STRUCTURE GEOTECHNICAL REPORT
US ROUTE 34 BRIDGE OVER INDIAN CREEK
F.A.P RT. 37, SECTION 10BR-1
EXISTING SN 037-0054, PROPOSED SN 037-0181
PTB 158 ITEM 016, IDOT JOB P-92-067-11
HENRY COUNTY, ILLINOIS

for

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10. Abstract

A new three-span bridge structure with integral abutments on driven piles will replace the US 34 Bridge over Indian Creek. This report provides geotechnical recommendations for the design of proposed bridge foundations.

Near the surface, foundation soils include medium stiff to very stiff silty loam to silty clay loam. Beneath the cohesive soil is medium dense to very dense weathered shale followed by poor to good shale. We applied 90% reductions to the predicted design scour depths at the piers due to shale deposit. The site classifies in the Seismic Class C.

Global stability analyses show suitable factors of safety for the 1:2 (V:H) end slope. We do not anticipate embankment settlement since there is no change in grade elevation.

The existing piers will be incorporated into the design and will support the new superstructure. The existing superstructure and abutments to be removed and replaced. The abutments are to be riprap protected. Negative skin friction allowances are not required. The abutment’s substructures could be supported on HP12x53 or HP14x73 steel H-piles. Tables are provided with a variety of factored loads for each pile size. We provide geotechnical parameters for pile analysis under lateral loads.

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FOR
STRAND ASSOCIATES, INC.

1.0 INTRODUCTION

This report presents the results of subsurface investigation, laboratory testing, and geotechnical evaluations for the proposed replacement of the US Route 34 (FAP 37) Bridge over Indian Creek in Henry County, Illinois.

1.1 Proposed Structure

Wang Engineering, Inc. (Wang) understands Strand Associates, Inc. (Strand) envisions a new three-span structure with integral abutments supported on driven piles. A revised preliminary type, size, and location (TSL) drawing provided by Strand on August 5, 2013 indicates the bridge will have a back-to-back abutment length of 175.9 feet (Station 687+65.52 to Station 689+41.42); the out-to-out deck width will measure 35.17 feet. The span length will be 63.67 feet at the center and 54.00 feet at both ends. The profile grade elevations will remain the same. Based on the revised TSL, Wang understands the existing superstructure and abutments will be removed and replaced, the existing piers will be used to support new superstructure, and the traffic will be detoured during the construction of the bridge.

The purpose of our investigation was to characterize the site soil and groundwater conditions, perform geotechnical analyses, and provide recommendations for the design and construction of the new bridge abutment foundations.

1.2 Existing Structure

The original US 34 Bridge over Indian Creek was built in 1960 as a three-span reinforced concrete arched girder (T-beams) superstructure. The substructure consists of two reinforced concrete solid wall piers (spread footings founded on rock) and two reinforced concrete closed abutments (founded on steel H battered piles). The back-to-back abutment length is 167 feet and the out-to out deck width is

35.67 feet. In 1988, the structure received deck repairs consisting of a 2.5-inch thick plasticized concrete wearing surface and thrie beam rail installed.

2.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The project area is located in southeast Henry County, 3.5 mile south of the City of Kewanee. On the USGS "*Kewanee South Quadrangle 7.5 Minute Series*" map, the bridge is located in the SE ¼ of Section 28, Tier 14 North, Range 5 East of the Forth Principal Meridian. A *Site Location Map* is presented as Exhibit 1.

The following review of the published geologic data, with emphasis on factors that might influence the design and construction of the proposed engineering works, is meant to place the project area within a geological framework and, thus, to confirm the dependability and consistency of the present subsurface investigation results and identify geological features that may influence the design and construction of the bridge. For the study of the regional geologic framework, Wang considered the northwestern Illinois area in general and Henry County in particular. Exhibit 2 illustrates the *Site and Regional Geology*.

2.1 Physiography

Indian Creek is approximately 25-foot wide as it passes US 34 to meet the Spoon River approximately 14 miles south from the job site. At the bridge site, Indian Creek run southward through a well-defined channel along the west limits of its floodplain approximately 800-foot wide. Along the US 34 the general elevation is approximately 750 feet. The Indian Creek water surface approximate elevation at the bridge site is 725 feet.

2.2 Surficial Cover

Quaternary glacigenic deposits unconformably overlie the Paleozoic bedrock. The Illinois Episode glaciation, advancing from east into Henry County, covered the entire county and left behind up to 50-foot thick pebbly silty clay diamicton of the Glasford Formation covering the bedrock. During Wisconsin Episode (from 60,000 to 12,000 years BP) approximately 20-foot thick windblown soil of the Peoria Silt covered most of the southeastern Henry County. The Cahokia Formation alluvium deposited on the floodplains by present-day streams, up to 20 feet sediments ranging in grain size from clay and silt to pebbly sand (Anderson and Miao 2011). At the bridge site, the surficial cover ranges from 15 to 30 feet in thickness (Anderson and Miao 2011).

2.3 Bedrock

The uppermost section of the bedrock in the project area consists of Pennsyivanian-age shale. The bedrock is made out of layered shale, sandstone, siltstone and coal. In the project area, the bedrock top lies at around 720 feet elevation, about 15 to 30 feet below ground surface (bgs).

2.4 Mining Activity

No underground mines are known in this area. The nearest coal mine is located about 3 miles southwest, in the vicinity of Lafayette, Stark County. Another coal mines are located about 4.5 miles west, in the vicinity of Galva, Henry County.

3.0 METHODS OF INVESTIGATION

The following section outlines the subsurface and laboratory investigations performed by IDOT and a site visit conducted by Wang.

3.1 Subsurface Investigation

The subsurface investigation was performed by IDOT District Two in February 2012. The investigation consisted of three structure borings, designated as B-1 through B-3. The station, offset, and elevation are shown in the *IDOT Boring Logs* (Appendix A). Boring B-1 was drilled behind the existing east abutment from elevation 751.7 feet to a depth of 46.5 feet bgs. Boring B-2 was drilled behind the existing west abutment from elevation 752.43 feet to a depth of 39.0 feet bgs. Boring B-3 was drilled along the Indian creek (south of the bridge) from elevation 734.1 to depth of 29.0 feet bgs.

The as-drilled boring locations are shown in the Boring Location Plan (Exhibit 3-A and 3-B). The boring locations were estimated based on correlation between the existing structures stationing and the proposed structure stationing which were provide to us by Strand.

Soils were sampled at 2.5 foot intervals to the termination depths. In Borings B-2 and B-3, soils were sampled to spoon or auger refusal. Upon reaching auger refusal, two 5-foot run bedrock cores were collected from each borings.

IDOT soil boring logs included visual-manual soil classification, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of standard penetration tests (SPT) recorded as blows per 6 inches of penetration. IDOT rock coring logs include percentage recovery, Rock Quality Designation (RQD), coring time, and uniaxial compressive strength test results. Groundwater observations were made in Borings B-1 and B-3 during drilling operation.

3.2 Laboratory Testing

The boring logs show moisture content results on cohesive soil samples and compressive strengths test results on selected rock cores. Soils are classified according to the IDH Soil Classification System. Laboratory test results are shown in Boring Logs (Appendix A).

3.3 Site Visit

Wang visited the site on April 1, 2013. Generally, the abutments and piers are in a good condition, as mentioned in Bridge Condition Report dated July 13, 2011. We noticed the concrete slope wall at the west abutment has been undermined and is failing. Also, sewer drainage running along south side parallel to the roadway towards west abutment is in bad condition. We found a cored pavement structure that we estimate coming from the drilling activity performed by IDOT. Some pictures taken during site visit are shown in the site visit photographs (Appendix B)

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented on the attached boring logs (Appendix A) and in the *Soil Profile* (Exhibit 4). Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical directions.

4.1 Soil Conditions

In descending order, the general lithologic succession encountered at the project site includes: 1) very soft to very stiff silty loam to silty clay loam; 2) medium dense to very dense weathered shale; and 3) poor to good shale.

1) Very Soft to Very Stiff Silty Loam to Silty Clay Loam

Near ground surface, the borings revealed 14.5 to 34.5 feet of very soft to very stiff, brown, gray, and black silty clay to silty clay loam. The loamy layer has unconfined compressive strength (Qu) values of 0.2 to 3.7 tsf, averaging 1.5 tsf and moisture content (MC) values from 16 to 29% with an average of 21%. Interbedded granular soil consisted of very loose to loose, fine to medium sand was encountered in Boring B-1 between 22.0 and 32.0 feet bgs. The sand layer has N-values of 1 to 8 blows/foot with an average of 5 blows/foot.

2) Medium Dense to Very Dense Weathered Shale

Underneath the loamy layer, the borings encountered up to 12 feet of gray weathered shale. The top of weathered shale lies between 717.20 and 732.93 feet elevation. The weathered shale has N-values of 16 to more than 100 blows/foot.

3) Poor to Good Shale

Shale was encountered at 19.0 to 29.0 feet bgs (715.1 to 723.4 feet elevation). The shale consists of poor to good quality, gray shale. Rock recovery ranged between 66% and 100% with RQD ranging between 32 and 80%. Compressive strength values determined on core samples collected from Borings B-2 and B-3 range from 139 to 376 tsf.

4.2 Groundwater Conditions

Groundwater was encountered while drilling between elevations 721.6 and 726.7 feet (12.5 to 25.0 feet bgs). At the completion of drilling, no groundwater was recorded in the boring logs.

4.3 Scour Considerations

The TSL plan shows a design high water elevation (DHWE) at 738.50 feet, an estimated water surface elevation (EWSE) at 726.98 feet, and a streambed elevation at 724.0 feet. Both the abutment foundations and piers foundations are shown in the TSL plan with stone riprap reinforcement for scour protection. However, riprap reinforcement is no longer considered appropriate scour protection at pier foundations (IDOT, 2012). At open abutments protected with riprap, design scour is typically set at the bottom of the abutment (IDOT 2012). The streambed boring (B-3) encountered weathered shale below the proposed footings and a 90% reduction to the pier scour estimate was applied within this layer. The design scour elevation table is included as Table 1.

