STRUCTURE GEOTECHNICAL REPORT

Route: FAI 74 (I-74)
Section: 48-(24B)I,I-1
County: Knox
Job No.: D-94-070-00
Contract No.: Not assigned
Structure No.: 048-0105 (Proposed)
048-0002 (Existing)

Description: Replacement of 2-span bridge structure carrying westbound I-74 over Pope Creek in Knox County, Illinois

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Report Date: March 26, 2015

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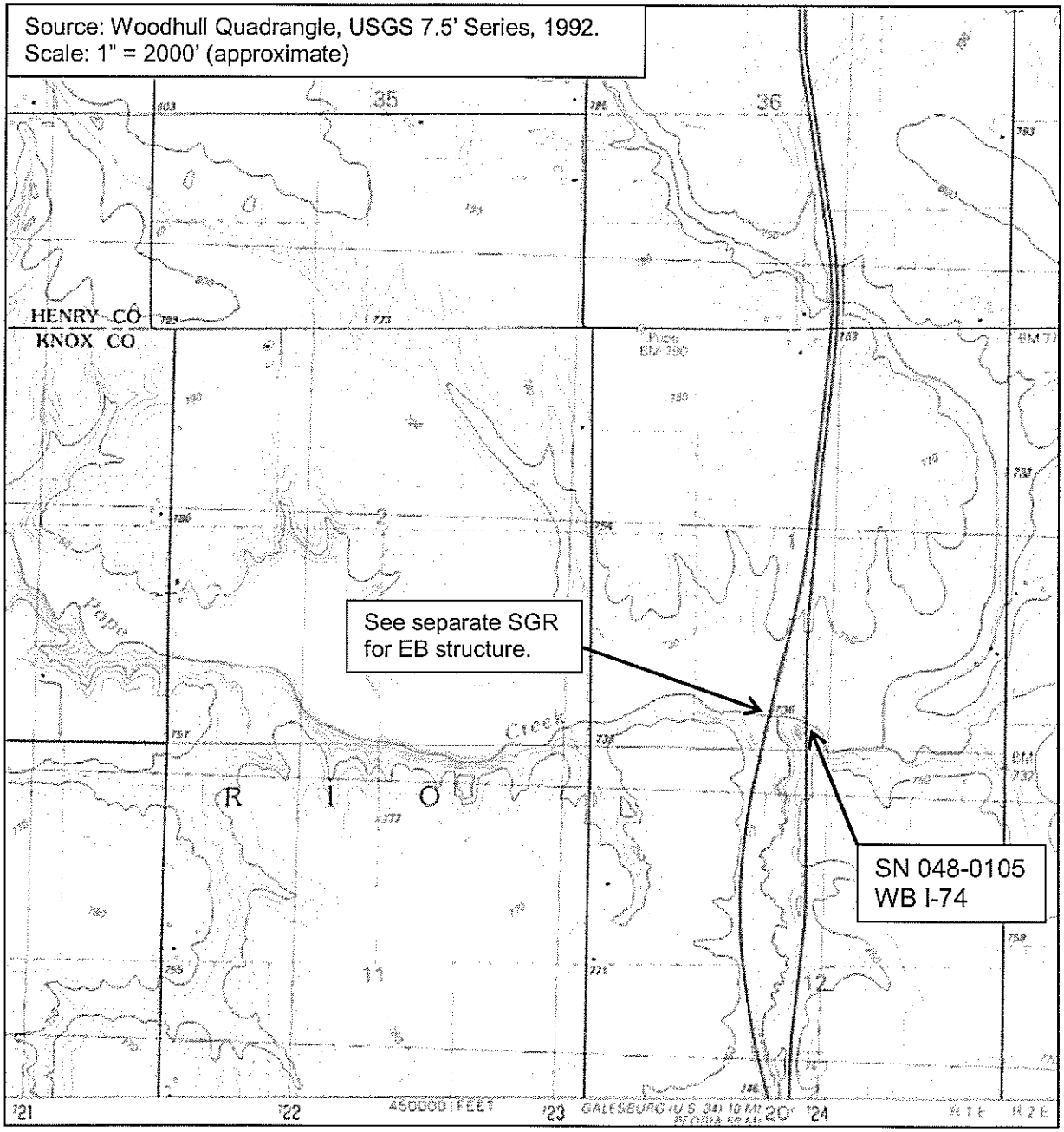
Table of Contents

1) Project Description and Proposed Structure Information

The geotechnical study summarized in this report was performed for the proposed replacement of a 2-span bridge structure that carries westbound I-74 over Pope Creek in Knox County, Illinois. As shown below, the bridge is located approximately one mile south of the Henry County line, in Section 1, Township 13 North, Range 1 East of the Fourth Principal Meridian, in the Galesburg Plain of the Till Plains Section.



Superstructure replacement was recommended for the bridge in a March 2012 Bridge Condition Report prepared by Epstein. In September 2012, Epstein submitted a memorandum documenting the cost benefit of a full structure replacement that reduced the number of spans and incorporated integral abutments. In June 2014, IDOT approved the Hydraulic Report which included the recommendation for full structure replacement for the bridge.

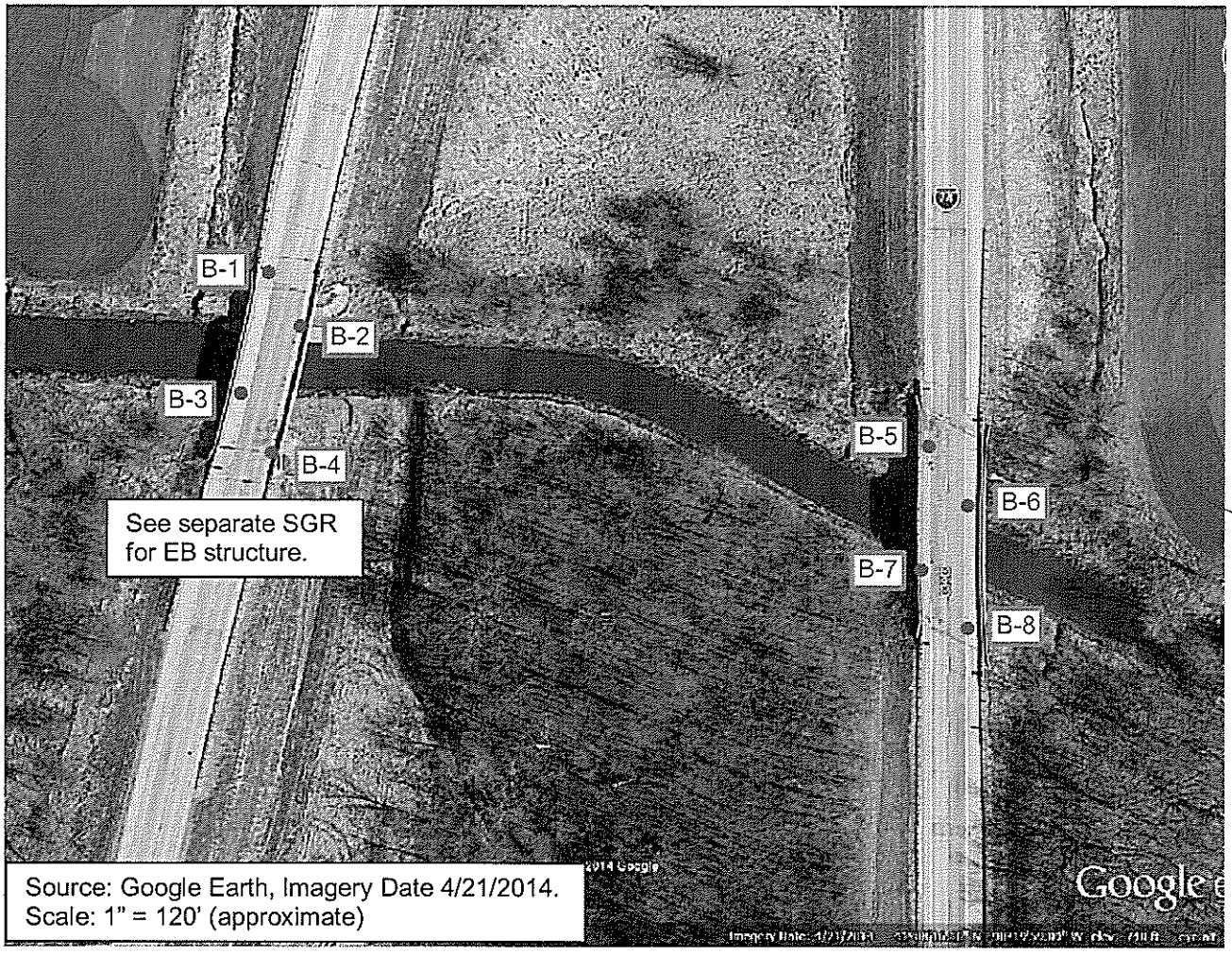
Based on the preliminary TS&L plan and other information prepared by Epstein, the existing bridge will be replaced by a single-span structure with an 8-inch concrete deck supported by PPC Bulb-T beams. The new structure will have a back to back abutment length of 114'-1", out to out deck width of 43'-2" and a 25-degree skew. The superstructure will be set on integral abutments. Piles are planned for foundation support of the abutments. Epstein calculated a factored load of 2,000 kips for each abutment. Appendix A contains the preliminary TS&L plan.

Structure replacement is expected to include removal of existing concrete abutments. Existing concrete piles will be removed to a minimum depth of 1.0 foot below the excavation line at the existing abutments and 1.0 foot below streambed for the existing pier piles. The end-slopes will be cut back to a 2 horizontal to 1 vertical (2H:1V) slope. Staged construction will be required for the new structure.

2) Subsurface Conditions

a) Geotechnical Borings

Four standard penetration test (SPT) borings B-5 through B-8 were drilled by IDOT in a June 1961 subsurface investigation for the design of the existing bridge (SN 048-0002). The boring locations are shown on the following aerial photo.



B-5 and B-8 were abutment borings, and B-6 and B-7 were pier borings. Each boring was advanced into hard, light gray shaley clay that exhibited SPT N-values exceeding 100 blows per foot (bpf). The borings were terminated at the following elevations: B-5 at 693.5, B-6 at 692.7, B-7 at 695.1, and B-8 at 701.7. Detailed information regarding the nature and thickness of the soils encountered, and the results of field sampling and laboratory testing are shown on the boring logs included in Appendix B. A subsurface data profile is included

in Appendix C. The reliability of this subsurface information and the performance of the existing substructure are such that additional exploration is not warranted.

