STRUCTURE GEOTECHNICAL REPORT

F.A.I. 64 (I-64)
I-64 over Wabash River
Public Waters

F.A.I. ROUTE 64 (I-64)
SECTION (97-2)B-5
WHITE COUNTY, ILLINOIS
POSEY COUNTY, INDIANA
JOB NO. P-99-003-08
PTB 147/42
CONTRACT NO. 78057
KEG NO. 08-0023.02

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1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed replacement structures for the existing I-64 dual structures over the Wabash River in White County, Illinois and Posey County, Indiana. The purpose of this report is to present the geotechnical analysis and recommendations for the design and construction of the proposed structure foundations. The report contains a description of the geologic setting, a summary of the field exploration and laboratory testing program, subsurface soil/rock profiles, and recommendations for planned foundations including recommended foundation type(s) and bearing elevations.

The scope of services of Kaskaskia Engineering Group, LLC (KEG) included establishing boring locations, supervision of the boring program and laboratory analysis, and producing boring logs. KEG's engineering analyses included liquefaction analyses, slope stability analyses, settlement estimates, and foundation analyses.

A total of 27 soil borings (SB-1 through SB-27), for a total of 1,496 lineal feet of drilling, were completed for the proposed bridge structures. Eighteen (18) Atterberg limit tests, 59 washed sieve analyses, and 12 unconfined compressive strength tests on rock core samples were performed. The boring logs and locations, along with soil profiles and lab data, are included in this report.

1.2 Project Description

The proposed project consists of replacement of the existing I-64 dual structures S.N. 097-0003/0004 over the Wabash River. The project is located south of Grayville, in White County, Illinois and in Posey County, Indiana. The general location of the site is shown in Exhibit A, Location Map. The site lies within the limits of the Second Principal Meridian (T.3S R. 14W Section 33) within the Mount Vernon Hill Country of the Till Plains section of the Central Lowland Province.

1.3 Existing Structure

The existing structures, built in 1967 as part of Section 97-3B, consist of two identical 28-span bridges with Structure Numbers (SN) 097-0003 (EB) and 097-0004 (WB) carrying FAI-64 over the Wabash River. The south bridge carries eastbound traffic, and the north bridge carries westbound traffic. Each bridge has one approach span at the west end and twenty approach spans at the east end. The approach and main spans over the river all consist of steel beams. The overall length of each of the bridge structures is 2,705.25 ft. back-to-back of abutments. The abutments and piers are constructed of reinforced concrete supported on combinations of reinforced concrete footings and pile supported piers. The substructure is skewed on the Indiana approach although the two bridges are at an angle of approximately 90 degrees with respect to the centerline of the Wabash River. The existing bridge currently carries traffic for I-64.

Several rehabilitations and repairs have been performed since the structures were built, including bridge deck repairs at the expansion joints and floor drains in 2005 scour mitigation at the river pier foundations in 2006, and steel sheet pile modification for scour mitigation in 2009.

The Bridge Condition Report (BCR) completed by Hutchison Engineering, Inc., on June 10, 2009, recommended total replacement of the existing 28-span structures and approach spans. The need for the bridge replacement is due to the age and deteriorated condition of the existing bridge. These conditions include scour problems and seismic deficiency of the piers; the existing steel

beams in the approach spans are overstressed and the approach piers have seismic deficiencies, including footing and pile embedment details. The structures also do not satisfy the current seismic design criteria. The BCR indicates that costs also favor the total replacement versus widening and/or rehabilitating the existing bridge.

1.4 Proposed Bridge Information

The proposed superstructure configuration consists of parallel dual bridges each consisting of 17 spans with a total length of 2,678'-6 3/8" back-to-back of abutments. Spans 1 through 8 comprise continuous 660' long units made up of four spans each. Spans 9 through 12 comprise a 615' long unit with four spans. Spans 13-17 comprise a 735' long unit with five spans. Each superstructure provides a 42' clear roadway width. The bridge parapet is a 44" F shape concrete parapet. The bridges are 44'-10" out-to-out of deck. Piers 1 through 8 will be supported on drilled shafts. The substructure of the abutments and Piers 9 through 16, will be supported on Steel H Piles. Stage construction will be utilized to maintain one lane of traffic in each direction. The proposed structure and alignment are shown in Exhibit B, Type, Size and Location (TS&L) Plan.

2.0 FIELD EXPLORATION

2.1 Geologic Setting

The proposed project is located in the Lower Wabash River Valley within the Mount Vernon Hill Country of the Till Plains section of the Central Lowland Physiographic Province. While this physiographic province is characterized by moderately rolling hills underlain by varying thicknesses of glacial till over sedimentary bedrock, the project site is dominated by Pennsylvania Age bedrock units overlain by river alluvium and glacial outwash deposits in the Lower Wabash River Valley. The surficial geologic materials consist of layers of clay, silt, sand, and gravel deposited as river alluvium and glacial outwash of both recent and Pleistocene Age. The river alluvium and glacial outwash deposits are generally less than one-foot-thick overlying bedrock on the Illinois bank of the Wabash River and trend to depths of 80 to 100 feet overlying bedrock towards the Indiana bank and flood plain.

The sediments within the river bottom and Indiana floodplain at the project site generally consist of loose to medium dense, poorly graded to well-graded sands with larger grained sands with intermittent mixtures of gravel, cobbles, and boulders with depth. The upper materials are estimated to be of the Cahokia Formation and the lower materials are estimated to be remnants of the Henry Formation and are characterized by varying amounts of gravels, cobbles, and boulders on top of bedrock and are interpreted to be outwash that was deposited during the Wisconsin Episode in the Quaternary Period.

2.2 Bedrock Geology

Bedrock within the project area consists of Pennsylvania Age limestones, sandstones, and shales. The bedrock encountered at the project site is estimated to be of the Missourian Series of the Pennsylvania Age, consisting of fluvial channel sandstones and shales, with some interbedded limestone of the Bond or Mattoon Formations.

The sandstone consists of fine-grained sand, light blue-gray, thin to medium bedded, with trace ribbons of lignite and/or interbedded chert and limestone fragments. The limestone bedrock is light blue-gray in color and thinly interbedded within the sandstone and is generally finely to

medium crystalline. The shale is light gray to black in color and fissile, and ranges from soft to hard in consistency.

Structurally, the bedrock appears to stair-step down in elevation from the Illinois bank to the Indiana bank of the Wabash River and floodplain. The project area lies on the southeastern portion of the Illinois Basin within the Wabash Valley Fault System. The fault system consists of vertically oriented "normal" faults that are believed to be Late Pennsylvanian or younger and pre-Pleistocene in age. The high angle north to north-east trending faults displace the upper Pennsylvanian Formations, but not the overlying Quaternary deposits.

2.3 General Seismicity

The Wabash Valley Fault System or Seismic Zone consists largely of north to north-east trending normal faults which generally parallel the Wabash River from Gallatin County to Clark County in Illinois. These faults are thought by some to be associated with a branch of the New Madrid rift zone where the crust actively began to pull apart in this area due to the North American Plate exerting tensional and compressional forces on the area. The epicenters of the largest historical earthquakes ever recorded in the central United States are all located in southeastern Missouri within the New Madrid Fault Zone. The New Madrid Fault Zone is located about 170 miles southwest of the Wabash Valley Fault Zone. The Wabash Valley Fault Zone has been proven to have had many minors to moderate earthquakes for the last 20,000 years with magnitudes up to 6.0 or greater. A magnitude 5.4 quake occurred in this region as recently as April of 2008, including several aftershocks of 4.0 magnitude or greater. Seismologists infer that this area is capable of producing strong earthquakes in the future.

2.4 Field Investigations

In October and November of 2012 and May of 2013, the field investigation was conducted for this project and included exploratory borings for sampling of the subgrade soils and bedrock on land and below the river. The soil boring locations and depths were selected by Knight E/A, Inc., and KEG and submitted to and approved by Illinois Department of Transportation (IDOT). Reference stakes and/or coordination of river boring locations were performed by representatives of the project surveyor; Lin Engineering, LTD. Elevations and stationing are included in Exhibit C, Boring Logs. The boring locations are included in Exhibit D, Subsurface Profile.

A total of 27 standard penetration test (SPT) borings, designated SB-1 through SB-27, were drilled for the project. Nineteen SPT borings (SB-1 through SB-4 and SB-13 through SB-27) were drilled on the Illinois and Indiana banks and floodplain between October 9 and November 6, 2012, and 8 SPT borings (SB-5 through SB-12) were drilled in the river between May 21 and May 29, 2013.

The test borings were made by ATV-mounted rigs equipped with 6-in. diameter helical augers and a rotary bit in combination with mud-rotary techniques. All the structure borings were extended to auger refusal. The bedrock was cored an additional 20 ft. at three locations using rock coring techniques. All borings are currently referenced to existing baseline stationing ranging from Sta. 5871+71.8 to Sta. 5902+46.1

Boring SB-1 was located north and west of the proposed bridges near the off-ramp for the westbound I-64 rest area, for a proposed sign truss. Boring SB-1 was located at Sta. 5871+71.8, 86.7 ft. left of the centerline. Boring SB-2 and SB-3 were located at the west abutment of the existing bridges on the Illinois side. Boring SB-2 was located at Sta. 5875+83.5, 4.3 ft. left of the centerline, and Boring SB-3 was located at Sta. 5875+26, 0.7 ft. right of the centerline. Boring SB-

4 was located on the WB side of proposed Pier 1. Boring SB-4 was located at Sta. 5876+83.2, 66.4 ft. left of the centerline. Borings SB-5 and SB-6 were located on the WB and EB near the ends of proposed Pier 2, at Sta. 5878+75.06, 64.4 ft. left of the centerline, and at Sta. 5878+84.43, 1.7 ft. left of the centerline, respectively. Borings SB-7 and SB-8 were located near the midspan of Span 4, at Sta. 5881+08.80, 63.3 ft left of the centerline, and at Sta. 5881+08.01, 3.8 ft. left of the centerline, respectively. Borings SB-9 and SB-10 were located near the ends of proposed Pier 5, at Sta. 5883+33.86, 65.0 ft. left of the centerline, and at Sta. 5883+30.04, 1.7 ft. right of the centerline, respectively. Borings SB-11 and SB-12 were located near the WB and EB ends of proposed Pier 6, at Sta. 5885+46.96, 67.0 ft. left of the centerline, and at Sta. 5885+50.49, 1.1 ft. right of the centerline, respectively.

Borings SB-13 through SB-24 alternated on the WB and EB bridge alignments. Boring SB-13 was located at Sta. 5887+50.3, 0.5 ft. left of the centerline. Boring SB-14 was located at Sta. 5888+60.3, 64.7 ft. left of the centerline near Pier 8. Boring SB-15 was located at Sta. 5889+90.1, 0.6 ft. left of the centerline. Boring SB-16 was located at Sta. 5891+9.5, 64.8 ft. left of the centerline. Boring SB-17 was located at Sta. 5892+29.5, 0.7 ft. left of the centerline. Boring SB-18 was located at Sta. 5893+50.1, 64.8 ft. left of the centerline. Boring SB-19 was located at Sta. 5894+54.9, 0.6 ft. left of the centerline. Boring SB-20 was located at Sta. 5895+88.7, 65.9 ft. left of the centerline. Boring SB-21 was located at Sta. 5897+9.8, 0.2 ft. left of the centerline. Boring SB-22 was located at Sta. 5898+26.0, 64.9 ft. left of the centerline. Boring SB-23 was located at Sta. 5899+50.7, 1.7 ft. right of the centerline. Boring SB-24 was located at Sta. 5900+54.5, 64.7 ft. left of the centerline.

Borings SB-25 through SB-27 were drilled for the east abutment on the Indiana side. Boring SB-25 was located at Sta. 5901+76.9, 65.9 ft. left of the centerline. Boring SB-26 was located at Sta. 5901+84.1, 1.6 ft. right of the centerline, and Boring SB-27 was located at Sta. 5902+46.1; 0.7 ft. left of the centerline.

It should be noted that Borings B-1 and B-4 were drilled on the south side of the existing structures prior to the current alignment selection.

2.5 Laboratory Testing Program

All samples were recovered in conformance with ASTM Standards D1586, D1587, and D2113 to permit proper laboratory identification and classification of the subsurface strata and bedrock. The field samples were delivered to the laboratory, SCI Engineering, Inc. (SCI), and were subject to a program of routine laboratory testing which included soil type classifications by visual methods as recommended in ASTM Standard D2488, moisture content determinations according to ASTM Standard D2216, and unconfined compressive strength measurements (of cohesive samples) in general conformance with ASTM Standard D2166. The results of the general soils testing, along with a visual classification of the material based on both the IDOT textural classification and an estimate of the AASHTO soil group classification system, are included in Exhibit C, Boring Logs, and Exhibit K, Laboratory Test Results. All split spoon soil samples obtained from the drilling operation were visually classified in the field and in the laboratory.

The requirements of this project are such that more precise classification of the subsoil types is required than can be obtained by the routine visual examinations and simple manual tests discussed previously. In addition to the regular laboratory testing program for moisture content, dry density, and visual description of the soil, Atterberg Limits (AASHTO T-89/90) and Grain Size Analysis (AASHTO T-311) tests were performed on selected samples from the borings. The results of the laboratory analyses are included under Exhibit K, Laboratory Test Results.

2.6 Generalized Subsurface Conditions

A generalized subsurface profile has been developed for this project to provide a baseline for geotechnical-related considerations. This profile is based upon the field test data, boring logs, and the laboratory testing program. The subsurface conditions along the site are included in Exhibit D, Soil Profiles. While boring comparisons show general uniformity in the types and sequence of substrata encountered at the boring locations, significant variations may exist within the areas between borings. Such variations should not be totally unexpected given the heterogeneous nature of many soil and rock deposits.

2.7 East Abutment

The profile at Boring SB-27, which was drilled at the crest of the highway embankment, generally consisted of silty clay loam and clay with blow counts ranging from 7 to 15 blows per foot (bpf) to a depth of 8.5 feet, which then continued with layers of sand with blow counts ranging from 20 to 22 bpf, followed by a layer of clay with blow counts ranging from 9 to 11 bpf to a depth of 26 feet, or El. 374.7. At this elevation, the profile transitioned to thick layers of loose fine sand and medium dense to very dense fine to coarse sand with varying amounts of gravel. Blow counts ranged from 6 to 75 with refusal noted at several locations during drilling within the very dense to hard sands and gravel from El. 312.5 to El. 271.0. The boring was terminated in very dense fine sand and gravel at a depth of 130 feet (El. 271.0).

The profiles at Boring SB-25 and SB-26 which were drilled at the toe of the existing abutment at floodplain elevation generally consisted of clay and silty clay loam with blow counts ranging from 7 to 15 to a depth of 6.0 feet in each boring, which then continued with layers of loose fine sand and medium dense to very dense fine to coarse sand with varying amounts of gravel with blow counts ranging from 5 to 64 until refusal on apparent sandstone at SB-26 to SB-25 feet (El. SB-26 and El. SB-25) for each boring, respectively.

2.8 East Approach Piers

The profile at Borings SB-13 through SB-24 for proposed Spans 8 through 14 consisted of approximately 5 to 15 feet of mixed cohesive soils consisting of clay, sandy clay, clay loam, sandy loam, silty clay, and silty clay loam. Blow counts in these materials generally ranged from 3 to 12 bpf. Below the surficial mixed cohesive soils, layers of loose to medium, fine to coarse sand with blow counts ranging from 1 to 34 bpf, extended to depths of 35 feet. Below 35 feet, the sands generally transitioned into medium dense to dense sands with blow counts ranging from 10 to greater than 50 bpf. In Borings SB-16, SB-20, SB-22, SB-23, and SB-24, materials classified as gravel with fine to coarse sand, ranging in thickness from 7 to 17 feet thick, were encountered prior to refusal. Refusal was encountered in each of the boring at depths ranging from 63.5 to 82.5 feet. Refusal occurred at sandstone or sandstone fragments in Borings SB-13, SB-14, SB-16, SB-18, SB-20, SB-22, and SB-24. Clayey shale was observed as the refusal material in Boring SB-15. Gravel and/or granite fragments were encountered as refusal in borings SB-17, SB-19, SB-21, and SB-23.

2.9 River Channel Piers

Borings SB-5 through SB-12 were drilled in the channel of the river. During drilling, the surface water elevation of the river ranged from El. 360.6 to El. 363.5. Borings SB-5 through SB-10 were all probes to the river bottom and refusal on bedrock, with no sampling of the overburden soils.

Borings SB-11 and SB-12 were sampled from the river bottom, down to refusal on bedrock. Bedrock was cored for 20 feet after auger refusal in Borings SB-8, SB-10, and SB-12, for additional information.

Boring SB-5 was drilled at El. 347.60 with refusal immediately following at El. 347.35 on sandy shale bedrock. Boring SB-6 was drilled at El. 347.73 encountering refusal within 9 inches at El. 346.98 on a shale and sandstone blend. Boring SB-7 was drilled at El. 344.91 and additionally blind drilled through overburden estimated to be sand and gravel until auger refusal on sandstone at El. 317.58. Boring SB-8 was drilled at El. 339.01 and additionally blind drilled through the overburden soils 20.4 ft. to auger refusal at El. 318.51. Twenty feet of rock core was retrieved from this borehole below auger refusal. The rock core information indicates recoveries of 72, 88, 98, and 100 percent for the four core runs ranging from 3 to 8 ft. long. The RQD values were 48, 15, 74, and 99 percent, respectively. The recovered cores were sandstone with traces of interbedded limestone coal and shale. Boring SB-9 was drilled at El. 343.41 and additionally blind drilled 26.3 ft. through the overburden soils to auger refusal at El. 317.08 ft. Boring SB-10 was drilled at El. 361.85 and additionally blind drilled through the overburden soils 27.0 ft. to auger refusal at El. 334.85. Twenty feet of rock core was retrieved from this borehole below auger refusal. The rock core information indicates recoveries of 100, 100, 98, 80, and 100 percent for the five core runs ranging from 1.5 to 6 ft. long. The RQD values were 100, 87, 75, 67, and 76 percent, respectively. The recovered cores were sandstone and shale with interbedded limestone in the sandstone. At Boring SB-11, the river bottom was at El. 353.52. The overburden soils were then sampled at 2.5 ft. intervals to auger refusal. The overburden soils consisted of 6.5 feet of silty clay to El. 347.02, which then transitioned into loose, fine to coarse sands with trace to some gravel to auger refusal on sandstone at El 309.85. At Boring SB-12 the river bottom was at El. 350.28. The overburden soils consisted of sandy loam with some organics to El. 341.78. The soils then transitioned to loose gravel and coarse sand, becoming medium dense to El. 331.78. Medium coarse to medium dense sands then continued to El. 319.28, where it transitioned back into a loose, coarse sand and gravel prior to refusal on sandstone at El. 311.58. Twenty feet of rock core was retrieved from this borehole below auger refusal. The rock core information indicates recoveries of 84, 88, 94, 100, 100, 16, and 60 percent for the seven core runs ranging from 1 to 6 ft. long. The RQD values were 51, 64, 0, 100, 94, 16, and 35 percent, respectively. The recovered cores were sandstone, limestone, and shale.

2.10 West Approach Piers

The profile at Boring SB-4, for proposed Pier 1, consisted of clay with some interbedded sand seams, shale and sandstone fragments, and trace gravel to El. 362.84. N-values of the clay ranged from 6 to 12 bpf. A 3-foot layer of sandy loam was encountered below the clay to El. 359.84. The sandy loam had trace iron nodules and shells with an N-value of 2 bpf. Clayey shale was encountered below the sandy loam. It continued to a thin coal seam which ranged from El. 354.84 to El. 354.51. The clayey shale had N-values of 49 bpf to greater than 50 blows for 5 inches. The coal seam had an N-value of 50 blows for 4 inches and a moisture content of 9 percent. Below the coal seam, shale was encountered to termination at El. 350.01. The shale had N-values of 50 blows for 1 to 4 inches, with a moisture content of 5 percent.

2.11 West Abutment

Borings SB-2 and SB-3 were drilled for the proposed west abutment. SB-2 was drilled at the toe of the existing abutment end slope and Boring SB-3 was drilled at the crest of the existing abutment end slope in the median of I-64. Below 6 inches of topsoil, Boring SB-2 consisted of shaley clay to El. 379.52. The N-value of the shaley clay was 6 bpf with a pocket penetrometer

value of 1.5 tons per square foot (tsf). Moisture content was 22 percent. The shaley clay then transitioned into a clayey shale, with an N-value of 22 bpf and a moisture content of 17 percent. Auger refusal was encountered at El. 376.10 on limestone.

Boring SB-3 consisted of intermittent layers of silty and sandy clay loam to EL. 394.31. The N-values of the soils ranged from 11 to 24 with strengths of 2.1 to 2.8 tsf and moisture contents of 13 to 20 percent. Below the clay soils, a thin bed of shaley clay was encountered to El. 392.98. The shaley clay had an N-value of 14, a Qu of 2.4 tsf, and a moisture content of 23 percent. Clayey shale was encountered below the shaley clay to auger refusal at El. 387.33. N-values of the clayey shale ranged from 25 to 28 and moisture contents of the shale were 5 to 19.

2.12 Bedrock

Bedrock core samples were obtained at three of the proposed foundation substructure unit borings using rock coring techniques and were transported to the laboratory for additional testing and analysis including Rock Quality Designation (RQD) and unconfined compressive strength testing (Qu). Descriptions of the bedrock and the laboratory testing results are included on the boring logs in Exhibit C.

In general, as described above, the bedrock consisted of shale, sandstone, and limestone. Table 2.12 below lists a summary of the bedrock by type and estimated bedrock elevations including top of rock and top of competent rock.

Table 2.12 – Estimated Bedrock Elevations

Boring	Bedrock Type	Top of Rock Elevation (Ft)	Top of Competent Rock Elevation (Ft)
SB-1	Shale	397.18*	
SB-2	Shale/Limestone	379.52	376.10*
SB-3	Shale	392.98	387.33*
SB-4	Shale	359.84	354.51*
SB-5	Shale	347.35*	
SB-6	Shale/Sandstone	346.98*	346.98
SB-7	Sandstone	318.58*	
SB-8	Sandstone	318.51	317.01
SB-9	Sandstone	317.08*	
SB-10	Sandstone	334.85	334.85
SB-11	Sandstone	309.85*	
SB-12	Sandstone/Limestone	312.86	311.58
SB-13	Sandstone	307.96*	
SB-14	Sandstone	306.08*	
SB-15	Shale	301.07*	
SB-16	Sandstone	301.98*	
SB-17	Unclassified	301.07*	
SB-18	Sandstone	302.18*	
SB-19	Unclassified	299.00*	
SB-20	Sandstone	301.62*	
SB-21	Unclassified	303.57*	
SB-22	Sandstone	293.76*	
SB-23	Unclassified	292.62*	
SB-24	Sandstone	298.52*	
SB-25	Sandstone	301.21*	
SB-26	Unclassified	301.41*	
SB-27	Not Encountered	270.95	

*** Elevations are based on auger/spoon refusal only.**
No rock core sampling performed.

2.13 Groundwater Levels

Groundwater levels encountered during drilling and after 24 hours were recorded on the attached boring logs where applicable. Groundwater readings at the conclusion of drilling were not recorded due to the introduction of water during the mud rotary and rock coring process. It should be noted that the groundwater levels will likely vary from these reported elevations due to seasonal and yearly fluctuations in precipitation, infiltration, and other factors and may be present at different depths in the future. In addition, without extended periods of observation, measurement of the true groundwater levels may not be possible. The levels of groundwater will also fluctuate with the level of the Wabash River. The levels of groundwater shown in Table 2.13

are based upon water level readings in the boring at the times and under conditions stated on the boring logs.

Table 2.13 Groundwater Levels

Boring No.	Groundwater Elevation During Drilling (Ft.)	Groundwater Elevation After 24 Hours (Ft.)
SB-13	354.4	358.4
SB-14	355.5	357.0
SB-15	355.9	357.7
SB-16	357.4	--
SB-17	354.9	356.2
SB-18	356.7	--
SB-19	357.0	--
SB-20	356.9	357.4
SB-21	356.6	356.6
SB-22	357.8	--
SB-23	357.6	--
SB-24	357.5	358.0
SB-25	357.7	--
SB-26	357.9	358.4
SB-27	357.5	357.5

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

Since no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that the existing embankments will experience settlements of less than 0.5 in. Therefore, no settlement calculations were performed for the proposed structure.

3.2 Slope Stability

The proposed construction of the new structure will result in new end slopes at the abutment locations.

The proposed abutments are stub abutments with end slopes at 1 Vertical to 2 Horizontal (1V:2H), to the toe. Slope stability of the end slopes was analyzed using SLOPE-W; the soil properties at the site, including those in Borings SB-2 and SB-3 for the West Abutment and Borings SB-26 and SB-27 for the East Abutment; and end slope 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 34 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 clay and silty clay materials, a nominal cohesion value of 100 psf to 250 psf was included in the drained strength parameters.

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 3.2. SLOPE-W program output from this analysis can be found in Exhibit E, SLOPE-W Slope Stability Analysis.

Table 3.2 – Slope Stability Critical FOS

Calculated Critical FOS				
Location	**Slope**	**End-of-Construction**	**Long-Term**	**Seismic**
East Abutment	1V:2H	3.5	1.8	1.3
West Abutment	1V:2H	3.7	1.9	1.2

The results of the analysis, as provided in Table 3.2, indicate an acceptable FOS will exist at the east and west abutments under all three modeled conditions.

3.3 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 D.

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. The United States Geological Survey (USGS) published information and mapping, including software directly applicable to the American Association of State Highway and Transportation Officials (AASHTO) Guide Specifications for LRFD Seismic Bridge Design, was used to develop 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 Soil Site Class D, are summarized below.

Table 3.3 – Summary of Seismic Parameters

Parameter	Value
Soil Site Class	D
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.657g (Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.276g (Site Class D)
Seismic Performance Zone	2

As indicated in the table above, the Seismic Performance Zone is 2, based on S_{D1} and Table 3.15.2 - in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-3 in the IDOT Bridge Manual.

3.4 Scour

The design scour elevations for the proposed structure are shown in Table 3.4. A concrete slope wall will be placed on the surface of the proposed abutment end slopes to reduce the potential for future scour. The scour elevations were adjusted for soil/rock according to the specifications in the IDOT Bridge Manual, Section 2.3.6.3.2.

Table 3.4 – Design Scour Elevations

Event/Limit State	Design Scour Elevations (ft.)						Item 113
	West Abutment	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	
Q_{100}	398.6	356.2	343.6	326.0	316.6	316.0	5
Q_{200}	398.6	356.0	343.4	325.8	316.4	315.8	
Design	398.6	356.2	343.6	326.0	316.6	316.0	
Check	398.6	356.0	343.4	325.8	316.4	315.8	

Event/Limit State	Design Scour Elevations (ft.)						Item 113
	Pier 6	Pier 7	Pier 8	Pier 9	Pier 10	Pier 11	
Q_{100}	310.9	307.8	305.3	347.9	350.1	351.6	5
Q_{200}	310.6	307.5	305.0	346.2	348.6	350.1	
Design	310.9	307.8	305.3	347.9	350.1	351.6	
Check	310.6	307.5	305.0	346.2	348.6	350.1	

Event/Limit State	Design Scour Elevations (ft.)						Item 113
	Pier 12	Pier 13	Pier 14	Pier 15	Pier 16	East Abutment	
Q_{100}	353.9	352.1	353.4	350.6	345.3	390.0	5
Q_{200}	352.5	350.7	352.0	349.0	343.4	390.0	
Design	353.9	352.1	353.4	350.6	345.3	390.0	
Check	352.5	350.7	352.0	349.0	343.47	390.0	

3.5 Liquefaction

A liquefaction analysis for multiple ground motion parameters (PGA and Mw) pairs was performed using the liquefaction analysis worksheet provided by IDOT BBS Central Geotechnical Unit and procedures outlined in AGMU 10.1 - Liquefaction Analysis. The PGA and Mw pairs to be used were obtained from the deaggregation data of the seismic hazard for the site, by accessing the USGS website: http://eqint.cr.usgs.gov/deaggint/2008/ for both NMSZ (far source-site) and CEUS (near source-site) models. The deaggregation data indicated a near source-site contributing at least 5% to the hazard for this site; hence, a PGA maximum from the CEUS Model was necessary. The Maximum Horizontal Ground Surface Acceleration value was set to the CEUS PGA (0.211g) calculated in the IDOT Liquefaction Analysis Spreadsheet.

The soil profiles for Borings SB-3, SB-4 and SB-11 through SB-27 were analyzed. The results from the analysis for the soil profile encountered in all borings showed no potential for liquefaction. Therefore, no reduction for liquefaction was considered for the pile design capacity or other foundation considerations. A summary of the liquefaction analysis including each specific run is included in Exhibit F, Liquefaction Analyses.

4.0 FOUNDATION EVALUATIONS AND DESIGN RECOMMENDATIONS

4.1 General Feasibility

Based on the proposed foundation loads and the loose to medium dense properties of the upper stratigraphy, deep foundations terminating on or within the underlying bedrock are recommended for support of the proposed structures. Driven piles are being considered for foundation support for much of the structure. Drilled shaft recommendations are also provided based on limited rock core data. Drilled shafts are recommended for consideration at the river pier locations (Pier 1 through Pier 8), versus piles or shallow foundations due to scour and seismic considerations and the depth to competent bedrock.

Based on the boring logs, the depth to bedrock, and the results of the pile design analysis, H-piles appear to be a feasible option for the land-based substructures for the Abutments and Piers 9 through 16. The Modified IDOT Static Method of Estimating Pile Length provided by IDOT BBS Foundations and Geotechnical Unit was used to calculate the design length of the piles.

4.2 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 driven to refusal on the underlying bedrock. The Modified IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths, see Exhibit G, Pile Design Tables.

The Total Factored Loads for the proposed abutments and piers, as provided by Knight E/A, Inc., are listed in Table 4.2.1.

Table 4.2.1 – Proposed Design Loads

Substructure Unit	West Abutment	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5
Factored Load (kips)	3,772	8,464	8,896	9,682	7,860	9,495
Substructure Unit	**Pier 6**	**Pier 7**	**Pier 8**	**Pier 9**	**Pier 10**	**Pier 11**
Factored Load (kips)	8,906	11,476	8,846	10,407	10,078	10,302
Substructure Unit	**Pier 12**	**Pier 13**	**Pier 14**	**Pier 15**	**Pier 16**	**East Abutment**
Factored Load (kips)	8,639	9,896	9,659	9,593	9,744	3,505

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 4.2.2 through 4.2.6. As shown in the Tables below, scour has been included in the capacity estimates. Downdrag and liquefaction have not been considered at the substructure locations.

Table 4.2.2 – Estimated Pile Lengths for HP 12X53 Steel H-Piles

Substructure Unit	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 SB-3	418	230	18	400.60
Pier 9 SB-15	418	221	69	367.50
Pier 10 SB-16	418	221	68	367.50
Pier 11 SB-18	418	223	67	367.50
Pier 12 SB-19	418	226	70	367.50
Pier 13 SB-20	418	225	68	367.50
Pier 14 SB-21	418	226	66	367.50
Pier 15 SB-23	418	218	71	367.50
Pier 16 SB-24	418	222	70	367.50
East Abutment SB-27	418	230	90	392.00

Table 4.2.3 – Estimated Pile Lengths for HP 12X74 Steel H-Piles

Substructure Unit	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 SB-3	589	324	21	400.60
Pier 9 SB-15	589	316	73	367.50
Pier 10 SB-16	589	315	69	367.50
Pier 11 SB-18	589	317	68	367.50
Pier 12 SB-19	589	319	72	367.50
Pier 13 SB-20	589	319	69	367.50
Pier 14 SB-21	589	320	67	367.50
Pier 15 SB-23	589	311	76	367.50
Pier 16 SB-24	589	316	71	367.50
East Abutment SB-27	589	324	104	392.00

Table 4.2.4 – Estimated Pile Lengths for HP 14X73 Steel H-Piles

Substructure Unit	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 SB-3	578	318	19	400.60
Pier 9 SB-15	578	309	70	367.50
Pier 10 SB-16	578	307	68	367.50
Pier 11 SB-18	578	310	67	367.50
Pier 12 SB-19	578	313	71	367.50
Pier 13 SB-20	578	312	68	367.50
Pier 14 SB-21	578	313	66	367.50
Pier 15 SB-23	578	303	75	367.50
Pier 16 SB-24	578	308	71	367.50
East Abutment SB-27	578	318	93	392.00

Table 4.2.4 – Estimated Pile Lengths for HP 14X89 Steel H-Piles

Substructure Unit	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 SB-3	705	388	21	400.60
Pier 9 SB-15	705	378	72	367.50
Pier 10 SB-16	705	377	69	367.50
Pier 11 SB-18	705	380	68	367.50
Pier 12 SB-19	705	382	72	367.50
Pier 13 SB-20	705	389	69	367.50
Pier 14 SB-21	705	383	67	367.50
Pier 15 SB-23	705	373	76	367.50
Pier 16 SB-24	705	378	72	367.50
East Abutment SB-27	705	388	102	392.00

Table 4.2.5 – Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	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 SB-3	929	510	24	400.60
Pier 9 SB-15	929	501	76	367.50
Pier 10 SB-16	929	500	71	367.50
Pier 11 SB-18	929	503	70	367.50
Pier 12 SB-19	929	505	73	367.50
Pier 13 SB-20	929	505	71	367.50
Pier 14 SB-21	929	506	69	367.50
Pier 15 SB-23	929	497	77	367.50
Pier 16 SB-24	929	501	73	367.50
East Abutment SB-27	929	511	122	392.00

As shown in Exhibit G, Pile Design Tables, scour has been incorporated into the calculations. Downdrag and liquefaction have not been considered at the substructure locations.

Due to the variable conditions, gravel, and cobbles, at depths just prior to refusal, KEG recommends a test pile be performed at every other land-based substructure unit on the Indiana side and one test pile at the East and West Abutments, respectively. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to further evaluate pile driving requirements for the project. This also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

4.3 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. Soil parameters for the structural engineer's use are included in Exhibit H, Soil Parameters for Lateral Pile Load Analysis, for evaluating lateral pile response. The values were estimated based on the descriptions as listed on the boring logs.

4.4 Foundations on Drilled Shafts

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including horizontal forces.

Competent sandstone and shale bedrock are generally encountered as indicated above in Section 2.12 and Table 2.12 – Estimated Bedrock Elevations.

Recommendations for drilled shafts with sockets extending various depths into the underlying sandstone, limestone, or shale, developing capacity from tip and side resistance, are provided for design support of the Abutments and Piers. The provided capacities are based on boring information as summarized in Section 2.0 above, laboratory unconfined compressive strength tests performed on rock core samples from Borings SB-8, SB-10, and SB-12 and utilizing the IDOT Drilled Shaft Axial Capacity in Rock spreadsheet as provided by IDOT BBS Foundations and Geotechnical Unit. LRFD Resistance Factors of 0.55 for side resistance and 0.5 for tip resistance are incorporated into the allowable capacities, respectively.

Tables 4.4.1 thru 4.4.4 – Drilled Shaft Axial Capacity below contain a summary of Factored Shaft Resistances available for various shaft diameters based on socket depths into the underlying limestones, dolomites, sandstones, or shales for each substructure. IDOT Drilled Axial Capacity Input sheets and Design Tables are included in Exhibit I, Drilled Shaft Design.

Table 4.4.1 – Estimated Drilled Shaft Axial Capacity for 48-inch Diameter Shaft

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
West Abutment SB-3	6	2118*	1083*	--	--	381.3
	8	4447*	2273*	--	--	379.3
	10	4574*	2343*	--	--	377.3
Pier #1 SB-3/4/5/6	6	1872*	958*	--	--	348.5
	8	4447*	2273*	--	--	346.5
	10	4703*	2414*	--	--	344.5
Pier #2 SB-5/6/7/8	6	7110*	3678*	--	--	341.0
	8	16588	8294	--	--	339.0
	10	16588	8294	--	--	337.0
Pier #3 SB-7/8	6	9245*	4746*	--	--	311.0
	8	17923	8961	--	--	309.0
	10	17562	8781	--	--	307.0
Pier #4 SB-7/8	6	6865	3432	2465	1356	311.0
	8	17923	8961	3286	1807	309.0
	10	17562	8781	4108	2259	307.0
Pier #5 SB-9/10	6	19352	9676	--	--	328.8
	8	26798	13399	--	--	326.8

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
	10	24976	12488	--	--	324.8
Pier #6 SB-12	6	3545*	1896*	--	--	305.6
	8	4443*	2376*	--	--	303.6
	10	5703*	3027*	--	--	301.6
Pier #7 SB-12/13	6	2386*	1262*	--	--	302.4
	8	5691*	2957*	--	--	300.4
	10	6557*	3406*	--	--	298.4
Pier #8 SB-12/14	6	1731*	900*	--	--	300.5
	8	5335*	2734*	--	--	298.5
	10	5619*	2893*	--	--	296.5
East Abutment SB-25/26/12	6	2796*	1427*	--	--	295.4
	8	5050*	2583*	--	--	293.4
	10	5353*	2749*	--	--	291.4

***Resistance Method = Side & Tip Combined**

Table 4.4.2 – Estimated Drilled Shaft Axial Capacity for 60-inch Diameter Shaft

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
West Abutment SB-3	6	3160*	1609*	--	--	381.3
	8	3291*	1680*	--	--	379.3
	10	6634*	3379*	--	--	377.3
Pier #1 SB-4/5/8	6	2784*	1419*	--	--	348.5
	8	6634*	3379*	--	--	346.5
	10	6948*	3551*	--	--	344.5
Pier #2 SB-5/6/8	6	10332*	5320*	--	--	341.0
	8	25918	12959	--	--	339.0
	10	25918	12959	--	--	337.0
Pier #3 SB-8	6	13638*	6970*	--	--	311.0
	8	27666	13833	--	--	309.0
	10	35991	17995	--	--	307.0
Pier #4 SB-8	6	13638*	6970*	--	--	311.0
	8	27666	13833	--	--	309.0
	10	35991	17995	--	--	307.0
Pier #5 SB-10	6	32377	16188	--	--	328.8
	8	36364	18182	--	--	326.8

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
	10	34086	17043	--	--	324.8
Pier #6 SB-12	6	4854*	2581*	--	--	305.6
	8	6264	3132	--	--	303.6
	10	7830*	4134*	--	--	301.6
Pier #7 SB-13/12	6	3232*	1699*	--	--	302.4
	8	8311*	4295*	--	--	300.4
	10	9395*	4856*	--	--	298.4
Pier #8 SB-14/12	6	2457*	1270*	--	--	300.5
	8	7881*	4024*	--	--	298.5
	10	8232*	4220*	--	--	296.5
East Abutment SB-25/26/12	6	4182*	2128*	--	--	295.4
	8	7525*	3834*	--	--	293.4
	10	7897*	4039*	--	--	291.4

***Resistance Method = Side & Tip Combined**

Table 4.4.3 – Estimated Drilled Shaft Axial Capacity for 72-inch Diameter Shaft

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
West Abutment SB-3	6	4408	2239	--	--	381.3
	8	4571	2327	--	--	379.3
	10	--	--	2878	1583	377.3
Pier #1 SB-4/5/8	6	3875*	1970*	--	--	348.5
	8	4208*	2149*	--	--	346.5
	10	9628*	4907*	--	--	344.5
Pier #2 SB-5/6/8	6	14097*	7233*	--	--	341.0
	8	15382*	7937*	--	--	339.0
	10	37322	18661	--	--	337.0
Pier #3 SB-8	6	18751*	9553*	--	--	311.0
	8	23849*	12170*	--	--	309.0
	10	--	--	6161	3389	307.0
Pier #4 SB-8	6	18751*	9553*	--	--	311.0
	8	23849*	12170*	--	--	309.0
	10	--	--	6161	3389	307.0
Pier #5 SB-10	6	41909	10955	--	--	328.8
	8	10063	20031	--	--	326.8

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
	10	--	--	6161	2289	324.8
Pier #6 SB-12	6	6319*	3344*	--	--	305.6
	8	5840*	3116*	--	--	303.6
	10	10205*	5366*	--	--	301.6
Pier #7 SB-13/12	6	4202*	2198*	--	--	302.4
	8	4280*	2238*	--	--	300.4
	10	12729*	6554*	--	--	298.4
Pier #8 SB-14/12	6	3313*	1705*	--	--	300.5
	8	6150*	3147*	--	--	298.5
	10	11335*	5793*	--	--	296.5
East Abutment SB-25/26/12	6	5844*	2966*	--	--	295.4
	8	6214*	3167*	--	--	293.4
	10	--	--	2473	1360	291.4

***Resistance Method = Side & Tip Combined**

Table 4.4.4 – Estimated Drilled Shaft Axial Capacity for 84-inch Diameter Shaft

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
West Abutment SB-3	6	5864*	2973*	--	--	381.3
	8	--	--	2687	1478	379.3
	10	--	--	3358	1847	377.3
Pier #1 SB-4/5	6	5147*	2612*	--	--	348.5
	8	5551*	2827*	--	--	346.5
	10	5960*	3046*	--	--	344.5
Pier #2 SB-5/6/8	6	18395*	9413*	--	--	341.0
	8	19951*	10263*	--	--	339.0
	10	--	--	7188	3954	337.0
Pier #3 SB-8	6	27468*	13950*	--	--	311.0
	8	--	--	5751	3163	309.0
	10	--	--	7188	3954	307.0
Pier #4 SB-8	6	27468*	13950*	--	--	311.0
	8	--	--	5751	3163	309.0
	10	--	--	7188	3954	307.0
Pier #5 SB-10	6	52460	26230	--	--	328.8
	8	--	--	5751	3163	326.8

Substructure Unit	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE &TIP* or TIP	Factored Shaft Resistance Available (kips) SIDE & TIP* or TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elevation (ft.)
	10	--	--	7188	3954	324.8
Pier #6 SB-12	6	7932*	4182*	--	--	305.6
	8	7116*	3784*	--	--	303.6
	10	11373*	5970*	--	--	301.6
Pier #7 SB-13/12	6	5298*	2760*	--	--	302.4
	8	5398*	2811*	--	--	300.4
	10	9458*	4883*	--	--	298.4
Pier #8 SB-14/12	6	4300*	2206*	--	--	300.5
	8	8079*	4123*	--	--	298.5
	10	8536*	4371*	--	--	296.5
East Abutment SB-25/26/12	6	7782*	3943*	--	--	295.4
	8	--	--	2172	1195	293.4
	10	--	--	2885	1587	291.4

***Resistance Method = Side & Tip Combined**

Minimum center-to-center spacing is three times the shaft diameter. There is no reduction in Factored Resistance Available with this or larger shaft spacing, and the grouping effect can be ignored. Shafts will also need to be evaluated for lateral resistance, which may control socket embedment lengths using L-Pile factors given in Exhibit H, Soil Parameters for Lateral Pile Load Analysis.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 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.

5.2 Temporary Sheeting and Soil Retention

Temporary sheeting should not be required since the proposed structure will be constructed in stages and traffic will be maintained using the existing EB structure.

As a reference, in case further updates to the construction method require the use of temporary sheeting, the IDOT Temporary Sheet Piling Design Guide and Charts and Spreadsheets were used to review various retained heights at the East and West Abutments, below existing grades. Based on these resources, Cantilevered Sheet Piling Systems are feasible for retained heights of 10 feet or less at the West Abutment and 18 feet or less at the East Abutment. It should be noted that auger refusal on hard clayey shale material was indicated at depths of 23.0 feet (~ El. 387.3) in Boring SB-03 at the West Abutment. Dense sands and gravels were encountered at depths below 40.0 feet (~El. 361.0) in Boring SB-27. These hard soils will limit the embedment depths of temporary support methods and the effectiveness of vibratory and hammer installation procedures.

Table 5.2, below, summarizes the retained heights versus required embedment depth and applicable section modulus.

Table 5.2 – Temporary Sheet Pile Design Parameters

Location	Reference Boring	Retained Height (Feet)	Embedment Depth (Feet)	Section Modulus (IN.^{3}/Foot)
West Abutment	SB-03	5	3.75	0.93
	SB-03	10	12.82	12.50
East Abutment	SB-27	5	7.82	2.44
	SB-27	10	12.43	12.33
	SB-27	15	19.22	35.77
	SB-27	18	23.44	59.68

Temporary Soil Retention Systems may be required versus Cantilevered Sheet Piling, depending upon the surcharge loading and retained heights required to be supported during construction. An Illinois-licensed Structural Engineer is required to seal the design of Temporary Soil Retention Systems, if deemed necessary.

5.3 Cofferdams and Seal Coats

Cofferdams will be required at the proposed pier locations. The estimated water surface elevation is greater than 6 ft. above the bottom elevation of the substructure. Therefore, a Type 2 cofferdam

will be required. All cofferdams are required to be dewatered. Sands and gravels are present at the site of the cofferdams requiring the use of a seal coat. A seal coat will reduce the potential for water from seeping beneath the sheet piling in the dewatered cofferdam. As per the 2012 IDOT Bridge Manual, if a seal coat is specified, General Note 26 shall be added to the plans. In selected pier locations, where the design should call for permanent casings with a load transfer beam poured above the EWSE, cofferdams will not be required.

The contractor is required to retain an Illinois licensed structural engineer to design the cofferdams. Per the Bridge Manual, the plans and computations shall be submitted to the Bureau of Bridges and Structures for review and final approval prior to beginning any work on the structure.

5.4 Site and Soil Conditions

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

5.5 Foundation Construction

Conventional pile driving equipment and methodologies should be assumed. Pile shoes should be implemented due to potential for hard driving.

Extra care should be taken when driving, as the existing foundations may be in close proximity to the proposed foundations. If conflicts occur, pre-coring or other special provisions may be required regarding pile penetration through any existing obstructions.

It is recommended that drilled shaft construction be performed by an experienced knowledgeable contractor familiar with the subsurface conditions in the area of the project site. The alluvial deposits in the area are known to contain cobbles and boulders. It should be anticipated that cobbles and boulders will be encountered during excavation of the drilled shafts as evidenced by the subsurface conditions encountered during drilling. Isolated zones of weathered rock may be encountered in the residual soil and above the shaft base that could require coring for removal. A full-time qualified geotechnical engineer or geologist who has knowledge of the design and soil conditions is recommended to perform inspection during the construction of the drilled shafts.

Each shaft should be cast the same day drilled to reduce the potential of bearing surface deterioration. The base of each shaft should be cleared of loose or softened material and should be pumped as necessary to limit the accumulations of water. The excavation should be dewatered immediately prior to concrete placement such that there is no more than 3 in. of standing water in the bottom of the excavation at the time of concrete placement. Inspection is recommended to be performed in all shafts according to Section 516 of IDOT's most recent version of the Standard Specifications for Road and Bridge Construction.

Permanent casing for the drilled shafts is recommended to add protection for the design life of the shafts. Permanent casing should be extended down to competent rock through the overburdened soils at each substructure, as applicable. Rock socket diameter shall be 6-inches less than the casing diameter. Permanent steel casing should be in accordance with IDOT Standard Specifications for Road and Bridge Construction, Section 1006.05 (d). Wall thickness should be between ¼-inch to 3/8-inch in thickness, but no less than ¼-inch thickness.

A Joint Utility Location Information for Excavators (JULIE) locate shall be conducted to determine if any underground utilities are present in the area of the proposed structure prior to construction. If utilities become a problem during construction, the appropriate owner shall be contacted immediately.

6.0 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.

7.0 GEOTECHNICAL DATA

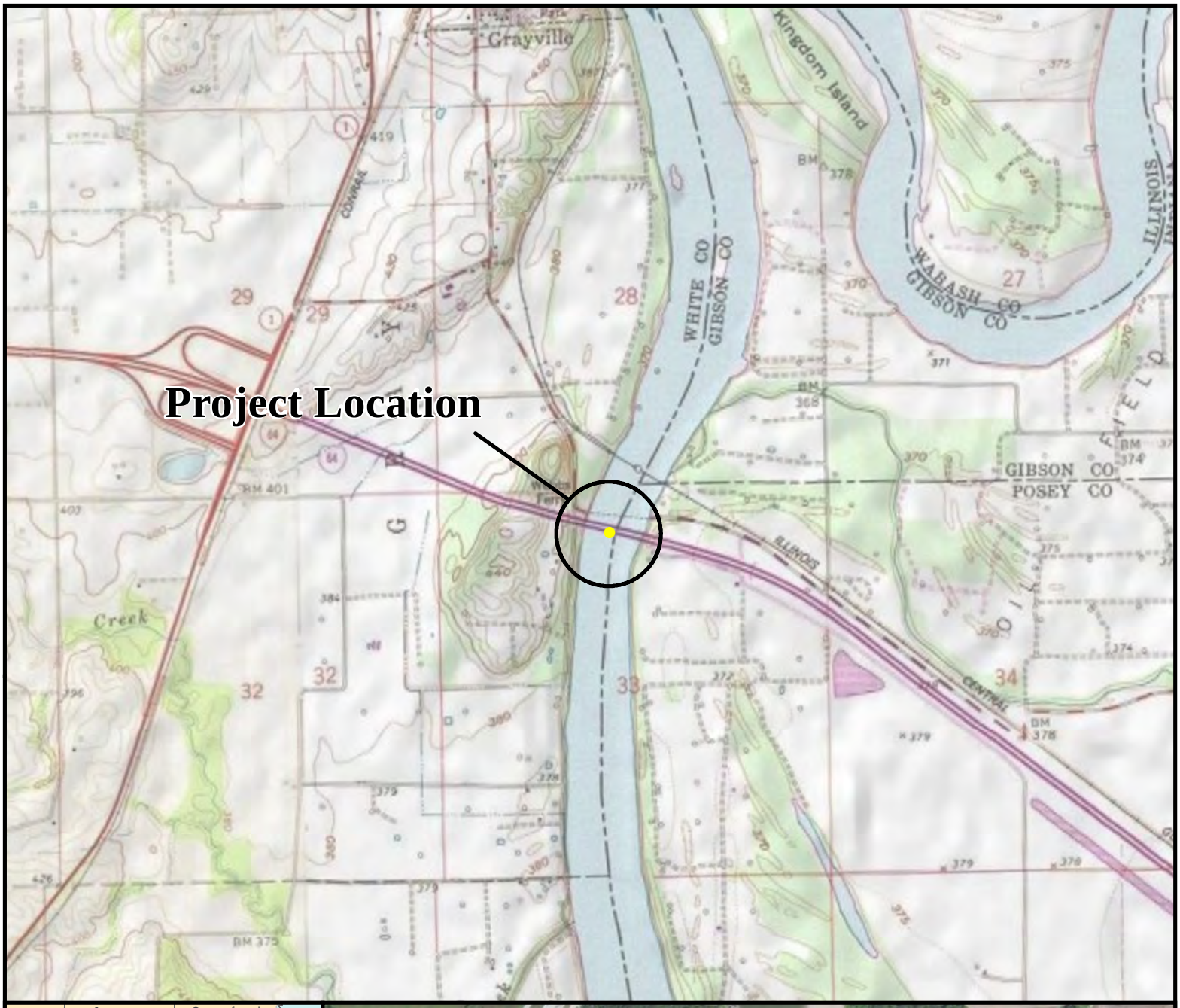
Soil boring logs can be found in Exhibit C. The Subsurface Profiles can be found in Exhibit D. Pile Design Tables can be found in Exhibit G, and Drilled Shaft Analysis can be found in Exhibit I.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of Knight E/A, Inc. and IDOT. They are specific only to the project described and are based on the subsurface information obtained by KEG at 27 boring locations within the bridge area in 2012 and 2013, 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.

EXHIBIT A

LOCATION MAP



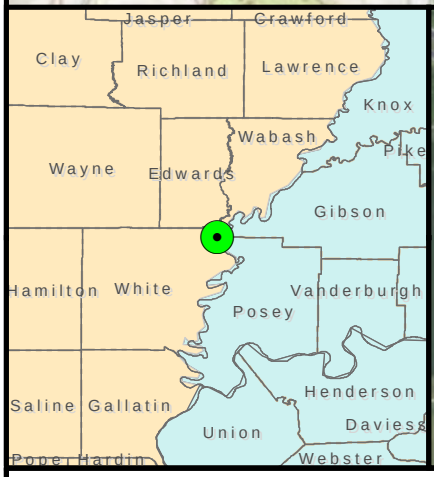


Exhibit A
Location Map
I-64 over Wabash River
White County, Illinois

N

0 500 1,000
Feet

Designed By: CRG
Drawn By: ASC
Checked By: CRG
Date: 6/19/13
Project #: 08-0023

Kaskaskia Engineering Group, LLC

EXHIBIT B

TYPE, SIZE AND LOCATION PLAN (TS&L)

Bench Mark: BM #101 chiseled square on SW wingwall of structure #097-0003, station 5875+05, 9.0 feet from edge of bit. pavement for I-64 EBL (Illinois). Elev. 411.35

BM #152 chiseled square on SE bridge abutment of the Wabash River Bridge (SN 097-0003) on the south side of EBL I-64 east side of the Wabash River, station 5902+40, 9.0 feet right from the edge of bit. pavement of EBL I-64 (Indiana). Elev. 403.14

Existing Structure: SN 097-0003 (EBL) and SN 097-0004 (WBL) are dual parallel strutures over the Wabash River built in 1967 under Section 97-3B and each consisting of 28 spans with total length of 2705'-3" back to back of abutments. Span lengths from west to east are 1 at 120', 6 at 160', 1 at 120', 1 at 67', 2 at 83', 2 at 67', 2 at 83', 2 at 67', 2 at 83', 2 at 67', 2 at 83', 2 at 67', 2 at 83' and 1 at 67'. The main spans consist of two 4-span continuous 600' units, and the approach spans are five 4-span 300' long units. The main spans 1 through 8 consist of a steel two-girder system with a 12" structural concrete deck supported on the main girder top flange. The main girders are spaced at 20' centers with 8' overhangs on each side. Each superstructure provides 30' clear roadway width between the 2' wide safety walks on each side. The bridge rail is aluminum tubular type mounted on 1' wide concrete parapet. The bridges are 36 ft. out to out of deck. The substructure consists of stub abutments and frame or hammerhead piers supported on piles.

Traffic Control: Construction of the proposed EB and WB structures will be done by utlizing median crossovers onto the existing EB roadway.

No Salvage

CURVE DATA

℄ EB I-64
PROP. CURVE I64PR_E_6
PI STA. 4898+86.30
Δ = 8° 20' 08" (RT)
D = 0° 59' 50"
R = 5,745.75'
T = 418.70'
L = 835.91'
E = 15.24'
SE = 3.4%
TR = 67.00'
SE RUN = 153.00'
PC STA. 4894+67.60
PT STA. 4903+03.52

℄ WB I-64
PROP. CURVE I64PR_W_6
PI STA. 1906+14.06
Δ = 22° 11' 00" (RT)
D = 0° 59' 40"
R = 5,761.92'
T = 1,129.57'
L = 2,230.85'
E = 109.68'
SE = 3.4%
TR = 67.00'
SE RUN = 153.00'
PC STA. 1894+84.49
PT STA. 1917+15.34

S.E. Transitions

Transition from normal crown to superelevation
Sta 1892+95 (WB), Sta 4892+78 (EB)
Full superelevation at Sta 1895+15 (WB), Sta 4894+98 (EB)
End superelevation at Sta 1916+85 (WB), Sta 4902+60 (EB)

DESIGN SPECIFICATIONS

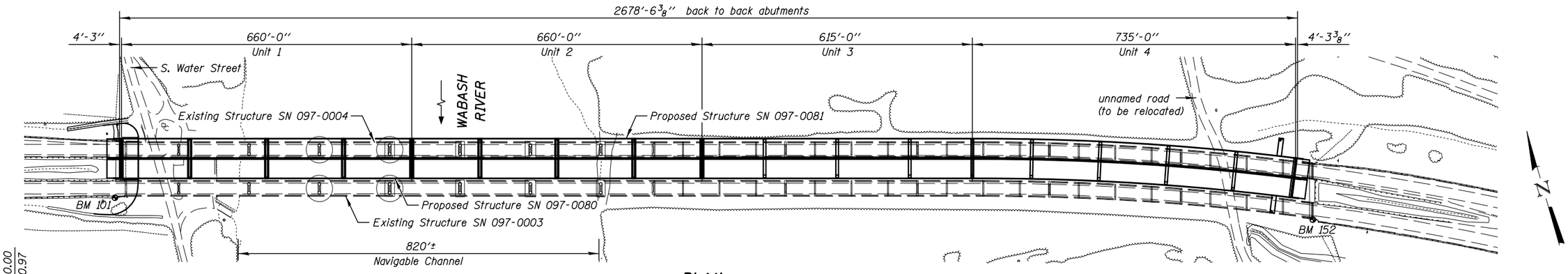
2020 AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 9th Edition

LOADING HL-93

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

HIGHWAY CLASSIFICATION

F.A.I. Rte. 64 - I-64
Functional Class: Interstate
Two-Way ADT: 16,400 (2019); 26,600 (2045)
DHV = 3,990 (2045)
ADTT: 9,500 (2045)
Design Speed: 70 mph
Posted Speed: 70 mph
Directional Distribution: 50:50

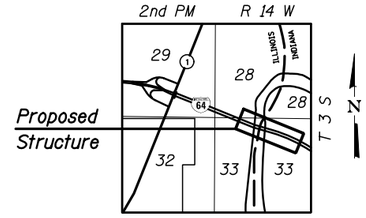


PLAN

℄ EASTBOUND I-64 - PROPOSED PROFILE GRADE LINE

Note: Profile Grade shows the final elevations after grinding.

℄ WESTBOUND I-64 - PROPOSED PROFILE GRADE LINE



LOCATION SKETCH

DESIGN STRESSES

FIELD UNITS

fc' = 3,500 psi
fc' = 4,000 psi (superstructure)
fy = 60,000 psi (reinforcement)
fy = 50,000 psi (AASHTO M270 Gr. 50W)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.276g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.657g
Soil Site Class = D

WATERWAY INFORMATION

Drainage Area = 29,070 sq. mi.

Existing Overtopping Elev. = 392.06 at Sta. 86+50 (Indiana)
Proposed Overtopping Elev. = 392.06 at Sta. 86+50 (Indiana)

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.
Design	Main Channel	50	282277	41746	41844	383.2	1.3	1.3	384.5	384.5
	Relief Structure			5747	5747					
	TOTAL			47493	47591					
Base	Main Channel	100	312019	45027	44663	384.5	1.4	1.4	385.9	385.9
	Relief Structure			6419	6419					
	TOTAL			51446	51082					
Scour Check	Main Channel	200	340000	47573	47067	385.5	1.5	1.5	387.0	387.0
	Relief Structure			6942	6942					
	TOTAL			54515	54009					
Overtopping	Main Channel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Relief Structure			N/A	N/A					
	TOTAL			N/A	N/A					
Max Calc	Main Channel	500	380000	50881	50408	386.8	1.6	1.6	388.4	388.4
	Relief Structure			7630	7630					
	TOTAL			58511	58038					

10 Year Velocity Through Existing Bridge = 5.8 ft/s
10 Year Velocity Through Proposed Bridge = 5.8 ft/s

DESIGN SCOUR ELEVATIONS (FT.)

Event/Limit State	Design Scour Elevations (ft.) W. Abut.	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	Pier 8	Item 113
Q100	376.71	305.76	306.22	305.76	305.85	305.99	306.27	297.72	298.47	5
Q200	374.80	303.62	304.06	303.61	303.70	303.83	304.12	294.85	295.58	
Design	376.71	305.76	306.22	305.76	305.85	305.99	306.27	297.72	298.47	
Check	374.80	303.62	304.06	303.61	303.70	303.83	304.12	294.85	295.58	

Event/Limit State	Design Scour Elevations (ft.) Pier 9	Pier 10	Pier 11	Pier 12	Pier 13	Pier 14	Pier 15	Pier 16	E. Abut.	Item 113
Q100	347.89	350.11	351.62	353.93	352.14	353.37	350.60	345.26	364.76	5
Q200	346.23	348.55	350.11	352.54	350.66	351.95	349.00	343.37	362.16	
Design	347.89	350.11	351.62	353.93	352.14	353.37	350.60	345.26	364.76	
Check	346.23	348.55	350.11	352.54	350.66	351.95	349.00	343.37	362.16	

KEY PLAN

I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

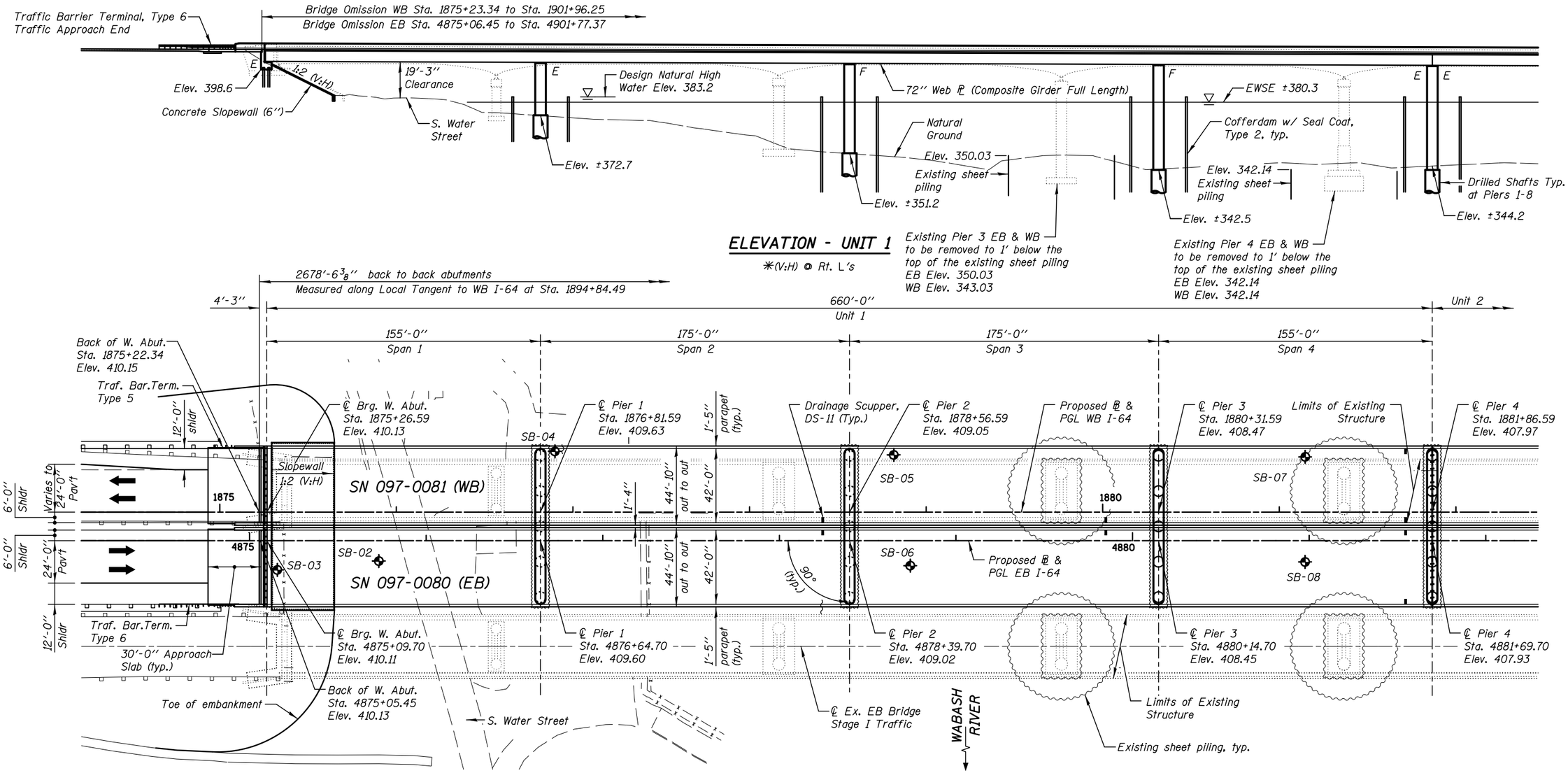
KNIGHT Engineers & Architects

		DESIGNED -	REVISED
		CHECKED -	REVISED
SCALE - NONE		DRAWN -	REVISED
DATE - 10/5/2021		CHECKED -	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



Notes:
Up to 1/4" may be ground off the bridge deck and approach slabs.

