STRUCTURE GEOTECHNICAL REPORT

County Highway 9 (CH-9) over
Interstate 74 (I-74)

Existing S.N.s 048-0044 & 048-0045
Proposed S.N. 048-0099

FAS ROUTE 1400
SECTION (48-27HB-3) BR
KNOX COUNTY, ILLINOIS
JOB NO. D-94-013-04
PTB 158/022
KEG NO. 11-1004.00

Authored By:
Matthew D. Masterson, P.E.
mmasterson@kaskaskiaeng.com
Kaskaskia Engineering Group, LLC
208 E. Main Street, Suite 100
Belleville, IL 62220
618-233-5877

Prepared for:
Mr. Chris Linneman, P.E.,S.E.
EFK Moen, LLC
13523 Barrett Parkway Drive, Suite 250
St. Louis, MO 63021

April 26, 2013

Revised October 2013

LICENSED PROFESSIONAL ENGINEER
MATTHEW DENNIS MASTERSON
062-060305
STATE OF ILLINOIS

10/3/2013
Exp. 11/30/2015

Kaskaskia
Engineering Group, LLC

FOR INFORMATION ONLY

EXECUTIVE SUMMARY

Bridge Replacement: County Highway 9 over Interstate 74
F.A.S. Route 1400
Section (48-27HB-3) BR
Knox County, Illinois
Job No. D-94-013-04
PTB 158/022
Existing Structure Nos. 048-0044 & 048-0045
Proposed Structure No. 048-0099

Original structures (SNs 048-0044 & 048-0045) will be replaced by a three-span structure (SN 048-0099) located at County Highway 9 (CH-9) over Interstate 74 (I-74) in Knox County, Illinois. This report summarizes the analysis of the proposed structure replacement.

A combination of H-piles and shallow foundations are considered as suitable options for foundation support at this location. Kaskaskia Engineering Group, LLC (KEG) recommends the use of H-piles at the abutment locations and shallow foundations bearing on the very stiff/hard silt/shale for Piers 1 and 2.

FOR INFORMATION ONLY

TABLE OF CONTENTS

FOR INFORMATION ONLY

TABLES

EXHIBITS

FOR INFORMATION ONLY

1.0 Project Description and Proposed Structure Information

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed bridge at CH-9 over I-74 in Knox County, Illinois. The purpose of this report is to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of complete replacement of the existing bridges (SNs 048-0044 & 048-0045) located at CH-9 over I-74. The project is located just north of Knoxville, Illinois. The general location of the bridge is shown on a USGS Topographic Location Map, Exhibit A. The site lies within the limits of the Fourth Principal Meridian, (T. 11N R. 2E Section 20) within the Galesburg Plain of the Till Plains Section of the Central Lowland Province.

1.3 Proposed Bridge Information

The proposed structure located at CH-9 over I-74 will consist of a single, three-span bridge built on integral abutments with a 28 degree 30 minute skew from the centerline. See Type, Size, and Location Plan (TS&L), Exhibit B. The proposed structure will measure 419 ft.-4½ in. back-to-back abutments, with an out-to-out deck width of 65 ft.-2 in. The centerline of the structure will lie at Station 494+63.32 of I-74 and Station 20+00.00 of CH-9.

Further substructure details will be based on the findings of this SGR. The project will utilize staged construction to maintain one lane of traffic during construction.

2.0 Existing Bridge Information

The original structures (SN 048-0044 & 048-0045) were constructed in 1962 as two separate three-span, rolled steel beam bridges. Both structures are supported on pile bent abutments and multiple column piers supported on spread footings. SN 048-0044 measures 166 ft.-8 in. back-to-back abutments, with an out-to-out width of 35 ft.-8 in. SN 048-0045 measures 158 ft.-7 in. back-to-back abutments, with a 35 ft.-8 in. out-to-out width.

3.0 Site Investigation, Subsurface Exploration, and Generalized Subsurface Conditions

The site investigation plan was developed by KEG and approved by IDOT District 4 Geotechnical personnel and EFK Moen, LLC. A representative of KEG conducted a site visit, laid out the borings, observed the drilling operations, and logged the subsurface conditions.

Four standard penetration test (SPT) borings, designated B-2, B-3, B-5, and B-6 were drilled near the proposed north and south abutments and Piers 1 and 3 on January 9-10, 2012. Additional borings were attempted at Pier 2 and at the north abutment, but were not completed due to impenetrable concrete and steel reinforcement in the approach pavements and the bridge deck. The borings were not relocated per the request of IDOT District 4 Geotechnical personnel. The boring locations are shown on the TS&L, Exhibit B, as provided by EFK Moen. Detailed information regarding the nature and thickness of the soils and rock encountered and the results of the field sampling and laboratory testing are shown on the Boring Logs, Exhibit C. The soil profile for the above mentioned borings can be found in Subsurface Profile, Exhibit D.

FOR INFORMATION ONLY

Table 3.0 – Boring Stations and Offsets

Designation	Stationing	Offset from Proposed Centerline	Surface Elevation (ft.)
B-2	19+39.50	61.0 ft. LT	746.10
B-3	20+04.59	34.7 ft. LT	747.30
B-5	21+79.51	32.6 ft. LT	748.20
B-6	22+58.93	60.4 ft. RT	754.30

An additional eight borings for the original two structures were drilled in 1957 and provided by IDOT District 4 to aid in developing the boring location plan and SGR. These borings identify the shale bedrock material found in the current borings as dense silt and were limited in information to develop the SGR. These borings are also included in Boring Logs, Exhibit C.

3.1 Subsurface Conditions

The subsurface conditions at all four borings exhibited similar lithologic profiles. Generally, the first 10 to 12 ft. below the ground surface (bgs), approximate El. 754 to El. 742, consisted of a moist silty clay with unconfined compressive strengths (Q_u) values ranging from 0.8 to 2.1 tons per square foot (tsf) with average Standard Penetration Test (SPT) N-values of 4 to 7. The moisture content varied from 20 to 23 percent. This material was followed by a very stiff to hard silt which exhibited Q_u values greater than 3.0 tsf, with an average moisture content of 14 percent. Shale bedrock was encountered in all borings at approximate El. 735 to 736. The shale bedrock ranged from 11.5 to 19 ft. bgs.

3.2 Shale

Shale was encountered in each of the borings at refusal depths. Table 3.2 shows the elevations at which shale was first encountered for each of the four borings.

Table 3.2 – Shale Elevations

Boring	Elevation (ft.)
B-2	732.1
B-3	735.8
B-5	736.2
B-6	735.3

FOR INFORMATION ONLY

3.3 Groundwater

Groundwater was encountered in two of the four borings. Table 3.3 shows the elevation that groundwater was encountered during drilling. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible.

Table 3.3 – Groundwater Elevations

Boring	Station/Offset (ft.)	Elevation (ft.)
B-2	19+39.50/61 LT	737.4
B-5	21+79.51/32.5 LT	737.2 (740.7 @ completion)

4.0 Geotechnical Evaluations

4.1 Settlement

The proposed structure will require widening of the exsting embankments to accommodate the new substructure units. Based on the borings that were obtained throughout the project area, no soft layers were encountered that would be susceptible to consolidation settlement. It is estimated that the existing and widened embankments will experience settlements of less than 0.5 in., and occur simultaneously with construction. It was assumed that the existing soils have been consolidated to the existing overburden pressures; therefore, no settlement calculations were performed for this structure and downdrag was not considered as a reduction in capacity for the pile design analysis.

4.2 Slope Stability

The construction of the new structure results in new endslopes at the abutment locations.

The proposed endslopes are at a 1 vertical to 2 horizontal (1V:2H) slope, to the toe. The endslopes will include a 4-in.-thick concrete slope wall. Slope stability of the endslopes was analyzed using SLOPE-W; the soil properties at the site, including those in Borings B-2 and B-6; and the endslope geometrics. Three conditions were modeled: end-of-construction, long-term, and a design seismic event. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability and 1.0 for the design seismic event.

In order to model the end-of-construction condition, undrained soil parameters were used with a friction angle of 0 degrees assumed for cohesive soils. Drained soil parameters with assumed friction angles ranging from 26 to 28 degrees were used to model the long-term and seismic conditions to analyze the condition where excess pore water pressure from construction has dissipated. For cohesive materials, a nominal cohesion value between 50 and 100 psf was included in the drained strength parameters.

FOR INFORMATION ONLY

The Modified Bishop Method, which generates circular-arc failure surfaces, was used to calculate the critical failure surfaces and FOS for the analyzed conditions. The FOS obtained in the analysis is shown in Table 4.2. SLOPE-W program output from this analysis can be found in SLOPE/W Stability Analysis, Exhibit E.

Table 4.2 – Slope Stability Critical FOS

Location	End-of-Construction	Long-Term	Seismic
West Abutment	6.7	1.9	1.7
East Abutment	4.7	1.9	1.7

The results of the analysis, as provided in Table 4.2, indicates an acceptable FOS will exist under undrained and drained conditions at both abutment locations.

4.3 Seismic Considerations

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

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. The USGS published information and mapping (http://earthquake.usgs.gov/), including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to determine the parameters for the project site location. The values, based on a 1000-Year Return Period with a Probability of Exceedance (PE) of 7 percent in 75 years and the Soil Site Class C, are summarized below.

Table 4.3 – Summary of Seismic Parameters

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.114g (Site Class C)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.072g (Site Class C)
Seismic Performance Zone	1

As indicated in the table above, the Seismic Performance Zone (SPZ) is 1, based on S_{D1} and Table 3.15.2-1 in the IDOT Bridge Manual, the Soil Site Class C, and Figure 2.3.10-3 in the IDOT Bridge Manual. According to IDOT, seismic parameters and analyses are not necessary for structures in SPZ 1.

FOR INFORMATION ONLY

4.4 Mining Activity

According to the Illinois State Geological Survey (ISGS) website, Knox County, Illinois, mine map, dated July 20, 2011, obtained from the ISGS website (http//www.isgs.illinois.edu/maps-data-pub/coal-maps.html), coal mining has not occurred at the project location. The closest underground coal mines are shown to be located at least 1 mile east and south of the project site.

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

No visual indication of surface or subsurface mining activities was evident at the project location. KEG's site observations did not detect any apparent depressions which could indicate a mine subsidence or shafts beneath the project location. Refer to Illinois State Geological Survey Mine Map for Knox County, Exhibit G, for additional information.

4.5 Liquefaction

A liquefaction analysis is not required to be performed for structures located in SPZ 1. Therefore, liquefaction was not considered as a reduction for the pile design capacity or other foundation considerations included herein.

4.6 Approach Slab

In accordance with the IDOT Bridge Manual, KEG has evaluated the foundation soils at the approach slabs for bearing capacity and excessive settlement. With proper compaction of the abutment wall backfill, the bearing capacity and settlement requirements of the IDOT Bridge Manual will be satisfied.

5.0 Foundation Evaluations and Design Recommendations

5.1 General Feasibility

According to the Bridge Manual, Section 3.8.3 on Open Abutments: Integral, the foundation shall consist of a single row of vertical H-piles or metal shell piles. Since the proposed bridge is approximately 400 ft. long, H-piles were considered. KEG has reviewed the applicability of integral abutments for this structure with respect to All Bridge Designers (ABD) Memo 12.3, dated July 25, 2012 by IDOT. As previously mentioned, due to impeneratable concrete and steel reinforcement, a boring was not performed in order to evaluate the strength charactersistics of the existing embankment materials. In KEG's experience, a properly constructed embankment should be composed of a cohesive soil with unconfined compressive strengths between 1.25 and 2.5 tsf. Based on this assumption, the average strength values ($Q_{u\ avg}$) within the critical depth at the abutment locations should range from > 1.5 tsf and ≤ 3.0 tsf. Please see ABD Memo 12.3 for additional information.

The Modified IDOT Static Method of Estimating Pile Length provided by IDOT BBS Foundations and Geotechnical Unit was used to determine the design length of the piles. Based on the boring logs, the depth to bedrock, and the results of the pile design analysis, H-piles are the

FOR INFORMATION ONLY

most feasible option for the abutments. Concrete spread footing will be used to support Piers 1 and 2.

There are no lateral or vertical capacity concerns resulting from potential liquefaction, low soil strengths, or inadequate pile embedment at this location to support the use of drilled shafts.

5.2 Pile Supported Foundations

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loadings. Based on the encountered subsurface conditions, the Modified IDOT Static Method of Estimating Pile Length provided by IDOT BBS Foundations and Geotechnical Unit, and the information available to date, KEG recommends using H-piles at the abutment locations. The Modified IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (IDOT Method Pile Length/Pile Type Analysis, Exhibit H).

The Strength 1 factored loads were 2,549 kips at the abutments. The loads were provided by EFK Moen. The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving, as well as assist the contractor in selecting a proper hammer size. The Factored Resistance Available (R_F) documents the net long term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

The estimated pile lengths for the pile types considered are shown in Tables 5.2.1 – 5.2.5 below. The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving, and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings. According to ABD Memo 12.3, if Integral Abutments are utilized for the proposed structure, H-pile sizes are limited to 12X74 or larger. Estimated pile lengths and capacities for HP 10X42 and HP 12X53 are only feasible for Non-Integral Abutments.

Table 5.2.1 – Estimated Pile Lengths for HP 10X42 Steel H-Piles

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	732.20	173	95	31	763.20
	731.20	233	128	32	763.20
	730.20	277	152	33	763.20
	729.20	335	184	34	763.20
East Abutment	734.40	198	109	26	760.40
	733.40	253	139	27	760.40
	732.40	294	162	28	760.40
	731.40	335	184	29	760.40

*10X42 H-piles are only feasible for Non-Integral Abutments

FOR INFORMATION ONLY

Table 5.2.2 – Estimated Pile Lengths for HP 12X53 Steel H-Piles

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	732.20	173	95	31	763.20
	731.20	233	128	32	763.20
	730.20	277	152	33	763.20
	729.20	418	229	34	763.20
East Abutment	734.40	237	131	26	760.40
	733.40	310	170	27	760.40
	732.40	374	206	28	760.40
	731.40	418	229	29	760.40

*12X53 H-piles are only feasible for Non-Integral Abutments

Table 5.2.3 – Estimated Pile Lengths for HP 12X74 Steel H-Piles

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	728.20	465	256	35	763.20
	727.20	515	283	36	763.20
	726.20	566	311	37	763.20
	725.20	589	324	38	763.20
East Abutment	731.40	430	237	29	760.40
	730.40	491	270	30	760.40
	729.40	541	298	31	760.40
	728.40	589	324	32	760.40

FOR INFORMATION ONLY

Table 5.2.4 – Estimated Pile Lengths for HP 14X73 Steel H-Piles

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	730.20	425	234	33	763.20
	729.20	504	277	34	763.20
	728.20	563	310	35	763.20
	727.20	578	318	36	763.20
East Abutment	733.40	375	206	27	760.40
	732.40	462	254	28	760.40
	731.40	529	291	29	760.40
	730.40	578	318	30	760.40

Table 5.2.5 – Estimated Pile Lengths for HP 14X117 Steel H-Piles

	Estimated Pile Tip Elevation (ft.)	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	727.20	647	356	36	763.20
	726.20	707	389	37	763.20
	725.20	768	422	38	763.20
	724.20	929	511	39*	763.20
East Abutment	729.40	678	373	31	760.40
	728.40	739	406	32	760.40
	727.40	799	440	33	760.40
	726.40	929	511	34**	760.40

*Estimated Length extends below bottom of boring **Limit of subsurface boring information

As shown in IDOT Method Pile Length/Pile Type Analysis, Exhibit H, downdrag, scour, and liquefaction have not been considered at the abutment locations.

Due to the inability to perform a soil boring at both abutment locations, KEG recommends one test pile be performed at both abutment locations. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to determine pile driving requirements

FOR INFORMATION ONLY

for the project. This also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

5.3 Shallow Foundations

The foundations supporting the proposed bridge Piers 1 and 2 must provide sufficient support to resist dead and live loads, including seismic loading. Based on the encountered subsurface conditions and the information available to date, we recommend using shallow foundations bearing in the stiff/hard silt/shale for Piers 1 and 2. The Strength 1 factored load for Piers 1 and 2 were 6,286 kips and 6,195 kips, respectively, as provided by EFK Moen.

The boring logs indicate a competent silt and/or shale material with an average Q_u of 4 tsf at the proposed bearing elevation of 736.9 at Pier 1 and 741.3 at Pier 2. Based on AASHTO LRFD Bridge Design Specifications Section 10.4.6.4, and Tables 10.4.6.4-1 and C10.6.2.6.1-1, we recommend a nominal bearing resistance of 10 ksf (5 tsf) for footings bearing in these competent silts/shales. The nominal sliding resistances will depend on the type of material present at the bearing elevation of the spread footing. The nominal sliding resistance of the silt material is estimated to be 6.0 ksf, while the nominal sliding resistance for the shale is estimated to be 2.5 ksf. The resistance factors for geotechnical resistance of shallow foundations to be used are 0.45 for bearing resistance and 0.85 for sliding resistance (2010 LRFD).

5.4 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program or other approved software can be used for the lateral or displacement analysis of the foundations. Due to the inability to perform a boring and sample the embankment material to obtain soil strength characteristics at the west abutment location, KEG assumed the embankment to be composed of a 1.5 tsf material. Table 5.1 is included for the structural engineer's use in determining lateral pile response.

