STRUCTURE GEOTECHNICAL REPORT

Proposed Structure No. 051-0074

EXISTING STRUCTURE No. 051-0004

IL 1 OVER EMBARRAS RIVER OVERFLOW
FAP ROUTE 332 (IL-1)
SECTION (16BR-1, BR-2)B-1
LAWRENCE COUNTY
STATION 85+13.18
P-97-025-06

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Bureau of Bridges and Structures
Illinois Department of Transportation

Prepared for:
Bridge Planning Unit and Bridge Design Section
Bureau of Bridges and Structures
Illinois Department of Transportation

December 13, 2018

Illinois Department of Transportation

Bureau of Bridges & Structures • 2300 S. Dirksen Parkway • Springfield, Illinois 62764

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TABLES

EXHIBITS

1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Scope

The project consists of total replacement of the existing 9-span bridge that carries FAP 332 (IL Route 1) over Embarras River Overflow with a 5-span bridge. The purpose of this SGR is to provide a geotechnical assessment of the planned replacement structure, based on subsurface conditions encountered at six borings.

1.2 Project Location

This project will be constructed on FAP 332 (U.S. Route 1) over Embarras River Overflow, located in the North of Section 30, Township 4N, Range 11W of the 3rd P.M; 1.5 miles North of Lawrenceville, in Lawrence County, Illinois. The general site area is shown on the attached Location Map, Exhibit A.

1.3 Existing Structure Information

The original structure number 051-0004 carries FAP 332 (IL Route 1) over the Embarras River Overflow. The original structure was built in 1923 with reconstruction occurring in 1963. There is no skew. This bridge is the north overflow structure that spans the Embarras River overflow on Illinois Route 1. The original structure consists of an 8-span bridge. The existing substructure consists of a closed abutment at the South, seven piers on pile-supported footings, and a spill-through abutment at the North; all substructures are supported by timber piles. The existing piers and the North Abutment are each two-column portal type structures.

1.4 Proposed Structure Information

The proposed replacement structure (S.N. 051-0074) will consist of a 5-span bridge with a total length of 384’-8” from back to back of abutments and width of 40’-0” out to out. Abutments and piers will be supported by steel H-piles. The proposed structure will carry IL 1 at 0 degree skew over Embarras River Overflow. The proposed grade of the roadway will have minimum variation when compared to the existing. The proposed bridge centerline station will be 85+13.18.. The new bridge is to be built using stage construction – Stage 1 traffic on the Northbound lane.

2.0 FIELD EXPLORATION AND SUBSURFACE CONDITIONS

2.1 Subsurface Exploration and Testing

A truck mounted drill rig with hollow-stem augers was used to drill the borings. Samples were collected using a standard split spoon sampler, driven by a 140# automatic hammer, according to the methods outline in ASTM D1586,"Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." Split spoon samples were obtained at 2½-foot intervals in the upper 30 feet and at 5-foot intervals thereafter. Unconfined compressive strengths of cohesive split-spoon samples were measured with Rimac testing apparatus. The sampling sequence for each boring is summarized in the Boring Logs in Exhibit D.

Six standard penetration test (SPT) borings, designated B-1 (S. Abut.), B-2 (Pier 1), B-3 (Pier 2), B-4 (Pier 3), B-5 (Pier 4) and B-6 (N. Abut.), were drilled in August and September of 2017. Detailed boring locations are shown on the TS&L Plan, Exhibit B. The borings were drilled to depths of approximately 130 feet, and 110 feet below existing ground surface for the abutments and piers, respectively, extending into rock (auger refusal); two rock cores were taken, one at B-2 (Pier 1), and one at B-3 (Pier 2).

2.2 Subsurface Conditions

Generalized subsurface conditions, based on borings B-1 to B-6, mainly consist of a mixture of soft silt, loose to medium sand, soft to stiff clay, and clay loam till. These soils were followed by shale. Rock Cores were taken at B-2 (Pier 1) from Elev. 303.98 to 293.98, and B-3 (Pier 2) from Elev. 306.06 to 291.06, which mainly consists of highly weathered to weathered silty clay shale. RQD values were from 0 to 63 %, and unconfined compressive strength values were from 5.4 to 86 tsf. Grain size distribution analyses (just the % passing the No. 200 Sieve) on some sand layers were performed on the borings.

The attached borings show that groundwater was encountered during drilling at approximate elevations 393 ft. to 404 ft. Seasonal variations and other unknown considerations could cause fluctuations in the water level and the presence of water in the soils at the site. Detailed information concerning top of rock elevations are presented in Table 2.2.1.

Table 2.2.1 – Summary of Rock Elevations

Boring	Estimated Top of Rock Elevation (ft)
B-1 (S. Abut.)	301.2
B-2 (Pier 1)	304.5
B-3 (Pier 2)	306.6
B-4 (Pier 3)	305.8
B-5 (Pier 4)	303.4
B-6 (N. Abut.)	301.4

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

The proposed profile grades will be 6 inches higher than the existing grade. The small additional load at each abutment by the new embankment will not cause any settlement concerns. No problems due to settlement are therefore anticipated.

3.2 Overall (Global) Stability

There is no significant increase in the roadway profile grade for slopes which have been stable for over 50 years; therefore, no stability problems are expected for the new side embankment slopes considering a proposed inclination equal to the existing or having the standard inclination of 2 horizontal to 1 vertical (2H:1V).

The overall stability was evaluated for the seismic conditions. The horizontal seismic coefficient used to evaluate the seismic slope stability was calculated based on the Federal Highway Administration (FHWA) Reference Manual titled “LRFD Seismic Analysis and Design of Transportation Geotechnical Features and Structural Foundations” (FHWA Publication No. FHWA-NHI-11-032). The controled horizontal seismic coefficient for the seismic slope stability analysis is 0.161. (See Exhibit E for calculation). The seismic slope stability Factor of Safety (FOS) for both abutments was above the required FOS of 1.0 (See Exhibit F for analyses).

Table 3.2.1 – Seismic Slope Stability Factor of Safety

Substructure	Seismic Slope Stability Factor of Safety
South Abutment	1.08
North Abutment	1.11

3.3 Seismic Considerations

Seismic Data

According to the AASHTO LRFD Bridge Design Specifications (Seventh Edition), a site coefficient, which is a function of the soil profile types, is required for the calculation of minimum earthquake design forces. Based on the soils encountered and the depth to bedrock, the Seismic Performance Zone (SPZ) is 3 and the Soil Site Class is E. The global site class definition is based on the results of IDOT Bureau of Bridge and Structures Seismic Site Class Determination spreadsheet (Exhibit G). The AASHTO Specifications indicate that the site has a Design Spectral Acceleration at 1.0 second (S_{D1}) of 0.326g, and a Design Spectral Acceleration (S_{Ds}) at 0.2 second of 0.746g.

Liquefaction

Liquefaction analyses were performed (attached in exhibit H) and potentially liquefiable soils were observed. Pile designs (axial capacities) were performed based on seismic analyses (applying the liquefaction geotechnical loss), and based on the Strength Limit State (Exhibit I). It was observed that the Strength Limit State analysis controls the axial pile design; therefore the control pile design was provided in Tables 4.2.2.

3.4 Scour

The design scour elevations shown in Table 3.4.1 were determined based on the hydraulic report, which 7’ of raw scour is predicted at each pier for each analyzed flood frequency. Scour reduction due to the soil was not applied due to the presence of soft soils (shown in the borings) within the scour depth. The design scour elevations at the abutments should correspond to the bottom of the abutment cap elevations, and at the piers should correspond 7’ below the streambed elevation (412.5 feet), as shown in Table 3.4.1.

Table 3.4.1 – Design Scour Elevation Table

Event/Limit State	Design Scour Elevations (ft.)						Item 113
	S. Abut.	Pier 1	Pier 2	Pier 3	Pier 4	N. Abut.	
Q100	423.9	405.5	405.5	405.5	405.5	424.1	5
Q200	423.9	405.5	405.5	405.5	405.5	424.1	
Design	423.9	405.5	405.5	405.5	405.5	424.1	
Check	423.9	405.5	405.5	405.5	405.5	424.1	

3.5 Mining Activity

According to the Illinois State Geological Survey (ISGS) "Coal Mines in Illinois Viewer," the project site was not undermined.

4.0 FOUNDATION TYPE EVALUATION AND DESIGN RECOMMENDATIONS

4.1 Foundation Type Feasibility

Based on the preliminary TSL, the proposed structure (SN 051-0074), Station 85+13.18 will be constructed on integral abutments and pile bent piers. H-piles are feasible to support the Abutments and Piers. End bearing large diameter open-end pipe piles and drilled shafts are also feasible, and would only be needed if driven H-piles are not able to withstand the lateral forces. Additional information for the large diameter open-end pipe piles and drilled shaft design will be provided during the Final Design phase if it is needed.

4.2 Driven Pile Supported Foundations

The piles initially considered for this site were end-bearing H-piles and metal shell (MS) piles. Due to the probability of liquefaction, H-piles driven into rock to their Maximum Nominal Required Bearing are the preferred foundation treatment to be used at this site. Metal shells might not achieve the necessary embedment needed for the Extreme Event Case and therefore are not recommended. At the North Abutment, a 9-inch concrete pavement located at Elev. 412.9, based on boring 6, should be cored before the start of driving the pile. The Modified IDOT static method Excel spreadsheet was used to estimate the pile lengths as per AGMU Memo 10.2. Pile shoes are not required for the H-piles.

Table 4.2.1 shows the preliminary axial foundation factored loads (strength 1) per each abutment, and per each pier that were obtained from the structural planning engineer.

Table 4.2.1 – Preliminary Axial Foundation Factored loads

Substructure Unit	Estimated Total Factored Load (kips)
South Abutment	667
Pier 1	1575
Pier 2	1542
Pier 3	1572
Pier 4	1409
North Abutment	531

Table 4.2.2 summarizes the estimated pile lengths for H-piles of various sizes for the South, North Abutments , and Piers. The pile cutoff elevations used for the analyses were taken at Elev. 426.0 for both Abutments, and 428.5 for the Piers. Geotechnical losses due to the scour or liquefaction were included in the axial pile capacity calculations. The LRFD pile capacity analysis including the scour depth controls the design camparing to the Seismic pile capacity analysis including the liquefaction.

Test Piles:

One test pile is recommended at the South Abutment, Pier 2 and Pier 4.

Table 4.2.2 – Estimated Pile Lengths

Substructure Unit	Assumed Pile Cut-off Elevation (ft.)	Pile Size	Maximum Nominal Bearing (kips)	Factored Resistance Available (kips) (Strength Limit State)	Seismic Resistance Available (kips) (Extreme Limit State)	Estimated Pile Length (ft.)
South Abutment	426.0	HP 14x73	578	318	578	127
		HP 14x89	705	388	705	129
		HP 14x102	810	446	810	131
		HP 14x117	929	511	929	132
Pier 1	428.5	HP 14x73	578	316	561	126
		HP 14x89	705	386	688	128
		HP 14x102	810	444	793	129
		HP 14x117	929	509	912	131
Pier 2	428.5	HP 14x73	578	313	531	126
		HP 14x89	705	383	658	128
		HP 14x102	810	441	763	129
		HP 14x117	929	506	881	131
Pier 3	428.5	HP 14x73	578	311	528	125
		HP 14x89	705	381	654	126
		HP 14x102	810	439	758	129
		HP 14x117	929	504	877	131
Pier 4	428.5	HP 14x73	578	310	509	128
		HP 14x89	705	380	636	130
		HP 14x102	810	438	740	132
		HP 14x117	929	502	859	134
North Abutment	426.0	HP 14x73	578	318	481	130
		HP 14x89	705	388	607	132
		HP 14x102	810	446	710	134
		HP 14x117	929	511	829	135

4.3 Lateral Pile Response

During the Final Design, using final loads, lateral load analyses will be performed on different sizes of H-piles. Soil parameters for both the strength Limit State and Extreme Limit State will be determined.

5.0 CONSTRUCTION CONSIDERATIONS

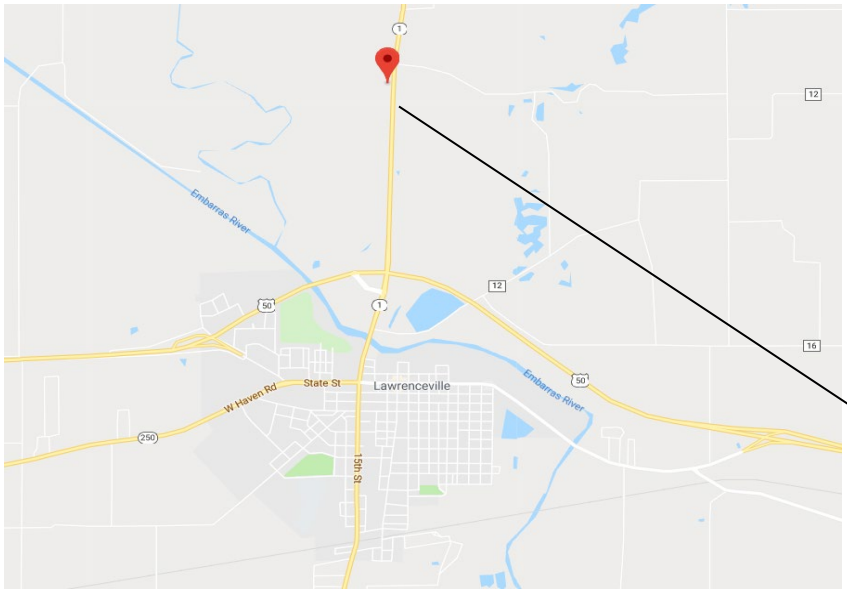
5.1 Temporary Sheeting and Soil Retention

Based on what the bridge planner has told us, the new bridge is to be built using stage construction; soil retention will be required. Based on the design charts, "*Temporary Sheet Piling"* appears feasible to be used for the South Abutment. However, "*Temporary Soil Retention System*" appears to be needed for the North Abutment due to the existing 9-inch concrete pavement located at Elev. 412.9, based on Boring 6. Soil retention will be required that will extend from each existing abutment to the far end of each new abutment's excavation.

5.2 Cofferdams and Seal Coats

With the preliminary proposed pile bent piers shown in the preliminary Plan and Profile, Type I Cofferdams are expected at the piers, based on the Estimated Water Surface Elevation (EWSE) of 414.8 ft. and the bottom of the solid wall encasement elevation of 410.0 ft. Seal coats are not needed at the piers based on the

EXHIBIT A – LOCATION MAP



Project Location

S.N. 051-0004 (Existing)

S.N. 051-0074 (Proposed)

Latitude = 38.755528

Longitude = -087.684231

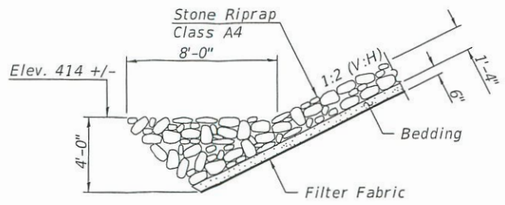
EXHIBIT B – TYPE, SIZE, AND LOCATION (TS&L) PRELIMINARY SKETCH

Benchmark: Chiseled square on southeast corner of bridge hubguard of structure 051-0004, Station 83+11, 16.1 ft rt, Elevation 431.16

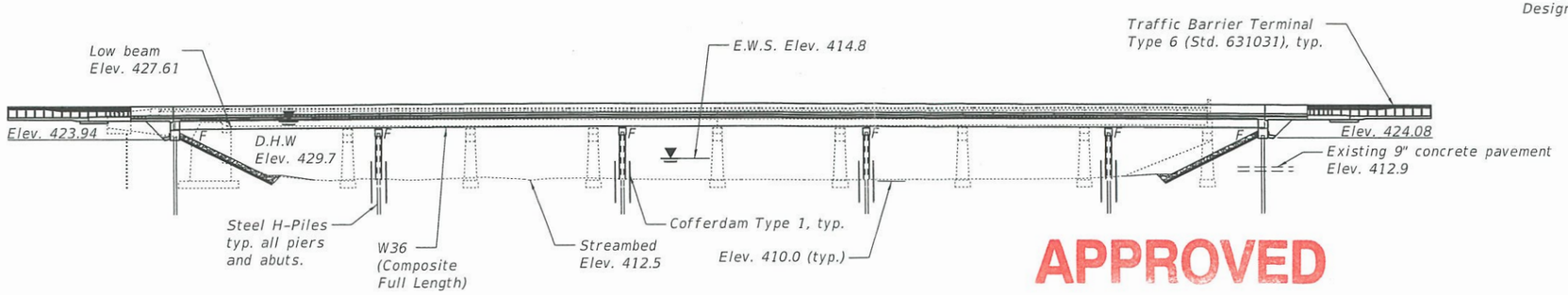
Existing Structure: SN 051-0004, an 11 span structure was built in 1923 as SBI Route 1, Section 16. In 1964 the superstructure was replaced, an approach span was added to the south abutment, and Pier 8 was converted to a new north abutment. The remaining three spans were filled. The existing bridge is 346'-0" back-to-back and 35'-8" out-to-out. The bridge is to be removed and replaced utilizing stage construction.

No salvage.

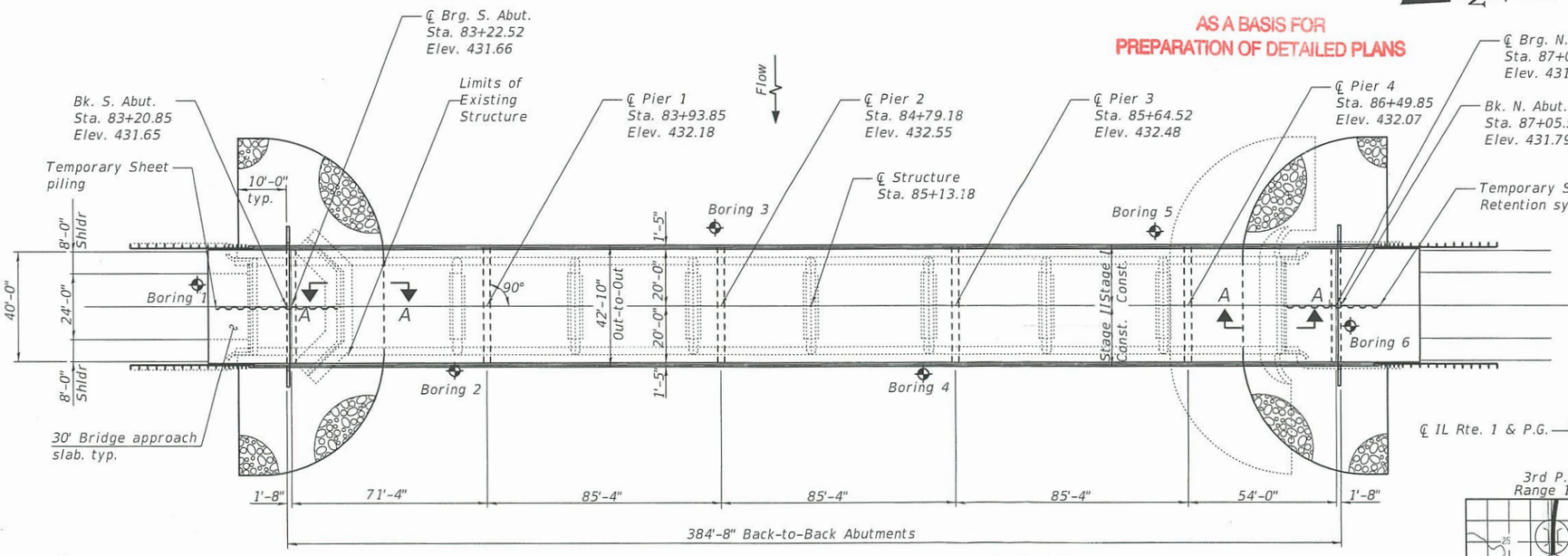
Note: Up to ¼" may be ground off the bridge deck and the bridge approach slab.



