STRUCTURE
GEOTECHNICAL REPORT

MATTIS AVENUE OVER INTERSTATE I-57
Existing SN: 010-0100

Proposed SN: 010-1100

FAU 7158 (N. MATTIS AVE.) OVER FAI 57
Section 10 (5-1-RS-1, 14-1,6) R
Champaign County

Contract No.: 70897
P-95-030-11
PTB: 161-28

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Attachments: Boring Location Map
Preliminary TSL
Boring Profile Sheet
Subsurface Boring Logs
Pile Tables
Est. Factored Loadings

1.0 Project Description

Bacon Farmer Workman (BFW) Engineering & Testing, Inc., completed a geotechnical investigation for the replacement of an existing bridge location (SN 010-0100) (Station 24+90.58) carrying N. Mattis Avenue over I-57 in Section 10R, Township 20 North, Range 8 East of the 3rd PM in the city of Champaign, Champaign County, Illinois. This structure is slated to be replaced by proposed structure SN 010-1100. Phased construction is planned during construction

The purpose of the investigation was to explore the subsurface conditions, to determined engineering properties of the subsurface soil, and develop design and construction recommendations for the project.

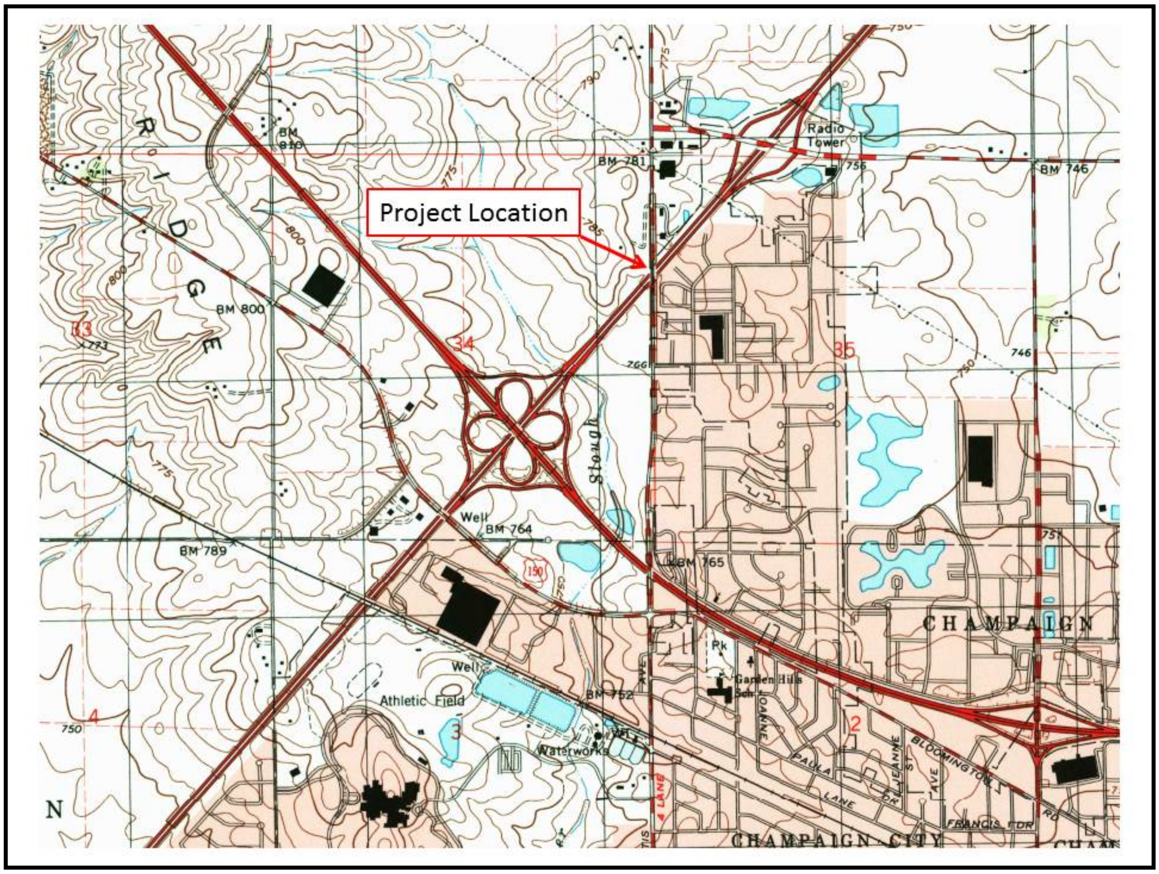


Exhibit 1: Project Location Map

2.0 Existing and Proposed Structure Information

Existing Structure (SN 010-0100)

Based on information from the Bridge Condition Report, the existing structure was constructed in 1965 as a four-span steel wide flange beam structure supported on open stub abutments on concrete piles and multi-column reinforced concrete piers. Pier 1 is supported on creosoted timber piles with Piers 2 and 3 on spread footings. Total length of the existing structure is 332'-4" back to back of abutments, with a total width of 33'-8" out to out, and a skew of 48°09'30" right.

Proposed Structure (SN 010-1100)

The proposed structure is a 360'-0" back to back of abutments, two span structure with 74" web plate steel girders supporting a composite 8" thick concrete deck. Total width from back to back of concrete barriers is 54'-6". The girders and decking will be supported by concrete abutments, which in turn will be supported with steel HP or metal shell piles.

The Type, Size and Location (TS&L) plan for the N. Mattis Avenue over Interstate I-57 bridge has been included in the Appendix.

3.0 Existing Site Conditions

N. Mattis Avenue extends north – south and crosses over I-57. The existing embankment slopes and the north and south sides of the bridge appear to be approximately 2H:1V from the pier supports to the abutments.

Exhibit 2: N. Mattis Avenue over I-57

3.1 Regional Geology

According to the Illinois State Geological Survey, "Bedrock Geology of Illinois" map, the site and surrounding area is situated in the Illinois Basin and is underlain by the Pennsylvanian-aged Tradewater Formation. The Illinois Basin is a Paleozoic depositional and structural basin centered in and underlying most of the state of Illinois. An Illinois Basin study reveals that the Tradewater Formation is composed of 70 to 80 percent shale and siltstone, 20 to 30 percent sandstone, and generally less than 5 percent coal and limestone. The Tradewater Formation is overlain by the Wedron Group, which is composed of mostly glacial till (an unsorted mixture of clay, silt, sand, and gravel) in broad ridges (last glaciation), and forms end moraines. The Wedron Group is finally capped by the Peoria and Roxana Silts, which are composed of windblown silt (loess) generally thicker than 20 feet blankets upland surfaces in these areas.

4.0 Subsurface Exploration and Generalized Subsurface Conditions

This section describes the subsurface exploration program and laboratory testing program completed as part of this Structure Geotechnical Report (SGR). The locations and subsurface data were provided by McCleary Engineering and were completed based on field conditions and accessibility. Therefore, no site observations have been made by BFW relative to existing conditions of the structure, roadway or of subsurface sample conditions. The locations of the soil borings are shown on the Boring Location Map located in the Appendix. The subsurface exploration program was performed in accordance with applicable IDOT geotechnical manuals and procedures.

4.1 Subsurface Exploration

The site subsurface exploration was conducted on January 21, and February 13, 2015 and included advancing a total of three (3) standard penetration test (SPT) borings within the vicinity of the proposed abutments and bridge pier locations. The locations of the soil borings are shown on the **Boring Location Map** provided in the Appendix.

Table 1 – Summary of Subsurface Exploration US 150

Boring ID	Location	Station	Offset	Depth (feet)	Surface Elevation (feet)
B-1	South Abutment	22+63	11.5 ft Left	75	789.97
B-2	Center Pier	24+59	30.0 ft Left	75	769.28
B-3	East Abutment	27+50	11.5 ft Right	75	790.90

The soil borings were drilled using a track mounted drill rig. All of the borings were drilled using 3¼ - inch I.D. hollow stem augers. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5 foot intervals to a minimum depth of 20 feet below existing grade and 5 foot intervals thereafter. McCleary Engineering field representative inspected, visually classified and logged the soil samples during the subsurface exploration activities, and performed unconfined compressive strength tests on cohesive soil samples using a calibrated Rimac compression tester and a calibrated hand penetrometer in accordance with IDOT procedures and requirements. Representative soil samples were collected from each sample interval, and were placed in jars and returned to the laboratory for further testing and evaluation.

4.2 Laboratory Testing

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area of the proposed bridge.

The following laboratory tests were performed on representative soil samples:

- Moisture content AASHTO T-265
- Grain Size Analysis AASHTO T-88 / AASHTO T-90
- Unconfined compression AASHTO T-208

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (1999) and per AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO classification system. The results of the laboratory testing program are included in the Appendix and are shown along with the field test results in the Soil Boring Logs also located in the appendix.

4.3 Subsurface Conditions

This section provides a brief description of the soils encountered in the borings performed in the vicinity of the proposed improvements. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the Soil Boring Logs located in the Appendix and are shown graphically in the Subsurface Profiles. The soil boring logs provide specific soil conditions encountered at each soil boring location. The soil boring logs include soil descriptions, stratifications, penetration resistance, elevations, location of the samples and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring locations, and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

Subsurface information was obtained during a geotechnical investigation conducted over the entire proposed I-57 / I-74 interchange modifications. Borings B-1, B-2, and B-3 (N. Mattis Avenue) were advanced in support of Proposed Structure 010-1100 on January 21 and February 13, 2015 along the existing N. Mattis Avenue.

