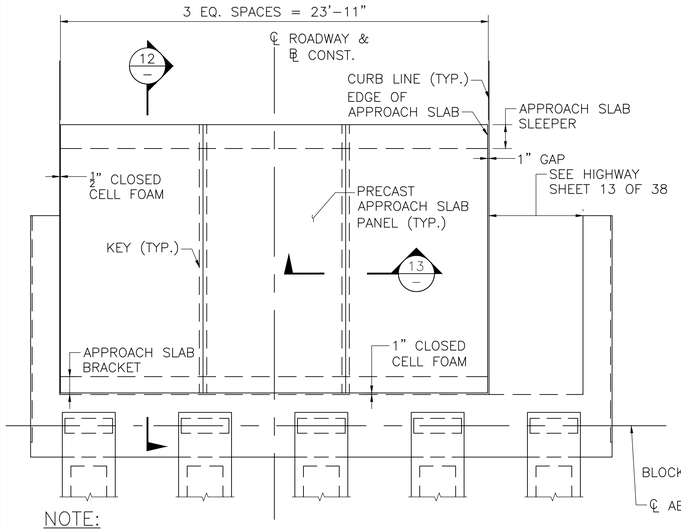
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

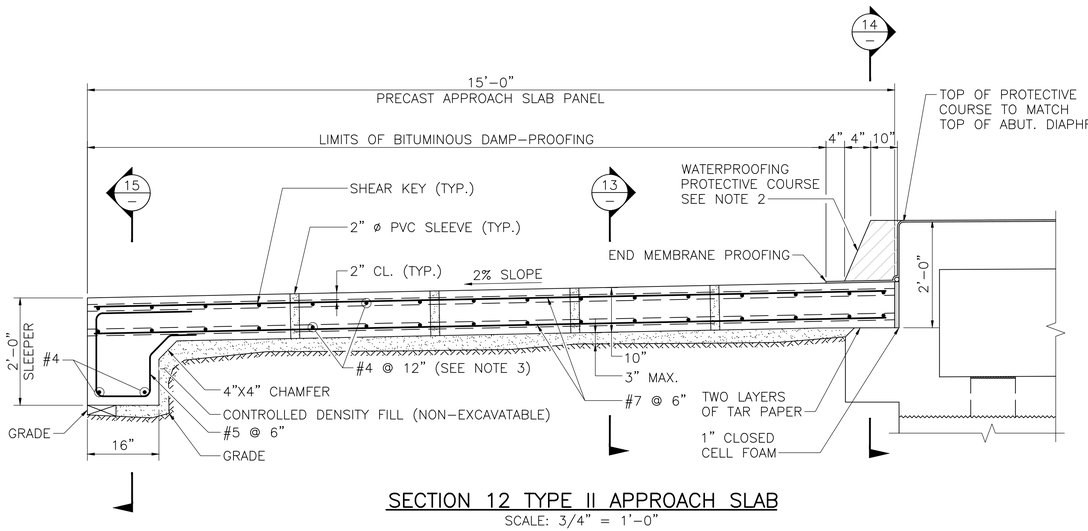
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	30	38
PROJECT FILE NO.		N/A	

APPROACH SLAB & MISC DETAILS



NOTE:
1. DRAWINGS DEPICT 3 PRECAST APPROACH SLAB PANELS. TO ACCOMMODATE CROSS SLOPE OF APPROACH SLAB BRACKET 4 PRECAST APPROACH SLAB UNITS MAY BE REQUIRED.

APPROACH SLAB PLAN
SCALE: 1/4" = 1'-0"

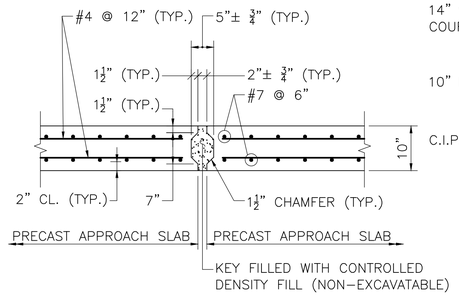


SECTION 12 TYPE II APPROACH SLAB
SCALE: 3/4" = 1'-0"

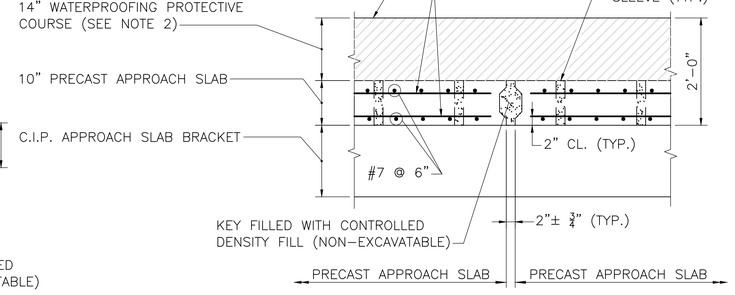
APPROACH SLAB NOTES:
1. PRECAST APPROACH SLAB PANEL TO BE 4000 PSI, 1.5 INCH, 565 CEMENT CONCRETE. SUBSTITUTIONS WILL NOT BE PERMITTED.
2. PROTECTIVE COURSE TO BE SUPERPAVE BRIDGE PROTECTIVE COURSE – 9.5(SPC-B-9.5), PLACED IN 2 INCH LAYERS AND COMPACTED WITH A MECHANICAL HAND-GUIDED TAMPER WITHIN 12 HOURS AFTER PLACING MEMBRANE WATERPROOFING.
3. PLACE LONGITUDINAL REINFORCEMENT PARALLEL TO THE ℄ OF THE BRIDGE. PLACE TRANSVERSE REINFORCEMENT PARALLEL TO THE ABUTMENT.
4. PVC SLEEVES TO BE INCLUDED IN PRECAST APPROACH SLAB TO FACILITATE PLACEMENT OF CONTROLLED DENSITY FILL (NON-EXCAVATABLE).

PARAFFIN JOINT NOTES:
1. ALL CONCRETE ABOVE SLAB SHALL BE POURED IN ALTERNATING SECTIONS WITH NOT LESS THAN 3 DAYS BETWEEN POURS.
2. DO NOT CARRY LONGITUDINAL BARS THROUGH THE PARAFFIN JOINTS. END THE REINFORCEMENT 2" CLEAR OF JOINT.
3. JOINT SHALL BE SQUARE TO FACE OF CURB.
4. FOR JOINT LOCATIONS SEE SHEET 6 OF 20.

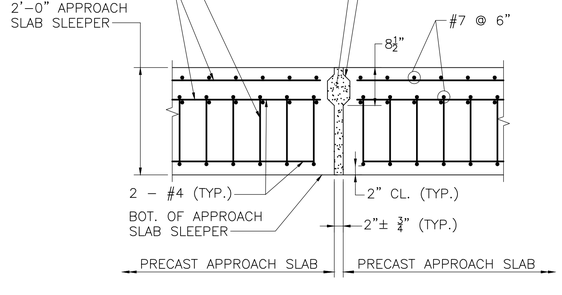
FACE OF CURB NOTES:
1. TURN MEMBRANE UP INTO 3" HIGH POCKET.
2. DIMENSIONS AT THE FACE OF SIDEWALK ARE THE SAME FOR SAFETY CURB.



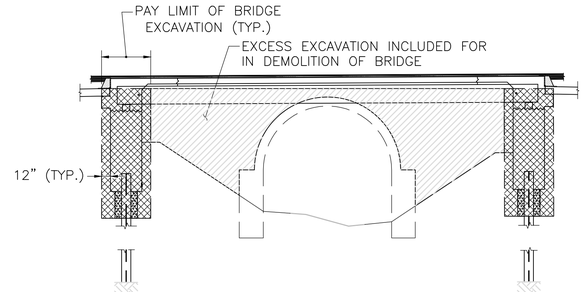
SECTION 13
SCALE: 3/4" = 1'-0"



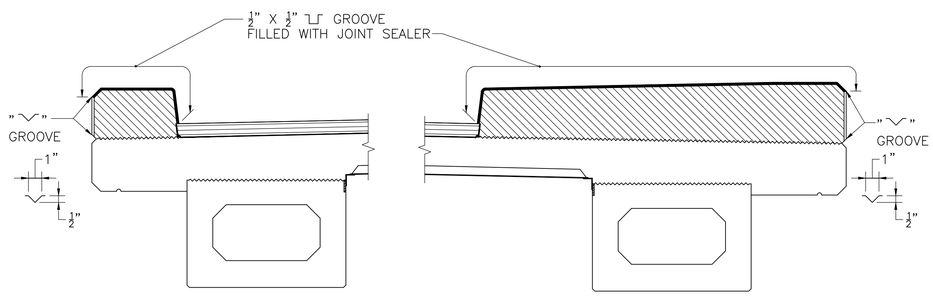
SECTION 14
SCALE: 3/4" = 1'-0"



SECTION 15
SCALE: 3/4" = 1'-0"

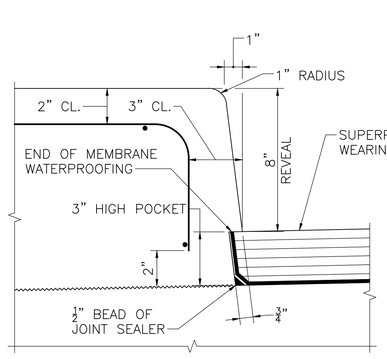


PAY LIMITS FOR BRIDGE EXCAVATION
SCALE: 1/8" = 1'-0"

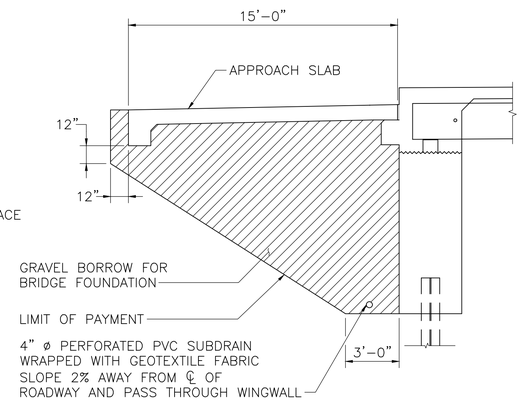


SAFETY CURB SIDEWALK

PARAFFIN JOINT DETAIL
SCALE: 3/4" = 1'-0"



FACE OF CURB DETAILS
SCALE: 3" = 1'-0"



INTEGRAL ABUTMENT BACKFILL
SCALE: 1/4" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
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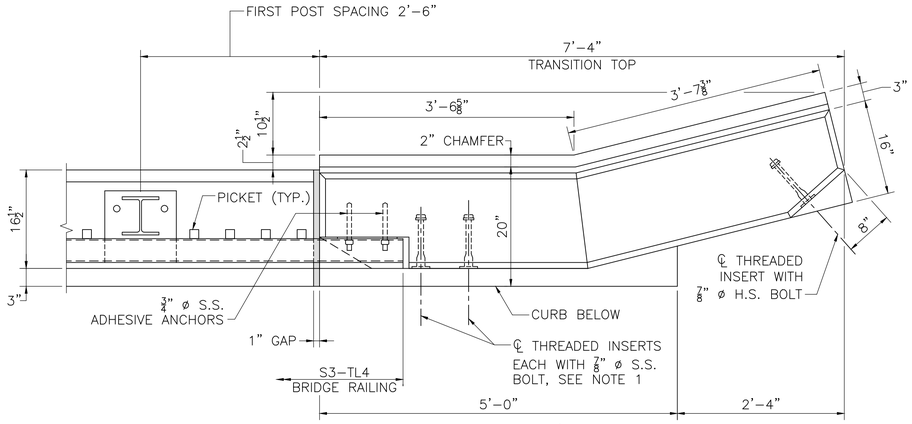
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

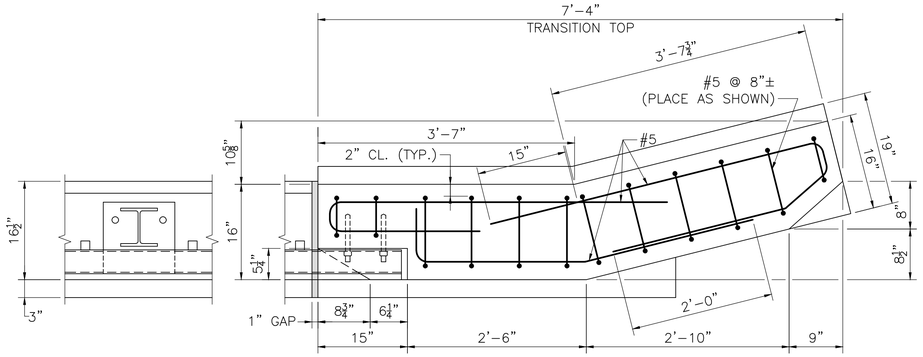
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	31	38
PROJECT FILE NO.		N/A	

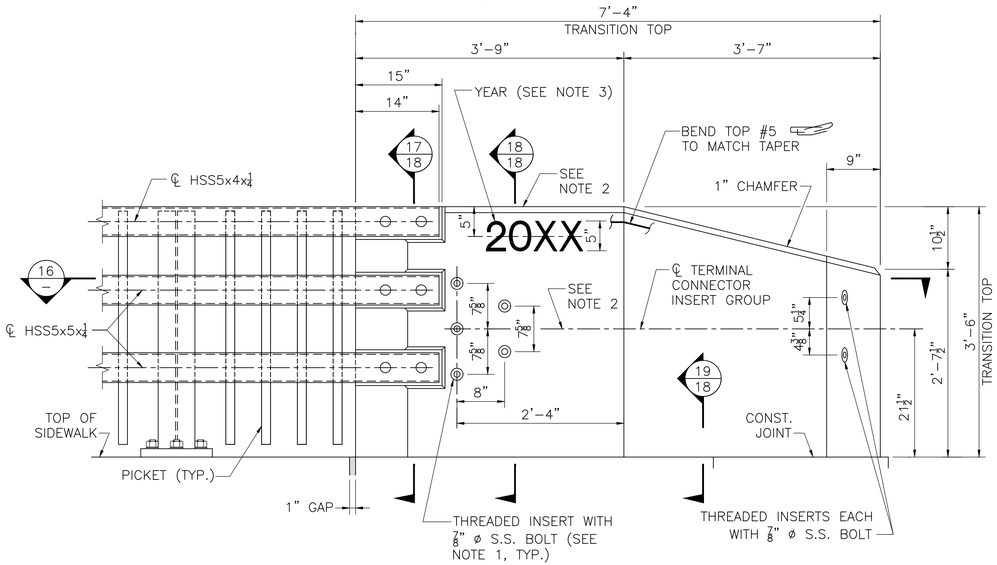
HIGHWAY GUARDRAIL
TRANSITION S3-TL4 (1 OF 2)



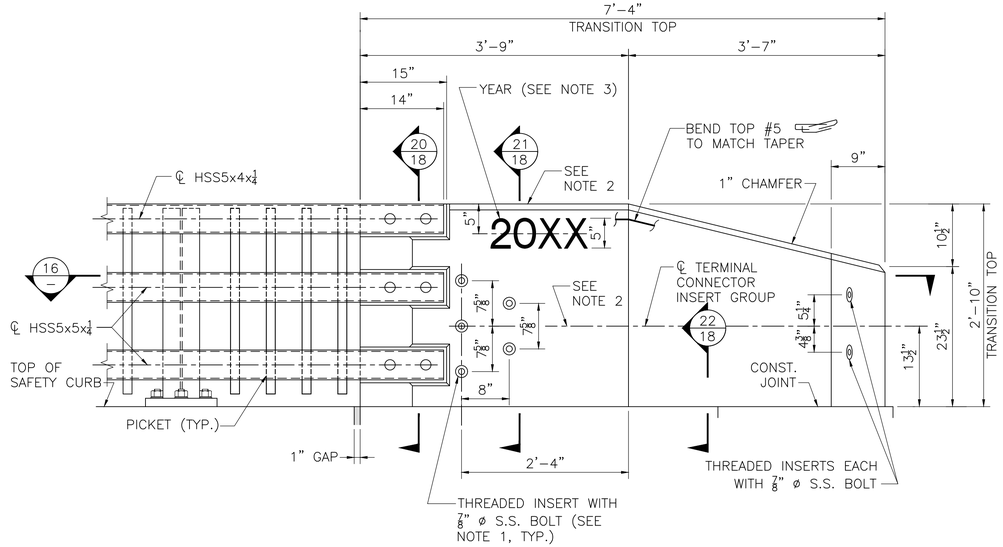
PLAN AT SAFETY CURB/SIDEWALK
SCALE: 1" = 1'-0"



SECTION 16
SCALE: 1" = 1'-0"



ELEVATION AT SIDEWALK
SCALE: 1" = 1'-0"



ELEVATION AT SAFETY CURB
SCALE: 1" = 1'-0"

NOTES:

1. THREADED INSERTS SHALL BE PREQUALIFIED BY THE MANUFACTURER AS BEING CAPABLE OF DEVELOPING A NOMINAL SHEAR RESISTANCE OF 20 KIPS PER ⅞" ø S.S. BOLT. S.S. BOLTS SHALL BE ⅞" ø x 1½" LONG FULLY THREADED AISI TYPE 304N STAINLESS STEEL. INSERTS FOR ⅞" S.S. BOLTS SHALL BE GALVANIZED AND CAST INTO THE TRANSITION.

2. FOR AN APPROACH GRADE UP TO 3%, THE TRANSITION MAY BE CAST SQUARE AND SET PLUMB WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SQUARE TO THE POST.

   FOR AN APPROACH GRADE IN EXCESS OF 3%, THE TRANSITION TOP AND THE TOP OF CURB SHALL FOLLOW THE APPROACH GRADE. THE HEIGHT OF THE TRANSITION TOP SHALL VARY PROVIDED THAT THE MINIMUM DIMENSIONS SHOWN ON THE CONSTRUCTION DRAWINGS ARE MET. THE BOTTOM OF THE TRANSITION BASE SHALL BE SET LEVEL WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SLOPED TO FOLLOW THE APPROACH GRADE.

3. USE LATEST CONTRACT COMPLETION YEAR IN EFFECT WHEN THE FIRST GUARDRAIL TRANSITION IS CAST. SEE GENERAL NOTES FOR LOCATION WHERE DATE IS TO BE PLACED.

4. ALL CONCRETE FOR THE PRECAST HIGHWAY GUARDRAIL TRANSITION SHALL BE 5000 PSI, ¾", 685 HP CEMENT CONCRETE.

5. LIFTING DEVICES (NOT SHOWN), INCLUDING THEIR NUMBER AND LOCATION, SHALL BE DESIGNED AND DETAILED BY THE PRECASTER. THEY SHALL BE GALVANIZED AND SHALL BE PLACED AND RECESSED IN POCKETS TO PROVIDE 1½" CLEAR COVER TO THE FACE OF THE TRANSITION CONCRETE. THESE DEVICES SHALL BE CLEARLY SHOWN ON THE SHOP DRAWINGS ALONG WITH ALL SUPPORTING CALCULATIONS AND/OR CATALOG CUTS. ONCE THE PRECAST TRANSITION IS SET IN PLACE, THE LIFTING DEVICE POCKETS SHALL BE FILLED WITH A NON-SHRINK GROUT THAT MATCHES THE COLOR OF THE TRANSITION CONCRETE WHEN CURED AND THE FILLED POCKETS SHALL BE RUBBED WITH A CORUNDUM STONE TO BLEND OUT THE JOINTS.

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
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DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

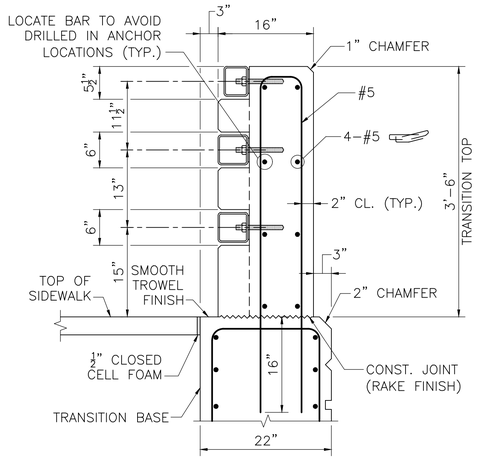
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	38
PROJECT FILE NO.		N/A	

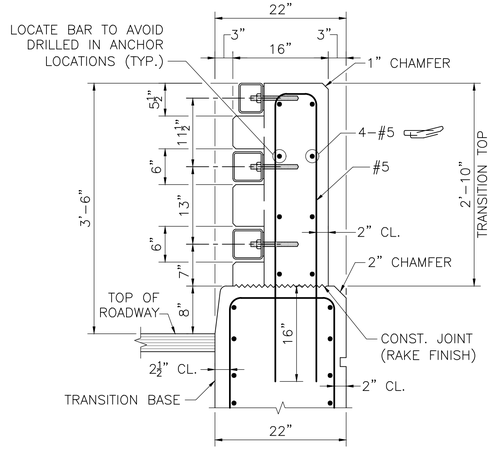
HIGHWAY GUARDRAIL
TRANSITION S3-TL4 (2 OF 2)

NOTE:

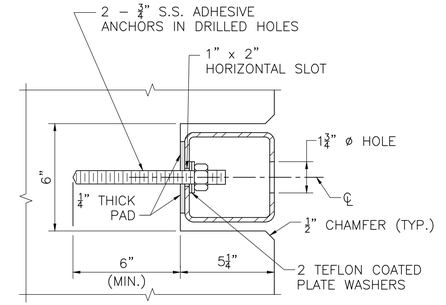
SEE SHEET 17 OF 20 FOR HIGHWAY GUARDRAIL TRANSITION NOTES.



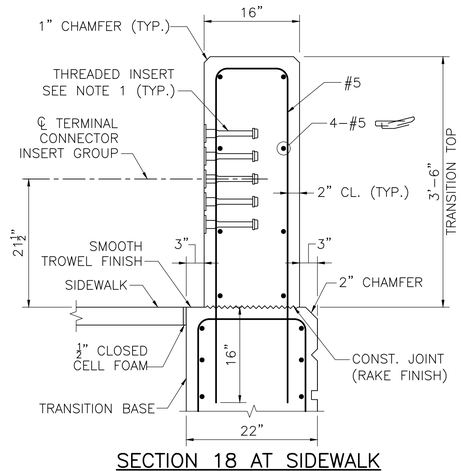
SECTION 17 AT SIDEWALK
SCALE: 1" = 1'–0"



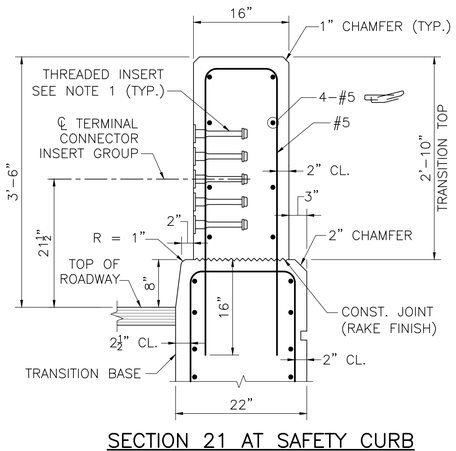
SECTION 20 AT SAFETY CURB
SCALE: 1" = 1'–0"



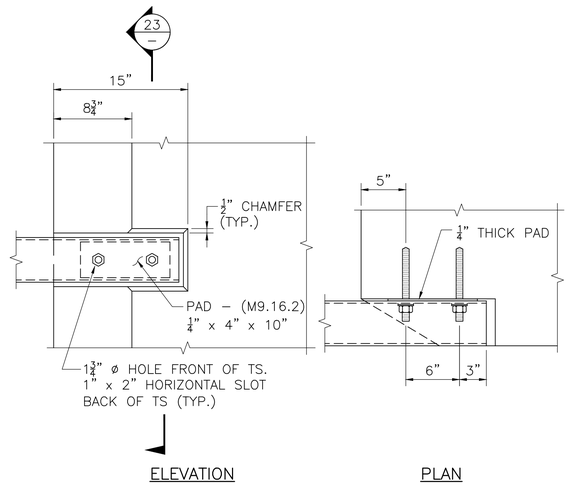
SECTION 23
SCALE: 3" = 1'–0"



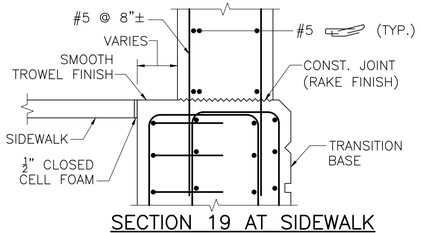
SECTION 18 AT SIDEWALK
SCALE: 1" = 1'–0"



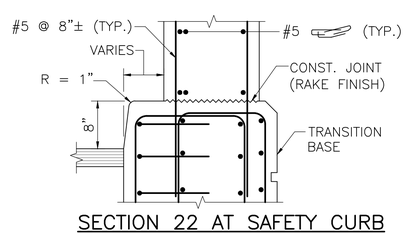
SECTION 21 AT SAFETY CURB
SCALE: 1" = 1'–0"



RAIL ATTACHMENT
SCALE: 1½" = 1'–0"



SECTION 19 AT SIDEWALK
SCALE: 1" = 1'–0"



SECTION 22 AT SAFETY CURB
SCALE: 1" = 1'–0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
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DATE	DESCRIPTION
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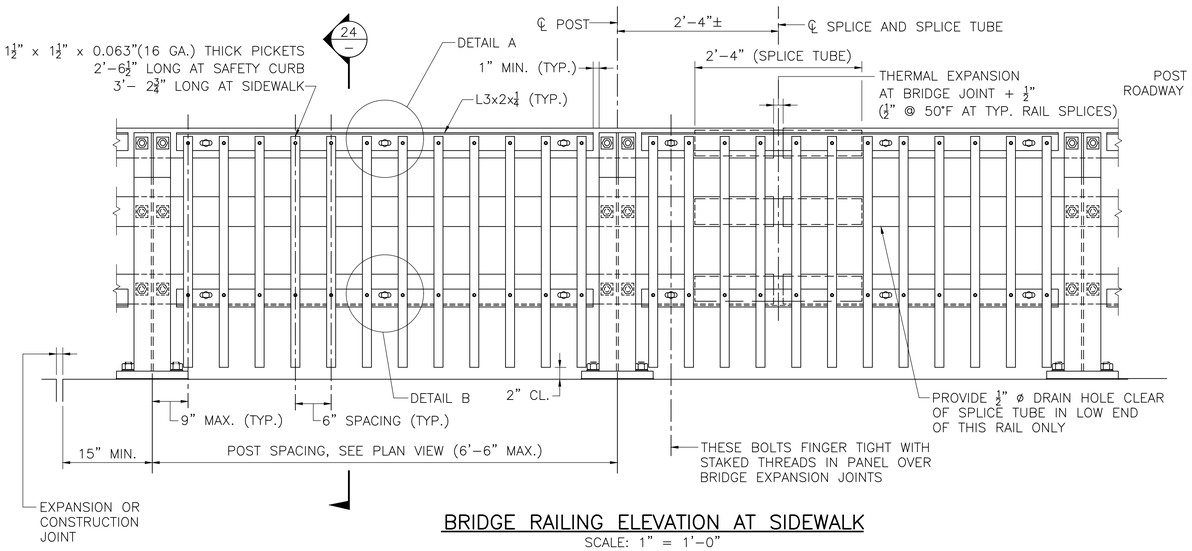
2839500_BR17-20N11007_W20001).DWG Plotted on 13-Dec-2022 10:32 AM

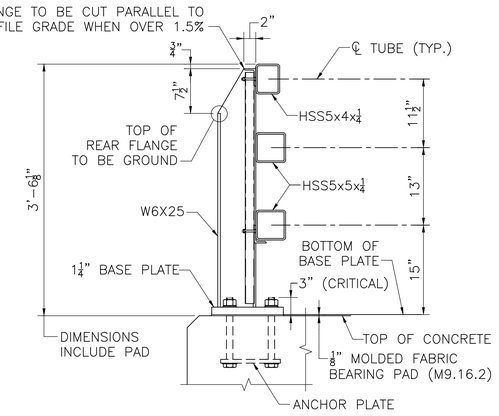
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	33	38
PROJECT FILE NO.		N/A	

S3-TL4 RAILING DETAILS (1 OF 2)



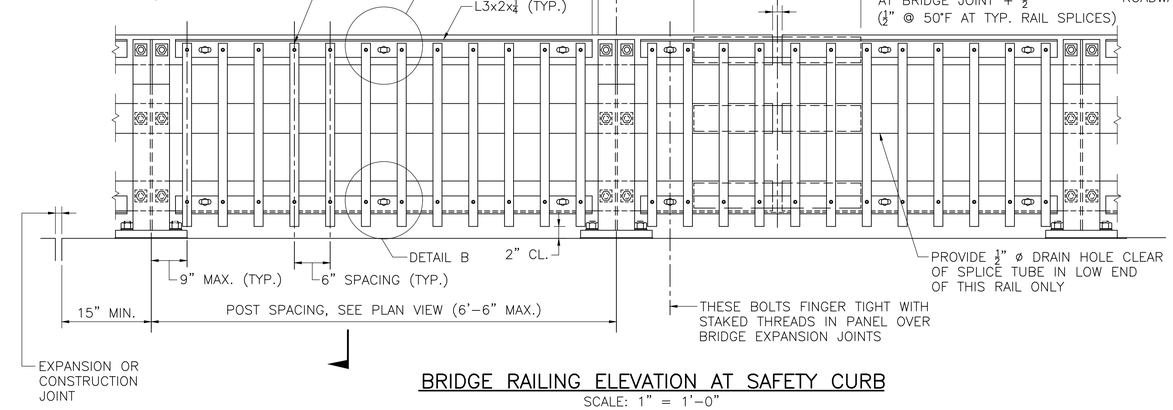
BRIDGE RAILING ELEVATION AT SIDEWALK
SCALE: 1" = 1'-0"



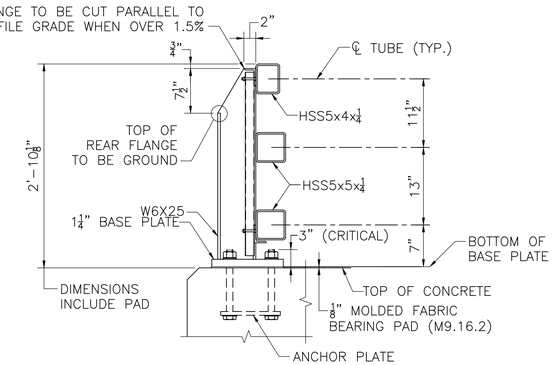
SECTION 24
SCALE: 1" = 1'-0"

RAILING NOTES:

1. RAIL POST AND BASE PLATES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 270 GRADE 50. HOLLOW RAILING STRUCTURAL TUBING (HSS) SHALL CONFORM TO THE REQUIREMENTS OF ASTM A 500 WITH A CERTIFIED Fy = 50 KSI MINIMUM. THE MINIMUM HORIZONTAL BENDING RADII OF THE HSS TUBING SHALL BE 8 FEET. PICKET CARRIER ANGLES, ANCHOR PLATES, AND SPLICE TUBE PLATES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 270 GRADE 36. PICKET TUBING SHALL CONFORM TO ASTM A 513 WITH Fy = 36 KSI MIN. OR A 500 GRADE B.
2. ALL STEEL (EXCEPT THE ⅝" ANCHOR PLATE AND FASTENERS) SHALL BE GALVANIZED AND PAINTED DARK BRONZE (FEDERAL STD. 595B COLOR NO. 10045). ANCHOR PLATE SHALL BE GALVANIZED ONLY. HEADS OF ⅞" ø ROUND HEAD BOLTS SHALL BE PAINTED TO MATCH RAIL.
3. ANCHOR BOLTS SHALL BE SET WITH TEMPLATES. THE NUT SECURING THE POST BASE PLATE TO THE CONCRETE SHALL BE TIGHTENED TO A SNUG FIT AND GIVEN AN ADDITIONAL 1/8 TURN AFTER STEEL IS IN PLACE.
4. RAILS SHALL BE CONTINUOUS OVER A MINIMUM OF FOUR (4) POSTS WITHOUT SPLICES WHERE POSSIBLE. RAILS SHALL BE SPLICED IN THE PANELS OVER EXPANSION JOINT.
5. ENDS OF TUBE SECTIONS SHALL BE SAWED. GRIND SMOOTH EXPOSED EDGES. ALL CUT ENDS SHALL BE TRUE AND SMOOTH.
6. ALL POSTS TO BE PLUMB WHEN PROFILE GRADE EXCEEDS 1.5%. FOR PROFILE GRADES LESS THAN 1.5%, POSTS SHALL BE SET PERPENDICULAR TO GRADE.
7. POST FLANGE WELD DOES NOT REQUIRE MAGNETIC PARTICLE TESTING. WELD SHALL BE BACK-GOUGED ON BACK SIDE EXCEPT AT WEB. WELD IS THE SAME ON BOTH FLANGES.
8. ⅞" ø ROUND HEAD BOLTS SHALL CONFORM TO THE CHEMICAL AND PHYSICAL REQUIREMENTS OF AASHTO M 164.



BRIDGE RAILING ELEVATION AT SAFETY CURB
SCALE: 1" = 1'-0"



SECTION 25
SCALE: 1" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

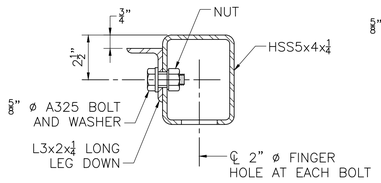
NEWBURYPORT = WEST NEWBURY
PLUMMER SPRING ROAD

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	38
PROJECT FILE NO.		N/A	

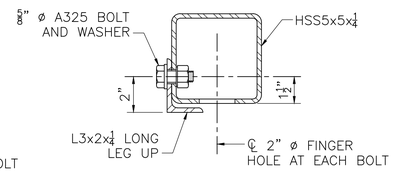
S3-TL4 RAILING DETAILS (2 OF 2)

NOTE:

SEE SHEET 19 OF 20 FOR RAILING NOTES.