SECTION A-A



ELEVATION



PLAN

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)						Item 113
	S. Abut.	Pier 1	Pier 2	Pier 3	Pier 4	N. Abut.	
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Q200	423.9	405.5	405.5	405.5	405.5	424.1	
Design	423.9	405.5	405.5	405.5	405.5	424.1	
Check	423.9	405.5	405.5	405.5	405.5	424.1	

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AS A BASIS FOR
PREPARATION OF DETAILED PLANS

HIGHWAY CLASSIFICATION

FAP 332 - IL Rte. 1
Functional Classification: Other Principal Arterial
ADT: 5400 (2020); 6600 (2040)
ADTT: 902 (2020); 1102 (2040)
DHV: 706 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

SEISMIC DATA

Seismic Performance Zone (SPZ) = 3
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.326g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.746g
Soil Site Class = E

DESIGN SPECIFICATIONS

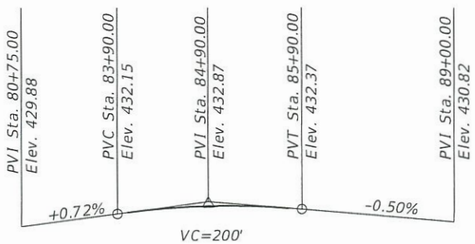
2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

DESIGN STRESSES

FIELD UNITS
f'c = 4,000 psi (Superstructure)
f'c = 3,500 psi (Substructure)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

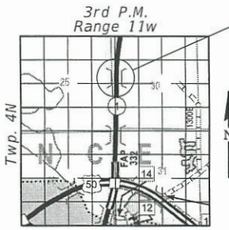
LOADING HL-93

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



PROFILE GRADE
(Along ℄ IL Rte. 1)

NOTE: The profile grade shows the final elevations after grinding



LOCATION SKETCH

GENERAL PLAN & ELEVATION
ILLINOIS ROUTE 1 OVER
EMBARRAS RIVER OVERFLOW
F.A.P. RTE. 332 - SEC. (16BR-1,BR-2)B-1
LAWRENCE COUNTY
STATION 85+13.18
STRUCTURE NO. 051-0074

DESIGNED -	NICHOLAS R. BARNETT
CHECKED -	JUSTIN T. BELUE
DRAWN -	JACQUES ELLOYE
CHECKED -	N.R.B./J.T.B.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	(16BR-1,BR-2)B-1	Lawrence	2	1
		CONTRACT NO. 74164		
	ILLINOIS	FED. AID PROJECT		

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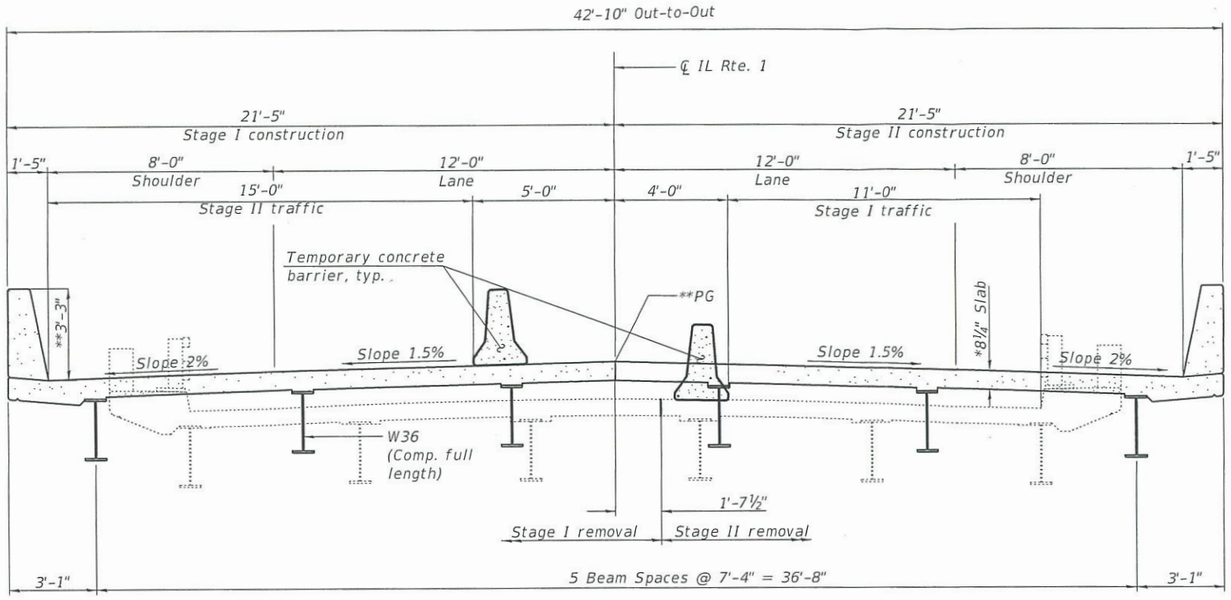
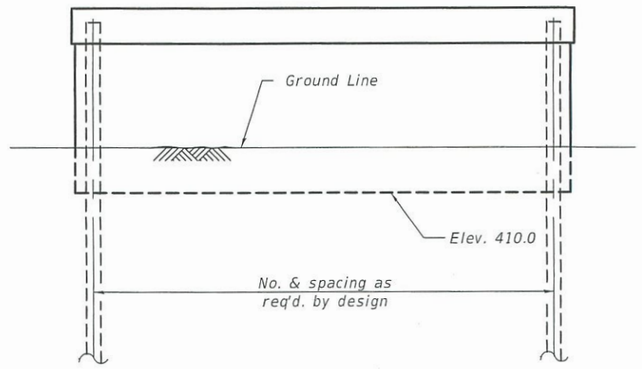
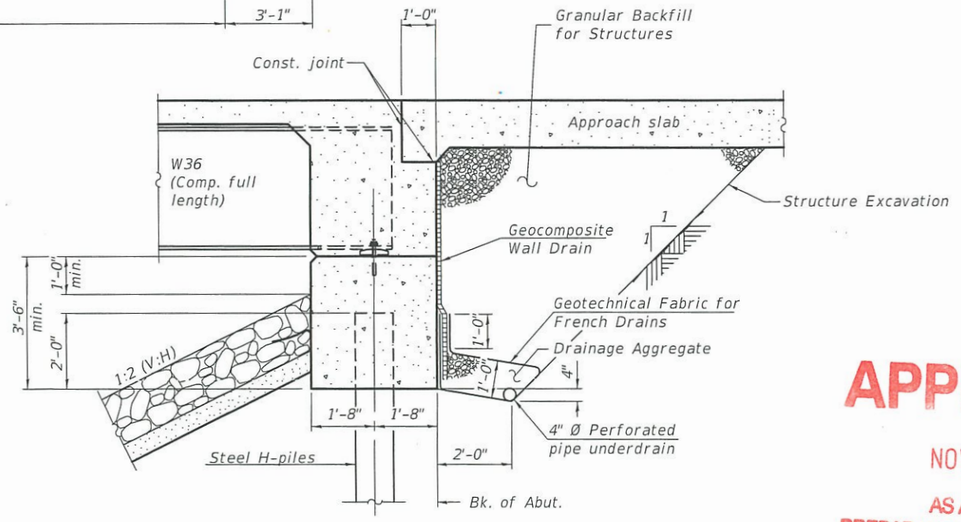


CROSS SECTION

(Looking North)



PIER SKETCH



SECTION THRU INTEGRAL ABUTMENT

* Prior to grinding
** After grinding

WATERWAY INFORMATION

Drainage Area = 2,329.3 sq. mi.

Existing Overtopping Elev. 428.23 at Sta. 66+41
Proposed Overtopping Elev. 428.23 at Sta. 66+41

Flood Event		Discharge (cfs)		Opening Ft²		Nat. H.W.E.	Head - Ft.		Headwater Elev.	
		Exist.	Prop.	Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
10	SN 051-0063	20466	20466	7639	7639	426.5	0.2	0.2	426.7	426.7
	SN 051-0075	12950	12860	7560	8349					
	SN 051-0074	6913	7003	4045	4609					
	Total	40329	40329	19244	20597					
30 Overtopping	SN 051-0063	27365	27365	8450	8450	428.5	0.1	0.1	428.6	428.6
	SN 051-0075	17240	17185	8555	9896					
	SN 051-0074	8843	8898	4425	5232					
	Total	53448	53448	21430	23578					
50	SN 051-0063	31775	31775	8933	8933	429.7	0.1	0.0	429.8	429.7
	SN 051-0075	18512	18760	8555	10310					
	SN 051-0074	9579	9331	4425	5232					
	Total	59866	59866	21913	24475					
100	SN 051-0063	39647	39647	9899	9899	432.0	0.1	0.1	432.1	432.1
	SN 051-0075	18858	19021	8555	10310					
	SN 051-0074	9623	9460	4425	5232					
	Total	68128	68128	22879	25441					
200	SN 051-0063	42689	42689	10488	10488	433.4	0.0	0.0	433.4	433.4
	SN 051-0075	22598	22833	8555	10310					
	SN 051-0074	11590	11355	4425	5232					
	Total	76877	76877	23468	26030					
500	SN 051-0063	45887	45887	10681	10681	434.9	0.1	0.0	435.0	434.9
	SN 051-0075	27792	28082	8555	10310					
	SN 051-0074	14255	13965	4425	5232					
	Total	87934	87934	23661	26223					

APPROVED

NOV 1 4 2018

AS A BASIS FOR PREPARATION OF DETAILED PLANS

DETAILS
ILLINOIS ROUTE 1 OVER EMBARRAS RIVER OVERFLOW
F.A.P. RTE. 332 - SEC. (16BR-1,BR-2)B-1
LAWRENCE COUNTY
STATION 85+13.18
STRUCTURE NO. 051-0074

DESIGNED -	NICHOLAS R. BARNETT
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	(16BR-1,BR-2)B-1	Lawrence	2	2
		CONTRACT NO. 74164		
	ILLINOIS	FED. AID PROJECT		

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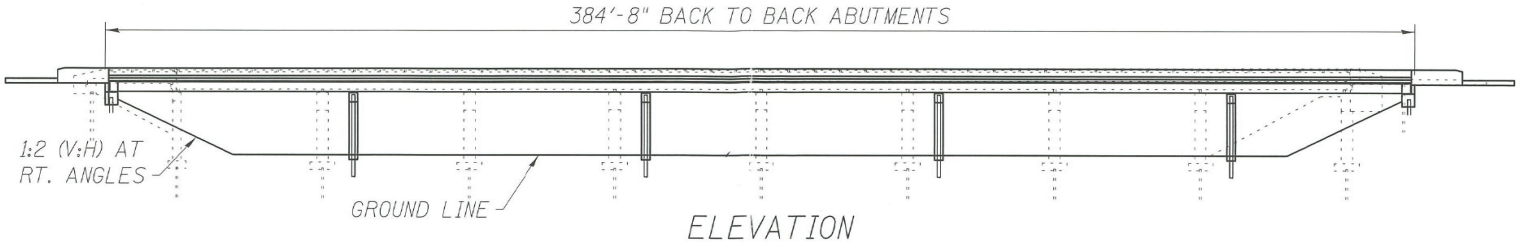
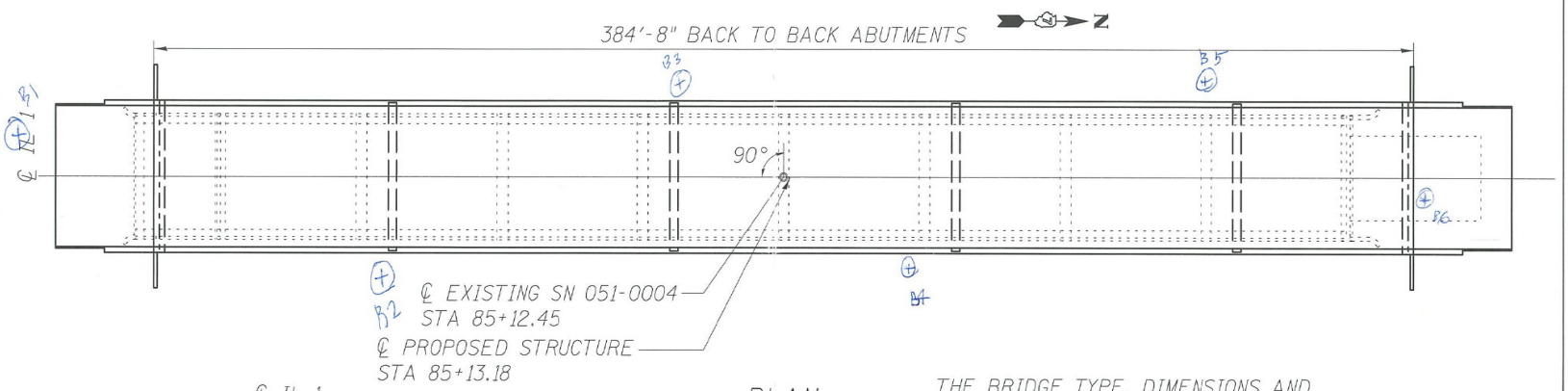
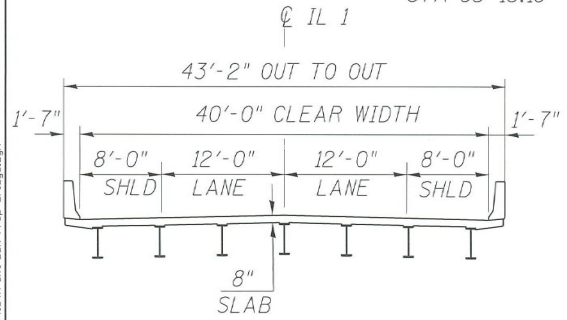


ELEVATION



PLAN

THE BRIDGE TYPE, DIMENSIONS AND DETAILS WILL BE DETERMINED DURING DEVELOPMENT OF THE TSL.



TYPICAL SECTION
(LOOKING NORTHBOUND)

051-0004(E)

PROPOSED STRUCTURE SN 051-0004 LAWRENCE COUNTY FAS 332 (IL 1) OVER EMBARRAS RIVER OVERFLOW

USER = slm
PRINT DATE = 8/9/2017
FILE NAME = D7741644-sht-BCR Prop Bridge.dgn

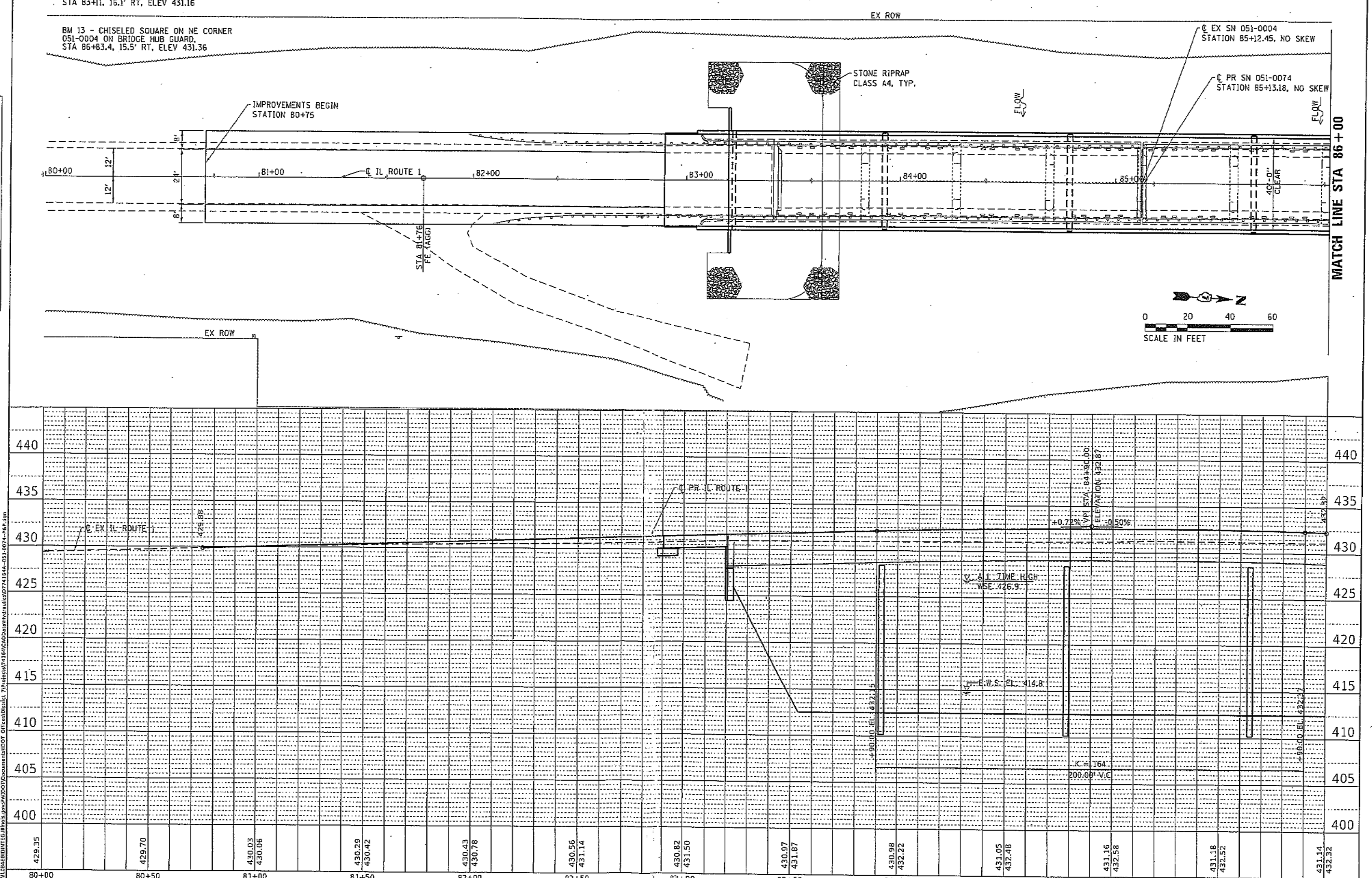
ESCA PROJECT NO. 1192.07

EXHIBIT C – PLAN AND PROFILE

BENCHMARKS

BM 12 - CHISELED SQUARE ON SE CORNER
051-0004 ON BRIDGE HUB GUARD.
STA 83+11, 16.1' RT, ELEV 431.16

BM 13 - CHISELED SQUARE ON NE CORNER
051-0004 ON BRIDGE HUB GUARD.
STA 86+83.4, 15.5' RT, ELEV 431.36



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	DRAWN - JPC/RTM	REVISED - D7 HYDRAULICS	
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PLOT DATE = 12/14/2017	DATE - 06/16/17	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

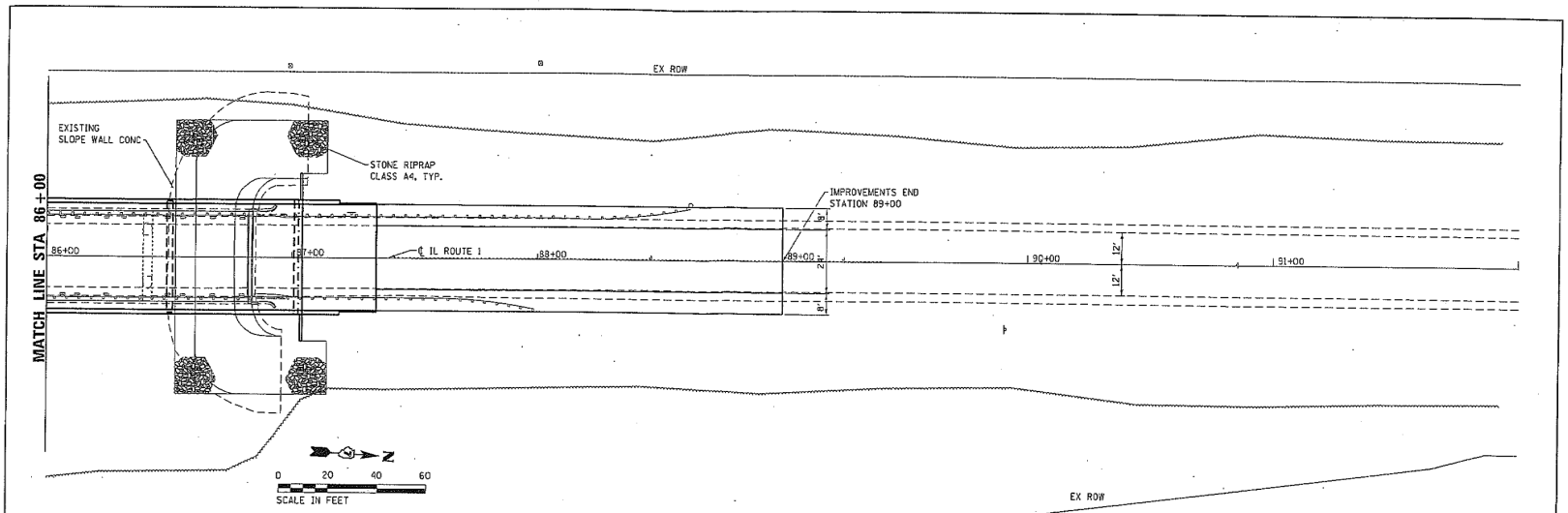
F.A.P. ROUTE 332 (IL 1) PLAN AND PROFILE
PROPOSED SN 051-0074

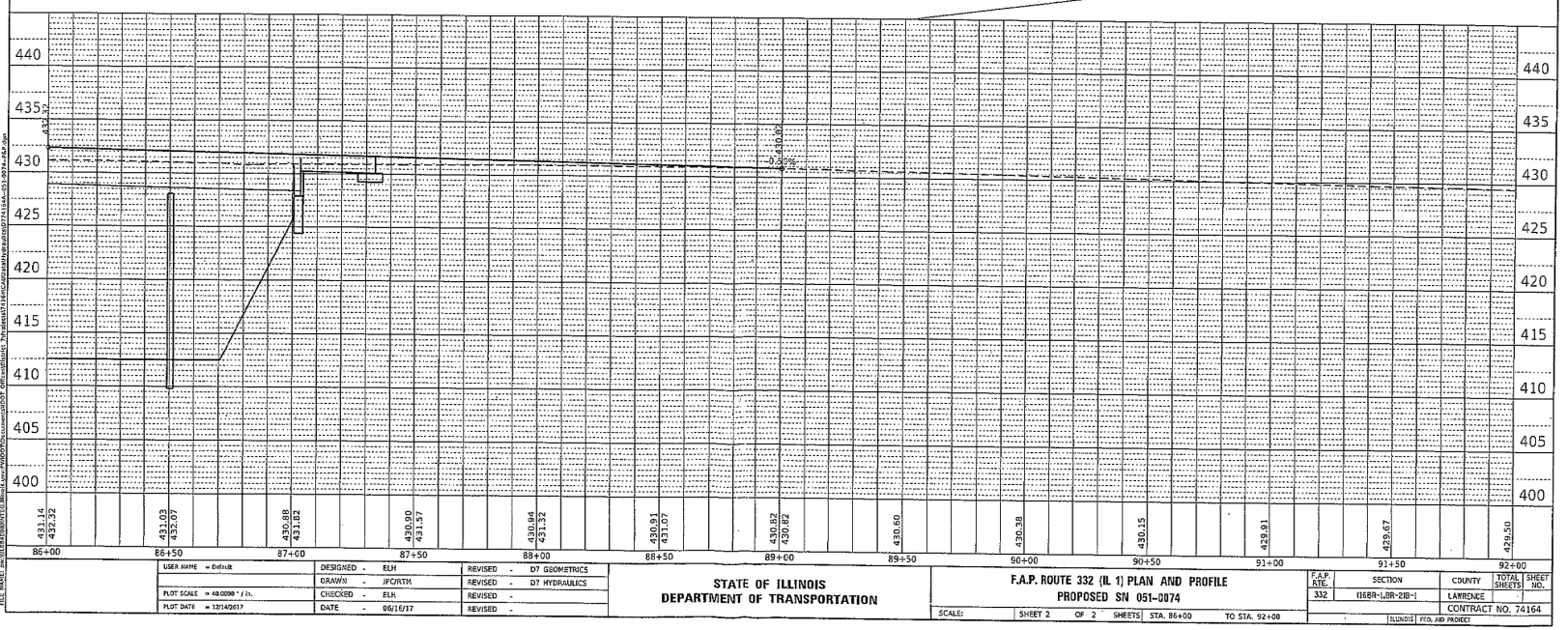
SCALE: | SHEET 1 OF 2 SHEETS | STA. 80+00 TO STA. 86+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	(16BR-1,BR-2)B-1	LAWRENCE		

CONTRACT NO. 74164

ILLINOIS | FED. AID PROJECT





USER NAME = Default	DESIGNED - ELH	REVISED -	D7 GEOMETRICS
	DRAWN - JPC/RTH	REVISED -	D7 HYDRAULICS
PLOT SCALE = 48.0000 ' / in.	CHECKED - ELH	REVISED -	
PLOT DATE = 12/14/2017	DATE - 06/16/17	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

F.A.P. ROUTE 332 (IL 1) PLAN AND PROFILE
PROPOSED SN 051-0074

SCALE: | SHEET 2 OF 2 SHEETS | STA. 86+00 | TO STA. 92+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	116BR-1,8R-2B-1	LAWRENCE	-	-
		CONTRACT NO. 74164		
		ILLINOIS FED. AID PROJECT		

EXHIBIT D – BORING LOGS AND SUBSURFACE DATA PROFILE

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/27/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 1 (S Abut)
Station 82+88
Offset 8.0ft Lt (West)
Ground Surface Elev. 430.73 ft

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

Groundwater Elev.:
▽ First Encounter 403.7 ft
▽ Upon Completion Washed ft
▼ After 24 Hrs. 406.7 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				7.25" Asphalt on 9.5" Concrete Pavement.
429.33				Estimated, CLAY, embankment.
				No samples.
426.23				
-5	3			Stiff, damp, gray, CLAY, embankment.
	3	1.40	27	
	4	B		
	2			
	3	1.24	27	
	4	B		
-10	3			
	4	1.90	24	
	4	B		
418.73				
	2			Medium, damp, gray, SILTY CLAY, embankment.
	3	0.82	28	
	3	B		
416.23				
-15	2			Stiff, damp, gray, CLAY w/ Silt, embankment.
	3	1.57	26	
	3	B		
413.73				
	1			Stiff, damp, gray, SILTY CLAY.
	1	1.15	27	
	1	B		
411.23				
-20	3			Stiff, damp, gray, CLAY w/ Silt.
				(continued)
	2			
408.23				
	2	0.82	19	Medium, damp, gray, LOAM.
	3	B		
▼ 406.23				
-25	2			Very soft, damp, gray, SANDY LOAM.
	2	0.21	16	
	2	B		
▽ 403.73				
	1			Loose to medium, wet, gray, fine grained, SAND. *6% passing #200 sieve.*
	2		21	
	4			
-30	1			
	5			*No recovery this trip.*
	16			
	7			
-35				
	10		17	*4% passing #200 sieve.*
	10			
390.73 -40	4			