The natural soils beneath the westbound structure consist of silty loam, silty clay, silty clay loam, sandy loam, sandy clay loam, silt, clay, and shaley clay. Based on the boring logs for B-5 through B-8, the natural soil profiles on either side of Pope Creek are noticeably different. Borings B-5, B-7, and B-8 revealed a medium to stiff silty clay that extended from the natural ground surface to depths ranging from 4.0 to 11.5 feet (Elev. 728.2 to 714.3). Moisture contents of the silty clay ranged from 27% to 34%, with an average of 31%. Unconfined compressive strengths ranged from 0.2 to 2.2 tsf with an average of 1.2 tsf. SPT N-values ranged from 3 to 12 bpf, with an average of 7 bpf. As shown on the subsurface profile in Appendix C, the bottom of the silty clay layer rises approximately 10 feet moving from the north side of Pope Creek to the south side. At the boring for the north pier (B-6), a 6.5-foot layer of stiff silty loam was encountered above the silty clay. The unconfined compressive strength of the silty loam was 1.5 tons per square foot (tsf). SPT N-values ranged from 8 to 12 bpf, with an average of 10 bpf.

On the north side of Pope Creek, the silty clay is underlain by a very soft to soft sandy clay loam that extended to depths of 16.5 to 20.0 feet (Elev. 710.7 to 710.0). One moisture content sample from this material yielded a result of 25%. One unconfined compressive strength test yielded a result of 0.4 tsf. SPT N-values ranged from 1 to 5 bpf, with an average of 3 bpf.

On the south side of Pope Creek, the silty clay is underlain by a very stiff to hard clay that extended to depths of 9.0 to 11.5 feet (Elev. 723.2 to 721.6). One moisture content sample from this upper clay yielded a result of 20%. Unconfined compressive strengths ranged from 2.2 to 3.7 tsf with an average of 2.7 tsf. SPT N-values ranged from 17 to 80 bpf, with an average of 37 bpf. Beneath the very stiff to hard clay is a 5-foot thick layer of hard silty clay loam underlain by a 2-foot layer of hard silt. The hard silt extended to depths of 16.5 to 19.0 feet (Elev. 715.7 to 714.1). SPT N-values for the silty clay loam and silt ranged from 30 to 100+ bpf, with an average of 58 bpf.

A hard clay underlies the sandy clay loam on the north side of Pope Creek. This hard clay layer laterally extends to the south side of Pope Creek, and is present beneath the hard silt in the area of the south pier (B-7). One moisture content sample from this material yielded a result of 25%. The hard clay was not encountered in the boring for the south abutment (B-5). Here the silt was underlain by a hard shaley clay. The hard shaley clay was also encountered beneath the hard clay and extended to the termination depth of each boring, which ranged from 38.0 to 40.5 feet (Elev. 688.4 to 685.5). It is notable that the top of the shaley clay layer rises nearly 10 feet moving from the north side of Pope Creek to the south side. Only one sample of the shaley clay was tested for moisture content, yielding a result of 10%. Unconfined compressive strengths ranged from 1.8 to 7.2 tsf with an average of 4.3 tsf. SPT N-values for the hard shaley clay ranged from 80 to 100+ bpf.

Table 1 summarizes the locations and elevations for B-5 through B-8, including the top of the shaley clay layer where SPT N-values exceeded 100 bpf. Also listed are groundwater elevations measured at least 20 hours after drilling. Groundwater levels will often vary due to seasonal and climatic variations, the water level in Pope Creek, and other factors. In addition, these levels were measured in 1961 before construction of the embankments and bridge. Based on these variables, groundwater may be present at different depths now and in the future.

Table 1 – Summary of Soil Boring Data

Westbound I-74

Boring	Location	Station	Offset	Ground Elevation*	Top of Shaley Clay Elevation	Groundwater Elevation
B-5	N Abutment	28+17	15 ft RT	726.5 ft	704.5 ft	722.5 ft
B-6	Pier 1 (North)	28+62	12 ft LT	730.7 ft	706.7 ft	722.2 ft
B-7	Pier 2 (South)	29+13	20 ft RT	730.6 ft	706.6 ft	721.6 ft
B-8	S Abutment	29+58	15 ft LT	724.7 ft	715.7 ft	721.7 ft

* At the time of drilling in 1961, prior to bridge and embankment construction.

b) Pile Driving Data

The existing bridge was built in 1966 and consists of a three-span structure with a cast-in-place concrete slab on continuous wide flange steel beams. The superstructure is set on concrete open abutments and pile bent piers. Concrete piles provide foundation support for the abutments and piers. Creosote timber piles support the approach slabs. Pile data from the 1966 construction was obtained from the IDOT records center and is included in Appendix C. Table 2 summarizes the concrete pile data.

Table 2 – Summary of Pile Data (1966)

Westbound I-74

Location	Required Bearing	Average Actual Bearing	Estimated Bearing Elevation
N. Abutment	27 tons	42 tons	704
S. Abutment	27 tons	36 tons	723
Piers	30 tons	52 tons	709

3) Geotechnical Evaluations

The following evaluations are based on the 1961 subsurface investigation performed by IDOT, the existing bridge plans, preliminary TS&L plans for the replacement structure, conversations with Epstein personnel familiar with the project, the Bridge Condition Report, and the Hydraulic Report. Appendix A includes the TS&L plan provided by Epstein.

a) Settlement

Settlement due to increased loading from new embankments or structures is expected to be negligible. The grade raise planned for the westbound structure is minimal and the natural soils encountered during the subsurface investigation do not appear to be highly compressible. Settlement of the natural soils caused by the existing embankments and structures occurred many years ago. Similarly, settlement within the existing embankment would also be complete. Based on this information, a rigorous settlement analysis was not performed for soils underlying the new abutments or approach slabs. The effects of downdrag on axial pile capacity have also been neglected.

b) Slope Stability

The construction of the replacement structure should have minimal impact on the existing sideslopes and bridge approaches. The backslopes at the new abutments are proposed at 2 horizontal to 1 vertical (2H:1V). Proposed backslope heights appear to be within 1 foot of existing heights. The natural soils above channel elevation appear to be of sufficient shear strength to maintain slope stability with the structure replacement. No evidence of instability has been observed in the existing slopes. Based on this information, slope stability analyses have not been performed.

c) Seismic Considerations

The seismic site soil classification for the bridge site was determined from design earthquake data, subsurface data, and the procedures described in AGMU Memo 09.1 – Seismic Site Class Definition of the IDOT Bridge Manual Design Guides. The "Seismic Site Class Determination" spreadsheet developed by the IDOT BBS Foundations and Geotechnical Unit was also utilized. Since the proposed structure size is less than 750 feet and has span lengths less than 200 feet, the global site class definition applies to this site.

Based on the evaluations described above, Site Class C is recommended for the proposed structure.

Based on Figure 2.3.10-2 of the IDOT Bridge Manual, the Seismic Performance Zone (SPZ) for this site is 1. A seismic design parameters program by the USGS was used to determine the site's seismic parameters for a 1000 year design return period earthquake (7% probability of exceedance in 75 years). Seismic design parameters for the site are summarized in Table 3.

Table 3 – Seismic Design Parameters

Westbound I-74, SN 048-0105

Parameter	Value
Site Class	C
Design Spectral Acceleration at 0.2 sec (S_{DS})	0.107g
Design Spectral Acceleration at 1.0 sec (S_{D1})	0.068g
Seismic Performance Zone	SPZ 1

Liquefaction analyses are not required for sites classified as SPZ 1. Since liquefaction is not a concern, the effects of liquefaction with respect to axial pile capacity are neglected.

d) Scour

Foundations for the abutments are areas of primary concern for damage from scour. In accordance with IDOT Bridge Manual Section 2.3.6.3.2, the design scour elevation for open abutments protected with riprap is typically set at the bottom of the abutment. The proposed replacement structure contains integral abutments protected by Class A4, Stone Riprap. Table 4 summarizes the design scour for the proposed westbound structure.

Table 4 – Design Scour Elevations

Westbound I-74, SN 048-0105

Event/Limit State	Design Scour Elevations (ft.)		Item 113
	N. Abut.	S. Abut	
Q100	731.75	732.75	8
Q200	731.75	732.75	
Design	731.75	732.75	
Check	731.75	732.75	

e) Mining Activity

According to the Knox County Mine Map dated September 18, 2013, obtained from the Illinois State Geological Survey (ISGS) website at https://www.isgs.illinois.edu/ilmines, the project site was not undermined. The Map Explanation indicates locations of some features on the Mine Map may be offset by 500 feet or more due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors. The location of this bridge is approximately 2.5 miles away from the closest mining area shown on the map. Based on the distance to the nearest mapped underground mine, a study of mining impacts on the project is not warranted.

4) Foundation Design Recommendations

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loading. The factored loads calculated by Epstein for the single-span, westbound structure are 2,000 kips per abutment. Integral abutments are planned for the replacement structure, limiting the abutment foundation alternatives to steel H-piles or metal shell piles. Metal shell piles are not feasible based on concerns that the high blow count material reported in the soil borings may cause piles to overstress before reaching the Nominal Required Bearing. Although each boring was terminated in a hard shaley clay (hard till) layer, auger refusal was not achieved and unconfined compressive strengths of the shaley clay sometimes fell below 4 tons per square foot. This leads to the conclusion that a hard bedrock unit is not present within a reasonable depth below the boring termination depths. Based on the pile design spreadsheets, H-piles must extend below the boring depths to achieve their maximum capacity and meet the required capacities for the replacement structure. Therefore, it is assumed that piles will be founded in hard till material and must rely on side friction in addition to end resistance.

For H-pile foundations, it is recommended that one test pile be driven for the proposed structure to verify the length of the piles. The test pile should be installed at an abutment to help determine the pile length. Further recommendations are provided below.

a) Steel H-Piles

The structural capacity of driven piles depends on the allowable stress and cross sectional areas of steel. The pile recommendations in this report assume that steel H-piles will conform to AASHTO M270 Grade 50 (ASTM 709 Gr 50) or equivalent with a minimum yield stress of 50 kips per square inch (ksi). Based on the current IDOT Bridge Manual, a geotechnical resistance factor (φ_G) of 0.55 was used for the design of the driven pile foundations. As liquefaction and settlement are not concerns at the site, geotechnical losses due to liquefaction and down-drag were not considered necessary in the static or seismic pile design. Geotechnical losses associated with scour were not considered since no piers are planned for the westbound structure. It is anticipated that scour will be reduced to above the proposed soil surface by using class A4 riprap at the abutments.

All estimates of capacity were calculated using the "Modified IDOT Static Method" spreadsheet associated with the IDOT Bridge Manual, and assume construction verification will follow the "WSDOT" formula outlined in Section 512 of the current IDOT Standard Specifications for Road and Bridge Construction. For each structure, the top of pile elevations were obtained from the TS&L plan provided by Epstein. Ground surface elevations during driving were assumed to be equal to the bottom elevation of the proposed abutment. Table 5 provides these elevations as well as the average Q_u within the critical pile depth for each integral abutment.