SECTION 26



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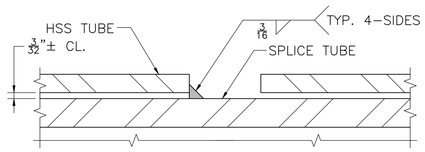
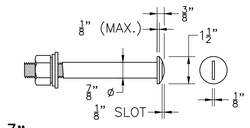
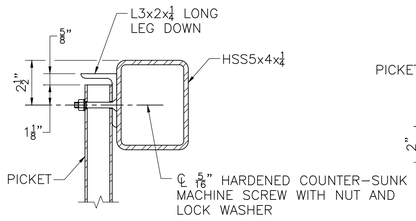


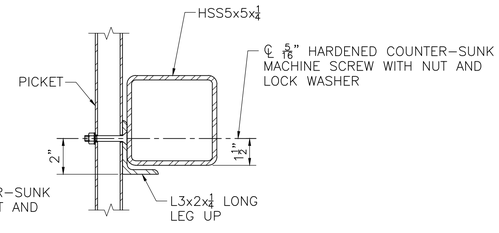
SPLICE DETAIL
FULL SIZE



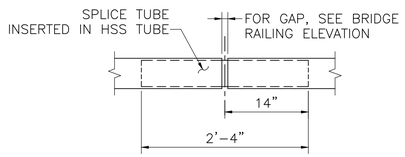
⅞" ø ROUND HEAD BOLT
SCALE: 3" = 1'-0"



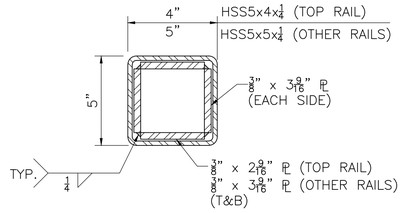
SECTION 27



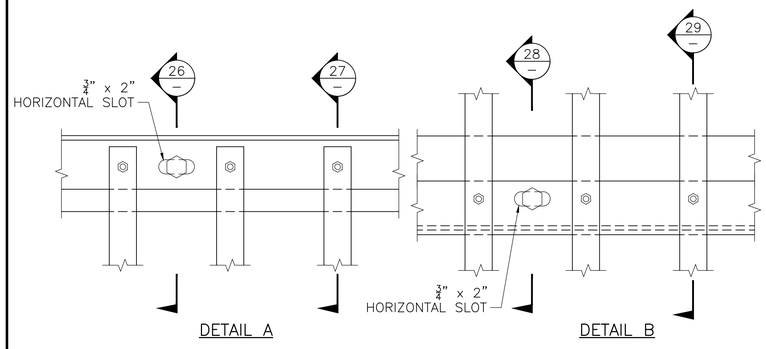
SECTION 29



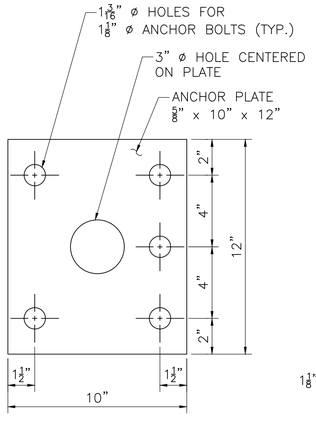
TYPICAL SPLICE
SCALE: 1" = 1'-0"



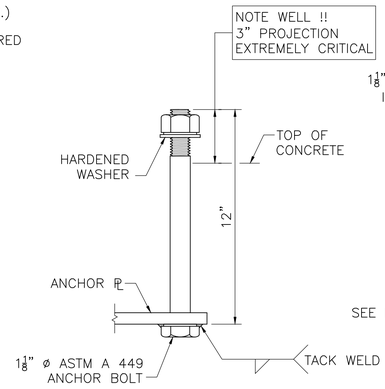
SPLICE TUBE DETAILS
SCALE: 3" = 1'-0"



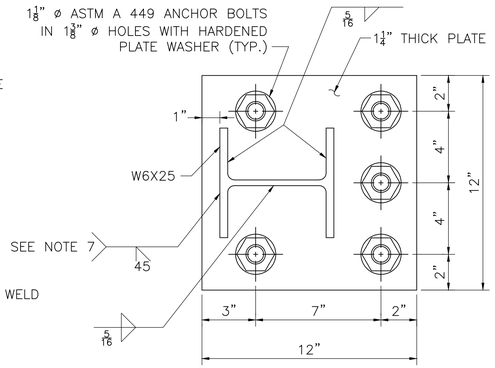
TYPICAL PICKET TO RAIL DETAILS
SCALE: 3" = 1'-0"



ANCHOR PLATE
SCALE: 3" = 1'-0"



ANCHOR BOLT
SCALE: 3" = 1'-0"



BASE PLATE
SCALE: 3" = 1'-0"

COMMONWEALTH OF MASSACHUSETTS
MassDOT, Highway Division
APPROVED UNDER PROVISIONS OF MASS. GEN. LAWS CH 85 S 35

STATE BRIDGE ENGINEER _____ DATE _____

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

CHAPTER 85 REVIEW 06-24-2021

2839500_BR17-20(N11007_W20001).DWG Plotted on 13-Dec-2022 10:32 AM

STRUCTURES INSPECTION FIELD REPORT

INITIAL ROUTINE ARCH INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
04	8BC	N-11-007=W-20-001

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	41-STATUS	90-ROUTINE INSP. DATE
NEWBURYPORT=WEST NEWBURY	N11007-8BC-MUN-BRI	000.000	A:OPEN	JUN 21, 2016

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	YR REHAB'D (NON 106)
HWY PLMMR SPRNG		1900	0000	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER
WATER ARTICHOKE RIVER	Rural Local	T. G. Weil

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER	PROJ MGR
811 : Masonry Arch - Deck	Town Agency	Town Agency	M. Scott	STV Incorporated

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
N : Not applicable	Sunny	24°C	J. MACKENZIE , A. GOUVEIA

ITEM 58 — DECK: N

		DEF
1. Wearing surface	5	M-P
2. Deck Condition	N	-
3. Spandrel Fill	H	-
4. Curbs	5	M-P
5. Median	N	-
6. Sidewalks	N	-
7. Parapets	N	-
8. Railing	2	S-A
9. Anti Missile Fence	N	-
10 Drainage System	N	-
11. Lighting Standards	N	-
12 Utilities	N	-
13 Deck Joints	N	-
14	N	-
15	N	-
16	N	-

CURB REVEAL (In millimeters): N = 191, S = 191

APPROACHES

		DEF
a. Appr. pavement condition	5	M-P
b. Appr. Roadway Settlement	5	M-P
c. Appr. Sidewalk Settlement	N	-
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: 6

		DEF
1. Arch/Arch Ring	6	-
2. Keystone Area	6	-
3. Stringers	N	-
4. Floorbeams	N	-
5. Spandrel Walls	5	M-P
6. Spring Lines	6	-
7. Diaphragms/Cross Frames	N	-
8. Conn Plt's, Gussets & Angles	N	-
9. Pin & Hangers	N	-
10 Masonry Joints	N	-
11. Rivets & Bolts	N	-
12 Welds	N	-
13 Deformation/Flattening	7	-
14 Member Alignment	7	-
15 Paint/Coating	N	-
16	N	-

Year Painted: N

COLLISION DAMAGE: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD DEFLECTION: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD VIBRATION: *Please explain*
None (X) Minor ( ) 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	N		-
c. Backwalls	N	N		-
d. Breastwalls	N	6		-
e. Wingwalls	N	4		S-P
f. Slope Paving/Rip-Rap	N	N		-
g. Pointing	N	6		-
h. Footings	N	X		-
i. Piles	N	N		-
j. Scour	N	H		-
k. Settlement	N	H		-
l.	N	N		-
m.	N	N		-
2. Piers or Bents			N	
a. Pedestals	N	N		-
b. Caps	N	N		-
c. Columns	N	N		-
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 ( )

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

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

ITEM 61 — CHANNEL & CHANNEL PROTECTION — 5

	Dive	Cur	DEF
1.Channel Scour	N	H	-
2.Embankment Erosion	N	5	M-P
3.Debris	N	N	-
4.Vegetation	N	6	-
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 (X) None ( )

ITEM 61 (Dive Report): N ***ITEM 61 (This Report):*** 5

93b-U/W INSP. DATE: 00/00/0000

ITEM 36 — *TRAFFIC SAFETY*

	36	COND	DEF
A. Bridge Railing	0	2	S-A
B. Transitions	0	2	S-A
C. Approach Guardrail	1	6	-
D. Approach Guardrail Ends	0	2	S-A

WEIGHT POSTING — *Not Applicable* X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	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

CLEARANCE POSTING — *Not* X

	N ft	N in	S ft	S in	meter
Actual Field Measurement		0		0	
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	N	N
Ladder	N	N
Boat	Y	Y
Waders	N	N
Inspector 50	N	N
Rigging	N	N
Staging	N	N
Traffic Control	N	N
RR Flagger	N	N
Police	N	N
Other:		
	N	N

TOTAL HOURS 70

PLANS (Y/N): N

(V.C.R.) (Y/N): N

TAPE#: _____

List of field tests performed:

RATING

Rating Report (Y/N): N

Date: 00/00/0000

Inspection data at time of existing rating

I 58: - I 59: - I 60: - Date : 00/00/0000

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].

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

REMARKS

BRIDGE ORIENTATION
The approaches are east and west. The elevations are north and south. The Artichoke River flows from south to north.

GENERAL REMARKS
There are no plans for this bridge; all bridge geometry dimensions were field measured **(see Sketches 1, 2, & 3)**.

ITEM 58 - DECK

Item 58.1 - Wearing surface
The bituminous wearing surface is worn and uneven. There is crack sealant in areas of bituminous failure and transverse cracking. The south edge of roadway has loss of pavement up to 35" long x 10" wide x 12" deep **(see Photo 1)**.

The bituminous wearing surface on the north side of the roadway has settlement up to 4".

Item 58.4 - Curbs
The spandral wall masonry stone act as the roadway curb. The south bridge curb line is displaced outward up to 8" **(see Photo 2)**.

Item 58.8 - Railing
See Item 36a.

APPROACHES

Approaches a - Appr. pavement condition
The east approach pavement is worn and uneven. There is widespread map cracking with crack sealants that have failed. Additional untreated cracks and failed pavement voids observed **(see Photo 3)**.

The southeast edge of roadway pavement has failed pavement void area up to 35" long x 10" wide x 12" deep **(see Photo 4)**.

The northeast approach pavement has a pothole up to 5' long x 48" wide x 4" deep **(see Photo 5)**.

Approaches b - Appr. Roadway Settlement
The east approach bituminous pavement has settlement up to 6" **(see Photo 6)**.

ITEM 59 - SUPERSTRUCTURE

Item 59.1 - Arch/Arch Ring
The arch/arch ring is masonry stone with random minor cracking in the underside of the stones with some areas of missing/deteriorated mortar.

Approximately 7'-5" from south fascia, 19" above east spring line there is a crack in the stone up to 7/16" wide x full height **(see Photo 7)**.

Approximately 10'-11" from south fascia, near mid-span, there is a hairline crack in the arch crown stone that extends the full height of the stone **(see Photo 8)**.

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REMARKS

Approximately 10'-11" from south fascia, above east spring line, a crack extends the full height of the stone **(see Photo 9)**.

Item 59.2 - Keystone Area
The south fascia east side of keystone immediately above arch ring is displaced up to 8" southerly with backfill falling out **(see Photo 10)**.

Item 59.5 - Spandrel Walls
The south spandrel wall is dry laid masonry stone that has voids of missing/deteriorated mortar with spandrel fill exposed **(see Photo 10)**.

Item 59.6 - Spring Lines
Both the east and west spring lines joints between stones typically were voided with radom cracks in the stones similar condition to arch ring.

ITEM 60 - SUBSTRUCTURE

Item 60.1 - Abutments
See Item 60.1.b

Item 60.1.d - Breastwalls
The breastwalls were below water level at time of inspection. The portion able to observe through the water exhibited similar condition to the arch ring near spring line.

Item 60.1.e - Wingwalls
The wingwalls are dry laid masonry stone.

Approximately 15'-10" from south springline, the southeast wingwall is leaning outward with a maximum lateral displacement up to 24" **(see Photo 11)**.

Approximately 15'-10" from south springline, the southeast wingwall there is a voided area at waterline up to 6' long x 20" high x 32" deep **(see Photo 12)**.

Approximately 15'-10" from south spring line in the southeast wall there is a voided area approximately 33" above waterline that is up to 57" long x 19" high x 32" deep. At the end of the southeast wingwall there are several stones that have slid down the eroded embankment **(see Photo 12)**.

ITEM 61 - CHANNEL AND CHANNEL PROTECTION

Item 61.2 - Embankment Erosion
The southeast embankment at the end of the southeast wingwall has sloughing with southeast approach curbing slid down the embankment **(see Photo 13)**.

Item 61.4 - Vegetation
The southeast embankment has minimal vegetation growth with exposed tree roots.

The northeast, northwest and southwest embankments have vegetation growth.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
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REMARKS

TRAFFIC SAFETY

Item 36a - Bridge Railing
Both the north and south bridge rail are 2.5" diameter steel pipe rails with 2.0" diameter steel pipe post system that is drilled into the masonry stone curb.

The south curb stones has displaced up to 24" so the south bridge rail is leaning outward **(see Photo 14)**.

The northwest bridge rail top steel pipe is broken/displaced and does not connect with transition rail **(see Photo 15)**.

The bridge railing does not meet current code requirements and has a minimal capacity to redirect/contain an errant vehicle.

Item 36b - Transitions
The northeast, southeast and southwest transitions are standard guardrail that are tack welded to the bridge rails **(see Photo 16)**.

The northwest transition rail does not connect with the bridge rail, it terminates with a fisted end.

Item 36c - Approach Guardrail
The southwest approach guardrail has areas of minor impact damage **(see Photo 17)**.

The northeast approach guardrail has several missing posts and excessive post spacing **(see Photo 13)**.

Item 36d - Approach Guardrail Ends
The southeast approach guardrail is a blunted end where the guardrail terminates **(see Photo 18)**.

The northwest and southwest approach guardrail ends are fisted and are in satisfactory condition.

The northeast approach guardrail end is a buried end and is in satisfactory condition.

Sketch / Photo Log
Sketch 1 : Plan View
Sketch 2 : Cross Section Looking East (@ Crown)
Sketch 3 : North Elevation
Photo 1 : Bridge Bituminous Wearing Surface Crack Sealant Failure
Photo 2 : South Bridge Curb Displaced Outwardly up to 8"
Photo 3 : East Approach Pavement Map Cracking and Settlement
Photo 4 : Southeast Approach Pavement Failed Pavement Voided Area
Photo 5 : Northeast Approach Pavement Pothole
Photo 6 : Southeast Approach Pavement Settlement
Photo 7 : East Arch Ring above Spring Line Approximately 7'-5" from South Fascia
Photo 8 : Arch Ring at Crown Approximately 10'-11" from South Fascia Crack in Stone
Photo 9 : Arch Ring above East Spring Line Approximately 10'-11" from South Fascia Crack in Stone
Photo 10 : South Fascia Stone above Keystone Displacement
Photo 11 : Southeast Wingwall Displacement up to 24"
Photo 12 : Southeast Wingwall Voided Areas of Missing Stones
Photo 13 : Southeast Wingwall End Displaced Curb Stones with Erosion
Photo 14 : Southeast Bridge Rail/Curb Leaning Outwardly
Photo 15 : Northwest Bridge Rail End is Bent and Transition Rail Ends with Fisted End

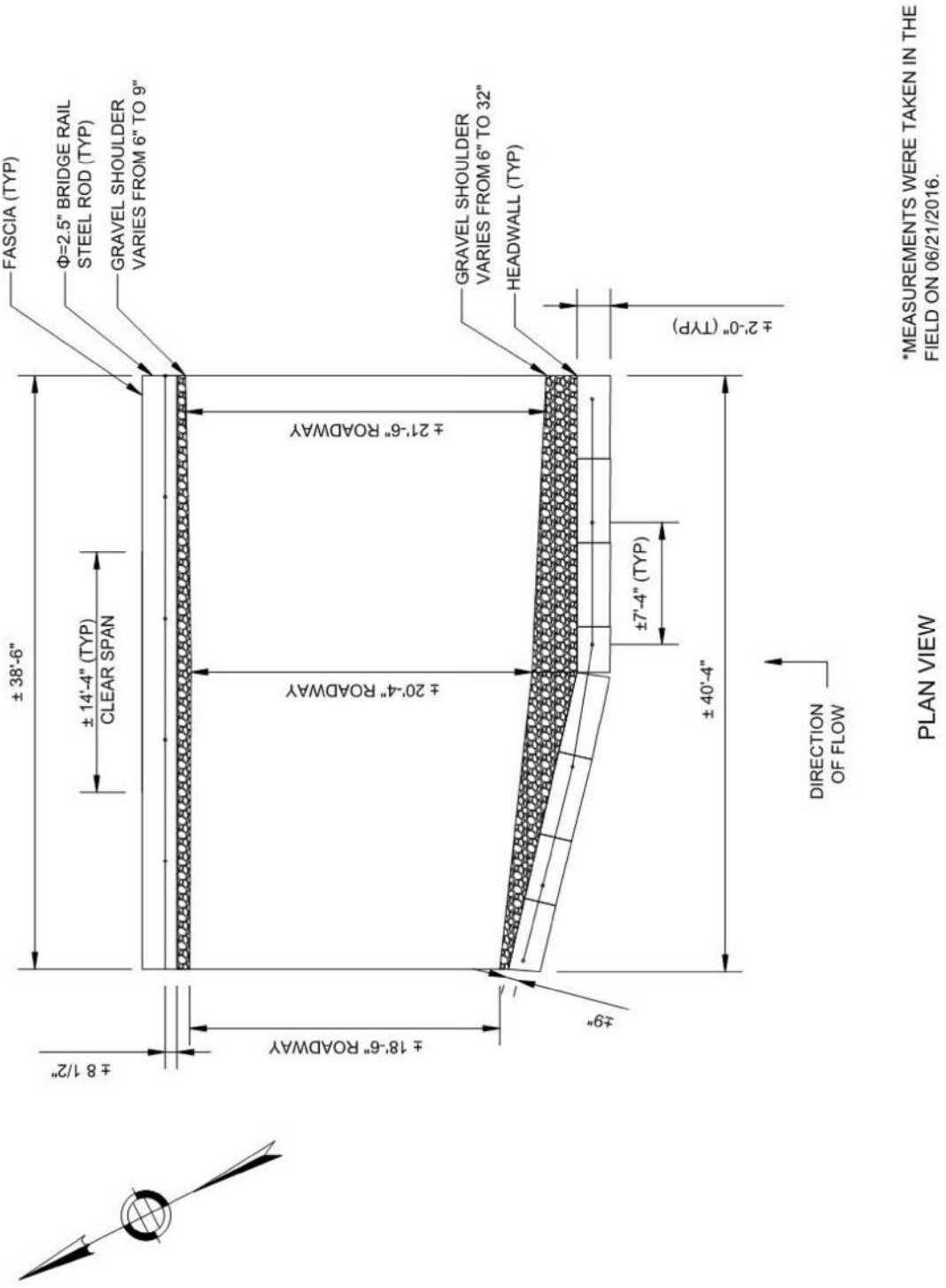
CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

REMARKS

Photo 16 : Southeast Bridge Rail and Transition Rail Tack Weld Connection
Photo 17 : Southwest Approach Guardrail Minor Impact Damage
Photo 18 : Southeast Approach Guardrail Terminates with Blunted End

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

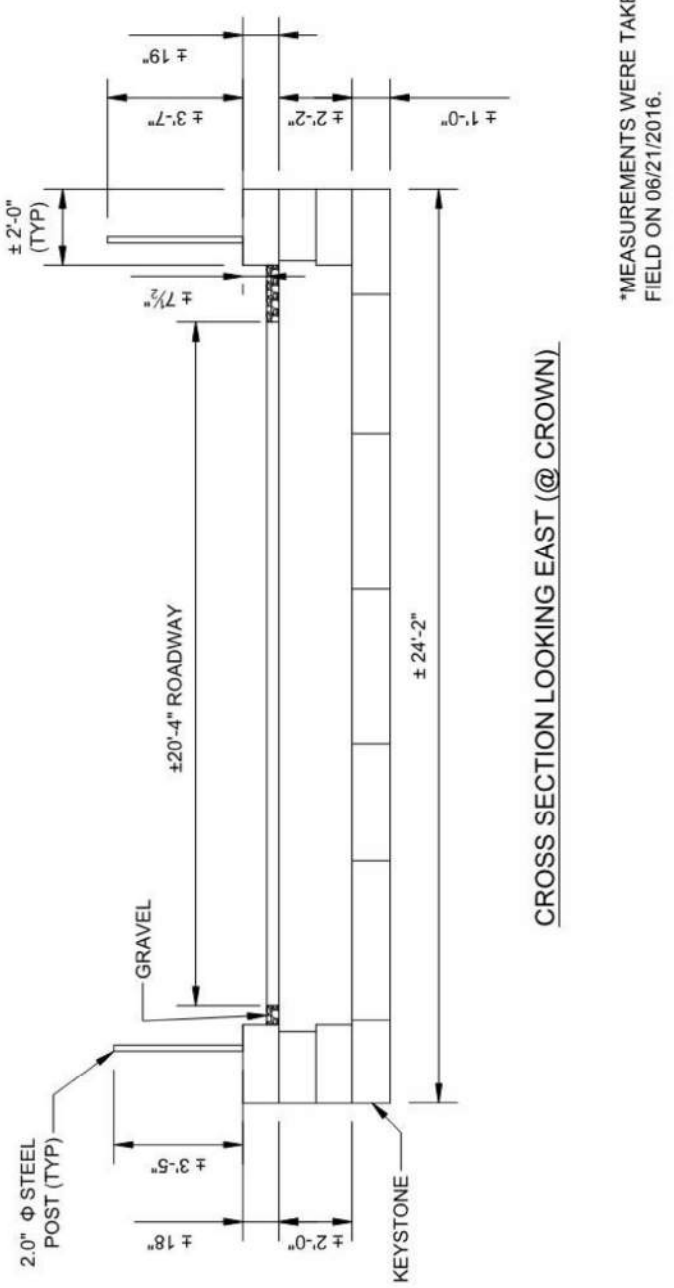
SKETCHES



Sketch 1: Plan View

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

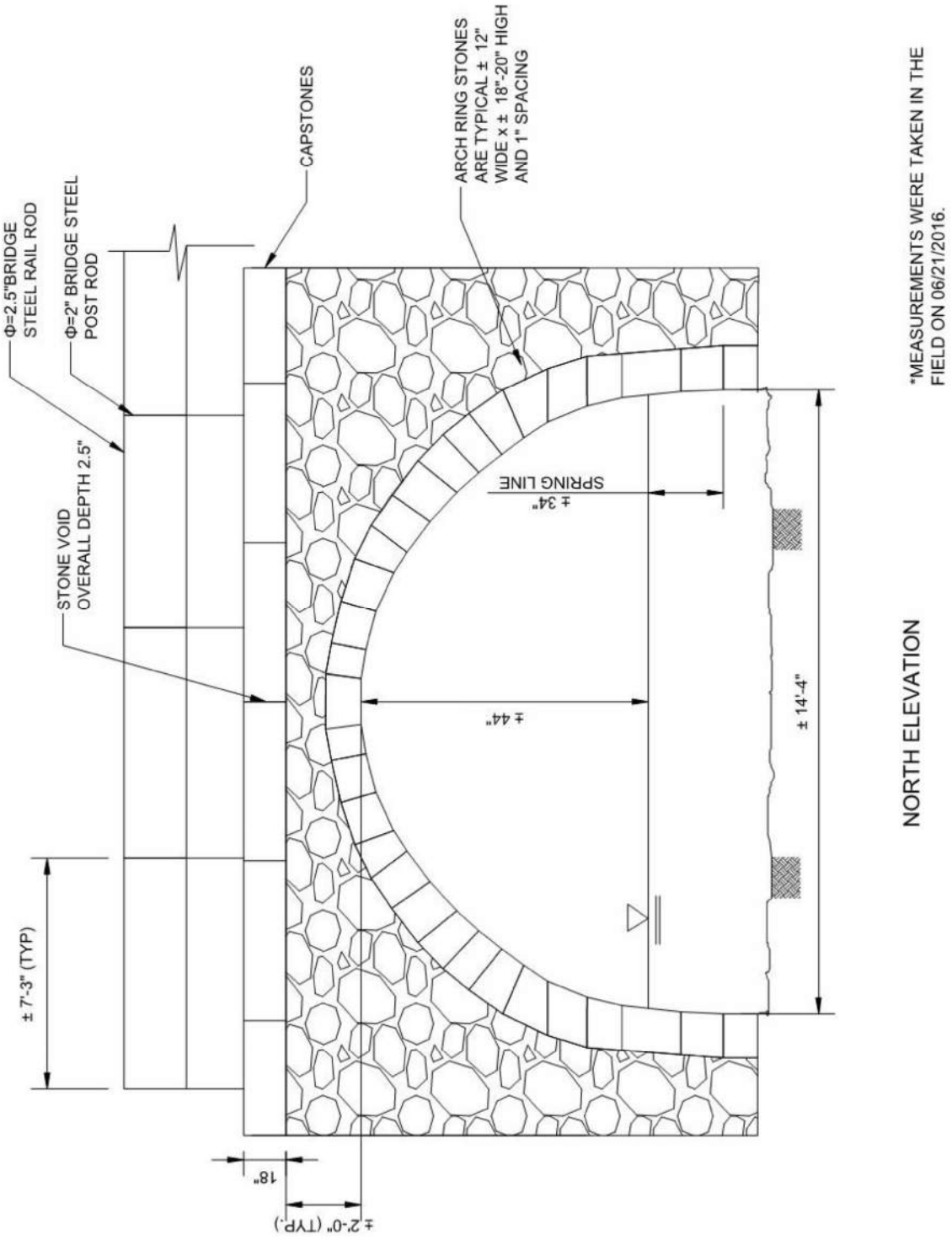
SKETCHES



Sketch 2: Cross Section Looking East (@ Crown)

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

SKETCHES



Sketch 3: North Elevation

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 1: Bridge Bituminous Wearing Surface Crack Sealant Failure

Photo 2: South Bridge Curb Displaced Outwardly up to 8"

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 3: East Approach Pavement Map Cracking and Settlement

Photo 4: Southeast Approach Pavement Failed Pavement Voided Area

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 5: Northeast Approach Pavement Pothole

Photo 6: Southeast Approach Pavement Settlement

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 7: East Arch Ring above Spring Line Approximately 7'-5" from South Fascia

Photo 8: Arch Ring at Crown Approximately 10'-11" from South Fascia Crack in Stone

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 9: Arch Ring above East Spring Line Approximately 10'-11" from South Fascia Crack in Stone

Photo 10: South Fascia Stone above Keystone Displacement

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 11: Southeast Wingwall Displacement up to 24"

Photo 12: Southeast Wingwall Voided Areas of Missing Stones

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 13: Southeast Wingwall End Displaced Curb Stones with Erosion

Photo 14: Southeast Bridge Rail/Curb Leaning Outwardly

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 15: Northwest Bridge Rail End is Bent and Transition Rail Ends with Fisted End

Photo 16: Southeast Bridge Rail and Transition Rail Tack Weld Connection

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
NEWBURYPORT=WEST NEWBURY	8BC	N-11-007=W-20-001	N11007-8BC-MUN-BRI	JUN 21, 2016

PHOTOS

Photo 17: Southwest Approach Guardrail Minor Impact Damage

Photo 18: Southeast Approach Guardrail Terminates with Blunted End

Report Date: December 12, 2022

State Information

BDEPT#= N11007=W20001 Agency Br.No.

Town= Newburyport=West Newbury L.O.

B.I.N= 8BC AASHTO= 021.0

RANK= 0 H.I.= 0 FHWA Select List= N (6/21/2017)

Identification

(8) Structure Number	N110078BCMUNBRI
(5) Inventory Route	150000000
(2) State Highway Department District	04
(3) County Code 009 (4) Place code	45245
(6) Features Intersected	**WATER ARTICHOKE RIVER**
(7) Facility Carried	**HWY PLMMR SPRNG**
(9) Location	.5 MI W OF TURKEY HILL RD
(11) Kilometerpoint	0000.000
(12) Base Highway Network	N
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 48 MIN 10.84 SEC
(17) Longitude	70 DEG 55 MIN 51.97 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No. #	

Structure Type and Material

(43) Structure Type Main: Masonry	Code 811
Arch - Deck	Jointless bridge type: Not applicable
(44) Structure Type Appr:	
Other	Code 000
(45) Number of spans in main unit	001
(46) Number of approach spans	0000
(107) Deck Structure Type - Not applicable	Code N
(108) Wearing Surface / Protective System:	
A) Type of wearing surface - Bituminous	Code 6
B) Type of membrane - Not applicable=no deck	Code N
C) Type of deck protection - Not applicable=no deck	Code N

Age and Service

(27) Year Built	1900
(106) Year Reconstructed	0000
(42) Type of Service: On - Highway	
Under - Waterway	Code 15
(28) Lanes: On Structure 02	Under structure 00
(29) Average Daily Traffic	000300
(30) Year of ADT 2017	(109) Truck ADT 06 %
(19) Bypass, detour length	006 KM

Geometric Data

(48) Length of maximum span	0004.4 M
(49) Structure Length	00004.4 M
(50) Curb or sidewalk: Left 00.0 M	Right 00.0 M
(51) Bridge Roadway Width Curb to Curb	006.2 M
(52) Deck Width Out to Out	007.4 M
(32) Approach Roadway Width (w/shoulders)	005.9 M
(33) Bridge Median - No median	Code 0
(34) Skew 00 DEG	(35) Structure Flared N
(10) Inventory Route MIN Vert Clear	99.99 M
(47) Inventory Route Total Horiz Clear	06.2 M
(53) Min Vert Clear Over Bridge Rdwy	99.99 M
(54) Min Vert Underclear ref N	00.00 M
(55) Min Lat Underclear RT ref N	00.0 M
(56) Min Lat Underclear LT	00.0 M

Navigation Data

(38) Navigation Control - No navigation control on waterway	Code 0
(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	N
(104) Highway System	N
(26) Functional Class - Rural Local	09
(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 - Town Agency	03
(22) Owner - Town Agency	03
(37) Historical Significance undetermined	

Condition

	Code
(58) Deck	N
(59) Superstructure	5
(60) Substructure	6
(61) Channel & Channel Protection	5
(62) Culverts	N

Load Rating and Posting

	Code
(31) Design Load - Unknown	0
(63) Operating Rating Method - Allowable Stress (AS)	2
(64) Operating Rating	00.0
(65) Inventory Rating Method - Allowable Stress (AS)	2
(66) Inventory Rating	00.0
(70) Bridge Posting	0
(41) Structure - Closed	K

Appraisal

	Code
(67) Structural Evaluation	0
(68) Deck Geometry	4
(69) Underclearances, vert. and horiz.	N
(71) Waterway adequacy	7
(72) Approach Roadway Alignment	4
(36) Traffic Safety Features	0 0 1 0
(113) Scour Critical Bridges	6

Inspections

(90) Inspection Date 06/16/22 (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	N	00	MO C)	05/23/17
(*) Other Inspection ()	N	00	MO *)	02/26/18
(*) Closed Bridge	Y	12	MO *)	06/16/22
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 00/00/00	H20	Type 3	Type 3S2	Type HS
Operating	0.0	0.0	0.0	0.0
Inventory	0.0	0.0	0.0	0.0

Field Posting

Status Posting Date 00/00/00

	2 Axle	3 Axle	5 Axle	Single
Actual				
Recommended				

Missing Signs N

Misc.

Bridge Name

N Anti-missile fence N Acrow Panel N Jointless Bridge

Freeze/Thaw N : Not Applicable

Stairs On/Adjacent 0 Stair Owner(s)

Accessibility (Needed/Used)

N / N Liftbucket	N / N Rigging	N / N Other
N / N Ladder	N / N Staging	
Y / N Boat	N / N Traffic Control	
Y / N Wader	N / N RR Flagperson	Inspection Hours: 008
N / N Inspector 50	N / N Police	

APPENDIX C
TEST BORING LOGS

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

ENGINEERING SINCE 1995

Project Name:	Plummer Spring Road
Location:	Newburyport, MA
Boring No.	BB-1
Page:	1 of 2
GTR Job #:	22.219
GTR Rep:	C. George
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation		
Driller:	Steve DeSimone	Helper(s):	Joe/Frank
Start Date:	2/4/2019	End Date:	2/5/2019
Gnd Surface Elev (ft):	~ 17.7'		
Location:	808857.91 E , 3118163.09 N		
Note:	Truck mounted Deidrich D50 with Automatic Hammer		

Equipment	Casing	Sampler	Core
Type	HW	SS	NX
Size I.D.	4"	1.75"	2.16"
Hammer Wt.	300 lb	140 lb	-
Hammer Fall	30 in	30 in	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
2/5	7am	5.5'	45'	

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
		SS-1A	24/16	0.7-1.7	59-20		S-1A,Dry, brown, dense, fine SAND, little Silt, trace Gravel	ASPHALT		1,2
		SS-1B		1.7-2.7	14-8		S-1B, Dry, brown, Hard, Clayey SILT, trace fine Sand	8"		
5		S-2	24/15	5-7	2-3		Wet, Brown, very loose, fine to medium SAND, little Clayey Silt, trace Gravel	FILL		
					1 for 12"					
10		SS-3	24/14	10-12	3-2		Wet, Brown, very loose, fine to medium SAND, trace Silt, trace Gravel			
					1 for 12"					
15		SS-4	24/12	15-17	20-7		Wet, Brown, loose, fine to medium SAND, some Gravel	18.5'		
					3-7					
20		SS-5	24/20	20-22	3-2		Gray, medium stiff, CLAY & SILT	CLAY		
					3-3					
25		SS-6	24/12	25-27	4-4		Gray, loose, fine to medium SAND, little Silt, trace Gravel	23.5'		
					5-7			SAND		

NOTES:

1. Water level checked prior to starting the second day of drilling.
2. The upper 15 feet of the boring was completed with 4-inch hollow stem augers.

