Millennia Professional Services, Ltd

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Structure Geotechnical Report

Interstate 57 over Central Grain RR and Township Road 86
Route: FAI 57
Section: (15-22VB)BR
Structure No.: 015-0003 (SB) & 015-0004 (NB)
Coles County, Illinois

Prepared For:
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Millennia Project Number: MG22067.01
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Structure Geotechnical Report
Interstate 57 over Central Grain RR and Township Road 86
Coles County, Illinois

1.0 Project Description and Proposed Structure Information

1.1 Introduction

This report summarizes the results of a geotechnical investigation performed for the design of the improvements and widening of the dual, four-span structures carrying Interstate 57 over Central Grain Railroad and Township Road 86 in Coles County, Illinois. The purpose of this study was to provide a geotechnical assessment for the proposed rehabilitation of the dual structures, based on subsurface conditions encountered at the borings performed by IDOT. This report describes the exploration procedures used, presents the field and laboratory data, includes an assessment of the subsurface conditions in the area, and provides geotechnical recommendations for design and construction.

1.2 Project Description

The existing dual structures will have a complete replacement of the bridge decks and approach pavements. The bridges will be widened to 42'-10" out-to-out of parapets, and have a back-to-back abutment length of 209'-1". This will provide a 40'-0" bridge roadway width, 6'-0" medians shoulder width, and a 10'-0" outside shoulder width. A complete replacement of the existing structural steel and bearings is planned, and the new superstructures will allow a minimum vertical clearance of 23'-0" over Central Grain Railroad and 24'-0" over Township Road 86. The existing substructures will be widened and repaired as follows. The structural concrete repairs will be performed on the abutment stems, the abutment backwalls will be replaced or be converted to semi-integral, and the existing pier and abutment stems will be extended to accommodate the widened superstructure and deck. The interior bent foundations will remain in place. The construction will be performed using staged construction with crossovers utilized to maintain traffic, with Stage 1 traffic on SN 015-0003. Millennia understands grade changes along both the profile and side slopes are anticipated to be minimal.

The general site area is shown on the attached Vicinity Map, Figure 1 in Appendix A, and plans showing the approximate boring locations performed for this study are presented as the Boring Location Plan, Figure 2 in Appendix A.

2.0 Subsurface Exploration and Laboratory Testing

2.1 Subsurface Exploration

From October 24 to November 5, 2019, IDOT personnel conducted a subsurface exploration at the site, consisting of three (3) borings. The borings were designated Boring 1 (south abutment), Boring 2 (center pier), and Boring 3 (north abutment), and were advanced to depths ranging from 91 to 96 feet below ground surface (bgs). The approximate locations of the borings are indicated on the Boring Location Plan, Figure 2 in Appendix A.

The borings were advanced using hollow-stem auger drilling methods using a 140-pound automatic hammer. Samples were generally obtained at 2.5-foot intervals to a depth of 30-feet, and 5-foot intervals to termination depths. Split-spoon samples were recovered using a 2-inch outside-diameter, split-barrel sampler, driven by a 140-pound automatic hammer, in accordance with ASTM D 1586. The sampling sequence for each boring is summarized on the Boring Logs in Appendix D of this report. Each boring was checked for groundwater during and after drilling and backfilled. Extended groundwater level readings were obtained.

Neither the soil borings nor the laboratory testing investigations were performed by Millennia. The soil and rock samples are no longer available for viewing or further testing, and Millennia is unable to physically verify the classifications and other test results. However, the work was done by established, experienced geotechnical personnel, and the content of the boring logs appear to be reliable for use in preparing this report. The analyses and conclusions contained in this report are based on field and laboratory test results and on the interpretations of the subsurface conditions as reported in the Boring Logs. Only data pertinent to the objectives of this report have been included on these Logs; therefore, these records should not be used for other purposes.

3.0 Subsurface Conditions

Details of the subsurface conditions encountered at the borings are shown on the boring logs. The general subsurface conditions encountered and their pertinent engineering characteristics are described in the following paragraphs. Conditions represented by the borings should be considered applicable only at the boring locations on the dates shown; the reported conditions may be different at other locations and at other times.

3.1 Generalized Subsurface Profile

In general, the subsurface conditions contain previously controlled placed structural fill for the embankments and underlying natural cohesive soils. Isolated layers of interbedded granular materials are indicated on the boring logs. The embankment material is approximately 30 to 40-feet thick and consists of medium-stiff to very-stiff clay. Moisture contents range from 10 to 23 percent. The standard penetration test (N) values range from 6 to 15 blows per foot (bpf), with Rimac unconfined compression test values on samples between 1.7 and 5.0 tons per square foot (tsf).

The natural soils generally consist of stiff to very-stiff clay loam till, with isolated interbedded layers of clay, clay loam, sandy clay loam and silty clay loam. Moisture contents of the clay loam till range from 8 to 24 percent, with one value of 49 percent. The N-values range from 3 to 92 bpf, with Rimac unconfined compression test values on samples between 0.7 and 8.2 tsf. Interbedded layers of granular soils consisting of sandy loam and fine-grained sands were encountered at all of the boring locations. The N-values of the sandy loam range from 3 to 12 bpf, and 7 bpf in the sand.

3.2 Groundwater

Groundwater was observed during drilling at all three of the boring locations. Groundwater levels may vary significantly over time due to the effect of seasonal variations in precipitation or other factors not evident at the time of exploration. The elevations groundwater was encountered are included in the table below:

Boring	During Drilling (ft.)	Upon Completion (ft.)	Extended Wait Readings (ft./hrs.)
Boring 1	703.2	725.7	725.4 (24)
Boring 2	719.2	720.7	724.7 (288)
Boring 3	706.2	722.4	728.9 (48)

3.3 Mining Activity

According to the Illinois State Geological Survey (ISGS) Coal Mines and Industrial Mineral Mines Map for Coles County, dated August 7, 2019, some mining has occurred in the county. However, the project site does not appear to be undermined.

No visual indications of subsurface mining activities were brought to our attention or observed prior to issuance of this report.

The listed disclaimer indicates locations of some features on the mine map may be offset by 500 feet or more due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors.

4.0 Geotechnical Evaluations

4.1 Settlement Consideration

Substantial amounts of new fill are not anticipated to be needed for the construction of the proposed improvements and structure widening. Fills from earthwork operations are anticipated to be no more than one to two feet. Based on the stiff to very stiff soil conditions, as indicated on the boring logs, any settlement is anticipated to occur with construction activities, and a settlement analysis was not performed.

4.2 Seismic Considerations

The determination of Seismic Site Class was based on the method described by IDOT AGMU Memo 09.1-Seismic Site Class Definition and the IDOT provided spreadsheet titled: '*Seismic Site Class Determination.'* Using these resources, the controlling global site class for this project is Soil Site Class C.

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. Published information and mapping, including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to develop the parameters for the project site location. The values for new and existing construction, based on Soil Site Class C, are summarized below.

New Construction

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.249g
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.098g
Seismic Performance Zone	1

Existing Construction

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.249g
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.098g
Seismic Performance Zone	1
Seismic Retrofit Category (SRC)	A (see Note below).
Performance Level	I (see Note below).

Note: Value provided by IDOT Bureau of Bridges & Structures, Planning Unit correspondence dated 6/16/2023.

As indicated in the tables above, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class C, and Figure 2.3.10-2 in the IDOT Bridge Manual, the Seismic Performance Zone is 1. Since the structures are located in Seismic Performance Zone 1, as per the IDOT Bridge Manual, 2012, liquefaction analysis is not required.

4.3 Global Stability

Based on the proposed improvements and widening, changes to the slopes and inclinations are not anticipated. Based on our understanding, the performance of the end and side slopes for

the structures are stable, and the lack of newly placed fill material, a stability analysis for these structures has not been performed.

4.4 Pile Supported Foundations

The foundations supporting the proposed structure must provide sufficient support to resist dead and live loads, including seismic loading. Based on the encountered subsurface conditions, and information available to date, steel H-pile and metal shell piles are feasible options for the additional support needed for the proposed improvements and widening of the existing structures. Precast concrete piles are also feasible options for widening of the existing abutments. Based on the encountered subsurface conditions, Millennia utilized the Modified IDOT Static Method of Estimating Pile Length (Appendix E) provided by IDOT BBS Foundations and Geotechnical Unit, and the information available to date, to estimate the pile lengths. Based on information provided by Kuhn & Trello, the outside of the north and south abutments will be widened by approximately 5.6-feet and two (2) piles will be added. On the median side, the pile cap will be widened by approximately 4.1-feet and one (1) pile will be added, centered. The abutment seat steps and backwall are extended 1.95-feet to outside of parapet. A factored load of 105 kips is anticipated for each new abutment pile. A factored load of 80 kips is anticipated to be placed on the existing pier piles. Millennia recommends the designers verify the existing pier piles capacity to handle the additional loading. In case it is determined during final design that additional piles are needed for pier widening, Millennia has included pile length estimates for the piers based on Boring 2 (Center Pier).

The Maximum Nominal required Bearing (R_N) represents the resistance the pile will experience during driving, and will assist the contractor in selecting a proper hammer size. The Maximum Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the tip of the pile to support factored substructure loading. The maximum factored resistance available uses a LRFD Resistance Factor of 0.55. Millennia assumes that the piles will be driven to the maximum nominal bearing required in cohesive or granular material and will not be driven to bedrock. Based on the geotechnical analysis performed for the proposed structure, the impacts of downdrag and liquefaction do not result in a need to reduce the axial factored pile capacity.

MS 12” Φ w/.25” walls

Location	R_N Maximum Nominal Required Bearing (kips)	R_F Maximum Factored Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment (Boring 1)	369	203	69	750.3
Piers (Boring 2)	392	216	85	716.9
North Abutment (Boring 3)	240	132	44	749.1

MS 14" Φ w/.312" walls

Location	R_N Maximum Nominal Required Bearing (kips)	R_F Maximum Factored Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
*South Abutment (Boring 1)	206	113**	37	750.3
	497*	273	86	
Piers (Boring 2)	570	313	85	716.9
North Abutment (Boring 3)	486	267	79	749.1

*Maximum Nominal Bearing of pile is not achieved in the depth of the provided soil boring.
**Maximum Factored Resistance exceeding the anticipated 105 kip/pile loading for new abutment piles.

HP 10X42

Location	R_N Maximum Nominal Required Bearing (kips)	R_F Maximum Factored Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
*South Abutment (Boring 1)	199	110**	64	750.3
	267*	147	86	
Piers (Boring 2)	335	184	85	716.9
*North Abutment (Boring 3)	196	108**	46	749.1
	286*	157	83	

*Maximum Nominal Bearing of pile is not achieved in the depth of the provided soil boring.
**Maximum Factored Resistance exceeding the anticipated 105 kip/pile loading for new abutment piles.

HP 12X53

Location	R_N Maximum Nominal Required Bearing (kips)	R_F Maximum Factored Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
*South Abutment (Boring 1)	195	107**	54	750.3
	327*	180	86	
*Piers (Boring 2)	172	95	49	716.9
	416	229	87	
*North Abutment (Boring 3)	193	106**	43	749.1
	352*	194	83	

*Maximum Nominal Bearing of pile is not achieved in the depth of the provided soil boring.
**Maximum Factored Resistance exceeding the anticipated 105 kip/pile loading for new abutment piles.

Precast Concrete 14'"x 14"

Location	R_N Maximum Nominal Required Bearing (kips)	R_F Maximum Factored Resistance Available (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment (Boring 1)	250	138	34	750.3
North Abutment (Boring 3)	233	128	24	749.1

Other pile configurations are available and could be considered as substitutes for the sections summarized above. The pile group capacity may be designed as the sum of the individual piles with the understanding that a spacing of at least three pile widths is maintained between piles, center to center.

ASTM A 572 Grade 50 high-strength steel is recommended for metal shell and H-piles in order to be driven through the stiff soils, while minimizing potential bending, buckling, distortion, or curling of pile tips. Steel piles should be equipped with tip reinforcement/shoes to promote penetration through the stiff to hard layers. After the pile section and driving equipment have been selected, a termination driving criteria should be established using a wave equation analysis to help assure adequate capacity and reduce the potential for over stressing the piles during installation.

Precast concrete piles appear to be feasible for widening the abutments and would provide an advantage over steel piles because the concrete cover over the steel reinforcement provides greater protection from corrosive soils. In addition, precast concrete piles would match the piles supporting the existing abutments. Of the two types of precast concrete piles typically used by IDOT, Millennia recommends prestressed, precast concrete piles rather than the less robust reinforced precast pile. One disadvantage to using precast concrete piles is the need for special handling and storage to protect against damage prior to pile driving. The prestressed, precast piles are less susceptible to such damage. In addition, prestressed piles can withstand more driving energy and thereby develop more capacity without overstressing. Splicing or cutting precast concrete piles can be problematic or, in some cases, not allowed. Extra lengths are recommended to be included in the plan estimates to lower the risk of needing to add extensions in the field.