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 S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Date Template D6TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 01.427 sec Longitude N 38 deg 45 min 14.475 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/27/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 1 (S Abut)
Station 82+88
Offset 8.0ft Lt (West)
Ground Surface Elev. 430.73 ft

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

Groundwater Elev.:
▽ First Encounter 403.7 ft
▼ Upon Completion Washed ft
▼ After 24 Hrs. 406.7 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	5		14	Medium, wet, gray, fine grained, SAND. *8% passing #200 sieve.*
	6			
386.23				
-45	6			Stiff, damp, brown, SILTY CLAY.
	5	1.73	29	
	9	B		
380.73				
-50	1			
	1	0.58	35	Medium, damp, brown, SILT CLAY.
	2	B		
				LL = 42.0
				PL = 31.7
				PI = 10.3
-55				
371.23				
-60	11			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	18		15	Dense to medium, wet, gray, fine grained, SAND. *5% passing #200 sieve.*
	17			
-65				
-70	15			
	16		21	*6% passing #200 sieve.* *(continued)*
	6			
-75				
351.23				
-80	2			

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
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Latitude W 87 deg 41 min 01.427 sec Longitude N 38 deg 45 min 14.475 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/27/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 1 (S Abut)
Station 82+88
Offset 8.0ft Lt (West)
Ground Surface Elev. 430.73 ft

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

Groundwater Elev.:
▽ First Encounter 403.7 ft
▽ Upon Completion Washed ft
▽ After 24 Hrs. 406.7 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	1	0.21	32	Very soft, damp, gray, SILTY CLAY. *(continued)*
	4	B		
-85				
341.23				
-90	4			Very soft, very damp, gray, SANDY LOAM.
	9	0.16	23	
	11	B		
-95				
331.23				
-100	6			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	8	2.47	15	Very dense, damp, gray, CLAY LOAM TILL. *(continued)*
	10	B		
-105				
-110	10			
	19		13	
	33			
-115				
310.73 -120	10			

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
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Latitude W 87 deg 41 min 01.427 sec Longitude N 38 deg 45 min 14.475 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/27/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 1 (S Abut)
Station 82+88
Offset 8.0ft Lt (West)
Ground Surface Elev. 430.73 ft

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

Groundwater Elev.:
▽ First Encounter 403.7 ft
▽ Upon Completion Washed ft
▼ After 24 Hrs. 406.7 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	21	+4.5	8	Very dense, damp, gray, CLAY LOAM TILL.
	33	PP		
-125				
301.23				
300.93 -130	50/1"		8	Very dense, moist, dark gray, SILTY CLAY SHALE.
	50/1"			
	50/1"			Extent of exploration.
-135				Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'
-140				

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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Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/23/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 2
Station 83+82
Offset 23.5ft Rt (East)
Ground Surface Elev. 413.98 ft

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

Groundwater Elev.:
▽ First Encounter 404.5 ft
▽ Upon Completion Washed ft
▼ After 528 Hrs. 407.0 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				Riprap and broken concrete on soft, SILTY LOAM.
				No samples.
409.48				
-5	4			Stiff, damp, brown, SILTY CLAY.
	4		16	
	4			
▼ 406.48				
	4	0.17	19	Very soft, damp, brown, SANDY LOAM.
	4	S		
▽ 404.48				
-10	3			Loose, wet, brown to gray, fine grained, SAND. *4% passing #200 sieve.*
	3		26	
	3			
	1			No recovery this trip.
	3			
	4			
-15	1			
	3		24	*2% passing #200 sieve.*
	3			
	3			
	4		22	*2% passing #200 sieve.*
	5			
393.98 -20	5			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	4		19	Loose, wet, gray, fine grained, SAND. *5% passing #200 sieve.*
	5			
391.98				
	2			Stiff, damp, gray, SANDY CLAY w/ Sand.
	3	1.5	11	
	4	PP		
389.48				
-25	4			Gray, fine grained, SAND. *6% passing #200 sieve.*
	5	0.3	32	
388.28	5	PP		Soft, damp, gray, SILTY LOAM.
386.98				
	3			Very stiff, damp, grayish brown, SILTY CLAY.
	6	3.09	25	
	7	B		
384.48				
-30	2			Medium to soft, damp, gray/brown, SILT.
	3	0.74	34	
	2	B		
-35	2			
	3	0.62	44	
	3	B		
373.98 -40	1			

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 S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D9TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 00.452 sec Longitude N 38 deg 45 min 15.419 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/23/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 2
Station 83+82
Offset 23.5ft Rt (East)
Ground Surface Elev. 413.98 ft

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

Groundwater Elev.:
▽ First Encounter 404.5 ft
▼ Upon Completion Washed ft
▼ After 528 Hrs. 407.0 ft

	DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)
Medium to soft, damp, gray/brown, SILT.		2	0.37	44
		7	B	
369.48	-45	7		
		9		
No recovery this trip.		12		
Medium, wet, gray, fine grained, SAND.	-50	7		
		7		16
		7		
	-55			
353.98	-60	6		

	DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)
Medium, wet, gray, fine grained, SAND.		6		
		9		
	-65			
344.48				
Medium, damp, gray, SANDY LOAM w/ fine grained, Sand.	-70	8		
		12	0.69	21
		18	S	
	-75			
334.48				
	-80	5		

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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Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/23/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 2
Station 83+82
Offset 23.5ft Rt (East)
Ground Surface Elev. 413.98 ft

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

Groundwater Elev.:
▽ First Encounter 404.5 ft
▽ Upon Completion Washed ft
▼ After 528 Hrs. 407.0 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	7		7	Medium, wet, gray, fine grained, SAND. *(continued)*
	9			
-85				
324.48				
-90	9			Gray, SANDY LOAM.
323.48	20	0.91	11	
	32	B		Medium to hard, damp, gray, SANDY CLAY TILL.
-95				
-100	10			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	20	7.42	9	Medium to hard, damp, gray, SANDY CLAY TILL. *(continued)*
	32	S		
-105				
304.48				
303.98 -110	50/2"		6	Very dense, moist, gray, SILTY CLAY SHALE.
	50/1"			Borehole continued with rock coring.
	50/1"			
-115				
-120				

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 S:\NEW GEOTECH\NICALI\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D6TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 00.452 sec Longitude N 38 deg 45 min 15.419 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

ROCK CORE LOG

Date 8/23/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

COUNTY Lawrence CORING METHOD Rotary, surf set diamond bit

STRUCT. NO. 051-0074
Station 85+12

CORING BARREL TYPE & SIZE NW, conv dbl bbl, split inner

Core Diameter 2.06 in
Top of Rock Elev. 304.48 ft
Begin Core Elev. 303.98 ft

BORING NO. 2
Station 83+82
Offset 23.5ft Rt (East)
Ground Surface Elev. 413.98 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray, weathered, SILTY CLAY SHALE	303.98	B2C1	88	0	3	
Limestone 0.15' lense.						
No recovery for bottom 0.5' of core run.	298.98 -115					
Gray, weathered, SILTY CLAY SHALE		B2C2	92	10	2.4	
Coal seam at depth 117.0' to 118.0'						
Rock Core B2C2 at depth 119.1' to 119.6' = 86 tsf Qu.						
No recovery for bottom 0.5' of core run.	293.98 -120					
Extent of exploration.						
Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'						
	-125					
	-130					

Color pictures of the cores Available on request
Cores will be stored for examination until 08/23/22
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)
RQD is the ratio of the total length of sound core specimens >4" to total length of core run

BBS, form 138 (Rev. 8-99)

ROCK CORE 051-0074 SOIL ROCK 2017.GPJ D6TEMPLT.GDT 10/17/17

Field Rock Core Log a.xls

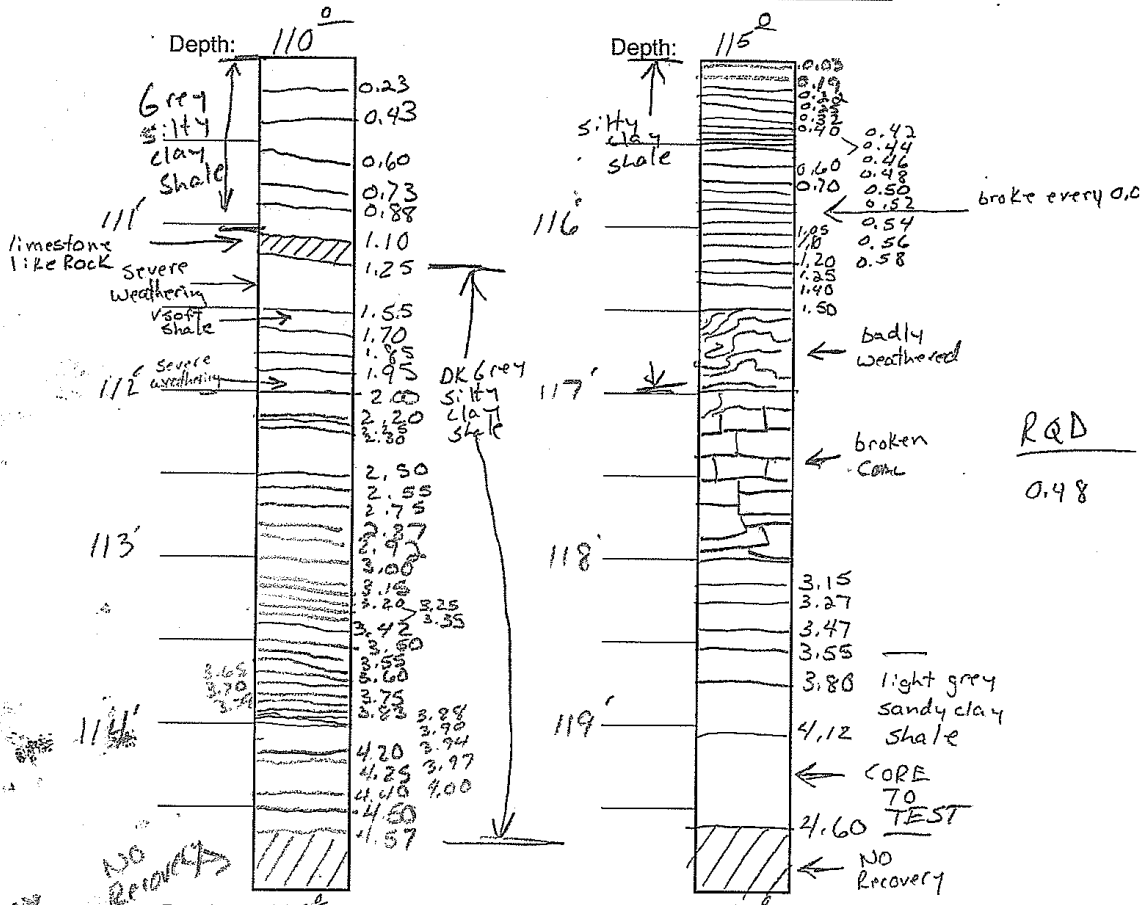
Field Rock Core Log

Date: 8-23-17

Structure # : 051-0004 Boring # : B2

Rock Core # : 1

Rock Core # : 2



RQD

0.48

Logged By: Eric Sandschafer

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/25/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 3
Station 84+77
Offset 28.5ft Lt (West)
Ground Surface Elev. 413.06 ft

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

Groundwater Elev.:
▽ First Encounter 400.6 ft
▽ Upon Completion Washed ft
▼ After 480 Hrs. 407.6 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				Riprap and broken concrete on soft, SILTY LOAM.
				No samples.
408.56				
-5	3			No recovery this trip.
	4			▼
	4			
				Medium, damp, gray, SILTY CLAY.
	2			
	3	0.7	40	
	3	B		
403.56				
-10	2			Very soft, damp, gray, SILT.
	1	0.29	33	
	1	B		
	1			▽
	1	0.21	36	
	1	B		
-15	1			
	1	0.21	42	
	1	B		
	1			
	2	0.21	44	
394.86	2	B		
				Loose, wet, gray, fine grained, SAND.
393.06 -20	3			
				Loose, wet, gray, fine grained, SAND. *5% passing #200 sieve.*
391.06				
	3			Very soft, wet, gray, SANDY LOAM w/ few wood pieces.
	2	0.23	30	
	4	S		
388.56				
-25	3			Very soft, damp, gray, SILT.
387.56	4	0.21	31	
	6	B		Grayish brown, SILTY CLAY.
386.06				
	3			Very stiff, damp, brownish gray, CLAY.
	4	2.06	27	
384.66	8	B		
				Brown, fine grained, SANDY LOAM.
383.56				
-30	2			Medium, damp, brownish gray, SILTY CLAY.
	2	0.41	38	
	3	B		
378.56				
-35	1			Medium, damp, brownish gray, SILT.
	1	0.82	49	
	2	B		
373.56				
-40	1			

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 S:\NEW GEOTECH\CAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D9TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 02.051 sec Longitude N 38 deg 45 min 16.372 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/25/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 3
Station 84+77
Offset 28.5ft Lt (West)
Ground Surface Elev. 413.06 ft

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

Groundwater Elev.:
▽ First Encounter 400.6 ft
▽ Upon Completion Washed ft
▼ After 480 Hrs. 407.6 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	4	0.49	26	Medium, damp, gray, SILTY LOAM w/ Sand. *(continued)*
372.46	5	B		
				Gray, SANDY LOAM.
368.56				
-45	8			Medium, wet, gray, fine grained, SAND. *3% passing #200 sieve.*
	8		19	
	8			
-50	6			*2% passing #200 sieve.*
	8		18	
	9			
-55				
353.06				
-60	6			
-65				
343.56				
-70	13			Very soft, damp, gray, fine grained, SANDY LOAM.
	11	0.23	21	
	15	S		
-75				
333.56				
-80	8			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	7		17	Medium, wet, gray, fine grained, SAND. *2% passing #200 sieve.*
	11			

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 S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D6TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 02.051 sec Longitude N 38 deg 45 min 16.372 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/25/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 3
Station 84+77
Offset 28.5ft Lt (West)
Ground Surface Elev. 413.06 ft

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

Groundwater Elev.:
▽ First Encounter 400.6 ft
▽ Upon Completion Washed ft
▼ After 480 Hrs. 407.6 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	12	0.15	19	Very soft, damp, gray, very fine grained, SANDY LOAM to SAND. *(continued)*
	16	S		
-85				
323.56				
-90	5			Medium, damp, gray, SANDY CLAY LOAM.
	4	0.91	18	
	6	B		
-95				
313.56				
-100	36			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	40	7.86	8	Hard, damp, gray, SANDY CLAY LOAM TILL. *(continued)*
	49	BS		
-105				
306.56				
306.06	50/2"		8	Very dense, moist, gray, SILTY CLAY SHALE.
	50/2"			
	50/2"			Borehole continued with rock coring.
-110				
-115				
-120				

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 W 87 deg 41 min 02.051 sec Longitude N 38 deg 45 min 16.372 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

ROCK CORE LOG

Date 8/25/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

COUNTY Lawrence CORING METHOD Rotary, surf set diamond bit

STRUCT. NO. 051-0074
Station 85+12

CORING BARREL TYPE & SIZE NW, conv dbl bbl, split inner

Core Diameter 2.06 in
Top of Rock Elev. 306.56 ft
Begin Core Elev. 306.06 ft

BORING NO. 3
Station 84+77
Offset 28.5ft Lt (West)
Ground Surface Elev. 413.06 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Highly weathered, gray, SILTY CLAY SHALE.	306.06		B3C1	89	10	3.3	
Alternating layers of Shale and Limestone from 108.7' to 109.8'.		-110					
Rock Core B3C1 at depth 110.75' to 111.22' = 5.4 tsf Qu.							
No recovery for bottom 0.5' of core run.	301.06						
Dark gray, SILTY CLAY SHALE.			B3C2	100	28	3.4	
Rock Core B3C2 at depth 114.65' to 115.15' = 22.4 tsf Qu.		-115					
Black, COAL at depth 116.8' to 117.0'.	296.06						
Black, COAL at depth 117.0' to 117.8'.			B3C3	97	63	2.1	
Highly weathered, gray, SILTY CLAY SHALE.							
Thinly layered, gray, SANDY CLAY LOAM SHALE.		-120					
	291.06						
Extent of exploration.							
Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'		-125					

Color pictures of the cores Available on request
Cores will be stored for examination until 08/25/22
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)
RQD is the ratio of the total length of sound core specimens >4" to total length of core run

BBS, form 138 (Rev. 8-99)

ROCK CORE 051-0074 SOIL ROCK 2017.GPJ D6TEMPLT.GDT 10/17/17

Field Rock Core Log a.xls

Field Rock Core Log

Date: 8-25-17

Structure # : 051-0004 (0074) Boring # : B3

Rock Core # : 1

Depth: 107'

RQD: 0.50

108

109

110

111

112'

Depth:

Core Time: 16.20

Recovery: 99%

RQD: 10%

Logged By: Eric Sandschafer

severe weathered silty clay shale

OJ 1.30
OJ 1.40
OJ 1.56
OJ 1.65
OJ 1.73
OJ 2.00
OJ 2.10
OJ 2.17
OJ 2.35
OJ 2.55
OJ 2.80
OJ 2.95
OJ 3.05
OJ 3.22
OJ 3.75
OJ 3.90
OJ 4.00
OJ 4.15
OJ 4.35

U. SOFT silty clay shale

Limestone like Rock

Limestone like Rock

Limestone like rock

CORE TO TEST

Grey silty clay shale

Rock Core # : 2

Depth: 112'

113

114

115

116

SEE NEXT SHEET

RQD

5'

5.5

4.25

Depth:

Core Time:

Recovery:

RQD:

Field Rock Core Log a.xls

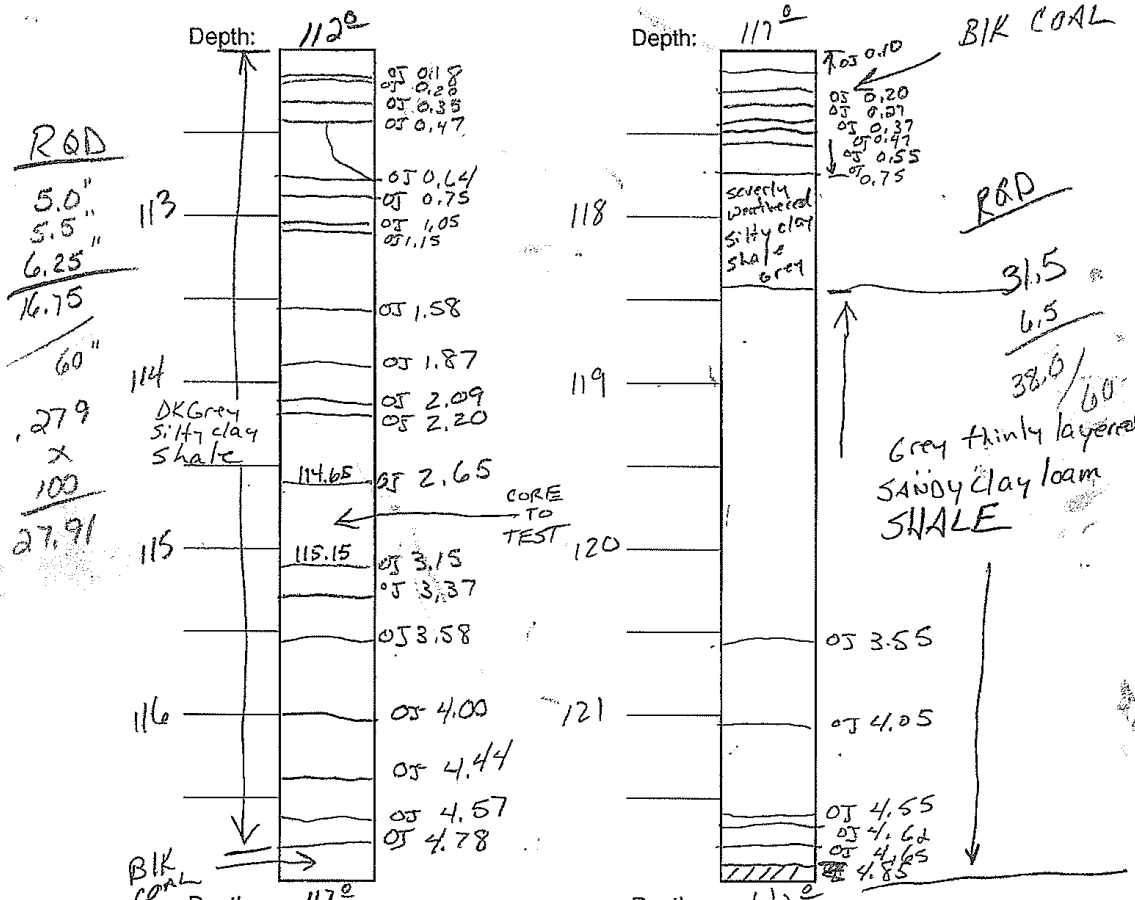
Field Rock Core Log

Date: 8-25-17

Structure # : 051-0004 (0074) Boring # : B3

Rock Core # : 2

Rock Core # : 3



Logged By: Eric Sandschafer

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/24/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 4
Station 85+53
Offset 25.0ft Rt (East)
Ground Surface Elev. 413.78 ft

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

Groundwater Elev.:
▽ First Encounter 394.3 ft
▼ Upon Completion Washed ft
▼ After 504 Hrs. 407.8 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				Riprap and broken concrete on soft, SILTY LOAM.
				No samples.
409.28				
-5	2			Medium, damp, gray, SILTY CLAY.
	3	0.75	19	
	3	PP		
	2			
	2	0.66	41	
	3	BS		
404.28				
-10	1			Soft, damp, gray, SILT.
	2	0.41	34	
	2	B		
	1			
	1	0.33	35	
	1	B		
-15	0			
	0	0.25	51	
	1	B		
	0			
	0	0.21	40	
	1	B		
▽ 394.28				
-20	0			
				Very loose, wet, gray, fine grained, SAND. *4% passing #200 sieve.* *(continued)*
391.78				
				Medium, wet, gray, fine grained, SAND.
389.28				
-25	3			Very soft, wet, gray, SANDY LOAM.
	3	0.23	22	
	3	S		
386.78				
	3			Very stiff, damp, grayish brown, SILTY CLAY.
	5	3.09	25	
	6	B		
384.28				
-30	7			Soft, damp, grayish brown, SILTY CLAY.
	5	0.49	47	
	3	B		
-35	1			
	1	0.49	48	
	2	B		
374.28				
-40	2			

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 S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D6TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 01.331 sec Longitude N 38 deg 45 min 17.580 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/24/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 4
Station 85+53
Offset 25.0ft Rt (East)
Ground Surface Elev. 413.78 ft

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

Groundwater Elev.:
▽ First Encounter 394.3 ft
▽ Upon Completion Washed ft
▼ After 504 Hrs. 407.8 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	3	1.24	34	Stiff, damp, grayish brown, SILTY CLAY. *(continued)*
	4	B		
368.78 -45	6			
	6		21	Medium, damp, gray, fine grained, SAND. *3% passing #200 sieve.*
	12			
-50	5			
	8		18	*2% passing #200 sieve.*
	8			
-55				
353.78 -60	6			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	9		17	Medium, damp, gray, fine grained, SAND. *7% passing #200 sieve.*
	9			
-65				
-70	5			
	12		25	*9% passing #200 sieve.*
	15			
-75				
333.78 -80	7			