Table 1: Design Scour Elevations

	Design Scour Elevation (ft.)			
	West Abutment	Pier 1	Pier 2	East Abutment
Q100	745.05	724.6	718.78	744.07
Q500	745.05	723.6	717.78	744.07

4.4 Seismic Design Considerations

The soils within the top 100 feet have a weighted average N-value of 74 blows/foot based on AASHTO (2012) Method C; the site classifies in Seismic Site Class C. The project location also belongs to Seismic Performance Zone 1. The seismic spectral acceleration parameters recommended for design in accordance with the AASHTO *LRFD Bridge Design Specifications* are summarized in Table 2 (AASHTO, 2012).

Table 2: Seismic Design Parameters

Spectral Acceleration Period (sec)	Spectral Acceleration Coefficient[1)] (% g)	Site Factors	Design Spectrum for Site Class C[2)] (% g)
0.0	PGA= 4.1	F_{pga}= 1.2	**A_s= 4.9**
0.2	S_s= 9.4	F_a= 1.2	**S_{DS}= 11.3**
1.0	S_1= 4.1	F_v= 1.7	**S_{D1}= 6.9**

1) Spectral acceleration coefficients based on Site Class C

2) Site Class C Spectrum to be included on plans; $A_s = PGA*F_{pga}$; $S_{DS}= S_s*F_a$; $S_{D1}= S_1*F_v$

5.0 FOUNDATION ANALYSIS AND RECOMMENDATIONS

The geotechnical evaluations and recommendations for abutment and pier foundations are included in the following sections. Wang estimates the proposed pile-supported integral abutment shown in the TSL plan provided by Strand, shown as Exhibit 5, are the most appropriate foundation types. The integral abutments should consist of single row of vertical Metal Shell Piles (MSP) or steel H-piles (IDOT 2012). Based on Boring B-3, top of weathered bedrock is 4 to 5 feet below the streambed elevation and top of bedrock is 9 feet below the streambed elevation.

5.1 Approach Embankments and Slabs

We have performed settlement and global stability analyses for the approach embankments.

5.1.1 Settlement

It is understood that the roadway profile grade will remain the same. No additional fill will be required at the abutment locations and therefore we do not anticipate any settlement of a new approach pavements and embankments.

5.1.2 Global Stability

The end slope for the proposed approach embankments shown in the TSL plan are anticipated at 1:2 (V:H). With the presence of very loose to loose sand between approximately 719.7 and 729.7 feet at the east embankment, we focused our evaluations at this critical condition.

The global stability of the east embankment slopes were analyzed based on the subsurface soil and groundwater conditions encountered in the borings and the information provided in the TSL plan. Slope stability analyses were performed with *Slide* v.5.0 and the slope stability evaluation exhibits are shown in Appendix C. The minimum required factor of safety (FOS) for both short-term and long-term conditions is 1.5 (IDOT, 1999). In the undrained (short-term) soil condition, Wang estimates the side slopes have a minimum FOS of 2. (Appendix C-1) and in the drained (long-term) soil condition, Wang estimates the side slopes have a FOS of 1.5 (Appendix C-2)

5.2 Foundation Recommendations

It is understood the existing superstructure and abutments will be removed and replace whereas the existing piers will be re-used to support the new superstructure. Therefore, the recommendations for driven pile foundations presented in Section 5.2.1 are only for abutments.

5.2.1 Driven Pile Foundations

Wang recommends the abutments be supported on steel H-piles. Metal Shell Piles (MSP) is not recommended due to shallow bedrock encountered near the abutments. IDOT specifies the maximum nominal required bearing (R_{NMAX}) for each pile and states the factored resistance available (R_F) for a steel H-pile should be based on a geotechnical resistance factor (Φ_G) of 0.55 (IDOT 2012). Nominal tip and side resistance were estimated using the methods and empirical equations presented in *AGMU Memorandum 10.2 – Geotechnical Pile Design* (IDOT, 2011). Based on data provided by Strand, the total preliminary factored load for abutment is 834 kips per abutment and the total preliminary factored load for pier is 1850 kips per pier. These loads are preliminary loading that is subject to refinement during final design. Due to anticipated pile spacing variations, we performed evaluations for a range of H-pile sizes and nominal and factored loads. The R_F, R_N, estimated pile tip elevations, and pile lengths for HP12x53 and HP14x73 steel H-piles are summarized in Tables 3 (HP12x53) and 4 (HP14x73). Soil boring performed near west abutments (Boring B-2) encountered bedrock at 723.4 feet elevation. Weathered shale was encountered in soil boring performed near east abutment (Boring B-1) at 717.2 feet elevation. Due to shallow bedrock at west abutment, we recommend the pile be driven to bedrock. The lengths shown in the tables include a 2-foot pile embedment into the abutments as per the preliminary TSL.

The R_F estimates are governed by the relationship $R_F = \phi_G R_N - \phi_G(DD_R+S_C+L_{iq})I_G - (\gamma_p)(\lambda_{IS})DD_L$ (IDOT 2012). Due to no additional fill at the abutment, we estimate the residual settlement at the completion of construction will be less than 0.4-inch. Therefore, we do not recommend negative skin friction allowances or precoring of the existing foundation soils for the abutment piles. No scour loss anticipated at the abutments.

Table 3: Estimated Pile Lengths and Tip Elevations for HP12x53 Steel H-Piles

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss, $(DD+S_c+L_{iq})$ (kips)	Factored Geotechnical Loss Load, (DD only) (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
East Abutment (B-1)	744.07	182	0.0	0.0	100	32	714.07
		218	0.0	0.0	120	34	712.07
		256	0.0	0.0	140	35	711.07
		291	0.0	0.0	160	36	710.07
		327	0.0	0.0	180	37	709.07
		364	0.0	0.0	200	38	708.07
		400	0.0	0.0	220	39	707.07
		418	0.0	0.0	230	39	707.07
West Abutment (B-2)	745.05	182	0.0	0.0	100	18	729.05
		218	0.0	0.0	120	19	728.05
		256	0.0	0.0	140	20	727.05
		291	0.0	0.0	160	21	726.05

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss, ($DD+S_c+L_{iq}$) (kips)	Factored Geotechnical Loss Load, (DD only) (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
		327	0.0	0.0	180	22	725.05
		364	0.0	0.0	200	23	724.05
		400	0.0	0.0	220*	24	723.05
		418	0.0	0.0	230*	24.3	722.75

* Factored Resistance Available achieved by driving the pile into the rock

Table 4: Estimated Pile Lengths and Tip Elevations for HP14x73 Steel H-Piles

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss, ($DD+S_c+L_{iq}$) (kips)	Factored Geotechnical Loss Load, (DD only) (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
East Abutment (B-1)	744.07	182	0.0	0.0	100	31	715.07
		218	0.0	0.0	120	32	714.07
		256	0.0	0.0	140	34	712.07
		291	0.0	0.0	160	35	711.07
		327	0.0	0.0	180	36	710.07
		364	0.0	0.0	200	36	710.07
		400	0.0	0.0	220	37	709.07
		436	0.0	0.0	240	38	708.07
		473	0.0	0.0	260	39	707.07
		509	0.0	0.0	280	39	707.07
		546	0.0	0.0	300	40	706.07
		578	0.0	0.0	318	41	705.07

Structure Unit	Pile Cap Base Elevations (feet)	Required Nominal Bearing, R_N (kips)	Factored Geotechnical Loss, $(DD+S_c+L_{iq})$ (kips)	Factored Geotechnical Loss Load, (DD only) (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
West Abutment (B-2)	745.05	182	0.0	0.0	100	17	730.05
		218	0.0	0.0	120	18	729.05
		256	0.0	0.0	140	19	728.05
		291	0.0	0.0	160	19	728.05
		327	0.0	0.0	180	20	727.05
		364	0.00	0.00	200	21	726.05
		400	0.0	0.0	220	22	725.05
		436	0.0	0.0	240	22	725.05
		473	0.0	0.0	260	24	723.05
		509	0.0	0.0	280*	24.1	722.95
		546	0.0	0.0	300*	24.7	722.35
		578	0.0	0.0	318*	25.3	721.75

* Factored Resistance Available achieved by driving the pile into the rock

Lateral loads on all piles should be analyzed for maximum moments and lateral deflections. Recommended lateral soil modulus parameters and soil strain parameters required for analysis via the p-y curve method are included in Table 5 and 6.

Table 5: Recommended Soil Parameters for Lateral Load Pile Analysis at East Abutment (B-1)

Layer Elevation/ Soil Description	Moist Unit Weight, γ_e (lbs/ft^3)	Undrained Shear Strength, c_u (lbs/ft^2)	Friction angle, ϕ (°)	Soil Lateral Modulus Parameter, k (lb/in^3)**	Soil Strain Parameter, ε_{50}
744.07* to 742.20 Silty Clay Loam	120	2100	0	750	0.0059
742.20 to 734.70	120	3500	0	1200	0.0048

Layer Elevation/ Soil Description	Moist Unit Weight, γ_e (lbs/ft^3)	Undrained Shear Strength, c_u (lbs/ft^2)	Friction angle, ϕ (°)	Soil Lateral Modulus Parameter, k (lb/in^3)**	Soil Strain Parameter, ε_{50}
Silty Loam to Silty Clay Loam					
734.70 to 729.70 Silty Loam	120	1150	0	375	0.0080
729.70 to 727.20 Sand	120	--	29	10	--
727.20 to 724.70 Silty Loam	120	1100	0	350	0.0080
724.70 to 719.70 Sand	120	--	29	10	--
719.70 to 717.20 Silty Loam	115	500	0	100	0.0150
717.20 to 714.70 Weathered Shale	130	--	36	140	--
714.70 to 705.2 Weathered Shale	135	--	38	200	--

*Pile Cap Base Elevation.