Millennia recommends a test pile be performed at one of the abutments. Test piles are performed prior to production driving so that actual, on-site field data can be gathered to further evaluate pile driving requirements for the project. The test pile results will also provide data for use in assessing the contractor's proposed equipment and methodologies, previously identified in their Pile Installation Plan.

Assuming that the piles are properly installed, as discussed herein, total settlement should be less than approximately one inch, with differential settlements up to approximately half the total.

4.5 Lateral Load Resistance

Lateral load resistance and induced lateral deflection for pile foundations are typically assessed using finite difference computer models based on the lateral modulus-of-subgrade reaction, such as LPILE. Based on the conditions encountered at the borings, the parameters listed in the table on the following page are recommended for use in the design of the substructure foundations.

Boring	Elev. at Bottom of Layer	Total Unit Weight (pcf)	Short Term		Long Term		N Value (bpf)	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)			
1 (South Abutment)	717.7	120	0	2,500	26	100	10	850	0.006
	713.2	120	0	1,800	28	100	11	600	0.007
	677.2	125	0	2,250	28	100	10	650	0.006
	661.7	125	0	2,050	28	100	16	650	0.006
2 (Center Pier)	719.2	120	0	2,400	26	100	7	800	0.006
	716.2	115	30	0	30	0	3	26	--
	654.2	125	0	2,500	28	100	14	850	0.006
	648.2	115	32	0	32	0	12	51	--
	644.2	115	0	900	28	50	15	300	0.009
	639.2	120	0	3,300	26	100	13	1,050	0.005
	634.2	125	0	1,700	28	100	21	550	0.007
	632.7	125	0	5,000	28	100	92	1,300	0.004
3 (North Abutment)	726.9	120	0	3,000	26	100	10	1,000	0.005
	721.9	120	0	1,800	26	100	11	600	0.007
	716.9	120	0	3,100	26	100	9	1,000	0.005
	716.2	120	0	800	26	50	4	150	0.010
	701.9	120	0	2,200	28	100	10	700	0.006
	696.4	125	0	5,000	28	100	40	1,300	0.004
	676.4	125	0	1,800	28	100	9	600	0.007
	671.9	110	31	0	31	0	7	41	--
	668.9	125	0	1,700	28	100	15	550	0.007
	665.4	125	0	3,900	28	100	27	1,200	0.004

pcf = pounds per cubic foot psf = pounds per square foot pci = pounds per cubic inch
RC=rock core -unit weight not adjusted for groundwater

4.6 Lateral Earth Pressures

Lateral earth pressure parameters are provided for the design of any below grade structures. Structures that are restricted from movement at the top should be designed to resist at-rest earth pressures. Structures that are free to move and deflect at the top may be designed to resist active earth pressures. A horizontal deflection at the top of the structure of approximately 1% of the supported height is typically required to permit active pressure to develop. Earth pressures are a function of the excavation configuration and the backfill materials. The following design parameters are recommended for the indicated backfill materials.

Lateral Earth Pressure Parameters

Parameter		Crushed Limestone	Cohesive Soil
At-Rest Equivalent Fluid Pressure	Drained	55 pcf	65 pcf
	Submerged	90 pcf	95 pcf
Active Equivalent Fluid Pressure	Drained	35 pcf	45 pcf
	Submerged	80 pcf	85 pcf
Passive Equivalent Fluid Pressure	Drained	480 pcf	320 pcf
	Submerged	310 pcf	215 pcf
Soil Wet Unit Weight		130 pcf	120 pcf
Angle of Internal Friction		35º	27º
Assumed Surcharge Condition		None	None
Ground Surface Profile		Horizontal	Horizontal

No factor of safety has been applied to the values above.
pcf = pounds per cubic foot

Submerged values should be used for the calculation of lateral pressures for those portions of the structure that extend below the highest level of anticipated groundwater. The values for undrained fluid pressure for active and at-rest conditions include hydrostatic pressures.

Significant movement would generally be necessary to develop the full values of passive pressures given; typically, the passive values stated are reduced by up to one-half for design. The effects of vertical surcharge loads or sloping ground behind the structures are not included for the stated fluid pressures. To use the lateral earth pressures recommended in the table above for design, the backfill material should be placed within a zone defined by a line beginning at the bottom edge of the structure pad or foundation and extending up at a 45° inclination. Resistance to sliding of the structure base may be analyzed using the resistance factors displayed in Section 4.7.

5.0 Construction Considerations

5.1 Subgrade, Fill, and Backfill

Earthwork activities including backfill and fill should be performed in accordance with Section 205 of the Standard Specifications.

5.2 Subgrade Protection

Construction areas should be properly drained in order to reduce or prevent surface runoff from collecting on the subgrade. Any ponded water on the exposed subgrade should be removed immediately. To prevent unnecessary disturbance of the subgrade soils, trucks and other heavy construction vehicles should be restricted from traveling through the finished subgrade area. If disturbed areas develop, they should be reworked and compacted as previously described.

If this project is constructed during the winter season, fill materials should be carefully observed to see that no ice or frozen soils are placed as fill or remain in the base materials upon which fill is placed.

5.3 Site Excavations

Millennia recommends that excavations be performed in accordance with Occupational Safety and Health Administration (OSHA) regulations, and any other applicable regulatory agencies. In accordance with the OSHA excavation regulations, the soil encountered in most of the boring locations would be classified as Type C materials. Excavations in sands, gravels, or silts will likely need to be at gentler inclinations, particularly if the soils are saturated. According to OSHA requirements, any excavation extending to a depth of more than 20 feet must be designed by a registered professional engineer. All excavations for this project are anticipated to be less than 20 feet.

In some areas of the project, existing utility trenches and existing substructures could contain crushed limestone or other types of granular bedding and backfill. It is possible that such granular materials are saturated and will be unstable when excavating through or adjacent to them. Undermining of adjacent utilities and structures could occur due to flowing and caving of the granular bedding and backfill, along with any overlying soil. A properly designed retention system, underpinning, or other suitable means of support should be used to maintain the integrity of nearby utilities and other structures.

It is anticipated that groundwater encountered in the site excavations can be controlled by a sump and pump arrangement in most situations. The sump and pump should be of large enough size to handle a high volume of flow that could be encountered if water-bearing zones of soil with significant granular content are intersected. Surface water should be routed away from the top of the excavations and prevented from flowing into the excavations.

Worker safety and classification of the excavation classifications are ultimately the responsibility of the contractor. Where the excavation lies within the zone of influence of existing pavements, buildings, slabs, utilities, or other structures, the integrity of those elements must be maintained by a properly designed earth retention system, underpinning, or other suitable means.

5.4 Temporary Sheeting and Soil Retention

Temporary shoring may be required at the proposed structures during construction, as stage construction is anticipated for this project. Similarly, temporary shoring and permitting may be required for excavation adjacent to the railroad. The IDOT Temporary Sheet Piling Design Guide and Charts should be used for a Cantilevered Sheet Piling System. If the necessary retained heights exceed what is feasible according to the design guide, the design charts will no longer be feasible and a soil retention system will be required. An Illinois-licensed structural engineer is required to seal the design of the temporary soil retention system, if deemed necessary.

It should be noted, that the presence of materials with unconfined compressive strengths exceeding 4.5 tsf are present. These very-stiff to hard soils may impact the embedment depths of a driven sheet pile system.

6.0 Closing

This report has been prepared for the exclusive use of Kuhn & Trello Consulting Engineers, LLC and the Illinois Department of Transportation for use in the design and construction of the proposed improvements and widening of the dual structures carrying Interstate 57 over Central Grain Rail Road and Township Road 86 in Coles County, Illinois. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made to the professional advice and recommendations included herein. This report is not for use by parties other than those named or for purposes other than those stated herein. It may not contain sufficient information for the use of other parties or for other purposes.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed by MPS to determine the applicability of the analyses and recommendations considering the changed conditions and time lapse. The report should also be reviewed by Millennia if changes occur in structure locations, sizes, and types, or in the planned loads, elevations, grading plans, and project concepts.

These analyses and recommendations are based on data obtained from site reconnaissance, the borings performed for this study and other pertinent information presented herein. This report does not reflect any variations between, beyond, or below the borings. Should such variations become evident, it may be necessary to re-evaluate the recommendations of this report after performing on-site observation during the construction period and noting the characteristics of any such variation.

We appreciate this opportunity to be of service to you and would be pleased to discuss any aspect of this report with you at your convenience.

Sincerely,

Millennia Professional Services, Ltd.

Joseph L. Olson, P.E.
Senior Geotechnical Engineer

Jacob A. Schaeffer, P.E.
Geotechnical Services Manager

Appendix A: Vicinity Map and Boring Location Plan

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Project No.: MG22067.01

FIGURE 1: VICINITY MAP

Interstate 57 over Central Grain RR and Township Road 86
Coles County, Illinois

N

Image obtained from TopoQuest

*Not to scale

Drawn by:	M. Jenkins	Checked by:	C. Graham
Project No.:	MG22067.01	Date:	12/7/2022

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Project No.: MG22067.01

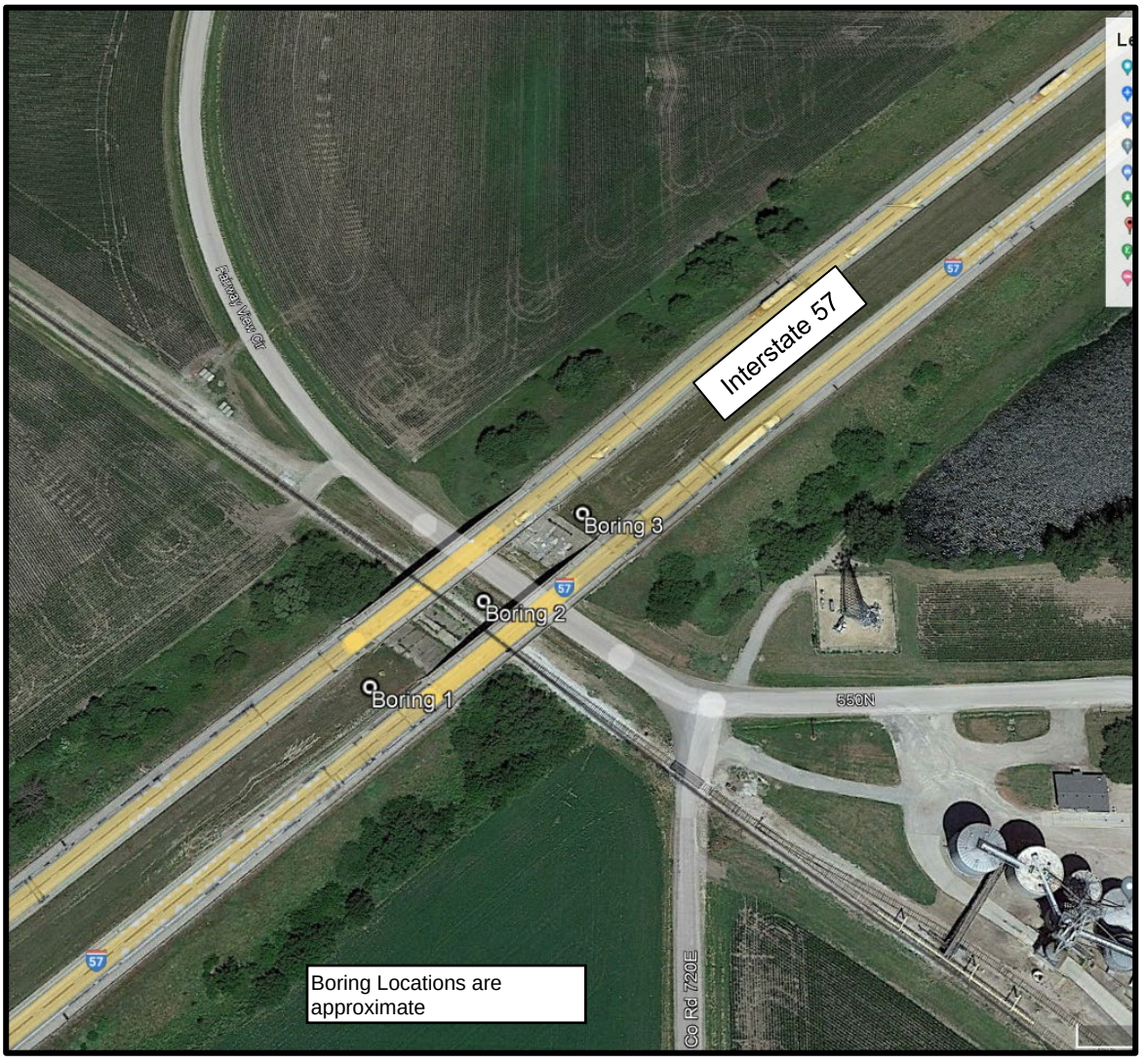


FIGURE 2: BORING LOCATION PLAN

Interstate 57 over Central Grain RR and Township Road 86
Coles County, Illinois

N

Approximate Boring Location:

Image obtained from Google Earth

*Not to scale

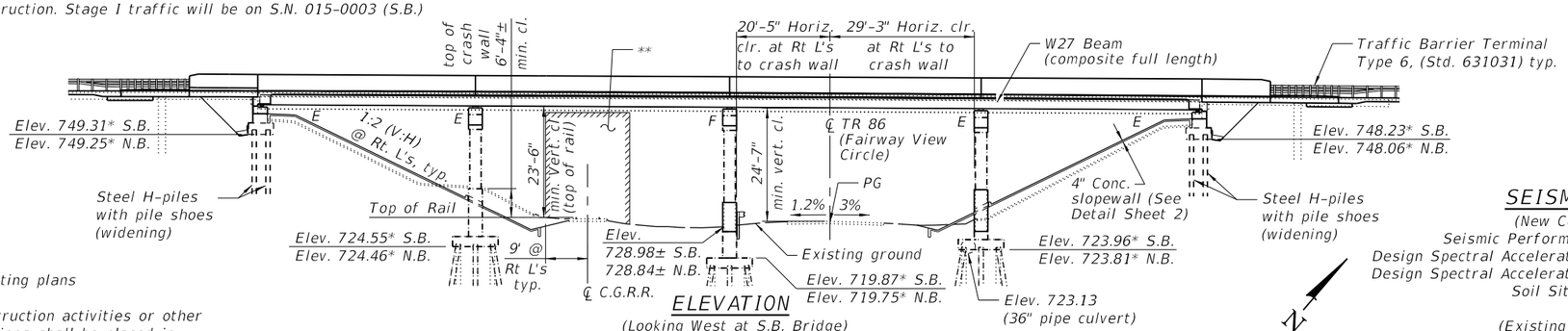
Drawn by:	M. Jenkins	Checked by:	C. Graham
Project No.:	MG22067.01	Date:	12/7/2022

Appendix B: Existing Structure Plans & Proposed Structure Drawing

Benchmark: BM384 – Chisled "□" on the SW corner of the east wingwall on south abutment of S.N. 015–0003 (S.B.) Elev. 759.899, Sta. 656+90.33, 19.78' RT CL SBL
BM385 – Chisled "□" on the NE corner of the west wingwall on north abutment of S.N. 015–0004 (N.B.) Elev. 758.554, Sta. 659+30.66, 19.68' LT CL NBL

Existing Structure: S.N. 015–0003 (S.B.) and 015–0004 (N.B.) built in 1964 as FAI 57, Section 15–22VB at Sta. 658+10.28. The superstructures are four span continuous non–composite wide flange multi–beam superstructures with 7" decks and 1.75" overlay on multi–column piers on wood piles and concrete abutments on two rows of concrete piles. The superstructures have overall lengths of 209'–1" back to back of abutments (per survey) and widths of 36'–4" out to out of parapets. The contractor will remove and replace the superstructures utilizing crossover traffic control for stage construction. Stage I traffic will be on S.N. 015–0003 (S.B.)

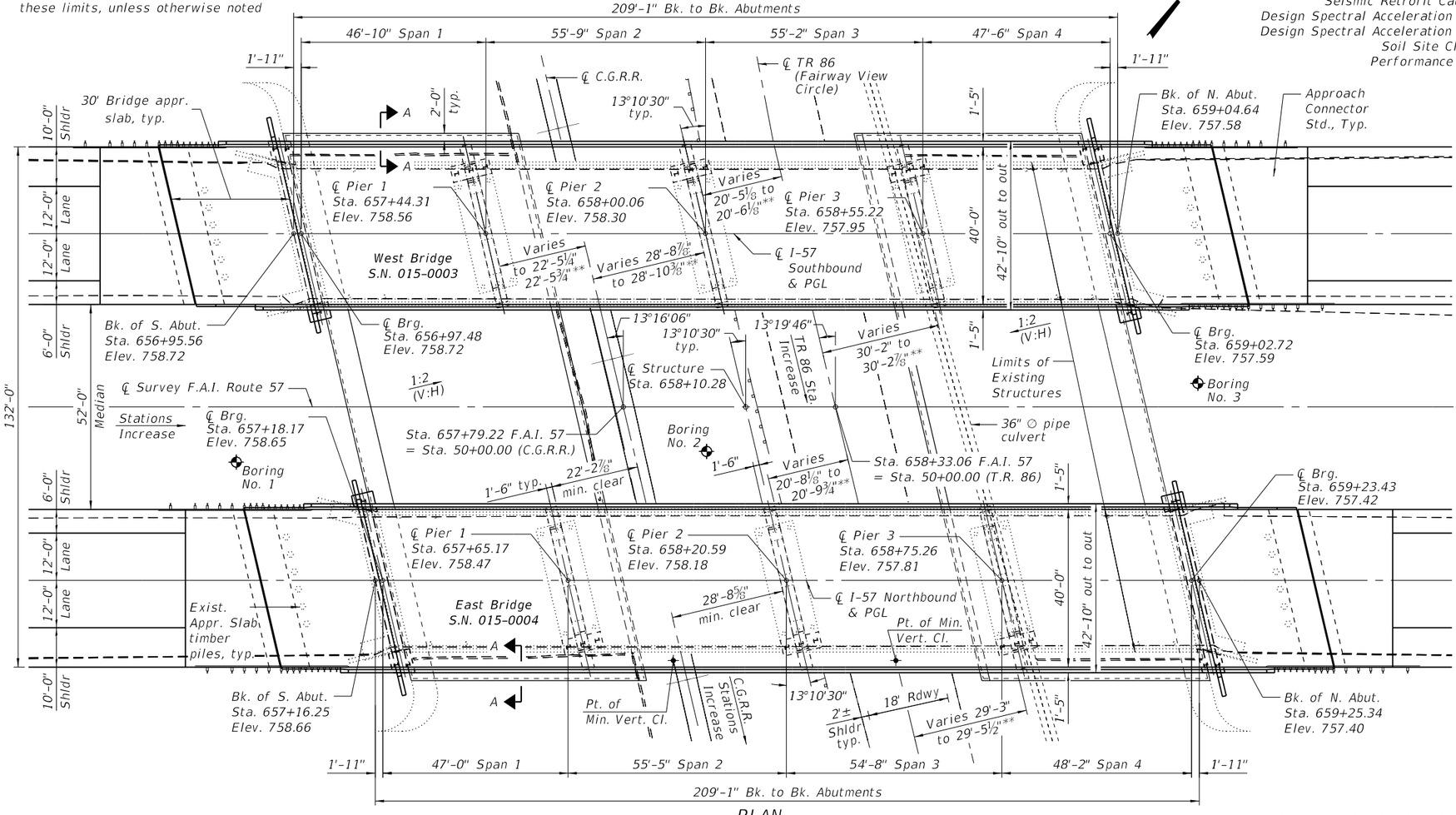
No Salvage



ELEVATION
(Looking West at S.B. Bridge)

* per existing plans

** No construction activities or other obstructions shall be placed in these limits, unless otherwise noted



PLAN

Note: See Sheet 2 For Section A–A

DESIGN SPECIFICATIONS

New Construction:
2020 AASHTO LRFD Bridge Design Specifications, 9th edition
Existing Structure:
2006 Seismic Retrofitting Manual For Highway Structures – Bridges (FHWA–HRT–06–032)

LOADING HL–93

Allow 50#/sq ft for future wearing surface

DESIGN STRESSES

FIELD UNITS (New Construction)

f'c = 4,000 psi (Superstructure)
f'c = 3,500 psi (Substructure)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)
All structural steel shall be galvanized

FIELD UNITS (Exist. Construction)

fc = 1,400 psi (Substructure)
fs = 20,000 psi (Reinforcement)

SEISMIC DATA

(New Construction)
Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec (SD1) = 0.098g
Design Spectral Acceleration at 0.2 sec (SDS) = 0.249g
Soil Site Class = C

(Existing Construction)
Seismic Retrofit Category (SRC) = A
Design Spectral Acceleration at 1.0 sec (SD1) = 0.098g
Design Spectral Acceleration at 0.2 sec (SDS) = 0.249g
Soil Site Class = C
Performance Level = 1

HIGHWAY CLASSIFICATION

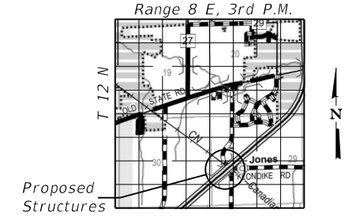
Rte. F.A.I. 57 – I–57
Functional Class: Interstate

SN 015–0003 S.B.
ADT: 11,000 (2025); 14,500 (2045)
ADTT: 4400 (2025); 5,655 (2045)
DHV: 1067 (2025)
Speed: 70 m.p.h. (posted); 75 m.p.h. (design)
One–Way Traffic

SN 015–0004 N.B.
ADT: 9,800 (2025); 14,000 (2045)
ADTT: 4047 (2025); 4638 (2045)
DHV: 1358 (2045)
Speed: 70 m.p.h. (posted); 75 m.p.h. (design)
One–Way Traffic

Rte: TR86 (550E/Fairway View Circle)
Functional Class: Local

ADT: 325 (2025); 400 (2045)
ADTT: 50 (2025); 70 (2045)
DHV: 39 (2025)
Speed: 55mph (posted/design)
Two–Way Traffic



LOCATION SKETCH

GENERAL PLAN & ELEVATION
I–57 OVER CENTRAL GRAIN RAILROAD & TR 86 (FAIRWAY VIEW CIRCLE)
F.A.I. RTE. 57 – SEC. (15–22VB)BR
COLES COUNTY
STATION 658+10.28
S.N. 015–0003 S.B. & S.N. 015–0004 N.B.

FILE NAME = $FILE$
MODEL = $MODEL$
PLOT DRIVER = $PLTDRVR$

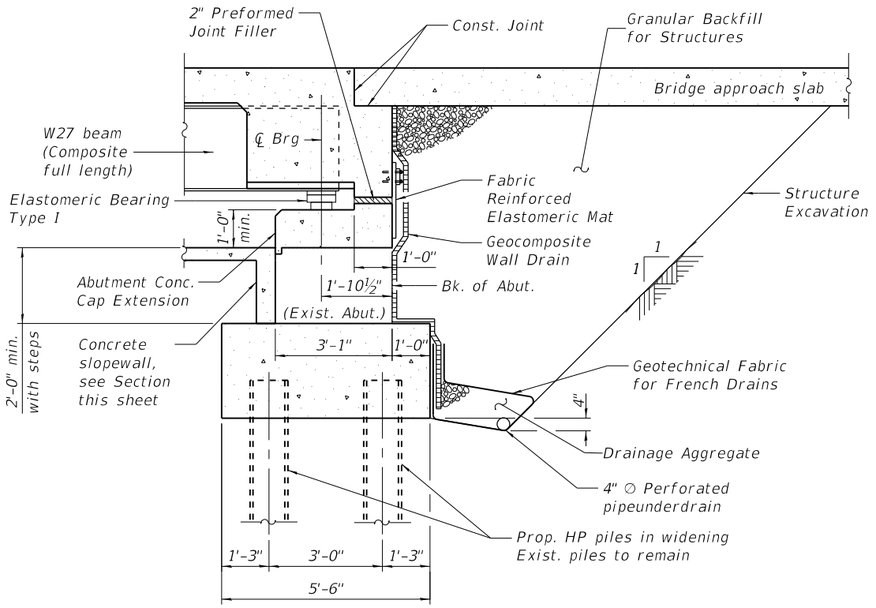
KUHN & TRELLO
CONSULTING ENGINEERS
A Limited Liability Company
109 N. 7th Street, 3rd Floor
Springfield, IL 62701
Phone: 217-679-0044
Professional Design Firm No. 184-006516

USER NAME	= $USER$	DESIGNED -	SPN/MJT	REVISED -	
		CHECKED -	MJT	REVISED -	
PLOT SCALE	= $SCALE$	DRAWN -	MMY	REVISED -	
PLOT DATE	= $DATE$	CHECKED -	MJT	REVISED -	

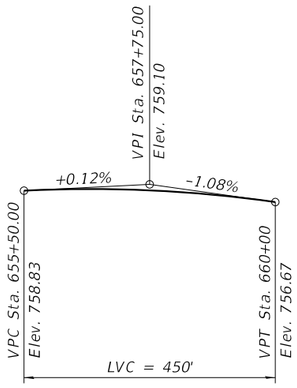
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.I RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	(15-22VB)BR	COLES		
		CONTRACT NO. 74650		
	ILLINOIS FED. AID PROJECT			



SECTION THRU SEMI-INTEGRAL ABUTMENT



** PROFILE GRADE

(along I-57 SB/NB PGL's)