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

GTR ENGINEERING SINCE 1995

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB-1
Page: 2 of 2
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Joe/Frank
Start Date: 2/4/2019 End Date: 2/5/2019
Gnd Surface Elev (ft): ~ 17.7'
Location: 808857.91 E , 3118163.09 N
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Type	HW	SS	NX	Date	Time	Water	Casing	Hole
Size I.D.	4"	1.75"	2.16"	2/5	7am	5.5'	45'	
Hammer Wt.	140 lb	140 lb	-					
Hammer Fall	30 in	30 in	-					

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test Results	Description and Classification	Stratum Description	Additional Data	Notes
30		SS-7A	24/14	30-31	10-7		SS-7A, Gray, medium dense, fine to medium SAND, little Gravel, trace Silt	SAND		
		SS-7B		31-32	17-12		SS-7B, Gray, medium dense, fine to medium SAND, some Clayey Silt, some Gravel	31'		
35		S-8	24/12	35-37	17-24		Gray, very dense, GRAVEL, some fine to coarse Sand, trace Clayey Silt	GLACIAL TILL		
					36-31					
40		SS-9	24/10	40-42	37-37		Gray, very dense, fine to medium SAND, little Gravel, little Silt			
					45-51					
45		SS-10	2/0	45-45.2	100 for 2"		No Recovery	44'		3
		C-1	60/51	45.2-50.2	5:45 min		Gray, slightly to moderately weathered, moderately to highly fractured, medium grained, moderately hard, TONALITE/ GRANODIORITE			
					6:30 min					
					6:45 min					
50					6:15 min					
					5:45 min			BEDROCK		
		C-2	60/54	50.2-55.2	4:45 min		Gray, slightly to moderately weathered, moderately to highly fractured, medium grained, moderately hard, TONALITE/ GRANODIORITE			
					4:00 min					
					6:00 min					
55					6:30 min					
					6:30 min					
							Bottom of boring at 55.2 feet below ground surface with 10 foot rock core.	55.2'		

NOTES:

3. Based on drilling action top of rock is at approximately 44 feet below ground surface.

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, N. Chelmsford, MA 01863
Ph: (978)251-9395, Fx: (978)251-9396

Project: Plummer Spring St Over Water Artichoke River
Project No: 19.107
Drawn By: C. George
Date: 2/11/19

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

Boring No.	BB-2A
Page:	1 of 2
GTR Job #:	22.219
GTR Rep:	C. George
Reviewer:	C. George

Project Name: Plummer Spring Road
Location: Newburyport, MA

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Frank
Start Date: 2/5/2019 End Date: 2/6/2019
Gnd Surface Elev (ft): ~ 17.9'
Location: 808900.72 E, 3118159.80 N
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	300 lb	140 lb	-
Hammer Fall	30 in	30 in	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
2/6	7am	6'	25'	

Sample Data

Depth	Case BPF	No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
		SS-1A	18/10	0.7-2.2	21-17		Dry, brown, dense, fine to medium SAND, little Silt, little Gravel	ASPHALT		1,2
		SS-1B			39			8"		
5		S-2	24/0	5-7	1-1		No Recovery			
					WOH for 12"					
		S-3	24/0	7-9	WOH for		No Recovery			
					24"					
10		SS-4	15/6	10-11.3	15-18		Wet, Brown, very dense, GRAVEL, little Sand, trace Silt	FILL		
					50 for 3"					3
15		SS-5	24/10	15-17	6-18		Wet, Brown, medium dense, fine to medium SAND, some Gravel, trace Clayey Silt, trace Wood Fibers			
					9-9					
								18'		4
20								PEAT		
		SS-6	24/6	20-22	7-10		Gray, medium dense, GRAVEL, some fine Sand, trace Silt	20'		
					12-16					
25		SS-7	24/7	25-27	46-10		Gray, medium dense,GRAVEL and fine to medium Sand, trace Clayey Silt	GLACIAL TILL		
					14-14					5
							Bottom of boring at 27 feet below ground surface due to battered casing.	27'		

NOTES:

1. Water level checked prior to starting the second day of drilling.
2. The upper 20 feet of the boring was completed with 4-inch hollow stem augers.
3. Boulder/Cobbles encountered at 10 to 15 feet below ground surface
4. Peat/Organic Silt observed on the augers at approximately 18 to 20 feet below ground surface.
5. Due to obstructions encountered casing was battered to much to continue drilling. Casing removed and rig moved ahead for BB-2B

Order of Sample Description (Modified Burmister)

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, N. Chelmsford, MA 01863
Ph: (978)251-9395, Fx: (978)251-9396

Project: Plummer Spring St Over Water Artichoke River
Project No: 19.107
Drawn By: C. George
Date: 2/11/19

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

ENGINEERING SINCE 1995

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB -2C
Page: 1 of 1
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Frank
Start Date: 2/6/2019 End Date: 2/6/2019
Gnd Surface Elev (ft): ~ 17.9'
Location: 808897.04 E, 3118156.24 E
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	300 lb	140 lb	-
Hammer Fall	30 in	30 in	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
2/6	7am	6'	25'	
Results from boring BB-2A				

Depth	Case BPF	Sample Data: No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test	Description and Classification	Stratum: Description	Additional Data	Notes
								ASPHALT		1,2
								8"		
5										
10								FILL		
										3
15										
								18'		
20								PEAT		
								20'		
25								GLACIAL TILL		

NOTES:

1. Stratum description from boring BB-2A. Boring BB-2B encountered obstruction at 10 feet below ground surface and relocated to BB-2C.
2. The upper 10 feet of the boring was completed with 4-inch hollow stem augers.
3. Boulder/Cobbles encountered at 5 to 15 feet below ground surface

Order of Sample Description (Modified Burmister)

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

GTR ENGINEERING SINCE 1995

Project Name: Plummer Spring Road
Location: Newburyport, MA

Boring No. BB-2C
Page: 2 of 2
GTR Job #: 22.219
GTR Rep: C. George
Reviewer: C. George

Drilling Co. Car-Dee Corporation
Driller: Steve DeSimone Helper(s): Frank
Start Date: 2/6/2019 End Date: 2/6/2019
Gnd Surface Elev (ft): ~ 17.9'
Location: 808897.04 E, 3118156.24 E
Note: Truck mounted Deidrich D50 with Automatic Hammer

Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Type	HW	SS	-	Date	Time	Water	Casing	Hole
Size I.D.	4"	1.75"	-	2/6	7am	6'	25'	
Hammer Wt.	140 lb	140 lb	-	Results from boring BB-2A				
Hammer Fall	30 in	30 in	-					

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (ft)	Blows per 6in	Field Test Results	Description and Classification	Stratum Description	Additional Data	Notes
30		SS-8	24/10	30-32	15-14		Gray, dense, GRAVEL and fine to coarse Sand, trace Clayey Silt			
					17-19					
										4
35		S-9	24/8	35-37	27-36		Gray, very dense, GRAVEL, some fine to coarse Sand, trace Clayey Silt	GLACIAL TILL		
					71-45					
40		SS-10	24/10	40-42	37-37		Gray, very dense, fine to medium SAND, little Gravel, little Clayey Silt			
					45-51					
							Bottom of boring at 42 feet below ground surface with no refusal encountered.	42'		
45										
50										
55										

NOTES:
3. Based on drilling action a cobble/boulder was encountered at approximately 32 to 33 feet below ground surface.

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

Project Name:	Plummer Spring Rd
Location:	West Newbury- Newburyport, MA

Boring No.	RW-1
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation			Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Driller:	Joe Desimone	Helper(s):	Frank Landers	Type	HW	SS	-	Date	Time	Water	Casing	Hole
Start Date:	7/8/2022	End Date:	7/8/2022	Size I.D.	4"	1.75"	-	8-Jul	EOD	8.5'		22'
Ground Surface Elev (ft):	~ 18.5 ft			Hammer Wt.	140 lb	140 lb	-	-	-	-	-	-
Boring Location:	808734.0596 E , 3118213.1986 N			Hammer Fall	30"	30"	-	-	-	-	-	-
Note:	Mobile Drill B-61 AutoHammer											

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
		SS-1	24/10	1-3	4 5		Loose, brown, f-c SAND, little Gravel.	10"		
					3 6		trace Silt,			
								GRANULAR FILL		
5		SS-2	24/6	5-7	8 7		M. dense, brown, f-m SAND, little Gravel,			
					3 1		trace Silt			
								8.5'		
10		SS-3	24/15	10-12	7 10		M. dense, brown, f-m SAND, trace Silt,			
					14 13					
		SS-4	24/17	12-14	12 14		M. dense, brown, f-m SAND, trace Silt,			
					14 11					
15		SS-5	24/15	14-16	9 14		M. dense, brown, GRAVEL, little Sand,	SAND		
					11 7		trace Silt			
		SS-6	24/14	16-18	6 7		M. dense, brown, f-c SAND, trace Silt,			
					7 8					
		SS-7	24/7	18-20	5 9		M. dense, brown, f-c SAND, trace Silt,			
					10 19					
20		SS-8	24/12	20-22	10 11		M. dense, brown, f-c SAND, trace Silt,			
					14 17					
							Bottom of boring at 22 feet below grade with no refusal encountered.	22'		
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

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Project Name:	Plummer Spring Rd
Location:	West Newbury- Newburyport, MA

Boring No.	Rw-2
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation			Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Driller:	Joe Desimone	Helper(s):	Frank Landers	Type	HW	SS	-	Date	Time	Water	Casing	Hole
Start Date:	7/8/2022	End Date:	7/8/2022	Size I.D.	4"	1.75"	-	8-Jul	EOD	8.5'		22'
Ground Surface Elev (ft):	~ 18 ft			Hammer Wt.	140 lb	140 lb	-	-	-	-	-	-
Boring Location:	808767.0992 E, 3118213.9304 N			Hammer Fall	30"	30"	-	-	-	-	-	-
Note:	Mobile Drill B-61 AutoHammer											

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								10"		
		SS-1	24/10	1-3	8 7		M. dense, brown, f-c SAND and Gravel,			
					7 8		trace Silt, moist			
5										
		SS-2	24/17	5-7	3 5		M. dense, brown, f-c SAND, some Gravel,	GRANULAR FILL		
					6 4		trace Silt, wet			
10										
		SS-3	24/0	10-12	1 1		no recovery			
					WH WH			12'		
		SS-4	24/20	12-14	3 6		V.stiff gray CLAY and SILT			
					10 22					
		SS-5	24/24	14-16	7 8		V.stiff gray CLAY and SILT			
15					11 12					
		SS-6	24/18	16-18	11 12		V.stiff gray CLAY and SILT	CLAY		
					12 10					
		SS-7	24/24	18-20	4 4		Stiff gray CLAY and SILT			
					7 7					
20		SS-8	24/21	20-22	9 7		Stiff gray CLAY and SILT			
					7 7					
							Bottom of boring at 22 feet below grade	22'		
							with no refusal encountered.			
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

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Project Name:	Plummer Spring Rd
Location:	West Newbury- Newburyport, MA

Boring No.	Rw-3
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation			Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Driller:	Joe Desimone	Helper(s):	Frank Landers	Type	HW	SS	-	Date	Time	Water	Casing	Hole
Start Date:	7/8/2022	End Date:	7/8/2022	Size I.D.	4"	1.75"	-	8-Jul	EOD	6'		22'
Ground Surface Elev (ft):	~ 17.5 ft			Hammer Wt.	140 lb	140 lb	-	-	-	-	-	-
Boring Location:	808792.8998 E , 3118185.1840 N			Hammer Fall	30"	30"	-	-	-	-	-	-
Note:	Mobile Drill B-61 AutoHammer											

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								5"		
		SS-1	24/9	.5-2.5	12 -8		M. dense, brown, f-m SAND , little Gravel,			
					5 -4		trace Silt			
5		SS-2	24/15	5-7	6 8		M. dense, brown, f-c SAND, trace Gravel,			
					3 1		trace Silt			
								GRANULAR FILL		
10		SS-3	24/6	10-12	3 2		loose, brown, f-c SAND, little Gravel, trace			
					2 1		Silt			
		SS-4	24/5	12-14	3 2		loose, brown, f-c GRAVEL, and Sand, trace			
					2 1		organics, trace Silt			
		SS-5	24/14	14-16	4-7		V.stiff gray CLAY and SILT	14'		
15					16-16					
		SS-6	24/18	16-18	15-17		V.stiff gray CLAY and SILT	CLAY		
					20-18					
		SS-7	24/22	18-20	5-6		Stiff gray CLAY and SILT			
					6-12					
20		SS-8	24/19	20-22	8-6		M. dense, brown, f-m SAND, trace Silt, wet	20'		
					5-5			SAND		
							Bottom of boring at 22 feet below grade	22'		
							with no refusal encountered.			
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

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Project Name:	Plummer Spring Rd
Location:	West Newbury- Newburyport, MA

Boring No.	Rw-4
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation			Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Driller:	Joe Desimone	Helper(s):	Frank Landers	Type	HW	SS	-	Date	Time	Water	Casing	Hole
Start Date:	7/8/2022	End Date:	7/8/2022	Size I.D.	4"	1.75"	-	8-Jul	EOD	6'		22'
Ground Surface Elev (ft):	~ 18 ft			Hammer Wt.	140 lb	140 lb	-	-	-	-	-	-
Boring Location:	808834.0589 E , 3118185.8987 N			Hammer Fall	30"	30"	-	-	-	-	-	-
Note:	Mobile Drill B-61 AutoHammer											

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								5"		
		SS-1	24/7	.5-2.5	6-3		M. stiff, brown, SILTY CLAY, little Gravel, moist			
					4-4					
5		SS-2	24/9	5-7	3-2		V. loose, brown, f. SAND and Silt, little small to medium Gravel, moist	GRANULAR FILL		
					1-1					
10		SS-3	24/19	10-12	1-2		V. loose, brown, F. SAND, trace small Gravel, trace Silt, wet			
					1-1					
		SS-4	24/15	12-14	1-3		M.dense, gray, f. SAND, trace silt, wet	12'		
					11-12					
		SS-5	24/16	14-16	9-5		M. dense, gray, f-c SAND, some gravel, trace Silt, wet	SAND		
15					8-5					
		SS-6	24/11	16-18	6-7		M. dense, gray, f. SAND, little silt, wet			
					9-10					
		SS-7	24/14	18-20	3-4		Stiff, gray, CLAYEY SILT, wet	18'		
					8-10			CLAY		
20		SS-8	24/21	20-22	7-7		Stiff, gray, CLAY, wet			
					5-6					
							Bottom of boring at 22 feet below grade with no refusal encountered.	22'		
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

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Phone: (978) 251-9395 www.gtrinc.net

Boring No.	Rw-5
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Project Name: Plummer Spring Rd
Location: West Newbury- Newburyport, MA

Drilling Co. Car-Dee Corporation
Driller: Joe Desimone Helper(s): Frank Landers
Start Date: 7/7/2022 End Date: 7/7/2022
Ground Surface Elev (ft): ~ 18 ft
Boring Location: 808914.2393 E , 3118137.8732 N
Note: Mobile Drill B-61 AutoHammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	140 lb	140 lb	-
Hammer Fall	30"	30"	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
7-Jul	EOD	6.5'		23'
-	-	-	-	-
-	-	-	-	-

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								4"		
		SS-1	24/15	.5-2.5	5-4		loose, brown, f-c SAND and Gravel, trace			
					3-1		Silt			
5										
		SS-2	24/14	5-7	5-3		loose, brown, GRAVEL and f-m Sand, trace			
					2-1		Silt			
								GRANULAR FILL		
10										
		SS-3	24/12	11-13	1-1		V. loose, brown, f-c SAND, little Gravel,			
					3-1		trace Silt			
		SS-4	24/2	13-15	3-8		M. Dense, brown, f-c SAND and Gravel,			
					17-20		trace Silt			
15		SS-5	24/6	15-17	11-19		M. Dense, gray, GRAVEL andf-m Sand,	15'		
					7-12		little Silt	PEAT		
		SS-6	24/9	17-19	10-7		V-Stiff, black, PEAT			
					9-5					
		SS-7	24/8	19-21	1-3		M. Stiff. Black, PEAT,	19'		
20					3-2					
		SS-8	24/22	21-23	5-8		M. Dense, brown, f-c SAND, little Gravel,	GLACIAL TILL		
					8-8		trace Silt			
							Bottom of boring at 23 feet below grade	23'		
							with no refusal encountered.			
25										

NOTES:

SS-4: Pushing stone in Tip
Organics 17-21'

Order of Sample Description (Modified Burmister)

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

Project Name:	Plummer Spring Rd
Location:	West Newbury- Newburyport, MA

Boring No.	RW-6
Page:	1 of 1
GTR Job #:	19.107
GTR Rep:	J. Roth
Reviewer:	C. George

Drilling Co.	Car-Dee Corporation			Equipment	Casing	Sampler	Core	Groundwater		Depth (ft)		
Driller:	Joe Desimone	Helper(s):	Frank Landers	Type	HW	SS	-	Date	Time	Water	Casing	Hole
Start Date:	7/7/2022	End Date:	7/7/2022	Size I.D.	4"	1.75"	-	7-Jul	EOD	9'		20'
Ground Surface Elev (ft):	~ 17.5 ft			Hammer Wt.	140 lb	140 lb	-	-	-	-	-	-
Boring Location:	808967.4360 E, 3118145.4665 N			Hammer Fall	30"	30"	-	-	-	-	-	-
Note:	Mobile Drill B-61 AutoHammer											

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								4"		
		SS-1	24/15	.5-2.5	8-11		M Dense, brown, GRAVEL and f-c Sand,			
					11-9		little Silt, moist			
								GRANULAR FILL		
5		SS-2	24/8	5-7	7-6		M. Dense, brown, f-c SAND and Gravel,			
					4-7		trace Silt, moist			
								8.5'		
10		SS-3	24/14	10-12	4-4		M. Dense, brown, GRAVEL, some f-c Sand,			
					7-5		trace Silt, wet			
								SAND		
15		SS-4	24/14	14-16	14-21		Dense, brown, GRAVEL and f-c Sand, trace			
					22-17		silt, wet			
		SS-5	24/15	16-18	36-26		Dense, brown, f-c SAND and Gravel, trace			
					18-19		silt, wet			
		SS-6	24/12	18-20	14-18		Dense, brown, f-c SAND and Gravel, trace			
					17-14		Silt, wet			
20							Bottom of boring at 20 feet below grade	20'		
							with no refusal encountered.			
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

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Boring No. RW-7
Page: 1 of 1
GTR Job #: 19.107
GTR Rep: J. Roth
Reviewer: C. George

Project Name: Plummer Spring Rd
Location: West Newbury- Newburyport, MA

Drilling Co. Car-Dee Corporation
Driller: Joe Desimone Helper(s): Frank Landers
Start Date: 7/7/2022 End Date: 7/7/2022
Ground Surface Elev (ft): ~ 17.5 ft
Boring Location: 808835.4063 E, 3118166.9332 N
Note: Mobile Drill B-61 AutoHammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	140 lb	140 lb	-
Hammer Fall	30"	30"	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
7-Jul	EOD	6'		22'
-	-	-	-	-
-	-	-	-	-

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
								4"		
		SS-1	24/12	.5-2.5	4-3		Loose, brown, f-m Sand, some Gravel,			
					4-3		trace Silt			
5										
		SS-2	24/16	5-7	6-3		loose, brown, f SAND, little Silt, trace			
					2-1		gravel, wet			
								GRANULAR FILL		
10		SS-3	24/6	10-12	3-2		V. loose, brown, f SAND, little Silt, trace			
					WH-1		Gravel			
		SS-4	24/17	14-16	7-6		loose, brown, f-c SAND and Gravel, trace			
15					2-5		Silt			
		SS-5	24/16	16-18	14-10		V. Stiff, gray, Clayey Silt	16'		
					9-9					
		SS-6	24/18	18-20	3-4		Stiff, gray, CLAY and SILT			
					6-7			CLAY		
20		SS-7	24/18	20-22	5-5		M. Stiff, gray, CLAY and SILT			
					3-3					
							Bottom of boring at 22 feet below grade	22'		
							with no refusal encountered.			
25										

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

GEOSCIENCES TESTING AND RESEARCH, INC.

55 Middlesex Street, Suite 225, North Chelmsford, MA.
Phone: (978) 251-9395 www.gtrinc.net

Boring No. RW-8
Page: 1 of 1
GTR Job #: 19.107
GTR Rep: J. Roth
Reviewer: C. George

Project Name: Plummer Spring Rd
Location: West Newbury- Newburyport, MA

Drilling Co. Car-Dee Corporation
Driller: Joe Desimone Helper(s): Frank Landers
Start Date: 7/7/2022 End Date: 7/7/2022
Ground Surface Elev (ft): ~ 18 ft
Boring Location: 808923.7848 E , 3118155.1964 N
Note: Mobile Drill B-61 AutoHammer

Equipment	Casing	Sampler	Core
Type	HW	SS	-
Size I.D.	4"	1.75"	-
Hammer Wt.	140 lb	140 lb	-
Hammer Fall	30"	30"	-

Groundwater		Depth (ft)		
Date	Time	Water	Casing	Hole
7-Jul	EOD	5.5		22'
-	-	-	-	-
-	-	-	-	-

Depth	Case BPF	Sample Data No.	Pen/ Rcvy	Depth (El.)	Blows per 6in	Field Test	Description and Classification	Stratum Description	Additional Data	Notes
0							Asphalt	ASPHALT		
		SS-1	24/20	.5-2.5	7-6		Stiff, brown, CLAYEY SILT, moist	4"		
					4-4					
5		SS-2	24/20	5-7	4-3		Loose, brown, f-c SAND, little Gravel, trace Silt			
					2-2					
								GRANULAR FILL		
10		SS-3	24/16	10-12	2-3		Loose, brown, f-c SAND and Gravel, trace Silt			
					2-1					
								13'		
15		SS-4	24/22	14-16	6-5		M. dense, brown, f-c GRAVEL and f- Sand, trace Silt			
					5-5					
		SS-5	24/22	16-18	3-7		M. dense, brown, fine SAND and Gravel, trace Silt			
					10-9			SAND		
		SS-6	24/14	18-20	WH-5		Loose, brown, f SAND and Gravel, trace Silt			
					4-7					
20		SS-7	24/10	20-22	5-8		M. dense, brown, f-c GRAVEL and Sand, trace Silt			
					6-16					
		SS-8	14/10	22-24	15-55/2		V. dense, brown, f-c GRAVEL and Sand, trace Silt	22' GLACIAL TILL		
25							Bottom of boring at 24 feet below grade with split spoon refusal encountered.	24'		

NOTES:

Order of Sample Description **(Modified Burmister)**

1. Moisture Content: Dry, Moist, Wet
2. Soil Relative Density or Consistency
3. Color
4. Major Component: Should be capitalized
5. Minor Component: "and" - 35% to 50% minor grain size
   "some" - 20% to 35% minor grain size
   "little" - 10% to 20% minor grain size
   "trace" - < 10% of minor grain size

PENETRATION RESISTANCE (N) GUIDE

Cohesionless Soils (Sands)	Cohesive Soils (Clays)
Relative Density / Blows per Foot	Consistency / Blows per Foot
Very Loose >> 0 - 4	Very Soft >> Below 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

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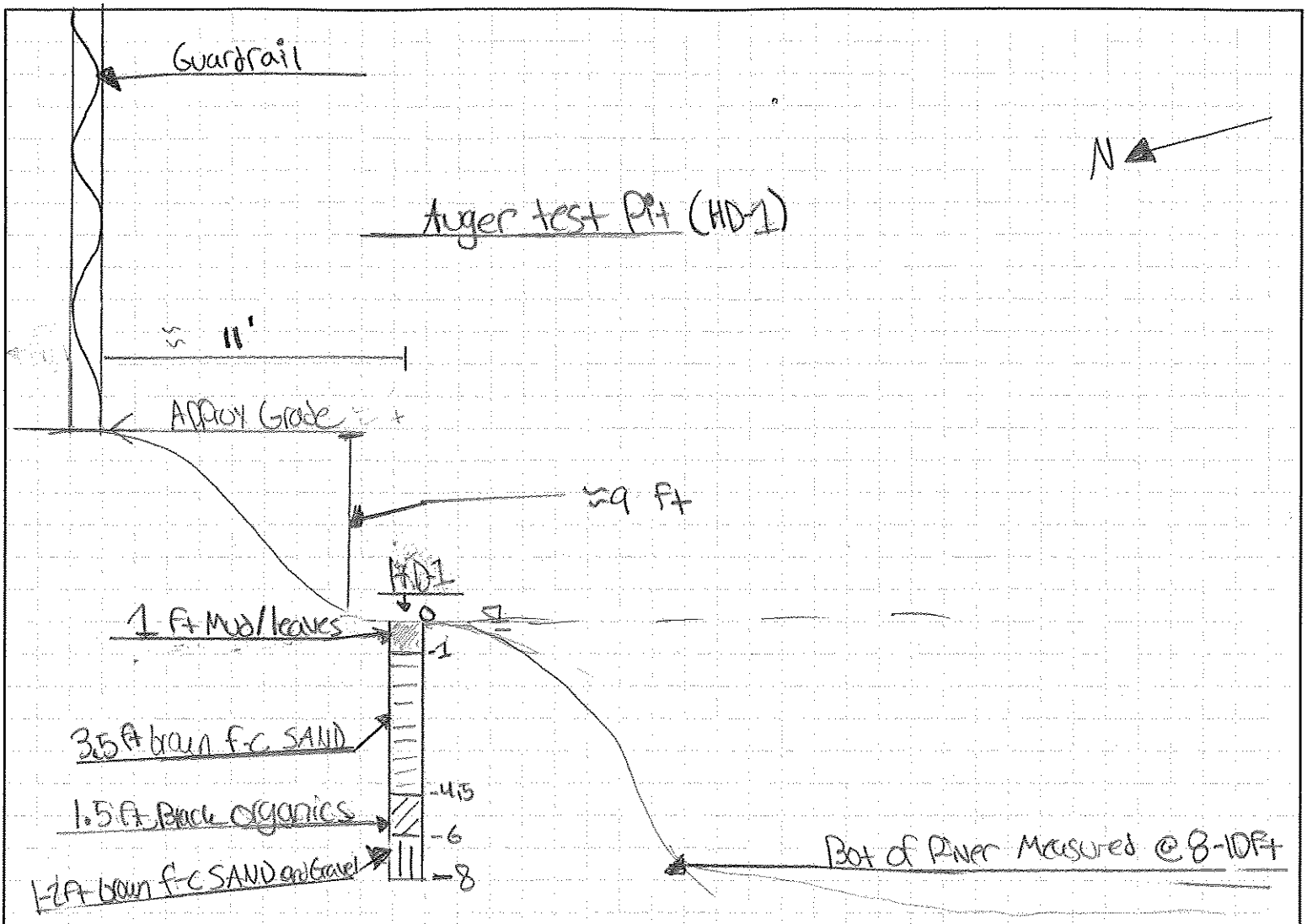
80 Business Park Drive, Suite 203, Armonk, New York 10504 (914) 600-8101

JOB 19.107
SHEET NO. 1 OF 1
CALCULATED BY LDD DATE 7/22/22
CHECKED BY _____ DATE _____
SCALE NTS



NOTES: 18" organic layer found between 13-15' below Grade

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JOB 14.107
SHEET NO. 1 OF 1
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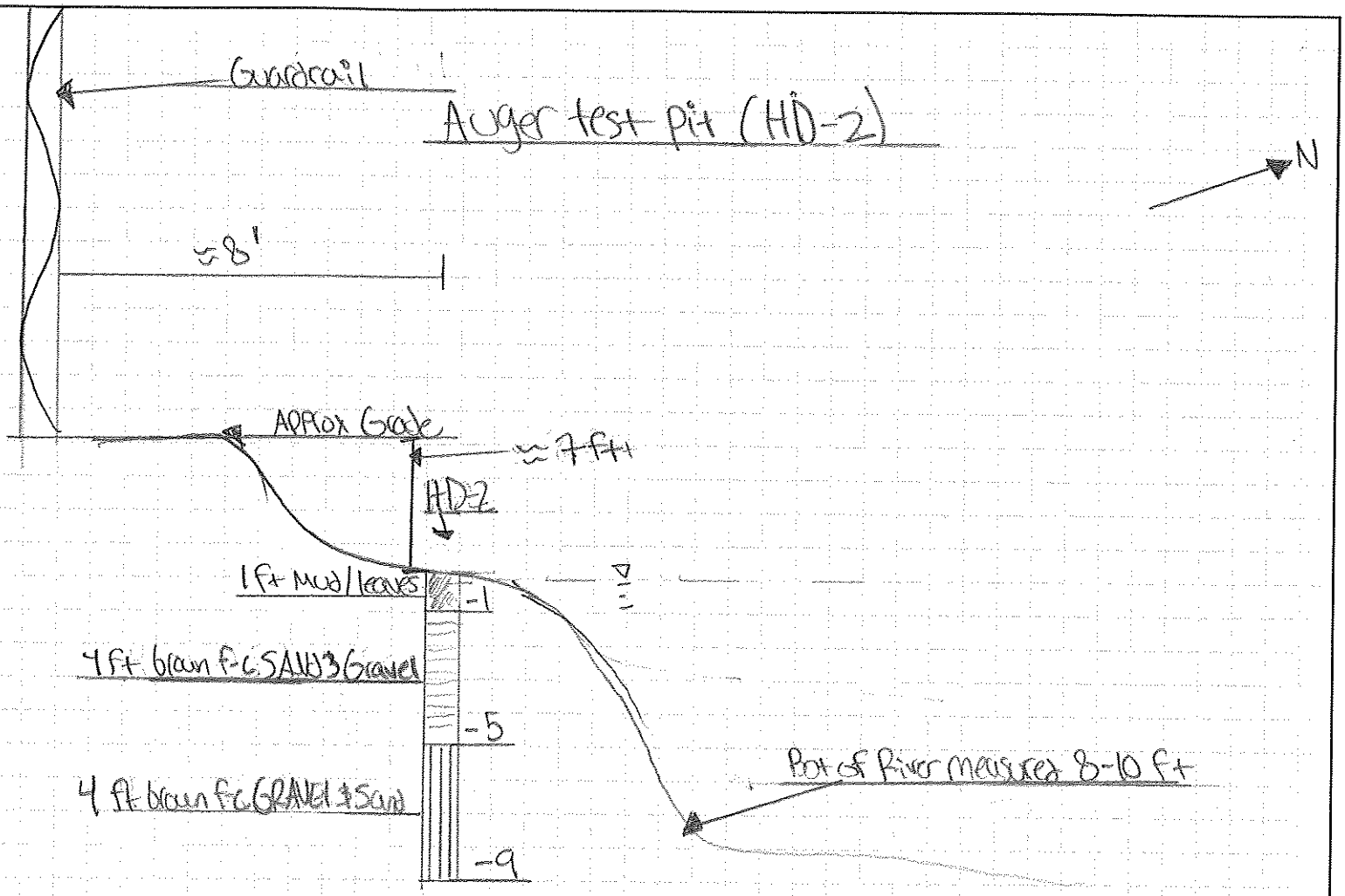
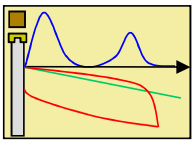
CHECKED BY _____ DATE _____
SCALE NTS



NOTES: No organic layer found

APPENDIX D
CALCULATIONS

Plummer Spring Road over Artichoke Reservoir
Newburyport/West Newbury, Massachusetts
AASHTO LRFD (8th Ed.)
Recommended Soil Design Parameters



Material	φ (degrees)	Wall Friction Angle
Exisiting Fill	32	17
Structural Fill	37	17
Glacial Till	38	17

Figure 5 pg 7.2-66

Interpolated Active and Passive Coefficients with Wall Friction				
Material	Fig 5 K_p	Interpolated Reduction Factor	Actual K_p	Fig 5 K_a
Existing Fill	7.7	0.737	5.7	0.29
Structural Fill	13.5	0.611	8.2	0.24
Glacial Till	14.7	0.585	8.6	0.23

Material	
Existing Fill	0.470
Structural Fill	0.398
Glacial Till	0.384

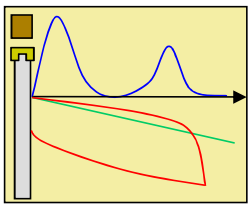
Recomended Values			
Material	K_p	K_a	K_o
Existing Fill	4	0.30	0.5
Structural Fill	7	0.27	0.5
Glacial Till	7	0.27	0.5

Determine Coefficient of Friction

Resistance Factor = 0.8 from Table 10.5.5.2.2-1 Cast in place on Sand
tanδ = 0.5 for cast concrete footing on Sand from Table C3.11.5.3-1

Calc SRH
Reviewed LRC

Plummer Spring Road over Artichoke Reservoir
Newburyport/West Newbury, Massachusetts
AASHTO LRFD (8th Ed.)
Seismic Site Class Calculations



Peck et al.
AASHTO C3.10.3.1-1: Method B

Granular Fill		Peat		Clay		Sand/Glacial Till		Bedrock	
Boring Number	Blow[1] Count	Boring Number	Blow Count	Boring Number	Blow Count	Boring Number	Blow Count	Boring Number	Blow Count
BB-1	34	BB-2	2	BB-1	5	BB-1	9	All Borings	100
	4						24		
	4						60		
	10						82		
	56					BB-2A	22		
	1						24		
BB-2A	0					BB-2C	31		
	36						100		
	27						82		
Avg N_1	19	Avg N_2	2	Avg N_3	5	Avg N_4	48	Avg N_5	100
d_1	18	d_2	2	d_3	5	d_4	22	d_5	53
d/N	0.94	d/N	1.00	d/N	1.00	d/N	0.46	d/N	0.53

AASHTO C3.10.3.1-1: Method B
The avg $\bar{N}$ for the top 100 ft

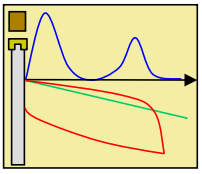
$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

$\bar{N}$	25

Seimic Site Class D: Stiff Soilk with 15 < $\bar{N}$ < 50 blows per foot

Calculated on 8/17/2022 by WGK
Reviewed on 8/17/2022 by CAG

Plummer Spring Road over Artichoke River
Newburyport/West Newbury, Massachusetts
AASHTO LRFD (8th Ed.)
Seismic Site Class Calculations



Peck et al.
AASHTO C3.10.3.1-1: Method B

Granular Fill		Peat		Clay		Sand/Glacial Till		Bedrock	
Boring Number	Blow[1] Count	Boring Number	Blow Count	Boring Number	Blow Count	Boring Number	Blow Count	Boring Number	Blow Count
BB-1	34	BB-2	2	BB-1	5	BB-1	9	BB-1, BB-2, BB-2A, & BB-2C	100
	4	RW-5	16	RW-2	16		24		
	4		6		19		60		
	10				24		82		
BB-2A	56				11	BB-2A	22		
	1				14		24		
	0			RW-3	23	BB-2C	31		
	36				37		100		
	27				11		82		
RW-1	8			RW-4	7	RW-8	9		
	10				12		14		
	24				12		100		
	28			RW-7	7				
	25				10				
	14				8				
	19			RW-8	10				
	25								
RW-2	14								
	11								
RW-3	13								
	11								
	4								
	4								
	11								
RW-4	3								
	3								
	14								
	13								
	16								
RW-5	7								
	5								
	4								
	25								
	26								
	16								
RW-6	22								
	10								
	11								
	43								
	44								
	35								
RW-7	5								
	2								
	8								
	19								
RW-8	5								
	5								
	10								
	17								
Avg N_1	16	Avg N_2	8	Avg N_3	14	Avg N_4	46	Avg N_5	100
d_1	18	d_2	4	d_3	5	d_4	22	d_5	53
d/N	1.16	d/N	0.50	d/N	0.35	d/N	0.47	d/N	0.53

AASHTO C3.10.3.1-1: Method B
The avg $\bar{N}$ for the top 100 ft

$\bar{N}$	33

$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

Seimic Site Class D: Stiff Soil with 15 < $\bar{N}$ < 50 blows per foot

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JOB 19107 Plummer St
SHEET NO. 1 OF 1
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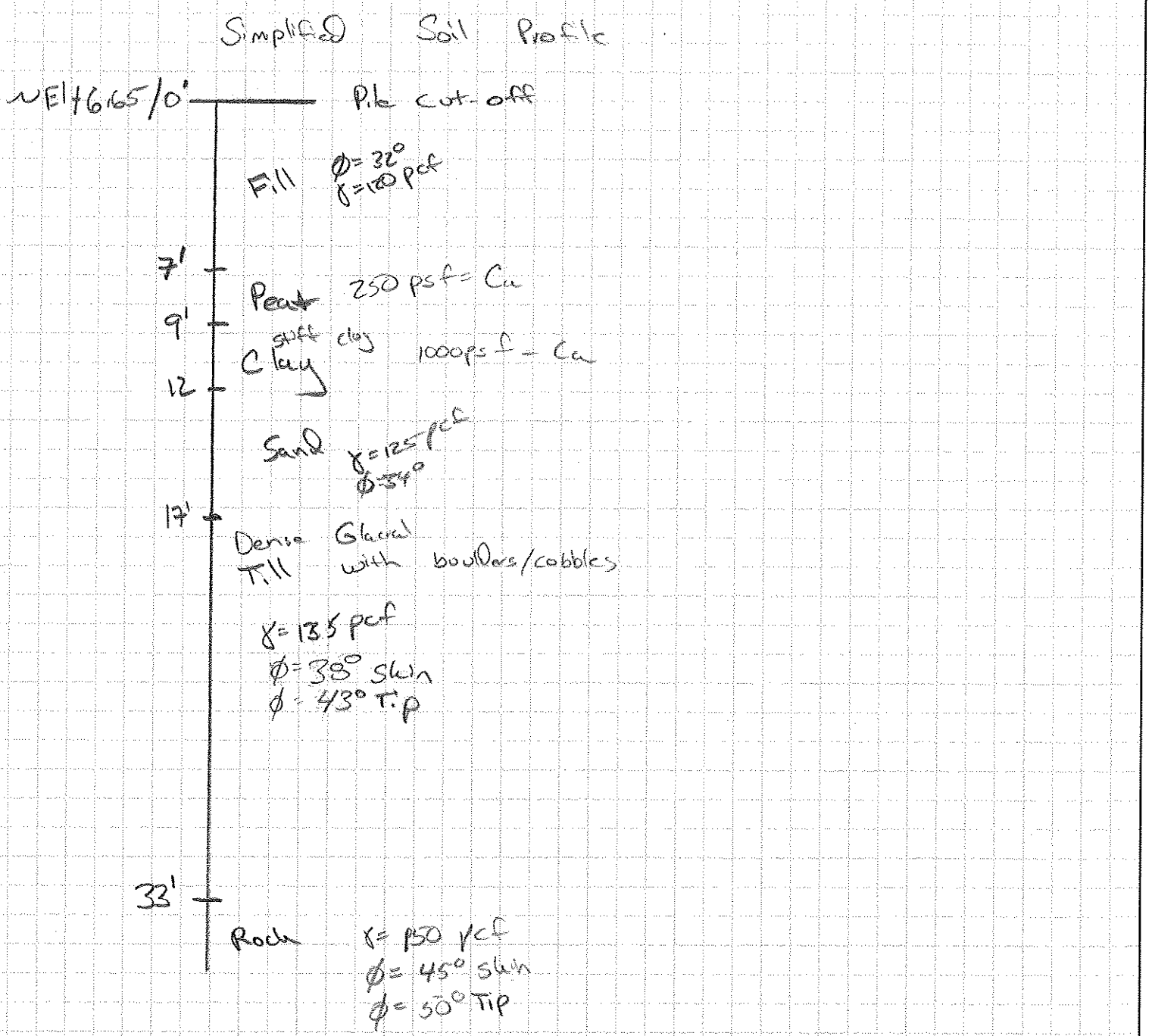
CHECKED BY LRC DATE 12/10/2019
SCALE N.T.S.