** Assumed submerged condition for granular soil

Table 6: Recommended Soil Parameters for Lateral Load Pile Analysis at West Abutment (B-2)

Soil Description	Moist Unit Weight, γ_e (lbs/ft^3)	Undrained Shear Strength, c_u (lbs/ft^2)	Friction angle, ϕ (°)	Soil Lateral Modulus Parameter, k (lb/in^3)**	Soil Strain Parameter, ε_{50}
745.05* to 740.43 Silty Loam to Silty Clay Loam	120	2050	0	750	0.0059
740.43 to 737.93 Silty Loam	120	3700	0	1300	0.0046
737.93 to 735.43 Silty Loam	120	1700	0	580	0.0065

Soil Description	Moist Unit Weight, γ_e (lbs/ft^3)	Undrained Shear Strength, c_u (lbs/ft^2)	Friction angle, ϕ (°)	Soil Lateral Modulus Parameter, k (lb/in^3)**	Soil Strain Parameter, ε_{50}
735.43 to 732.93 Silty Clay Loam	115	600	0	140	0.0130
732.93 to 730.43 Weathered Shale	130	--	36	140	--
730.43 to 723.43 Weathered Shale	135	--	38	200	--

*Pile Cap Base Elevation.

** Assumed submerged condition for granular soil

5.2.2 Spread Footings

Wang understands the existing piers will be incorporated into the design and will support the new superstructure. Based on information provided by Strand, Wang understands the piers were investigated for reuse as per ABD Memo 08.1. The results show re-using the existing piers is feasible and has been approved by IDOT BBS. Based on TSL plan, the existing spread footings were founded on bedrock elevations at 720.88 feet for Pier 1 and 713.88 feet for pier 2. The footing can be proportioned using presumptive bearing resistance at the service limit state of 30 kips per square foot (ksf).

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation

All vegetation, surface topsoil, existing pavement, and debris should be cleared and stripped where foundations and structural fills will be placed. The exposed subgrade should be proofrolled. To aid in locating unstable and unsuitable materials, the proofrolling should be observed by a qualified engineer. Any unstable or unsuitable materials should be removed and replaced with compacted structural fill as described in Section 6.3.

6.2 Excavation and Dewatering

Foundation excavations should be performed in accordance with local, State, and federal regulations. The potential effect of ground movements upon nearby utilities should be considered during construction. Water that does accumulate into the open excavations by seepage or runoff should be immediately removed. Wang estimates that the sump/pump method will be enough to maintain a relatively dry working area.

6.3 Filling and Backfilling

Fill material used to attain the final design elevations should be structural fill material. Coarse aggregate of IDOT gradation CA-6 or pre-approved, compacted, cohesive or granular soil conforming to Section 204 would be acceptable as structural fill (IDOT, 2012). The fill material should be free of organic matter and debris and should be placed in lifts and compacted according to IDOT Section 205, *Embankment* (IDOT, 2012).

All backfill materials must be pre-approved by the site engineer. To backfill the abutments we recommend porous granular material, such as crushed stone or crushed gravel that conforms to the gradation requirements specified in IDOT Articles 1004.01 or 1004.05 (IDOT, 2012). Backfill material should be placed and compacted in accordance with the IDOT Section 205, *Embankment* (IDOT, 2009). Estimated design parameters for granular structural backfill materials are presented in Table 7.

Table 7: Estimated Granular Backfill Parameters

Soil Description	Porous Granular Material Backfill
Unit Weight	125 lbs/ft^3
Angle of Effective Internal Friction	32 degrees
Active Earth Pressure Coefficient	0.31
Passive Earth Pressure Coefficient	3.26
At-Rest Earth Pressure Coefficient	0.5

6.4 Earthwork Operations

The required earthwork can be accomplished with conventional construction equipment. Moisture and traffic will cause deterioration of exposed subgrade soils. Precautions should be taken by the contractor to prevent water erosion of the exposed subgrade. A compacted subgrade will minimize water runoff erosion.

Earth moving operations should be scheduled to not coincide with excessive cold or wet weather (early spring, late fall or winter). Any soil allowed to freeze or soften due to the standing water should be removed. Wet weather can cause problems with subgrade compaction.

It is recommended that an experienced geotechnical engineer be retained to inspect the exposed subgrade, monitor earthwork operations, and provide material inspection services during the construction phase of this project.

6.5 Pile Installation

The driven piles shall be furnished and installed according to the requirements of IDOT Section 512, *Piling* (IDOT, 2012). Wang recommends that at a minimum of one test pile be performed at each substructure location. The test piles shall be driven to 110 percent of the nominal required bearing indicated in Section 5.2.1. Since hard driving is expected, the piles should be installed with metal shoes.

6.6 Cofferdam

Existing piers will be used to support new superstructure. Therefore, cofferdam and seal coat will not be necessary for their construction. If the designed decided to remove and replace the existing piers, a temporary soil retention system would be required to construct new spread footings. A temporary sheet piling would not be feasible due to shallow shale encountered below the footing elevation

7.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of the bridge are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

It has been a pleasure to assist Strand Associates, Inc. and the Illinois Department of Transportation on this project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

WANG ENGINEERING, INC.

Andri Kurnia, P.E.
Geotechnical Engineer

Jerry W.H. Wang, Ph.D., P.E.
QA/QC Reviewer

JERRY W. H. WANG
062-034375
REGISTERED
ENGINEER
OF
ILLINOIS

Corina T. Farez, P.E., P.G.
Principal

REFERENCES

AASHTO (2012) *LRFD Bridge Design Specifications*. American Association of State Highway and Transportation Officials, Washington, D.C.

ANDERSON, R.C., AND X. MIAO (2011), Surficial Geology of Henry County, Illinois: Illinois State Geological Survey, Illinois County Geologic Map, ICGM Henry County-SG, 1:62,500, report, 4 p.

HANSEL, A.K., AND JOHNSON, W.H. (1996) Wedron and Mason Groups: Lithostratigraphic Reclassification of the Wisconsin Episode, Lake Michigan Lobe Area: ISGS Bulletin 104: Champaign, Illinois State Geological Survey, 116 p.

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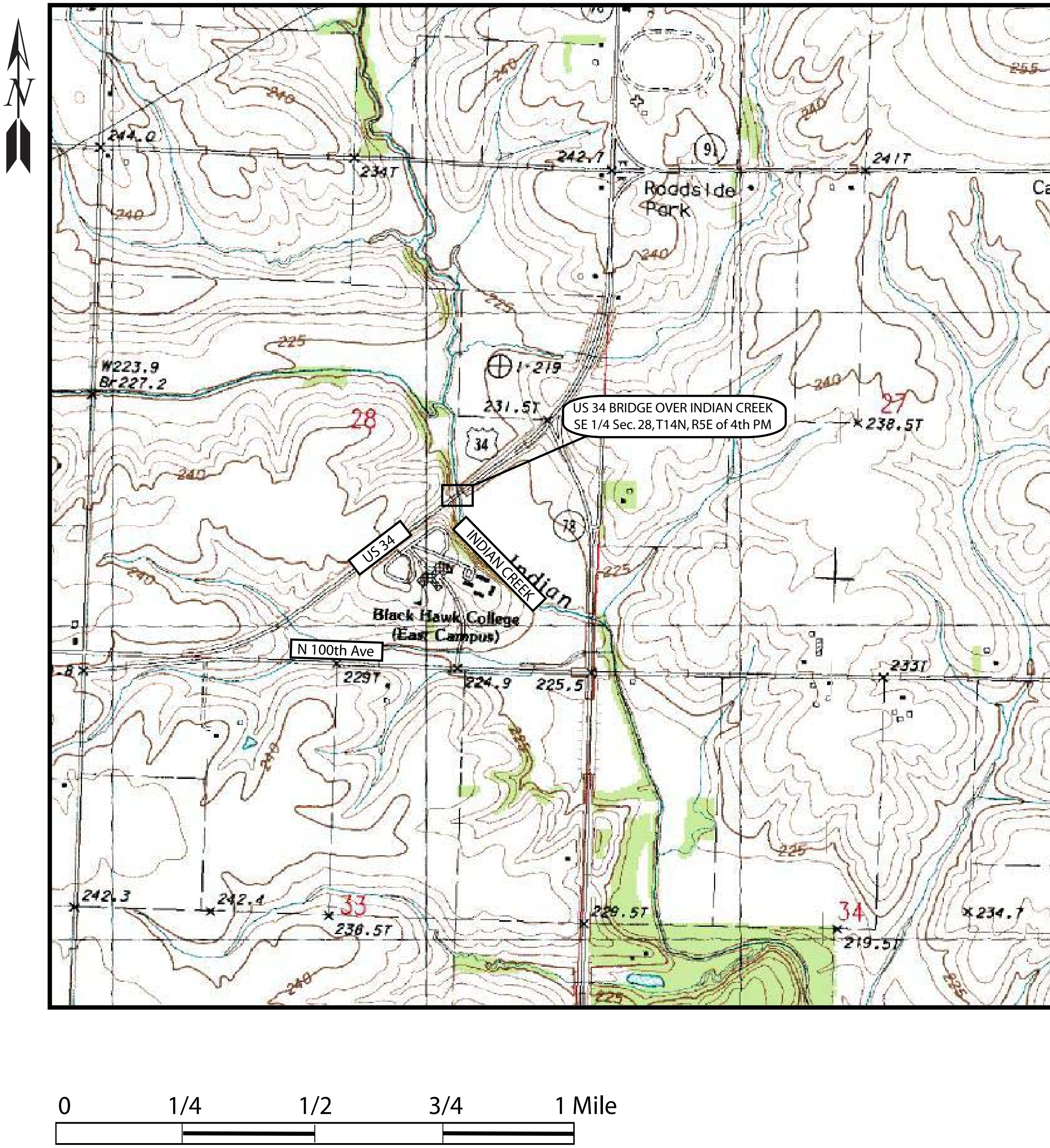
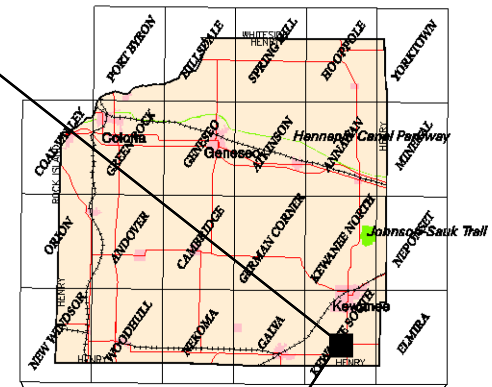
ISGS (2008) *Directory of Coal Mines in Illinois: McDonough County*. Illinois State Geological Survey.