PROFILE GRADE

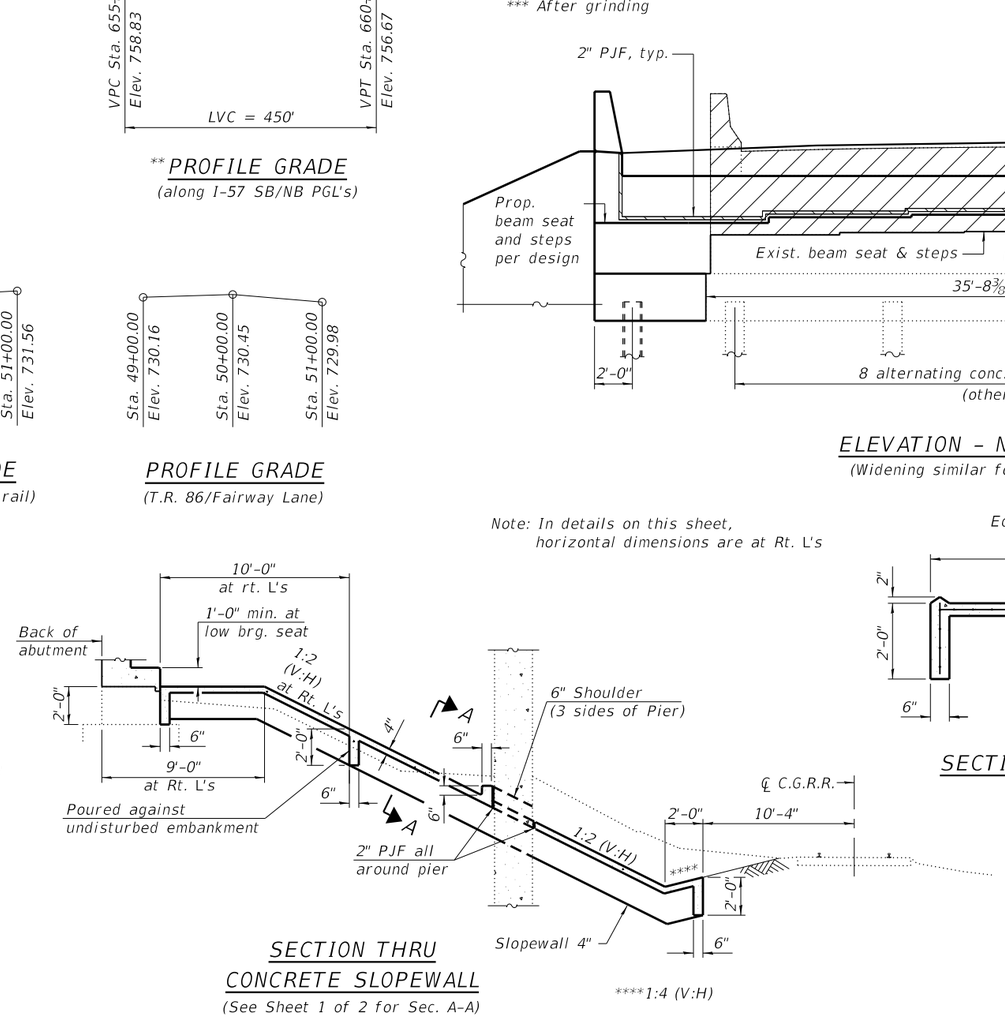
(C.G.R.R. - Top of high rail)

PROFILE GRADE

(T.R. 86/Fairway Lane)

PIER SKETCH

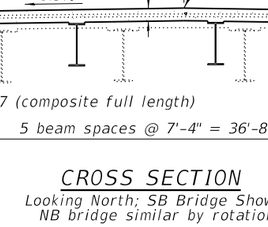
Looking North; SB Bridge Shown
NB bridge similar by rotation



SECTION THRU CONCRETE SLOPEWALL

(See Sheet 1 of 2 for Sec. A-A)

**** 1:4 (V:H)

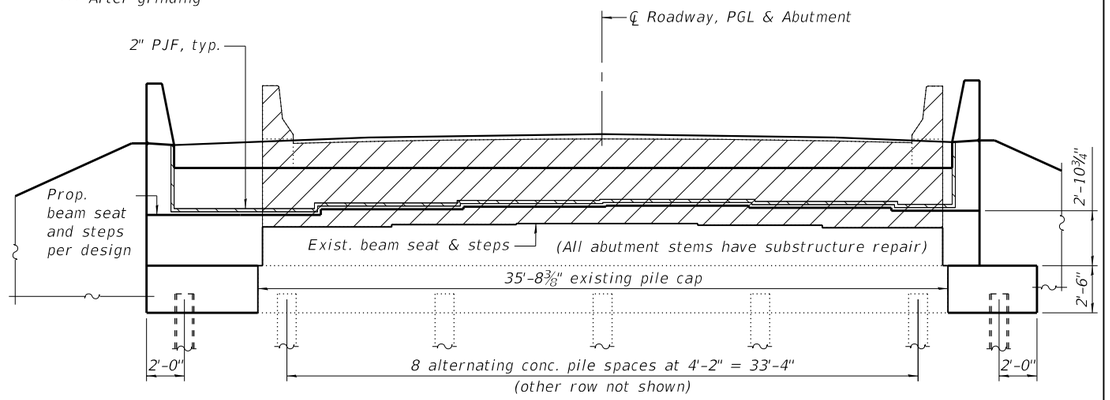


SECTION A-A

CROSS SECTION

Looking North; SB Bridge Shown
NB bridge similar by rotation

* Prior to grinding
** PGL Elevations after Diamond Grinding
*** After grinding



ELEVATION - NORTH ABUTMENT (S.B.)

(Widening similar for other abutments - see plan)

Abutment removal to top of stem

Note: In details on this sheet, horizontal dimensions are at Rt. L's

GENERAL NOTES

Both structures stationing and span lengths were derived from survey data and differ from the stations and span lengths shown in the existing plans.

No freefall deck drains will be permitted in the span over the tracks or within 10 ft. of cross arms of a railroad pole line.

Up to ¼ inch may be ground off the bridge deck and the bridge approach slabs. The elevations shown in the plan correspond to the elevations after grinding.

GENERAL DETAILS

I-57 OVER CENTRAL GRAIN RAILROAD & TR 86 (FAIRWAY VIEW CIRCLE)

F.A.P. RTE. 57 - SEC. (15-22VB)BR

COLES COUNTY

STATION 658+10.28

S.N. 015-0003 S.B. & S.N. 015-0004 N.B.

FILE NAME = S:\2022\22034.01 IDOT D7 - PTB 203-037 - W01 - Coles County 74650\CADData\CADSheets\0150003_0004-74650-TSL2.dgn
MODEL = SMODELS
PLOT DRIVER = SPLTDRVSS

KUHN & TRELLO CONSULTING ENGINEERS, A Limited Liability Company
109 N. 7th Street, 3rd Floor Springfield, IL 62701 Phone: 217-679-0644
Professional Design Firm No. 184-006516

USER NAME = myoung	DESIGNED - SPN/MJT	REVISED -		
	CHECKED - MJT	REVISED -		
PLOT SCALE = 0.1667 ' / in.	DRAWN - MMY	REVISED -		
PLOT DATE = 10/30/2023	CHECKED - MJT	REVISED -		

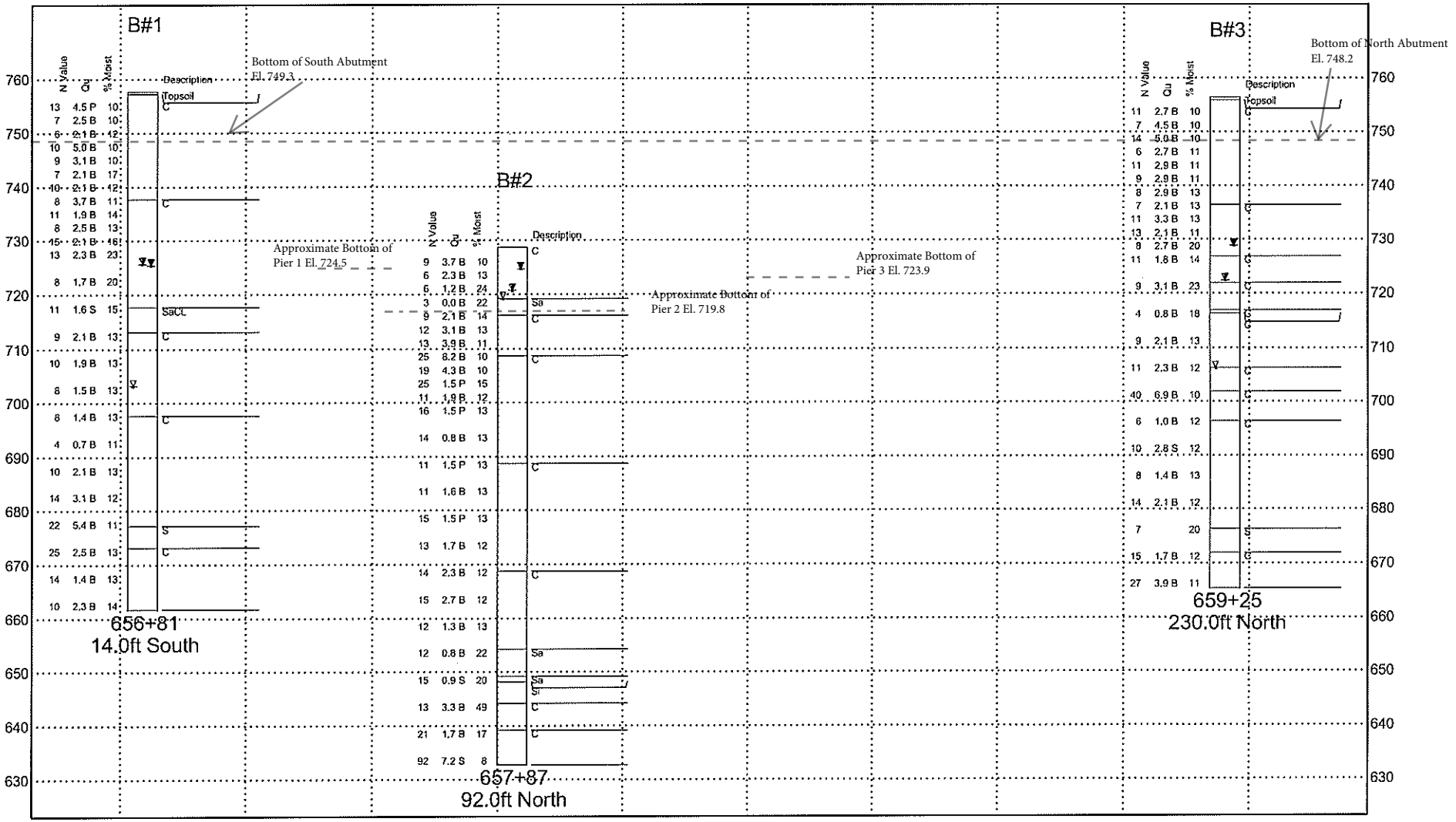
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.I RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57	(15-22VB)BR	COLES		
		CONTRACT NO. 74650		
	ILLINOIS	FED. AID PROJECT		

Appendix C: Soil Profile

Structure Number 015-0003 & 15-0004 I-57 over ICCR and Twp Road (Jones Switch)
Located in the SW 1/4 of Section 29, Township 12N, Range 8E of the 3 P.M.



NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways
IDOT

VARIATIONS IN SUBSURFACE CONDITIONS MAY EXIST BETWEEN BORINGS

Groundwater
- First Encounter
- Completion
- after (refer to log) hours

Abbreviations
WOH - Sampler Advanced by Weight of Hammer, WOP - Weight of Pipe
B.S. - Before Sealing

SUBSURFACE DATA PROFILE

Route: FAI 57
Section: 15-22VB
County: Coles

SUBSURFACE DATA PROFILE 015-0003, 0004 SOIL 2019.GPJ D7.GDT 11/25/19

SUBSURFACE DATA PROFILE 015-0003, 0004 SOIL 2019.GPJ D7.GDT 11/25/19

Appendix D: Boring Logs

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/5/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453400, Longitude W 88.337539

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 1 (South Abutment)
Station 656+81
Offset 14.0 ft South
Ground Surface Elev. 757.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 703.2 ft
Upon Completion 725.7 ft
After 24 Hrs. 725.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				6" Topsoil 757.19
				Brown, CLAY (Embankment)
	3			
	7	4.5	10	*Hard, moist (Embankment)*
	6	P		
-5	2			
	3	2.5	10	*Very stiff (Embankment)*
	4	B		
	2			
	2	2.1	12	*(Embankment)*
	4	B		
-10	2			
	4	5.0	10	*Hard, grey (Embankment)*
	6	B		
	3			
	4	3.1	10	*Very stiff (Embankment)*
	5	B		
-15	2			
	3	2.1	17	*(Embankment)*
	4	B		
	4			
	4	2.1	12	*(Embankment)*
	6	B		
737.69 -20	1			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	3	3.7	11	Very stiff, moist, grey, CLAY (Embankment)
	5	B		
	4			
	5	1.9	14	*Stiff, brown (Embankment)*
	6	B		
-25	2			
	3	2.5	13	*Very stiff (Embankment)*
	5	B		
	5			
	7	2.1	16	*Grey (Embankment)*
	8	B		*Rock stuck in sampler*
-30	2			
	5	2.3	23	*Grey/black*
	8	B		
				▽▼
-35	1			
	2	1.7	20	*Stiff*
	6	B		
717.69 -40	1			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/5/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453400, Longitude W 88.337539