Table 5 – Steel H-Pile Design Information

Westbound I-74, SN 048-0105

Location	Top of Pile Elevation (ft)	Ground Elevation During Driving (ft)	Average Q_u Within Critical Pile Depth (psf)
N. Abutment	733.75	731.75	1.2
S. Abutment	734.75	732.75	2.6

A summary of the design capacities, or factored resistance available (R_F), and nominal required bearing (R_N) is presented in Appendix F for each H-pile size. Recommended pile lengths were calculated from the embedment depth estimates from the IDOT design spreadsheet and the top elevations estimated from the preliminary TS&L plan. Table 6 summarizes the recommended pile lengths and corresponding bottom of pile elevation. It is important to note that pile tips may extend below the termination depths of soil borings. If so, it is assumed that piles will be founded in soil conditions similar to those identified at the end of the corresponding boring.

Table 6 – Recommended Pile Lengths

Westbound I-74, SN 048-0105

Location	Pile Type & Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Length (ft)
North Abutment	HP 12 x 63	397	218	50
		429	236	53
		460	253	55
		492	271	58
	HP 12 x 74	467	257	55
		499	274	58
		530	292	60
		558	307	63
		579	319	65
	HP 12 x 84	505	278	58
		537	295	60
		567	312	63
		589	324	65
		655	360	73
	HP 14 x 73	433	238	48
		470	259	50
		508	279	53
		545	300	55
	HP 14 x 89	518	285	53
		556	306	55
		594	327	58
		632	347	60
		669	368	63
	HP 14 x 102	525	289	53
		563	309	55
		601	330	58
		639	351	60
		806	443	73
	HP 14 x 117	534	294	53
		573	315	55
		611	336	58
		649	357	60
		922	507	83

Table 6 continues on the following page.

Table 6 continued – Recommended Pile Lengths

Westbound I-74, SN 048-0105

Location	Pile Type & Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Length (ft)
South Abutment	HP 12 x 63	407	224	41
		439	241	43
		471	259	46
	HP 12 x 74	477	262	46
		509	280	48
		541	297	51
		564	310	53
		586	322	56
	HP 12 x 84	547	301	51
		574	316	53
		596	328	56
		618	340	58
		662	364	63
	HP 14 x 73	445	244	38
		482	265	41
		520	286	43
		557	307	46
	HP 14 x 89	530	291	43
		568	312	46
		606	333	48
		644	354	51
		682	375	53
	HP 14 x 102	537	295	43
		613	337	48
		689	379	53
		763	419	58
		788	434	61
	HP 14 x 117	547	301	43
		700	385	53
		738	406	56
		800	440	61
		904	497	71

b) Lateral Pile Response

A representation of the shaft response under lateral loading exceeding 3 kips per pile is required for design of the bridge superstructure per Section 3.10.1.10 of the current Bridge Manual. The lateral response can be developed by modeling the soil/shaft interaction with the computer program LPILE. Discrete elements are used in LPILE to represent the shaft and non-linear soil using springs. The non-linear soil springs are commonly referred to as P-Y curves.

Based on the encountered subsurface conditions, the approximate soil modulus parameters (k) for the LPILE analyses are presented in Table 7 (Reference: LPILE User's Manual, Ensoft, Inc., July 2004). Soils located above the 200-year design scour elevation (Q200) should not be considered during analysis. When pile/shaft design details and load information are refined in the development of the structure plans, LPILE analyses can be performed.

Table 7 – Soil Parameters for Lateral Pile Load Analysis

Westbound I-74, SN 048-0105

Location	Expected Groundwater Elevation (ft)	Depth Below Natural Ground Surface (ft)	Elevation at Bottom of Layer (ft)	Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	K (pci)	E_{50}
B-5 N Abutment	722	0.0-11.5	715.0	105	800	26	180	0.010
		11.5-16.5	710.0	120	400	30	50	0.015
		16.5-22.0	704.5	100	2700	26	900	0.005
		22.0-33.0	693.5	130	5100	12	1800	0.004
B-8 S Abutment	722	0.0-9.0	725.7	105	2200	26	670	0.010
		9.0-19.0	715.7	110	3700	30	1200	0.005
		19.0-34.0	701.7	130	5800	12	2000	0.004

5) Wingwalls

In accordance with the current Bridge Manual, integral abutments should be provided with "dog-ear" type wingwalls. The length of the wingwalls should be limited to 10 feet, and if a wing extension is required, its length shall be retained by independent walls, gabions, or rip rap. If independent walls are designed for the wingwall extensions, the Bridge Manual recommends using an at rest earth pressure coefficient of 0.5 with an equivalent fluid pressure of 60 pcf. If an uncompacted, clean rock backfill is proposed for the wingwalls, the active earth pressure coefficient of 0.3 with an equivalent fluid pressure of 40 pcf could be used for design of the wall. Typically, active pressures can be used for design if the

proposed wall can tolerate deflections of approximately 1% of the wall vertical height. If the proposed wall cannot tolerate the deflection as described, then at-rest pressures should be used for a more rigid design. Passive earth pressures can be ignored to provide a more conservative design.

6) Construction Considerations

a) Construction Activities

The construction activities should be performed in accordance with the current *IDOT Standard Specifications for Road and Bridge Construction* and any pertinent *Special Provisions* or policies.

b) Temporary Sheeting and Soil Retention

Because the construction will be staged, temporary shoring is recommended for the proposed abutments. Temporary sheet piling, which is typically used for retaining soil in "cut" situations, is not feasible. Both of the proposed abutments will be located in front of the existing abutments, resulting in a "fill" situation. Therefore, a Temporary Soil Retention System is recommended for both abutments. An Illinois-licensed structural engineer must seal the design of such a system.

Nominal values for the embankment of Q_u of about 1.0 tsf (cohesive soils) and N-value of 10 bpf (granular soils) should not be exceeded without field verification.

c) Site and Soil Conditions

Should any bridge or embankment design considerations assumed by IDOT change, the author of this SGR should be contacted to evaluate if the recommendations herein are still applicable.

Soils with high moisture content could complicate construction activities. Soft or disturbed areas should be undercut (typically 1 to 2 feet) and replaced with crushed rock, such as CA-6, to provide a working platform.

d) Foundation Construction

Conventional pile driving equipment and methodologies should be assumed. During construction and pile driving, it is likely that when the hard till material is encountered, resistance to the driven pile will increase rapidly. To limit damage to the pile, attention should be given in the field to terminate driving as soon as the maximum capacity of the pile is reached.

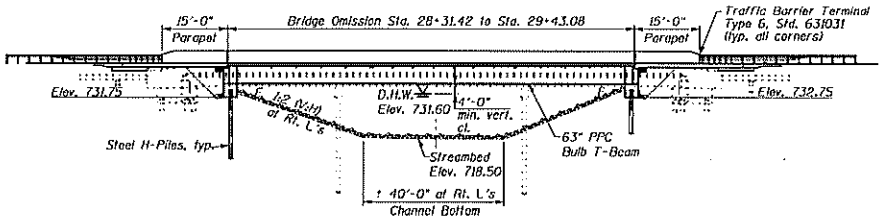
Appendix A

Type, Size and Location Plan

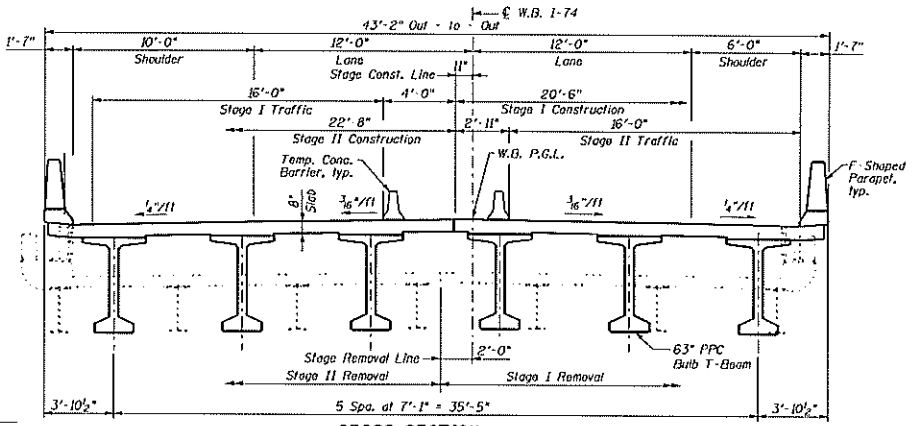
Bench Mark: #13A - Spike in roof of 15" tree 114 ft. right of ℄ WB I-74 Station +32+31. Elevation 734.99.

Existing Structure: S.N. 048-0002 Built in 1966 as F.A.I. Route 74, Section 48-24B. at Sta. 28+87.23. Existing structure consists of 3-span reinforced concrete cast in place deck on continuous steel WF beams and supported by split-thru concrete abutments and concrete pile bent piers. Structure is 141'-0" long Bk. to Bk. abutments and 43'-8" Out to Out of deck. Structure to be removed and replaced.
Traffic to be maintained utilizing stage construction.

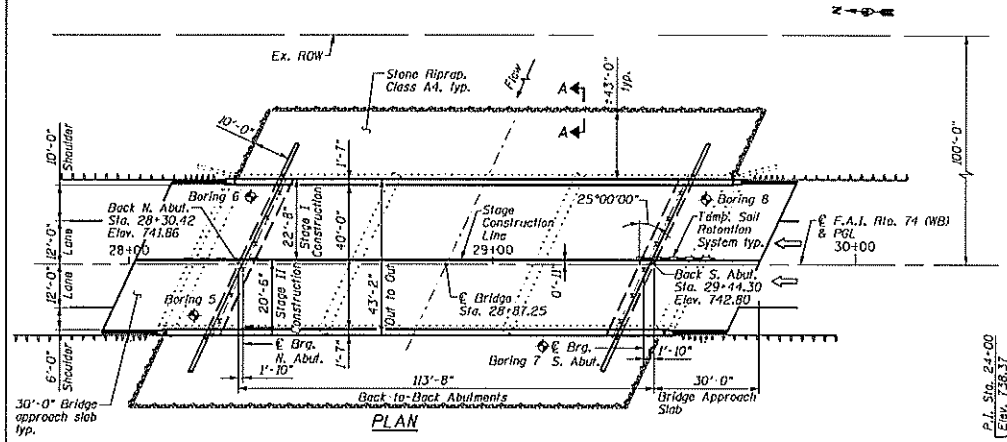
No salvage



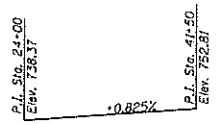
ELEVATION



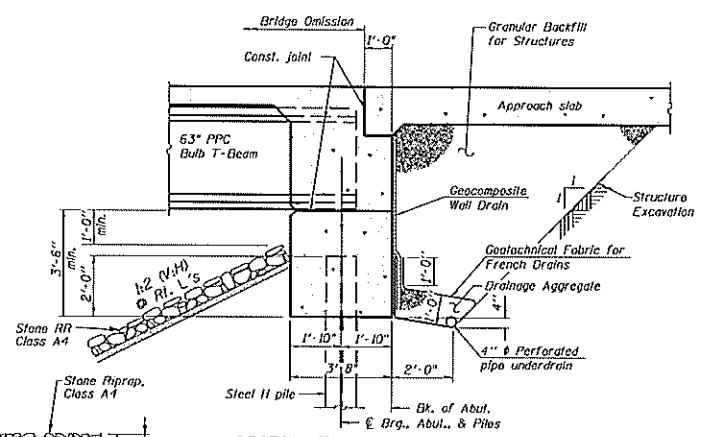
CROSS SECTION
(Looking South)