WB SCUPPER LOCATIONS

Station	Offset (ft)
1878+41.59	6.0
1880+01.59	6.0
1881+71.59	6.0
1881+71.59	-36.0

EB SCUPPER LOCATIONS

Station	Offset (ft)
4878+24.70	-6.0
4879+84.70	-6.0
4881+54.70	-6.0
4881+54.70	36.0

Legend
Soil Borings

GENERAL PLAN & ELEVATION - UNIT 1
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

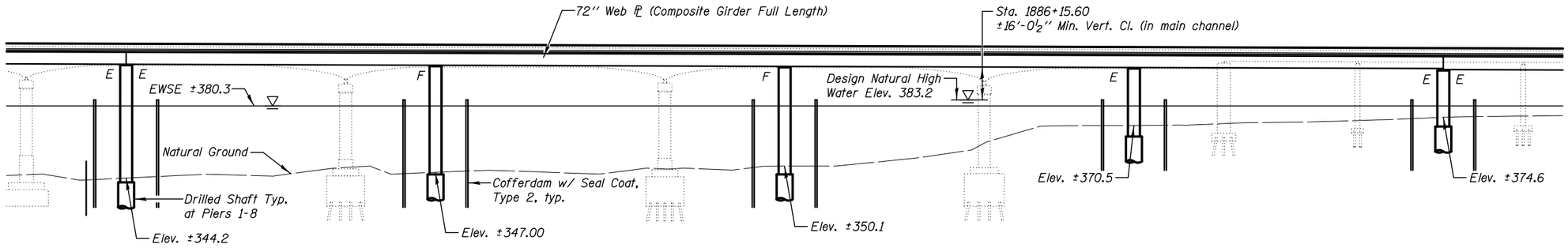
KNIGHT
Engineers & Architects

	DESIGNED -	REVISED	
	CHECKED -	REVISED	
SCALE - NONE	DRAWN -	REVISED	
DATE - 10/5/2021	CHECKED -	REVISED	

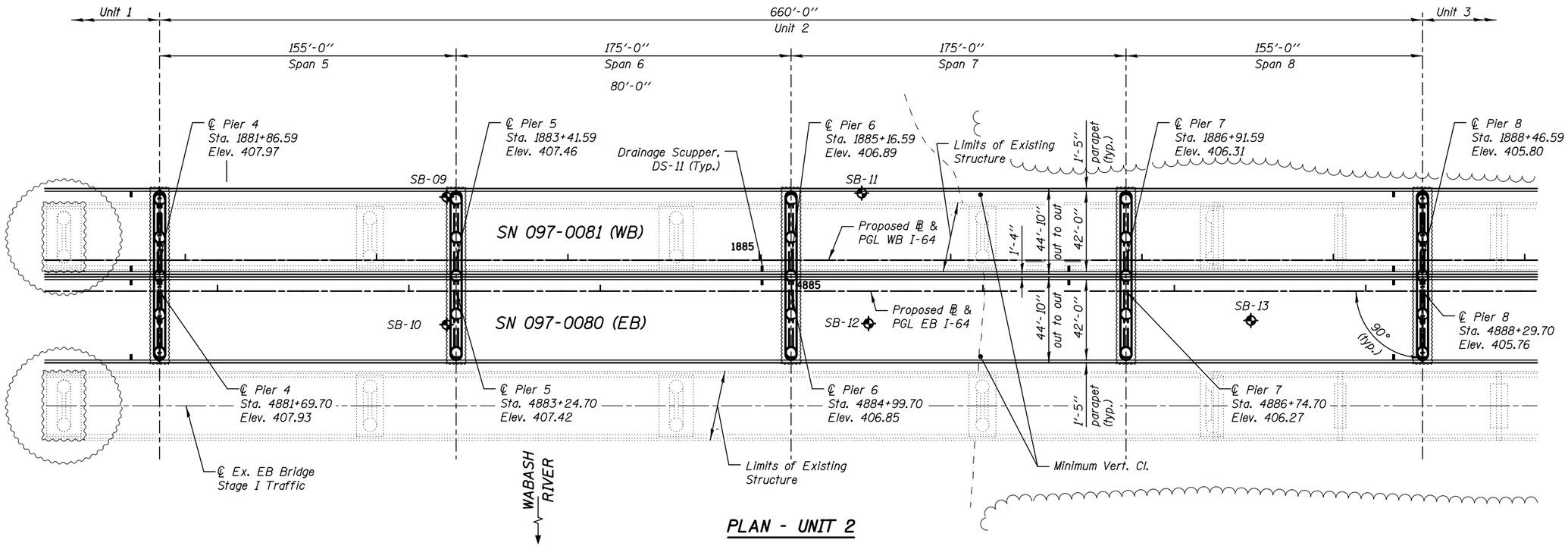
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



ELEVATION - UNIT 2



PLAN - UNIT 2

Notes:
Up to ¼" may be ground off the bridge deck and approach slabs.

WB SCUPPER LOCATIONS

Station	Offset (ft)
1885+01.59	6.0
1886+61.59	6.0
1888+31.59	6.0
1888+31.59	-36.0

EB SCUPPER LOCATIONS

Station	Offset (ft)
4884+84.70	-6.0
4886+44.70	-6.0
4888+14.70	-6.0
4888+14.70	36.0

Legend
Soil Borings

GENERAL PLAN & ELEVATION - UNIT 2
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

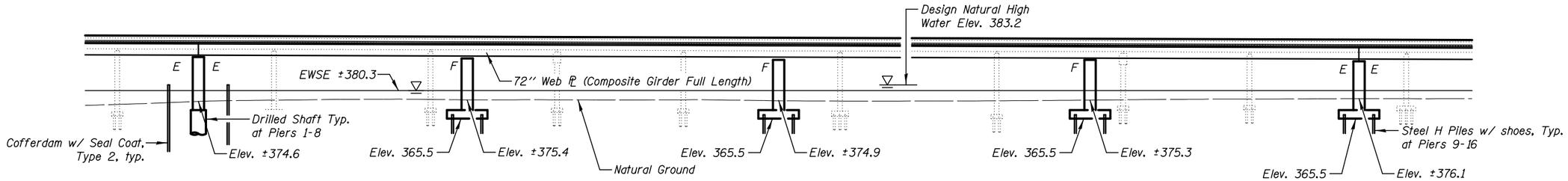
KNIGHT
Engineers & Architects

		DESIGNED -	REVISED
		CHECKED -	REVISED
SCALE -	NONE	DRAWN -	REVISED
DATE -	10/5/2021	CHECKED -	REVISED

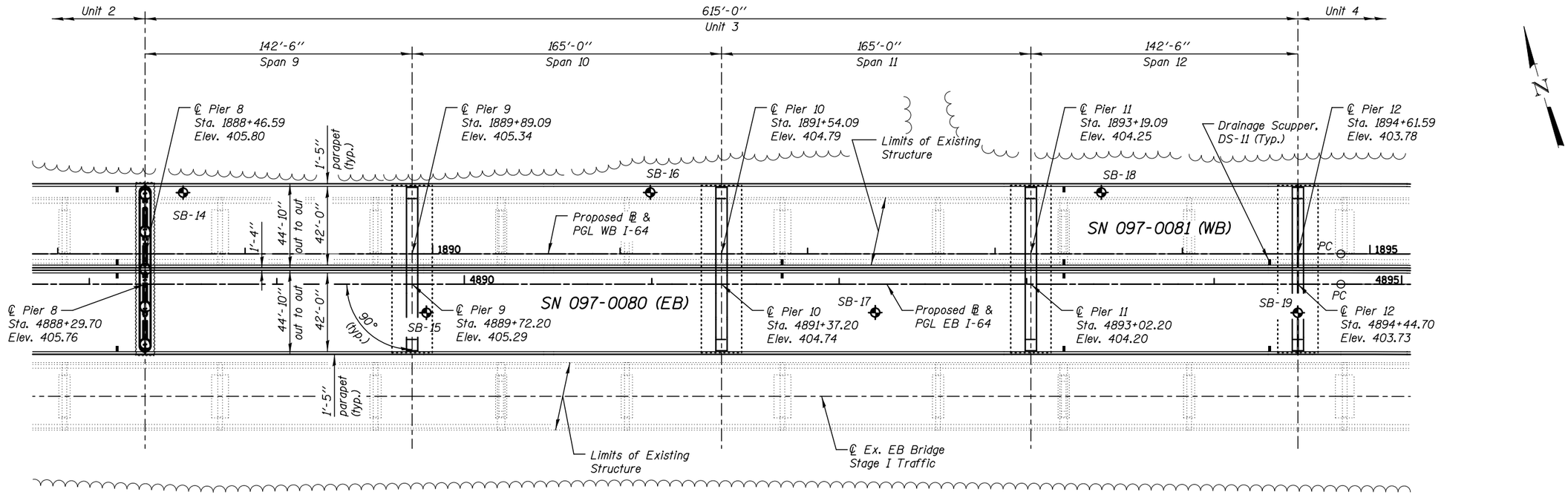
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 3 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



ELEVATION - UNIT 3



PLAN - UNIT 3

Notes:
Up to ¼" may be ground off the bridge deck and approach slabs.

WB SCUPPER LOCATIONS

Station	Offset (ft)
1891+86.59	6.0
1893+36.59	6.0
1893+36.59	-36.0
1894+46.59	6.0

EB SCUPPER LOCATIONS

Station	Offset (ft)
4891+69.70	-6.0
4893+19.70	-6.0
4893+19.70	-6.0
4894+29.70	36.0

Legend
Soil Borings

GENERAL PLAN & ELEVATION - UNIT 3
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

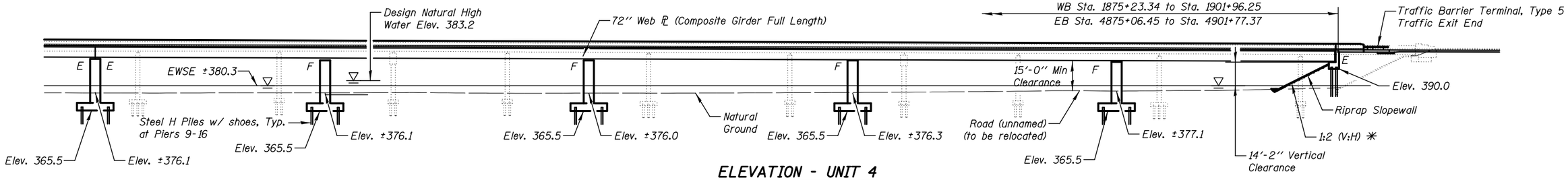
KNIGHT
Engineers & Architects

	DESIGNED -	REVISED	
	CHECKED -	REVISED	
SCALE - NONE	DRAWN -	REVISED	
DATE - 10/5/2021	CHECKED -	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

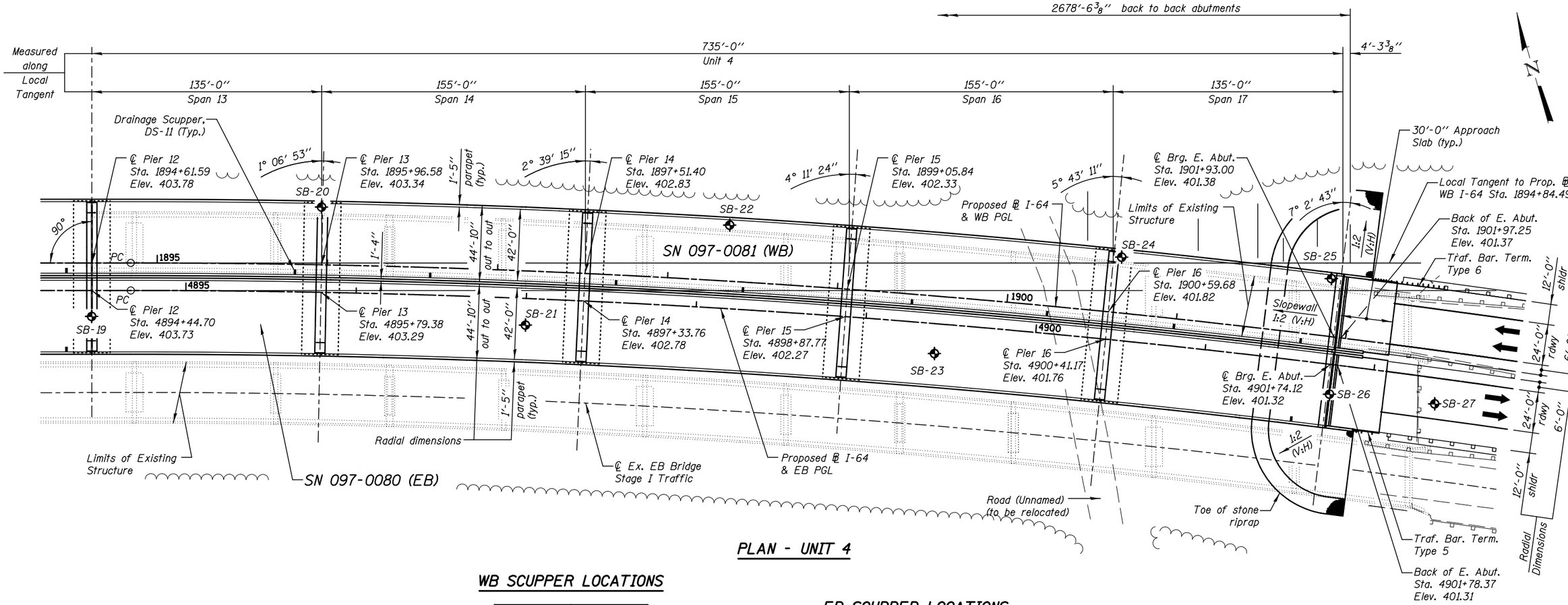
SHEET NO. 4 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



ELEVATION - UNIT 4

✳(V:H) @ Rt. L's



PLAN - UNIT 4

WB SCUPPER LOCATIONS

Station	Offset (ft)
1895+81.00	6.0
1896+60.52	6.0
1897+69.93	6.0
1898+44.58	6.0
1899+44.21	6.0
1900+24.02	6.0
1900+98.93	6.0
1901+73.94	6.0

EB SCUPPER LOCATIONS

Station	Offset (ft)
4901+55.12	36.0

Notes:

Up to 1/4" may be ground off the bridge deck and approach slabs.

Legend

✳ Soil Borings

GENERAL PLAN & ELEVATION - UNIT 4

I-64 OVER WABASH RIVER

PUBLIC WATER

F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5

WHITE (IL) & POSEY (IN) COUNTIES

STATION 4888+41.96

SN 097-0080 (EB) SN 097-0081 (WB)

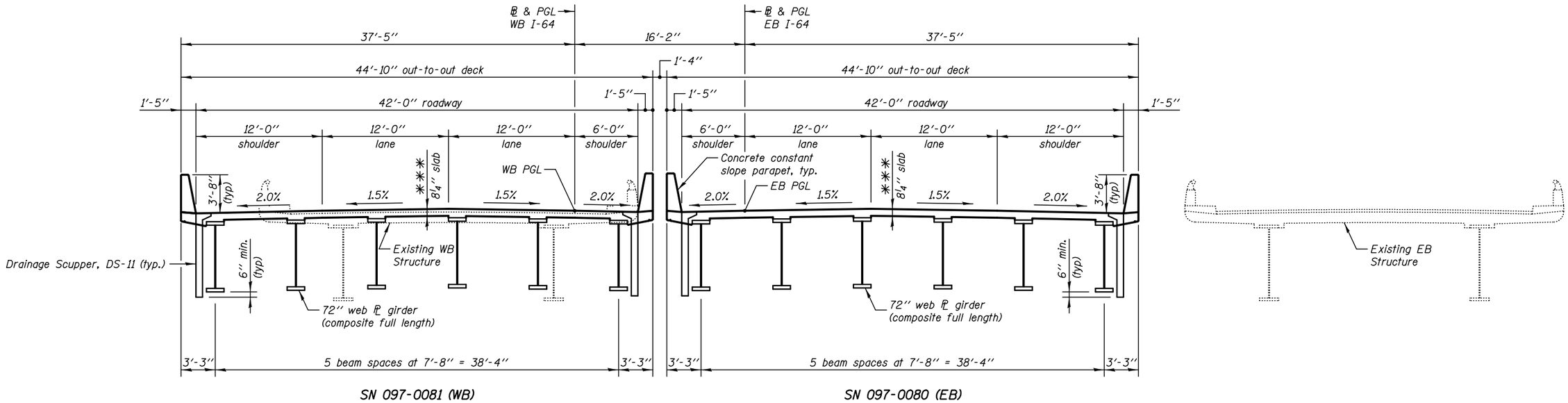
KNIGHT Engineers & Architects

		DESIGNED -	REVISED
		CHECKED -	REVISED
SCALE -	NONE	DRAWN -	REVISED
DATE -	10/5/2021	CHECKED -	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 5 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



SN 097-0081 (WB)

SN 097-0080 (EB)

CROSS SECTION - TANGENT SECTION

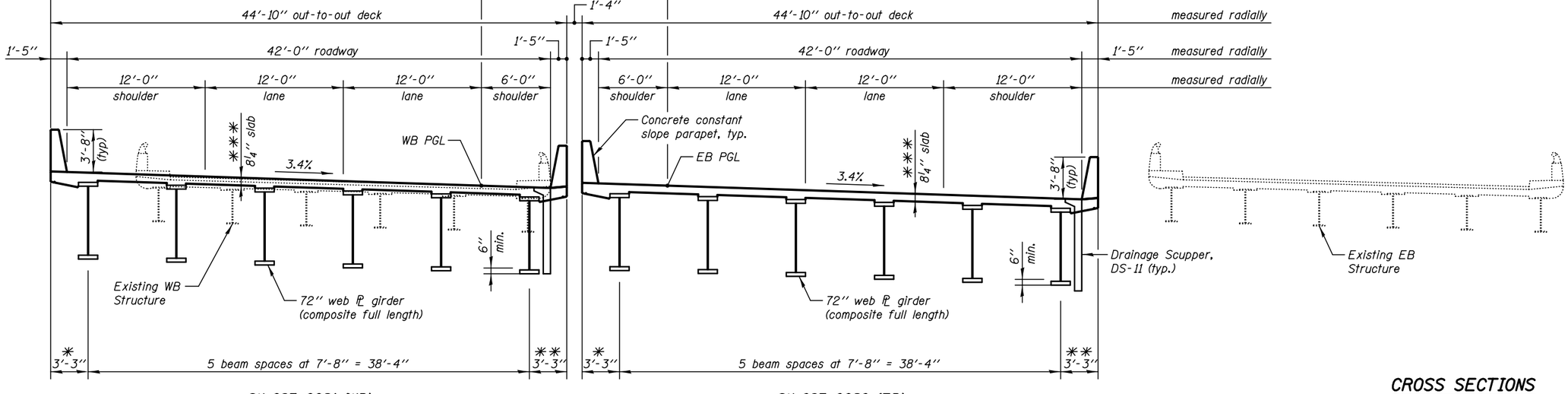
(Looking East)

✳✳✳ Prior to grinding

Span 13 - Overhang Varies

Sta 1894+61.59 to PC Sta 1894+84.49 (WB)
Sta 4894+44.70 to PC Sta 4894+67.60 (EB)

✳ varies 3′-3″ to 3′-3½″
✳✳ varies 3′-3″ to 3′-2½″



SN 097-0081 (WB)

SN 097-0080 (EB)

CROSS SECTION - CURVED SECTION

(Looking East)

Structure Superelevation

Transition from normal crown to superelevation
Sta 1892+95 (WB), Sta 4892+78 (EB)
Full superelevation at Sta 1895+15 (WB), Sta 4894+98 (EB)
End superelevation at Sta 1916+85 (WB), Sta 4902+60 (EB)

CROSS SECTIONS
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

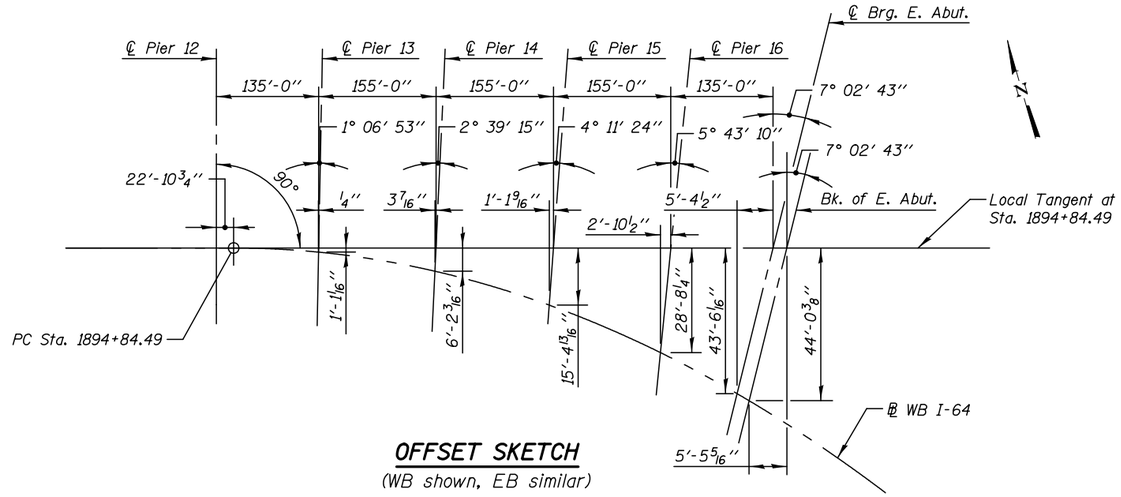
KNIGHT
Engineers & Architects

		DESIGNED -	REVISED
		CHECKED -	REVISED
SCALE -	NONE	DRAWN -	REVISED
DATE -	10/5/2021	CHECKED -	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

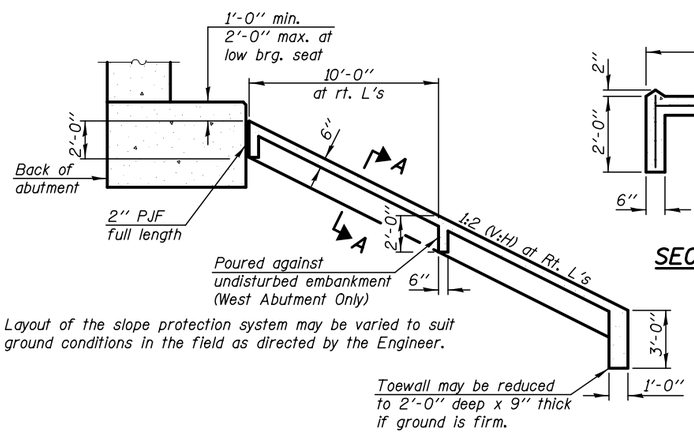
SHEET NO. 6 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



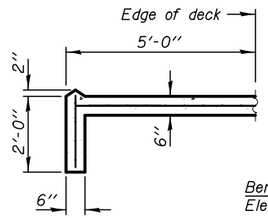
OFFSET SKETCH

(WB shown, EB similar)

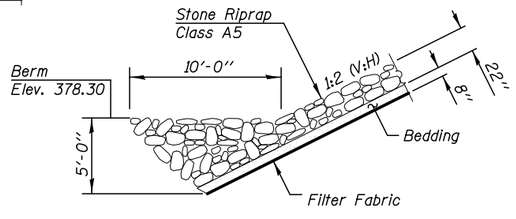


Layout of the slope protection system may be varied to suit ground conditions in the field as directed by the Engineer.

SECTION THRU CONCRETE SLOPEWALL



SECTION A-A

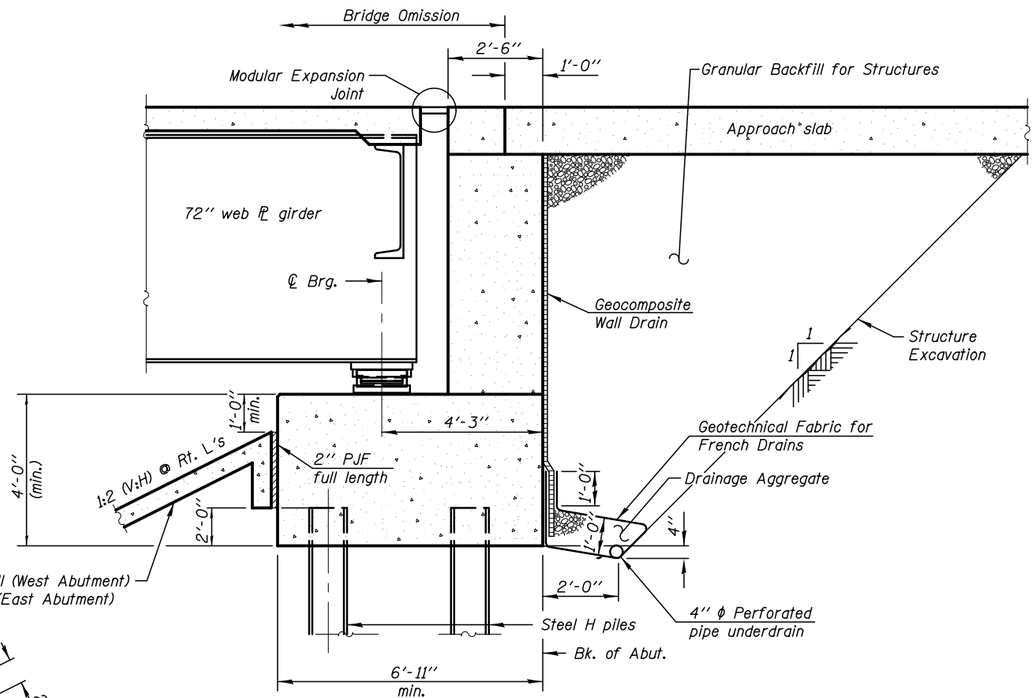


SECTION A-A

ELEVATIONS OF DRILLED SHAFT PIERS

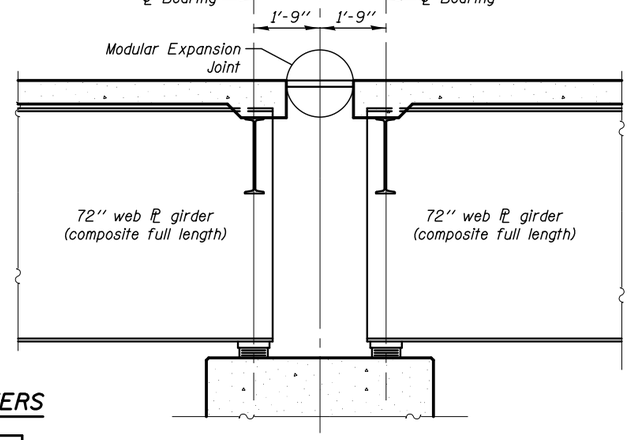
Pier	Elevation	
	A	B
1	372.7	357.3
2	351.2	347.0
3	342.5	317.0
4	344.2	317.0
5	347.0	✳317.8
6	350.1	311.6
7	370.5	307.4
8	374.6	306.5

✳Bedrock elev. shown corresponds to SB-09. SB-10 shows elev. approx. 17' higher



SECTION THRU PILE SUPPORTED STUB ABUTMENT

(Horiz. dim. @ Rt. L's)

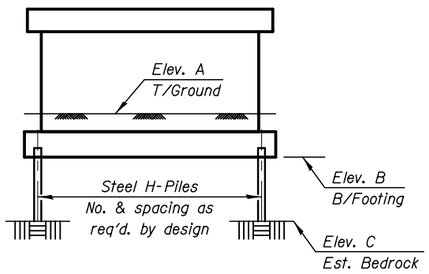


SECTION THRU EXPANSION JOINT (PIER 8 SHOWN, PIERS 4 AND 12 SIMILAR)

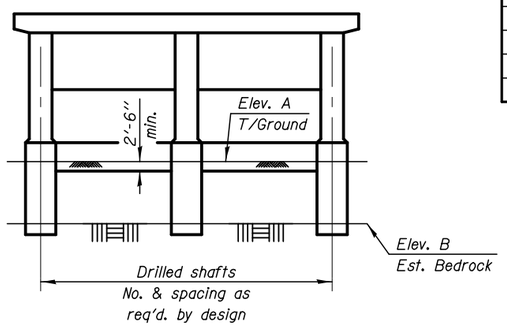
(Horiz. dim. @ Rt. L's)

ELEVATIONS OF PILE FOOTING PIERS

Pier	Elevation		
	A	B	C
9	375.4	365.5	301.1
10	374.9	365.5	301.5
11	375.3	365.5	302.5
12	376.1	365.5	299.0
13	376.1	365.5	301.9
14	376.0	365.5	303.6
15	376.3	365.5	293.8
16	377.1	365.5	299.5



PIER 9-16 SKETCH



PIER 1-8 SKETCH

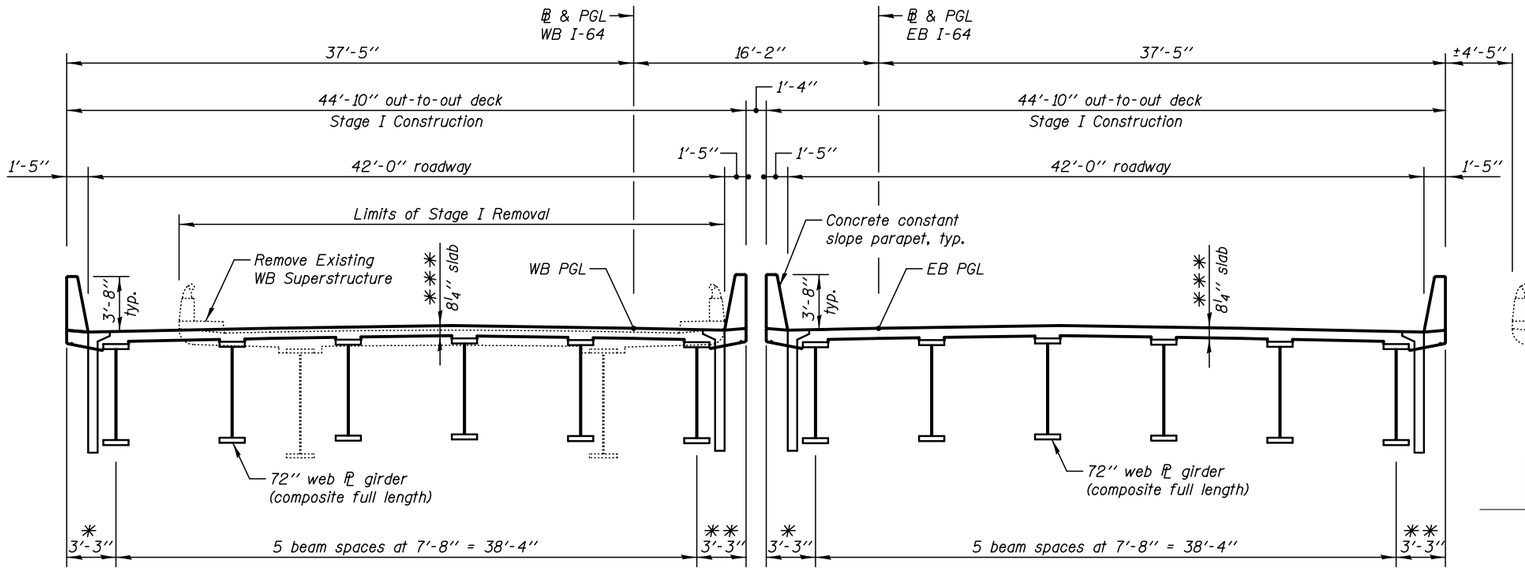
DETAILS
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

KNIGHT Engineers & Architects		DESIGNED -	REVISED
		CHECKED -	REVISED
	SCALE - NONE	DRAWN -	REVISED
	DATE - 10/5/2021	CHECKED -	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 7 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS	FED. AID PROJECT		



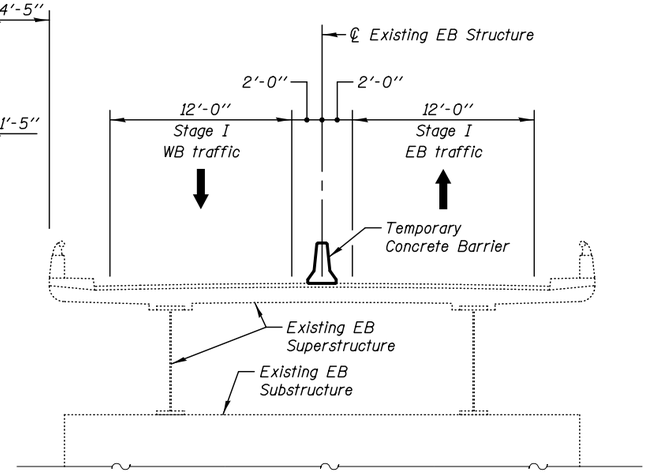
SN 097-0081 (WB)

SN 097-0080 (EB)

✳✳✳ Prior to grinding

STAGE I CONSTRUCTION

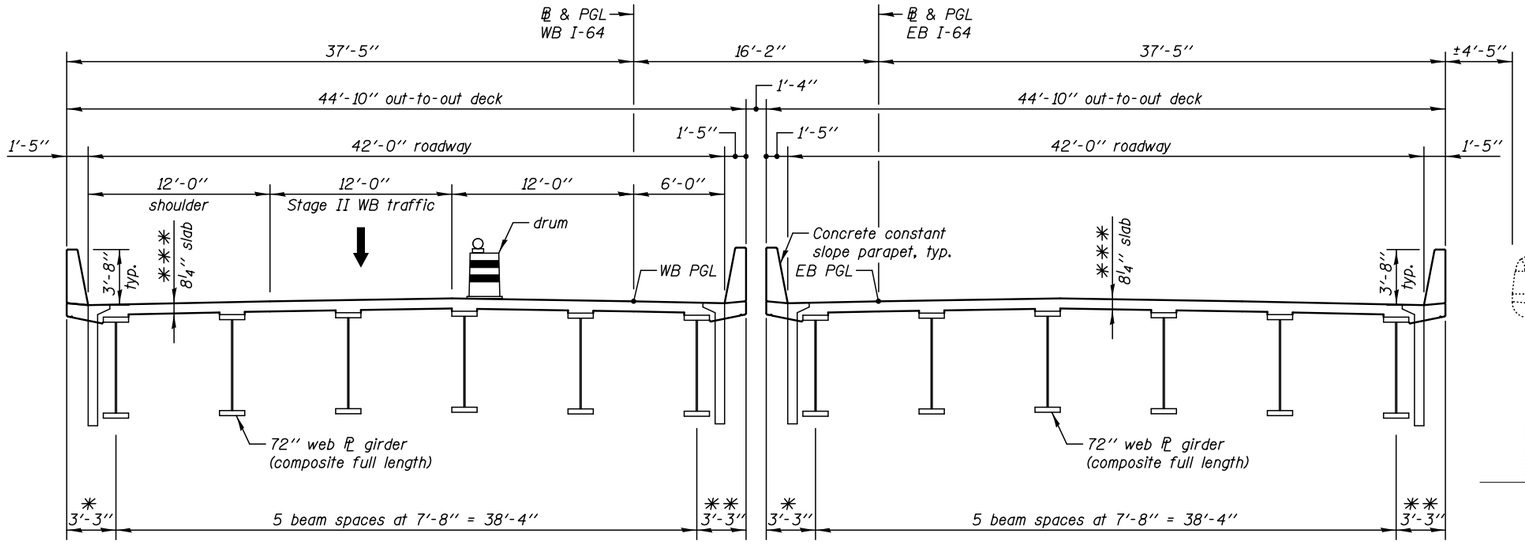
(Looking East)



Span 13 - Overhang Varies

Sta 1894+61.59 to PC Sta 1894+84.49 (WB)
Sta 4894+44.70 to PC Sta 4894+67.65 (EB)

✳ varies 3′-3″ to 3′-3½″
✳✳ varies 3′-3″ to 3′-2½″

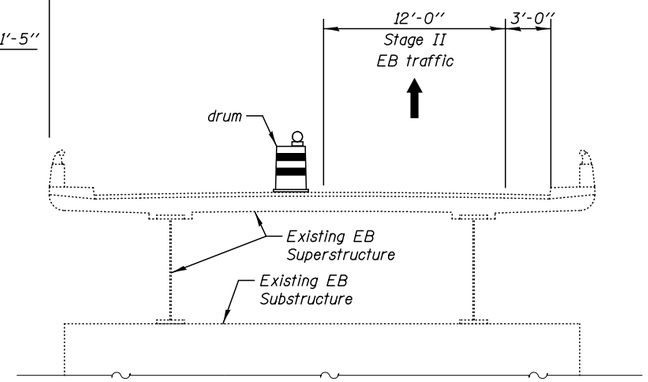


SN 097-0081 (WB)

SN 097-0080 (EB)

STAGE II CONSTRUCTION

(Looking East)



Note

Stage II Construction consists of roadway work outside the limits of the structure. Stage II WB traffic will travel on the outside lane of the PR WB Structure, while the EB traffic will travel on the outside lane of the EX EB structure.

STAGE CONSTRUCTION DETAILS
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

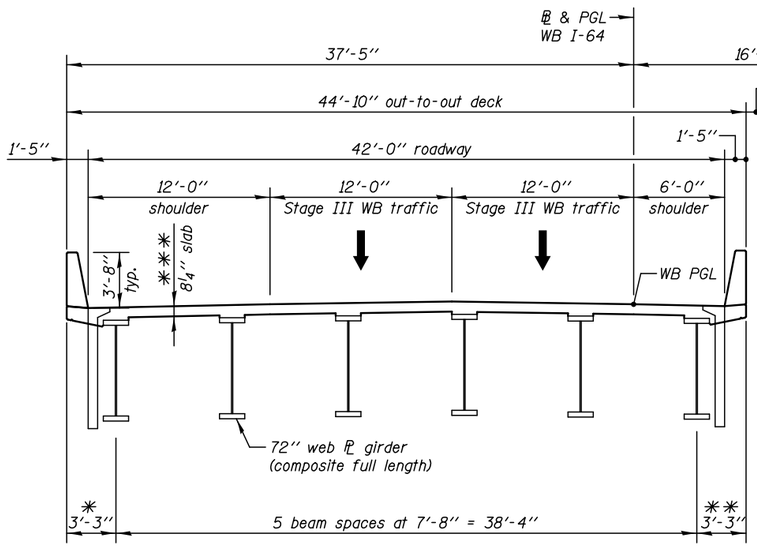
KNIGHT
Engineers & Architects

	DESIGNED -	REVISED	
	CHECKED -	REVISED	
SCALE - NONE	DRAWN -	REVISED	
DATE - 10/5/2021	CHECKED -	REVISED	

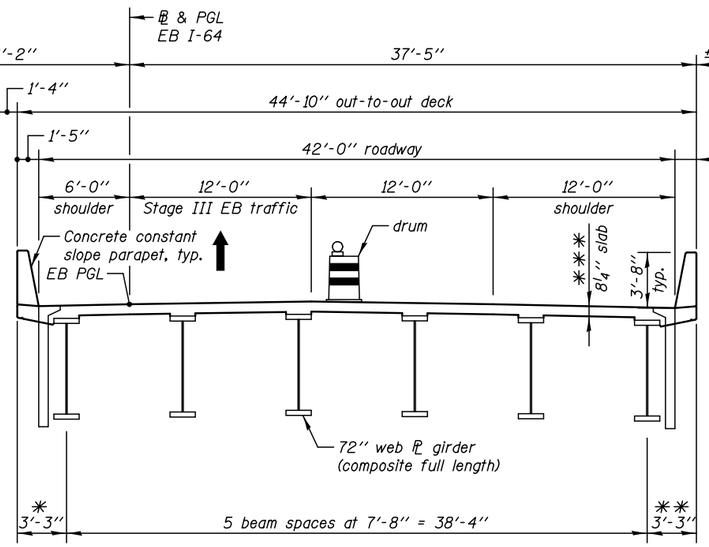
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 8 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			



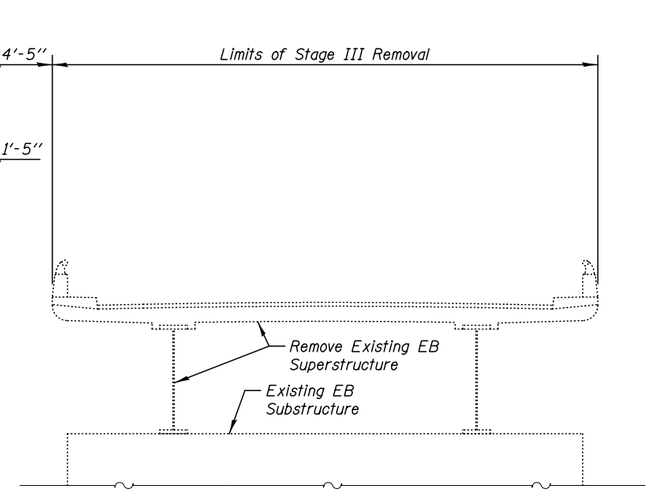
SN 097-0081 (WB)



SN 097-0080 (EB)

STAGE III CONSTRUCTION

(Looking East)



Span 13 - Overhang Varies

Sta 1894+61.59 to PC Sta 1894+84.49 (WB)
Sta 4894+44.70 to PC Sta 4894+67.60 (EB)

✳ varies 3′-3″ to 3′-3½″
✳✳ varies 3′-3″ to 3′-2½″

✳✳✳ Prior to grinding

STAGE CONSTRUCTION DETAILS
I-64 OVER WABASH RIVER
PUBLIC WATER
F.A.I. RTE. 64 (I-64) SEC. (97-2)B-5
WHITE (IL) & POSEY (IN) COUNTIES
STATION 4888+41.96
SN 097-0080 (EB) SN 097-0081 (WB)

KNIGHT
Engineers & Architects

	DESIGNED -	REVISED	
	CHECKED -	REVISED	
SCALE - NONE	DRAWN -	REVISED	
DATE - 10/5/2021	CHECKED -	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 9 OF 9 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
	P-99-003-08			
	ILLINOIS FED. AID PROJECT			

EXHIBIT C

BORING LOGS

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 10/9/12

ROUTE FAI 64 **DESCRIPTION** Sign Truss Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** WB I-64 @ Rest Area Exit, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. Sign Truss
Station 5871+71.8

BORING NO. SB-01
Station 5871+71.8
Offset 86.7 ft LT
Ground Surface Elev. 408.33 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 (%)
TOPSOIL - 3 inches 408.08				
CLAY: Gray, trace iron stains, A-7		2		
		2 5	0.9 B	23
405.33				
SILTY CLAY: Bluish gray, A-6 LL=37, PI=20		2		
		4 4	2.1 B	19
	-5			
402.83				
CLAY LOAM: Greenish gray, trace gravel, A-6		1		
		2 3	1.1 B	21
400.33				
SHALEY CLAY LOAM: Brownish gray, trace sandstone and shale fragments		1		
		4 4	1.8 B	19
	-10			
397.18		24		
SANDY SHALE: Brown, with sandstone fragments		50/5"	- -	7
395.33				
CLAYEY SHALE: Gray, trace sand		13		
		50/4"	- -	9
	-15			
		40		
		50/1"	- -	7
389.25		30		
End of Boring		50/1"	- -	7
	-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)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 10/8/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Toe of West Abutment End Slope (EB), **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-02
Station 5875+83.5
Offset 4.3 ft LT
Ground Surface Elev. 383.52 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 (%)
TOPSOIL - 6 inches	383.02				
SHALEY CLAY: Gray, with iron stains, A-7-6 LL=54, PI=27			3		
			2 4	1.5 P	22
			5		
	379.52				
CLAYEY SHALE: Greenish gray, with iron stains		-5	9 13	- -	17
			6		
Auger refusal at 7.0 ft.	376.60		13 50/5"	- -	12
LIMESTONE: Gray	376.10				
End of Boring		-10			
		-15			
		-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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/9/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** West Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-03
Station 5875+26.0
Offset 0.7 ft RT
Ground Surface Elev. 410.48 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
409.98				TOPSOIL - 6 inches
	4			SILTY CLAY: Brown, trace roots, A-6
408.73	5 6	2.8 P	17	SANDY CLAY LOAM: Gray, with iron nodules and stains, trace roots, A-6
407.48				SILTY CLAY: Gray, with sand seams, A-6
	3			
-5	5 8	2.4 B	20	
	3			
403.98				SILTY LOAM: Gray, trace roots and wood fragments, A-4
	4 7	2.2 P	15	
	3			With sand seams LL=24, PI=2
-10	9 15	2.1 P	18	
	4			
398.98				SANDY LOAM: Gray, A-2 (grain size test at 11.5 feet)
	8 13	NC	13	
	5			
-15	7 7	NC	16	
	3			
394.31				SHALEY CLAY: Bluish gray, with iron stains, trace shale fragments, A-7
392.98	5 9	2.4 B	23	
	9			CLAYEY SHALE: Brown, with interbedded sandy shale layers, trace coal
-20	13 15	- -	18	
-25	4			CLAYEY SHALE: Brown, with interbedded sandy shale layers, trace coal *(continued)* Becomes dark and light gray, trace roots and iron stains
	9 16	- -	19	
387.33				Auger refusal at 23.0 ft.
	50/2"	- -	5	End of Boring
-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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/8/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 1 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** HSA **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-04
Station 5876+83.2
Offset 66.4 ft LT
Ground Surface Elev. 371.34 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
371.17				GRAVEL - 2 inches
	5			CLAY: Dark gray, trace gravel and roots, A-6
	5 7	3.2 P	22	
	3			
	3 4	1.2 B	20	With sand seams
-5				
	4			With shale and sandstone fragments, trace gravel
	3 3	- -	24	LL=35, PI=16
362.84				
	2			SANDY LOAM: Brown and gray,
	1 1	NC	25	trace iron nodules and shells, A-2
-10				
359.84	10			
	13 36	- -	11	CLAYEY SHALE: Dark brown, with iron stains
	15			Becomes gray
	50/5"	- -	13	
-15				
354.84	25			
354.51	50/4"	- -	9	COAL
				SHALE: Gray, hard
	35			
	50/1"	- -	5	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				SHALE: Gray, hard *(continued)*
350.01	50/4"	- -	5	
				End of Boring
-25				
-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)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

SOIL BORING LOG

Date 5/24/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 2 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** BLIND DRILLING **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX
097-0081 PR
Station

BORING NO. SB-5
Station 5878+75.06
Offset 64.4 ft LT
Ground Surface Elev. 347.60 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
347.35			
-5			
-10			
-15			
-20			

Surface Water Elev. 362.35 ft
Stream Bed Elev. 347.60 ft

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

SANDY SHALE
(Depth of River 17' 9" at time of drilling)

End of Boring

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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/24/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 2 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** BLIND DRILLING **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX
097-0080 PR
Station

BORING NO. SB-6
Station 5878+84.43
Offset 1.7 ft LT
Ground Surface Elev. 347.73 ft

Surface Water Elev. 362.23 ft
Stream Bed Elev. 347.73 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SHALE & SANDSTONE (17' 5' depth of river at time of drilling) 346.98			
End of Boring			
-5			
-10			
-15			
-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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/28/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 4 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** MUD ROTARY **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-7
Station 5881+08.08
Offset 63.3 ft LT
Ground Surface Elev. 344.91 ft

Surface Water Elev. 360.66 ft
Stream Bed Elev. 344.91 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
BLIND DRILLING (18' 9" to river bottom)				BLIND DRILLING (18' 9" to river bottom) *(continued)*			
-5				-25			
				318.58 SANDSTONE: Gray			
-10				317.58 End of Boring -30			
-15				-35			
-20				-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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/28/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 4 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**, **Latitude** 76.64, **Longitude** -87.0

COUNTY White **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-08
Station 5881+08.01
Offset 3.8 ft LT
Ground Surface Elev. 339.01 ft

Surface Water Elev. 360.59 ft
Stream Bed Elev. 339.01 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Blind Drilling				318.51			
				Borehole continued with rock coring.			
-5				-25			
-10				-30			
-15				-35			
-20				-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
Kaskaskia Engineering

ROCK CORE LOG

Date 5/28/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 4 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude 76.64, **Longitude** -87.0

COUNTY White **CORING METHOD**

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-08
Station 5881+08.01
Offset 3.8 ft LT
Ground Surface Elev. 339.01 ft

CORING BARREL TYPE & SIZE Split Barrel, NX
Core Diameter in
Top of Rock Elev. 318.51 ft
Begin Core Elev. 317.01 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Light gray, fine grained, slightly weathered, with sub-bituminous coal stringers, slightly to moderately calcareous	317.01	1	72	48	0.6	264.0
	-25					
	-30	2	88	15	0.4	291.0
	-35	3	98	74	0.5	268.0
	-40	4	100	99	0.8	
	297.21					

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
Kaskaskia Engineering

ROCK CORE LOG

Date 5/28/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 4 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude 76.64, **Longitude** -87.0

COUNTY White **CORING METHOD**

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-08
Station 5881+08.01
Offset 3.8 ft LT
Ground Surface Elev. 339.01 ft

CORING BARREL TYPE & SIZE Split Barrel, NX
Core Diameter in
Top of Rock Elev. 318.51 ft
Begin Core Elev. 317.01 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE: Light gray to white, finely crystalline, slightly weathered, with sand, occasional sub-bituminous coal stringers *(continued)*						715.0
	295.31					
End of Boring						
	-45					
	-50					
	-55					
	-60					

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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/24/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 5 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY White **DRILLING METHOD** MUD ROTARY **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX
097-0081 PR
Station

BORING NO. SB-9
Station 5883+30.04
Offset 65.0 ft LT
Ground Surface Elev. 343.41 ft

Surface Water Elev. 362.91 ft
Stream Bed Elev. 343.41 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
BLIND DRILLING (22' 6" to river bottom during drilling)				BLIND DRILLING (22' 6" to river bottom during drilling) *(continued)*			
-5				-25			
				317.08			
				Auger Refusal on SANDSTONE End of Boring			
-10				-30			
-15				-35			
-20				-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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/23/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 5 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX
097-0080 PR
Station

BORING NO. SB-10
Station 5883+30.04
Offset 1.7 ft RT
Ground Surface Elev. 361.85 ft

Surface Water Elev. 363.01 ft
Stream Bed Elev. 361.85 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Blind Drilling			
-5			
-10			
-15			
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Blind Drilling *(continued)*			
-25			
334.85			
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
Kaskaskia Engineering

ROCK CORE LOG

Date 5/23/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 5 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **CORING METHOD**

STRUCT. NO. 097-0003 EX / 097-0080 PR **CORING BARREL TYPE & SIZE** Split Barrel, NX
Station

Core Diameter in
Top of Rock Elev. 334.85 ft
Begin Core Elev. 334.85 ft

BORING NO. SB-10
Station 5883+30.04
Offset 1.7 ft RT
Ground Surface Elev. 361.85 ft

DESCRIPTION		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Light gray, fine grained, slightly weathered, with sub-bituminous coal stringers, slightly to moderately calcareous, rare gravels	334.85		1	100	100	1	277.0
		-30					
			2	100	87	0.9	262.0
		-35					
			3	98	75	1.3	541.0
	322.10	-40					
LIMESTONE: Light gray to white, finely crystalline, slightly weathered, with sand, occasional sub-bituminous coal stringers 7 inch layer of sandstone Trace sand, no coal							
	319.05						
CALCAREOUS MUDSTONE: Dark gray, moderately to highly weathered, with gravel	318.45		4	80	67	5	
SHALE: Dark gray, slightly weathered, with sand							
		-45	5	100	76	8.3	146.0
End of Boring	314.85						

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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/21/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 6 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-11
Station 5885+46.96
Offset 67.0 ft LT
Ground Surface Elev. 353.52 ft

Surface Water Elev. 363.52 ft
Stream Bed Elev. 353.52 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY: Dark gray
				Split spoon sampler sank to 5 ft.
	WOH			A-7-6(45)
	WOH	--		LL=69, PI=40
-5	WOH			(grain size test at 3.5 feet)
	WOR			347.02
	5	--		SAND: Gray, fine to coarse, trace gravel, A-3
	3	NC		
	1			Becomes fine, no gravel
	WOR	NC		
-10	WOR			
				342.52
	1			SAND: Brown, fine to coarse, with gravel, A-1-b
	2	NC		(grain size test at 11 feet)
	2			
	2			Trace gravel and clay
	4	NC		
-15	5			
	5			No clay
	4	NC		
	5			
				335.02
	4			SAND: Gray, fine to coarse, trace gravel, A-3
	5	NC		
-20	5			(grain size test at 18.5 feet)

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, trace gravel, A-3 *(continued)*
	WOH			Becomes fine
	5	NC		
	6			
	2			
	7	NC		
-25	8			
	1			(grain size test at 26 feet)
	7	NC		
	9			
	2			
	5	NC		
-30	6			
				322.52
	1			SAND: Gray, fine to coarse, trace gravel, A-1-b
	6	NC		(grain size test at 31 feet)
	9			
	8			
	11	NC		
-35	12			
	4			
	4	NC		
	8			
				315.52
	3			SAND: Gray, fine to coarse, trace gravel, A-3
	3	NC		
-40	4			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/21/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 6 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-11
Station 5885+46.96
Offset 67.0 ft LT
Ground Surface Elev. 353.52 ft

Surface Water Elev. 363.52 ft
Stream Bed Elev. 353.52 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, trace gravel, A-3 *(continued)*
	2			(grain size test at 41 feet)
	3	NC		
	2			
				Refusal at 43.5 ft. 309.94
	50/2"	--		~~309.85~~ SANDSTONE: Gray
-45				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
Kaskaskia Engineering

SOIL BORING LOG

Date 5/22/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 6 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-12
Station 5885+50.49
Offset 1.1 ft RT
Ground Surface Elev. 350.28 ft

Surface Water Elev. 363.28 ft
Stream Bed Elev. 350.28 ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				RIVER BOTTOM
				Set casing to 6 ft.
-5				
344.28				
	4			SANDY LOAM: Gray, fine to coarse, trace organics and gravel, A-2-4(0)
	1	NC		LL=25, PI=4
	2			(grain size test at 6 feet)
341.78				
	4			SANDY GRAVEL: Brown, A-1-b
	3	NC		
-10	5			(grain size test at 8.5 feet)
	2			
	2	NC		
	3			
337.28				
	2			SAND: Brown, fine to coarse, with gravel, trace shell fragments, A-1
	3	NC		
-15	3			
	3			Trace clay seam
	5	NC		
	3			
331.78				
	3			SAND: Gray, fine to coarse, trace gravel, A-3
	3	NC		
-20	5			(grain size test at 18.5 feet)
				SAND: Gray, fine to coarse, trace gravel, A-3 *(continued)*
	3			Trace to no gravel
	4	NC		
	6			(grain size test at 21 feet)
				Drilled past due to mud loss.
-25				
				Drilled past due to mud loss.
				Set casing to 30 ft. after sampling at 28.5 ft
	4			(No recovery)
	1	NC		Chert fragment and wood fragment
-30	2			
319.28				
	6			SAND: Gray, fine to coarse, trace gravel, A-1-b
	6	NC		
	5			(grain size test at 31 feet)
	6			No gravel
	4	NC		
-35	9			
	4			Trace gravel
	7	NC		
	50/5"			(grain size test at 36 feet)
312.86				
				WEATHERED SANDSTONE: Greenish brown
311.58				
	50/2"			Borehole continued with rock coring.
-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
Kaskaskia Engineering

ROCK CORE LOG

Date 5/22/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 6 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **CORING METHOD**

STRUCT. NO. 097-0003 EX / 097-0080 PR **CORING BARREL TYPE & SIZE** Split Barrel, NX
Station

Core Diameter in
Top of Rock Elev. 312.86 ft
Begin Core Elev. 311.58 ft

BORING NO. SB-12
Station 5885+50.49
Offset 1.1 ft RT
Ground Surface Elev. 350.28 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Light gray, fine grained, slightly weathered, with sub-bituminous coal stringers, slightly to moderately calcareous	311.58		1	84	51	1	
6 inch gravelly layer		-40					
Trace gravel	309.58						
LIMESTONE: Light gray to white, finely crystalline, slightly weathered, trace sand							815.0
Trace coal stringers and gravel							
2 inch calcareous mudstone layer		-45	2	88	64	0.4	
3/4 inch calcareous mudstone layer	304.48						
CALCAREOUS MUDSTONE: Dark gray, moderately to highly weathered, with sand and gravel							62.0
	302.08						
CLAYEY SHALE: Gray	301.78		3	94		5.9	
SHALE: Dark gray, slightly weathered, trace sand		-50	4	100	100	8	
			5	100	94	6.7	66.0
4 inch clayey shale layer			6	16	16	3.7	
Becomes moderately weathered							
Becomes highly weathered							
Becomes slightly weathered		-55					
			7	60	35	6.7	62.0

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
Kaskaskia Engineering

ROCK CORE LOG

Date 5/22/13

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 6 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **CORING METHOD**

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-12
Station 5885+50.49
Offset 1.1 ft RT
Ground Surface Elev. 350.28 ft

CORING BARREL TYPE & SIZE Split Barrel, NX
Core Diameter in
Top of Rock Elev. 312.86 ft
Begin Core Elev. 311.58 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
End of Boring 291.48					
-60					
-65					
-70					
-75					

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/9/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 7 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-13
Station 5887+50.3
Offset 0.5 ft LT
Ground Surface Elev. 371.38 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 354.4 ft
Upon Completion ft
After 24 **Hrs.** 358.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
371.01				TOPSOIL - 4.5 inches
	2			CLAY LOAM: Brown, trace roots, A-6
	3 6	1.3 B	12	
367.38	2			
-5	3 4	1.4 B	26	CLAY: Dark gray, trace organics, A-7
	2			
	2 3	1.0 B	15	Trace gravel
362.88				
	WOH			SILTY CLAY LOAM: Greenish gray, A-4 LL=30, PI=9
-10	2 1	0.3 P	25	
				(SHELBY TUBE) Rec 23.5/24
	ST			
				▽
357.38	WOH			
	2	NC		SAND: Gray, fine, A-3
-15	2			
	1			Becomes brown (grain size test at 16 feet)
	1 2	NC		▼
				Begin mud rotary at 17.5 feet
	1			
351.38	2 5	NC		
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
	4			SAND: Brown, fine, A-3 *(continued)*
	5 5	NC		
348.38				
	6			SAND: Brown, fine to coarse, A-1
-25	6 8	NC		
	7			Trace gravel
	11 10	NC		
	4			
	4	NC		With gravel
-30	8			
				▽
	10			[A-1-b]
	10	NC		(grain size test at 33.5 feet)
-35	14			
	8			
	12	NC		Trace gravel
-40	10			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/9/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 7 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-13
Station 5887+50.3
Offset 0.5 ft LT
Ground Surface Elev. 371.38 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 354.4 ft
Upon Completion ft
After 24 **Hrs.** 358.4 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Brown, fine to coarse, A-1 *(continued)*				
Becomes gray, with gravel		7		
		7	NC	
	-45	8		
		5		
Trace gravel		6	NC	
	-50	7		
	319.38			
SAND: Gray, fine, trace gravel, A-3				
(grain size test at 53.5 feet)		14		
		12	NC	
	-55	11		
	314.38			
SAND: Gray, fine to coarse, trace gravel, A-1				
		13		
		13	NC	
	-60	18		