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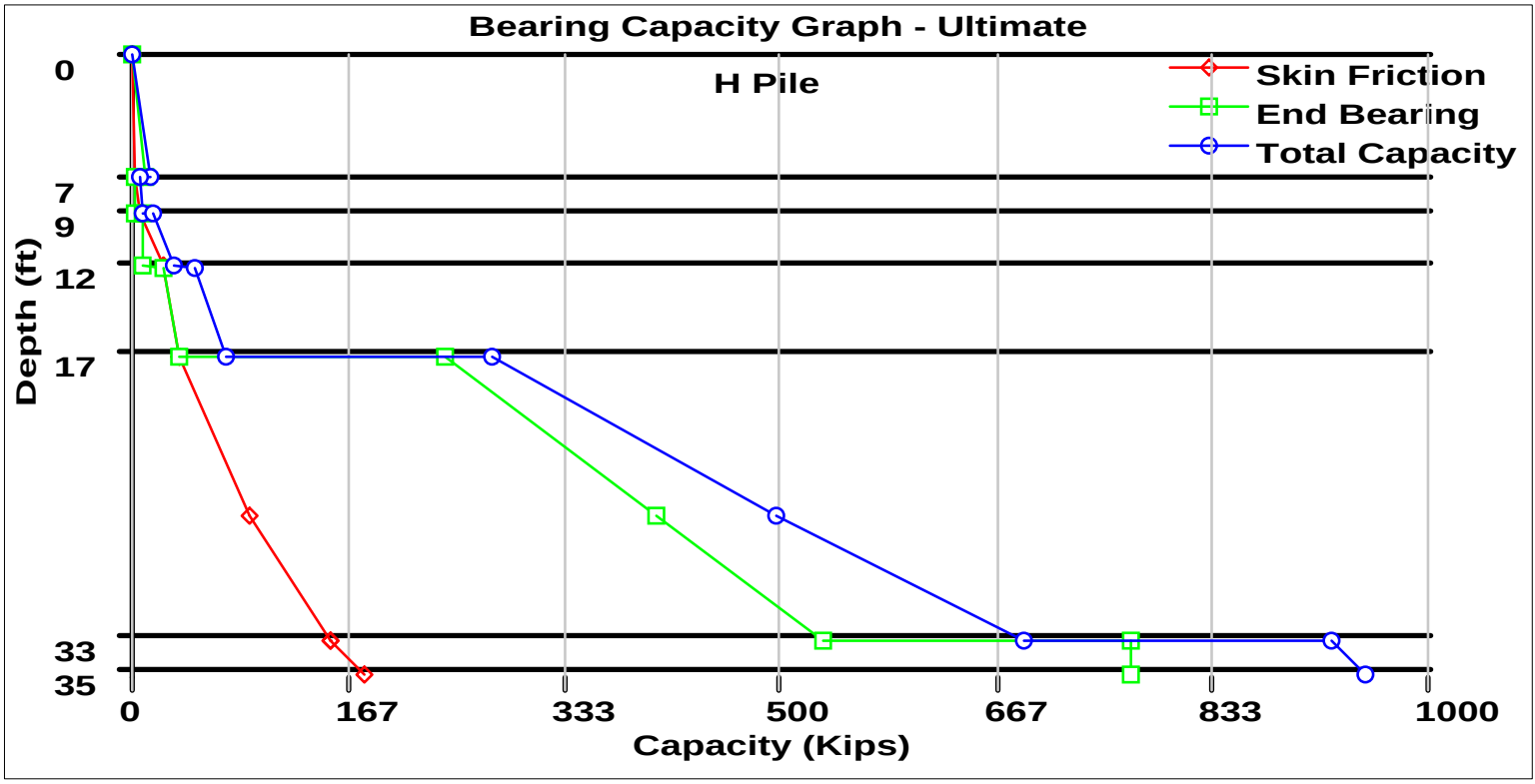
Bearing Capacity Graph - Ultimate
H Pile
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
7
9
12
17
33
35
0
167
333
500
667
833
1000
Capacity (Kips)

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename:
Project Name: Newburyport MA
Project Date: 12/10/2019
Project Client: BSC Group
Computed By: CAG
Project Manager: CAG

PILE INFORMATION

Pile Type: H Pile - HP12X84
Top of Pile: 0.00 ft
Perimeter Analysis: Pile
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	7.00 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
2	Cohesive	2.00 ft	50.00%	105.00 pcf	250.00 psf	User Def.
3	Cohesive	3.00 ft	25.00%	115.00 pcf	1000.00 psf	User Def.
4	Cohesionless	5.00 ft	0.00%	125.00 pcf	34.0/34.0	Nordlund
5	Cohesionless	16.00 ft	0.00%	135.00 pcf	38.0/43.0	Nordlund
6	Cohesionless	2.00 ft	0.00%	150.00 pcf	45.0/50.0	Nordlund

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.29 psf	25.72	N/A	0.00 Kips
6.99 ft	Cohesionless	201.31 psf	25.72	N/A	3.66 Kips
7.01 ft	Cohesive	N/A	N/A	250.00 psf	3.69 Kips
8.99 ft	Cohesive	N/A	N/A	250.00 psf	6.67 Kips
9.01 ft	Cohesive	N/A	N/A	1000.00 psf	6.75 Kips
11.99 ft	Cohesive	N/A	N/A	1000.00 psf	24.72 Kips
12.01 ft	Cohesionless	646.51 psf	27.32	N/A	24.80 Kips
16.99 ft	Cohesionless	802.39 psf	27.32	N/A	37.20 Kips
17.01 ft	Cohesionless	959.56 psf	30.54	N/A	37.27 Kips
26.01 ft	Cohesionless	1286.26 psf	30.54	N/A	92.22 Kips
32.99 ft	Cohesionless	1539.64 psf	30.54	N/A	154.06 Kips
33.01 ft	Cohesionless	2121.24 psf	36.17	N/A	154.29 Kips
34.99 ft	Cohesionless	2207.96 psf	36.17	N/A	180.55 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.58 psf	40.40	34.46 Kips	0.02 Kips
6.99 ft	Cohesionless	402.62 psf	40.40	34.46 Kips	10.63 Kips
7.01 ft	Cohesive	N/A	N/A	N/A	2.35 Kips
8.99 ft	Cohesive	N/A	N/A	N/A	2.35 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	9.40 Kips
11.99 ft	Cohesive	N/A	N/A	N/A	9.40 Kips
12.01 ft	Cohesionless	646.83 psf	55.60	76.77 Kips	24.89 Kips
16.99 ft	Cohesionless	958.57 psf	55.60	76.77 Kips	36.89 Kips
17.01 ft	Cohesionless	959.93 psf	307.00	707.57 Kips	241.26 Kips
26.01 ft	Cohesionless	1613.33 psf	307.00	707.57 Kips	405.49 Kips
32.99 ft	Cohesionless	2120.07 psf	307.00	707.57 Kips	532.85 Kips
33.01 ft	Cohesionless	2121.68 psf	475.00	770.23 Kips	770.23 Kips
34.99 ft	Cohesionless	2295.12 psf	475.00	770.23 Kips	770.23 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
6.99 ft	3.66 Kips	10.63 Kips	14.29 Kips
7.01 ft	3.69 Kips	2.35 Kips	6.04 Kips
8.99 ft	6.67 Kips	2.35 Kips	9.02 Kips
9.01 ft	6.75 Kips	9.40 Kips	16.15 Kips
11.99 ft	24.72 Kips	9.40 Kips	34.12 Kips
12.01 ft	24.80 Kips	24.89 Kips	49.69 Kips
16.99 ft	37.20 Kips	36.89 Kips	74.08 Kips
17.01 ft	37.27 Kips	241.26 Kips	278.53 Kips
26.01 ft	92.22 Kips	405.49 Kips	497.71 Kips
32.99 ft	154.06 Kips	532.85 Kips	686.91 Kips
33.01 ft	154.29 Kips	770.23 Kips	924.52 Kips
34.99 ft	180.55 Kips	770.23 Kips	950.78 Kips

Estimated downdrag load (~ 7 kips)

Factored Geotechnical Resistance
0.45 *(686 - 7 dd) kips = 306 kips

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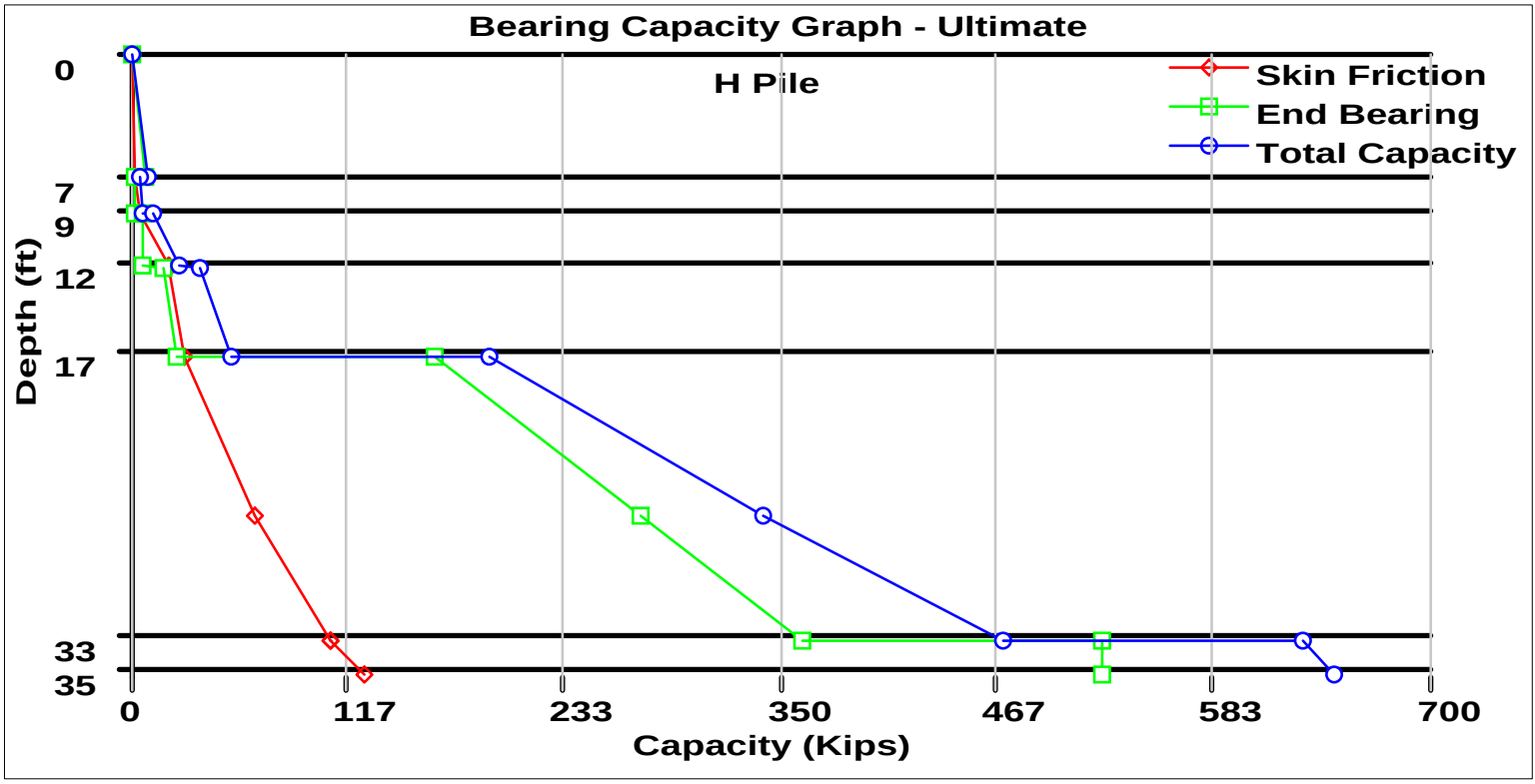
Bearing Capacity Graph - Ultimate
H Pile
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
7
9
12
17
33
35
0
117
233
350
467
583
700
Capacity (Kips)

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename:
Project Name: Newburyport MA
Project Date: 12/10/2019
Project Client: BSC Group
Computed By: CAG
Project Manager: CAG

PILE INFORMATION

Pile Type: H Pile - HP10X57
Top of Pile: 0.00 ft
Perimeter Analysis: Pile
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	7.00 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
2	Cohesive	2.00 ft	50.00%	105.00 pcf	250.00 psf	User Def.
3	Cohesive	3.00 ft	25.00%	115.00 pcf	1000.00 psf	User Def.
4	Cohesionless	5.00 ft	0.00%	125.00 pcf	34.0/34.0	Nordlund
5	Cohesionless	16.00 ft	0.00%	135.00 pcf	38.0/43.0	Nordlund
6	Cohesionless	2.00 ft	0.00%	150.00 pcf	45.0/50.0	Nordlund

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.29 psf	24.33	N/A	0.00 Kips
6.99 ft	Cohesionless	201.31 psf	24.33	N/A	2.60 Kips
7.01 ft	Cohesive	N/A	N/A	250.00 psf	2.62 Kips
8.99 ft	Cohesive	N/A	N/A	250.00 psf	5.09 Kips
9.01 ft	Cohesive	N/A	N/A	1000.00 psf	5.15 Kips
11.99 ft	Cohesive	N/A	N/A	1000.00 psf	19.99 Kips
12.01 ft	Cohesionless	646.51 psf	25.85	N/A	20.05 Kips
16.99 ft	Cohesionless	802.39 psf	25.85	N/A	28.75 Kips
17.01 ft	Cohesionless	959.56 psf	28.89	N/A	28.80 Kips
26.01 ft	Cohesionless	1286.26 psf	28.89	N/A	66.08 Kips
32.99 ft	Cohesionless	1539.64 psf	28.89	N/A	108.03 Kips
33.01 ft	Cohesionless	2121.24 psf	34.22	N/A	108.18 Kips
34.99 ft	Cohesionless	2207.96 psf	34.22	N/A	125.61 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.58 psf	40.40	23.41 Kips	0.01 Kips
6.99 ft	Cohesionless	402.62 psf	40.40	23.41 Kips	7.22 Kips
7.01 ft	Cohesive	N/A	N/A	N/A	1.60 Kips
8.99 ft	Cohesive	N/A	N/A	N/A	1.60 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	6.38 Kips
11.99 ft	Cohesive	N/A	N/A	N/A	6.38 Kips
12.01 ft	Cohesionless	646.83 psf	55.60	52.15 Kips	16.91 Kips
16.99 ft	Cohesionless	958.57 psf	55.60	52.15 Kips	25.06 Kips
17.01 ft	Cohesionless	959.93 psf	307.00	480.67 Kips	163.90 Kips
26.01 ft	Cohesionless	1613.33 psf	307.00	480.67 Kips	275.46 Kips
32.99 ft	Cohesionless	2120.07 psf	307.00	480.67 Kips	361.98 Kips
33.01 ft	Cohesionless	2121.68 psf	475.00	523.23 Kips	523.23 Kips
34.99 ft	Cohesionless	2295.12 psf	475.00	523.23 Kips	523.23 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
6.99 ft	2.60 Kips	7.22 Kips	9.82 Kips
7.01 ft	2.62 Kips	1.60 Kips	4.22 Kips
8.99 ft	5.09 Kips	1.60 Kips	6.68 Kips
9.01 ft	5.15 Kips	6.38 Kips	11.53 Kips
11.99 ft	19.99 Kips	6.38 Kips	26.37 Kips
12.01 ft	20.05 Kips	16.91 Kips	36.96 Kips
16.99 ft	28.75 Kips	25.06 Kips	53.81 Kips
17.01 ft	28.80 Kips	163.90 Kips	192.70 Kips
26.01 ft	66.08 Kips	275.46 Kips	341.54 Kips
32.99 ft	108.03 Kips	361.98 Kips	470.01 Kips
33.01 ft	108.18 Kips	523.23 Kips	631.42 Kips
34.99 ft	125.61 Kips	523.23 Kips	648.84 Kips

Factored Geotechnical Resistance
0.45 *(470 - 5) kips = 209 kips

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JOB 19107 Plummer St
SHEET NO. 1 OF 1
CALCULATED BY CNO DATE 12/10/2019
CHECKED BY LRC DATE 12/10/2019
SCALE N.T.S.

Downdrag Calculation for new fill

up to 2 feet of new fill placed on road way

check consolidation in peat. Assume Peat is normally consolidated.

Section 10.6.2.4.3-5

$$S_c = H_c C_\alpha \log\left[\frac{\sigma'_f}{\sigma'_p}\right]$$

H_c = 2 feet of peat

C_α = 0.22 peat

$\sigma'_p = (6' \cdot 120\,pcf) + (11.5' \cdot (120-62.4)) + 1'(105\,pcf - 62.4\,pcf)$

$\sigma'_p = 1425\,psf$

$\sigma'_f = (2' \cdot 130\,pcf) + 1425\,psf = 1685$

$S_c = 2'\,(.22)\,\log\left(\frac{1685}{1425}\right)$

$S_c = .032\,ft \approx .38\,inches$

Assume down drag occurs in fill above peat and peat.
from Driven cales 7 kips skin friction in upper 9 ft (fill and peat).

Load factor from Table 3.4.1-2 Down drag = 1.4

$(1.4 \cdot 7\,kips) = 10\,kips$

from BSC Factored Axial Load = 207 kips

207 kips + 10 kips = 217 kips

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LPile Plus for Windows, Version 2013-07.007

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Files Used for Analysis

Path to file locations: J:\2019 Jobs\19.107 Plummer St Newburyport - Geotech\Pile Calcs\
Name of input data file: HP10x57 H-Pile L-Pile.lp7d
Name of output report file: HP10x57 H-Pile L-Pile.lp7o
Name of plot output file: HP10x57 H-Pile L-Pile.lp7p
Name of runtime messeage file: HP10x57 H-Pile L-Pile.lp7r

Date and Time of Analysis

Date: December 10, 2019 Time: 12:23:48

Problem Title

Project Name: Plummer St Newburyport, MA

Job Number: 19.107

Client: BSC Group

Engineer: CAG

Description: HP10x57

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 1000
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 33.00 ft

Depth of ground surface below top of pile = 3.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	10.0000000
2	33.000000	10.0000000

Input Structural Properties:

Pile Section No. 1:

Section Type	= Elastic Pile
Cross-sectional Shape	= Weak H-Pile
Section Length	= 33.00000 ft
Flange Width	= 10.20000 in
Section Depth	= 10.00000 in
Flange Thickness	= 0.68500 in
Web Thickness	= 0.68500 in
Section Area	= 16.70000 Sq. in
Moment of Inertia	= 101.00000 in^4
Elastic Modulus	= 29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 3.00000 ft
Distance from top of pile to bottom of layer	= 7.00000 ft
Effective unit weight at top of layer	= 120.00000 pcf
Effective unit weight at bottom of layer	= 120.00000 pcf
Friction angle at top of layer	= 32.00000 deg.
Friction angle at bottom of layer	= 32.00000 deg.
Subgrade k at top of layer	= 0.0000 pci
Subgrade k at bottom of layer	= 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	= 7.00000 ft
Distance from top of pile to bottom of layer	= 9.00000 ft
Effective unit weight at top of layer	= 105.00000 pcf
Effective unit weight at bottom of layer	= 105.00000 pcf
Undrained cohesion at top of layer	= 250.00000 psf
Undrained cohesion at bottom of layer	= 250.00000 psf
Epsilon-50 at top of layer	= 0.0000

Epsilon-50 at bottom of layer = 0.0000

NOTE: Internal default values for Epsilon-50 will be computed for this soil layer.

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 9.00000 ft
Distance from top of pile to bottom of layer = 12.00000 ft
Effective unit weight at top of layer = 115.00000 pcf
Effective unit weight at bottom of layer = 115.00000 pcf
Undrained cohesion at top of layer = 1000.00000 psf
Undrained cohesion at bottom of layer = 1000.00000 psf
Epsilon-50 at top of layer = 0.0000
Epsilon-50 at bottom of layer = 0.0000

NOTE: Internal default values for Epsilon-50 will be computed for this soil layer.

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 12.00000 ft
Distance from top of pile to bottom of layer = 17.00000 ft
Effective unit weight at top of layer = 125.00000 pcf
Effective unit weight at bottom of layer = 125.00000 pcf
Friction angle at top of layer = 34.00000 deg.
Friction angle at bottom of layer = 34.00000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 17.00000 ft
Distance from top of pile to bottom of layer = 33.00000 ft
Effective unit weight at top of layer = 135.00000 pcf
Effective unit weight at bottom of layer = 135.00000 pcf
Friction angle at top of layer = 38.00000 deg.
Friction angle at bottom of layer = 38.00000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

(Depth of lowest soil layer extends 0.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Sand (Reese, et al.)	3.000	120.000	--	32.000	--	default

		7.000	120.000	--	32.000	--	default
2	Soft Clay	7.000	105.000	250.000	--	default	--
		9.000	105.000	250.000	--	default	--
3	Stiff Clay w/o Free Water	9.000	115.000	1000.000	--	default	--
		12.000	115.000	1000.000	--	default	--
4	Sand (Reese, et al.)	12.000	125.000	--	34.000	--	default
		17.000	125.000	--	34.000	--	default
5	Sand (Reese, et al.)	17.000	135.000	--	38.000	--	default
		33.000	135.000	--	38.000	--	default

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	2	V = 5000.00000 lbs	S = 0.0000 in/in	206000.	Yes
2	2	V = 7500.00000 lbs	S = 0.0000 in/in	206000.	Yes
3	2	V = 10000.00000 lbs	S = 0.0000 in/in	206000.	Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 5000.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2241	-281862.	5000.0000	0.000	26289.	2.929E+09	0.000	0.000	0.000
0.330	0.2233	-261906.	5000.0000	-0.000368	25301.	2.929E+09	0.000	0.000	0.000
0.660	0.2212	-241662.	5000.0000	-0.000708	24299.	2.929E+09	0.000	0.000	0.000
0.990	0.2177	-221151.	5000.0000	-0.001021	23283.	2.929E+09	0.000	0.000	0.000
1.320	0.2131	-200396.	5000.0000	-0.001306	22256.	2.929E+09	0.000	0.000	0.000
1.650	0.2074	-179421.	5000.0000	-0.001563	21218.	2.929E+09	0.000	0.000	0.000
1.980	0.2007	-158247.	5000.0000	-0.001791	20169.	2.929E+09	0.000	0.000	0.000
2.310	0.1932	-136899.	5000.0000	-0.001990	19112.	2.929E+09	0.000	0.000	0.000
2.640	0.1849	-115400.	5000.0000	-0.002161	18048.	2.929E+09	0.000	0.000	0.000
2.970	0.1761	-93773.	5000.0000	-0.002302	16978.	2.929E+09	0.000	0.000	0.000
3.300	0.1667	-72043.	4964.2282	-0.002414	15902.	2.929E+09	-18.0666	429.1763	0.000
3.630	0.1569	-50517.	4848.1729	-0.002497	14836.	2.929E+09	-40.5472	1023.0705	0.000
3.960	0.1469	-29572.	4643.8584	-0.002551	13799.	2.929E+09	-62.6420	1688.3980	0.000
4.290	0.1367	-9575.3538	4357.7979	-0.002578	12809.	2.929E+09	-81.8331	2369.9100	0.000
4.620	0.1265	9148.0846	4001.8178	-0.002578	12788.	2.929E+09	-97.9548	3066.2917	0.000
4.950	0.1163	26325.	3590.4121	-0.002554	13639.	2.929E+09	-109.8258	3738.9125	0.000
5.280	0.1063	41751.	3141.4144	-0.002508	14402.	2.929E+09	-116.9407	4357.3838	0.000
5.610	0.0965	55297.	2671.5707	-0.002443	15073.	2.929E+09	-120.3541	4941.1633	0.000
5.940	0.0869	66895.	2191.4540	-0.002360	15647.	2.929E+09	-122.1291	5563.3935	0.000
6.270	0.0778	76504.	1718.6751	-0.002263	16123.	2.929E+09	-116.6481	5940.0524	0.000
6.600	0.0690	84199.	1249.0007	-0.002154	16504.	2.929E+09	-120.5612	6918.3602	0.000
6.930	0.0607	89911.	761.9854	-0.002037	16786.	2.929E+09	-125.4061	8181.0735	0.000
7.260	0.0529	93557.	451.9912	-0.001913	16967.	2.929E+09	-31.1566	2333.3188	0.000
7.590	0.0456	96611.	328.9938	-0.001784	17118.	2.929E+09	-30.9633	2691.6356	0.000
7.920	0.0387	99073.	207.1270	-0.001652	17240.	2.929E+09	-30.5856	3125.8492	0.000
8.250	0.0325	100947.	87.1407	-0.001517	17333.	2.929E+09	-30.0135	3660.2300	0.000
8.580	0.0267	102238.	-30.1711	-0.001379	17397.	2.929E+09	-29.2349	4330.1043	0.000
8.910	0.0215	102958.	-142.3429	-0.001241	17432.	2.929E+09	-27.4176	5038.6873	0.000
9.240	0.0169	103135.	-410.0185	-0.001101	17441.	2.929E+09	-107.7722	25237.	0.000
9.570	0.0128	101507.	-831.0373	-0.000963	17360.	2.929E+09	-104.8636	32376.	0.000
9.900	0.009285	98124.	-1238.0373	-0.000828	17193.	2.929E+09	-100.6920	42944.	0.000
10.230	0.006269	93053.	-1625.2823	-0.000699	16942.	2.929E+09	-94.8862	59936.	0.000
10.560	0.003751	86391.	-1984.7569	-0.000577	16612.	2.929E+09	-86.6666	91484.	0.000
10.890	0.001696	78276.	-2302.5099	-0.000466	16210.	2.929E+09	-73.8148	172322.	0.000
11.220	6.017E-05	68916.	-2475.1910	-0.000367	15747.	2.929E+09	-13.3979	881772.	0.000
11.550	-0.001207	59270.	-2359.4433	-0.000280	15269.	2.929E+09	71.8564	235757.	0.000
11.880	-0.002157	50686.	-2046.8564	-0.000206	14845.	2.929E+09	86.0158	157931.	0.000
12.210	-0.002835	43394.	-1825.4617	-0.000142	14484.	2.929E+09	25.7997	36035.	0.000
12.540	-0.003281	36460.	-1712.1211	-8.801E-05	14140.	2.929E+09	31.4431	37946.	0.000
12.870	-0.003532	29978.	-1579.4702	-4.310E-05	13819.	2.929E+09	35.5524	39858.	0.000
13.200	-0.003623	24021.	-1433.4187	-6.593E-06	13524.	2.929E+09	38.2110	41769.	0.000

13.530	-0.003584	18636.	-1279.4751	2.224E-05	13258.	2.929E+09	39.5383	43681.	0.000
13.860	-0.003446	13851.	-1122.6229	4.420E-05	13021.	2.929E+09	39.6800	45592.	0.000
14.190	-0.003234	9672.8632	-967.2346	6.011E-05	12814.	2.929E+09	38.7989	47504.	0.000
14.520	-0.002970	6092.4621	-817.0204	7.076E-05	12637.	2.929E+09	37.0668	49415.	0.000
14.850	-0.002674	3086.6088	-675.0069	7.697E-05	12488.	2.929E+09	34.6572	51327.	0.000
15.180	-0.002361	620.8310	-543.5423	7.948E-05	12366.	2.929E+09	31.7391	53238.	0.000
15.510	-0.002044	-1347.9122	-424.3235	7.898E-05	12402.	2.929E+09	28.4724	55150.	0.000
15.840	-0.001735	-2868.6754	-318.4395	7.613E-05	12477.	2.929E+09	25.0044	57061.	0.000
16.170	-0.001441	-3994.1661	-226.4270	7.149E-05	12533.	2.929E+09	21.4666	58973.	0.000
16.500	-0.001169	-4778.6218	-148.3350	6.556E-05	12572.	2.929E+09	17.9739	60884.	0.000
16.830	-0.000922	-5275.9481	-83.7914	5.877E-05	12597.	2.929E+09	14.6239	62796.	0.000
17.160	-0.000704	-5538.1295	-20.4010	5.146E-05	12609.	2.929E+09	17.3915	97881.	0.000
17.490	-0.000515	-5521.4766	40.0675	4.398E-05	12609.	2.929E+09	13.1481	101165.	0.000
17.820	-0.000355	-5292.5501	84.6556	3.667E-05	12597.	2.929E+09	9.3711	104449.	0.000
18.150	-0.000224	-4910.8322	115.2897	2.977E-05	12578.	2.929E+09	6.1006	107733.	0.000
18.480	-0.000119	-4428.0304	134.0017	2.346E-05	12555.	2.929E+09	3.3499	111017.	0.000
18.810	-3.844E-05	-3887.8138	142.8315	1.784E-05	12528.	2.929E+09	1.1096	114302.	0.000
19.140	2.179E-05	-3325.9085	143.7475	1.296E-05	12500.	2.929E+09	-0.6470	117586.	0.000
19.470	6.421E-05	-2770.4804	138.5858	8.841E-06	12472.	2.929E+09	-1.9600	120870.	0.000
19.800	9.181E-05	-2242.7321	129.0061	5.452E-06	12446.	2.929E+09	-2.8783	124154.	0.000
20.130	0.000107	-1757.6463	116.4644	2.747E-06	12422.	2.929E+09	-3.4560	127438.	0.000
20.460	0.000114	-1324.8168	102.1989	6.636E-07	12401.	2.929E+09	-3.7488	130723.	0.000
20.790	0.000113	-949.3138	87.2286	-8.737E-07	12382.	2.929E+09	-3.8119	134007.	0.000
21.120	0.000107	-632.5410	72.3603	-1.943E-06	12367.	2.929E+09	-3.6973	137291.	0.000
21.450	9.726E-05	-373.0501	58.2037	-2.623E-06	12354.	2.929E+09	-3.4525	140575.	0.000
21.780	8.587E-05	-167.2883	45.1911	-2.988E-06	12344.	2.929E+09	-3.1195	143859.	0.000
22.110	7.359E-05	-10.2614	33.6002	-3.108E-06	12336.	2.929E+09	-2.7344	147144.	0.000
22.440	6.126E-05	103.8963	23.5788	-3.045E-06	12340.	2.929E+09	-2.3269	150428.	0.000
22.770	4.948E-05	181.4500	15.1690	-2.852E-06	12344.	2.929E+09	-1.9205	153712.	0.000
23.100	3.867E-05	228.6878	8.3311	-2.575E-06	12347.	2.929E+09	-1.5330	156996.	0.000
23.430	2.908E-05	251.6332	2.9649	-2.250E-06	12348.	2.929E+09	-1.1772	160280.	0.000
23.760	2.085E-05	255.8410	-1.0709	-1.907E-06	12348.	2.929E+09	-0.8611	163565.	0.000
24.090	1.398E-05	246.2629	-3.9423	-1.568E-06	12348.	2.929E+09	-0.5891	166849.	0.000
24.420	8.434E-06	227.1753	-5.8261	-1.247E-06	12347.	2.929E+09	-0.3623	170133.	0.000
24.750	4.102E-06	202.1552	-6.8992	-9.572E-07	12345.	2.929E+09	-0.1796	173417.	0.000
25.080	8.523E-07	174.0953	-7.3302	-7.029E-07	12344.	2.929E+09	-0.0380	176701.	0.000
25.410	-1.465E-06	145.2471	-7.2736	-4.870E-07	12343.	2.929E+09	0.0666	179986.	0.000
25.740	-3.005E-06	117.2830	-6.8664	-3.095E-07	12341.	2.929E+09	0.1391	183270.	0.000
26.070	-3.917E-06	91.3702	-6.2257	-1.685E-07	12340.	2.929E+09	0.1845	186554.	0.000
26.400	-4.339E-06	68.2501	-5.4485	-6.059E-08	12339.	2.929E+09	0.2080	189838.	0.000
26.730	-4.397E-06	48.3169	-4.6121	1.821E-08	12338.	2.929E+09	0.2144	193122.	0.000
27.060	-4.195E-06	31.6926	-3.7756	7.230E-08	12337.	2.929E+09	0.2081	196407.	0.000
27.390	-3.824E-06	18.2962	-2.9818	1.061E-07	12336.	2.929E+09	0.1928	199691.	0.000
27.720	-3.355E-06	7.9035	-2.2596	1.238E-07	12336.	2.929E+09	0.1720	202975.	0.000
28.050	-2.843E-06	0.1986	-1.6258	1.293E-07	12335.	2.929E+09	0.1481	206259.	0.000
28.380	-2.331E-06	-5.1841	-1.0884	1.259E-07	12336.	2.929E+09	0.1233	209543.	0.000
28.710	-1.846E-06	-8.6268	-0.6477	1.166E-07	12336.	2.929E+09	0.0992	212828.	0.000
29.040	-1.408E-06	-10.5041	-0.2991	1.036E-07	12336.	2.929E+09	0.0768	216112.	0.000
29.370	-1.025E-06	-11.1651	-0.0345	8.899E-08	12336.	2.929E+09	0.0568	219396.	0.000
29.700	-7.029E-07	-10.9229	0.1562	7.406E-08	12336.	2.929E+09	0.0395	222680.	0.000
30.030	-4.388E-07	-10.0489	0.2840	5.988E-08	12336.	2.929E+09	0.0250	225964.	0.000
30.360	-2.286E-07	-8.7711	0.3598	4.716E-08	12336.	2.929E+09	0.0132	229249.	0.000
30.690	-6.532E-08	-7.2761	0.3936	3.631E-08	12336.	2.929E+09	0.003835	232533.	0.000
31.020	5.900E-08	-5.7129	0.3942	2.753E-08	12336.	2.929E+09	-0.003514	235817.	0.000
31.350	1.527E-07	-4.1986	0.3690	2.083E-08	12336.	2.929E+09	-0.009222	239101.	0.000
31.680	2.240E-07	-2.8242	0.3236	1.608E-08	12335.	2.929E+09	-0.0137	242385.	0.000
32.010	2.801E-07	-1.6617	0.2621	1.305E-08	12335.	2.929E+09	-0.0174	245670.	0.000