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 W 87 deg 41 min 01.331 sec Longitude N 38 deg 45 min 17.589 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/24/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 4
Station 85+53
Offset 25.0ft Rt (East)
Ground Surface Elev. 413.78 ft

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

Groundwater Elev.:
▽ First Encounter 394.3 ft
▽ Upon Completion Washed ft
▼ After 504 Hrs. 407.8 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	11 14			Low recovery, some small gravel retained. Estimated SAND w/ small gravel.
-85				
324.28				
-90	3			Stiff, damp, gray, LOAM.
	4 5	1.03 B	17	
-95				
314.28				
-100	15			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	34 42	5.24 S	8	Hard, damp, gray, SANDY CLAY TILL. *(continued)*
-105				
305.78				
				Very dense, moist, gray, SILTY CLAY SHALE.
303.98				
-110	50/1" 50/1" 50/1"		8	Extent of exploration
				Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'
-115				
-120				

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
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Latitude W 87 deg 41 min 01.331 sec Longitude N 38 deg 45 min 17.580 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/21/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 5
Station 86+38
Offset 27.0ft Lt (West)
Ground Surface Elev. 412.91 ft

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

Groundwater Elev.:
▽ First Encounter 393.4 ft
▽ Upon Completion Washed ft
▼ After 576 Hrs. 407.9 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				Riprap and broken concrete on soft, SILTY LOAM.
				No samples.
408.41				
-5	2			Stiff to medium, damp, gray, SILTY CLAY. ▼
	3	1.03		
	4	B		
	3			
	3	0.82		
	3	B		
-10	2			
	3	0.74		
	3	B		
	1			
	1	0.58		
	1	B		
398.41				
-15	1			Soft, damp, gray, SILT.
	1	0.33		
	1	B		
	1			
	0	0.33		
	1	B		
▽ 393.41				
-20	0			
				Loose, wet, gray, fine grained, SAND. *6% passing #200 sieve.* *(continued)*
390.91				
	2			Soft, wet, gray, SANDY LOAM.
	5	0.24		
	8	S		
-25	2			
387.61				
	3	0.4		Medium, damp, gray, SILT.
	2	PP		
385.91				
	4			Stiff, damp, gray, SILTY LOAM.
	6	1.65		
	6	B		
383.41				
-30	1			Medium, damp, gray, SILT.
	2	0.54		
	2	B		
-35	1			
	1	0.58		
	2	B		
372.91 -40	3			

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
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File Name S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D8TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 02.084 sec Longitude N 38 deg 45 min 17.561 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/21/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 5
Station 86+38
Offset 27.0ft Lt (West)
Ground Surface Elev. 412.91 ft

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

Groundwater Elev.:
▽ First Encounter 393.4 ft
▽ Upon Completion Washed ft
▼ After 576 Hrs. 407.9 ft

	DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)
Stiff to medium, damp, gray, SILT.		6	1.24	
		8	B	
	-45	5		
	367.41	9	0.91	
Medium, wet, gray, fine grained, SAND.		13	B	
	-50	6		
7% passing #200 sieve.		8		
		7		
	-55			
	352.91 -60	6		
Medium, wet, gray, fine grained, SAND. *6% passing #200 sieve.*		7		
		7		
	-65			
	343.41			
Medium, very wet, gray, SANDY LOAM.	-70	6		
		8		
		10		
	-75			
	333.41			
Medium, damp, gray, LOAM.	-80	8		

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
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Latitude W 87 deg 41 min 02.084 sec Longitude N 38 deg 45 min 17.561 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/21/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 5
Station 86+38
Offset 27.0ft Lt (West)
Ground Surface Elev. 412.91 ft

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

Groundwater Elev.:
▽ First Encounter 393.4 ft
▽ Upon Completion Washed ft
▼ After 576 Hrs. 407.9 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	16	0.82		Medium, damp, gray, LOAM. *(continued)*
	22	B		
-85				
-90	6			
	3	0.62		
	6	B		
-95				
313.41				
-100	14			Hard, damp, gray, SANDY CLAY.
	28	6.18		Hard, damp, gray, SANDY CLAY. *(continued)*
	41	BS		
308.41				
-105	25			Very stiff, damp, gray, SILTY CLAY LOAM TILL.
	36	2.89		
	45	S		
303.41				
303.11				
-110	50/2"			Very dense, moist, gray, SILTY CLAY SHALE.
	50/1"			Extent of exploration.
	50/1"			
-115				Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'
-120				

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
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Latitude W 87 deg 41 min 02.084 sec Longitude N 38 deg 45 min 17.961 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/26/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 6 (N Abut)
Station 87+09
Offset 7.5ft Rt (East)
Ground Surface Elev. 430.88 ft

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

Groundwater Elev.:
▽ First Encounter 400.0 ft
▽ Upon Completion Washed ft
▼ After 120 Hrs. 406.9 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
				3.75" Asphalt on 11" Concrete Pavement.
				429.68 Estimated, CLAY, embankment.
				No samples.
				426.38 Stiff to very stiff, damp, gray, CLAY w/ Silt, embankment.
-5	3			
	4	1.24	21	
	5	B		
	4			
	4	1.81	20	
	4	B		
-10	4			
	4	2.27	20	
	5	B		
	5			
	6	2.06	20	
	8	B		
-15	3			
	4	1.24	32	
	6	B		
	11			
	50/1"	1.65	31	
	50/1"	B		
				412.88 9" concrete pavement, augered through. 412.08
-20	3			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	4			Estimated, CLAY.
	3			*No recovery this trip.*
	2			
	3	1.48	32	Stiff, damp, gray/brown, CLAY.
	5	B		*(continued)*
-25	3			
	4	1.24	33	
	4	BS		
				403.88
	2			Medium to stiff, damp, gray, SILTY CLAY.
	2	0.74	26	
	2	B		
-30	1			
	2	1.03	38	
	3	B		▽ 399.98
				Very loose, wet, gray, fine grained, SAND.
-35	1			
	1		23	*3% passing #200 sieve.*
	1			
				390.88
-40	8			

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 S:\NEW GEOTECHNICAL\GINTDATA\PROJECTS\LAWRENCE CO (051)\051-0074 SOIL ROCK 2017.GPJ Data Template D6TEMPLT.GDT Date Printed 10/17/17
Latitude W 87 deg 41 min 00.959 sec Longitude N 38 deg 45 min 18.636 sec Datum Job Number

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/26/17

ROUTE FAP 332 (IL 1) DESCRIPTION Embarras River Overflow LOGGED BY E. Sandschafer

SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 6 (N Abut)
Station 87+09
Offset 7.5ft Rt (East)
Ground Surface Elev. 430.88 ft

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

Groundwater Elev.:
▽ First Encounter 400.0 ft
▽ Upon Completion Washed ft
▼ After 120 Hrs. 406.9 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	14		25	Dense, wet, gray, fine grained, SAND. *5% passing #200 sieve.*
	22			
386.38				
-45	4			Very stiff, damp, gray, SILTY CLAY.
	6	3.30	27	
	9	B		
381.38				
-50	1			Soft, damp, gray, SILT.
	2	0.41	47	LL = 42.6
	3	B		PL = 30.9
				PI = 11.7
-55				
-60	5			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
370.68	5	0.58	22	Medium, damp, gray, SANDY LOAM.
	5	B		
-65				
361.38				
-70	12			Dense, wet, gray, SAND. *3% passing #200 sieve.*
	20		24	
	24			
-75				
351.38				
-80	5			

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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STRUCT. NO. 051-0074
Station 85+12

BORING NO. 6 (N Abut)
Station 87+09
Offset 7.5ft Rt (East)
Ground Surface Elev. 430.88 ft

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

Groundwater Elev.:
▽ First Encounter 400.0 ft
▽ Upon Completion Washed ft
▼ After 120 Hrs. 406.9 ft

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	10	0.99	25	Medium, damp, gray, SANDY LOAM. *(continued)*
	13	B		
-85				
341.38				
-90	5			Medium, wet, gray, fine grained, SAND.
	7		24	
	12			
-95				
330.88 -100	10			

DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)	Description
	12		25	Medium, wet, gray, fine grained, SAND. *5% passing #200 sieve.*
	14			
-105				
321.38				
-110	13			Very soft, damp, gray, fine grained, SANDY LOAM.
	17	0.23	20	
	21	S		
-115				
311.38				
-120	18			

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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SECTION (16BR-1,BR-2)B-1 LOCATION W 1/2, SEC. 30, TWP. 4 N, RNG. 11 W, 3 PM

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

STRUCT. NO. 051-0074
Station 85+12

BORING NO. 6 (N Abut)
Station 87+09
Offset 7.5ft Rt (East)
Ground Surface Elev. 430.88 ft

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

Groundwater Elev.:
▽ First Encounter 400.0 ft
▽ Upon Completion Washed ft
▼ After 120 Hrs. 406.9 ft

	DEPTH (ft)	BLOWS /6"	UCS Qu (tsf)	MOIST (%)
Hard, damp, gray, SANDY CLAY LOAM TILL. *(continued)*		20 27	4.61 S	9
	-125	15		
		23 36	5.27 S	11
	301.38			
Stiff, damp, gray, SILTY CLAY SHALE.	-130	20		
		30 44	1.24 BS	9
	298.38			
Very dense, moist, black, COAL.	298.28	50/1" 50/0" 50/0"		22
Auger Refusal. Extent of exploration.	-135			
Benchmark: BM13 Chiseled square on hubguard NE corner of existing structure Sta 86+83 Rt 15.5' = 431.16'	-140			

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
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EXHIBIT E – HORIZONTAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS

INPUT PARAMETERS:	R=215; M=7.7	
LOCATION ====================	South Abut.	
EMBANKMENT HEIGHT (H) ====================	19	FT
PEAK HORIZONTAL GROUND ACCELERATION (PGA) ====================	0.076	DIM
SEISMIC SITE CLASSIFICATION ====================	E	
SITE FACTOR AT ZERO PERIOD ON ACCELERATION SPECTRUM (F_{pga}) ====================	2.5	DIM
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1) ====================	0.093	DIM
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V) ====================	2.656	DIM
STEP 1: PSEUDO-STATIC SLOPE STABILITY ANALYSIS:		
MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max}) ====================	0.19	DIM
$k_{max} = F_{pga}$ * PGA = 2.5*0.076 ======= 0.19 [EQ. 6-1 FHWA-NHI-11-032]		
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av}) ====================	0.177	DIM
$k_{av} = \alpha * k_{max}$ ===== 0.934*0.19 ====== 0.177 [EQ. 6-2 FHWA-NHI-11-032]		
SLOPE & HEIGHT ADJUSTMENT FACTORS		
α = 1+0.01*H*(0.5*β-1) ==== 1+0.01*19*(0.5*1.3-1) ====== 0.934 [EQ. 6-3 FHWA-NHI-11-032]		
NOTE: EQUATION IS APPLICABLE FOR H <= 100 FT.		
FOR SITE CLASS A & B EQUATION 6-3 SHOULD BE MULTIPLIED BY 1.2.		
α = 1.2*[1+0.01*H*(0.5*β-1)]		
$\beta = (F_v*S_1)/k_{max}$ == (2.656*0.093)/0.19 =============== 1.3 [EQ. 6-4 FHWA-NHI-11-032]		
HORIZONTAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_h) ====================	**0.089**	Other event controls
$k_h = 0.5*\alpha*F_{pga}$*PGA = $0.5*\alpha*k_{max} = 0.5*k_{av}$ ==== 0.5*0.177 ======= 0.089 [EQ. 6-5 FHWA-NHI-11-032]		
NOTE: THIS k_h VALUE IS FOR A FACTOR OF SAFETY (FOS) OF 1.1 AND ASSUMES THE SLOPE CAN ACCOMMODATE 1-2 INCHES OF PERMANENT DISPLACEMENT.		
VERTICAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_v) ====================	**0**	
NOTE: VERTICAL ACCELERATION IS NORMALLY SET EQUAL TO ZERO [FHWA-NHI-11-032 PAGE 6-6].		
RUN THE SEISMIC SLOPE STABILITY ANALYSIS WITH THE k_h AND k_v SHOWN ABOVE. IF THE FACTOR OF SAFETY (FOS) IS GREATER THAN OR EQUAL TO 1.1 THEN THE SLOPE IS STABLE UNDER SEISMIC CONDITIONS. IF THE FOS < 1.1 THEN CONTINUE BELOW.		
STEP 2: DISPLACEMENT-BASED SEISMIC SLOPE STABILITY:		
USING THE SAME STABILITY MODEL AS ABOVE, REDUCE THE HORIZONTAL SEISMIC LOAD/COEFFICIENT (k_h) UNTIL THE FOS INCREASES TO 1.0 [PAGE 6-10 FROM FHWA-NHI-11-032]. THE COEFFICIENT AT WHICH THE FOS = 1.0 IS KNOWN AS THE YIELD ACCELERATION COEFFICIENT. RECORD THIS COEFFICIENT BELOW.		
YIELD ACCELERATION SEISMIC COEFFICIENT (k_y) ====================		DIM
MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max}) ====================		DIM (SEE ABOVE)
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av}) ====================		DIM (SEE ABOVE)
SLOPE & HEIGHT ADJUSTMENT FACTORS		
α ===== DIM (SEE ABOVE)		
β ====== DIM (SEE ABOVE)		
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1) ====================		DIM (SEE ABOVE)
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V) ====================		DIM (SEE ABOVE)
PEAK GROUND VELOCITY (PGV) ====================		
PGV = $38*F_V*S_1$ ====== [EQ. 6-9 FHWA-NHI-11-032]		
ESTIMATED HORIZONTAL DISPLACEMENT (d) ====================		INCH
FOR SITES IN SITE CLASS A & B: [EQ. 6-8 FHWA-NHI-11-032]		
$\log(d) = -1.31 - 0.93*\log(k_y/k_{max}) + 4.52*\log(1-(k_y/k_{max})) - 0.46*\log(k_{max}) + 1.12*\log(PGV)$		
FOR ALL OTHER SITE CLASSES: [EQ. 6-7 FHWA-NHI-11-032]		
$\log(d) = -1.51 - 0.74*\log(k_y/k_{max}) + 3.27*\log(1-(k_y/k_{max})) - 0.80*\log(k_{max}) + 1.59*\log(PGV)$		
		INCH

INPUT PARAMETERS:	R=10; M=5.3	
LOCATION	South Abut.	
EMBANKMENT HEIGHT (H)	19	FT
PEAK HORIZONTAL GROUND ACCELERATION (PGA)	0.357	DIM
SEISMIC SITE CLASSIFICATION	E	
SITE FACTOR AT ZERO PERIOD ON ACCELERATION SPECTRUM (F_{pga})	1.029	DIM
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1)	0.093	DIM
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V)	2.656	DIM

STEP 1: PSEUDO-STATIC SLOPE STABILITY ANALYSIS:

MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max})	0.367353	DIM
$k_{max} = F_{pga}$ * PGA = 1.029*0.357 ===== 0.36735 [EQ. 6-1 FHWA-NHI-11-032]		
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av})	0.321	DIM
$k_{av} = \alpha * k_{max}$ ===== 0.874*0.367353 == 0.321 [EQ. 6-2 FHWA-NHI-11-032]		
SLOPE & HEIGHT ADJUSTMENT FACTORS		
α = 1+0.01*H*(0.5*β-1) ==== 1+0.01*19*(0.5*0.67-1) ===== 0.874 [EQ. 6-3 FHWA-NHI-11-032]		
NOTE: EQUATION IS APPLICABLE FOR H <= 100 FT.		
FOR SITE CLASS A & B EQUATION 6-3 SHOULD BE MULTIPLIED BY 1.2.		
α = 1.2*[1+0.01*H*(0.5*β-1)]		
$\beta = (F_v*S_1)/k_{max}$ == (2.656*0.093)/0.367353 ============ 0.672 [EQ. 6-4 FHWA-NHI-11-032]		
HORIZONTAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_h)	**0.161**	CONTROL
$k_h = 0.5*\alpha*F_{pga}$*PGA = $0.5*\alpha*k_{max} = 0.5*k_{av}$ ==== 0.5*0.321 ======= 0.161 [EQ. 6-5 FHWA-NHI-11-032]		
NOTE: THIS k_h VALUE IS FOR A FACTOR OF SAFETY (FOS) OF 1.1 AND ASSUMES THE SLOPE CAN ACCOMMODATE 1-2 INCHES OF PERMANENT DISPLACEMENT.		
VERTICAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_v)	**0**	
NOTE: VERTICAL ACCELERATION IS NORMALLY SET EQUAL TO ZERO [FHWA-NHI-11-032 PAGE 6-6].		

RUN THE SEISMIC SLOPE STABILITY ANALYSIS WITH THE k_h AND k_v SHOWN ABOVE. IF THE FACTOR OF SAFETY (FOS) IS GREATER THAN OR EQUAL TO 1.1 THEN THE SLOPE IS STABLE UNDER SEISMIC CONDITIONS.
IF THE FOS < 1.1 THEN CONTINUE BELOW.

STEP 2: DISPLACEMENT-BASED SEISMIC SLOPE STABILITY:

USING THE SAME STABILITY MODEL AS ABOVE, REDUCE THE HORIZONTAL SEISMIC LOAD/COEFFICIENT (k_h) UNTIL THE FOS INCREASES TO 1.0 [PAGE 6-10 FROM FHWA-NHI-11-032]. THE COEFFICIENT AT WHICH THE FOS = 1.0 IS KNOWN AS THE YIELD ACCELERATION COEFFICIENT. RECORD THIS COEFFICIENT BELOW.

YIELD ACCELERATION SEISMIC COEFFICIENT (k_y)		DIM
MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max})		DIM (SEE ABOVE)
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av})		DIM (SEE ABOVE)
SLOPE & HEIGHT ADJUSTMENT FACTORS		
α ===== DIM (SEE ABOVE)		
β ===== DIM (SEE ABOVE)		
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1)		DIM (SEE ABOVE)
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V)		DIM (SEE ABOVE)
PEAK GROUND VELOCITY (PGV)		
PGV = $38*F_V*S_1$ ====== [EQ. 6-9 FHWA-NHI-11-032]		
ESTIMATED HORIZONTAL DISPLACEMENT (d)		INCH
FOR SITES IN SITE CLASS A & B: [EQ. 6-8 FHWA-NHI-11-032]		
log(d) = -1.31 -0.93*log(k_y/k_{max}) +4.52*log(1-(k_y/k_{max})) -0.46*log(k_{max}) +1.12*log(PGV)		
FOR ALL OTHER SITE CLASSES: [EQ. 6-7 FHWA-NHI-11-032]		
log(d) = -1.51 -0.74*log(k_y/k_{max}) +3.27*log(1-(k_y/k_{max})) -0.80*log(k_{max}) +1.59*log(PGV)		
		INCH

INPUT PARAMETERS:				R=215; M=7.7	
LOCATION				North Abut.	
EMBANKMENT HEIGHT (H)				19	FT
PEAK HORIZONTAL GROUND ACCELERATION (PGA)				0.076	DIM
SEISMIC SITE CLASSIFICATION				E	
SITE FACTOR AT ZERO PERIOD ON ACCELERATION SPECTRUM (F_{pga})				2.5	DIM
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1)				0.093	DIM
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V)				2.656	DIM
STEP 1: PSEUDO-STATIC SLOPE STABILITY ANALYSIS:					
MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max})				0.19	DIM
$k_{max} = F_{pga} * PGA$ =	2.5*0.076 =	0.19	[EQ. 6-1 FHWA-NHI-11-032]		
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av})				0.177	DIM
$k_{av} = \alpha * k_{max}$ =	0.934*0.19 =	0.177	[EQ. 6-2 FHWA-NHI-11-032]		
SLOPE & HEIGHT ADJUSTMENT FACTORS					
$\alpha = 1+0.01*H*(0.5*\beta-1)$ =	1+0.01*19*(0.5*1.3-1) =	0.934	[EQ. 6-3 FHWA-NHI-11-032]		
NOTE: EQUATION IS APPLICABLE FOR H <= 100 FT.					
FOR SITE CLASS A & B EQUATION 6-3 SHOULD BE MULTIPLIED BY 1.2.					
$\alpha = 1.2*[1+0.01*H*(0.5*\beta-1)]$					
$\beta = (F_V*S_1)/k_{max}$ =	(2.656*0.093)/0.19 =	1.3	[EQ. 6-4 FHWA-NHI-11-032]		
HORIZONTAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_h)				**0.089**	Other event controls
$k_h = 0.5*\alpha*F_{pga}*PGA = 0.5*\alpha*k_{max} = 0.5*k_{av}$ =	0.5*0.177 =	0.089	[EQ. 6-5 FHWA-NHI-11-032]		
NOTE: THIS k_h VALUE IS FOR A FACTOR OF SAFETY (FOS) OF 1.1 AND ASSUMES THE SLOPE					
CAN ACCOMMODATE 1-2 INCHES OF PERMANENT DISPLACEMENT.					
VERTICAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_v)				**0**	
NOTE: VERTICAL ACCELERATION IS NORMALLY SET EQUAL TO ZERO [FHWA-NHI-11-032 PAGE 6-6].					
RUN THE SEISMIC SLOPE STABILITY ANALYSIS WITH THE k_h AND k_v SHOWN ABOVE. IF THE FACTOR OF SAFETY (FOS)					
IS GREATER THAN OR EQUAL TO 1.1 THEN THE SLOPE IS STABLE UNDER SEISMIC CONDITIONS.					
IF THE FOS < 1.1 THEN CONTINUE BELOW.					
STEP 2: DISPLACEMENT-BASED SEISMIC SLOPE STABILITY:					
USING THE SAME STABILITY MODEL AS ABOVE, REDUCE THE HORIZONTAL SEISMIC LOAD/COEFFICIENT (k_h) UNTIL THE FOS					
INCREASES TO 1.0 [PAGE 6-10 FROM FHWA-NHI-11-032]. THE COEFFICIENT AT WHICH THE FOS = 1.0 IS KNOWN AS THE					
YIELD ACCELERATION COEFFICIENT. RECORD THIS COEFFICIENT BELOW.					
YIELD ACCELERATION SEISMIC COEFFICIENT (k_y)					DIM
MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max})					DIM (SEE ABOVE)
PEAK AVERAGE SEISMIC COEFFICIENT (k_{av})					DIM (SEE ABOVE)
SLOPE & HEIGHT ADJUSTMENT FACTORS					
α =	DIM (SEE ABOVE)				
β =	DIM (SEE ABOVE)				
AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1)					DIM (SEE ABOVE)
AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V)					DIM (SEE ABOVE)
PEAK GROUND VELOCITY (PGV)					
$PGV = 38*F_V*S_1$ =			[EQ. 6-9 FHWA-NHI-11-032]		
ESTIMATED HORIZONTAL DISPLACEMENT (d)					INCH
FOR SITES IN SITE CLASS A & B:			[EQ. 6-8 FHWA-NHI-11-032]		
$\log(d) = -1.31 -0.93*\log(k_y/k_{max}) +4.52*\log(1-(k_y/k_{max})) -0.46*\log(k_{max}) +1.12*\log(PGV)$					
FOR ALL OTHER SITE CLASSES:			[EQ. 6-7 FHWA-NHI-11-032]		
$\log(d) = -1.51 -0.74*\log(k_y/k_{max}) +3.27*\log(1-(k_y/k_{max})) -0.80*\log(k_{max}) +1.59*\log(PGV)$					
					INCH

INPUT PARAMETERS: R=10; M=5.3

LOCATION == North Abut.