PLAN



PROFILE GRADE



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. at Rt. L's)

HIGHWAY CLASSIFICATION

F.A.I. Rte. 74 - WB I-74
Functional Class: Interstate
ADT: 7150 (2009); 9014 (2020)
ADTT: 33%
DHV: 950
Design Speed: 65 m.p.h.
Posted Speed: 65 m.p.h.
One-Way Traffic

SEISMIC DATA

Seismic Performance Zone (SPZ) = C
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.107g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.068g
Soil Site Class = SPZ I

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications
7th edition

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

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

PRECAST PRESTRESSED UNITS

f'c = 7,000 psi
f'ci = 6,000 psi
fpu = 270,000 psi
(½" ϕ low lax strands)
fpbt = 201,960 psi
(½" ϕ low lax strands)

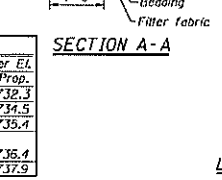
DESIGN SCOUR ELEVATION TABLE

Design Scour Elevations (ft.)		
	N. Abut.	S. Abut.
0100	731.75	732.75
0200	731.75	732.75

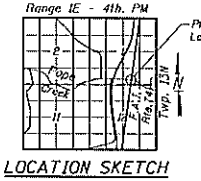
WATERWAY INFORMATION

Drainage Area = - Low Grade Elev. - ℄ Sta. -

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Hat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	3030	492	600	730.5	2.1	1.8	732.6	732.3
Design	50	4810	583	686	731.6	3.3	2.9	734.9	734.5
Base	100	5620	618	719	732.0	3.9	3.4	735.9	735.4
Scour Design Check	200	6420	653	752	732.4	4.4	4.0	736.8	736.4
Max. Calc.	500	7580	707	803	733.0	5.3	4.9	738.3	737.9



SECTION A-A



LOCATION SKETCH

GENERAL PLAN AND ELEVATION
W.B. I-74 OVER POPE CREEK
F.A.I. RT. 74 SECTION 48-(24B)1,I-1
KNOX COUNTY
STATION 28+87.25
STRUCTURE NO. 048-0105

FILE NAME =	DESIGNED EV	REVISED -
PLOT TIME = 10:37:13 AM	DRAWN PRD	REVISED -
PLOT DATE = 5/2/2015	CHECKED PC	REVISED -
	DATE 10 10 2014	REVISED -

SEPSTEIN

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN
STRUCTURE NO. 048-0105
SHEET NO. 1 OF 1 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	48-124B)1,I-1	KNOX	1	1
		CONTRACT NO. 68084		
		ILLINOIS FED. AID PROJECT		

Appendix B

Boring Logs

Illinois Department of Transportation
Division of Highways
idot

SOIL BORING LOG

Date 6/13/61

ROUTE FAI 74 DESCRIPTION WB I74 over Pope Creek (Lt. Lane) LOGGED BY A.E.Moine

SECTION 48-24B LOCATION SE¼, SW¼ SEC. 1, TWP. 13N, RNG. 1E, 4th PM,
Latitude , Longitude

COUNTY Knox DRILLING METHOD HSA HAMMER TYPE Cathead,Safety Hammer

STRUCT. NO. 048-0002 (WB)
Station 28+87.25

BORING NO. B-5 (N. ABUT)
Station 28+17
Offset 15.0 ft RT WB CL
Ground Surface Elev. 726.50 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 721.5 ft ▽
After 20 Hrs. 722.5 ft ▽

Material	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff Dark Brown SILTY CLAY				
		9	1.5 E	
722.5 ▽				
Very Soft Dark Brown SILTY CLAY	-5	4	0.2	34
720.0				
Medium Dark Gray SILTY CLAY		5	0.6	
	-10	3	0.7	
715.0				
Soft Gray SANDY LOAM		3		25
712.5				
Soft Gray SANDY CLAY LOAM	-15	5	0.4	
710.0				
Hard Light Gray CLAY		54	2.5 S	15
	-20			
Hard Light Gray CLAY *(continued)*			33	2.9 S
704.5				
Hard Light Gray SHALEY CLAY	-25		100	4.6 S
			90	4.0 S
	-30		100/11"	3.7 S
			50/3"	7.2 S
693.5			50/4"	6.0 S
End of Boring	-35			
	-40			

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

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
idot

SOIL BORING LOG

Date 6/13/61

ROUTE FAI 74 DESCRIPTION WB I74 over Pope Creek (Lt. Lane) LOGGED BY A.E.Moine

SECTION 48-24B LOCATION SE¼, SW¼ SEC. 1, TWP. 13N, RNG. 1E, 4th PM,
Latitude , Longitude

COUNTY Knox DRILLING METHOD HSA HAMMER TYPE Cathead,Safety Hammer

STRUCT. NO. 048-0002 (WB)
Station 28+87.25

BORING NO. B-6 (N. PIER)
Station 28+62
Offset 12.0 ft LT WB CL
Ground Surface Elev. 730.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 721.2 ft
After 24 Hrs. 722.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Stiff Dark Brown SILTY LOAM
	8	1.5 E		
-5				
	12	1.5 E		
724.2				
				Medium Dark Brown SILTY CLAY
	8	1.1 S		
-10				
	5	0.8 B		
719.2				
				Medium Dark Gray SILTY CLAY
	8	0.9 B		
716.7				
				Very Soft Gray SANDY CLAY LOAM
-15				
	3			
	1			
710.7 -20				
				Stiff Gray CLAY
	22	1.5 S		
708.7				
				Hard Light Gray CLAY
	41	2.7 S		
706.7				
				Hard Light Gray SHALEY CLAY
-25				
	100/10"	5.9 S		
-30				
	100	2.0 E		
	80	1.8 S		
-35				
	100/8"	4.3 S		
	50/4"	2.4 S		
692.7				
	50/4"	1.9 S		End of Boring Note: Water contents comparable to Boring 5
-40				

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

Illinois Department of Transportation
Division of Highways
idot

SOIL BORING LOG

Date 6/16/61

ROUTE FAI 74 DESCRIPTION WB I74 over Pope Creek (Lt. Lane) LOGGED BY A.E.Moine

SECTION 48-24B LOCATION SE¼, SW¼ SEC. 1, TWP. 13N, RNG. 1E, 4th PM,
Latitude , Longitude

COUNTY Knox DRILLING METHOD HSA HAMMER TYPE Cathead,Safety Hammer

STRUCT. NO. 048-0002 (WB)
Station 28+87.25

BORING NO. B-7 (S. PIER)
Station 29+13
Offset 20.0 ft RT WB CL
Ground Surface Elev. 730.60 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 721.6 ft
After 48 Hrs. 721.6 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff Brown SILTY CLAY				
		6	1.5 E	
	726.6			
Very Stiff Light Brown and Light Gray CLAY	-5			
		17	2.2 S	
		32	2.5 S	
	721.6 ▽			
Hard Light Brown SILTY CLAY LOAM	-10			
		30		
		54		
	716.6			
Hard Light Gray SILT	-15			
		31		
	714.1			
Very Stiff Gray CLAY				
		21	2.5 E	
	711.6			
Hard Light Gray CLAY	-20			
Hard Light Gray CLAY *(continued)*		43	3.1 S	
		58	3.1 S	
	706.6			
Hard Light Gray SHALEY CLAY	-25			
		100/10"	6.4 S	
		92	4.6 S	
	-30			
		50/2"	4.2 S	
		50/4"	2.9 S	
	-35			
	695.1	100/6"	4.2 S	
End of Boring				
Note: Water contents comparable to Boring 8	-40			

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

Illinois Department of Transportation
Division of Highways
idot

SOIL BORING LOG

Date 6/16/61

ROUTE FAI 74 DESCRIPTION WB I74 over Pope Creek (Lt. Lane) LOGGED BY A.E.Moine

SECTION 48-24B LOCATION SE¼, SW¼ SEC. 1, TWP. 13N, RNG. 1E, 4th PM,
Latitude , Longitude

COUNTY Knox DRILLING METHOD HSA HAMMER TYPE Cathead,Safety Hammer

STRUCT. NO. 048-0002 (WB)
Station 28+87.25

BORING NO. B-8 (S. ABUT)
Station 29+58
Offset 15.0 ft LT WB CL
Ground Surface Elev. 734.70 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 721.7 ft
After 70 Hrs. 721.7 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff Dark Brown SILTY CLAY		9	2.0 E	
	730.7			
Very Stiff Brown and Gray SILTY CLAY	-5	21	2.2 S	27
	728.2			
Very Stiff Light Brown and Light Gray CLAY		20	2.5 E	
	725.7			
Hard Light Brown and Light Gray CLAY	-10	80	3.7 S	20
	723.2			
Hard Light Brown SILTY CLAY LOAM	▽▽	91		
	-15	50		
	718.2			
Hard Light Gray SILT		50/3"		
	715.7			
Hard Light Gray SHALEY CLAY	-20			
Hard Light Gray SHALEY CLAY *(continued)*		100/7"		10
		50/5"		
	710.7			
Stiff Light Gray SHALEY CLAY	-25	11		
	708.2			
Hard Light Gray SHALEY CLAY		100/11"	6.4 S	
	-30	50/3"	5.2 S	
	701.7	50/2"		
End of Boring	-35			
	-40			

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

BBS, form 137 (Rev. 8-99)

