STRUCTURE GEOTECHNICAL REPORT

U.S. 150 (BLOOMINGTON RD) OVER FAI 57

Existing SN: 010-0050

Proposed SN: 010-1050

FAI RTE. 719
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

1.0 Introduction

Bacon Farmer Workman (BFW) Engineering & Testing, Inc., completed a geotechnical investigation for the replacement of an existing bridge location (SN 010-0050) (Station 157+29.99) carrying U.S. 150 (Bloomington Road) 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 010-1050. 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.

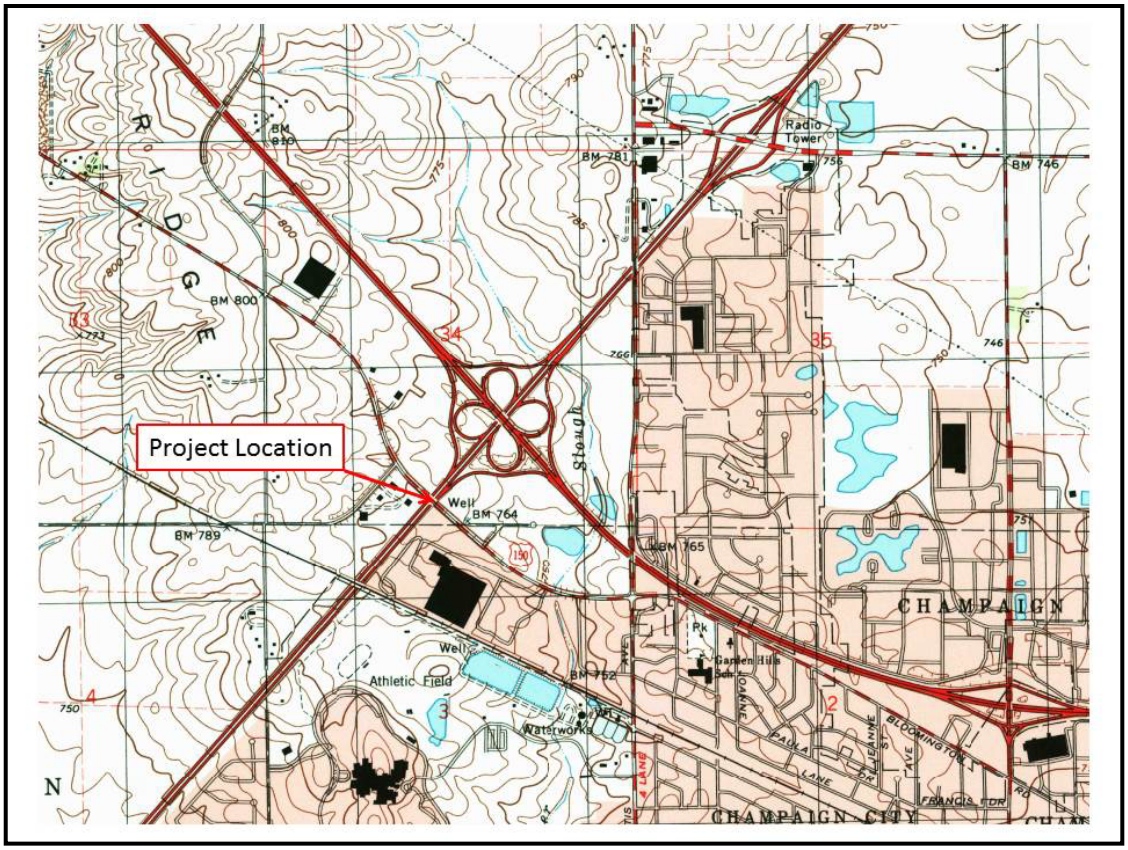


Exhibit 1: Project Location Map

2.0 Existing and Proposed Structure Information

Existing Structure (SN 010-0050)

Based on information from the Bridge Condition Report, the existing structure was originally constructed in 1964 as a four-span rolled steel beam (W36) structure with open stub abutments on concrete piles and single hammerhead reinforced concrete piers supported on spread footings.

In 2000, the structure was widened from 33'-8" to 42'-7.75". The deck was replaced and the existing abutments and piers were widened. The area below the existing pier cap overhangs was filled in during the widening, creating a solid wall straight stem type pier. Two new beam lines, one each side of the bridge, composite in the positive moment regions were added. The beams were painted, raised approximately 2 ½", and steel studs were added in the positive moment regions to make them composite with the new deck. Total length of the existing structure is 258'-6" back to back of abutments and 48'-10" out to out deck width.

Proposed Structure (SN 010-1050)

The proposed structure (SN 010-1050) will consist of two main spans supported by a central pier and two integral abutments (east abutment and west abutment) with a total back to back of abutment length of 332'-8" and 48'-10" out to out deck width. Two new 30-foot long precast approach slabs will be constructed on either end of the bridge. The proposed structure is at a 0° skew to I-57 with the centerline at Station: 157+29.99. The existing four spans will be replaced with a double-span structure with plate steel girders supporting an 8" concrete slab. The girders and decking will be supported by concrete abutments, which in turn will be supported with steel H piles.

The Type, Size and Location (TS&L) plan for the US 150 (Bloomington Road) bridge over I-57 has been included in the Appendix.

3.0 Existing Site Conditions

US 150 (Bloomington Road) extends northwest – southeast 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: US 150 (Bloomington Road) 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 from January 22 to February 10, 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	West Abutment	155+27	10.5 ft Left	75	790.50
B-2	Center Pier	157+30	35.0 ft Left	75	770.00
B-3	East Abutment	159+25	12.0 ft Right	75	791.30

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 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 (Bloomington Road) were advanced in support of Proposed Structure 010-1050 on January 22 and February 10, 2015 along the existing Highway 150 alignment.

Bridge Abutments

Boring **B-1** was advanced near the west abutment, was located at Station 155+27 (Elev. 790.50'). The soil profile underlying the surface cover in boring **B-1** is described as a brown/black/gray very stiff silty clay loam till, which extends to approximately 19.5 feet deep (Elev. 771.00'). The silty clay loam till continues with depth, becoming gray in color at 30 feet deep (Elev. 760.50'). This gray silty clay loam till continues to 69 feet deep (Elev. 721.50'). These soils had SPT N-values ranging from 6 to 12 and unconfined compressive strength (Qu) values from 1.32 to 3.5. Below the silty clay loam till soils a coarse sandy gravel was identified to boring completion depth of 75 feet deep (Elev. 715.50'). The sand and gravels had SPT N-values ranging from 23 to 40.

Soil boring, **B-3**, was advanced at the east abutment, located at Station 159+25 (Elev. 791.30'). In boring **B-3**, underlying the surface cover is a fill soil consisting of brown hard silty clay loam, which extends to 4.5 feet deep (Elev. 786.80'), where the soil changes to a black stiff silty clay. This silty clay continues with depth becoming dark gray to gray/brown/black in color until 27 feet deep (Elev. 764.30') where a olive brown to gray silty clay loam till is encountered. This till continues with depth, becoming stiff, then hard by 37 feet deep (Elev. 754.30') until 67 feet deep (Elev. 724.30'). These soils had SPT N-values ranging from 7 to 17 and unconfined compressive strength (Qu) values from 0.74 to 4.5. Below the silty clay loam till, a medium to coarse sand and fine gravel was encountered to boring completion depths of 75 feet deep (716.30'). The sand and gravels had SPT N-values ranging from 16 to 21.