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*				
Refusal at 63.0 ft.	308.38			
GRANITE and SANDSTONE fragments	307.96	50/5"	- -	
End of Boring				
	-65			
	-70			
	-75			
	-80			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/10/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 8 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-14
Station 5888+60.3
Offset 64.7 ft LT
Ground Surface Elev. 374.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 355.5 ft
Upon Completion ft
After 24 **Hrs.** 357.0 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
373.71				TOPSOIL - 3.5 inches
	2			SANDY CLAY: Brown, A-6
	5 7	2.6 B	15	
370.00	3			
	4 4	NC	5	SAND: Brown, fine, A-3
-5				
368.00	3			
	5 6	NC	7	SANDY LOAM: Brown, A-2
366.00				
	3			SILTY LOAM: Brown, trace roots, A-4
	6 6	1.6 P	9	LL=27, PI=10
-10				
	4			
	5 6	NC	12	
	2			
359.50	4 2	NC	6	
-15				SAND: Brown, fine, A-3
358.00	1			
	1 4	0.3 P	24	SILTY CLAY LOAM: Gray, with iron stains and sand layers, A-4
356.50				
	1			SAND: Gray, fine, A-3 (grain size test at 18.5 feet)
	2 4	NC		Begin mud rotary at 20 feet
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	4			SAND: Gray, fine, A-3 *(continued)*
	3 3	NC		
	3			
-25	2 3	NC		
348.00	4			
	6 5	NC		SAND: Brown, fine to coarse, with gravel, A-1
	5			
	9 9	NC		
-30				
	7			[A-1-b]
	9 10	NC		(grain size test at 33.5 feet)
-35				
	8			Trace gravel
334.00	11 10	NC		
-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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/10/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 8 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-14
Station 5888+60.3
Offset 64.7 ft LT
Ground Surface Elev. 374.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 355.5 ft
Upon Completion ft
After 24 **Hrs.** 357.0 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*			
With gravel	6			With gravel	13		
[A-1-b]	7	NC			16	NC	
(grain size test at 43.5 feet) -45	7			-65	10		
				Refusal at 67.0 ft. 306.50	49		
				SANDSTONE: Gray 306.08	50/5"	- -	
Becomes gray, trace gravel	8			End of Boring			
	12	NC					
-50	8			-70			
	8						
	8	NC					
-55	7			-75			
	8						
	12	NC					
314.00 -60	12			-80			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/11/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 9 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-15
Station 5889+90.1
Offset 0.6 ft LT
Ground Surface Elev. 374.90 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 355.9 ft
Upon Completion ft
After 24 **Hrs.** 357.7 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				TOPSOIL - 4 inches 374.57
	2			CLAY LOAM: Gray, trace iron nodules and roots, A-6
	4 4	2.1 B	20	373.15 CLAY: Brown, trace organics, A-7
	6			Becomes brown and gray, trace organics
-5	6 5	2.5 B	31	
	2			
	4 4	1.4 B	26	
	2			Trace iron stains
-10	2 3	1.1 B	27	
	WOH			363.90 SILTY CLAY LOAM: Brown, with iron stains, A-6 LL=32, PI=14
	1 2	0.3 P	24	
	ST	- -		(SHELBY TUBE) Rec 19.5/24
-15				
	WOH			359.40 SANDY LOAM: Brown, trace gravel, A-2
▽	1 2	NC	22	
	WOR			356.40 SAND: Brown, fine to coarse, with gravel, A-1-b (grain size test at 18.5 feet)
-20	WOR 1	NC		354.90
				Begin mud rotary at 20 feet
	4			SAND: Brown, fine to coarse, with gravel, A-1-b *(continued)*
	4 5	NC		
	6			
-25	5 7	NC		
	5			Trace gravel
	5 7	NC		(grain size test at 26 feet)
	7			
-30	10 10	NC		
	10			With gravel
-35	13 11	NC		
	14			
-40	16 18	NC		334.90

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/11/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 9 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-15
Station 5889+90.1
Offset 0.6 ft LT
Ground Surface Elev. 374.90 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 355.9 ft
Upon Completion ft
After 24 **Hrs.** 357.7 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Brown, fine to coarse, with gravel, A-1-b *(continued)*
332.90				
				SAND: Gray, fine, A-3
	5			
	8	NC		
-45	9			
	11			
	14	NC		
-50	19			
	10			(grain size test at 53.5 feet)
	8	NC		
-55	10			
	8			(No recovery)
	9	- -		
-60	9			
				SAND: Gray, fine, A-3 *(continued)*
	10			
	14	NC		
309.90 -65	12			
				GRAVEL: with fine to coarse sand, A-1
	11			
	9	NC		
-70	9			
301.40				Refusal at 73.5 ft.
301.07	50/4"	- -	11	CLAYEY SHALE: Gray
				End of Boring
-75				
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/11/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 9 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-16
Station 5891+9.5
Offset 64.8 ft LT
Ground Surface Elev. 374.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.4 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL - 5 inches 373.98
	3			SANDY LOAM: Brown, A-2
	2 2	NC	14	
	2			370.40
-5	2 2	NC	7	SAND: Brown, fine, A-3
	2			(grain size test at 6 feet)
	2 2	NC	6	
				366.40
	1			SAND: Brown, fine to coarse, trace gravel, A-1
-10	3 3	NC	7	
	3			
	6 7	NC	6	
	4			
-15	7 8	NC	5	
	5			
▼	7 9	NC		
	3			
-20	5 7	NC		Begin mud rotary at 20 feet
	6			SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	9 8	NC		
	4			350.90
-25	5 5	NC		GRAVEL, with fine to coarse sand, A-1
	4			
	5 10	- -		
	3			345.90
-30	8 13	NC		SAND: Brown, fine to coarse, with gravel, A-1
	3			[A-1-b]
-35	5 5	NC		(grain size test at 33.5 feet)
	4			Becomes gray, trace gravel
-40	9 8	NC		334.40

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/11/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 9 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-16
Station 5891+9.5
Offset 64.8 ft LT
Ground Surface Elev. 374.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.4 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
	9			
	15	NC		
-45	12			
	7			[A-1-b]
	7	NC		(grain size test at 48.5 feet)
-50	8			
	9			
	9	NC		
-55	7			
317.40				
				SAND: Gray, fine, A-3
	9			
	16	NC		
-60	14			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine, A-3 *(continued)*
310.90				
	5			GRAVEL, with fine to coarse sand, A-1
	7	- -		
-65	5			
	7			
	8	- -		
-70	10			
				Refusal at 71.5 ft.
	26			With sandstone fragments
301.98	50/5"	- -		
				End of Boring
-75				
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/16/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 10 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**, **Latitude** , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-17
Station 5892+29.5
Offset 0.7 ft LT
Ground Surface Elev. 374.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 354.9 ft
Upon Completion ft
After 24 **Hrs.** 356.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				TOPSOIL - 5 inches 373.98
	3			CLAY LOAM: Brown, trace organics, A-6
	5 5	3.2 P	15	
				370.90
	3			SANDY LOAM: Brown, A-2
	6 5	NC	12	369.82
-5				SAND: Brown, fine, A-3
	2			
	2 4	NC		
	2			
	5 6	NC		
-10				363.90
	2			SAND: Brown, fine to coarse, A-1
	5 5	NC		
	2			[A-1-b]
	3 5	NC		(grain size test at 13.5 feet)
-15				
	2			
	7 8	NC		
	2			Trace gravel
	7 7	NC		Begin mud rotary at 20 feet
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Brown, fine to coarse, A-1 *(continued)*
	6			
	8 8	NC		
				350.90
	6			With gravel
	6 11	NC		Gravel: with fine to coarse sand, A-1
-25				
	11			
	11 18	NC		
				345.90
	8			SAND: Brown, fine to coarse, trace gravel, A-1
	13 12	NC		
-30				
	10			[A-1-b]
	8 10	NC		(grain size test at 33.5 feet)
-35				
	7			Becomes gray, trace gravel
	8 10	NC		334.40
-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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/16/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 10 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-17
Station 5892+29.5
Offset 0.7 ft LT
Ground Surface Elev. 374.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 354.9 ft
Upon Completion ft
After 24 **Hrs.** 356.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*			
	8			With gravel	3		
	8	NC		[A-1-b]	6	NC	
-45	12			(grain size test at 63.5 feet)	-65 12		
	10			Trace gravel	16		
	14	NC			20	NC	
-50	10				-70 14		
				Refusal at 72.0 ft. 302.40	33		
				Granite boulders and chert fragments, trace sand, A-1	31	- -	
				301.07	50/4"		
	9			End of Boring			
	10	NC					
-55	14				-75		
	7						
	10	NC					
314.40 -60	13				-80		

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/16-17/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 10 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-18
Station 5893+50.1
Offset 64.8 ft LT
Ground Surface Elev. 375.22 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
0				TOPSOIL - 2.5 inches 375.01
	2			SAND: Brown, fine, A-3
	3 3	NC		
				372.72
				SANDY LOAM: Brown, A-2
	1			
	2 3	NC	15	
-5				370.22
				SAND: Brown, fine, A-3
	2			
	1 2	NC		
	1			(grain size test at 8.5 feet)
	1 2	NC		
-10				
	1			
	3 3	NC		
				362.22
	2			SAND: Brown, fine to coarse, trace gravel, A-1
	3 5	NC		
-15				
	4			
	5 8	NC		
	▼			
	3			
	4 7	NC		
-20				Begin mud rotary at 20 feet
				SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	5			
	5 7	NC		
	6			
	7 8	NC		
-25				
	7			With gravel
	7 9	NC		
				346.72
	5			SAND: Brown, fine to coarse, trace gravel, A-3
	9 14	NC		
-30				
				(grain size test at 33.5 feet)
	8			
	8 8	NC		
-35				
				338.22
				SAND: Gray, fine to coarse, A-1
	10			
	14 9	NC		
-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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/16-17/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 10 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-18
Station 5893+50.1
Offset 64.8 ft LT
Ground Surface Elev. 375.22 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, A-1 *(continued)*
	6			Trace gravel
	6	NC		
-45	8			
	12			With gravel
	10	NC		
-50	12			
	10			[A-1-b]
	10	NC		(grain size test at 53.5 feet)
-55	10			
	8			
	13	NC		
315.22 -60	12			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, with gravel, A-1 *(continued)*
	9			Trace sandstone fragments
	11	NC		
-65	7			
309.22				
309.12	16			0.75-inch SANDSTONE seam
	8	NC		SAND: Gray, fine, A-3
	12			
-70				
302.22				Refusal at 73.0 ft.
302.18	50/0.5	- -		SANDSTONE: Gray (No recovery)
				End of Boring
-75				
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/17-18/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 11 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-19
Station 5894+54.9
Offset 0.6 ft LT
Ground Surface Elev. 376.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.0 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL - 6 inches
375.50				
	3			SANDY CLAY: Brown, trace organics, A-6
	5	3.3	13	
	6	S		
372.42				
	2			CLAY: Brown, trace organics, A-7
	4	3.1	25	
-5	5	B		
	2			With iron stains
	3	1.6	25	[A-7-6]
	2	B		LL=48, PI=26
367.50				
	1			SANDY CLAY LOAM: Brown, A-4
	2	0.3	20	
-10	4	P		
364.83				
	1			SAND: Brown, fine to coarse, trace gravel, A-3
	2	NC		
	3			
	1			(grain size test at 13.5 feet)
	2	NC		
-15	2			
	3			
	4	NC		
	5			
357.50				
▼	3			SAND: Brown, fine to coarse, trace gravel, A-1
	3	NC		
-20	6			Begin mud rotary at 20 feet
	6			SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	6	NC		
	10			
	8			With gravel
	8	NC		
-25	8			
350.00				
	8			GRAVEL: with coarse sand, A-1
	8	NC		
	12			
	4			With sandstone fragments
	9	NC		
-30	9			
	7			[A-1-b]
	9	NC		(grain size test at 33.5 feet)
-35	9			
337.50				
	10			SAND: Gray, fine to coarse, trace gravel, A-1
	9	NC		
-40	12			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/17-18/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 11 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX
097-0080 PR
Station

BORING NO. SB-19
Station 5894+54.9
Offset 0.6 ft LT
Ground Surface Elev. 376.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.0 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*				
		6		
		7	NC	
	-45	7		
[A-1-b]		6		
(grain size test at 48.5 feet)		6	NC	
	-50	7		
		6		
		7	NC	
	-55	6		
		14		
		17	NC	
	316.00 -60	15		
SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*				
		10		
		13	NC	
	-65	14		
		7		
		8	NC	
	-70	14		
		13		
		18	NC	
	-75	26		
Refusal at 75.5 ft.	300.50			
		44		
GRANITE cobbles and large GRAVEL, with fine to coarse sand, A-1		18	- -	
	299.00	12		
End of Boring				
	-80			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/18/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 11 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-20
Station 5895+88.7
Offset 65.9 ft LT
Ground Surface Elev. 375.37 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.9 ft
Upon Completion ft
After 24 **Hrs.** 357.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				TOPSOIL - 6 inches 374.87
	3			SANDY LOAM: Brown, A-2
	5 6	3.1 P	12	
	1			[A-2-4]
	2	NC	15	LL=17, PI=2
-5	2			
				369.37
	2			SAND: Brown, fine, A-3
	3 3	NC		
	2			
	4	NC		
-10	4			
	2			
	4	NC		
	5			
	2			Trace gravel
	4	NC		
-15	6			
	4			Becomes fine to coarse
	6	NC		(grain size test at 16 feet)
	6			
				356.87
	4			SAND: Brown, fine to coarse, trace gravel, A-1
	4	NC		
-20	9			Begin mud rotary at 20 feet

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	7			
	4 5	NC		
	5			
	7	NC		
-25	7			
				349.87
	8			SAND: Brown, fine to coarse, trace gravel, A-3
	10 12	NC		
	9			Becomes fine
	13	NC		(grain size test at 28.5 feet)
-30	12			
				343.37
				SAND: Gray, fine to coarse, trace gravel, A-1
	10			
	14	NC		
-35	12			
	8			Trace shale fragments
	10	NC		
-40	11			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/18/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 11 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-20
Station 5895+88.7
Offset 65.9 ft LT
Ground Surface Elev. 375.37 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.9 ft
Upon Completion ft
After 24 **Hrs.** 357.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
	10			SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
	16	NC		
-45	15			
	8			
	12	NC		
-50	13			
				with gravel
321.87				
321.74	9		31	1.5-inch CLAY seam
	9	NC		SAND: Gray, fine to coarse, trace gravel, A-1-b (grain size test at 53.5 feet)
-55	9			
	5			
	7	NC		
-60	7			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
	4			SAND: Gray, fine to coarse, trace gravel, A-1-b *(continued)*
	6	NC		
-65	10			
	15			
	23	NC		
-70	20			
	7			Trace chert fragments
	15	NC		
	12			
301.87				Refusal at 73.5 ft.
301.62	50/3"	- -		SANDSTONE: Dark gray
				End of Boring
-75				
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/24/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 12 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-21
Station 5897+9.8
Offset 0.2 ft LT
Ground Surface Elev. 376.07 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.6 ft
Upon Completion ft
After 24 **Hrs.** 356.6 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				TOPSOIL - 4.5 inches
375.70				
	3			CLAY LOAM: Brown, trace roots, A-6
	4	1.8	17	
	7	B		
372.57				
	2			SANDY LOAM: Brown, A-2
	2	NC	15	LL=20, PI=4
-5	3			
370.07				
	1			SAND: Brown, fine, with clay
	2	NC	11	lumps, A-3
	2			
367.57				
	2			SANDY LOAM: Gray and brown,
	2	NC	20	trace iron stains, A-2
-10	3			
365.07				
	2			SAND: Brown, fine to coarse, A-3
	4	NC		
	7			
363.07				
	1			SAND: Brown, fine to coarse,
	5	NC		trace gravel, A-1
-15	6			
	4			
	4	NC		
	4			
	3			
▼	4	NC		
-20	4			Begin mud rotary at 20 feet

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	3			[A-1-b]
	3	NC		(grain size test at 21 feet)
	3			
353.07				
	5			SAND: Gray, fine to coarse, trace gravel, A-3
	12	NC		
-25	13			
	8			No gravel
	14	NC		
	12			
348.07				
	8			SAND: Gray, fine to coarse, trace gravel, A-1
	17	NC		
-30	17			
	7			
	11	NC		
-35	13			
	5			[A-1-b]
	9	NC		(grain size test at 38.5 feet)
-40	8			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/24/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 12 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-21
Station 5897+9.8
Offset 0.2 ft LT
Ground Surface Elev. 376.07 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 356.6 ft
Upon Completion ft
After 24 **Hrs.** 356.6 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
334.07				
				SAND: Gray, fine, trace gravel, A-3
	10			
	10	NC		
-45	10			
329.07				
				SAND: Gray, fine to coarse, trace gravel, A-1
	10			
	14	NC		
-50	15			
	7			
	10	NC		
-55	12			
				with gravel and granite cobbles
	6			[A-1-b]
	9	NC		(grain size test at 58.5 feet)
-60	9			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
	6			
	10	NC		
311.07 -65	14			
				GRAVEL, with fine to coarse sand, A-1
	3			
	10	- -		
-70	12			
				with Boulders
	7			
	16	- -		
	12			Refusal at 72.5 ft. 303.57
				End of Boring
-75				
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/25/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 12 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-22
Station 5898+26.0
Offset 64.9 ft LT
Ground Surface Elev. 376.26 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.8 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL - 6 inches 375.76
				CLAY: Brown, trace organics, A-7
	3			
	5 6	3.6 B	20	
	2			
-5	4 4	1.6 B	21	
	2			
				369.76
	5 4	NC	11	SANDY LOAM: Brown, A-2-4 LL=20, PI=15
				367.76
	1			SAND: Brown, fine, A-3
-10	2 3	NC		
	2			
	2 2	NC		
	2			Trace gravel (grain size test at 13.5 feet)
-15	2 2	NC		
	2			
				359.76
	5 4	NC		SAND: Brown, fine to coarse, trace gravel, A-1
▼	3			
	4 4	NC		Begin mud rotary at 20 feet
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	5			
	4 5	NC		
	3			[A-1-b]
-25	2 3	NC		(grain size test at 23.5 feet)
	2			
	3 7	NC		
	11			Becomes gray
-30	11 17	NC		
	8			
-35	8 12	NC		
	11			
-40	9 13	NC		336.26

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/25/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 12 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-22
Station 5898+26.0
Offset 64.9 ft LT
Ground Surface Elev. 376.26 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.8 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*			
	10				10		
	11	NC		With gravel and sandstone fragments	14	NC	
-45	11			-65	8		
329.26							
SAND: Gray, fine to coarse, trace gravel, A-3							
				307.76			
(grain size test at 48.5 feet)	9			GRAVEL, with fine to coarse sand and granite fragments, A-1	11		
	8	NC			14	- -	
-50	9			-70	14		
				302.76			
No gravel	8			SAND: Gray, fine to coarse, with gravel, A-1	15		
	12	NC			19	NC	
-55	10			-75	12		
319.26				299.26			
SAND: Gray, fine to coarse, trace gravel, A-1				GRAVEL: large with granite cobbles and sandstone fragments, A-1	29		
					23	- -	
	5				50		
	13	NC		With fine to coarse sand	15		
-60	15			296.26 -80	31	- -	

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/25/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 12 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-22
Station 5898+26.0
Offset 64.9 ft LT
Ground Surface Elev. 376.26 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.8 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	19			GRAVEL, with sandstone fragments and fine to coarse sand, A-1 *(continued)*
	30			
	30	- -		Refusal at 81.0 ft. with Granite Boulders
293.76	40			
				End of Boring
-85				
-90				
-95				
-100				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/30/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 13 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-23
Station 5899+50.7
Offset 1.7 ft RT
Ground Surface Elev. 376.62 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.6 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
376.20				TOPSOIL - 5 inches
	2			CLAY LOAM: Brown, trace roots, A-6
	4 6	1.6 B	28	
373.12				
	2			SAND: Brown, trace gravel, A-3
-5	4 2	NC		
370.62				
	1			SANDY CLAY LOAM: Greenish gray, A-4
	1 1	0.3 B	19	
368.62				
	WOH			SILTY CLAY: Gray and brown, trace iron stains, A-6 LL=29, PI=11
-10	WOH 1	<0.25 P	29	
366.12				
	ST			(SHELBY TUBE) Rec 24/24
363.37				
	5			SAND: Brown, fine to coarse, trace gravel, A-3
-15	8 9	NC		
360.62				
	8			SAND: Brown, fine to coarse, trace gravel, A-1
	11 12	NC		
▼	7			
-20	8 9	NC		Begin mud rotary at ?? feet
	8			SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*
	10 12	NC		
	9			
-25	12 10	NC		
	8			With gravel
	11 9	NC		[A-1-b] (grain size test at 26 feet)
	8			Becomes gray, with clay lumps
-30	11 10	NC		
343.12				
	8			SAND: Gray, fine to coarse, A-3
-35	12 14	NC		
	17			Becomes fine
336.62 -40	21 20	NC		

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/30/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 13 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-23
Station 5899+50.7
Offset 1.7 ft RT
Ground Surface Elev. 376.62 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.6 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine, A-3 *(continued)*
334.62				
				SAND: Gray, fine to coarse, A-1-b
	5			(grain size test at 43.5 feet)
	7	NC		
-45	7			
	29			(No recovery)
	21	- -		
-50	21			
	10			Trace gravel
	14	NC		
-55	16			
	6			(grain size test at 58.5 feet)
	8	NC		
316.62	12			
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine to coarse, trace gravel, A-1-b *(continued)*
	8			
	9	NC		
-65	12			
309.62				
				GRAVEL, with fine to coarse sand and granite cobbles, A-1
	10			
	10	- -		
-70	10			
	9			
	8	- -		
-75	7			
	25			With sandstone and chert fragments
	45	- -		
296.62 -80	50/5"			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/30/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 13 EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-23
Station 5899+50.7
Offset 1.7 ft RT
Ground Surface Elev. 376.62 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.6 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				GRAVEL, with fine to coarse sand, granite cobbles, sandstone, and chert fragments, A-1 *(continued)*
				Cobbles
				Refusal at 82.0 ft.
	31			
	17	- -		
	17			Refusal at 84.0 ft.
292.62				End of Boring
-85				
-90				
-95				
-100				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/30-31/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 13 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-24
Station 5900+54.5
Offset 64.7 ft LT
Ground Surface Elev. 377.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 358.0 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL - 3 inches 376.77
	2			CLAY: Brown, trace organics, A-7
	4 6	2.8 B	24	
	1			
	3	1.3	25	372.52
-5	3	B		SAND: Brown, fine, A-3
	2			
	1 3	NC		
	1			
-10	2 3	NC		
	1			(grain size test at 11 feet)
	2 2	NC		
	4			363.52
	7	NC		SAND: Brown, fine to coarse, with gravel, A-1
-15	7			
	5			
	7 8	NC		
	2			No gravel
	4	NC		
-20	5			Begin mud rotary at ?? feet 357.02

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Brown, fine to coarse, A-1 *(continued)*
	6			
	6 8	NC		Trace gravel
	5			
-25	5 5	NC		
	2			Becomes gray
	1 2	NC		[A-1-b] (grain size test at 26 feet)
	10			348.52 GRAVEL: with sand
-30	11 13	NC		
	10			
-35	12 15	NC		
	5			
-40	6 7	NC		337.02

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
Kaskaskia Engineering

SOIL BORING LOG

Date 10/30-31/2012

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** Proposed Pier 13 WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-24
Station 5900+54.5
Offset 64.7 ft LT
Ground Surface Elev. 377.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 358.0 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
333.02	11			
	20	NC		SAND: Gray, fine, A-3
-45	22			
	18			
327.35	16	NC		
-50	12			SAND: Gray, fine to coarse, with gravel, A-1
	8			[A-1-b]
	8	NC		(grain size test at 53.5 feet)
-55	11			
	9			
	10	NC		
-60	11			
				SAND: Gray, fine to coarse, with gravel, A-1 *(continued)*
313.52	17			
	25	- -		GRAVEL, with fine to coarse sand, A-1
-65	17			
	11			
	15	- -		
-70	14			
	7			With granite cobbles and sandstone fragments
	17	- -		
-75	17			
	17			Refusal at 77.0 ft.
299.52	26	- -		WEATHERED SANDSTONE: Gray
298.52	26			Refusal at 78.5 ft.
				End of Boring
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/1/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-25
Station 5901+76.9
Offset 65.9 ft LT
Ground Surface Elev. 378.71 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
0				TOPSOIL - 5 inches 378.29
	4			FILL: RIP-RAP, CONCRETE, and CLAY 377.38
	5 8	3.2 S	23	CLAY: Brown, trace roots, A-7
				375.71
	3			SILTY CLAY LOAM: Brown, trace organics, A-6
-5	4 3	1.1 B	22	
				372.71
	3			SAND: Brown, fine, A-2-4 LL=19, PI=2
	3 3	NC	15	
				370.71
	2			SAND: Brown, fine, with clay lumps, A-3
-10	3 4	NC	9	
	2			No clay lumps (grain size test at 11 feet)
	2 3	NC		
				365.21
	2			SAND: Brown, fine to coarse, trace gravel, A-1
-15	4 6	NC		
	5			
	6 8	NC		
	2			
-20	5 9	NC		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)* ▼
	3			
	5 6	NC		
				Begin mud rotary at 22.5 feet
	5			[A-1-b]
-25	8 7	NC		(grain size test at 23.5 feet)
	8			
	8 10	NC		
	8			Becomes gray
-30	14 19	NC		
	8			Becomes brown, with granite cobbles and gravel
-35	12 21	NC		
	7			Trace gravel
338.71 -40	8 14	NC		

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/1/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment WB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0004 EX / 097-0081 PR
Station

BORING NO. SB-25
Station 5901+76.9
Offset 65.9 ft LT
Ground Surface Elev. 378.71 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine to coarse, trace gravel, A-1 *(continued)*
	8			
	10	NC		
-45	13			
				330.21
	20			SAND: Gray, fine, A-3
	16	NC		
	16			328.79
-50				
				SAND: Gray, fine to coarse, trace gravel, A-1
	12			[A-1-b]
	11	NC		(grain size test at 53.5 feet)
-55	13			
				321.71
				SAND: Gray, fine, with gravel, A-3
	11			
	15	NC		
-60	21			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Gray, fine, with gravel, A-3 *(continued)*
	16			Becomes fine to coarse
	16	NC		
-65	14			
				310.21
	12			GRAVEL, with fine to coarse sand and chert fragments, A-1
	16	- -		
-70	16			
	6			
	10	- -		
-75	16			
				Refusal at 76.0 ft.
	21			
	33	- -		With sandstone fragments and granite boulders
	18			301.21
				End of Boring
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/5/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-26
Station 5901+84.1
Offset 1.6 ft RT
Ground Surface Elev. 378.91 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.9 ft
Upon Completion ft
After 24 **Hrs.** 358.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
0				TOPSOIL - 5 inches (378.49)
				FILL: Brown, clay, with rip-rap
	6			(377.41)
	8	- -		(No recovery)
	7			
				Begin mud rotary at 22.5 feet
	3			SANDY CLAY LOAM: Brown, A-4
				[A-1-b]
	5	1.2	16	(grain size test at 23.5 feet)
-5	3	P		
				(372.91)
	3			SAND: Brown, fine, A-3
	3	NC		
	3			
	1			(Atterberg limits test was
	2	NC	14	non-plastic)
-10	3			
	1			
	2	NC		
	3			
	2			Becomes fine to coarse, trace
	3	NC		gravel
-15	5			(grain size test at 13.5 feet)
	5			
	8	NC		
	7			
				(360.41)
	5			SAND: Brown, fine to coarse,
	7	NC		trace gravel, A-1
-20	7			
				SAND: Brown, fine to coarse,
				trace gravel, A-1 *(continued)*
	5			
	7	NC		
	9			
	6			With gravel
-25	5	NC		
	3			
	4			
	9	NC		
	13			
	8			Becomes gray
	8	NC		
-30	7			
	9			Becomes brown
	11	NC		
-35	11			
				(341.91)
	11			SAND: Gray, fine, trace gravel,
				A-3
	11	NC		
-40	12			(338.91)

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/5/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-26
Station 5901+84.1
Offset 1.6 ft RT
Ground Surface Elev. 378.91 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.9 ft
Upon Completion ft
After 24 **Hrs.** 358.4 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	9			SAND: Gray, fine to coarse, trace gravel, A-1
	12	NC		
-45	14			
	12			With gravel
	17	NC		
-50	20			
325.41				
	8			GRAVEL, with fine to coarse sand, A-1-a (grain size test at 53.5 feet)
	11	NC		
-55	11			
	9			
	15	NC		
-60	15			
315.41				GRAVEL, with fine to coarse sand, A-1-a *(continued)*
	5			
	8	NC		SAND: Gray, fine to coarse, trace gravel, A-3
-65	12			
310.41				
	6			GRAVEL and GRANITE cobbles, A-1
	5	- -		
-70	9			
	7			With fine to coarse sand
	12	- -		
-75	13			
	9			
	19	- -		
301.41	45			Refusal at 77.5 ft.
				End of Boring
-80				

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/6/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-27
Station 5902+46.1
Offset 0.7 ft LT
Ground Surface Elev. 400.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 357.5 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL - 6 inches 400.45
	4			SILTY CLAY LOAM: Brown, trace roots, A-6
	5 5	1.8 B	18	
				397.45
	3			CLAY: Brown, trace organics, A-7
-5	4 3	1.7 P	25	
				394.95
	3			LOAM: Brown, A-4
	7 8	- -	12	LL=22, PI=7
				392.45
	6			SAND: Brown, fine, trace clay
-10	10 10	NC	9	lumps, A-3
	5			
	8 14	NC	5	
				387.45
	3			SAND: Brown, fine, A-2
-15	10 12	NC	13	
	5			
	9 13	NC	12	
				382.45
	3			CLAY: Greenish gray, A-7-6
	3 6	2.1 B	20	LL=41, PI=21
				380.95

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				CLAY: Greenish gray, A-7-6 *(continued)*
	3			With sand lenses
	5 6	2.7 B	20	
	2			
-25	6 5	2.4 B	17	
				374.70
	4			SAND: Brown, fine, A-2
	3 4	NC	8	
	3			(grain size test at 28.5 feet)
-30	3 3	NC		
				368.95
	5			SAND: Brown, fine, A-3
-35	4 8	NC		
				363.95
	3			SAND: Brown, fine to coarse, trace gravel, A-1
-40	7 10	NC		

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/6/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-27
Station 5902+46.1
Offset 0.7 ft LT
Ground Surface Elev. 400.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 357.5 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Brown, fine to coarse, trace gravel, A-1 *(continued)*				SAND: Brown, fine to coarse, with gravel, A-1 *(continued)*			
[A-1-b]	10				6		
(grain size test at 43.5 feet)	10	NC			13	NC	
-45	13			-65	10		
Begin mud rotary at 45.0 feet							
With gravel	12			Becomes gray	10		
	12	NC		[A-1-b]	10	NC	
-50	11			(grain size test at 63.5 feet) -70	13		
Trace gravel	6				8		
	9	NC			10	NC	
-55	16			-75	13		
With gravel	8			Trace gravel	7		
	14	NC			11	NC	
340.95 -60	19			-80	14		

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/6/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-27
Station 5902+46.1
Offset 0.7 ft LT
Ground Surface Elev. 400.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 357.5 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Brown, fine to coarse, with gravel, A-1 *(continued)* *(continued)*
	12			
	22	NC		
-85	26			
312.45				
	16			GRAVEL: with coarse sand, A-1
	20	NC		
-90	22			
	18			Refusal at 93.0 ft.
	14	NC		
	12			
-95				
	28			Refusal at 97.0 ft. with granite cobbles
	36	NC		
	34			
-100				Refusal at 100.0 ft.

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	15			GRAVEL: with coarse sand, A-1 *(continued)*
	22	NC		
	37			
-105				
	16			Trace coal and gravel
	19	NC		
-110	26			
288.95				
				SAND: Gray, fine, A-3
	21			
	35	NC		
-115	40			
282.45				
	14			GRAVEL: with fine to coarse sand, A-1
	16	NC		
-120	23			

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
Kaskaskia Engineering

SOIL BORING LOG

Date 11/6/12

ROUTE FAI 64 **DESCRIPTION** Structure Boring **LOGGED BY** KEG (CRG)

SECTION 97-3B **LOCATION** East Abutment EB, **SEC.** 33, **TWP.** 3S, **RNG.** 14W, 3rd **PM**,
Latitude , **Longitude**

COUNTY Posey, IN **DRILLING METHOD** HSA w/mud rotary **HAMMER TYPE** Automatic

STRUCT. NO. 097-0003 EX / 097-0080 PR
Station

BORING NO. SB-27
Station 5902+46.1
Offset 0.7 ft LT
Ground Surface Elev. 400.95 ft

Surface Water Elev. ft
Stream Bed Elev. ft

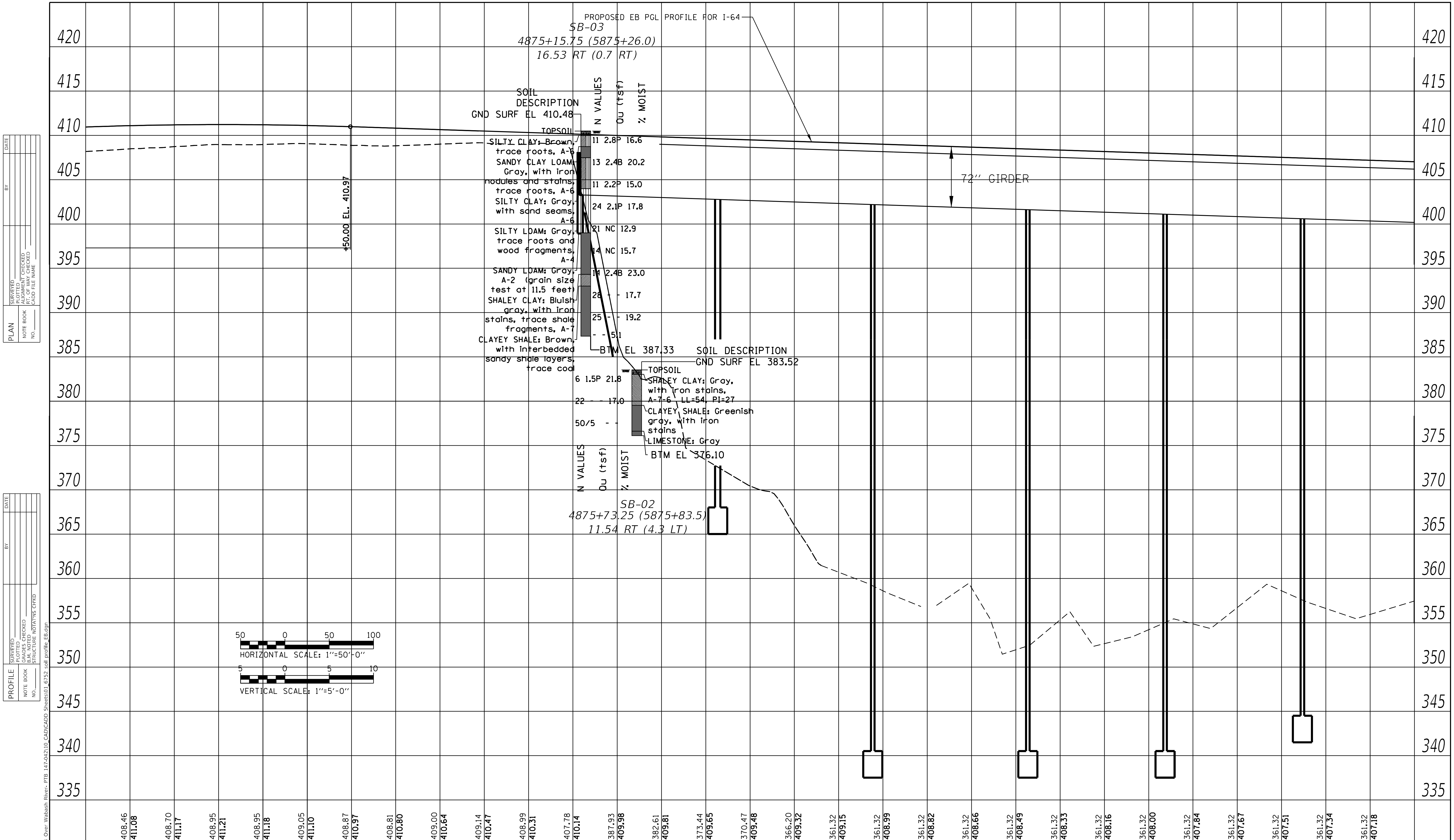
Groundwater Elev.:
First Encounter 357.5 ft
Upon Completion ft
After 24 **Hrs.** 357.5 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
GRAVEL: with fine to coarse sand, A-1 *(continued)*	-125			
272.45				
SAND: Gray, fine, trace gravel A-3		13		
		19	NC	
270.95	-130	35		
End of Boring	-135			
	-140			

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)

EXHIBIT D

SUBSURFACE PROFILE



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Kaskaskia Engineering Group, LLC

USER NAME = bbb	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
	DRAWN -	REVISED -	
PLOT SCALE = 100.000 ' / in.	CHECKED -	REVISED -	
PLOT DATE = 10/12/2018	DATE -	REVISED -	

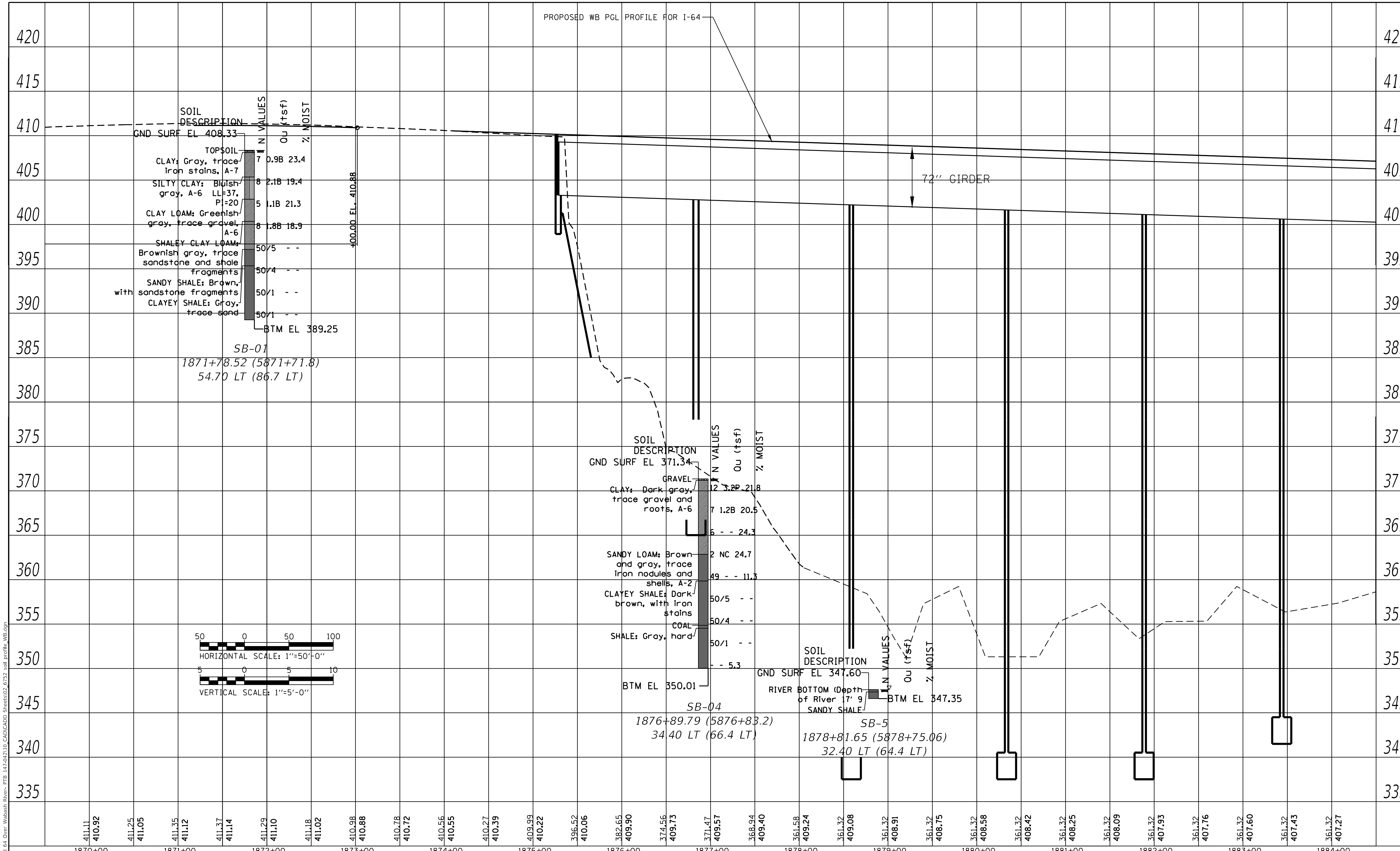
SOIL PROFILE – INTERSTATE 64 EASTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE: | SHEET 1 OF 10 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.

ILLINOIS | FED. AID PROJECT



PLAN — SURVEYED, PLOTTED, ALIGNMENT CHECKED, RT. OF WAY CHECKED, CADD FILE NAME; NOTE BOOK NO.____; BY; DATE

PROFILE — SURVEYED, PLOTTED, GRADES CHECKED, B.M. NOTED, STRUCTURE NOTAT'NS CH'KD; NOTE BOOK NO.____; BY; DATE

MODEL: Default
FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\02_6752 soil profile_WB.dgn

Kaskaskia Engineering Group, LLC — 208 E. Main St., Suite 100, Belleville, Illinois 62220, 618.233.5877 phone, 618.233.5977 fax, www.kaskaskiaeng.com — PROFESSIONAL REGISTRATIONS / LICENSE NO.: Illinois Professional Design Firm 184.004773; Professional Engineering Group 20-5080586

USER NAME = bbb	DESIGNED -	REVISED -
	DRAWN -	REVISED -
PLOT SCALE = 100.000 ' / in.	CHECKED -	REVISED -
PLOT DATE = 10/12/2018	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 WESTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE: | SHEET 2 OF 10 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.
ILLINOIS | FED. AID PROJECT

PROFILE		BY	DATE
NOTE BOOK	SURVEYED		
NO.	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK	SURVEYED		
NO.	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

MODEL: Default
FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\01_6752 soil profile_EB.dgn

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USER NAME = bbb
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PLOT DATE = 10/12/2018

DESIGNED -
DRAWN -
CHECKED -
DATE -

REVISED -
REVISED -
REVISED -
REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE:

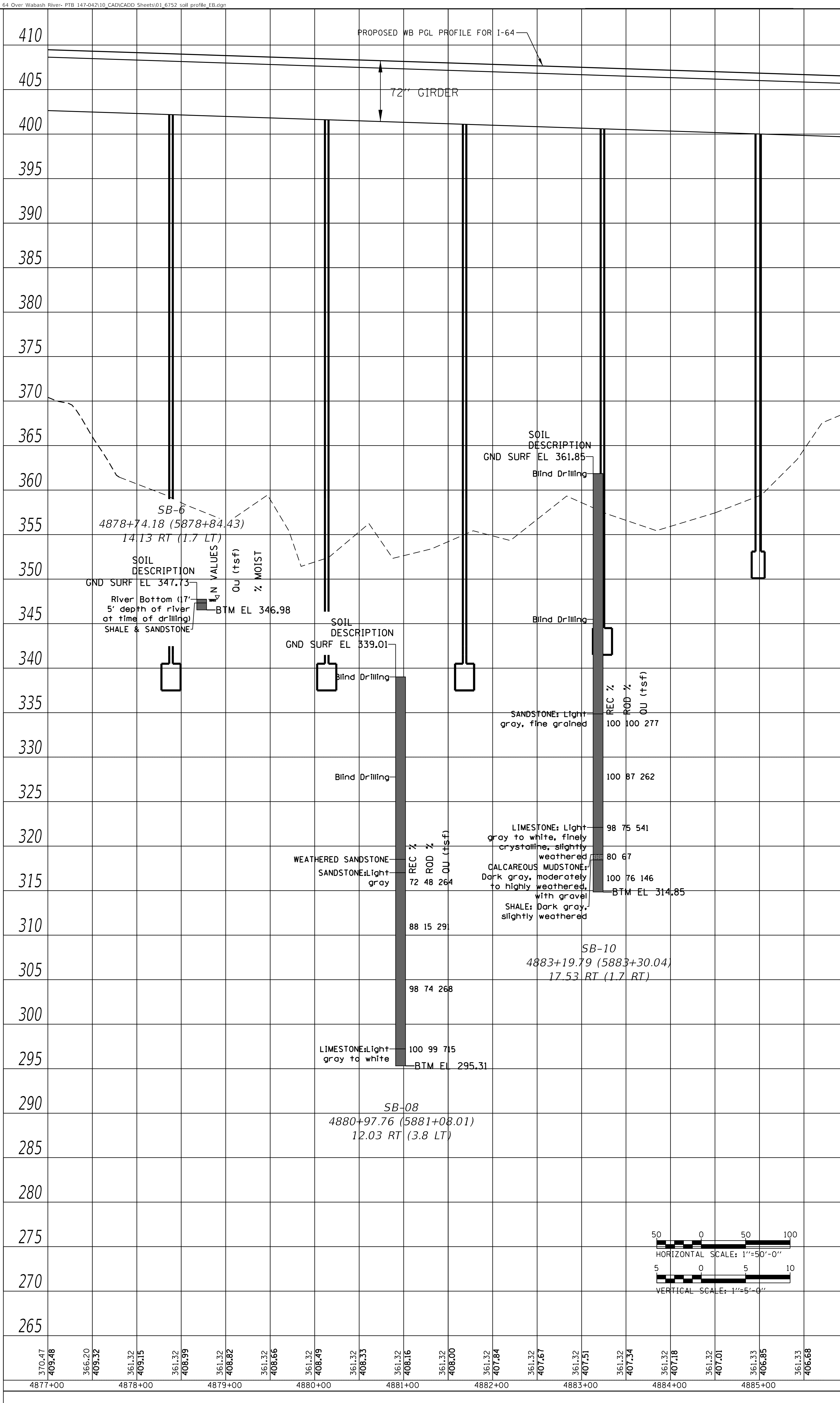
SHEET 3 OF 10 SHEETS STA. TO STA.

SOIL PROFILE – INTERSTATE 64 EASTBOUND
SN 097-0080 (EB) & SN 097-0081 (WB)

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.

ILLINOIS FED. AID PROJECT



PROFILE		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

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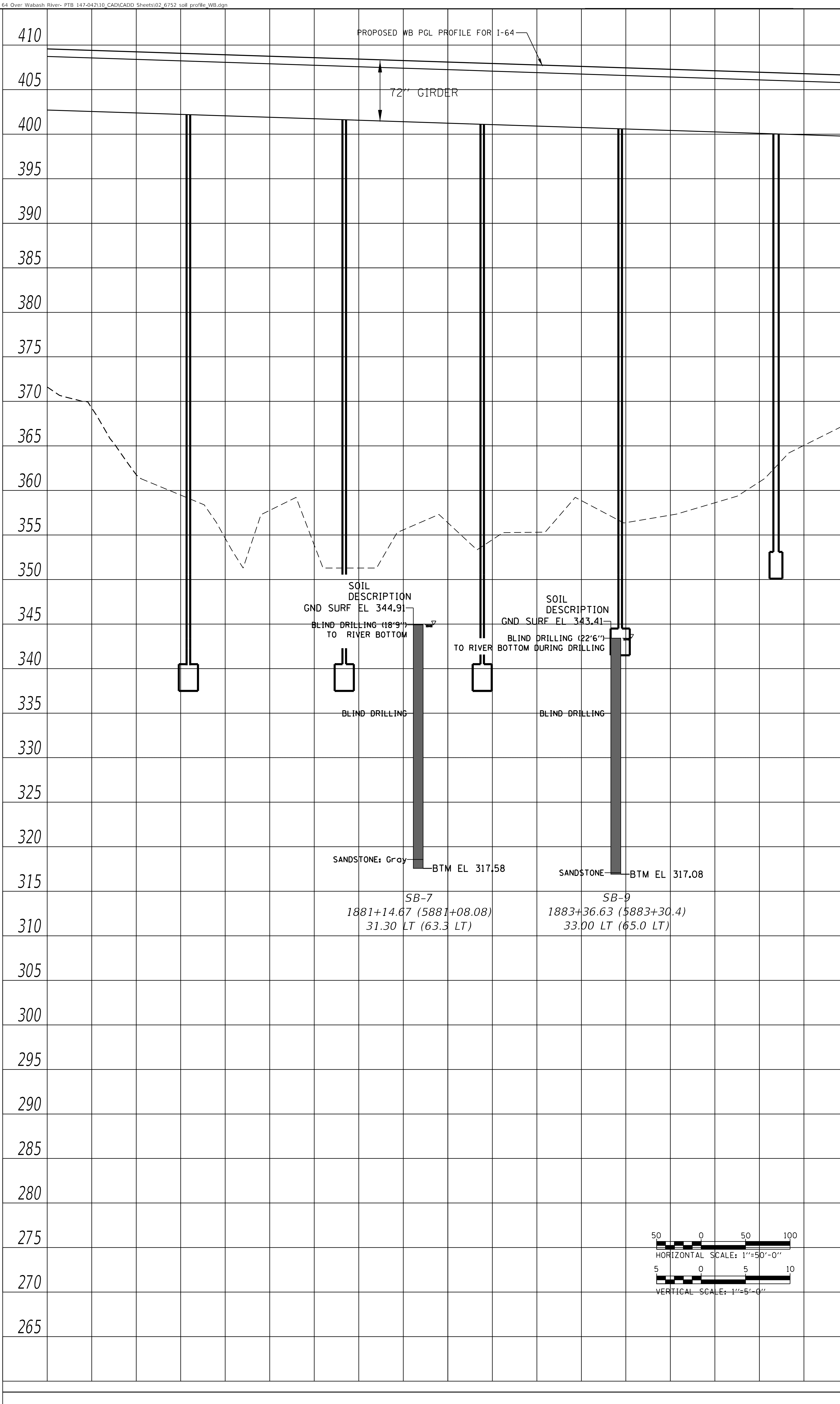

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www.kaskaskiaeng.com

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PLOT DATE	= 10/12/2018

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CHECKED	-
DATE	-

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REVISED	-
REVISED	-
REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 WESTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE: | SHEET 4 OF 10 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

PROFILE		BY	DATE
NOTE BOOK NO.	SURVEYED		
	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK NO.	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

MODEL: Default
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USER NAME = bbb
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PLOT DATE = 10/12/2018

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DRAWN -
CHECKED -
DATE -

REVISED -
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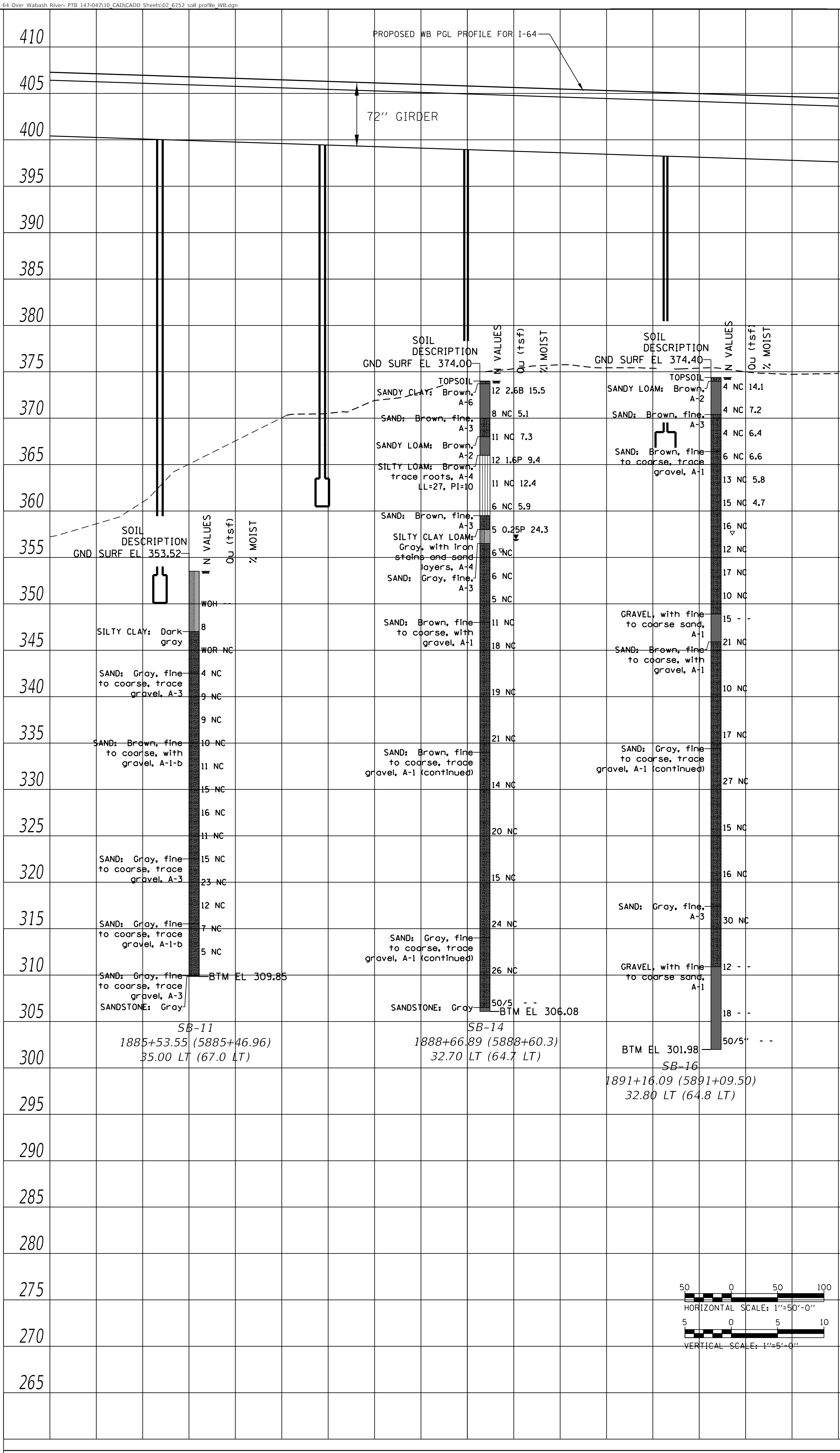
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 WESTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE: | SHEET 5 OF 10 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.
ILLINOIS | FED. AID PROJECT



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285
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275
270
265
PROPOSED WB PGL PROFILE FOR I-64
72'' GIRDER
SOIL DESCRIPTION
GND SURF EL 353.52
N VALUES
Qu (tsf)
% MOIST
WOH --
8
SILTY CLAY: Dark gray
WOR NC
SAND: Gray, fine to coarse, trace gravel, A-3
4 NC
9 NC
9 NC
SAND: Brown, fine to coarse, with gravel, A-1-b
10 NC
11 NC
15 NC
16 NC
11 NC
SAND: Gray, fine to coarse, trace gravel, A-3
15 NC
23 NC
12 NC
SAND: Gray, fine to coarse, trace gravel, A-1-b
7 NC
5 NC
SAND: Gray, fine to coarse, trace gravel, A-3
SANDSTONE: Gray
BTM EL 309.85
SB-11
1885+53.55 (5885+46.96)
35.00 LT (67.0 LT)
SOIL DESCRIPTION
GND SURF EL 374.00
N VALUES
Qu (tsf)
% MOIST
TOPSOIL
SANDY CLAY: Brown, A-6
12 2.6B 15.5
8 NC 5.1
SAND: Brown, fine, A-3
11 NC 7.3
SANDY LOAM: Brown, A-2
12 1.6P 9.4
SILTY LOAM: Brown, trace roots, A-4 LL=27, PI=10
11 NC 12.4
6 NC 5.9
SAND: Brown, fine, A-3
5 0.25P 24.3
SILTY CLAY LOAM: Gray, with iron stains and sand layers, A-4
6 NC
SAND: Gray, fine, A-3
6 NC
5 NC
SAND: Brown, fine to coarse, with gravel, A-1
11 NC
18 NC
19 NC
21 NC
SAND: Brown, fine to coarse, trace gravel, A-1 (continued)
14 NC
20 NC
15 NC
24 NC
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)
26 NC
SANDSTONE: Gray
50/5 - -
BTM EL 306.08
SB-14
1888+66.89 (5888+60.3)
32.70 LT (64.7 LT)
SOIL DESCRIPTION
GND SURF EL 374.40
N VALUES
Qu (tsf)
% MOIST
TOPSOIL
SANDY LOAM: Brown, A-2
4 NC 14.1
4 NC 7.2
SAND: Brown, fine, A-3
4 NC 6.4
SAND: Brown, fine to coarse, trace gravel, A-1
6 NC 6.6
13 NC 5.8
15 NC 4.7
16 NC
12 NC
17 NC
10 NC
GRAVEL, with fine to coarse sand, A-1
15 - -
21 NC
SAND: Brown, fine to coarse, with gravel, A-1
10 NC
17 NC
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)
27 NC
15 NC
16 NC
SAND: Gray, fine, A-3
30 NC
GRAVEL, with fine to coarse sand, A-1
12 - -
18 - -
50/5'' - -
BTM EL 301.98
SB-16
1891+16.09 (5891+09.50)
32.80 LT (64.8 LT)
50 0 50 100
HORIZONTAL SCALE: 1''=50'-0''
5 0 5 10
VERTICAL SCALE: 1''=5'-0''

PROFILE		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
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FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\01_6752 soil profile_EB.dgn

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Illinois Professional Design Firm 184.004773
Professional Engineering Group 20-5080586

USER NAME = bbb
PLOT SCALE = 100.000 ' / in.
PLOT DATE = 10/12/2018

DESIGNED -
DRAWN -
CHECKED -
DATE -

REVISED -
REVISED -
REVISED -
REVISED -

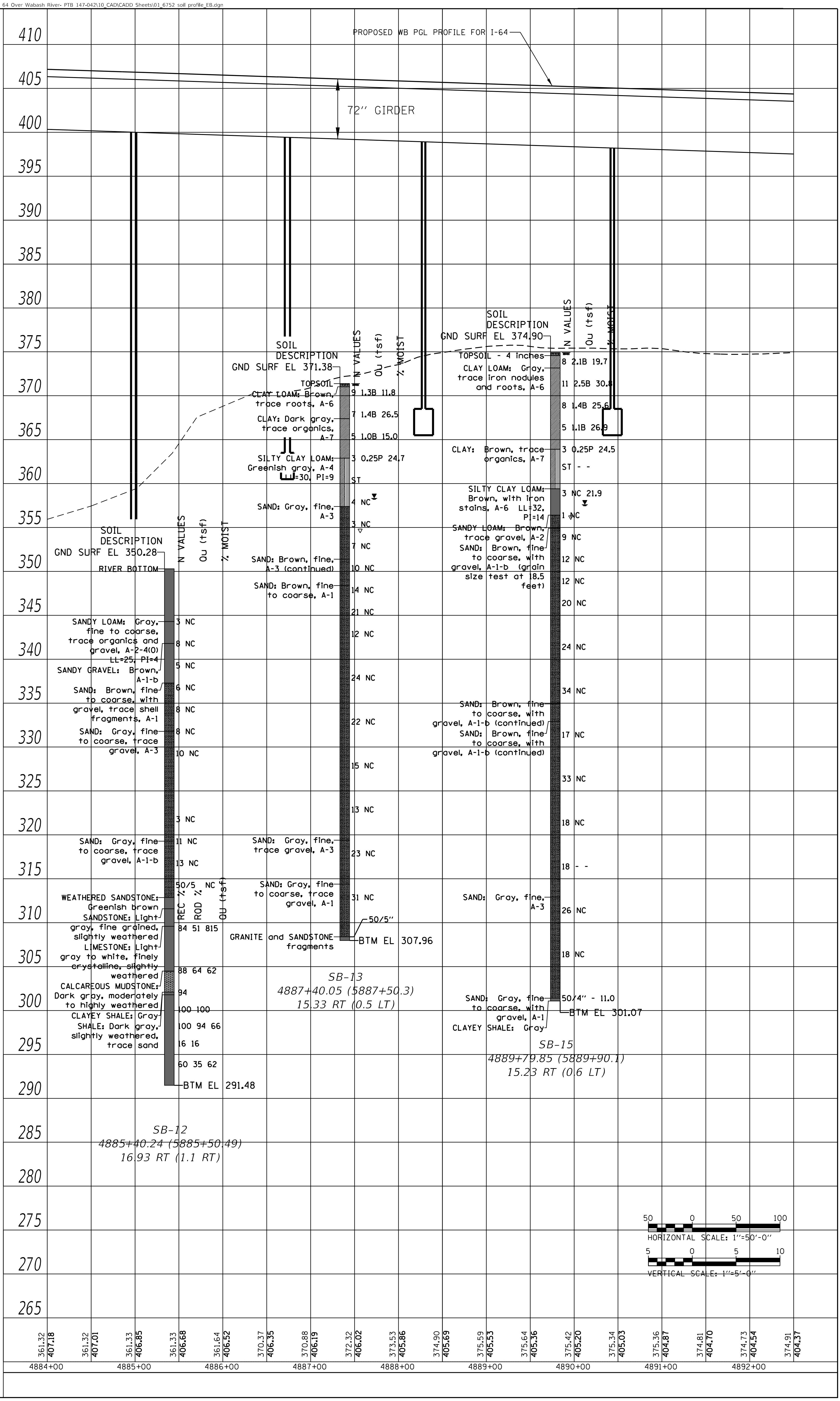
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 EASTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE:
SHEET 6 OF 10 SHEETS STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.
ILLINOIS FED. AID PROJECT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285
280
275
270
265
PROPOSED WB PGL PROFILE FOR I-64
72'' GIRDER
SOIL DESCRIPTION
GND SURF EL 350.28
RIVER BOTTOM
N VALUES
Qu (tsf)
% MOIST
SANDY LOAM: Gray, fine to coarse, trace organics and gravel, A-2-4(0) LL=25, PI=4
SANDY GRAVEL: Brown, A-1-b
SAND: Brown, fine to coarse, with gravel, trace shell fragments, A-1
SAND: Gray, fine to coarse, trace gravel, A-3
3 NC
8 NC
5 NC
6 NC
8 NC
8 NC
10 NC
3 NC
SAND: Gray, fine to coarse, trace gravel, A-1-b
11 NC
13 NC
50/5 NC
WEATHERED SANDSTONE: Greenish brown
SANDSTONE: Light gray, fine grained, slightly weathered
LIMESTONE: Light gray to white, finely crystalline, slightly weathered
CALCAREOUS MUDSTONE: Dark gray, moderately to highly weathered
CLAYEY SHALE: Gray
SHALE: Dark gray, slightly weathered, trace sand
REC %
RQD %
QU (tsf)
84 51 815
88 64 62
94
100 100
100 94 66
16 16
60 35 62
BTM EL 291.48
SB-12
4885+40.24 (5885+50.49)
16.93 RT (1.1 RT)
SOIL DESCRIPTION
GND SURF EL 371.38
TOPSOIL
CLAY LOAM: Brown, trace roots, A-6
CLAY: Dark gray, trace organics, A-7
SILTY CLAY LOAM: Greenish gray, A-4 LL=30, PI=9
SAND: Gray, fine, A-3
SAND: Brown, fine, A-3 (continued)
SAND: Brown, fine to coarse, A-1
SAND: Gray, fine, trace gravel, A-3
SAND: Gray, fine to coarse, trace gravel, A-1
GRANITE and SANDSTONE fragments
9 1.3B 11.8
7 1.4B 26.5
5 1.0B 15.0
3 0.25P 24.7
ST
4 NC
3 NC
7 NC
10 NC
14 NC
21 NC
12 NC
24 NC
22 NC
15 NC
13 NC
23 NC
31 NC
50/5''
BTM EL 307.96
SB-13
4887+40.05 (5887+50.3)
15.33 RT (0.5 LT)
SOIL DESCRIPTION
GND SURF EL 374.90
TOPSOIL - 4 inches
CLAY LOAM: Gray, trace iron nodules and roots, A-6
CLAY: Brown, trace organics, A-7
SILTY CLAY LOAM: Brown, with iron stains, A-6 LL=32, PI=14
SANDY LOAM: Brown, trace gravel, A-2
SAND: Brown, fine to coarse, with gravel, A-1-b (grain size test at 18.5 feet)
SAND: Brown, fine to coarse, with gravel, A-1-b (continued)
SAND: Brown, fine to coarse, with gravel, A-1-b (continued)
SAND: Gray, fine, A-3
SAND: Gray, fine to coarse, with gravel, A-1
CLAYEY SHALE: Gray
8 2.1B 19.7
11 2.5B 30.8
8 1.4B 25.6
5 1.1B 26.9
3 0.25P 24.5
ST - -
3 NC 21.9
1 NC
9 NC
12 NC
12 NC
20 NC
24 NC
34 NC
17 NC
33 NC
18 NC
18 - -
26 NC
18 NC
50/4'' - 11.0
BTM EL 301.07
SB-15
4889+79.85 (5889+90.1)
15.23 RT (0.6 LT)
50 0 50 100
HORIZONTAL SCALE: 1''=50'-0''
5 0 5 10
VERTICAL SCALE: 1''=5'-0''
361.32 407.18
361.32 407.01
361.33 406.85
361.33 406.68
361.64 406.52
370.37 406.35
370.88 406.19
372.32 406.02
373.53 405.86
374.90 405.69
375.59 405.53
375.64 405.36
375.42 405.20
375.34 405.03
375.36 404.87
374.81 404.70
374.73 404.54
374.91 404.37
4884+00
4885+00
4886+00
4887+00
4888+00
4889+00
4890+00
4891+00
4892+00