Appendix C

Subsurface Data Profile

11

STATE OF ILLINOIS

DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

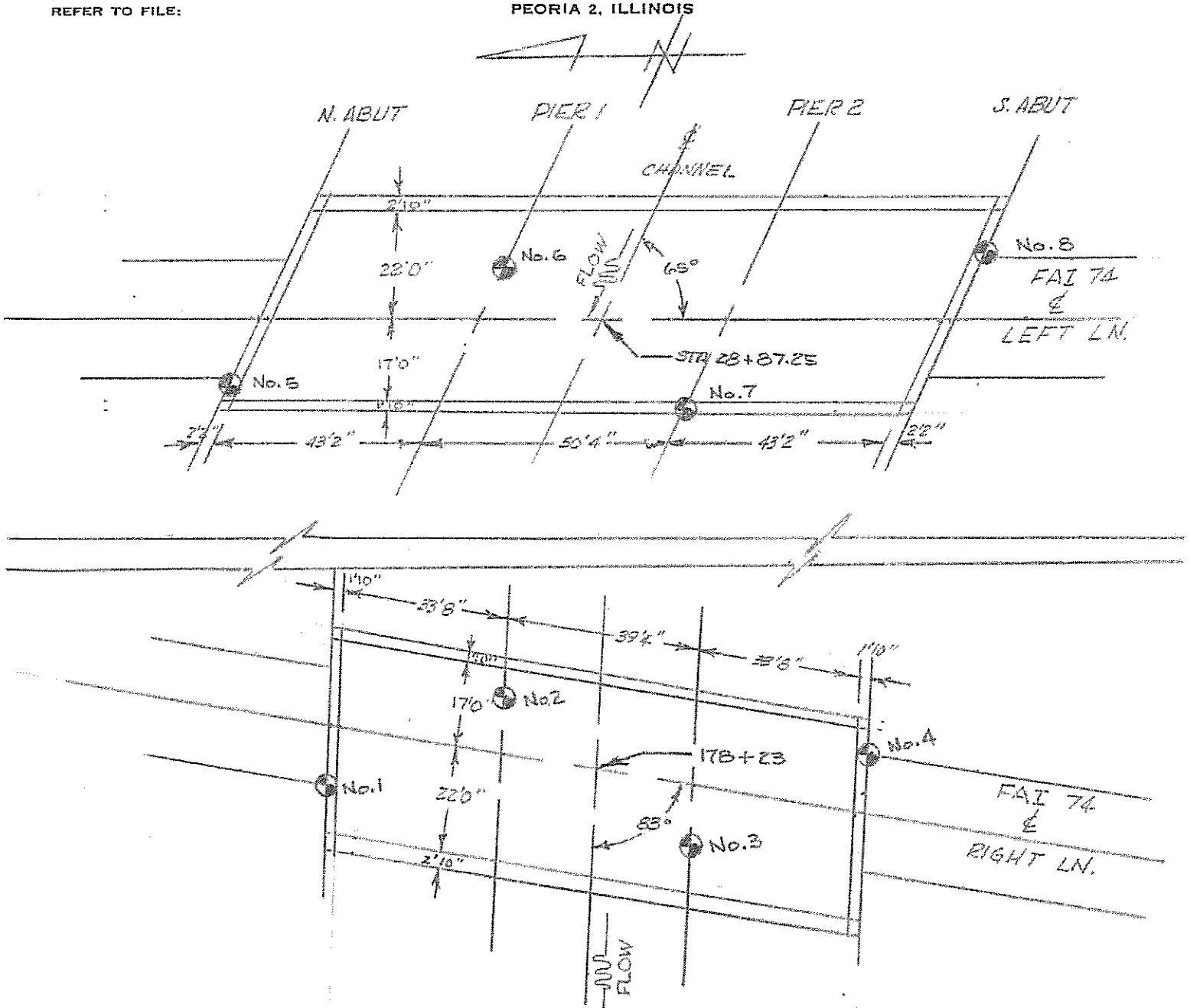
W. J. PAVES, JR., DIRECTOR

DIVISION OF HIGHWAYS

RALPH R. BARTELSMEYER
CHIEF HIGHWAY ENGINEER

IN YOUR REPLY PLEASE
REFER TO FILE:

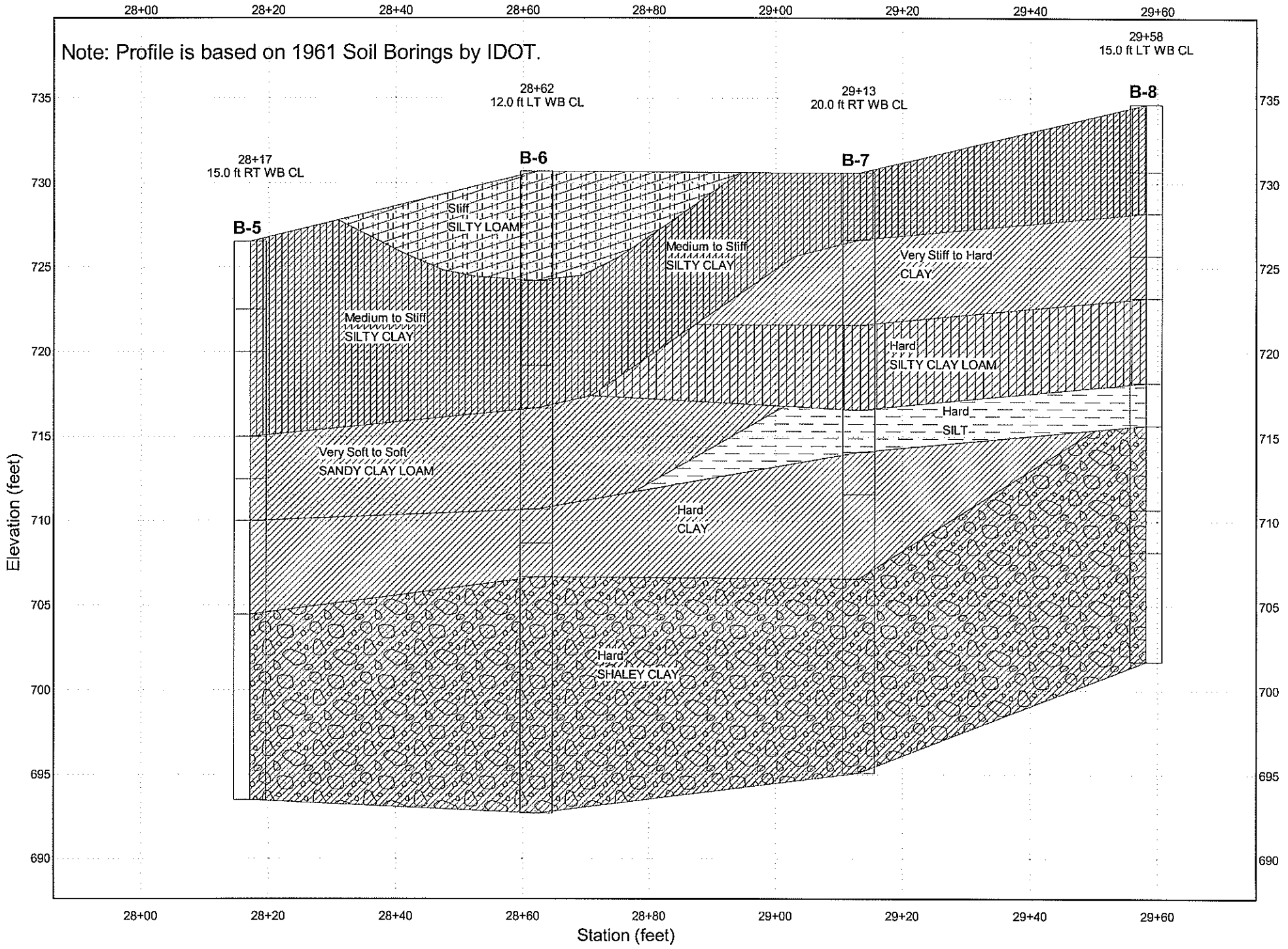
OFFICE OF DISTRICT ENGINEER
6035 N. MOUNT HAWLEY ROAD, ROUTE 88
PEORIA 2, ILLINOIS



LOCATION: SE¼ OF SW¼ & SW¼ OF SE¼
SEC 1; NE¼ OF NW¼ & NW¼ OF NE¼
SEC 12 - T13N, R1E, 4TH P.M.

RTE: FAI 74
SEC: 48-24-B
PROJ: I-74-2( )34
COUNTY: KNOX

FAI 74 OVER POPE CREEK
STA. 178+23 RT. LN.
STA. 28+87.25 LT. LN.



SUBSURFACE DATA PROFILE

Appendix D

Existing Pile Data

F. A. I. 74
Sec. 48-24B
Proj. I-74-2(45)34
Knox County

PILE DATA
Summary of Length

Precast Conc. Piling

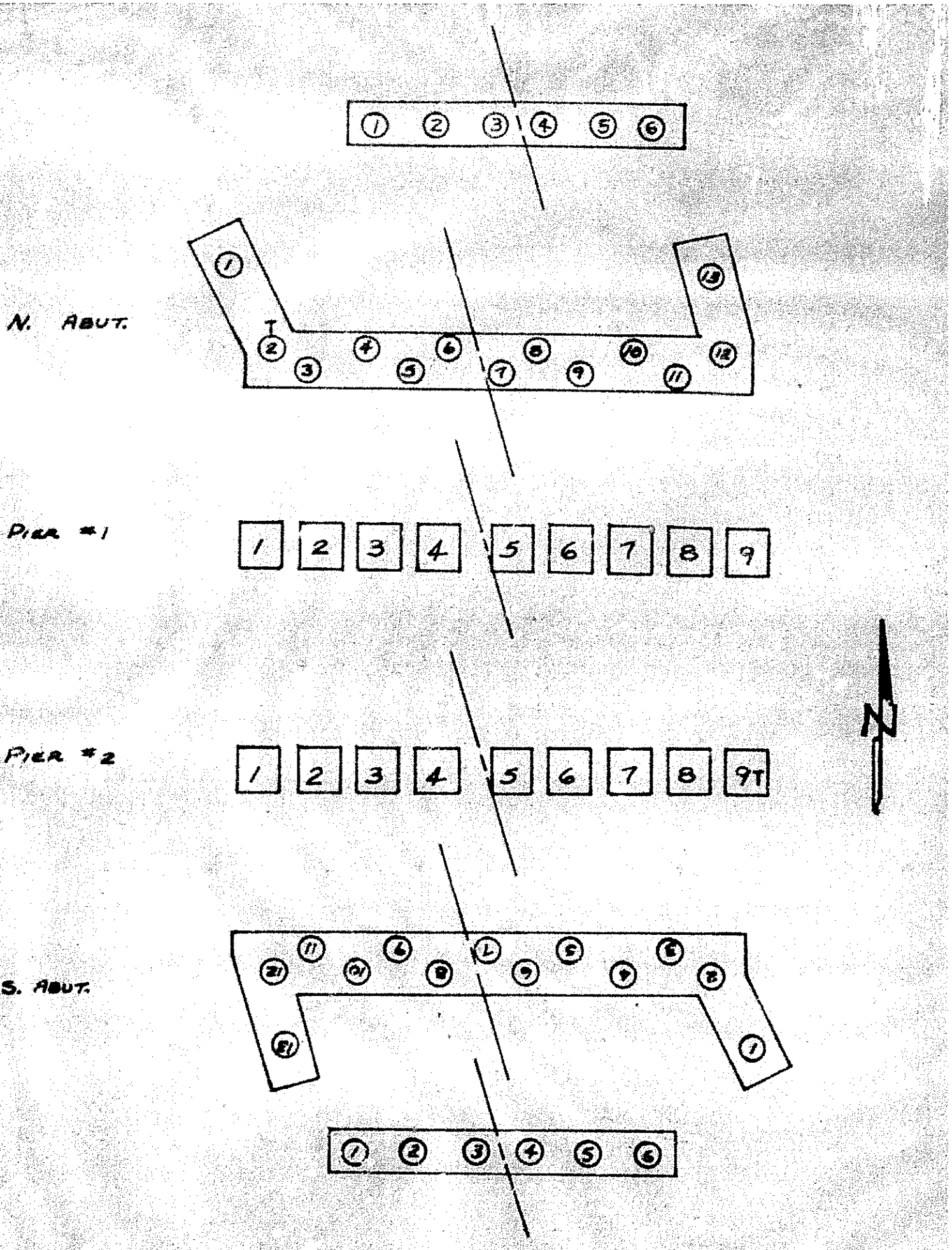
	Length Furnished	Cutoff Length	Length Driven
Left Lane-Pier #1	252.00	3.90	249.80
Pier #2	224.00	10.40	213.60
Right Lane-Pier #1	240.00	30.40	209.60
Pier #2	270.00	35.00	235.00
	986.00	79.70	908.00