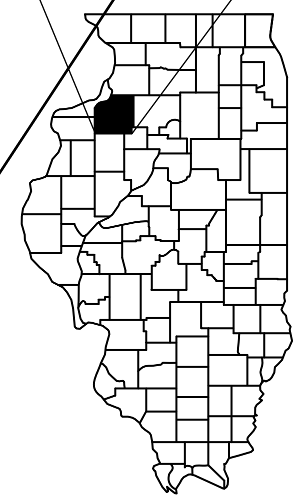
Willman, H.B. (1970) *Pleistocene Stratigraphy of Illinois*. Illinois State Geological Survey, Urbana, 204 pp.

EXHIBITS



Henry County





Illinois

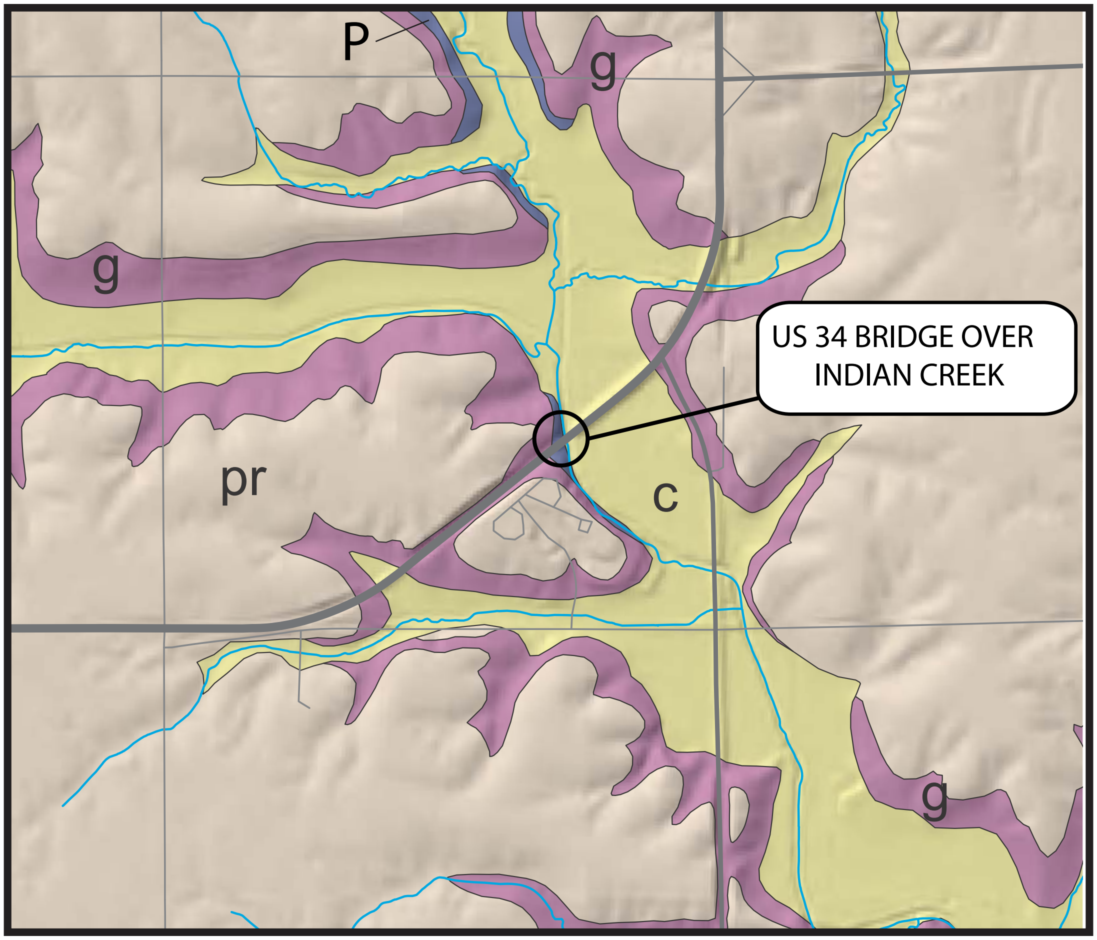
SITE LOCATION MAP: US 34 BRIDGE OVER INDIAN CREEK
IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: R. Gorlagunta CHECKED BY: A. Kurnia

Wang Engineering

1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

FOR STRAND ASSOCIATES, INC. | 195-07-01



Modified after Anderson and Miao (2011)

0 0.25 0.5 0.75 1.0 miles

LEGEND

Post Glacial Deposits

c — **Cahokia Alluvium,**
Deposits in flood plains and channels of modern rivers and streams; yellowish brown to dark gray silt, sand, minor clay and gravel; organic matter in upper few feet.

Glacial Cover

pr — **Peoria Silt,**
Eolian silt (loess), yellowish brown to gray; calcareous except the upper 3 to 6 feet; generally may exceed 20 feet.

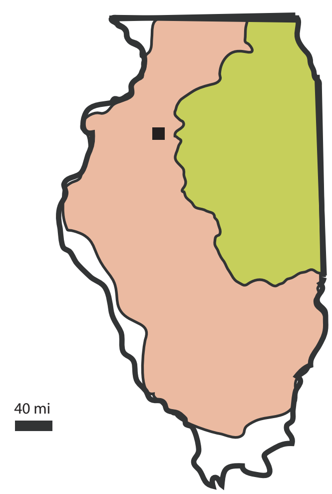
g — **Glasford Formation,**
Glacial diamicton and associated deposits of the Illinois Episode; pebbly, silty, and clayey; may exceed 50 feet in thickness.

Bedrock

P — **Pennsylvanian,**
Bedrock; brown to gray mudstone, siltstone, and shale.

Modified after Anderson and Miao (2011)

REGIONAL GEOLOGY

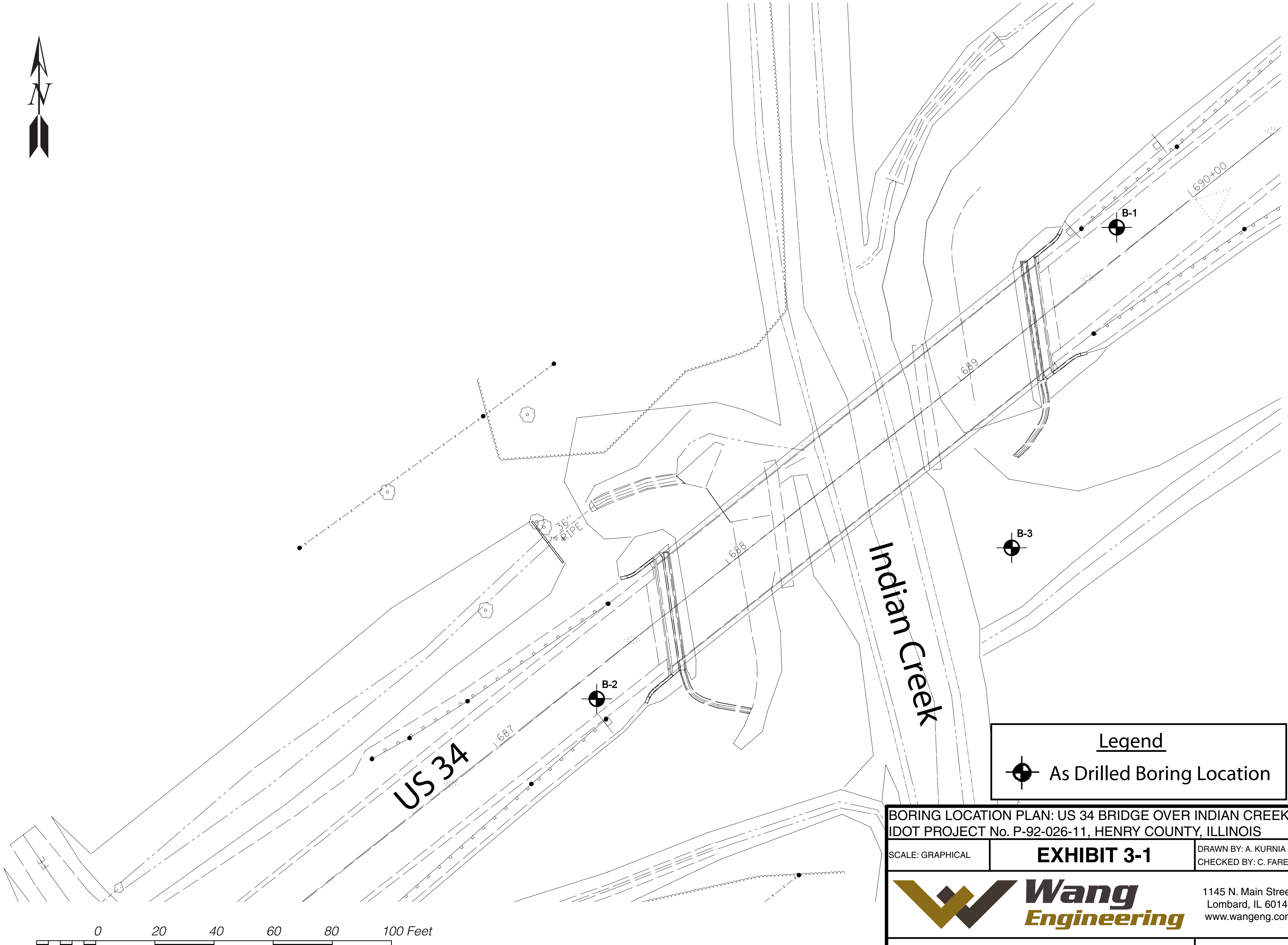


Wisconsinan-age drift (approximate extent)

Illinoian-age drift (Glasford Formation approximate extent)

Modified after Hansel and Johnson (1996)