Bridge Abutments

Boring **B-1**, advanced near the proposed south abutment, was located at Station 22+63 (Elev. 789.97'). The borings were advanced in a relatively flat area, with approximately 12 inches of topsoil and HMA/aggregate base, depending upon boring location, overlying the soil at each point. The soil profile underlying the surface cover in Boring **B-1** is described as a fill material composed of a medium to very stiff brownish gray silty clay which extends to approximately 23 feet deep (Elev. 766.97'), where the material transitions to a stiff black silty clay. This clay continues with depth, transitioning to a medium gray silty clay with sand seams, until 34.5 feet deep (Elev. 755.64') where the soil changes to a stiff gray silty clay till, wet. This till material continues with depth to 64 feet deep (Elev. 726.22') where the soil changes to a gray coarse, medium dense wet sand layer is encountered, that stretches to 68.5 feet deep (Elev. 721.47') where the soil transitions back to a gray very stiff sandy silty clay that continues to boring completion depth of 75 feet deep (Elev. 714.97').

Soil boring **B-3**, advanced near the proposed north abutment was located at Station 27+50 (Elev. 790.90). The upper portion of the boring was comprised of 5-inches of HMA over 7-inch of aggregate base. Underlying the surface cover, a fill soil composed of grayish brown silty clay, extending down to 18 feet deep (Elev. 772.90'), where the soil changes to a natural black/gray medium to soft silty clay. The black/gray silty clay extended to approximately 27 feet deep (Elev. 763.90'), where the soil changes to a brown to gray, stiff to very stiff, silty clay till. This till continues to boring completion depth of 75 feet deep (Elev. 715.90).

Center Pier

Boring **B-2**, was advanced near the proposed pier location located at Station 24+59 (Elev. 769.28'). Underlying a topsoil layer is a moist stiff brown silty clay was encountered. By approximately 11 feet deep (Elev. 758.28'), the material changed to a very stiff gray silty clay till with trace gravel. From 16 to 18.5 feet deep (Elev. 753.28' – 750.78') a gray medium dense moist clayey sand was identified. The gray silty clay till continued to boring completion depth of 75 feet deep (Elev. 694.28').

4.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed.

Groundwater was identified in each boring as follows:

Table 2 – Groundwater Elevations

Boring	Groundwater Elevation (At time of drilling)	Groundwater Elevation (24-hours)
B-1 (South Abut)	755.6	N/A
B-2 (Center Pier)	Dry	N/A
B-3 (North Abut)	Dry	N/A

No 24-hour groundwater readings were noted. No streambed elevations or surface water elevations were noted.

Water level readings were made in the boreholes at times and under conditions shown on the boring logs and stated in the text of this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported.

5.0 Geotechnical Evaluations

The section provides geotechnical analysis and recommendations for the design of the proposed bridge based on the results of the field exploration, laboratory testing, and geotechnical analysis.

5.1 Derivation of Soil Parameters for Design

Unit weights, friction angles and shear strength parameters were estimated using corrected standard penetration test (SPT) using published correlations for N values results. The SPT values were corrected for hammer efficiency. The hammer efficiency correction factor considers the use of a safety hammer/rope/cat-head system, generally estimated to be 60% efficient. Thus, correlations should be based upon what is currently termed as N60 data. The efficiency of the automatic hammer used for this exploration was estimated to be approximately 80%.

The correction for hammer efficiency is a direct ratio of relative efficiencies as follows:

$$N60 = N^* (80/60)$$

*Where the N value is the field recorded blow counts.

Table 3 - presents generalized soil parameters to be used based for designs on the laboratory and in-situ testing data:

Table 3 – Summary of Soil Parameters

Approximate Depth / Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle Φ (degrees)	Cohesion c (psf)	Friction Angle Φ (degrees)
766' to surface	Existing Clay Fill	118	2,000	0	120	28
755 – 766	Silty Clay	120	2,000	0	125	28
726 – 755	Silty Clay Till	125	1,800	0	125	28

5.2 Settlement

The existing side and end slopes are about 2H:1V towards the north and south abutments of N. Mattis Avenue. The preliminary TS&L shows the side slopes near the proposed approaches and new endslopes at the abutment locations will remain at 2H:1V.

The new approach slabs on either end of the bridge will be supported by new engineered fill. It is anticipated that approximately 3.6 feet (at the north abutment) and 2.4 feet (at the south abutment) will be placed at the new embankment approaches. To accommodate the proposed increase in approach and abutment heights, the abutment slopes will need to be regraded. The design grading shows that the proposed abutment slope will be a 2H:1V. Based on preliminary settlement calculations, the increase in stress due to the increase in fill would produce only minor settlements in the range of less than 0.5-inch near the north and south abutments and should not adversely affect the approach pavements. Therefore the anticipated settlement of the abutments due to the regarding activities is considered to be negligible.

5.3 Slope Stability – Bridge Abutments

The proposed construction of the N. Mattis Avenue over I-57 bridge requires the abutments to be moved outward away from I-57. This new construction will result in changes to the endslopes at the new abutment locations. The proposed abutments are integral type with endslopes at 2 horizontal to 1 vertical (2H:1V). Slope stability of the bridge abutments was evaluated using a slope stability analysis software: *GSTABL7 with STEDwin.*

The proposed side slopes were analyzed based on the grading and the soils encountered during subsurface exploration. Three analyses were evaluated using the Bishop and Janbu analyses methods for the proposed slope geometry: end-of-construction (short term - undrained), long-term (drained) and a design seismic event. The analyses were performed using the soil parameters in Table 3 above. A critical factor of safety (FOS) was calculated for each condition. According to the current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability and 1.0 for the design seismic event.

In an effort to model the end-of-construction conditions, full cohesion was used with a friction angle of 0 degrees assumed. Nominal values for cohesion were used with full friction angle to model the long-term and seismic conditions to analyze the condition where pore water pressure has dissipated. The results of the analysis are shown on the following page in Table 4.

Based on the analysis performed, the proposed slopes meet the minimum required factor of safety of 1.5 (end-of-construction, long-term) and 1.0 (seismic).

Table 4 – Stability Analysis Results – Bridge Abutments

Boring Location	Slope	Calculated Critical FOS		
		End-of-Construction	Long Term	Seismic
B-1,South Abut	2H:1V	2.2	1.7	1.5
B-3, North Abut	2H:1V	2.0	1.8	1.5

5.4 Seismic Parameters

The seismic hazard for the site was analyzed per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRDF Bride Design Specifications. The Seismic Soil Site Class was determined per the requirements of All Geotechnical Manual Users (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the "Seismic Site class Determination" Excel spreadsheet provided by IDOT.

The proposed bridge has a total length less than 750 feet, with no single span longer than 200 feet, therefore, a global Site Class Definition was determined for this project Based on the seismic hazard maps the following coefficients should be used in design:

$\mathbf{S_s}$=0.145 g, $\mathbf{F_a}$=1.60; therefore Design Spectral Accelerations at 0.2 sec, ($\mathbf{S_{Ds}}$)=0.234g
$\mathbf{S_1}$=0.056 g, $\mathbf{F_v}$=2.40; therefore Design Spectral Accelerations at 1.0 sec, ($\mathbf{S_{D1}}$)=0.135g

According to Table 3.10.3.1-1 (Site Class Definitions) of the 2008 AASHTO LRFD Manual, the project site soil profile is most accurately described as the AASHTO Soil Site Class D.

According to Table 3.10.6-1 (Seismic Zones) of the 2008 AASHTO LRFD Manual, the Seismic Performance Zone is most accurately described as (SPZ)=1 ($F_vS_1 \leq 0.15$)

Liquefaction analysis was conducted using Design Guide AGMU Memo 10.1 – Liquefaction Analysis. As noted in the previous paragraph the Seismic Performance Zone (SPZ) is SPZ – 1 and the Peak Ground Acceleration (PGA) modified by the zero-period site factor, F_{pga} is less than 0.15. Therefore, no liquefaction of soil layers are anticipated to occur.

Table 5 – Seismic Coefficients Summary Table

Seismic Performance Zone (SPZ)	1
Design Spectral Acceleration at 0.2 sec. (S_{DS})	0.234 g
Design Spectral Acceleration at 1.0 sec. (S_{D1})	0.135 g
Soil Site Class	D

5.5 Scour

The proposed bridge structure carrying N. Mattis Avenue crosses over Interstate I-57 and no waterways are in the vicinity of the proposed project; therefore scour will not be a concern for this project.

5.6 Mining Activity

Based on a review of the Illinois State Geological Survey's on-line collection of County Coal Maps and Directories, the proposed structure is not located over a mine or mined out area.

5.7 Liquefaction

Based on the AGMU Memo 10.1 – Liquefaction Analysis Seismic Performance Zones 3 and 4 required liquefaction analysis, as well as, SPZ 2 with a Peak Seismic Ground Surface Acceleration, As equal to or greater than 0.15. The subject site is in SPZ 1 with a less than 0.15. Therefore liquefaction was not considered as a reduction for the pile design capacity or other foundation considerations included herein.

5.8 Approach Slabs

Based on information from the structural engineer, the approach slabs are 30 feet in length and are precast. In accordance with the IDOT Bridge Manual, BFW evaluated the foundation soils at the approach slabs for bearing capacity and excessive settlement. With proper compaction of the approach subgrades, the bearing capacity and settlement requirements of the IDOT Bridge manual will be satisfied.

6.0 Foundation Type Evaluation and Design Recommendations

6.1 Foundation Type Feasibility

According to the existing plans, the existing abutment foundations consisted of prestressed concrete piles with the individual pier foundations supported by shallow spread foundations.

The initially proposed abutment type for this structure is integral. According to the Bridge manual, Section 3.8.3 on Integral Abutments: metal shell or HP-piles are permitted based on the overall length of the bridge. However, the All Bridge Designers Memorandum (7/25/2012) Integral Abutment Bridge Policies and Details, states on Page 6, Assumption #11 that, "End Spans and simple spans exceeding 150 feet shall only utilize HP piles of HP 12 x 84 size and larger. Therefore, the use of metal shell piles would be excluded for use with the choice of integral abutments.