32.340	3.274E-07	-0.7699	0.1869	1.141E-08	12335.	2.929E+09	-0.0206	248954.	0.000
32.670	3.705E-07	-0.2001	0.0994	1.075E-08	12335.	2.929E+09	-0.0236	252238.	0.000
33.000	4.125E-07	0.000	0.000	1.062E-08	12335.	2.929E+09	-0.0266	127761.	0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.2240700 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -281862. inch-lbs
Maximum shear force = 5000.0000000 lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 2.9700000 feet below pile head
Number of iterations = 13
Number of zero deflection points = 4

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 2, Shear and Slope

Shear = 5000. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.2240700	-281862.	5000.0000000
31.3500	0.2235766	-281692.	5000.0000000
29.7000	0.2268030	-282837.	5000.0000000
28.0500	0.2300081	-284004.	5000.0000000
26.4000	0.2267726	-282726.	5000.0000000
24.7500	0.2243346	-282059.	5000.0000000
23.1000	0.2232781	-281908.	5000.0000000
21.4500	0.2252786	-282598.	5000.0000000
19.8000	0.2248892	-282246.	5000.0000000
18.1500	0.2257385	-282554.	5000.0000000
16.5000	0.2251282	-282385.	5000.0000000
14.8500	0.2264916	-282507.	5000.0000001
13.2000	0.2470689	-288591.	5000.0000002
11.5500	0.3231174	-325622.	5000.0000002
9.9000	0.3746202	-372479.	5000.0000010
8.2500	0.3592443	-405021.	5000.0000029
6.6000	0.3856958	-366321.	5000.0000091

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 7500.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*h	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in	lb/inch	lb/inch
0.00	0.4078	-452157.	7500.0000	0.000	34719.	2.929E+09	0.000	0.000	0.000
0.330	0.4066	-422208.	7500.0000	-0.000591	33237.	2.929E+09	0.000	0.000	0.000
0.660	0.4032	-391793.	7500.0000	-0.001141	31731.	2.929E+09	0.000	0.000	0.000
0.990	0.3976	-360945.	7500.0000	-0.001650	30204.	2.929E+09	0.000	0.000	0.000
1.320	0.3901	-329700.	7500.0000	-0.002117	28657.	2.929E+09	0.000	0.000	0.000
1.650	0.3808	-298091.	7500.0000	-0.002541	27092.	2.929E+09	0.000	0.000	0.000
1.980	0.3700	-266154.	7500.0000	-0.002923	25511.	2.929E+09	0.000	0.000	0.000
2.310	0.3577	-233923.	7500.0000	-0.003261	23916.	2.929E+09	0.000	0.000	0.000
2.640	0.3441	-201434.	7500.0000	-0.003555	22307.	2.929E+09	0.000	0.000	0.000
2.970	0.3295	-168722.	7500.0000	-0.003805	20688.	2.929E+09	0.000	0.000	0.000
3.300	0.3140	-135825.	7455.5143	-0.004011	19059.	2.929E+09	-22.4675	283.3502	0.000
3.630	0.2977	-103130.	7310.7406	-0.004173	17441.	2.929E+09	-50.6505	673.6402	0.000
3.960	0.2809	-71116.	7055.2396	-0.004291	15856.	2.929E+09	-78.3904	1104.9196	0.000
4.290	0.2638	-40252.	6696.6502	-0.004366	14328.	2.929E+09	-102.7153	1542.0874	0.000
4.620	0.2464	-10955.	6248.2118	-0.004401	12878.	2.929E+09	-123.7687	1989.3759	0.000
4.950	0.2289	16413.	5726.6276	-0.004397	13148.	2.929E+09	-139.6577	2415.9345	0.000
5.280	0.2115	41573.	5150.3850	-0.004358	14393.	2.929E+09	-151.3739	2833.5966	0.000
5.610	0.1944	64314.	4531.9463	-0.004286	15519.	2.929E+09	-160.9688	3278.9499	0.000
5.940	0.1776	84459.	3875.0538	-0.004186	16516.	2.929E+09	-170.7950	3808.2261	0.000
6.270	0.1613	101833.	3193.9659	-0.004060	17377.	2.929E+09	-173.1888	4253.1032	0.000
6.600	0.1455	116379.	2484.9843	-0.003912	18097.	2.929E+09	-184.8828	5033.5864	0.000
6.930	0.1303	127897.	1728.3714	-0.003747	18667.	2.929E+09	-197.2449	5995.9362	0.000
7.260	0.1158	136181.	1257.7506	-0.003568	19077.	2.929E+09	-40.4424	1383.3095	0.000
7.590	0.1020	143680.	1097.4996	-0.003379	19448.	2.929E+09	-40.4925	1571.9367	0.000
7.920	0.0890	150386.	937.4536	-0.003180	19780.	2.929E+09	-40.3388	1794.6321	0.000
8.250	0.0768	156294.	778.4379	-0.002973	20073.	2.929E+09	-39.9721	2060.5539	0.000
8.580	0.0655	161402.	621.3175	-0.002758	20326.	2.929E+09	-39.3817	2382.2585	0.000
8.910	0.0550	165715.	469.2108	-0.002537	20539.	2.929E+09	-37.4399	2697.0119	0.000
9.240	0.0454	169258.	122.2069	-0.002311	20714.	2.929E+09	-137.8146	12029.	0.000
9.570	0.0367	170453.	-420.3904	-0.002081	20774.	2.929E+09	-136.2245	14710.	0.000
9.900	0.0289	169324.	-954.5767	-0.001851	20718.	2.929E+09	-133.5666	18311.	0.000
10.230	0.0220	165913.	-1475.7982	-0.001625	20549.	2.929E+09	-129.6766	23334.	0.000
10.560	0.0160	160286.	-1978.6616	-0.001404	20270.	2.929E+09	-124.2948	30730.	0.000
10.890	0.0109	152533.	-2456.3527	-0.001193	19886.	2.929E+09	-116.9633	42551.	0.000
11.220	0.006570	142778.	-2899.2608	-0.000993	19404.	2.929E+09	-106.7277	64331.	0.000
11.550	0.003019	131192.	-3290.5699	-0.000808	18830.	2.929E+09	-90.9031	119246.	0.000
11.880	0.000170	118035.	-3550.6502	-0.000640	18179.	2.929E+09	-40.4506	941423.	0.000
12.210	-0.002047	104114.	-3593.8692	-0.000489	17489.	2.929E+09	18.6228	36035.	0.000
12.540	-0.003706	90370.	-3486.6857	-0.000358	16809.	2.929E+09	35.5103	37946.	0.000
12.870	-0.004881	77083.	-3319.0983	-0.000245	16151.	2.929E+09	49.1298	39858.	0.000
13.200	-0.005644	64482.	-3103.9498	-0.000149	15528.	2.929E+09	59.5310	41769.	0.000
13.530	-0.006061	52743.	-2853.6946	-6.977E-05	14946.	2.929E+09	66.8605	43681.	0.000
13.860	-0.006197	41995.	-2580.0539	-5.730E-06	14414.	2.929E+09	71.3419	45592.	0.000

14.190	-0.006107	32319.	-2293.7490	4.451E-05	13935.	2.929E+09	73.2566	47504.	0.000
14.520	-0.005844	23756.	-2004.3085	8.241E-05	13511.	2.929E+09	72.9255	49415.	0.000
14.850	-0.005454	16310.	-1719.9454	0.000109	13143.	2.929E+09	70.6922	51327.	0.000
15.180	-0.004977	9955.0086	-1447.4957	0.000127	12828.	2.929E+09	66.9086	53238.	0.000
15.510	-0.004446	4638.2465	-1192.4113	0.000137	12565.	2.929E+09	61.9219	55150.	0.000
15.840	-0.003891	287.4036	-958.7968	0.000140	12350.	2.929E+09	56.0652	57061.	0.000
16.170	-0.003334	-3184.5639	-749.4818	0.000138	12493.	2.929E+09	49.6494	58973.	0.000
16.500	-0.002794	-5874.4364	-566.1188	0.000132	12626.	2.929E+09	42.9581	60884.	0.000
16.830	-0.002286	-7884.1778	-409.2979	0.000123	12726.	2.929E+09	36.2444	62796.	0.000
17.160	-0.001819	-9316.8543	-248.4915	0.000111	12797.	2.929E+09	44.9710	97881.	0.000
17.490	-0.001403	-10034.	-88.4782	9.835E-05	12832.	2.929E+09	35.8438	101165.	0.000
17.820	-0.001040	-10178.	36.8296	8.469E-05	12839.	2.929E+09	27.4430	104449.	0.000
18.150	-0.000732	-9880.5209	130.6146	7.113E-05	12824.	2.929E+09	19.9232	107733.	0.000
18.480	-0.000477	-9259.6500	196.5457	5.819E-05	12794.	2.929E+09	13.3753	111017.	0.000
18.810	-0.000271	-8418.8201	238.5422	4.624E-05	12752.	2.929E+09	7.8351	114302.	0.000
19.140	-0.000111	-7445.8389	260.5739	3.552E-05	12704.	2.929E+09	3.2921	117586.	0.000
19.470	9.845E-06	-6413.0206	266.4973	2.615E-05	12653.	2.929E+09	-0.3005	120870.	0.000
19.800	9.622E-05	-5377.8414	259.9290	1.818E-05	12602.	2.929E+09	-3.0168	124154.	0.000
20.130	0.000154	-4384.0395	244.1551	1.158E-05	12552.	2.929E+09	-4.9498	127438.	0.000
20.460	0.000188	-3463.0235	222.0714	6.274E-06	12507.	2.929E+09	-6.2035	130723.	0.000
20.790	0.000203	-2635.4696	196.1533	2.151E-06	12466.	2.929E+09	-6.8864	134007.	0.000
21.120	0.000205	-1912.9991	168.4484	-9.235E-07	12430.	2.929E+09	-7.1059	137291.	0.000
21.450	0.000196	-1299.8513	140.5893	-3.095E-06	12400.	2.929E+09	-6.9643	140575.	0.000
21.780	0.000180	-794.4815	113.8205	-4.511E-06	12375.	2.929E+09	-6.5553	143859.	0.000
22.110	0.000160	-391.0331	89.0359	-5.313E-06	12355.	2.929E+09	-5.9621	147144.	0.000
22.440	0.000138	-80.6495	66.8234	-5.631E-06	12339.	2.929E+09	-5.2563	150428.	0.000
22.770	0.000116	147.3959	47.5117	-5.586E-06	12343.	2.929E+09	-4.4971	153712.	0.000
23.100	9.413E-05	304.7577	31.2187	-5.281E-06	12350.	2.929E+09	-3.7318	156996.	0.000
23.430	7.403E-05	403.2635	17.8968	-4.802E-06	12355.	2.929E+09	-2.9965	160280.	0.000
23.760	5.610E-05	454.3353	7.3762	-4.222E-06	12358.	2.929E+09	-2.3170	163565.	0.000
24.090	4.059E-05	468.5716	-0.5978	-3.598E-06	12359.	2.929E+09	-1.7103	166849.	0.000
24.420	2.760E-05	455.4712	-6.3318	-2.974E-06	12358.	2.929E+09	-1.1856	170133.	0.000
24.750	1.704E-05	423.2758	-10.1568	-2.380E-06	12356.	2.929E+09	-0.7462	173417.	0.000
25.080	8.749E-06	378.9117	-12.4073	-1.837E-06	12354.	2.929E+09	-0.3904	176701.	0.000
25.410	2.487E-06	328.0075	-13.4042	-1.360E-06	12352.	2.929E+09	-0.1131	179986.	0.000
25.740	-2.018E-06	274.9687	-13.4431	-9.520E-07	12349.	2.929E+09	0.0934	183270.	0.000
26.070	-5.052E-06	223.0915	-12.7869	-6.153E-07	12346.	2.929E+09	0.2380	186554.	0.000
26.400	-6.891E-06	174.7006	-11.6615	-3.464E-07	12344.	2.929E+09	0.3304	189838.	0.000
26.730	-7.795E-06	131.2977	-10.2546	-1.395E-07	12342.	2.929E+09	0.3802	193122.	0.000
27.060	-7.996E-06	93.7116	-8.7166	1.260E-08	12340.	2.929E+09	0.3966	196407.	0.000
27.390	-7.696E-06	62.2415	-7.1630	1.180E-07	12338.	2.929E+09	0.3881	199691.	0.000
27.720	-7.062E-06	36.7881	-5.6780	1.850E-07	12337.	2.929E+09	0.3620	202975.	0.000
28.050	-6.231E-06	16.9702	-4.3187	2.213E-07	12336.	2.929E+09	0.3245	206259.	0.000
28.380	-5.309E-06	2.2226	-3.1200	2.343E-07	12335.	2.929E+09	0.2809	209543.	0.000
28.710	-4.375E-06	-8.1222	-2.0982	2.303E-07	12336.	2.929E+09	0.2351	212828.	0.000
29.040	-3.485E-06	-14.7707	-1.2560	2.148E-07	12336.	2.929E+09	0.1902	216112.	0.000
29.370	-2.674E-06	-18.4205	-0.5862	1.924E-07	12336.	2.929E+09	0.1481	219396.	0.000
29.700	-1.961E-06	-19.7270	-0.0745	1.666E-07	12336.	2.929E+09	0.1103	222680.	0.000
30.030	-1.354E-06	-19.2823	0.2969	1.402E-07	12336.	2.929E+09	0.0773	225964.	0.000
30.360	-8.507E-07	-17.6045	0.5474	1.153E-07	12336.	2.929E+09	0.0492	229249.	0.000
30.690	-4.413E-07	-15.1349	0.6962	9.316E-08	12336.	2.929E+09	0.0259	232533.	0.000
31.020	-1.129E-07	-12.2423	0.7608	7.465E-08	12336.	2.929E+09	0.006723	235817.	0.000
31.350	1.499E-07	-9.2308	0.7562	6.013E-08	12336.	2.929E+09	-0.009053	239101.	0.000
31.680	3.634E-07	-6.3511	0.6943	4.960E-08	12336.	2.929E+09	-0.0222	242385.	0.000
32.010	5.428E-07	-3.8131	0.5836	4.273E-08	12336.	2.929E+09	-0.0337	245670.	0.000
32.340	7.018E-07	-1.7989	0.4295	3.893E-08	12335.	2.929E+09	-0.0441	248954.	0.000
32.670	8.511E-07	-0.4747	0.2348	3.740E-08	12335.	2.929E+09	-0.0542	252238.	0.000

33.000 9.980E-07 0.000 0.000 3.708E-08 12335. 2.929E+09 -0.0644 127761. 0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.4078426 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -452157. inch-lbs
Maximum shear force = 7500.0000000 lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 2.6400000 feet below pile head
Number of iterations = 14
Number of zero deflection points = 4

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 2, Shear and Slope

Shear = 7500. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.4078426	-452157.	7500.0000000
31.3500	0.4075487	-452087.	7500.0000000
29.7000	0.4140473	-454237.	7500.0000000
28.0500	0.4220162	-456503.	7500.0000000
26.4000	0.4137683	-454007.	7500.0000000
24.7500	0.4089263	-452627.	7500.0000000
23.1000	0.4069664	-452298.	7500.0000002
21.4500	0.4114203	-453707.	7500.0000000
19.8000	0.4100158	-453044.	7500.0000001
18.1500	0.4122132	-453714.	7500.0000000
16.5000	0.4112732	-453382.	7500.0000003
14.8500	0.4210913	-454877.	7500.0000003
13.2000	0.4911170	-476622.	7500.0000006
11.5500	0.6548302	-566900.	7500.0000004
9.9000	0.7015980	-630536.	7500.0000030
8.2500	0.6390385	-636591.	7500.0000010

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 10000.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.6195	-629357.	10000.	0.000	43492.	2.929E+09	0.000	0.000	0.000
0.330	0.6178	-589410.	10000.	-0.000824	41514.	2.929E+09	0.000	0.000	0.000
0.660	0.6130	-548813.	10000.	-0.001593	39504.	2.929E+09	0.000	0.000	0.000
0.990	0.6052	-507611.	10000.	-0.002307	37465.	2.929E+09	0.000	0.000	0.000
1.320	0.5947	-465849.	10000.	-0.002966	35397.	2.929E+09	0.000	0.000	0.000
1.650	0.5817	-423573.	10000.	-0.003567	33304.	2.929E+09	0.000	0.000	0.000
1.980	0.5664	-380829.	10000.	-0.004111	31188.	2.929E+09	0.000	0.000	0.000
2.310	0.5491	-337666.	10000.	-0.004596	29051.	2.929E+09	0.000	0.000	0.000
2.640	0.5300	-294130.	10000.	-0.005023	26896.	2.929E+09	0.000	0.000	0.000
2.970	0.5093	-250270.	10000.	-0.005391	24725.	2.929E+09	0.000	0.000	0.000
3.300	0.4873	-206134.	9951.8998	-0.005700	22540.	2.929E+09	-24.2931	197.4050	0.000
3.630	0.4642	-162152.	9792.5363	-0.005949	20363.	2.929E+09	-56.1935	479.3737	0.000
3.960	0.4402	-118872.	9504.2916	-0.006139	18220.	2.929E+09	-89.3846	804.0765	0.000
4.290	0.4156	-76862.	9088.2616	-0.006271	16140.	2.929E+09	-120.7316	1150.4256	0.000
4.620	0.3905	-36661.	8550.9182	-0.006348	14150.	2.929E+09	-150.6539	1527.5887	0.000
4.950	0.3653	1217.6331	7908.1808	-0.006372	12396.	2.929E+09	-173.9609	1885.7672	0.000
5.280	0.3401	36367.	7187.1282	-0.006346	14136.	2.929E+09	-190.2071	2214.8424	0.000
5.610	0.3150	68494.	6403.0542	-0.006276	15726.	2.929E+09	-205.7899	2586.7121	0.000
5.940	0.2904	97318.	5553.3157	-0.006163	17153.	2.929E+09	-223.3710	3046.2179	0.000
6.270	0.2662	122532.	4648.8827	-0.006015	18401.	2.929E+09	-233.4134	3471.8817	0.000
6.600	0.2427	143951.	3687.2899	-0.005835	19462.	2.929E+09	-252.2395	4114.9951	0.000
6.930	0.2200	161255.	2649.9981	-0.005628	20318.	2.929E+09	-271.6452	4889.1996	0.000
7.260	0.1982	174121.	2016.3578	-0.005402	20955.	2.929E+09	-48.3751	966.7121	0.000
7.590	0.1772	186037.	1824.1930	-0.005158	21545.	2.929E+09	-48.6778	1087.6025	0.000
7.920	0.1573	196985.	1631.2486	-0.004899	22087.	2.929E+09	-48.7689	1227.6771	0.000
8.250	0.1384	206950.	1438.3778	-0.004626	22580.	2.929E+09	-48.6406	1391.3847	0.000
8.580	0.1207	215924.	1246.4659	-0.004340	23025.	2.929E+09	-48.2846	1584.5525	0.000
8.910	0.1041	223903.	1059.1641	-0.004043	23420.	2.929E+09	-46.3122	1762.4140	0.000
9.240	0.0886	230909.	644.8617	-0.003736	23766.	2.929E+09	-162.9314	7278.2559	0.000
9.570	0.0745	235105.	0.2829	-0.003421	23974.	2.929E+09	-162.6134	8646.6251	0.000
9.900	0.0616	236492.	-641.2085	-0.003102	24043.	2.929E+09	-161.3721	10381.	0.000
10.230	0.0499	235088.	-1275.7961	-0.002783	23973.	2.929E+09	-159.1267	12626.	0.000
10.560	0.0395	230928.	-1899.2894	-0.002468	23767.	2.929E+09	-155.7689	15610.	0.000
10.890	0.0304	224072.	-2506.9783	-0.002160	23428.	2.929E+09	-151.1447	19713.	0.000
11.220	0.0224	214598.	-3093.3774	-0.001864	22959.	2.929E+09	-145.0165	25629.	0.000
11.550	0.0156	202613.	-3651.7320	-0.001582	22366.	2.929E+09	-136.9807	34770.	0.000
11.880	0.009879	188257.	-4172.9232	-0.001318	21655.	2.929E+09	-126.2471	50605.	0.000
12.210	0.005166	171713.	-4515.9658	-0.001074	20836.	2.929E+09	-47.0067	36035.	0.000
12.540	0.001372	154243.	-4635.0612	-0.000854	19971.	2.929E+09	-13.1424	37946.	0.000
12.870	-0.001597	136396.	-4629.2587	-0.000657	19088.	2.929E+09	16.0730	39858.	0.000
13.200	-0.003835	118652.	-4517.3402	-0.000485	18209.	2.929E+09	40.4515	41769.	0.000
13.530	-0.005438	101410.	-4318.4786	-0.000336	17356.	2.929E+09	59.9836	43681.	0.000
13.860	-0.006498	84998.	-4051.5828	-0.000210	16543.	2.929E+09	74.8122	45592.	0.000
14.190	-0.007103	69665.	-3734.7486	-0.000106	15784.	2.929E+09	85.2051	47504.	0.000
14.520	-0.007335	55591.	-3384.8178	-2.099E-05	15087.	2.929E+09	91.5277	49415.	0.000
14.850	-0.007269	42891.	-3017.0444	4.559E-05	14459.	2.929E+09	94.2165	51327.	0.000

15.180	-0.006974	31622.	-2644.8616	9.596E-05	13901.	2.929E+09	93.7546	53238.	0.000
15.510	-0.006509	21787.	-2279.7407	0.000132	13414.	2.929E+09	90.6499	55150.	0.000
15.840	-0.005928	13351.	-1931.1307	0.000156	12996.	2.929E+09	85.4157	57061.	0.000
16.170	-0.005275	6238.6511	-1606.4667	0.000169	12644.	2.929E+09	78.5560	58973.	0.000
16.500	-0.004589	351.6335	-1311.2319	0.000174	12353.	2.929E+09	70.5525	60884.	0.000
16.830	-0.003901	-4429.3960	-1049.0617	0.000171	12555.	2.929E+09	61.8567	62796.	0.000
17.160	-0.003236	-8235.5278	-768.1922	0.000162	12743.	2.929E+09	79.9966	97881.	0.000
17.490	-0.002616	-10778.	-477.4648	0.000149	12869.	2.929E+09	66.8354	101165.	0.000
17.820	-0.002054	-12261.	-237.8788	0.000134	12942.	2.929E+09	54.1676	104449.	0.000
18.150	-0.001557	-12880.	-46.7692	0.000117	12973.	2.929E+09	42.3525	107733.	0.000
18.480	-0.001129	-12822.	99.7486	9.940E-05	12970.	2.929E+09	31.6464	111017.	0.000
18.810	-0.000770	-12253.	206.3882	8.245E-05	12942.	2.929E+09	22.2120	114302.	0.000
19.140	-0.000476	-11322.	278.3440	6.651E-05	12896.	2.929E+09	14.1294	117586.	0.000
19.470	-0.000243	-10157.	320.9917	5.199E-05	12838.	2.929E+09	7.4098	120870.	0.000
19.800	-6.406E-05	-8864.1256	339.6399	3.913E-05	12774.	2.929E+09	2.0085	124154.	0.000
20.130	6.718E-05	-7530.4401	339.3358	2.805E-05	12708.	2.929E+09	-2.1620	127438.	0.000
20.460	0.000158	-6222.3533	324.7207	1.876E-05	12643.	2.929E+09	-5.2193	130723.	0.000
20.790	0.000216	-4989.2513	299.9323	1.118E-05	12582.	2.929E+09	-7.3001	134007.	0.000
21.120	0.000247	-3865.1238	268.5484	5.191E-06	12527.	2.929E+09	-8.5503	137291.	0.000
21.450	0.000257	-2870.8162	233.5667	6.370E-07	12477.	2.929E+09	-9.1172	140575.	0.000
21.780	0.000252	-2016.3150	197.4121	-2.667E-06	12435.	2.929E+09	-9.1427	143859.	0.000
22.110	0.000236	-1302.9619	161.9678	-4.910E-06	12400.	2.929E+09	-8.7585	147144.	0.000
22.440	0.000213	-725.5184	128.6222	-6.282E-06	12371.	2.929E+09	-8.0828	150428.	0.000
22.770	0.000186	-274.0256	98.3261	-6.957E-06	12349.	2.929E+09	-7.2183	153712.	0.000
23.100	0.000158	64.5753	71.6567	-7.099E-06	12339.	2.929E+09	-6.2511	156996.	0.000
23.430	0.000130	305.0774	48.8824	-6.849E-06	12350.	2.929E+09	-5.2511	160280.	0.000
23.760	0.000103	462.8981	30.0265	-6.330E-06	12358.	2.929E+09	-4.2721	163565.	0.000
24.090	7.960E-05	553.2147	14.9269	-5.643E-06	12363.	2.929E+09	-3.3539	166849.	0.000
24.420	5.874E-05	590.3260	3.2895	-4.870E-06	12365.	2.929E+09	-2.5235	170133.	0.000
24.750	4.103E-05	587.2135	-5.2648	-4.074E-06	12364.	2.929E+09	-1.7969	173417.	0.000
25.080	2.647E-05	555.2755	-11.1613	-3.302E-06	12363.	2.929E+09	-1.1812	176701.	0.000
25.410	1.488E-05	504.2027	-14.8393	-2.586E-06	12360.	2.929E+09	-0.6764	179986.	0.000
25.740	5.993E-06	441.9666	-16.7278	-1.946E-06	12357.	2.929E+09	-0.2774	183270.	0.000
26.070	-5.295E-07	374.8935	-17.2276	-1.394E-06	12354.	2.929E+09	0.0249	186554.	0.000
26.400	-5.045E-06	307.7981	-16.6993	-9.322E-07	12351.	2.929E+09	0.2419	189838.	0.000
26.730	-7.913E-06	244.1559	-15.4564	-5.591E-07	12347.	2.929E+09	0.3859	193122.	0.000
27.060	-9.473E-06	186.2957	-13.7620	-2.681E-07	12345.	2.929E+09	0.4698	196407.	0.000
27.390	-1.004E-05	135.5979	-11.8297	-5.051E-08	12342.	2.929E+09	0.5061	199691.	0.000
27.720	-9.873E-06	92.6869	-9.8256	1.038E-07	12340.	2.929E+09	0.5061	202975.	0.000
28.050	-9.214E-06	57.6095	-7.8734	2.054E-07	12338.	2.929E+09	0.4799	206259.	0.000
28.380	-8.246E-06	29.9943	-6.0592	2.646E-07	12337.	2.929E+09	0.4364	209543.	0.000
28.710	-7.118E-06	9.1889	-4.4377	2.911E-07	12336.	2.929E+09	0.3826	212828.	0.000
29.040	-5.941E-06	-5.6276	-3.0384	2.935E-07	12336.	2.929E+09	0.3242	216112.	0.000
29.370	-4.793E-06	-15.3538	-1.8706	2.793E-07	12336.	2.929E+09	0.2656	219396.	0.000
29.700	-3.728E-06	-20.8985	-0.9297	2.548E-07	12336.	2.929E+09	0.2097	222680.	0.000
30.030	-2.775E-06	-23.1324	-0.2010	2.251E-07	12336.	2.929E+09	0.1584	225964.	0.000
30.360	-1.946E-06	-22.8576	0.3356	1.940E-07	12336.	2.929E+09	0.1126	229249.	0.000
30.690	-1.239E-06	-20.7912	0.7026	1.645E-07	12336.	2.929E+09	0.0727	232533.	0.000
31.020	-6.432E-07	-17.5610	0.9225	1.385E-07	12336.	2.929E+09	0.0383	235817.	0.000
31.350	-1.416E-07	-13.7108	1.0153	1.174E-07	12336.	2.929E+09	0.008547	239101.	0.000
31.680	2.867E-07	-9.7115	0.9975	1.016E-07	12336.	2.929E+09	-0.0175	242385.	0.000
32.010	6.629E-07	-5.9767	0.8813	9.097E-08	12336.	2.929E+09	-0.0411	245670.	0.000
32.340	1.007E-06	-2.8801	0.6745	8.498E-08	12335.	2.929E+09	-0.0633	248954.	0.000
32.670	1.336E-06	-0.7733	0.3806	8.251E-08	12335.	2.929E+09	-0.0851	252238.	0.000
33.000	1.661E-06	0.000	0.000	8.199E-08	12335.	2.929E+09	-0.1072	127761.	0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.6194764 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -629357. inch-lbs
Maximum shear force = 10000. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.3300000 feet below pile head
Number of iterations = 16
Number of zero deflection points = 4

Pile-head Deflection vs. Pile Length for Load Case 3

Boundary Condition Type 2, Shear and Slope

Shear = 10000. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.6194764	-629357.	10000.
31.3500	0.6191807	-629540.	10000.0000000
29.7000	0.6318094	-633269.	10000.
28.0500	0.6466866	-637738.	10000.0000000
26.4000	0.6310607	-632865.	10000.
24.7500	0.6220832	-630304.	10000.
23.1000	0.6192966	-629744.	10000.
21.4500	0.6276942	-632380.	10000.
19.8000	0.6242609	-631095.	10000.
18.1500	0.6275562	-632366.	10000.
16.5000	0.6297955	-632025.	10000.
14.8500	0.6629330	-638738.	10000.
13.2000	0.9311649	-732394.	10000.
11.5500	1.4802634	-1009544.	10000.
9.9000	1.2677669	-989341.	10000.
8.2500	1.7722564	-897225.	10000.

Summary of Pile Response(s)

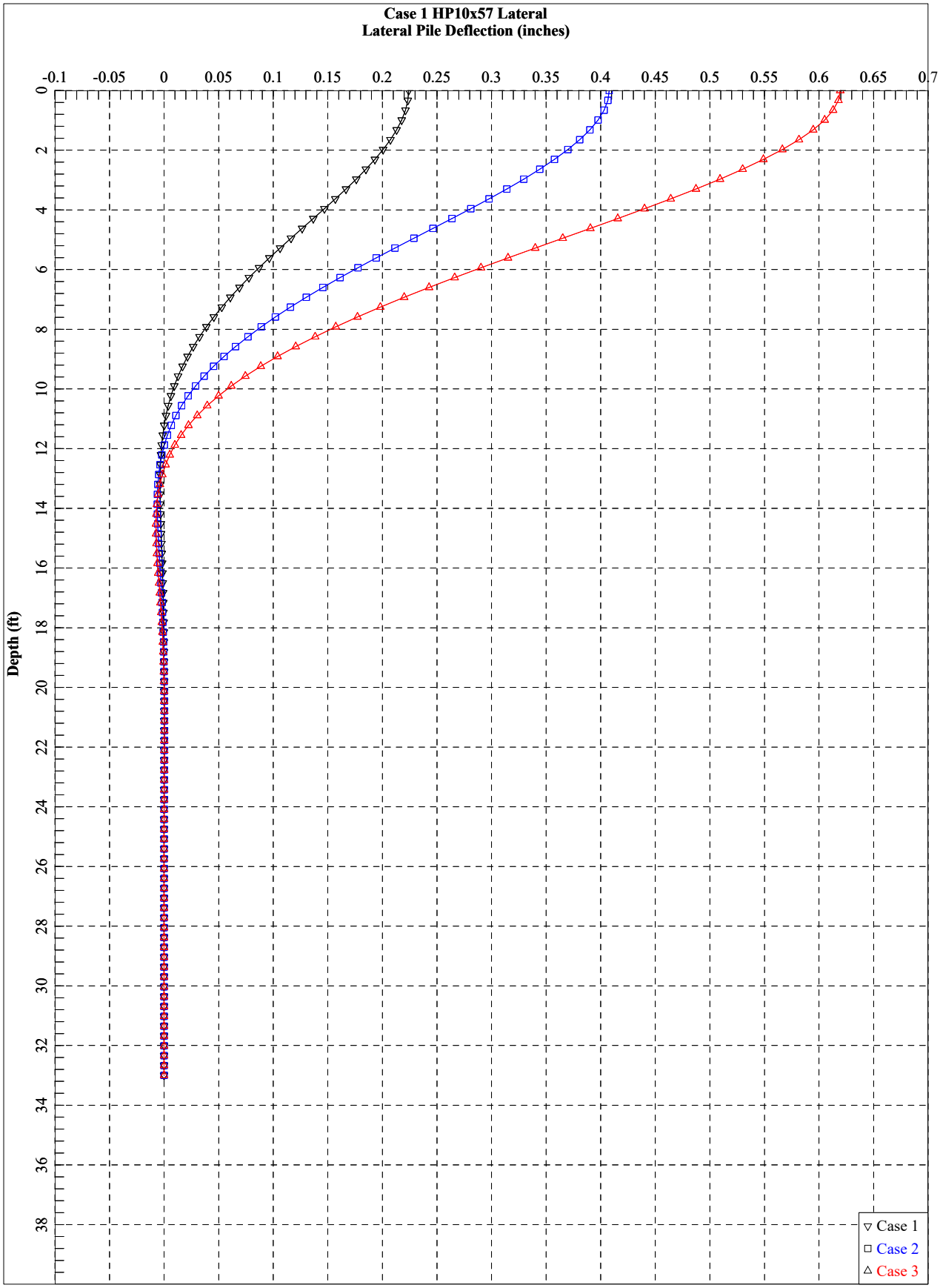
Definitions of Pile-head Loading Conditions:

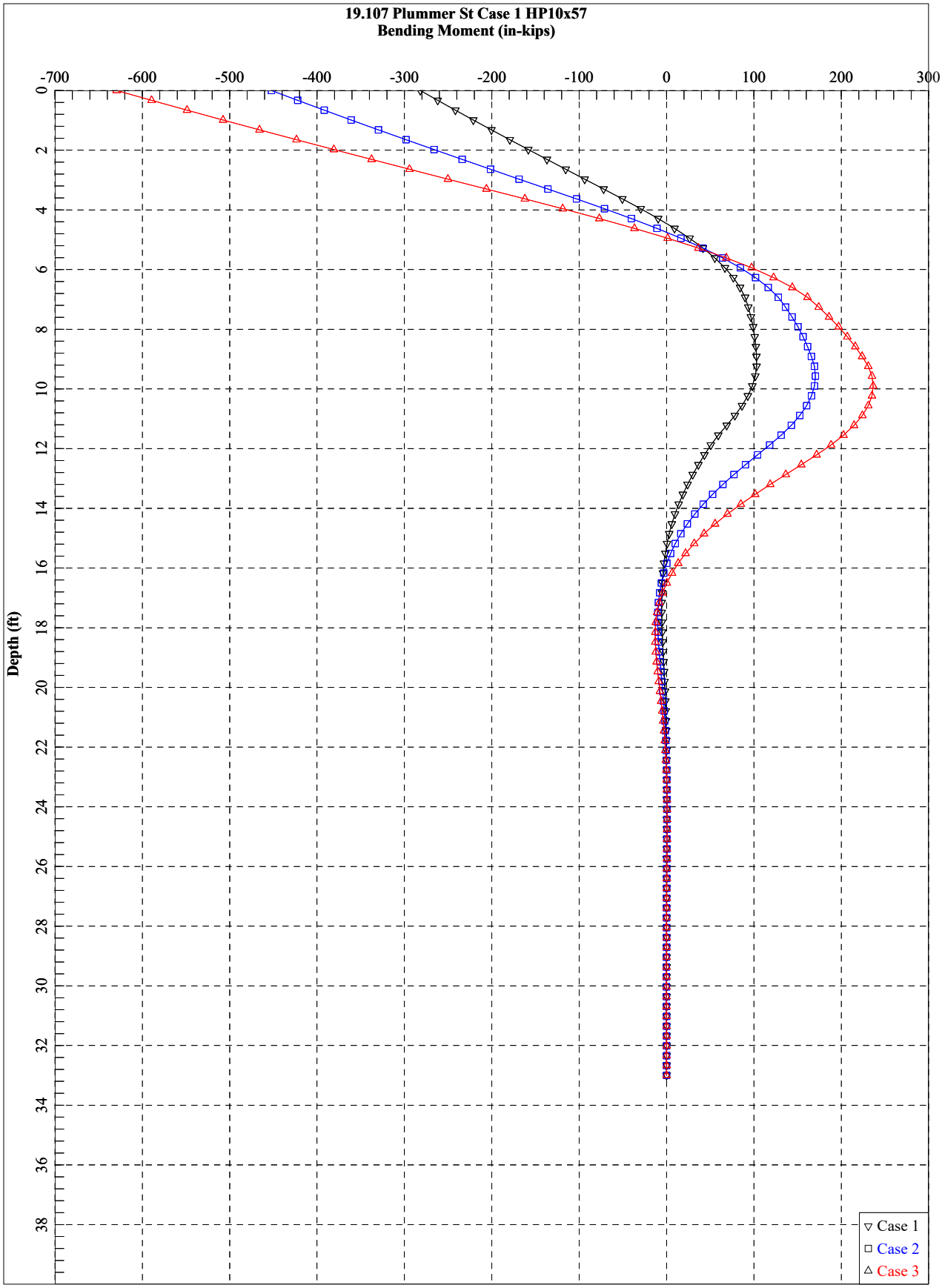
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs

Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Maximum Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Shear in Pile lbs	Pile-head Rotation radians
1	2	V = 5000.0000	S = 0.000	206000.	0.22407001	-281862.	5000.0000	-0.00000000
2	2	V = 7500.0000	S = 0.000	206000.	0.40784256	-452157.	7500.0000	0.00000000
3	2	V = 10000.0000	S = 0.000	206000.	0.61947642	-629357.	10000.	-0.00000000

The analysis ended normally.