Center Pier

Boring B-2, advanced near the proposed pier location located at Station 157+30 (Elev. 770.00'). In boring **B-2**, underlying the bare soil cover is a very stiff brown and black silty clay / silty clay loam which extends down to 5.5 feet deep (Elev. 767.00') where a brown stiff silty clay till is encountered. This silty clay till continues with depth, becoming gray in color, to 42 feet deep (Elev. 728.00'). These soils had SPT N-values ranging from 2 to 15 and unconfined compressive strength (Qu) values from 0.25 to 2.5. Below the silty clay till, a gray medium-grained very loose sand is identified. This loose sand continues with depth to 53 feet deep (Elev. 717.00'). The sand had SPT N-values ranging from WHO (0) to 25. Below the loose sand a gray silty clay loam till is encountered with very hard consistencies. This till continues to boring completion depth of 75 feet deep (Elev. 695.00'). These soils had SPT N-values ranging from 10 to 26 and unconfined compressive strength (Qu) values from 1.24 to 7.6.

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 (West Abut)	715.5	N/A
B-2 (Center Pier)	727.0	N/A
B-3 (East Abut)	725.0	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)
786' to surface	Existing Clay Fill	120	3,000	0	150	28
764.3 – 786.8	Silty Clay	125	2,000	0	125	28
721.5 – 789.7 724.3 – 764.3	Silty Clay Till	125	2,000	0	125	28
716.0 – 721.5 715.5 – 724.3	Sand & Gravel	130	0	34	0	34

5.2 Settlement

The existing I-57 abutment side slopes are about 2H:1V towards the east and west abutments of US 150 (Bloomington Road). 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 4.8 feet (at the west abutment) and 3.7 feet (at the east 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 regarded. 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 0.4-inch near the east and west 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 US 150 (Bloomington Road) over I-57 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 ws 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, West Abut	2H:1V	2.9	1.8	1.5
B-3, East Abut	2H:1V	2.5	1.7	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:

$\mathbf{S_s}$=0.146 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#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. ($\mathbf{S_{DS}}$)	0.234 g
Design Spectral Acceleration at 1.0 sec. ($\mathbf{S_{D1}}$)	0.135 g
Soil Site Class	D

5.5 Scour

The proposed bridge structure carrying US 150 (Bloomington Road) 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 analyses, 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 H-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 74 size and larger. Therefore, the use of metal shell piles would be excluded for use with the choice of integral abutments.

However, it is 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 metal shell and H-piles sizes.

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 5,087 kips; and the factored bearing resistance of the soil at or below a footing elevation of Elev. 763.70 is approximately 1,800 psf in addition to a soft sand layers located below the pier foundation depth. Therefore, a spread footing, while feasible may be fairly large in footprint in order to support the proposed load. A large footing excavation may encroach on the existing I-57 roadbeds. Temporary shoring may then be required for installation of shallow foundation 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, metal shell piles are IDOT's preferred foundation choice for the footing 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 14 x 102 and larger 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	
W. Abut.	1720.6	1912.9	2045.0		2045
Pier 1	4414.1	4812.6	5086.7		5087
E. Abut.	1474.2	1657.4	1783.3		1783

*** 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. 786.20 and Elev. 7835.80 for the West and East abutments, respectively which includes a 2 feet embedment into the abutment as required by the Bridge Manual. A pile cutoff elevation of Elev. 765.7 for the pile supported center pier was used for analysis. 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 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.

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 Loam	28	1500	300	0.010	57.6	120
Silty Clay Till	28	2000	500	0.005	62.6	125
Loose Fine Sand (Saturated)	30	n/a	20	n/a	67.6	130
Medium Sand (Saturated)	32	n/a	60	n/a	67.6	130

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.

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

Table 7 – West Abutment

Piling Driven at West Abutment (B-1 data)		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft)
Metal Shell 12" Φ w/0.25 walls		
289	159	48
303	167	50
316	174	53
332	183	55
353*	194*	58*
Metal Shell 14" Φ w/0.25" walls		
340	187	48
356	196	50
371	204	53
391	215	55
413*	227*	58*
Metal Shell 14" Φ w/0.312 walls		
408	224	58
415	228	60
427	235	63
444	244	65
513*	282*	68*
HP 14 x 102		
535	294	75
545	300	77
612	337	87
679	374	97
810*	445*	107*
HP 14 x117		
620	341	87
688	378	97
756	416	107
824	453	117
929*	510*	127*

Table 8 – East Abutment

Piling Driven at East Abutment (B-3 data)		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft)
Metal Shell 12" Φ w/0.25 walls		
264	145	37
285	157	40
312	171	42
336	185	45
353*	194*	47*
Metal Shell 14" Φ w/0.25" walls		
314	173	37
339	186	40
371	204	42
398	219	45
413*	227*	47*
Metal Shell 14" Φ w/0.312 walls		
423	233	50
441	242	52
459	252	55
484	266	57
513*	282*	59*
HP 14 x 102		
620	341	131
663	364	151
705	388	171
748	411	191
810*	445*	107*
HP 14 x 117		
670	369	151
713	392	171
756	416	191
799	440	211
929*	510*	231*

*- 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		
292	161	57
304	167	59
308	170	61
326	179	64
353*	194*	66*
Metal Shell 14" Φ w/0.25" walls		
344	189	57
358	197	59
362	199	61
384	211	64
413*	227*	66*
Metal Shell 14" Φ w/0.312 walls		
362	199	61
384	211	64
406	223	66
425	234	69
513*	282*	71*
HP 14 x 102		
449	247	83
526	289	95
603	331	95
679	374	119
810*	445*	107*
HP 14 x 117		
532	292	95
609	335	107
687	378	119
765	421	131
929*	510*	231*

*- Maximum Nominal Required 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 20.5 feet of retaining height above an excavation line at Elev. 770.5' at the west abutment and 16 feet of retained height above an excavation line at Elev. 776.5' at the east abutment was calculated. Embedment depths of 15.8 feet and 12.0 feet for the west and east 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.

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 (Bloomington Rd I-57)	West Abut Bloomington Rd. over I-57	155+27	10.5 LT	790.5	40.143338	-88.287889
B-2 (Bloomington Rd I-57)	Pier Boring Bloomington Road	157+30	35 LT	770	40.143063	-88.287373
B-3 (Bloomington Rd I-57)	East Abut Bloomington Rd./I-57	159+25	12 RT	791.3	40.142681	-88.287029

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

US 150 (BLOOMINGTON RD.)
(I-57/I-74 INTERCHANGE)

SCALE: SHEET OF SHEETS STA. TO STA.