Table 5.4 – Soil Parameters for Lateral Pile Load Analysis

Boring	Elev. at Bottom of Layer	γ (pcf)	Short Term		Long Term		N	Assumed % fines < #200	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)				
B-2 (W Abt)	745.6	120	0	1500	26	100	12	80	500	0.007
	732.1	115	0	3300	28	100	64	60	1000	0.005
	707.4	125	12	11000	12	11000	100+	10	2000	0.004
B-6 (E Abt)	742.3	120	0	1400	26	50	6	60	500	0.007
	735.3	115	0	3000	28	100	43	60	1000	0.005
	710.6	125	12	11000	12	11000	100+	10	0.004	

*Q_u value for the shale was estimated at 11 tsf with an average moisture content of 10%, due to lack of laboratory unconfined compressive strength testing, and c = Q_u/2 as per the IDOT Geotechnical Manual.

FOR INFORMATION ONLY

6.0 Construction Considerations

6.1 Construction Activities

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

6.2 Temporary Sheeting and Soil Retention

Due to the impenetrable concrete and steel reinforcement, a soil boring was not obtained to determine the strength characteristics of the existing soils present in the center embankment. KEG estimated that the soils in the existing embankment have a minimum N-value of 8 to the hard silt material indicated at approximate El. 745.5. Based on average N-values and an estimated maximum embedment depth of 19 ft., the IDOT temporary sheet piling design charts should be feasible for retained heights of 11 ft.

If the soil to be retained is greater than 11 ft., the design guide and charts will not apply; and a Temporary Soil Retention System will be required. An Illinois-licensed structural engineer is required to seal the design of the temporary soil retention system, if deemed necessary.

6.3 Site and Soil Conditions

Should any bridge or embankment design considerations assumed by either IDOT or KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

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

6.4 Foundation Construction

Conventional pile driving equipment and methodologies should be assumed. Protective tips should be provided for the piles.

According to the existing survey information and TS&L, no existing utilities are present in the bridge area. A JULIE locate shall be conducted to determine if any underground utilities are present in the area of the proposed structure prior to construction. Any utilities that may interfere with construction shall be moved by the owner. If utilities become a problem during construction, the appropriate owner shall be contacted immediately.

7.0 Computations

Computations and analyses for special circumstances, if any, are included as exhibits. Please refer to each section of the report for reference to the exhibit containing any such calculations or analysis used.

8.0 Geotechnical Data

Soil boring logs can be found in Exhibit C. The Subsurface Profile can be found in Exhibit D.

FOR INFORMATION ONLY

9.0 Limitations

The recommendations provided herein are for the exclusive use of EFK Moen and IDOT. They are specific only to the project described and are based on the subsurface information obtained at four boring locations by KEG within the proposed bridge area in January 2012, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

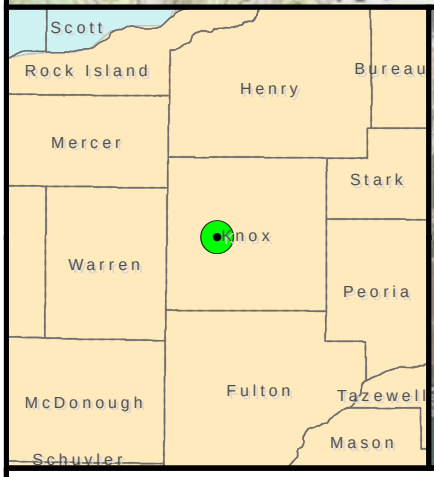
FOR INFORMATION ONLY

FOR INFORMATION ONLY

EXHIBIT A

USGS TOPOGRAPHIC LOCATION MAP

FOR INFORMATION ONLY



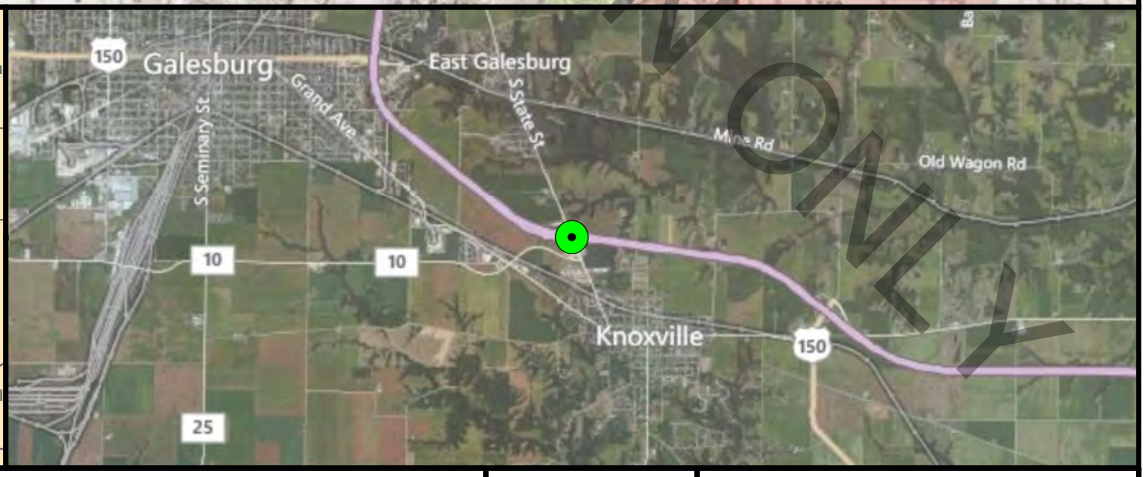


Exhibit A
Location Map
County Highway 9 over Interstate 74
Knox County, Illinois

N

0 0.2 0.4
Miles

Designed By: ASC
Drawn By: ASC
Checked By: CRG
Date: 3/12/13
Project #: 11-1004

Kaskaskia Engineering Group, LLC

FOR INFORMATION ONLY

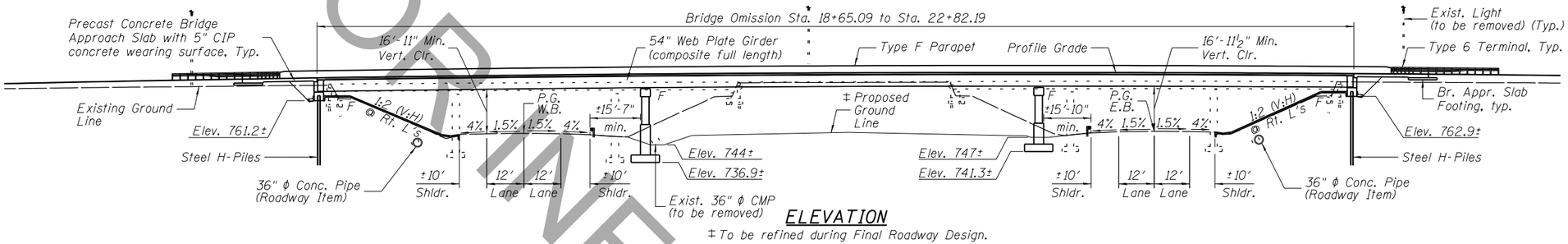
EXHIBIT B

TYPE, SIZE, AND LOCATION PLAN (TS&L)

Bench Mark: Control Point 1002 - $^{5}/_{8}$" Iron Rod in southwest quadrant of existing intersection between C.H. 9 and the eastbound off ramp. Located 64.76' right of Station 26+70.01. Elevation = 767.58.

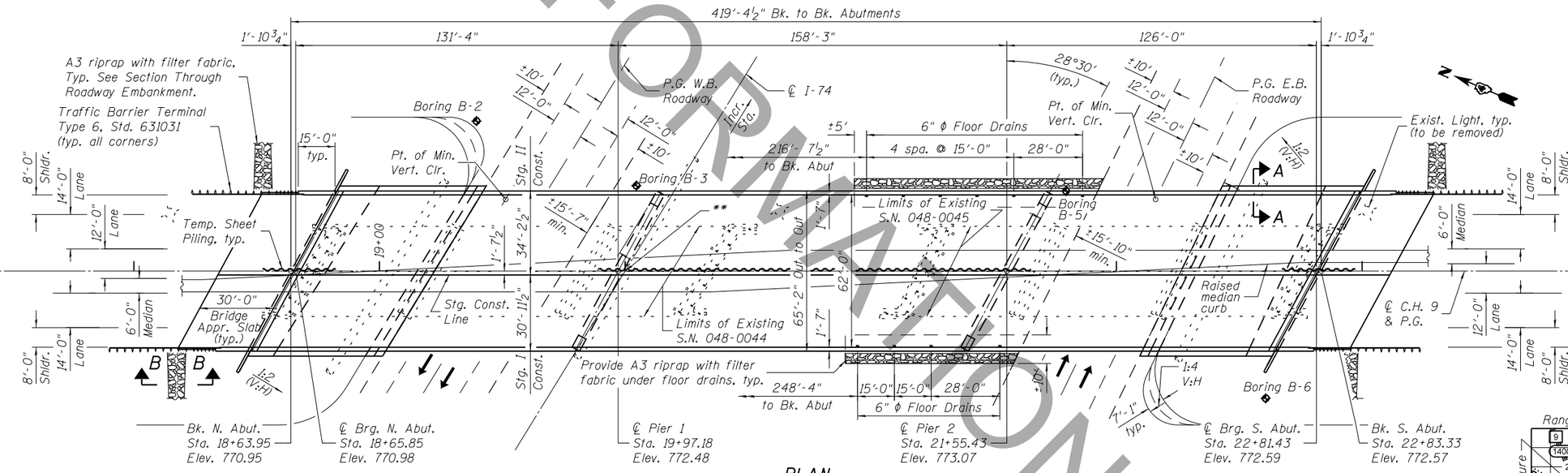
Existing Structures: S.N. 048-0044 (W.B.) and S.N. 048-0045 (E.B.) built in 1962 as S.A. Route 9 over F.A.I. Route 74, Sec. 48-27 HB-3 and HF-5 at Sta. 494+63.13. Existing structures consist of two separate three span rolled steel beam bridges, (49'-64'-49') for S.N. 048-0044 and (47'-61'-47') for S.N. 048-0045. The back to back of abutment length of S.N. 048-0044 is 166'-8" and the out to out bridge width is 35'-8". The back to back of abutment length of S.N. 048-0045 is 158'-7" and the out to out bridge width is 35'-8". both structures are supposed on pile bent abutments and multiple colun piers supported on spread footings. Both structures are to be replaced using stage construction. One lane of traffic is to be maintained during construction.

Salvage: None.



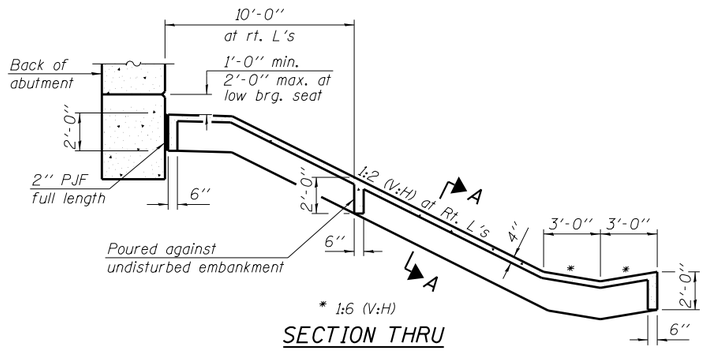
ELEVATION

‡ To be refined during Final Roadway Design.



PLAN

** ℄ C.H. 9 Sta. 20+00.00 = ℄ I-74 Sta. 494+63.32



SECTION THRU CONCRETE SLOPEWALL

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.072
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.114
Soil Site Class = C

DESIGN SPECIFICATIONS

AASHTO LRFD Bridge Design Specifications
Customary U.S. Units, 2012

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

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

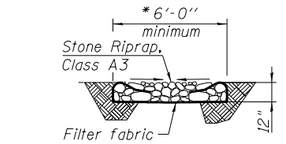
PRECAST PRESTRESSED UNITS (APPROACH SLABS)

f'c = 6,000 psi
f'ci = 4,500 psi
f_{pu} = 270,000 psi ($^{1}/_{2}$"ϕ Low Relax. Strands)
f_{pbt} = 201,960 psi ($^{1}/_{2}$"ϕ Low Relax. Strands)

HIGHWAY CLASSIFICATION

F.A.I. Rte. 74 - I-74
Functional Class: Interstate
ADT: 15700 (2012); 19157 (2035)
ADTT: 4025 (2012); 4911 (2035)
DHV: 711
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
Two-Way Traffic
Directional Distribution: 50/50

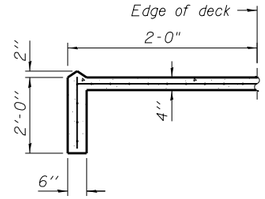
F.A.S. Rte. 1400 - County Highway 9
Functional Class: Major Collector (Non-Urban)
ADT: 4650 (2012); 5674 (2035)
ADTT: 632 (2012); 711 (2035)
DHV: 251
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 60 (NB)/40 (SB)



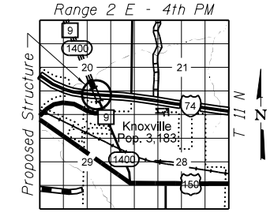
SECTION B-B
THRU RDWY. EMBANKMENT

* Provides drainage down embankment from bridge appr. slab.

Riprap under floor drain drip line similar.



SECTION A-A



LOCATION SKETCH

GENERAL PLAN & ELEVATION
CH-9 OVER I-74
F.A.S. 1400 - SECTION (48-27HB-3) BR
KNOX COUNTY
STA. 20+00.00
STRUCTURE NO. 048-0099

FOR INFORMATION ONLY

EFK•Moen, LLC
Civil Engineering Design
303 Fountain Parkway, Suite 240
Fairview Heights, IL 62208
Phone 618-206-4250

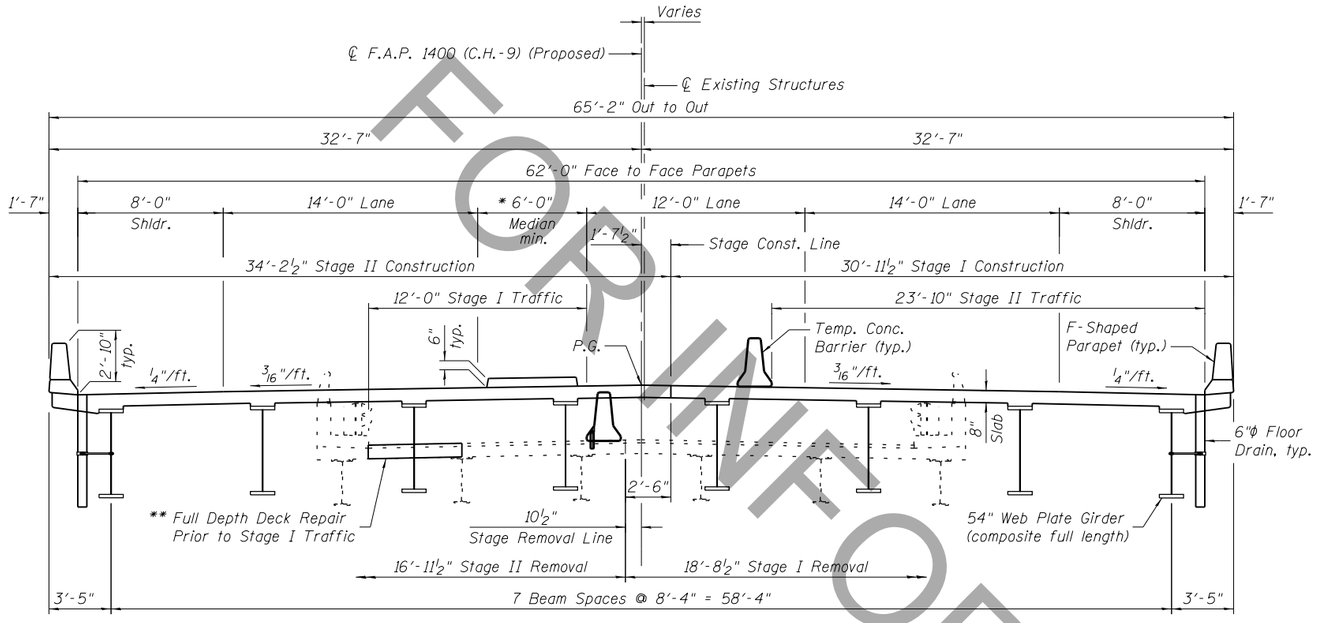
USER NAME = ctw	DESIGNED - CDL	REVISED -
	CHECKED - CTW	REVISED -
PLOT SCALE = 0.1667 ' / in.	DRAWN - JAA	REVISED -
PLOT DATE = 4/25/2013	CHECKED - CTW	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1400	(48-27HB-3) BR	KNOX		
		CONTRACT NO. ____		
	ILLINOIS FED. AID PROJECT			

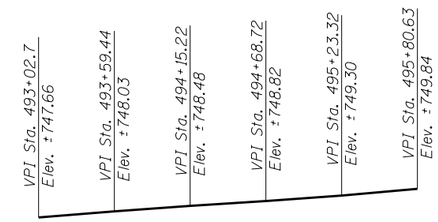
PRINT DATE: 4/25/2013 2:23:00 PM Y:\1018 IDOT I-74 CH-9\DGN\Bridge\prelim\Plotsheets\TSL.dgn



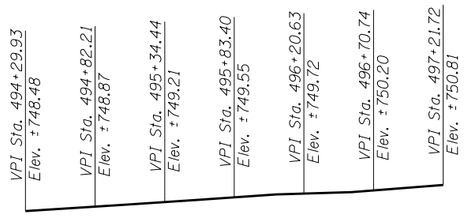
CROSS SECTION
(Looking South)

* Varies 6'-0" to ±16'-4"

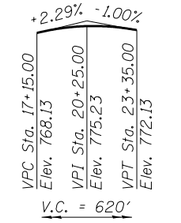
** The condition of the existing deck for the duration of Stage I Traffic should be verified during final design, based on the current Damage Inspection Report. Full Depth Deck Repair is required prior to Stage I Traffic at the direction of the Engineer.