PROFILE		BY	DATE
NOTE BOOK	SURVEYED		
NO.	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK	SURVEYED		
NO.	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

MODEL: Default
FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\01_6752 soil profile_EB.dgn

Kaskaskia Engineering Group, LLC

USER NAME = bbb
PLOT SCALE = 100.000 ' / in.
PLOT DATE = 10/12/2018

DESIGNED -
DRAWN -
CHECKED -
DATE -

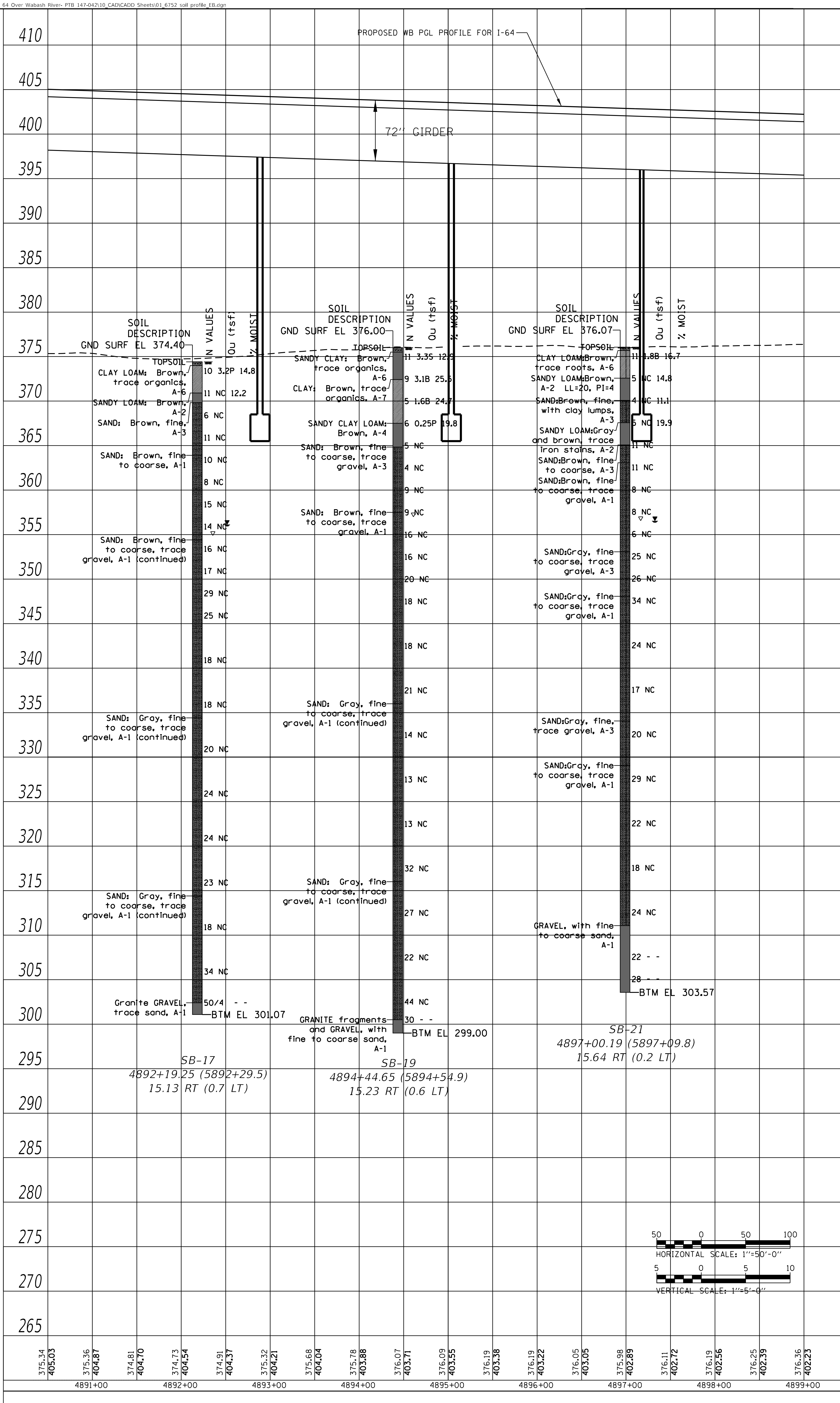
REVISED -
REVISED -
REVISED -
REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 EASTBOUND
SN 097-0080 (EB) & SN 097-0081 (WB)

SCALE: SHEET 7 OF 10 SHEETS STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		
		CONTRACT NO.		
ILLINOIS	FED. AID PROJECT			



PROFILE		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK NO.____	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

MODEL: Default
FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\02_6752 soil profile_WB.dgn

Kaskaskia Engineering Group, LLC
PROFESSIONAL REGISTRATIONS
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Belleville, Illinois 62220
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www.kaskaskiaeng.com
LICENSE NO.
184.004773
20-5080586

USER NAME = bbb
PLOT SCALE = 100.000 ' / in.
PLOT DATE = 10/12/2018

DESIGNED -
DRAWN -
CHECKED -
DATE -

REVISED -
REVISED -
REVISED -
REVISED -

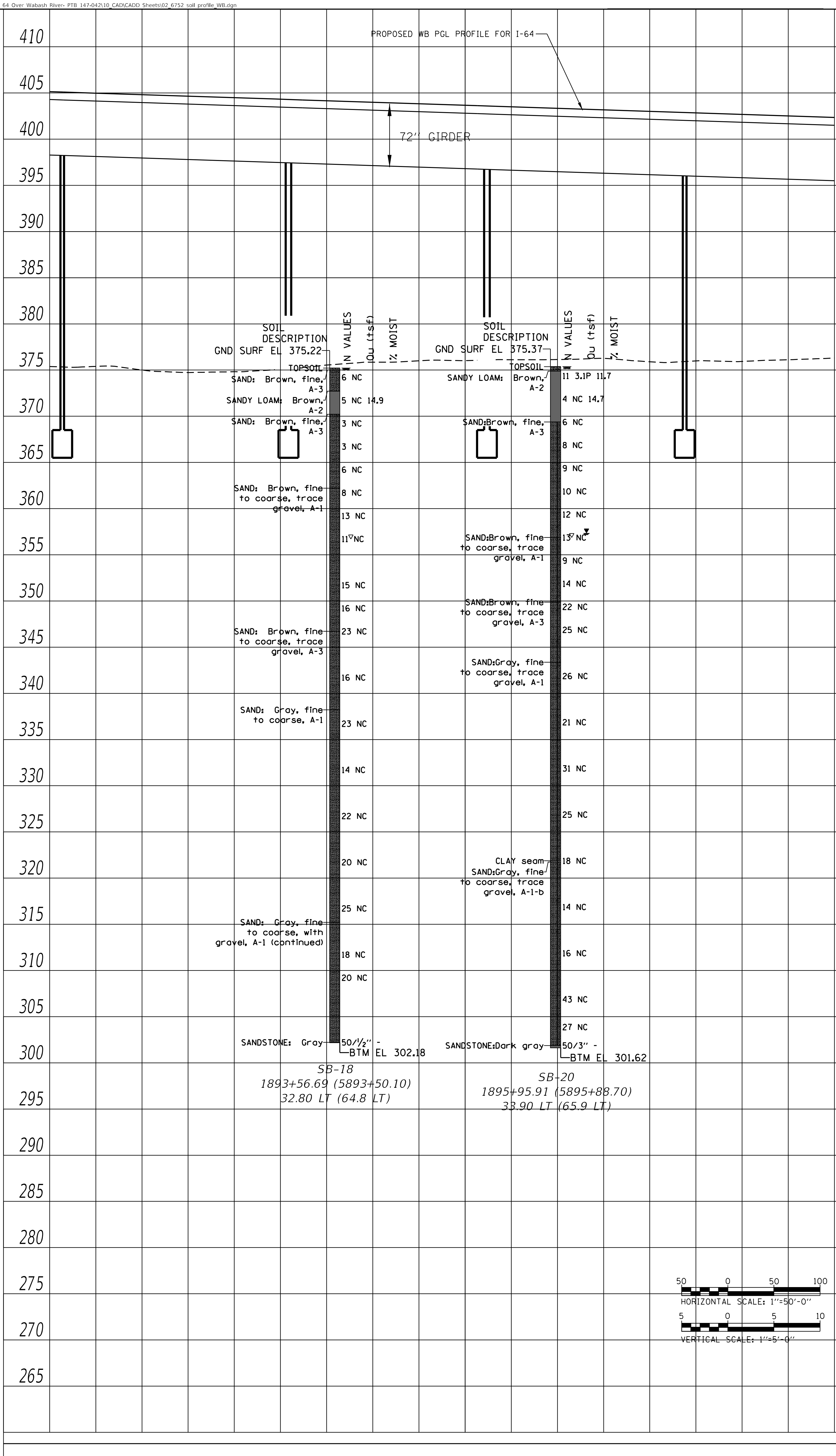
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE – INTERSTATE 64 WESTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SCALE: | SHEET 8 OF 10 SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

CONTRACT NO.
ILLINOIS | FED. AID PROJECT



PROFILE		BY	DATE
	SURVEYED		
	PLOTTED		
NOTE BOOK	GRADES CHECKED		
	B.M. NOTED		
NO.	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
	SURVEYED		
	PLOTTED		
NOTE BOOK	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
NO.	CADD FILE NAME		

MODEL: Default
FILE NAME: P:\08-0023 Knight-I 64 Over Wabash River- PTB 147-042\10_CAD\CADD Sheets\02_6752 soil profile_WB.dgn

Kaskaskia Engineering Group, LLC
Illinois Professional Design Firm
Professional Engineering Group
Illinois Professional Design Firm
Professional Engineering Group

PROPOSED WB PGL PROFILE FOR I-64

72'' GIRDER

+75.00 EL. 400.46

SB-22*
1898+34.54 (5898+26.00)
32.90 LT (64.9 LT)

SOIL DESCRIPTION (GND SURF EL 376.26)	N VALUES	Qu (tsf)	% MOIST
TOPSOIL			
CLAY: Brown, trace organics, A-7	11	3.6B	19.6
	8	1.6B	21.1
SANDY LOAM: Brown, A-2-4 LL=20, PI=15	9	NC	10.9
	5	NC	
SAND: Brown, fine, A-3	4	NC	
	4	NC	
	9	NC	
SAND: Brown, fine to coarse, trace gravel, A-1	8	NC	
	9	NC	
	5	NC	
	10	NC	
	28	NC	
	20	NC	
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)	22	NC	
	22	NC	
SAND: Gray, fine to coarse, trace gravel, A-3	17	NC	
	22	NC	
SAND: Gray, fine to coarse, trace gravel, A-1	28	NC	
	22	NC	
GRAVEL, with fine to coarse sand and granite fragments, A-1	28	- -	
SAND: Gray, fine to coarse, with gravel, A-1	31	NC	
GRAVEL, with sandstone fragments, A-1	73	- -	
	50	- -	
GRAVEL, with sandstone fragments and fine to coarse sand, A-1 (continued)	70	- -	
BTM EL 293.76			

SB-24
1900+64.31 (5900+54.50)
32.70 LT (64.7 LT)

SOIL DESCRIPTION (GND SURF EL 377.02)	N VALUES	Qu (tsf)	% MOIST
TOPSOIL			
CLAY: Brown, trace organics, A-7	10	2.8B	24.1
	6	1.3B	25.1
SAND: Brown, fine, A-3	4	NC	
	5	NC	
	4	NC	
SAND: Brown, fine to coarse, A-1 (continued)	14	NC	
	15	NC	
	9	NC	
	14	NC	
	10	NC	
	3	NC	
	24	NC	
	27	NC	
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)	13	NC	
SAND: Gray, fine, A-3	42	NC	
SAND: Gray, fine to coarse, with gravel, A-1	28	NC	
	19	NC	
	21	NC	
GRAVEL, with fine to coarse sand, A-1	42	- -	
	29	- -	
	34	- -	
WEATHERED SANDSTONE: Gray	52	- -	
BTM EL 298.52			

SB-25*
1901+87.40 (5901+76.90)
33.90 LT (65.9 LT)

SOIL DESCRIPTION (GND SURF EL 378.71)	N VALUES	Qu (tsf)	% MOIST
TOPSOIL			
FILL: RIP-RAP, CONCRETE, and CLAY	13	3.2S	23.3
CLAY: Brown, trace roots, A-7	7	1.1B	22.1
SILTY CLAY LOAM: Brown, trace organics, A-6	6	NC	15.2
	7	NC	9.0
SAND: Brown, fine, A-2-4 LL=19, PI=2	5	NC	
SAND: Brown, fine, with clay lumps, A-3	10	NC	
SAND: Brown, fine to coarse, trace gravel, A-1	14	NC	
	14	NC	
	11	NC	
	15	NC	
	18	NC	
	33	NC	
	33	NC	
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)	22	NC	
	23	NC	
SAND: Gray, fine, A-3	32	NC	
SAND: Gray, fine to coarse, trace gravel, A-1	24	NC	
SAND: Gray, fine, with gravel, A-3	36	NC	
	30	NC	
GRAVEL, with fine to coarse sand and chert fragments, A-1	32	- -	
	26	- -	
	51	- -	
BTM EL 301.21			

50 0 50 100
HORIZONTAL SCALE: 1''=50'-0''
5 0 5 10
VERTICAL SCALE: 1''=5'-0''

PLOT DATE = 10/12/2018
PLOT SCALE = 100.000 ' / in.
USER NAME = bbb

DESIGNED	-	REVISED	-
DRAWN	-	REVISED	-
CHECKED	-	REVISED	-
DATE	-	REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL PROFILE - INTERSTATE 64 WESTBOUND
SN 097-0080 (EB) & SN 097-0081 (WB)

SHEET 9 OF 10 SHEETS STA. TO STA.

SCALE:

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

ILLINOIS FED. AID PROJECT

CONTRACT NO.

PROFILE		BY	DATE
NOTE BOOK NO.	SURVEYED		
	PLOTTED		
	GRADES CHECKED		
	B.M. NOTED		
	STRUCTURE NOTAT'NS CH'KD		

PLAN		BY	DATE
NOTE BOOK NO.	SURVEYED		
	PLOTTED		
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		
	CADD FILE NAME		

MODEL: Default
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Kaskaskia Engineering Group, LLC
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www.kaskaskiaeng.com
LICENSE NO.
184.004773
20-5080586

USER NAME = bbb
PLOT SCALE = 100.000 ' / in.
PLOT DATE = 10/12/2018

DESIGNED -
DRAWN -
CHECKED -
DATE -

REVISED -
REVISED -
REVISED -
REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

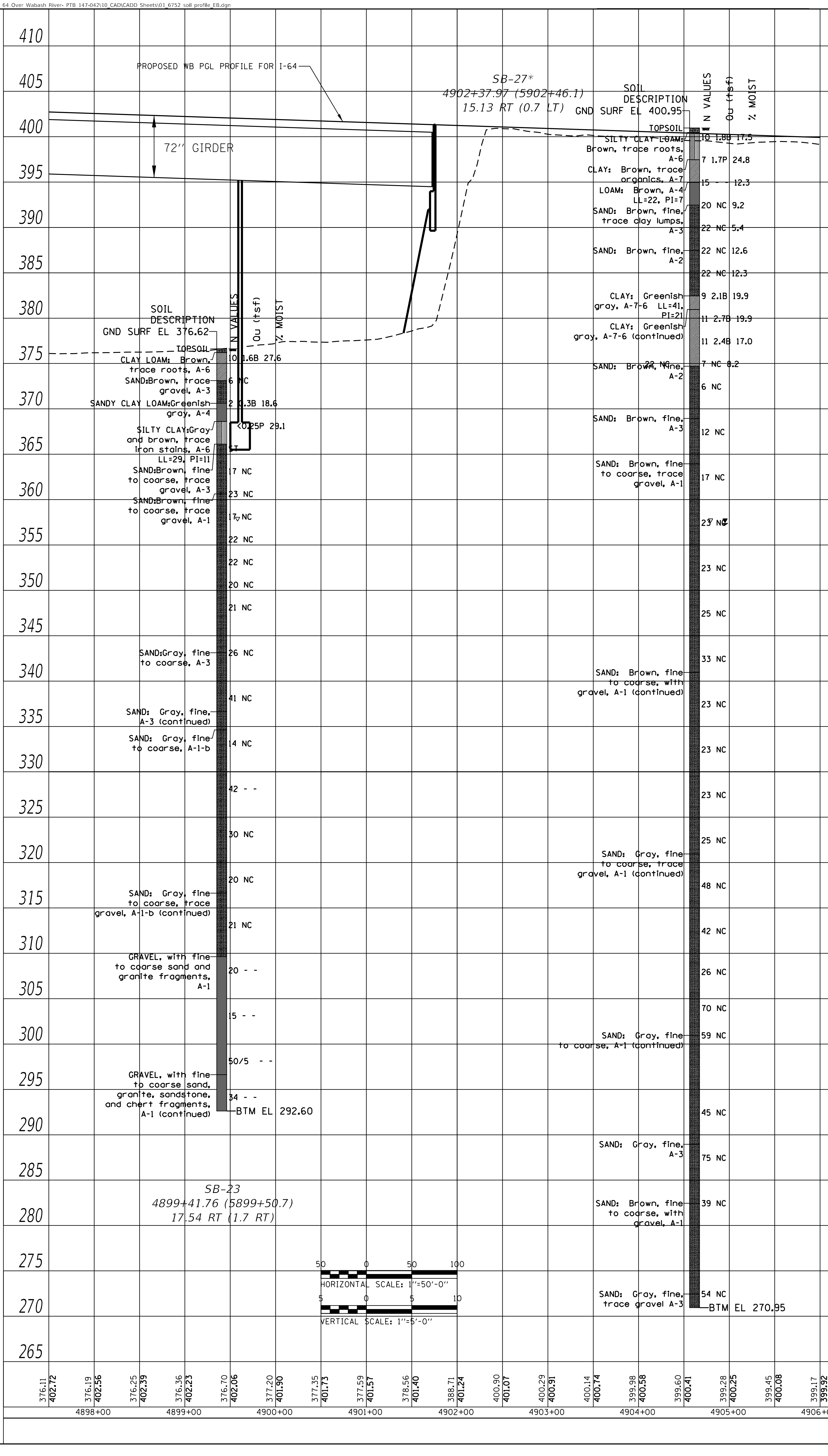
SCALE:

SOIL PROFILE – INTERSTATE 64 EASTBOUND
SN 097–0080 (EB) & SN 097–0081 (WB)

SHEET 10 OF 10 SHEETS STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
64	(97-2)B-5	WHITE		

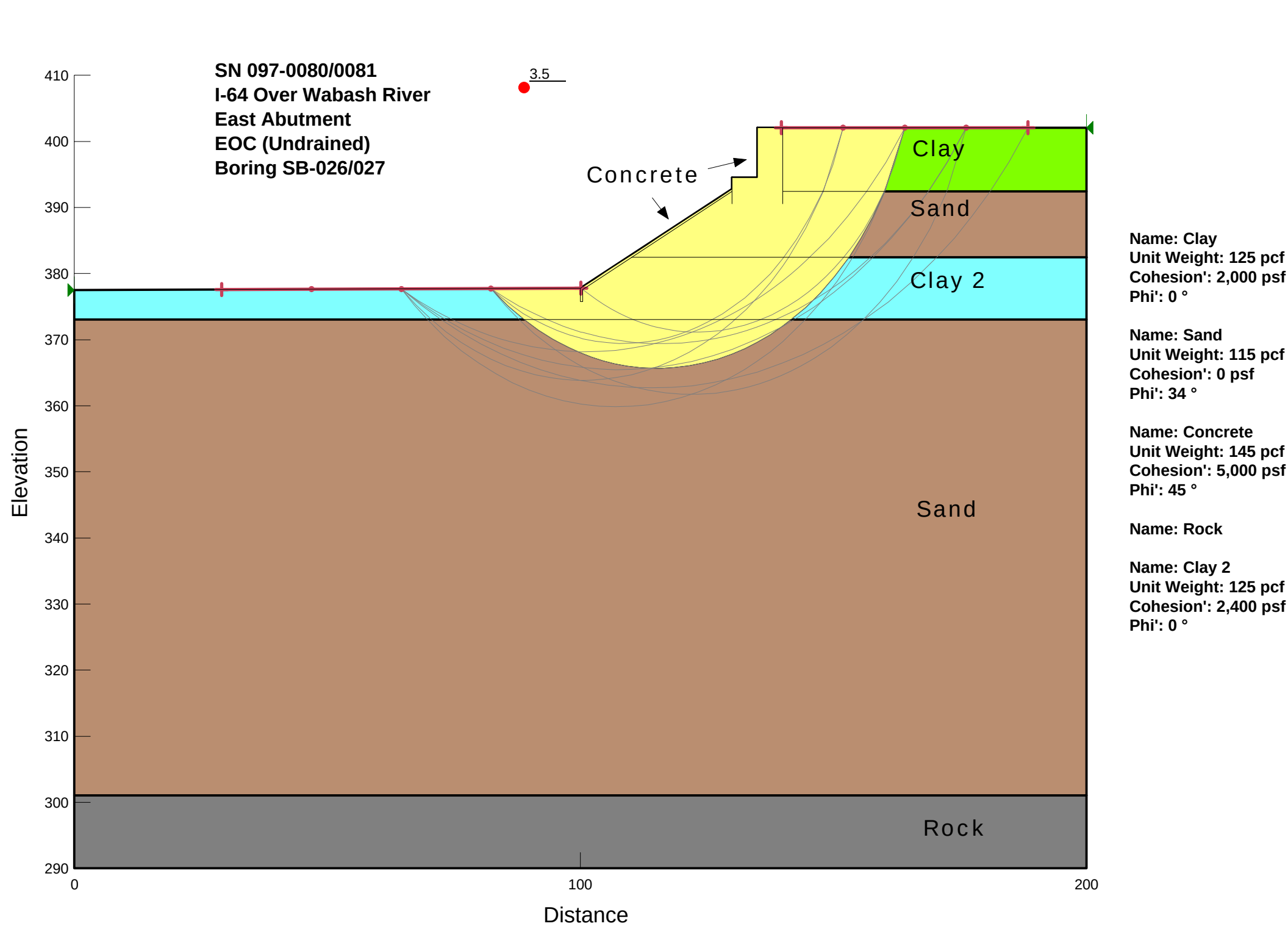
CONTRACT NO.
ILLINOIS FED. AID PROJECT



410
405
400
395
390
385
380
375
370
365
360
355
350
345
340
335
330
325
320
315
310
305
300
295
290
285
280
275
270
265
PROPOSED WB PGL PROFILE FOR I-64
72" GIRDER
SB-27*
4902+37.97 (5902+46.1)
15.13 RT (0.7 LT)
SOIL DESCRIPTION
GND SURF EL 400.95
N VALUES
Qu (tsf)
% MOIST
TOPSOIL
SILTY CLAY LOAM: Brown, trace roots, A-6
10 1.8B 17.5
7 1.7P 24.8
CLAY: Brown, trace organics, A-7
15 - - 12.3
LOAM: Brown, A-4 LL=22, PI=7
20 NC 9.2
SAND: Brown, fine, trace clay lumps, A-3
22 NC 5.4
SAND: Brown, fine, A-2
22 NC 12.6
22 NC 12.3
CLAY: Greenish gray, A-7-6 LL=41, PI=21
9 2.1B 19.9
CLAY: Greenish gray, A-7-6 (continued)
11 2.7B 19.9
11 2.4B 17.0
SAND: Brown, fine, A-2
22 NC
7 NC 8.2
6 NC
SAND: Brown, fine, A-3
12 NC
SAND: Brown, fine to coarse, trace gravel, A-1
17 NC
23 NC
23 NC
25 NC
33 NC
SAND: Brown, fine to coarse, with gravel, A-1 (continued)
23 NC
23 NC
23 NC
25 NC
SAND: Gray, fine to coarse, trace gravel, A-1 (continued)
48 NC
42 NC
26 NC
70 NC
SAND: Gray, fine to coarse, A-1 (continued)
59 NC
45 NC
SAND: Gray, fine, A-3
75 NC
SAND: Brown, fine to coarse, with gravel, A-1
39 NC
SAND: Gray, fine, trace gravel A-3
54 NC
BTM EL 270.95
SOIL DESCRIPTION
GND SURF EL 376.62
N VALUES
Qu (tsf)
% MOIST
TOPSOIL
CLAY LOAM: Brown, trace roots, A-6
10 1.6B 27.6
SAND:Brown, trace gravel, A-3
6 NC
SANDY CLAY LOAM:Greenish gray, A-4
2 0.3B 18.6
SILTY CLAY:Gray and brown, trace iron stains, A-6 LL=29, PI=11
<0.25P 29.1
ST
SAND:Brown, fine to coarse, trace gravel, A-3
17 NC
23 NC
SAND:Brown, fine to coarse, trace gravel, A-1
17 NC
22 NC
22 NC
20 NC
21 NC
SAND:Gray, fine to coarse, A-3
26 NC
41 NC
SAND: Gray, fine, A-3 (continued)
SAND: Gray, fine to coarse, A-1-b
14 NC
42 - -
30 NC
20 NC
SAND: Gray, fine to coarse, trace gravel, A-1-b (continued)
21 NC
GRAVEL, with fine to coarse sand and granite fragments, A-1
20 - -
15 - -
50/5 - -
GRAVEL, with fine to coarse sand, granite, sandstone, and chert fragments, A-1 (continued)
34 - -
BTM EL 292.60
SB-23
4899+41.76 (5899+50.7)
17.54 RT (1.7 RT)
50 0 50 100
HORIZONTAL SCALE: 1"=50'-0"
5 0 5 10
VERTICAL SCALE: 1"=5'-0"
376.11 402.72
376.19 402.56
376.25 402.39
376.36 402.23
376.70 402.06
377.20 401.90
377.35 401.73
377.59 401.57
378.56 401.40
388.71 401.24
400.90 401.07
400.29 400.91
400.14 400.74
399.98 400.58
399.60 400.41
399.28 400.25
399.45 400.08
399.17 399.92
4898+00
4899+00
4900+00
4901+00
4902+00
4903+00
4904+00
4905+00
4906+00

EXHIBIT E

SLOPE-W SLOPE STABILITY ANALYSIS



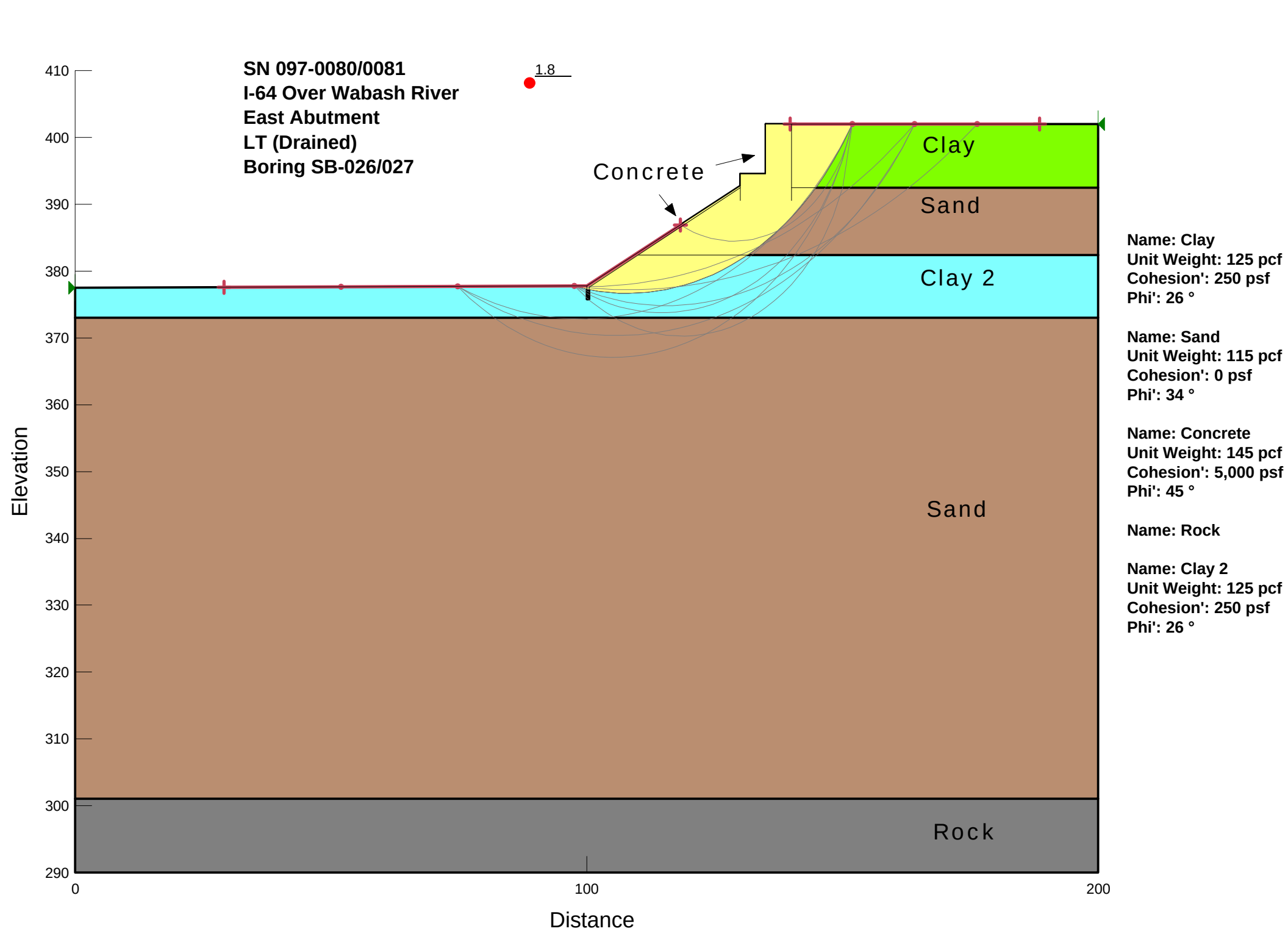
Name: Clay
Unit Weight: 125 pcf
Cohesion': 2,000 psf
Phi': 0 °

Name: Sand
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rock

Name: Clay 2
Unit Weight: 125 pcf
Cohesion': 2,400 psf
Phi': 0 °



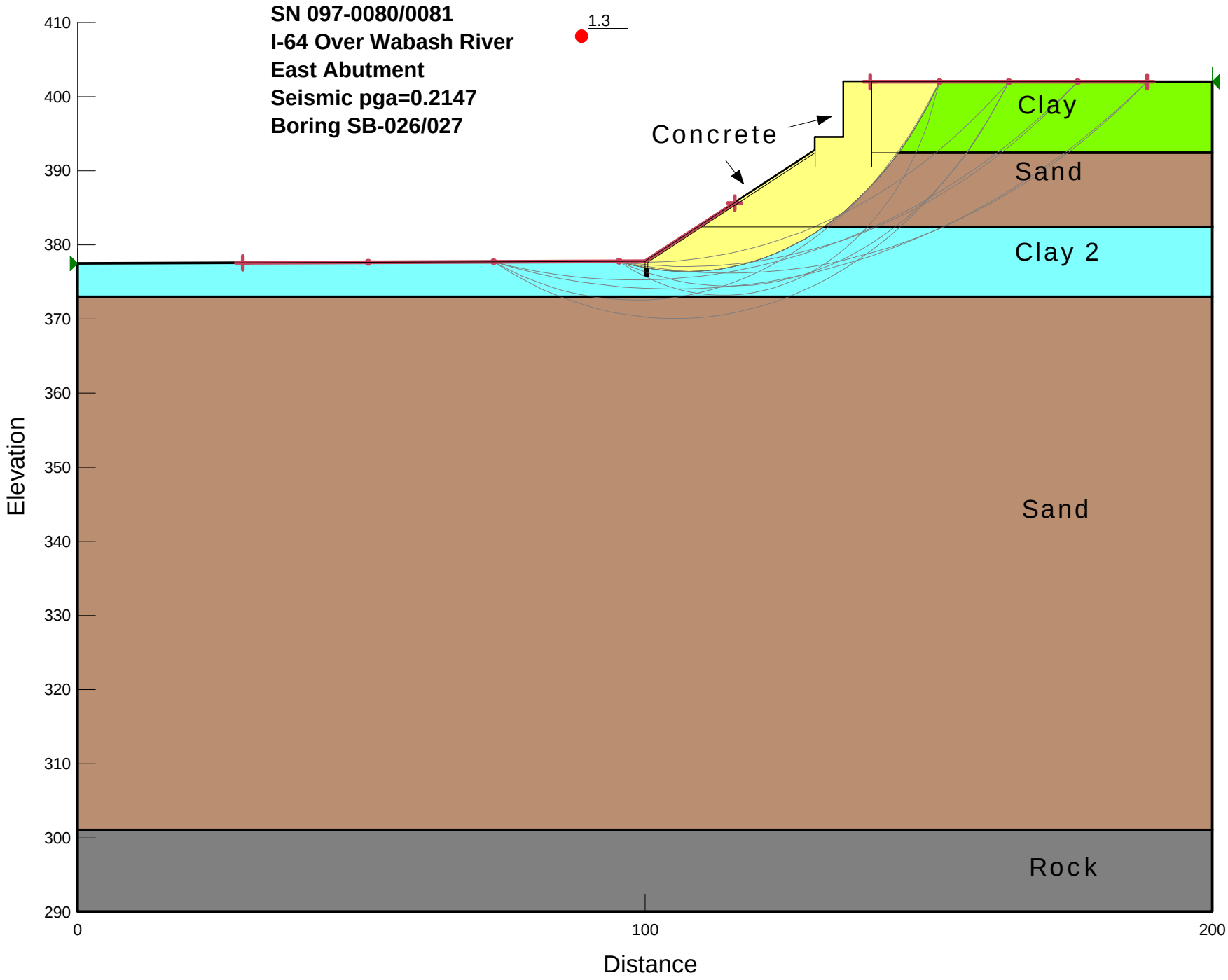
Name: Clay
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °

Name: Sand
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rock

Name: Clay 2
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °



Name: Clay
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °

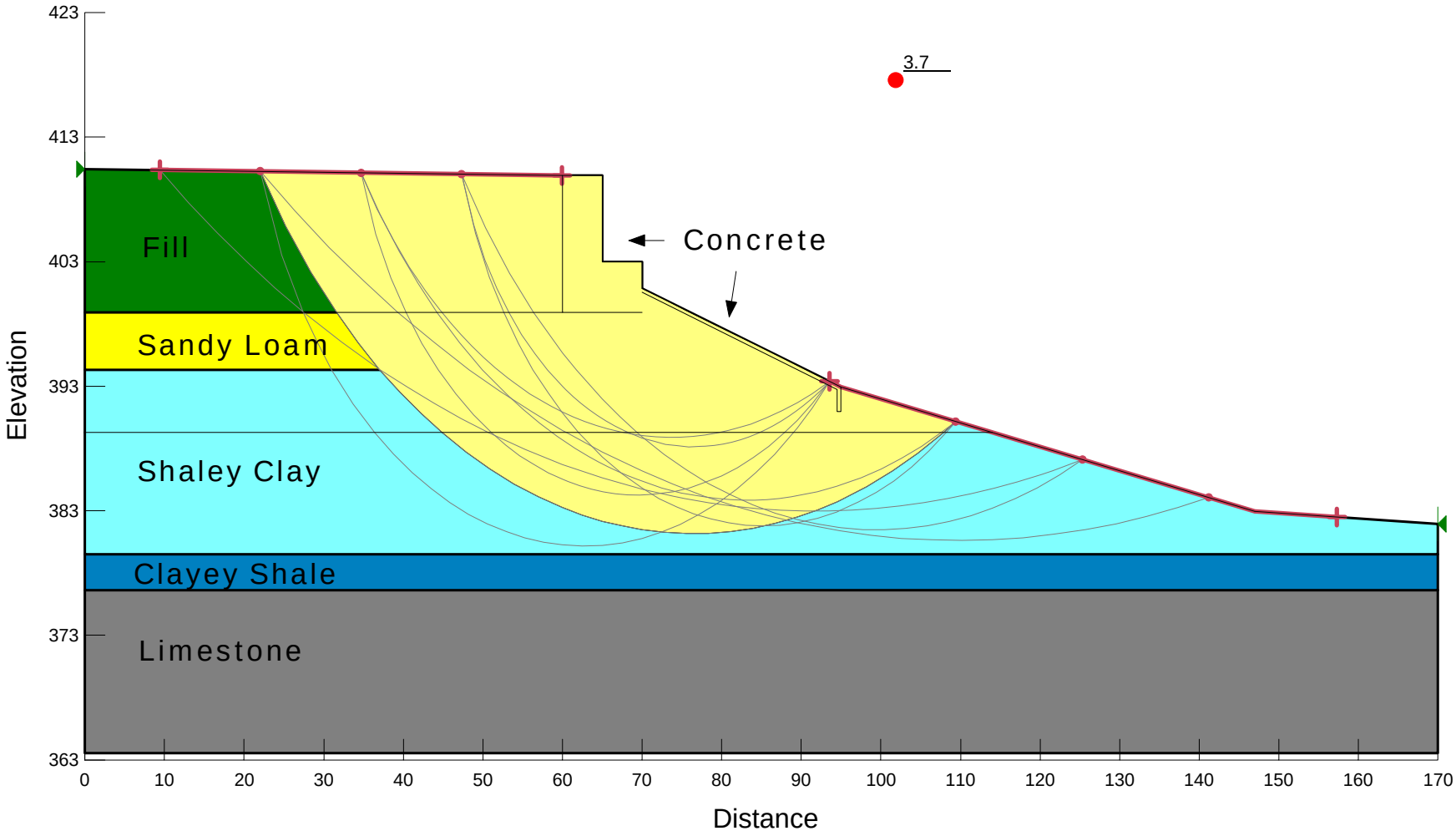
Name: Sand
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rock

Name: Clay 2
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °

SN 097-0080/0081
I-64 Over Wabash River
West Abutment
EOC (Undrained)
Boring SB-02/SB-03



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °

Name: Clayey Shale
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 5,000 psf
Phi': 0 °
Phi-B: 0 °

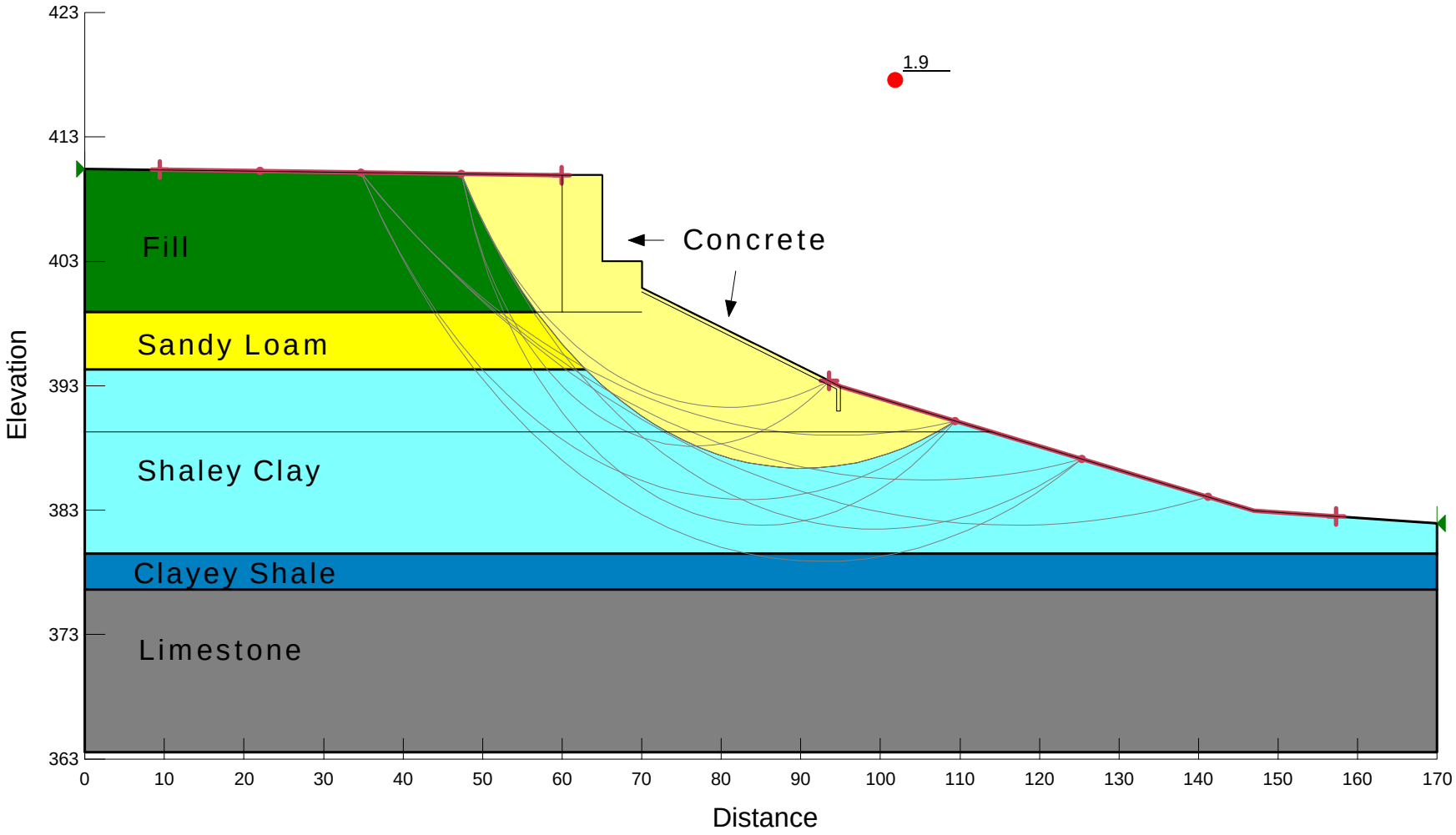
Name: Sandy Loam
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Name: Shaley Clay
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °
Phi-B: 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °
Phi-B: 0 °

Name: Limestone
Model: Bedrock (Impenetrable)

SN 097-0080/0081
I-64 Over Wabash River
West Abutment
LT (Drained)
Boring SB-02/SB-03



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °
Phi-B: 0 °

Name: Clayey Shale
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 26 °
Phi-B: 0 °

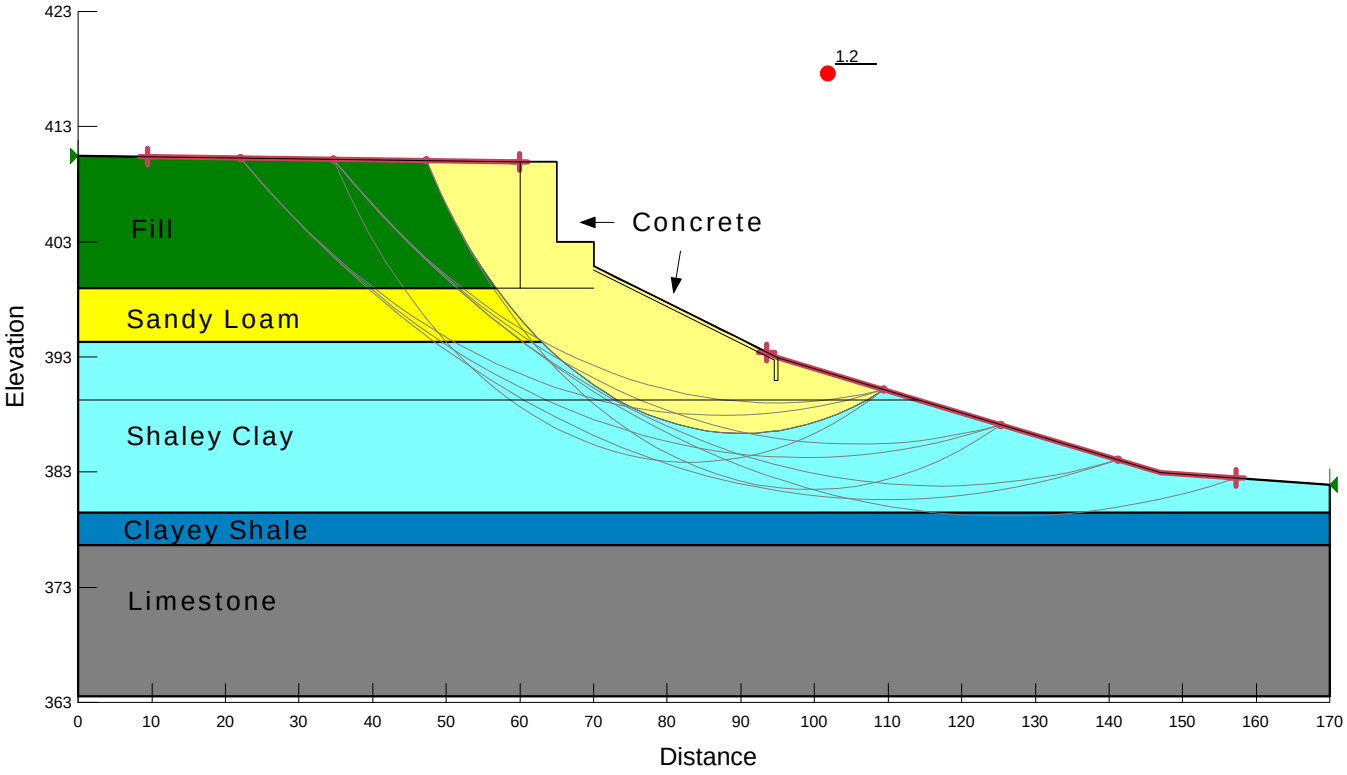
Name: Sandy Loam
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

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

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °
Phi-B: 0 °

Name: Limestone
Model: Bedrock (Impenetrable)

SN 097-0080/0081
I-64 Over Wabash River
West Abutment
Seismic pga = 0.2147
Boring SB-02/SB-03



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 26 °
Phi-B: 0 °

Name: Clayey Shale
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 26 °
Phi-B: 0 °

Name: Sandy Loam
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

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

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °
Phi-B: 0 °

Name: Limestone
Model: Bedrock (Impenetrable)

EXHIBIT F

LIQUEFACTION ANALYSES

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER	SB-3		
ELEVATION OF BORING GROUND SURFACE	410.48	FT.	
DEPTH TO GROUNDWATER - DURING DRILLING	0.00	FT.	(Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE	48.90	FT.	(Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As)	0.211		
EARTHQUAKE MOMENT MAGNITUDE	5.0		
FINISHED GRADE FILL OR CUT FROM BORING SURFACE	-2.48	FT.	(Cut Depth)
HAMMER EFFICIENCY	73	%	
BOREHOLE DIAMETER	6	IN.	
SAMPLING METHOD	Sampler w/out Liners		

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **746** FT./SEC.