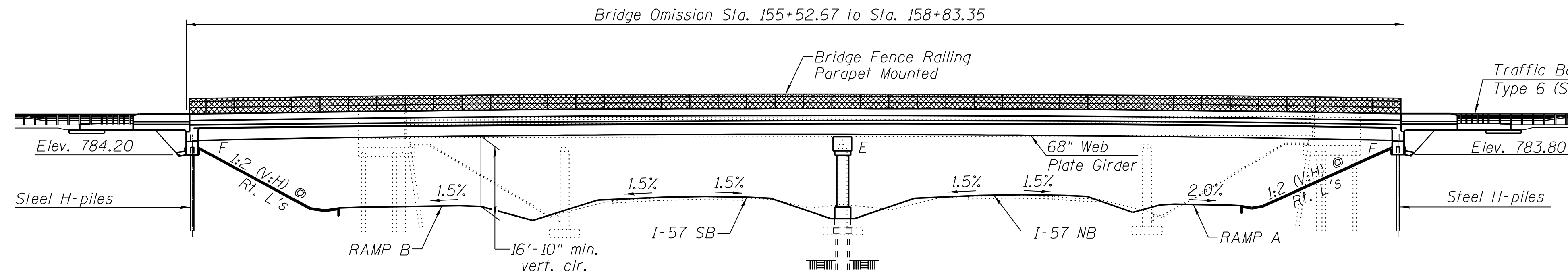
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
57/74	10(5-1-RS-1 ,14-1, 6)R	CHAMPAIGN		
		CONTRACT NO. 70897		
		ILLINOIS FED. AID PROJECT		

Appendix B

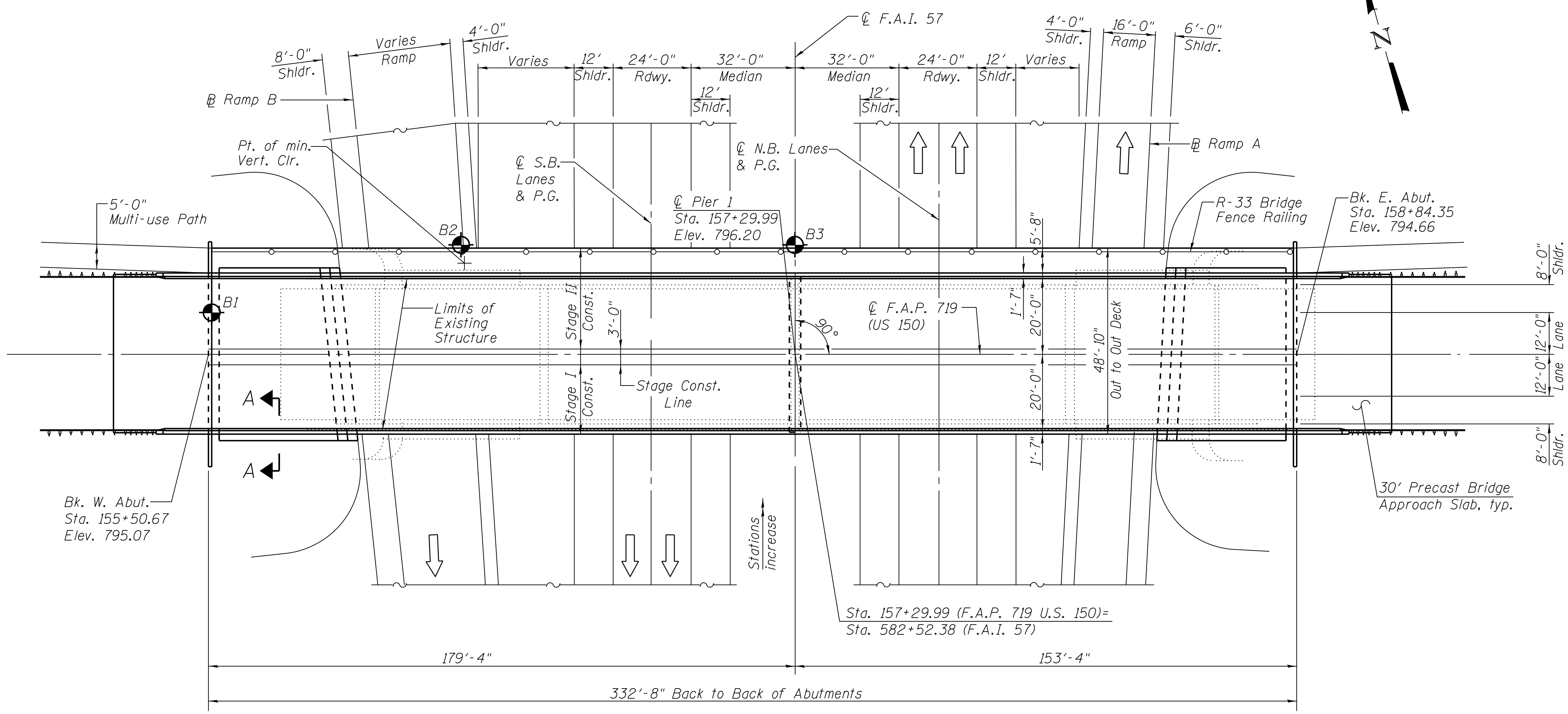
Preliminary TSL

Bench Mark:

Existing Structure: S.N. 010-0050 built 1964 as F.A.S. Route 719 (U.S. 150) Section (10-34HB)BR at Station 157+29.38. Existing structure is a four-span rolled steel beam structure with open stub abutments on concrete piles and single hammerhead reinforced concrete piers supported on spread footings. In 2000, the structure was widened, the deck replaced, and the existing abutments and piers were widened. 258'-6" back-to-back abutments. 42'-7¾" out-to-out deck. Structure to be removed and replaced using stage construction.



ELEVATION



PLAN

HIGHWAY CLASSIFICATION

F.A.P. 719 (U.S. 150)
Functional Class: Other Principal Arterial
ADT: 7,450 (2013); 12,100 (2040)
ADTT: 825 (2013); 1,016 (2040)
DHV: 1,040 (2040)
Design Speed: 50 m.p.h.
Posted Speed: 50 m.p.h.
2-Way Traffic
Directional Distribution: 50:50

F.A.I. 57
Functional Class: Interstate
ADT: 32,400 (2013); 49,900 (2040)
ADTT: 9,450 (2013); 14,170 (2040)
DHV: 3,640 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
2-Way Traffic
Directional Distribution: 50:50

DESIGN STRESSES

FIELD UNITS

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

LOADING HL-93

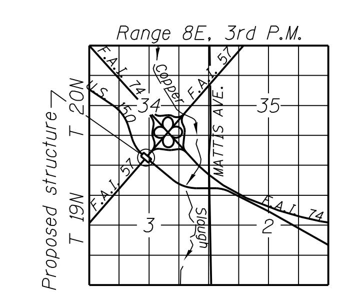
Allow 50#/sq. ft. for future wearing surface.

SEISMIC DATA

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

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition



LOCATION SKETCH

GENERAL PLAN & ELEVATION
U.S. 150 (BLOOMINGTON RD.) OVER F.A.I. 57
F.A.P. RT 719 - SEC 10(5-1RS-1,14-1,6)R
CHAMPAIGN COUNTY
STATION 157+29.99
STRUCTURE NO. 010-1050

FILE NAME = D570897-TSL_150 over 157.dgn
BFW BACON | FARMER | WORKMAN ENGINEERING & TESTING, INC. 403 NORTH COURT STREET MARION, ILLINOIS 62959 PHONE: 618.997.3150