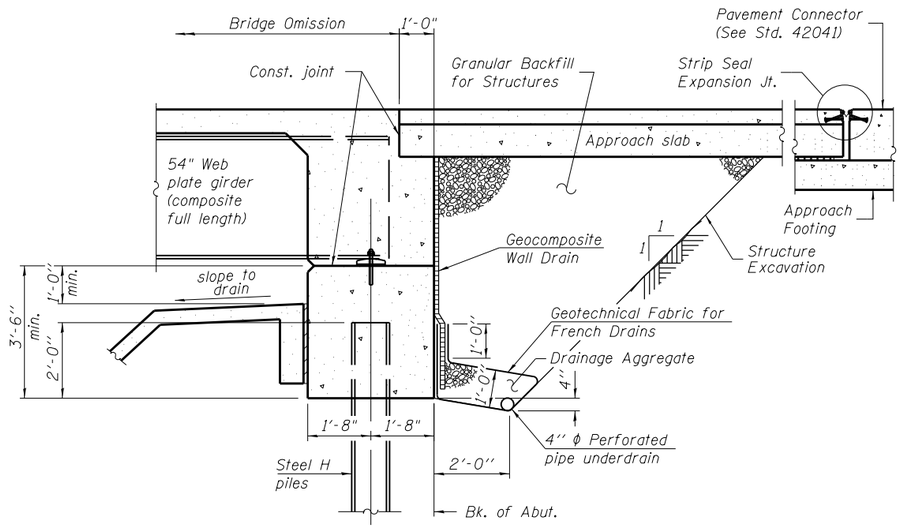
PROFILE GRADE
(along PG W.B. I-74)



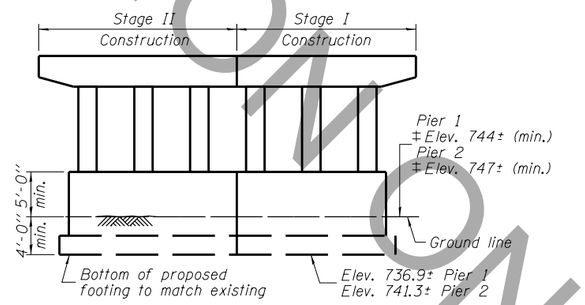
PROFILE GRADE
(along PG E.B. I-74)



PROFILE GRADE
(℄ CH-9)



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



PIER SKETCH
‡ To be refined during Final Roadway Design.

DETAILS
CH-9 OVER I-74
F.A.S. 1400 - SECTION (48-27HB-3) BR
KNOX COUNTY
STA. 20+00.00
STRUCTURE NO. 048-0099

FOR INFORMATION ONLY

EFK•Moen, LLC
Civil Engineering Design
303 Fountain Parkway, Suite 240
Fairview Heights, IL 62208
Phone 618-206-4250

USER NAME = $USER$	DESIGNED - CDL	REVISED -
	CHECKED - CTW	REVISED -
PLOT SCALE = $SCALE$	DRAWN - JAA	REVISED -
PLOT DATE = $DATE$	CHECKED - CTW	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1400	(48-27HB-3) BR	KNOX		
		CONTRACT NO. ____		
	ILLINOIS FED. AID PROJECT			

PRINT DATE= $DATE$ $TIME$ $FILE$

FOR INFORMATION ONLY

EXHIBIT C

BORING LOGS

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Date 1/9/12

ROUTE F.A.S. 1400 (I-74)/CH 9 **DESCRIPTION** Bridge Structure Boring **LOGGED BY** KEG

SECTION (48-27HB-3)BY, BY-1 **LOCATION** CH 9 over I-74

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

STRUCT. NO. TBD
Station 20+00.00

BORING NO. B-2
Station 19+39.50
Offset 61.0 ft LT
Ground Surface Elev. 746.10 ft

Surface Water Elev. -- ft
Stream Bed Elev. -- ft

Groundwater Elev.:
First Encounter 727.4 ft ▼
Upon Completion -- ft
After ____ **Hrs.** -- ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				745.6 TOPSOIL & GRASS
	2 5 11	3.5 P	15	SILT: Light brown, trace sand and organics, stiff
	5 17 25	3.7 P	16	hard
-5				
	10 35 50/5"	2.6 P	18	iron staining, and rock fragments
	7 33 50/5"	4.0 P	12	becomes light brown and reddish brown
-10				
	8 38 50/5"	2.7 P	12	becomes gray and brown
	12 50/5"		9	732.1 SHALE: Gray, highly weathered with sand
-15				
	25 50/1"		9	
▼	32 50/0.5"		9	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SHALE: Gray, highly weathered with sand *(continued)*
	50/3"		9	
	50/3"		9	
-25				
	50/4"		7	
	50/4"		8	
-30				
	50/2"		9	
-35				
	50/3"		8	707.4 Boring terminated at 38.8 ft.
-40				

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

BBS, form 137 (Rev. 8-99)

FOR INFORMATION ONLY

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Date 1/9/12

ROUTE F.A.S. 1400 (I-74)/CH 9 **DESCRIPTION** Bridge Structure Boring **LOGGED BY** KEG

SECTION (48-27HB-3)BY, BY-1 **LOCATION** CH 9 over I-74

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

STRUCT. NO. TBD
Station 20+00.00

BORING NO. B-3
Station 20+04.59
Offset 34.7 ft LT
Ground Surface Elev. 747.30 ft

Surface Water Elev. -- ft
Stream Bed Elev. -- ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				746.8 TOPSOIL
	1 4 3	2.1 B	20	SILTY CLAY: Brown, trace sand and pebbles, medium
				743.8
	2 6 8	2.5 P	15	SILT: Tan, trace sand, stiff
-5				
	9 21 34	3.2 P	14	becomes tan and reddish brown, trace iron stains, hard
	9 26 50/5"	>4.5 P	12	becomes light brown
-10				
	10 50/4"		10	735.8 SHALE: Gray, highly weathered, trace sand and silt, hard
	14 50/4"		11	trace sand
-15				
	21 50/4"		11	
	20 50/4"		9	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SHALE: Gray, highly weathered, trace sand and silt, hard *(continued)*
	50/6"		9	
	50/5"		9	
-25				
	50/4"		9	
	50/5"		8	
-30				
	50/3"		9	
-35				
	50/4"		7	708.5 Boring terminated at 38.8 ft.
-40				

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

BBS, form 137 (Rev. 8-99)

FOR INFORMATION ONLY

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Date 1/10/12

ROUTE F.A.S. 1400 (I-74)/CH 9 **DESCRIPTION** Bridge Structure Boring **LOGGED BY** KEG

SECTION (48-27HB-3)BY, BY-1 **LOCATION** CH 9 over I-74

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

STRUCT. NO. TBD
Station 20+00.00

BORING NO. B-5
Station 21+79.51
Offset 32.6 ft LT
Ground Surface Elev. 748.20 ft

Surface Water Elev. -- ft
Stream Bed Elev. -- ft

Groundwater Elev.:
First Encounter 737.2 ft ▼
Upon Completion 740.7 ft ▽
After ____ **Hrs.** -- ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
747.7				TOPSOIL
	2 4 5	1.3 B	19	SILT: Reddish brown, trace sand and clay, stiff
	2 10 17	>4.5 P	17	becomes brown, trace sand, hard
-5				
	9 32 44	3.2 P	11	becomes tan
▽				
	10 41 50/3"	3.1 P	13	becomes gray and brown, trace iron stains
-10				
▼				
	13 41 50/4"		12	
736.2				SHALE: Gray, highly weathered, trace sand, hard
	14 50/3"			No Recovery: Shoe lost in hole
-15				
	50/4"		9	
	50/4"			No Recovery: Spoon lost in hole
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SHALE: Gray, highly weathered, trace sand, hard *(continued)*
	50/4"		17	
	50/5"		16	
-25				
	50/5"		14	
	50/4"		18	
-30				
	50/3"		19	No sand
-35				
709.5				
	50/2"		11	Boring terminated at 38.7 ft.
-40				

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

BBS, form 137 (Rev. 8-99)

FOR INFORMATION ONLY

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Date 1/10/12

ROUTE F.A.S. 1400 (I-74)/CH 9 **DESCRIPTION** Bridge Structure Boring **LOGGED BY** KEG

SECTION (48-27HB-3)BY, BY-1 **LOCATION** CH 9 over I-74

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

STRUCT. NO. TBD
Station 20+00.00

BORING NO. B-6
Station 22+58.93
Offset 60.4 ft RT
Ground Surface Elev. 754.30 ft

Surface Water Elev. -- ft
Stream Bed Elev. -- ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
753.8				TOPSOIL & GRASS
	2 2 3	1.2 B	21	SILTY CLAY: Reddish Brown, moist, medium
	2 3 4	1.6 B	23	trace sand and pebbles
-5				
	2 2 5	1.5 B	21	trace sand
	2 1 3	0.8 B	23	becomes brown, trace pebbles, soft
-10				
742.3	1 3 6	1.9 S	17	SILT: Tan, trace sand, stiff
	2 8 20	3.1 P	14	becomes tan and brown, trace iron stains
-15				
	25 50/5"		11	becomes brown and gray, hard
735.3	10 50/5.5"		11	SHALE: Gray, weathered, trace sand
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SHALE: Gray, weathered, trace sand *(continued)*
	50/5"		10	
	50/5"		10	no sand
-25				
	50/4"		11	trace sand
	50/3"		9	
-30				
	50/2"		10	
-35				
	50/3"		8	
-40				

FOR INFORMATION ONLY

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

Kaskaskia Engineering Group, LLC

SOIL BORING LOG

Date 1/10/12

ROUTE F.A.S. 1400 (I-74)/CH 9 **DESCRIPTION** Bridge Structure Boring **LOGGED BY** KEG

SECTION (48-27HB-3)BY, BY-1 **LOCATION** CH 9 over I-74

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

STRUCT. NO. TBD
Station 20+00.00

BORING NO. B-6
Station 22+58.93
Offset 60.4 ft RT
Ground Surface Elev. 754.30 ft

Surface Water Elev. -- ft
Stream Bed Elev. -- ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SHALE: Gray, weathered, trace sand *(continued)*				
	710.6	50/2"		8
Boring terminated at 43.7 ft.	-45			
	-50			
	-55			
	-60			

FOR INFORMATION ONLY

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

WALTER H. FLOOD AND COMPANY

STRUCTURE BORINGS
FEDERAL AID INTERSTATE HIGHWAY

F.A.I. ROUTE 5 SECTION 27-HB-3
PROJECT I-05-2( )
KNOX COUNTY, ILLINOIS

S.A. ROUTE 9 OVER RIGHT SLAB F.A.I. ROUTE 5

FOR
MISSMAN STANLEY FARMER & ASSOCIATES
ROBERT HOFMANN & ASSOCIATES

6-20-57

FOR INFORMATION ONLY

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5.0 ' BX

BORE NO. 1 DATE JUNE 11, 1957

SURFACE ELEVATION 760.2 WATER LEVEL 5.0 FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									SMALL TO MEDIUM GRAVEL, AND BROWN CLAY, MOIST
0.2									
4.0	1	SS	6						YELLOW GREY SILTY CLAY, STIFF, MOIST
8.5									
9.0	2	SS	16					2770	BROWN SILTY CLAY, TRACE OF FINE SAND, TOUGH, MOIST
14.0									
14.0	3	SS	21						YELLOW FINE SAND AND SILT, TRACE OF SMALL GRAVEL, MEDIUM DENSE, MOIST
17.0									
									YELLOW SILT AND FINE SAND, DENSE, DRY
19.8									
19.8	4	SS	50/3"						YELLOW SILT, SOME FINE SAND, VERY DENSE, DRY
23.0	5	SS	50/1"						
23.1									END OF BORE

FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM MEAN SEA LEVEL

FOR: ROBERT HOFMANN AND ASSOCIATES
SITE F.A.I. ROUTE 5, SEC. 4R-27 HB3R, KNOX COUNTY
LOCATION S.A.9 OVER RIGHT SLAB F.A.I. 5
SHEET 1 OF 5 DATE 6-19-57

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5.0' BX

BORE NO. 2 DATE June 11, 1957

SURFACE ELEVATION 760.7 WATER LEVEL 5.2' FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
0.3									Small to medium gravel and brown clay, moist
4.0	1	SS	4						Yellow silty clay, soft moist
8.5									
9.0	2	SS	15						Brown clay, trace of fine sand, tough moist
13.5									
14.0	3	SS	18						Fine yellow sand and silt, medium dense, wet
17.5									
17.5	4	SS	50/5"						Yellow silt some fine sand very dense dry
20.5	5	SS	50/3"						
20.8									End of bore

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR Robert Hoffman and Associates
SITE: FAI Route 5 Section 48-27 HB3R
LOCATION: SA Route 9 over Right Slab FAI 5
SHEET 2 OF 5 DATE 6-19-57

FOR INFORMATION ONLY

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5.0' BX

BORE NO. 3 DATE June 11, 1957

SURFACE ELEVATION 759.9 WATER LEVEL 5.0 FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									Small to medium gravel and brown clay, moist
0.4									
4.0	1	SS	5					1895	Yellow gray silty clay, stiff moist
8.5									
9.0	2	SS	16					3900	Brown clay trace of fine sand, tough, moist
13.5									
14.0	3	SS	23						Fine yellow sand, trace of silt, medium dense
18.5									
18.5	4	SS	50/5"						Yellow silt trace of fine sand, very dense, dry
21.5	5	SS	50/1"						Note: sample 5 not retained
21.6									End of bore

FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR Robert Hoffman and Associates
SITE FAI Route 5 Section 48-27 HB3R
LOCATION: SA Route 9 over Right Slab FAI5
SHEET 3 OF 5 DATE 6-19-57

ALL TELEPHONES HYDE PARK 3-1512

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5'.0 BX

BORE NO. 4 DATE June 11, 1957

SURFACE ELEVATION 759.6 WATER LEVEL 5'.4 FT. AT 24 HRS.

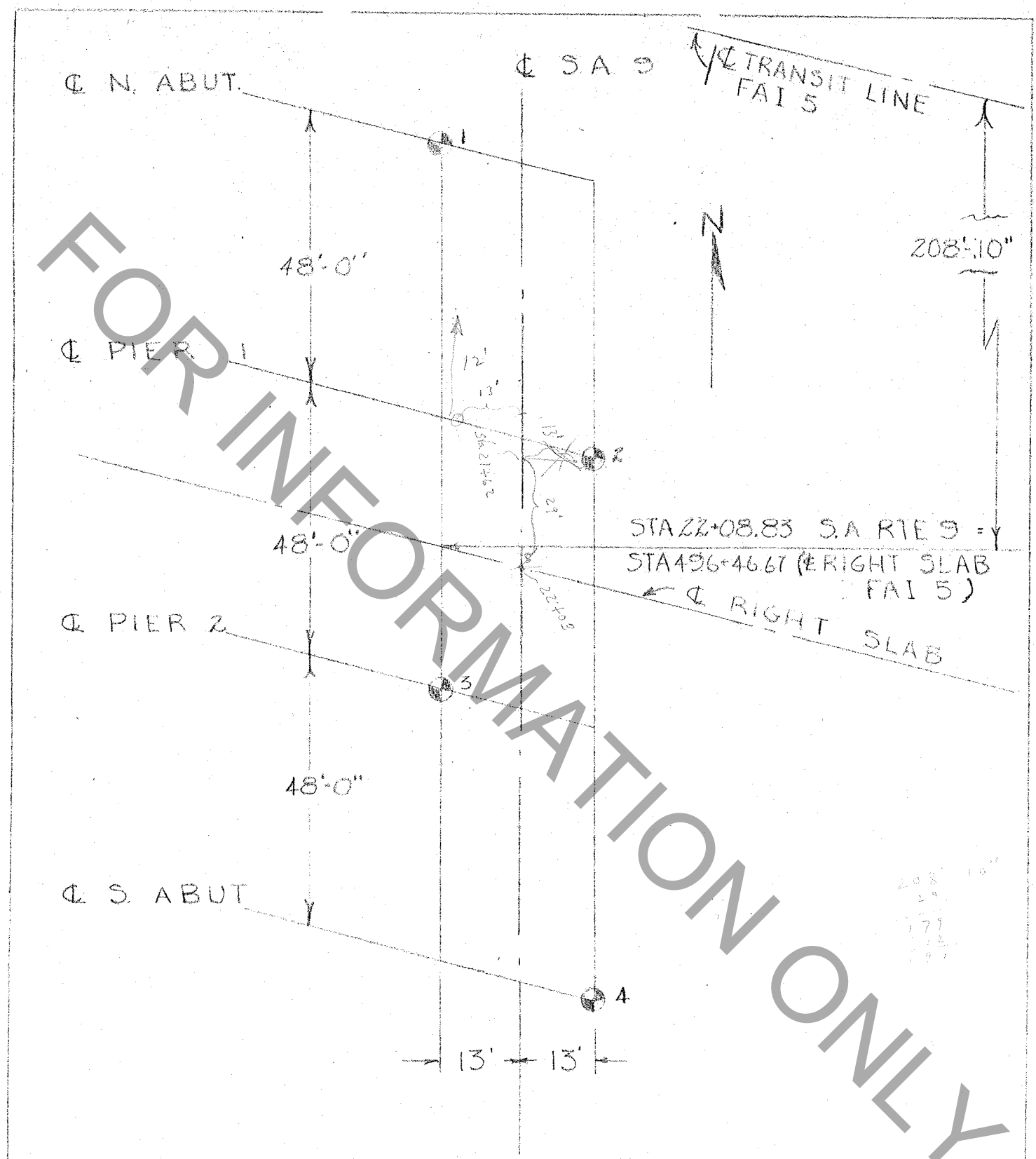
D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									Small to medium grave and brown clay, moist
0.5									
4.5	1	SS	4					1430	Yellow gray silty clay, soft moist
9.0									
9.5	2	SS	16					6930	Brown clay trace of fine sand, tough moist
14.0									
14.5	3	SS	14						Brown sandy clay trace of small gravel
17.0									
17.5	4	SS	38						Yellow fine sand and silt dense dry
18.5									
19.0	5	SS	50/4"						Very yellow silt, trace of fine sand, very dense, dry
22.5	6	SS	50/1"						
22.6									End of bore

FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR Robert Hoffman and Associates
SITE: FAI Route 5 Section 48-27 HB3R
LOCATION SA Route 9 over Right Slab FAI5
SHEET 4 OF 5 DATE 6-13-57



FOR INFORMATION ONLY

WALTER H. FLOOD & COMPANY
LOCATION DIAGRAM STRUCTURE BORINGS
FAIRTE 5, S27-HB5; PROJ 1-052( )
S.A. RTE 9 OVER R.R. FAI 5
SCALE 1"=24' SHEET 6 OF 6

Elev Rt slab 751.±

6-21-57

To, C. SAVILLE: ENGINEER OF DESIGN

Boeing locations do not comply with revisions requested in letter of June 18, 1957. However, they are satisfactory as there seems to be no substantial change in soil conditions at this site

R. Hofmann

WALTER H. FLOOD AND COMPANY

FOR INFORMATION ONLY

STRUCTURE BORINGS
FEDERAL AID INTERSTATE HIGHWAY

F.A.I. ROUTE 5 SECTION 27-HB-3
PROJECT 1-05-2( )
KNOX COUNTY, ILLINOIS

S.A. ROUTE 9 OVER LEFT SLAB F.A.I. ROUTE 5

FOR

MISSMAN STANLEY FARMER & ASSOCIATES

ROBERT HOFMANN & ASSOCIATES

6-15-57

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5'.0 BX

BORE NO. 1 DATE June 11, 1957

SURFACE ELEVATION 749.2 WATER LEVEL 4.7' FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
0.7									Small to medium gravel and brown clay, moist
4.5	1	SS	19						Brown and yellow silty clay, trace of fine sand, very tough
9.0									
9.5	2	SS	50						Yellow silt, some fine sand dense, dry
11.5									
11.5	3	SS	50/3"						Yellow silt, some fine sand very dense dry
14.5	4	SS	50/1½"						Note: sample 4 not retained
14.7									End of bore

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR Robert Hoffman and Associates
SITE SA Route 9 over Left Slab FAI5
LOCATION

SHEET 1 OF 2 DATE 6-18-57

FOR INFORMATION ONLY

ALL TELEPHONES HYDE PARK 3-1512

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5'.0 BX

BORE NO. 2 DATE June 12, 1957

SURFACE ELEVATION 751.0 WATER LEVEL FT. AT HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									Small to medium gravel and brown clay, moist
0.5									
4.5	1	SS	16						Brown silty clay, trace of fine sand, tough, moist
8.5									
9.0	2	SS	19						Brown silty clay, trace of fine sand, very tough, moist
12.5									Yellow silt, trace of fine sand, dense, dry
13.0									
13.0	3	SS	50/6"						Yellow silt, trace of fine sand, dense, dry
16.5	4	SS	50/3"						
16.7									End of bore

FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR FAI Route 5 Section 48-27HB3
SITE SA Route 9 over Left Slab FAI5
LOCATION

SHEET 2 OF 5 DATE 6-12-57

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5'.0 BX

BORE NO. 3 DATE June 12, 1957

SURFACE ELEVATION 752.5 WATER LEVEL 4.8' FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									small to medium gravel and brown clay, moist
0.3									
4.0	1	SS	11					2240	Brown silty clay, tough moist
8.5									
9.0	2	SS	24					4790	Brown and yellow clay, trace of small gravel, very tough
13.5									
14.0	3	SS	43						Yellow silt, some fine sand, dense, dry
16.0									
16.0	4	SS	50/4"						Yellow silt, trace of fine sand, very dense dry
19.5	5	SS	50/2½"						
19.7									End of bore

FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR: Robert Hoffman and Associates
SITE: SA Route 9 over Left Slab FAI5
LOCATION
SHEET 3 OF 5 DATE 6-18-57

ALL TELEPHONES HYDE PARK 3-1812

WALTER H. FLOOD & CO.

CHEMICAL ENGINEERS
INSPECTION AND TESTING OF
MATERIALS AND STRUCTURES
6102 SOUTH BLACKSTONE AVENUE
CHICAGO 37

SOIL BORING LOG

WO WASH OUT
ST SHELBY TUBE
SS SPLIT SPOON
DB DIAMOND BIT
C CORE

METHOD OF BORE W.O.
SPLIT SPOON SIZE 2 IN.
WT. OF HAMMER 140 LB.
30 IN. DROP
CASING USED 5.0 BX

BORE NO. 4 DATE June 12,1957

SURFACE ELEVATION 752.5 WATER LEVEL 4.8 FT. AT 24 HRS.

D	S	T	N	R	WD	DD	WC	QU	DESCRIPTION
									Small to medium gravel and brown clay, moist
0.2									
4.0	1	SS	12						Brown silty clay, tough, moist
7.5									
9.0	2	SS	28						Brown and yellow clay, trace of small gravel very tough, moist
14.0									
14.0	3	SS	35						Fine yellow sand and silt, dense dry
17.5									
17.5	4	SS	50/5"						Very dense yellow silt some fine sand, very d dense dry
21.0	5,	SS	50/3"						
21.3									End of bore

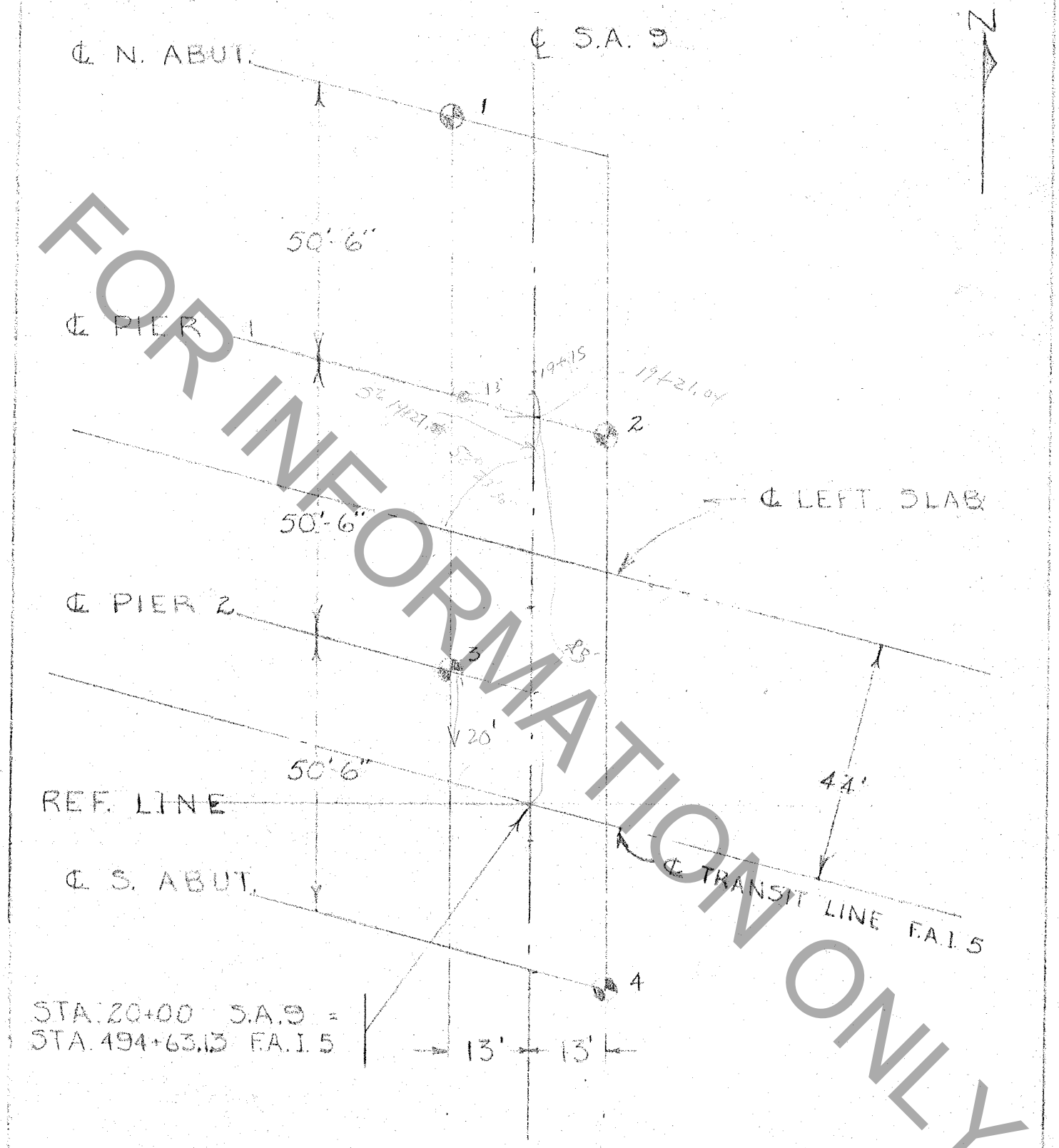
FOR INFORMATION ONLY

D DEPTH IN FEET BELOW GROUND SURFACE
S SAMPLE NUMBER
T TYPE OF SAMPLE
N PENETRATION, BLOWS PER FOOT
R LENGTH OF SAMPLE RECOVERED, INCHES
WD WET DENSITY, LB. PER CU. FT.
DD DRY DENSITY, LB. PER CU. FT.
WC WATER CONTENT, PERCENT DRY WEIGHT
QU UNCONFINED COMPRESSIVE STRENGTH, LB. PER SQ. FT.

DATUM Mean sea level

FOR Robert Hoffman and Associates
SITE SA Route 9 over Left Slab FAI5
LOCATION

SHEET 4 OF 5 DATE 6-18-57



FOR INFORMATION ONLY

WALTER H. FLOOD & COMPANY

LOCATION DIAGRAM
STRUCTURE BORINGS

F.A.RTE 5, S 47-H&S, PROJ. I-05-2( )

S.A. RTE 9 OVER L.S. F.A.I 5

SCALE 1"=25' SHEET 5 OF 5

6-16-57

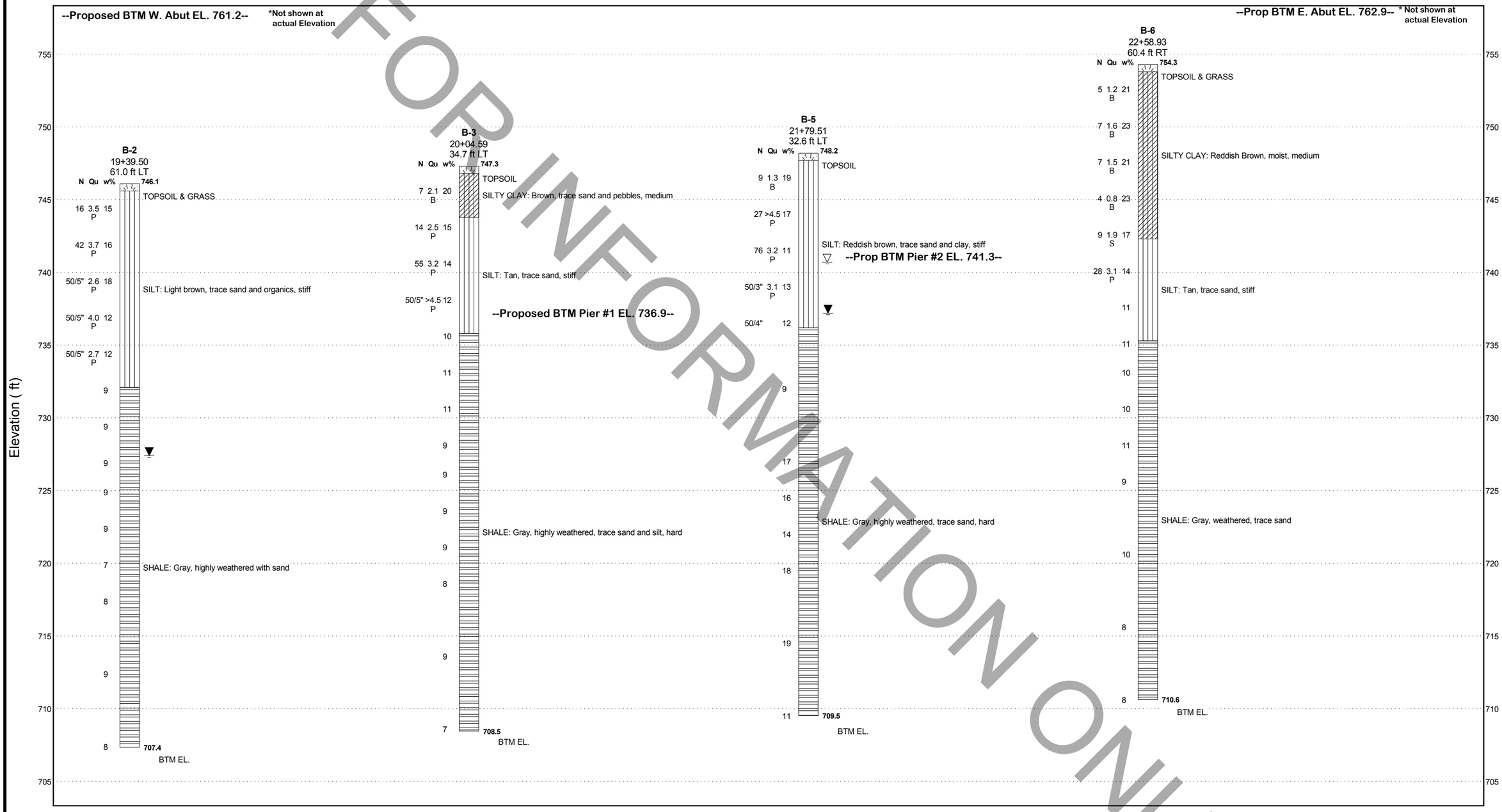
Elev Ft slab - 750 ft

FOR INFORMATION ONLY

EXHIBIT D

SUBSURFACE PROFILE

FOR INFORMATION ONLY



Kaskaskia Engineering Group, LLC

SUBSURFACE PROFILE :CH 9 over I-74

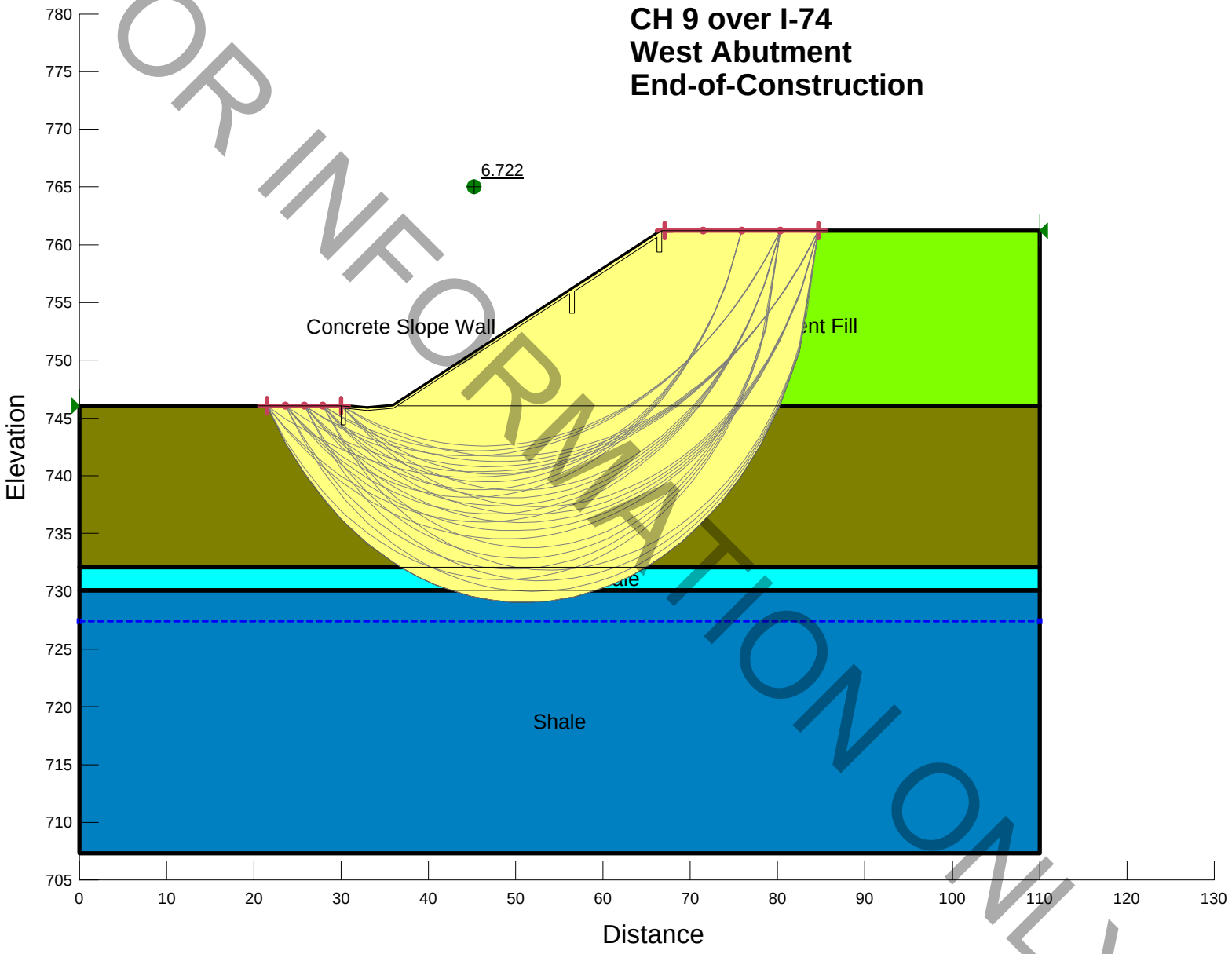
Route: F.A.S. 1400 (I-74)/CH 9
Section: (48-27HB-3)BY, BY-1
County: Knox