Case 1 HP10x57 Lateral
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Case 1
Case 2
Case 3


19.107 Plummer St Case 1 HP10x57
Bending Moment (in-kips)
-700
-600
-500
-400
-300
-200
-100
0
100
200
300
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Case 1
Case 2
Case 3

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LPile Plus for Windows, Version 2013-07.007

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Files Used for Analysis

Path to file locations: J:\2019 Jobs\19.107 Plummer St Newburyport - Geotech\Pile Calcs\
Name of input data file: HP12x84 H-Pile L-Pile.lp7d
Name of output report file: HP12x84 H-Pile L-Pile.lp7o
Name of plot output file: HP12x84 H-Pile L-Pile.lp7p
Name of runtime messeage file: HP12x84 H-Pile L-Pile.lp7r

Date and Time of Analysis

Date: December 10, 2019 Time: 12:35:25

Problem Title

Project Name: Plummer St Newburyport, MA

Job Number: 19.107

Client: BSC Group

Engineer: CAG

Description: HP12x84

Program Options and Settings

Engineering Units of Input Data and Computations:
- Engineering units are US Customary Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 1000
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

Computational Options:
- Use unfactored loads in computations (conventional analysis)
- Compute pile response under loading and nonlinear bending properties of pile (only if nonlinear pile properties are input)
- Use of p-y modification factors for p-y curves not selected
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- No p-y curves to be computed and reported for user-specified depths
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 33.00 ft

Depth of ground surface below top of pile = 3.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.3000000
2	33.000000	12.3000000

Input Structural Properties:

Pile Section No. 1:

Section Type	= Elastic Pile
Cross-sectional Shape	= Weak H-Pile
Section Length	= 33.00000 ft
Flange Width	= 12.30000 in
Section Depth	= 12.30000 in
Flange Thickness	= 0.68500 in
Web Thickness	= 0.68500 in
Section Area	= 24.60000 Sq. in
Moment of Inertia	= 213.00000 in^4
Elastic Modulus	= 29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 3.00000 ft
Distance from top of pile to bottom of layer	= 7.00000 ft
Effective unit weight at top of layer	= 120.00000 pcf
Effective unit weight at bottom of layer	= 120.00000 pcf
Friction angle at top of layer	= 32.00000 deg.
Friction angle at bottom of layer	= 32.00000 deg.
Subgrade k at top of layer	= 0.0000 pci
Subgrade k at bottom of layer	= 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	= 7.00000 ft
Distance from top of pile to bottom of layer	= 9.00000 ft
Effective unit weight at top of layer	= 105.00000 pcf
Effective unit weight at bottom of layer	= 105.00000 pcf
Undrained cohesion at top of layer	= 250.00000 psf
Undrained cohesion at bottom of layer	= 250.00000 psf
Epsilon-50 at top of layer	= 0.0000

Epsilon-50 at bottom of layer = 0.0000

NOTE: Internal default values for Epsilon-50 will be computed for this soil layer.

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 9.00000 ft
Distance from top of pile to bottom of layer = 12.00000 ft
Effective unit weight at top of layer = 115.00000 pcf
Effective unit weight at bottom of layer = 115.00000 pcf
Undrained cohesion at top of layer = 1000.00000 psf
Undrained cohesion at bottom of layer = 1000.00000 psf
Epsilon-50 at top of layer = 0.0000
Epsilon-50 at bottom of layer = 0.0000

NOTE: Internal default values for Epsilon-50 will be computed for this soil layer.

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 12.00000 ft
Distance from top of pile to bottom of layer = 17.00000 ft
Effective unit weight at top of layer = 125.00000 pcf
Effective unit weight at bottom of layer = 125.00000 pcf
Friction angle at top of layer = 34.00000 deg.
Friction angle at bottom of layer = 34.00000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 17.00000 ft
Distance from top of pile to bottom of layer = 33.00000 ft
Effective unit weight at top of layer = 135.00000 pcf
Effective unit weight at bottom of layer = 135.00000 pcf
Friction angle at top of layer = 38.00000 deg.
Friction angle at bottom of layer = 38.00000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Internal default values for subgrade k will be computed for this soil layer.

(Depth of lowest soil layer extends 0.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Sand (Reese, et al.)	3.000	120.000	--	32.000	--	default

		7.000	120.000	--	32.000	--	default
2	Soft Clay	7.000	105.000	250.000	--	default	--
		9.000	105.000	250.000	--	default	--
3	Stiff Clay w/o Free Water	9.000	115.000	1000.000	--	default	--
		12.000	115.000	1000.000	--	default	--
4	Sand (Reese, et al.)	12.000	125.000	--	34.000	--	default
		17.000	125.000	--	34.000	--	default
5	Sand (Reese, et al.)	17.000	135.000	--	38.000	--	default
		33.000	135.000	--	38.000	--	default

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	2	V = 5000.00000 lbs	S = 0.0000 in/in	206000.	Yes
2	2	V = 7500.00000 lbs	S = 0.0000 in/in	206000.	Yes
3	2	V = 10000.00000 lbs	S = 0.0000 in/in	206000.	Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 5000.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1077	-276045.	5000.0000	0.000	16344.	6.177E+09	0.000	0.000	0.000
0.330	0.1073	-256172.	5000.0000	-0.000171	15771.	6.177E+09	0.000	0.000	0.000
0.660	0.1063	-236166.	5000.0000	-0.000328	15193.	6.177E+09	0.000	0.000	0.000
0.990	0.1047	-216037.	5000.0000	-0.000473	14612.	6.177E+09	0.000	0.000	0.000
1.320	0.1026	-195794.	5000.0000	-0.000605	14027.	6.177E+09	0.000	0.000	0.000
1.650	0.0999	-175449.	5000.0000	-0.000724	13440.	6.177E+09	0.000	0.000	0.000
1.980	0.0968	-155012.	5000.0000	-0.000830	12850.	6.177E+09	0.000	0.000	0.000
2.310	0.0933	-134494.	5000.0000	-0.000923	12257.	6.177E+09	0.000	0.000	0.000
2.640	0.0895	-113906.	5000.0000	-0.001003	11663.	6.177E+09	0.000	0.000	0.000
2.970	0.0854	-93258.	5000.0000	-0.001069	11067.	6.177E+09	0.000	0.000	0.000
3.300	0.0810	-72562.	4966.4995	-0.001122	10469.	6.177E+09	-16.9194	826.7622	0.000
3.630	0.0765	-52093.	4859.0161	-0.001162	9878.0641	6.177E+09	-37.3651	1934.0976	0.000
3.960	0.0718	-32182.	4670.2602	-0.001189	9303.1845	6.177E+09	-57.9662	3195.4524	0.000
4.290	0.0671	-13164.	4403.1543	-0.001204	8754.0649	6.177E+09	-76.9358	4541.4941	0.000
4.620	0.0623	4654.9126	4067.1108	-0.001207	8508.3861	6.177E+09	-92.7832	5897.5000	0.000
4.950	0.0575	21016.	3674.2576	-0.001198	8980.7892	6.177E+09	-105.6275	7270.8151	0.000
5.280	0.0528	35710.	3237.3849	-0.001180	9405.0490	6.177E+09	-115.0153	8624.3879	0.000
5.610	0.0482	48582.	2772.4178	-0.001153	9776.6931	6.177E+09	-119.8166	9847.3528	0.000
5.940	0.0437	59549.	2298.8584	-0.001118	10093.	6.177E+09	-119.3548	10821.	0.000
6.270	0.0393	68613.	1832.7290	-0.001077	10355.	6.177E+09	-116.0641	11688.	0.000
6.600	0.0351	75822.	1385.4586	-0.001031	10563.	6.177E+09	-109.8301	12375.	0.000
6.930	0.0312	81268.	973.2646	-0.000981	10720.	6.177E+09	-98.3487	12499.	0.000
7.260	0.0274	85130.	725.2267	-0.000927	10832.	6.177E+09	-26.9229	3894.0802	0.000
7.590	0.0238	88525.	618.8832	-0.000872	10930.	6.177E+09	-26.7859	4454.1140	0.000
7.920	0.0205	91454.	513.3698	-0.000814	11015.	6.177E+09	-26.5037	5126.0086	0.000
8.250	0.0174	93919.	409.2780	-0.000755	11086.	6.177E+09	-26.0679	5943.7713	0.000
8.580	0.0145	95926.	307.2360	-0.000694	11144.	6.177E+09	-25.4685	6956.1816	0.000
8.910	0.0119	97484.	207.9160	-0.000632	11189.	6.177E+09	-24.6931	8235.7002	0.000
9.240	0.009495	98604.	-42.0665	-0.000569	11221.	6.177E+09	-101.5606	42355.	0.000
9.570	0.007368	98079.	-439.2363	-0.000506	11206.	6.177E+09	-99.0302	53226.	0.000
9.900	0.005489	95950.	-824.3592	-0.000444	11144.	6.177E+09	-95.4763	68878.	0.000
10.230	0.003854	92274.	-1192.8246	-0.000383	11038.	6.177E+09	-90.6173	93104.	0.000
10.560	0.002454	87128.	-1538.3711	-0.000326	10890.	6.177E+09	-83.9011	135418.	0.000
10.890	0.001274	80622.	-1850.9427	-0.000272	10702.	6.177E+09	-73.9633	229907.	0.000
11.220	0.000299	72913.	-2106.2548	-0.000223	10479.	6.177E+09	-54.9822	727932.	0.000
11.550	-0.000491	64304.	-2096.5725	-0.000179	10231.	6.177E+09	59.8722	483223.	0.000
11.880	-0.001117	56600.	-1825.8161	-0.000140	10008.	6.177E+09	76.8735	272493.	0.000
12.210	-0.001600	50072.	-1644.2273	-0.000106	9819.7160	6.177E+09	14.8380	36725.	0.000
12.540	-0.001956	43750.	-1577.0680	-7.580E-05	9637.1931	6.177E+09	19.0808	38636.	0.000
12.870	-0.002200	37705.	-1494.6793	-4.969E-05	9462.6490	6.177E+09	22.5297	40548.	0.000
13.200	-0.002349	31993.	-1400.1976	-2.735E-05	9297.7365	6.177E+09	25.1884	42459.	0.000

13.530	-0.002417	26660.	-1296.7047	-8.548E-06	9143.7456	6.177E+09	27.0808	44371.	0.000
13.860	-0.002417	21737.	-1187.1547	6.966E-06	9001.6138	6.177E+09	28.2475	46282.	0.000
14.190	-0.002362	17246.	-1074.3142	1.946E-05	8871.9436	6.177E+09	28.7426	48193.	0.000
14.520	-0.002263	13197.	-960.7154	2.922E-05	8755.0271	6.177E+09	28.6305	50105.	0.000
14.850	-0.002130	9589.8760	-848.6211	3.652E-05	8650.8745	6.177E+09	27.9828	52016.	0.000
15.180	-0.001974	6416.4407	-740.0016	4.166E-05	8559.2472	6.177E+09	26.8756	53928.	0.000
15.510	-0.001800	3661.1020	-636.5210	4.489E-05	8479.6916	6.177E+09	25.3873	55839.	0.000
15.840	-0.001618	1301.9627	-539.5331	4.648E-05	8411.5756	6.177E+09	23.5964	57751.	0.000
16.170	-0.001432	-687.8275	-450.0844	4.667E-05	8393.8435	6.177E+09	21.5796	59662.	0.000
16.500	-0.001248	-2338.8547	-368.9235	4.570E-05	8441.5141	6.177E+09	19.4107	61574.	0.000
16.830	-0.001070	-3684.2673	-296.5146	4.377E-05	8480.3605	6.177E+09	17.1594	63485.	0.000
17.160	-0.000902	-4758.6659	-217.9948	4.107E-05	8511.3818	6.177E+09	22.4970	98802.	0.000
17.490	-0.000745	-5477.7862	-135.4182	3.779E-05	8532.1452	6.177E+09	19.2083	102086.	0.000
17.820	-0.000602	-5892.8252	-65.6468	3.414E-05	8544.1287	6.177E+09	16.0298	105370.	0.000
18.150	-0.000475	-6053.4093	-8.1179	3.031E-05	8548.7653	6.177E+09	13.0252	108655.	0.000
18.480	-0.000362	-6006.5720	37.9533	2.645E-05	8547.4129	6.177E+09	10.2431	111939.	0.000
18.810	-0.000265	-5795.9652	73.5170	2.266E-05	8541.3320	6.177E+09	7.7184	115223.	0.000
19.140	-0.000183	-5461.2907	99.6358	1.905E-05	8531.6689	6.177E+09	5.4729	118507.	0.000
19.470	-0.000114	-5037.9355	117.4365	1.569E-05	8519.4453	6.177E+09	3.5173	121791.	0.000
19.800	-5.863E-05	-4556.7891	128.0674	1.261E-05	8505.5530	6.177E+09	1.8519	125076.	0.000
20.130	-1.447E-05	-4044.2189	132.6630	9.856E-06	8490.7534	6.177E+09	0.4691	128360.	0.000
20.460	1.942E-05	-3522.1776	132.3133	7.430E-06	8475.6804	6.177E+09	-0.6457	131644.	0.000
20.790	4.438E-05	-3008.4196	128.0412	5.337E-06	8460.8466	6.177E+09	-1.5120	134928.	0.000
21.120	6.169E-05	-2516.7986	120.7843	3.566E-06	8446.6519	6.177E+09	-2.1531	138212.	0.000
21.450	7.262E-05	-2057.6256	111.3837	2.099E-06	8433.3941	6.177E+09	-2.5947	141497.	0.000
21.780	7.832E-05	-1638.0651	100.5768	9.148E-07	8421.2800	6.177E+09	-2.8634	144781.	0.000
22.110	7.986E-05	-1262.5498	88.9951	-1.499E-08	8410.4376	6.177E+09	-2.9860	148065.	0.000
22.440	7.820E-05	-933.1996	77.1651	-7.188E-07	8400.9282	6.177E+09	-2.9887	151349.	0.000
22.770	7.417E-05	-650.2292	65.5131	-1.226E-06	8392.7580	6.177E+09	-2.8962	154633.	0.000
23.100	6.849E-05	-412.3351	54.3711	-1.567E-06	8385.8892	6.177E+09	-2.7311	157918.	0.000
23.430	6.176E-05	-217.0533	43.9859	-1.769E-06	8380.2508	6.177E+09	-2.5140	161202.	0.000
23.760	5.448E-05	-61.0811	34.5278	-1.858E-06	8375.7473	6.177E+09	-2.2628	164486.	0.000
24.090	4.704E-05	59.4383	26.1013	-1.858E-06	8375.6999	6.177E+09	-1.9930	167770.	0.000
24.420	3.976E-05	148.6729	18.7546	-1.792E-06	8378.2764	6.177E+09	-1.7174	171054.	0.000
24.750	3.285E-05	210.8981	12.4904	-1.676E-06	8380.0731	6.177E+09	-1.4463	174339.	0.000
25.080	2.648E-05	250.3323	7.2749	-1.529E-06	8381.2116	6.177E+09	-1.1878	177623.	0.000
25.410	2.075E-05	271.0090	3.0465	-1.361E-06	8381.8086	6.177E+09	-0.9477	180907.	0.000
25.740	1.570E-05	276.6817	-0.2758	-1.186E-06	8381.9724	6.177E+09	-0.7302	184191.	0.000
26.070	1.135E-05	270.7594	-2.7858	-1.010E-06	8381.8014	6.177E+09	-0.5375	187475.	0.000
26.400	7.696E-06	256.2667	-4.5841	-8.415E-07	8381.3830	6.177E+09	-0.3707	190760.	0.000
26.730	4.689E-06	235.8266	-5.7730	-6.838E-07	8380.7928	6.177E+09	-0.2297	194044.	0.000
27.060	2.280E-06	211.6604	-6.4528	-5.403E-07	8380.0951	6.177E+09	-0.1136	197328.	0.000
27.390	4.091E-07	185.6018	-6.7188	-4.130E-07	8379.3427	6.177E+09	-0.0207	200612.	0.000
27.720	-9.908E-07	159.1211	-6.6589	-3.025E-07	8378.5781	6.177E+09	0.0510	203896.	0.000
28.050	-1.987E-06	133.3571	-6.3521	-2.087E-07	8377.8342	6.177E+09	0.1039	207181.	0.000
28.380	-2.644E-06	109.1533	-5.8680	-1.310E-07	8377.1353	6.177E+09	0.1405	210465.	0.000
28.710	-3.024E-06	87.0960	-5.2666	-6.810E-08	8376.4985	6.177E+09	0.1632	213749.	0.000
29.040	-3.183E-06	67.5531	-4.5979	-1.853E-08	8375.9342	6.177E+09	0.1745	217033.	0.000
29.370	-3.171E-06	50.7107	-3.9032	1.938E-08	8375.4479	6.177E+09	0.1764	220317.	0.000
29.700	-3.030E-06	36.6085	-3.2151	4.737E-08	8375.0407	6.177E+09	0.1711	223602.	0.000
30.030	-2.796E-06	25.1700	-2.5592	6.717E-08	8374.7105	6.177E+09	0.1602	226886.	0.000
30.360	-2.498E-06	16.2303	-1.9545	8.044E-08	8374.4524	6.177E+09	0.1452	230170.	0.000
30.690	-2.159E-06	9.5589	-1.4151	8.871E-08	8374.2597	6.177E+09	0.1273	233454.	0.000
31.020	-1.795E-06	4.8783	-0.9506	9.333E-08	8374.1246	6.177E+09	0.1073	236738.	0.000
31.350	-1.420E-06	1.8782	-0.5677	9.550E-08	8374.0380	6.177E+09	0.0860	240023.	0.000
31.680	-1.039E-06	0.2264	-0.2709	9.618E-08	8373.9903	6.177E+09	0.0638	243307.	0.000
32.010	-6.579E-07	-0.4244	-0.0634	9.611E-08	8373.9960	6.177E+09	0.0410	246591.	0.000

32.340	-2.778E-07	-0.4325	0.0524	9.584E-08	8373.9962	6.177E+09	0.0175	249875.	0.000
32.670	1.012E-07	-0.1656	0.0743	9.565E-08	8373.9885	6.177E+09	-0.006468	253159.	0.000
33.000	4.797E-07	0.000	0.000	9.559E-08	8373.9837	6.177E+09	-0.0311	128222.	0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.1076559 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -276045. inch-lbs
Maximum shear force = 5000.0000000 lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.3300000 feet below pile head
Number of iterations = 11
Number of zero deflection points = 4

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 2, Shear and Slope

Shear = 5000. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.1076559	-276045.	5000.0000000
31.3500	0.1072203	-275779.	5000.0000000
29.7000	0.1086758	-276790.	5000.0000000
28.0500	0.1100456	-277691.	5000.0000000
26.4000	0.1086639	-276680.	5000.0000000
24.7500	0.1077294	-276137.	5000.0000000
23.1000	0.1071210	-275948.	5000.0000000
21.4500	0.1078765	-276485.	5000.0000001
19.8000	0.1078935	-276325.	5000.0000000
18.1500	0.1081435	-276496.	5000.0000001
16.5000	0.1083053	-276548.	5000.0000000
14.8500	0.1113285	-278056.	5000.0000000
13.2000	0.1258657	-287873.	5000.0000000
11.5500	0.1540990	-317138.	5000.0000006
9.9000	0.1707137	-350657.	5000.0000019
8.2500	0.1629290	-366808.	5000.0000017
6.6000	0.2056546	-339160.	5000.0000001

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 7500.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*h	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in	lb/inch	lb/inch
0.00	0.2021	-445910.	7500.0000	0.000	21249.	6.177E+09	0.000	0.000	0.000
0.330	0.2015	-416093.	7500.0000	-0.000276	20388.	6.177E+09	0.000	0.000	0.000
0.660	0.1999	-386059.	7500.0000	-0.000533	19521.	6.177E+09	0.000	0.000	0.000
0.990	0.1973	-355823.	7500.0000	-0.000771	18648.	6.177E+09	0.000	0.000	0.000
1.320	0.1938	-325401.	7500.0000	-0.000990	17769.	6.177E+09	0.000	0.000	0.000
1.650	0.1895	-294808.	7500.0000	-0.001188	16886.	6.177E+09	0.000	0.000	0.000
1.980	0.1844	-264062.	7500.0000	-0.001368	15998.	6.177E+09	0.000	0.000	0.000
2.310	0.1786	-233177.	7500.0000	-0.001527	15107.	6.177E+09	0.000	0.000	0.000
2.640	0.1723	-202171.	7500.0000	-0.001666	14211.	6.177E+09	0.000	0.000	0.000
2.970	0.1654	-171058.	7500.0000	-0.001786	13313.	6.177E+09	0.000	0.000	0.000
3.300	0.1582	-139857.	7459.8183	-0.001886	12412.	6.177E+09	-20.2938	508.1454	0.000
3.630	0.1505	-108900.	7329.8416	-0.001966	11518.	6.177E+09	-45.3510	1193.2462	0.000
3.960	0.1426	-78597.	7099.6408	-0.002026	10643.	6.177E+09	-70.9121	1969.4550	0.000
4.290	0.1345	-49366.	6771.3491	-0.002067	9799.3374	6.177E+09	-94.8918	2794.6227	0.000
4.620	0.1262	-21597.	6354.6547	-0.002089	8997.5476	6.177E+09	-115.5599	3625.6740	0.000
4.950	0.1179	4371.8343	5862.1457	-0.002095	8500.2128	6.177E+09	-133.1820	4472.7428	0.000
5.280	0.1096	28249.	5307.8226	-0.002084	9189.6376	6.177E+09	-146.7792	5302.1678	0.000
5.610	0.1014	49811.	4709.9022	-0.002059	9812.1775	6.177E+09	-155.2008	6060.7658	0.000
5.940	0.0933	68912.	4087.5389	-0.002021	10364.	6.177E+09	-159.1241	6752.8479	0.000
6.270	0.0854	85482.	3454.5651	-0.001972	10842.	6.177E+09	-160.5596	7445.4792	0.000
6.600	0.0777	99489.	2821.8952	-0.001913	11247.	6.177E+09	-158.9706	8102.3827	0.000
6.930	0.0702	110952.	2209.0720	-0.001845	11578.	6.177E+09	-150.5360	8485.9079	0.000
7.260	0.0631	119995.	1840.6326	-0.001771	11839.	6.177E+09	-35.5445	2231.3012	0.000
7.590	0.0562	128419.	1699.6678	-0.001691	12082.	6.177E+09	-35.6498	2511.0232	0.000
7.920	0.0497	136217.	1558.5990	-0.001607	12307.	6.177E+09	-35.5971	2837.1002	0.000
8.250	0.0435	143384.	1418.0658	-0.001517	12514.	6.177E+09	-35.3793	3220.9823	0.000
8.580	0.0377	149923.	1278.7375	-0.001423	12703.	6.177E+09	-34.9885	3677.9934	0.000
8.910	0.0322	155834.	1141.3164	-0.001325	12873.	6.177E+09	-34.4160	4229.0604	0.000
9.240	0.0272	161124.	811.9160	-0.001223	13026.	6.177E+09	-131.9478	19226.	0.000
9.570	0.0225	164260.	291.7207	-0.001119	13117.	6.177E+09	-130.7771	22979.	0.000
9.900	0.0183	165260.	-222.2244	-0.001013	13146.	6.177E+09	-128.7912	27848.	0.000
10.230	0.0145	164154.	-726.4830	-0.000908	13114.	6.177E+09	-125.8848	34355.	0.000
10.560	0.0111	160987.	-1217.1029	-0.000804	13022.	6.177E+09	-121.9030	43398.	0.000
10.890	0.008145	155825.	-1689.3347	-0.000702	12873.	6.177E+09	-116.5979	56686.	0.000
11.220	0.005563	148753.	-2137.0646	-0.000604	12669.	6.177E+09	-109.5283	77971.	0.000
11.550	0.003358	139886.	-2551.4706	-0.000512	12413.	6.177E+09	-99.7676	117660.	0.000
11.880	0.001508	129381.	-2916.6798	-0.000426	12110.	6.177E+09	-84.6815	222370.	0.000
12.210	-1.332E-05	117480.	-3084.1047	-0.000347	11766.	6.177E+09	0.1235	36725.	0.000
12.540	-0.001236	105520.	-3059.9753	-0.000275	11421.	6.177E+09	12.0631	38636.	0.000
12.870	-0.002192	93694.	-2991.6584	-0.000211	11079.	6.177E+09	22.4404	40548.	0.000
13.200	-0.002909	82171.	-2885.4709	-0.000155	10747.	6.177E+09	31.1896	42459.	0.000
13.530	-0.003418	71094.	-2747.8935	-0.000106	10427.	6.177E+09	38.2939	44371.	0.000
13.860	-0.003746	60580.	-2585.3873	-6.347E-05	10123.	6.177E+09	43.7799	46282.	0.000

14.190	-0.003920	50721.	-2404.2350	-2.779E-05	9838.4641	6.177E+09	47.7111	48193.	0.000
14.520	-0.003966	41584.	-2210.4075	1.793E-06	9574.6416	6.177E+09	50.1815	50105.	0.000
14.850	-0.003906	33212.	-2009.4556	2.577E-05	9332.9124	6.177E+09	51.3093	52016.	0.000
15.180	-0.003762	25627.	-1806.4256	4.463E-05	9113.9134	6.177E+09	51.2311	53928.	0.000
15.510	-0.003553	18832.	-1605.7975	5.888E-05	8917.7238	6.177E+09	50.0962	55839.	0.000
15.840	-0.003296	12813.	-1411.4438	6.902E-05	8743.9323	6.177E+09	48.0622	57751.	0.000
16.170	-0.003006	7540.7239	-1226.6068	7.555E-05	8591.7089	6.177E+09	45.2898	59662.	0.000
16.500	-0.002697	2974.8693	-1053.8912	7.892E-05	8459.8779	6.177E+09	41.9403	61574.	0.000
16.830	-0.002381	-934.8504	-895.2696	7.957E-05	8400.9759	6.177E+09	38.1716	63485.	0.000
17.160	-0.002067	-4245.4894	-717.5731	7.791E-05	8496.5648	6.177E+09	51.5741	98802.	0.000
17.490	-0.001764	-6745.1434	-525.4184	7.439E-05	8568.7379	6.177E+09	45.4737	102086.	0.000
17.820	-0.001478	-8528.1696	-357.5148	6.949E-05	8620.2196	6.177E+09	39.3261	105370.	0.000
18.150	-0.001214	-9690.0397	-213.7189	6.365E-05	8653.7666	6.177E+09	33.2981	108655.	0.000
18.480	-0.000974	-10325.	-93.2850	5.724E-05	8672.0905	6.177E+09	27.5271	111939.	0.000
18.810	-0.000760	-10522.	5.0180	5.055E-05	8677.7949	6.177E+09	22.1209	115223.	0.000
19.140	-0.000573	-10367.	82.7943	4.386E-05	8673.3245	6.177E+09	17.1600	118507.	0.000
19.470	-0.000413	-9938.0666	141.9146	3.735E-05	8660.9279	6.177E+09	12.6987	121791.	0.000
19.800	-0.000278	-9304.3872	184.4185	3.118E-05	8642.6315	6.177E+09	8.7680	125076.	0.000
20.130	-0.000166	-8528.3464	212.4284	2.547E-05	8620.2247	6.177E+09	5.3785	128360.	0.000
20.460	-7.591E-05	-7663.5024	228.0744	2.028E-05	8595.2539	6.177E+09	2.5235	131644.	0.000
20.790	-5.346E-06	-6755.0776	233.4317	1.565E-05	8569.0247	6.177E+09	0.1822	134928.	0.000
21.120	4.807E-05	-5840.2633	230.4705	1.162E-05	8542.6111	6.177E+09	-1.6777	138212.	0.000
21.450	8.666E-05	-4948.7038	221.0179	8.158E-06	8516.8688	6.177E+09	-3.0964	141497.	0.000
21.780	0.000113	-4103.1123	206.7300	5.257E-06	8492.4539	6.177E+09	-4.1197	144781.	0.000
22.110	0.000128	-3319.9790	189.0752	2.877E-06	8469.8423	6.177E+09	-4.7968	148065.	0.000
22.440	0.000135	-2610.3307	169.3260	9.764E-07	8449.3524	6.177E+09	-5.1776	151349.	0.000
22.770	0.000136	-1980.5102	148.5575	-4.952E-07	8431.1675	6.177E+09	-5.3115	154633.	0.000
23.100	0.000132	-1432.9474	127.6538	-1.589E-06	8415.3576	6.177E+09	-5.2459	157918.	0.000
23.430	0.000123	-966.8992	107.3179	-2.359E-06	8401.9013	6.177E+09	-5.0247	161202.	0.000
23.760	0.000113	-579.1414	88.0864	-2.854E-06	8390.7054	6.177E+09	-4.6882	164486.	0.000
24.090	0.000101	-264.5987	70.3456	-3.125E-06	8381.6236	6.177E+09	-4.2718	167770.	0.000
24.420	8.812E-05	-16.9060	54.3508	-3.215E-06	8374.4719	6.177E+09	-3.8064	171054.	0.000
24.750	7.537E-05	171.1047	40.2443	-3.165E-06	8378.9241	6.177E+09	-3.3181	174339.	0.000
25.080	6.305E-05	306.9933	28.0749	-3.012E-06	8382.8476	6.177E+09	-2.8281	177623.	0.000
25.410	5.151E-05	398.3727	17.8160	-2.786E-06	8385.4861	6.177E+09	-2.3532	180907.	0.000
25.740	4.098E-05	452.6414	9.3821	-2.513E-06	8387.0530	6.177E+09	-1.9063	184191.	0.000
26.070	3.161E-05	476.7795	2.6450	-2.215E-06	8387.7499	6.177E+09	-1.4963	187475.	0.000
26.400	2.344E-05	477.2039	-2.5533	-1.910E-06	8387.7622	6.177E+09	-1.1291	190760.	0.000
26.730	1.648E-05	459.6732	-6.3879	-1.609E-06	8387.2560	6.177E+09	-0.8076	194044.	0.000
27.060	1.069E-05	429.2371	-9.0420	-1.324E-06	8386.3772	6.177E+09	-0.5328	197328.	0.000
27.390	5.993E-06	390.2209	-10.6982	-1.062E-06	8385.2507	6.177E+09	-0.3036	200612.	0.000
27.720	2.284E-06	346.2396	-11.5322	-8.256E-07	8383.9808	6.177E+09	-0.1176	203896.	0.000
28.050	-5.457E-07	300.2328	-11.7086	-6.184E-07	8382.6524	6.177E+09	0.0285	207181.	0.000
28.380	-2.613E-06	254.5168	-11.3770	-4.406E-07	8381.3325	6.177E+09	0.1389	210465.	0.000
28.710	-4.035E-06	210.8457	-10.6708	-2.914E-07	8380.0715	6.177E+09	0.2178	213749.	0.000
29.040	-4.921E-06	170.4797	-9.7055	-1.692E-07	8378.9060	6.177E+09	0.2697	217033.	0.000
29.370	-5.375E-06	134.2542	-8.5794	-7.149E-08	8377.8601	6.177E+09	0.2990	220317.	0.000
29.700	-5.487E-06	102.6478	-7.3738	4.450E-09	8376.9475	6.177E+09	0.3099	223602.	0.000
30.030	-5.340E-06	75.8466	-6.1545	6.167E-08	8376.1737	6.177E+09	0.3059	226886.	0.000
30.360	-4.999E-06	53.8032	-4.9735	1.032E-07	8375.5372	6.177E+09	0.2906	230170.	0.000
30.690	-4.522E-06	36.2882	-3.8703	1.321E-07	8375.0315	6.177E+09	0.2666	233454.	0.000
31.020	-3.953E-06	22.9346	-2.8746	1.511E-07	8374.6459	6.177E+09	0.2363	236738.	0.000
31.350	-3.325E-06	13.2749	-2.0076	1.627E-07	8374.3670	6.177E+09	0.2016	240023.	0.000
31.680	-2.664E-06	6.7689	-1.2844	1.691E-07	8374.1792	6.177E+09	0.1637	243307.	0.000
32.010	-1.986E-06	2.8264	-0.7154	1.722E-07	8374.0653	6.177E+09	0.1237	246591.	0.000
32.340	-1.301E-06	0.8218	-0.3081	1.734E-07	8374.0075	6.177E+09	0.0821	249875.	0.000
32.670	-6.130E-07	0.1037	-0.0680	1.737E-07	8373.9867	6.177E+09	0.0392	253159.	0.000

33.000 7.485E-08 0.000 0.000 1.737E-07 8373.9837 6.177E+09 -0.004847 128222. 0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.2020987 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -445910. inch-lbs
Maximum shear force = 7500.0000000 lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.3300000 feet below pile head
Number of iterations = 15
Number of zero deflection points = 4