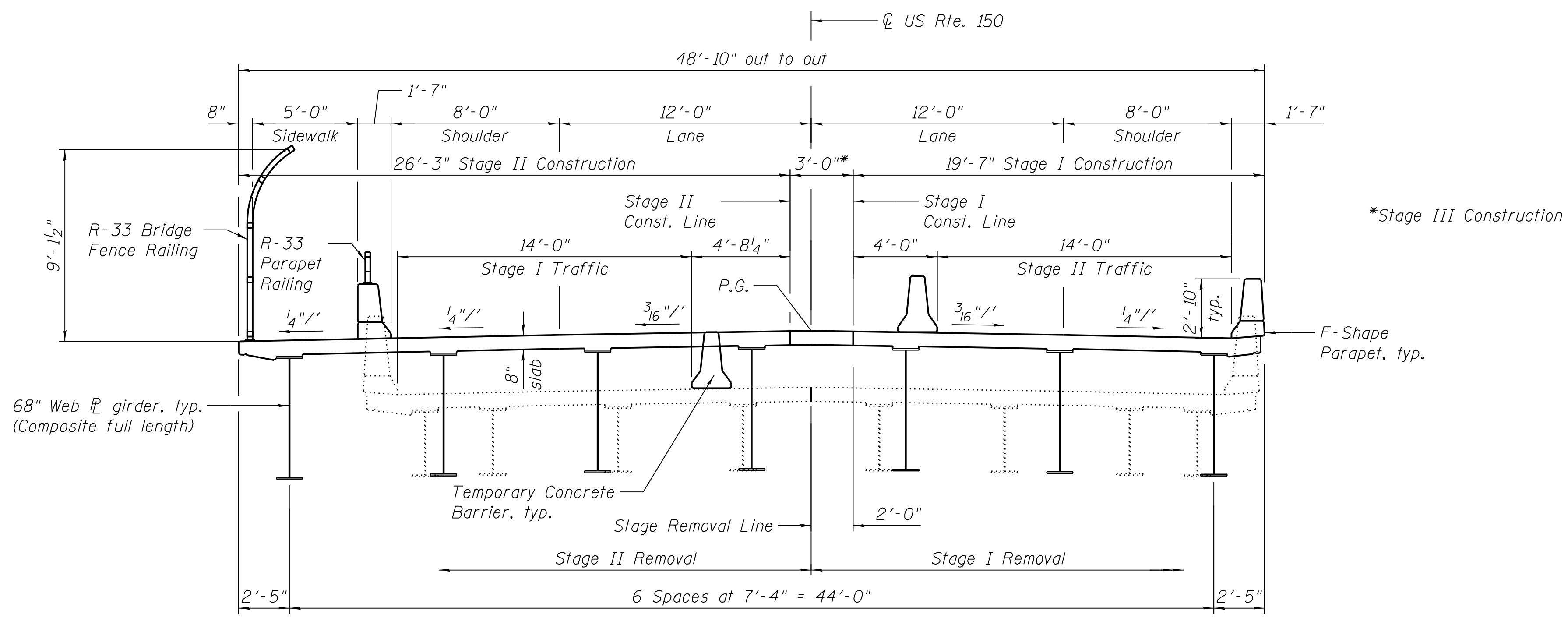
USER NAME =	DESIGNED - BWP	REVISED -
	CHECKED - RSB	REVISED -
PLOT SCALE =	DRAWN - BJV	REVISED -
PLOT DATE = 3/26/2015	CHECKED - RSB	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

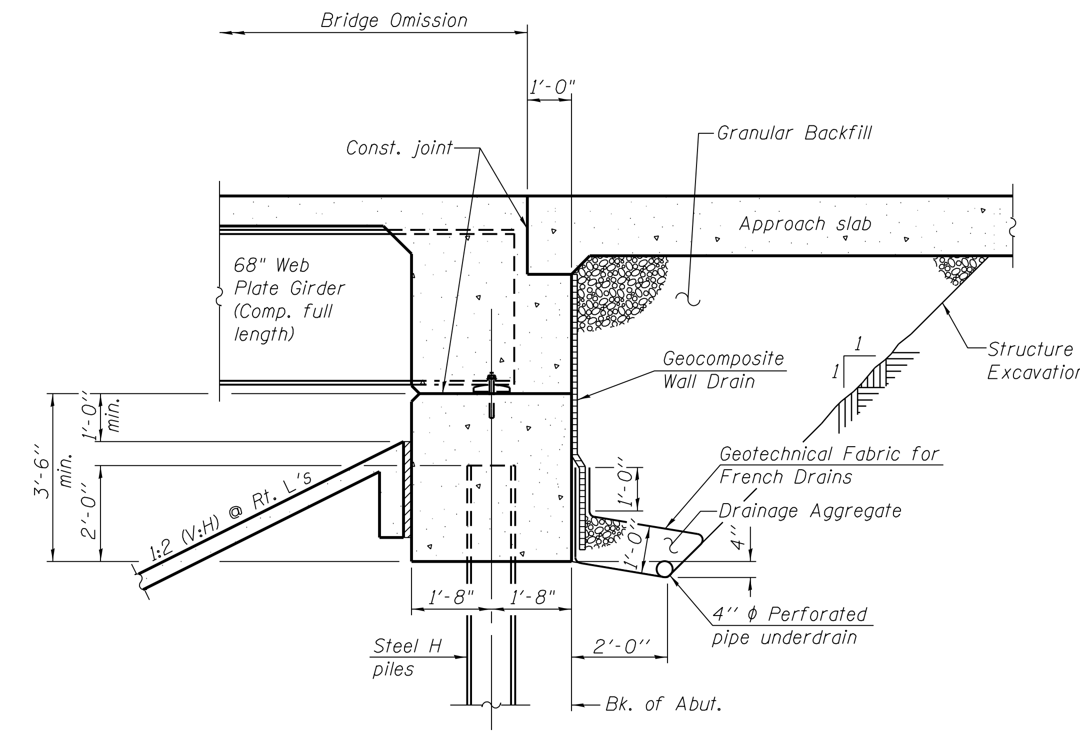
SHEET NO. 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
719	(10(5-1-RS-1,14-1,6)R	CHAMPAIGN	XXX	
		CONTRACT NO. 70897		

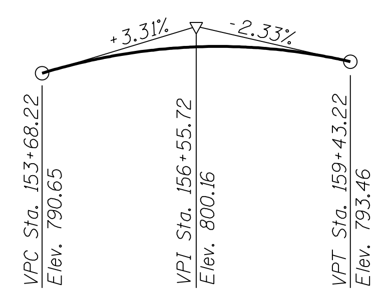
ILLINOIS | FED. AID PROJECT



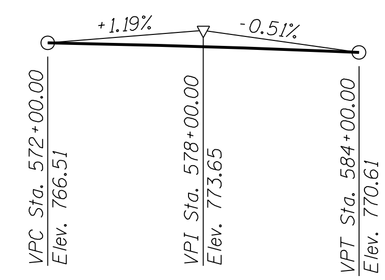
CROSS SECTION
(Looking East)