PRINTERMOD2 11X17 11-1004 CH 9 O I74.GPJ IL_DOT.GDT 3/13/13

FOR INFORMATION ONLY

EXHIBIT E

SLOPE/W STABILITY ANALYSIS



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: CH 9 over I-74 Knox County, Illinois West Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 10000 psf
Phi: 45 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 1000 psf
Phi: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 3300 psf
Phi: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

FOR INFORMATION ONLY

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (21.53278, 746.08466) ft
Left-Zone Right Coordinate: (30, 746.08466) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (67.03645, 761.1983) ft
Right-Zone Right Coordinate: (84.7, 761.1983) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 746.08466) ft
Right Coordinate: (110, 761.1983) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	727.41932
	110	727.41932

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	11.656449
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	876.83243
Region 3	Silt	20,1,16,15,14,13,12,19,18,21,22	1535.0581
Region 4	Weathered Shale	22,21,23,24	224.4385
Region 5	Shale	24,23,25,26	2502.0622

Points

	X (ft)	Y (ft)
Point 1	30	746.08466
Point 2	33	745.85795

FOR INFORMATION ONLY

Point 3	36	746.08466
Point 4	66.7	761.1983
Point 5	66.7	759.38466
Point 6	66.2	759.38466
Point 7	66.2	760.66932
Point 8	56.7	755.98409
Point 9	56.7	754.09489
Point 10	56.2	754.09489
Point 11	56.2	755.75739
Point 12	36	745.85795
Point 13	33	745.63125
Point 14	30.5	745.85795
Point 15	30.5	744.42216
Point 16	30	744.42216
Point 17	110	761.1983
Point 18	110	746.08466
Point 19	36.4626	746.08466
Point 20	0	746.08466
Point 21	110	732.10455
Point 22	0	732.10455
Point 23	110	730.0642
Point 24	0	730.0642
Point 25	110	707.31818
Point 26	0	707.31818

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	25	6.722	(50.907, 762.875)	33.834	(84.7, 761.198)	(21.5328, 746.085)

Slices of Slip Surface: 25

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	25	22.59118	744.4574	-	941.87483	0	3300

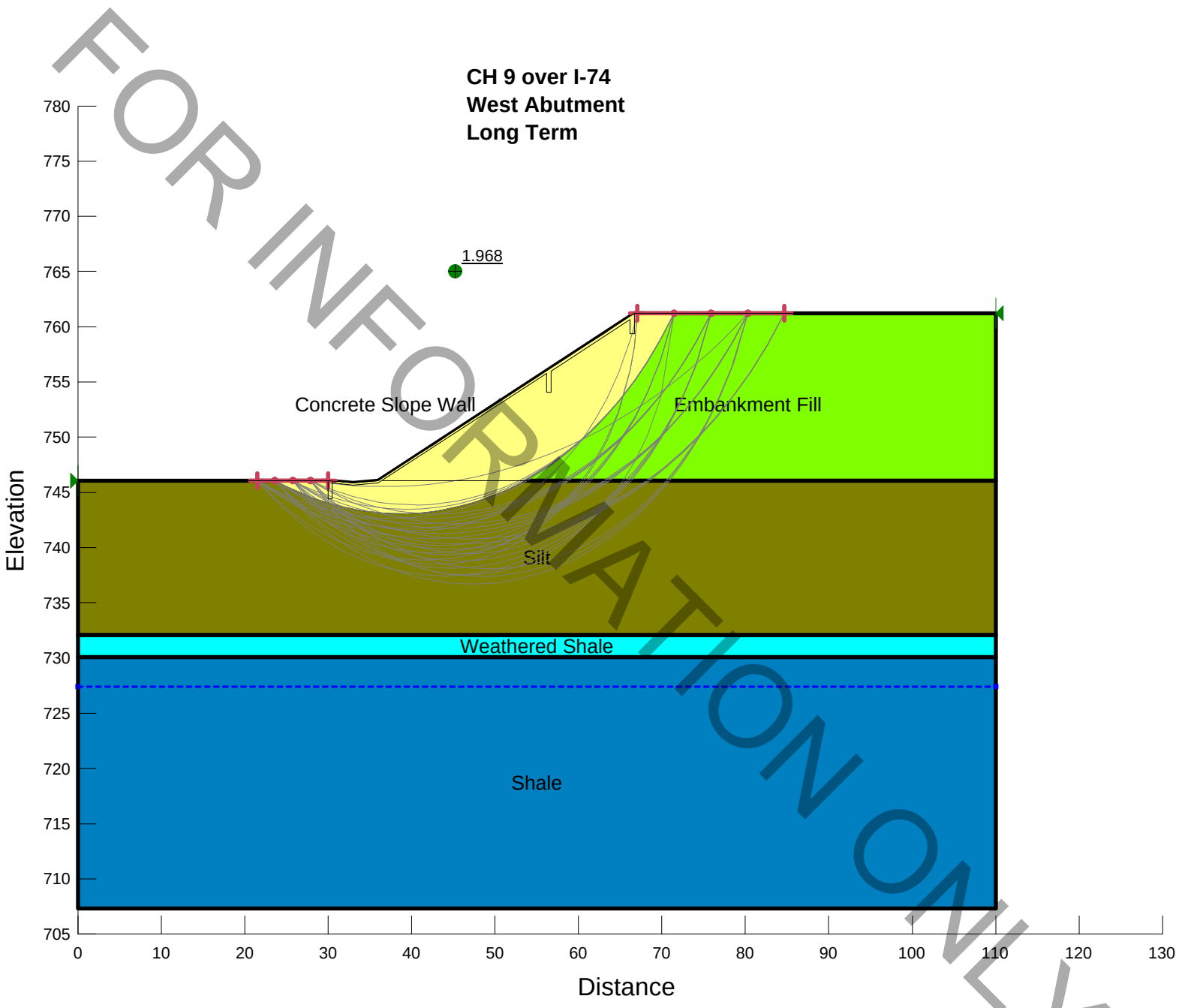
FOR INFORMATION ONLY

				1063.1669			
2	25	24.707985	741.53095	-880.57066	1126.2544	0	3300
3	25	26.82479	739.1571	-732.45017	1295.1135	0	3300
4	25	28.941595	737.1777	-608.9212	1443.8941	0	3300
5	25	30.25	736.08025	-540.43711	1576.0901	0	3300
6	25	31.75	735.0276	-474.74799	1600.2889	0	3300
7	25	34.5	733.33455	-369.11961	1732.6795	0	3300
8	25	36.2313	732.39005	-310.17726	1831.1268	0	3300
9	25	36.65	732.19165	-297.78576	1870.3617	0	3300
10	25	37.80565	731.6977	-266.96932	1798.2034	382.21994	0
11	25	39.74215	730.95215	-220.44534	2008.9894	427.02388	0
12	25	41.67865	730.33885	-182.1756	2202.4022	468.13504	0
13	25	43.776325	729.82055	-149.83452	2405.0811	511.21578	375
14	25	46.035175	729.41245	-124.37212	2586.7998	549.84128	375
15	25	48.294025	729.16045	-108.64552	2748.4248	584.19573	375
16	25	50.552875	729.0611	-102.44478	2890.4285	614.37955	375
17	25	52.811725	729.113	-105.68231	3012.9846	640.42966	375
18	25	55.070575	729.3168	-118.4008	3115.984	662.32285	375
19	25	56.45	729.49845	-129.73715	3206.8792	681.64322	375
20	25	57.933755	729.8021	-148.68478	3217.6121	683.92456	375
21	25	60.13576	730.33885	-182.1756	3289.9414	699.29863	0
22	25	62.07226	730.95215	-	3325.1297	706.77814	0

FOR INFORMATION ONLY

				220.44534			
23	25	64.00876	731.6977	-266.96932	3343.4244	710.66679	0
24	25	65.588505	732.39915	-310.74056	3163.8329	0	3300
25	25	66.45	732.823	-337.19069	3178.8052	0	3300
26	25	67.831805	733.6068	-386.10674	3040.2846	0	3300
27	25	70.09541	735.04155	-475.63226	2820.7317	0	3300
28	25	72.359015	736.7512	-582.31439	2559.4383	0	3300
29	25	74.62262	738.7953	-709.8574	2244.0156	0	3300
30	25	76.886225	741.271	-864.34379	1852.4639	0	3300
31	25	79.14983	744.35835	-1056.993	1338.9838	0	3300
32	25	81.386225	748.4126	-1309.9888	1284.7045	0	1000
33	25	83.59541	755.9694	-1781.5292	-50.566166	0	1000

FOR INFORMATION ONLY



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: CH 9 over I-74 Knox County, Illinois West Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 10000 psf
Phi: 45 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

FOR INFORMATION ONLY

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (21.53278, 746.08466) ft
Left-Zone Right Coordinate: (30, 746.08466) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (67.03645, 761.1983) ft
Right-Zone Right Coordinate: (84.7, 761.1983) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 746.08466) ft
Right Coordinate: (110, 761.1983) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	727.41932
	110	727.41932

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	11.656449
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	876.83243
Region 3	Silt	20,1,16,15,14,13,12,19,18,21,22	1535.0581
Region 4	Weathered Shale	22,21,23,24	224.4385
Region 5	Shale	24,23,25,26	2502.0622

Points

	X (ft)	Y (ft)
Point 1	30	746.08466
Point 2	33	745.85795

FOR INFORMATION ONLY

Point 3	36	746.08466
Point 4	66.7	761.1983
Point 5	66.7	759.38466
Point 6	66.2	759.38466
Point 7	66.2	760.66932
Point 8	56.7	755.98409
Point 9	56.7	754.09489
Point 10	56.2	754.09489
Point 11	56.2	755.75739
Point 12	36	745.85795
Point 13	33	745.63125
Point 14	30.5	745.85795
Point 15	30.5	744.42216
Point 16	30	744.42216
Point 17	110	761.1983
Point 18	110	746.08466
Point 19	36.4626	746.08466
Point 20	0	746.08466
Point 21	110	732.10455
Point 22	0	732.10455
Point 23	110	730.0642
Point 24	0	730.0642
Point 25	110	707.31818
Point 26	0	707.31818

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	33	1.968	(38.62, 781.888)	38.807	(71.4523, 761.198)	(23.6496, 746.085)

Slices of Slip Surface: 33

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	33	24.44339	745.77305	-	62.396551	33.176834	100

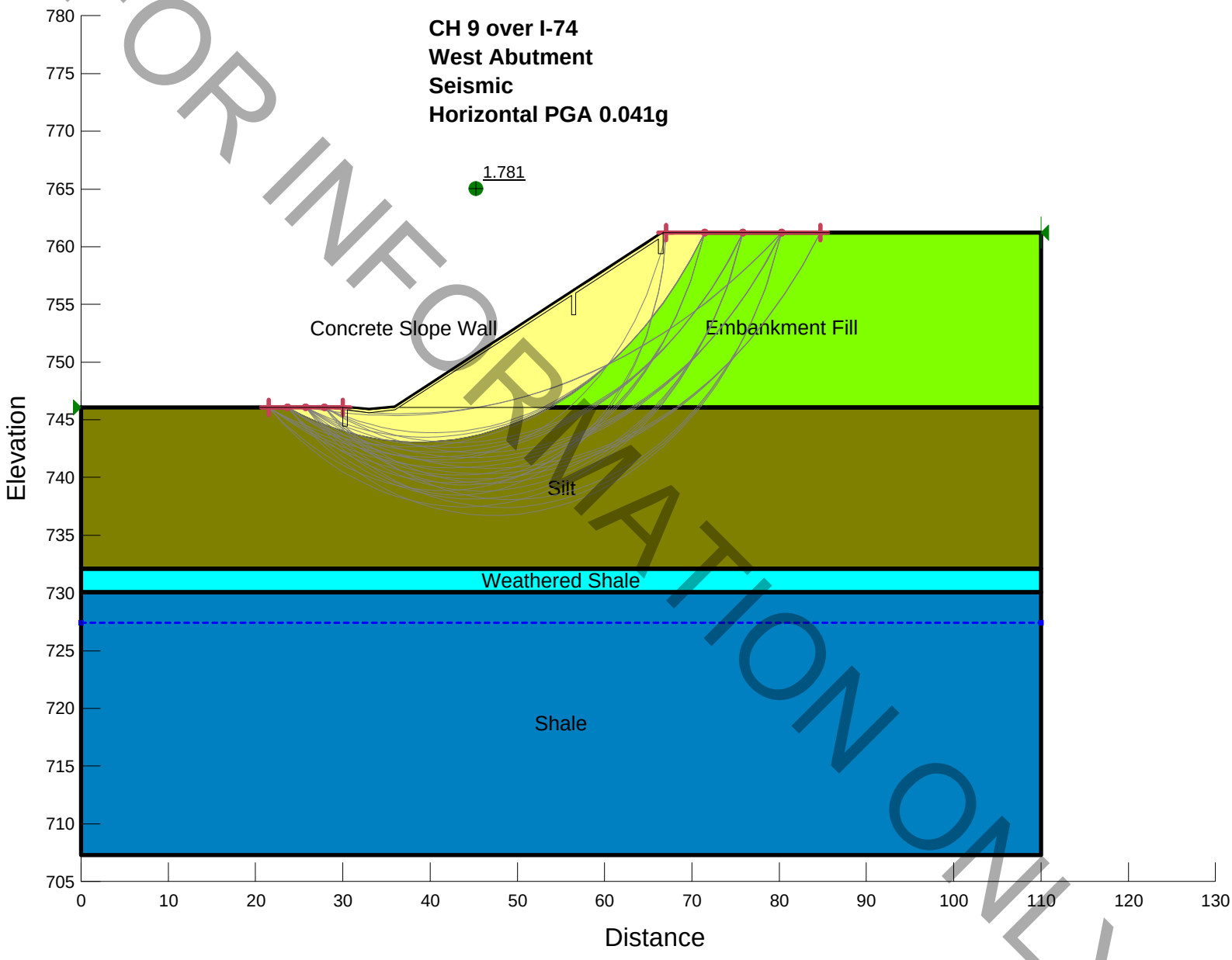
FOR INFORMATION ONLY

				1145.2658			
2	33	26.03099	745.1891	-1108.8411	132.70822	70.562213	100
3	33	27.618595	744.6821	-1077.2205	191.62131	101.88686	100
4	33	29.2062	744.24885	-1050.1629	240.0416	127.63238	100
5	33	30.25	743.9951	-1034.3263	317.60378	168.87293	100
6	33	31.125	743.81685	-1023.2379	281.97128	149.92679	100
7	33	32.375	743.59185	-1009.1487	293.77511	156.203	100
8	33	33.75	743.395	-996.85243	313.7056	166.80022	100
9	33	35.25	743.2347	-986.85587	340.4749	181.03372	100
10	33	36.2313	743.15505	-981.9213	366.03592	194.62475	100
11	33	37.241165	743.1131	-979.26082	428.62076	227.9017	100
12	33	38.798295	743.089	-977.81517	520.4846	276.74657	100
13	33	40.355425	743.12745	-980.18333	603.26377	320.76104	100
14	33	41.912555	743.2286	-986.52069	677.19715	360.07211	100
15	33	43.46968	743.39295	-996.72749	742.43231	394.75826	100
16	33	45.026805	743.62135	-1011.021	799.08791	424.88258	100
17	33	46.583935	743.915	-1029.3507	847.20142	450.46499	100
18	33	48.141065	744.27535	-1051.836	886.79207	471.5157	100
19	33	49.698195	744.70435	-1078.6182	917.85638	488.03289	100
20	33	51.255325	745.2045	-1109.7786	940.24853	499.93901	100
21	33	52.812455	745.7787	-1145.6124	953.81031	507.14994	100

FOR INFORMATION ONLY

22	33	54.243265	746.3716	-1182.6389	964.62188	470.47753	100
23	33	55.547755	746.9747	-1220.2281	957.42032	466.96509	100
24	33	56.45	747.42025	-1248.0659	980.66384	478.30171	100
25	33	57.491665	747.99035	-1283.607	933.14108	455.12331	100
26	33	59.075	748.9223	-1341.7697	901.00678	439.45037	100
27	33	60.658335	749.95995	-1406.5319	857.12162	418.04615	100
28	33	62.241665	751.11405	-1478.569	800.65772	390.50686	100
29	33	63.825	752.3983	-1558.6831	730.63421	356.35411	100
30	33	65.408335	753.83075	-1648.0693	645.83412	314.99435	100
31	33	66.45	754.8439	-1711.3426	605.93905	295.53622	100
32	33	67.492055	755.98395	-1782.4531	466.38629	227.47179	100
33	33	69.076165	757.87115	-1900.1948	267.43526	130.43689	100
34	33	70.66028	760.03695	-2035.349	51.844064	25.286039	100