Conc. Piling

	Length Furnished	Cutoff Length	Length Driven
Left Lane-N. Abut.	408.00	33.80	374.20
S. Abut.	195.00	34.10	160.90
Right Lane-N. Abut.	330.00	26.80	303.20
S. Abut.	325.00	22.80	302.20
	1258.00	117.50	1140.50

Creaos. Timber

	Length Furnished	Cutoff Length	Length Driven
Lt Lane-N. Approach	120.0	1.2	118.8
S. Approach	48.0	0.5	47.5
Rt Lane-N. Approach	90.0	0.0	90.0
S. Approach	90.0	0.0	90.0
	348.0	1.7	346.3



PILING DIAGRAM – LEFT LANE

FAI-74

PILE DATA

Hammer:
Delmag D-12:27500#
H equals Variable
Req'd. Brg. is 30 Tons

FAI-74
Sec. 48-24B
Proj. I-74-2(45)34
Knox County

Lt. Lane-Pier #1 Prec. Conc. Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	28.0'	1.1'	26.9'	52.6
2	28.0'	0.9'	27.1'	42.6
3	28.0'	1.0'	27.0'	52.6
4	28.0'	0.6'	27.4'	52.6
5	28.0'	0.3'	27.7'	31.1
6	28.0'	0.0'	28.0'	36.7
7	28.0'	0.0'	28.0'	42.6
8	28.0'	0.0'	28.9'	44.9
9	28.0'	0.0'	28.8'	53.3
Total	252.0'	3.9'	249.8'	

Lt. Lane-Pier #2 Prec. Conc. Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	28.0'	1.4'	26.6'	66.0
2	28.0'	1.6'	26.4'	66.0
3	28.0'	1.1'	26.9'	58.9
4	28.0'	1.1'	26.9'	55.0
5	28.0'	1.2'	26.8'	51.6
6	28.0'	1.0'	27.0'	49.6
7	28.0'	1.6'	26.4'	57.1
8	28.0'	1.4'	26.6'	66.0
9	Test Pile			
Total	224.0'	10.4'	213.6'	

PILE DATA

Hammer:
Delmag D-12: 2750#
H equals Variable
Req'd. Brg. is 27 Tons

FAI-74
Sec. 48-24B
Proj. I-74-2(45)34
Knox County

Lt. Lane- N. Abut. Conc. Filling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	34.0'	1.7'	32.3'	59.7
2	Test Pile			
3	34.0'	4.5'	29.5'	47.2
4	34.0'	3.1'	30.9'	29.9
5	34.0'	3.5'	30.5'	52.5
6	34.0'	2.0'	32.0'	47.2
7	34.0'	4.0'	30.0'	40.4
8	34.0'	3.0'	31.0'	33.9
9	34.0'	2.0'	32.0'	45.6
10	34.0'	3.0'	31.0'	38.3
11	34.0'	3.0'	31.0'	34.2
12	34.0'	3.0'	31.0'	33.0
13	34.0'	1.0'	33.0'	
Total	408.0'	33.8'	374.2'	

Pile Data

Hammer:
Delmag D-12; 27104
H equals Variable
Req'd. Brg. is 47 Tons

FAI-74
Sec. 43-24B
Proj. I-74-2(45)34
Knox County

Lt. Lane- S. Abut. Conc. Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	15.0'	3.0'	12.0'	30.3
2	15.0'	3.0'	12.0'	34.7
3	15.0'	4.0'	11.0'	45.2
4	15.0'	3.5'	11.5'	44.3
5	15.0'	3.0'	12.0'	29.4
6	15.0'	3.5'	11.5'	41.2
7	15.0'	3.5'	11.5'	47.1
8	15.0'	3.0'	12.0'	28.4
9	15.0'	1.7'	13.3'	55.0
10	15.0'	1.0'	14.0'	31.3
11	15.0'	1.2'	13.8'	29.4
12	15.0'	1.2'	13.8'	30.3
13	15.0'	2.5'	12.5'	27.8
Total	195.0'	34.1'	160.9'	

Hammer:
Gravity
H equals 15 ft.
Req'd Brg. is 24 ton or Plan Length

FAI-74
Sec. 48-24B
Proj. I-74-2(45)34
Knox County

Rt. Lane- S. Abut. Creos. Timber Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	15.0'	0.0'	15.0'	16.6
2	15.0'	0.0'	15.0'	16.6
3	15.0'	0.0'	15.0'	18.0
4	15.0'	0.0'	15.0'	15.0
5	15.0'	0.0'	15.0'	16.6
6	15.0'	0.0'	15.0'	18.0
Total	90.0'	0.0'	90.0'	

Lt. Lane- N. Abut. Creos. Timber Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last Ft. Driven
1	20.0'	0.4'	19.6'	23.4
2	20.0'	0.0'	20.0'	20.8
3	20.0'	0.4'	19.6'	24.2
4	20.0'	0.0'	20.0'	21.5
5	20.0'	0.4'	19.6'	21.5
6	20.0'	0.0'	20.0'	16.6
Total	120.0'	1.2'	118.8'	

Lt. Lane- S. Abut. Creos. Timber Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last ft. Driven
1	8.0'	0.1'	7.9'	9.0
2	8.0'	0.1'	7.9'	9.0
3	8.0'	0.0'	8.0'	6.4
4	8.0'	0.1'	7.9'	11.3
5	8.0'	0.2'	7.8'	9.0
6	8.0'	0.0'	8.0'	9.0
Total	48.0'	0.5'	47.5'	

Rt. Lane- N. Abut. Creos. Timber Piling

Pile No.	Length Furnished	Cutoff Length	Length Driven	Ton Brg. Last ft. Driven
1	15.0'	0.0'	15.0'	16.6
2	15.0'	0.0'	15.0'	16.6
3	15.0'	0.0'	15.0'	15.0
4	15.0'	0.0'	15.0'	15.0
5	15.0'	0.0'	15.0'	13.2
6	15.0'	0.0'	15.0'	13.2
Total	90.0'	0.0'	90.0'	

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS

TEST PILE DRIVING RECORD

6-16-65

PROJECT I-74-2(45)34
ROUTE FAI 74
SECTION 48-2RB
COUNTY KNOX
STATION OF STRUCTURE 28+87.25 LT LANE

STREAM BED ELEV. 719.8

STATION LOCATION AT WHICH PILE WAS DRIVEN PIER 2 - 29+12.42 - 25.10' LT ℄
ELEV. FROM WHICH PILE WAS DRIVEN 720.0

TYPE & WEIGHT OF HAMMER DELMAG D-12 2750#
LENGTH OF FALL VARIABLE
TYPE OF PILE 14" PRECAST CONC
REQUIRED BEARING 30 TON
ELEV. TOP PILE 737.80
ELEV. TIP OF PILE 710.80
ELEV. CUTOFF 736.17
ESTIMATED PLAN LENGTH 37 FT
ORDERED LENGTH 28' PIER 1&2 LT LANE

R.D. PAGE, PROJ. ENGR.
J.R. ABBOTT, RES.ENGR.

ELEV.	FEET BELOW CUT OFF	BLOWS PER FOOT	HEIGHT OF FALL	BEARING IN TONS	REMARKS
	22-23	79	7.0	38.2	
	24	125	7.0	43.0	
711.17	25	260	7.0	48.5	
710.80	26	150	7.0	51.0	DROVE 4½ INCHES

NOTE - BEARINGS PRIOR TO THOSE SHOWN ON THIS RECORD WERE INSIGNIFICIENT AND WERE NOT RECORDED.

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS

TEST PILE DRIVING RECORD AUGUST 17, 1965

PROJECT I-74-2(45)34
ROUTE FAI 74
SECTION 48-24B
COUNTY KNOX
STATION OF STRUCTURE 28+87.25 LT LANE

RIGHT END PILE BACK ROW NORTH ABUTMENT

STATION LOCATION AT WHICH PILE WAS DRIVEN 18.79' RT STA 28+17.90
ELEV. FROM WHICH PILE WAS DRIVEN 719.86

40' PILE FURNISHED

TYPE & WEIGHT OF HAMMER DELMAG D-12 2750#
LENGTH OF FALL VARIABLE
TYPE OF PILE 12" METAL SHELL
REQUIRED BEARING 27 TONS
ELEV. TOP PILE 741.86
ELEV. TIP OF PILE 701.86
ELEV. CUTOFF 734.86
ESTIMATED PLAN LENGTH 30 FT
ORDERED LENGTH N ABUT 34' S ABUT 15'

R.D. PAGE, PROJECT ENGINEER
J.R. ABBOTT, RESIDENT ENGINEER

ELEV.	FEET BELOW CUT OFF	BLOWS PER FOOT	HEIGHT OF FALL	BEARING IN TONS	REMARKS
	19-20				
	21				
	22				
	23				
710.86	24				
	24-25				
	26	11	5	11.5	
	27	11	5	11.5	
	28	13	5	13.5	
705.86	29	17	5½	18.7	
	29-30	19	5½	20.7	
	31	26	6	29.4	
	32	40	6½	44.5	
701.86	32-33	71	6½	66.3	REFUSAL