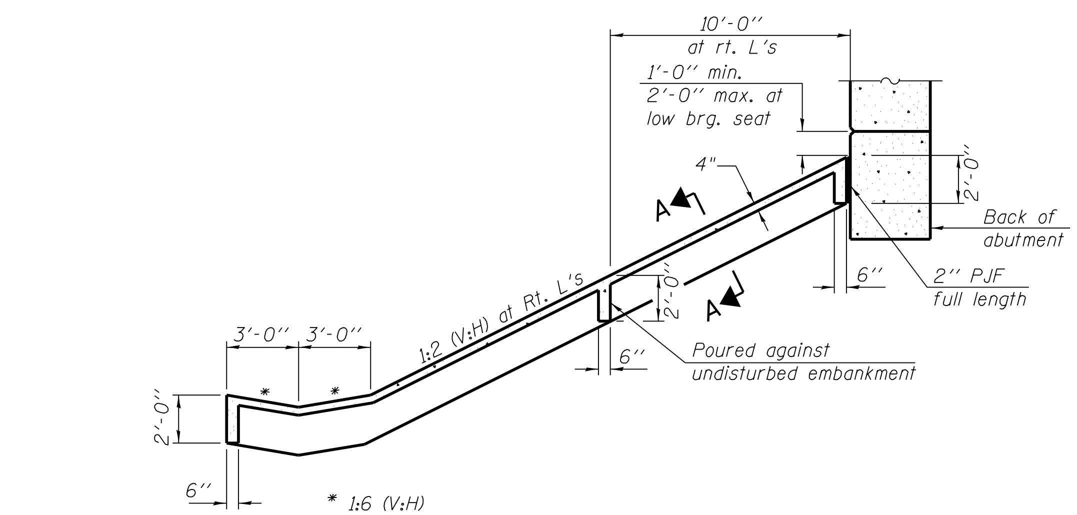
SECTION THRU INTEGRAL ABUTMENT
(Horizontal Dimensions @ Rt. L's)



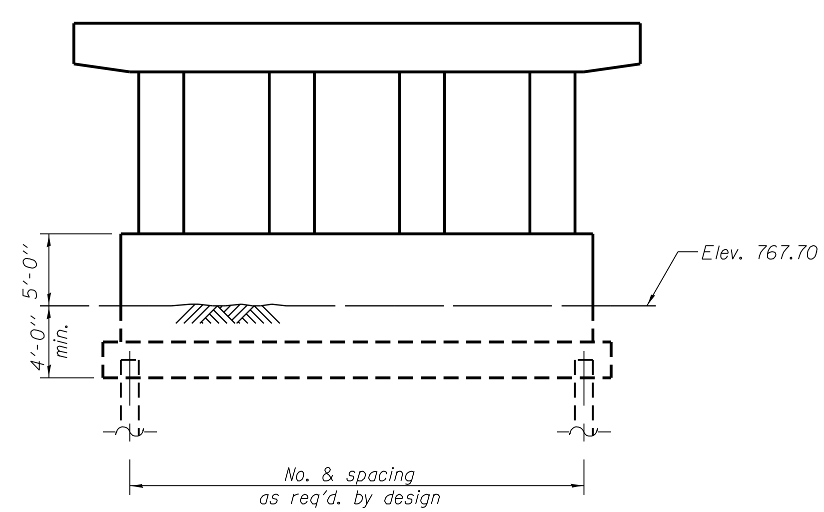
PROFILE GRADE F.A.P. 719 (U.S. 150)
(along ℄ roadway)



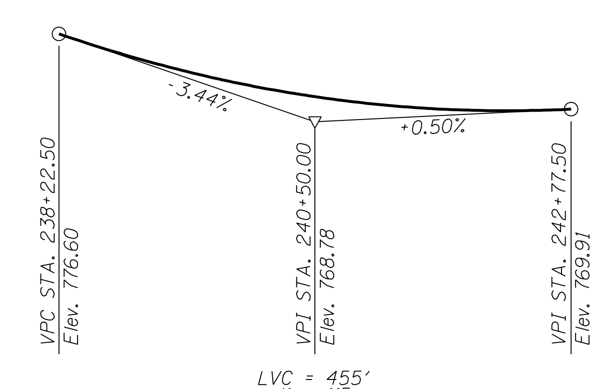
PROFILE GRADE F.A.I. 57
(along ℄ roadway)



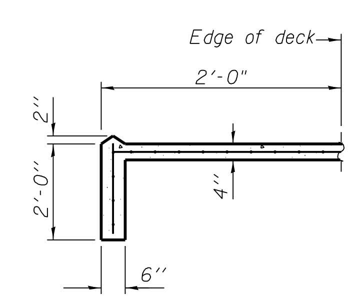
SECTION THRU CONCRETE SLOPEWALL



PIER SKETCH



PROFILE GRADE RAMP B
(along ℄ roadway)



SECTION A-A

STAGING & DETAILS
U.S. 150 (BLOOMINGTON RD.) OVER F.A.I. 57
F.A.P. RT. 719 - SECTION 10(5-1-RS-1,14-1,6)R
CHAMPAIGN COUNTY
STATION 157+29.99
STRUCTURE NO. 010-1050

FILE NAME = D570897-TSL_150 over 157.dgn

BFW BACON | FARMER | WORKMAN ENGINEERING & TESTING, INC.

USER NAME =	DESIGNED - BWP	REVISED -
	CHECKED - RSB	REVISED -
PLOT SCALE =	DRAWN - BJV	REVISED -
PLOT DATE = 3/26/2015	CHECKED - RSB	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
719	(10(5-1-RS-1,14-1,6)R	CHAMPAIGN	XXX	

CONTRACT NO. 70897

ILLINOIS | FED. AID PROJECT

Appendix C

Soil Boring Profile Sheet

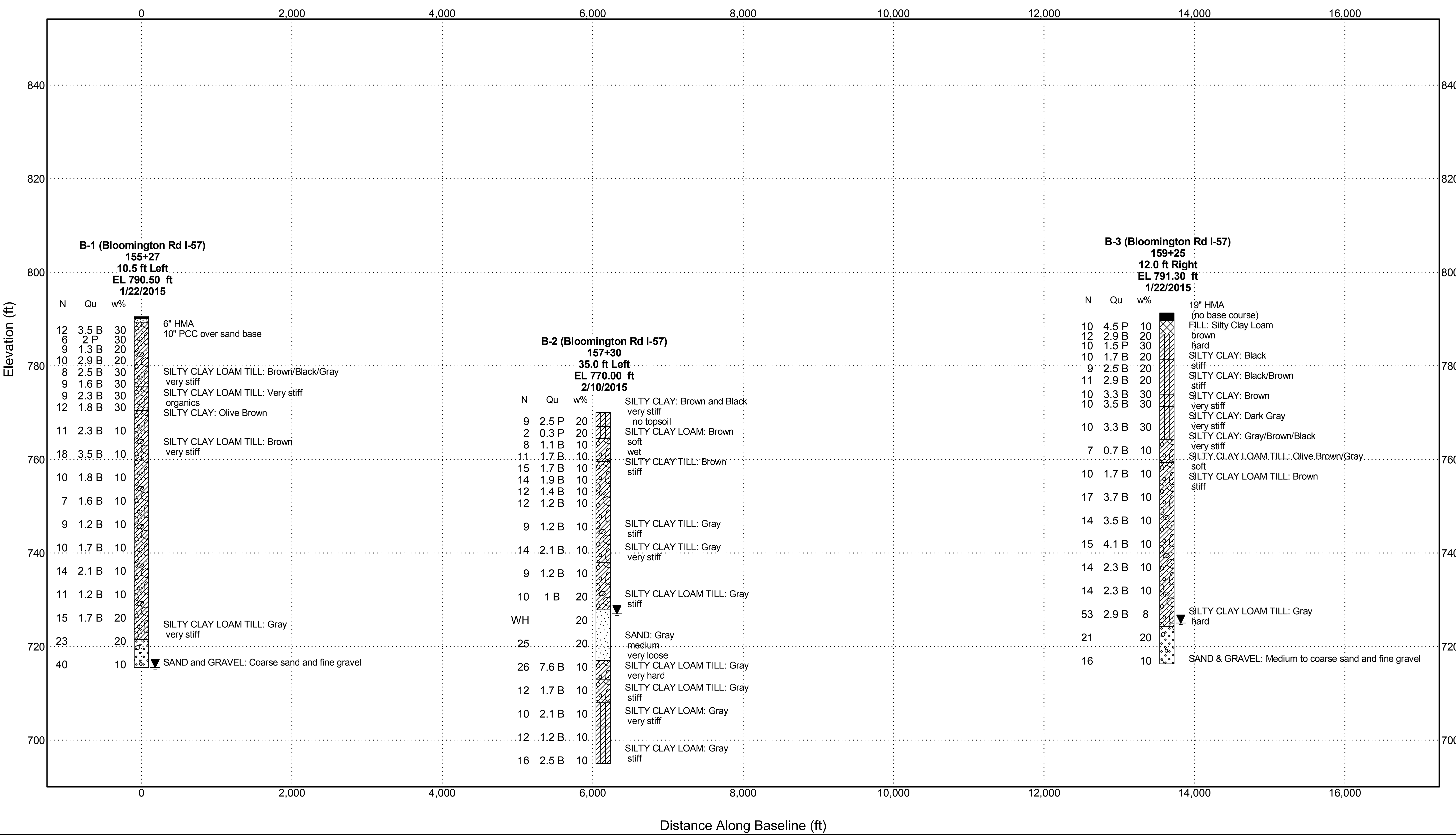
Illinois Department of Transportation
Division of Highways
BFW Engineering & Testing Inc.

