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Structure Geotechnical Report

BRIDGE REPLACEMENT
FAP ROUTE 799 (MLK BRIDGE APPROACH)
ST. CLAIR COUNTY, ILLINOIS
PTB 172-022
CONTRACT NO. 76G39
JOB NO.: P/D-98-038-13
SECTION: 1BR-1-1
STRUCTURE NO. 082-6003 (E), 082-0374 (P)

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August 8, 2016
Revised January 20, 2017

Prepared for:
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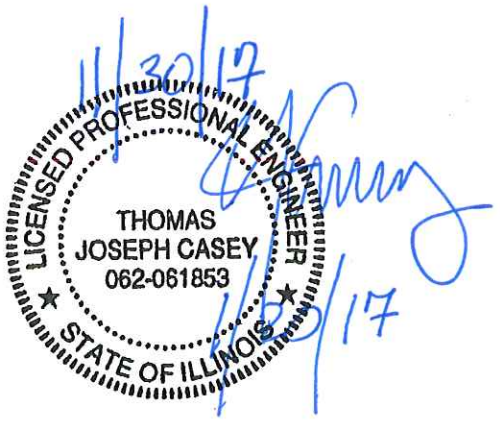
SCI No. 2014-3149.51



SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT,
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GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

January 20, 2017

Ms. Jerilyn Hassard, PE, SE
Modjeski and Masters, Inc.
4 Sunset Hills Professional Center
Edwardsville, Illinois 62025

RE: Structure Geotechnical Report
MLK Bridge Approach
F.A.P. Route 799
St. Clair County, Illinois
PTB 172-022
Contract No. 76G39
Job No.: P/D-98-038-13
Section: 1BR-1-1
Structure No: 082-6003 (E), 082-0374 (P)
SCI No.: 2014-3149.51

Dear Ms. Hassard:

Enclosed is our *Structure Geotechnical Report (SGR)* dated August 2016 and revised January 2017. This report should be read in its entirety, and our recommendations considered in the design and construction of the proposed new bridge structure. Please call if you have any questions.

Respectfully,

SCI ENGINEERING, INC.

Bronson L. Bowling, E.I.
Staff Engineer

Thomas J. Casey, P.E.
Senior Engineer

BLB/TJC/tlw

Enclosure

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1.0 PROJECT DESCRIPTION

The geotechnical study summarized in this report was performed for the proposed replacement bridge that will replace the existing Martin Luther King Bridge Approach in East St. Louis, Illinois. The new bridge will carry traffic over relocated Illinois Route 3, various railroads tracks, Missouri Avenue, and Interstates 55 and 64. For the east end of the replacement bridge structure, a retaining wall(s) will be required. The retaining wall (SN 082-W315) is discussed in a separate report. This report will discuss SN 082-0374 (P). The location of the site is shown on the *Vicinity and Topographic Map*, Figure 1.

2.0 SUBSURFACE EXPLORATION

2.1 Area Geology

The project is located approximately 0.6 miles east of the Mississippi River in the floodplain known locally as the American Bottoms. Physiographically, the project is located in the Springfield Plain, Till Plains Section, and Central Lowland Province. The soils in the immediate area were formed in alluvial sediment on bottomlands known as the Cahokia Alluvium.

The near-surface soils are of the Darwin Association and Landes-Riley Association comprised mainly of clayey alluvial sediment, loam, and sandy alluvial sediment. Underlying the Cahokia Alluvium is the Henry Formation consisting of glacial deposits of sands and gravels. The bedrock which underlies the Henry Formation was formed in the Mississippi Period, and generally consists of St. Genevieve Limestone underlain by St. Louis Limestone (*Bedrock Geology of Granite City Quadrangle, Madison and St. Clair Counties, Illinois and St. Louis County, Missouri*, Illinois State Geological Survey, 2003).

2.2 Exploration Procedures

Six (6) standard penetration test (SPT) borings were drilled for the bridge structure discussed in this report. The bridge borings designated BB-301, BB-302B, BB-303, BB-304, BB-305, and BB-306 were drilled near the proposed abutment and pier locations for SN 082-0374 (P), as shown on the *Site Plan*, Figure 2. BB-302 and BB-302A met refusal within the fill and were offset until BB-302B was

successfully advanced to the planned termination depth. Detailed information regarding the nature and thickness of the soils and rock encountered, and the results of the field sampling and laboratory testing are shown in the appended Boring Logs in Appendix A.

The boring locations were selected by SCI and staked in the field using a GPS unit with sub-meter accuracy. The boring locations were collected by submeter GPS trimble units, while offsets and surface elevations were interpreted by SCI from survey data provided by IDOT for an adjacent project in 2012. Additionally, the station, offset, and elevation for Boring BB-302A and BB-302B were estimated by measuring from existing site features as the boring had to be relocated. The field exploration was performed in general accordance with procedures outlined in the 2015 *IDOT Geotechnical Manual*.

Personnel from SCI were with the drill rigs to supervise drilling, log the borings, and perform field unconfined compressive strength tests of the borings. Two geotechnical drill rigs, one all-terrain mounted CME-550 and one track mounted CME 550, equipped with hollow-stem augers and mud-rotary techniques were used to advance the borings. SPTs were performed with a split-spoon sampler at 2½-foot intervals to 30 feet, and at 5-foot intervals thereafter to the termination depths of the borings. The unconfined compressive strength of the cohesive soils was determined with a Rimac test apparatus. A pocket penetrometer was used to measure the compressive strength if the soils were not conducive to Rimac testing. The borings were drilled to depths ranging from approximately 116.5 feet to 126.6 feet below the existing ground surface, as detailed in Table 2.1, and on the appended boring logs. In addition, rock cores were collected from the six bridge borings, near the proposed pier locations.