PGA CALCULATOR

Earthquake Moment Magnitude =	5.03
Source-To-Site Distance, R (km) =	12.5
Ground Motion Prediction Equations =	CEUS
PGA =	**0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
407.98	2.5	11	2.8	80			17	0.072	0.180	21.267	30.521	0.509	0.134	0.003	0.003	1.500	**1.859**	1.000	**0.137**	**N.L. (1)**
405.48	5	13	2.4	80			20	0.070	0.355	24.230	34.076	-12.888	0.132	0.333	0.333	1.500	**-47.079**	0.998	**0.137**	**N.L. (1)**
402.98	7.5	11	2.2	80			15	0.069	0.528	18.798	27.558	0.355	0.131	0.660	0.660	1.489	**1.287**	0.996	**0.137**	**N.L. (1)**
400.48	10	24	2.1	75	2	24	18	0.068	0.698	46.738	61.086	0.411	0.130	0.985	0.985	1.359	**1.359**	0.994	**0.136**	**N.L. (1)**
397.98	12.5	21		33			13	0.068	0.868	40.595	52.767	0.333	0.130	1.310	1.310	1.212	**0.982**	0.990	**0.136**	**N.L. (1)**
395.48	15	14		33			16	0.064	1.028	24.673	33.985	67.107	0.126	1.625	1.625	1.107	**180.857**	0.986	**0.135**	**N.L. (1)**
392.98	17.5	14	2.4	80			23	0.070	1.203	23.981	33.778	4.740	0.132	1.955	1.955	1.031	**11.904**	0.980	**0.134**	**N.L. (1)**
390.48	20	28		80			18	0.070	1.378	51.688	67.026	0.461	0.132	2.285	2.285	0.970	**1.090**	0.973	**0.133**	**N.L. (1)**
387.98	22.5	25		80			19	0.069	1.550	44.270	58.124	0.384	0.131	2.613	2.613	0.920	**0.861**	0.964	**0.132**	**N.L. (1)**
387.48	23	100					5	0.083	1.592	######	177.757	1.305	0.145	2.685	2.685	0.910	**2.891**	0.962	**0.132**	**N.L. (1)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-4 (Pier 1)
ELEVATION OF BORING GROUND SURFACE ========== 371.30 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 13.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -1.34 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **679** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
370.3	1	12	3.2	80				0.136	0.136	23.533	33.240	1.557								
367.8	3.5	7	1.2	80	16	35	20	0.124	0.446	11.604	18.925	0.202	0.062	0.134	0.269	1.500	**0.739**	0.997	**0.274**	**N.L. (2)**
365.3	6	6	0.75	80	10	10	24	0.118	0.741	8.978	15.774	0.168	0.056	0.274	0.565	1.500	**0.613**	0.993	**0.281**	**2.181 (D)**
362.8	8.5	2					25	0.101	0.994	2.894	2.894	0.058	0.039	0.371	0.818	1.417	**0.199**	0.988	**0.299**	**0.666 (C)**
360.3	11	49					11	0.137	1.336	81.639	81.639	0.579	0.075	0.559	1.162	1.500	**2.114**	0.982	**0.280**	**N.L. (3)**
357.8	13.5	65					13	0.078	1.531	######	108.040	0.782	0.078	0.754	1.513	1.500	**2.856**	0.974	**0.268**	**N.L. (3)**
355.3	16	75					9	0.080	1.731	######	122.803	0.893	0.080	0.954	1.869	1.376	**2.995**	0.964	**0.259**	**N.L. (3)**
352.8	18.5	100					5	0.083	1.939	######	159.818	1.171	0.083	1.161	2.232	1.272	**3.627**	0.952	**0.251**	**N.L. (3)**
350.3	21	100					5	0.083	2.146	######	155.257	1.137	0.083	1.369	2.596	1.191	**3.298**	0.937	**0.244**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-11
ELEVATION OF BORING GROUND SURFACE ========== 353.52 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 0.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **369** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
347.02	6.5	1		96	40	69		0.043	0.280	1.741	7.089	0.088	0.043	0.280	0.685	1.500	**0.323**	0.866	**0.291**	**N.L. (2)**
346.02	7.5	8						0.059	0.339	14.099	14.099	0.151	0.059	0.339	0.807	1.500	**0.552**	0.843	**0.275**	**2.007 (D)**
343.52	10	1						0.043	0.446	1.786	1.786	0.052	0.043	0.446	1.070	1.366	**0.173**	0.783	**0.257**	**0.673 (C)**
341.02	12.5	4		3.2				0.053	0.579	7.220	7.220	0.089	0.053	0.579	1.359	1.321	**0.288**	0.721	**0.232**	**1.241 (C)**
338.52	15	9		3.5				0.060	0.729	16.512	16.512	0.176	0.060	0.729	1.665	1.337	**0.572**	0.660	**0.207**	**2.763 (D)**
336.02	17.5	9		3.5				0.060	0.879	16.134	16.134	0.172	0.060	0.879	1.971	1.268	**0.530**	0.601	**0.185**	**2.865 (D)**
333.52	20	10		3.5				0.061	1.031	17.608	17.608	0.187	0.061	1.031	2.279	1.223	**0.558**	0.547	**0.166**	**3.361 (D)**
331.02	22.5	11		4.4				0.062	1.186	18.929	18.929	0.202	0.062	1.186	2.590	1.182	**0.583**	0.498	**0.149**	**3.913 (D)**
328.52	25	15		4.4				0.065	1.349	25.894	25.894	0.311	0.065	1.349	2.909	1.161	**0.879**	0.456	**0.135**	**N.L. (3)**
326.02	27.5	16		4.4				0.065	1.511	26.793	26.793	0.333	0.065	1.511	3.227	1.121	**0.908**	0.419	**0.123**	**N.L. (3)**
323.52	30	11		4.4				0.062	1.666	16.898	16.898	0.180	0.062	1.666	3.538	1.068	**0.468**	0.389	**0.113**	**4.142 (D)**
321.02	32.5	15		2.9				0.065	1.829	23.036	23.036	0.258	0.065	1.829	3.857	1.047	**0.657**	0.364	**0.105**	**6.257 (D)**
318.52	35	23		2.9				0.068	1.999	36.361	36.361	-0.159	0.068	1.999	4.183	1.024	**-0.396**	0.343	**0.098**	**N.L. (3)**
316.02	37.5	12		2.9				0.063	2.156	16.653	16.653	0.177	0.063	2.156	4.496	0.995	**0.429**	0.327	**0.093**	**4.613 (D)**
313.52	40	7						0.058	2.301	9.291	9.291	0.107	0.058	2.301	4.797	0.982	**0.256**	0.314	**0.090**	**2.844 (C)**
311.02	42.5	5						0.055	2.439	6.472	6.472	0.083	0.055	2.439	5.091	0.971	**0.197**	0.303	**0.087**	**2.264 (C)**
310.02	43.5	100						0.083	2.522	######	150.633	1.102	0.083	2.522	5.236	0.933	**2.504**	0.300	**0.085**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-12
ELEVATION OF BORING GROUND SURFACE ========== 350.28 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 0.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **415** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
342.78	7.5	3			4	25		0.051	0.383	5.072	5.072	0.073	0.051	0.383	0.851	1.410	**0.249**	0.883	**0.269**	**0.926** (C)
340.28	10	8		23				0.059	0.530	14.171	19.651	0.211	0.059	0.530	1.154	1.499	**0.770**	0.834	**0.249**	**3.092** (D)
337.78	12.5	5		4				0.055	0.668	8.775	8.775	0.102	0.055	0.668	1.448	1.295	**0.323**	0.782	**0.233**	**1.386** (C)
335.28	15	6						0.057	0.810	10.471	10.471	0.117	0.057	0.810	1.746	1.253	**0.358**	0.728	**0.215**	**1.665** (D)
332.78	17.5	8						0.059	0.958	13.817	13.817	0.148	0.059	0.958	2.050	1.225	**0.443**	0.673	**0.198**	**2.237** (D)
330.28	20	8						0.059	1.105	13.457	13.457	0.145	0.059	1.105	2.353	1.179	**0.416**	0.620	**0.181**	**2.298** (D)
327.78	22.5	10						0.061	1.258	16.664	16.664	0.177	0.061	1.258	2.662	1.153	**0.498**	0.571	**0.166**	**3.000** (D)
320.28	30	3						0.051	1.640	4.547	4.547	0.069	0.051	1.640	3.512	1.053	**0.176**	0.451	**0.132**	**1.333** (C)
317.78	32.5	11						0.062	1.795	16.411	16.411	0.175	0.062	1.795	3.823	1.046	**0.445**	0.422	**0.123**	**3.618** (D)
315.28	35	13						0.063	1.953	19.061	19.061	0.204	0.063	1.953	4.137	1.024	**0.509**	0.397	**0.115**	**4.426** (D)
312.78	37.5	57						0.077	2.145	92.104	92.104	0.660	0.077	2.145	4.485	0.995	**1.600**	0.377	**0.108**	**N.L. (3)**
311.48	38.8	50						0.076	2.244	79.253	79.253	0.560	0.076	2.244	4.665	0.978	**1.333**	0.369	**0.105**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-13
ELEVATION OF BORING GROUND SURFACE ==========: 371.40 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 13.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 9.88 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **501** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
370.4	1	9	1.3	80				0.125	0.125	16.902	25.283	0.298	0.125	0.125	0.125	1.500	**1.087**	0.994	**0.136**	**N.L. (1)**
367.9	3.5	7	1.4	80				0.125	0.438	11.641	18.969	0.203	0.125	0.438	0.438	1.500	**0.741**	0.975	**0.134**	**N.L. (1)**
365.4	6	5	1	80				0.122	0.743	7.478	13.974	0.150	0.122	0.743	0.743	1.309	**0.478**	0.953	**0.131**	**N.L. (1)**
362.9	8.5	3	0.3	65	9	30	25	0.108	1.013	4.318	10.181	0.115	0.108	1.013	1.013	1.188	**0.332**	0.927	**0.127**	**N.L. (1)**
357.9	13.5	4						0.053	1.278	5.999	5.999	0.080	0.053	1.278	1.503	1.110	**0.215**	0.861	**0.139**	**1.547 (C)**
355.4	16	3						0.051	1.405	4.500	4.500	0.068	0.051	1.405	1.787	1.086	**0.181**	0.822	**0.143**	**1.266 (C)**
352.9	18.5	7						0.058	1.550	10.364	10.364	0.116	0.058	1.550	2.088	1.076	**0.305**	0.779	**0.144**	**2.118 (C)**
350.4	21	10						0.061	1.703	14.639	14.639	0.156	0.061	1.703	2.396	1.059	**0.403**	0.735	**0.142**	**2.838 (D)**
347.9	23.5	14						0.064	1.863	20.669	20.669	0.224	0.064	1.863	2.712	1.039	**0.567**	0.690	**0.138**	**4.109 (D)**
345.4	26	21						0.068	2.033	31.825	31.825	0.691	0.068	2.033	3.038	1.016	**1.709**	0.646	**0.132**	**N.L. (3)**
342.9	28.5	12						0.063	2.190	16.292	16.292	0.173	0.063	2.190	3.352	0.991	**0.418**	0.604	**0.127**	**3.291 (D)**
337.9	33.5	24						0.069	2.535	33.432	33.432	2.003	0.069	2.535	4.009	0.935	**4.560**	0.531	**0.115**	**N.L. (3)**
332.9	38.5	22						0.068	2.875	28.177	28.177	0.376	0.068	2.875	4.661	0.900	**0.824**	0.476	**0.106**	**N.L. (3)**
327.9	43.5	15						0.065	3.200	17.195	17.195	0.183	0.065	3.200	5.298	0.892	**0.398**	0.437	**0.099**	**4.020 (D)**
322.9	48.5	13						0.063	3.515	13.924	13.924	0.149	0.063	3.515	5.925	0.879	**0.320**	0.412	**0.095**	**3.368 (D)**
317.9	53.5	23						0.068	3.855	24.854	24.854	0.289	0.068	3.855	6.577	0.824	**0.580**	0.396	**0.093**	**6.237 (D)**
312.9	58.5	31						0.071	4.210	33.079	33.079	1.326	0.071	4.210	7.244	0.773	**2.496**	0.386	**0.091**	**N.L. (3)**
308.4	63	50						0.076	4.552	54.427	54.427	0.349	0.076	4.552	7.867	0.737	**0.627**	0.380	**0.090**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-14
ELEVATION OF BORING GROUND SURFACE ==========: 374.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 17.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 12.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **552** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
373	1	12	2.6	25				0.133	0.133	23.533	30.528	0.510	0.133	0.133	0.133	1.500	**1.861**	0.996	**0.137**	**N.L. (1)**
370.5	3.5	8						0.116	0.423	13.564	13.564	0.146	0.116	0.423	0.423	1.500	**0.533**	0.984	**0.135**	**N.L. (1)**
368	6	11						0.119	0.721	17.424	17.424	0.185	0.119	0.721	0.721	1.350	**0.610**	0.970	**0.133**	**N.L. (1)**
365.5	8.5	12	1.6					0.127	1.038	18.024	18.024	0.192	0.127	1.038	1.038	1.223	**0.572**	0.952	**0.131**	**N.L. (1)**
363	11	11						0.119	1.336	15.964	15.964	0.170	0.119	1.336	1.336	1.132	**0.468**	0.931	**0.128**	**N.L. (1)**
360.5	13.5	6						0.113	1.618	8.262	8.262	0.098	0.051	1.463	1.525	1.085	**0.259**	0.906	**0.129**	**2.008 (C)**
358	16	5	0.3		10	24	24	0.108	1.888	6.682	6.682	0.085	0.046	1.578	1.796	1.064	**0.221**	0.876	**0.137**	**1.613 (C)**
355.5	18.5	6						0.057	2.031	7.951	7.951	0.096	0.057	1.721	2.095	1.047	**0.243**	0.843	**0.141**	**1.723 (C)**
353	21	6						0.057	2.173	7.837	7.837	0.095	0.057	1.863	2.393	1.029	**0.237**	0.806	**0.142**	**1.669 (C)**
350.5	23.5	5						0.055	2.311	6.419	6.419	0.083	0.055	2.001	2.687	1.012	**0.205**	0.767	**0.141**	**1.454 (C)**
348	26	11						0.062	2.466	13.829	13.829	0.149	0.062	2.156	2.998	0.996	**0.360**	0.727	**0.139**	**2.590 (D)**
345.5	28.5	18						0.066	2.631	23.238	23.238	0.261	0.066	2.321	3.319	0.972	**0.617**	0.687	**0.135**	**4.570 (D)**
340.5	33.5	19						0.067	2.966	23.208	23.208	0.260	0.067	2.656	3.966	0.932	**0.590**	0.611	**0.125**	**4.720 (D)**
335.5	38.5	21						0.068	3.306	24.458	24.458	0.282	0.068	2.996	4.618	0.895	**0.613**	0.548	**0.116**	**5.284 (D)**
330.5	43.5	14						0.064	3.626	14.729	14.729	0.157	0.064	3.316	5.250	0.890	**0.341**	0.502	**0.109**	**3.128 (D)**
325.5	48.5	20						0.067	3.961	20.740	20.740	0.225	0.067	3.651	5.897	0.850	**0.466**	0.470	**0.104**	**4.481 (D)**
320.5	53.5	15						0.065	4.286	14.340	14.340	0.153	0.065	3.976	6.534	0.850	**0.318**	0.448	**0.101**	**3.149 (D)**
315.5	58.5	24						0.069	4.631	22.956	22.956	0.256	0.069	4.321	7.191	0.801	**0.500**	0.435	**0.099**	**5.051 (D)**
310.5	63.5	26						0.069	4.976	23.859	23.859	0.271	0.069	4.666	7.848	0.778	**0.513**	0.427	**0.099**	**5.182 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-15
ELEVATION OF BORING GROUND SURFACE ========== 374.90 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 17.20 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 13.40 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **462** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
373.9	1	8	2.1					0.130	0.130	14.803	14.803	0.158	0.130	0.130	0.130	1.500	**0.577**	0.991	**0.136**	**N.L. (1)**
371.4	3.5	11	2.5					0.133	0.463	19.140	19.140	0.205	0.133	0.463	0.463	1.500	**0.749**	0.966	**0.133**	**N.L. (1)**
368.9	6	8	1.4					0.125	0.775	11.982	11.982	0.131	0.125	0.775	0.775	1.278	**0.408**	0.937	**0.128**	**N.L. (1)**
366.4	8.5	5	1.1					0.123	1.083	7.057	7.057	0.088	0.123	1.083	1.083	1.154	**0.248**	0.902	**0.124**	**N.L. (1)**
363.9	11	3	0.3					0.108	1.353	4.211	4.211	0.066	0.108	1.353	1.353	1.094	**0.177**	0.863	**0.118**	**N.L. (1)**
361.4	13.5	3	0.3		10	24	24	0.108	1.623	4.127	4.127	0.066	0.046	1.468	1.474	1.076	**0.172**	0.819	**0.113**	**1.522 (C)**
358.9	16	3						0.105	1.885	4.012	4.012	0.065	0.043	1.575	1.737	1.061	**0.168**	0.773	**0.117**	**1.436 (C)**
356.4	18.5	1						0.043	1.993	1.336	1.336	0.050	0.043	1.683	2.001	1.047	**0.128**	0.724	**0.118**	**1.085 (C)**
353.9	21	9						0.060	2.143	11.832	11.832	0.130	0.060	1.833	2.307	1.036	**0.327**	0.675	**0.117**	**2.795 (D)**
351.4	23.5	12						0.063	2.300	15.658	15.658	0.167	0.063	1.990	2.620	1.017	**0.413**	0.628	**0.113**	**3.655 (D)**
348.9	26	12						0.063	2.458	15.241	15.241	0.162	0.063	2.148	2.934	0.997	**0.394**	0.583	**0.109**	**3.615 (D)**
346.4	28.5	20						0.067	2.625	26.253	26.253	0.319	0.067	2.315	3.257	0.971	**0.755**	0.542	**0.105**	**N.L. (3)**
341.4	33.5	24						0.069	2.970	30.356	30.356	0.495	0.069	2.660	3.914	0.922	**1.110**	0.475	**0.096**	**N.L. (3)**
336.4	38.5	34						0.072	3.330	42.896	42.896	0.201	0.072	3.020	4.586	0.868	**0.424**	0.426	**0.089**	**N.L. (3)**
331.4	43.5	17						0.066	3.660	18.139	18.139	0.193	0.066	3.350	5.228	0.879	**0.414**	0.393	**0.084**	**4.929 (D)**
326.4	48.5	33						0.072	4.020	36.612	36.612	-0.116	0.072	3.710	5.900	0.800	**-0.227**	0.372	**0.081**	**N.L. (3)**
321.4	53.5	18						0.066	4.350	17.345	17.345	0.185	0.066	4.040	6.542	0.836	**0.376**	0.359	**0.080**	**4.700 (D)**
316.4	58.5	18						0.066	4.680	16.510	16.510	0.176	0.066	4.370	7.184	0.821	**0.351**	0.351	**0.079**	**4.443 (D)**
311.4	63.5	26						0.069	5.025	23.681	23.681	0.268	0.069	4.715	7.841	0.776	**0.506**	0.346	**0.079**	**6.405 (D)**
306.4	68.5	18						0.066	5.355	14.982	14.982	0.160	0.066	5.045	8.483	0.796	**0.310**	0.334	**0.077**	**4.026 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-16
ELEVATION OF BORING GROUND SURFACE ==========: 374.40 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 17.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 12.90 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **566** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
373.4	1	4						0.108	0.108	7.167	7.167	0.089	0.108	0.108	0.108	1.500	**0.325**	0.996	**0.137**	**N.L. (1)**
370.9	3.5	4						0.108	0.378	6.729	6.729	0.085	0.108	0.378	0.378	1.439	**0.300**	0.986	**0.135**	**N.L. (1)**
368.4	6	4						0.108	0.648	6.160	6.160	0.081	0.108	0.648	0.648	1.279	**0.252**	0.973	**0.133**	**N.L. (1)**
365.9	8.5	6						0.113	0.931	8.839	8.839	0.103	0.113	0.931	0.931	1.203	**0.302**	0.958	**0.131**	**N.L. (1)**
363.4	11	13						0.121	1.233	19.863	19.863	0.214	0.121	1.233	1.233	1.172	**0.610**	0.938	**0.129**	**N.L. (1)**
360.9	13.5	15						0.123	1.541	22.411	22.411	0.248	0.061	1.386	1.423	1.140	**0.689**	0.915	**0.129**	**5.341 (D)**
358.4	16	16						0.124	1.851	22.933	22.933	0.256	0.062	1.541	1.734	1.105	**0.689**	0.889	**0.137**	**5.029 (D)**
355.9	18.5	12						0.063	2.008	16.313	16.313	0.174	0.063	1.698	2.047	1.062	**0.449**	0.858	**0.142**	**3.162 (D)**
353.4	21	17						0.066	2.173	23.580	23.580	0.266	0.066	1.863	2.368	1.042	**0.675**	0.824	**0.144**	**4.688 (D)**
350.9	23.5	10						0.061	2.326	12.799	12.799	0.139	0.061	2.016	2.677	1.013	**0.342**	0.787	**0.143**	**2.392 (D)**
348.4	26	15						0.065	2.488	19.397	19.397	0.208	0.065	2.178	2.995	0.992	**0.503**	0.748	**0.141**	**3.567 (D)**
345.9	28.5	21						0.068	2.658	27.572	27.572	0.355	0.068	2.348	3.321	0.966	**0.836**	0.708	**0.137**	**N.L. (3)**
340.9	33.5	10						0.061	2.963	11.580	11.580	0.127	0.061	2.653	3.938	0.947	**0.294**	0.633	**0.129**	**2.279 (C)**
335.9	38.5	17						0.066	3.293	19.304	19.304	0.207	0.066	2.983	4.580	0.906	**0.456**	0.569	**0.120**	**3.800 (D)**
330.9	43.5	27						0.070	3.643	30.828	30.828	0.539	0.070	3.333	5.242	0.849	**1.114**	0.520	**0.112**	**N.L. (3)**
325.9	48.5	15						0.065	3.968	15.048	15.048	0.161	0.065	3.658	5.879	0.866	**0.339**	0.486	**0.107**	**3.168 (D)**
320.9	53.5	16						0.065	4.293	15.372	15.372	0.164	0.065	3.983	6.516	0.846	**0.338**	0.463	**0.104**	**3.250 (D)**
315.9	58.5	30						0.071	4.648	29.579	29.579	0.441	0.071	4.338	7.183	0.776	**0.833**	0.449	**0.102**	**N.L. (3)**
310.9	63.5	12						0.063	4.963	10.448	10.448	0.117	0.063	4.653	7.810	0.832	**0.237**	0.440	**0.101**	**2.347 (C)**
305.9	68.5	18						0.066	5.293	15.112	15.112	0.161	0.066	4.983	8.452	0.798	**0.313**	0.422	**0.098**	**3.194 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-17
ELEVATION OF BORING GROUND SURFACE ==========: 374.40 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 18.20 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 12.90 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **657** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
373.4	1	10	3.2					0.136	0.136	19.057	19.057	0.204	0.136	0.136	0.136	1.500	**0.745**	0.999	**0.137**	**N.L. (1)**
370.9	3.5	11						0.119	0.434	19.354	19.354	0.208	0.119	0.434	0.434	1.500	**0.758**	0.994	**0.136**	**N.L. (1)**
368.4	6	6						0.113	0.716	9.047	9.047	0.105	0.113	0.716	0.716	1.277	**0.326**	0.989	**0.136**	**N.L. (1)**
365.9	8.5	11						0.119	1.014	16.463	16.463	0.175	0.119	1.014	1.014	1.222	**0.521**	0.981	**0.135**	**N.L. (1)**
363.4	11	10						0.118	1.309	14.470	14.470	0.155	0.118	1.309	1.309	1.133	**0.427**	0.973	**0.133**	**N.L. (1)**
360.9	13.5	8						0.116	1.599	11.068	11.068	0.123	0.054	1.444	1.481	1.096	**0.327**	0.962	**0.135**	**2.422 (D)**
358.4	16	15						0.123	1.906	21.003	21.003	0.228	0.061	1.596	1.789	1.089	**0.605**	0.948	**0.146**	**4.144 (D)**
355.9	18.5	14						0.064	2.066	19.105	19.105	0.205	0.064	1.756	2.105	1.056	**0.526**	0.932	**0.153**	**3.438 (D)**
353.4	21	16						0.065	2.229	21.714	21.714	0.238	0.065	1.919	2.424	1.031	**0.597**	0.912	**0.158**	**3.778 (D)**
350.9	23.5	17						0.066	2.394	22.641	22.641	0.251	0.066	2.084	2.745	1.005	**0.616**	0.889	**0.161**	**3.826 (D)**
348.4	26	29						0.071	2.571	40.955	40.955	0.155	0.071	2.261	3.078	0.975	**0.367**	0.864	**0.161**	**N.L. (3)**
345.9	28.5	25						0.069	2.744	33.169	33.169	1.444	0.069	2.434	3.407	0.949	**3.340**	0.835	**0.160**	**N.L. (3)**
340.9	33.5	18						0.066	3.074	21.352	21.352	0.233	0.066	2.764	4.049	0.923	**0.524**	0.771	**0.155**	**3.381 (D)**
335.9	38.5	18						0.066	3.404	20.154	20.154	0.217	0.066	3.094	4.691	0.895	**0.473**	0.707	**0.147**	**3.218 (D)**
330.9	43.5	20						0.067	3.739	21.459	21.459	0.234	0.067	3.429	5.338	0.864	**0.494**	0.649	**0.139**	**3.554 (D)**
325.9	48.5	24						0.069	4.084	24.971	24.971	0.291	0.069	3.774	5.995	0.829	**0.588**	0.603	**0.131**	**4.489 (D)**
320.9	53.5	24						0.069	4.429	23.657	23.657	0.268	0.069	4.119	6.652	0.810	**0.528**	0.569	**0.126**	**4.190 (D)**
315.9	58.5	23						0.068	4.769	21.410	21.410	0.234	0.068	4.459	7.304	0.798	**0.455**	0.547	**0.123**	**3.699 (D)**
310.9	63.5	18						0.066	5.099	15.532	15.532	0.165	0.066	4.789	7.946	0.805	**0.324**	0.532	**0.121**	**2.678 (D)**
305.9	68.5	34						0.072	5.459	30.254	30.254	0.486	0.072	5.149	8.618	0.728	**0.862**	0.504	**0.116**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-18
ELEVATION OF BORING GROUND SURFACE ==========: 375.22 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 18.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 13.70 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **539** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
374.22	1	6						0.113	0.113	10.770	10.770	0.120	0.113	0.113	0.113	1.500	**0.438**	0.995	**0.137**	**N.L. (1)**
371.72	3.5	5						0.111	0.391	8.375	8.375	0.099	0.111	0.391	0.391	1.454	**0.351**	0.982	**0.135**	**N.L. (1)**
369.22	6	3						0.105	0.653	4.613	4.613	0.069	0.105	0.653	0.653	1.266	**0.213**	0.966	**0.133**	**N.L. (1)**
366.72	8.5	3						0.105	0.916	4.439	4.439	0.068	0.105	0.916	0.916	1.183	**0.196**	0.946	**0.130**	**N.L. (1)**
364.22	11	6						0.113	1.198	8.771	8.771	0.102	0.113	1.198	1.198	1.136	**0.283**	0.923	**0.127**	**N.L. (1)**
361.72	13.5	8						0.116	1.488	11.371	11.371	0.125	0.116	1.488	1.488	1.089	**0.332**	0.895	**0.123**	**N.L. (1)**
359.22	16	13						0.121	1.791	18.408	18.408	0.196	0.059	1.636	1.779	1.076	**0.515**	0.863	**0.129**	**3.992 (D)**
356.72	18.5	11						0.119	2.088	14.536	14.536	0.155	0.181	2.088	2.388	1.004	**0.380**	0.828	**0.130**	**2.923 (D)**
354.22	21	12						0.063	2.246	15.674	15.674	0.167	0.063	2.246	2.701	0.985	**0.400**	0.789	**0.130**	**3.077 (D)**
351.72	23.5	15						0.065	2.408	19.588	19.588	0.210	0.065	2.408	3.020	0.964	**0.494**	0.748	**0.129**	**3.829 (D)**
349.22	26	16						0.065	2.571	20.480	20.480	0.221	0.065	2.571	3.338	0.944	**0.509**	0.707	**0.126**	**4.040 (D)**
346.72	28.5	23						0.068	2.741	30.094	30.094	0.474	0.068	2.741	3.664	0.912	**1.054**	0.666	**0.122**	**N.L. (3)**
341.72	33.5	16						0.065	3.066	18.736	18.736	0.200	0.065	3.066	4.301	0.900	**0.439**	0.590	**0.114**	**3.851 (D)**
336.72	38.5	23						0.068	3.406	26.627	26.627	0.328	0.068	3.406	4.953	0.853	**0.682**	0.529	**0.106**	**N.L. (3)**
331.72	43.5	14						0.064	3.726	14.472	14.472	0.155	0.064	3.726	5.585	0.864	**0.326**	0.485	**0.100**	**3.260 (D)**
326.72	48.5	22						0.068	4.066	22.684	22.684	0.252	0.068	4.066	6.237	0.817	**0.501**	0.454	**0.096**	**5.219 (D)**
321.72	53.5	20						0.067	4.401	19.347	19.347	0.207	0.067	4.401	6.884	0.809	**0.409**	0.434	**0.093**	**4.398 (D)**
316.72	58.5	25						0.069	4.746	23.615	23.615	0.267	0.069	4.746	7.541	0.775	**0.504**	0.422	**0.092**	**5.478 (D)**
311.72	63.5	18						0.066	5.076	15.584	15.584	0.166	0.066	5.076	8.183	0.792	**0.320**	0.415	**0.092**	**3.478 (D)**
309.22	66	20						0.067	5.243	17.092	17.092	0.182	0.067	5.243	8.507	0.779	**0.345**	0.402	**0.089**	**3.876 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-19
ELEVATION OF BORING GROUND SURFACE ==========: 376.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 19.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 14.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **566** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
375	1	11	3.3					0.136	0.136	21.267	21.267	0.232	0.136	0.136	0.136	1.500	**0.847**	0.996	**0.137**	**N.L. (1)**
372.5	3.5	9	3.1					0.135	0.474	15.182	15.182	0.162	0.135	0.474	0.474	1.485	**0.586**	0.986	**0.135**	**N.L. (1)**
370	6	5	1.6					0.127	0.791	7.370	7.370	0.091	0.127	0.791	0.791	1.236	**0.273**	0.973	**0.133**	**N.L. (1)**
367.5	8.5	6	0.3					0.108	1.061	8.519	8.519	0.100	0.108	1.061	1.061	1.166	**0.285**	0.958	**0.131**	**N.L. (1)**
365	11	5						0.111	1.339	7.044	7.044	0.088	0.111	1.339	1.339	1.103	**0.236**	0.938	**0.129**	**N.L. (1)**
362.5	13.5	4						0.108	1.609	5.521	5.521	0.076	0.108	1.609	1.609	1.058	**0.196**	0.915	**0.126**	**N.L. (1)**
360	16	9						0.117	1.901	11.992	11.992	0.131	0.055	1.746	1.840	1.048	**0.335**	0.889	**0.128**	**2.617 (D)**
357.5	18.5	9						0.117	2.194	11.516	11.516	0.127	0.055	1.884	2.133	1.029	**0.318**	0.858	**0.133**	**2.391 (D)**
355	21	16						0.065	2.356	21.075	21.075	0.229	0.065	2.046	2.452	1.011	**0.564**	0.824	**0.135**	**4.178 (D)**
352.5	23.5	16						0.065	2.519	20.547	20.547	0.222	0.065	2.209	2.770	0.988	**0.535**	0.787	**0.135**	**3.963 (D)**
350	26	20						0.067	2.686	25.743	25.743	0.307	0.067	2.376	3.094	0.963	**0.721**	0.748	**0.134**	**N.L. (3)**
347.5	28.5	18						0.066	2.851	22.161	22.161	0.244	0.066	2.541	3.415	0.946	**0.563**	0.708	**0.131**	**4.298 (D)**
342.5	33.5	18						0.066	3.181	20.900	20.900	0.227	0.066	2.871	4.057	0.913	**0.505**	0.633	**0.123**	**4.106 (D)**
337.5	38.5	21						0.068	3.521	23.468	23.468	0.264	0.068	3.211	4.709	0.877	**0.565**	0.569	**0.114**	**4.956 (D)**
332.5	43.5	14						0.064	3.841	14.186	14.186	0.152	0.064	3.531	5.341	0.877	**0.325**	0.520	**0.108**	**3.009 (D)**
327.5	48.5	13						0.063	4.156	12.591	12.591	0.137	0.063	3.846	5.968	0.863	**0.287**	0.486	**0.103**	**2.786 (C)**
322.5	53.5	13						0.063	4.471	12.072	12.072	0.132	0.063	4.161	6.595	0.848	**0.272**	0.463	**0.101**	**2.693 (C)**
317.5	58.5	32						0.071	4.826	30.994	30.994	0.558	0.071	4.516	7.262	0.760	**1.032**	0.449	**0.099**	**N.L. (3)**
312.5	63.5	27						0.070	5.176	24.172	24.172	0.276	0.070	4.866	7.924	0.766	**0.516**	0.440	**0.098**	**5.265 (D)**
307.5	68.5	22						0.068	5.516	18.287	18.287	0.195	0.068	5.206	8.576	0.775	**0.368**	0.422	**0.095**	**3.874 (D)**
302.5	73.5	44						0.074	5.886	38.584	38.584	0.063	0.074	5.576	9.258	0.679	**0.104**	0.415	**0.094**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-20
ELEVATION OF BORING GROUND SURFACE ==========: 375.37 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 17.97 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 13.87 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **619** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
374.37	1	11	3.1					0.135	0.135	21.267	21.267	0.232	0.135	0.135	0.135	1.500	**0.847**	0.998	**0.137**	**N.L. (1)**
371.87	3.5	4						0.108	0.405	6.667	6.667	0.085	0.108	0.405	0.405	1.417	**0.293**	0.992	**0.136**	**N.L. (1)**
369.37	6	6						0.113	0.688	9.127	9.127	0.106	0.113	0.688	0.688	1.290	**0.331**	0.984	**0.135**	**N.L. (1)**
366.87	8.5	8						0.116	0.978	11.691	11.691	0.128	0.116	0.978	0.978	1.206	**0.377**	0.974	**0.134**	**N.L. (1)**
364.37	11	9						0.117	1.270	13.026	13.026	0.141	0.117	1.270	1.270	1.137	**0.390**	0.961	**0.132**	**N.L. (1)**
361.87	13.5	10						0.118	1.565	14.119	14.119	0.151	0.118	1.565	1.565	1.081	**0.398**	0.946	**0.130**	**N.L. (1)**
359.37	16	12						0.120	1.865	16.515	16.515	0.176	0.058	1.710	1.843	1.060	**0.454**	0.928	**0.137**	**3.314 (D)**
356.87	18.5	13						0.063	2.023	17.771	17.771	0.189	0.063	1.868	2.156	1.036	**0.478**	0.906	**0.143**	**3.343 (D)**
354.37	21	9						0.060	2.173	11.757	11.757	0.129	0.060	2.018	2.462	1.012	**0.318**	0.881	**0.147**	**2.163 (D)**
351.87	23.5	14						0.064	2.333	18.445	18.445	0.197	0.064	2.178	2.778	0.992	**0.476**	0.852	**0.149**	**3.195 (D)**
349.37	26	22						0.068	2.503	29.969	29.969	0.465	0.068	2.348	3.104	0.964	**1.093**	0.820	**0.149**	**N.L. (3)**
346.87	28.5	25						0.069	2.675	33.684	33.684	3.409	0.069	2.520	3.433	0.937	**7.776**	0.786	**0.147**	**N.L. (3)**
341.87	33.5	26						0.069	3.020	32.995	32.995	1.234	0.069	2.865	4.090	0.893	**2.685**	0.716	**0.140**	**N.L. (3)**
336.87	38.5	22						0.068	3.360	25.524	25.524	0.303	0.068	3.205	4.742	0.873	**0.643**	0.649	**0.132**	**N.L. (3)**
331.87	43.5	31						0.071	3.715	35.786	35.786	-0.299	0.071	3.560	5.409	0.816	**-0.595**	0.594	**0.124**	**N.L. (3)**
326.87	48.5	25						0.069	4.060	26.275	26.275	0.320	0.069	3.905	6.066	0.816	**0.635**	0.552	**0.118**	**N.L. (3)**
321.87	53.5	18						0.066	4.390	17.235	17.235	0.183	0.066	4.235	6.708	0.826	**0.369**	0.524	**0.114**	**3.237 (D)**
316.87	58.5	14						0.064	4.710	12.602	12.602	0.137	0.064	4.555	7.340	0.827	**0.276**	0.505	**0.112**	**2.464 (C)**
311.87	63.5	16						0.065	5.035	13.799	13.799	0.148	0.065	4.880	7.977	0.808	**0.292**	0.493	**0.110**	**2.655 (D)**
306.87	68.5	43						0.074	5.405	40.261	40.261	0.134	0.074	5.250	8.659	0.696	**0.227**	0.470	**0.106**	**N.L. (3)**
303.87	71.5	27						0.070	5.615	22.705	22.705	0.252	0.070	5.460	9.056	0.745	**0.458**	0.465	**0.106**	**4.321 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-21
ELEVATION OF BORING GROUND SURFACE ==========: 376.07 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 19.47 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 14.57 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========:

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **581** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
375.07	1	11	1.8		12	20	20	0.128	0.128	21.267	21.267	0.232	0.128	0.128	0.128	1.500	**0.847**	0.997	**0.137**	**N.L. (1)**
372.57	3.5	5						0.111	0.406	8.333	8.333	0.099	0.111	0.406	0.406	1.441	**0.347**	0.988	**0.135**	**N.L. (1)**
370.07	6	4						0.108	0.676	6.107	6.107	0.081	0.108	0.676	0.676	1.267	**0.249**	0.977	**0.134**	**N.L. (1)**
367.57	8.5	5						0.111	0.953	7.319	7.319	0.090	0.111	0.953	0.953	1.187	**0.261**	0.963	**0.132**	**N.L. (1)**
365.07	11	11						0.119	1.251	16.364	16.364	0.174	0.119	1.251	1.251	1.154	**0.489**	0.946	**0.130**	**N.L. (1)**
362.57	13.5	11						0.119	1.548	15.762	15.762	0.168	0.119	1.548	1.548	1.088	**0.445**	0.925	**0.127**	**N.L. (1)**
360.07	16	8						0.116	1.838	10.813	10.813	0.120	0.054	1.683	1.772	1.056	**0.310**	0.901	**0.130**	**2.385 (D)**
357.57	18.5	8						0.116	2.128	10.380	10.380	0.116	0.054	1.818	2.063	1.037	**0.294**	0.873	**0.136**	**2.162 (C)**
355.07	21	6						0.057	2.271	7.678	7.678	0.093	0.057	1.961	2.362	1.017	**0.231**	0.841	**0.139**	**1.662 (C)**
352.57	23.5	25						0.069	2.443	35.045	35.045	-0.702	0.069	2.133	2.690	0.998	**-1.705**	0.806	**0.139**	**N.L. (3)**
350.07	26	26						0.069	2.616	35.555	35.555	-0.384	0.069	2.306	3.019	0.968	**-0.906**	0.769	**0.138**	**N.L. (3)**
347.57	28.5	34						0.072	2.796	47.469	47.469	0.273	0.072	2.486	3.355	0.938	**0.623**	0.731	**0.135**	**N.L. (3)**
342.57	33.5	24						0.069	3.141	29.296	29.296	0.425	0.069	2.831	4.012	0.903	**0.935**	0.656	**0.128**	**N.L. (3)**
337.57	38.5	17						0.066	3.471	18.668	18.668	0.199	0.066	3.161	4.654	0.892	**0.433**	0.591	**0.119**	**3.639 (D)**
332.57	43.5	20						0.067	3.806	21.204	21.204	0.231	0.067	3.496	5.301	0.860	**0.484**	0.540	**0.112**	**4.321 (D)**
327.57	48.5	29						0.071	4.161	30.665	30.665	0.522	0.071	3.851	5.968	0.806	**1.026**	0.504	**0.107**	**N.L. (3)**
322.57	53.5	22						0.068	4.501	21.189	21.189	0.231	0.068	4.191	6.620	0.814	**0.458**	0.479	**0.104**	**4.404 (D)**
317.57	58.5	18						0.066	4.831	16.139	16.139	0.172	0.066	4.521	7.262	0.815	**0.341**	0.464	**0.102**	**3.343 (D)**
312.57	63.5	24						0.069	5.176	21.153	21.153	0.230	0.069	4.866	7.919	0.779	**0.437**	0.454	**0.101**	**4.327 (D)**
307.57	68.5	22						0.068	5.516	18.288	18.288	0.195	0.068	5.206	8.571	0.775	**0.368**	0.435	**0.098**	**3.755 (D)**
305.07	71	28						0.070	5.691	23.416	23.416	0.264	0.070	5.381	8.902	0.745	**0.478**	0.431	**0.098**	**4.878 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-22
ELEVATION OF BORING GROUND SURFACE ========== 376.26 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.46 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 14.76 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **535** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
375.26	1	11	3.6					0.137	0.137	21.267	21.267	0.232	0.137	0.137	0.137	1.500	**0.847**	0.995	**0.137**	**N.L. (1)**
372.76	3.5	8	1.6					0.127	0.455	13.406	13.406	0.144	0.127	0.455	0.455	1.476	**0.519**	0.982	**0.135**	**N.L. (1)**
370.26	6	9						0.117	0.747	13.779	13.779	0.148	0.117	0.747	0.747	1.305	**0.470**	0.965	**0.132**	**N.L. (1)**
367.76	8.5	5						0.111	1.025	7.172	7.172	0.089	0.111	1.025	1.025	1.168	**0.253**	0.945	**0.130**	**N.L. (1)**
365.26	11	4						0.108	1.295	5.700	5.700	0.077	0.108	1.295	1.295	1.106	**0.208**	0.920	**0.126**	**N.L. (1)**
362.76	13.5	4						0.108	1.565	5.580	5.580	0.076	0.108	1.565	1.565	1.064	**0.198**	0.892	**0.122**	**N.L. (1)**
360.26	16	9						0.117	1.857	12.112	12.112	0.132	0.055	1.702	1.779	1.055	**0.340**	0.859	**0.123**	**2.764 (D)**
357.76	18.5	8						0.059	2.005	10.661	10.661	0.119	0.059	1.850	2.083	1.033	**0.299**	0.823	**0.127**	**2.354 (C)**
355.26	21	9						0.060	2.155	11.802	11.802	0.129	0.060	2.000	2.389	1.014	**0.320**	0.784	**0.128**	**2.500 (D)**
352.76	23.5	5						0.055	2.292	6.444	6.444	0.083	0.055	2.137	2.682	0.998	**0.202**	0.742	**0.128**	**1.578 (C)**
350.26	26	10						0.061	2.445	12.597	12.597	0.137	0.061	2.290	2.991	0.981	**0.327**	0.700	**0.125**	**2.616 (D)**
347.76	28.5	28						0.070	2.620	39.051	39.051	0.087	0.070	2.465	3.322	0.942	**0.198**	0.659	**0.122**	**N.L. (3)**
342.76	33.5	20						0.067	2.955	24.664	24.664	0.285	0.067	2.800	3.969	0.914	**0.635**	0.584	**0.114**	**5.570 (D)**
337.76	38.5	22						0.068	3.295	25.853	25.853	0.310	0.068	3.140	4.621	0.878	**0.663**	0.523	**0.106**	**N.L. (3)**
332.76	43.5	22						0.068	3.635	24.371	24.371	0.280	0.068	3.480	5.273	0.853	**0.581**	0.479	**0.100**	**5.810 (D)**
327.76	48.5	17						0.066	3.965	17.286	17.286	0.184	0.066	3.810	5.915	0.850	**0.381**	0.450	**0.096**	**3.969 (D)**
322.76	53.5	22						0.068	4.305	21.874	21.874	0.240	0.068	4.150	6.567	0.814	**0.476**	0.430	**0.093**	**5.118 (D)**
317.76	58.5	28						0.070	4.655	27.279	27.279	0.346	0.070	4.500	7.229	0.775	**0.653**	0.418	**0.092**	**N.L. (3)**
312.76	63.5	22						0.068	4.995	19.701	19.701	0.212	0.068	4.840	7.881	0.786	**0.405**	0.411	**0.092**	**4.402 (D)**
307.76	68.5	28						0.070	5.345	24.587	24.587	0.284	0.070	5.190	8.543	0.749	**0.518**	0.395	**0.089**	**5.820 (D)**
302.76	73.5	31						0.071	5.700	26.278	26.278	0.320	0.071	5.545	9.210	0.726	**0.565**	0.388	**0.088**	**N.L. (3)**
299.26	77	73						0.079	5.976	66.274	66.274	0.455	0.079	5.821	9.705	0.668	**0.740**	0.383	**0.088**	**N.L. (3)**
297.26	79	50						0.076	6.128	43.564	43.564	0.213	0.076	5.973	9.982	0.661	**0.343**	0.380	**0.087**	**N.L. (3)**
295.26	81	70						0.079	6.286	61.404	61.404	0.413	0.079	6.131	10.264	0.654	**0.658**	0.377	**0.087**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-23
ELEVATION OF BORING GROUND SURFACE ========== 376.62 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 19.02 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 15.12 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **569** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
375.62	1	10	1.6					0.127	0.127	19.057	19.057	0.204	0.127	0.127	0.127	1.500	**0.745**	0.997	**0.137**	**N.L. (1)**
373.12	3.5	6						0.113	0.410	9.986	9.986	0.113	0.113	0.410	0.410	1.463	**0.403**	0.986	**0.135**	**N.L. (1)**
370.62	6	2	0.3					0.108	0.680	3.050	3.050	0.059	0.108	0.680	0.680	1.256	**0.179**	0.974	**0.134**	**N.L. (1)**
368.12	8.5	1	0.25					0.107	0.947	1.466	1.466	0.051	0.107	0.947	0.947	1.175	**0.145**	0.958	**0.131**	**N.L. (1)**
363.12	13.5	17						0.124	1.567	25.701	25.701	0.306	0.124	1.567	1.567	1.105	**0.824**	0.917	**0.126**	**N.L. (1)**
360.62	16	23						0.128	1.887	34.715	34.715	-1.145	0.066	1.732	1.787	1.081	**-3.016**	0.891	**0.126**	**N.L. (3)**
358.12	18.5	17						0.124	2.197	23.064	23.064	0.258	0.062	1.887	2.098	1.037	**0.651**	0.861	**0.131**	**4.969 (D)**
355.62	21	22						0.068	2.367	30.334	30.334	0.493	0.068	2.057	2.424	1.011	**1.213**	0.827	**0.134**	**N.L. (3)**
353.12	23.5	22						0.068	2.537	29.487	29.487	0.435	0.068	2.227	2.750	0.983	**1.042**	0.790	**0.134**	**N.L. (3)**
350.62	26	20						0.067	2.705	25.639	25.639	0.305	0.067	2.395	3.073	0.961	**0.714**	0.752	**0.132**	**N.L. (3)**
348.12	28.5	22						0.068	2.875	27.756	27.756	0.361	0.068	2.565	3.399	0.937	**0.824**	0.712	**0.129**	**N.L. (3)**
343.12	33.5	26						0.069	3.220	31.655	31.655	0.656	0.069	2.910	4.056	0.890	**1.423**	0.637	**0.122**	**N.L. (3)**
338.12	38.5	41						0.074	3.590	50.711	50.711	0.311	0.074	3.280	4.738	0.840	**0.636**	0.573	**0.113**	**N.L. (3)**
333.12	43.5	14						0.064	3.910	14.021	14.021	0.150	0.064	3.600	5.370	0.873	**0.320**	0.524	**0.107**	**2.991 (D)**
328.12	48.5	42						0.074	4.280	46.735	46.735	0.263	0.074	3.970	6.052	0.778	**0.498**	0.489	**0.102**	**N.L. (3)**
323.12	53.5	30						0.071	4.635	29.574	29.574	0.440	0.071	4.325	6.719	0.777	**0.833**	0.466	**0.099**	**N.L. (3)**
318.12	58.5	20						0.067	4.970	17.763	17.763	0.189	0.067	4.660	7.366	0.802	**0.370**	0.452	**0.098**	**3.776 (D)**
313.12	63.5	21						0.068	5.310	17.870	17.870	0.190	0.068	5.000	8.018	0.786	**0.364**	0.443	**0.097**	**3.753 (D)**
308.12	68.5	20						0.067	5.645	16.169	16.169	0.172	0.067	5.335	8.665	0.779	**0.327**	0.424	**0.094**	**3.479 (D)**
303.12	73.5	15						0.065	5.970	11.522	11.522	0.127	0.065	5.660	9.302	0.789	**0.244**	0.417	**0.094**	**2.596 (C)**
298.12	78.5	95						0.082	6.380	82.392	82.392	0.585	0.082	6.070	10.024	0.657	**0.935**	0.410	**0.093**	**N.L. (3)**
293.12	83.5	34						0.072	6.740	25.549	25.549	0.303	0.072	6.430	10.696	0.694	**0.513**	0.403	**0.092**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ==========: SB-24
ELEVATION OF BORING GROUND SURFACE ==========: 377.02 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 19.02 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 15.52 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.211
EARTHQUAKE MOMENT MAGNITUDE ==========: 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ==========: 0.00 FT.
HAMMER EFFICIENCY==========: 73 %
BOREHOLE DIAMETER==========: 6 IN.
SAMPLING METHOD==========: Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **534** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
376.02	1	10	2.8					0.134	0.134	19.057	19.057	0.204	0.134	0.134	0.134	1.500	**0.745**	0.995	**0.137**	**N.L. (1)**
373.52	3.5	6	1.3					0.125	0.447	9.862	9.862	0.112	0.125	0.447	0.447	1.432	**0.390**	0.982	**0.135**	**N.L. (1)**
371.02	6	4						0.108	0.717	6.030	6.030	0.080	0.108	0.717	0.717	1.251	**0.244**	0.965	**0.132**	**N.L. (1)**
368.52	8.5	5						0.111	0.994	7.234	7.234	0.090	0.111	0.994	0.994	1.176	**0.257**	0.944	**0.129**	**N.L. (1)**
366.02	11	4						0.108	1.264	5.746	5.746	0.078	0.108	1.264	1.264	1.112	**0.210**	0.920	**0.126**	**N.L. (1)**
363.52	13.5	14						0.122	1.569	20.550	20.550	0.222	0.122	1.569	1.569	1.094	**0.592**	0.891	**0.122**	**N.L. (1)**
361.02	16	15						0.123	1.877	21.163	21.163	0.230	0.061	1.722	1.751	1.065	**0.597**	0.858	**0.120**	**4.975 (D)**
358.52	18.5	9						0.117	2.169	11.575	11.575	0.127	0.055	1.859	2.045	1.032	**0.320**	0.821	**0.124**	**2.581 (D)**
356.02	21	14						0.064	2.329	18.248	18.248	0.195	0.064	2.019	2.361	1.014	**0.481**	0.782	**0.125**	**3.848 (D)**
353.52	23.5	10						0.061	2.482	12.402	12.402	0.135	0.061	2.172	2.669	0.994	**0.327**	0.740	**0.125**	**2.616 (D)**
351.02	26	3						0.051	2.609	3.659	3.659	0.063	0.051	2.299	2.953	0.984	**0.150**	0.698	**0.123**	**1.220 (C)**
348.52	28.5	24						0.069	2.782	31.347	31.347	0.605	0.069	2.472	3.281	0.946	**1.392**	0.657	**0.120**	**N.L. (3)**
343.52	33.5	27						0.070	3.132	33.699	33.699	3.568	0.070	2.822	3.943	0.897	**7.796**	0.582	**0.112**	**N.L. (3)**
338.52	38.5	13						0.063	3.447	13.945	13.945	0.150	0.063	3.137	4.570	0.905	**0.330**	0.522	**0.104**	**3.173 (D)**
333.52	43.5	42						0.074	3.817	50.385	50.385	0.307	0.074	3.507	5.252	0.818	**0.612**	0.478	**0.098**	**N.L. (3)**
328.52	48.5	28						0.070	4.167	29.405	29.405	0.431	0.070	3.857	5.914	0.810	**0.850**	0.448	**0.094**	**N.L. (3)**
323.52	53.5	19						0.067	4.502	17.979	17.979	0.192	0.067	4.192	6.561	0.825	**0.385**	0.429	**0.092**	**4.185 (D)**
318.52	58.5	21						0.068	4.842	19.118	19.118	0.205	0.068	4.532	7.213	0.803	**0.400**	0.417	**0.091**	**4.396 (D)**
313.52	63.5	42						0.074	5.212	40.307	40.307	0.135	0.074	4.902	7.895	0.715	**0.236**	0.410	**0.090**	**N.L. (3)**
308.52	68.5	29						0.071	5.567	24.794	24.794	0.288	0.071	5.257	8.562	0.745	**0.522**	0.394	**0.088**	**5.932 (D)**
303.52	73.5	34						0.072	5.927	28.331	28.331	0.382	0.072	5.617	9.234	0.714	**0.664**	0.387	**0.087**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-25
ELEVATION OF BORING GROUND SURFACE ========== 378.71 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 21.01 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 17.21 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **633** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING						CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
377.71	1	13	3.2					0.136	0.136	25.854	25.854	0.310	0.136	0.136	0.136	1.500	**1.132**	0.998	**0.137**	**N.L. (1)**
375.21	3.5	7	1.1					0.123	0.444	11.615	11.615	0.128	0.123	0.444	0.444	1.459	**0.454**	0.993	**0.136**	**N.L. (1)**
372.71	6	6						0.113	0.726	9.019	9.019	0.105	0.113	0.726	0.726	1.273	**0.324**	0.986	**0.135**	**N.L. (1)**
370.21	8.5	7						0.114	1.011	10.079	10.079	0.114	0.114	1.011	1.011	1.187	**0.329**	0.977	**0.134**	**N.L. (1)**
367.71	11	5						0.111	1.289	7.136	7.136	0.089	0.111	1.289	1.289	1.112	**0.240**	0.966	**0.132**	**N.L. (1)**
365.21	13.5	10						0.118	1.584	14.050	14.050	0.151	0.118	1.584	1.584	1.078	**0.395**	0.952	**0.131**	**N.L. (1)**
362.71	16	14						0.122	1.889	19.512	19.512	0.209	0.122	1.889	1.889	1.034	**0.527**	0.936	**0.128**	**N.L. (1)**
360.21	18.5	14						0.122	2.194	18.529	18.529	0.198	0.060	2.039	2.119	1.011	**0.487**	0.916	**0.131**	**3.718 (D)**
357.71	21	11						0.119	2.491	13.484	13.484	0.145	0.057	2.181	2.417	0.993	**0.351**	0.893	**0.136**	**2.581 (D)**
355.21	23.5	15						0.065	2.654	18.553	18.553	0.198	0.065	2.344	2.736	0.972	**0.469**	0.867	**0.139**	**3.374 (D)**
352.71	26	18						0.066	2.819	22.178	22.178	0.245	0.066	2.509	3.057	0.950	**0.566**	0.837	**0.140**	**4.043 (D)**
350.21	28.5	33						0.072	2.999	43.725	43.725	0.216	0.072	2.689	3.393	0.909	**0.479**	0.805	**0.139**	**N.L. (3)**
345.21	33.5	33						0.072	3.359	40.864	40.864	0.152	0.072	3.049	4.065	0.865	**0.321**	0.737	**0.135**	**N.L. (3)**
340.21	38.5	22						0.068	3.699	23.946	23.946	0.272	0.068	3.389	4.717	0.861	**0.571**	0.670	**0.128**	**4.461 (D)**
335.21	43.5	23						0.068	4.039	23.851	23.851	0.271	0.068	3.729	5.369	0.836	**0.551**	0.614	**0.121**	**4.554 (D)**
330.21	48.5	32						0.071	4.394	33.065	33.065	1.310	0.071	4.084	6.036	0.782	**2.493**	0.570	**0.116**	**N.L. (3)**
325.21	53.5	24						0.069	4.739	22.517	22.517	0.250	0.069	4.429	6.693	0.796	**0.484**	0.540	**0.112**	**4.321 (D)**
320.21	58.5	36						0.073	5.104	34.080	34.080	-12.320	0.073	4.794	7.370	0.732	**-21.968**	0.520	**0.110**	**N.L. (3)**
315.21	63.5	30						0.071	5.459	26.170	26.170	0.317	0.071	5.149	8.037	0.744	**0.575**	0.507	**0.109**	**N.L. (3)**
310.21	68.5	32						0.071	5.814	26.819	26.819	0.333	0.071	5.504	8.704	0.725	**0.589**	0.482	**0.105**	**N.L. (3)**
305.21	73.5	26						0.069	6.159	20.237	20.237	0.218	0.069	5.849	9.361	0.741	**0.394**	0.475	**0.104**	**3.788 (D)**
302.71	76	51						0.076	6.349	43.239	43.239	0.207	0.076	6.039	9.707	0.658	**0.332**	0.472	**0.104**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-26
ELEVATION OF BORING GROUND SURFACE ========== 378.91 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 20.51 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 17.41 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **601** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
377.91	1	15						0.123	0.123	30.662	30.662	0.522	0.123	0.123	0.123	1.500	**1.907**	0.997	**0.137**	**N.L. (1)**
375.41	3.5	8	1.2					0.124	0.433	13.514	13.514	0.145	0.124	0.433	0.433	1.496	**0.530**	0.990	**0.136**	**N.L. (1)**
372.91	6	6						0.113	0.716	9.048	9.048	0.105	0.113	0.716	0.716	1.278	**0.326**	0.980	**0.134**	**N.L. (1)**
370.41	8.5	5						0.111	0.993	7.236	7.236	0.090	0.111	0.993	0.993	1.176	**0.257**	0.969	**0.133**	**N.L. (1)**
367.91	11	5						0.111	1.271	7.170	7.170	0.089	0.111	1.271	1.271	1.116	**0.242**	0.954	**0.131**	**N.L. (1)**
365.41	13.5	8						0.116	1.561	11.171	11.171	0.124	0.116	1.561	1.561	1.076	**0.324**	0.937	**0.128**	**N.L. (1)**
362.91	16	15						0.123	1.868	21.209	21.209	0.231	0.123	1.868	1.868	1.039	**0.585**	0.916	**0.126**	**N.L. (1)**
360.41	18.5	14						0.122	2.173	18.620	18.620	0.199	0.060	2.018	2.086	1.014	**0.491**	0.891	**0.126**	**3.897 (D)**
357.91	21	16						0.065	2.336	21.175	21.175	0.231	0.065	2.181	2.405	0.992	**0.557**	0.863	**0.130**	**4.285 (D)**
355.41	23.5	8						0.059	2.483	9.919	9.919	0.112	0.059	2.328	2.708	0.979	**0.268**	0.831	**0.133**	**2.015 (C)**
352.91	26	22						0.068	2.653	28.959	28.959	0.408	0.068	2.498	3.034	0.944	**0.939**	0.796	**0.133**	**N.L. (3)**
350.41	28.5	15						0.065	2.816	18.186	18.186	0.194	0.065	2.661	3.353	0.938	**0.443**	0.760	**0.131**	**3.382 (D)**
345.41	33.5	22						0.068	3.156	26.406	26.406	0.323	0.068	3.001	4.005	0.890	**0.700**	0.687	**0.126**	**N.L. (3)**
340.41	38.5	23						0.068	3.496	26.170	26.170	0.317	0.068	3.341	4.657	0.860	**0.664**	0.621	**0.119**	**N.L. (3)**
335.41	43.5	26						0.069	3.841	28.443	28.443	0.386	0.069	3.686	5.314	0.826	**0.776**	0.568	**0.112**	**N.L. (3)**
330.41	48.5	37						0.073	4.206	40.607	40.607	0.145	0.073	4.051	5.991	0.772	**0.272**	0.529	**0.107**	**N.L. (3)**
325.41	53.5	22						0.068	4.546	21.037	21.037	0.229	0.068	4.391	6.643	0.804	**0.448**	0.502	**0.104**	**4.308 (D)**
320.41	58.5	30						0.071	4.901	28.418	28.418	0.385	0.071	4.746	7.310	0.756	**0.709**	0.485	**0.102**	**N.L. (3)**
315.41	63.5	20						0.067	5.236	17.108	17.108	0.182	0.067	5.081	7.957	0.786	**0.348**	0.474	**0.102**	**3.412 (D)**
310.41	68.5	14						0.064	5.556	11.300	11.300	0.125	0.064	5.401	8.589	0.799	**0.243**	0.453	**0.099**	**2.455 (C)**
305.41	73.5	25						0.069	5.901	20.031	20.031	0.216	0.069	5.746	9.246	0.746	**0.392**	0.446	**0.098**	**4.000 (D)**
302.91	76	64						0.078	6.096	57.282	57.282	0.376	0.078	5.941	9.597	0.662	**0.607**	0.442	**0.098**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

L I Q U E F A C T I O N A N A L Y S I S

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== SB-27
ELEVATION OF BORING GROUND SURFACE ========== 400.95 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 43.46 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 39.46 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.211
EARTHQUAKE MOMENT MAGNITUDE ========== 5.0
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.435**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **620** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.03
Source-To-Site Distance, R (km) = 12.5
Ground Motion Prediction Equations = CEUS
PGA = **0.211**

IF(P22="","",IF(B22>=(K$7+K$12-K$9),"N.L. (1)",IF(OR(G22>=12,AND(H22>0,I22>(

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
399.95	1	10	1.8					0.128	0.128	19.057	19.057	0.204	0.128	0.128	0.128	1.500	**0.745**	0.998	**0.137**	**N.L. (1)**
397.45	3.5	7	1.7					0.128	0.448	11.596	11.596	0.127	0.128	0.448	0.448	1.455	**0.452**	0.992	**0.136**	**N.L. (1)**
394.95	6	15						0.123	0.756	24.623	24.623	0.285	0.123	0.756	0.756	1.395	**0.967**	0.984	**0.135**	**N.L. (1)**
392.45	8.5	20						0.126	1.071	32.392	32.392	0.857	0.126	1.071	1.071	1.289	**2.691**	0.974	**0.134**	**N.L. (1)**
389.95	11	22						0.127	1.388	35.083	35.083	-0.668	0.127	1.388	1.388	1.179	**-1.918**	0.961	**0.132**	**N.L. (1)**
387.45	13.5	22						0.127	1.706	33.487	33.487	2.192	0.127	1.706	1.706	1.086	**5.795**	0.946	**0.130**	**N.L. (1)**
384.95	16	22						0.127	2.023	31.765	31.765	0.678	0.127	2.023	2.023	1.017	**1.680**	0.928	**0.127**	**N.L. (1)**
382.45	18.5	9						0.117	2.316	11.227	11.227	0.124	0.117	2.316	2.316	0.979	**0.296**	0.907	**0.124**	**N.L. (1)**
379.95	21	11	2.7					0.134	2.651	13.047	13.047	0.141	0.134	2.651	2.651	0.946	**0.325**	0.881	**0.121**	**N.L. (1)**
377.45	23.5	11	2.4					0.132	2.981	12.410	12.410	0.135	0.132	2.981	2.981	0.919	**0.302**	0.853	**0.117**	**N.L. (1)**
374.95	26	7						0.114	3.266	7.572	7.572	0.092	0.114	3.266	3.266	0.911	**0.205**	0.821	**0.113**	**N.L. (1)**
372.45	28.5	6						0.113	3.548	6.227	6.227	0.081	0.113	3.548	3.548	0.898	**0.178**	0.787	**0.108**	**N.L. (1)**
367.45	33.5	12						0.120	4.148	11.435	11.435	0.126	0.120	4.148	4.148	0.851	**0.261**	0.717	**0.098**	**N.L. (1)**
362.45	38.5	17						0.124	4.768	15.038	15.038	0.160	0.124	4.768	4.768	0.808	**0.316**	0.650	**0.089**	**N.L. (1)**
357.45	43.5	23						0.068	5.108	20.115	20.115	0.217	0.068	5.108	5.360	0.772	**0.408**	0.595	**0.086**	**4.744 (D)**
352.45	48.5	23						0.068	5.448	19.256	19.256	0.206	0.068	5.448	6.012	0.761	**0.382**	0.553	**0.084**	**4.548 (D)**
347.45	53.5	25						0.069	5.793	20.242	20.242	0.218	0.069	5.793	6.669	0.743	**0.395**	0.524	**0.083**	**4.759 (D)**
342.45	58.5	33						0.072	6.153	26.511	26.511	0.325	0.072	6.153	7.341	0.700	**0.555**	0.506	**0.083**	**N.L. (3)**
337.45	63.5	23						0.068	6.493	16.918	16.918	0.180	0.068	6.493	7.993	0.735	**0.322**	0.494	**0.083**	**3.880 (D)**
332.45	68.5	23						0.068	6.833	16.245	16.245	0.173	0.068	6.833	8.645	0.729	**0.307**	0.470	**0.082**	**3.744 (D)**
327.45	73.5	23						0.068	7.173	15.625	15.625	0.166	0.068	7.173	9.297	0.723	**0.293**	0.463	**0.082**	**3.573 (D)**
322.45	78.5	25						0.069	7.518	16.505	16.505	0.176	0.069	7.518	9.954	0.709	**0.303**	0.456	**0.083**	**3.651 (D)**
317.45	83.5	48						0.075	7.893	33.280	33.280	1.631	0.075	7.893	10.641	0.609	**2.419**	0.449	**0.083**	**N.L. (3)**
312.45	88.5	42						0.074	8.263	27.353	27.353	0.349	0.074	8.263	11.323	0.630	**0.535**	0.442	**0.083**	**N.L. (3)**
307.95	93	26						0.069	8.574	15.454	15.454	0.165	0.069	8.574	11.914	0.690	**0.277**	0.436	**0.083**	**3.337 (D)**
303.95	97	70						0.079	8.890	46.648	46.648	0.262	0.079	8.890	12.480	0.564	**0.359**	0.430	**0.083**	**N.L. (3)**
300.95	100	59						0.077	9.121	36.509	36.509	-0.133	0.077	9.121	12.898	0.560	**-0.181**	0.426	**0.083**	**N.L. (3)**
292.45	108.5	45						0.075	9.758	22.001	22.001	0.242	0.075	9.758	14.066	0.626	**0.369**	0.414	**0.082**	**4.500 (D)**
287.45	113.5	75						0.080	10.158	33.652	33.652	3.119	0.080	10.158	14.778	0.552	**4.193**	0.407	**0.081**	**N.L. (3)**
282.45	118.5	39						0.073	10.523	15.194	15.194	0.162	0.073	10.523	15.455	0.655	**0.258**	0.400	**0.081**	**3.185 (C)**
272.45	128.5	54						0.076	11.283	20.631	20.631	0.223	0.076	11.283	16.839	0.608	**0.331**	0.386	**0.079**	**4.190 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