However, it is highly recommended that the use of semi-integral abutments be considered for multiple reasons including: 1) metal shell piles can be used with the proposed span length, 2) friction H-piles are notorious for being the most difficult pile to accurately estimate the length at which bearing will be obtained during construction, 3) the estimated H-pile lengths provided within the SGR extend beyond the depths of the borings which make the pile length estimates more subject to error, 4) the borings were terminated per department policy, however; no indication of either a hard layer, which either crush a shell pile or adequate end bearing layer(such as hard pan or bedrock that would stop an H-pile was encountered, 5) H-piles are highly subject to being driven substantially longer than the estimated pile length. When this occurs in the field the equipment and crew are on hold until additional piling can be located, shipped and spliced, typically resulting in project delays and extra costs for all the splices, extra pile and working days. 6) In addition, metal shell piles are IDOT Foundation and Geotechnical Unit's preferred foundation choice for the abutments because the pile lengths will be substantially shorter in comparison to HP-piles.

The Modified IDOT Static Method of Estimating Pile Length Excel spreadsheet was used to estimate the pile lengths at various axial geotechnical resistances for driven piles per AGMU Memo 10.2. Tables 7, 8 and 9 summarize the estimated pile lengths at various axial resistances for HP-piles, sizes HP 12 x 84 and larger (per ABD Memo 7/25/12) and for metal shell piles for each substructure.

A spread footing was considered for support at the proposed pier location, since the existing pier is currently supported on shallow foundations. The structural engineer has provided a preliminary pier load of 5,947 kips. Based on preliminary settlement calculations, due to the increased individual pier load and subsurface conditions anticipated settlements would preclude the use of shallow foundations at the pier. A pile supported pier is recommended in this location. Driven metal shell piles or HP piles are feasible in this location. However, as stated previously, metal shell piles are the IDOT Foundation and Geotechnical Unit's preferred foundation choice for the abutments because the pile lengths will be substantially shorter in comparison to HP-piles.

6.2 Driven Pile Supported Foundations

Piles considered for this site include HP-piles and metal shell piles. Metal shell piles are not feasible for the integral abutments based on All Bridge Designers Memorandum (7/25/2012) Integral Abutment Bridge Policies and Details. However, as stated previously, it is highly recommended that **semi-integral** abutments be considered which will allow the use of metal shell piles. Metal shell piles were considered feasible for the pile supported center pier.

The Modified IDOT static method Excel spreadsheet was used to estimate the pile lengths at various axial geotechnical resistances for driven piles per AGMU Memo 10.2. Tables 7, 8 and 9 summarize the estimated pile lengths at various axial resistances for HP-piles various sizes HP 12 x 84 and larger and for metal shell piles for each substructure. The complete IDOT Pile Design Tables for each substructure are included in the Appendix.

The factored resistance includes reduction for the geotechnical resistance of 0.55 for the pile installation. Based on the results of the subsurface investigation no geotechnical losses due to down drag or liquefaction were included in the axial pile capacity calculations. The anticipated factored structural loadings were obtained from the structural engineer and are provided in the following table:

Table 6 – Structural Loadings

STRENGTH I Loads, Fy (kips):

	# of Lanes Loaded				STRENGTH I (max)
	1	2	3	4	
*MPF, m	1.20	1.00	0.85	0.65	
S. Abut.	1986.8	2180.2	2313.2		2313
Pier 1	5251.6	5663.8	5947.1		5947
N. Abut.	1949.7	2142.0	2274.1		2274

*** Multiple Presence Factor (LRFD Table 3.6.1.1.2-1)**

The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving as well as assists the contractor in selecting a proper hammer size. The Factored Resistance Available (RF) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loads.

The pile cutoff elevations used for analysis were Elev. 785.29 and Elev. 783.53 for the North and South abutments, respectively which includes a 2 feet embedment into the abutment as required by the Bridge Manual. A pile cutoff elevation of Elev. 759.9 for the pile supported center pier was used for analysis which includes a 1 feet embedment into the pier foundation as required by the Bridge Manual. Pile shoes for the metal shell and HP piles should not be required due to the subsurface conditions and the absence of bedrock

Due to the relative consistency between the soil test borings, only one test pile should be required for abutments and one for the center pier. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to further evaluate pile driving requirements for the project. This is also the time in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

6.3 Shallow Foundations

Based on the soils encountered, the new span lengths and the higher anticipated loads, shallow foundations are not a feasible option for the proposed substructures of the bridge. It is anticipated that shallow foundations designed for the loads provided will undergo settlement and therefore will not be a feasible option and are not discussed in the report.

Design Capacity Limitations

There are no downdrag, liquefaction, scour, or settlement issues at this structure that would result in the loss of capacity of the piling. Therefore, no design capacity limitations are necessary.

6.4 Lateral Load Resistance

Lateral loadings applied to pile foundations are typically resisted by battering selected piles, the soil/structure interaction, pile flexure, or a combination of these factors. Based on information provided by the structural engineer the lateral loads were anticipated to be greater than 3 kips.

Pile Capacity Tables (Tables 7 & 8)
(Abutments)

Table 7 – North Abutment

Piling Driven at North Abutment (B-5 data)		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft)
Metal Shell 12" Φ w/0.25 walls		
295	162	58
303	167	60
312	172	63
326	179	65
353*	194*	68*
Metal Shell 14" Φ w/0.25" walls		
345	191	58
355	196	60
366	201	63
383	211	65
413*	227*	68*
Metal Shell 14" Φ w/0.312 walls		
398	219	68
424	233	70
444	244	73
470	258	75
513*	282*	77*
HP 12 x 84		
368	202	77
432	238	87
496	273	97
560	308	107
664*	365*	122*
HP 14 x 73		
389	214	73
415	228	75
429	236	77
503	277	87
578*	318*	97*
HP 14 x 89		
420	231	75
435	239	77
509	280	87
583	321	97
705*	387*	107*

Table 8 – South Abutment

Piling Driven at South Abutment (B-6 data)		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft)
Metal Shell 12" Φ w/0.25 walls		
256	141	39
267	147	42
278	153	44
391	160	47
353*	194*	49*
Metal Shell 14" Φ w/0.25" walls		
301	166	39
314	172	42
326	179	44
343	188	47
413*	227*	71*
Metal Shell 14" Φ w/0.312 walls		
504	277	54
407	224	57
424	233	59
432	238	62
513*	282*	64*
HP 12 x 84		
387	213	79
447	246	89
506	278	99
565	311	109
664*	365*	119*
HP 14 x 73		
357	197	64
379	208	72
390	215	74
451	248	79
578*	318*	89*
HP 14 x 89		
395	217	74
456	251	79
525	289	89
594	327	99
705*	387*	109*

*- Maximum Nominal Required Bearing

Pile Capacity Table (Tables 9)

Center Pier

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft)
Metal Shell 12" Φ w/0.25 walls		
266	146	36
297	163	38
320	176	41
328	181	43
353*	194*	46*
Metal Shell 14" Φ w/0.25" walls		
314	172	36
353	194	38
380	209	41
387	213	43
413*	227*	46*
Metal Shell 14" Φ w/0.312 walls		
433	238	51
448	246	53
463	255	56
487	268	58
513*	282*	61*
HP 12 x 84		
419	213	76
473	260	86
528	290	96
582	320	106
664	365	116*
HP 14 x 73		
394	217	61
407	224	63
424	233	66
486	268	76
578*	318*	86*
HP 14 x 89		
429	236	66
492	271	76
555	305	86
618	340	96
705*	387*	106*

*- Maximum Nominal Required Bearing

Section 3.10.1.10 of the 2012 IDOT Bridge manual requires performing detailed structure interaction analysis if the factored lateral loading per pile exceeds 3 kips. The analysis shall determine actual pile moment and deflection to determine the selected pile adequacy for the existing loadings. Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program, or other approved software, can be used for the lateral or displacement analysis of the foundations. Table 10 is included for the structural engineer's use in determining lateral pile response. The values were estimated based on the descriptions listed on the boring logs, SPT and laboratory data.

Table 10 - Soil Parameters for Static Lateral Load Analysis

Soil Type	Angle of Internal Friction (degrees)	Undrained Shear Strength (psf)	Static Soil Modulus, k (pci)	Soil Strain Parameter E50	Effective Unit Weight (pcf)	Moist Unit Weight (pcf)
Silty Clay Fill	26	1500	300	0.010	52.6	115
Silty Clay Till	28	1800	500	0.005	62.6	125

6.5 Wingwall Foundation Recommendations

Based on information provided by the structural engineer and the preliminary TS&L the wing walls for the integral abutment will be cantilever in design and will not rely on soil bearing.

7.0 Construction Considerations

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (2012) and the Supplemental Specifications and Recurring Special Provisions (2015). Any deviation from the requirements in the manuals above should be approved by the design engineer.

7.1 Site Preparation

Based on the design drawings, the demolition includes the removal of the existing bridge superstructure, abutments and piers. The existing below grade foundations for the piers may be abandoned in place provided they do not interfere with the proposed new roadway construction or new pier foundations. It is anticipated that the existing abutments will be completely removed; the piles for the abutments may be abandoned in place provided the tops of the piles are cut off to a minimum depth of 4 feet below the proposed new slope grades. The resulting excavation should be backfilled with structural fill consisting of crushed aggregate meeting IDOT CA-6 gradation requirements to the final finished grade.

All existing backfill materials around the old foundations should be removed where it will interfere with new construction.

The proposed bridge and approach slabs are wider than the existing structure therefore additional site preparation will be necessary on either end of the bridge. For the proposed approach slabs and transitions slabs on either end of the bridge, site preparation should include the removal of existing pavements, curbs, foundations and landscaping as necessary. All vegetation, surface topsoil, pavements and debris should be cleared and removed. The exposed subgrade should then be field inspected to determine if undercuts are required. Any undercut areas may be backfilled with structural fill consisting of crushed aggregate meeting IDOT CA-6 gradation requirements to the final proposed foundation bearing elevation.