FOR INFORMATION ONLY



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: CH 9 over I-74 Knox County, Illinois West Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    Apply Phreatic Correction: No
    PWP Conditions Source: Piezometric Line
    Use Staged Rapid Drawdown: No
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 10000 psf
Phi: 45 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

FOR INFORMATION ONLY

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (21.53278, 746.08466) ft
Left-Zone Right Coordinate: (30, 746.08466) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (67.03645, 761.1983) ft
Right-Zone Right Coordinate: (84.7, 761.1983) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 746.08466) ft
Right Coordinate: (110, 761.1983) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	727.41932
	110	727.41932

Seismic Loads

Horz Seismic Load: 0.041
Ignore seismic load in strength: No

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	11.656449
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	876.83243
Region 3	Silt	20,1,16,15,14,13,12,19,18,21,22	1535.0581
Region 4	Weathered Shale	22,21,23,24	224.4385
Region 5	Shale	24,23,25,26	2502.0622

FOR INFORMATION ONLY

Points

	X (ft)	Y (ft)
Point 1	30	746.08466
Point 2	33	745.85795
Point 3	36	746.08466
Point 4	66.7	761.1983
Point 5	66.7	759.38466
Point 6	66.2	759.38466
Point 7	66.2	760.66932
Point 8	56.7	755.98409
Point 9	56.7	754.09489
Point 10	56.2	754.09489
Point 11	56.2	755.75739
Point 12	36	745.85795
Point 13	33	745.63125
Point 14	30.5	745.85795
Point 15	30.5	744.42216
Point 16	30	744.42216
Point 17	110	761.1983
Point 18	110	746.08466
Point 19	36.4626	746.08466
Point 20	0	746.08466
Point 21	110	732.10455
Point 22	0	732.10455
Point 23	110	730.0642
Point 24	0	730.0642
Point 25	110	707.31818
Point 26	0	707.31818

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	33	1.781	(38.62, 781.888)	38.807	(71.4523, 761.198)	(23.6496, 746.085)

FOR INFORMATION ONLY

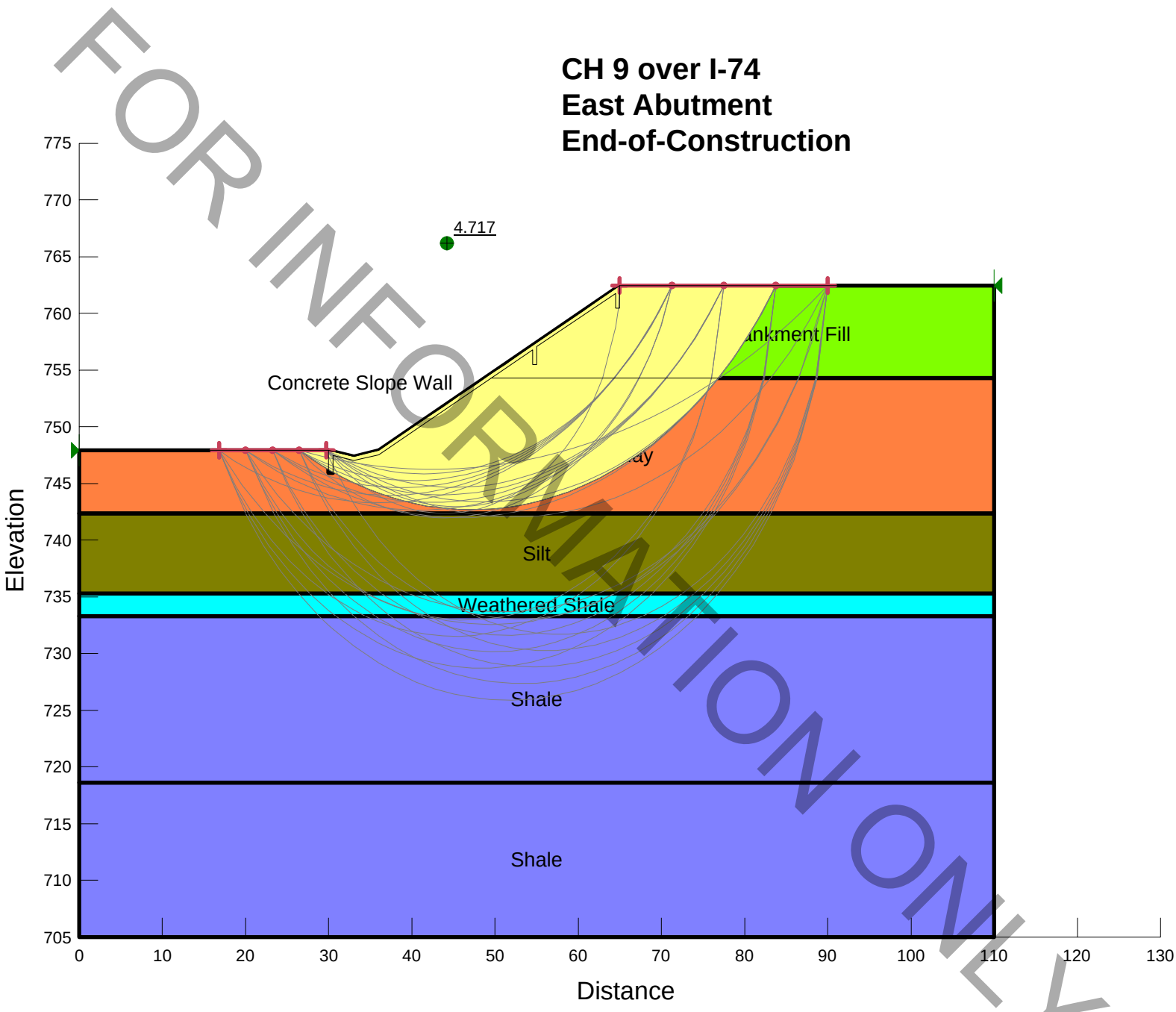
Slices of Slip Surface: 33

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	33	24.44339	745.77305	-1145.2658	65.539245	34.847835	100
2	33	26.03099	745.1891	-1108.8411	136.16981	72.402773	100
3	33	27.618595	744.6821	-1077.2205	195.09446	103.73356	100
4	33	29.2062	744.24885	-1050.1629	243.31076	129.37062	100
5	33	30.25	743.9951	-1034.3263	320.98234	170.66934	100
6	33	31.125	743.81685	-1023.2379	284.74994	151.40423	100
7	33	32.375	743.59185	-1009.1487	296.11224	157.44567	100
8	33	33.75	743.395	-996.85243	315.56411	167.78841	100
9	33	35.25	743.2347	-986.85587	341.80984	181.74352	100
10	33	36.2313	743.15505	-981.9213	367.02842	195.15247	100
11	33	37.241165	743.1131	-979.26082	429.2433	228.23271	100
12	33	38.798295	743.089	-977.81517	520.38827	276.69535	100
13	33	40.355425	743.12745	-980.18333	602.27576	320.2357	100
14	33	41.912555	743.2286	-986.52069	675.14949	358.98335	100
15	33	43.46968	743.39295	-996.72749	739.24646	393.06431	100
16	33	45.026805	743.62135	-1011.021	794.59083	422.49144	100
17	33	46.583935	743.915	-1029.3507	841.4189	447.39037	100
18	33	48.141065	744.27535	-1051.836	879.63248	467.70889	100
19	33	49.698195	744.70435	-	909.30129	483.48407	100

FOR INFORMATION ONLY

				1078.6182			
20	33	51.255325	745.2045	-1109.7786	930.29045	494.64421	100
21	33	52.812455	745.7787	-1145.6124	942.51377	501.14346	100
22	33	54.243265	746.3716	-1182.6389	952.76321	464.69367	100
23	33	55.547755	746.9747	-1220.2281	944.52136	460.67385	100
24	33	56.45	747.42025	-1248.0659	966.7546	471.51772	100
25	33	57.491665	747.99035	-1283.607	918.90392	448.17939	100
26	33	59.075	748.9223	-1341.7697	885.81917	432.04287	100
27	33	60.658335	749.95995	-1406.5319	841.16429	410.26324	100
28	33	62.241665	751.11405	-1478.569	784.12452	382.44308	100
29	33	63.825	752.3983	-1558.6831	713.83029	348.1583	100
30	33	65.408335	753.83075	-1648.0693	629.16066	306.86216	100
31	33	66.45	754.8439	-1711.3426	589.08766	287.31725	100
32	33	67.492055	755.98395	-1782.4531	451.50476	220.21359	100
33	33	69.076165	757.87115	-1900.1948	255.92355	124.82225	100
34	33	70.66028	760.03695	-2035.349	44.883386	21.89109	100

FOR INFORMATION ONLY



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: County Highway 9 over I-74 Knox County, Illinois East Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    PWP Conditions Source: (none)
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °
Phi-B: 0 °

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 1000 psf
Phi: 0 °
Phi-B: 0 °

Silty Clay

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 1275 psf
Phi: 0 °
Phi-B: 0 °

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 3100 psf
Phi: 0 °
Phi-B: 0 °

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range

FOR INFORMATION ONLY

Left-Zone Left Coordinate: (16.78771, 747.90496) ft
Left-Zone Right Coordinate: (29.7, 747.90496) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (65, 762.42739) ft
Right-Zone Right Coordinate: (90, 762.42739) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 747.90496) ft
Right Coordinate: (110, 762.42739) ft

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	15.402474
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	425.02776
Region 3	Silty Clay	19,18,20,21,22,1,16,15,14,13,12	1035.2827
Region 4	Silt	21,20,23,24	774.5298
Region 5	Weathered Shale	24,23,25,26	217.8363
Region 6	Shale	26,25,27,28	1613.6032
Region 7	Shale	28,27,29,30	1500.6508

Points

	X (ft)	Y (ft)
Point 1	30	747.90496
Point 2	33	747.39154
Point 3	36	747.90496
Point 4	65	762.42739
Point 5	65	760.44706
Point 6	64.5	760.44706
Point 7	64.5	761.76728
Point 8	55	757.07316
Point 9	55	755.45956
Point 10	54.5	755.45956
Point 11	54.5	756.77978

FOR INFORMATION ONLY

Point 12	36	747.53824
Point 13	33	747.02482
Point 14	30.5	747.46489
Point 15	30.5	745.92463
Point 16	30	745.92463
Point 17	110	762.42739
Point 18	110	754.28603
Point 19	49.50794	754.28603
Point 20	110	742.3307
Point 21	0	742.3307
Point 22	0	747.90496
Point 23	110	735.28952
Point 24	0	735.28952
Point 25	110	733.30919
Point 26	0	733.30919
Point 27	110	718.64007
Point 28	0	718.64007
Point 29	110	704.99779
Point 30	0	704.99779

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	93	4.717	(47.191, 786.402)	43.718	(83.75, 762.427)	(26.4719, 747.905)

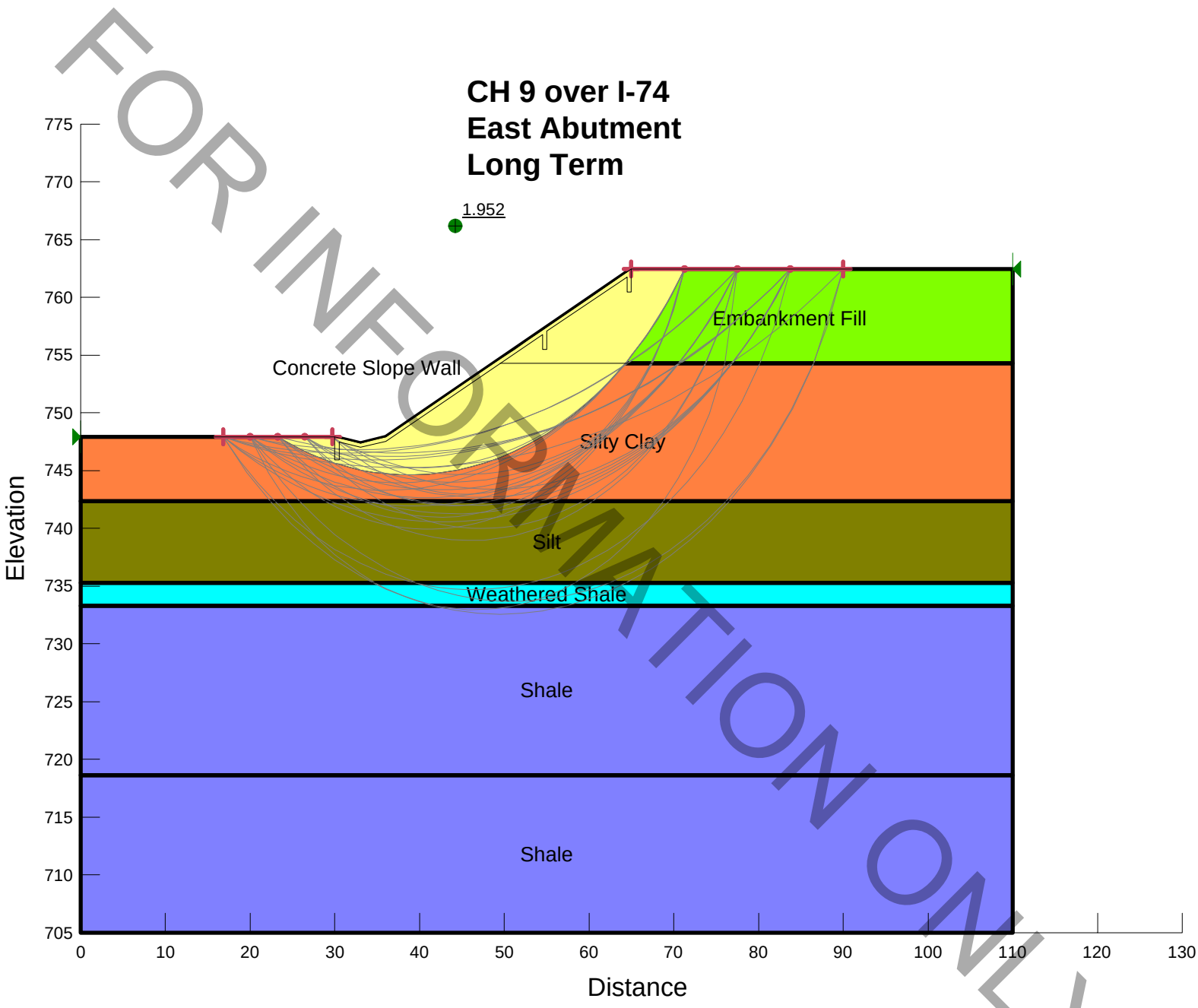
Slices of Slip Surface: 93

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	93	27.353945	747.4557	0	193.82813	0	1275
2	93	29.11798	746.60585	0	285.13959	0	1275
3	93	30.25	746.1002	0	769.64305	769.64305	5000
4	93	31.75	745.52295	0	369.62475	0	1275
5	93	33.75	744.8084	0	433.61952	0	1275
6	93	35.25	744.353	0	512.03861	0	1275

FOR INFORMATION ONLY

7	93	36.964855	743.9078	0	632.45635	0	1275
8	93	38.89456	743.48905	0	792.84925	0	1275
9	93	40.824265	743.16045	0	942.31572	0	1275
10	93	42.75397	742.9199	0	1080.9757	0	1275
11	93	44.683675	742.76595	0	1209.0186	0	1275
12	93	46.61338	742.69775	0	1326.4072	0	1275
13	93	48.543085	742.71485	0	1433.2117	0	1275
14	93	50.33995	742.8048	0	1523.2978	0	1275
15	93	52.00397	742.95705	0	1598.0786	0	1275
16	93	53.66799	743.17385	0	1664.6331	0	1275
17	93	54.75	743.3424	0	1733.2585	0	1275
18	93	55.95	743.5806	0	1741.1105	0	1275
19	93	57.85	744.0138	0	1793.4846	0	1275
20	93	59.75	744.53765	0	1834.0433	0	1275
21	93	61.65	745.15565	0	1862.3135	0	1275
22	93	63.55	745.87215	0	1877.616	0	1275
23	93	64.75	746.3652	0	1910.7228	0	1275
24	93	65.98785	746.9454	0	1806.4931	0	1275
25	93	67.963555	747.94965	0	1663.6852	0	1275
26	93	69.93926	749.0855	0	1502.9857	0	1275
27	93	71.914965	750.36545	0	1322.2954	0	1275
28	93	73.89067	751.80555	0	1119.1514	0	1275
29	93	75.866375	753.42695	0	890.02264	0	1275
30	93	77.7162	755.12735	0	705.60809	0	1000
31	93	79.44014	756.91125	0	457.68633	0	1000
32	93	81.164085	758.91935	0	176.44902	0	1000
33	93	82.88803	761.20615	0	-147.6863	0	1000

FOR INFORMATION ONLY



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: County Highway 9 over I-74 Knox County, Illinois East Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    PWP Conditions Source: (none)
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °
Phi-B: 0 °

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °

Silty Clay

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range

FOR INFORMATION ONLY

Left-Zone Left Coordinate: (16.78771, 747.90496) ft
Left-Zone Right Coordinate: (29.7, 747.90496) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (65, 762.42739) ft
Right-Zone Right Coordinate: (90, 762.42739) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 747.90496) ft
Right Coordinate: (110, 762.42739) ft

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	15.402474
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	425.02776
Region 3	Silty Clay	19,18,20,21,22,1,16,15,14,13,12	1035.2827
Region 4	Silt	21,20,23,24	774.5298
Region 5	Weathered Shale	24,23,25,26	217.8363
Region 6	Shale	26,25,27,28	1613.6032
Region 7	Shale	28,27,29,30	1500.6508