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 1 (South Abutment)
Station 656+81
Offset 14.0 ft South
Ground Surface Elev. 757.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 703.2 ft ▼
Upon Completion 725.7 ft ▽
After 24 Hrs. 725.4 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	4 7	1.6 S	15	Stiff, moist, brown, SANDY CLAY LOAM
713.19				
-45	1			Very stiff, moist, grey, CLAY LOAM (Till)
	3 6	2.1 B	13	
-50	2			
	4 6	1.9 B	13	*Stiff*
▼ -55	1			
	3 5	1.5 B	13	
697.69 -60	2			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	3 5	1.4 B	13	Stiff, moist, grey, CLAY LOAM (Till)
-65	0			
	1 3	0.7 B	11	*Medium with 1/2"- 3/4" gravel*
-70	1			
	4 6	2.1 B	13	*Very stiff*
-75	2			
	6 8	3.1 B	12	
-80	5			*Hard*

SOIL_BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/5/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BYE. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453400, Longitude W 88.337539

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 1 (South Abutment)
Station 656+81
Offset 14.0 ft South
Ground Surface Elev. 757.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 703.2 ft ▼
Upon Completion 725.7 ft ▽
After 24 Hrs. 725.4 ft ▽

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
677.19		11	5.4	11
Grey, moist, fine grained, SAND		11	B	
673.19				
Very stiff, moist, grey, CLAY LOAM (Till)	-85	11		
		14	2.5	13
		11	B	
	-90	5		
Stiff		6	1.4	13
		8	B	
	-95	5		
Very stiff		4	2.3	14
661.69		6	B	
Benchmark: BM 384 - Chiseled square on the NW corner of the SW wingwall of Structure No. 015-0003, Sta 657+00, 8.2' right of SB I-57.				
End of Boring	-100			

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/24/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453590, Longitude W 88.337195

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 2 (Center Pier)
Station 657+87
Offset 92.0 ft North
Ground Surface Elev. 728.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 719.2 ft
Upon Completion 720.7 ft
After 288 Hrs. 724.7 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	4			Brown, CLAY
	4 5	3.7 B	10	*Very stiff, moist*
-5	3			
	3 3	2.3 B	13	
	1			*Stiff*
	2 4	1.2 B	24	
719.19				
-10	1			Very soft, moist, brown, SANDY LOAM
	1 2	0.0 B	22	
716.19	1			
	3 6	2.1 B	14	Very stiff, moist, brown, CLAY LOAM (Till)
-15	1			
	4 8	3.1 B	13	*Grey*
	2			
	5 8	3.9 B	11	
708.69 -20	2			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	8 17	8.2 B	10	Hard, moist, grey, CLAY LOAM (Till)
	5			
	8 11	4.3 B	10	
-25	6			
	12 13	1.5 P	15	*Stiff*
	3			
	4 7	1.9 B	12	
-30	4			
	7 9	1.5 P	13	*Medium*
-35	4			
	6 8	0.8 B	13	
688.69 -40	2			

SOIL_BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/24/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453590, Longitude W 88.337195

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 2 (Center Pier)
Station 657+87
Offset 92.0 ft North
Ground Surface Elev. 728.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 719.2 ft ▼
Upon Completion 720.7 ft ▽
After 288 Hrs. 724.7 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	5 6	1.5 P	13	Stiff, moist, grey ribbons, CLAY LOAM (Till) *Rock in front of sampler*
-45	3			
	5 6	1.6 B	13	
-50	4			
	7 8	1.5 P	13	*Rock in front of sampler*
-55	4			
	6 7	1.7 B	12	
668.69 -60	3			
	5 9	2.3 B	12	Very stiff, moist, grey, CLAY LOAM (TIII)
-65	2			
	6 9	2.7 B	12	
-70	3			
	5 7	1.3 B	13	*Stiff*
654.19 -75	1			Medium, moist, grey, SANDY LOAM
	4 8	0.8 B	22	
649.19 -80	2			Grey, SANDY LOAM

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/24/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BYE. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453590, Longitude W 88.337195

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 2 (Center Pier)
Station 657+87
Offset 92.0 ft North
Ground Surface Elev. 728.69 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 719.2 ft
Upon Completion 720.7 ft
After 288 Hrs. 724.7 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
648.19		8	0.9	20
Medium, moist, brown, SILTY LOAM		7	S	
644.19				
Very stiff, moist, grey, CLAY	-85	3		
		5	3.3	49
		8	B	
639.19				
Stiff, moist, grey, CLAY LOAM (Till)	-90	4		
		9	1.7	17
		12	B	
	-95	11		
Hard		43	7.2	8
632.69		49	S	
Benchmark: BM 384 - Chiseled square on the NW corner of the SW wingwall of Structure No. 015-0003, Sta 657+00, 8.2' right of SB I-57. End of Boring	-100			

SOIL_BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/4/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453858, Longitude W 88.336888

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 3 (North Abutment)
Station 659+25
Offset 230.0 ft North
Ground Surface Elev. 756.38 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 706.2 ft
Upon Completion 722.4 ft
After 48 Hrs. 728.9 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				6" Topsoil 755.88
				Brown, CLAY (Embankment)
	2			
	5 6	2.7 B	10	*Very stiff, moist (Embankment)*
-5	2			
	3 4	4.5 B	10	*Hard (Embankment)*
	5			
	7 7	5.0 B	10	*Grey (Embankment)*
-10	2			
	3 3	2.7 B	11	*Very stiff (Embankment)*
	3			
	5 6	2.9 B	11	*(Embankment)*
-15	3			
	4 5	2.9 B	11	*2" rock stuck in sampler (Embankment)*
	3			
	4 4	2.9 B	13	*(Embankment)*
736.38 -20	2			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	3 4	2.1 B	13	Very stiff, moist, brown, CLAY (Embankment)
	2			
	4 7	3.3 B	13	*Grey (Embankment)*
-25	3			
	5 8	2.1 B	11	*(Embankment)*
	2			
	4 4	2.7 B	20	*Brown (Embankment)*
726.88				
-30	3			Stiff, moist, brown, CLAY LOAM
	5 6	1.8 B	14	
721.88				
-35	2			Very stiff, moist, black, CLAY with SILT
	3 6	3.1 B	23	
716.88				
716.38 -40	1			Medium, moist, brown, CLAY

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/4/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453858, Longitude W 88.336888

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 3 (North Abutment)
Station 659+25
Offset 230.0 ft North
Ground Surface Elev. 756.38 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 706.2 ft
Upon Completion 722.4 ft
After 48 Hrs. 728.9 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	LOAM		
	2 2	0.8 B	18
	Medium, moist, brown, CLAY LOAM		
-45	1		
	4 5	2.1 B	13
	Very stiff, grey (Till)		
706.18 -50	2		
	4 7	2.3 B	12
	Very stiff, moist, grey, CLAY LOAM (Till) with 2" fine grained SAND lense.		
701.88 -55	2		
	Hard, moist, grey, CLAY LOAM (Till)		
	12 28	6.9 B	10
696.38 -60	1		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	Stiff, moist, grey, CLAY LOAM (Till)		
	2 4	1.0 B	12
-65	2		
	very stiff with a very fine SAND lense		
	3 7	2.8 S	12
-70	1		
	Stiff		
	3 5	1.4 B	13
-75	1		
	Very stiff		
	6 8	2.1 B	12
676.38 -80	1		

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 11/4/19

ROUTE FAI 57 DESCRIPTION I-57 over ICCR and Twp Road (Jones Switch) LOGGED BY E. Sandschafer

SECTION 15-22VB LOCATION SW 1/4, SEC. 29, TWP. 12N, RNG. 8E, 3rd PM,
Latitude N 39.453858, Longitude W 88.336888

COUNTY Coles DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 015-0003 & 15-0004
Station 658+10.28

BORING NO. 3 (North Abutment)
Station 659+25
Offset 230.0 ft North
Ground Surface Elev. 756.38 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter 706.2 ft
Upon Completion 722.4 ft
After 48 Hrs. 728.9 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Loose, moist, grey, fine grained SAND		3 4		20
671.88				
Stiff, moist, grey, CLAY LOAM (Till)	-85	8		
		7 8	1.7 B	12
	-90	11		
		15 12	3.9 B	11
Very stiff 665.38				
Benchmark: BM 384 - Chiseled square on the NW corner of the SW wingwall of Structure No. 015-0003, Sta 657+00, 8.2' right of SB I-57. End of Boring	-95			
	-100			

SOIL BORING 015-0003, 0004 SOIL 2019.GPJ IL_DOT.GDT 11/25/19

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Appendix E: IDOT Estimated Pile Length Spreadsheets

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 750.28 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 749.28 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 105 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 5.56 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 75.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 28.33 KIPS

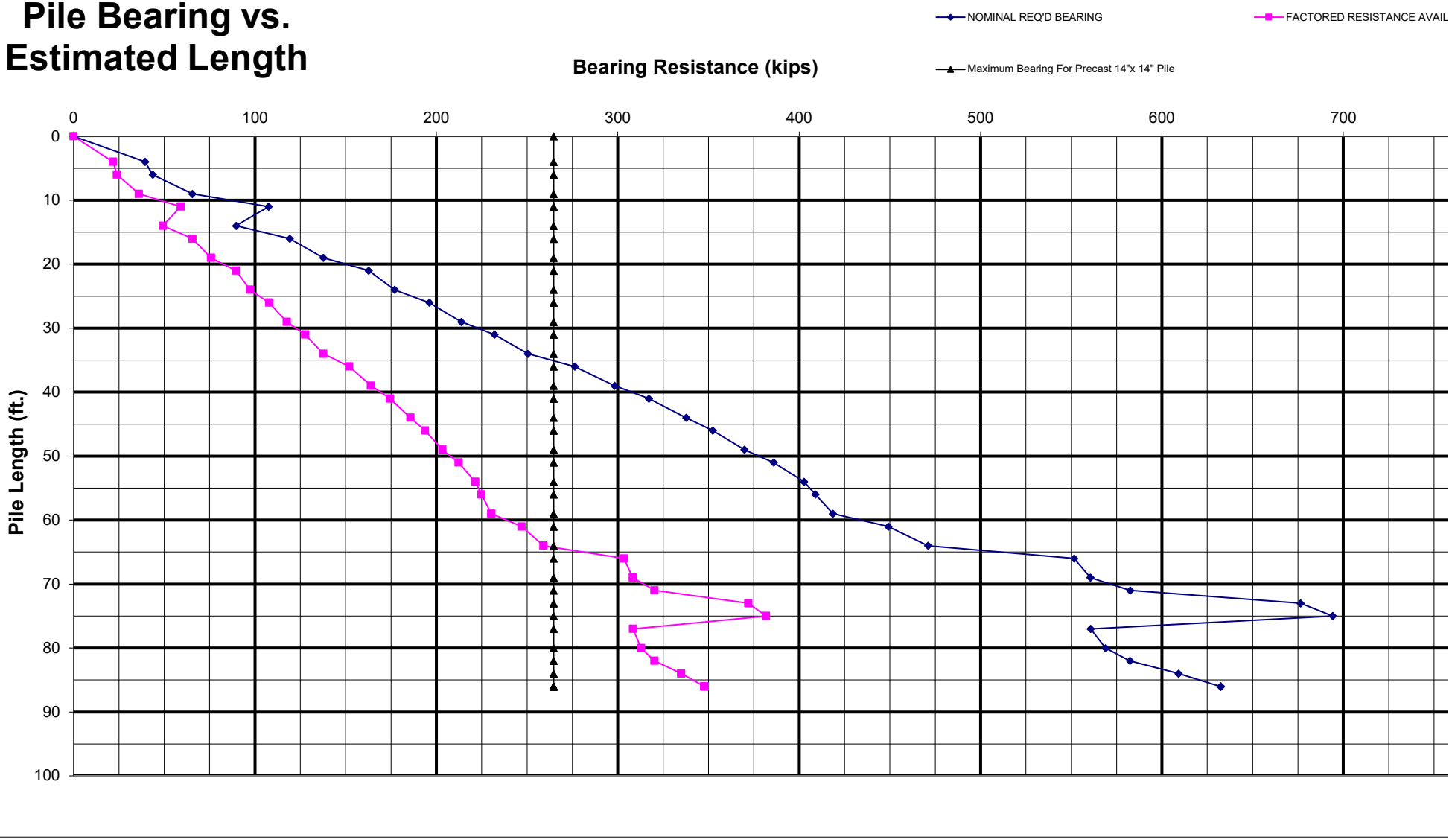
PILE TYPE AND SIZE ========== Precast 14"x 14"
Pile Perimeter========== 4.667 FT.
Pile End Bearing Area========== 1.361 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
265 KIPS	**250** KIPS	**138** KIPS	**34** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
746.78	2.50		10	Hard Till	6.4		***39.5***				39	0	0	22	4
744.28	2.50		9	Hard Till	5.8	33.0	***43.6***				44	0	0	24	6
741.78	2.50	2.10			21.9	31.4	***65.5***				65	0	0	36	9
739.28	2.50	2.10			21.9	31.4	***107.5***				107	0	0	59	11
736.78	2.50		8	Hard Till	5.1	51.4	***89.6***				90	0	0	49	14
734.28	2.50	1.90			20.6	28.4	***119.1***				119	0	0	66	16
731.78	2.50	2.50			24.6	37.3	***137.7***				138	0	0	76	19
729.28	2.50	2.10			21.9	31.4	***162.6***				163	0	0	89	21
726.78	2.50	2.30			23.3	34.3	***176.9***				177	0	0	97	24
724.28	2.50	1.70			19.1	25.4	***196.1***				196	0	0	108	26
721.78	2.50	1.70			19.1	25.4	***213.7***				214	0	0	118	29
719.28	2.50	1.60			18.4	23.9	***232.1***				232	0	0	128	31
716.78	2.50	1.60			18.4	23.9	***250.4***				250	0	0	138	34
714.28	2.50	1.60			18.4	23.9	***276.2***				~~276~~	~~0~~	~~0~~	~~152~~	~~36~~
711.78	2.50	2.10			21.9	31.4	***298.2***				~~298~~	~~0~~	~~0~~	~~164~~	~~39~~
709.28	2.50	2.10			21.9	31.4	***317.1***				~~317~~	~~0~~	~~0~~	~~174~~	~~41~~
706.78	2.50	1.90			20.6	28.4	***337.7***				~~338~~	~~0~~	~~0~~	~~186~~	~~44~~
704.28	2.50	1.90			20.6	28.4	***352.3***				~~352~~	~~0~~	~~0~~	~~194~~	~~46~~
701.78	2.50	1.50			17.6	22.4	***369.8***				~~370~~	~~0~~	~~0~~	~~203~~	~~49~~
699.28	2.50	1.50			17.6	22.4	***385.9***				~~386~~	~~0~~	~~0~~	~~212~~	~~51~~
696.78	2.50	1.40			16.7	20.9	***402.7***				~~403~~	~~0~~	~~0~~	~~221~~	~~54~~
694.28	2.50	1.40			16.7	20.9	***409.0***				~~409~~	~~0~~	~~0~~	~~225~~	~~56~~
691.78	2.50	0.70			9.6	10.5	***418.6***				~~419~~	~~0~~	~~0~~	~~230~~	~~59~~
689.28	2.50	0.70			9.6	10.5	***449.1***				~~449~~	~~0~~	~~0~~	~~247~~	~~61~~
686.78	2.50	2.10			21.9	31.4	***471.0***				~~471~~	~~0~~	~~0~~	~~259~~	~~64~~
684.28	2.50	2.10			21.9	31.4	***551.6***				~~552~~	~~0~~	~~0~~	~~303~~	~~66~~
681.78	2.50		14	Hard Till	9.0	90.0	***560.6***				~~561~~	~~0~~	~~0~~	~~308~~	~~69~~
679.28	2.50		14	Hard Till	9.0	90.0	***582.4***				~~582~~	~~0~~	~~0~~	~~320~~	~~71~~
677.28	2.00		16	Hard Till	8.2	102.8	***676.3***				~~676~~	~~0~~	~~0~~	~~372~~	~~73~~
675.28	2.00		22	Fine Sand	17.8	188.5	***694.1***				~~694~~	~~0~~	~~0~~	~~382~~	~~75~~
673.28	2.00		22	Fine Sand	17.8	188.5	***560.7***				~~561~~	~~0~~	~~0~~	~~308~~	~~77~~
670.78	2.50	2.50			24.6	37.3	***568.9***				~~569~~	~~0~~	~~0~~	~~313~~	~~80~~
668.78	2.00	1.40			13.4	20.9	***582.3***				~~582~~	~~0~~	~~0~~	~~320~~	~~82~~
666.78	2.00	1.40			13.4	20.9	***609.1***				~~609~~	~~0~~	~~0~~	~~335~~	~~84~~
664.28	2.50	2.30			23.3	34.3	***632.3***				~~632~~	~~0~~	~~0~~	~~348~~	~~86~~
661.78	2.50	2.30				34.3									