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

SUBSURFACE PROFILE
SN 010-0050

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 1/22/15

ROUTE I-57/74 **DESCRIPTION** West Abut Bloomington Rd. over I-57 **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 155+27
Offset 10.5ft Left
Ground Surface Elev. 790.5 ft

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

Groundwater Elev.:
▽ **First Encounter** 715.5 ft
▼ **Upon Completion** ft
▼ **After** Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
6" HMA	790.00				
10" PCC over sand base	789.17				
SILTY CLAY LOAM TILL: Brown/Black/Gray, very stiff			4 5 7	3.5 B	27.2
		-5	3 3 3	2.0 P	27.4
			3 3 6	1.32 B	22.2
		-10	3 4 6	2.89 B	23.8
			3 3 5	2.47 B	25.4
	775.50	-15	3 4 5	1.57 B	25.2
SILTY CLAY LOAM TILL: Very stiff, organics			3 4 5	2.27 B	25.4
	771.00		3 5 7	1.81 B	26.1
SILTY CLAY: Olive Brown	770.50	-20			
SILTY CLAY LOAM TILL: Brown, very stiff		-25	3 5 6	2.27 B	14.6
	760.50	-30	2 7 11	3.5 B	13.0
SILTY CLAY LOAM TILL: Gray, very stiff		-35	3 5 5	1.81 B	12.3
		-40	2 3 4	1.57 B	12.6

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 1/22/15

ROUTE I-57/74 **DESCRIPTION** West Abut Bloomington Rd. over I-57 **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 155+27
Offset 10.5ft Left
Ground Surface Elev. 790.5 ft

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

Groundwater Elev.:
First Encounter 715.5 ft
Upon Completion ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, very stiff *(continued)*				
		2		
		4	1.24	12.6
	-45	5	B	
		3		
		3	1.65	12.1
	-50	7	B	
		4		
		6	2.06	10.4
	-55	8	B	
		2		
		5	1.24	10.2
	-60	6	B	

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, very stiff *(continued)*				
		4		
		7	1.65	16.8
	-65	8	B	
721.50		4		
SAND and GRAVEL: Coarse sand and fine gravel		8		16.2
	-70	15		
		12		
		17		11.1
▽ 715.50	-75	23		
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 2/10/15

ROUTE I-57/74 **DESCRIPTION** Pier Boring Bloomington Road **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 157+30
Offset 35.0ft Left
Ground Surface Elev. 770.00 ft

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

Groundwater Elev.:
First Encounter 727.0 ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY: Brown and Black, very stiff no topsoil			2 4 5	2.5 P	22.0
	767.00				
SILTY CLAY LOAM: Brown, soft, wet		-5	1 1 1	0.25 P	24.2
	764.50				
SILTY CLAY TILL: Brown, stiff			2 3 5	1.07 B	14.5
		-10	3 4 7	1.65 B	14.6
	759.50				
SILTY CLAY TILL: Gray, stiff			3 6 9	1.73 B	11.2
		-15	3 5 9	1.90 B	11.8
			2 5 7	1.4 B	11.9
		-20	3 5 7	1.24 B	12.5
SILTY CLAY TILL: Gray, stiff *(continued)*		-25	2 3 6	1.24 B	11.6
	743.00				
SILTY CLAY TILL: Gray, very stiff		-30	3 6 8	2.06 B	11.8
	738.00				
SILTY CLAY LOAM TILL: Gray, stiff		-35	2 4 5	1.24 B	12.4
		-40	5 5 5	0.99 B	15.0

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)

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Latitude 40.143063 Longitude -88.287373 Datum Job Number MCE-14044

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 2/10/15

ROUTE I-57/74 **DESCRIPTION** Pier Boring Bloomington Road **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 157+30
Offset 35.0ft Left
Ground Surface Elev. 770.00 ft

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

Groundwater Elev.:
First Encounter 727.0 ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, stiff *(continued)*					
	728.00				
SAND: Gray, medium, very loose					
			WH		
			WH		19.0
		-45	WH		
			8		
trace gravel			12		16.7
		-50	13		
	717.00				
SILTY CLAY LOAM TILL: Gray, very hard			9		
			12	7.62	10.5
		-55	14	B	
	713.00				
SILTY CLAY LOAM TILL: Gray, stiff			5		
			5	1.65	12.6
		-60	7	B	

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, stiff *(continued)*					
	708.00				
SILTY CLAY LOAM: Gray, very stiff			2		
			4	2.06	12.6
		-65	6	B	
	703.00				
SILTY CLAY LOAM: Gray, stiff			2		
			5	1.24	13.6
		-70	7	B	
			4		
			6	2.47	13.2
	695.00	-75	10	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)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering Group

SOIL BORING LOG

Date 1/22/15

ROUTE I-57/74 **DESCRIPTION** East Abut Bloomington Rd./I-57 **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 159+25
Offset 12.0ft Right
Ground Surface Elev. 791.30 ft

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

Groundwater Elev.:
First Encounter 725.0 ft
Upon Completion ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
19" HMA (no base course)				
789.72				
FILL: Silty Clay Loam, brown, hard		5		
		4	4.5	11.8
		6	P	
		3		
786.80		4	2.89	22.0
SILTY CLAY: Black, stiff	-5	8	B	
		4		
		4	1.5	27.8
783.80		6	P	
SILTY CLAY: Black/Brown, stiff		3		
		3	1.65	18.5
781.30	-10	7	B	
SILTY CLAY: Brown, very stiff		3		
		3	2.47	18.9
		6	B	
		3		
		5	2.89	23.0
	-15	6	B	
		3		
773.80		4	3.30	25.6
SILTY CLAY: Dark Gray, very stiff		6	B	
		3		
		4	3.50	25.1
771.30	-20	6	B	