EMBANKMENT HEIGHT (H) == 19 FT

PEAK HORIZONTAL GROUND ACCELERATION (PGA) == 0.357 DIM

SEISMIC SITE CLASSIFICATION == E

SITE FACTOR AT ZERO PERIOD ON ACCELERATION SPECTRUM (F_{pga}) == 1.029 DIM

AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1) == 0.093 DIM

AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V) == 2.656 DIM

STEP 1: PSEUDO-STATIC SLOPE STABILITY ANALYSIS:

MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max}) == 0.367353 DIM

$k_{max} = F_{pga}$ * PGA = 1.029*0.357 ===== 0.36735 [EQ. 6-1 FHWA-NHI-11-032]

PEAK AVERAGE SEISMIC COEFFICIENT (k_{av}) == 0.321 DIM

$k_{av} = \alpha * k_{max}$ ==== 0.874*0.367353 == 0.321 [EQ. 6-2 FHWA-NHI-11-032]

SLOPE & HEIGHT ADJUSTMENT FACTORS

α = 1+0.01*H*(0.5*β-1) ==== 1+0.01*19*(0.5*0.67-1) ===== 0.874 [EQ. 6-3 FHWA-NHI-11-032]

NOTE: EQUATION IS APPLICABLE FOR H <= 100 FT.

FOR SITE CLASS A & B EQUATION 6-3 SHOULD BE MULTIPLIED BY 1.2.

α = 1.2*[1+0.01*H*(0.5*β-1)]

$\beta = (F_v*S_1)/k_{max}$ == (2.656*0.093)/0.367353 =========== 0.672 [EQ. 6-4 FHWA-NHI-11-032]

HORIZONTAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_h) ========== **0.161** CONTROL

$k_h = 0.5*\alpha*F_{pga}*PGA = 0.5*\alpha*k_{max} = 0.5*k_{av}$ ==== 0.5*0.321 ======= 0.161 [EQ. 6-5 FHWA-NHI-11-032]

NOTE: THIS k_h VALUE IS FOR A FACTOR OF SAFETY (FOS) OF 1.1 AND ASSUMES THE SLOPE CAN ACCOMMODATE 1-2 INCHES OF PERMANENT DISPLACEMENT.

VERTICAL SEISMIC COEFFICIENT FOR SEISMIC SLOPE STABILITY ANALYSIS (k_v) ========== **0**

NOTE: VERTICAL ACCELERATION IS NORMALLY SET EQUAL TO ZERO [FHWA-NHI-11-032 PAGE 6-6].

RUN THE SEISMIC SLOPE STABILITY ANALYSIS WITH THE k_h AND k_v SHOWN ABOVE. IF THE FACTOR OF SAFETY (FOS) IS GREATER THAN OR EQUAL TO 1.1 THEN THE SLOPE IS STABLE UNDER SEISMIC CONDITIONS.
IF THE FOS < 1.1 THEN CONTINUE BELOW.

STEP 2: DISPLACEMENT-BASED SEISMIC SLOPE STABILITY:

USING THE SAME STABILITY MODEL AS ABOVE, REDUCE THE HORIZONTAL SEISMIC LOAD/COEFFICIENT (k_h) UNTIL THE FOS INCREASES TO 1.0 [PAGE 6-10 FROM FHWA-NHI-11-032]. THE COEFFICIENT AT WHICH THE FOS = 1.0 IS KNOWN AS THE YIELD ACCELERATION COEFFICIENT. RECORD THIS COEFFICIENT BELOW.

YIELD ACCELERATION SEISMIC COEFFICIENT (k_y) == DIM

MAXIMUM POSSIBLE SEISMIC COEFFICIENT (k_{max}) == DIM (SEE ABOVE)

PEAK AVERAGE SEISMIC COEFFICIENT (k_{av}) == DIM (SEE ABOVE)

SLOPE & HEIGHT ADJUSTMENT FACTORS

α ===== DIM (SEE ABOVE)

β ====== DIM (SEE ABOVE)

AASHTO SPECTRAL ACCELERATION AT 1.0 SEC. FOR SITE CLASS B (S_1) == DIM (SEE ABOVE)

AASHTO SITE FACTOR FOR 1.0 SEC. SPECTRAL ACCELERATION (F_V) == DIM (SEE ABOVE)

PEAK GROUND VELOCITY (PGV) ==

$PGV = 38*F_V*S_1$ ====== [EQ. 6-9 FHWA-NHI-11-032]

ESTIMATED HORIZONTAL DISPLACEMENT (d) == INCH

FOR SITES IN SITE CLASS A & B: [EQ. 6-8 FHWA-NHI-11-032]

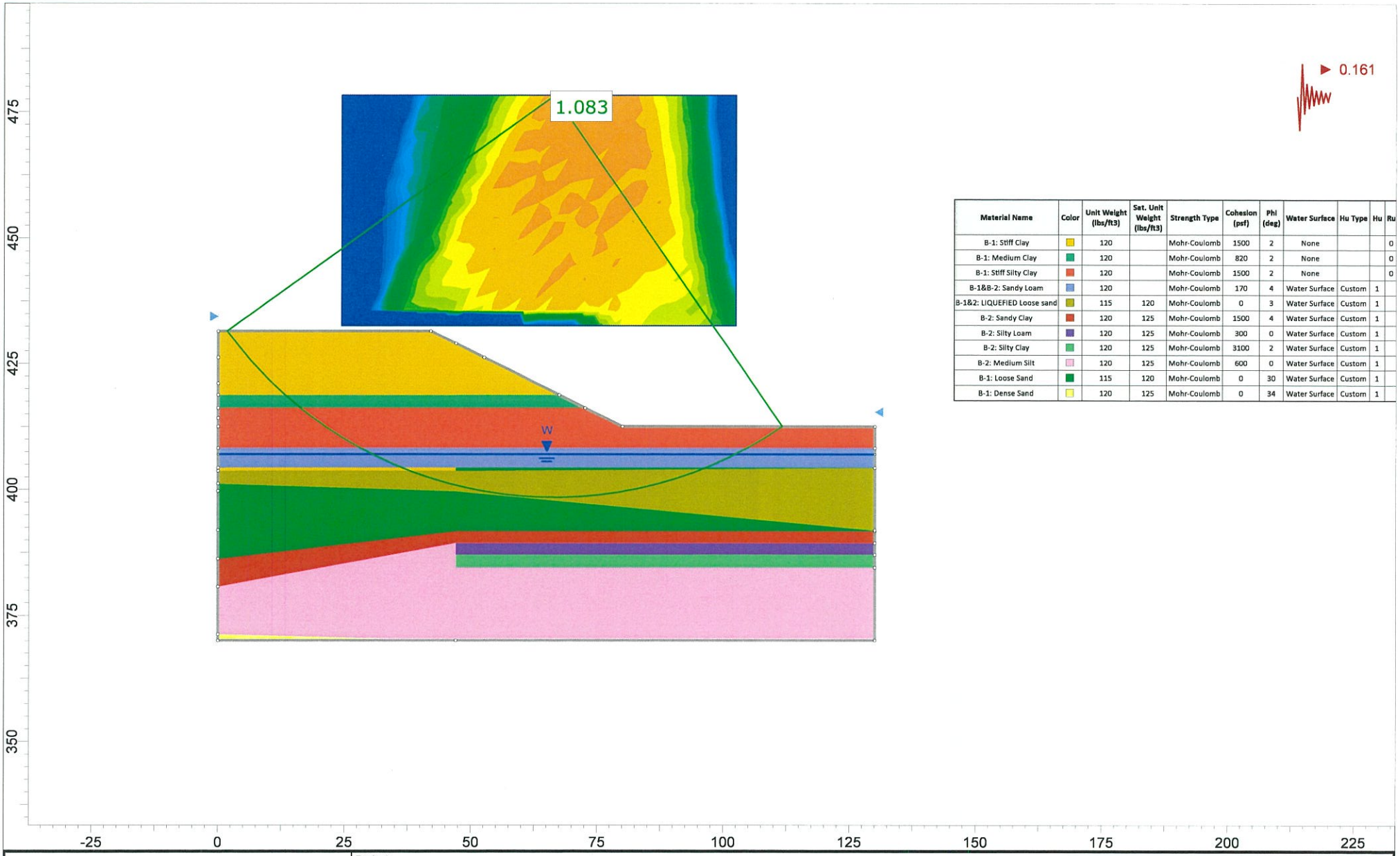
$\log(d) = -1.31 - 0.93*\log(k_y/k_{max}) + 4.52*\log(1-(k_y/k_{max})) - 0.46*\log(k_{max}) + 1.12*\log(PGV)$

FOR ALL OTHER SITE CLASSES: [EQ. 6-7 FHWA-NHI-11-032]

$\log(d) = -1.51 - 0.74*\log(k_y/k_{max}) + 3.27*\log(1-(k_y/k_{max})) - 0.80*\log(k_{max}) + 1.59*\log(PGV)$

INCH

EXHIBIT F – SEISMIC SLOPE STABILITY ANALYSIS

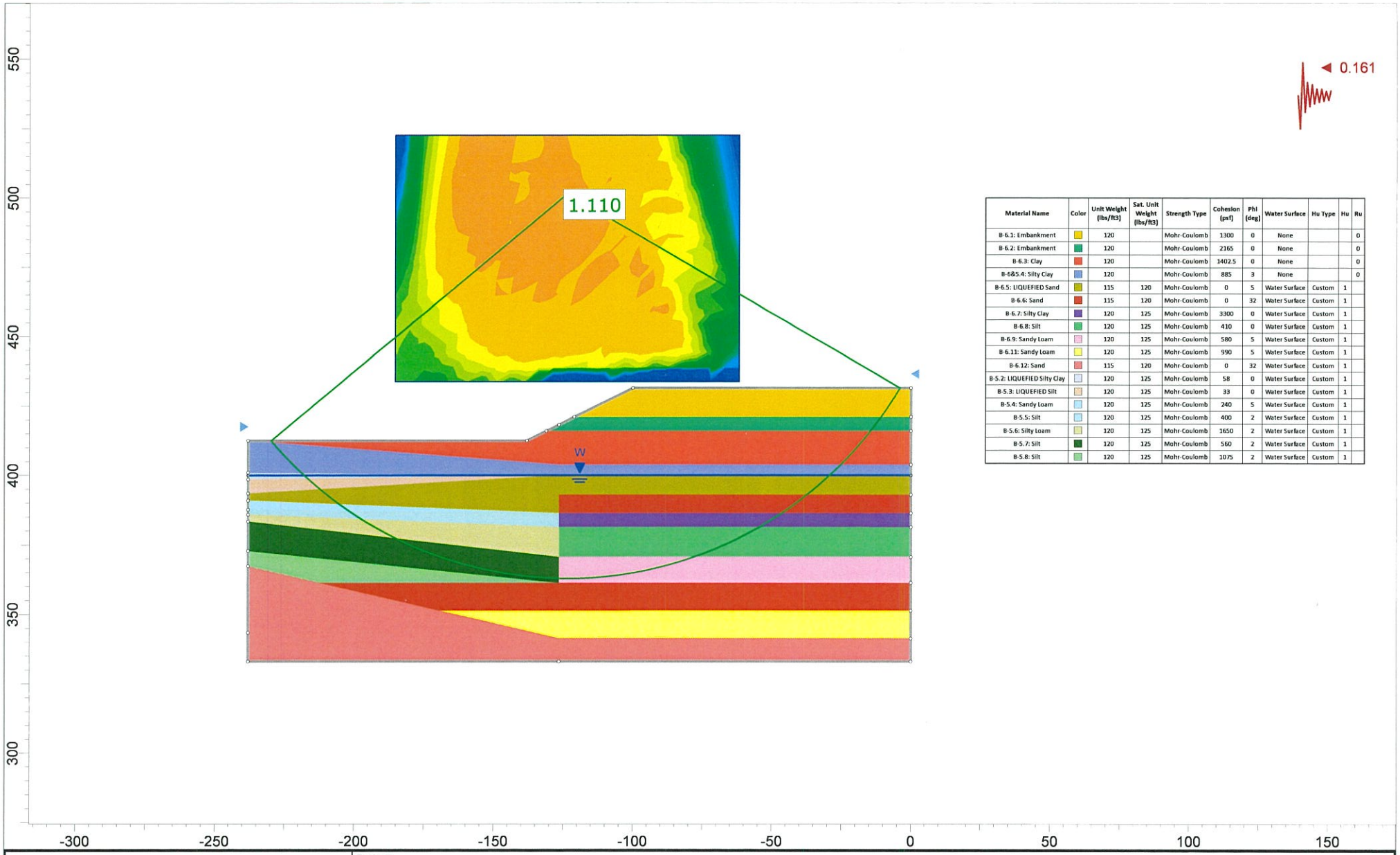


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
B-1: Stiff Clay		120		Mohr-Coulomb	1500	2	None			0
B-1: Medium Clay		120		Mohr-Coulomb	820	2	None			0
B-1: Stiff Silty Clay		120		Mohr-Coulomb	1500	2	None			0
B-1&B-2: Sandy Loam		120		Mohr-Coulomb	170	4	Water Surface	Custom	1	
B-1&2: LIQUEFIED Loose sand		115	120	Mohr-Coulomb	0	3	Water Surface	Custom	1	
B-2: Sandy Clay		120	125	Mohr-Coulomb	1500	4	Water Surface	Custom	1	
B-2: Silty Loam		120	125	Mohr-Coulomb	300	0	Water Surface	Custom	1	
B-2: Silty Clay		120	125	Mohr-Coulomb	3100	2	Water Surface	Custom	1	
B-2: Medium Silt		120	125	Mohr-Coulomb	600	0	Water Surface	Custom	1	
B-1: Loose Sand		115	120	Mohr-Coulomb	0	30	Water Surface	Custom	1	
B-1: Dense Sand		120	125	Mohr-Coulomb	0	34	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 8.013

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		Scale 1:315	Company
Date	6/19/2018, 1:23:13 PM		File Name 051-0074 Slide South Abutment Seismic B-1B-2 E.slim



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
B-6.1: Embankment		120		Mohr-Coulomb	1300	0	None			0
B-6.2: Embankment		120		Mohr-Coulomb	2165	0	None			0
B-6.3: Clay		120		Mohr-Coulomb	1402.5	0	None			0
B-6&5.4: Silty Clay		120		Mohr-Coulomb	885	3	None			0
B-6.5: LIQUEFIED Sand		115	120	Mohr-Coulomb	0	5	Water Surface	Custom	1	
B-6.6: Sand		115	120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
B-6.7: Silty Clay		120	125	Mohr-Coulomb	3300	0	Water Surface	Custom	1	
B-6.8: Silt		120	125	Mohr-Coulomb	410	0	Water Surface	Custom	1	
B-6.9: Sandy Loam		120	125	Mohr-Coulomb	580	5	Water Surface	Custom	1	
B-6.11: Sandy Loam		120	125	Mohr-Coulomb	990	5	Water Surface	Custom	1	
B-6.12: Sand		115	120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
B-5.2: LIQUEFIED Silty Clay		120	125	Mohr-Coulomb	58	0	Water Surface	Custom	1	
B-5.3: LIQUEFIED Silt		120	125	Mohr-Coulomb	33	0	Water Surface	Custom	1	
B-5.4: Sandy Loam		120	125	Mohr-Coulomb	240	5	Water Surface	Custom	1	
B-5.5: Silt		120	125	Mohr-Coulomb	400	2	Water Surface	Custom	1	
B-5.6: Silty Loam		120	125	Mohr-Coulomb	1650	2	Water Surface	Custom	1	
B-5.7: Silt		120	125	Mohr-Coulomb	560	2	Water Surface	Custom	1	
B-5.8: Silt		120	125	Mohr-Coulomb	1075	2	Water Surface	Custom	1	

rocscience	Project: SLIDE - An Interactive Slope Stability Program		
	Analysis Description:		
	Drawn By:	Scale: 1:572	Company:
	Date: 6/28/2018, 5:05:05 PM		File Name: 051-0074 Slide North Abutment Seismic_B-5B-6 E.slim

SLIDEINTERPRET 8.013

EXHIBIT G – SEISMIC SITE CLASS DETERMINATION

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====

Substructure 1

Base of Substruct. Elev. (or ground surf for bents	424	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-1	
Top of Boring Elev.	430.7	ft.
Approximate Fixity Elev.	418	ft.

Individual Site Class Definition:

N (bar):	9	(Blows/ft.)	Soil Site Class E <----Controls
N_{ch} (bar):	20	(Blows/ft.)	Soil Site Class D
s_u (bar):	0.43	(ksf)	Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	418.0	12.70	11	1.50	
1.5	416.5	1.50	6	0.80	B
4.0	414.0	2.50	6	1.60	B
6.5	411.5	2.50	2	1.20	B
9.5	408.5	3.00	8	1.80	B
11.5	406.5	2.00	5	0.80	B
14.0	404.0	2.50	4	0.20	B
16.0	402.0	2.00	6		
20.0	398.0	4.00	21		
25.0	393.0	5.00	20		
31.5	386.5	6.50	11		B
37.0	381.0	5.50	14	1.70	B
46.5	371.5	9.50	3	0.60	B
52.5	365.5	6.00	35		
66.5	351.5	14.00	22		B
76.5	341.5	10.00	5	0.21	B
86.5	331.5	10.00	20	0.20	B
92.5	325.5	6.00	18	2.50	
99.2	318.8	6.70	52		B

Substructure 2

Base of Substruct. Elev. (or ground surf for bents	412.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-2	
Top of Boring Elev.	414	ft.
Approximate Fixity Elev.	406.5	ft.

Individual Site Class Definition:

N (bar):	14	(Blows/ft.)	Soil Site Class E <----Controls
N_{ch} (bar):	14	(Blows/ft.)	Soil Site Class E
s_u (bar):	0.92	(ksf)	Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	406.5	7.50	9	1.00	B
2.0	404.5	2.00	8	0.20	B
4.5	402.0	2.50	6		
7.0	399.5	2.50	7		
9.5	397.0	2.50	6		
12.0	394.5	2.50	9		
14.5	392.0	2.50	9		B
17.0	389.5	2.50	7	1.50	B
19.5	387.0	2.50	10	0.30	B
22.0	384.5	2.50	13	3.10	B
25.5	381.0	3.50	5	0.70	
30.5	376.0	5.00	6	0.60	
37.0	369.5	6.50	9	0.40	B
40.5	366.0	3.50	21		
48.5	358.0	8.00	14		
62.0	344.5	13.50	15		B
72.0	334.5	10.00	30	0.70	B
73.0	333.5	1.00	52	0.90	B
92.0	314.5	19.00	52	5.00	B
100.0	306.5	8.00	100	5.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents	412.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-3	
Top of Boring Elev.	413	ft.
Approximate Fixity Elev.	406.5	ft.

Individual Site Class Definition:

N (bar):	9	(Blows/ft.)	Soil Site Class E <----Controls
N_{ch} (bar):	14	(Blows/ft.)	Soil Site Class E
s_u (bar):	0.34	(ksf)	Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	406.5	6.50	4	0.40	B
3.0	403.5	3.00	6	0.70	B
5.0	401.5	2.00	2	0.30	
10.0	396.5	5.00	2	0.20	
11.6	394.9	1.60	4	0.20	B
15.6	390.9	4.00	7		B
18.1	388.4	2.50	6	0.20	B
20.4	386.1	2.30	10	0.20	B
21.9	384.6	1.50	12	2.10	B
27.9	378.6	6.00	5	0.40	B
32.9	373.6	5.00	3	0.80	B
37.9	368.6	5.00	9	0.50	B
41.9	364.6	4.00	16		
48.9	357.6	7.00	17		
62.9	343.6	14.00	18		B
72.9	333.6	10.00	26	0.20	B
82.9	323.6	10.00	28	0.20	B
92.9	313.6	10.00	10	0.90	B
100.0	306.5	7.10	89	5.00	B

Substructure 4

Base of Substruct. Elev. (or ground surf for bents	412.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-4	
Top of Boring Elev.	413.8	ft.
Approximate Fixity Elev.	406.5	ft.

Individual Site Class Definition:

N (bar):	6	(Blows/ft.)	Soil Site Class E
N_{ch} (bar):	14	(Blows/ft.)	Soil Site Class E
s_u (bar):	0.73	(ksf)	Soil Site Class E <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	406.5	7.30	4	0.40	B
2.2	404.3	2.20	5	0.70	B
4.7	401.8	2.50	4	0.40	
7.2	399.3	2.50	2	0.30	
9.7	396.8	2.50	1	0.30	
12.2	394.3	2.50	1	0.20	B
14.7	391.8	2.50	2		B
17.2	389.3	2.50	18		B
19.7	386.8	2.50	6	0.20	B
22.2	384.3	2.50	11	3.10	B
25.7	380.8	3.50	0.5	5.00	
32.2	374.3	6.50	3	0.50	B
37.7	368.8	5.50	7	1.20	B
40.7	365.8	3.00	18		
47.7	358.8	7.00	16		
58.7	347.8	11.00	18		
67.7	338.8	9.00	27		
82.2	324.3	14.50	25		B
92.2	314.3	10.00	9	1.00	B
100.0	306.5	7.80	76	5.00	B

Global Site Class Definition: Substructures 1 through 6

N (bar):	10	(Blows/ft.)	Soil Site Class E <----Controls
N_{ch} (bar):	17	(Blows/ft.)	Soil Site Class D
s_u (bar):	0.61	(ksf)	Soil Site Class E

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====

Substructure 5

Base of Substruct. Elev. (or ground surf for bents)	412.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-5	
Top of Boring Elev.	413	ft.
Approximate Fixity Elev.	406.5	ft.

Individual Site Class Definition:

N (bar): 10 (Blows/ft.) Soil Site Class E <----Controls
N_{ch} (bar): 14 (Blows/ft.) Soil Site Class E
s_u (bar): 0.63 (ksf) Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	406.5	6.50	4	0.40	B
2.5	404.0	2.50	6	0.80	
5.0	401.5	2.50	6	0.70	
8.0	398.5	3.00	2	0.60	B
10.5	396.0	2.50	2	0.30	
13.0	393.5	2.50	1	0.30	B
15.5	391.0	2.50	5		B
19.0	387.5	3.50	13	0.20	B
20.5	386.0	1.50	5	0.40	B
23.0	383.5	2.50	12	1.70	B
26.5	380.0	3.50	4	0.50	
31.5	375.0	5.00	3	0.60	
36.5	370.0	5.00	14	1.20	
39.0	367.5	2.50	22	0.90	B
48.5	358.0	9.50	15		
63.0	343.5	14.50	14		B
73.0	333.5	10.00	18		B
79.0	327.5	6.00	38	0.80	
93.0	313.5	14.00	9	0.60	B
98.0	308.5	5.00	69	5.00	B
100.0	306.5	2.00	81	2.90	B

Substructure 6

Base of Substruct. Elev. (or ground surf for bents)	424	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-6	
Top of Boring Elev.	431	ft.
Approximate Fixity Elev.	418	ft.