Appendix E

Pile Length vs. Capacity Reports

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== N Abut - WB I-74 over Pope Cl
REFERENCE BORING ========== 5
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 733.75 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 731.75 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 47.63 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 285.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.07 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Borin	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	579 KIPS	319 KIPS	65 FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 74
Plugged Pile Perimeter========== 4.050 FT. Unplugged Pile Perimeter========== 5.908 FT.
Plugged Pile End Bearing Area========== 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
726.50	5.25	1.00			15.1		36.7	22.0		***25.2***	25	0	0	14	7
722.50	4.00	1.50			15.6	21.5	***33.6***	22.7	3.2	45.2	34	0	0	18	11
720.00	2.50	0.20			1.7	2.9	***41.0***	2.4	0.4	48.5	41	0	0	23	14
717.50	2.50	0.60			4.7	8.6	***47.1***	6.8	1.3	55.5	47	0	0	26	16
715.00	2.50	0.70			5.3	10.1	***48.1***	7.8	1.5	62.6	48	0	0	26	19
712.50	2.50		3	Very Fine Silty Sand	0.5	5.7	***48.6***	0.7	0.8	63.3	49	0	0	27	21
710.00	2.50	0.40			3.2	5.7	81.9	4.7	0.8	***72.4***	72	0	0	40	24
707.00	3.00	2.50			16.4	35.9	104.0	23.9	5.3	***97.2***	97	0	0	53	27
704.50	2.50	2.90			15.1	41.7	269.1	22.1	6.2	***141.4***	141	0	0	78	29
702.00	2.50		100	Hard Till	21.8	191.6	271.7	31.8	28.3	***170.4***	170	0	0	94	32
699.50	2.50		90	Hard Till	17.9	172.4	308.8	26.1	25.5	***199.3***	199	0	0	110	34
697.00	2.50		100	Hard Till	21.8	191.6	330.6	31.8	28.3	***231.1***	231	0	0	127	37
694.50	2.50		100	Hard Till	21.8	191.6	352.4	31.8	28.3	***263.0***	263	0	0	145	39
693.50	1.00		100	Hard Till	8.7	191.6	361.1	12.7	28.3	***275.7***	276	0	0	152	40
691.00	2.50		100	Hard Till	21.8	191.6	383.0	31.8	28.3	***307.5***	308	0	0	169	43
688.50	2.50		100	Hard Till	21.8	191.6	404.8	31.8	28.3	***339.4***	339	0	0	187	45
686.00	2.50		100	Hard Till	21.8	191.6	426.6	31.8	28.3	***371.2***	371	0	0	204	48
683.50	2.50		100	Hard Till	21.8	191.6	448.4	31.8	28.3	***403.1***	403	0	0	222	50
681.00	2.50		100	Hard Till	21.8	191.6	470.3	31.8	28.3	***434.9***	435	0	0	239	53
678.50	2.50		100	Hard Till	21.8	191.6	492.1	31.8	28.3	***466.7***	467	0	0	257	55
676.00	2.50		100	Hard Till	21.8	191.6	513.9	31.8	28.3	***498.6***	499	0	0	274	58
673.50	2.50		100	Hard Till	21.8	191.6	535.7	31.8	28.3	***530.4***	530	0	0	292	60
671.00	2.50		100	Hard Till	21.8	191.6	***557.6***	31.8	28.3	562.2	558	0	0	307	63
668.50	2.50		100	Hard Till	21.8	191.6	***579.4***	31.8	28.3	594.1	579	0	0	319	65
666.00	2.50		100	Hard Till	21.8	191.6	***601.2***	31.8	28.3	625.9	601	0	0	331	68
663.50	2.50		100	Hard Till	21.8	191.6	***623.0***	31.8	28.3	657.7	623	0	0	343	70
661.00	2.50		100	Hard Till	21.8	191.6	***644.9***	31.8	28.3	689.6	645	0	0	355	73
658.50	2.50		100	Hard Till	21.8	191.6	***666.7***	31.8	28.3	721.4	667	0	0	367	75
656.00	2.50		100	Hard Till	21.8	191.6	***688.5***	31.8	28.3	753.3	689	0	0	379	78
653.50	2.50		100	Hard Till	21.8	191.6	***710.3***	31.8	28.3	785.1	710	0	0	391	80
651.00	2.50		100	Hard Till	21.8	191.6	***732.1***	31.8	28.3	816.9	732	0	0	403	83
648.50	2.50		100	Hard Till	21.8	191.6	***754.0***	31.8	28.3	848.8	754	0	0	415	85
646.00	2.50		100	Hard Till	21.8	191.6	***775.8***	31.8	28.3	880.6	776	0	0	427	88
643.50	2.50		100	Hard Till		191.6			28.3						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== N Abut - WB I-74 over Pope Cl
REFERENCE BORING ========== 5
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 733.75 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 731.75 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 47.63 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 285.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.07 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area===== 0.171 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Borin	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
664 KIPS	**655** KIPS	**360** KIPS	**73** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
726.50	5.25	1.00			15.3		37.4	22.2		***25.8***	26	0	0	14	7
722.50	4.00	1.50			15.8	22.1	***34.0***	22.9	3.6	45.5	34	0	0	19	11
720.00	2.50	0.20			1.7	2.9	***41.6***	2.4	0.5	48.9	42	0	0	23	14
717.50	2.50	0.60			4.7	8.8	***47.8***	6.8	1.4	56.0	48	0	0	26	16
715.00	2.50	0.70			5.4	10.3	***48.7***	7.8	1.7	63.1	49	0	0	27	19
712.50	2.50		3	Very Fine Silty Sand	0.5	5.9	***49.2***	0.7	1.0	63.8	49	0	0	27	21
710.00	2.50	0.40			3.3	5.9	83.4	4.7	1.0	***73.5***	74	0	0	40	24
707.00	3.00	2.50			16.6	36.8	105.9	24.0	6.0	***98.5***	98	0	0	54	27
704.50	2.50	2.90			15.3	42.7	274.8	22.2	6.9	***145.6***	146	0	0	80	29
702.00	2.50		100	Hard Till	22.1	196.3	277.2	32.0	31.9	***174.4***	174	0	0	96	32
699.50	2.50		90	Hard Till	18.1	176.7	315.0	26.2	28.7	***203.9***	204	0	0	112	34
697.00	2.50		100	Hard Till	22.1	196.3	337.1	32.0	31.9	***235.9***	236	0	0	130	37
694.50	2.50		100	Hard Till	22.1	196.3	359.2	32.0	31.9	***267.9***	268	0	0	147	39
693.50	1.00		100	Hard Till	8.8	196.3	368.0	12.8	31.9	***280.7***	281	0	0	154	40
691.00	2.50		100	Hard Till	22.1	196.3	390.1	32.0	31.9	***312.7***	313	0	0	172	43
688.50	2.50		100	Hard Till	22.1	196.3	412.2	32.0	31.9	***344.8***	345	0	0	190	45
686.00	2.50		100	Hard Till	22.1	196.3	434.3	32.0	31.9	***376.8***	377	0	0	207	48
683.50	2.50		100	Hard Till	22.1	196.3	456.4	32.0	31.9	***408.8***	409	0	0	225	50
681.00	2.50		100	Hard Till	22.1	196.3	478.5	32.0	31.9	***440.8***	441	0	0	242	53
678.50	2.50		100	Hard Till	22.1	196.3	500.6	32.0	31.9	***472.8***	473	0	0	260	55
676.00	2.50		100	Hard Till	22.1	196.3	522.7	32.0	31.9	***504.8***	505	0	0	278	58
673.50	2.50		100	Hard Till	22.1	196.3	544.7	32.0	31.9	***536.9***	537	0	0	295	60
671.00	2.50		100	Hard Till	22.1	196.3	***566.8***	32.0	31.9	568.9	567	0	0	312	63
668.50	2.50		100	Hard Till	22.1	196.3	***588.9***	32.0	31.9	600.9	589	0	0	324	65
666.00	2.50		100	Hard Till	22.1	196.3	***611.0***	32.0	31.9	632.9	611	0	0	336	68
663.50	2.50		100	Hard Till	22.1	196.3	***633.1***	32.0	31.9	664.9	633	0	0	348	70
661.00	2.50		100	Hard Till	22.1	196.3	***655.2***	32.0	31.9	696.9	655	0	0	360	73
658.50	2.50		100	Hard Till	22.1	196.3	***677.3***	32.0	31.9	729.0	677	0	0	373	75
656.00	2.50		100	Hard Till	22.1	196.3	***699.4***	32.0	31.9	761.0	699	0	0	386	78
653.50	2.50		100	Hard Till	22.1	196.3	***721.5***	32.0	31.9	793.0	724	0	0	397	80
651.00	2.50		100	Hard Till	22.1	196.3	***743.6***	32.0	31.9	825.0	744	0	0	409	83
648.50	2.50		100	Hard Till	22.1	196.3	***765.7***	32.0	31.9	857.0	760	0	0	424	85
646.00	2.50		100	Hard Till	22.1	196.3	***787.8***	32.0	31.9	889.0	785	0	0	433	88
643.50	2.50		100	Hard Till		196.3			31.9						

Pile Design Table for N Abut - WB I-74 over Pope Ck utilizing Boring #5

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
102	56	27
Metal Shell 12"Φ w/.25" walls		
102	56	27
Metal Shell 14"Φ w/.25" walls		
124	68	27
Metal Shell 14"Φ w/.312" walls		
124	68	27
Steel HP 8 X 36		
177	97	40
198	109	43
219	120	45
240	132	48
256	141	50
270	149	53
285	157	55
Steel HP 10 X 42		
183	101	37
209	115	39
220	121	40
246	135	43
272	150	45
298	164	48
324	178	50

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
189	104	37
216	119	39
226	124	40
253	139	43
279	153	45
305	168	48
332	182	50
358	197	53
382	210	55
400	220	58
418	230	60
436	240	63
Steel HP 12 X 53		
188	103	34
219	121	37
250	138	39
263	145	40
294	162	43
325	179	45
357	196	48
388	213	50
Steel HP 12 X 63		
194	107	34
226	124	37
258	142	39
270	149	40
302	166	43
334	184	45
365	201	48
397	218	50
429	236	53
460	253	55
492	271	58
Steel HP 12 X 74		
170	94	32
199	110	34
231	127	37
263	145	39
276	152	40
308	169	43
339	187	45
371	204	48
403	222	50
435	239	53
467	257	55
499	274	58
530	292	60
558	307	63
579	319	65
Steel HP 12 X 84		
174	96	32
204	112	34
236	130	37
268	147	39
281	154	40
313	172	43
345	190	45
377	207	48
409	225	50
441	242	53
473	260	55
505	278	58
537	295	60
567	312	63
589	324	65
611	336	68
633	348	70
655	360	73

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
161	89	29
196	108	32
230	126	34
267	147	37
305	168	39
320	176	40
357	197	43
395	217	45
433	238	48
470	259	50
508	279	53
545	300	55
Steel HP 14 X 89		
168	93	29
203	112	32
237	131	34
275	151	37
313	172	39
328	181	40
366	201	43
404	222	45
442	243	48
480	264	50
518	285	53
556	306	55
594	327	58
632	347	60
669	368	63
Steel HP 14 X 102		
174	96	29
208	114	32
243	134	34
281	155	37
319	176	39
334	184	40
373	205	43
411	226	45
449	247	48
487	268	50
525	289	53
563	309	55
601	330	58
639	351	60
677	372	63
715	393	65
753	414	68
780	429	70
806	443	73
Steel HP 14 X 117		
181	99	29
215	118	32
251	138	34
289	159	37
327	180	39
343	188	40
381	210	43
419	231	45
458	252	48
496	273	50
534	294	53
573	315	55
611	336	58
649	357	60
688	378	63
726	399	65
764	420	68
791	435	70
817	450	73
844	464	75
870	478	78
896	493	80
922	507	83
Precast 14"x 14"		
158	87	27
Timber Pile		
86	47	27