SITE AND REGIONAL GEOLOGY: US 34 BRIDGE OVER INDIAN CREEK HENRY COUNTY, ILLINOIS		
SCALE: GRAPHICAL	EXHIBIT 2	DRAWN BY: C. Marin CHECKED BY: L. Iordache
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR STRAND ASSOCIATES, INC.		195-07-01



BORING LOCATION PLAN: US 34 BRIDGE OVER INDIAN CREEK
IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 3-1	DRAWN BY: A. KURNIA CHECKED BY: C. FAREZ

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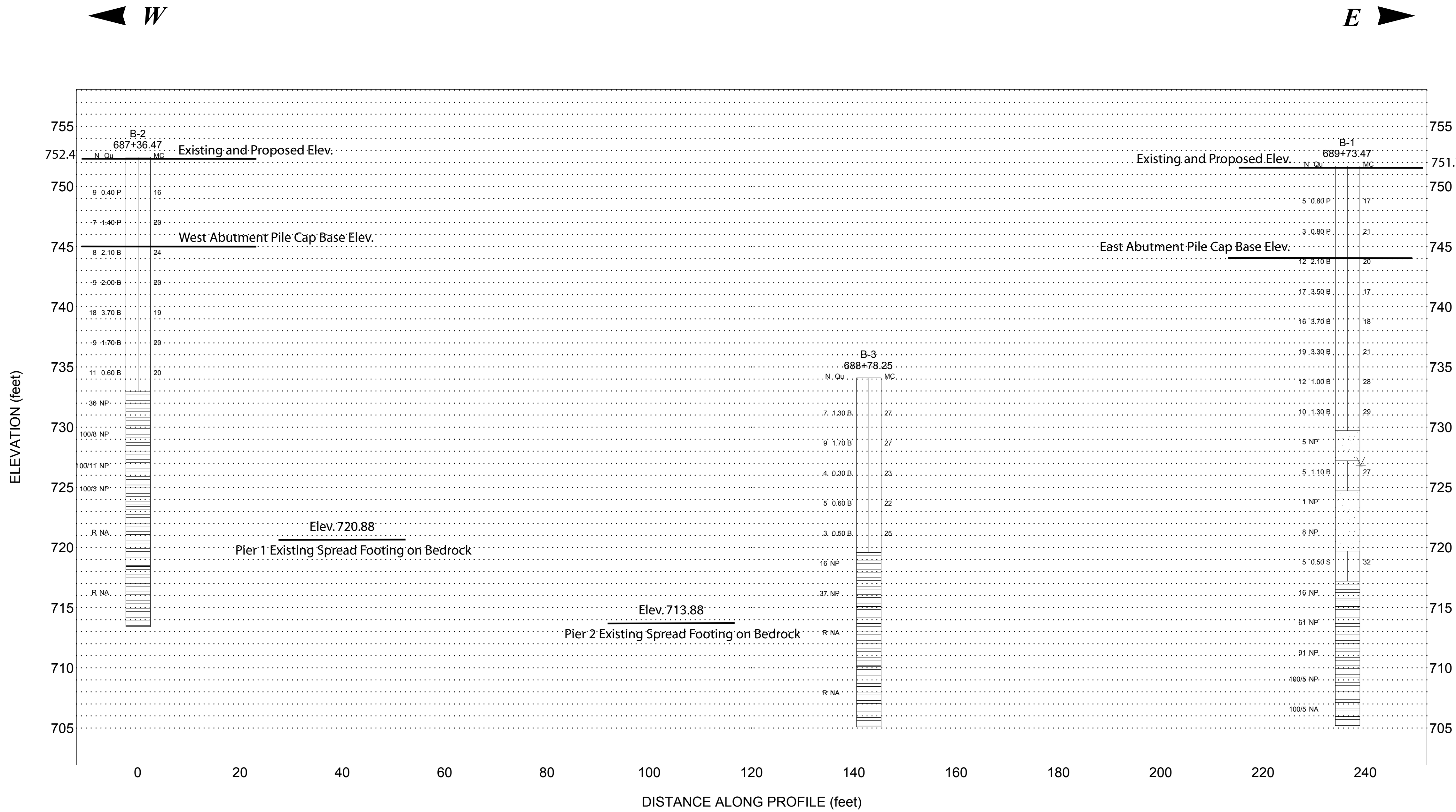
www.wangeng.com

FOR STRAND ASSOCIATES, INC. | 195-07-01

LEGEND

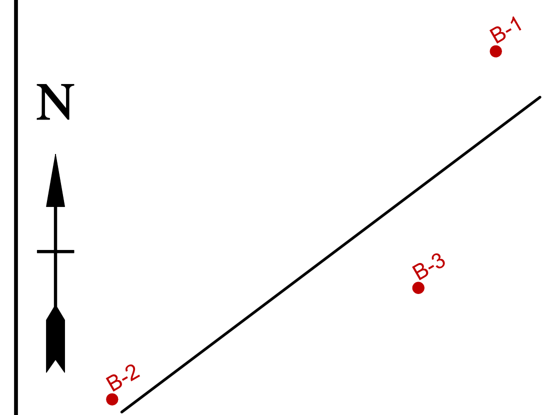
As Drilled Boring Location

BORING LOCATION PLAN: US 34 BRIDGE OVER INDIAN CREEK IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS		
SCALE: SEE SCALE	**EXHIBIT 3-2**	DRAWN BY: A. KURNIA CHECKED BY: C. FAREZ
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR STRAND ASSOCIATES, INC.		**195-07-01**



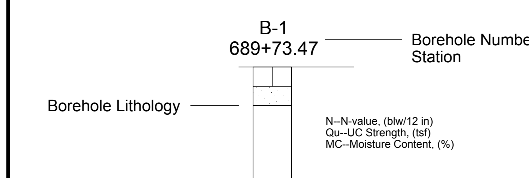
Lithology Graphics

IDH Silt, Silty Loam | IDH Sand, Sandy Loam | Shale



Site Map Scale 1 inch equals 90 feet

Explanation:



▽ Water Level Reading at time of drilling.

▼ Water Level Reading 24-hr after drilling or at end of drilling

Horizontal Scale (feet)

Vertical Exaggeration: 2.5x

Wang Engineering
1145 N Main Street
Lombard, IL 60148

Soil Profile

US 34 over Indian Creek
Henry County

WEI SINCE 1982

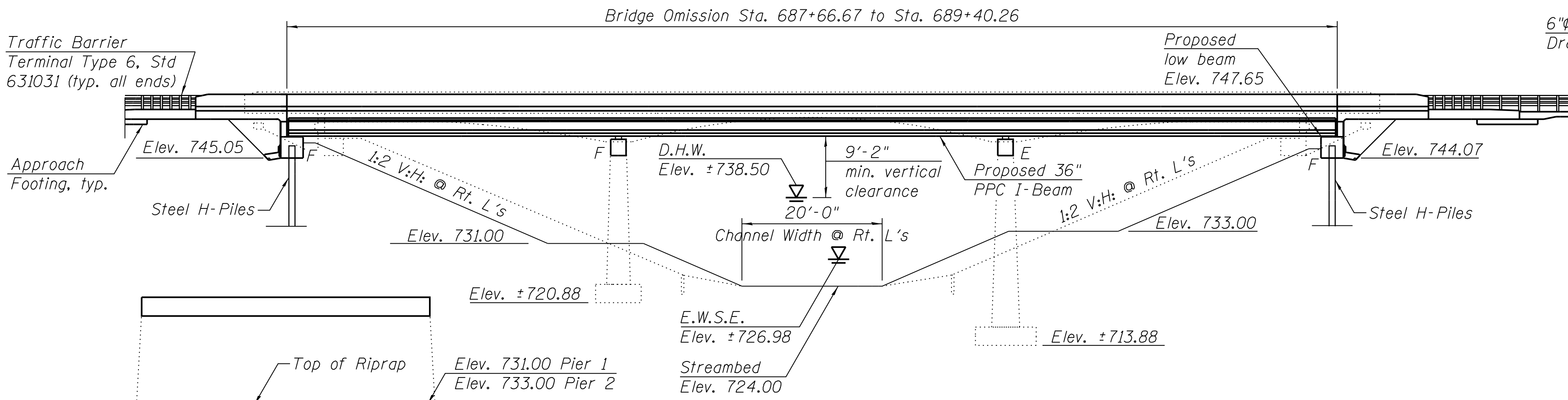
JOB NUMBER	PLATE NUMBER
195-07-01	EXHIBIT 4

Benchmark: Chiseled square corner of N.E. wingwall. Elev. 753.77.

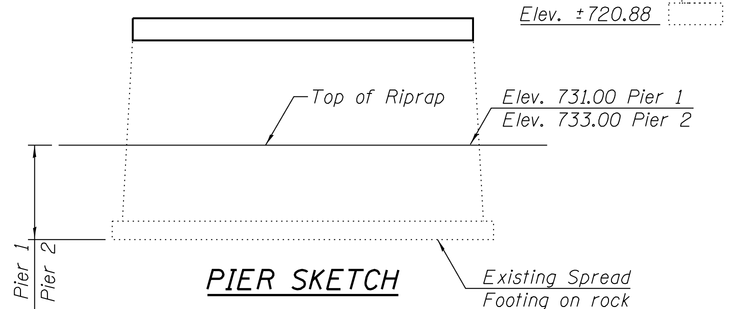
Existing Structure: S.N. 037-0054 was originally constructed in 1960 under SBI Route 28 Section 10B-1 as a three span reinforced concrete arched girder (T-Beam) superstructure on two reinforced concrete solid wall piers on spread footings and two reinforced concrete stub abutments on battered H-Piles. In 1988 the bridge received deck repairs, an overlay and thrie beam rails. The structure is 167'-0" back-to-back abutments and 35'-8" out-to-out. The Superstructure and abutments to be removed and replaced. Existing Piers to support new Superstructure. Traffic to be detoured.

No salvage.