Individual Site Class Definition:

N (bar): 13 (Blows/ft.) Soil Site Class E <----Controls
N_{ch} (bar): 24 (Blows/ft.) Soil Site Class D
s_u (bar): 0.7 (ksf) Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	418.0	13.00	4	0.40	B
1.5	416.5	1.50	14	2.10	
5.5	412.5	4.00	10	1.20	B
9.0	409.0	3.50	7		
11.5	406.5	2.50	8	1.50	
14.5	403.5	3.00	8	1.20	B
16.5	401.5	2.00	4	0.70	
18.5	399.5	2.00	5	1.00	B
25.5	392.5	7.00	2		
32.0	386.0	6.50	36		B
37.0	381.0	5.00	15	3.30	B
43.0	375.0	6.00	5	0.40	
57.0	361.0	14.00	10	0.60	B
67.0	351.0	10.00	44		B
77.0	341.0	10.00	23	1.00	B
83.0	335.0	6.00	19		
97.0	321.0	14.00	26		B
100.0	318.0	3.00	38	0.20	B

Substructure 7

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Substructure 8

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

EXHIBIT H – LIQUEFACTION ANALYSIS

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B1
ELEVATION OF BORING GROUND SURFACE ========== 430.70 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 27.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 24.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 1.00 FT. (Fill Height)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **481** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
426.2	4.5	8		95			27	0.116	0.522	12.456	19.947	0.215	0.116	0.642	0.642	1.420	**0.289**	0.964	**0.119**	**N.L. (1)**
418.7	12	8	1.5	95			27	0.126	1.467	10.607	17.728	0.189	0.126	1.587	1.587	1.084	**0.194**	0.889	**0.110**	**N.L. (1)**
416.2	14.5	6	0.8	95			28	0.119	1.765	7.713	14.255	0.153	0.119	1.885	1.885	1.031	**0.149**	0.858	**0.106**	**N.L. (1)**
413.7	17	6	1.6	95			26	0.127	2.082	7.392	13.870	0.149	0.127	2.202	2.202	0.990	**0.140**	0.824	**0.102**	**N.L. (1)**
411.2	19.5	2	1.2	95			27	0.124	2.392	2.356	7.827	0.094	0.124	2.512	2.512	0.964	**0.086**	0.790	**0.098**	**N.L. (1)**
408.2	22.5	8	1.8	80			21	0.128	2.776	8.889	15.667	0.167	0.128	2.896	2.896	0.920	**0.146**	0.749	**0.092**	**N.L. (1)**
406.2	24.5	5	0.8	55	1	19	19	0.119	3.014	5.359	11.431	0.126	0.057	3.010	3.104	0.919	**0.110**	0.722	**0.092**	**1.196 (C)**
403.7	27	4	0.2	35	1	16	16	0.104	3.274	4.126	9.951	0.113	0.166	3.425	3.675	0.895	**0.096**	0.691	**0.092**	**1.043 (C)**
399.7	31	21		6				0.068	3.546	22.015	22.148	0.244	0.068	3.697	4.196	0.843	**0.195**	0.648	**0.091**	**2.143 (D)**
395.2	35.5	20		4			17	0.067	3.848	19.853	19.853	0.214	0.067	3.999	4.779	0.830	**0.168**	0.609	**0.090**	**1.867 (D)**
386.2	44.5	11		8			14	0.062	4.406	9.743	10.165	0.115	0.062	4.557	5.898	0.837	**0.091**	0.562	**0.090**	**1.011 (C)**
380.7	50	14	1.7	95	1	29	29	0.065	4.763	11.856	19.228	0.206	0.065	4.914	6.599	0.784	**0.153**	0.546	**0.091**	**1.681 (C)**
370.7	60	3	0.6	95	10.3	42	35	0.053	5.293	2.382	7.858	0.095	0.053	5.444	7.753	0.814	**0.073**	0.533	**0.094**	**N.L. (2)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B2
ELEVATION OF BORING GROUND SURFACE ========== 414.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 9.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 5.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.364 (PGA (0.357) x Fpga (1.02) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 5.3
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -1.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.169**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **477** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.3
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = CEUS
PGA = **0.357**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
412.5	1.5	8		100				0.116	0.174	14.098	21.917	0.241								
409.5	4.5	8		100				0.116	0.522	12.456	19.947	0.215	0.116	0.348	0.348	1.500	**0.699**	0.974	**0.231**	**N.L. (1)**
406.5	7.5	8		90				0.116	0.870	11.135	18.362	0.196	0.054	0.510	0.541	1.498	**0.637**	0.942	**0.237**	**2.688 (D)**
404.5	9.5	8	0.2	35	10	19	19	0.104	1.078	11.119	18.343	0.196	0.166	0.842	0.998	1.299	**0.552**	0.917	**0.257**	**2.148 (D)**
402.5	11.5	6		4			26	0.057	1.192	8.456	8.456	0.100	0.057	0.956	1.237	1.193	**0.258**	0.889	**0.272**	**0.949 (C)**
400	14	7		4			26	0.058	1.337	9.919	9.919	0.112	0.058	1.101	1.538	1.163	**0.284**	0.850	**0.281**	**1.011 (D)**
397	17	6		2			24	0.057	1.508	8.439	8.439	0.100	0.057	1.272	1.896	1.120	**0.242**	0.798	**0.281**	**0.861 (C)**
392	22	9		2			21	0.060	1.808	12.197	12.197	0.133	0.060	1.572	2.508	1.076	**0.310**	0.703	**0.265**	**1.170 (D)**
389.5	24.5	10	0.3	75	1	32	32	0.046	1.923	13.390	21.068	0.229	0.046	1.687	2.779	1.071	**0.532**	0.655	**0.255**	**2.086 (D)**
387	27	13	3.1	95	1	25	25	0.073	2.106	17.242	25.690	0.306	0.073	1.870	3.118	1.042	**0.692**	0.609	**0.240**	**2.883 (D)**
383	31	5	0.7	95	1	34	34	0.055	2.326	6.212	12.454	0.135	0.055	2.090	3.587	1.004	**0.295**	0.542	**0.220**	**1.341 (C)**
378	36	6	0.6	95	1	44	44	0.053	2.591	7.121	13.546	0.146	0.053	2.355	4.164	0.974	**0.308**	0.475	**0.199**	**1.548 (C)**
371.5	42.5	9	0.4	95	1	44	44	0.049	2.909	10.137	17.165	0.183	0.049	2.673	4.888	0.938	**0.372**	0.415	**0.180**	**2.067 (C)**
367.5	46.5	21					16	0.068	3.181	24.088	24.088	0.275	0.068	2.945	5.410	0.900	**0.537**	0.391	**0.170**	**3.159 (D)**
360.5	53.5	14					16	0.064	3.629	14.145	14.145	0.152	0.064	3.393	6.295	0.886	**0.291**	0.365	**0.160**	**1.819 (D)**
354	60	15					16	0.065	4.052	14.228	14.228	0.152	0.065	3.816	7.123	0.859	**0.284**	0.353	**0.156**	**1.821 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR w_c/LL $\leq$ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B2
ELEVATION OF BORING GROUND SURFACE ========== 414.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 9.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 5.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -1.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **472** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 CRR $_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. CRR $_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
412.5	1.5	8		100				0.116	0.174	14.098	21.917	0.241								
409.5	4.5	8		100				0.116	0.522	12.456	19.947	0.215	0.116	0.348	0.348	1.500	**0.305**	0.981	**0.121**	**N.L. (1)**
406.5	7.5	8		90				0.116	0.870	11.135	18.362	0.196	0.054	0.510	0.541	1.498	**0.278**	0.957	**0.125**	**2.224 (D)**
404.5	9.5	8	0.2	35	10	19	19	0.104	1.078	11.119	18.343	0.196	0.166	0.842	0.998	1.299	**0.241**	0.938	**0.137**	**1.759 (D)**
402.5	11.5	6		4			26	0.057	1.192	8.456	8.456	0.100	0.057	0.956	1.237	1.193	**0.113**	0.917	**0.146**	**0.774 (C)**
400	14	7		4			26	0.058	1.337	9.919	9.919	0.112	0.058	1.101	1.538	1.163	**0.124**	0.887	**0.153**	**0.810 (D)**
397	17	6		2			24	0.057	1.508	8.439	8.439	0.100	0.057	1.272	1.896	1.120	**0.106**	0.849	**0.156**	**0.679 (C)**
394.5	19.5	9		2			22	0.060	1.658	12.454	12.454	0.135	0.060	1.422	2.202	1.104	**0.142**	0.814	**0.156**	**0.910 (D)**
392	22	9		5			19	0.060	1.808	12.197	12.197	0.133	0.060	1.572	2.508	1.076	**0.136**	0.779	**0.153**	**0.889 (D)**
389.5	24.5	7	1.5	40	12	18	11	0.064	1.968	9.242	16.091	0.171	0.064	1.732	2.824	1.056	**0.171**	0.744	**0.150**	**N.L. (2)**
389.5	24.5	10	0.3	75	1	32	32	0.046	1.968	13.244	20.893	0.227	0.046	1.732	2.824	1.062	**0.229**	0.744	**0.150**	**1.527 (D)**
387	27	13	3.1	95	1	25	25	0.073	2.151	17.058	25.469	0.301	0.073	1.915	3.163	1.034	**0.296**	0.710	**0.145**	**2.041 (D)**
383	31	5	0.7	95	1	40	34	0.055	2.371	6.155	12.386	0.135	0.055	2.135	3.632	0.998	**0.128**	0.662	**0.139**	**N.L. (2)**
378	36	6	0.6	95	1	44	44	0.053	2.636	7.060	13.471	0.145	0.053	2.400	4.209	0.969	**0.133**	0.614	**0.133**	**1.000 (C)**
371.5	42.5	9	0.4	95	1	44	44	0.049	2.954	10.054	17.065	0.182	0.049	2.718	4.933	0.934	**0.161**	0.572	**0.128**	**1.258 (C)**
367.5	46.5	21					16	0.068	3.226	23.873	23.873	0.271	0.068	2.990	5.455	0.896	**0.231**	0.555	**0.125**	**1.848 (D)**
360.5	53.5	14					16	0.064	3.674	14.032	14.032	0.150	0.064	3.438	6.340	0.883	**0.126**	0.536	**0.122**	**1.033 (D)**
354	60	15					16	0.065	4.097	14.122	14.122	0.151	0.065	3.861	7.168	0.857	**0.123**	0.527	**0.121**	**1.017 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR w_c/LL $\leq$ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B3
ELEVATION OF BORING GROUND SURFACE ========== 413.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 12.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 5.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -1.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **371** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
408.5	4.5	8						0.116	0.522	12.456	12.456	0.135	0.116	0.348	0.348	1.500	**0.193**	0.958	**0.118**	**N.L. (1)**
403.5	9.5	7	0.7	95	20	40	40	0.117	1.107	9.625	16.551	0.176	0.055	0.623	0.779	1.396	**0.233**	0.875	**0.135**	**N.L. (2)**
401	12	2	0.3	95	5	39	33	0.108	1.377	2.713	8.255	0.098	0.046	0.738	1.050	1.262	**0.117**	0.829	**0.146**	**N.L. (2)**
398.5	14.5	2	0.2	95	10	43	36	0.042	1.482	2.751	8.302	0.098	0.042	0.843	1.311	1.226	**0.114**	0.783	**0.150**	**N.L. (2)**
396	17	2	0.2	95	11	43	42	0.042	1.587	2.759	8.311	0.099	0.042	0.948	1.572	1.195	**0.112**	0.738	**0.151**	**0.742 (C)**
395	18	4	0.2	95	11	43	44	0.042	1.629	5.512	11.614	0.128	0.042	0.990	1.676	1.202	**0.145**	0.720	**0.151**	**0.960 (C)**
391	22	7		15	6	21	18	0.058	1.861	9.372	12.321	0.134	0.058	1.222	2.158	1.145	**0.146**	0.655	**0.143**	**1.021 (C)**
388.5	24.5	6	0.2	35	1	30	30	0.042	1.966	7.926	14.511	0.155	0.042	1.327	2.419	1.129	**0.166**	0.619	**0.139**	**1.194 (C)**
386	27	10	0.2	75	1	31	31	0.042	2.071	13.015	20.618	0.223	0.042	1.432	2.680	1.124	**0.238**	0.588	**0.136**	**1.750 (D)**
383.5	29.5	12	2	95	1	27	27	0.067	2.239	15.373	23.448	0.264	0.067	1.600	3.004	1.093	**0.274**	0.561	**0.130**	**2.108 (D)**
378.5	34.5	5	0.4	95	1	38	38	0.049	2.484	6.049	12.258	0.134	0.049	1.845	3.561	1.035	**0.131**	0.521	**0.124**	**1.056 (C)**
373.5	39.5	3	0.8	95	12	49	49	0.057	2.769	3.456	9.148	0.106	0.057	2.130	4.158	0.999	**0.100**	0.494	**0.119**	**N.L. (2)**
372.5	40.5	9	0.5	75	1	26	26	0.051	2.820	10.283	17.340	0.185	0.051	2.181	4.271	0.992	**0.174**	0.490	**0.119**	**1.462 (C)**
368.5	44.5	6	0.2	25	1	19	19	0.042	2.988	6.677	11.734	0.129	0.042	2.349	4.689	0.975	**0.119**	0.477	**0.118**	**1.008 (C)**
357.5	55.5	16						0.065	3.703	16.191	16.191	0.172	0.065	3.064	6.090	0.905	**0.148**	0.459	**0.113**	**1.310 (D)**
353	60	18						0.066	4.000	17.555	17.555	0.187	0.066	3.361	6.668	0.880	**0.156**	0.456	**0.112**	**1.393 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B4
ELEVATION OF BORING GROUND SURFACE ========== 414.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 19.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 6.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -1.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **334** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
409.3	4.7	12						0.120	0.564	19.391	19.391	0.208	0.120	0.384	0.384	1.500	**0.296**	0.943	**0.116**	**N.L. (1)**
406.5	7.5	6	0.8	95	20	30	19	0.119	0.897	8.216	14.859	0.159	0.119	0.717	0.717	1.328	**0.200**	0.888	**0.110**	**N.L. (1)**
404.3	9.7	5	0.7	95	14	43	41	0.117	1.155	6.824	13.188	0.142	0.055	0.838	0.975	1.263	**0.170**	0.843	**0.121**	**N.L. (2)**
401.5	12.5	4	0.4	95	11	40	34	0.111	1.465	5.355	11.426	0.126	0.049	0.975	1.287	1.205	**0.144**	0.785	**0.128**	**N.L. (2)**
399	15	2	0.3	95	11	42	35	0.108	1.735	2.605	8.126	0.097	0.046	1.090	1.558	1.157	**0.106**	0.735	**0.130**	**N.L. (2)**
396.5	17.5	1	0.3	95	11.7	42.6	51	0.108	2.005	1.258	6.510	0.084	0.046	1.205	1.829	1.126	**0.089**	0.688	**0.129**	**0.690 (C)**
394.5	19.5	1	0.2	95	11.7	42.6	40	0.104	2.213	1.222	6.467	0.083	0.166	1.537	2.286	1.070	**0.085**	0.653	**0.120**	**0.708 (C)**
392	22	2		4			22	0.048	2.333	2.418	2.418	0.055	0.048	1.657	2.562	1.050	**0.055**	0.614	**0.117**	**0.470 (C)**
389.5	24.5	18						0.066	2.498	22.552	22.552	0.250	0.066	1.822	2.883	1.048	**0.249**	0.580	**0.113**	**2.204 (D)**
387	27	6	0.2	35	11	25	22	0.042	2.603	6.995	13.394	0.144	0.042	1.927	3.144	1.024	**0.140**	0.551	**0.111**	**1.261 (C)**
384.5	29.5	11	3.1	95	10	38	25	0.073	2.786	12.452	19.943	0.215	0.073	2.110	3.483	1.001	**0.204**	0.527	**0.107**	**N.L. (2)**
381	33	8	0.5	95	12	52	47	0.051	2.964	8.814	15.577	0.166	0.051	2.288	3.880	0.980	**0.154**	0.501	**0.105**	**N.L. (2)**
374.5	39.5	3	0.5	95	12	52	48	0.051	3.296	3.144	8.773	0.102	0.051	2.620	4.617	0.954	**0.093**	0.468	**0.102**	**N.L. (2)**
369	45	7	1.2		12	42	34	0.061	3.631	6.981	6.981	0.088	0.061	2.955	5.295	0.932	**0.077**	0.453	**0.100**	**N.L. (2)**
366	48	18						0.066	3.829	17.949	17.949	0.191	0.066	3.153	5.681	0.894	**0.162**	0.447	**0.099**	**1.636 (D)**
359	55	16						0.065	4.284	14.673	14.673	0.157	0.065	3.608	6.572	0.871	**0.129**	0.439	**0.099**	**1.303 (D)**
354	60	18						0.066	4.614	15.890	15.890	0.169	0.066	3.938	7.214	0.847	**0.136**	0.436	**0.099**	**1.374 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR w_c/LL $\leq$ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B5
ELEVATION OF BORING GROUND SURFACE ========== 413.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 20.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 5.10 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -0.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **358** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
408.5	4.5	8		95			27	0.116	0.522	12.456	19.947	0.215	0.116	0.464	0.464	1.500	**0.305**	0.937	**0.116**	**N.L. (1)**
406	7	7	1	95	1	1	19	0.122	0.827	9.721	16.666	0.177	0.060	0.614	0.701	1.403	**0.236**	0.893	**0.126**	**1.873 (D)**
403.5	9.5	6	0.8	95	1	1	40	0.119	1.125	8.211	14.853	0.159	0.057	0.757	1.000	1.310	**0.197**	0.846	**0.138**	**1.428 (C)**
401	12	6	0.7	95	1	1	40	0.117	1.417	8.056	14.667	0.157	0.055	0.894	1.293	1.252	**0.186**	0.798	**0.143**	**1.301 (C)**
398.5	14.5	2	0.6	95	11	42	41	0.116	1.707	2.606	8.127	0.097	0.054	1.029	1.584	1.172	**0.108**	0.751	**0.143**	**0.755 (C)**
396	17	2	0.3	95	11	41	35	0.108	1.977	2.521	8.025	0.096	0.046	1.144	1.855	1.145	**0.104**	0.705	**0.141**	**0.738 (C)**
393.5	19.5	1	0.3	95	11	43	45	0.108	2.247	1.214	6.456	0.083	0.046	1.259	2.126	1.115	**0.088**	0.663	**0.138**	**0.638 (C)**
391	22	5		6				0.055	2.385	5.983	6.041	0.080	0.055	1.397	2.420	1.090	**0.083**	0.625	**0.134**	**0.619 (C)**
388	25	13	0.2	35	1	1	20	0.042	2.511	15.626	23.751	0.269	0.042	1.523	2.733	1.111	**0.283**	0.586	**0.130**	**2.177 (D)**
386	27	5	0.4	95	12	40	34	0.049	2.609	5.823	11.988	0.131	0.049	1.621	2.956	1.068	**0.133**	0.563	**0.127**	**N.L. (2)**
383.5	29.5	12	1.7	70	11	25	25	0.065	2.771	13.688	21.426	0.234	0.065	1.783	3.274	1.054	**0.234**	0.540	**0.122**	**1.918 (D)**
380	33	4	0.5	90	12	43	47	0.051	2.950	4.419	10.303	0.116	0.051	1.962	3.671	1.018	**0.112**	0.513	**0.119**	**N.L. (2)**
375	38	3	0.6	90	12	43	47	0.053	3.215	3.183	8.820	0.103	0.053	2.227	4.248	0.989	**0.096**	0.486	**0.115**	**N.L. (2)**
367.5	45.5	14	1.2	90	12	43	35	0.061	3.672	13.942	21.731	0.238	0.061	2.684	5.174	0.931	**0.210**	0.464	**0.110**	**N.L. (2)**
365	48	22	0.9	90	12	43	40	0.058	3.817	22.555	32.067	0.750	0.058	2.829	5.475	0.899	**0.639**	0.459	**0.110**	**N.L. (2)**
401	12	15						0.123	-0.611	33.173	33.173	1.451	0.061	0.633	1.032	1.500	**2.064**	0.798	**0.161**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

SGR 051-0074

REFERENCE BORING NUMBER ========== B6
ELEVATION OF BORING GROUND SURFACE ========== 431.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 31.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 24.10 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.190 (PGA (0.076) x Fpga (2.5) (Table 3.10.3.2-1)
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.50 FT. (Fill Height)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **422** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 216
Ground Motion Prediction Equations = NMSZ
PGA = **0.076**

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
426.5	4.5	8		95			27	0.116	0.522	12.456	19.947	0.215	0.116	0.582	0.582	1.462	**0.298**	0.948	**0.117**	**N.L. (1)**
412	19	9	1.5	95	1	1	30	0.126	2.349	10.658	17.790	0.189	0.126	2.409	2.409	0.965	**0.173**	0.732	**0.090**	**N.L. (1)**
404	27	8	1.3	95	1	1	32	0.125	3.349	8.146	14.776	0.158	0.063	2.913	3.125	0.920	**0.138**	0.623	**0.083**	**1.663 (C)**
402.5	28.5	4	0.7	95	11	42	26	0.117	3.525	3.969	9.763	0.111	0.055	2.996	3.301	0.924	**0.097**	0.607	**0.083**	**N.L. (2)**
400	31	5	1	95	11	42	38	0.122	3.830	4.746	10.695	0.119	0.184	3.456	3.917	0.891	**0.101**	0.583	**0.082**	**1.232 (C)**
393	38	2		3			23	0.048	4.166	1.821	1.821	0.052	0.048	3.792	4.690	0.890	**0.044**	0.535	**0.082**	**0.537 (C)**
386.5	44.5	36	0.3				25	0.046	4.465	35.631	35.631	-0.354	0.046	4.091	5.395	0.773	**-0.259**	0.510	**0.083**	**N.L. (3)**
381.5	49.5	15	3.3	90	11	27	27	0.074	4.835	12.575	20.090	0.217	0.074	4.461	6.077	0.803	**0.165**	0.499	**0.084**	**1.964 (C)**
371	60	5	0.4	60	11.7	42.6	47	0.049	5.349	3.941	9.729	0.111	0.049	4.975	7.246	0.822	**0.086**	0.488	**0.088**	**0.977 (C)**
362	69	10	0.6	35	1	22	22	0.053	5.826	7.439	13.926	0.149	0.053	5.452	8.285	0.785	**0.111**	0.476	**0.089**	**1.247 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