Points

	X (ft)	Y (ft)
Point 1	30	747.90496
Point 2	33	747.39154
Point 3	36	747.90496
Point 4	65	762.42739
Point 5	65	760.44706
Point 6	64.5	760.44706
Point 7	64.5	761.76728
Point 8	55	757.07316
Point 9	55	755.45956
Point 10	54.5	755.45956
Point 11	54.5	756.77978

FOR INFORMATION ONLY

Point 12	36	747.53824
Point 13	33	747.02482
Point 14	30.5	747.46489
Point 15	30.5	745.92463
Point 16	30	745.92463
Point 17	110	762.42739
Point 18	110	754.28603
Point 19	49.50794	754.28603
Point 20	110	742.3307
Point 21	0	742.3307
Point 22	0	747.90496
Point 23	110	735.28952
Point 24	0	735.28952
Point 25	110	733.30919
Point 26	0	733.30919
Point 27	110	718.64007
Point 28	0	718.64007
Point 29	110	704.99779
Point 30	0	704.99779

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	58	1.952	(38.812, 783.051)	38.439	(71.25, 762.427)	(23.2438, 747.905)

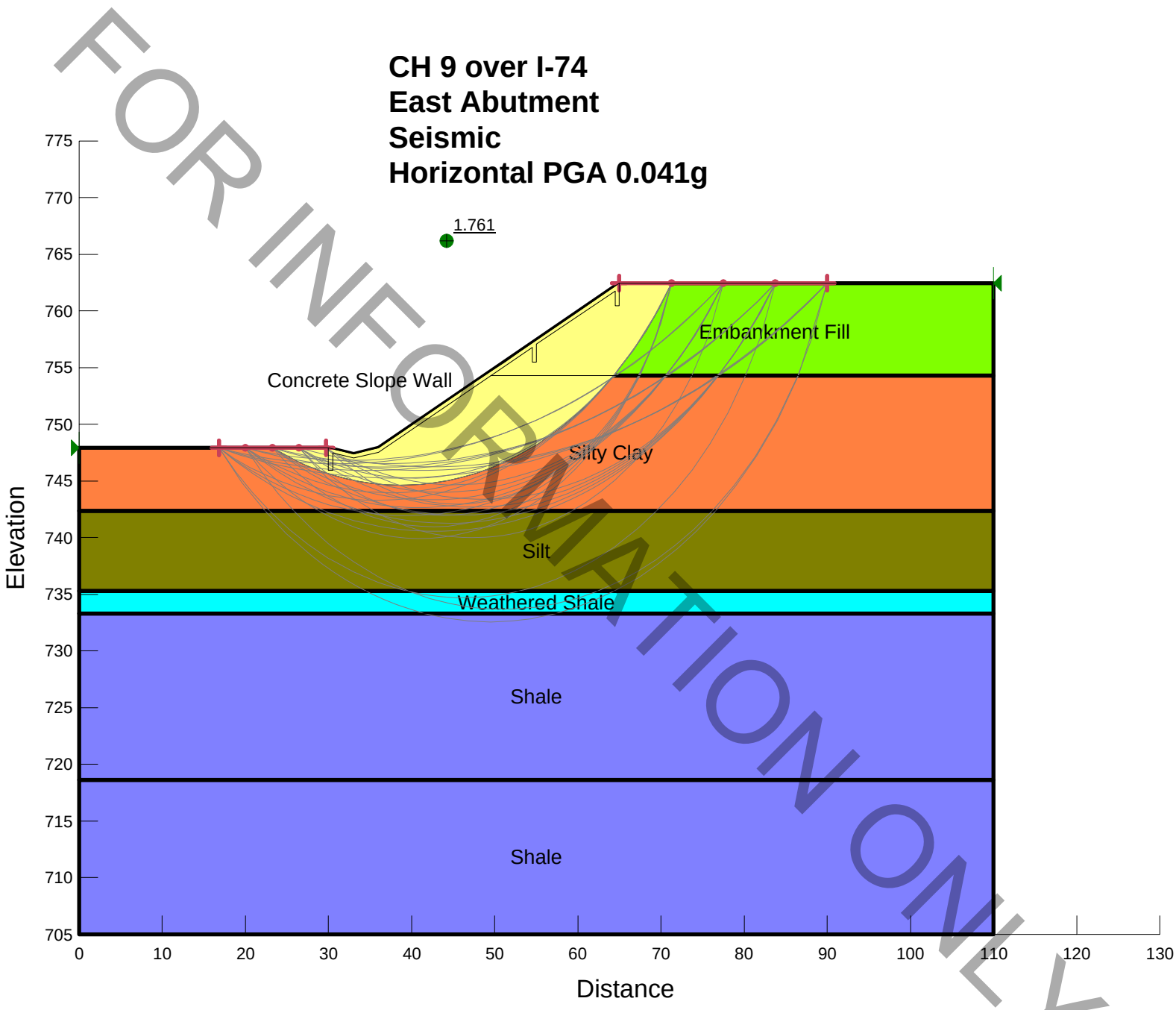
Slices of Slip Surface: 58

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	58	24.08837	747.5547	0	72.548574	35.384304	100
2	58	25.77741	746.8999	0	158.36557	77.24005	100
3	58	27.466445	746.33445	0	229.88636	112.12307	100
4	58	29.15548	745.85425	0	288.32891	140.6274	100
5	58	30.25	745.5779	0	356.31839	173.78809	100
6	58	31.125	745.3932	0	324.03075	158.04035	100

FOR INFORMATION ONLY

7	58	32.375	745.15945	0	322.01914	157.05923	100
8	58	33.75	744.95365	0	346.41593	168.95834	100
9	58	35.25	744.7842	0	395.33802	192.81923	100
10	58	36.844245	744.67115	0	473.11513	230.75366	100
11	58	38.532735	744.62175	0	577.76051	281.79263	100
12	58	40.22123	744.6466	0	670.91612	327.22765	100
13	58	41.909725	744.7459	0	752.94848	367.23751	100
14	58	43.598215	744.92015	0	823.97774	401.8808	100
15	58	45.28671	745.17045	0	884.18806	431.24733	100
16	58	46.975205	745.4983	0	933.60209	455.34817	100
17	58	48.663695	745.90575	0	972.24989	474.19796	100
18	58	50.33995	746.39135	0	999.85038	487.65961	100
19	58	52.00397	746.9571	0	1016.4877	495.77416	100
20	58	53.66799	747.60995	0	1022.1093	498.51602	100
21	58	54.75	748.07265	0	1046.9142	510.61418	100
22	58	55.77583	748.56825	0	1012.3931	493.77711	100
23	58	57.327485	749.3765	0	993.70099	484.66036	100
24	58	58.87914	750.27815	0	964.14016	470.24258	100
25	58	60.4308	751.28115	0	923.14004	450.24548	100
26	58	61.98246	752.39555	0	869.95685	424.30631	100
27	58	63.534115	753.634	0	803.70266	391.99198	100
28	58	64.40497	754.3708	0	762.34198	371.81903	100
29	58	64.75	754.6842	0	767.25297	374.21428	100
30	58	65.78125	755.6827	0	636.05158	310.22309	100
31	58	67.34375	757.31885	0	455.5837	222.20302	100
32	58	68.90625	759.16965	0	260.62606	127.11582	100
33	58	70.46875	761.2908	0	49.553982	24.169092	100

FOR INFORMATION ONLY



FOR INFORMATION ONLY

SLOPE/W Analysis

Report generated using GeoStudio 2007, version 7.15. Copyright © 1991-2009 GEO-SLOPE International Ltd.

FOR INFORMATION ONLY

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SLOPE/W Analysis

Description: County Highway 9 over I-74 Knox County, Illinois East Abutment
Kind: SLOPE/W
Method: Bishop, Ordinary and Janbu
Settings
    PWP Conditions Source: (none)
SlipSurface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 0.1 ft
    Optimization Maximum Iterations: 2000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Concrete Slope Wall

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion: 5000 psf
Phi: 45 °
Phi-B: 0 °

Embankment Fill

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °

Silty Clay

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 26 °
Phi-B: 0 °

Silt

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °

Weathered Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 12 °
Phi-B: 0 °

Shale

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 375 psf
Phi: 12 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range

FOR INFORMATION ONLY

Left-Zone Left Coordinate: (16.78771, 747.90496) ft
Left-Zone Right Coordinate: (29.7, 747.90496) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (65, 762.42739) ft
Right-Zone Right Coordinate: (90, 762.42739) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 747.90496) ft
Right Coordinate: (110, 762.42739) ft

Seismic Loads

Horz Seismic Load: 0.041
Ignore seismic load in strength: No

Regions

	Material	Points	Area (ft²)
Region 1	Concrete Slope Wall	1,2,3,4,5,6,7,8,9,10,11,19,12,13,14,15,16	15.402474
Region 2	Embankment Fill	4,17,18,19,11,10,9,8,7,6,5	425.02776
Region 3	Silty Clay	19,18,20,21,22,1,16,15,14,13,12	1035.2827
Region 4	Silt	21,20,23,24	774.5298
Region 5	Weathered Shale	24,23,25,26	217.8363
Region 6	Shale	26,25,27,28	1613.6032
Region 7	Shale	28,27,29,30	1500.6508

Points

	X (ft)	Y (ft)
Point 1	30	747.90496
Point 2	33	747.39154
Point 3	36	747.90496
Point 4	65	762.42739
Point 5	65	760.44706
Point 6	64.5	760.44706
Point 7	64.5	761.76728

FOR INFORMATION ONLY

Point 8	55	757.07316
Point 9	55	755.45956
Point 10	54.5	755.45956
Point 11	54.5	756.77978
Point 12	36	747.53824
Point 13	33	747.02482
Point 14	30.5	747.46489
Point 15	30.5	745.92463
Point 16	30	745.92463
Point 17	110	762.42739
Point 18	110	754.28603
Point 19	49.50794	754.28603
Point 20	110	742.3307
Point 21	0	742.3307
Point 22	0	747.90496
Point 23	110	735.28952
Point 24	0	735.28952
Point 25	110	733.30919
Point 26	0	733.30919
Point 27	110	718.64007
Point 28	0	718.64007
Point 29	110	704.99779
Point 30	0	704.99779

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	58	1.761	(38.812, 783.051)	38.439	(71.25, 762.427)	(23.2438, 747.905)

Slices of Slip Surface: 58

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	58	24.08837	747.5547	0	76.070455	37.10204	100
2	58	25.77741	746.8999	0	162.30884	79.16331	100

FOR INFORMATION ONLY

3	58	27.466445	746.33445	0	233.86864	114.06536	100
4	58	29.15548	745.85425	0	292.07098	142.45254	100
5	58	30.25	745.5779	0	360.04243	175.60442	100
6	58	31.125	745.3932	0	327.1269	159.55045	100
7	58	32.375	745.15945	0	324.55876	158.29788	100
8	58	33.75	744.95365	0	348.47781	169.96398	100
9	58	35.25	744.7842	0	396.89794	193.58006	100
10	58	36.844245	744.67115	0	474.06739	231.21811	100
11	58	38.532735	744.62175	0	577.91449	281.86773	100
12	58	40.22123	744.6466	0	670.08753	326.82353	100
13	58	41.909725	744.7459	0	750.88238	366.2298	100
14	58	43.598215	744.92015	0	820.56947	400.21847	100
15	58	45.28671	745.17045	0	879.34271	428.8841	100
16	58	46.975205	745.4983	0	927.29397	452.27149	100
17	58	48.663695	745.90575	0	964.35007	470.34496	100
18	58	50.33995	746.39135	0	990.44865	483.07408	100
19	58	52.00397	746.9571	0	1005.4812	490.40595	100
20	58	53.66799	747.60995	0	1009.6392	492.43392	100
21	58	54.75	748.07265	0	1033.1917	503.92127	100
22	58	55.77583	748.56825	0	998.10961	486.81058	100
23	58	57.327485	749.3765	0	978.17088	477.08582	100
24	58	58.87914	750.27815	0	947.5417	462.14696	100
25	58	60.4308	751.28115	0	905.61072	441.69586	100
26	58	61.98246	752.39555	0	851.7567	415.4295	100
27	58	63.534115	753.634	0	785.0532	382.89603	100
28	58	64.40497	754.3708	0	743.57688	362.66668	100
29	58	64.75	754.6842	0	748.02109	364.83426	100
30	58	65.78125	755.6827	0	618.41008	301.61875	100
31	58	67.34375	757.31885	0	440.41043	214.80252	100
32	58	68.90625	759.16965	0	248.83458	121.36473	100
33	58	70.46875	761.2908	0	42.397675	20.678728	100

FOR INFORMATION ONLY

FOR INFORMATION ONLY

EXHIBIT F

IDOT SEISMIC DESIGN SPREADSHEET

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====CH 9 over I-74: Knox County, Illinois

FOR INFORMATION ONLY

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	761.2	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-2	
Top of Boring Elev.	761.2	ft.
Approximate Fixity Elev.	755.2	ft.

Individual Site Class Definition:

N (bar):	47	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	100	(Blows/ft.)	Soil Site Class C
s_u (bar):	3.5	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
9.1	746.1	15.10	8	1.00	B
11.6	743.6	2.50	16	3.50	
14.1	741.1	2.50	42	3.70	
16.6	738.6	2.50	85	2.60	
19.1	736.1	2.50	83	4.00	
21.6	733.6	2.50	62	2.70	B
24.1	731.1	2.50	100		
26.6	728.6	2.50	100		
29.1	726.1	2.50	100		
31.6	723.6	2.50	100		
34.1	721.1	2.50	100		
36.6	718.6	2.50	100		
39.1	716.1	2.50	100		
44.1	711.1	5.00	100		
49.1	706.1	5.00	100		
54.1	701.1	5.00	100		
59.1	696.1	5.00	100		
64.1	691.1	5.00	100		
69.1	686.1	5.00	100		
74.1	681.1	5.00	100		
79.1	676.1	5.00	100		
84.1	671.1	5.00	100		
89.1	666.1	5.00	100		
94.1	661.1	5.00	100		
99.1	656.1	5.00	100		
100.0	655.2	0.90	100	7.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	740.6	ft.
Pile or Shaft Dia.		inches
Boring Number	B-3	
Top of Boring Elev.	747.3	ft.
Approximate Fixity Elev.	740.6	ft.

Individual Site Class Definition:

N (bar):	93	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	94	(Blows/ft.)	Soil Site Class C <----Controls
s_u (bar):	4.95	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	744.8	2.50	7	2.10	
	742.3	2.50	14	2.50	
0.8	739.8	2.50	55	3.20	
3.3	737.3	2.50	76	4.50	B
5.3	735.3	2.00	60		
7.8	732.8	2.50	64		
10.3	730.3	2.50	71		
12.8	727.8	2.50	70		
14.8	725.8	2.00	100		
17.3	723.3	2.50	100		
19.8	720.8	2.50	100		
22.3	718.3	2.50	100		
27.3	713.3	5.00	100		
31.8	708.8	4.50	100		
36.8	703.8	5.00	100		
41.8	698.8	5.00	100		
46.8	693.8	5.00	100		
51.8	688.8	5.00	100		
56.8	683.8	5.00	100		
61.8	678.8	5.00	100		
66.8	673.8	5.00	100		
71.8	668.8	5.00	100		
76.8	663.8	5.00	100		
81.8	658.8	5.00	100		
86.8	653.8	5.00	100		
91.8	648.8	5.00	100		
96.8	643.8	5.00	100		
100.0	640.6	3.20	100	7.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	756	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-6	
Top of Boring Elev.	754.3	ft.
Approximate Fixity Elev.	750	ft.

Individual Site Class Definition:

N (bar):	53	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	97	(Blows/ft.)	Soil Site Class C
s_u (bar):	4.19	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	751.8	2.50	5	1.20	
0.7	749.3	2.50	7	1.60	
3.2	746.8	2.50	7	1.50	
5.7	744.3	2.50	4	0.80	
8.2	741.8	2.50	9	1.90	
10.7	739.3	2.50	28	3.10	B
12.7	737.3	2.00	75		
15.2	734.8	2.50	60		
17.2	732.8	2.00	100		
19.7	730.3	2.50	100		
22.2	727.8	2.50	100		
24.7	725.3	2.50	100		
29.7	720.3	5.00	100		
34.7	715.3	5.00	100		
39.7	710.3	5.00	100		
44.7	705.3	5.00	100		
49.7	700.3	5.00	100		
54.7	695.3	5.00	100		
59.7	690.3	5.00	100		
64.7	685.3	5.00	100		
69.7	680.3	5.00	100		
74.7	675.3	5.00	100		
79.7	670.3	5.00	100		
84.7	665.3	5.00	100		
89.7	660.3	5.00	100		
94.7	655.3	5.00	100		
99.7	650.3	5.00	100		
100.0	650.0	0.30	100	7.00	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	742.2	ft.
Pile or Shaft Dia.		inches
Boring Number	B-5	
Top of Boring Elev.	748.2	ft.
Approximate Fixity Elev.	742.2	ft.