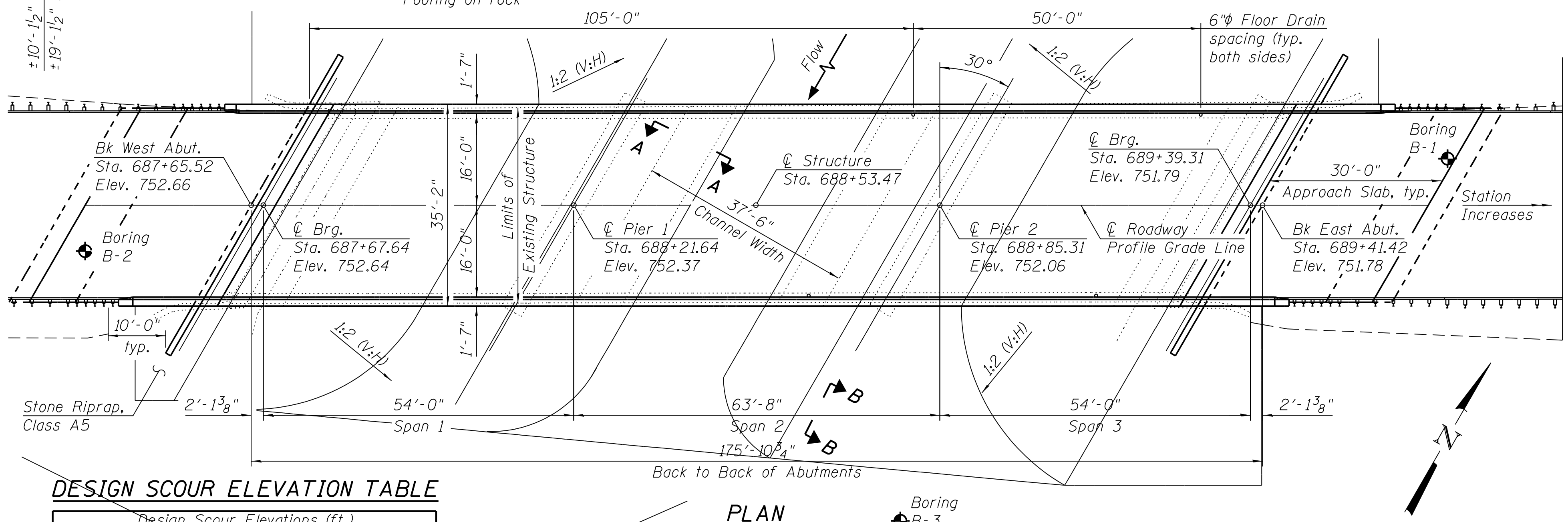
EXHIBIT 5
DRAFT TSL PLAN



ELEVATION



PIER SKETCH



PLAN

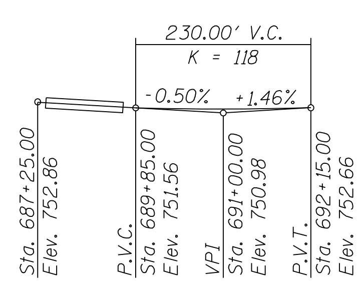
DESIGN SCOUR ELEVATION TABLE

Design Scour Elevations (ft.)			
W. Abut.	Pier 1	Pier 2	E. Abut.
744.94	721.84	714.77	744.11

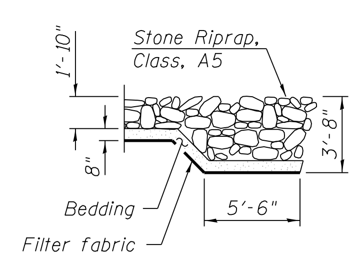
WATERWAY INFORMATION

Drainage Area = 17.6 sq. mi.
Existing Low Grade Elev. 751.6 @ Sta. 690+00
Proposed Low Grade Elev. 751.7 @ Sta. 690+00

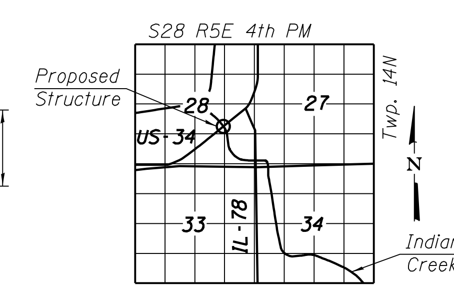
Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	2,876	740	842	736.5	1.0	0.8	737.5	737.3
Design	50	4,656	926	1,030	738.5	1.0	0.8	739.5	739.3
Base	100	5,483	984	1,115	739.2	1.2	0.9	740.4	740.1
Overtopping	-	-	-	-	-	-	-	-	-
Max. Calc.	500	7,499	1,257	1,373	741.6	1.2	0.9	742.8	742.5



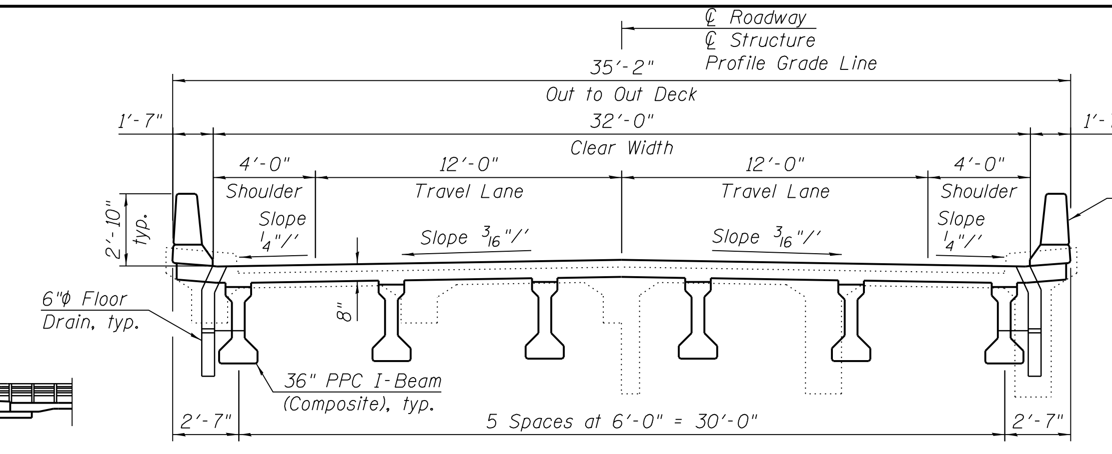
PROFILE GRADE
(Along ℄ Roadway)



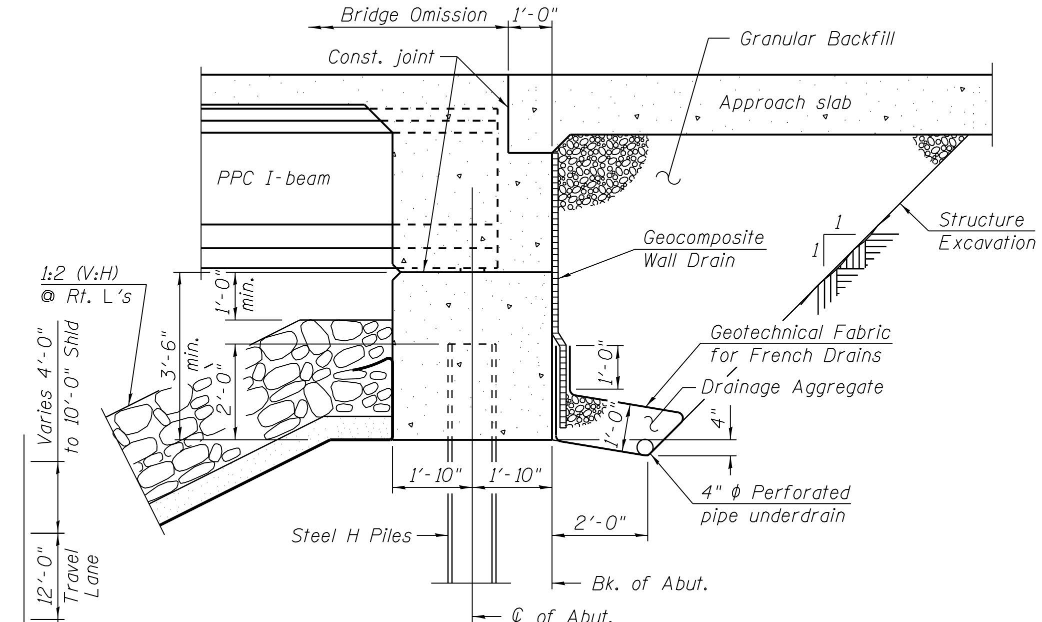
SECTION B-B



LOCATION SKETCH



SECTION THRU BARREL



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

DESIGN SPECIFICATIONS

2012 AASHTO LRFD Bridge Design Specifications, 6th Edition with 2013 interim

DESIGN STRESSES

NEW CONSTRUCTION
FIELD UNITS

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

PRECAST PRESTRESSED UNITS

f'c = 6,000 psi
f'ci = 5,000 psi
fpu = 270,000 (½"φ low lax. strands)
fpbt = 201,960 psi (½"φ low lax. strands)

EXISTING CONSTRUCTION

f'c = 2,500 psi
fy = 40,000 psi (Reinforcement)

LOADING HL-93

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = .069
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = .113
Soil Site Class = C

HIGHWAY CLASSIFICATION

FAP Rte. 37 - US Rte. 34
Functional Class: Minor Arterial, (Non-Urban)
ADT: 2,550 (2011); 2,606 (2032)
ADTT: 332 (2011); 339 (2032)
DHV: 250
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
2-Way Traffic
Directional Distribution: 50-50

GENERAL PLAN
US-34 OVER INDIAN CREEK
F.A.P. RT. 37 SECTION 10BR-1
HENRY COUNTY
STATION 688+53.47
STRUCTURE NO. 037-0054

FILE NAME = S:\JOL\6300--6399\6346\049\Micros\CADD Sheets\Structural\D123456-sht-TSBL.dgn

STRAND ASSOCIATES
1170 SOUTH HOUBOLT ROAD
JOLIET, ILLINOIS 60431
(815) 744-4200
IDFPR NO. 184-001273

USER NAME =	DESIGNED - RRD	REVISED
	CHECKED - AJS	REVISED
PLOT SCALE =	DRAWN - BJF	REVISED
PLOT DATE =	CHECKED - RRD	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
STRUCTURE NO. 037-0054
SHEET NO. 1 OF 1 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
37	10BR-1	HENRY	1	1

CONTRACT NO.
ILLINOIS FED. AID PROJECT

Wang Engineering

APPENDIX A

COPY

Illinois Department of Transportation

To:	Program Development	Attn: Becky Marruffo
From:	John H. Wegmeyer	By: Jan R. Twardowski
Subject:	Structure Borings	
Date:	August 9, 2012	

Route: FAP 37
Section: 10B-1
County: Henry
Job No.: P92-067-11
Description: IL 78 over Indian Creek

Attached are the boring logs for the bridge structure carrying IL 78 over Indian Creek.