Pile Bearing vs. Estimated Length



Pile Design Table for South Abutment utilizing Boring #1

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls		
41	23	9
58	32	14
77	42	16
90	49	19
106	58	21
117	64	24
130	71	26
142	78	29
154	85	31
166	91	34
183	101	36
198	109	39
211	116	41
225	124	44
235	129	46
247	136	49
258	142	51
269	148	54
274	151	56
281	154	59
299	165	61
314	173	64
363	199	66
369	203	69
Metal Shell 14"Φ w/.25" walls		
51	28	9
70	39	14
94	51	16
108	59	19
128	70	21
139	76	24
154	85	26
168	92	29
182	100	31
197	108	34
217	119	36
234	129	39
249	137	41
265	146	44
277	152	46
290	160	49
303	167	51
316	174	54
321	177	56

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42		
49	27	16
63	34	19
74	41	21
79	44	24
88	48	26
96	53	29
104	57	31
112	62	34
125	69	36
135	74	39
143	79	41
152	84	44
158	87	46
166	91	49
173	95	51
180	99	54
181	100	56
186	102	59
203	112	61
213	117	64
221	122	66
222	122	69
226	124	71
236	130	77
236	130	80
242	133	82
257	141	84
267	147	86
Steel HP 10 X 57		
51	28	16
64	35	19
76	42	21
81	45	24
90	49	26
98	54	29
106	58	31
115	63	34
128	70	36
138	76	39
146	80	41
156	86	44
161	89	46
169	93	49
177	97	51

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84		
45	25	14
63	35	16
82	45	19
99	55	21
103	57	24
114	63	26
123	68	29
134	74	31
144	79	34
162	89	36
174	96	39
183	101	41
195	107	44
201	110	46
210	116	49
219	120	51
227	125	56
233	128	59
259	142	61
271	149	64
280	154	66
281	155	69
287	158	71
298	164	80
305	168	82
326	179	84
339	186	86
Steel HP 14 X 73		
51	28	14
72	40	16
95	52	19
116	64	21
123	67	24
135	74	26
145	80	29
157	86	31
169	93	34
190	105	36
205	112	39
215	118	41
228	125	44
234	128	46
245	135	49
254	140	51

329	181	59
353	194	61
370	203	64
433	238	66
440	242	69
Metal Shell 14"Φ w/.312" walls		
51	28	9
70	39	14
94	51	16
108	59	19
128	70	21
139	76	24
154	85	26
168	92	29
182	100	31
197	108	34
217	119	36
234	129	39
249	137	41
265	146	44
277	152	46
290	160	49
303	167	51
316	174	54
321	177	56
329	181	59
353	194	61
370	203	64
433	238	66
440	242	69
440	242	77
447	246	80
457	252	82
478	263	84
497	273	86
Metal Shell 16"Φ w/.312" walls		
43	24	6
63	35	9
84	46	14
112	61	16
128	70	19
150	83	21
162	89	24
179	99	26
195	107	29
211	116	31
228	125	34
252	139	36
272	149	39
288	159	41

184	101	54
185	102	56
189	104	59
208	114	61
218	120	64
226	124	66
227	125	69
231	127	71
241	132	77
241	133	80
247	136	82
262	144	84
273	150	86
Steel HP 12 X 53		
42	23	14
59	33	16
78	43	19
95	52	21
99	55	24
110	60	26
119	65	29
129	71	31
139	76	34
155	85	36
167	92	39
176	97	41
188	103	44
193	106	46
203	112	49
211	116	51
220	121	56
225	124	59
249	137	61
261	144	64
270	148	66
271	149	69
277	152	71
287	158	80
294	162	82
314	173	84
327	180	86
Steel HP 12 X 63		
43	24	14
61	33	16
80	44	19
96	53	21
100	55	24
111	61	26
120	66	29
130	71	31

262	144	56
268	148	59
302	166	61
316	174	64
325	179	66
327	180	69
334	184	71
344	189	80
353	194	82
379	209	84
394	217	86
Steel HP 14 X 89		
49	27	11
52	29	14
74	40	16
96	53	19
118	65	21
124	68	24
137	75	26
147	81	29
159	88	31
171	94	34
193	106	36
207	114	39
217	120	41
231	127	44
236	130	46
248	136	49
257	141	51
265	146	56
271	149	59
305	168	61
320	176	64
329	181	66
331	182	69
338	186	71
348	192	80
357	196	82
384	211	84
399	219	86
Steel HP 14 X 102		
49	27	11
53	29	14
75	41	16
97	54	19
119	66	21
126	69	24
139	76	26
149	82	29
161	89	31

307	169	44
319	175	46
335	184	49
349	192	51
364	200	54
368	203	56
377	207	59
407	224	61
427	235	64
507	279	66
508	279	77
513	282	80
525	289	82
551	303	84
572	315	86
Metal Shell 16"Φ w/.375" walls		
43	24	6
63	35	9
84	46	14
112	61	16
128	70	19
150	83	21
162	89	24
179	99	26
195	107	29
211	116	31
228	125	34
252	139	36
272	149	39
288	159	41
307	169	44
319	175	46
335	184	49
349	192	51
364	200	54
368	203	56
377	207	59
407	224	61
427	235	64
507	279	66
508	279	77
513	282	80
525	289	82
551	303	84
572	315	86
Steel HP 8 X 36		
48	27	19
58	32	21
62	34	24
69	38	26

140	77	34
157	86	36
169	93	39
178	98	41
189	104	44
195	107	46
205	113	49
213	117	51
221	122	56
227	125	59
252	138	61
264	145	64
272	150	66
274	151	69
279	154	71
290	159	80
297	163	82
317	174	84
330	181	86
Steel HP 12 X 74		
44	24	14
62	34	16
81	44	19
98	54	21
102	56	24
112	62	26
122	67	29
132	72	31
142	78	34
159	88	36
171	94	39
181	99	41
192	106	44
198	109	46
208	114	49
216	119	51
224	123	56
230	126	59
255	140	61
267	147	64
276	152	66
278	153	69
283	156	71
294	161	80
301	166	82
321	177	84
334	184	86

173	95	34
195	107	36
210	115	39
220	121	41
234	129	44
239	132	46
251	138	49
260	143	51
268	147	56
274	151	59
309	170	61
323	178	64
333	183	66
335	184	69
342	188	71
352	194	80
361	199	82
388	213	84
403	222	86
Steel HP 14 X 117		
50	27	11
54	30	14
76	42	16
99	54	19
121	67	21
128	70	24
140	77	26
151	83	29
163	90	31
175	96	34
198	109	36
212	117	39
223	123	41
237	130	44
242	133	46
254	139	49
263	145	51
271	149	56
277	153	59
313	172	61
327	180	64
337	185	66
339	186	69
346	190	71
356	196	80
365	201	82
393	216	84
408	224	86
Precast 14"x 14"		
44	24	6

76	42	29
83	45	31
89	49	34
99	55	36
107	59	39
114	63	41
122	67	44
127	70	46
133	73	49
139	77	51
145	80	54
147	81	56
151	83	59
163	90	61
171	94	64
178	98	66
179	98	69
182	100	71
189	104	77
191	105	80
196	108	82
207	114	84
215	118	86

65	36	9
90	49	14
119	66	16
138	76	19
163	89	21
177	97	24
196	108	26
214	118	29
232	128	31
250	138	34

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Center Pier
REFERENCE BORING ========== 2 (Center Pier)
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 720.90 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 716.90 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 80 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 36.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 3
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 5.93 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 2.22 KIPS