7.2 Site Excavation

The contractor will be responsible to provide a safe excavation during the construction activities of the project. All excavation should be conducted in accordance with applicable federal, state, and local safety regulation, including, but not limited to the Occupational Safety and Health Administration (OSHA) excavation safety standards. Excavation stability and soil pressures on temporary shoring are dependent on soil conditions, depths of excavation, installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures. Excavation should not extend below the level of adjacent existing foundations or utilities unless underpinning or other support is installed. It is the responsibility of the contractor for field determinations of applicable conditions and providing adequate shoring for all excavation activities.

7.3 Groundwater Management

Based on the depth of groundwater observed in the borings, significant groundwater management is not anticipated for bridge construction. The contactor should control groundwater and surface water infiltration to provide construction in dry condition. Temporary ditches, sumps, granular drainage blankets, stone ditch protection, or hand-laid riprap with geotextile underlayment could be used to divert groundwater if significant seepage is encountered during construction. If water seepage occurs during footing or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation.

The CA-7 stone should be placed to 12 inches about the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footing should be backfilled using approved structural fill.

7.4 Temporary Sheeting and Soil Retention

The preliminary TS&L plans indicate that the construction of the proposed bridge will require complete removal of the existing structure and abutments. Based on information provided by the structural engineer, the construction for the proposed structure will be phased maintaining one lane of traffic.

Temporary Sheeting and Soil Retention

In evaluating the use of temporary cantilever sheet piling, a maximum of about 10 feet of retaining height above an excavation line at Elev. 781.8' at the north abutment and at Elev. 781.3' at the south abutment was calculated. Embedment depths of approximately 8.0 feet and 7.5 feet for the north and south abutments, respectively were determined from the Design chart. Based on the subsurface soils encountered and on preliminary calculations for the depth of embedment as per IDOT Bridge Manual using the "Design Guide and Charts for Temporary Cantilever Sheet Piling" simple cantilever sheeting piles are feasible to be used for both the east and west abutments.

For the center pier location, the existing center pier footing will need to be removed. The proposed center pier would need to bear a minimum elevation of the existing pier at 758.90. Due to the depth of the existing pier and the proximity of the existing roadways, temporary soil retention system will be required due to the height restrictions for temporary sheet piling instillation.

8.0 Limitations

This report has been prepared for the exclusive use of the Illinois Department of Transportation and its structural consultant. The recommendations provided in the repot are specific to the project described herein, and are based on the information obtained from the soil boring locations within the project limits. The analysis have been performed and the recommendations have been provided in this report are based on subsurface conditions determined at the location of the borings. The report may not reflect all variations that may occur between boring locations or at some other time, the nature and extend of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations provided herein in light of the new conditions.

Appendix A

Soil Boring Location Map

Boring Number	Location	Station	Offset	Elevation	Latitude	Longitude
B-1 (Mattis Ave I-57)	South Abut Mattis Ave over I-57	22+63	11.5 LT	789.97	40.15149	-88.277065
B-2 (Mattis Ave I-57)	N. Mat. Ave. Pier Boring Overpass I-57	24+59	30 LT	769.28	40.152069	-88.277124
B-3 (Mattis Ave I-57)	North Abut Mattis Ave over I-57	27+50	11.5 RT	790.9	40.152731	-88.27702

FILE NAME = $FILEL$ $MODELNAME$	USER NAME = $USER$ PLOT SCALE = $SCALE$ PLOT DATE = $DATE$	DESIGNED - DRAWN - CHECKED - DATE -	REVISED - REVISED - REVISED - REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

MATTIS AVENUE
(I-57/I-74 INTERCHANGE)

SCALE: SHEET OF SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57/74	10(5-1-RS, 14-1 ,6)R	CHAMPAIGN		

CONTRACT NO. 70897

ILLINOIS FED. AID PROJECT

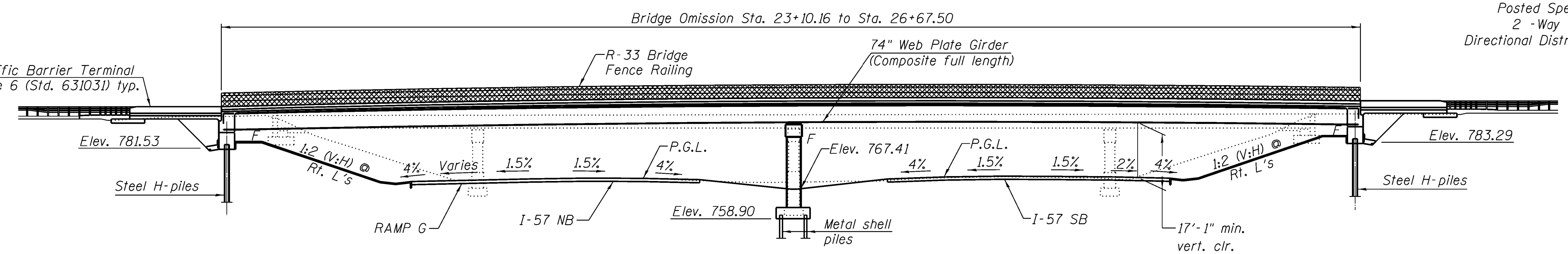
Appendix B

Preliminary TSL

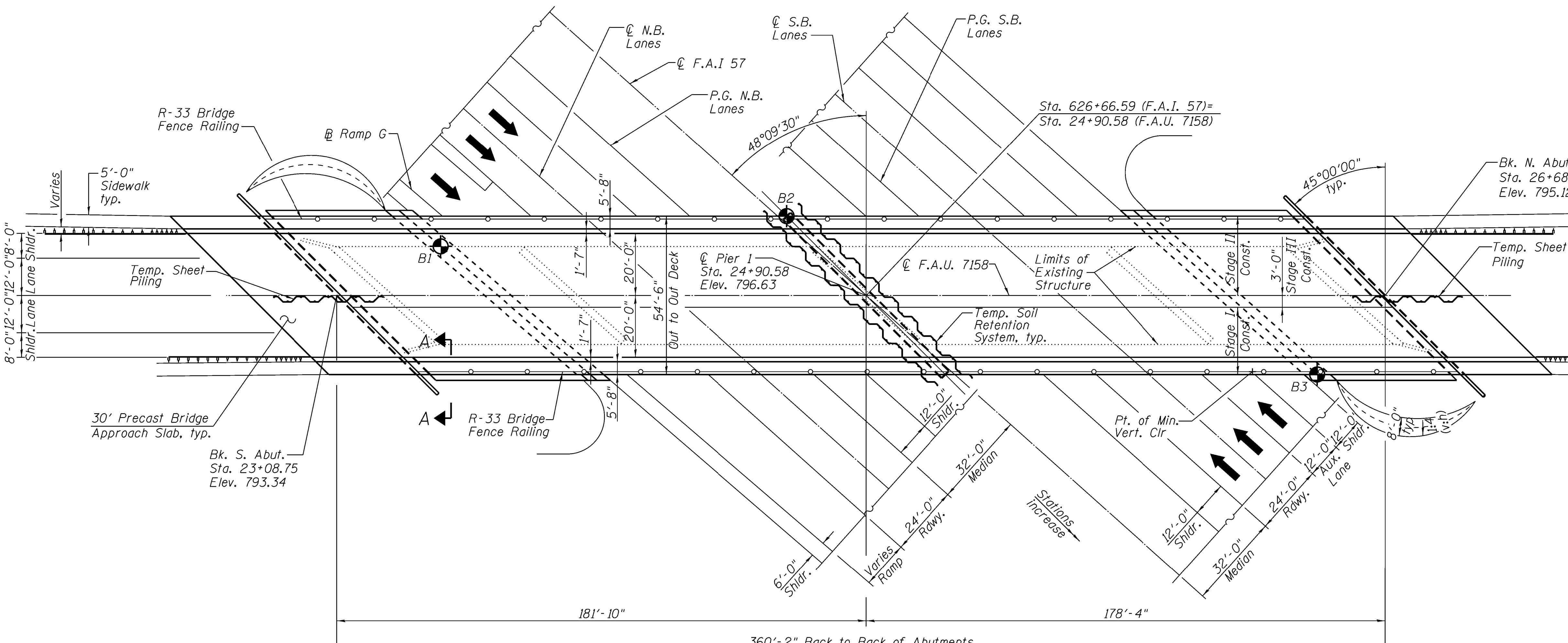
Bench Mark: Chisled "□" on crash wall at the east end of Pier 1 of SN 010-0100. Elev. 772.23.

Existing Structure: S.N. 010-0100 built 1965 as F.A.U. 7158 (Mattis Ave.), Section 10-34HB-3 at Station 24+90.58.
The existing structure consists of a four span steel wide flange beam bridge supported by open stub abutments on concrete piles and multi-column reinforced concrete piers. 332'-4" back-to-back abutments. 33'-8" out-to-out deck.
Structure to be removed and replaced using stage construction.

No Salvage



ELEVATION



PLAN

HIGHWAY CLASSIFICATION

F.A.U. 7158 - Mattis Avenue	F.A.I. 57
Functional Class: Minor Arterial	Functional Class: Interstate
ADT: 5,800 (2013); 6,700 (2040)	ADT: 22,200 (2013); 33,400 (2040)
ADTT: 476 (2013); 550 (2040)	ADTT: 5,775 (2013); 9,420 (2040)
DHV: 701 (2040)	DHV: 2,250 (2040)
Design Speed: 45 m.p.h.	Design Speed: 75 m.p.h.
Posted Speed: 45 m.p.h.	Posted Speed: 70 m.p.h.
2 -Way Traffic	2-Way Traffic
Directional Distribution: 50:50	Directional Distribution: 50:50

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (superstructure concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

LOADING HL-93

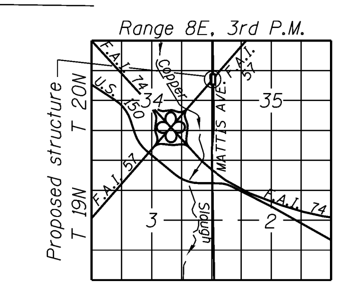
Allow 50#/sq. ft. for future wearing surface.