The elevation datum was taken from existing plans.

If you have any questions, please contact Tim Bratt at 815/284-5435.

Jt8-9-12-2
Attachment
c: Andrea Schumaker
Soils File

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 2/9/12

ROUTE FAP 37 (US 34) DESCRIPTION 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) LOGGED BY B. Wetzell

SECTION 10B-1 LOCATION Wethersfield Twp. - 28SE, SEC. , TWP. 14N, RNG. 5E

COUNTY Henry DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. 037-0054
Station 272+00

BORING NO. B-1
Station 273+20
Offset 8.00ft Lt CL
Ground Surface Elev. 751.7 ft

Surface Water Elev. 725.5 ft
Stream Bed Elev. 724.5 ft

Groundwater Elev.:
First Encounter 726.7 ft ▼
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SOFT brown SILTY LOAM				0.5 P	20
	749.20				
MEDIUM gray SILTY LOAM	747.70		1 1 4	0.8 P	17
		-5			
MEDIUM gray SILTY CLAY LOAM	745.20		1 1 2	0.8 P	21
STIFF brown SILTY CLAY LOAM	742.70		3 5 7	2.1 B	20
		-10			
VERY STIFF tanish-brown SILTY LOAM	740.20		5 7 10	3.5 B	17
VERY STIFF tan SILTY LOAM	737.70		6 6 10	3.7 B	18
		-15			
VERY STIFF gray SILTY CLAY LOAM	735.20		6 7 12	3.3 B	21
STIFF black SILTY LOAM with ORGANICS	732.70		4 5 7	1.0 B	28
		-20			
STIFF black SILTY LOAM	729.70		2 4 6	1.3 B	29
LOOSE black dirty fine SAND	727.20		0 2 3		
		▼-25			
MEDIUM gray SILTY LOAM	724.70		0 2 3	1.1 B	27
VERY LOOSE gray dirty medium SAND	722.70		0 0 1		
		-30			
LOOSE gray dirty medium SAND	719.70		0 2 6		
SOFT gray SILTY LOAM	717.20		1 1 4	0.5 S	32
		-35			
MEDIUM gray weathered SHALE	715.20		0 6 10		
VERY DENSE gray weathered SHALE	712.70		11 23 38		
		-40			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 2/9/12

ROUTE FAP 37 (US 34) **DESCRIPTION** 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) **LOGGED BY** B. Wetzell

SECTION 10B-1 **LOCATION** Wethersfield Twp. - 28SE, **SEC.** , **TWP.** 14N, **RNG.** 5E

COUNTY Henry **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** B-53 Diedrich Automatic

STRUCT. NO. 037-0054
Station 272+00

BORING NO. B-1
Station 273+20
Offset 8.00ft Lt CL
Ground Surface Elev. 751.7 ft

Surface Water Elev. 725.5 ft
Stream Bed Elev. 724.5 ft

Groundwater Elev.:
First Encounter 726.7 ft ▼
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY DENSE gray weathered SHALE			22		
			32		
	710.20		59		
VERY DENSE gray weathered SHALE			60		
			100/5"		
	707.70				
		-45			
VERY DENSE gray weathered SHALE			38		
			100/5"		
	705.20				
End of Boring					
		-50			
		-55			
		-60			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 2/15/12

ROUTE FAP 37 (US 34) **DESCRIPTION** 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) **LOGGED BY** B. Wetzell

SECTION 10B-1 **LOCATION** Wethersfield Twp. - 28SE, **SEC.**, **TWP.** 14N, **RNG.** 5E

COUNTY Henry **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** B-53 Diedrich Automatic

STRUCT. NO. 037-0054
Station 272+00

BORING NO. B-2
Station 270+83
Offset 8.00ft Rt CL
Ground Surface Elev. 752.43 ft

Surface Water Elev. 725.5 ft
Stream Bed Elev. 724.5 ft

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

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SOFT brown SILTY LOAM				0.3 P	16
	749.93				
SOFT tan SANDY LOAM	748.43		3 6 3	0.4 P	16
		-5			
STIFF gray SILTY LOAM	745.93		2 2 5	1.4 P	20
VERY STIFF tan SILTY CLAY LOAM	743.43		2 3 5	2.1 B	24
		-10			
STIFF tan SILTY LOAM	740.93		4 4 5	2.0 B	20
VERY STIFF tan SILTY LOAM	738.43		6 8 10	3.7 B	19
		-15			
STIFF tan SILTY LOAM	735.93		2 4 5	1.7 B	20
MEDIUM gray SILTY CLAY LOAM with ORGANICS			3 5 6	0.6 B	20
	732.93	-20			

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
DENSE gray very weathered SHALE	730.93		6 14 22		
VERY DENSE gray weathered SHALE	728.43		28 64 100/8"		
		-25			
VERY DENSE gray weathered SHALE	725.93		24 47 100/11"		
VERY DENSE gray weathered SHALE	723.43		50 100/3"		
Borehole continued with rock coring.		-30			
		-35			
		-40			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 2/15/12

ROUTE FAP 37 (US 34) DESCRIPTION 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) LOGGED BY B. Wetzell

SECTION 10B-1 LOCATION Wethersfield Twp. - 28SE, SEC. , TWP. 14N, RNG. 5E

COUNTY Henry CORING METHOD

STRUCT. NO. 037-0054
Station 272+00

CORING BARREL TYPE & SIZE

Core Diameter 2 in
Top of Rock Elev. 732.93 ft
Begin Core Elev. 723.43 ft

BORING NO. B-2
Station 270+83
Offset 8.00ft Rt CL
Ground Surface Elev. 752.43 ft

Description	Elev.	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Shale: light to medium gray, dense, soapy with moderate fissility. t.s.f.: 721.5 to 720.8	723.43	-30	1	92	80	3.8	355
	718.43						
Shale: as above, although more fissile. t.s.f.: 715.9 to 714.8		-35	2	90	43	5.8	376
	713.43						
End of Boring		-40					
		-45					

Color pictures of the cores
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 2/14/12

ROUTE FAP 37 (US 34) DESCRIPTION 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) LOGGED BY B. Wetzell

SECTION 10B-1 LOCATION Wethersfield Twp. - 28SE, SEC. , TWP. 14N, RNG. 5E

COUNTY Henry DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. 037-0054
Station 272+00

BORING NO. B-3
Station 272+25
Offset 55.00ft Rt CL
Ground Surface Elev. 734.1 ft

Surface Water Elev. 725.5 ft
Stream Bed Elev. 724.5 ft

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

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY SOFT brown SILTY CLAY LOAM				0.2 P	29
	731.60				
STIFF brown SILTY CLAY LOAM			2 3 4	1.3 B	27
	730.10				
		-5			
STIFF black SILTY CLAY LOAM			3 4 5	1.7 B	27
	727.60				
SOFT black SILTY CLAY LOAM			0 2 2	0.3 B	23
	725.10				
		-10			
SOFT gray SILTY LOAM			1 2 3	0.6 B	22
	722.60				
		▼			
SOFT gray SILTY LOAM			0 1 2	0.5 B	25
	719.60				
		-15			
MEDIUM gray weathered SHALE			5 7 9		
	717.60				
DENSE gray weathered SHALE			3 21 16		
	715.10				
Borehole continued with rock coring.		-20			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 2/14/12

ROUTE FAP 37 (US 34) DESCRIPTION 037-0054 P92-067-11 Bridge over Indian Creek, 1/4 m. W. of IL 78 (S) LOGGED BY B. Wetzell

SECTION 10B-1 LOCATION Wethersfield Twp. - 28SE, SEC. , TWP. 14N, RNG. 5E

COUNTY Henry CORING METHOD

STRUCT. NO. 037-0054
Station 272+00

CORING BARREL TYPE & SIZE
Core Diameter 2 in
Top of Rock Elev. 719.60 ft
Begin Core Elev. 715.10 ft

BORING NO. B-3
Station 272+25
Offset 55.00ft Rt CL
Ground Surface Elev. 734.1 ft

Description	Elev.	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Shale: light to medium gray, dense, soapy and fissile. t.s.f.: 711.7 to 711.3	715.10	-20	1	66	32	6	267
Shale: as above, although comparatively intact. t.s.f.: 707.6 to 706.5	710.10	-25	2	100	68	4.8	139
End of Boring	705.10	-30 -35					

Color pictures of the cores
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

APPENDIX B

Failing Concrete Slope Wall At West Abutment

SITE VISIT PHOTOGRAPHS: US 34 BRIDGE OVER INDIAN CREEK IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS		
Site Visit Date: 04/01/2013	APPENDIX B-1	DRAWN BY: A. KURNIA CHECKED BY: C. FAREZ
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR STRAND ASSOCIATES, INC.		195-07-01

Existing Pier 1 and West Abutment

Existing Pier 2 and East Abutment

SITE VISIT PHOTOGRAPHS: US 34 BRIDGE OVER INDIAN CREEK IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS		
Site Visit Date: 04/01/2013	**APPENDIX B-2**	DRAWN BY: A. KURNIA CHECKED BY: C. FAREZ
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR STRAND ASSOCIATES, INC.		**195-07-01**