EXHIBIT I – PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== N. Abut.
REFERENCE BORING ========== B6
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 412.00 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 ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
705 KIPS	**705** KIPS	**388** KIPS	**132** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 89
Plugged Pile Perimeter========== 4.750 FT. Unplugged Pile Perimeter========== 7.033 FT.
Plugged Pile End Bearing Area========== 1.409 SQFT. Unplugged Pile End Bearing Area======== 0.181 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.)
407.00	5.00	1.50	7		22.8		46.5	33.8		***36.9***	37	0	0	20	19
404.00	3.00	1.20	8		11.7	23.7	***48.3***	17.3	3.0	52.9	48	0	0	27	22
402.00	2.00	0.70	4		5.0	13.8	***59.3***	7.4	1.8	61.1	59	0	0	33	24
400.00	2.00	1.00	5		6.7	19.7	***53.3***	10.0	2.5	69.4	53	0	0	29	26
393.00	7.00		2	Fine Sand	1.1	7.0	173.8	1.7	0.9	***86.5***	86	0	0	48	33
386.50	6.50		36	Fine Sand	20.5	126.4	133.1	30.4	16.3	***109.0***	109	0	0	60	40
381.50	5.00	3.30	15		38.9	65.2	***114.8***	57.7	8.4	159.3	115	0	0	63	45
371.50	10.00	0.40	5		15.1	7.9	***133.8***	22.3	1.0	182.1	134	0	0	74	55
366.50	5.00	0.60	10		10.9	11.8	***144.7***	16.2	1.5	198.2	145	0	0	80	60
361.50	5.00	0.60	10		10.9	11.8	298.2	16.2	1.5	***232.8***	233	0	0	128	65
356.50	5.00		44	Medium Sand	25.5	154.4	323.7	37.7	19.9	***270.5***	270	0	0	149	70
351.50	5.00		44	Medium Sand	25.5	154.4	***214.4***	37.7	19.9	290.8	214	0	0	118	75
346.50	5.00	1.00	23		16.9	19.7	***231.3***	25.0	2.5	315.8	231	0	0	127	80
341.50	5.00	1.00	23		16.9	19.7	***295.1***	25.0	2.5	346.8	295	0	0	162	85
337.50	4.00		19	Fine Sand	6.2	66.7	***301.3***	9.2	8.6	356.0	301	0	0	166	89
334.50	3.00		19	Fine Sand	4.6	66.7	***330.5***	6.9	8.6	366.0	331	0	0	182	92
330.50	4.00		26	Fine Sand	8.5	91.3	***339.0***	12.5	11.7	378.5	339	0	0	186	96
327.50	3.00		26	Fine Sand	6.3	91.3	***345.3***	9.4	11.7	387.9	345	0	0	190	99
324.50	3.00		26	Fine Sand	6.3	91.3	***351.7***	9.4	11.7	397.3	352	0	0	193	102
321.50	3.00		26	Fine Sand	6.3	91.3	***270.7***	9.4	11.7	395.5	271	0	0	149	105
319.00	2.50	0.20	38		2.0	3.9	***272.7***	2.9	0.5	398.4	273	0	0	150	107
316.50	2.50	0.20	38		2.0	3.9	***274.6***	2.9	0.5	401.3	275	0	0	151	110
314.00	2.50	0.20	38		2.0	3.9	***276.6***	2.9	0.5	404.2	277	0	0	152	112
311.50	2.50	0.20	38		2.0	3.9	***398.3***	2.9	0.5	422.5	398	0	0	219	115
308.00	3.50		47	Hard Till	9.6	123.7	***439.5***	14.2	15.9	440.8	439	0	0	242	118
301.50	6.50		59	Hard Till	25.7	155.3	***333.6***	38.0	20.0	461.9	334	0	0	183	125
298.50	3.00	1.20	74		11.7	23.7	***497.0***	17.3	3.0	498.7	497	0	0	273	128
297.50	1.00			Shale	59.2	175.5	***556.2***	87.6	22.6	586.3	556	0	0	306	128.5
296.50	1.00			Shale	59.2	175.5	***615.4***	87.6	22.6	673.9	615	0	0	338	129.5
295.50	1.00			Shale	59.2	175.5	***674.5***	87.6	22.6	761.5	675	0	0	371	130.5
294.50	1.00			Shale	59.2	175.5	***733.7***	87.6	22.6	849.1	~~734~~	~~0~~	~~0~~	~~404~~	~~131.5~~
293.50	1.00			Shale	59.2	175.5	***792.9***	87.6	22.6	936.8	~~793~~	~~0~~	~~0~~	~~436~~	~~132.5~~
292.50	1.00			Shale	59.2	175.5	***852.1***	87.6	22.6	1024.4	~~852~~	~~0~~	~~0~~	~~469~~	~~133.5~~
291.50	1.00			Shale	59.2	175.5	***911.2***	87.6	22.6	1112.0	~~911~~	~~0~~	~~0~~	~~501~~	~~134.5~~
290.50	1.00			Shale		175.5			22.6						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== N. Abut.
REFERENCE BORING ========== B6
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 412.00 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 ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
570 KIPS	**226** KIPS	**124** KIPS	**60** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
407.00	5.00	1.50	7		27.6		***41.7***				42	0	0	23	19
404.00	3.00	1.20	8		14.1	14.1	***49.9***				50	0	0	27	22
402.00	2.00	0.70	4		6.0	8.2	***59.5***				59	0	0	33	24
400.00	2.00	1.00	5		8.2	11.7	***69.3***				69	0	0	38	26
393.00	7.00		2	Fine Sand	4.4	13.5	***302.6***				303	0	0	166	33
386.50	6.50		36	Fine Sand	80.0	242.3	***179.0***				179	0	0	98	40
381.50	5.00	3.30	15		47.0	38.7	***192.0***				192	0	0	106	45
371.50	10.00	0.40	5		18.2	4.7	***212.6***				213	0	0	117	55
366.50	5.00	0.60	10		13.2	7.0	***225.8***				226	0	0	124	60
361.50	5.00	0.60	10		13.2	7.0	***528.0***				528	0	0	290	65
356.50	5.00		44	Medium Sand	99.3	296.1	***627.3***				~~627~~	~~0~~	~~0~~	~~345~~	~~70~~
351.50	5.00		44	Medium Sand	99.3	296.1	***442.2***				442	0	0	243	75
346.50	5.00	1.00	23		20.4	11.7	***462.6***				463	0	0	254	80
341.50	5.00	1.00	23		20.4	11.7	***599.1***				~~599~~	~~0~~	~~0~~	~~330~~	~~85~~
337.50	4.00		19	Fine Sand	24.1	127.9	***623.2***				~~623~~	~~0~~	~~0~~	~~343~~	~~89~~
334.50	3.00		19	Fine Sand	18.1	127.9	***688.4***				~~688~~	~~0~~	~~0~~	~~379~~	~~92~~
330.50	4.00		26	Fine Sand	33.0	175.0	***721.4***				~~721~~	~~0~~	~~0~~	~~397~~	~~96~~
327.50	3.00		26	Fine Sand	24.7	175.0	***746.1***				~~746~~	~~0~~	~~0~~	~~410~~	~~99~~
324.50	3.00		26	Fine Sand	24.7	175.0	***770.9***				~~771~~	~~0~~	~~0~~	~~424~~	~~102~~
321.50	3.00		26	Fine Sand	24.7	175.0	***623.0***				~~623~~	~~0~~	~~0~~	~~343~~	~~105~~
319.00	2.50	0.20	38		2.4	2.3	***625.4***				~~625~~	~~0~~	~~0~~	~~344~~	~~107~~
316.50	2.50	0.20	38		2.4	2.3	***627.7***				~~628~~	~~0~~	~~0~~	~~345~~	~~110~~
314.00	2.50	0.20	38		2.4	2.3	***630.1***				~~630~~	~~0~~	~~0~~	~~347~~	~~112~~
311.50	2.50	0.20	38		2.4	2.3	***867.3***				~~867~~	~~0~~	~~0~~	~~477~~	~~115~~
308.00	3.50		47	Hard Till	37.5	237.2	***965.4***				~~965~~	~~0~~	~~0~~	~~531~~	~~118~~
301.50	6.50		59	Hard Till	100.1	297.8	***781.8***				~~782~~	~~0~~	~~0~~	~~430~~	~~125~~
298.50	3.00	1.20	74		14.1	14.1	***1118.3***				~~1118~~	~~0~~	~~0~~	~~615~~	~~128~~
297.50	1.00			Shale	230.7	336.5	***1349.0***				~~1349~~	~~0~~	~~0~~	~~742~~	~~128.5~~
296.50	1.00			Shale	230.7	336.5	***1579.7***				~~1580~~	~~0~~	~~0~~	~~869~~	~~129.5~~
295.50	1.00			Shale	230.7	336.5	***1810.5***				~~1810~~	~~0~~	~~0~~	~~996~~	~~130.5~~
294.50	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== N. Abut.
REFERENCE BORING ========== B6
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 412.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Liquef.
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 393.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 400.00 ft

TOTAL SEISMIC SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 249.00 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 93.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area======== 0.239 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**511** KIPS	**411** KIPS	**128** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)	ULTIMATE UNPLUGGED SIDE RESIST. (KIPS)	ULTIMATE UNPLUGGED END BRG. RESIST. (KIPS)	ULTIMATE UNPLUGGED TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
407.00	5.00	1.50	7		23.3		48.0	34.2		***38.2***	38	23	26	-11	19
404.00	3.00	1.20	8		11.9	24.7	***49.7***	17.5	4.0	54.1	50	35	39	-24	22
402.00	2.00	0.70	4		5.1	14.4	***60.9***	7.5	2.3	62.6	61	40	44	-24	24
400.00	2.00	1.00	5		6.9	20.6	***54.6***	10.1	3.3	70.5	55	47	52	-45	26
393.00	7.00		2	Fine Sand	1.2	7.3	180.2	1.7	1.2	***92.5***	92	48	52	-8	33
386.50	6.50		36	Fine Sand	20.9	131.8	137.3	30.7	21.4	***112.8***	113	48	52	12	40
381.50	5.00	3.30	15		39.8	68.0	***117.4***	58.3	11.0	161.5	117	48	52	17	45
371.50	10.00	0.40	5		15.4	8.2	***136.9***	22.6	1.3	184.7	137	48	52	36	55
366.50	5.00	0.60	10		11.1	12.4	***148.0***	16.4	2.0	201.1	148	48	52	48	60
361.50	5.00	0.60	10		11.1	12.4	307.9	16.4	2.0	***241.6***	242	48	52	141	65
356.50	5.00		44	Medium Sand	26.0	161.1	333.9	38.1	26.2	***279.7***	280	48	52	179	70
351.50	5.00		44	Medium Sand	26.0	161.1	***219.4***	38.1	26.2	295.0	219	48	52	119	75
346.50	5.00	1.00	23		17.2	20.6	***236.6***	25.3	3.3	320.3	237	48	52	136	80
341.50	5.00	1.00	23		17.2	20.6	***302.8***	25.3	3.3	353.6	303	48	52	202	85
337.50	4.00		19	Fine Sand	6.3	69.6	***309.1***	9.3	11.3	362.8	309	48	52	209	89
334.50	3.00		19	Fine Sand	4.7	69.6	***339.5***	6.9	11.3	373.9	339	48	52	239	92
330.50	4.00		26	Fine Sand	8.6	95.2	***348.1***	12.7	15.5	386.6	348	48	52	248	96
327.50	3.00		26	Fine Sand	6.5	95.2	***354.6***	9.5	15.5	396.1	355	48	52	254	99
324.50	3.00		26	Fine Sand	6.5	95.2	***361.1***	9.5	15.5	405.6	361	48	52	261	102
321.50	3.00		26	Fine Sand	6.5	95.2	***276.5***	9.5	15.5	400.3	276	48	52	176	105
319.00	2.50	0.20	38		2.0	4.1	***278.5***	2.9	0.7	403.3	278	48	52	178	107
316.50	2.50	0.20	38		2.0	4.1	***280.5***	2.9	0.7	406.2	280	48	52	180	110
314.00	2.50	0.20	38		2.0	4.1	***282.5***	2.9	0.7	409.1	282	48	52	182	112
311.50	2.50	0.20	38		2.0	4.1	***409.4***	2.9	0.7	432.3	409	48	52	309	115
308.00	3.50		47	Hard Till	9.8	129.0	452.2	14.4	21.0	***452.1***	452	48	52	352	118
301.50	6.50		59	Hard Till	26.2	162.0	***341.1***	38.5	26.3	468.3	341	48	52	241	125
298.50	3.00	1.20	74		11.9	24.7	***511.3***	17.5	4.0	511.5	511	48	52	411	128
297.50	1.00			Shale	60.4	183.0	***571.8***	88.7	29.8	600.2	572	48	52	471	128.5
296.50	1.00			Shale	60.4	183.0	***632.2***	88.7	29.8	688.8	632	48	52	532	129.5
295.50	1.00			Shale	60.4	183.0	***692.6***	88.7	29.8	777.5	693	48	52	592	130.5
294.50	1.00			Shale	60.4	183.0	***753.0***	88.7	29.8	866.1	753	48	52	653	131.5
293.50	1.00			Shale	60.4	183.0	***813.4***	88.7	29.8	954.8	813	48	52	713	132.5
292.50	1.00			Shale	60.4	183.0	***873.8***	88.7	29.8	1043.4	874	48	52	773	133.5
291.50	1.00			Shale	60.4	183.0	***934.3***	88.7	29.8	1132.1	~~934~~	~~48~~	~~52~~	~~834~~	~~134.5~~
290.50	1.00			Shale	60.4	183.0	***994.7***	88.7	29.8	1220.7	~~995~~	~~48~~	~~52~~	~~894~~	~~135.5~~
289.50	1.00			Shale	60.4	183.0	***1055.1***	88.7	29.8	1309.4	~~1055~~	~~48~~	~~52~~	~~955~~	~~136.5~~
288.50	1.00			Shale	60.4	183.0	***1115.5***	88.7	29.8	1398.0	~~1116~~	~~48~~	~~52~~	~~1015~~	~~137.5~~
287.50	1.00			Shale		183.0			29.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S. Abut.
REFERENCE BORING ========== B1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 424.00 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 ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
570 KIPS	**474** KIPS	**261** KIPS	**98** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
422.00	2.00	1.20	7		9.4		***31.7***				32	0	0	17	4
419.00	3.00	1.90	8		19.4	22.3	***38.2***				38	0	0	21	7
416.50	2.50	0.80	6		8.5	9.4	***56.0***				56	0	0	31	10
414.00	2.50	1.60	6		14.4	18.8	***65.8***				66	0	0	36	12
411.50	2.50	1.20	2		11.8	14.1	***84.5***				85	0	0	46	15
408.50	3.00	1.80	8		18.7	21.1	***91.5***				92	0	0	50	18
406.50	2.00	0.80	5		6.8	9.4	***91.3***				91	0	0	50	20
403.70	2.80	0.20	4		2.6	2.3	***131.9***				132	0	0	73	22
401.70	2.00		6	Fine Sand	3.8	40.4	***236.7***				237	0	0	130	24
397.70	4.00		21	Fine Sand	26.6	141.3	***256.6***				257	0	0	141	28
392.70	5.00		20	Fine Sand	31.7	134.6	***227.8***				228	0	0	125	33
386.20	6.50		11	Fine Sand	22.7	74.0	***196.4***				196	0	0	108	40
380.70	5.50	1.70	14		33.0	19.9	***216.5***				217	0	0	119	45
371.20	9.50	0.60	3		25.0	7.0	***470.0***				470	0	0	259	55
365.20	6.00		35	Fine Sand	70.7	235.5	***453.3***				453	0	0	249	61
351.20	14.00		22	Fine Sand	97.7	148.0	***405.3***				405	0	0	223	75
347.20	4.00	0.20	5		3.8	2.3	***409.0***				409	0	0	225	79
344.20	3.00	0.20	5		2.8	2.3	***411.9***				412	0	0	227	82
341.20	3.00	0.20	5		2.8	2.3	***414.7***				415	0	0	228	85
337.20	4.00	0.20	23		3.8	2.3	***418.5***				418	0	0	230	89
334.20	3.00	0.20	23		2.8	2.3	***421.3***				421	0	0	232	92
331.20	3.00	0.20	23		2.8	2.3	***451.1***				451	0	0	248	95
328.20	3.00	2.50	18		23.2	29.3	***474.3***				474	0	0	261	98
325.20	3.00	2.50	18		23.2	29.3	***730.6***				~~731~~	~~0~~	~~0~~	~~402~~	~~101~~
321.20	4.00		52	Hard Till	50.1	262.4	***780.7***				~~781~~	~~0~~	~~0~~	~~429~~	~~105~~
318.20	3.00		52	Hard Till	37.6	262.4	***818.3***				~~818~~	~~0~~	~~0~~	~~450~~	~~108~~
315.20	3.00		52	Hard Till	37.6	262.4	***866.0***				~~866~~	~~0~~	~~0~~	~~476~~	~~111~~
312.20	3.00		54	Hard Till	39.9	272.5	***906.0***				~~906~~	~~0~~	~~0~~	~~498~~	~~114~~
309.20	3.00		54	Hard Till	39.9	272.5	***945.9***				~~946~~	~~0~~	~~0~~	~~520~~	~~117~~
306.20	3.00		54	Hard Till	39.9	272.5	***985.8***				~~986~~	~~0~~	~~0~~	~~542~~	~~120~~
303.20	3.00		54	Hard Till	39.9	272.5	***1025.8***				~~1026~~	~~0~~	~~0~~	~~564~~	~~123~~
301.20	2.00		54	Hard Till	26.6	272.5	***1116.3***				~~1116~~	~~0~~	~~0~~	~~614~~	~~125~~
300.20	1.00			Shale	230.7	336.5	***1347.1***				~~1347~~	~~0~~	~~0~~	~~741~~	~~125.8~~
299.20	1.00			Shale	230.7	336.5	***1577.8***				~~1578~~	~~0~~	~~0~~	~~868~~	~~126.8~~
298.20	1.00			Shale	230.7	336.5	***1808.5***				~~1809~~	~~0~~	~~0~~	~~995~~	~~127.8~~
297.20	1.00			Shale	230.7	336.5	***2039.2***				~~2039~~	~~0~~	~~0~~	~~1122~~	~~128.8~~
296.20	1.00			Shale	230.7	336.5	***2270.0***				~~2270~~	~~0~~	~~0~~	~~1248~~	~~129.8~~
295.20	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S. Abut.
REFERENCE BORING ========== B1
LRFD or ASD or SEISMIC ========== SEISMIC
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 424.00 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 SEISMIC SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Seismic Loading Applied per pile spaced at 8 ft. Cts ======= 249.00 KIPS
Approx. Seismic Loading Applied per pile spaced at 3 ft. Cts ======= 93.38 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Seismic Resistance Available in Boring	Maximum Pile Driveable Length in Boring
578 KIPS	**578** KIPS	**578** KIPS	**127** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area======== 0.149 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE PLUGGED SIDE RESIST. (KIPS)	ULTIMATE PLUGGED END BRG. RESIST. (KIPS)	ULTIMATE PLUGGED TOTAL RESIST. (KIPS)	ULTIMATE UNPLUGGED SIDE RESIST. (KIPS)	ULTIMATE UNPLUGGED END BRG. RESIST. (KIPS)	ULTIMATE UNPLUGGED TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
422.00	2.00	1.20	7		7.7		44.4	11.4		***15.4***	15	0	0	15	4
419.00	3.00	1.90	8		15.9	36.7	39.0	23.6	4.0	***36.7***	37	0	0	37	7
416.50	2.50	0.80	6		6.9	15.5	61.4	10.3	1.7	***48.6***	49	0	0	49	10
414.00	2.50	1.60	6		11.8	30.9	65.5	17.5	3.3	***65.3***	65	0	0	65	12
411.50	2.50	1.20	2		9.6	23.2	86.8	14.3	2.5	***80.9***	81	0	0	81	15
408.50	3.00	1.80	8		15.3	34.8	***82.8***	22.8	3.7	101.5	83	0	0	83	18
406.50	2.00	0.80	5		5.6	15.5	***76.7***	8.2	1.7	108.5	77	0	0	77	20
403.70	2.80	0.20	4		2.2	3.9	***95.6***	3.2	0.4	113.5	96	0	0	96	22
401.70	2.00		6	Fine Sand	1.0	20.6	148.1	1.4	2.2	***120.5***	121	0	0	121	24
397.70	4.00		21	Fine Sand	6.8	72.1	151.4	10.0	7.8	***130.2***	130	0	0	130	28
392.70	5.00		20	Fine Sand	8.1	68.7	***128.6***	11.9	7.4	138.8	129	0	0	129	33
386.20	6.50		11	Fine Sand	5.8	37.8	***129.4***	8.5	4.1	146.8	129	0	0	129	40
380.70	5.50	1.70	14		27.1	32.9	***135.2***	40.2	3.5	184.7	135	0	0	135	45
371.20	9.50	0.60	3		20.5	11.6	264.4	30.4	1.2	***226.9***	227	0	0	227	55
365.20	6.00		35	Fine Sand	17.9	120.2	***237.7***	26.6	13.0	248.7	238	0	0	238	61
351.20	14.00		22	Fine Sand	24.8	75.6	***190.7***	36.8	8.1	277.7	191	0	0	191	75
347.20	4.00	0.20	5		3.1	3.9	***193.8***	4.6	0.4	282.3	194	0	0	194	79
344.20	3.00	0.20	5		2.3	3.9	***196.1***	3.4	0.4	285.8	196	0	0	196	82
341.20	3.00	0.20	5		2.3	3.9	***198.5***	3.4	0.4	289.2	198	0	0	198	85
337.20	4.00	0.20	23		3.1	3.9	***201.5***	4.6	0.4	293.8	202	0	0	202	89
334.20	3.00	0.20	23		2.3	3.9	***203.9***	3.4	0.4	297.2	204	0	0	204	92
331.20	3.00	0.20	23		2.3	3.9	***250.6***	3.4	0.4	305.4	251	0	0	251	95
328.20	3.00	2.50	18		19.0	48.3	***269.6***	28.2	5.2	333.6	270	0	0	270	98
325.20	3.00	2.50	18		19.0	48.3	374.3	28.2	5.2	***371.0***	371	0	0	371	101
321.20	4.00		52	Hard Till	12.7	134.0	***387.0***	18.9	14.4	389.9	387	0	0	387	105
318.20	3.00		52	Hard Till	9.5	134.0	***396.5***	14.2	14.4	404.1	397	0	0	397	108
315.20	3.00		52	Hard Till	9.5	134.0	***411.2***	14.2	14.4	418.8	411	0	0	411	111
312.20	3.00		54	Hard Till	10.1	139.1	***421.4***	15.0	15.0	433.8	421	0	0	421	114
309.20	3.00		54	Hard Till	10.1	139.1	***431.5***	15.0	15.0	448.9	431	0	0	431	117
306.20	3.00		54	Hard Till	10.1	139.1	***441.6***	15.0	15.0	463.9	442	0	0	442	120
303.20	3.00		54	Hard Till	10.1	139.1	***451.8***	15.0	15.0	479.0	452	0	0	452	123
301.20	2.00		54	Hard Till	6.8	139.1	***491.2***	10.0	15.0	492.5	491	0	0	491	125
300.20	1.00			Shale	58.5	171.8	***549.7***	86.9	18.5	579.4	550	0	0	550	125.8
299.20	1.00			Shale	58.5	171.8	***608.3***	86.9	18.5	666.3	~~608~~	~~0~~	~~0~~	~~608~~	~~126.8~~
298.20	1.00			Shale	58.5	171.8	***666.8***	86.9	18.5	753.2	~~667~~	~~0~~	~~0~~	~~667~~	~~127.8~~
297.20	1.00			Shale		171.8			18.5						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S. Abut.
REFERENCE BORING ========== B1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 426.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 424.00 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 ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**513** KIPS	**282** KIPS	**125** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area======== 0.239 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 SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL 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.)
422.00	2.00	1.20	7		7.9		47.1	11.7		***18.0***	18	0	0	10	4
419.00	3.00	1.90	8		16.4	39.1	40.8	24.1	6.4	***38.4***	38	0	0	21	7
416.50	2.50	0.80	6		7.2	16.5	64.4	10.5	2.7	***51.6***	52	0	0	28	10
414.00	2.50	1.60	6		12.2	32.9	68.4	17.9	5.4	***68.1***	68	0	0	37	12
411.50	2.50	1.20	2		9.9	24.7	90.7	14.6	4.0	***84.7***	85	0	0	47	15
408.50	3.00	1.80	8		15.8	37.1	***85.9***	23.2	6.0	104.6	86	0	0	47	18
406.50	2.00	0.80	5		5.7	16.5	***79.3***	8.4	2.7	111.0	79	0	0	44	20
403.70	2.80	0.20	4		2.2	4.1	***99.4***	3.3	0.7	117.2	99	0	0	55	22
401.70	2.00		6	Fine Sand	1.0	22.0	155.3	1.5	3.6	***127.5***	128	0	0	70	24
397.70	4.00		21	Fine Sand	7.0	76.9	158.6	10.2	12.5	***137.2***	137	0	0	75	28
392.70	5.00		20	Fine Sand	8.3	73.2	***134.0***	12.2	11.9	144.0	134	0	0	74	33
386.20	6.50		11	Fine Sand	5.9	40.3	***134.6***	8.7	6.5	151.9	135	0	0	74	40
380.70	5.50	1.70	14		27.9	35.0	***139.9***	41.0	5.7	189.2	140	0	0	77	45
371.20	9.50	0.60	3		21.2	12.4	276.9	31.1	2.0	***239.1***	239	0	0	131	55
365.20	6.00		35	Fine Sand	18.5	128.1	***247.8***	27.2	20.8	258.5	248	0	0	136	61
351.20	14.00		22	Fine Sand	25.6	80.5	***197.0***	37.5	13.1	283.6	197	0	0	108	75
347.20	4.00	0.20	5		3.2	4.1	***200.1***	4.7	0.7	288.3	200	0	0	110	79
344.20	3.00	0.20	5		2.4	4.1	***202.5***	3.5	0.7	291.8	203	0	0	111	82
341.20	3.00	0.20	5		2.4	4.1	***204.9***	3.5	0.7	295.3	205	0	0	113	85
337.20	4.00	0.20	23		3.2	4.1	***208.1***	4.7	0.7	300.0	208	0	0	114	89
334.20	3.00	0.20	23		2.4	4.1	***210.5***	3.5	0.7	303.5	210	0	0	116	92
331.20	3.00	0.20	23		2.4	4.1	***260.2***	3.5	0.7	314.7	260	0	0	143	95
328.20	3.00	2.50	18		19.6	51.5	***279.8***	28.8	8.4	343.5	280	0	0	154	98
325.20	3.00	2.50	18		19.6	51.5	390.7	28.8	8.4	***387.1***	387	0	0	213	101
321.20	4.00		52	Hard Till	13.1	142.8	***403.9***	19.3	23.2	406.3	404	0	0	222	105
318.20	3.00		52	Hard Till	9.8	142.8	***413.7***	14.4	23.2	420.8	414	0	0	228	108
315.20	3.00		52	Hard Till	9.8	142.8	***429.0***	14.4	23.2	436.1	429	0	0	236	111
312.20	3.00		54	Hard Till	10.5	148.3	***439.5***	15.3	24.1	451.5	439	0	0	242	114
309.20	3.00		54	Hard Till	10.5	148.3	***450.0***	15.3	24.1	466.8	450	0	0	247	117
301.20	8.00		54	Hard Till	27.9	148.3	***512.6***	40.9	24.1	513.4	513	0	0	282	125
300.20	1.00			Shale	60.4	183.0	***573.0***	88.7	29.8	602.0	573	0	0	315	125.8
299.20	1.00			Shale	60.4	183.0	***633.5***	88.7	29.8	690.7	633	0	0	348	126.8
298.20	1.00			Shale	60.4	183.0	***693.9***	88.7	29.8	779.3	694	0	0	382	127.8
297.20	1.00			Shale	60.4	183.0	***754.3***	88.7	29.8	868.0	754	0	0	415	128.8
296.20	1.00			Shale	60.4	183.0	***814.7***	88.7	29.8	956.6	815	0	0	448	129.8
295.20	1.00			Shale	60.4	183.0	***875.1***	88.7	29.8	1045.3	875	0	0	481	130.8
294.20	1.00			Shale	60.4	183.0	***935.5***	88.7	29.8	1134.0	~~936~~	~~0~~	~~0~~	~~515~~	~~131.8~~
293.20	1.00			Shale		183.0			29.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== B2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 428.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 410.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 405.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 102
Plugged Pile Perimeter========== 4.800 FT. Unplugged Pile Perimeter========== 7.058 FT.
Plugged Pile End Bearing Area========== 1.439 SQFT. Unplugged Pile End Bearing Area======== 0.208 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
810 KIPS	**810** KIPS	**445** KIPS	**129** Below Boring