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY: Gray/Brown/Black, very stiff				
		3		
		4	3.30	25.3
	-25	6	B	
764.30				
SILTY CLAY LOAM TILL: Olive Brown/Gray, soft		2		
		3	0.74	14.8
	-30	4	B	
759.30				
SILTY CLAY LOAM TILL: Brown, stiff		2		
		5	1.65	14.7
	-35	5	B	
754.30				
SILTY CLAY LOAM TILL: Gray, hard		6		
		8	3.71	10.8
	-40	9	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)

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 1/22/15

ROUTE I-57/74 **DESCRIPTION** East Abut Bloomington Rd./I-57 **LOGGED BY** TLM

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 (Bloomington Rd I-57)
Station 159+25
Offset 12.0ft Right
Ground Surface Elev. 791.30 ft

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

Groundwater Elev.:
▽ **First Encounter** 725.0 ft
▼ **Upon Completion** ft
▼ **After** Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, hard *(continued)*				
		5		
		6	3.50	12.1
	-45	8	B	
		5		
		6	4.12	11.8
	-50	9	B	
		4		
		6	2.27	11.8
	-55	8	B	
		3		
		6	2.27	11.3
	-60	8	B	

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
SILTY CLAY LOAM TILL: Gray, hard *(continued)*				
		7		
		20	2.89	7.6
	-65	33	B	
▽ 724.30				
SAND & GRAVEL: Medium to coarse sand and fine gravel				
		6		
		7		15.7
	-70	14		
		6		
		5		12.8
716.30	-75	11		
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 (East Abutment, West Abutment, Center Pier)

Pile Design Table for West Abutment utilizing Boring #1

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	226	124	33
	233	128	35
	246	135	38
Metal Shell 12"Φ w/.25" walls			
	226	124	33
	233	128	35
	246	135	38
	257	142	40
	270	148	43
	279	153	45
	289	159	48
	303	167	50
	316	174	53
	332	183	55
	347	191	58
Metal Shell 14"Φ w/.25" walls			
	213	117	28
	245	135	30
	270	148	33
	274	151	35
	290	160	38
	303	167	40
	317	174	43
	328	180	45
	340	187	48
	356	196	50
	371	204	53
	391	215	55
	408	224	58
Metal Shell 14"Φ w/.312" walls			
	213	117	28
	245	135	30
	270	148	33
	274	151	35
	290	160	38
	303	167	40
	317	174	43
	328	180	45
	340	187	48
	356	196	50
	371	204	53
	391	215	55
	408	224	58
	415	228	60
	427	235	63
	444	244	65
	459	252	68
Steel HP 8 X 36			
	217	119	68

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	223	122	53
	235	129	55
	245	135	58
	247	136	60
	254	140	63
	265	146	65
	274	151	68
	307	169	70
	310	171	73
	345	190	75
	352	194	77
	399	220	87
	446	245	97
Steel HP 12 X 53			
	228	126	43
	234	128	45
	242	133	48
	256	141	50
	266	146	53
	282	155	55
	294	161	58
	294	162	60
	302	166	63
	316	174	65
	327	180	68
	370	204	70
	374	206	73
Steel HP 12 X 63			
	220	121	40
	230	127	43
	236	130	45
	244	134	48
	258	142	50
	268	148	53
	284	156	55
	296	163	58
	297	163	60
	305	168	63
	319	176	65
	329	181	68
	374	206	70
	378	208	73
	426	234	75
	434	239	77
	490	270	87
Steel HP 12 X 74			
	223	123	40
	233	128	43
	239	131	45

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	196	108	28
	235	129	30
	242	133	35
	255	140	38
	263	145	40
	275	151	43
	280	154	45
	290	160	48
	308	169	50
	320	176	53
	340	187	55
	352	194	60
	362	199	63
	380	209	65
	392	216	68
	451	248	70
	456	251	73
	521	286	75
	531	292	77
Steel HP 14 X 89			
	199	109	28
	238	131	30
	245	135	35
	258	142	38
	267	147	40
	278	153	43
	284	156	45
	294	161	48
	312	171	50
	324	178	53
	344	189	55
	356	196	60
	366	201	63
	384	211	65
	396	218	68
	457	251	70
	462	254	73
	528	290	75
	538	296	77
	604	332	87
	671	369	97
Steel HP 14 X 102			
	201	111	28
	241	133	30
	248	137	35
	261	144	38
	270	148	40
	282	155	43
	287	158	45

239	132	70
242	133	73
265	146	75
271	149	77
Steel HP 10 X 42		
218	120	53
230	127	55
240	132	58
242	133	60
249	137	63
260	143	65
268	148	68
300	165	70
304	167	73

247	136	48
262	144	50
272	150	53
288	159	55
300	165	58
301	165	60
309	170	63
323	178	65
334	184	68
379	209	70
384	211	73
432	238	75
441	243	77
498	274	87
554	305	97
Steel HP 12 X 84		
226	125	40
237	130	43
242	133	45
251	138	48
265	146	50
276	152	53
292	161	55
304	167	58
305	167	60
313	172	63
328	180	65
338	186	68
385	212	70
389	214	73
439	241	75
448	246	77
505	278	87
563	309	97
620	341	107

297	163	48
315	173	50
328	180	53
348	192	55
360	198	60
370	204	63
389	214	65
401	220	68
462	254	70
467	257	73
535	294	75
545	300	77
612	337	87
679	374	97
747	411	107
Steel HP 14 X 117		
204	112	28
245	135	30
251	138	35
265	146	38
273	150	40
285	157	43
290	160	45
300	165	48
319	175	50
331	182	53
352	194	55
364	200	60
374	206	63
393	216	65
405	223	68
468	257	70
473	260	73
542	298	75
552	304	77
620	341	87
688	378	97
756	416	107
824	453	117
892	491	127
Precast 14"x 14"		
221	121	23
248	136	25
Timber Pile		
151	83	25

Pile Design Table for East Abutment utilizing Boring #3

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	192	105	30
	222	122	32
	244	134	35
Metal Shell 12"Φ w/.25" walls			
	192	105	30
	222	122	32
	244	134	35
	264	145	37
	285	157	40
	312	171	42
	336	185	45
	344	189	47
Metal Shell 14"Φ w/.25" walls			
	193	106	25
	212	116	27
	227	125	30
	265	146	32
	291	160	35
	314	173	37
	339	186	40
	371	204	42
	398	219	45
	405	223	47
Metal Shell 14"Φ w/.312" walls			
	193	106	25
	212	116	27
	227	125	30
	265	146	32
	291	160	35
	314	173	37
	339	186	40
	371	204	42
	398	219	45
	405	223	47
	423	233	50
	441	242	52
	459	252	55
	484	266	57
	501	276	59
Steel HP 8 X 36			
	192	106	47
	201	110	50
	209	115	52
	218	120	55
	230	126	57
	238	131	59
	251	138	61
	254	140	64
	254	140	66

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	195	107	37
	209	115	40
	230	126	42
	244	134	47
	255	140	50
	265	146	52
	276	152	55
	293	161	57
	303	167	59
	321	177	61
	324	178	66
	327	180	69
	331	182	71
	361	198	91
	391	215	111
	420	231	131
	450	248	151
Steel HP 12 X 53			
	166	91	30
	205	112	32
	222	122	35
	237	130	37
	254	140	40
	280	154	42
	293	161	47
	305	168	50
	318	175	52
	330	182	55
	351	193	57
	363	200	59
	387	213	61
	389	214	66
	393	216	69
	397	218	71
Steel HP 12 X 63			
	168	92	30
	207	114	32
	225	124	35
	240	132	37
	257	141	40
	282	155	42
	295	162	47
	308	169	50
	321	176	52
	333	183	55
	355	195	57
	366	202	59
	390	215	61
	393	216	66