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 2, Shear and Slope

Shear = 7500. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.2020987	-445910.	7500.0000000
31.3500	0.2011870	-445598.	7500.0000000
29.7000	0.2047360	-447569.	7500.0000000
28.0500	0.2085665	-449587.	7500.0000000
26.4000	0.2047573	-447418.	7500.0000000
24.7500	0.2024306	-446196.	7500.0000000
23.1000	0.2012846	-445691.	7500.0000000
21.4500	0.2032369	-446919.	7500.0000000
19.8000	0.2028119	-446593.	7500.0000000
18.1500	0.2033252	-447090.	7500.0000003
16.5000	0.2060862	-447722.	7500.0000002
14.8500	0.2196672	-454638.	7500.0000000
13.2000	0.2673010	-489201.	7500.0000000
11.5500	0.3205599	-552832.	7500.0000009
9.9000	0.3268864	-591224.	7500.0000016
8.2500	0.3360959	-565439.	7500.0000128
6.6000	0.4769681	-514011.	7500.0000060

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 10000.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.3201	-627450.	10000.	0.000	26491.	6.177E+09	0.000	0.000	0.000
0.330	0.3193	-587686.	10000.	-0.000390	25342.	6.177E+09	0.000	0.000	0.000
0.660	0.3170	-547615.	10000.0000	-0.000753	24185.	6.177E+09	0.000	0.000	0.000
0.990	0.3133	-507257.	10000.0000	-0.001092	23020.	6.177E+09	0.000	0.000	0.000
1.320	0.3084	-466634.	10000.0000	-0.001404	21847.	6.177E+09	0.000	0.000	0.000
1.650	0.3022	-425767.	10000.0000	-0.001690	20667.	6.177E+09	0.000	0.000	0.000
1.980	0.2950	-384677.	10000.0000	-0.001950	19481.	6.177E+09	0.000	0.000	0.000
2.310	0.2868	-343386.	10000.0000	-0.002183	18289.	6.177E+09	0.000	0.000	0.000
2.640	0.2777	-301916.	10000.0000	-0.002390	17091.	6.177E+09	0.000	0.000	0.000
2.970	0.2679	-260287.	10000.0000	-0.002570	15889.	6.177E+09	0.000	0.000	0.000
3.300	0.2574	-218523.	9953.8853	-0.002723	14683.	6.177E+09	-23.2902	358.3810	0.000
3.630	0.2463	-177009.	9804.0156	-0.002850	13485.	6.177E+09	-52.4016	842.5517	0.000
3.960	0.2348	-136225.	9537.3629	-0.002951	12307.	6.177E+09	-82.2715	1387.6852	0.000
4.290	0.2229	-96659.	9155.4612	-0.003025	11165.	6.177E+09	-110.6081	1964.8812	0.000
4.620	0.2108	-58777.	8668.0558	-0.003075	10071.	6.177E+09	-135.5562	2546.3141	0.000
4.950	0.1986	-22991.	8087.6097	-0.003101	9037.8031	6.177E+09	-157.5984	3143.0267	0.000
5.280	0.1863	10336.	7428.6710	-0.003105	8672.4288	6.177E+09	-175.1989	3724.9781	0.000
5.610	0.1740	40911.	6711.0330	-0.003089	9555.2108	6.177E+09	-187.2446	4262.2007	0.000
5.940	0.1618	68528.	5952.1845	-0.003054	10353.	6.177E+09	-196.0122	4797.6864	0.000
6.270	0.1498	93035.	5161.8947	-0.003002	11060.	6.177E+09	-203.1240	5370.2932	0.000
6.600	0.1380	114308.	4348.2827	-0.002936	11674.	6.177E+09	-207.7912	5962.2144	0.000
6.930	0.1265	132263.	3531.2273	-0.002857	12193.	6.177E+09	-204.8630	6411.5205	0.000
7.260	0.1154	146936.	3039.5535	-0.002767	12616.	6.177E+09	-43.4570	1491.4158	0.000
7.590	0.1046	160850.	2866.7169	-0.002668	13018.	6.177E+09	-43.8341	1659.2471	0.000
7.920	0.0943	173994.	2692.7074	-0.002561	13398.	6.177E+09	-44.0495	1850.7249	0.000
8.250	0.0843	186355.	2518.1766	-0.002446	13755.	6.177E+09	-44.0974	2070.7036	0.000
8.580	0.0749	197928.	2343.7990	-0.002322	14089.	6.177E+09	-43.9721	2325.3435	0.000
8.910	0.0659	208707.	2170.2715	-0.002192	14400.	6.177E+09	-43.6680	2622.5509	0.000
9.240	0.0575	218693.	1768.9171	-0.002055	14688.	6.177E+09	-159.0363	10949.	0.000
9.570	0.0497	226070.	1138.8110	-0.001913	14901.	6.177E+09	-159.1991	12695.	0.000
9.900	0.0424	230832.	509.4125	-0.001766	15039.	6.177E+09	-158.6789	14829.	0.000
10.230	0.0357	232986.	-116.4839	-0.001617	15101.	6.177E+09	-157.4303	17476.	0.000
10.560	0.0296	232549.	-735.8818	-0.001468	15088.	6.177E+09	-155.3969	20814.	0.000
10.890	0.0240	229553.	-1345.5273	-0.001320	15002.	6.177E+09	-152.5049	25115.	0.000
11.220	0.0191	224046.	-1941.8193	-0.001175	14843.	6.177E+09	-148.6527	30804.	0.000
11.550	0.0147	216090.	-2520.6618	-0.001034	14613.	6.177E+09	-143.6919	38596.	0.000
11.880	0.0109	205768.	-3077.1988	-0.000898	14315.	6.177E+09	-137.3874	49802.	0.000
12.210	0.007628	193185.	-3489.2951	-0.000770	13952.	6.177E+09	-70.7421	36725.	0.000
12.540	0.004822	179390.	-3722.5215	-0.000651	13554.	6.177E+09	-47.0490	38636.	0.000
12.870	0.002472	164764.	-3865.7932	-0.000541	13131.	6.177E+09	-25.3104	40548.	0.000
13.200	0.000540	149655.	-3927.3673	-0.000440	12695.	6.177E+09	-5.7876	42459.	0.000
13.530	-0.001012	134377.	-3916.3668	-0.000349	12254.	6.177E+09	11.3434	44371.	0.000
13.860	-0.002223	119207.	-3842.4551	-0.000268	11816.	6.177E+09	25.9858	46282.	0.000
14.190	-0.003132	104382.	-3715.5371	-0.000196	11388.	6.177E+09	38.1142	48193.	0.000
14.520	-0.003775	90100.	-3545.4928	-0.000134	10975.	6.177E+09	47.7667	50105.	0.000

14.850	-0.004190	76519.	-3341.9438	-8.019E-05	10583.	6.177E+09	55.0358	52016.	0.000
15.180	-0.004410	63762.	-3114.0547	-3.522E-05	10215.	6.177E+09	60.0597	53928.	0.000
15.510	-0.004469	51914.	-2870.3691	1.861E-06	9872.8961	6.177E+09	63.0138	55839.	0.000
15.840	-0.004396	41026.	-2618.6789	3.165E-05	9558.5336	6.177E+09	64.1024	57751.	0.000
16.170	-0.004218	31122.	-2365.9248	5.478E-05	9272.5759	6.177E+09	63.5511	59662.	0.000
16.500	-0.003962	22198.	-2118.1254	7.187E-05	9014.9228	6.177E+09	61.6000	61574.	0.000
16.830	-0.003649	14229.	-1880.3314	8.355E-05	8784.8257	6.177E+09	58.4979	63485.	0.000
17.160	-0.003300	7169.8449	-1601.4822	9.041E-05	8581.0004	6.177E+09	82.3350	98802.	0.000
17.490	-0.002933	1397.9237	-1288.7549	9.315E-05	8414.3463	6.177E+09	75.6080	102086.	0.000
17.820	-0.002562	-3189.0736	-1004.0591	9.258E-05	8466.0626	6.177E+09	68.1777	105370.	0.000
18.150	-0.002200	-6705.2675	-749.5649	8.941E-05	8567.5865	6.177E+09	60.3547	108655.	0.000
18.480	-0.001854	-9271.4962	-526.2877	8.429E-05	8641.6819	6.177E+09	52.4115	111939.	0.000
18.810	-0.001532	-11011.	-334.2443	7.778E-05	8691.9064	6.177E+09	44.5801	115223.	0.000
19.140	-0.001238	-12046.	-172.6145	7.039E-05	8721.7797	6.177E+09	37.0511	118507.	0.000
19.470	-0.000975	-12493.	-39.9032	6.253E-05	8734.6952	6.177E+09	29.9749	121791.	0.000
19.800	-0.000743	-12464.	65.9046	5.453E-05	8733.8501	6.177E+09	23.4634	125076.	0.000
20.130	-0.000543	-12060.	147.1964	4.667E-05	8722.1931	6.177E+09	17.5931	128360.	0.000
20.460	-0.000373	-11374.	206.6001	3.916E-05	8702.3882	6.177E+09	12.4087	131644.	0.000
20.790	-0.000233	-10488.	246.8650	3.215E-05	8676.7931	6.177E+09	7.9271	134928.	0.000
21.120	-0.000119	-9471.2848	270.7608	2.575E-05	8647.4504	6.177E+09	4.1415	138212.	0.000
21.450	-2.871E-05	-8385.1287	280.9923	2.003E-05	8616.0896	6.177E+09	1.0259	141497.	0.000
21.780	3.995E-05	-7278.4991	280.1318	1.501E-05	8584.1376	6.177E+09	-1.4605	144781.	0.000
22.110	9.013E-05	-6190.9663	270.5674	1.069E-05	8552.7370	6.177E+09	-3.3700	148065.	0.000
22.440	0.000125	-5153.0423	254.4663	7.051E-06	8522.7688	6.177E+09	-4.7619	151349.	0.000
22.770	0.000146	-4187.0982	233.7511	4.058E-06	8494.8788	6.177E+09	-5.7002	154633.	0.000
23.100	0.000157	-3308.3534	210.0894	1.655E-06	8469.5066	6.177E+09	-6.2501	157918.	0.000
23.430	0.000159	-2525.8904	184.8918	-2.152E-07	8446.9144	6.177E+09	-6.4759	161202.	0.000
23.760	0.000155	-1843.6595	159.3196	-1.616E-06	8427.2162	6.177E+09	-6.4393	164486.	0.000
24.090	0.000146	-1261.4429	134.2985	-2.611E-06	8410.4057	6.177E+09	-6.1976	167770.	0.000
24.420	0.000134	-775.7554	110.5369	-3.264E-06	8396.3823	6.177E+09	-5.8031	171054.	0.000
24.750	0.000120	-380.6647	88.5485	-3.635E-06	8384.9748	6.177E+09	-5.3021	174339.	0.000
25.080	0.000106	-68.5209	68.6755	-3.779E-06	8375.9622	6.177E+09	-4.7347	177623.	0.000
25.410	9.051E-05	169.4108	51.1142	-3.746E-06	8378.8752	6.177E+09	-4.1347	180907.	0.000
25.740	7.589E-05	342.4157	35.9388	-3.582E-06	8383.8704	6.177E+09	-3.5297	184191.	0.000
26.070	6.213E-05	459.8908	23.1258	-3.325E-06	8387.2623	6.177E+09	-2.9416	187475.	0.000
26.400	4.955E-05	530.9971	12.5755	-3.008E-06	8389.3153	6.177E+09	-2.3869	190760.	0.000
26.730	3.831E-05	564.3956	4.1322	-2.657E-06	8390.2797	6.177E+09	-1.8774	194044.	0.000
27.060	2.851E-05	568.0584	-2.3979	-2.294E-06	8390.3854	6.177E+09	-1.4207	197328.	0.000
27.390	2.015E-05	549.1459	-7.2319	-1.935E-06	8389.8394	6.177E+09	-1.0207	200612.	0.000
27.720	1.318E-05	513.9396	-10.5968	-1.595E-06	8388.8228	6.177E+09	-0.6787	203896.	0.000
28.050	7.519E-06	467.8211	-12.7196	-1.280E-06	8387.4913	6.177E+09	-0.3934	207181.	0.000
28.380	3.045E-06	415.2889	-13.8189	-9.969E-07	8385.9745	6.177E+09	-0.1618	210465.	0.000
28.710	-3.758E-07	360.0020	-14.0991	-7.483E-07	8384.3782	6.177E+09	0.0203	213749.	0.000
29.040	-2.882E-06	304.8449	-13.7462	-5.352E-07	8382.7856	6.177E+09	0.1580	217033.	0.000
29.370	-4.615E-06	252.0055	-12.9251	-3.567E-07	8381.2600	6.177E+09	0.2567	220317.	0.000
29.700	-5.708E-06	203.0604	-11.7786	-2.109E-07	8379.8468	6.177E+09	0.3223	223602.	0.000
30.030	-6.285E-06	159.0631	-10.4275	-9.479E-08	8378.5764	6.177E+09	0.3601	226886.	0.000
30.360	-6.458E-06	120.6292	-8.9713	-5.134E-09	8377.4667	6.177E+09	0.3754	230170.	0.000
30.690	-6.325E-06	88.0188	-7.4897	6.175E-08	8376.5251	6.177E+09	0.3729	233454.	0.000
31.020	-5.969E-06	61.2101	-6.0448	1.096E-07	8375.7511	6.177E+09	0.3569	236738.	0.000
31.350	-5.458E-06	39.9655	-4.6832	1.420E-07	8375.1377	6.177E+09	0.3308	240023.	0.000
31.680	-4.844E-06	23.8873	-3.4389	1.625E-07	8374.6734	6.177E+09	0.2977	243307.	0.000
32.010	-4.171E-06	12.4644	-2.3353	1.741E-07	8374.3436	6.177E+09	0.2597	246591.	0.000
32.340	-3.465E-06	5.1076	-1.3881	1.798E-07	8374.1312	6.177E+09	0.2187	249875.	0.000
32.670	-2.747E-06	1.1771	-0.6075	1.818E-07	8374.0177	6.177E+09	0.1756	253159.	0.000
33.000	-2.026E-06	0.000	0.000	1.822E-07	8373.9837	6.177E+09	0.1312	128222.	0.000

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 3:

Pile-head deflection = 0.3201064 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -627450. inch-lbs
Maximum shear force = 10000. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 0.3300000 feet below pile head
Number of iterations = 15
Number of zero deflection points = 3

Pile-head Deflection vs. Pile Length for Load Case 3

Boundary Condition Type 2, Shear and Slope

Shear = 10000. lb
Slope = 0.00000
Axial Load = 206000. lb

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.0000	0.3201064	-627450.	10000.
31.3500	0.3189227	-627093.	10000.
29.7000	0.3250046	-630388.	10000.
28.0500	0.3315183	-633928.	10000.
26.4000	0.3249969	-630198.	10000.
24.7500	0.3208806	-628049.	10000.
23.1000	0.3190290	-627288.	10000.
21.4500	0.3225885	-629435.	10000.
19.8000	0.3215503	-628675.	10000.
18.1500	0.3233548	-629574.	10000.
16.5000	0.3335414	-632809.	10000.
14.8500	0.3702662	-651619.	10000.
13.2000	0.4534118	-717596.	10000.
11.5500	0.5140147	-806676.	10000.
9.9000	0.5046328	-841651.	10000.
8.2500	0.5604923	-759718.	10000.

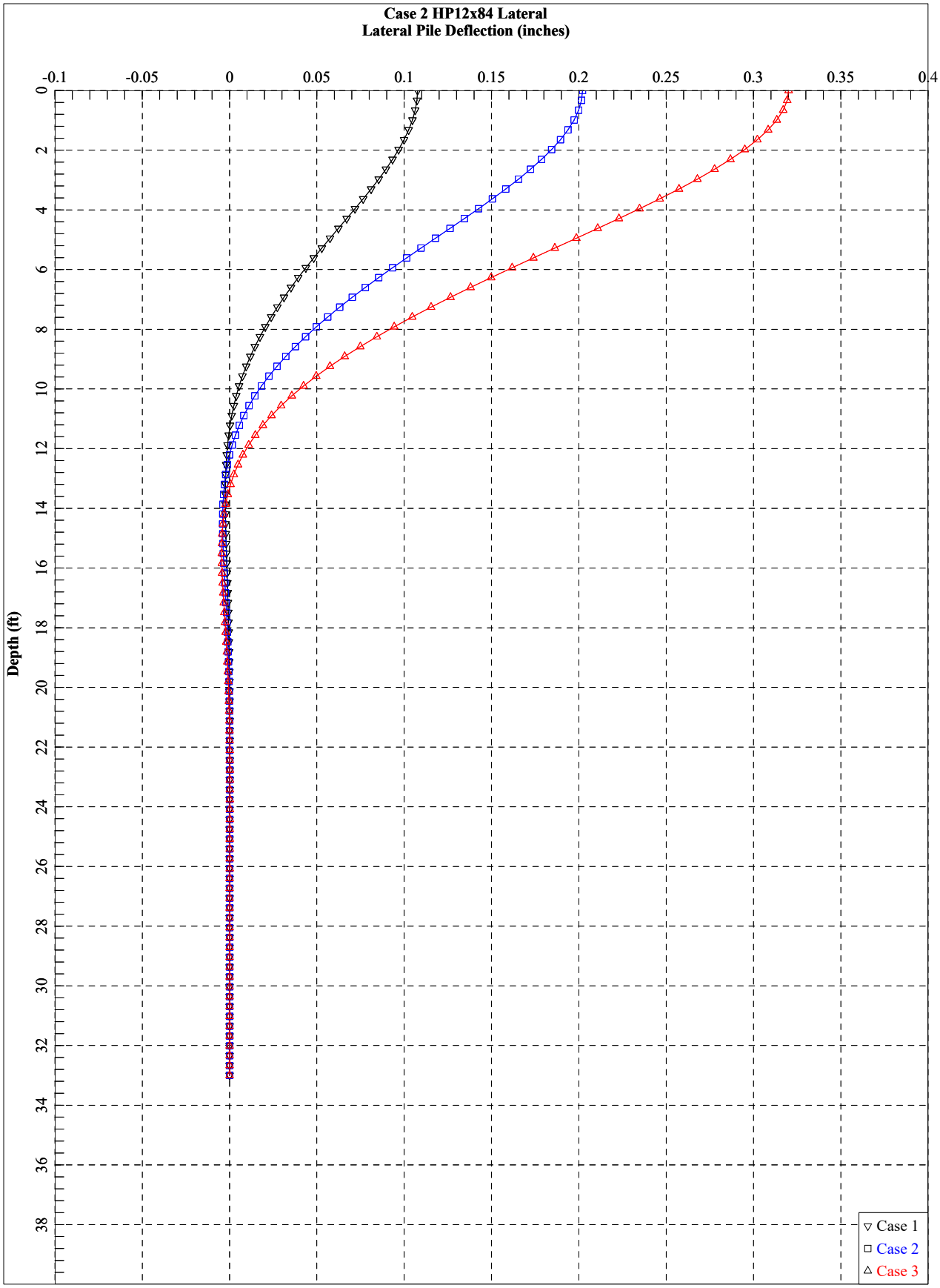
Summary of Pile Response(s)

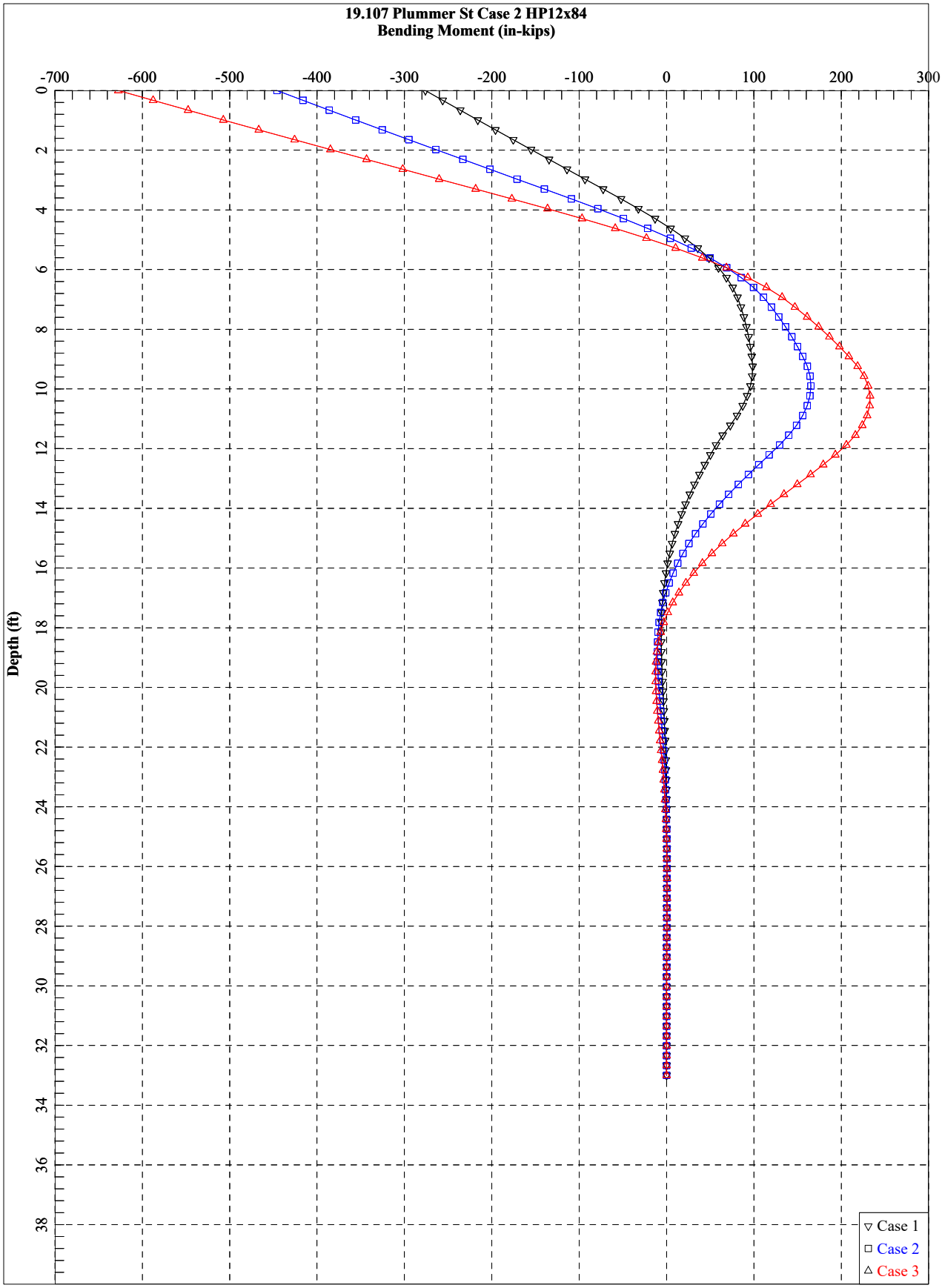
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Maximum Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	2	V = 5000.0000	S = 0.000	206000.	0.10765589	-276045.	5000.0000	0.00000000
2	2	V = 7500.0000	S = 0.000	206000.	0.20209870	-445910.	7500.0000	-0.00000000
3	2	V = 10000.0000	S = 0.000	206000.	0.32010636	-627450.	10000.	-0.00000000

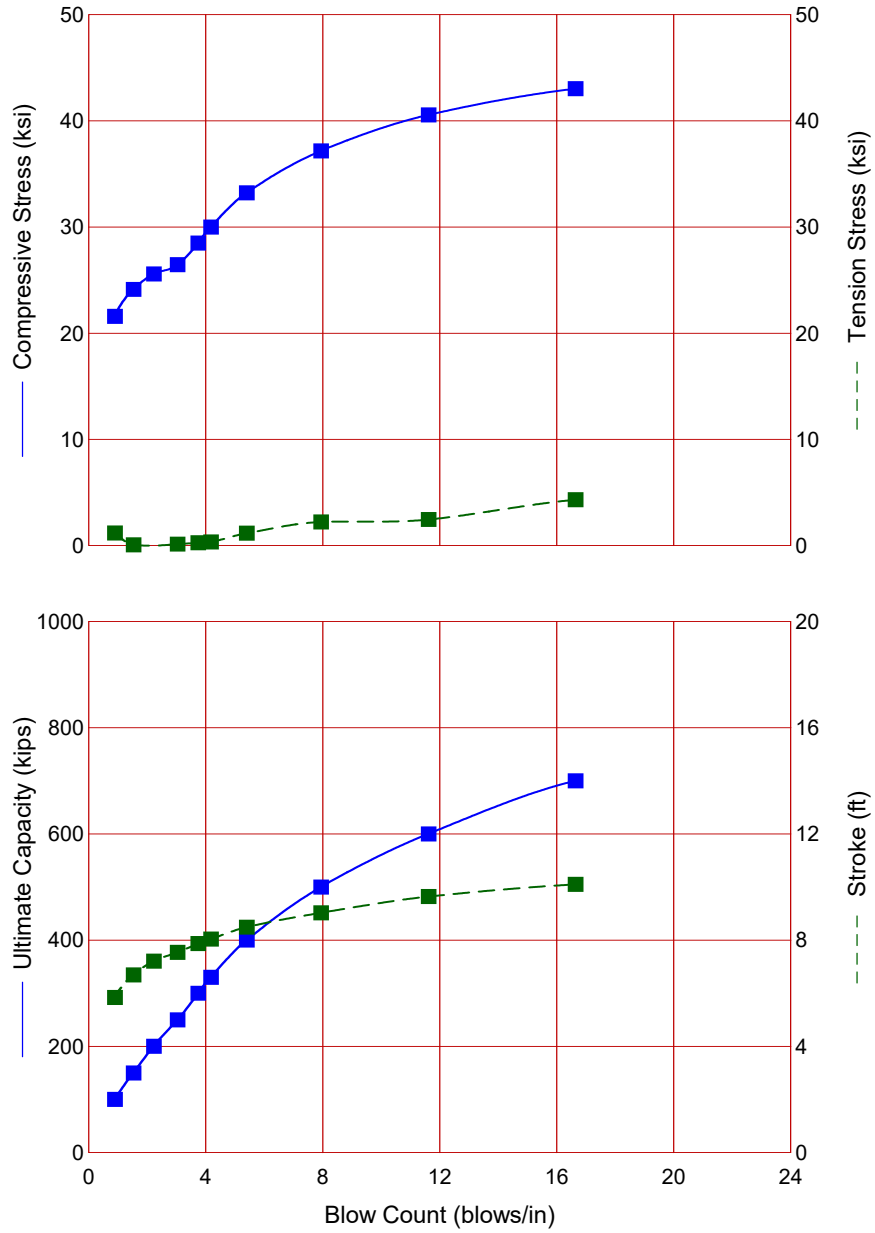
The analysis ended normally.


Case 2 HP12x84 Lateral
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Case 1
Case 2
Case 3


19.107 Plummer St Case 2 HP12x84
Bending Moment (in-kips)
-700
-600
-500
-400
-300
-200
-100
0
100
200
300
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Case 1
Case 2
Case 3

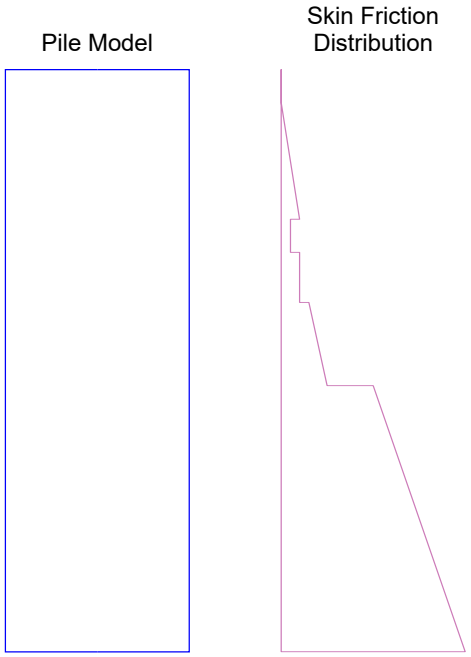
Geosciences Testing & Research Inc
19.107 Plummer HP12x84

10-Dec-2019
GRLWEAP Version 2010



DELMAG D 19-32

Ram Weight	4.00	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.040	in
Skin Damping	Variable	
Toe Damping	0.150	sec/ft
Pile Length	35.00	ft
Pile Penetration	33.00	ft
Pile Top Area	24.60	in2

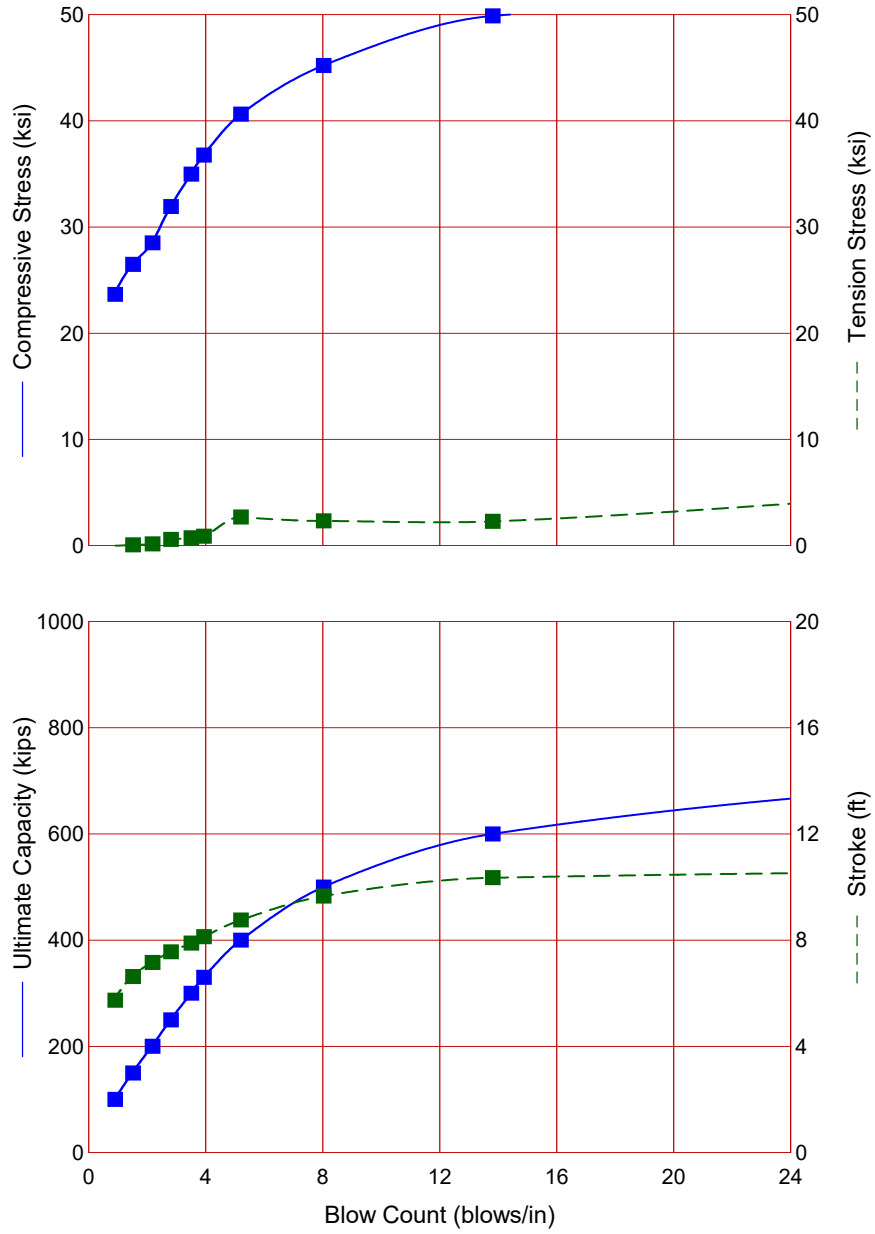


Res. Shaft = 25 %
(Proportional)

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count blows/in	Stroke ft	Energy kips-ft
100.0	21.59	1.19	0.9	5.84	17.88
150.0	24.13	0.08	1.5	6.69	16.91
200.0	25.57	0.00	2.2	7.21	16.16
250.0	26.45	0.14	3.0	7.54	15.87
300.0	28.49	0.28	3.8	7.87	15.98
330.0	29.99	0.35	4.2	8.04	16.17
400.0	33.22	1.18	5.4	8.49	16.71
500.0	37.16	2.23	8.0	9.03	17.74
600.0	40.55	2.46	11.6	9.64	19.20
700.0	43.02	4.32	16.6	10.10	20.25

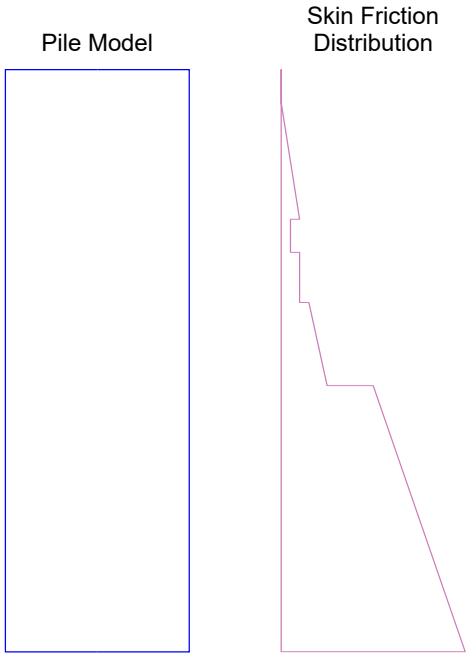
Geosciences Testing & Research Inc
19.107 Plummer HP10x57