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.234 g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.135 g
Soil Site Class = D

DESIGN SPECIFICATIONS

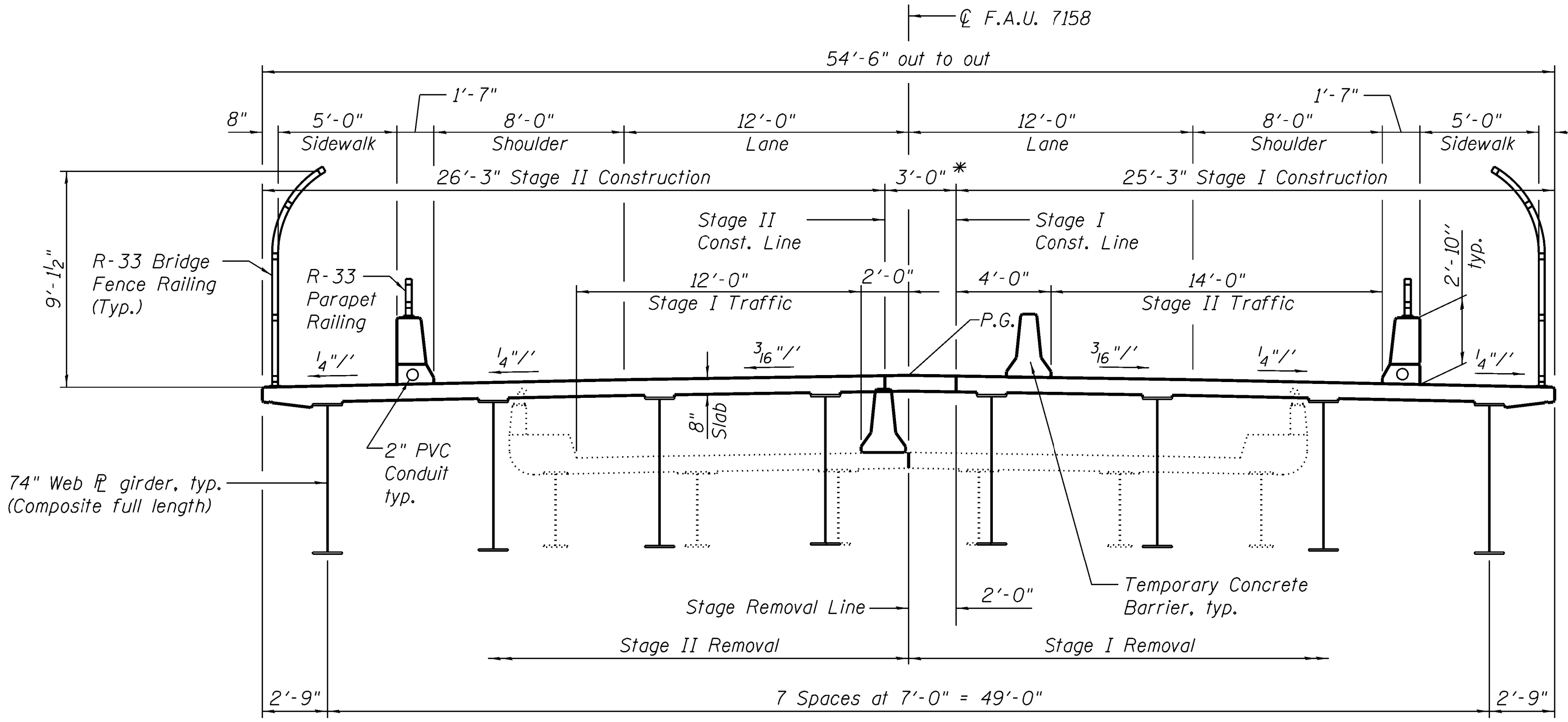
2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 Interims.



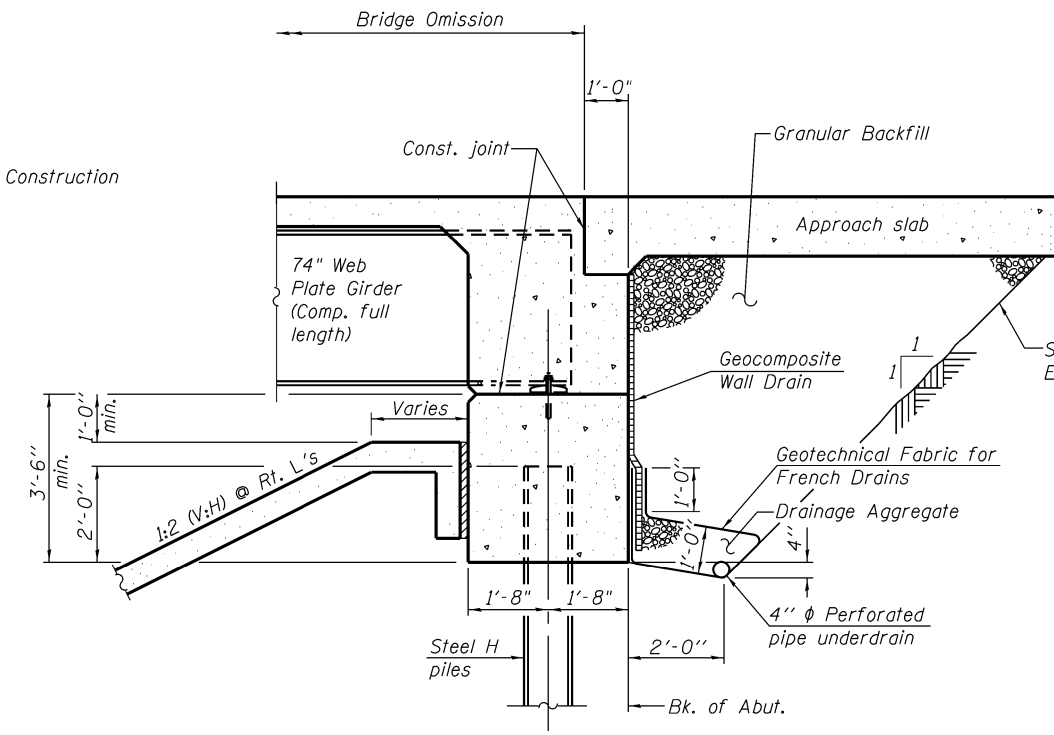
LOCATION SKETCH

GENERAL PLAN & ELEVATION
MATTIS AVE. OVER F.A.I. 57
F.A.U. 7158-SECTION 10(5-1-RS-1,14-1,6)R
CHAMPAIGN COUNTY
STATION 24+90.58
STRUCTURE NO. 010-1100

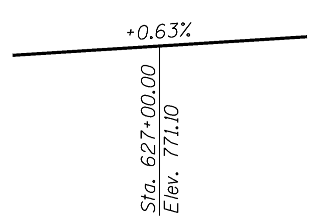
FILE NAME = D570897-TSL_Mattis over I57.dgn	USER NAME =	DESIGNED - BWP	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION		F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
BFW BACON | FARMER | WORKMAN ENGINEERING & TESTING, INC. 403 NORTH COURT STREET MARION, ILLINOIS 62959 PHONE: 618.997.3190		CHECKED - RSB	REVISED -			7158	10-34HB-3	CHAMPAIGN		
	PLOT SCALE =	DRAWN - BJV	REVISED -					CONTRACT NO. 70897		
	PLOT DATE = 5/4/2015	CHECKED - RSB	REVISED -		SHEET NO. 1 OF 2 SHEETS	ILLINOIS FED. AID PROJECT				



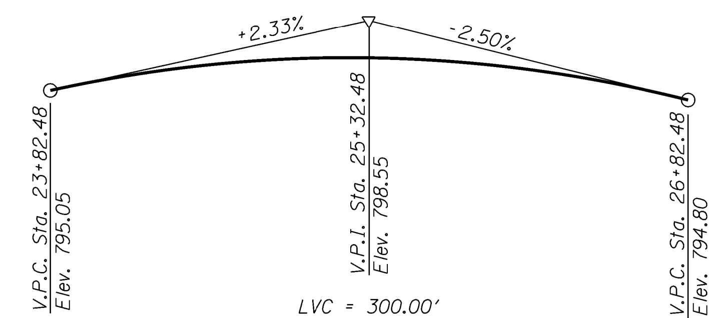
CROSS SECTION
(Looking North)



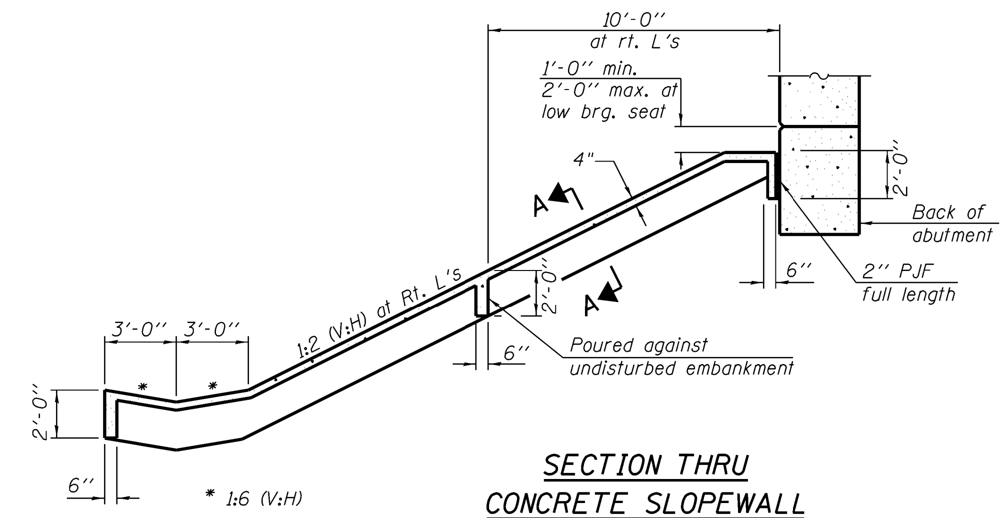
SECTION THRU INTEGRAL ABUTMENT
(Horizontal Dimensions @ Rt. L's)