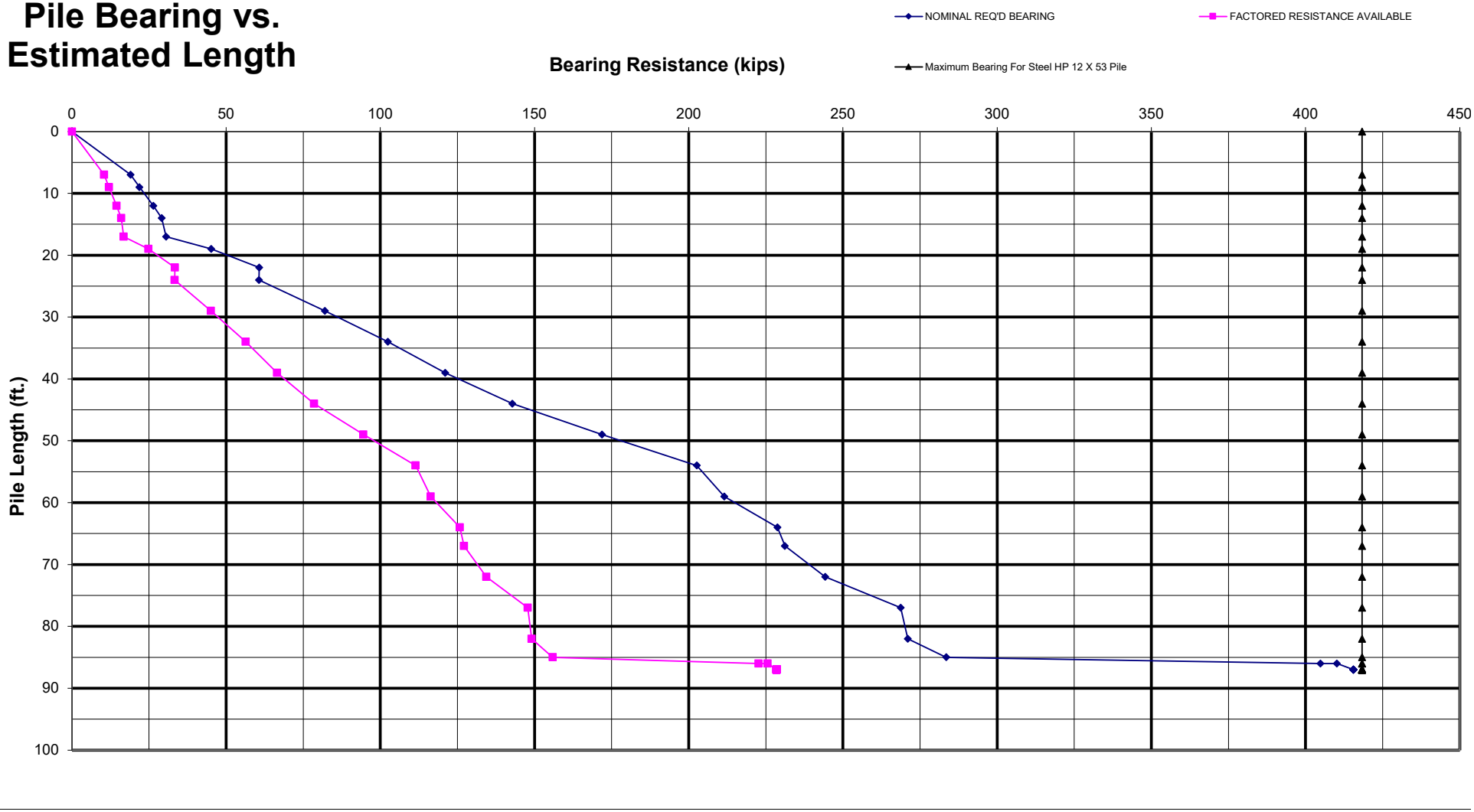
MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	**416** KIPS	**229** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
714.40	2.50	2.10			11.9		26.6	17.4		***19.0***	19	0	0	10	7
711.90	2.50		12	Hard Till	1.3	14.7	37.1	1.9	1.6	***21.9***	22	0	0	12	9
709.40	2.50		13	Hard Till	1.4	23.9	60.5	2.1	2.6	***26.4***	26	0	0	15	12
706.90	2.50		25	Hard Till	2.7	45.9	52.2	4.0	5.0	***29.1***	29	0	0	16	14
704.40	2.50		19	Hard Till	2.1	34.9	40.0	3.0	3.8	***30.6***	31	0	0	17	17
701.90	2.50	1.50			9.5	20.7	55.1	13.9	2.3	***45.1***	45	0	0	25	19
699.40	2.50	1.90			11.2	26.2	***60.7***	16.3	2.9	60.9	61	0	0	33	22
696.90	2.50	1.50			9.5	20.7	***60.6***	13.9	2.3	73.7	61	0	0	33	24
691.90	5.00	0.80			11.7	11.0	***82.0***	17.1	1.2	91.9	82	0	0	45	29
686.90	5.00	1.50			19.1	20.7	***102.5***	27.9	2.3	120.0	102	0	0	56	34
681.90	5.00	1.60			19.9	22.0	***121.0***	29.2	2.4	149.0	121	0	0	67	39
676.90	5.00	1.50			19.1	20.7	***142.8***	27.9	2.3	177.2	143	0	0	79	44
671.90	5.00	1.70			20.8	23.4	***171.9***	30.4	2.6	208.4	172	0	0	95	49
666.90	5.00	2.30			25.3	31.7	***202.7***	36.9	3.5	246.0	203	0	0	111	54
661.90	5.00	2.70			28.2	37.2	***211.5***	41.2	4.1	285.1	212	0	0	116	59
656.90	5.00	1.30			17.2	17.9	***228.8***	25.2	2.0	310.3	229	0	0	126	64
654.20	2.70	1.30			9.3	17.9	***231.2***	13.6	2.0	323.1	231	0	0	127	67
649.20	5.00	0.80			11.7	11.0	***244.3***	17.1	1.2	340.4	244	0	0	134	72
644.20	5.00	0.90			12.9	12.4	***268.7***	18.9	1.4	360.6	269	0	0	148	77
639.20	5.00		13	Hard Till	2.8	23.9	***271.1***	4.1	2.6	364.6	271	0	0	149	82
636.20	3.00	1.70			12.5	23.4	***283.5***	18.2	2.6	382.9	284	0	0	156	85
635.20	1.00	1.70			4.2	23.4	433.3	6.1	2.6	***404.9***	405	0	0	223	86
634.70	0.50		92	Hard Till	3.7	169.0	436.9	5.3	18.5	***410.2***	410	0	0	226	86
634.20	0.50		92	Hard Till	3.7	169.0	440.6	5.3	18.5	***415.6***	416	0	0	229	87
633.70	0.50		92	Hard Till		169.0			18.5						

Pile Bearing vs. Estimated Length



Pile Design Table for Center Pier utilizing Boring #2 (Center Pier)

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls		
44	24	7
58	32	17
73	40	19
83	46	22
89	49	24
110	60	29
134	74	34
158	87	39
183	101	44
214	118	49
249	137	54
272	150	59
293	161	64
300	165	67
316	174	72
350	193	82
365	201	85
Metal Shell 14"Φ w/.25" walls		
52	29	7
70	38	17
88	48	19
100	55	22
105	58	24
130	72	29
159	87	34
187	103	39
217	119	44
254	140	49
295	162	54
319	176	59
344	189	64
352	194	67
370	203	72
411	226	82
429	236	85
Metal Shell 14"Φ w/.312" walls		
52	29	7
70	38	17
88	48	19
100	55	22
105	58	24
130	72	29
159	87	34
187	103	39
217	119	44
254	140	49
295	162	54
319	176	59
344	189	64
352	194	67
370	203	72
411	226	82

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42		
16	9	7
18	10	9
22	12	12
24	13	14
26	14	17
38	21	19
48	26	22
49	27	24
65	36	29
82	45	34
98	54	39
116	64	44
139	76	49
163	90	54
173	95	59
188	103	64
191	105	67
201	111	72
220	121	77
222	122	82
233	128	85
Steel HP 10 X 57		
17	9	7
19	10	9
23	13	12
25	14	14
26	14	17
39	21	19
49	27	22
50	28	24
67	37	29
84	46	34
100	55	39
118	65	44
142	78	49
167	92	54
177	97	59
192	105	64
195	107	67
206	113	72
225	124	77
227	125	82
237	131	85
345	190	86
349	192	86
352	194	87
Steel HP 12 X 53		
19	10	7
22	12	9
26	15	12
29	16	14
31	17	17

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84		
20	11	7
24	13	9
30	16	12
32	18	14
33	18	17
48	26	19
63	35	24
85	47	29
107	59	34
126	69	39
148	82	44
179	98	49
211	116	54
219	121	59
237	130	64
239	132	67
253	139	72
279	153	77
281	155	82
294	162	85
425	234	86
431	237	86
436	240	87
Steel HP 14 X 73		
23	13	7
26	14	9
33	18	12
36	20	14
37	20	17
55	30	19
74	40	22
74	41	24
102	56	29
126	69	34
148	81	39
174	96	44
211	116	49
248	137	54
255	140	59
275	151	64
276	152	67
292	161	72
324	178	77
326	179	82
341	188	85
490	270	86
497	273	86
503	277	87
Steel HP 14 X 89		
23	13	7
27	15	9
34	19	12

429	236	85
Metal Shell 16"Φ w/.312" walls		
65	36	7
82	45	17
104	57	19
117	64	22
122	67	24
152	83	29
185	102	34
216	119	39
251	138	44
294	162	49
342	188	54
367	202	59
396	218	64
404	222	67
425	234	72
473	260	82
494	272	85
Metal Shell 16"Φ w/.375" walls		
65	36	7
82	45	17
104	57	19
117	64	22
122	67	24
152	83	29
185	102	34
216	119	39
251	138	44
294	162	49
342	188	54
367	202	59
396	218	64
404	222	67
425	234	72
473	260	82
494	272	85
Steel HP 8 X 36		
13	7	7
15	8	9
18	10	12
20	11	14
21	11	17
30	17	19
37	20	22
39	21	24
51	28	29
65	36	34
78	43	39
92	51	44
110	60	49
130	71	54
140	77	59
152	83	64
155	85	67
163	90	72
177	98	77
179	98	82
45	25	19
61	33	24
82	45	29
102	56	34
121	67	39
143	79	44
172	95	49
203	111	54
212	116	59
229	126	64
231	127	67
244	134	72
269	148	77
271	149	82
284	156	85
405	223	86
410	226	86
416	229	87
Steel HP 12 X 63		
20	11	7
23	12	9
28	15	12
30	17	14
31	17	17
46	25	19
61	34	24
83	46	29
103	57	34
122	67	39
144	79	44
174	95	49
205	113	54
213	117	59
231	127	64
233	128	67
246	136	72
271	149	77
274	150	82
286	157	85
414	228	86
419	231	86
425	234	87
Steel HP 12 X 74		
20	11	7
23	13	9
29	16	12
31	17	14
32	18	17
47	26	19
62	34	24
84	46	29
105	58	34
124	68	39
146	80	44
176	97	49
208	114	54
216	119	59
234	129	64
37	20	14
38	21	17
56	31	19
75	41	22
75	41	24
103	57	29
128	70	34
150	82	39
177	97	44
213	117	49
251	138	54
258	142	59
278	153	64
279	154	67
295	162	72
327	180	77
330	182	82
345	190	85
500	275	86
506	278	86
513	282	87
Steel HP 14 X 102		
24	13	7
28	15	9
36	20	12
38	21	14
39	21	17
57	31	19
76	42	22
76	42	24
104	57	29
130	71	34
152	83	39
179	98	44
216	119	49
255	140	54
261	143	59
281	155	64
283	155	67
299	164	72
331	182	77
334	184	82
349	192	85
506	278	86
513	282	86
519	285	87
Steel HP 14 X 117		
24	13	7
29	16	9
37	21	12
40	22	14
40	22	17
58	32	19
77	42	22
77	42	24
106	58	29
131	72	34
154	84	39

188	103	85
258	142	86
260	143	86
263	144	87

236	130	67
250	137	72
275	151	77
277	152	82
290	159	85
420	231	86
425	234	86
430	237	87

181	100	44
219	120	49
258	142	54
263	145	59
285	157	64
286	157	67
302	166	72
335	184	77
338	186	82
353	194	85
515	283	86
522	287	86
528	291	87
Precast 14"x 14"		
66	36	7
89	49	17
112	62	19
127	70	22
134	74	24
166	91	29
203	111	34
238	131	39

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 749.10 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 748.10 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 105 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 5.56 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 75.54 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 28.33 KIPS