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.)
405.50	4.50	0.20	8		3.5		7.6	5.2		***5.8***	6	2	0	1	23
404.50	1.00	0.20	8		0.8	4.0	18.2	1.2	0.6	***8.4***	8	2	0	3	24
402.50	2.00		6	Fine Sand	1.0	13.8	26.8	1.5	2.0	***10.9***	11	2	0	4	26
400.00	2.50		7	Fine Sand	1.4	21.5	28.3	2.1	3.1	***13.1***	13	2	0	5	29
397.50	2.50		6	Fine Sand	1.2	21.5	40.3	1.8	3.1	***16.4***	16	2	0	7	31
395.00	2.50		9	Fine Sand	1.8	32.3	42.1	2.7	4.7	***19.1***	19	2	0	9	34
392.00	3.00		9	Fine Sand	2.2	32.3	42.3	3.3	4.7	***22.1***	22	2	0	10	37
389.50	2.50	1.50	7		11.5	30.2	***29.7***	17.0	4.4	35.6	30	2	0	14	39
387.00	2.50	0.30	10		2.9	6.0	89.0	4.3	0.9	***48.0***	48	2	0	24	42
384.50	2.50	3.10	13		18.8	62.5	***59.4***	27.6	9.0	68.7	59	2	0	31	44
381.00	3.50	0.70	5		8.8	14.1	***66.3***	13.0	2.0	81.4	66	2	0	34	48
376.50	4.50	0.60	6		9.9	12.1	***72.1***	14.6	1.8	95.4	72	2	0	38	52
369.50	7.00	0.40	9		10.7	8.1	150.0	15.7	1.2	***120.8***	121	2	0	64	59
366.00	3.50		21	Fine Sand	6.0	75.3	131.0	8.9	10.9	***126.1***	126	2	0	67	63
359.00	7.00		14	Fine Sand	8.1	50.2	142.6	11.8	7.3	***138.4***	138	2	0	74	70
355.00	4.00		15	Fine Sand	4.9	53.8	147.5	7.3	7.8	***145.7***	146	2	0	78	74
351.00	4.00		15	Fine Sand	4.9	53.8	***152.5***	7.3	7.8	152.9	152	2	0	82	78
346.50	4.50		15	Fine Sand	5.5	53.8	***118.4***	8.2	7.8	155.4	118	2	0	63	82
342.50	4.00	0.70	30		10.1	14.1	***128.5***	14.9	2.0	170.2	128	2	0	69	86
339.50	3.00	0.70	30		7.6	14.1	***136.1***	11.1	2.0	181.4	136	2	0	73	89
336.50	3.00	0.70	30		7.6	14.1	***186.9***	11.1	2.0	198.8	187	2	0	101	92
332.50	4.00		16	Fine Sand	5.3	57.4	***192.1***	7.7	8.3	206.5	192	2	0	104	96
329.50	3.00		16	Fine Sand	3.9	57.4	***196.1***	5.8	8.3	212.3	196	2	0	106	99
326.50	3.00		16	Fine Sand	3.9	57.4	***160.8***	5.8	8.3	212.4	161	2	0	87	102
324.50	2.00	0.90	52		6.3	18.1	288.8	9.2	2.6	***239.3***	239	2	0	130	104
321.50	3.00		52	Hard Till	9.7	139.8	298.5	14.3	20.2	***253.6***	254	2	0	138	107
318.50	3.00		52	Hard Till	9.7	139.8	308.2	14.3	20.2	***267.9***	268	2	0	145	110
315.50	3.00		52	Hard Till	9.7	139.8	318.0	14.3	20.2	***282.2***	282	2	0	153	113
312.50	3.00		52	Hard Till	9.7	139.8	327.7	14.3	20.2	***296.6***	297	2	0	161	116
309.50	3.00		52	Hard Till	9.7	139.8	337.5	14.3	20.2	***310.9***	311	2	0	169	119
306.50	3.00		52	Hard Till	9.7	139.8	386.7	14.3	20.2	***330.9***	331	2	0	180	122
305.50	1.00			Shale	59.8	179.2	446.4	87.9	25.9	***418.9***	419	2	0	228	123
304.50	1.00			Shale	59.8	179.2	***506.2***	87.9	25.9	506.8	506	2	0	276	124
303.50	1.00			Shale	59.8	179.2	***566.0***	87.9	25.9	594.7	566	2	0	309	125
302.50	1.00			Shale	59.8	179.2	***625.8***	87.9	25.9	682.6	626	2	0	342	126
301.50	1.00			Shale	59.8	179.2	***685.6***	87.9	25.9	770.6	686	2	0	375	127
300.50	1.00			Shale	59.8	179.2	***745.4***	87.9	25.9	858.5	745	2	0	408	128
299.50	1.00			Shale		179.2			25.9						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== B3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 428.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 410.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 405.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area======== 0.239 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**345** KIPS	**185** KIPS	**122** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL 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.)
406.50	3.50	0.70	8		8.9		23.3	13.1		***15.5***	15	5	0	4	22
403.50	3.00	0.70	6		7.7	14.4	***22.8***	11.2	2.3	25.4	23	5	0	8	25
401.00	2.50	0.30	2		2.9	6.2	***23.7***	4.3	1.0	29.3	24	5	0	8	28
398.50	2.50	0.20	2		2.0	4.1	***25.6***	2.9	0.7	32.3	26	5	0	9	30
396.00	2.50	0.20	2		2.0	4.1	***27.6***	2.9	0.7	35.2	28	5	0	10	33
395.00	1.00	0.20	4		0.8	4.1	49.9	1.2	0.7	***39.8***	40	5	0	17	34
391.00	4.00		7	Fine Sand	2.3	25.6	***30.8***	3.4	4.2	39.8	31	5	0	12	38
388.50	2.50	0.20	6		2.0	4.1	***32.7***	2.9	0.7	42.7	33	5	0	13	40
386.00	2.50	0.20	10		2.0	4.1	73.9	2.9	0.7	***52.0***	52	5	0	24	43
384.50	1.50	2.10	12		8.7	43.2	***47.6***	12.8	7.0	59.1	48	5	0	21	44
378.50	6.00	0.40	5		9.2	8.2	***65.1***	13.6	1.3	74.0	65	5	0	31	50
373.50	5.00	0.80	3		14.3	16.5	***73.2***	21.0	2.7	94.0	73	5	0	35	55
368.50	5.00	0.50	9		9.5	10.3	130.9	13.9	1.7	***115.7***	116	5	0	59	60
365.50	3.00		16	Fine Sand	4.0	58.6	138.6	5.9	9.5	***122.2***	122	5	0	62	63
358.50	7.00		17	Fine Sand	9.9	62.2	152.1	14.5	10.1	***137.3***	137	5	0	71	70
343.50	15.00		18	Fine Sand	22.4	65.9	***112.8***	32.9	10.7	160.1	113	5	0	57	85
333.50	10.00	0.20	26		8.0	4.1	***120.7***	11.7	0.7	171.8	121	5	0	61	95
323.50	10.00	0.20	28		8.0	4.1	***143.1***	11.7	0.7	185.8	143	5	0	74	105
313.50	10.00	0.90	10		31.6	18.5	400.6	46.4	3.0	***269.0***	269	5	0	143	115
311.50	2.00		89	Hard Till	16.8	244.3	417.3	24.6	39.7	***293.6***	294	5	0	157	117
309.50	2.00		89	Hard Till	16.8	244.3	434.1	24.6	39.7	***318.2***	318	5	0	170	119
307.50	2.00		89	Hard Till	16.8	244.3	450.9	24.6	39.7	***342.8***	343	5	0	184	121
306.50	1.00		89	Hard Till	8.4	244.3	398.0	12.3	39.7	***345.2***	345	5	0	185	122
305.50	1.00			Shale	60.4	183.0	458.4	88.7	29.8	***433.8***	434	5	0	234	123
304.50	1.00			Shale	60.4	183.0	***518.8***	88.7	29.8	522.5	519	5	0	280	124
303.50	1.00			Shale	60.4	183.0	***579.2***	88.7	29.8	611.1	579	5	0	314	125
302.50	1.00			Shale	60.4	183.0	***639.7***	88.7	29.8	699.8	640	5	0	347	126
301.50	1.00			Shale	60.4	183.0	***700.1***	88.7	29.8	788.4	700	5	0	380	127
300.50	1.00			Shale	60.4	183.0	***760.5***	88.7	29.8	877.1	760	5	0	413	128
299.50	1.00			Shale	60.4	183.0	***820.9***	88.7	29.8	965.8	821	5	0	447	129
298.50	1.00			Shale	60.4	183.0	***881.3***	88.7	29.8	1054.4	881	5	0	480	130
297.50	1.00			Shale	60.4	183.0	***941.7***	88.7	29.8	1143.1	~~942~~	~~5~~	~~0~~	~~513~~	~~131~~
296.50	1.00			Shale	60.4	183.0	***1002.2***	88.7	29.8	1231.7	~~1002~~	~~5~~	~~0~~	~~546~~	~~132~~
295.50	1.00			Shale		183.0			29.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 3
REFERENCE BORING ========== B4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 428.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 410.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 405.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area======== 0.149 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
578 KIPS	**578** KIPS	**311** KIPS	**126** 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.)
406.50	3.50	0.80	6		9.7		23.2	14.4		***15.9***	16	5	0	3	22
405.50	1.00	0.70	5		2.5	13.5	25.7	3.7	1.5	***19.5***	20	7	0	4	23
404.50	1.00	0.70	5		2.5	13.5	***22.4***	3.7	1.5	22.6	22	7	0	6	24
402.00	2.50	0.40	4		3.7	7.7	***24.2***	5.5	0.8	27.9	24	7	0	7	27
399.50	2.50	0.30	2		2.8	5.8	***27.0***	4.2	0.6	32.1	27	7	0	8	29
397.00	2.50	0.30	1		2.8	5.8	***27.9***	4.2	0.6	36.2	28	7	0	9	32
394.50	2.50	0.20	1		1.9	3.9	***32.9***	2.9	0.4	39.3	33	7	0	11	34
392.00	2.50		2	Fine Sand	0.4	6.9	88.3	0.6	0.7	***45.9***	46	7	0	19	37
389.50	2.50		18	Fine Sand	3.6	61.8	***33.9***	5.4	6.7	45.0	34	7	0	12	39
387.00	2.50	0.20	6		1.9	3.9	91.9	2.9	0.4	***53.9***	54	7	0	23	42
384.50	2.50	3.10	11		18.4	59.9	***60.0***	27.3	6.5	75.8	60	7	0	26	44
381.00	3.50	0.50	8		6.4	9.7	***66.4***	9.5	1.0	85.3	66	7	0	30	48
374.50	6.50	0.50	3		11.9	9.7	***91.9***	17.7	1.0	104.4	92	7	0	44	54
371.50	3.00	1.20	7		11.6	23.2	***103.4***	17.1	2.5	121.6	103	7	0	50	57
369.00	2.50	1.20	7		9.6	23.2	151.7	14.3	2.5	***140.0***	140	7	0	70	60
366.00	3.00		18	Fine Sand	4.3	61.8	149.2	6.5	6.7	***145.8***	146	7	0	73	63
359.00	7.00		16	Fine Sand	9.0	55.0	165.1	13.4	5.9	***159.9***	160	7	0	81	70
355.00	4.00		18	Fine Sand	5.8	61.8	170.9	8.6	6.7	***168.5***	168	7	0	86	74
351.00	4.00		18	Fine Sand	5.8	61.8	***176.7***	8.6	6.7	177.1	177	7	0	90	78
348.00	3.00		18	Fine Sand	4.3	61.8	211.9	6.5	6.7	***186.9***	187	7	0	96	81
345.00	3.00		27	Fine Sand	6.5	92.8	218.5	9.7	10.0	***196.5***	197	7	0	101	84
342.00	3.00		27	Fine Sand	6.5	92.8	225.0	9.7	10.0	***206.2***	206	7	0	107	87
339.00	3.00		27	Fine Sand	6.5	92.8	224.6	9.7	10.0	***215.2***	215	7	0	112	90
334.00	5.00		25	Fine Sand	10.1	85.9	234.7	14.9	9.3	***230.1***	230	7	0	120	95
329.00	5.00		25	Fine Sand	10.1	85.9	***244.8***	14.9	9.3	245.0	245	7	0	128	100
324.50	4.50		25	Fine Sand	9.1	85.9	***187.3***	13.4	9.3	251.3	187	7	0	96	104
320.50	4.00	1.00	9		13.4	19.3	***200.6***	19.8	2.1	271.1	201	7	0	104	108
317.50	3.00	1.00	9		10.0	19.3	***210.6***	14.9	2.1	286.0	211	7	0	109	111
314.50	3.00	1.00	9		10.0	19.3	397.1	14.9	2.1	***319.9***	320	7	0	169	114
312.00	2.50		76	Hard Till	15.2	195.8	412.3	22.6	21.1	***342.4***	342	7	0	182	117
310.00	2.00		76	Hard Till	12.2	195.8	424.5	18.1	21.1	***360.5***	360	7	0	192	119
308.00	2.00		76	Hard Till	12.2	195.8	436.7	18.1	21.1	***378.5***	379	7	0	201	121
306.00	2.00		76	Hard Till	12.2	195.8	424.8	18.1	21.1	***394.0***	394	7	0	210	123
305.00	1.00			Shale	58.5	171.8	483.3	86.9	18.5	***480.9***	481	7	0	258	123.5
304.00	1.00			Shale	58.5	171.8	***541.9***	86.9	18.5	567.8	542	7	0	291	124.5
303.00	1.00			Shale	58.5	171.8	***600.4***	86.9	18.5	654.7	~~600~~	~~7~~	~~0~~	~~324~~	~~125.5~~
302.00	1.00			Shale	58.5	171.8	***659.0***	86.9	18.5	741.6	~~659~~	~~7~~	~~0~~	~~356~~	~~126.5~~
301.00	1.00			Shale		171.8			18.5						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 4
REFERENCE BORING ========== B5
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 428.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 410.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 405.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1245 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 40.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 249.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 93.38 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area======== 0.239 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**409** KIPS	**216** KIPS	**125** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL 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.)
407.50	2.50	1.00	7		8.6		29.2	12.6		***16.0***	16	5	0	4	21
405.50	2.00	1.00	7		6.9	20.6	32.0	10.1	3.3	***25.4***	25	9	0	5	23
403.50	2.00	0.80	6		5.7	16.5	35.6	8.4	2.7	***33.5***	34	9	0	10	25
401.00	2.50	0.70	6		6.4	14.4	***40.0***	9.4	2.3	42.5	40	9	0	13	28
398.50	2.50	0.60	2		5.6	12.4	***39.4***	8.2	2.0	49.7	39	9	0	13	30
393.50	5.00	0.30	1		5.9	6.2	***57.4***	8.6	1.0	60.3	57	9	0	23	35
391.00	2.50		5	Fine Sand	1.0	18.3	***44.2***	1.5	3.0	59.5	44	9	0	16	38
387.50	3.50	0.20	13		2.8	4.1	***51.1***	4.1	0.7	64.3	51	9	0	20	41
386.00	1.50	0.40	5		2.3	8.2	80.2	3.4	1.3	***72.0***	72	9	0	31	43
383.50	2.50	1.70	12		12.7	35.0	***68.2***	18.6	5.7	86.6	68	9	0	29	45
380.00	3.50	0.50	4		6.6	10.3	***76.9***	9.7	1.7	96.7	77	9	0	34	49
375.00	5.00	0.60	3		11.1	12.4	***98.3***	16.4	2.0	114.7	98	9	0	46	54
367.50	7.50	1.10	18		27.9	22.7	***158.4***	40.9	3.7	160.8	158	9	0	79	61
357.50	10.00		15	Fine Sand	12.5	54.9	***167.2***	18.3	8.9	178.5	167	9	0	83	71
343.50	14.00		14	Fine Sand	16.3	51.2	***198.2***	23.9	8.3	204.8	198	9	0	100	85
333.50	10.00		18	Fine Sand	15.0	65.9	***163.7***	21.9	10.7	218.7	164	9	0	82	95
330.50	3.00	0.80	38		8.6	16.5	***172.3***	12.6	2.7	231.3	172	9	0	86	98
327.50	3.00	0.80	38		8.6	16.5	***176.8***	12.6	2.7	243.3	177	9	0	89	101
324.50	3.00	0.60	9		6.7	12.4	***183.5***	9.8	2.0	253.1	183	9	0	92	104
321.50	3.00	0.60	9		6.7	12.4	***190.1***	9.8	2.0	262.9	190	9	0	96	107
318.50	3.00	0.60	9		6.7	12.4	***196.8***	9.8	2.0	272.7	197	9	0	100	110
315.50	3.00	0.60	9		6.7	12.4	***203.5***	9.8	2.0	282.5	204	9	0	103	113
313.50	2.00	0.60	9		4.5	12.4	385.1	6.5	2.0	***317.8***	318	9	0	166	115
311.00	2.50		69	Hard Till	13.2	189.4	398.3	19.4	30.8	***337.2***	337	9	0	177	118
308.50	2.50		69	Hard Till	13.2	189.4	***281.7***	19.4	30.8	335.5	282	9	0	146	120
306.00	2.50	2.90	81		18.1	59.7	***299.8***	26.6	9.7	362.1	300	9	0	156	123
303.50	2.50	2.90	81		18.1	59.7	441.3	26.6	9.7	***408.7***	409	9	0	216	125
302.50	1.00			Shale	60.4	183.0	501.7	88.7	29.8	***497.3***	497	9	0	265	126
301.50	1.00			Shale	60.4	183.0	***562.1***	88.7	29.8	586.0	562	9	0	301	127
300.50	1.00			Shale	60.4	183.0	***622.5***	88.7	29.8	674.6	623	9	0	334	128
299.50	1.00			Shale	60.4	183.0	***682.9***	88.7	29.8	763.3	683	9	0	367	129
298.50	1.00			Shale	60.4	183.0	***743.3***	88.7	29.8	851.9	743	9	0	400	130
297.50	1.00			Shale	60.4	183.0	***803.8***	88.7	29.8	940.6	804	9	0	434	131
296.50	1.00			Shale	60.4	183.0	***864.2***	88.7	29.8	1029.2	864	9	0	467	132
295.50	1.00			Shale	60.4	183.0	***924.6***	88.7	29.8	1117.9	925	9	0	500	133
294.50	1.00			Shale	60.4	183.0	***985.0***	88.7	29.8	1206.6	~~985~~	~~9~~	~~0~~	~~533~~	~~134~~
293.50	1.00			Shale		183.0			29.8						