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	190	104	27
	202	111	30
	253	139	32
	274	151	35
	291	160	37
	312	171	40
	344	189	42
	354	194	47
	368	203	50
	383	211	52
	398	219	55
	425	234	57
	439	241	59
	469	258	61
	471	259	66
	475	261	69
	481	264	71
	522	287	91
	564	310	111
Steel HP 14 X 89			
	192	106	27
	204	112	30
	257	141	32
	278	153	35
	295	162	37
	316	174	40
	348	192	42
	358	197	47
	373	205	50
	388	213	52
	403	222	55
	430	236	57
	444	244	59
	475	261	61
	477	262	66
	481	265	69
	486	268	71
	529	291	91
	571	314	111
	613	337	131
	655	360	151
	697	383	171
Steel HP 14 X 102			
	194	107	27
	207	114	30
	260	143	32
	282	155	35
	299	165	37
	320	176	40

257	141	69
260	143	71
284	156	91
Steel HP 10 X 42		
191	105	37
205	113	40
225	124	42
239	131	47
249	137	50
260	143	52
270	149	55
287	158	57
296	163	59
314	173	61
317	175	66
320	176	69
324	178	71

396	218	69
401	220	71
436	240	91
472	259	111
Steel HP 12 X 74		
170	93	30
210	115	32
228	125	35
243	134	37
260	143	40
287	158	42
299	165	47
312	172	50
325	179	52
338	186	55
360	198	57
372	204	59
396	218	61
398	219	66
402	221	69
406	224	71
442	243	91
478	263	111
514	283	131
550	303	151
586	322	171
Steel HP 12 X 84		
172	95	30
213	117	32
232	127	35
247	136	37
264	145	40
291	160	42
304	167	47
316	174	50
329	181	52
342	188	55
364	200	57
377	207	59
401	221	61
404	222	66
407	224	69
412	227	71
448	247	91
485	267	111
521	287	131
558	307	151
594	327	171
630	347	191

353	194	42
362	199	47
377	207	50
392	216	52
407	224	55
435	239	57
449	247	59
481	264	61
483	266	66
487	268	69
492	271	71
535	294	91
577	318	111
620	341	131
663	364	151
705	388	171
748	411	191
790	435	211
Steel HP 14 X 117		
197	108	27
209	115	30
264	145	32
286	157	35
303	167	37
324	178	40
357	197	42
366	201	47
382	210	50
397	218	52
412	227	55
440	242	57
455	250	59
487	268	61
489	269	66
493	271	69
498	274	71
541	298	91
584	321	111
627	345	131
670	369	151
713	392	171
756	416	191
799	440	211
842	463	231
Precast 14"x 14"		
186	102	15
214	118	17
236	130	22
246	135	25
Timber Pile		

Pile Design Table for Center Pier utilizing Boring #2

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	133	73	27
	143	79	30
	152	83	32
	160	88	35
	165	91	37
	166	91	40
Metal Shell 12"Φ w/.25" walls			
	133	73	27
	143	79	30
	152	83	32
	160	88	35
	165	91	37
	166	91	40
	263	145	52
	276	152	55
	292	161	57
	304	167	59
	308	170	61
	326	179	64
	344	189	66
Metal Shell 14"Φ w/.25" walls			
	133	73	22
	150	82	25
	157	86	27
	169	93	30
	178	98	32
	189	104	35
	194	107	37
	195	107	40
	310	170	52
	325	178	55
	344	189	57
	358	197	59
	362	199	61
	384	211	64
	406	223	66
Metal Shell 14"Φ w/.312" walls			
	133	73	22
	150	82	25
	157	86	27
	169	93	30
	178	98	32
	189	104	35
	194	107	37
	195	107	40
	310	170	52
	325	178	55
	344	189	57
	358	197	59

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	112	61	40
	154	85	42
	158	87	45
	169	93	52
	178	98	55
	190	105	57
	198	109	61
	214	118	64
	228	125	66
	239	131	69
	250	138	71
	304	167	83
	358	197	95
	412	227	107
Steel HP 12 X 53			
	132	73	40
	191	105	42
	195	107	45
	203	111	52
	213	117	55
	229	126	57
	236	130	61
	257	141	64
	274	150	66
	287	158	69
	300	165	71
	364	200	83
Steel HP 12 X 63			
	133	73	40
	193	106	42
	198	109	45
	205	113	52
	215	118	55
	231	127	57
	238	131	61
	259	143	64
	276	152	66
	289	159	69
	303	167	71
	367	202	83
	431	237	95
	495	272	107
Steel HP 12 X 74			
	135	74	40
	196	108	42
	201	110	45
	207	114	52
	218	120	55
	234	129	57

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	141	77	27
	151	83	30
	156	86	32
	157	86	37
	157	86	40
	237	130	42
	245	135	45
	245	135	52
	257	141	55
	277	152	57
	284	156	61
	311	171	64
	331	182	66
	347	191	69
	363	200	71
	438	241	83
	514	282	95
Steel HP 14 X 89			
	131	72	22
	143	78	27
	153	84	30
	158	87	32
	158	87	37
	159	87	40
	241	133	42
	248	136	52
	260	143	55
	280	154	57
	287	158	61
	315	173	64
	336	185	66
	351	193	69
	367	202	71
	443	244	83
	520	286	95
	596	328	107
	672	370	119
Steel HP 14 X 102			
	132	73	22
	144	79	27
	154	85	30
	160	88	32
	160	88	37
	160	88	40
	244	134	42
	251	138	52
	263	145	55
	284	156	57
	290	160	61

362	199	61
384	211	64
406	223	66
425	234	69
444	244	71
Steel HP 8 X 36		
140	77	55
149	82	57
156	86	59
157	86	61
168	92	64
178	98	66
187	103	69
196	108	71
240	132	83
283	156	95
Steel HP 10 X 42		
109	60	40
150	83	42
154	85	45
165	91	52
174	96	55
186	102	57
194	107	59
194	107	61
210	115	64
223	123	66
234	129	69
245	135	71
298	164	83

242	133	61
263	145	64
280	154	66
294	161	69
307	169	71
372	205	83
437	240	95
502	276	107
567	312	119
Steel HP 12 X 84		
136	75	40
199	110	42
204	112	45
210	116	52
221	121	55
237	131	57
245	135	61
267	147	64
284	156	66
298	164	69
311	171	71
377	207	83
443	244	95
508	280	107
574	316	119
640	352	131

318	175	64
340	187	66
356	196	69
372	204	71
449	247	83
526	289	95
603	331	107
679	374	119
756	416	131
Steel HP 14 X 117		
134	74	22
146	80	27
156	86	30
161	89	32
162	89	37
162	89	40
247	136	42
254	140	52
266	147	55
287	158	57
293	161	61
322	177	64
344	189	66
360	198	69
376	207	71
454	250	83
532	292	95
609	335	107
687	378	119
765	421	131
843	463	143
Precast 14"x 14"		
142	78	20
169	93	22
191	105	25
200	110	27
216	119	30
227	125	32
240	132	35
247	136	37
248	136	40
Timber Pile		
136	75	30
146	80	32