EXHIBIT G

PILE DESIGN TABLES

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== SB-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 400.60 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 398.60 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 398.60 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3772 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 336.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 126.21 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**387** KIPS	**213** KIPS	**18** 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.)
397.00	1.60		21	Very Fine Silty Sand	2.1		16.8	3.0		***4.6***	5	0	0	3	4
394.30	2.70		14	Very Fine Silty Sand	2.3	14.7	37.5	3.4	1.6	***10.1***	10	0	0	6	6
392.97	1.33	2.40	14		6.9	33.1	56.8	10.1	3.6	***21.5***	22	0	0	12	8
391.97	1.00		28	Hard Till	1.2	45.5	64.0	1.8	5.0	***24.0***	24	0	0	13	9
390.97	1.00		28	Hard Till	1.2	51.4	65.2	1.8	5.6	***25.7***	26	0	0	14	10
389.97	1.00		28	Hard Till	1.2	51.4	66.4	1.8	5.6	***27.5***	27	0	0	15	11
389.47	0.50		28	Hard Till	0.6	51.4	61.5	0.9	5.6	***27.8***	28	0	0	15	11
388.47	1.00		25	Hard Till	1.1	45.9	62.6	1.6	5.0	***29.4***	29	0	0	16	12
387.32	1.15		25	Hard Till	1.2	45.9	140.4	1.8	5.0	***39.6***	40	0	0	22	13
386.32	1.00			Shale	49.4	122.5	189.8	72.3	13.4	***111.8***	112	0	0	61	14.3
385.32	1.00			Shale	49.4	122.5	239.2	72.3	13.4	***184.1***	184	0	0	101	15.3
384.32	1.00			Shale	49.4	122.5	288.6	72.3	13.4	***256.3***	256	0	0	141	16.3
383.32	1.00			Shale	49.4	122.5	338.0	72.3	13.4	***328.6***	329	0	0	181	17.3
382.32	1.00			Shale	49.4	122.5	***387.4***	72.3	13.4	400.8	387	0	0	213	18.3
381.32	1.00			Shale	49.4	122.5	***436.9***	72.3	13.4	473.1	~~437~~	~~0~~	~~0~~	~~240~~	~~19.3~~
380.32	1.00			Shale	49.4	122.5	***486.3***	72.3	13.4	545.3	~~486~~	~~0~~	~~0~~	~~267~~	~~20.3~~
379.32	1.00			Shale	49.4	122.5	***535.7***	72.3	13.4	617.6	~~536~~	~~0~~	~~0~~	~~295~~	~~21.3~~
378.32	1.00			Shale	49.4	122.5	***585.1***	72.3	13.4	689.8	~~585~~	~~0~~	~~0~~	~~322~~	~~22.3~~
377.32	1.00			Shale	49.4	122.5	***634.5***	72.3	13.4	762.1	~~635~~	~~0~~	~~0~~	~~349~~	~~23.3~~
376.32	1.00			Shale	49.4	122.5	***683.9***	72.3	13.4	834.3	~~684~~	~~0~~	~~0~~	~~376~~	~~24.3~~
375.32	1.00			Shale	49.4	122.5	***733.3***	72.3	13.4	906.6	~~733~~	~~0~~	~~0~~	~~403~~	~~25.3~~
374.32	1.00			Shale	49.4	122.5	***782.8***	72.3	13.4	978.8	~~783~~	~~0~~	~~0~~	~~431~~	~~26.3~~
373.32	1.00			Shale	49.4	122.5	***832.2***	72.3	13.4	1051.1	~~832~~	~~0~~	~~0~~	~~458~~	~~27.3~~
372.32	1.00			Shale	49.4	122.5	***881.6***	72.3	13.4	1123.3	~~882~~	~~0~~	~~0~~	~~485~~	~~28.3~~
371.32	1.00			Shale	49.4	122.5	***931.0***	72.3	13.4	1195.6	~~931~~	~~0~~	~~0~~	~~512~~	~~29.3~~
370.32	1.00			Shale	49.4	122.5	***980.4***	72.3	13.4	1267.8	~~980~~	~~0~~	~~0~~	~~539~~	~~30.3~~
369.32	1.00			Shale	49.4	122.5	***1029.8***	72.3	13.4	1340.1	~~1030~~	~~0~~	~~0~~	~~566~~	~~31.3~~
368.32	1.00			Shale	49.4	122.5	***1079.2***	72.3	13.4	1412.3	~~1079~~	~~0~~	~~0~~	~~594~~	~~32.3~~
367.32	1.00			Shale	49.4	122.5	***1128.6***	72.3	13.4	1484.6	~~1129~~	~~0~~	~~0~~	~~621~~	~~33.3~~
366.32	1.00			Shale	49.4	122.5	***1178.1***	72.3	13.4	1556.8	~~1178~~	~~0~~	~~0~~	~~648~~	~~34.3~~
365.32	1.00			Shale		122.5			13.4						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #9
REFERENCE BORING ========== SB-15
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 346.23 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 10407 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 928.57 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 348.22 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**371** KIPS	**195** KIPS	**69** 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.)
363.90	1.60	1.10	5		4.9		9.0	7.1		***7.6***	8	3	0	1	4
362.40	1.50	0.30	3		1.4	4.1	10.4	2.1	0.5	***9.7***	10	3	0	2	5
359.40	3.00	0.30	3		2.9	4.1	14.7	4.2	0.5	***14.0***	14	5	0	3	8
356.40	3.00		3	Very Fine Silty Sand	0.6	5.5	***12.2***	0.8	0.6	14.5	12	5	0	1	11
354.90	1.50		1	Medium Sand	0.1	2.4	31.9	0.2	0.3	***16.8***	17	5	0	4	13
352.40	2.50		9	Medium Sand	1.6	22.0	40.9	2.4	2.4	***20.0***	20	6	0	5	15
349.90	2.50		12	Medium Sand	2.2	29.4	43.0	3.2	3.2	***23.2***	23	8	0	5	18
347.40	2.50		12	Medium Sand	2.2	29.4	64.8	3.2	3.2	***28.5***	28	9	0	7	20
344.90	2.50		20	Medium Sand	3.6	49.0	78.2	5.3	5.4	***34.8***	35	9	0	10	23
339.90	5.00		24	Sandy Gravel	11.3	58.8	114.0	16.5	6.4	***54.1***	54	9	0	21	28
334.90	5.00		34	Medium Sand	13.7	83.3	127.7	20.0	9.1	***74.1***	74	9	0	32	33
332.90	2.00		34	Medium Sand	5.5	83.3	91.5	8.0	9.1	***77.5***	78	9	0	34	35
329.90	3.00		17	Fine Sand	3.5	41.6	134.2	5.1	4.6	***86.9***	87	9	0	39	38
324.90	5.00		33	Fine Sand	11.6	80.8	109.0	16.9	8.8	***99.8***	100	9	0	46	43
319.90	5.00		18	Fine Sand	6.1	44.1	115.1	8.9	4.8	***108.7***	109	9	0	51	48
314.90	5.00		18	Fine Sand	6.1	44.1	140.9	8.9	4.8	***119.8***	120	9	0	57	53
309.90	5.00		26	Fine Sand	8.8	63.7	***130.1***	12.9	7.0	130.6	130	9	0	63	58
304.90	5.00		18	Sandy Gravel	8.3	44.1	***138.4***	12.2	4.8	142.8	138	9	0	67	63
301.40	3.50		18	Sandy Gravel	5.8	44.1	222.7	8.5	4.8	***159.9***	160	9	0	79	66
300.40	1.00			Shale	49.4	122.5	272.1	72.3	13.4	***232.1***	232	9	0	119	67.1
299.40	1.00			Shale	49.4	122.5	321.5	72.3	13.4	***304.4***	304	9	0	159	68.1
298.40	1.00			Shale	49.4	122.5	***370.9***	72.3	13.4	376.6	371	9	0	195	69.1
297.40	1.00			Shale	49.4	122.5	***420.3***	72.3	13.4	448.9	~~420~~	~~9~~	~~0~~	~~222~~	~~70.1~~
296.40	1.00			Shale	49.4	122.5	***469.7***	72.3	13.4	521.1	~~470~~	~~9~~	~~0~~	~~250~~	~~71.1~~
295.40	1.00			Shale	49.4	122.5	***519.1***	72.3	13.4	593.4	~~519~~	~~9~~	~~0~~	~~277~~	~~72.1~~
294.40	1.00			Shale	49.4	122.5	***568.6***	72.3	13.4	665.6	~~569~~	~~9~~	~~0~~	~~304~~	~~73.1~~
293.40	1.00			Shale	49.4	122.5	***618.0***	72.3	13.4	737.9	~~618~~	~~9~~	~~0~~	~~331~~	~~74.1~~
292.40	1.00			Shale	49.4	122.5	***667.4***	72.3	13.4	810.1	~~667~~	~~9~~	~~0~~	~~358~~	~~75.1~~
291.40	1.00			Shale	49.4	122.5	***716.8***	72.3	13.4	882.4	~~717~~	~~9~~	~~0~~	~~386~~	~~76.1~~
290.40	1.00			Shale	49.4	122.5	***766.2***	72.3	13.4	954.6	~~766~~	~~9~~	~~0~~	~~413~~	~~77.1~~
289.40	1.00			Shale	49.4	122.5	***815.6***	72.3	13.4	1026.9	~~816~~	~~9~~	~~0~~	~~440~~	~~78.1~~
288.40	1.00			Shale		122.5			13.4						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #10
REFERENCE BORING ========== SB-16
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 348.55 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 10078 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 899.22 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 337.21 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**385** KIPS	**203** KIPS	**68** 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.)
364.40	1.10		6	Medium Sand	0.5		11.9	0.7		***2.0***	2	0	0	1	3
361.90	2.50		13	Medium Sand	2.3	11.5	25.2	3.4	1.3	***6.6***	7	2	0	2	6
359.40	2.50		15	Medium Sand	2.7	22.4	39.2	4.0	2.5	***11.8***	12	3	0	3	8
356.90	2.50		16	Medium Sand	2.9	33.7	37.8	4.2	3.7	***15.5***	16	5	0	4	11
354.40	2.50		12	Medium Sand	2.2	29.4	52.2	3.2	3.2	***20.0***	20	6	0	5	13
351.90	2.50		17	Medium Sand	3.1	41.6	55.3	4.5	4.6	***24.5***	25	8	0	6	16
350.90	1.00		17	Medium Sand	1.2	41.6	39.4	1.8	4.6	***24.5***	24	8	0	5	17
349.40	1.50		10	Sandy Gravel	1.4	24.5	53.0	2.0	2.7	***27.8***	28	9	0	6	18
346.90	2.50		15	Sandy Gravel	3.5	36.7	56.5	5.1	4.0	***32.9***	33	9	0	9	21
345.90	1.00		15	Sandy Gravel	1.4	36.7	72.6	2.0	4.0	***36.6***	37	9	0	11	22
344.40	1.50		21	Medium Sand	2.3	51.4	47.9	3.3	5.6	***36.9***	37	9	0	11	23
339.40	5.00		10	Medium Sand	3.6	24.5	68.7	5.3	2.7	***44.1***	44	9	0	15	28
334.40	5.00		17	Medium Sand	6.1	41.6	99.3	9.0	4.6	***55.8***	56	9	0	22	33
329.40	5.00		27	Medium Sand	9.9	66.1	79.8	14.4	7.2	***67.0***	67	9	0	28	38
324.40	5.00		15	Medium Sand	5.4	36.7	87.7	7.9	4.0	***75.2***	75	9	0	32	43
319.40	5.00		16	Medium Sand	5.8	39.2	93.4	8.5	4.3	***83.6***	84	9	0	37	48
317.40	2.00		16	Medium Sand	2.3	39.2	130.1	3.4	4.3	***90.7***	91	9	0	41	50
314.40	3.00		30	Fine Sand	6.2	73.5	136.2	9.0	8.0	***99.7***	100	9	0	46	53
310.90	3.50		30	Fine Sand	7.2	73.5	***99.3***	10.5	8.0	105.4	99	9	0	46	57
309.40	1.50		12	Sandy Gravel	1.7	29.4	115.7	2.4	3.2	***109.5***	109	9	0	51	58
304.40	5.00		18	Sandy Gravel	8.3	44.1	124.0	12.2	4.8	***121.7***	122	9	0	58	63
302.00	2.40		18	Sandy Gravel	4.0	44.1	283.0	5.9	4.8	***144.5***	144	9	0	71	66
301.00	1.00			Sandstone	82.4	199.1	365.3	120.4	21.8	***264.9***	265	9	0	137	66.5
300.00	1.00			Sandstone	82.4	199.1	447.7	120.4	21.8	***385.3***	385	9	0	203	67.5
299.00	1.00			Sandstone	82.4	199.1	530.0	120.4	21.8	***505.7***	~~506~~	~~9~~	~~0~~	~~269~~	~~68.5~~
298.00	1.00			Sandstone	82.4	199.1	***612.4***	120.4	21.8	626.2	~~612~~	~~9~~	~~0~~	~~328~~	~~69.5~~
297.00	1.00			Sandstone	82.4	199.1	***694.7***	120.4	21.8	746.6	~~695~~	~~9~~	~~0~~	~~373~~	~~70.5~~
296.00	1.00			Sandstone	82.4	199.1	***777.1***	120.4	21.8	867.0	~~777~~	~~9~~	~~0~~	~~418~~	~~71.5~~
295.00	1.00			Sandstone	82.4	199.1	***859.5***	120.4	21.8	987.4	~~859~~	~~9~~	~~0~~	~~464~~	~~72.5~~
294.00	1.00			Sandstone	82.4	199.1	***941.8***	120.4	21.8	1107.8	~~942~~	~~9~~	~~0~~	~~509~~	~~73.5~~
293.00	1.00			Sandstone	82.4	199.1	***1024.2***	120.4	21.8	1228.3	~~1024~~	~~9~~	~~0~~	~~554~~	~~74.5~~
292.00	1.00			Sandstone	82.4	199.1	***1106.5***	120.4	21.8	1348.7	~~1107~~	~~9~~	~~0~~	~~600~~	~~75.5~~
291.00	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #11
REFERENCE BORING ========== SB-18
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 350.11 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 10302 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 919.21 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 344.70 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**388** KIPS	**207** KIPS	**67** 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.)
362.20	3.30		6	Fine Sand	1.3		11.7	2.0		***3.1***	3	1	0	1	5
360.20	2.00		8	Medium Sand	1.2	10.4	27.3	1.7	1.1	***6.4***	6	1	0	2	7
357.70	2.50		13	Medium Sand	2.3	24.8	31.8	3.4	2.7	***10.0***	10	3	0	3	10
355.20	2.50		11	Medium Sand	2.0	26.9	36.2	2.9	2.9	***13.2***	13	4	0	4	12
352.70	2.50		12	Medium Sand	2.2	29.4	45.8	3.2	3.2	***17.2***	17	5	0	5	15
350.20	2.50		15	Medium Sand	2.7	36.7	50.9	4.0	4.0	***21.4***	21	6	0	5	17
347.70	2.50		16	Medium Sand	2.9	39.2	53.8	4.2	4.3	***25.6***	26	6	0	8	20
346.70	1.00		16	Medium Sand	1.2	39.2	72.1	1.7	4.3	***29.2***	29	6	0	10	21
345.20	1.50		23	Medium Sand	2.5	56.3	57.5	3.6	6.2	***31.0***	31	6	0	11	22
340.20	5.00		16	Medium Sand	5.8	39.2	63.2	8.5	4.3	***39.4***	39	6	0	15	27
338.20	2.00		16	Medium Sand	2.3	39.2	82.7	3.4	4.3	***44.7***	45	6	0	18	29
335.20	3.00		23	Medium Sand	5.0	56.3	65.6	7.3	6.2	***49.6***	50	6	0	21	32
330.20	5.00		14	Medium Sand	5.1	34.3	90.3	7.4	3.8	***59.1***	59	6	0	26	37
325.20	5.00		22	Medium Sand	7.9	53.9	93.3	11.6	5.9	***70.2***	70	6	0	32	42
320.20	5.00		20	Medium Sand	7.2	49.0	112.8	10.6	5.4	***82.1***	82	6	0	39	47
315.20	5.00		25	Medium Sand	9.0	61.2	104.7	13.2	6.7	***93.4***	93	6	0	45	52
309.20	6.00		18	Medium Sand	7.8	44.1	267.5	11.4	4.8	***121.8***	122	6	0	61	58
309.10	0.10			Sandstone	8.2	199.1	125.6	12.0	21.8	***117.4***	117	6	0	58	58.4
307.20	1.90		20	Fine Sand	2.6	49.0	128.2	3.8	5.4	***121.2***	121	6	0	60	60
302.20	5.00		20	Fine Sand	6.8	49.0	285.1	9.9	5.4	***147.6***	148	6	0	75	65
301.20	1.00			Sandstone	82.4	199.1	367.4	120.4	21.8	***268.0***	268	6	0	141	66.3
300.20	1.00			Sandstone	82.4	199.1	449.8	120.4	21.8	***388.4***	388	6	0	207	67.3
299.20	1.00			Sandstone	82.4	199.1	532.1	120.4	21.8	***508.8***	~~509~~	~~6~~	~~0~~	~~273~~	~~68.3~~
298.20	1.00			Sandstone	82.4	199.1	***614.5***	120.4	21.8	629.2	~~614~~	~~6~~	~~0~~	~~332~~	~~69.3~~
297.20	1.00			Sandstone	82.4	199.1	***696.9***	120.4	21.8	749.7	~~697~~	~~6~~	~~0~~	~~377~~	~~70.3~~
296.20	1.00			Sandstone	82.4	199.1	***779.2***	120.4	21.8	870.1	~~779~~	~~6~~	~~0~~	~~422~~	~~71.3~~
295.20	1.00			Sandstone	82.4	199.1	***861.6***	120.4	21.8	990.5	~~862~~	~~6~~	~~0~~	~~467~~	~~72.3~~
294.20	1.00			Sandstone	82.4	199.1	***943.9***	120.4	21.8	1110.9	~~944~~	~~6~~	~~0~~	~~513~~	~~73.3~~
293.20	1.00			Sandstone	82.4	199.1	***1026.3***	120.4	21.8	1231.3	~~1026~~	~~6~~	~~0~~	~~558~~	~~74.3~~
292.20	1.00			Sandstone	82.4	199.1	***1108.6***	120.4	21.8	1351.8	~~1109~~	~~6~~	~~0~~	~~603~~	~~75.3~~
291.20	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #12
REFERENCE BORING ========== SB-19
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 352.54 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 8639 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 770.82 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 289.06 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**323** KIPS	**173** KIPS	**70** 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.)
364.83	0.67	0.30	6		0.6		3.1	0.9		***1.2***	1	0	0	0	3
363.50	1.33		5	Medium Sand	0.5	2.4	5.5	0.7	0.3	***2.1***	2	1	0	1	4
361.00	2.50		4	Medium Sand	0.7	4.4	19.5	1.1	0.5	***4.6***	5	1	0	2	7
357.50	3.50		9	Medium Sand	2.3	17.6	25.1	3.3	1.9	***8.3***	8	2	0	2	10
356.00	1.50		9	Medium Sand	1.0	20.9	44.3	1.4	2.3	***11.7***	12	3	0	4	12
353.50	2.50		16	Medium Sand	2.9	39.2	47.2	4.2	4.3	***16.0***	16	4	0	4	14
350.00	3.50		16	Medium Sand	4.0	39.2	61.0	5.9	4.3	***23.0***	23	4	0	8	18
348.50	1.50		20	Sandy Gravel	2.8	49.0	58.9	4.1	5.4	***26.5***	27	4	0	10	19
346.00	2.50		18	Sandy Gravel	4.2	44.1	63.1	6.1	4.8	***32.6***	33	4	0	14	22
341.00	5.00		18	Sandy Gravel	8.3	44.1	71.4	12.2	4.8	***44.8***	45	4	0	20	27
337.50	3.50		18	Sandy Gravel	5.8	44.1	84.6	8.5	4.8	***54.1***	54	4	0	25	30
336.00	1.50		21	Medium Sand	2.3	51.4	69.7	3.3	5.6	***55.6***	56	4	0	26	32
331.00	5.00		14	Medium Sand	5.1	34.3	72.4	7.4	3.8	***62.7***	63	4	0	30	37
326.00	5.00		13	Medium Sand	4.7	31.8	77.1	6.9	3.5	***69.6***	70	4	0	34	42
321.00	5.00		13	Medium Sand	4.7	31.8	128.3	6.9	3.5	***81.5***	82	4	0	40	47
316.00	5.00		32	Medium Sand	12.5	78.4	128.5	18.2	8.6	***98.4***	98	4	0	50	52
311.00	5.00		27	Medium Sand	9.9	66.1	126.1	14.4	7.2	***111.5***	112	4	0	57	57
306.00	5.00		22	Medium Sand	7.9	53.9	188.0	11.6	5.9	***129.0***	129	4	0	67	62
300.50	5.50		44	Sandy Gravel	38.7	107.8	192.4	56.6	11.8	***181.9***	182	4	0	96	67
299.00	1.50		30	Sandy Gravel	4.8	73.5	322.7	7.0	8.0	***202.6***	203	4	0	107	69
298.00	1.00			Sandstone	82.4	199.1	405.1	120.4	21.8	***323.0***	323	4	0	173	69.5
297.00	1.00			Sandstone	82.4	199.1	487.4	120.4	21.8	***443.5***	~~443~~	*~~4~~*	*~~0~~*	*~~240~~*	*~~70.5~~*
296.00	1.00			Sandstone	82.4	199.1	569.8	120.4	21.8	***563.9***	~~564~~	*~~4~~*	*~~0~~*	*~~306~~*	*~~71.5~~*
295.00	1.00			Sandstone	82.4	199.1	***652.2***	120.4	21.8	684.3	~~652~~	*~~4~~*	*~~0~~*	*~~354~~*	*~~72.5~~*
294.00	1.00			Sandstone	82.4	199.1	***734.5***	120.4	21.8	804.7	~~735~~	*~~4~~*	*~~0~~*	*~~400~~*	*~~73.5~~*
293.00	1.00			Sandstone	82.4	199.1	***816.9***	120.4	21.8	925.1	~~817~~	*~~4~~*	*~~0~~*	*~~445~~*	*~~74.5~~*
292.00	1.00			Sandstone	82.4	199.1	***899.2***	120.4	21.8	1045.6	~~899~~	*~~4~~*	*~~0~~*	*~~490~~*	*~~75.5~~*
291.00	1.00			Sandstone	82.4	199.1	***981.6***	120.4	21.8	1166.0	~~982~~	*~~4~~*	*~~0~~*	*~~535~~*	*~~76.5~~*
290.00	1.00			Sandstone	82.4	199.1	***1063.9***	120.4	21.8	1286.4	~~1064~~	*~~4~~*	*~~0~~*	*~~581~~*	*~~77.5~~*
289.00	1.00			Sandstone	82.4	199.1	***1146.3***	120.4	21.8	1406.8	~~1146~~	*~~4~~*	*~~0~~*	*~~626~~*	*~~78.5~~*
288.00	1.00			Sandstone	82.4	199.1	***1228.6***	120.4	21.8	1527.2	~~1229~~	*~~4~~*	*~~0~~*	*~~671~~*	*~~79.5~~*
287.00	1.00			Sandstone	82.4	199.1	***1311.0***	120.4	21.8	1647.7	~~1311~~	*~~4~~*	*~~0~~*	*~~717~~*	*~~80.5~~*
286.00	1.00			Sandstone	82.4	199.1	***1393.4***	120.4	21.8	1768.1	~~1393~~	*~~4~~*	*~~0~~*	*~~762~~*	*~~81.5~~*
285.00	1.00			Sandstone	82.4	199.1	***1475.7***	120.4	21.8	1888.5	~~1476~~	*~~4~~*	*~~0~~*	*~~807~~*	*~~82.5~~*
284.00	1.00			Sandstone	82.4	199.1	***1558.1***	120.4	21.8	2008.9	~~1558~~	*~~4~~*	*~~0~~*	*~~853~~*	*~~83.5~~*
283.00	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #13
REFERENCE BORING ========== SB-20
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 350.66 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 9896 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 882.98 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 331.12 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
418 KIPS	**414** KIPS	**223** KIPS	**68** FT.

*Scour needs added from updated TS&L

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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.)
362.90	2.60		9	Fine Sand	1.6		14.1	2.3		***3.7***	4	1	0	1	5
360.40	2.50		10	Fine Sand	1.7	12.5	25.6	2.5	1.4	***7.3***	7	2	0	2	7
357.90	2.50		12	Medium Sand	2.2	22.3	30.7	3.2	2.4	***10.7***	11	3	0	3	10
356.90	1.00		12	Medium Sand	0.9	25.3	38.2	1.3	2.8	***12.7***	13	3	0	4	11
355.40	1.50		13	Medium Sand	1.4	31.8	29.8	2.1	3.5	***13.7***	14	4	0	3	12
352.90	2.50		9	Medium Sand	1.6	22.0	43.7	2.4	2.4	***17.4***	17	5	0	4	15
349.90	3.00		14	Medium Sand	3.0	34.3	66.3	4.4	3.8	***24.0***	24	5	0	8	18
347.90	2.00		22	Medium Sand	3.2	53.9	76.8	4.6	5.9	***29.5***	29	5	0	11	20
345.40	2.50		25	Fine Sand	4.2	61.2	81.1	6.2	6.7	***35.7***	36	5	0	14	22
343.40	2.00		25	Fine Sand	3.4	61.2	86.9	5.0	6.7	***40.9***	41	5	0	17	24
340.40	3.00		26	Medium Sand	5.6	63.7	80.3	8.3	7.0	***47.8***	48	5	0	21	27
335.40	5.00		21	Medium Sand	7.6	51.4	112.4	11.1	5.6	***61.6***	62	5	0	29	32
330.40	5.00		31	Medium Sand	11.9	75.9	109.6	17.4	8.3	***77.4***	77	5	0	37	37
325.40	5.00		25	Medium Sand	9.0	61.2	118.6	13.2	6.7	***90.6***	91	5	0	45	42
321.90	3.50		25	Medium Sand	6.3	61.2	107.8	9.2	6.7	***98.0***	98	5	0	49	46
320.40	1.50		18	Medium Sand	2.0	44.1	100.0	2.9	4.8	***99.8***	100	5	0	50	47
315.40	5.00		14	Medium Sand	5.1	34.3	109.9	7.4	3.8	***107.7***	108	5	0	54	52
310.40	5.00		16	Medium Sand	5.8	39.2	181.8	8.5	4.3	***123.4***	123	5	0	63	57
305.40	5.00		43	Medium Sand	20.4	105.3	163.0	29.8	11.5	***148.9***	149	5	0	77	62
301.90	3.50		27	Medium Sand	6.9	66.1	302.8	10.1	7.2	***173.5***	174	5	0	90	66
300.90	1.00			Sandstone	82.4	199.1	385.2	120.4	21.8	***294.0***	294	5	0	157	66.6
299.90	1.00			Sandstone	82.4	199.1	467.6	120.4	21.8	***414.4***	414	5	0	223	67.6
298.90	1.00			Sandstone	82.4	199.1	549.9	120.4	21.8	***534.8***	~~535~~	~~5~~	~~0~~	~~289~~	~~68.6~~
297.90	1.00			Sandstone	82.4	199.1	***632.3***	120.4	21.8	655.2	~~632~~	~~5~~	~~0~~	~~343~~	~~69.6~~
296.90	1.00			Sandstone	82.4	199.1	***714.6***	120.4	21.8	775.6	~~715~~	~~5~~	~~0~~	~~388~~	~~70.6~~
295.90	1.00			Sandstone	82.4	199.1	***797.0***	120.4	21.8	896.1	~~797~~	~~5~~	~~0~~	~~433~~	~~71.6~~
294.90	1.00			Sandstone	82.4	199.1	***879.3***	120.4	21.8	1016.5	~~879~~	~~5~~	~~0~~	~~478~~	~~72.6~~
293.90	1.00			Sandstone	82.4	199.1	***961.7***	120.4	21.8	1136.9	~~962~~	~~5~~	~~0~~	~~524~~	~~73.6~~
292.90	1.00			Sandstone	82.4	199.1	***1044.1***	120.4	21.8	1257.3	~~1044~~	~~5~~	~~0~~	~~569~~	~~74.6~~
291.90	1.00			Sandstone	82.4	199.1	***1126.4***	120.4	21.8	1377.7	~~1126~~	~~5~~	~~0~~	~~614~~	~~75.6~~
290.90	1.00			Sandstone	82.4	199.1	***1208.8***	120.4	21.8	1498.2	~~1209~~	~~5~~	~~0~~	~~660~~	~~76.6~~
289.90	1.00			Sandstone	82.4	199.1	***1291.1***	120.4	21.8	1618.6	~~1291~~	~~5~~	~~0~~	~~705~~	~~77.6~~
288.90	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier # 14
REFERENCE BORING ========== SB-21
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 351.95 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 9659 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 861.83 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 323.19 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
418 KIPS	**399** KIPS	**215** KIPS	**66** FT.

*Scour needed to be added from updated TS&L

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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.)
365.07	0.43		5	Very Fine Silty Sand	0.1		6.7	0.2		***0.9***	1	0	0	0	2
363.07	2.00		11	Medium Sand	1.6	6.5	13.7	2.3	0.7	***3.8***	4	1	0	1	4
361.07	2.00		11	Medium Sand	1.6	11.9	16.9	2.3	1.3	***6.3***	6	2	0	2	6
358.57	2.50		8	Medium Sand	1.4	13.6	23.2	2.1	1.5	***9.0***	9	3	0	2	9
356.07	2.50		8	Medium Sand	1.4	18.5	20.9	2.1	2.0	***10.7***	11	3	0	2	11
353.07	3.00		6	Medium Sand	1.3	14.7	68.8	1.9	1.6	***17.7***	18	4	0	6	14
351.07	2.00		25	Medium Sand	3.6	61.2	74.8	5.3	6.7	***23.2***	23	4	0	9	16
348.07	3.00		26	Medium Sand	5.6	63.7	100.1	8.3	7.0	***33.6***	34	4	0	14	19
346.07	2.00		34	Medium Sand	5.5	83.3	81.0	8.0	9.1	***39.0***	39	4	0	17	21
341.07	5.00		24	Medium Sand	8.7	58.8	72.6	12.7	6.4	***49.8***	50	4	0	23	26
336.07	5.00		17	Medium Sand	6.1	41.6	78.7	9.0	4.6	***58.7***	59	4	0	28	31
334.07	2.00		17	Medium Sand	2.5	41.6	88.5	3.6	4.6	***63.1***	63	4	0	31	33
329.07	5.00		20	Fine Sand	6.8	49.0	117.4	9.9	5.4	***75.5***	75	4	0	37	38
326.07	3.00		29	Medium Sand	6.5	71.0	106.7	9.5	7.8	***83.1***	83	4	0	42	41
321.07	5.00		22	Medium Sand	7.9	53.9	104.9	11.6	5.9	***93.7***	94	4	0	47	46
316.07	5.00		18	Medium Sand	6.5	44.1	126.1	9.5	4.8	***104.8***	105	4	0	53	51
311.07	5.00		24	Medium Sand	8.7	58.8	129.8	12.7	6.4	***116.9***	117	4	0	60	56
306.07	5.00		22	Sandy Gravel	10.2	53.9	154.7	14.9	5.9	***133.4***	133	4	0	69	61
303.57	2.50		28	Sandy Gravel	7.1	68.6	292.3	10.4	7.5	***158.1***	158	4	0	83	64
302.57	1.00			Sandstone	82.4	199.1	374.6	120.4	21.8	***278.5***	278	4	0	149	64.9
301.57	1.00			Sandstone	82.4	199.1	457.0	120.4	21.8	***398.9***	399	4	0	215	65.9
300.57	1.00			Sandstone	82.4	199.1	539.3	120.4	21.8	***519.3***	~~519~~	~~4~~	~~0~~	~~282~~	~~66.9~~
299.57	1.00			Sandstone	82.4	199.1	***621.7***	120.4	21.8	639.7	~~622~~	~~4~~	~~0~~	~~338~~	~~67.9~~
298.57	1.00			Sandstone	82.4	199.1	***704.0***	120.4	21.8	760.2	~~704~~	~~4~~	~~0~~	~~383~~	~~68.9~~
297.57	1.00			Sandstone	82.4	199.1	***786.4***	120.4	21.8	880.6	~~786~~	~~4~~	~~0~~	~~428~~	~~69.9~~
296.57	1.00			Sandstone	82.4	199.1	***868.8***	120.4	21.8	1001.0	~~869~~	~~4~~	~~0~~	~~474~~	~~70.9~~
295.57	1.00			Sandstone	82.4	199.1	***951.1***	120.4	21.8	1121.4	~~951~~	~~4~~	~~0~~	~~519~~	~~71.9~~
294.57	1.00			Sandstone	82.4	199.1	***1033.5***	120.4	21.8	1241.8	~~1033~~	~~4~~	~~0~~	~~564~~	~~72.9~~
293.57	1.00			Sandstone	82.4	199.1	***1115.8***	120.4	21.8	1362.3	~~1116~~	~~4~~	~~0~~	~~610~~	~~73.9~~
292.57	1.00			Sandstone	82.4	199.1	***1198.2***	120.4	21.8	1482.7	~~1198~~	~~4~~	~~0~~	~~655~~	~~74.9~~
291.57	1.00			Sandstone	82.4	199.1	***1280.5***	120.4	21.8	1603.1	~~1281~~	~~4~~	~~0~~	~~700~~	~~75.9~~
290.57	1.00			Sandstone	82.4	199.1	***1362.9***	120.4	21.8	1723.5	~~1363~~	~~4~~	~~0~~	~~745~~	~~76.9~~
289.57	1.00			Sandstone	82.4	199.1	***1445.2***	120.4	21.8	1843.9	~~1445~~	~~4~~	~~0~~	~~791~~	~~77.9~~
288.57	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #15
REFERENCE BORING ========== SB-23
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 349.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 9593 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 855.94 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 320.98 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
418 KIPS	**344** KIPS	**177** KIPS	**71** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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.)
363.37	2.13	0.25	1		1.7		22.0	2.5		***4.7***	5	1	0	2	4
360.62	2.75		17	Medium Sand	3.4	20.3	41.0	4.9	2.2	***11.4***	11	3	0	3	7
359.12	1.50		23	Medium Sand	2.5	35.9	44.6	3.6	3.9	***15.1***	15	4	0	4	8
356.62	2.50		17	Medium Sand	3.1	37.0	64.6	4.5	4.0	***21.5***	21	6	0	6	11
354.12	2.50		22	Medium Sand	4.0	53.9	68.5	5.8	5.9	***27.3***	27	8	0	7	13
351.62	2.50		22	Medium Sand	4.0	53.9	67.6	5.8	5.9	***32.6***	33	10	0	8	16
349.12	2.50		20	Medium Sand	3.6	49.0	73.7	5.3	5.4	***38.1***	38	12	0	9	18
346.62	2.50		21	Medium Sand	3.8	51.4	77.5	5.5	5.6	***43.7***	44	12	0	12	21
343.12	3.50		21	Medium Sand	5.3	51.4	95.0	7.8	5.6	***52.8***	53	12	0	17	24
341.62	1.50		26	Medium Sand	2.8	63.7	134.6	4.1	7.0	***60.9***	61	12	0	21	26
336.62	5.00		41	Fine Sand	16.3	100.4	150.9	23.8	11.0	***84.8***	85	12	0	34	31
334.62	2.00		41	Fine Sand	6.5	100.4	91.3	9.5	11.0	***87.1***	87	12	0	36	33
331.62	3.00		14	Medium Sand	3.0	34.3	162.9	4.4	3.8	***99.0***	99	12	0	42	36
326.62	5.00		42	Medium Sand	19.5	102.9	153.1	28.6	11.3	***124.4***	124	12	0	56	41
321.62	5.00		30	Medium Sand	11.3	73.5	139.9	16.6	8.0	***138.3***	138	12	0	64	46
316.62	5.00		20	Medium Sand	7.2	49.0	149.6	10.6	5.4	***149.1***	149	12	0	70	51
311.62	5.00		21	Medium Sand	7.6	51.4	***157.2***	11.1	5.6	160.2	157	12	0	74	56
309.62	2.00		21	Medium Sand	3.0	51.4	***157.8***	4.4	5.6	164.4	158	12	0	75	58
306.62	3.00		20	Sandy Gravel	5.6	49.0	***151.1***	8.2	5.4	171.2	151	12	0	71	61
301.62	5.00		15	Sandy Gravel	6.9	36.7	366.3	10.2	4.0	***204.2***	204	12	0	100	66
296.62	5.00		100	Sandy Gravel	139.0	245.0	***343.6***	203.2	26.8	389.7	344	12	0	177	71
292.62	4.00		34	Sandy Gravel	16.0	83.3	475.3	23.4	9.1	***425.8***	~~426~~	~~12~~	~~0~~	~~222~~	~~75~~
291.62	1.00			Sandstone	82.4	199.1	557.7	120.4	21.8	***546.2***	~~546~~	~~12~~	~~0~~	~~288~~	~~75.9~~
290.62	1.00			Sandstone	82.4	199.1	***640.1***	120.4	21.8	666.6	~~640~~	~~12~~	~~0~~	~~340~~	~~76.9~~
289.62	1.00			Sandstone	82.4	199.1	***722.4***	120.4	21.8	787.0	~~722~~	~~12~~	~~0~~	~~385~~	~~77.9~~
288.62	1.00			Sandstone	82.4	199.1	***804.8***	120.4	21.8	907.4	~~805~~	~~12~~	~~0~~	~~430~~	~~78.9~~
287.62	1.00			Sandstone	82.4	199.1	***887.1***	120.4	21.8	1027.9	~~887~~	~~12~~	~~0~~	~~476~~	~~79.9~~
286.62	1.00			Sandstone	82.4	199.1	***969.5***	120.4	21.8	1148.3	~~969~~	~~12~~	~~0~~	~~521~~	~~80.9~~
285.62	1.00			Sandstone	82.4	199.1	***1051.8***	120.4	21.8	1268.7	~~1052~~	~~12~~	~~0~~	~~566~~	~~81.9~~
284.62	1.00			Sandstone	82.4	199.1	***1134.2***	120.4	21.8	1389.1	~~1134~~	~~12~~	~~0~~	~~612~~	~~82.9~~
283.62	1.00			Sandstone	82.4	199.1	***1216.6***	120.4	21.8	1509.5	~~1217~~	~~12~~	~~0~~	~~657~~	~~83.9~~
282.62	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier #16
REFERENCE BORING ========== SB-24
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 367.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 365.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 343.37 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

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
418 KIPS	**329** KIPS	**173** KIPS	**70** FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 9744 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 869.42 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 326.03 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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.)
363.50	2.00		4	Fine Sand	0.5		12.5	0.8		***2.1***	2	0	0	1	4
362.00	1.50		14	Medium Sand	1.5	12.0	24.1	2.2	1.3	***5.4***	5	1	0	2	6
359.50	2.50		15	Medium Sand	2.7	22.0	23.5	4.0	2.4	***9.0***	9	3	0	2	8
357.00	2.50		9	Medium Sand	1.6	18.7	40.7	2.4	2.1	***13.1***	13	4	0	4	11
354.50	2.50		14	Medium Sand	2.5	34.3	33.4	3.7	3.8	***15.7***	16	5	0	4	13
352.00	2.50		10	Medium Sand	1.8	24.5	18.1	2.6	2.7	***16.5***	16	6	0	3	16
349.50	2.50		3	Medium Sand	0.5	7.3	18.6	0.8	0.8	***17.3***	17	6	0	3	18
348.50	1.00		3	Medium Sand	0.2	7.3	70.3	0.3	0.8	***23.2***	23	6	0	6	19
347.00	1.50		24	Sandy Gravel	3.4	58.8	81.0	5.0	6.4	***29.0***	29	8	0	8	21
342.00	5.00		27	Sandy Gravel	13.4	66.1	60.1	19.5	7.2	***44.8***	45	8	0	16	26
337.00	5.00		13	Sandy Gravel	6.0	31.8	66.1	8.8	3.5	***53.6***	54	8	0	21	31
333.00	4.00		13	Medium Sand	3.8	31.8	140.9	5.5	3.5	***66.9***	67	8	0	29	35
332.00	1.00		42	Fine Sand	3.4	102.9	110.0	5.0	11.3	***68.1***	68	8	0	29	36
327.35	4.65		28	Fine Sand	8.8	68.6	96.8	12.9	7.5	***78.6***	79	8	0	35	40
322.00	5.35		19	Medium Sand	7.3	46.5	109.1	10.7	5.1	***89.9***	90	8	0	41	46
317.00	5.00		21	Medium Sand	7.6	51.4	116.7	11.1	5.6	***101.0***	101	8	0	47	51
313.50	3.50		21	Medium Sand	5.3	51.4	173.4	7.8	5.6	***114.4***	114	8	0	55	54
312.00	1.50		42	Sandy Gravel	9.5	102.9	151.0	13.8	11.3	***124.7***	125	8	0	60	56
307.00	5.00		29	Sandy Gravel	15.0	71.0	178.3	21.9	7.8	***148.0***	148	8	0	73	61
302.00	5.00		34	Sandy Gravel	20.0	83.3	198.3	29.3	9.1	***177.3***	177	8	0	89	66
299.50	2.50		34	Sandy Gravel	10.0	83.3	220.6	14.6	9.1	***193.2***	193	8	0	98	68
298.50	1.00		52	Hard Till	2.7	95.5	326.8	3.9	10.5	***208.5***	208	8	0	106	69
297.50	1.00			Sandstone	82.4	199.1	409.1	120.4	21.8	***328.9***	329	8	0	173	70
296.50	1.00			Sandstone	82.4	199.1	491.5	120.4	21.8	***449.3***	~~449~~	~~8~~	~~0~~	~~239~~	~~71~~
295.50	1.00			Sandstone	82.4	199.1	573.8	120.4	21.8	***569.8***	~~570~~	~~8~~	~~0~~	~~305~~	~~72~~
294.50	1.00			Sandstone	82.4	199.1	***656.2***	120.4	21.8	690.2	~~656~~	~~8~~	~~0~~	~~353~~	~~73~~
293.50	1.00			Sandstone	82.4	199.1	***738.5***	120.4	21.8	810.6	~~739~~	~~8~~	~~0~~	~~398~~	~~74~~
292.50	1.00			Sandstone	82.4	199.1	***820.9***	120.4	21.8	931.0	~~821~~	~~8~~	~~0~~	~~443~~	~~75~~
291.50	1.00			Sandstone	82.4	199.1	***903.2***	120.4	21.8	1051.4	~~903~~	~~8~~	~~0~~	~~489~~	~~76~~
290.50	1.00			Sandstone	82.4	199.1	***985.6***	120.4	21.8	1171.9	~~986~~	~~8~~	~~0~~	~~534~~	~~77~~
289.50	1.00			Sandstone		199.1			21.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== SB-27
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 392.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 390.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 390.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 3505 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 44.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 312.74 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 117.28 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 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
418 KIPS	**403** KIPS	**222** KIPS	**90** 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.)
387.45	2.55		22	Fine Sand	3.8		25.6	5.6		***8.0***	8	0	0	4	5
385.95	1.50		22	Fine Sand	2.2	21.8	41.4	3.3	2.4	***12.7***	13	0	0	7	6
383.45	2.50		22	Fine Sand	3.7	35.3	50.5	5.5	3.9	***18.8***	19	0	0	10	9
382.45	1.00		22	Fine Sand	1.5	40.7	40.2	2.2	4.5	***19.7***	20	0	0	11	10
380.95	1.50	2.10	9		7.1	28.9	55.6	10.4	3.2	***31.0***	31	0	0	17	11
378.45	2.50	2.70	11		14.1	37.2	65.6	20.6	4.1	***51.2***	51	0	0	28	14
375.95	2.50	2.40	11		13.0	33.1	78.6	19.0	3.6	***70.2***	70	0	0	39	16
374.70	1.25	2.40	11		6.5	33.1	***69.2***	9.5	3.6	77.9	69	0	0	38	17
373.45	1.25		7	Fine Sand	0.6	17.1	***67.3***	0.9	1.9	78.5	67	0	0	37	19
370.95	2.50		6	Fine Sand	1.0	14.7	***68.3***	1.5	1.6	80.0	68	0	0	38	21
368.95	2.00		6	Fine Sand	0.8	14.7	83.8	1.2	1.6	***82.8***	83	0	0	46	23
365.95	3.00		12	Fine Sand	2.4	29.4	***86.3***	3.6	3.2	86.4	86	0	0	47	26
363.95	2.00		12	Fine Sand	1.6	29.4	100.2	2.4	3.2	***90.1***	90	0	0	50	28
360.95	3.00		17	Medium Sand	3.7	41.6	118.5	5.4	4.6	***97.1***	97	0	0	53	31
355.95	5.00		23	Medium Sand	8.3	56.3	126.9	12.2	6.2	***109.3***	109	0	0	60	36
350.95	5.00		23	Medium Sand	8.3	56.3	140.1	12.2	6.2	***121.9***	122	0	0	67	41
345.95	5.00		25	Medium Sand	9.0	61.2	168.7	13.2	6.7	***137.3***	137	0	0	76	46
340.95	5.00		33	Medium Sand	13.1	80.8	157.3	19.1	8.8	***153.7***	154	0	0	85	51
335.95	5.00		23	Medium Sand	8.3	56.3	***165.6***	12.2	6.2	165.9	166	0	0	91	56
330.95	5.00		23	Medium Sand	8.3	56.3	***173.9***	12.2	6.2	178.0	174	0	0	96	61
325.95	5.00		23	Medium Sand	8.3	56.3	***187.1***	12.2	6.2	190.7	187	0	0	103	66
320.95	5.00		25	Medium Sand	9.0	61.2	252.5	13.2	6.7	***210.1***	210	0	0	116	71
315.95	5.00		48	Medium Sand	25.0	117.6	277.5	36.5	12.9	***246.6***	247	0	0	136	76
312.45	3.50		48	Medium Sand	17.5	117.6	280.3	25.6	12.9	***270.6***	271	0	0	149	80
310.95	1.50		42	Sandy Gravel	9.5	102.9	***250.5***	13.8	11.3	280.1	251	0	0	138	81
306.45	4.50		26	Sandy Gravel	11.4	63.7	369.7	16.6	7.0	***308.5***	309	0	0	170	86
302.45	4.00		70	Sandy Gravel	66.7	171.5	409.4	97.5	18.8	***403.1***	403	0	0	222	90
300.95	1.50		59	Sandy Gravel	18.9	144.5	***428.3***	27.6	15.8	430.8	~~428~~	~~0~~	~~0~~	~~236~~	~~91~~
299.45	1.50		59	Sandy Gravel	18.9	144.5	***412.9***	27.6	15.8	454.6	413	0	0	227	93
290.95	8.50		45	Sandy Gravel	63.0	110.2	***475.9***	92.1	12.1	546.8	~~476~~	~~0~~	~~0~~	~~262~~	~~101~~
288.95	2.00		45	Sandy Gravel	14.8	110.2	***564.3***	21.7	12.1	576.5	~~564~~	~~0~~	~~0~~	~~310~~	~~103~~
285.95	3.00		75	Fine Sand	27.4	183.7	***591.6***	40.0	20.1	616.5	~~592~~	~~0~~	~~0~~	~~325~~	~~106~~
282.45	3.50		75	Fine Sand	31.9	183.7	***535.3***	46.7	20.1	653.5	~~535~~	~~0~~	~~0~~	~~294~~	~~110~~
280.95	1.50		39	Sandy Gravel	7.9	95.5	***543.3***	11.6	10.5	665.1	~~543~~	~~0~~	~~0~~	~~299~~	~~111~~
275.95	5.00		39	Sandy Gravel	26.4	95.5	***569.6***	38.6	10.5	703.7	~~570~~	~~0~~	~~0~~	~~313~~	~~116~~
272.45	3.50		39	Sandy Gravel	18.5	95.5	***624.9***	27.0	10.5	734.7	~~625~~	~~0~~	~~0~~	~~344~~	~~120~~
270.95	1.50		54	Fine Sand	7.8	132.3	***699.4***	11.4	14.5	753.4	~~699~~	~~0~~	~~0~~	~~385~~	~~121~~
269.95	1.00			Sandstone	82.4	199.1	***781.8***	120.4	21.8	873.8	~~782~~	~~0~~	~~0~~	~~430~~	~~122.1~~
268.95	1.00			Sandstone		199.1			21.8						

EXHIBIT H

SOIL PARAMETERS FOR LATERAL PILE LOAD ANALYSIS

Soil Parameters for Lateral Pile Analysis

Boring SB-1 **Grd. Srf. Elev = 408.33**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3	405.30	125	26	100	7	80	900	0.01		
3-5.5	402.80	125	26	1000	8	65	2100	0.005		
5.5-8	400.30	120	26	500	5	65	1100	0.005		
8-11	397.20	120	26	500	8	n/a	1800	0.005		
11-13	395.30	115	12	2000	100+	n/a	10000	0.004		
13-19	389.30	125	12	2000	100+	n/a	10000	0.004		
Notes:										
For the layer from depth 13-19: Unconfined Compression vs Moisture Content Correllation to determine c' (psf)										

Boring SB-02 **Grd. Srf. Elev = 383.52**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-4	379.50	125	26	500	6	85	1500	0.005		
4-7	376.60	125	12	1000	22	n/a	3500	0.005		
Notes:										
For the layer from depth 4-7: Unconfined Compression vs Moisture Content Correllation to determine C (psf)										

Boring SB-03 **Grd. Srf. Elev = 410.48**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
1-2	408.7	125	26	1000	11	60	2800	0.005		
2-3	407.5	120	30	1000	11	25	2800	0.005		
3-6.5	404	120	26	1000	13	60	2400	0.005		
6.5-11.5	399	115	28	1000	24	65	2100	0.005		
11.5-16	394.3	115	30	20	17	25	n/a	n/a		
16-17.5	393	125	26	1000	14	85	2400	0.005		
17.5-23	387.3	125	10	1000	26	85	2200	0.005		
Notes:										
For the layer from depth 17.5-23: Unconfined Compression vs Moisture Content Correllation to determine C (psf)										

Boring SB-04 **Grd. Srf. Elev = 371.34**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-8.5	362.80	125	26	1000	8	85	2200	0.005		
8.5-11.5	359.80	115	30	25	2	25	n/a	n/a		
11.5-17	354.80	125	12	2000	100+	85	4000	0.005		
17-21.5	350.00	125	12	2000	100+	n/a	55000	0.004		
Notes:										
For the layer from depth 11.5-16.5 and 17-21.5: Unconfined Compression vs Moisture Content Correllation to determine C (psf)										

Boring SB-05 **Grd. Srf. Elev = 347.6**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-1	346.6	125	12	2000	n/a	n/a	10000	0.005		
Note: As noted on the boring logs, shale was encountered at the bottom of the river channel. Values are estimated										

Boring SB-06 **Grd. Srf. Elev = 347.73**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-1	346.50	125	12	2000	n/a	n/a	10000	0.005		
Note: As noted on the boring logs, shale was encountered at the bottom of the river channel. Values are estimated										

Boring SB-07 **Grd. Srf. Elev = 344.91**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-27	317.60	110	34	20	11	n/a	n/a	n/a		
Note: Blind Drilling to top of rock. Values estimated										

Boring SB-09 **Grd. Srf. Elev = 343.41**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-26.5	317.10	110	34	20	11	n/a	n/a	n/a		

Boring SB-13 **Grd. Srf. Elev = 371.38**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-4	367.40	120	26	500	9	65	1300	0.005		
4-8.5	362.90	125	19	500	6	85	1100	0.005		
8.5-14	357.40	120	26	30	3	65	300	0.02		
14-23	348.40	110	34	20	6	3	n/a	n/a		
23-52	319.40	110	34	20	17	3	n/a	n/a		
52-57	314.40	110	34	60	23	3	n/a	n/a		
57-63	308.40	110	34	60	31	3	n/a	n/a		
63-63.5	308.00	125	34	125	100+	n/a	n/a	n/a		

Boring SB-15 **Grd. Srf. Elev = 374.90**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-2	373.20	120	26	1000	8	80	2100	0.005		
2-11	363.90	125	26	500	8	85	1775	0.005		
11-15.5	359.40	120	26	30	3	65	300	0.02		
15.5-18.5	356.40	115	30	20	3	25	n/a	n/a		
18.5-73.5	301.40	120	34	60	20	3	n/a	n/a		
73.5-74	301.10	125	12	2000	100+	n/a	10000	0.004		
For the layer from depth 73.5-74: Unconfined Compression vs Moisture Content Correllation to determine C (psf)										

Boring SB-17 **Grd. Srf. Elev = 374.40**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3.5	370.90	120	26	1000	10	65	3200	0.005		
3.5-4.5	369.80	115	30	20	11	25	n/a	n/a		
4.5-72	302.40	110	34	60	18	3	n/a	n/a		
72-73.5	301.10	125	34	125	100+	n/a	n/a	n/a		

Boring SB-19 **Grd. Srf. Elev = 376.00**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3.5	372.40	120	30	1000	11	25	3300	0.005		
3.5-8.5	367.50	125	19	1000	7	85	2350	0.005		
8.5-11	364.80	120	30	30	6	25	300	0.02		
11-18.5	357.50	110	34	20	6	3	n/a	n/a		
18.5-75.5	300.50	110	34	60	20	3	n/a	n/a		
75.5-77	299.00	125	34	90	30	3	n/a	n/a		

Boring SB-21 **Grd. Srf. Elev = 376.07**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3.5	372.60	120	26	500	11	80	1800	0.005		
3.5-6	370.10	115	30	20	5	25	n/a	n/a		
6-8.5	367.60	110	34	20	4	3	n/a	n/a		
8.5-11	365.10	115	30	20	5	25	n/a	n/a		
11-23	353.10	110	34	20	8	3	n/a	n/a		
23-65	311.10	110	34	60	23	3	n/a	n/a		
65-72.5	303.60	125	38	60	25	3	n/a	n/a		

Boring SB-23 **Grd. Srf. Elev = 376.62**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3.5	373.1	120	26	500	10	80	1600	0.005		
3.5-6	370.60	110	34	25	6	3	n/a	n/a		
6-8	368.60	120	30	30	2	25	300	0.02		
8-13	363.40	120	26	30	1	65	250	0.02		
13-67	309.60	110	34	60	24	3	n/a	n/a		
67-84	292.60	125	34	60	23	3	n/a	n/a		

Boring SB-27 **Grd. Srf. Elev = 400.95**

Depth	Elev. @ Bottom of Layer	γ(pcf)	Ø(degrees)	K (pci)	n	% fines < # 200	C (psf)	ε_{50}	RQD (%)	Recovery (%)
0-3.5	397.5	120	26	500	10	65	1800	0.005		
3.5-6	395.00	125	26	500	7	85	1700	0.005		
6-8.5	392.50	115	26	20	15	25	n/a	n/a		
8.5-18.5	382.50	110	34	60	21	3	n/a	n/a		
18.5-26	374.70	125	26	1000	10	85	2400	0.005		
26-80	321.00	110	34	60	20	3	n/a	n/a		
80-130	271.00	110	34	125	50	4	n/a	n/a		

EXHIBIT I

DRILLED SHAFT DESIGN

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/0081
SUBSTRUCTURE & REFERENCE BORING ======= West Abutment SB-03
GROUND SURFACE ELEVATION ========== 410.50 FT
GROUND WATER ELEVATION ========== 347.70 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 387.33 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 3772 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
5.00	382.33	5.00	110.0	Shale	70	Normal	70	Closed	Yes	959	959	528	188	0.017	1.465	110.0	1629	815	0.320	0.81	2018	1028	276	0.018	0.323
6.00	381.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1151	633	226	0.019	1.471	110.0	1647	824	0.327	0.78	2118	1083	322	0.020	0.331
7.00	380.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1343	739	264	0.021	1.475	110.0	3456	1728	0.692	0.80	4321	2204	368	0.022	0.698
8.00	379.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1535	844	302	0.023	1.479	110.0	3456	1728	0.722	0.78	4447	2273	412	0.024	0.707
9.00	378.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1727	950	341	0.024	1.483	110.0	3456	1728	0.694	0.76	4574	2343	456	0.025	0.716
10.00	377.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1919	1055	380	0.026	1.486	110.0	3456	1728	0.713	0.73	4703	2414	499	0.027	0.725
11.00	376.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2111	1161	419	0.027	1.489	110.0	3456	1728	0.708	0.72	4833	2485	541	0.029	0.734
12.00	375.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2303	1267	458	0.029	1.491	110.0	3456	1728	0.715	0.70	4964	2557	584	0.030	0.744
13.00	374.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2495	1372	497	0.030	1.494										
14.00	373.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2687	1478	537	0.031	1.497										
15.00	372.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2878	1583	577	0.033	1.499										
16.00	371.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3070	1689	617	0.034	1.502										
17.00	370.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3262	1794	657	0.036	1.505										
18.00	369.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3454	1900	697	0.037	1.508										
19.00	368.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3646	2005	737	0.038	1.511										
20.00	367.33	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3838	2111	778	0.040	1.514										

Drilled Shaft Design Table for West Abutment SB-03

Estimated Top of Rock Elevation: 387.33

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
5	382.33	2018	1028	SIDE + TIP	276	0.018	0.323
6	381.33	2118	1083	SIDE + TIP	322	0.020	0.331
7	380.33	4321	2204	SIDE + TIP	368	0.022	0.698
8	379.33	4447	2273	SIDE + TIP	412	0.024	0.707
9	378.33	4574	2343	SIDE + TIP	456	0.025	0.716
10	377.33	4703	2414	SIDE + TIP	499	0.027	0.725
11	376.33	4833	2485	SIDE + TIP	541	0.029	0.734
12	375.33	4964	2557	SIDE + TIP	584	0.030	0.744
13	374.33	2495	1372	SIDE	497	0.030	1.494
14	373.33	2687	1478	SIDE	537	0.031	1.497
15	372.33	2878	1583	SIDE	577	0.033	1.499
16	371.33	3070	1689	SIDE	617	0.034	1.502
17	370.33	3262	1794	SIDE	657	0.036	1.505
18	369.33	3454	1900	SIDE	697	0.037	1.508
19	368.33	3646	2005	SIDE	737	0.038	1.511
20	367.33	3838	2111	SIDE	778	0.040	1.514
60 in. Diameter Drilled Shaft							
5	382.33	3030	1539	SIDE + TIP	355	0.019	0.398
6	381.33	3160	1609	SIDE + TIP	416	0.022	0.407
7	380.33	3291	1680	SIDE + TIP	475	0.024	0.415
8	379.33	6634	3379	SIDE + TIP	532	0.026	0.867
9	378.33	6790	3465	SIDE + TIP	588	0.028	0.875
10	377.33	6948	3551	SIDE + TIP	644	0.030	0.884
11	376.33	2639	1451	SIDE	521	0.030	1.853
12	375.33	2878	1583	SIDE	569	0.031	1.856
13	374.33	3118	1715	SIDE	618	0.033	1.859
14	373.33	3358	1847	SIDE	667	0.034	1.862
15	372.33	3598	1979	SIDE	716	0.036	1.864
16	371.33	3838	2111	SIDE	765	0.037	1.867
17	370.33	4078	2243	SIDE	814	0.038	1.870
18	369.33	4318	2375	SIDE	864	0.040	1.872
19	368.33	4558	2507	SIDE	914	0.041	1.875
20	367.33	4797	2639	SIDE	963	0.043	1.878
72 in. Diameter Drilled Shaft							
5	382.33	4247	2153	SIDE + TIP	434	0.020	0.474
6	381.33	4408	2239	SIDE + TIP	511	0.023	0.483
7	380.33	4571	2327	SIDE + TIP	584	0.026	0.492
8	379.33	4735	2415	SIDE + TIP	656	0.028	0.502
9	378.33	2591	1425	SIDE	508	0.029	2.206
10	377.33	2878	1583	SIDE	565	0.031	2.211
11	376.33	3166	1741	SIDE	623	0.032	2.215
12	375.33	3454	1900	SIDE	680	0.034	2.219
13	374.33	3742	2058	SIDE	738	0.035	2.222
14	373.33	4030	2216	SIDE	796	0.037	2.226
15	372.33	4318	2375	SIDE	855	0.038	2.229
16	371.33	4606	2533	SIDE	913	0.040	2.232
17	370.33	4893	2691	SIDE	972	0.041	2.234
18	369.33	5181	2850	SIDE	1031	0.043	2.237
19	368.33	5469	3008	SIDE	1090	0.044	2.240
20	367.33	5757	3166	SIDE	1149	0.046	2.242
84 in. Diameter Drilled Shaft							
5	382.33	5668	2868	SIDE + TIP	513	0.021	0.550
6	381.33	5864	2973	SIDE + TIP	606	0.024	0.559
7	380.33	2351	1293	SIDE	459	0.026	2.551
8	379.33	2687	1478	SIDE	525	0.028	2.559
9	378.33	3022	1662	SIDE	591	0.031	2.565
10	377.33	3358	1847	SIDE	658	0.033	2.571
11	376.33	3694	2032	SIDE	725	0.034	2.576
12	375.33	4030	2216	SIDE	792	0.036	2.581
13	374.33	4366	2401	SIDE	859	0.038	2.585
14	373.33	4702	2586	SIDE	926	0.040	2.589
15	372.33	5037	2771	SIDE	994	0.041	2.592
16	371.33	5373	2955	SIDE	1061	0.043	2.596
17	370.33	5709	3140	SIDE	1129	0.044	2.599
18	369.33	6045	3325	SIDE	1197	0.046	2.602
19	368.33	6381	3509	SIDE	1266	0.047	2.605
20	367.33	6716	3694	SIDE	1334	0.048	2.607

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier # 1 SB-03/04/05/06
GROUND SURFACE ELEVATION ========== 372.70 FT
GROUND WATER ELEVATION ========== 372.70 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 354.51 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 8464 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
1.00	353.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	192	106	37	0.002	1.403	110.0	1313	656	0.248	0.95	1384	696	46	0.002	0.248
2.00	352.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	384	211	74	0.008	1.432	110.0	1338	669	0.255	0.90	1479	747	118	0.008	0.255
3.00	351.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	576	317	112	0.012	1.448	110.0	1362	681	0.262	0.86	1575	798	175	0.012	0.263
4.00	350.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	768	422	150	0.015	1.458	110.0	1386	693	0.270	0.83	1673	851	227	0.015	0.271
5.00	349.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	959	528	188	0.017	1.465	110.0	1409	704	0.277	0.80	1771	904	276	0.018	0.279
6.00	348.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1151	633	226	0.019	1.471	110.0	1431	716	0.284	0.76	1872	958	322	0.020	0.288
7.00	347.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1343	739	264	0.021	1.475	110.0	3456	1728	0.692	0.80	4321	2204	368	0.022	0.698
8.00	346.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1535	844	302	0.023	1.479	110.0	3456	1728	0.722	0.78	4447	2273	412	0.024	0.707
9.00	345.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1727	950	341	0.024	1.483	110.0	3456	1728	0.694	0.76	4574	2343	456	0.025	0.716
10.00	344.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	1919	1055	380	0.026	1.486	110.0	3456	1728	0.713	0.73	4703	2414	499	0.027	0.725
11.00	343.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2111	1161	419	0.027	1.489	110.0	3456	1728	0.708	0.72	4833	2485	541	0.029	0.734
12.00	342.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2303	1267	458	0.029	1.491	110.0	3456	1728	0.715	0.70	4964	2557	584	0.030	0.744
13.00	341.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2495	1372	497	0.030	1.494	110.0	3456	1728	0.721	0.68	5097	2631	625	0.032	0.754
14.00	340.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2687	1478	537	0.031	1.497	110.0	3456	1728	0.762	0.66	5231	2704	667	0.033	0.764
15.00	339.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	2878	1583	577	0.033	1.499	110.0	3456	1728	0.746	0.64	5367	2779	708	0.035	0.775
16.00	338.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3070	1689	617	0.034	1.502	110.0	3456	1728	0.753	0.63	5504	2854	749	0.036	0.786
17.00	337.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3262	1794	657	0.036	1.505	110.0	3456	1728	0.760	0.61	5643	2931	790	0.038	0.797
18.00	336.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3454	1900	697	0.037	1.508										
19.00	335.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3646	2005	737	0.038	1.511										
20.00	334.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	3838	2111	778	0.040	1.514										
21.00	333.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	4030	2216	819	0.041	1.517										
22.00	332.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	4222	2322	859	0.043	1.520										
23.00	331.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	4414	2428	900	0.044	1.524										
24.00	330.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	4606	2533	941	0.046	1.527										
25.00	329.51	1.00	110.0	Shale	70	Normal	70	Closed	Yes	192	4797	2639	983	0.047	1.531										

Drilled Shaft Design Table for Pier # 1 SB-03/04/05/06

Estimated Top of Rock Elevation: 354.51

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
1	353.51	1384	696	SIDE + TIP	46	0.002	0.248
2	352.51	1479	747	SIDE + TIP	118	0.008	0.255
3	351.51	1575	798	SIDE + TIP	175	0.012	0.263
4	350.51	1673	851	SIDE + TIP	227	0.015	0.271
5	349.51	1771	904	SIDE + TIP	276	0.018	0.279
6	348.51	1872	958	SIDE + TIP	322	0.020	0.288
7	347.51	4321	2204	SIDE + TIP	368	0.022	0.698
8	346.51	4447	2273	SIDE + TIP	412	0.024	0.707
9	345.51	4574	2343	SIDE + TIP	456	0.025	0.716
10	344.51	4703	2414	SIDE + TIP	499	0.027	0.725
11	343.51	4833	2485	SIDE + TIP	541	0.029	0.734
12	342.51	4964	2557	SIDE + TIP	584	0.030	0.744
13	341.51	5097	2631	SIDE + TIP	625	0.032	0.754
14	340.51	5231	2704	SIDE + TIP	667	0.033	0.764
15	339.51	5367	2779	SIDE + TIP	708	0.035	0.775
16	338.51	5504	2854	SIDE + TIP	749	0.036	0.786
17	337.51	5643	2931	SIDE + TIP	790	0.038	0.797
18	336.51	3454	1900	SIDE	697	0.037	1.508
19	335.51	3646	2005	SIDE	737	0.038	1.511
20	334.51	3838	2111	SIDE	778	0.040	1.514
21	333.51	4030	2216	SIDE	819	0.041	1.517
22	332.51	4222	2322	SIDE	859	0.043	1.520
23	331.51	4414	2428	SIDE	900	0.044	1.524
24	330.51	4606	2533	SIDE	941	0.046	1.527
25	329.51	4797	2639	SIDE	983	0.047	1.531
60 in. Diameter Drilled Shaft							
1	353.51	2051	1026	TIP	--	--	0.337
2	352.51	2267	1142	SIDE + TIP	144	0.008	0.318
3	351.51	2395	1211	SIDE + TIP	221	0.013	0.327
4	350.51	2523	1279	SIDE + TIP	290	0.016	0.336
5	349.51	2653	1349	SIDE + TIP	355	0.019	0.345
6	348.51	2784	1419	SIDE + TIP	416	0.022	0.354
7	347.51	2916	1490	SIDE + TIP	475	0.024	0.363
8	346.51	6634	3379	SIDE + TIP	532	0.026	0.867
9	345.51	6790	3465	SIDE + TIP	588	0.028	0.875
10	344.51	6948	3551	SIDE + TIP	644	0.030	0.884
11	343.51	7107	3639	SIDE + TIP	699	0.031	0.893
12	342.51	7268	3727	SIDE + TIP	753	0.033	0.902
13	341.51	7429	3816	SIDE + TIP	806	0.035	0.911
14	340.51	7592	3906	SIDE + TIP	859	0.036	0.920
15	339.51	7757	3996	SIDE + TIP	912	0.038	0.930
16	338.51	3838	2111	SIDE	765	0.037	1.867
17	337.51	4078	2243	SIDE	814	0.038	1.870
18	336.51	4318	2375	SIDE	864	0.040	1.872
19	335.51	4558	2507	SIDE	914	0.041	1.875
20	334.51	4797	2639	SIDE	963	0.043	1.878
21	333.51	5037	2771	SIDE	1014	0.044	1.880
22	332.51	5277	2902	SIDE	1064	0.046	1.883
23	331.51	5517	3034	SIDE	1114	0.047	1.886
24	330.51	5757	3166	SIDE	1165	0.048	1.889
25	329.51	5997	3298	SIDE	1215	0.050	1.892
72 in. Diameter Drilled Shaft							
1	353.51	2954	1477	TIP	--	--	0.353
2	352.51	3223	1622	SIDE + TIP	164	0.007	0.380
3	351.51	3385	1709	SIDE + TIP	265	0.012	0.390
4	350.51	3548	1795	SIDE + TIP	353	0.017	0.400
5	349.51	3711	1883	SIDE + TIP	434	0.020	0.410
6	348.51	3875	1970	SIDE + TIP	511	0.023	0.420
7	347.51	4041	2059	SIDE + TIP	584	0.026	0.430
8	346.51	4208	2149	SIDE + TIP	656	0.028	0.441
9	345.51	4376	2239	SIDE + TIP	725	0.030	0.451
10	344.51	9628	4907	SIDE + TIP	794	0.032	1.043
11	343.51	9816	5010	SIDE + TIP	861	0.034	1.052
12	342.51	10006	5115	SIDE + TIP	927	0.036	1.061
13	341.51	10196	5219	SIDE + TIP	993	0.037	1.069
14	340.51	4030	2216	SIDE	796	0.037	2.226
15	339.51	4318	2375	SIDE	855	0.038	2.229
16	338.51	4606	2533	SIDE	913	0.040	2.232
17	337.51	4893	2691	SIDE	972	0.041	2.234
18	336.51	5181	2850	SIDE	1031	0.043	2.237
19	335.51	5469	3008	SIDE	1090	0.044	2.240
20	334.51	5757	3166	SIDE	1149	0.046	2.242
21	333.51	6045	3325	SIDE	1208	0.047	2.245
22	332.51	6333	3483	SIDE	1268	0.048	2.248
23	331.51	6621	3641	SIDE	1327	0.050	2.250