10-Dec-2019
GRLWEAP Version 2010



DELMAG D 19-32

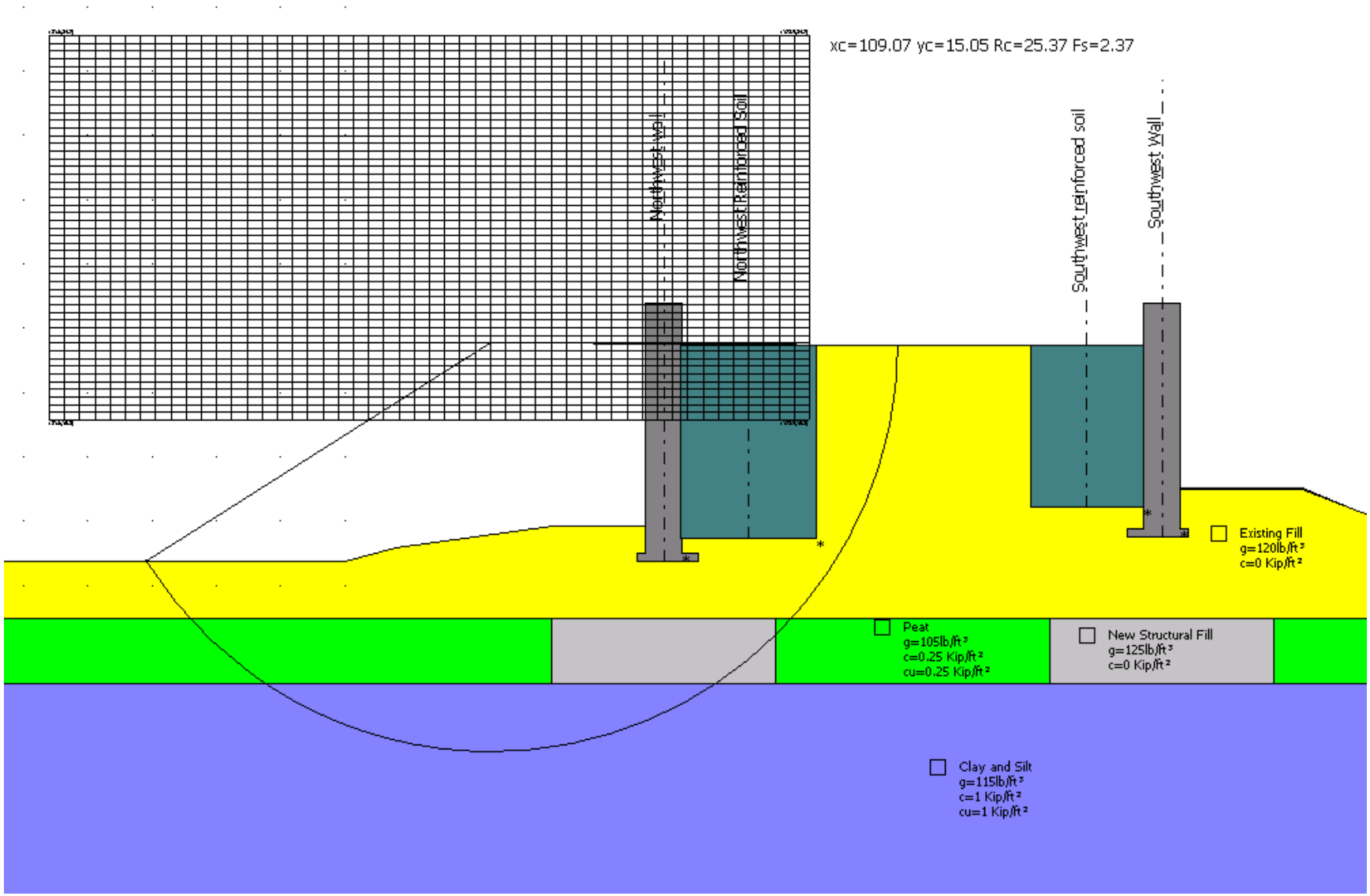
Ram Weight	4.00	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.040	in
Skin Damping	Variable	
Toe Damping	0.150	sec/ft
Pile Length	35.00	ft
Pile Penetration	33.00	ft
Pile Top Area	16.70	in2



Res. Shaft = 25 %
(Proportional)

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count blows/in	Stroke ft	Energy kips-ft
100.0	23.66	0.00	0.9	5.74	17.97
150.0	26.47	0.07	1.5	6.63	16.95
200.0	28.50	0.17	2.2	7.16	16.49
250.0	31.93	0.59	2.8	7.56	16.48
300.0	34.97	0.74	3.5	7.89	16.79
330.0	36.76	0.89	3.9	8.13	17.21
400.0	40.62	2.69	5.2	8.76	18.20
500.0	45.20	2.33	8.0	9.66	19.66
600.0	49.87	2.29	13.8	10.35	20.95
700.0	52.69	5.19	31.8	10.61	21.53

Northwest Wall – Tallest Section



Analysis of slope stability performed with: BISHOP (1955)

Calculated according to	User
Number of layers	5.0
Number of slices	10.0
Acceptable level of safety	1.1
Partial resistance factor	1.0
Geotechnical parameters to use. Friction angle:	Peak
Analysis	Drained state
Circular form surface	

Centres' grid

Lower left vertex abscissa xi	81.62 ft
Lower left vertex ordinate yi	10.27 ft
Upper right vertex abscissa xs	128.94 ft
Upper right vertex ordinate yz	34.19 ft
Search step	10.0
Number of cells along the x axis	50.0
Number of cells along the y axis	50.0

Profile vertices

Nr	X (ft)	y (ft)
1	0.0	1.51
2	100.0	1.51
3	103.2	2.31
4	113.0	3.71
5	117.2	3.71
6	119.2	3.71
7	120.7	3.71
8	120.7	14.92
9	150.0	14.91
10	150.0	6.01
11	154.3	6.01
12	154.9	6.01
13	159.6	6.01
14	163.1	4.61
15	178.0	0.0
16	278.0	0.0

Layer vertices.....1

N	X (ft)	y (ft)
1	0.0	1.5
2	100.0	1.5
3	103.2	2.3
4	113.0	3.7
5	117.2	3.7
6	119.2	3.7
7	120.7	3.7
8	120.7	14.9
9	150.0	14.9
10	150.0	6.0
11	154.3	6.0
12	154.9	6.0
13	159.6	6.0
14	163.1	4.6

15	178.0	0.0
16	278.0	0.0

Layer vertices.....2

N	X (ft)	y (ft)
1	0.0	-2.09
2	178.0	-2.09
3	278.0	-2.09

Layer vertices.....3

N	X (ft)	y (ft)
1	0.0	-2.1
2	112.9	-2.1
3	112.9	-6.09
4	126.85	-6.09
5	126.85	-2.1
6	143.9	-2.1
7	143.9	-6.1
8	157.85	-6.1
9	157.85	-2.1
10	278.0	-2.1

Layer vertices.....4

N	X (ft)	y (ft)
1	0.0	-6.1
2	178.0	-6.1
3	278.0	-6.1

Actions partial coefficients

Unfavorable: Permanent, variable	1.0 1.0
Favorable: Permanent, variable	1.0 1.0

Partial factors for soil geotechnical parameters

Tangent angle of shearing resistance	1.25
Effective cohesion	1.25
Undrained cohesion	1.4
Reduction soil geotechnical parameters	No

Stratigraphy

Layer	Cohesion (Kip/ft²)	Undrained cohesion (Kip/ft²)	Angle of shearing resistance (°)	Unit weight (lb/ft³)	Saturated weight (lb/ft³)	Lithology description	
1	0	0	45	125	130	Reinforced Soil	
2	0	0	32	120	125	Existing Fill	
3	0	0	37	125	130	New Structural Fill	
4	0.25	0.25	0	105	110	Peat	
5	1	1	0	115	120	Clay and Silt	

Retaining walls - Geometrical characteristics

N°	x (ft)	y (ft)	Base of cantilever downstream (ft)	Base of cantilever upstream (ft)	Wall height (ft)	Peak thickness (ft)	Base thickness (ft)	Specific weight (lb/ft³)
1	152	3.5	1	0.5	14	2.25	2.25	150

2	121	2	0.5	1	15.5	2.25	2.25	150
3	129.35	2.9	0	0	12	8.4	8.4	125
4	149.7	4.9	0	0	10	7	7	125

Slope analysis results [User]

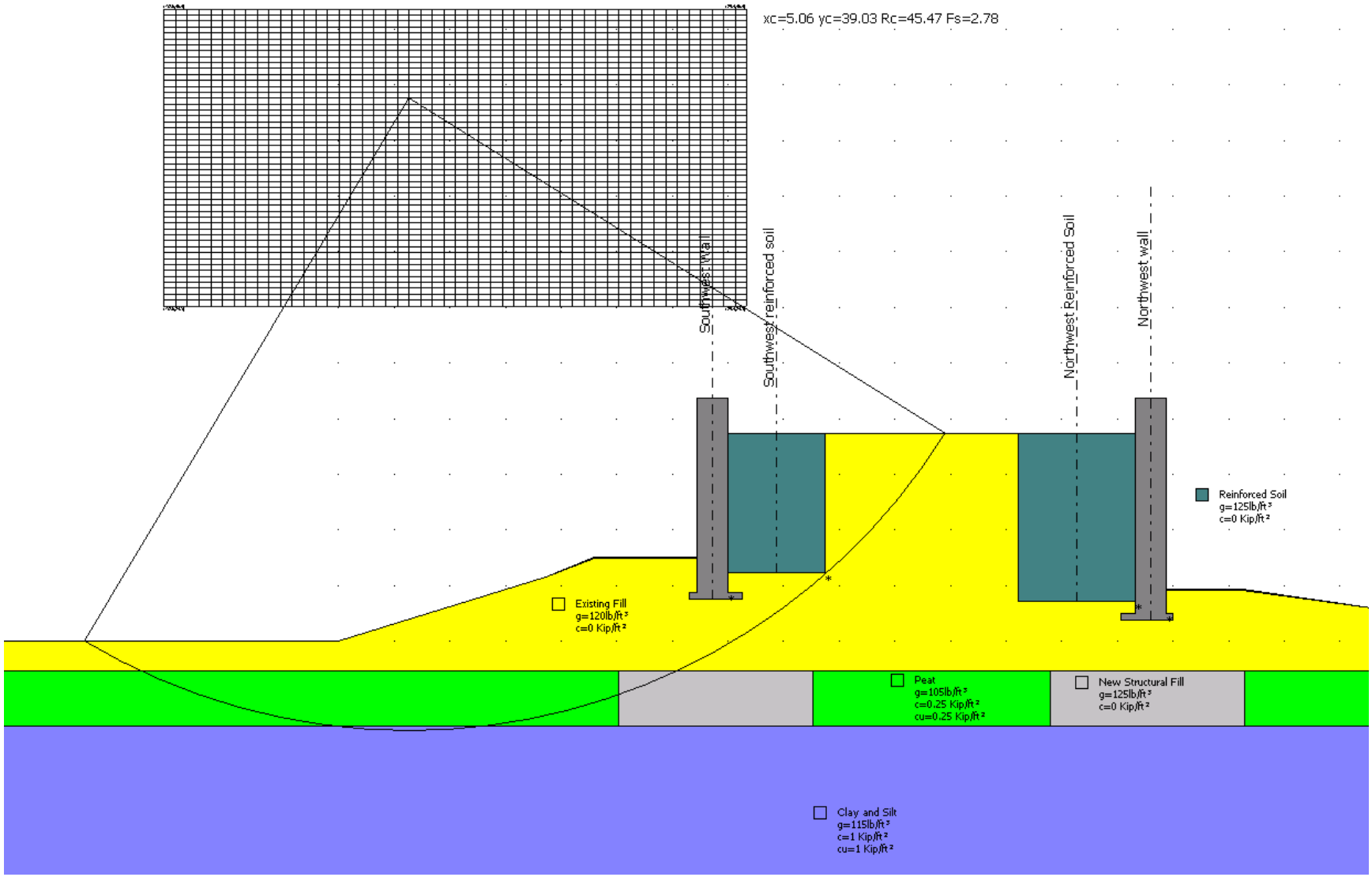
Minimal Fs found	2.37
Abscissa for surface centre	109.07 ft
Ordinate for surface centre	15.05 ft
Surface radius	25.37 ft

B: Slice width; Alfa: Slice base inclination angle; Li: Length of slice base; Wi: Slice weight; Ut: Forces resultant from neutral pressures.; Ni: Forces normal to slide direction; Ti: Forces parallel to slide surface; Fi: Friction angle; c: cohesion.

xc = 109.066 yc = 15.053 Rc = 25.372 Fs=2.373

Nr.	B ft	Alfa (°)	Li ft	Wi (kips)	Kh•Wi (kips)	Kv•Wi (kips)	c (Kip/ft²)	Fi (°)	Ui (kips)	N'i (kips)	Ti (kips)
1	4.68	-49.6	7.22	5.79	0.0	0.0	0.0	32.0	0.0	12.9	3.4
2	4.68	-34.9	5.71	12.65	0.0	0.0	0.25	0.0	0.0	16.8	2.0
3	6.22	-20.9	6.66	23.53	0.0	0.0	1.0	0.0	0.0	28.7	9.2
4	3.14	-9.8	3.19	14.63	0.0	0.0	1.0	0.0	0.0	15.6	4.4
5	6.66	1.4	6.66	33.74	0.0	0.0	1.0	0.0	0.0	33.5	9.2
6	2.71	12.0	2.77	14.37	0.0	0.0	1.0	0.0	0.0	13.9	3.8
7	5.16	21.4	5.54	43.17	0.0	0.0	1.0	0.0	0.0	43.4	7.7
8	4.21	33.4	5.04	35.21	0.0	0.0	1.0	0.0	0.0	37.6	7.0
9	4.68	46.9	6.85	73.31	0.0	0.0	0.25	0.0	0.0	104.7	2.4
10	4.68	72.2	15.28	19.38	0.0	0.0	0.0	32.0	0.0	34.8	9.2

Southwest Wall – Tallest Section



Analysis of slope stability performed with: BISHOP (1955)

Calculated according to	User
Number of layers	5.0
Number of slices	10.0
Acceptable level of safety	1.1
Partial resistance factor	1.0
Geotechnical parameters to use. Friction angle:	Peak
Analysis	Drained state
Circular form surface	

Centres' grid

Lower left vertex abscissa xi	-12.55 ft
Lower left vertex ordinate yi	24.1 ft
Upper right vertex abscissa xs	29.38 ft
Upper right vertex ordinate yz	45.44 ft
Search step	10.0
Number of cells along the x axis	50.0
Number of cells along the y axis	50.0

Profile vertices

Nr	X (ft)	y (ft)
1	-100.0	0.0
2	0.0	0.0
3	14.9	4.61
4	18.4	6.01
5	23.1	6.01
6	23.7	6.01
7	28.0	6.01
8	28.0	14.91
9	57.3	14.92
10	57.3	3.71
11	58.8	3.71
12	60.8	3.71
13	65.0	3.71
14	74.8	2.31
15	78.0	1.51
16	178.0	1.51

Layer vertices.....1

N	X (ft)	y (ft)
1	-100.0	0.0
2	0.0	0.0
3	14.9	4.6
4	18.4	6.0
5	23.1	6.0
6	23.7	6.0
7	28.0	6.0
8	28.0	14.9
9	57.3	14.9
10	57.3	3.7
11	58.8	3.7
12	60.8	3.7
13	65.0	3.7
14	74.8	2.3

15	78.0	1.5
16	178.0	1.5

Layer vertices.....2

N	X (ft)	y (ft)
1	-100.0	-2.09
2	0.0	-2.09
3	178.0	-2.09

Layer vertices.....3

N	X (ft)	y (ft)
1	-100.0	-2.1
2	20.15	-2.1
3	20.15	-6.1
4	34.1	-6.1
5	34.1	-2.1
6	51.15	-2.1
7	51.15	-6.09
8	65.1	-6.09
9	65.1	-2.1
10	178.0	-2.1

Layer vertices.....4

N	X (ft)	y (ft)
1	-100.0	-6.1
2	0.0	-6.1
3	178.0	-6.1

Actions partial coefficients

Unfavorable: Permanent, variable	1.0 1.0
Favorable: Permanent, variable	1.0 1.0

Partial factors for soil geotechnical parameters

Tangent angle of shearing resistance	1.25
Effective cohesion	1.25
Undrained cohesion	1.4
Reduction soil geotechnical parameters	No

Stratigraphy

Layer	Cohesion (Kip/ft²)	Undrained cohesion (Kip/ft²)	Angle of shearing resistance (°)	Unit weight (lb/ft³)	Saturated weight (lb/ft³)	Lithology description	
1	0	0	45	125	130	Reinforced Soil	
2	0	0	32	120	125	Existing Fill	
3	0	0	37	125	130	New Structural Fill	
4	0.25	0.25	0	105	110	Peat	
5	1	1	0	115	120	Clay and Silt	

Retaining walls - Geometrical characteristics

N°	x (ft)	y (ft)	Base of cantilever downstream (ft)	Base of cantilever upstream (ft)	Wall height (ft)	Peak thickness (ft)	Base thickness (ft)	Specific weight (lb/ft³)
1	28	3.5	0.5	1	14	2.25	2.25	150

2	59.5	2	1	0.5	15.5	2.25	2.25	150
3	57.3	2.9	0	0	12	8.4	8.4	125
4	35	4.9	0	0	10	7	7	125

Slope analysis results [User]

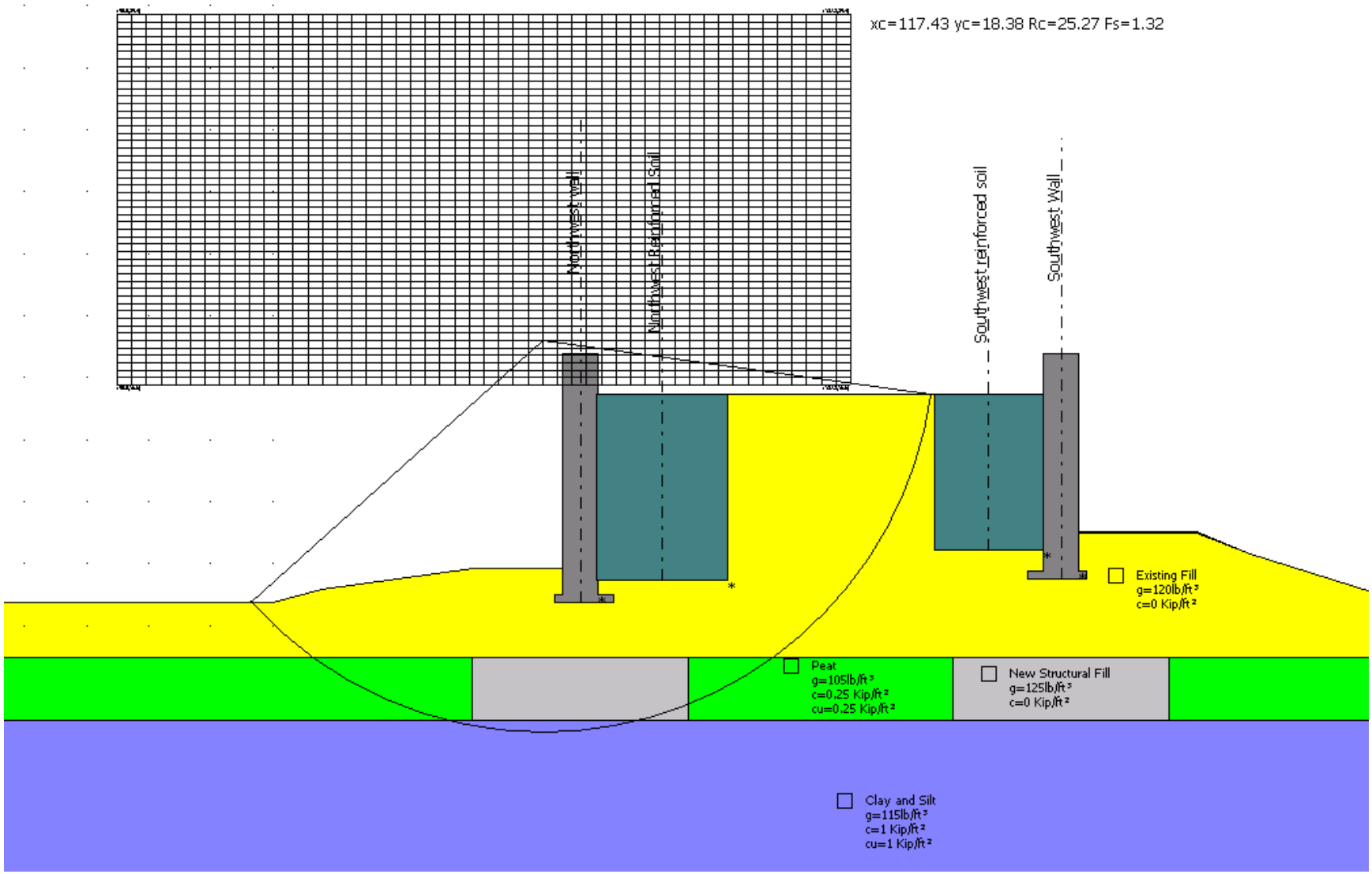
Minimal Fs found	2.78
Abscissa for surface centre	5.06 ft
Ordinate for surface centre	39.03 ft
Surface radius	45.47 ft

B: Slice width; Alfa: Slice base inclination angle; Li: Length of slice base; Wi: Slice weight; Ut: Forces resultant from neutral pressures.; Ni: Forces normal to slide direction; Ti: Forces parallel to slide surface; Fi: Friction angle; c: cohesion.

xc = 5.061 yc = 39.035 Rc = 45.469 Fs=2.778

Nr.	B ft	Alfa (°)	Li ft	Wi (kips)	Kh•Wi (kips)	Kv•Wi (kips)	c (Kip/ft²)	Fi (°)	Ui (kips)	N'i (kips)	Ti (kips)
1	6.19	-26.5	6.91	4.11	0.0	0.0	0.0	32.0	0.0	5.2	1.2
2	6.19	-18.0	6.51	9.62	0.0	0.0	0.25	0.0	0.0	10.7	1.9
3	6.19	-10.0	6.28	12.9	0.0	0.0	0.25	0.0	0.0	13.4	1.9
4	6.19	-2.1	6.19	16.91	0.0	0.0	1.0	0.0	0.0	17.2	7.3
5	8.41	7.1	8.48	29.46	0.0	0.0	0.25	0.0	0.0	29.4	2.5
6	3.96	15.1	4.1	15.48	0.0	0.0	0.25	0.0	0.0	15.7	1.2
7	6.19	21.9	6.67	22.49	0.0	0.0	0.0	37.0	0.0	21.9	5.9
8	3.12	28.3	3.54	25.03	0.0	0.0	0.0	32.0	0.0	25.4	5.7
9	9.26	38.0	11.74	72.11	0.0	0.0	0.0	32.0	0.0	77.8	17.5
10	6.19	51.7	9.97	10.6	0.0	0.0	0.0	32.0	0.0	13.3	3.0

Northwest Wall Seismic Analysis: k_h = PGA



Analysis of slope stability performed with: BISHOP (1955)

Calculated according to	User
Number of layers	5.0
Number of slices	10.0
Acceptable level of safety	1.1
Partial resistance factor	1.0
Geotechnical parameters to use. Friction angle:	Peak
Analysis	Drained state
Circular form surface	

Centres' grid

Lower left vertex abscissa xi	89.98 ft
Lower left vertex ordinate yi	15.51 ft
Upper right vertex abscissa xs	137.31 ft
Upper right vertex ordinate yz	39.43 ft
Search step	10.0
Number of cells along the x axis	50.0
Number of cells along the y axis	50.0

Seism

Horizontal seismic coefficient Kh	0.149

Profile vertices

Nr	X (ft)	y (ft)
1	0.0	1.51
2	100.0	1.51
3	103.2	2.31
4	113.0	3.71
5	117.2	3.71
6	119.2	3.71
7	120.7	3.71
8	120.7	14.92
9	150.0	14.91
10	150.0	6.01
11	154.3	6.01
12	154.9	6.01
13	159.6	6.01
14	163.1	4.61
15	178.0	0.0
16	278.0	0.0

Layer vertices.....1

N	X (ft)	y (ft)
1	0.0	1.5
2	100.0	1.5
3	103.2	2.3
4	113.0	3.7
5	117.2	3.7
6	119.2	3.7
7	120.7	3.7
8	120.7	14.9
9	150.0	14.9

10	150.0	6.0
11	154.3	6.0
12	154.9	6.0
13	159.6	6.0
14	163.1	4.6
15	178.0	0.0
16	278.0	0.0

Layer vertices.....2

N	X (ft)	y (ft)
1	0.0	-2.09
2	178.0	-2.09
3	278.0	-2.09

Layer vertices.....3

N	X (ft)	y (ft)
1	0.0	-2.1
2	112.9	-2.1
3	112.9	-6.09
4	126.85	-6.09
5	126.85	-2.1
6	143.9	-2.1
7	143.9	-6.1
8	157.85	-6.1
9	157.85	-2.1
10	278.0	-2.1

Layer vertices.....4

N	X (ft)	y (ft)
1	0.0	-6.1
2	178.0	-6.1
3	278.0	-6.1

Actions partial coefficients

Unfavorable: Permanent, variable	1.0 1.0
Favorable: Permanent, variable	1.0 1.0

Partial factors for soil geotechnical parameters

Tangent angle of shearing resistance	1.25
Effective cohesion	1.25
Undrained cohesion	1.4
Reduction soil geotechnical parameters	No

Stratigraphy

Layer	Cohesion (Kip/ft²)	Undrained cohesion (Kip/ft²)	Angle of shearing resistance (°)	Unit weight (lb/ft³)	Saturated weight (lb/ft³)	Lithology description	
1	0	0	45	125	130	Reinforced Soil	
2	0	0	32	120	125	Existing Fill	
3	0	0	37	125	130	New Structural Fill	
4	0.25	0.25	0	105	110	Peat	
5	1	1	0	115	120	Clay and Silt	

Retaining walls - Geometrical characteristics

N°	x (ft)	y (ft)	Base of cantilever downstream (ft)	Base of cantilever upstream (ft)	Wall height (ft)	Peak thickness (ft)	Base thickness (ft)	Specific weight (lb/ft³)
1	152	3.5	1	0.5	14	2.25	2.25	150
2	121	2	0.5	1	15.5	2.25	2.25	150
3	129.35	2.9	0	0	12	8.4	8.4	125
4	149.7	4.9	0	0	10	7	7	125

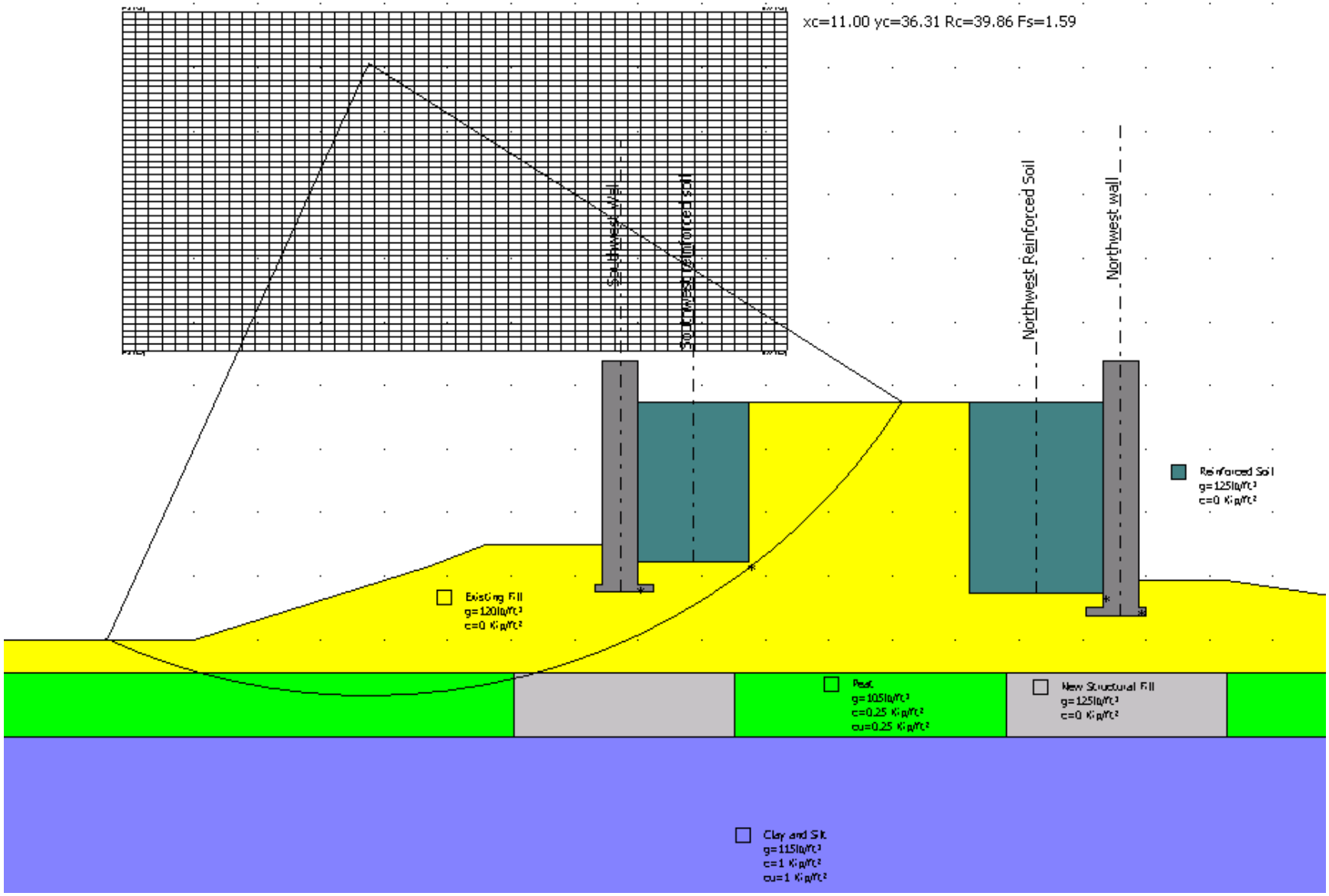
Slope analysis results [User]

Minimal Fs found	1.32
Abscissa for surface centre	117.43 ft
Ordinate for surface centre	18.38 ft
Surface radius	25.27 ft

xc = 117.433 yc = 18.38 Rc = 25.271 Fs=1.325

Nr.	B ft	Alfa (°)	Li ft	Wi (kips)	Kh•Wi (kips)	Kv•Wi (kips)	c (Kip/ft²)	Fi (°)	Ui (kips)	N'i (kips)	Ti (kips)
1	4.58	-41.2	6.09	4.47	0.67	0.0	0.0	32.0	0.0	10.1	4.8
2	4.19	-28.9	4.78	10.19	1.52	0.0	0.25	0.0	0.0	13.3	3.0
3	5.61	-16.8	5.86	19.17	2.86	0.0	0.25	0.0	0.0	21.1	3.6
4	3.16	-6.5	3.18	13.14	1.96	0.0	1.0	0.0	0.0	14.1	7.9
5	4.71	2.5	4.71	37.94	5.65	0.0	1.0	0.0	0.0	37.5	11.7
6	4.06	12.5	4.16	34.17	5.09	0.0	1.0	0.0	0.0	32.7	10.3
7	4.38	22.6	4.75	75.04	11.18	0.0	0.25	0.0	0.0	80.1	2.9
8	4.38	34.0	5.29	30.15	4.49	0.0	0.25	0.0	0.0	34.2	3.3
9	4.38	47.4	6.48	23.82	3.55	0.0	0.0	32.0	0.0	23.3	11.0
10	4.38	68.5	11.94	12.69	1.89	0.0	0.0	32.0	0.0	15.7	7.4

Southwest Wall Seismic Analysis: k_h = PGA



Analysis of slope stability performed with: BISHOP (1955)

Calculated according to	User
Number of layers	5.0
Number of slices	10.0
Acceptable level of safety	1.1
Partial resistance factor	1.0
Geotechnical parameters to use. Friction angle:	Peak
Analysis	Drained state
Circular form surface	

Centres' grid

Lower left vertex abscissa xi	-4.51 ft
Lower left vertex ordinate yi	18.17 ft
Upper right vertex abscissa xs	37.42 ft
Upper right vertex ordinate yz	39.51 ft
Search step	10.0
Number of cells along the x axis	50.0
Number of cells along the y axis	50.0

Seism

Horizontal seismic coefficient Kh	0.149

Profile vertices

Nr	X (ft)	y (ft)
1	-100.0	0.0
2	0.0	0.0
3	14.9	4.61
4	18.4	6.01
5	23.1	6.01
6	23.7	6.01
7	28.0	6.01
8	28.0	14.91
9	57.3	14.92
10	57.3	3.71
11	58.8	3.71
12	60.8	3.71
13	65.0	3.71
14	74.8	2.31
15	78.0	1.51
16	178.0	1.51

Layer vertices.....1

N	X (ft)	y (ft)
1	-100.0	0.0
2	0.0	0.0
3	14.9	4.6
4	18.4	6.0
5	23.1	6.0
6	23.7	6.0
7	28.0	6.0
8	28.0	14.9
9	57.3	14.9

10	57.3	3.7
11	58.8	3.7
12	60.8	3.7
13	65.0	3.7
14	74.8	2.3
15	78.0	1.5
16	178.0	1.5

Layer vertices.....2

N	X (ft)	y (ft)
1	-100.0	-2.09
2	0.0	-2.09
3	178.0	-2.09

Layer vertices.....3

N	X (ft)	y (ft)
1	-100.0	-2.1
2	20.15	-2.1
3	20.15	-6.1
4	34.1	-6.1
5	34.1	-2.1
6	51.15	-2.1
7	51.15	-6.09
8	65.1	-6.09
9	65.1	-2.1
10	178.0	-2.1

Layer vertices.....4

N	X (ft)	y (ft)
1	-100.0	-6.1
2	0.0	-6.1
3	178.0	-6.1

Actions partial coefficients

Unfavorable: Permanent, variable	1.0 1.0
Favorable: Permanent, variable	1.0 1.0

Partial factors for soil geotechnical parameters

Tangent angle of shearing resistance	1.25
Effective cohesion	1.25
Undrained cohesion	1.4
Reduction soil geotechnical parameters	No

Stratigraphy

Layer	Cohesion (Kip/ft²)	Undrained cohesion (Kip/ft²)	Angle of shearing resistance (°)	Unit weight (lb/ft³)	Saturated weight (lb/ft³)	Lithology description	
1	0	0	45	125	130	Reinforced Soil	
2	0	0	32	120	125	Existing Fill	
3	0	0	37	125	130	New Structural Fill	
4	0.25	0.25	0	105	110	Peat	
5	1	1	0	115	120	Clay and Silt	

Retaining walls - Geometrical characteristics

N°	x (ft)	y (ft)	Base of cantilever downstream (ft)	Base of cantilever upstream (ft)	Wall height (ft)	Peak thickness (ft)	Base thickness (ft)	Specific weight (lb/ft³)
1	28	3.5	0.5	1	14	2.25	2.25	150
2	59.5	2	1	0.5	15.5	2.25	2.25	150
3	57.3	2.9	0	0	12	8.4	8.4	125
4	35	4.9	0	0	10	7	7	125

Slope analysis results [User]

Minimal Fs found	1.59
Abscissa for surface centre	11.0 ft
Ordinate for surface centre	36.31 ft
Surface radius	39.86 ft

xc = 11.003 yc = 36.309 Rc = 39.856 Fs=1.585

Nr.	B ft	Alfa (°)	Li ft	Wi (kips)	Kh•Wi (kips)	Kv•Wi (kips)	c (Kip/ft²)	Fi (°)	Ui (kips)	N'i (kips)	Ti (kips)
1	5.01	-20.5	5.35	2.03	0.3	0.0	0.0	32.0	0.0	2.5	1.0
2	5.01	-13.0	5.14	6.16	0.92	0.0	0.25	0.0	0.0	6.9	2.7
3	5.01	-5.7	5.03	10.62	1.58	0.0	0.25	0.0	0.0	10.9	2.6
4	5.31	1.8	5.32	14.93	2.23	0.0	0.25	0.0	0.0	14.9	2.8
5	4.7	9.0	4.76	15.7	2.34	0.0	0.25	0.0	0.0	15.5	2.5
6	5.01	16.2	5.21	15.73	2.34	0.0	0.0	32.0	0.0	14.7	5.8
7	3.56	22.7	3.86	25.49	3.8	0.0	0.0	32.0	0.0	23.7	9.3
8	6.45	30.9	7.52	61.36	9.14	0.0	0.0	32.0	0.0	57.9	22.8
9	5.01	41.1	6.65	17.17	2.56	0.0	0.0	32.0	0.0	17.0	6.7
10	5.01	51.7	8.08	6.9	1.03	0.0	0.0	32.0	0.0	7.4	2.9