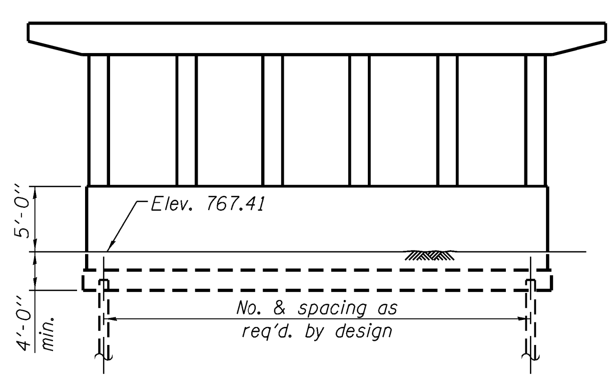
PROFILE GRADE F.A.I. 57
(along ℄ roadway)



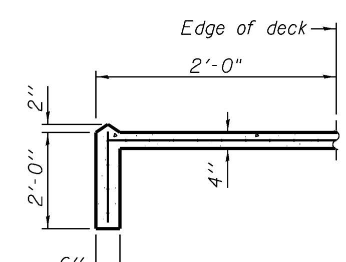
PROFILE GRADE F.A.U. 7158 (MATTIS AVE.)
(along ℄ roadway)



SECTION THRU CONCRETE SLOPEWALL



PIER SKETCH



SECTION A-A

STAGING & DETAILS
MATTIS AVE. OVER F.A.I. 57
F.A.U. 7158-SECTION 10(5-1-RS-1,14-1,6)R
CHAMPAIGN COUNTY
STATION 24+90.58
STRUCTURE NO. 010-1100

FILE NAME = D570897-TSL_Mattis over I57.dgn	USER NAME =	DESIGNED - BWP	REVISED -
BACON | FARMER | WORKMAN ENGINEERING & TESTING, INC. 403 NORTH COURT STREET MARION, ILLINOIS 62959 PHONE: 618.997.3190		CHECKED - RSB	REVISED -
	PLOT SCALE =	DRAWN - BJV	REVISED -
	PLOT DATE = 5/4/2015	CHECKED - RSB	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
7158	10-34HB-3	CHAMPAIGN		
		CONTRACT NO. 70897		
		ILLINOIS FED. AID PROJECT		

Appendix C

Soil Boring Profile Sheet

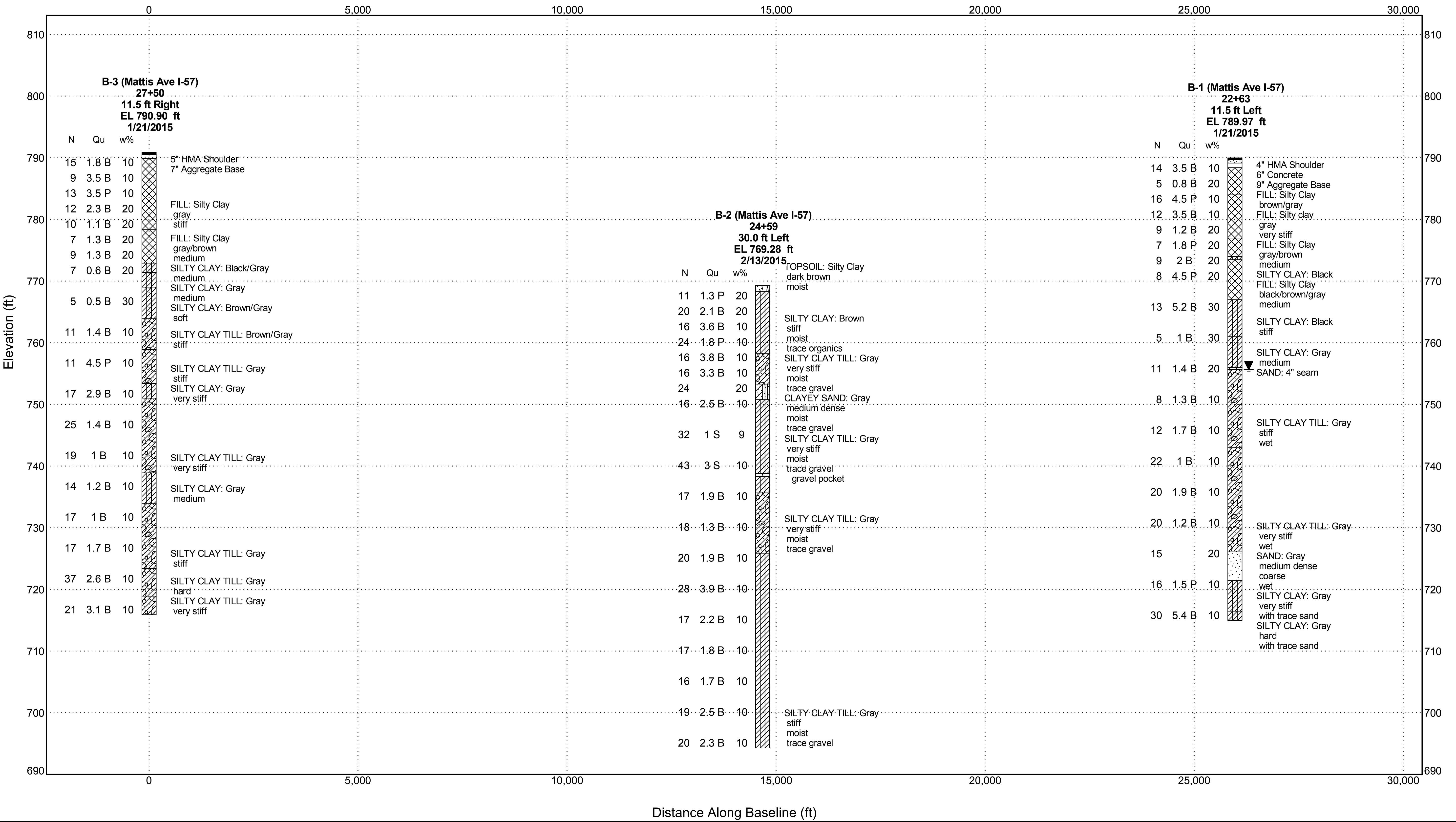
Illinois Department of Transportation
Division of Highways
BFW Engineering & Testing Inc.

ROUTE I-57/74
SECTION 10(5-1-RS-1, 14-1,6)R
COUNTY Champaign
PROJECT LOCATION

SUBSURFACE PROFILE SN 010-0100

LEGEND
EL = Elevation (ft)
D = Depth Below Existing Ground Surface (ft)
N = SPT N-Value (AASHTO T206)
Qu = Unconfined compressive Strength (tsf)
Failure Mode (B= Bulge, S= shear, P= penetrometer)
w% = Moisture Content Percentage

WATER TABLE LEGEND
▼ = First Encountered
▽ = Upon Completion
▽ = After __ hours



Appendix D

Soil Boring Logs

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 1/21/15

ROUTE I-57/74 **DESCRIPTION** South Abut Mattis Ave over I-57 **LOGGED BY** MLL, TQC

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO.
Station

BORING NO. B-1 (Mattis Ave I-57)
Station 22+63
Offset 11.5ft Left
Ground Surface Elev. 789.97 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 755.6 ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
4" HMA Shoulder	789.64				
6" Concrete	789.14				
9" Aggregate Base	788.39		5		
FILL: Silty Clay, brown/gray			7	3.50	14.2
			7	B	
			4		
			2	0.82	22.6
		-5	3	B	
FILL: Silty clay, gray, very stiff	783.97		5		
			8	4.5	13.2
			8	P	
			3		
			5	3.5	10.3
		-10	7	B	
			4		
			4	1.24	16.9
			5	B	
FILL: Silty Clay, gray/brown, medium	776.97		3		
			3	1.75	18.2
		-15	4	P	
SILTY CLAY: Black	773.97		4		
FILL: Silty Clay, black/brown/gray, medium	773.47		4	1.98	18.0
			5	B	
			3		
			4	4.5	18.7
		-20	4	P	
FILL: Silty Clay, black/brown/gray, medium *(continued)*					
SILTY CLAY: Black, stiff	766.97		4		
			5	5.15	25.3
		-25	8	B	
	760.97		2		
SILTY CLAY: Gray, medium			2	0.99	25.1
		-30	3	B	
	755.97		3		
SAND: 4" seam	755.64		5	1.40	19.5
SILTY CLAY TILL: Gray, stiff, wet		-35	6	B	
			2		
			3	1.32	13.5
		-40	5	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 1/21/15

ROUTE I-57/74 **DESCRIPTION** South Abut Mattis Ave over I-57 **LOGGED BY** MLL, TQC