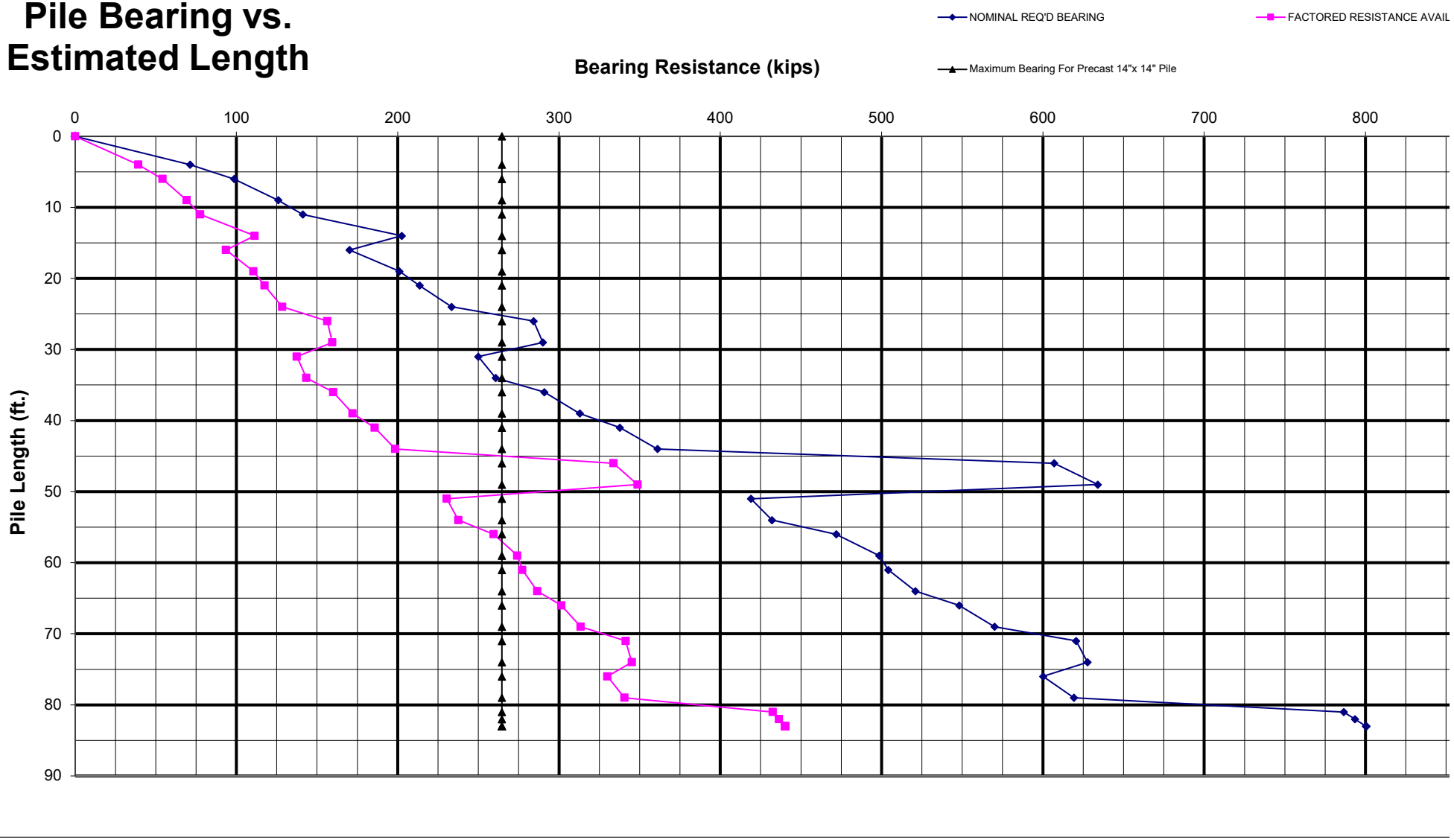
PILE TYPE AND SIZE ========== Precast 14"x 14"
Pile Perimeter========== 4.667 FT.
Pile End Bearing Area========== 1.361 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
265 KIPS	**233** KIPS	**128** KIPS	**24** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
745.40	2.70	2.70			28.0		***71.3***				71	0	0	39	4
742.90	2.50	2.90			27.3	43.3	***98.6***				99	0	0	54	6
740.40	2.50	2.90			27.3	43.3	***125.8***				126	0	0	69	9
737.90	2.50	2.90			27.3	43.3	***141.2***				141	0	0	78	11
735.40	2.50	2.10			21.9	31.4	***202.4***				202	0	0	111	14
732.90	2.50		11	Hard Till	7.1	70.7	***170.2***				170	0	0	94	16
730.40	2.50	2.10			21.9	31.4	***201.0***				201	0	0	111	19
727.90	2.50	2.70			25.9	40.3	***213.5***				214	0	0	117	21
725.40	2.50	1.80			19.9	26.9	***233.4***				233	0	0	128	24
722.90	2.50	1.80			19.9	26.9	***284.2***				~~284~~	~~0~~	~~0~~	~~156~~	~~26~~
720.40	2.50		9	Hard Till	5.8	57.8	***290.0***				~~290~~	~~0~~	~~0~~	~~160~~	~~29~~
717.90	2.50		9	Hard Till	5.8	57.8	***249.9***				250	0	0	137	31
715.40	2.50	0.80			10.8	11.9	***260.7***				261	0	0	143	34
712.90	2.50	0.80			10.8	11.9	***290.9***				~~291~~	~~0~~	~~0~~	~~160~~	~~36~~
710.40	2.50	2.10			21.9	31.4	***312.8***				~~313~~	~~0~~	~~0~~	~~172~~	~~39~~
707.90	2.50	2.10			21.9	31.4	***337.7***				~~338~~	~~0~~	~~0~~	~~186~~	~~41~~
705.40	2.50	2.30			23.3	34.3	***361.0***				~~361~~	~~0~~	~~0~~	~~199~~	~~44~~
702.90	2.50	2.30			23.3	34.3	***607.0***				~~607~~	~~0~~	~~0~~	~~334~~	~~46~~
700.40	2.50		40	Hard Till	27.1	257.0	***634.0***				~~634~~	~~0~~	~~0~~	~~349~~	~~49~~
697.90	2.50		40	Hard Till	27.1	257.0	***419.0***				~~419~~	~~0~~	~~0~~	~~230~~	~~51~~
695.40	2.50	1.00			13.0	14.9	***432.0***				~~432~~	~~0~~	~~0~~	~~238~~	~~54~~
692.90	2.50	1.00			13.0	14.9	***471.8***				~~472~~	~~0~~	~~0~~	~~260~~	~~56~~
690.40	2.50	2.80			26.6	41.8	***498.4***				~~498~~	~~0~~	~~0~~	~~274~~	~~59~~
687.90	2.50	2.80			26.6	41.8	***504.1***				~~504~~	~~0~~	~~0~~	~~277~~	~~61~~
685.40	2.50	1.40			16.7	20.9	***520.9***				~~521~~	~~0~~	~~0~~	~~286~~	~~64~~
682.90	2.50	1.40			16.7	20.9	***548.1***				~~548~~	~~0~~	~~0~~	~~301~~	~~66~~
680.40	2.50	2.10			21.9	31.4	***570.0***				~~570~~	~~0~~	~~0~~	~~314~~	~~69~~
677.90	2.50	2.10			21.9	31.4	***620.6***				~~621~~	~~0~~	~~0~~	~~341~~	~~71~~
675.40	2.50		7	Fine Sand	7.1	60.0	***627.6***				~~628~~	~~0~~	~~0~~	~~345~~	~~74~~
672.90	2.50		7	Fine Sand	7.1	60.0	***600.1***				~~600~~	~~0~~	~~0~~	~~330~~	~~76~~
670.40	2.50	1.70			19.1	25.4	***619.2***				~~619~~	~~0~~	~~0~~	~~341~~	~~79~~
667.90	2.50	1.70			19.1	25.4	***786.5***				~~786~~	~~0~~	~~0~~	~~433~~	~~81~~
666.90	1.00		27	Hard Till	6.9	173.5	***793.4***				~~793~~	~~0~~	~~0~~	~~436~~	~~82~~
665.90	1.00		27	Hard Till	6.9	173.5	***800.4***				~~800~~	~~0~~	~~0~~	~~440~~	~~83~~
665.40	0.50		27	Hard Till		173.5									

Pile Bearing vs. Estimated Length



Pile Design Table for North Abutment utilizing Boring #3

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls		
44	24	4
62	34	6
81	44	9
92	51	11
112	61	16
131	72	19
141	78	21
155	85	24
167	92	31
174	96	34
193	106	36
208	114	39
224	123	41
240	132	44
Metal Shell 14"Φ w/.25" walls		
56	31	4
77	43	6
99	54	9
111	61	11
134	74	16
158	87	19
168	92	21
183	101	24
196	108	31
205	113	34
228	126	36
246	135	39
265	146	41
284	156	44
Metal Shell 14"Φ w/.312" walls		
56	31	4
77	43	6
99	54	9
111	61	11
134	74	16
158	87	19
168	92	21
183	101	24
196	108	31
205	113	34
228	126	36
246	135	39
265	146	41
284	156	44
329	181	51
339	187	54
371	204	56
391	215	59
396	218	61
409	225	64
430	237	66
448	246	69

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42		
40	22	6
58	32	9
70	38	11
74	40	14
81	44	16
96	53	19
99	55	21
108	60	24
109	60	31
114	63	34
131	72	36
141	78	39
153	84	41
164	90	44
169	93	51
175	96	54
198	109	56
209	115	61
217	119	64
231	127	66
241	132	69
242	133	71
243	134	74
249	137	76
257	142	79
284	156	81
285	157	82
286	157	83
Steel HP 10 X 57		
42	23	6
60	33	9
71	39	11
75	41	14
83	45	16
99	54	19
102	56	21
111	61	24
112	61	31
117	64	34
134	74	36
145	80	39
157	86	41
167	92	44
173	95	51
179	98	54
203	111	56
213	117	61
221	122	64
236	130	66
246	135	69
247	136	71
248	137	74

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84		
30	16	4
52	29	6
74	41	9
93	51	11
96	53	14
106	58	16
127	70	19
129	71	21
138	76	31
144	79	34
169	93	36
182	100	39
197	108	41
210	115	44
213	117	51
221	121	54
254	140	56
264	145	61
273	150	64
293	161	66
305	168	71
306	168	74
314	173	76
325	179	79
363	200	81
365	201	82
366	201	83
Steel HP 14 X 73		
33	18	4
59	32	6
85	47	9
109	60	11
113	62	14
127	70	16
152	83	21
160	88	31
167	92	34
199	110	36
213	117	39
231	127	41
246	135	44
247	136	51
255	140	54
298	164	56
306	168	61
316	174	64
341	187	66
352	194	71
354	195	74
364	200	76
376	207	79
425	234	81

471	259	76
486	267	79
Metal Shell 16"Φ w/.312" walls		
70	38	4
94	52	6
119	65	9
131	72	11
157	86	16
186	102	19
195	107	21
213	117	24
226	124	31
236	130	34
265	146	36
285	157	39
308	169	41
328	181	44
378	208	51
390	214	54
429	236	56
453	249	59
455	250	61
470	259	64
496	273	66
516	284	69
542	298	76
559	307	79
Metal Shell 16"Φ w/.375" walls		
70	38	4
94	52	6
119	65	9
131	72	11
157	86	16
186	102	19
195	107	21
213	117	24
226	124	31
236	130	34
265	146	36
285	157	39
308	169	41
328	181	44
378	208	51
390	214	54
429	236	56
453	249	59
455	250	61
470	259	64
496	273	66
516	284	69
542	298	76
559	307	79
728	401	81
734	404	82
741	407	83
Steel HP 8 X 36		
47	26	9
54	30	11
254	140	76
263	145	79
290	160	81
291	160	82
292	161	83
Steel HP 12 X 53		
48	27	6
70	38	9
89	49	11
92	50	14
102	56	16
122	67	19
124	68	21
133	73	31
139	77	34
163	90	36
175	96	39
189	104	41
202	111	44
206	113	51
213	117	54
245	135	56
254	140	61
264	145	64
282	155	66
294	162	69
294	162	71
295	163	74
303	167	76
313	172	79
350	192	81
351	193	82
352	194	83
Steel HP 12 X 63		
50	27	6
72	39	9
90	49	11
93	51	14
103	57	16
123	68	19
125	69	21
134	74	31
140	77	34
164	90	36
177	97	39
191	105	41
204	112	44
208	114	51
215	118	54
247	136	56
257	141	61
266	146	64
285	157	66
297	163	69
297	163	71
298	164	74
306	168	76
316	174	79
427	235	82
428	235	83
Steel HP 14 X 89		
34	19	4
61	33	6
87	48	9
111	61	11
115	63	14
129	71	16
154	85	21
162	89	31
169	93	34
202	111	36
216	119	39
234	129	41
249	137	44
250	137	51
258	142	54
302	166	56
309	170	61
320	176	64
345	190	66
356	196	71
358	197	74
368	203	76
381	209	79
431	237	81
432	238	82
433	238	83
Steel HP 14 X 102		
36	20	4
62	34	6
88	49	9
112	62	11
116	64	14
130	72	16
156	86	21
164	90	31
171	94	34
204	112	36
219	120	39
237	131	41
253	139	44
253	139	51
261	144	54
306	168	56
313	172	61
324	178	64
349	192	66
360	198	71
362	199	74
372	205	76
385	212	79
436	240	81
437	241	82
439	241	83
Steel HP 14 X 117		
37	20	4

58	32	14
63	35	16
75	41	19
79	43	21
86	47	24
88	48	31
92	51	34
104	57	36
112	62	39
122	67	41
130	72	44
137	75	51
142	78	54
158	87	56
168	92	59
169	93	61
175	96	64
185	102	66
194	106	69
196	108	71
197	108	74
201	110	76
208	114	79
227	125	81
228	125	82
228	126	83

353	194	81
354	195	82
356	196	83
Steel HP 12 X 74		
51	28	6
73	40	9
91	50	11
94	52	14
104	57	16
125	69	19
127	70	21
136	75	31
142	78	34
167	92	36
179	98	39
194	107	41
207	114	44
211	116	51
218	120	54
251	138	56
260	143	61
269	148	64
289	159	66
301	165	71
302	166	74
310	170	76
320	176	79
358	197	81
359	198	82
361	198	83

64	35	6
90	50	9
114	63	11
118	65	14
132	73	16
158	87	21
166	91	31
173	95	34
207	114	36
222	122	39
240	132	41
256	141	51
264	145	54
310	170	56
316	174	61
327	180	64
353	194	66
364	200	71
366	201	74
377	207	76
389	214	79
441	243	81
443	243	82
444	244	83
Precast 14"x 14"		
71	39	4
99	54	6
126	69	9
141	78	11
170	94	16
201	111	19
214	117	21
233	128	24