Individual Site Class Definition:

N (bar):	97	(Blows/ft.)	Soil Site Class C <----Controls
N_{ch} (bar):	98	(Blows/ft.)	Soil Site Class C
s_u (bar):	4.6	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	745.7	2.50	9	1.30	
	743.2	2.50	27	4.50	
1.5	740.7	2.50	76	3.20	
4.0	738.2	2.50	81	3.10	B
6.5	735.7	2.50	91		
8.5	733.7	2.00	64		
10.5	731.7	2.00	100		
13.0	729.2	2.50	100		
15.5	726.7	2.50	100		
18.0	724.2	2.50	100		
20.5	721.7	2.50	100		
23.0	719.2	2.50	100		
28.0	714.2	5.00	100		
33.0	709.2	5.00	100		
38.0	704.2	5.00	100		
43.0	699.2	5.00	100		
48.0	694.2	5.00	100		
53.0	689.2	5.00	100		
58.0	684.2	5.00	100		
63.0	679.2	5.00	100		
68.0	674.2	5.00	100		
73.0	669.2	5.00	100		
78.0	664.2	5.00	100		
83.0	659.2	5.00	100		
88.0	654.2	5.00	100		
93.0	649.2	5.00	100		
98.0	644.2	5.00	100		
100.0	642.2	2.00	100	7.00	R

Global Site Class Definition: Substructures 1 through 5

N (bar):	66	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	97	(Blows/ft.)	Soil Site Class C
s_u (bar):	4.17	(ksf)	Soil Site Class C <----Controls

FOR INFORMATION ONLY

EXHIBIT G

ILLINOIS STATE GEOLOGICAL SURVEY MINE MAP

ILLINOIS STATE GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

For further information contact:
Prairie Research Institute
Illinois State Geological Survey
University of Illinois at Urbana-Champaign
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 333-4747
http://www.isgs.illinois.edu

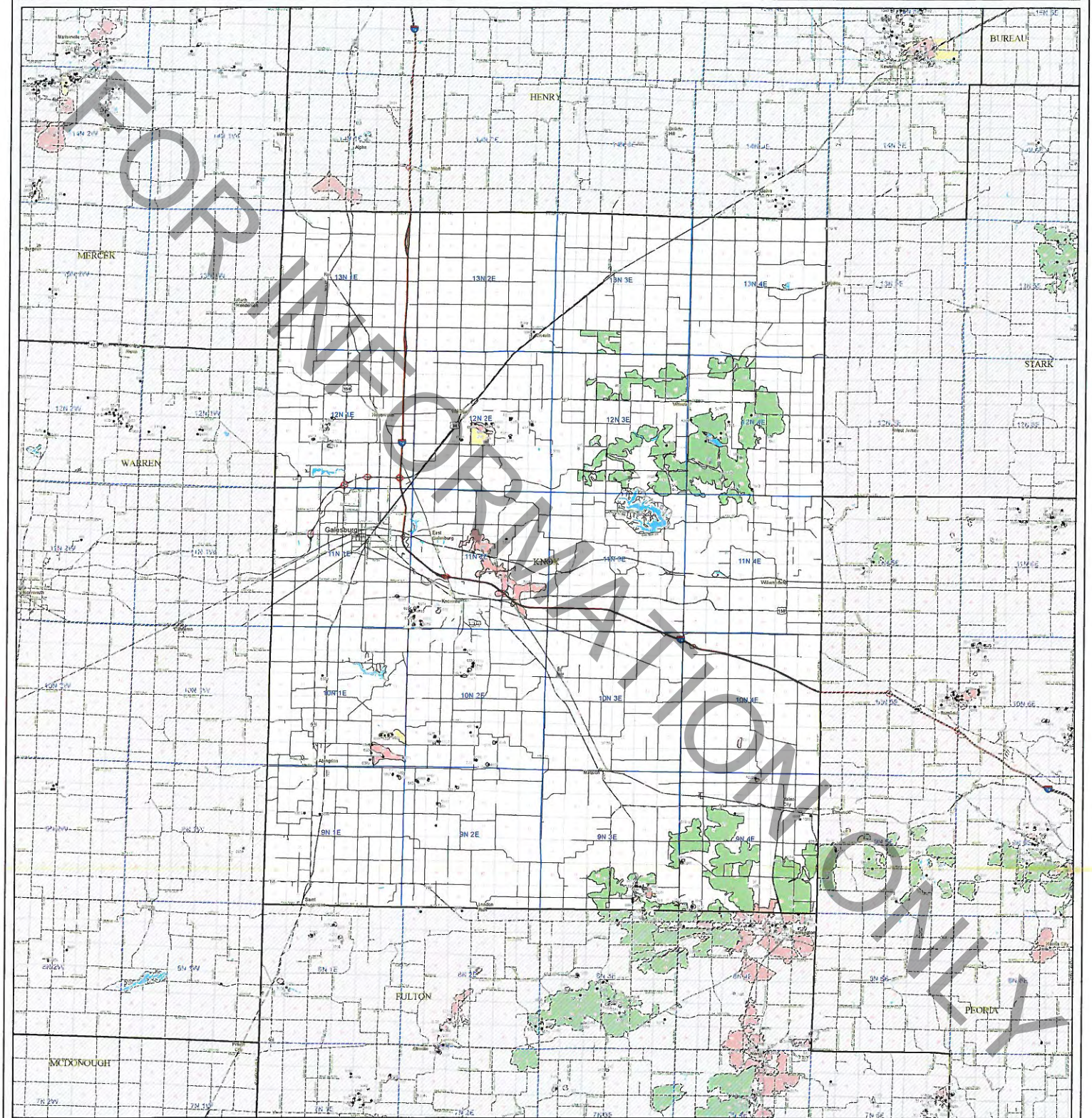
Coal Mines and Underground Industrial Mines
KNOX
County

County Coal Map Series
ISGS Coal Section
Map contribution: Aug 9, 2012

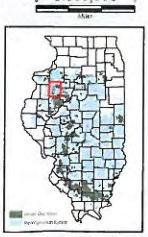
This product is under review and may not meet the standards of the Illinois State Geological Survey.

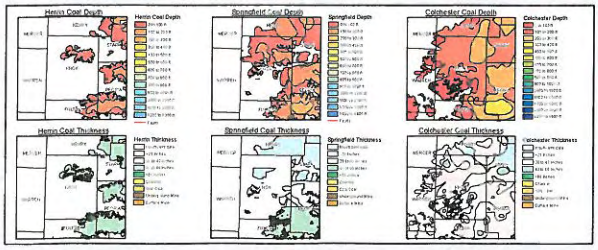
County coal maps and select quadrangle maps available as downloadable PDF files at http://www.isgs.illinois.edu/maps-data-pub/coal-mapsand-county-index.shtml

FOR INFORMATION ONLY



1:100,000
Map





County
Township
Section
Quadrangle study - Available on Website
Lake or river
Coal mine - active
Underground coal mine - abandoned
Surface coal mine - abandoned
Indefinite underground coal mine boundary - abandoned
Underground industrial mine and surrounding buffer region
Coal mine index number (polygon label, point label)

Opening type unknown
Uncertain location
Active surface pipple
Abandoned surface pipple
Active shaft
Abandoned shaft
Active slope
Abandoned slope
Active drift
Abandoned drift
Underground industrial mine entrance or prompt location

Map Explanation

This map accompanies the coal mines directory for this county. Please consult the directory for an explanation of the coal mine information shown on this map. Buffer regions for industrial mines were interpolated into this map due to limited information regarding these mines. The size of the buffer region is dependent on the uncertainty or inaccuracy of the mine location. For more information regarding individual mineral mines please contact the ISGS Industrial Minerals Section.

The maps and digital files used for this study were compiled from data obtained from a variety of public and private sources and have varying degrees of completeness and accuracy. They present reasonable interpretations of the geology of the area and are based on available data. These data were compiled and digitized at a scale of 1:62,500. Locations of some features may be offset by 500 feet or more due to errors in the original source maps, the interpolation process, digitizing, or a combination of these factors.

These data are not intended for use in site-specific screening or decision-making. Data included in this map are suitable for use at a scale of 1:100,000.

Disclaimer

The Illinois State Geological Survey and the University of Illinois make no guarantee, expressed or implied, regarding the correctness of the interpretations presented in this data set and accept no liability for the consequences of decisions made by others on the basis of the information presented here.

© 2012 Board of Trustees of the University of Illinois. All rights reserved.

FOR INFORMATION ONLY

EXHIBIT H

IDOT METHOD PILE LENGTH/PILE TYPE ANALYSIS

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 763.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 758.20 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ======== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) === 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 2549 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 65.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 312.90 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 117.34 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	**564** KIPS	**310** KIPS	**36** 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.)
745.60	12.60	1.00	8		42.1		109.7	62.4		***69.7***	70	0	0	38	18
743.60	2.00	3.50	16		16.1	67.6	166.4	23.9	7.3	***98.0***	98	0	0	54	20
741.10	2.50		42	Hard Till	5.8	108.2	283.0	8.6	11.7	***118.5***	119	0	0	65	22
738.60	2.50		85	Hard Till	18.7	219.0	309.4	27.7	23.6	***147.0***	147	0	0	81	25
736.10	2.50		88	Hard Till	19.9	226.7	329.3	29.5	24.4	***176.6***	177	0	0	97	27
733.60	2.50		88	Hard Till	19.9	226.7	282.2	29.5	24.4	***198.9***	199	0	0	109	30
732.10	1.50		62	Hard Till	6.4	159.7	300.6	9.5	17.2	***209.7***	210	0	0	115	31
731.85	0.25			Shale	14.6	171.8	315.2	21.7	18.5	***231.4***	231	0	0	127	31.4
731.60	0.25			Shale	14.6	171.8	329.9	21.7	18.5	***253.1***	253	0	0	139	31.6
731.35	0.25			Shale	14.6	171.8	344.5	21.7	18.5	***274.8***	275	0	0	151	31.9
731.10	0.25			Shale	14.6	171.8	359.1	21.7	18.5	***296.6***	297	0	0	163	32.1
730.85	0.25			Shale	14.6	171.8	373.8	21.7	18.5	***318.3***	318	0	0	175	32.4
730.60	0.25			Shale	14.6	171.8	388.4	21.7	18.5	***340.0***	340	0	0	187	32.6
730.35	0.25			Shale	14.6	171.8	403.0	21.7	18.5	***361.7***	362	0	0	199	32.9
730.10	0.25			Shale	14.6	171.8	417.7	21.7	18.5	***383.4***	383	0	0	211	33.1
729.85	0.25			Shale	14.6	171.8	432.3	21.7	18.5	***405.2***	405	0	0	223	33.4
729.60	0.25			Shale	14.6	171.8	446.9	21.7	18.5	***426.9***	427	0	0	235	33.6
729.35	0.25			Shale	14.6	171.8	461.6	21.7	18.5	***448.6***	449	0	0	247	33.9
729.10	0.25			Shale	14.6	171.8	476.2	21.7	18.5	***470.3***	470	0	0	259	34.1
728.85	0.25			Shale	14.6	171.8	***490.9***	21.7	18.5	492.1	491	0	0	270	34.4
728.60	0.25			Shale	14.6	171.8	***505.5***	21.7	18.5	513.8	505	0	0	278	34.6
728.35	0.25			Shale	14.6	171.8	***520.1***	21.7	18.5	535.5	520	0	0	286	34.9
728.10	0.25			Shale	14.6	171.8	***534.8***	21.7	18.5	557.2	535	0	0	294	35.1
727.85	0.25			Shale	14.6	171.8	***549.4***	21.7	18.5	578.9	549	0	0	302	35.4
727.60	0.25			Shale	14.6	171.8	***564.0***	21.7	18.5	600.7	564	0	0	310	35.6
727.35	0.25			Shale	14.6	171.8	***578.7***	21.7	18.5	622.4	~~579~~	~~0~~	~~0~~	~~318~~	~~35.9~~
727.10	0.25			Shale	14.6	171.8	***593.3***	21.7	18.5	644.1	~~593~~	~~0~~	~~0~~	~~326~~	~~36.1~~
726.85	0.25			Shale	14.6	171.8	***608.0***	21.7	18.5	665.8	~~608~~	~~0~~	~~0~~	~~334~~	~~36.4~~
726.60	0.25			Shale	14.6	171.8	***622.6***	21.7	18.5	687.6	~~623~~	~~0~~	~~0~~	~~342~~	~~36.6~~
726.35	0.25			Shale	14.6	171.8	***637.2***	21.7	18.5	709.3	~~637~~	~~0~~	~~0~~	~~350~~	~~36.9~~
726.10	0.25			Shale	14.6	171.8	***651.9***	21.7	18.5	731.0	~~652~~	~~0~~	~~0~~	~~359~~	~~37.1~~
725.85	0.25			Shale	14.6	171.8	***666.5***	21.7	18.5	752.7	~~667~~	~~0~~	~~0~~	~~367~~	~~37.4~~
725.60	0.25			Shale	14.6	171.8	***681.1***	21.7	18.5	774.4	~~681~~	~~0~~	~~0~~	~~375~~	~~37.6~~
725.35	0.25			Shale	14.6	171.8	***695.8***	21.7	18.5	796.2	~~696~~	~~0~~	~~0~~	~~383~~	~~37.9~~
725.10	0.25			Shale	14.6	171.8	***710.4***	21.7	18.5	817.9	~~710~~	~~0~~	~~0~~	~~391~~	~~38.1~~
724.85	0.25			Shale	14.6	171.8	***725.1***	21.7	18.5	839.6	~~725~~	~~0~~	~~0~~	~~399~~	~~38.4~~
724.60	0.25			Shale		171.8			18.5						

FOR INFORMATION ONLY

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== B-6
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 764.90 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DR 759.90 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ======== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) === 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ======== 2549 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)=== 65.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 312.90 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 117.34 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
578 KIPS	**554** KIPS	**305** KIPS	**34** 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	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.)
753.80	6.10	1.00	8		20.4		43.6	30.2		***32.7***	33	0	0	18	11
751.30	2.50	1.20	5		9.6	23.2	60.9	14.3	2.5	***47.9***	48	0	0	26	14
748.80	2.50	1.60	7		11.8	30.9	70.8	17.5	3.3	***65.2***	65	0	0	36	16
746.30	2.50	1.50	7		11.3	29.0	***68.6***	16.8	3.1	80.5	69	0	0	38	19
743.80	2.50	0.80	4		6.9	15.5	96.8	10.3	1.7	***93.1***	93	0	0	51	21
742.30	1.50	1.90	9		7.9	36.7	127.9	11.8	4.0	***107.4***	107	0	0	59	23
738.80	3.50	3.10	28		25.8	59.9	287.0	38.2	6.5	***160.0***	160	0	0	88	26
736.30	2.50		75	Hard Till	14.8	193.2	263.2	22.0	20.8	***177.8***	178	0	0	98	29
735.30	1.00		60	Hard Till	4.0	154.6	284.4	6.0	16.7	***185.7***	186	0	0	102	30
734.80	0.50			Shale	29.3	171.8	313.7	43.4	18.5	***229.1***	229	0	0	126	30.1
734.30	0.50			Shale	29.3	171.8	342.9	43.4	18.5	***272.5***	273	0	0	150	30.6
733.80	0.50			Shale	29.3	171.8	372.2	43.4	18.5	***316.0***	316	0	0	174	31.1
733.30	0.50			Shale	29.3	171.8	401.5	43.4	18.5	***359.4***	359	0	0	198	31.6
732.80	0.50			Shale	29.3	171.8	430.8	43.4	18.5	***402.9***	403	0	0	222	32.1
732.55	0.25			Shale	14.6	171.8	445.4	21.7	18.5	***424.6***	425	0	0	234	32.4
732.30	0.25			Shale	14.6	171.8	460.0	21.7	18.5	***446.3***	446	0	0	245	32.6
732.05	0.25			Shale	14.6	171.8	474.7	21.7	18.5	***468.0***	468	0	0	257	32.9
731.80	0.25			Shale	14.6	171.8	***489.3***	21.7	18.5	489.8	489	0	0	269	33.1
731.70	0.10			Shale	5.9	171.8	***495.2***	8.7	18.5	498.5	495	0	0	272	33.2
731.60	0.10			Shale	5.9	171.8	***501.0***	8.7	18.5	507.1	501	0	0	276	33.3
731.50	0.10			Shale	5.9	171.8	***506.9***	8.7	18.5	515.8	507	0	0	279	33.4
731.40	0.10			Shale	5.9	171.8	***512.7***	8.7	18.5	524.5	513	0	0	282	33.5
731.30	0.10			Shale	5.9	171.8	***518.6***	8.7	18.5	533.2	519	0	0	285	33.6
731.20	0.10			Shale	5.9	171.8	***524.4***	8.7	18.5	541.9	524	0	0	288	33.7
730.70	0.50			Shale	29.3	171.8	***553.7***	43.4	18.5	585.3	554	0	0	305	34.2
730.20	0.50			Shale	29.3	171.8	***583.0***	43.4	18.5	628.8	~~583~~	~~0~~	~~0~~	~~321~~	~~34.7~~
729.70	0.50			Shale	29.3	171.8	***612.3***	43.4	18.5	672.2	~~612~~	~~0~~	~~0~~	~~337~~	~~35.2~~
729.20	0.50			Shale	29.3	171.8	***641.5***	43.4	18.5	715.7	~~642~~	~~0~~	~~0~~	~~353~~	~~35.7~~
728.70	0.50			Shale	29.3	171.8	***670.8***	43.4	18.5	759.1	~~671~~	~~0~~	~~0~~	~~369~~	~~36.2~~
728.20	0.50			Shale	29.3	171.8	***700.1***	43.4	18.5	802.6	~~700~~	~~0~~	~~0~~	~~385~~	~~36.7~~
727.70	0.50			Shale	29.3	171.8	***729.4***	43.4	18.5	846.0	~~729~~	~~0~~	~~0~~	~~401~~	~~37.2~~
727.20	0.50			Shale	29.3	171.8	***758.6***	43.4	18.5	889.5	~~759~~	~~0~~	~~0~~	~~417~~	~~37.7~~
726.70	0.50			Shale	29.3	171.8	***787.9***	43.4	18.5	932.9	~~788~~	~~0~~	~~0~~	~~433~~	~~38.2~~
726.20	0.50			Shale	29.3	171.8	***645.4***	43.4	18.5	957.8	~~645~~	~~0~~	~~0~~	~~355~~	~~38.7~~
725.70	0.50					0.0			0.0						

FOR INFORMATION ONLY