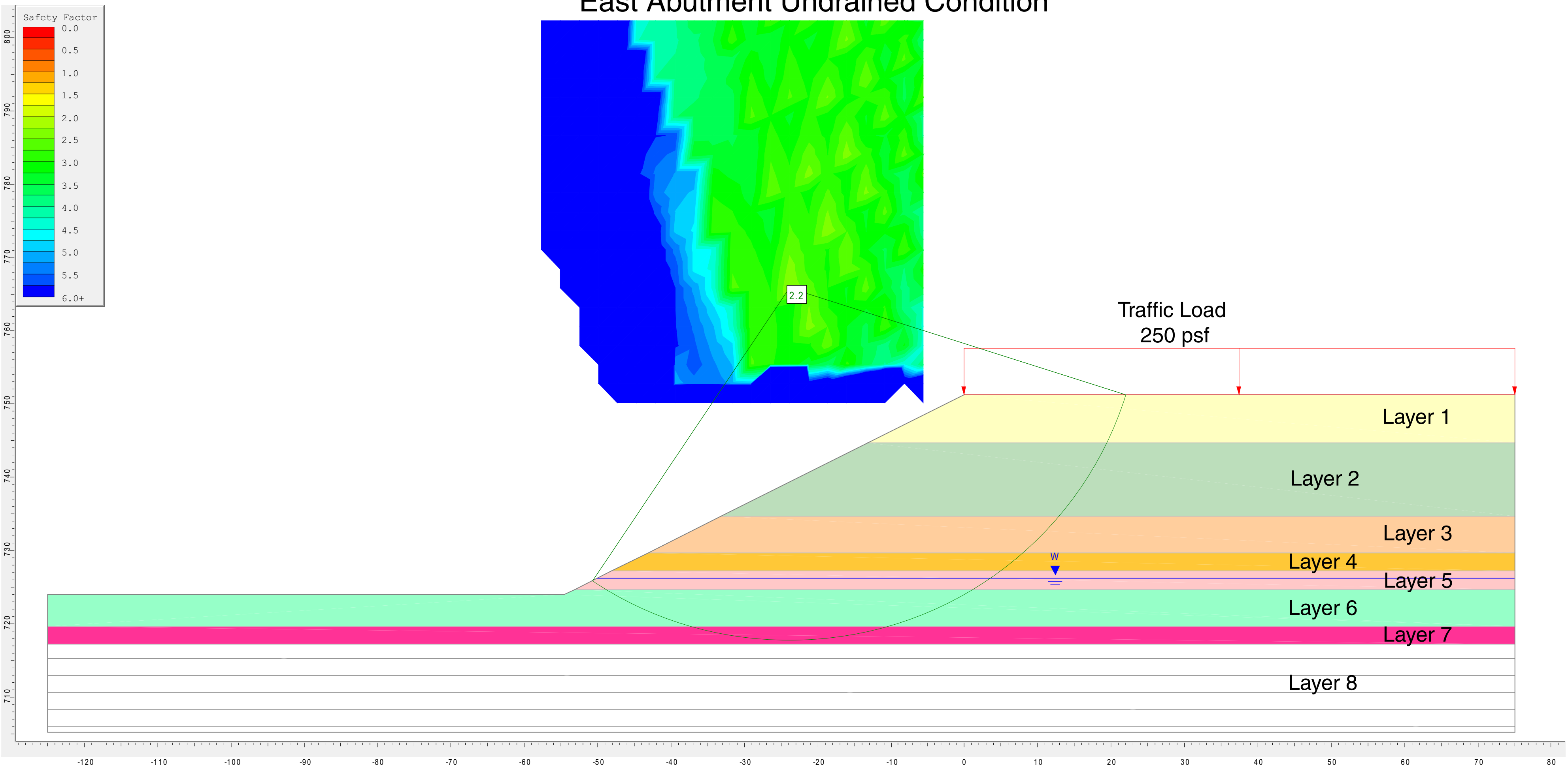
Failing Drainage at South West of the Bridge

Pavement Core Found on The West Approach Embankment

SITE VISIT PHOTOGRAPHS: US 34 BRIDGE OVER INDIAN CREEK IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS		
Site Visit Date: 04/01/2013	PPENDIX B-3	DRAWN BY: A. KURNIA CHECKED BY: C. FAREZ
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR STRAND ASSOCIATES, INC.		195-07-01

APPENDIX C

Global Stability Analysis
East Abutment Undrained Condition



Soil Properties as per Boring B-01

Soil ID	Soil Type	Unit Weight	Soil Parameters	
		[pcf]	c_u [psf]	ϕ [deg.]
Layer 1	Medium Stiff Silty Loam to Silty Clay Loam	120	800	0
Layer 2	Very Stiff Silty Loam to Silty Clay Loam	120	3,150	0
Layer 3	Stiff Silty Loam to Silty Clay Loam	120	1,150	0
Layer 4	Loose Fine Sand	115	0	28
Layer 5	Stiff Silty Loam	120	1,100	0
Layer 6	Very Loose to Loose Medium Sand	115	0	28
Layer 7	Soft Silty Loam	120	500	0
Layer 8	Very Dense Shale	150	0	43

GLOBAL STABILITY ANALYSIS: US 34 BRIDGE OVER INDIAN CREEK
IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-1 | DRAWN BY: R. Gorlagunta
CHECKED BY: A. Kurnia

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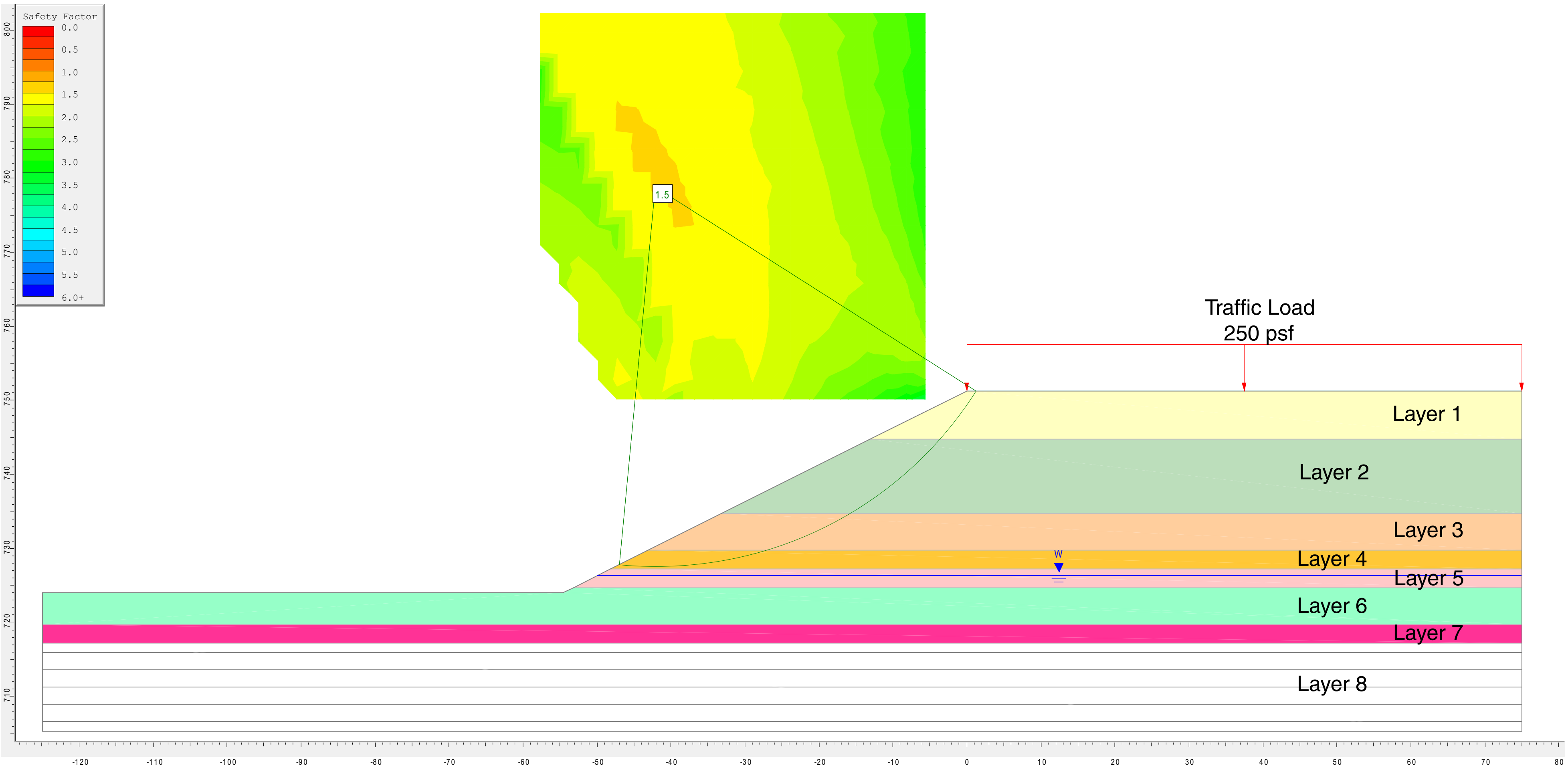
FOR STRAND ASSOCIATES, INC. | 195-07-01

Global Stability Analysis
East Abutment Drained Condition



Soil Properties as per Boring B-01

Soil ID	Soil Type	Unit Weight	Soil Parameters	
		[pcf]	c_u [psf]	ϕ [deg.]
Layer 1	Medium Stiff Silty Loam to Silty Clay Loam	120	100	28
Layer 2	Very Stiff Silty Loam to Silty Clay Loam	120	100	29
Layer 3	Stiff Silty Loam to Silty Clay Loam	120	100	28
Layer 4	Loose Fine Sand	115	0	28
Layer 5	Stiff Silty Loam	120	100	28
Layer 6	Very Loose to Loose Medium Sand	115	0	28
Layer 7	Soft Silty Loam	120	50	27
Layer 8	Very Dense Shale	150	0	43

GLOBAL STABILITY ANALYSIS: US 34 BRIDGE OVER INDIAN CREEK
IDOT PROJECT No. P-92-026-11, HENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL | APPENDIX C-2 | DRAWN BY: R. Gorlagunta | CHECKED BY: A. Kurnia

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