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier #2 SB-05/06/07/08
GROUND SURFACE ELEVATION ========== 351.20 FT
GROUND WATER ELEVATION ========== 347.70 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 347.00 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 8896 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
5.00	342.00	5.00	528.0	Sandstone	59	Normal	48	Closed	Yes	2054	2054	1130	550	0.041	0.913	528.0	5839	2920	0.903	0.69	6697	3451	837	0.044	0.728
6.00	341.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	2465	1356	666	0.046	0.922	528.0	5942	2971	0.931	0.65	7110	3678	988	0.050	0.742
7.00	340.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	2875	1581	784	0.051	0.929	528.0	16588	8294	2.631	0.62	7511	3899	1136	0.055	0.754
8.00	339.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	3286	1807	903	0.055	0.935	528.0	16588	8294	2.686	0.58	7902	4115	1283	0.061	0.766
9.00	338.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	3697	2033	1025	0.060	0.941	528.0	16588	8294	2.684	0.55	8286	4328	1430	0.066	0.777
10.00	337.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	4108	2259	1149	0.064	0.946	528.0	16588	8294	2.728	0.53	8664	4537	1576	0.071	0.788
11.00	336.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	4518	2485	1275	0.068	0.951	528.0	16588	8294	2.749	0.50	9038	4745	1722	0.076	0.798
12.00	335.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	4929	2711	1402	0.073	0.955	528.0	16588	8294	2.781	0.48	9408	4950	1868	0.081	0.809
13.00	334.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	5340	2937	1532	0.077	0.960	528.0	16588	8294	2.813	0.45	9775	5154	2015	0.086	0.819
14.00	333.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	5751	3163	1664	0.081	0.965	528.0	16588	8294	2.880	0.43	10139	5357	2162	0.091	0.830
15.00	332.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	6161	3389	1798	0.086	0.969										
16.00	331.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	6572	3615	1934	0.090	0.974										
17.00	330.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	6983	3841	2072	0.095	0.979										
18.00	329.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	7394	4067	2212	0.100	0.985										
19.00	328.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	7805	4292	2355	0.104	0.990										
20.00	327.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	8215	4518	2499	0.109	0.996										
21.00	326.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	8626	4744	2645	0.114	1.003										
22.00	325.00	1.00	528.0	Sandstone	59	Normal	48	Closed	Yes	411	9037	4970	2792	0.119	1.009										

Drilled Shaft Design Table for Pier #2 SB-05/06/07/08

Estimated Top of Rock Elevation: 347.00

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
5	342	6697	3451	SIDE + TIP	837	0.044	0.728
6	341	7110	3678	SIDE + TIP	988	0.050	0.742
7	340	16588	8294	TIP	--	--	2.631
8	339	16588	8294	TIP	--	--	2.686
9	338	16588	8294	TIP	--	--	2.684
10	337	16588	8294	TIP	--	--	2.728
11	336	16588	8294	TIP	--	--	2.749
12	335	16588	8294	TIP	--	--	2.781
13	334	16588	8294	TIP	--	--	2.813
14	333	16588	8294	TIP	--	--	2.880
15	332	6161	3389	SIDE	1798	0.086	0.969
16	331	6572	3615	SIDE	1934	0.090	0.974
17	330	6983	3841	SIDE	2072	0.095	0.979
18	329	7394	4067	SIDE	2212	0.100	0.985
19	328	7805	4292	SIDE	2355	0.104	0.990
20	327	8215	4518	SIDE	2499	0.109	0.996
21	326	8626	4744	SIDE	2645	0.114	1.003
22	325	9037	4970	SIDE	2792	0.119	1.009
60 in. Diameter Drilled Shaft							
5	342	9789	5023	SIDE + TIP	1066	0.046	0.891
6	341	10332	5320	SIDE + TIP	1260	0.053	0.907
7	340	10854	5607	SIDE + TIP	1450	0.059	0.921
8	339	25918	12959	TIP	--	--	3.293
9	338	25918	12959	TIP	--	--	3.269
10	337	25918	12959	TIP	--	--	3.329
11	336	25918	12959	TIP	--	--	3.347
12	335	25918	12959	TIP	--	--	3.394
13	334	6675	3671	SIDE	1873	0.082	1.185
14	333	7188	3954	SIDE	2031	0.086	1.190
15	332	7702	4236	SIDE	2191	0.091	1.194
16	331	8215	4518	SIDE	2353	0.095	1.199
17	330	8729	4801	SIDE	2517	0.099	1.203
18	329	9242	5083	SIDE	2684	0.104	1.208
19	328	9756	5366	SIDE	2852	0.108	1.213
20	327	10269	5648	SIDE	3022	0.113	1.218
21	326	10783	5930	SIDE	3195	0.117	1.223
22	325	11296	6213	SIDE	3369	0.122	1.228
72 in. Diameter Drilled Shaft							
5	342	13415	6862	SIDE + TIP	1293	0.048	1.050
6	341	14097	7233	SIDE + TIP	1535	0.055	1.069
7	340	14750	7591	SIDE + TIP	1768	0.062	1.085
8	339	15382	7937	SIDE + TIP	1997	0.068	1.099
9	338	15998	8276	SIDE + TIP	2223	0.074	1.113
10	337	37322	18661	TIP	--	--	3.964
11	336	6778	3728	SIDE	1852	0.078	1.397
12	335	7394	4067	SIDE	2033	0.083	1.403
13	334	8010	4405	SIDE	2215	0.087	1.409
14	333	8626	4744	SIDE	2399	0.092	1.414
15	332	9242	5083	SIDE	2585	0.096	1.419
16	331	9858	5422	SIDE	2773	0.100	1.424
17	330	10474	5761	SIDE	2963	0.104	1.428
18	329	11091	6100	SIDE	3155	0.109	1.433
19	328	11707	6439	SIDE	3350	0.113	1.438
20	327	12323	6778	SIDE	3546	0.117	1.442
21	326	12939	7116	SIDE	3744	0.122	1.447
22	325	13555	7455	SIDE	3945	0.126	1.452
84 in. Diameter Drilled Shaft							
5	342	17883	8941	TIP	--	--	1.499
6	341	18395	9413	SIDE + TIP	1808	0.057	1.228
7	340	19187	9845	SIDE + TIP	2089	0.064	1.247
8	339	19951	10263	SIDE + TIP	2362	0.071	1.263
9	338	6470	3558	SIDE	1735	0.072	1.599
10	337	7188	3954	SIDE	1938	0.078	1.609
11	336	7907	4349	SIDE	2142	0.083	1.617
12	335	8626	4744	SIDE	2348	0.087	1.624
13	334	9345	5140	SIDE	2556	0.092	1.631
14	333	10064	5535	SIDE	2766	0.097	1.637
15	332	10783	5930	SIDE	2979	0.101	1.643
16	331	11501	6326	SIDE	3193	0.105	1.648
17	330	12220	6721	SIDE	3409	0.110	1.653
18	329	12939	7116	SIDE	3627	0.114	1.658
19	328	13658	7512	SIDE	3848	0.118	1.663
20	327	14377	7907	SIDE	4070	0.123	1.667
21	326	15096	8303	SIDE	4295	0.127	1.672
22	325	15814	8698	SIDE	4521	0.131	1.676

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/097-0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier#3/Pier #4 SB-07/08
GROUND SURFACE ELEVATION ========== 343.00 FT
GROUND WATER ELEVATION ========== 339.00 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 317.00 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 9682 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
5.00	312.00	5.00	527.0	Sandstone	59	Normal	48	Closed	Yes	2054	2054	1130	549	0.041	0.914	561.4	6709	3354	0.695	0.75	8361	4283	993	0.045	0.663
6.00	311.00	1.00	527.0	Sandstone	59	Normal	48	Closed	Yes	411	2465	1356	665	0.046	0.923	568.3	6865	3432	0.655	0.73	9245	4746	1224	0.052	0.661
7.00	310.00	1.00	527.0	Sandstone	59	Normal	48	Closed	Yes	411	2875	1581	783	0.051	0.930	569.4	17887	8944	1.558	0.72	10179	5233	1478	0.060	0.655
8.00	309.00	1.00	527.0	Sandstone	59	Normal	48	Closed	Yes	411	3286	1807	902	0.055	0.937	570.5	17923	8961	1.435	0.71	11181	5755	1767	0.067	0.647
9.00	308.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	3697	2033	1043	0.054	0.813	564.8	17742	8871	1.422	0.64	10409	5389	1871	0.066	0.573
10.00	307.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	4108	2259	1190	0.054	0.734	559.0	17562	8781	1.453	0.59	10035	5223	2003	0.067	0.528
11.00	306.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	4518	2485	1342	0.055	0.679	665.0	20892	10446	1.671	0.55	10096	5274	2212	0.070	0.491
12.00	305.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	4929	2711	1501	0.057	0.639	771.0	24222	12111	1.860	0.52	10263	5378	2440	0.074	0.465
13.00	304.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	5340	2937	1665	0.060	0.609	877.0	27552	13776	2.042	0.49	10500	5517	2687	0.078	0.447
14.00	303.00	1.00	582.0	Sandstone	77	Normal	15	Closed	Yes	411	5751	3163	1835	0.063	0.586										
15.00	302.00	1.00	536.0	Sandstone	77	Normal	74	Closed	Yes	411	6161	3389	2002	0.066	0.571										
16.00	301.00	1.00	536.0	Sandstone	77	Normal	74	Closed	Yes	411	6572	3615	2174	0.069	0.558										
17.00	300.00	1.00	536.0	Sandstone	77	Normal	74	Closed	Yes	411	6983	3841	2352	0.073	0.549										
18.00	299.00	1.00	536.0	Sandstone	77	Normal	74	Closed	Yes	411	7394	4067	2535	0.077	0.541										
18.80	298.20	0.80	1430.0	Limestone	80	Normal	99	Closed	Yes	329	7722	4247	2884	0.082	0.475										
19.80	297.20	1.00	1430.0	Limestone	80	Normal	99	Closed	Yes	411	8133	4473	3367	0.090	0.415										
20.80	296.20	1.00	1430.0	Limestone	80	Normal	99	Closed	Yes	411	8544	4699	3907	0.099	0.372										
21.80	295.20	1.00	1430.0	Limestone	80	Normal	99	Closed	Yes	411	8955	4925	4513	0.110	0.340										

Drilled Shaft Design Table for Pier#3/Pier #4 SB-07/08

Estimated Top of Rock Elevation: 317.00

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
5	312	8361	4283	SIDE + TIP	993	0.045	0.663
6	311	9245	4746	SIDE + TIP	1224	0.052	0.661
7	310	17887	8944	TIP	--	--	1.558
8	309	17923	8961	TIP	--	--	1.435
9	308	17742	8871	TIP	--	--	1.422
10	307	17562	8781	TIP	--	--	1.453
11	306	20892	10446	TIP	--	--	1.671
12	305	24222	12111	TIP	--	--	1.860
13	304	27552	13776	TIP	--	--	2.042
14	303	5751	3163	SIDE	1835	0.063	0.586
15	302	6161	3389	SIDE	2002	0.066	0.571
16	301	6572	3615	SIDE	2174	0.069	0.558
17	300	6983	3841	SIDE	2352	0.073	0.549
18	299	7394	4067	SIDE	2535	0.077	0.541
18.8	298.2	7722	4247	SIDE	2884	0.082	0.475
19.8	297.2	8133	4473	SIDE	3367	0.090	0.415
20.8	296.2	8544	4699	SIDE	3907	0.099	0.372
21.8	295.2	8955	4925	SIDE	4513	0.110	0.340
60 in. Diameter Drilled Shaft							
5	312	12837	6547	SIDE + TIP	1318	0.048	0.793
6	311	13638	6970	SIDE + TIP	1621	0.056	0.767
7	310	14156	7247	SIDE + TIP	1949	0.063	0.724
8	309	27666	13833	TIP	--	--	1.704
9	308	31828	15914	TIP	--	--	1.844
10	307	35991	17995	TIP	--	--	2.054
11	306	40153	20077	TIP	--	--	2.207
12	305	6161	3389	SIDE	1820	0.060	0.791
13	304	6675	3671	SIDE	2011	0.062	0.754
14	303	7188	3954	SIDE	2208	0.065	0.724
15	302	7702	4236	SIDE	2401	0.067	0.704
16	301	8215	4518	SIDE	2598	0.070	0.687
17	300	8729	4801	SIDE	2801	0.073	0.673
18	299	9242	5083	SIDE	3010	0.076	0.662
18.8	298.2	9653	5309	SIDE	3393	0.080	0.578
19.8	297.2	10166	5592	SIDE	3916	0.085	0.502
20.8	296.2	10680	5874	SIDE	4493	0.093	0.445
21.8	295.2	11193	6156	SIDE	5130	0.101	0.402
72 in. Diameter Drilled Shaft							
5	312	18045	9175	SIDE + TIP	1648	0.049	0.908
6	311	18751	9553	SIDE + TIP	2030	0.058	0.867
7	310	21316	10870	SIDE + TIP	2495	0.067	0.878
8	309	23849	12170	SIDE + TIP	3047	0.076	0.868
9	308	41876	20938	TIP	--	--	1.830
10	307	6161	3389	SIDE	1721	0.061	1.082
11	306	6778	3728	SIDE	1928	0.062	1.002
12	305	7394	4067	SIDE	2141	0.063	0.943
13	304	8010	4405	SIDE	2359	0.065	0.898
14	303	8626	4744	SIDE	2583	0.067	0.863
15	302	9242	5083	SIDE	2801	0.069	0.838
16	301	9858	5422	SIDE	3024	0.071	0.818
17	300	10474	5761	SIDE	3252	0.074	0.801
18	299	11091	6100	SIDE	3486	0.077	0.786
18.8	298.2	11584	6371	SIDE	3905	0.079	0.686
19.8	297.2	12200	6710	SIDE	4470	0.084	0.593
20.8	296.2	12816	7049	SIDE	5085	0.090	0.524
21.8	295.2	13432	7388	SIDE	5755	0.096	0.471
84 in. Diameter Drilled Shaft							
5	312	25045	12702	SIDE + TIP	2012	0.050	1.031
6	311	27468	13950	SIDE + TIP	2543	0.060	1.017
7	310	30071	15287	SIDE + TIP	3140	0.070	0.996
8	309	5751	3163	SIDE	1533	0.067	1.591
9	308	6470	3558	SIDE	1758	0.065	1.385
10	307	7188	3954	SIDE	1987	0.064	1.253
11	306	7907	4349	SIDE	2222	0.065	1.162
12	305	8626	4744	SIDE	2463	0.066	1.094
13	304	9345	5140	SIDE	2708	0.068	1.043
14	303	10064	5535	SIDE	2959	0.069	1.002
15	302	10783	5930	SIDE	3203	0.071	0.973
16	301	11501	6326	SIDE	3451	0.074	0.949
17	300	12220	6721	SIDE	3705	0.076	0.929
18	299	12939	7116	SIDE	3964	0.078	0.912
18.8	298.2	13514	7433	SIDE	4420	0.080	0.795
19.8	297.2	14233	7828	SIDE	5028	0.084	0.686
20.8	296.2	14952	8224	SIDE	5684	0.088	0.606
21.8	295.2	15671	8619	SIDE	6391	0.094	0.544

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/097-0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier #5 SB-09/10
GROUND SURFACE ELEVATION ========== 347.00 FT
GROUND WATER ELEVATION ========== 347.00 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 334.85 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 9495 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
3.00	331.85	3.00	554.0	Sandstone	80	Normal	100	Closed	Yes	1232	1232	678	349	0.012	0.322	535.3	14081	7040	0.858	0.72	4337	2230	576	0.013	0.193
4.00	330.85	1.00	554.0	Sandstone	80	Normal	100	Closed	Yes	411	1643	904	476	0.015	0.324	601.3	15838	7919	0.938	0.66	4828	2496	792	0.018	0.195
5.00	329.85	1.00	554.0	Sandstone	80	Normal	100	Closed	Yes	411	2054	1130	609	0.018	0.325	667.3	17595	8797	1.012	0.61	5301	2753	1018	0.022	0.196
6.00	328.85	1.00	554.0	Sandstone	80	Normal	100	Closed	Yes	411	2465	1356	747	0.021	0.325	733.3	19352	9676	1.080	0.57	5765	3006	1257	0.027	0.198
7.00	327.85	1.00	524.0	Sandstone	80	Normal	87	Closed	Yes	411	2875	1581	887	0.024	0.327	803.0	25227	12613	1.364	0.54	6245	3266	1501	0.031	0.201
8.00	326.85	1.00	524.0	Sandstone	80	Normal	87	Closed	Yes	411	3286	1807	1032	0.027	0.329	853.0	26798	13399	1.489	0.50	6628	3478	1719	0.036	0.207
9.00	325.85	1.00	524.0	Sandstone	80	Normal	87	Closed	Yes	411	3697	2033	1183	0.030	0.330	824.0	25887	12943	1.661	0.45	6695	3532	1797	0.038	0.223
10.00	324.85	1.00	524.0	Sandstone	80	Normal	87	Closed	Yes	411	4108	2259	1341	0.033	0.331	795.0	24976	12488	1.859	0.40	6813	3612	1902	0.041	0.238
11.00	323.85	1.00	524.0	Sandstone	80	Normal	87	Closed	Yes	411	4518	2485	1505	0.037	0.332	766.0	24065	12032	2.016	0.35	6971	3711	2024	0.044	0.250
12.70	322.15	1.70	1082.0	Limestone	80	Normal	75	Closed	Yes	698	5217	2869	2075	0.045	0.262										
13.70	321.15	1.00	1082.0	Limestone	80	Normal	75	Closed	Yes	411	5627	3095	2465	0.051	0.237										
14.70	320.15	1.00	1082.0	Limestone	80	Normal	75	Closed	Yes	411	6038	3321	2900	0.058	0.218										
15.80	319.05	1.10	1082.0	Limestone	80	Normal	75	Closed	Yes	452	6490	3570	3439	0.067	0.203										
16.80	318.05	1.00	292.0	Shale	80	Normal	67	Closed	Yes	313	6803	3742	3551	0.070	0.217										
17.80	317.05	1.00	292.0	Shale	80	Normal	76	Closed	Yes	313	7115	3913	3665	0.074	0.231										
18.90	315.95	1.10	292.0	Shale	80	Normal	76	Closed	Yes	344	7459	4103	3791	0.078	0.246										
20.00	314.85	1.10	292.0	Shale	80	Normal	76	Closed	Yes	344	7803	4292	3917	0.083	0.262										

Drilled Shaft Design Table for Pier #5 SB-09/10

Estimated Top of Rock Elevation: 334.85

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
3	331.85	14081	7040	TIP	--	--	0.858
4	330.85	15838	7919	TIP	--	--	0.938
5	329.85	17595	8797	TIP	--	--	1.012
6	328.85	19352	9676	TIP	--	--	1.080
7	327.85	25227	12613	TIP	--	--	1.364
8	326.85	26798	13399	TIP	--	--	1.489
9	325.85	25887	12943	TIP	--	--	1.661
10	324.85	24976	12488	TIP	--	--	1.859
11	323.85	24065	12032	TIP	--	--	2.016
12.7	322.15	5217	2869	SIDE	2075	0.045	0.262
13.7	321.15	5627	3095	SIDE	2465	0.051	0.237
14.7	320.15	6038	3321	SIDE	2900	0.058	0.218
15.8	319.05	6490	3570	SIDE	3439	0.067	0.203
16.8	318.05	6803	3742	SIDE	3551	0.070	0.217
17.8	317.05	7115	3913	SIDE	3665	0.074	0.231
18.9	315.95	7459	4103	SIDE	3791	0.078	0.246
20	314.85	7803	4292	SIDE	3917	0.083	0.262
60 in. Diameter Drilled Shaft							
3	331.85	26335	13168	TIP	--	--	1.136
4	330.85	28558	14279	TIP	--	--	1.172
5	329.85	30781	15390	TIP	--	--	1.288
6	328.85	32377	16188	TIP	--	--	1.324
7	327.85	31585	15792	TIP	--	--	1.506
8	326.85	36364	18182	TIP	--	--	1.991
9	325.85	35225	17613	TIP	--	--	2.094
10	324.85	34086	17043	TIP	--	--	2.267
11	323.85	5648	3106	SIDE	1790	0.037	0.415
12.7	322.15	6521	3586	SIDE	2418	0.043	0.326
13.7	321.15	7034	3869	SIDE	2837	0.048	0.293
14.7	320.15	7548	4151	SIDE	3296	0.054	0.268
15.8	319.05	8113	4462	SIDE	3852	0.060	0.248
16.8	318.05	8503	4677	SIDE	3987	0.064	0.263
17.8	317.05	8894	4892	SIDE	4124	0.067	0.279
18.9	315.95	9324	5128	SIDE	4276	0.071	0.296
20	314.85	9754	5365	SIDE	4429	0.075	0.312
72 in. Diameter Drilled Shaft							
3	331.85	42083	21041	TIP	--	--	1.415
4	330.85	44031	22015	TIP	--	--	1.423
5	329.85	42971	21486	TIP	--	--	1.594
6	328.85	41909	20955	TIP	--	--	1.755
7	327.85	40988	20494	TIP	--	--	1.895
8	326.85	40063	20031	TIP	--	--	2.010
9	325.85	5545	3050	SIDE	1658	0.031	0.495
10	324.85	6161	3389	SIDE	1865	0.034	0.497
11	323.85	6778	3728	SIDE	2078	0.037	0.498
12.7	322.15	7825	4304	SIDE	2768	0.043	0.392
13.7	321.15	8441	4643	SIDE	3220	0.047	0.352
14.7	320.15	9057	4982	SIDE	3708	0.052	0.321
15.8	319.05	9735	5354	SIDE	4292	0.057	0.296
16.8	318.05	10204	5612	SIDE	4446	0.060	0.313
17.8	317.05	10673	5870	SIDE	4601	0.064	0.331
18.9	315.95	11189	6154	SIDE	4774	0.067	0.349
20	314.85	11705	6438	SIDE	4949	0.071	0.368
84 in. Diameter Drilled Shaft							
3	331.85	56065	28032	TIP	--	--	1.706
4	330.85	54867	27433	TIP	--	--	1.865
5	329.85	53665	26832	TIP	--	--	1.957
6	328.85	52460	26230	TIP	--	--	2.120
7	327.85	5032	2768	SIDE	1450	0.026	0.571
8	326.85	5751	3163	SIDE	1671	0.029	0.575
9	325.85	6470	3558	SIDE	1898	0.032	0.578
10	324.85	7188	3954	SIDE	2130	0.035	0.580
11	323.85	7907	4349	SIDE	2368	0.038	0.581
12.7	322.15	9129	5021	SIDE	3123	0.043	0.458
13.7	321.15	9848	5416	SIDE	3610	0.047	0.411
14.7	320.15	10567	5812	SIDE	4131	0.051	0.376
15.8	319.05	11358	6247	SIDE	4747	0.056	0.345
16.8	318.05	11905	6548	SIDE	4919	0.059	0.365
17.8	317.05	12452	6849	SIDE	5093	0.062	0.385
18.9	315.95	13054	7180	SIDE	5285	0.065	0.406
20	314.85	13656	7511	SIDE	5480	0.068	0.426

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/097-0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier #6 SB-12
GROUND SURFACE ELEVATION ========== 350.10 FT
GROUND WATER ELEVATION ========== 350.10 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 311.60 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 8906 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
2.00	309.60	2.00	1630.0	Sandstone	46	Normal	51	Closed	Yes	822	822	452	456	0.070	0.526	1084.1	7059	3530	1.900	0.67	2520	1301	731	0.072	0.458
3.00	308.60	1.00	1630.0	Limestone	46	Normal	51	Closed	Yes	411	1232	678	698	0.079	0.427	895.8	4499	2249	1.250	0.52	2563	1343	1010	0.082	0.373
4.00	307.60	1.00	1630.0	Limestone	46	Normal	51	Closed	Yes	411	1643	904	950	0.089	0.400	707.6	3771	1886	1.080	0.42	2849	1507	1303	0.094	0.352
5.00	306.60	1.00	1630.0	Limestone	46	Normal	51	Closed	Yes	411	2054	1130	1211	0.099	0.389	520.2	3013	1506	0.889	0.36	3188	1697	1603	0.105	0.344
6.00	305.60	1.00	1630.0	Limestone	46	Normal	51	Closed	Yes	411	2465	1356	1483	0.109	0.384	333.0	2196	1098	0.666	0.30	3545	1896	1913	0.116	0.342
7.10	304.50	1.10	1630.0	Limestone	46	Normal	51	Closed	Yes	452	2916	1604	1794	0.119	0.381	127.0	3990	1995	1.248	0.26	3948	2120	2264	0.129	0.342
8.00	303.60	0.90	124.0	Shale	46	Normal	64	Closed	Yes	183	3100	1705	1823	0.125	0.436	127.9	4018	2009	1.112	0.30	4443	2376	2383	0.136	0.387
9.60	302.00	1.60	124.0	Shale	46	Normal	64	Closed	Yes	326	3426	1884	1880	0.133	0.535	128.5	4037	2018	0.784	0.39	5601	2972	2701	0.150	0.459
10.00	301.60	0.40	124.0	Shale	71	Normal	100	Closed	Yes	81	3507	1929	1901	0.131	0.543	128.5	4037	2018	0.798	0.39	5703	3027	2706	0.148	0.467
12.10	299.50	2.10	124.0	Shale	71	Normal	100	Closed	Yes	428	3935	2164	2009	0.126	0.582	128.5	4037	2018	0.815	0.37	6231	3312	2741	0.142	0.508
14.10	297.50	2.00	132.0	Shale	71	Normal	94	Closed	Yes	420	4356	2396	2117	0.124	0.620	126.5	3974	1987	0.806	0.35	6740	3588	2793	0.139	0.547
16.60	295.00	2.50	132.0	Shale	71	Fractured	16	Closed	Yes	123	4479	2463	2253	0.123	0.582	124.0	3896	1948	0.821	0.32	6631	3539	2869	0.138	0.522
17.60	294.00	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4682	2575	2305	0.123	0.601	124.0	3896	1948	0.828	0.32	6875	3672	2899	0.137	0.542
18.60	293.00	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4886	2687	2357	0.123	0.619	124.0	3896	1948	0.824	0.31	7116	3802	2930	0.137	0.561
20.10	291.50	1.50	124.0	Shale	71	Normal	35	Closed	Yes	306	5192	2855	2436	0.124	0.647	124.0	3896	1948	0.870	0.31	7471	3995	2978	0.138	0.590
21.10	290.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5395	2967	2488	0.125	0.664	124.0	3896	1948	0.855	0.30	7704	4122	3011	0.138	0.610
22.10	289.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5599	3080	2541	0.126	0.681	124.0	3896	1948	0.851	0.29	7934	4247	3044	0.139	0.628
23.10	288.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5803	3192	2593	0.127	0.698										
24.10	287.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6007	3304	2645	0.128	0.715										
25.10	286.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6210	3416	2698	0.129	0.732										
26.10	285.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6414	3528	2750	0.130	0.748										
27.10	284.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6618	3640	2802	0.132	0.764										
28.10	283.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6822	3752	2854	0.133	0.780										
29.10	282.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	7025	3864	2906	0.135	0.796										
30.10	281.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	7229	3976	2958	0.136	0.812										

Drilled Shaft Design Table for Pier #6 SB-12

Estimated Top of Rock Elevation: 311.60

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
2	309.6	7059	3530	TIP	--	--	1.900
3	308.6	4499	2249	TIP	--	--	1.250
4	307.6	3771	1886	TIP	--	--	1.080
5	306.6	3188	1697	SIDE + TIP	1603	0.105	0.344
6	305.6	3545	1896	SIDE + TIP	1913	0.116	0.342
7.1	304.5	3990	1995	TIP	--	--	1.248
8	303.6	4443	2376	SIDE + TIP	2383	0.136	0.387
9.6	302	5601	2972	SIDE + TIP	2701	0.150	0.459
10	301.6	5703	3027	SIDE + TIP	2706	0.148	0.467
12.1	299.5	6231	3312	SIDE + TIP	2741	0.142	0.508
14.1	297.5	6740	3588	SIDE + TIP	2793	0.139	0.547
16.6	295	6631	3539	SIDE + TIP	2869	0.138	0.522
17.6	294	6875	3672	SIDE + TIP	2899	0.137	0.542
18.6	293	7116	3802	SIDE + TIP	2930	0.137	0.561
20.1	291.5	7471	3995	SIDE + TIP	2978	0.138	0.590
21.1	290.5	7704	4122	SIDE + TIP	3011	0.138	0.610
22.1	289.5	7934	4247	SIDE + TIP	3044	0.139	0.628
23.1	288.5	5803	3192	SIDE	2593	0.127	0.698
24.1	287.5	6007	3304	SIDE	2645	0.128	0.715
25.1	286.5	6210	3416	SIDE	2698	0.129	0.732
26.1	285.5	6414	3528	SIDE	2750	0.130	0.748
27.1	284.5	6618	3640	SIDE	2802	0.132	0.764
28.1	283.5	6822	3752	SIDE	2854	0.133	0.780
29.1	282.5	7025	3864	SIDE	2906	0.135	0.796
30.1	281.5	7229	3976	SIDE	2958	0.136	0.812
60 in. Diameter Drilled Shaft							
2	309.6	9430	4715	TIP	--	--	1.881
3	308.6	6031	3015	TIP	--	--	1.245
4	307.6	5122	2561	TIP	--	--	1.057
5	306.6	4410	2333	SIDE + TIP	2040	0.110	0.408
6	305.6	4854	2581	SIDE + TIP	2424	0.123	0.406
7.1	304.5	5356	2860	SIDE + TIP	2854	0.136	0.407
8	303.6	6264	3132	TIP	--	--	1.294
9.6	302	7688	4058	SIDE + TIP	3408	0.159	0.551
10	301.6	7830	4134	SIDE + TIP	3414	0.158	0.561
12.1	299.5	8560	4526	SIDE + TIP	3459	0.151	0.610
14.1	297.5	9258	4901	SIDE + TIP	3524	0.148	0.657
16.6	295	9078	4819	SIDE + TIP	3618	0.146	0.624
17.6	294	9410	4998	SIDE + TIP	3656	0.145	0.646
18.6	293	9737	5174	SIDE + TIP	3695	0.145	0.669
20.1	291.5	10218	5433	SIDE + TIP	3755	0.144	0.702
21.1	290.5	6744	3709	SIDE	3025	0.131	0.808
22.1	289.5	6999	3849	SIDE	3088	0.131	0.828
23.1	288.5	7254	3990	SIDE	3151	0.131	0.848
24.1	287.5	7508	4130	SIDE	3215	0.132	0.867
25.1	286.5	7763	4270	SIDE	3278	0.133	0.886
26.1	285.5	8018	4410	SIDE	3341	0.134	0.904
27.1	284.5	8272	4550	SIDE	3405	0.135	0.923
28.1	283.5	8527	4690	SIDE	3468	0.136	0.940
29.1	282.5	8782	4830	SIDE	3531	0.137	0.958
30.1	281.5	9036	4970	SIDE	3595	0.138	0.975
72 in. Diameter Drilled Shaft							
2	309.6	12030	6015	TIP	--	--	1.901
3	308.6	7718	3859	TIP	--	--	1.294
4	307.6	6623	3312	TIP	--	--	1.072
5	306.6	5785	3047	SIDE + TIP	2480	0.113	0.468
6	305.6	6319	3344	SIDE + TIP	2945	0.128	0.467
7.1	304.5	6924	3681	SIDE + TIP	3460	0.142	0.469
8	303.6	5840	3116	SIDE + TIP	3664	0.152	0.349
9.6	302	10016	5265	SIDE + TIP	4131	0.168	0.641
10	301.6	10205	5366	SIDE + TIP	4140	0.166	0.652
12.1	299.5	11168	5879	SIDE + TIP	4197	0.160	0.711
14.1	297.5	12081	6367	SIDE + TIP	4276	0.156	0.766
16.6	295	11815	6243	SIDE + TIP	4389	0.153	0.725
17.6	294	12247	6475	SIDE + TIP	4434	0.153	0.752
18.6	293	7329	4031	SIDE	3380	0.138	0.893
20.1	291.5	7788	4283	SIDE	3489	0.137	0.930
21.1	290.5	8093	4451	SIDE	3562	0.137	0.954
22.1	289.5	8399	4619	SIDE	3636	0.137	0.977
23.1	288.5	8704	4787	SIDE	3709	0.138	1.000
24.1	287.5	9010	4955	SIDE	3782	0.138	1.022
25.1	286.5	9316	5124	SIDE	3856	0.138	1.044
26.1	285.5	9621	5292	SIDE	3930	0.139	1.065
27.1	284.5	9927	5460	SIDE	4004	0.140	1.085
28.1	283.5	10232	5628	SIDE	4078	0.140	1.105

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 100-1111
SUBSTRUCTURE & REFERENCE BORING ======= Pier #7 SB-12/13
GROUND SURFACE ELEVATION ========== 370.50 FT
GROUND WATER ELEVATION ========== 354.40 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 308.38 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 11476 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SETTLEMENT Q_{C1} (KIPS)	SETTLEMENT w_{C1} (IN.)	SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
2.00	306.38	2.00	1630.0	Limestone	46	Normal	51	Closed	Yes	822	822	452	465	0.033	0.258	294.7	2286	1143	1.043	0.39	1336	709	541	0.033	0.236
2.90	305.48	0.90	1630.0	Limestone	46	Normal	51	Closed	Yes	370	1191	655	686	0.051	0.280	126.2	1311	656	0.608	0.31	1738	929	806	0.052	0.257
3.90	304.48	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	1395	767	724	0.063	0.412	127.2	976	488	0.407	0.39	2282	1211	888	0.065	0.376
4.90	303.48	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	1599	879	763	0.072	0.544	128.2	994	497	0.392	0.42	2395	1268	971	0.074	0.382
6.00	302.38	1.10	124.0	Shale	46	Normal	64	Closed	Yes	224	1823	1003	807	0.079	0.686	129.0	1013	506	0.324	0.42	2386	1262	1072	0.083	0.347
7.00	301.38	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	2027	1115	848	0.085	0.811	129.0	4053	2026	1.110	0.56	4586	2394	1179	0.090	0.715
8.00	300.38	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	2230	1227	889	0.090	0.932	129.0	4053	2026	0.945	0.61	5691	2957	1312	0.096	0.805
8.70	299.68	0.70	124.0	Shale	46	Normal	64	Closed	Yes	143	2373	1305	918	0.093	1.014	129.0	4053	2026	0.769	0.64	6337	3283	1432	0.101	0.810
9.70	298.68	1.00	132.0	Shale	71	Normal	94	Closed	Yes	210	2583	1421	965	0.088	1.014	128.0	4021	2011	0.782	0.62	6507	3378	1446	0.096	0.816
10.00	298.38	0.30	132.0	Shale	71	Normal	94	Closed	Yes	63	2646	1455	980	0.087	1.015	127.7	4012	2006	0.793	0.61	6557	3406	1451	0.095	0.818
11.70	296.68	1.70	132.0	Shale	71	Normal	16	Closed	Yes	357	3004	1652	1061	0.083	1.026	126.0	3958	1979	0.785	0.58	6827	3557	1493	0.091	0.828
12.70	295.68	1.00	132.0	Shale	71	Normal	16	Closed	Yes	210	3214	1768	1109	0.082	1.035	125.0	3927	1963	0.820	0.56	6979	3642	1523	0.089	0.834
13.70	294.68	1.00	132.0	Shale	71	Normal	16	Closed	Yes	210	3424	1883	1157	0.081	1.045	124.0	3896	1948	0.799	0.55	7128	3726	1556	0.088	0.841
14.70	293.68	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3628	1995	1204	0.080	1.055	124.0	3896	1948	0.806	0.53	7320	3831	1588	0.088	0.854
15.70	292.68	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3832	2107	1250	0.080	1.065	124.0	3896	1948	0.836	0.52	7511	3936	1622	0.088	0.868
16.90	291.48	1.20	124.0	Shale	71	Normal	35	Closed	Yes	244	4076	2242	1307	0.080	1.078	124.0	3896	1948	0.811	0.50	7741	4063	1664	0.088	0.884
17.90	290.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4280	2354	1354	0.080	1.088	124.0	3896	1948	0.830	0.49	7934	4169	1700	0.088	0.898
18.90	289.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4483	2466	1401	0.081	1.099	124.0	3896	1948	0.861	0.48	8128	4276	1737	0.088	0.913
19.90	288.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4687	2578	1448	0.082	1.110	124.0	3896	1948	0.868	0.47	8323	4383	1774	0.089	0.928
20.90	287.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4891	2690	1496	0.082	1.120	124.0	3896	1948	0.853	0.46	8519	4491	1812	0.090	0.943
21.90	286.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5095	2802	1543	0.083	1.131	124.0	3896	1948	0.849	0.45	8717	4600	1850	0.090	0.959
22.90	285.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5298	2914	1591	0.084	1.141	124.0	3896	1948	0.868	0.44	8917	4710	1889	0.091	0.975
23.90	284.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5502	3026	1639	0.085	1.152	124.0	3896	1948	0.898	0.43	9118	4820	1927	0.092	0.991
24.90	283.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5706	3138	1687	0.087	1.162										
25.90	282.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5910	3250	1735	0.088	1.173										
26.90	281.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6113	3362	1783	0.089	1.183										
27.90	280.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6317	3474	1831	0.091	1.194										
28.90	279.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6521	3587	1880	0.092	1.204										
29.90	278.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6725	3699	1928	0.094	1.214										
30.90	277.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	6928	3811	1976	0.095	1.225										
31.90	276.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	7132	3923	2025	0.097	1.235										

Drilled Shaft Design Table for Pier #7 SB-12/13

Estimated Top of Rock Elevation: 308.38

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
2	306.38	2286	1143	TIP	--	--	1.043
2.9	305.48	1738	929	SIDE + TIP	806	0.052	0.257
3.9	304.48	2282	1211	SIDE + TIP	888	0.065	0.376
4.9	303.48	2395	1268	SIDE + TIP	971	0.074	0.382
6	302.38	2386	1262	SIDE + TIP	1072	0.083	0.347
7	301.38	4586	2394	SIDE + TIP	1179	0.090	0.715
8	300.38	5691	2957	SIDE + TIP	1312	0.096	0.805
8.7	299.68	6337	3283	SIDE + TIP	1432	0.101	0.810
9.7	298.68	6507	3378	SIDE + TIP	1446	0.096	0.816
10	298.38	6557	3406	SIDE + TIP	1451	0.095	0.818
11.7	296.68	6827	3557	SIDE + TIP	1493	0.091	0.828
12.7	295.68	6979	3642	SIDE + TIP	1523	0.089	0.834
13.7	294.68	7128	3726	SIDE + TIP	1556	0.088	0.841
14.7	293.68	7320	3831	SIDE + TIP	1588	0.088	0.854
15.7	292.68	7511	3936	SIDE + TIP	1622	0.088	0.868
16.9	291.48	7741	4063	SIDE + TIP	1664	0.088	0.884
17.9	290.48	7934	4169	SIDE + TIP	1700	0.088	0.898
18.9	289.48	8128	4276	SIDE + TIP	1737	0.088	0.913
19.9	288.48	8323	4383	SIDE + TIP	1774	0.089	0.928
20.9	287.48	8519	4491	SIDE + TIP	1812	0.090	0.943
21.9	286.48	8717	4600	SIDE + TIP	1850	0.090	0.959
22.9	285.48	8917	4710	SIDE + TIP	1889	0.091	0.975
23.9	284.48	9118	4820	SIDE + TIP	1927	0.092	0.991
24.9	283.48	5706	3138	SIDE	1687	0.087	1.162
25.9	282.48	5910	3250	SIDE	1735	0.088	1.173
26.9	281.48	6113	3362	SIDE	1783	0.089	1.183
27.9	280.48	6317	3474	SIDE	1831	0.091	1.194
28.9	279.48	6521	3587	SIDE	1880	0.092	1.204
29.9	278.48	6725	3699	SIDE	1928	0.094	1.214
30.9	277.48	6928	3811	SIDE	1976	0.095	1.225
31.9	276.48	7132	3923	SIDE	2025	0.097	1.235
60 in. Diameter Drilled Shaft							
2	306.38	3295	1647	TIP	--	--	1.042
2.9	305.48	2410	1279	SIDE + TIP	1013	0.051	0.302
3.9	304.48	3245	1710	SIDE + TIP	1133	0.067	0.448
4.9	303.48	3239	1704	SIDE + TIP	1252	0.079	0.424
6	302.38	3232	1699	SIDE + TIP	1393	0.089	0.387
7	301.38	3253	1709	SIDE + TIP	1537	0.097	0.351
8	300.38	8311	4295	SIDE + TIP	1709	0.105	0.976
8.7	299.68	9128	4706	SIDE + TIP	1857	0.110	0.980
9.7	298.68	9335	4822	SIDE + TIP	1872	0.105	0.985
10	298.38	9395	4856	SIDE + TIP	1879	0.104	0.986
11.7	296.68	9723	5039	SIDE + TIP	1928	0.099	0.995
12.7	295.68	9908	5143	SIDE + TIP	1965	0.097	1.000
13.7	294.68	10088	5244	SIDE + TIP	2005	0.096	1.006
14.7	293.68	10317	5370	SIDE + TIP	2044	0.095	1.018
15.7	292.68	10545	5495	SIDE + TIP	2085	0.095	1.030
16.9	291.48	10818	5646	SIDE + TIP	2137	0.094	1.045
17.9	290.48	11046	5771	SIDE + TIP	2182	0.094	1.058
18.9	289.48	11274	5896	SIDE + TIP	2228	0.095	1.071
19.9	288.48	11503	6022	SIDE + TIP	2274	0.095	1.085
20.9	287.48	11733	6149	SIDE + TIP	2322	0.095	1.098
21.9	286.48	11964	6276	SIDE + TIP	2370	0.096	1.112
22.9	285.48	6623	3643	SIDE	1957	0.089	1.403
23.9	284.48	6878	3783	SIDE	2015	0.090	1.414
24.9	283.48	7132	3923	SIDE	2074	0.091	1.426
25.9	282.48	7387	4063	SIDE	2132	0.092	1.437
26.9	281.48	7642	4203	SIDE	2191	0.093	1.448
27.9	280.48	7897	4343	SIDE	2250	0.094	1.459
28.9	279.48	8151	4483	SIDE	2309	0.095	1.469
29.9	278.48	8406	4623	SIDE	2368	0.097	1.480
30.9	277.48	8661	4763	SIDE	2427	0.098	1.491
31.9	276.48	8915	4903	SIDE	2486	0.099	1.501
72 in. Diameter Drilled Shaft							
2	306.38	4469	2235	TIP	--	--	1.066
2.9	305.48	3179	1679	SIDE + TIP	1213	0.048	0.344
3.9	304.48	4253	2229	SIDE + TIP	1380	0.068	0.499
4.9	303.48	4201	2199	SIDE + TIP	1540	0.082	0.466
6	302.38	4202	2198	SIDE + TIP	1723	0.094	0.427
7	301.38	4232	2213	SIDE + TIP	1907	0.104	0.391
8	300.38	4280	2238	SIDE + TIP	2120	0.112	0.352
8.7	299.68	4321	2260	SIDE + TIP	2295	0.118	0.324
9.7	298.68	12658	6514	SIDE + TIP	2313	0.112	1.155
10	298.38	12729	6554	SIDE + TIP	2321	0.111	1.156
11.7	296.68	13115	6770	SIDE + TIP	2379	0.106	1.164

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/097-0081
SUBSTRUCTURE & REFERENCE BORING ======= Pier #8 SB-12/14
GROUND SURFACE ELEVATION ========== 374.60 FT
GROUND WATER ELEVATION ========== 355.50 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 306.50 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 48 IN.
FACTORED AXIAL LOAD ========== 8846 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE: NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SIDE SETTLEMENT: Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE: NOM. RESIST. (KIPS)	FACT. RESIST. (KIPS)	SETTL. w_{Rn} (IN.)	R_P/R_n	COMBINED SIDE & TIP RESISTANCE: NOM. RESIST. (KIPS)	FACT. RESIST. (KIPS)	SETTLEMENT: Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
1.20	305.30	1.20	1630.0	Limestone	46	Normal	51	Closed	Yes	493	493	271	275	0.010	0.224	126.4	1331	666	0.624	0.48	947	498	296	0.010	0.206
2.20	304.30	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	697	383	314	0.036	0.538	127.4	991	496	0.402	0.61	1620	841	406	0.036	0.404
3.20	303.30	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	900	495	355	0.050	0.835	128.4	1009	505	0.362	0.62	1627	844	497	0.051	0.369
4.20	302.30	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	1104	607	395	0.059	1.105	128.6	1023	512	0.309	0.62	1656	860	590	0.061	0.330
5.20	301.30	1.00	124.0	Shale	46	Normal	64	Closed	Yes	204	1308	719	436	0.066	1.347	128.6	1036	518	0.276	0.61	1695	880	693	0.068	0.290
5.82	300.68	0.62	124.0	Shale	46	Normal	64	Closed	Yes	126	1434	789	461	0.070	1.483	128.6	1044	522	0.248	0.61	1722	895	766	0.073	0.265
6.00	300.50	0.18	124.0	Shale	46	Normal	100	Closed	Yes	37	1471	809	469	0.071	1.521	128.6	1046	523	0.240	0.60	1731	900	790	0.074	0.257
6.82	299.68	0.82	124.0	Shale	46	Normal	100	Closed	Yes	167	1638	901	503	0.075	1.683	128.6	4040	2020	0.774	0.78	5154	2633	913	0.079	0.782
7.82	298.68	1.00	132.0	Shale	71	Normal	94	Closed	Yes	210	1848	1017	547	0.068	1.575	127.6	4009	2004	0.776	0.76	5308	2719	915	0.072	0.786
8.00	298.50	0.18	132.0	Shale	71	Normal	94	Closed	Yes	38	1886	1037	555	0.067	1.562	127.4	4003	2002	0.799	0.75	5335	2734	917	0.072	0.787
8.82	297.68	0.82	132.0	Shale	71	Normal	94	Closed	Yes	172	2058	1132	592	0.064	1.513	126.6	3977	1989	0.766	0.73	5455	2801	933	0.069	0.791
9.82	296.68	1.00	132.0	Shale	71	Fractured	16	Closed	Yes	49	2108	1159	637	0.062	1.334	125.6	3946	1973	0.768	0.71	5595	2880	959	0.066	0.795
10.00	296.50	0.18	132.0	Shale	71	Fractured	16	Closed	Yes	9	2116	1164	645	0.061	1.307	125.4	3940	1970	0.779	0.70	5619	2893	964	0.066	0.796
11.42	295.08	1.42	132.0	Shale	71	Fractured	16	Closed	Yes	70	2186	1202	710	0.060	1.133	124.0	3896	1948	0.804	0.67	5810	3001	1010	0.064	0.803
12.42	294.08	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2390	1315	754	0.059	1.145	124.0	3896	1948	0.789	0.65	5981	3095	1044	0.064	0.814
13.42	293.08	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2594	1427	798	0.059	1.157	124.0	3896	1948	0.796	0.63	6152	3189	1079	0.064	0.826
14.42	292.08	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2798	1539	842	0.059	1.169	124.0	3896	1948	0.804	0.62	6323	3283	1115	0.064	0.838
15.02	291.48	0.60	124.0	Shale	71	Normal	35	Closed	Yes	122	2920	1606	869	0.059	1.176	124.0	3896	1948	0.831	0.61	6427	3340	1138	0.064	0.845
16.02	290.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3124	1718	913	0.060	1.188	124.0	3896	1948	0.816	0.59	6599	3435	1176	0.064	0.858
17.02	289.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3327	1830	958	0.060	1.199	124.0	3896	1948	0.824	0.58	6773	3530	1215	0.065	0.871
18.02	288.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3531	1942	1003	0.061	1.209	124.0	3896	1948	0.831	0.56	6949	3627	1254	0.066	0.884
19.02	287.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3735	2054	1049	0.062	1.219	124.0	3896	1948	0.839	0.55	7126	3725	1294	0.067	0.898
20.02	286.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3939	2166	1094	0.063	1.229	124.0	3896	1948	0.846	0.53	7304	3822	1334	0.068	0.912
21.02	285.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4142	2278	1140	0.064	1.239	124.0	3896	1948	0.843	0.52	7485	3922	1374	0.069	0.926
22.02	284.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4346	2390	1185	0.065	1.248	124.0	3896	1948	0.862	0.51	7667	4022	1414	0.070	0.940
23.02	283.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4550	2502	1231	0.066	1.258										
24.02	282.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4753	2614	1277	0.067	1.267										
25.02	281.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	4957	2726	1324	0.069	1.276										
26.02	280.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5161	2839	1370	0.070	1.284										
27.02	279.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5365	2951	1416	0.072	1.293										
28.02	278.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5568	3063	1463	0.073	1.302										
29.02	277.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5772	3175	1510	0.075	1.311										
30.02	276.48	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	5976	3287	1556	0.076	1.319										

Drilled Shaft Design Table for Pier #8 SB-12/14

Estimated Top of Rock Elevation: 306.50

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
1.2	305.3	1331	666	TIP	--	--	0.624
2.2	304.3	1620	841	SIDE + TIP	406	0.036	0.404
3.2	303.3	1627	844	SIDE + TIP	497	0.051	0.369
4.2	302.3	1656	860	SIDE + TIP	590	0.061	0.330
5.2	301.3	1695	880	SIDE + TIP	693	0.068	0.290
5.82	300.68	1722	895	SIDE + TIP	766	0.073	0.265
6	300.5	1731	900	SIDE + TIP	790	0.074	0.257
6.82	299.68	5154	2633	SIDE + TIP	913	0.079	0.782
7.82	298.68	5308	2719	SIDE + TIP	915	0.072	0.786
8	298.5	5335	2734	SIDE + TIP	917	0.072	0.787
8.82	297.68	5455	2801	SIDE + TIP	933	0.069	0.791
9.82	296.68	5595	2880	SIDE + TIP	959	0.066	0.795
10	296.5	5619	2893	SIDE + TIP	964	0.066	0.796
11.42	295.08	5810	3001	SIDE + TIP	1010	0.064	0.803
12.42	294.08	5981	3095	SIDE + TIP	1044	0.064	0.814
13.42	293.08	6152	3189	SIDE + TIP	1079	0.064	0.826
14.42	292.08	6323	3283	SIDE + TIP	1115	0.064	0.838
15.02	291.48	6427	3340	SIDE + TIP	1138	0.064	0.845
16.02	290.48	6599	3435	SIDE + TIP	1176	0.064	0.858
17.02	289.48	6773	3530	SIDE + TIP	1215	0.065	0.871
18.02	288.48	6949	3627	SIDE + TIP	1254	0.066	0.884
19.02	287.48	7126	3725	SIDE + TIP	1294	0.067	0.898
20.02	286.48	7304	3822	SIDE + TIP	1334	0.068	0.912
21.02	285.48	7485	3922	SIDE + TIP	1374	0.069	0.926
22.02	284.48	7667	4022	SIDE + TIP	1414	0.070	0.940
23.02	283.48	4550	2502	SIDE	1231	0.066	1.258
24.02	282.48	4753	2614	SIDE	1277	0.067	1.267
25.02	281.48	4957	2726	SIDE	1324	0.069	1.276
26.02	280.48	5161	2839	SIDE	1370	0.070	1.284
27.02	279.48	5365	2951	SIDE	1416	0.072	1.293
28.02	278.48	5568	3063	SIDE	1463	0.073	1.302
29.02	277.48	5772	3175	SIDE	1510	0.075	1.311
30.02	276.48	5976	3287	SIDE	1556	0.076	1.319
60 in. Diameter Drilled Shaft							
1.2	305.3	2092	1046	TIP	--	--	0.665
2.2	304.3	2309	1192	SIDE + TIP	511	0.034	0.449
3.2	303.3	2317	1196	SIDE + TIP	645	0.052	0.411
4.2	302.3	2357	1217	SIDE + TIP	776	0.064	0.372
5.2	301.3	2410	1245	SIDE + TIP	916	0.074	0.331
5.82	300.68	2446	1264	SIDE + TIP	1013	0.079	0.305
6	300.5	2457	1270	SIDE + TIP	1043	0.081	0.298
6.82	299.68	2507	1297	SIDE + TIP	1199	0.087	0.263
7.82	298.68	7848	4005	SIDE + TIP	1198	0.080	0.957
8	298.5	7881	4024	SIDE + TIP	1201	0.079	0.958
8.82	297.68	8029	4106	SIDE + TIP	1218	0.075	0.961
9.82	296.68	8201	4203	SIDE + TIP	1250	0.073	0.965
10	296.5	8232	4220	SIDE + TIP	1257	0.072	0.966
11.42	295.08	8467	4352	SIDE + TIP	1314	0.071	0.972
12.42	294.08	8675	4467	SIDE + TIP	1355	0.070	0.983
13.42	293.08	8882	4581	SIDE + TIP	1399	0.070	0.994
14.42	292.08	9089	4695	SIDE + TIP	1444	0.070	1.005
15.02	291.48	9214	4763	SIDE + TIP	1472	0.070	1.012
16.02	290.48	9422	4878	SIDE + TIP	1520	0.070	1.023
17.02	289.48	9631	4993	SIDE + TIP	1569	0.071	1.035
18.02	288.48	9841	5108	SIDE + TIP	1618	0.071	1.047
19.02	287.48	10052	5224	SIDE + TIP	1668	0.072	1.059
20.02	286.48	10264	5341	SIDE + TIP	1718	0.073	1.072
21.02	285.48	5178	2848	SIDE	1408	0.068	1.530
22.02	284.48	5433	2988	SIDE	1464	0.069	1.541
23.02	283.48	5687	3128	SIDE	1520	0.070	1.551
24.02	282.48	5942	3268	SIDE	1576	0.071	1.561
25.02	281.48	6197	3408	SIDE	1633	0.073	1.570
26.02	280.48	6451	3548	SIDE	1690	0.074	1.580
27.02	279.48	6706	3688	SIDE	1746	0.075	1.589
28.02	278.48	6961	3828	SIDE	1804	0.076	1.598
29.02	277.48	7215	3968	SIDE	1861	0.078	1.606
30.02	276.48	7470	4108	SIDE	1918	0.079	1.615
72 in. Diameter Drilled Shaft							
1.2	305.3	3006	1503	TIP	--	--	0.757
2.2	304.3	3113	1601	SIDE + TIP	604	0.030	0.491
3.2	303.3	3131	1609	SIDE + TIP	790	0.052	0.453
4.2	302.3	3185	1638	SIDE + TIP	964	0.066	0.414
5.2	301.3	3254	1674	SIDE + TIP	1145	0.078	0.374
5.82	300.68	3300	1698	SIDE + TIP	1267	0.084	0.348
6	300.5	3313	1705	SIDE + TIP	1305	0.086	0.341

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 097-0080/097-0081
SUBSTRUCTURE & REFERENCE BORING ====== East Abutment SB-25/26/12
GROUND SURFACE ELEVATION ========== 390.00 FT
GROUND WATER ELEVATION ========== 357.90 FT
ESTIMATED TOP OF ROCK ELEVATION ======== 301.41 FT
DRILLED SHAFT DIAMETER IN ROCK ========= 48 IN.
FACTORED AXIAL LOAD ========== 3505 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ==== 3.5 KSI

FOUNDATION REDUNDANCY ==== REDUNDANT

Drilled Shaft Dia.'s for Design Table

48	IN.
60	IN,
72	IN.
84	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
0.62	300.79	0.62	124.0	Shale	46	Normal	100	Closed	Yes	126	126	69	0	0.000	4.009	128.6	1109	555	0.222	1.00	1109	555	0	0.000	0.199
1.73	299.68	1.11	124.0	Shale	71	Normal	100	Closed	Yes	226	352	194	70	0.009	1.756	128.6	2195	1097	0.399	0.94	2343	1179	122	0.009	0.399
2.73	298.68	1.00	132.0	Shale	71	Normal	94	Closed	Yes	210	563	309	112	0.014	1.587	127.6	2198	1099	0.404	0.90	2449	1237	188	0.014	0.404
3.73	297.68	1.00	132.0	Shale	71	Normal	94	Closed	Yes	210	773	425	155	0.017	1.524	126.6	2201	1100	0.408	0.86	2555	1295	247	0.017	0.410
4.73	296.68	1.00	132.0	Shale	71	Fractured	16	Closed	Yes	49	822	452	197	0.019	1.190	125.6	2203	1102	0.413	0.83	2661	1353	302	0.020	0.416
6.00	295.41	1.27	132.0	Shale	71	Fractured	16	Closed	Yes	62	885	487	252	0.022	0.939	124.3	2206	1103	0.419	0.79	2796	1427	369	0.023	0.423
6.33	295.08	0.33	132.0	Shale	71	Fractured	16	Closed	Yes	16	901	495	266	0.023	0.892	124.0	3896	1948	0.743	0.81	4769	2430	386	0.024	0.743
7.33	294.08	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	1105	608	308	0.024	0.963	124.0	3896	1948	0.728	0.79	4949	2527	434	0.025	0.758
8.00	293.41	0.67	124.0	Shale	71	Normal	35	Closed	Yes	137	1241	683	336	0.025	1.002	124.0	3896	1948	0.778	0.77	5050	2583	466	0.027	0.764
9.00	292.41	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	1445	795	378	0.027	1.048	124.0	3896	1948	0.752	0.75	5201	2666	512	0.028	0.774
10.00	291.41	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	1649	907	421	0.028	1.086	124.0	3896	1948	0.770	0.73	5353	2749	559	0.030	0.785
10.91	290.50	0.91	124.0	Shale	71	Normal	35	Closed	Yes	185	1834	1009	459	0.030	1.114	124.0	3896	1948	0.755	0.71	5493	2826	601	0.031	0.794
11.91	289.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2038	1121	502	0.031	1.140	124.0	3896	1948	0.785	0.69	5649	2912	646	0.033	0.805
12.91	288.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2241	1233	545	0.033	1.163	124.0	3896	1948	0.781	0.67	5806	2999	692	0.035	0.816
13.91	287.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2445	1345	588	0.034	1.183										
14.91	286.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2649	1457	632	0.035	1.200										
15.91	285.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	2853	1569	675	0.037	1.215										
16.91	284.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3056	1681	719	0.038	1.229										
17.91	283.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3260	1793	763	0.040	1.242										
18.91	282.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3464	1905	807	0.041	1.254										
19.91	281.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3668	2017	852	0.043	1.265										
20.91	280.50	1.00	124.0	Shale	71	Normal	35	Closed	Yes	204	3871	2129	896	0.044	1.276										

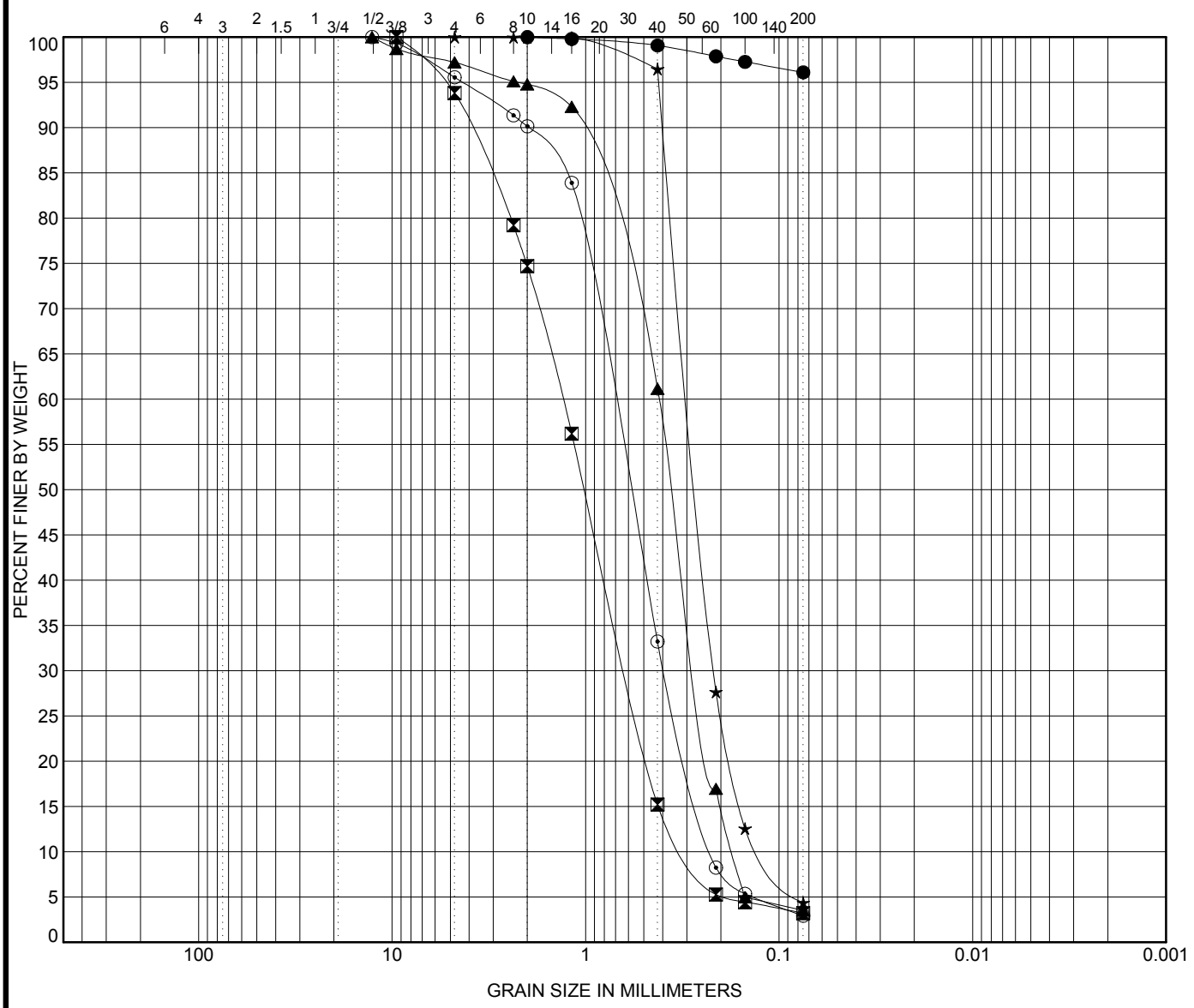
Drilled Shaft Design Table for East Abutment SB-25/26/12