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== S Abut - WB I-74 over Pope Cl
REFERENCE BORING ========== 8
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 734.75 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 732.75 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 47.63 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 285.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.07 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Borin	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
589 KIPS	586 KIPS	322 KIPS	56 FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 74
Plugged Pile Perimeter========== 4.050 FT. Unplugged Pile Perimeter========== 5.908 FT.
Plugged Pile End Bearing Area========== 1.025 SQFT. Unplugged Pile End Bearing Area===== 0.151 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
730.70	2.05	2.00			9.7		41.3	14.1		***18.8***	19	0	0	10	4
728.20	2.50	2.20			12.5	31.6	58.1	18.3	4.7	***37.7***	38	0	0	21	7
725.70	2.50	2.50			13.6	35.9	189.1	19.9	5.3	***74.9***	75	0	0	41	9
723.20	2.50		60	Hard Till	14.4	153.2	224.5	21.0	22.6	***99.0***	99	0	0	54	12
720.70	2.50		91	Hard Till	18.3	174.3	164.3	26.6	25.7	***114.0***	114	0	0	63	14
718.20	2.50		50	Hard Till	6.4	95.8	266.5	9.4	14.1	***137.6***	138	0	0	76	17
715.70	2.50		100	Hard Till	21.8	191.6	288.3	31.8	28.3	***169.4***	169	0	0	93	19
710.70	5.00		100	Hard Till	43.6	191.6	***161.5***	63.7	28.3	207.9	161	0	0	89	24
708.20	2.50		11	Hard Till	1.2	21.1	333.2	1.8	3.1	***234.9***	235	0	0	129	27
701.70	6.50		100	Hard Till	56.7	191.6	389.9	82.8	28.3	***317.6***	318	0	0	175	33
699.20	2.50		100	Hard Till	21.8	191.6	411.7	31.8	28.3	***349.5***	349	0	0	192	36
696.70	2.50		100	Hard Till	21.8	191.6	433.5	31.8	28.3	***381.3***	381	0	0	210	38
694.20	2.50		100	Hard Till	21.8	191.6	455.4	31.8	28.3	***413.2***	413	0	0	227	41
691.70	2.50		100	Hard Till	21.8	191.6	477.2	31.8	28.3	***445.0***	445	0	0	245	43
689.20	2.50		100	Hard Till	21.8	191.6	499.0	31.8	28.3	***476.8***	477	0	0	262	46
686.70	2.50		100	Hard Till	21.8	191.6	520.8	31.8	28.3	***508.7***	509	0	0	280	48
684.20	2.50		100	Hard Till	21.8	191.6	542.7	31.8	28.3	***540.5***	541	0	0	297	51
681.70	2.50		100	Hard Till	21.8	191.6	***564.5***	31.8	28.3	572.3	564	0	0	310	53
679.20	2.50		100	Hard Till	21.8	191.6	***586.3***	31.8	28.3	604.2	586	0	0	322	56
676.70	2.50		100	Hard Till	21.8	191.6	***608.1***	31.8	28.3	636.0	636	0	0	334	58
674.20	2.50		100	Hard Till	21.8	191.6	***630.0***	31.8	28.3	667.8	630	0	0	346	61
671.70	2.50		100	Hard Till	21.8	191.6	***651.8***	31.8	28.3	699.7	652	0	0	358	63
669.20	2.50		100	Hard Till	21.8	191.6	***673.6***	31.8	28.3	731.5	674	0	0	370	66
666.70	2.50		100	Hard Till	21.8	191.6	***695.4***	31.8	28.3	763.4	695	0	0	382	68
664.20	2.50		100	Hard Till	21.8	191.6	***717.2***	31.8	28.3	795.2	717	0	0	394	71
661.70	2.50		100	Hard Till	21.8	191.6	***739.1***	31.8	28.3	827.0	739	0	0	406	73
659.20	2.50		100	Hard Till	21.8	191.6	***760.9***	31.8	28.3	858.9	761	0	0	418	76
656.70	2.50		100	Hard Till	21.8	191.6	***782.7***	31.8	28.3	890.7	783	0	0	430	78
654.20	2.50		100	Hard Till		191.6			28.3						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== S Abut - WB I-74 over Pope Cl
REFERENCE BORING ========== 8
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 734.75 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 732.75 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 47.63 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 285.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.07 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Borin	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
664 KIPS	662 KIPS	364 KIPS	63 FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area===== 0.171 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
730.70	2.05	2.00			9.8		42.2	14.2		***19.4***	19	0	0	11	4
728.20	2.50	2.20			12.7	32.4	59.3	18.4	5.3	***38.5***	39	0	0	21	7
725.70	2.50	2.50			13.8	36.8	193.3	20.0	6.0	***78.1***	78	0	0	43	9
723.20	2.50		60	Hard Till	14.6	157.1	229.5	21.1	25.5	***102.7***	103	0	0	56	12
720.70	2.50		91	Hard Till	18.5	178.6	167.5	26.8	29.0	***116.4***	116	0	0	64	14
718.20	2.50		50	Hard Till	6.5	98.2	272.2	9.5	16.0	***141.8***	142	0	0	78	17
715.70	2.50		100	Hard Till	22.1	196.3	294.3	32.0	31.9	***173.8***	174	0	0	96	19
710.70	5.00		100	Hard Till	44.2	196.3	***163.7***	64.0	31.9	209.5	164	0	0	90	24
708.20	2.50		11	Hard Till	1.2	21.6	339.7	1.8	3.5	***239.7***	240	0	0	132	27
701.70	6.50		100	Hard Till	57.4	196.3	397.1	83.2	31.9	***322.9***	323	0	0	178	33
699.20	2.50		100	Hard Till	22.1	196.3	419.2	32.0	31.9	***354.9***	355	0	0	195	36
696.70	2.50		100	Hard Till	22.1	196.3	441.3	32.0	31.9	***386.9***	387	0	0	213	38
694.20	2.50		100	Hard Till	22.1	196.3	463.4	32.0	31.9	***418.9***	419	0	0	230	41
691.70	2.50		100	Hard Till	22.1	196.3	485.5	32.0	31.9	***451.0***	451	0	0	248	43
689.20	2.50		100	Hard Till	22.1	196.3	507.6	32.0	31.9	***483.0***	483	0	0	266	46
686.70	2.50		100	Hard Till	22.1	196.3	529.7	32.0	31.9	***515.0***	515	0	0	283	48
684.20	2.50		100	Hard Till	22.1	196.3	551.8	32.0	31.9	***547.0***	547	0	0	301	51
681.70	2.50		100	Hard Till	22.1	196.3	***573.9***	32.0	31.9	579.0	574	0	0	316	53
679.20	2.50		100	Hard Till	22.1	196.3	***595.9***	32.0	31.9	611.0	596	0	0	328	56
676.70	2.50		100	Hard Till	22.1	196.3	***618.0***	32.0	31.9	643.1	618	0	0	340	58
674.20	2.50		100	Hard Till	22.1	196.3	***640.1***	32.0	31.9	675.1	640	0	0	352	61
671.70	2.50		100	Hard Till	22.1	196.3	***662.2***	32.0	31.9	707.1	662	0	0	364	63
669.20	2.50		100	Hard Till	22.1	196.3	***684.3***	32.0	31.9	739.1	684	0	0	376	65
666.70	2.50		100	Hard Till	22.1	196.3	***706.4***	32.0	31.9	771.1	706	0	0	388	67
664.20	2.50		100	Hard Till	22.1	196.3	***728.5***	32.0	31.9	803.1	729	0	0	401	71
661.70	2.50		100	Hard Till	22.1	196.3	***750.6***	32.0	31.9	835.2	751	0	0	413	73
659.20	2.50		100	Hard Till	22.1	196.3	***772.7***	32.0	31.9	867.2	773	0	0	425	75
656.70	2.50		100	Hard Till	22.1	196.3	***794.8***	32.0	31.9	899.2	795	0	0	437	78
654.20	2.50		100	Hard Till		196.3			31.9						

Pile Design Table for S Abut - WB I-74 over Pope Ck utilizing Boring #8

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
48	27	7
Metal Shell 12"Φ w/.25" walls		
48	27	7
340	187	9
Metal Shell 14"Φ w/.25" walls		
61	33	7
Metal Shell 14"Φ w/.312" walls		
61	33	7
Steel HP 8 X 36		
150	82	27
204	112	33
225	124	36
246	135	38
260	143	41
275	151	43
Steel HP 10 X 42		
186	102	27
254	140	33
280	154	36
306	169	38
333	183	41

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
193	106	27
261	144	33
287	158	36
314	172	38
340	187	41
366	201	43
388	213	46
406	223	48
424	233	51
442	243	53
Steel HP 12 X 53		
158	87	24
223	123	27
304	167	33
335	184	36
367	202	38
398	219	41
Steel HP 12 X 63		
159	88	24
230	126	27
312	172	33
344	189	36
375	206	38
407	224	41
439	241	43
471	259	46
Steel HP 12 X 74		
161	89	24
235	129	27
318	175	33
349	192	36
381	210	38
413	227	41
445	245	43
477	262	46
509	280	48
541	297	51
564	310	53
586	322	56
Steel HP 12 X 84		
164	90	24
240	132	27
323	178	33
355	195	36
387	213	38
419	230	41
451	248	43
483	266	46
515	283	48
547	301	51
574	316	53
596	328	56
618	340	58
640	352	61
662	364	63

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
191	105	24
272	149	27
369	203	33
407	224	36
445	244	38
482	265	41
520	286	43
557	307	46
Steel HP 14 X 89		
194	106	24
280	154	27
378	208	33
416	229	36
454	250	38
492	271	41
530	291	43
568	312	46
606	333	48
644	354	51
682	375	53
Steel HP 14 X 102		
169	93	17
196	108	24
286	157	27
385	212	33
423	232	36
461	253	38
499	274	41
537	295	43
575	316	46
613	337	48
651	358	51
689	379	53
727	400	56
763	419	58
788	434	61
Steel HP 14 X 117		
176	97	17
198	109	24
293	161	27
393	216	33
432	237	36
470	258	38
508	280	41
547	301	43
585	322	46
623	343	48
662	364	51
700	385	53
738	406	56
773	425	58
800	440	61
826	454	63
852	468	66
878	483	68
904	497	71
Precast 14"x 14"		
77	43	7
Timber Pile		
144	79	9