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO.
Station

BORING NO. B-1 (Mattis Ave I-57)
Station 22+63
Offset 11.5ft Left
Ground Surface Elev. 789.97 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 755.6 ft
Upon Completion ft
After Hrs. ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, stiff, wet *(continued)*			2 5 7	1.65 B	13.3
		-45			
SILTY CLAY TILL: Gray, very stiff, wet	742.97		6 10 12	0.99 B	13.6
		-50	5 9 11	1.90 B	11.6
		-55	4 8 12	1.24 B	11.4
		-60			
SILTY CLAY TILL: Gray, very stiff, wet *(continued)*					
SAND: Gray, medium dense, coarse, wet	726.22		4 6 9		18.2
		-65			
SILTY CLAY: Gray, very stiff, with trace sand	721.47		5 7 9	1.5 P	11.3
		-70			
SILTY CLAY: Gray, hard, with trace sand	716.47		5 12 18	5.36 B	13.8
End of Boring	714.97	-75			
		-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name P:\GINT\PROJECTS\I 57 74 CHAMPAIGN COUNTY.GPJ Data Template D6TEMPLT.GDT Date Printed 3/2/15
Latitude Longitude Datum Job Number MCE-14044

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 2/13/15

ROUTE I-57/74 **DESCRIPTION** N. Mat. Ave. Pier Boring Overpass I-57 **LOGGED BY** GW

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO.
Station

BORING NO. B-2 (Mattis Ave I-57)
Station 24+59
Offset 30.0ft Left
Ground Surface Elev. 769.28 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
▽ **First Encounter** Dry ft
▼ **Upon Completion** Dry ft
▼ **After** Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
TOPSOIL: Silty Clay, dark brown, moist	768.28				
SILTY CLAY: Brown, stiff, moist, trace organics			3		
			5	1.25	23.0
			6	P	
			5		
			10	2.14	16.2
very stiff, trace gravel		-5	10	B	
			4		
becomes more grayish-green			7	3.63	14.1
			9	B	
			3		
			11	1.75	14.9
		-10	13	P	
	758.28				
SILTY CLAY TILL: Gray, very stiff, moist, trace gravel			4		
			7	3.79	11.4
			9	B	
			5		
			7	3.30	11.8
		-15	9	B	
	753.28				
CLAYEY SAND: Gray, medium dense, moist, trace gravel			7		
			10		16.2
			14		
	750.78				
SILTY CLAY TILL: Gray, very stiff, moist, trace gravel			4		
			7	2.47	11.2
		-20	9	B	

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, very stiff, moist, trace gravel *(continued)*					
some fine-medium grained sand, hard			8		
			16	1.0	9.4
		-25	16	S	
			9		
			11	2.99	10.6
		-30	32	S	
	738.78				
gravel pocket	738.28				
	735.78				
SILTY CLAY TILL: Gray, very stiff, moist, trace gravel			7		
			8	1.90	11.7
		-35	9	B	
			4		
			8	1.32	10.6
		-40	10	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 2/13/15

ROUTE I-57/74 **DESCRIPTION** N. Mat. Ave. Pier Boring Overpass I-57 **LOGGED BY** GW

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO.
Station

BORING NO. B-2 (Mattis Ave I-57)
Station 24+59
Offset 30.0ft Left
Ground Surface Elev. 769.28 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion Dry ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, very stiff, moist, trace gravel *(continued)*				
725.78				
SILTY CLAY TILL: Gray, stiff, moist, trace gravel		5 8 12	1.90 B	12.7
	-45			
		6 11 17	3.88 B	11.5
	-50			
trace pebbles		4 6 11	2.23 B	12.6
	-55			
		3 6 11	1.81 B	12.6
	-60			

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, stiff, moist, trace gravel *(continued)*				
		3 6 10	1.73 B	12.8
	-65			
		4 7 12	2.47 B	12.7
	-70			
		4 7 13	2.33 B	12.4
694.28	-75			
End of Boring				
	-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 1/21/15

ROUTE I-57/74 **DESCRIPTION** North Abut Mattis Ave over I-57 **LOGGED BY** MLL

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO.
Station

BORING NO. B-3 (Mattis Ave I-57)
Station 27+50
Offset 11.5ft Right
Ground Surface Elev. 790.90 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
5" HMA Shoulder	790.48				
7" Aggregate Base	789.90				
FILL: Silty Clay, gray, stiff			5		
			6	1.81	12.2
			9	B	
			3		
			4	3.50	12.4
		-5	5	B	
			5		
			6	3.50	14.2
			7	P	
			3		
			5	2.27	15.4
		-10	7	B	
			3		
			5	1.07	21.9
	778.40		5	B	
FILL: Silty Clay, gray/brown, medium					
			2		
			3	1.32	19.6
		-15	4	B	
			4		
			4	1.32	21.8
			5	B	
	772.90				
SILTY CLAY: Black/Gray, medium					
			2		
	771.40		3	0.58	21.2
SILTY CLAY: Gray, medium		-20	4	B	

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY: Gray, medium *(continued)*					
	768.90				
SILTY CLAY: Brown/Gray, soft					
			2		
			2	0.49	31.4
		-25	3	B	
	763.90				
SILTY CLAY TILL: Brown/Gray, stiff					
			3		
			5	1.40	14.3
		-30	6	B	
	758.90				
SILTY CLAY TILL: Gray, stiff					
			3		
			5	4.5	11.0
		-35	6	P	
	753.40				
SILTY CLAY: Gray, very stiff					
			4		
			6	2.89	10.4
	750.90	-40	11	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 1/21/15

ROUTE I-57/74 **DESCRIPTION** North Abut Mattis Ave over I-57 **LOGGED BY** MLL

SECTION 10(5-1-RS-1, 14-1,6)R **LOCATION** , **SEC.** 34, **TWP.** 20N, **RNG.** 8E, 3 **PM**

COUNTY Champaign **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO.
Station

BORING NO. B-3 (Mattis Ave I-57)
Station 27+50
Offset 11.5ft Right
Ground Surface Elev. 790.90 ft

Surface Water Elev. n/a ft
Stream Bed Elev. ft

Groundwater Elev.:
▽ **First Encounter** Dry ft
▼ **Upon Completion** ft
▼ **After** Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, very stiff				
		7		
		11	1.40	9.5
	-45	14	B	
		7		
		8	1.03	9.5
	-50	11	B	
738.90				
SILTY CLAY: Gray, medium				
		4		
		6	1.24	12.8
	-55	8	B	
733.90				
SILTY CLAY TILL: Gray, stiff				
		4		
		7	0.99	11.6
	-60	10	B	

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY TILL: Gray, stiff *(continued)*				
		4		
		7	1.65	12.7
	-65	10	B	
723.40				
SILTY CLAY TILL: Gray, hard				
		7		
		15	2.62	11.3
	-70	22	B	
718.90				
SILTY CLAY TILL: Gray, very stiff				
		7		
		9	3.09	12.6
715.90	-75	12	B	
End of Boring				
	-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name P:\GINT\PROJECTS\I 57 74 CHAMPAIGN COUNTY.GPJ Data Template D6TEMPLT.GDT Date Printed 3/2/15
Latitude Longitude Datum Job Number MCE-14044

Appendix D

Pile Tables (North Abutment, South Abutment, Center Pier)

Pile Design Table for North Abutment - Integral utilizing Boring #3

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	147	81	33
	185	102	35
	210	116	38
	222	122	40
	240	132	43
	246	135	45
Metal Shell 12"Φ w/.25" walls			
	147	81	33
	185	102	35
	210	116	38
	222	122	40
	240	132	43
	246	135	45
	257	141	48
	265	146	50
	274	151	53
	285	157	55
	295	162	58
	303	167	60
	312	172	63
	326	179	65
	339	186	68
Metal Shell 14"Φ w/.25" walls			
	160	88	30
	173	95	33
	223	123	35
	253	139	38
	264	145	40
	285	157	43
	289	159	45
	302	166	48
	311	171	50
	321	177	53
	334	184	55
	346	191	58
	355	196	60
	366	201	63
	383	211	65
	398	219	68
Metal Shell 14"Φ w/.312" walls			
	160	88	30
	173	95	33
	223	123	35
	253	139	38
	264	145	40
	285	157	43
	289	159	45
	302	166	48
	311	171	50

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	144	79	35
	162	89	38
	163	90	40
	174	96	45
	181	100	48
	186	102	50
	192	105	53
	200	110	55
	207	114	58
	212	116	60
	217	120	63
	230	126	65
	239	131	68
	257	141	70
	268	148	73
	285	157	75
	295	162	77
	348	191	87
	401	220	97
	453	249	107
Steel HP 12 X 53			
	128	70	33
	179	98	35
	199	109	40
	208	114	45
	217	119	48
	221	121	50
	228	125	53
	238	131	55
	247	136	58
	251	138	60
	258	142	63
	274	151	65
	285	157	68
	308	170	70
	322	177	73
	342	188	75
	355	195	77
	417	229	87
Steel HP 12 X 63			
	129	71	33
	182	100	35
	201	110	40
	210	115	45
	219	120	48
	223	123	50
	230	127	53
	240	132	55
	249	137	58

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	156	86	33
	216	119	35
	244	134	40
	250	138	45
	261	144	48
	265	146	50
	273	150	53
	286	157	55
	296	163	58
	301	165	60
	309	170	63
	330	182	65
	342	188	68
	373	205	70
	389	214	73
	415	228	75
	429	236	77
	503	277	87
	576	317	97
Steel HP 14 X 89			
	158	87	33
	220	121	35
	247	136	40
	253	139	45
	264	145	48
	268	147	50
	276	152	53
	289	159	55
	299	165	58
	304	167	60
	313	172	63
	334	184	65
	346	190	68
	378	208	70
	394	217	73
	420	231	75
	435	239	77
	509	280	87
	583	321	97
	657	362	107
Steel HP 14 X 102			
	160	88	33
	223	122	35
	251	138	40
	256	141	45
	267	147	48
	271	149	50
	280	154	53
	293	161	55