Estimated Top of Rock Elevation: 301.41

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
48 in. Diameter Drilled Shaft							
0.62	300.79	1109	555	TIP	--	--	0.222
1.73	299.68	2343	1179	SIDE + TIP	122	0.009	0.399
2.73	298.68	2449	1237	SIDE + TIP	188	0.014	0.404
3.73	297.68	2555	1295	SIDE + TIP	247	0.017	0.410
4.73	296.68	2661	1353	SIDE + TIP	302	0.020	0.416
6	295.41	2796	1427	SIDE + TIP	369	0.023	0.423
6.33	295.08	4769	2430	SIDE + TIP	386	0.024	0.743
7.33	294.08	4949	2527	SIDE + TIP	434	0.025	0.758
8	293.41	5050	2583	SIDE + TIP	466	0.027	0.764
9	292.41	5201	2666	SIDE + TIP	512	0.028	0.774
10	291.41	5353	2749	SIDE + TIP	559	0.030	0.785
10.91	290.5	5493	2826	SIDE + TIP	601	0.031	0.794
11.91	289.5	5649	2912	SIDE + TIP	646	0.033	0.805
12.91	288.5	5806	2999	SIDE + TIP	692	0.035	0.816
13.91	287.5	2445	1345	SIDE	588	0.034	1.183
14.91	286.5	2649	1457	SIDE	632	0.035	1.200
15.91	285.5	2853	1569	SIDE	675	0.037	1.215
16.91	284.5	3056	1681	SIDE	719	0.038	1.229
17.91	283.5	3260	1793	SIDE	763	0.040	1.242
18.91	282.5	3464	1905	SIDE	807	0.041	1.254
19.91	281.5	3668	2017	SIDE	852	0.043	1.265
20.91	280.5	3871	2129	SIDE	896	0.044	1.276
60 in. Diameter Drilled Shaft							
0.62	300.79	1725	863	TIP	--	--	0.276
1.73	299.68	3597	1808	SIDE + TIP	144	0.008	0.494
2.73	298.68	3734	1883	SIDE + TIP	237	0.014	0.500
3.73	297.68	3871	1958	SIDE + TIP	316	0.018	0.506
4.73	296.68	4008	2033	SIDE + TIP	389	0.022	0.512
6	295.41	4182	2128	SIDE + TIP	476	0.025	0.520
6.33	295.08	4227	2152	SIDE + TIP	498	0.026	0.522
7.33	294.08	4380	2235	SIDE + TIP	561	0.028	0.531
8	293.41	7525	3834	SIDE + TIP	602	0.029	0.936
9	292.41	7710	3936	SIDE + TIP	662	0.031	0.946
10	291.41	7897	4039	SIDE + TIP	722	0.033	0.955
10.91	290.5	8069	4134	SIDE + TIP	775	0.034	0.964
11.91	289.5	2547	1401	SIDE	624	0.034	1.418
12.91	288.5	2802	1541	SIDE	677	0.036	1.446
13.91	287.5	3056	1681	SIDE	730	0.037	1.470
14.91	286.5	3311	1821	SIDE	783	0.039	1.491
15.91	285.5	3566	1961	SIDE	837	0.040	1.510
16.91	284.5	3821	2101	SIDE	891	0.041	1.526
17.91	283.5	4075	2241	SIDE	945	0.043	1.541
18.91	282.5	4330	2381	SIDE	999	0.044	1.555
19.91	281.5	4585	2522	SIDE	1054	0.046	1.568
20.91	280.5	4839	2662	SIDE	1109	0.047	1.580
72 in. Diameter Drilled Shaft							
0.62	300.79	2477	1238	TIP	--	--	0.296
1.73	299.68	5119	2571	SIDE + TIP	157	0.006	0.589
2.73	298.68	5289	2663	SIDE + TIP	281	0.014	0.596
3.73	297.68	5459	2756	SIDE + TIP	383	0.019	0.603
4.73	296.68	5628	2848	SIDE + TIP	476	0.022	0.609
6	295.41	5844	2966	SIDE + TIP	586	0.026	0.618
6.33	295.08	5900	2997	SIDE + TIP	613	0.027	0.620
7.33	294.08	6088	3098	SIDE + TIP	691	0.030	0.630
8	293.41	6214	3167	SIDE + TIP	742	0.031	0.636
9	292.41	2167	1192	SIDE	563	0.032	1.557
10	291.41	2473	1360	SIDE	625	0.034	1.613
10.91	290.5	2751	1513	SIDE	682	0.035	1.655
11.91	289.5	3057	1681	SIDE	745	0.037	1.694
12.91	288.5	3362	1849	SIDE	808	0.038	1.728
13.91	287.5	3668	2017	SIDE	871	0.040	1.756
14.91	286.5	3973	2185	SIDE	935	0.042	1.781
15.91	285.5	4279	2353	SIDE	999	0.043	1.804
16.91	284.5	4585	2522	SIDE	1063	0.044	1.823
17.91	283.5	4890	2690	SIDE	1127	0.046	1.841
18.91	282.5	5196	2858	SIDE	1191	0.047	1.857
19.91	281.5	5502	3026	SIDE	1256	0.049	1.872
20.91	280.5	5807	3194	SIDE	1321	0.050	1.885
84 in. Diameter Drilled Shaft							
0.62	300.79	3364	1682	TIP	--	--	0.384
1.73	299.68	6907	3467	SIDE + TIP	160	0.004	0.685
2.73	298.68	7113	3579	SIDE + TIP	320	0.013	0.692
3.73	297.68	7318	3690	SIDE + TIP	447	0.019	0.699
4.73	296.68	7522	3801	SIDE + TIP	561	0.023	0.706
6	295.41	7782	3943	SIDE + TIP	695	0.028	0.716

EXHIBIT J

LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-11**	**3.50**	**A-7-6 (45)**	**69.4**	**29.2**	**40.2**		
⊠	**SB-11**	**11.00**	**SAND**				**0.97**	**4.46**
▲	**SB-11**	**18.50**	**SAND**				**0.94**	**2.41**
★	**SB-11**	**26.00**	**SAND**				**1.33**	**2.43**
⊙	**SB-11**	**31.00**	**SAND**				**0.93**	**3.27**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-11**	**3.50**	**2**				**0.0**	**3.9**	**96.1**	
⊠	**SB-11**	**11.00**	**9.5**	**1.316**	**0.614**	**0.295**	**6.2**	**90.6**	**3.2**	
▲	**SB-11**	**18.50**	**12.7**	**0.417**	**0.26**	**0.173**	**2.8**	**93.7**	**3.5**	
★	**SB-11**	**26.00**	**4.75**	**0.294**	**0.217**	**0.121**	**0.0**	**95.6**	**4.4**	
⊙	**SB-11**	**31.00**	**12.7**	**0.729**	**0.389**	**0.223**	**4.4**	**92.6**	**2.9**	

Illinois Department of Transportation
Division of Highways
Kaskaskia Engineering

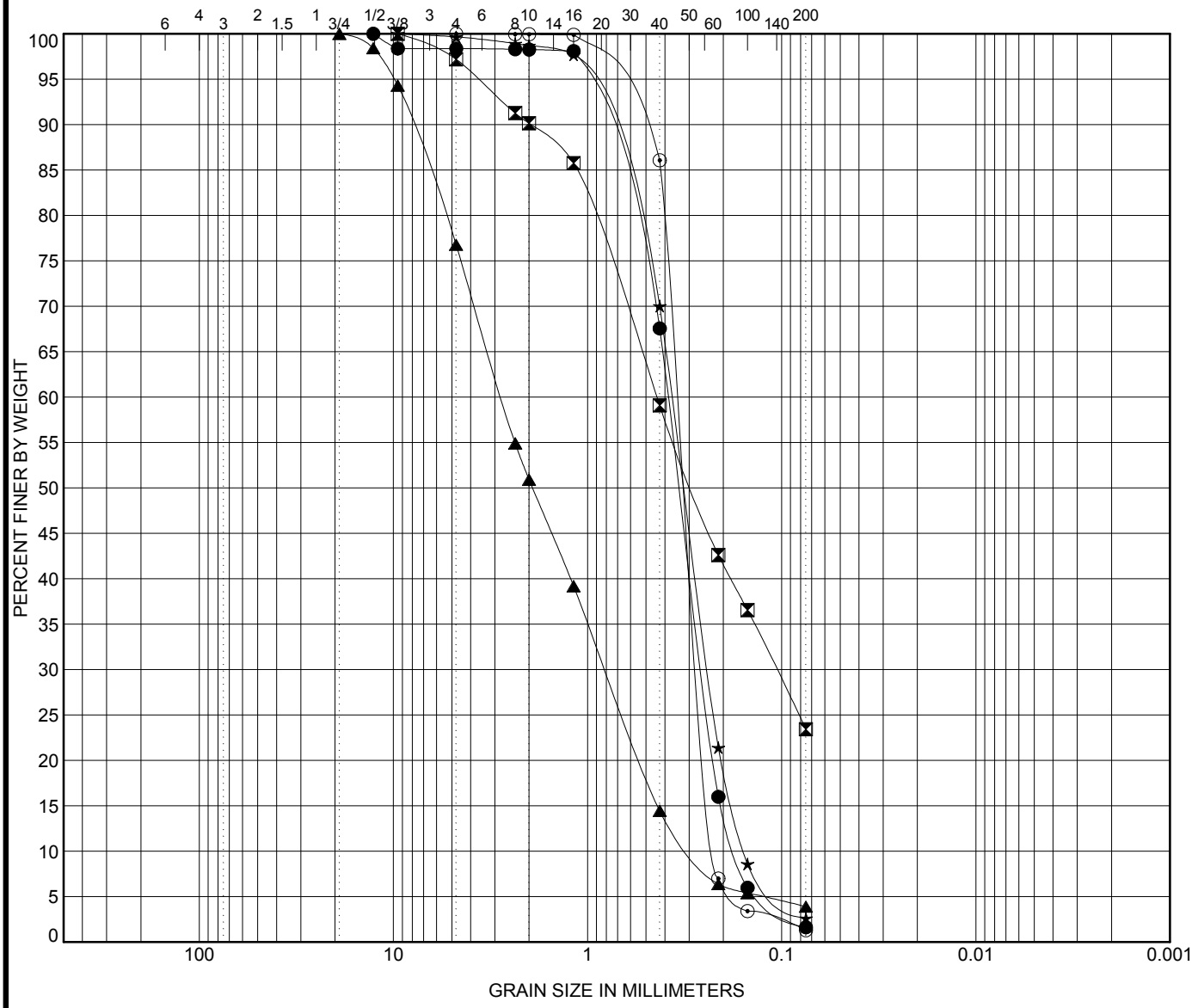
GRAIN SIZE DISTRIBUTION

Route: FAI 64

Section: (97-2)B-5

County: White, IL / Posey, IN

GRAIN_SIZE 2012-3258.50 I-64 WABASH RIVER (KEG) - SB8, SB10-12.GPJ IL_DOT.GDT 10/2/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-11	41.00	SAND				0.99	2.23
⊠	SB-12	6.00	A-2-4 (0)	25.1	20.6	4.5		
▲	SB-12	8.50	SAND				0.81	9.59
★	SB-12	18.50	SAND				1.00	2.36
⊙	SB-12	21.00	SAND				0.92	1.55

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-11	41.00	12.7	0.384	0.256	0.172	1.6	96.8	1.6	
⊠	SB-12	6.00	9.5	0.44	0.106		2.8	73.8	23.4	
▲	SB-12	8.50	19	2.778	0.808	0.29	23.2	72.9	3.9	
★	SB-12	18.50	9.5	0.368	0.24	0.156	0.3	97.0	2.6	
⊙	SB-12	21.00	4.75	0.338	0.26	0.218	0.0	98.7	1.3	

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Route: FAI 64

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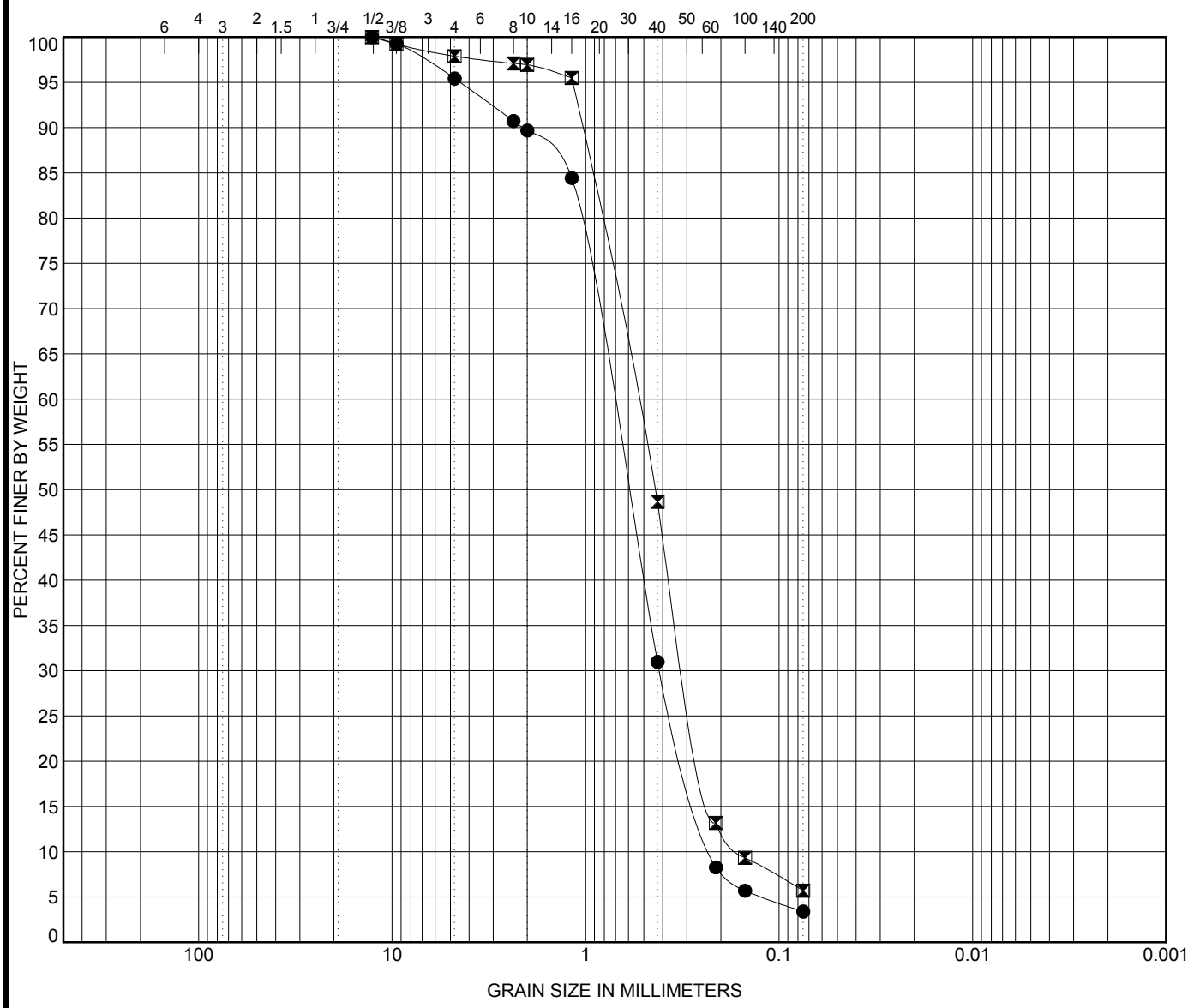
County: White, IL / Posey, IN

GRAIN_SIZE 2012-3258.50 I-64 WABASH RIVER (KEG) - SB8, SB10-12.GPJ IL_DOT.GDT 10/2/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-12**	**31.00**	**SAND**				**1.03**	**3.31**
⧓	**SB-12**	**36.00**	**SAND**				**1.00**	**3.41**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-12**	**31.00**	**12.7**	**0.74**	**0.413**	**0.224**	**4.6**	**92.0**	**3.4**	
⧓	**SB-12**	**36.00**	**12.7**	**0.544**	**0.295**	**0.159**	**2.1**	**92.2**	**5.7**	

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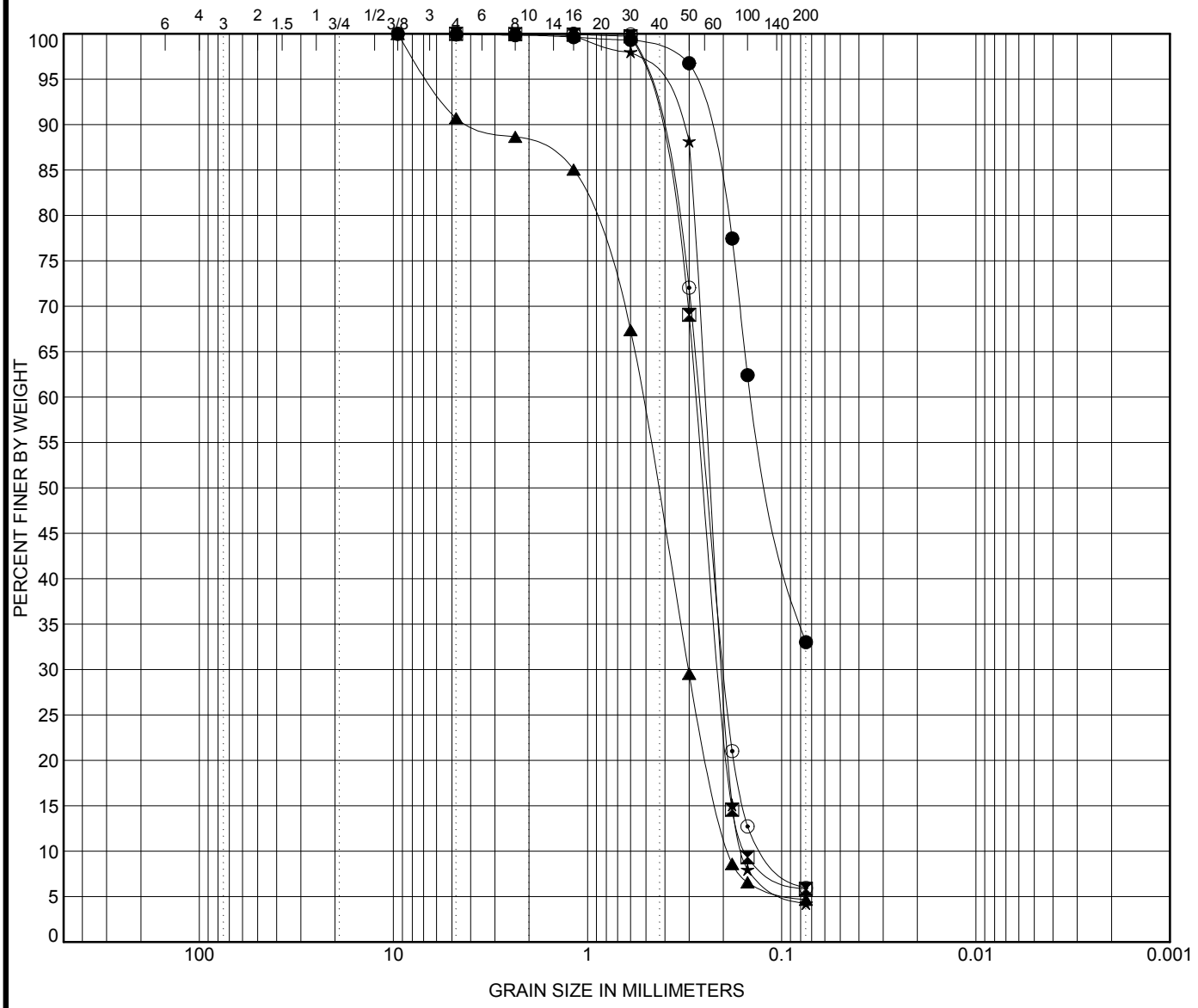
GRAIN_SIZE 2012-3258.50 I-64 WABASH RIVER (KEG) - SB8, SB10-12.GPJ IL_DOT.GDT 10/2/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-03**	**11.00**						
⊠	**SB-13**	**16.00**	**SAND**				**1.02**	**1.80**
▲	**SB-13**	**33.50**	**SAND**				**0.94**	**2.81**
★	**SB-13**	**53.50**	**SAND**				**1.03**	**1.56**
⊙	**SB-14**	**18.50**	**SAND**				**1.28**	**2.34**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-03**	**11.00**	**9.5**	**0.142**			**0.1**	**66.9**	**33.0**	
⊠	**SB-13**	**16.00**	**4.75**	**0.276**	**0.208**	**0.154**	**0.0**	**94.2**	**5.8**	
▲	**SB-13**	**33.50**	**9.5**	**0.524**	**0.302**	**0.186**	**9.3**	**86.1**	**4.7**	
★	**SB-13**	**53.50**	**4.75**	**0.246**	**0.2**	**0.158**	**0.0**	**95.8**	**4.2**	
⊙	**SB-14**	**18.50**	**1.18**	**0.266**	**0.197**	**0.113**	**0.0**	**94.1**	**5.9**	

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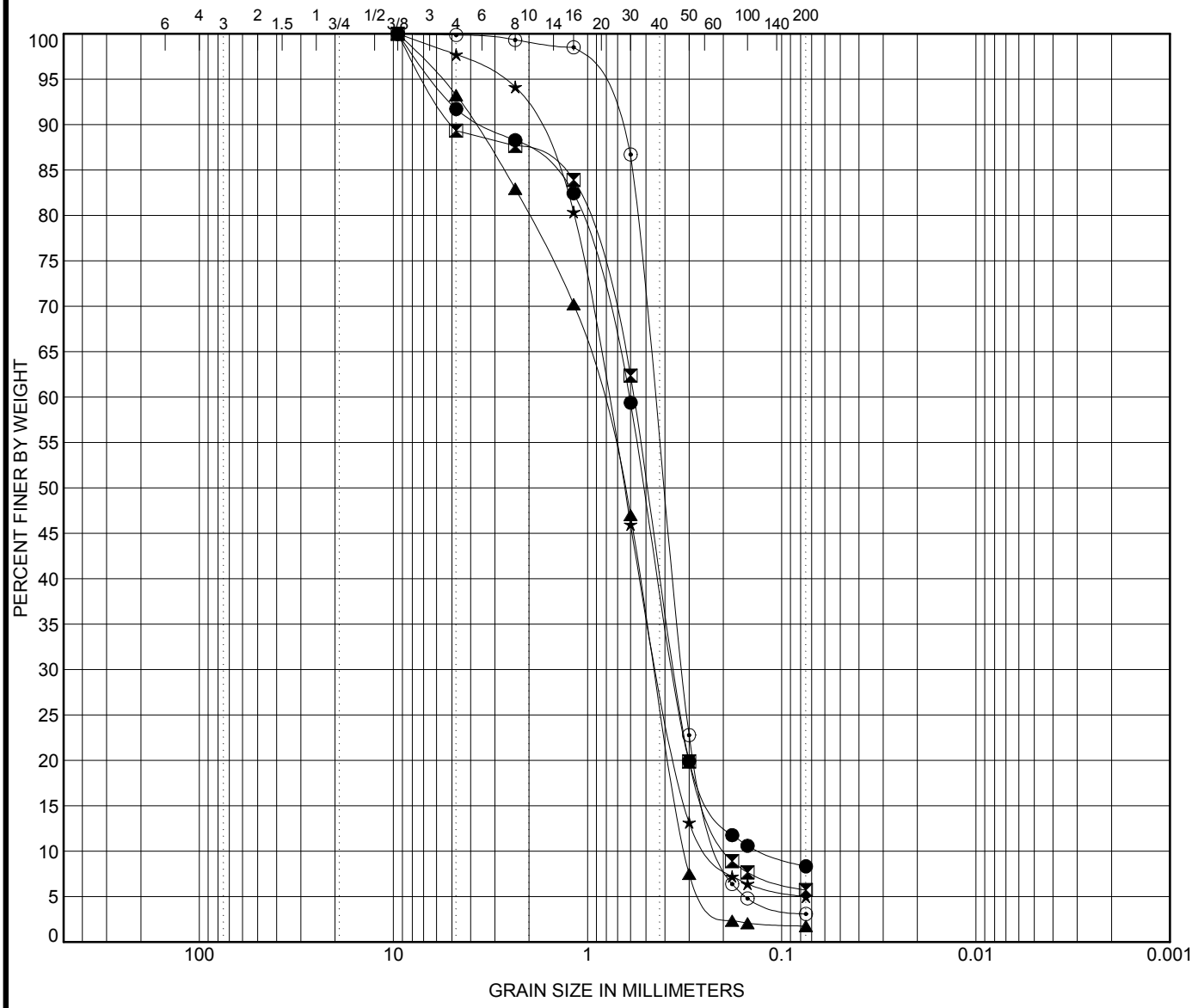

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-14**	**33.50**	**SAND**				**1.68**	**4.90**
⊠	**SB-14**	**43.50**	**SAND**				**1.15**	**3.05**
▲	**SB-15**	**18.50**	**SAND**				**0.72**	**2.80**
★	**SB-15**	**26.00**	**SAND**				**1.01**	**3.46**
⊙	**SB-15**	**53.50**	**SAND**				**1.16**	**2.23**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-14**	**33.50**	**9.5**	**0.611**	**0.358**	**0.125**	**8.3**	**83.4**	**8.3**	
⊠	**SB-14**	**43.50**	**9.5**	**0.577**	**0.354**	**0.189**	**10.7**	**83.6**	**5.7**	
▲	**SB-15**	**18.50**	**9.5**	**0.876**	**0.445**	**0.313**	**6.8**	**91.5**	**1.8**	
★	**SB-15**	**26.00**	**9.5**	**0.791**	**0.428**	**0.229**	**2.3**	**92.7**	**5.0**	
⊙	**SB-15**	**53.50**	**9.5**	**0.449**	**0.324**	**0.201**	**0.1**	**96.8**	**3.1**	

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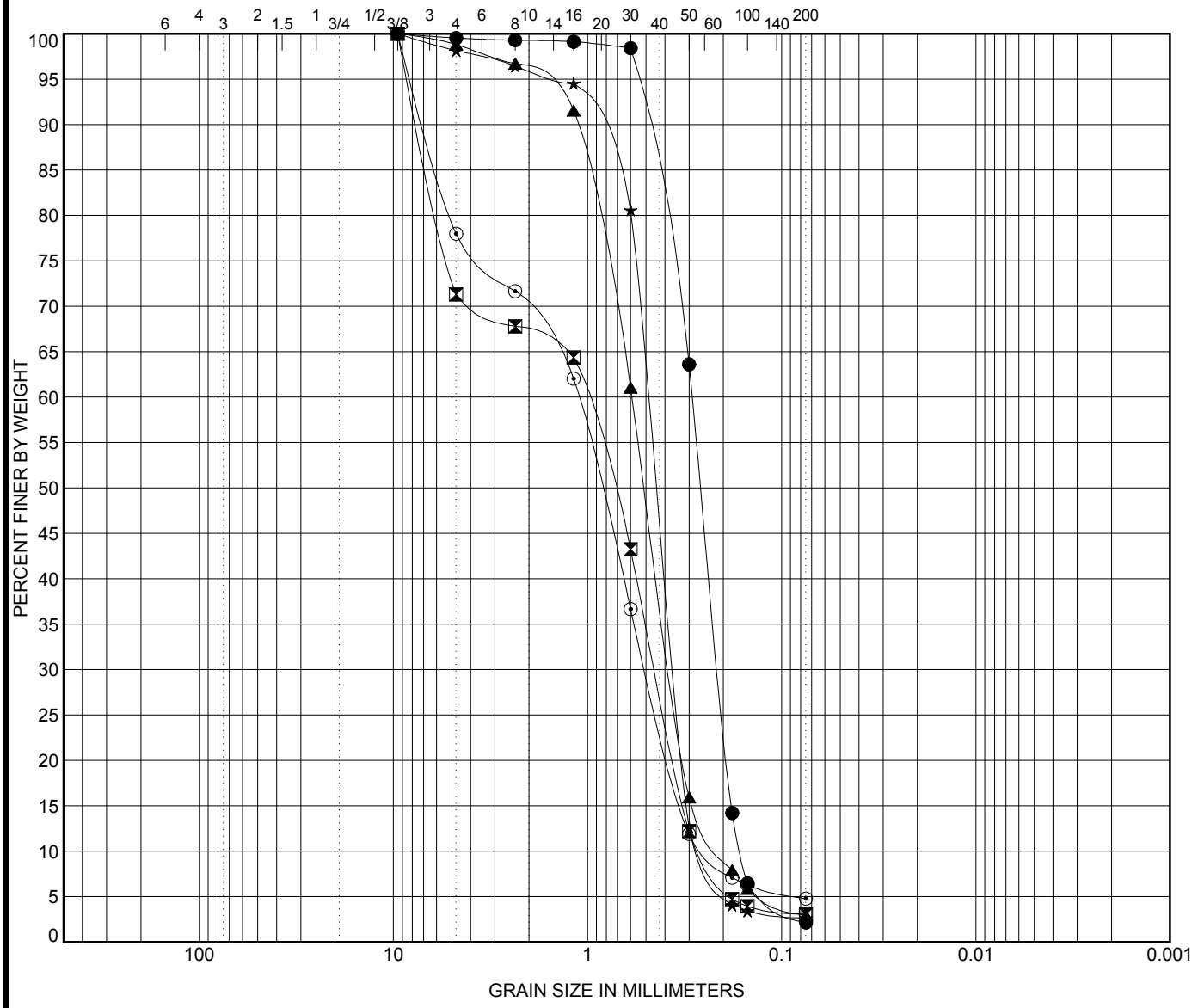

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-16	6.00	SAND				0.95	1.77
⊠	SB-16	33.50	SAND				0.75	3.98
▲	SB-16	48.50	SAND				1.14	2.87
★	SB-17	13.50	SAND				1.03	1.90
⊙	SB-17	33.50	SAND				0.90	4.56

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-16	6.00	9.5	0.289	0.212	0.163	0.5	97.4	2.2	
⊠	SB-16	33.50	9.5	1.026	0.446	0.258	28.7	68.3	3.0	
▲	SB-16	48.50	9.5	0.59	0.372	0.206	1.2	95.8	3.0	
★	SB-17	13.50	9.5	0.486	0.358	0.257	1.9	95.5	2.6	
⊙	SB-17	33.50	9.5	1.118	0.498	0.245	22.0	73.2	4.8	

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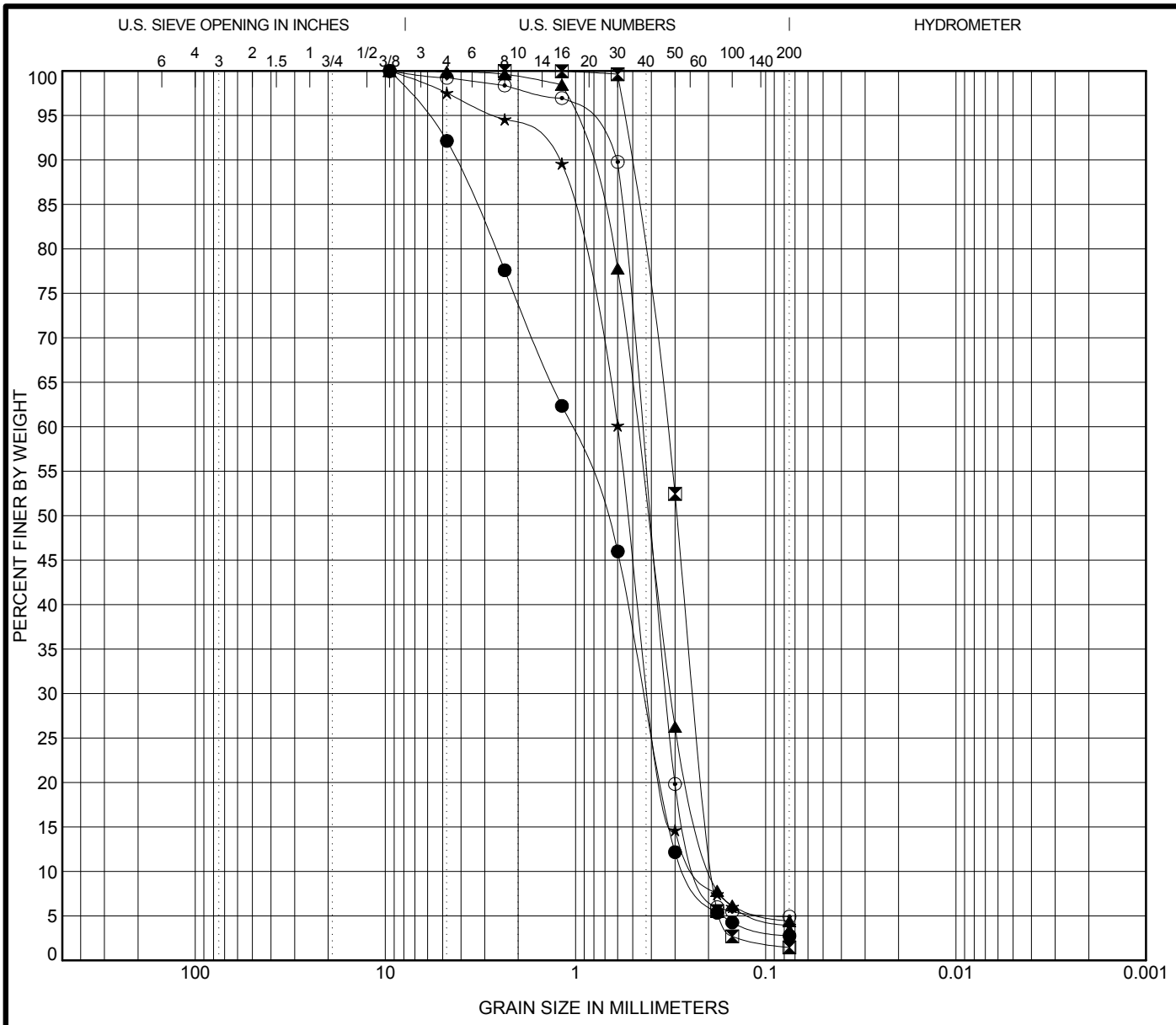

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-17	63.50	SAND				0.68	4.20
⊠	SB-18	8.50	SAND				0.87	1.77
▲	SB-18	33.50	SAND				1.10	2.47
★	SB-18	53.50	SAND				1.11	2.77
⊙	SB-19	13.50	SAND				1.18	2.14

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-17	63.50	9.5	1.071	0.432	0.255	7.9	89.4	2.8	
⊠	SB-18	8.50	2.36	0.335	0.235	0.189	0.0	98.5	1.5	
▲	SB-18	33.50	9.5	0.472	0.315	0.191	0.1	95.5	4.4	
★	SB-18	53.50	9.5	0.599	0.379	0.216	2.5	93.6	3.9	
⊙	SB-19	13.50	9.5	0.447	0.332	0.209	0.8	94.3	4.9	

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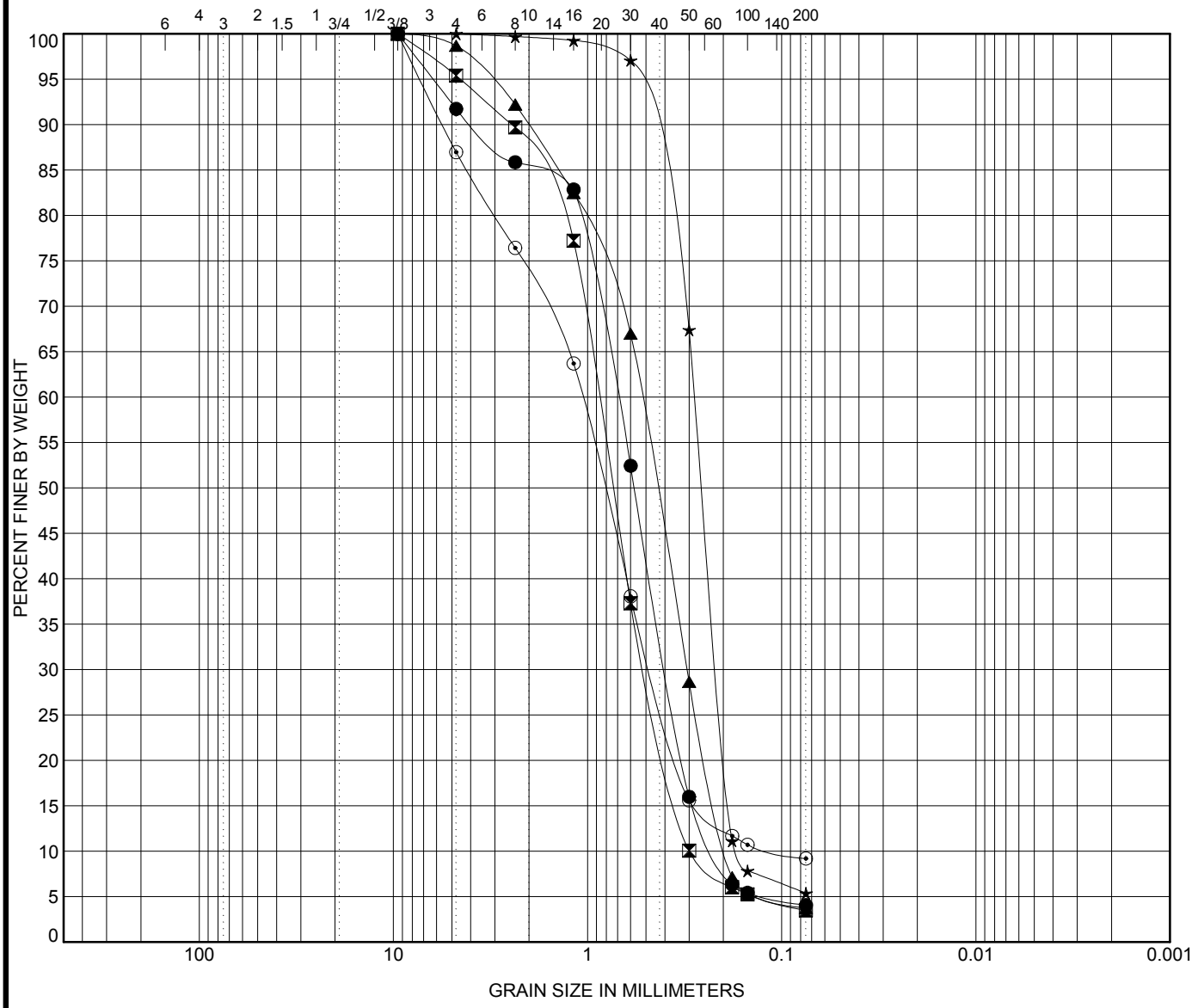

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-19	33.50	SAND				0.99	3.25
⊠	SB-19	48.50	SAND				0.95	2.96
▲	SB-20	16.00	SAND				0.93	2.74
★	SB-20	28.50	SAND				0.96	1.66
⊙	SB-20	53.50	SAND				1.88	9.86

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-19	33.50	9.5	0.71	0.392	0.218	8.3	87.7	4.1	
⊠	SB-19	48.50	9.5	0.882	0.498	0.298	4.6	91.9	3.5	
▲	SB-20	16.00	9.5	0.529	0.307	0.193	1.3	94.9	3.7	
★	SB-20	28.50	4.75	0.281	0.214	0.169	0.0	94.6	5.4	
⊙	SB-20	53.50	9.5	1.07	0.468	0.109	13.0	77.8	9.2	

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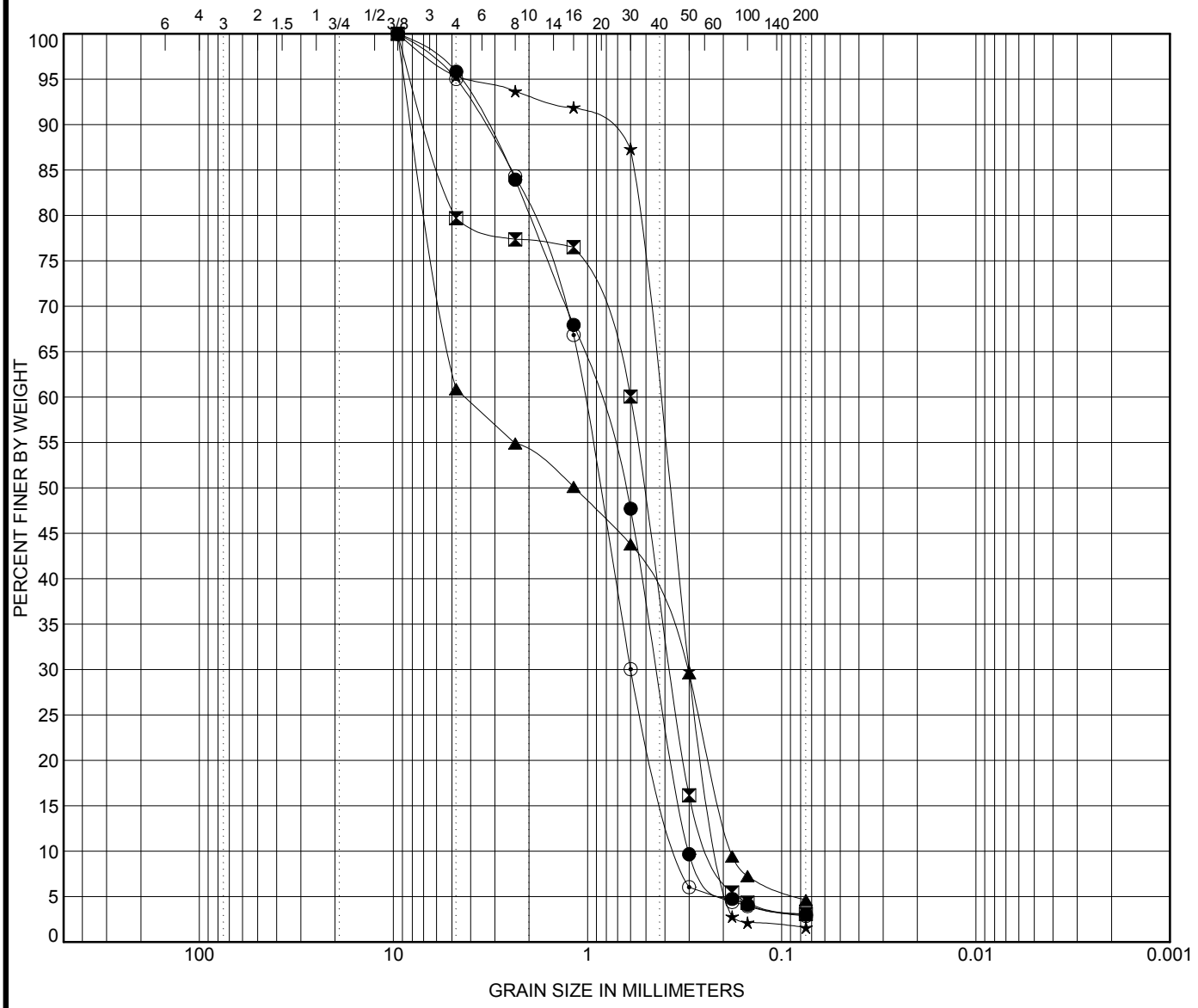

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-21	21.00	SAND				0.69	3.00
⊠	SB-21	38.50	SAND				1.04	2.68
▲	SB-21	58.50	SAND				0.12	23.46
★	SB-22	13.50	SAND				1.02	2.09
⊙	SB-22	23.50	SAND				1.03	3.09

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-21	21.00	9.5	0.905	0.435	0.302	4.2	92.8	3.0	
⊠	SB-21	38.50	9.5	0.599	0.373	0.224	20.3	76.6	3.1	
▲	SB-21	58.50	9.5	4.284	0.306	0.183	39.1	56.3	4.6	
★	SB-22	13.50	9.5	0.432	0.301	0.206	4.7	93.7	1.6	
⊙	SB-22	23.50	9.5	1.041	0.599	0.336	5.0	92.2	2.9	

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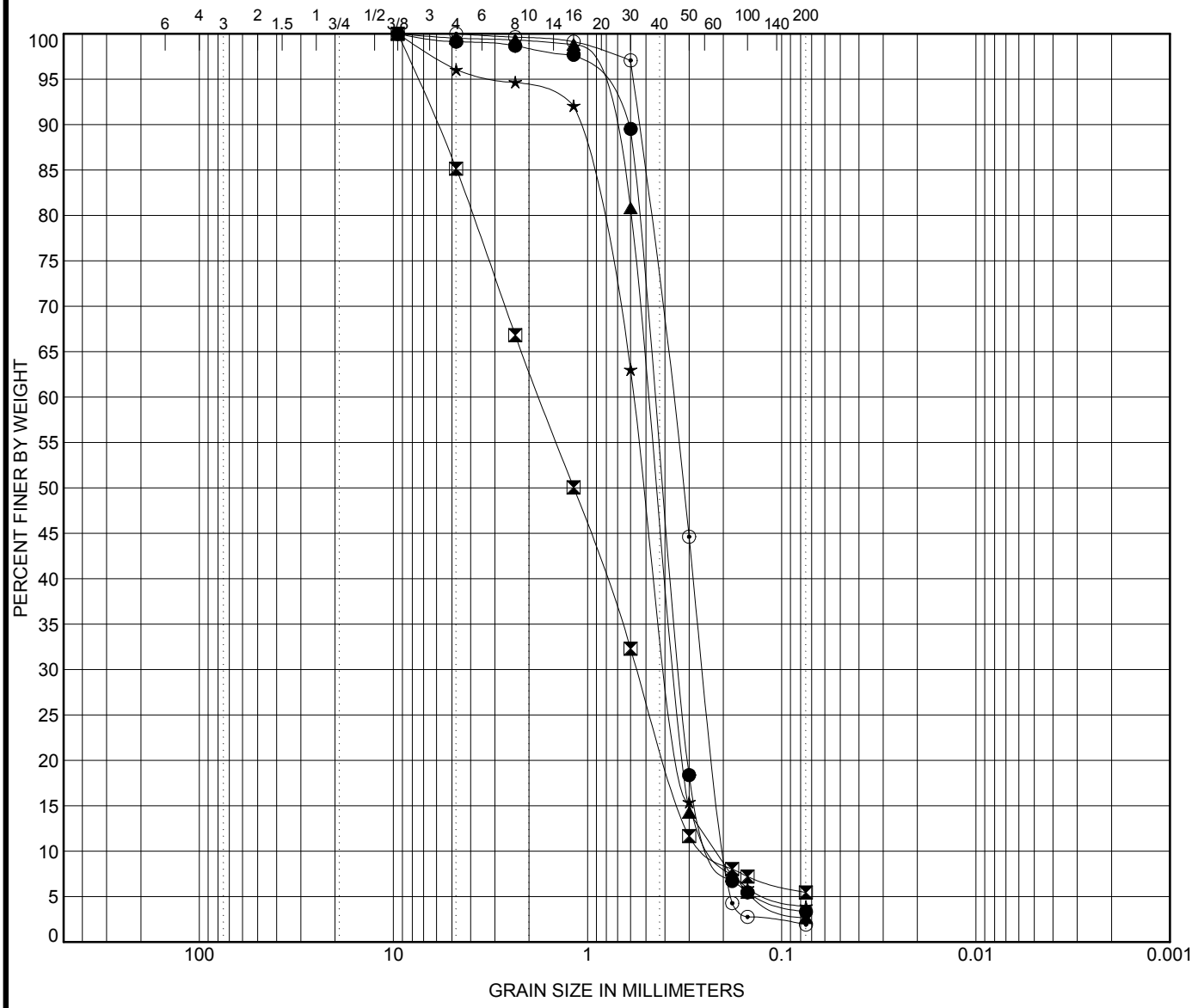

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-22**	**48.50**	**SAND**				**1.21**	**2.17**
⊠	**SB-23**	**26.00**	**SAND**				**0.73**	**7.50**
▲	**SB-23**	**43.50**	**SAND**				**1.18**	**2.20**
★	**SB-23**	**58.50**	**SAND**				**1.13**	**2.70**
⊙	**SB-24**	**11.00**	**SAND**				**0.87**	**1.90**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-22**	**48.50**	**9.5**	**0.45**	**0.336**	**0.208**	**0.9**	**95.8**	**3.3**	
⊠	**SB-23**	**26.00**	**9.5**	**1.78**	**0.555**	**0.237**	**14.8**	**79.7**	**5.5**	
▲	**SB-23**	**43.50**	**9.5**	**0.483**	**0.353**	**0.22**	**0.5**	**96.9**	**2.7**	
★	**SB-23**	**58.50**	**9.5**	**0.574**	**0.371**	**0.213**	**4.0**	**92.1**	**3.9**	
⊙	**SB-24**	**11.00**	**4.75**	**0.368**	**0.249**	**0.194**	**0.0**	**98.1**	**1.9**	

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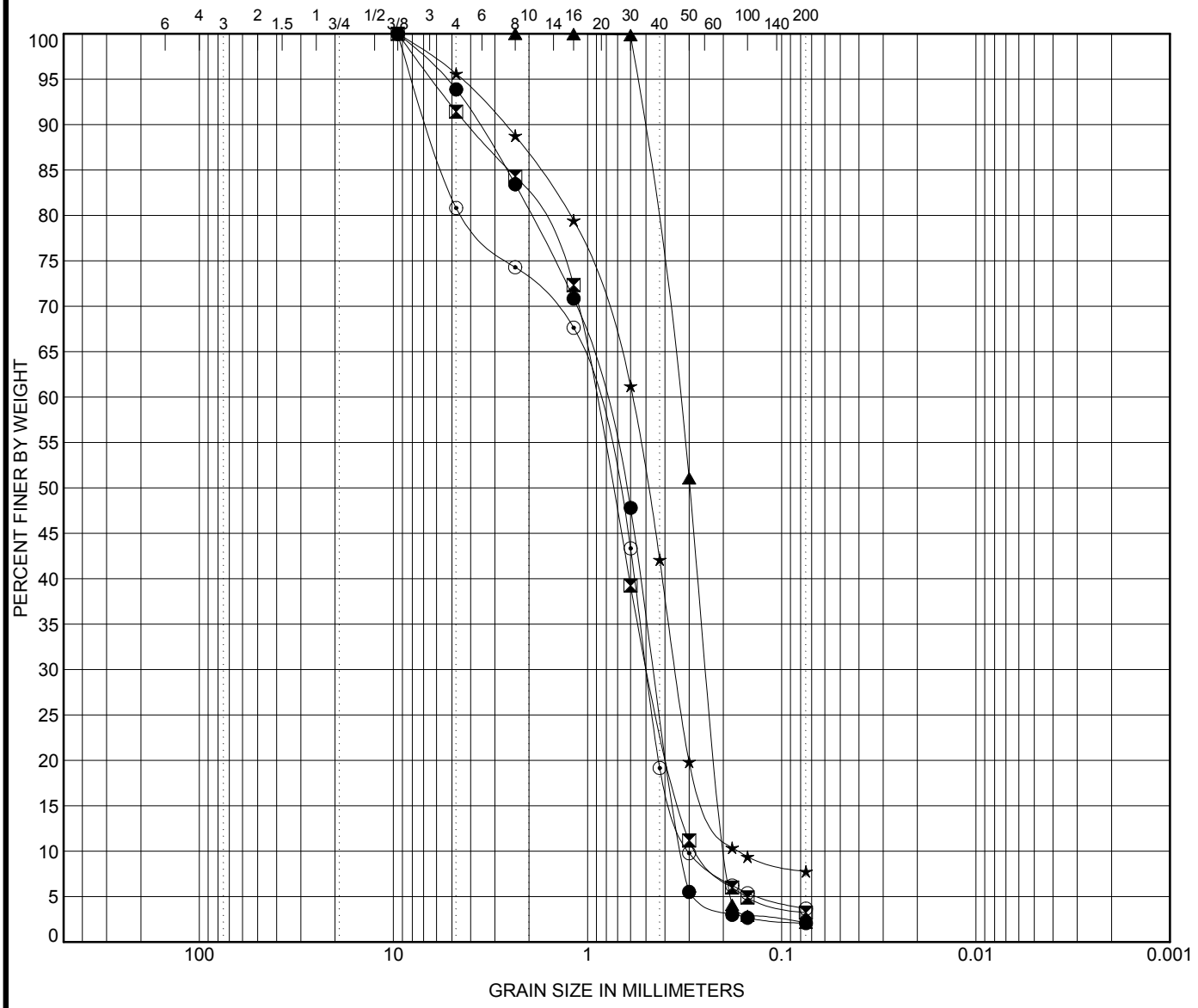

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-24	26.00	SAND				0.72	2.66
⊠	SB-24	53.50	SAND				0.93	3.44
▲	SB-25	11.00	SAND				0.87	1.77
★	SB-25	23.50	SAND				1.26	3.50
⊙	SB-25	53.50	SAND				0.85	3.15

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-24	26.00	9.5	0.858	0.448	0.323	6.1	91.8	2.1	
⊠	SB-24	53.50	9.5	0.917	0.477	0.267	8.6	88.2	3.2	
▲	SB-25	11.00	2.36	0.341	0.239	0.192	0.0	97.9	2.1	
★	SB-25	23.50	9.5	0.587	0.352	0.168	4.4	87.8	7.8	
⊙	SB-25	53.50	9.5	0.954	0.496	0.302	19.2	77.1	3.7	

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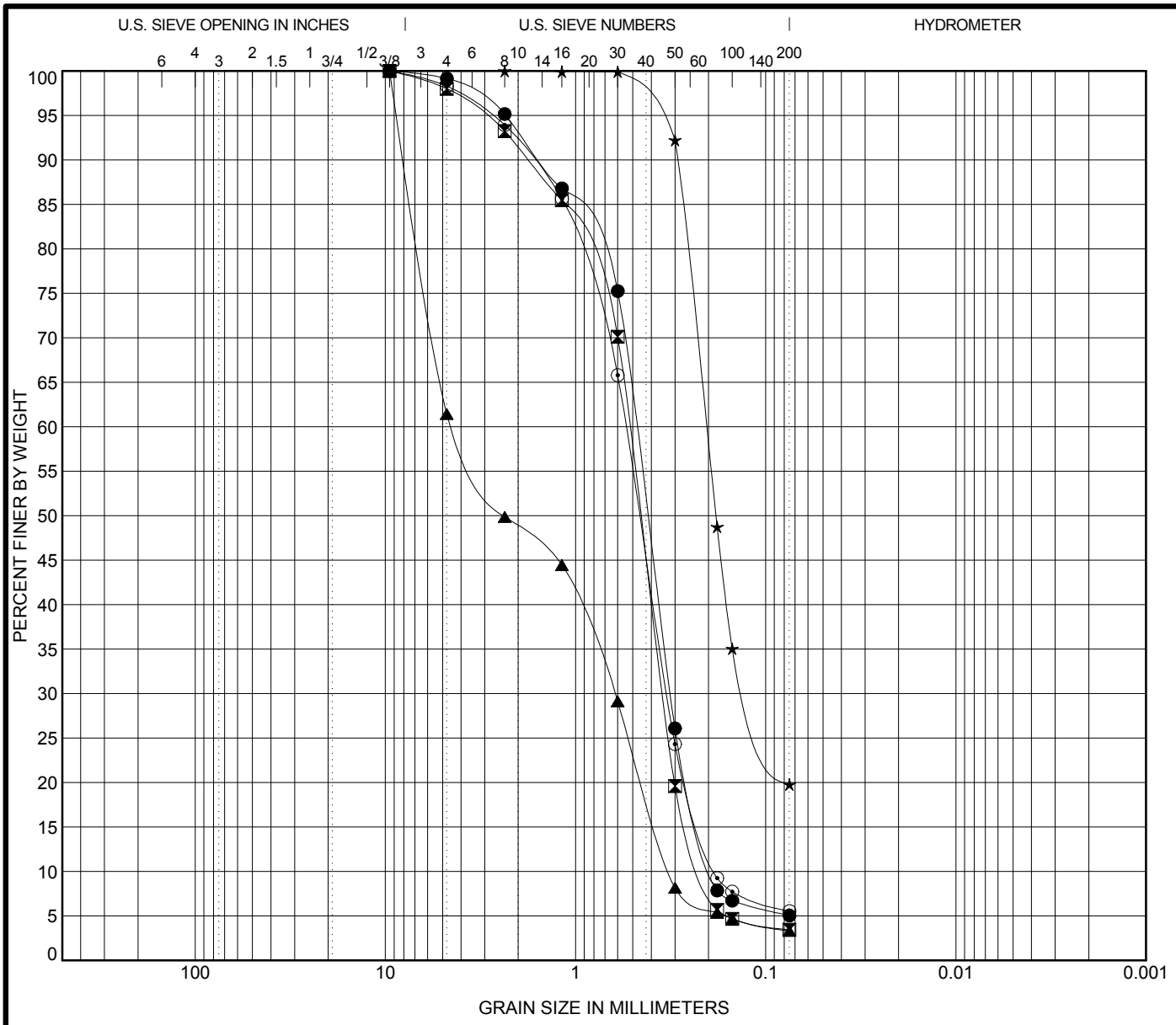

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-26**	**13.50**	**SAND**				**1.09**	**2.53**
⊠	**SB-26**	**23.50**	**SAND**				**1.09**	**2.48**
▲	**SB-26**	**53.50**	**SAND**				**0.28**	**13.66**
★	**SB-27**	**28.50**	**SAND**					
⊙	**SB-27**	**43.50**	**SAND**				**1.08**	**2.95**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-26**	**13.50**	**9.5**	**0.484**	**0.317**	**0.191**	**0.8**	**94.1**	**5.1**	
⊠	**SB-26**	**23.50**	**9.5**	**0.522**	**0.346**	**0.211**	**2.0**	**94.6**	**3.5**	
▲	**SB-26**	**53.50**	**9.5**	**4.355**	**0.623**	**0.319**	**38.6**	**58.1**	**3.3**	
★	**SB-27**	**28.50**	**2.36**	**0.205**	**0.119**		**0.0**	**80.2**	**19.8**	
⊙	**SB-27**	**43.50**	**9.5**	**0.545**	**0.33**	**0.185**	**1.7**	**92.8**	**5.5**	

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County: White, IL / Posey, IN

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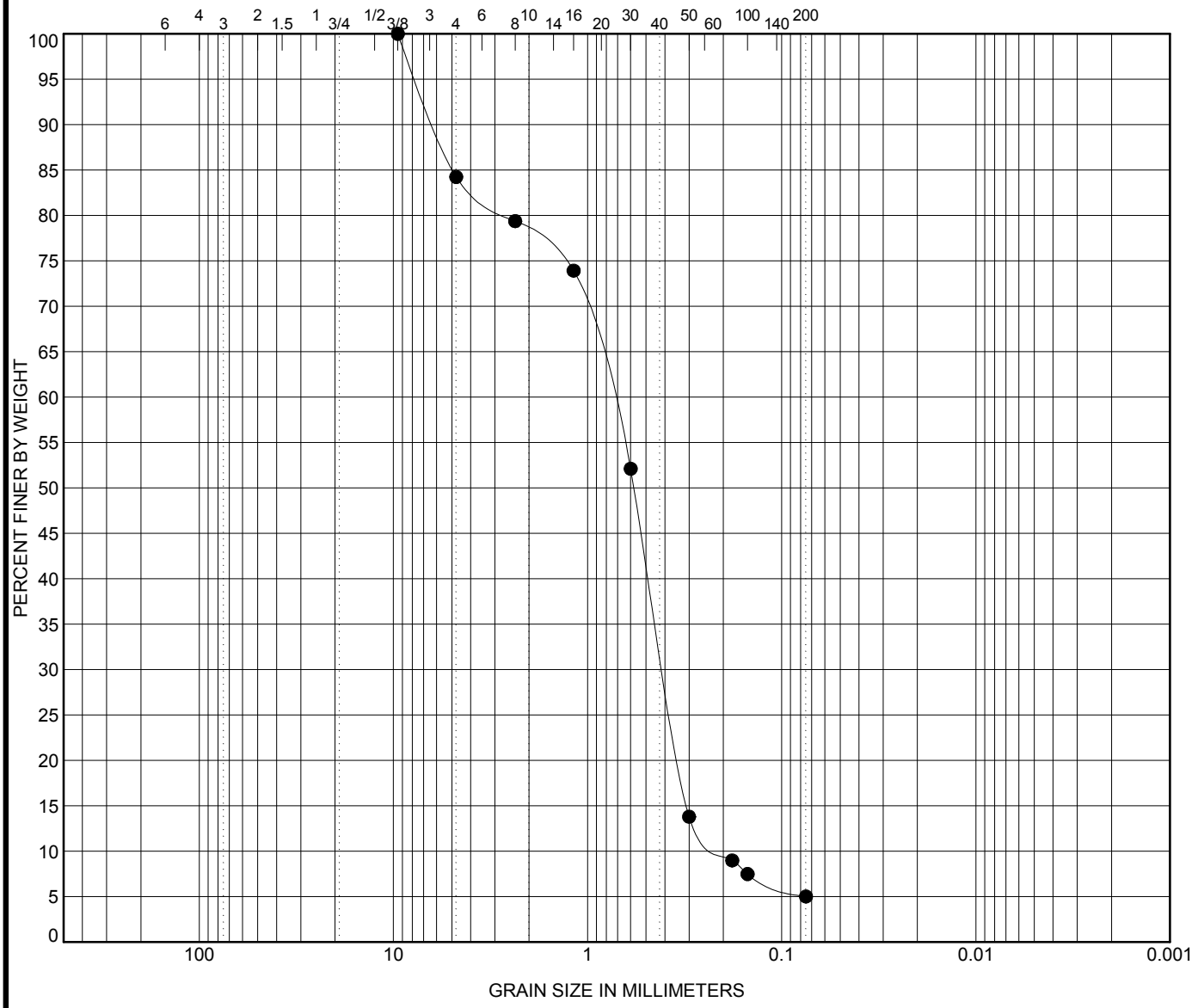

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SB-27**	**68.50**	**SAND**				**1.05**	**3.82**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**SB-27**	**68.50**	**9.5**	**0.766**	**0.402**	**0.201**	**15.8**	**79.2**	**5.0**	

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