321	177	53
334	184	55
346	191	58
355	196	60
366	201	63
383	211	65
398	219	68
424	233	70
444	244	73
470	258	75
488	268	77
Steel HP 8 X 36		
158	87	55
164	90	58
168	92	60
173	95	63
182	100	65
188	104	68
202	111	70
211	116	73
223	123	75
232	127	77
274	151	87
Steel HP 10 X 42		
160	88	40
170	94	45
178	98	48
182	100	50
188	103	53
196	108	55
203	111	58
207	114	60
213	117	63
225	124	65
234	128	68
251	138	70
263	145	73
279	153	75
289	159	77

254	139	60
261	143	63
277	152	65
287	158	68
311	171	70
325	179	73
345	190	75
358	197	77
421	231	87
483	266	97
Steel HP 12 X 74		
131	72	33
185	102	35
204	112	40
213	117	45
222	122	48
226	124	50
233	128	53
244	134	55
252	139	58
257	141	60
264	145	63
281	154	65
291	160	68
315	173	70
330	181	73
350	193	75
363	200	77
426	234	87
490	269	97
553	304	107
Steel HP 12 X 84		
133	73	33
187	103	35
207	114	40
215	118	45
225	124	48
229	126	50
236	130	53
247	136	55
255	140	58
260	143	60
268	147	63
284	156	65
295	162	68
320	176	70
334	184	73
355	195	75
368	202	77
432	238	87
496	273	97
560	308	107
656	361	122

303	166	58
308	169	60
316	174	63
338	186	65
350	193	68
382	210	70
399	219	73
425	234	75
440	242	77
515	283	87
590	324	97
665	366	107
778	428	122
Steel HP 14 X 117		
150	83	30
162	89	33
226	124	35
254	140	40
259	143	45
270	149	48
274	151	50
283	155	53
296	163	55
306	168	58
311	171	60
320	176	63
342	188	65
354	195	68
387	213	70
403	222	73
430	237	75
445	245	77
521	287	87
597	328	97
673	370	107
786	432	122
900	495	137
Precast 14"x 14"		
149	82	16
165	91	18
170	94	21
176	97	25
184	101	28
204	112	30
221	121	33
Timber Pile		
139	76	33

Pile Design Table for South Abutment - Integral utilizing Boring #1

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	157	86	22
	183	101	25
	209	115	27
	224	123	32
	233	128	34
	245	135	37
Metal Shell 12"Φ w/.25" walls			
	157	86	22
	183	101	25
	209	115	27
	224	123	32
	233	128	34
	245	135	37
	256	141	39
	267	147	42
	278	153	44
	291	160	47
	304	167	49
Metal Shell 14"Φ w/.25" walls			
	145	80	20
	191	105	22
	221	121	25
	252	139	27
	263	145	32
	273	150	34
	288	158	37
	301	166	39
	314	172	42
	326	179	44
	343	188	47
	357	197	49
Metal Shell 14"Φ w/.312" walls			
	145	80	20
	191	105	22
	221	121	25
	252	139	27
	263	145	32
	273	150	34
	288	158	37
	301	166	39
	314	172	42
	326	179	44
	343	188	47
	357	197	49
	407	224	57
	424	233	59
	432	238	62
	444	244	64
Steel HP 8 X 36			

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	163	90	34
	173	95	37
	181	100	39
	188	103	42
	195	107	44
	206	113	47
	215	118	49
	232	127	57
	241	133	59
	244	134	62
	251	138	64
	265	146	72
	273	150	74
	312	171	79
	360	198	89
	409	225	99
Steel HP 12 X 53			
	146	81	22
	177	97	25
	188	103	32
	195	107	34
	207	114	37
	216	119	39
	224	123	42
	233	128	44
	246	135	47
	256	141	49
	277	152	57
	288	158	59
	290	160	62
	299	164	64
	316	174	72
	325	179	74
	373	205	79
Steel HP 12 X 63			
	150	82	22
	180	99	25
	189	104	32
	196	108	34
	209	115	37
	218	120	39
	226	124	42
	235	129	44
	248	137	47
	259	142	49
	280	154	57
	291	160	59
	293	161	62
	301	166	64

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	138	76	20
	177	98	22
	214	117	25
	225	124	32
	233	128	34
	250	137	37
	260	143	39
	270	148	42
	280	154	44
	297	163	47
	309	170	49
	334	184	57
	347	191	59
	348	191	62
	357	197	64
	379	208	72
	390	215	74
	451	248	79
	519	285	89
Steel HP 14 X 89			
	140	77	20
	181	99	22
	217	120	25
	228	125	32
	236	130	34
	253	139	37
	263	145	39
	273	150	42
	283	156	44
	300	165	47
	312	172	49
	338	186	57
	351	193	59
	352	193	62
	362	199	64
	383	211	72
	395	217	74
	456	251	79
	525	289	89
	594	327	99
	662	364	109
Steel HP 14 X 102			
	142	78	20
	183	101	22
	220	121	25
	230	127	32
	239	131	34
	256	141	37
	267	147	39

162	89	47
169	93	49
182	100	57
190	105	59
193	106	62
199	110	64
210	116	72
217	119	74
245	135	79
284	156	89

Steel HP 10 X 42

160	88	34
170	93	37
177	97	39
184	101	42
191	105	44
202	111	47
210	116	49
227	125	57
236	130	59
239	131	62
246	135	64
260	143	72
268	147	74
305	168	79

319	175	72
328	181	74
377	207	79
435	239	89
493	271	99

Steel HP 12 X 74

152	84	22
183	100	25
192	105	32
199	109	34
212	117	37
221	122	39
229	126	42
238	131	44
252	139	47
262	144	49
283	156	57
295	162	59
297	163	62
305	168	64
323	178	72
333	183	74
382	210	79
441	242	89
499	275	99
558	307	109

Steel HP 12 X 84

154	85	22
185	102	25
194	107	32
202	111	34
215	118	37
224	123	39
232	128	42
241	133	44
255	140	47
266	146	49
287	158	57

276	152	42
287	158	44
304	167	47
316	174	49
342	188	57
355	195	59
356	196	62
366	201	64
388	213	72
399	219	74
461	254	79
531	292	89
600	330	99
670	369	109
740	407	119
809	445	129

Steel HP 14 X 117

144	79	20
186	103	22
223	123	25
233	128	32
242	133	34
259	142	37
270	148	39
279	154	42
290	159	44
307	169	47
320	176	49
346	190	57
359	198	59
360	198	62
370	203	64
392	216	72
404	222	74
467	257	79
537	295	89
607	334	99
678	373	109

Pile Design Table for Center Pier - Mattis over I 57 (010-100) utilizing Boring #2

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	108	59	11
Metal Shell 12"Φ w/.25" walls			
	236	130	31
	252	139	33
	266	146	36
	297	163	38
	320	176	41
	328	181	43
	344	189	46
Metal Shell 14"Φ w/.25" walls			
	240	132	23
	256	141	26
	265	146	28
	278	153	31
	297	164	33
	314	172	36
	353	194	38
	380	209	41
	387	213	43
	405	223	46
Metal Shell 14"Φ w/.312" walls			
	240	132	23
	256	141	26
	265	146	28
	278	153	31
	297	164	33
	314	172	36
	353	194	38
	380	209	41
	387	213	43
	405	223	46
	418	230	48
	433	238	51
	448	246	53
	463	255	56
	487	268	58
	506	278	61
Steel HP 8 X 36			
	232	128	66
	267	147	76
Steel HP 10 X 42			
	240	132	56
	256	141	58
	267	147	61
	277	152	63
	288	158	66
	332	182	76

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	245	135	56
	261	144	58
	273	150	61
	282	155	63
	294	162	66
	339	186	76
	383	211	86
	428	235	96
Steel HP 12 X 53			
	243	133	43
	255	140	46
	262	144	48
	272	150	51
	282	155	53
	293	161	56
	313	172	58
	327	180	61
	338	186	63
	352	194	66
	404	222	76
Steel HP 12 X 63			
	245	135	43
	257	142	46
	264	145	48
	275	151	51
	285	157	53
	295	162	56
	316	174	58
	330	181	61
	341	188	63
	355	195	66
	408	224	76
	461	254	86
Steel HP 12 X 74			
	235	129	38
	248	137	43
	261	144	46
	268	147	48
	279	153	51
	289	159	53
	299	165	56
	321	176	58
	334	184	61
	346	190	63
	360	198	66
	414	227	76
	467	257	86
	521	286	96
	574	316	106

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	231	127	36
	282	155	38
	294	162	43
	309	170	46
	315	173	48
	328	180	51
	339	187	53
	352	194	56
	379	208	58
	394	217	61
	407	224	63
	424	233	66
	486	268	76
	549	302	86
Steel HP 14 X 89			
	234	129	36
	286	157	38
	298	164	43
	313	172	46
	319	175	48
	332	183	51
	343	189	53
	356	196	56
	383	211	58
	399	219	61
	412	227	63
	429	236	66
	492	271	76
	555	305	86
	618	340	96
	680	374	106
Steel HP 14 X 102			
	237	130	36
	290	160	38
	301	166	43
	316	174	46
	323	178	48
	336	185	51
	347	191	53
	360	198	56
	388	213	58
	404	222	61
	417	229	63
	434	239	66
	498	274	76
	561	309	86
	625	344	96
	688	378	106
	752	413	116

Steel HP 12 X 84

238	131	38
252	138	43
265	146	46
271	149	48
282	155	51
292	161	53
303	167	56
325	179	58
339	186	61
350	193	63
365	201	66
419	231	76
473	260	86
528	290	96
582	320	106
636	350	116

Steel HP 14 X 117

240	132	36
294	162	38
305	168	43
320	176	46
327	180	48
340	187	51
351	193	53
364	200	56
392	216	58
409	225	61
422	232	63
439	242	66
504	277	76
568	312	86
632	347	96
696	383	106
760	418	116
824	453	126

Precast 14"x 14"

165	91	11

Timber Pile

94	52	11