Table 2.1 - Summary of Borings Drilled for Structure SN 082-6003 (E)

Boring	Location	Ground Surface Elevation (ft)	Refusal Depth (ft)	Refusal Elevation (ft)	Station	Offset	
BB-301	West Abutment	417.0 +/-	120.9	296.1	61+50	80	LT
BB-302	Pier 1	416.0 +/-	30	386.0	63+91	32	LT
BB-302A	Pier 1	416.0 +/-	23.5	392.5	63+91	34	LT
BB-302B	Pier 1	416.0 +/-	122.8	293.2	64+01	34	LT
BB-303	Pier 2	416.0 +/-	119.5	296.5	65+93	20	RT
BB-304	Pier 3	416.0 +/-	119.6	296.4	68+79	35	LT
BB-305	Pier 4	415.0 +/-	116.5	298.5	71+43	55	LT
BB-306	East Abutment	427.0 +/-	126.6	300.4	74+00	31	LT

2.3 Subsurface Conditions

Detailed information regarding the nature and thickness of the soils encountered, and the results of the field sampling and laboratory testing are shown on the Boring Logs in Appendix A. Figure 2, *Site Plan* indicates the boring locations with respect to the proposed structure. The generalized soil profiles are included on the subsurface profile, Figure 3.

The borings encountered fill with varying amounts of debris to depths ranging from approximately 6.5 to 33 feet beneath the existing ground surface. The deeper fills (20 to 30 feet) were encountered in the vicinity of Borings BB-302 and BB-306. The fill generally consisted of cinders, coal, slag, glass, wood, brick and concrete fragments, sand, clay and silt. Near boring BB-302, auger refusal within the fill occurred several times at depths of approximately 22 to 30 feet. Based on construction observations of the adjacent IL Route 3 widening, and our knowledge of the site, it is believed that an unknown quantity of old railroad structures and/or debris are likely buried at this location.

Beneath the fill, the natural soils consisted of interbedded layers of silt (A-4 in accordance with the AASHTO soil classification system, based on our visual classification unless lab tests were noted on the logs), clay (A-6), silty loam (A-4), sandy loam, (A-2), and sand (A-3) which extended to a nominal depth of 30 feet. Beneath the interbedded layers, the exploration encountered fine to coarse sand (A-2 and A-3) with varying amounts of gravel to a nominal depth of 108 feet. This sand generally becomes more dense with depth as well as an increase in gravel with depth. Below the sand deposit, large gravel with cobbles (A-1) extended to the top of limestone bedrock at a nominal depth of 120 feet (ranging from approximately 116.5 to 126.6 feet).

Below the natural soils, bedrock consisting of limestone was encountered between elevation 293.2 and 300.4 in all six bridge borings. In general, the Rock Quality Designation (RQD) for the observed limestone ranged from 72 to 100 percent, indicating moderate to excellent quality rock. A lower RQD ranging from 33 to 67 percent, indicating fair to poor quality rock, was observed in BB-303 and BB-306, which is attributed to the weathering and thin bedding of the limestone. In general, the limestone observed in the other borings was medium to thickly bedded. Unconfined compressive strength tests yielded results of 6.2 tons per square foot (tsf) to 1243.8 tsf, with an average of 611.5 tsf. A summary of the depth and elevation to the top of limestone in each of borings is presented in Table 2.2 below.

Table 2.2 – Summary of Bedrock Elevations

Boring	Depth to Rock (ft)	Rock Elevation (ft)
BB-301	120.5	296.5
BB-302B	122.8	293.2
BB-303	119.5	296.5
BB-304	119.6	296.4
BB-305	116.5	298.5
BB-306	126.6	300.4

2.4 Groundwater Conditions

Groundwater levels observed at the time of drilling are summarized in Table 2.3. Due to the use of mud-rotary drilling techniques, measurements of groundwater after drilling were not possible. It should be noted that the groundwater level is subject to seasonal and climatic variations, the water level in the Mississippi River, and other factors; and may be present at different depths in the future. Further, the project area is in the vicinity of a dewatering system that maintains a depressed groundwater table to prevent flooding of the nearby highway. In addition, without extended periods of observation, measurement of the true groundwater levels may not be possible.

Table 2.3 – Summary of Approximate Groundwater Levels

Boring No.	Depth to Groundwater During Drilling (ft)	Groundwater Elevation During Drilling (ft)
BB-301	24.0	393.0
BB-302	21.1	394.9
BB-302A	N/A	N/A
BB-302B	N/A	N/A
BB-303	29.5	386.5
BB-304	27.0	389.0
BB-305	37.5	378.5
BB-306	N/A	N/A

3.0 GEOTECHNICAL EVALUATIONS

In order to provide design recommendations for founding the structures, SCI performed the following evaluations based on all available data collected and reviewed at the time of this report. This information includes subsurface explorations performed by SCI, preliminary TS&L plans, and communications with Modjeski and Masters (M&M) personnel familiar with the project.

3.1 Seismic Considerations

3.1.1 Design Earthquake

For the purposes of seismic design the bridge has been classified as *Regular* and *Essential*. According to the Illinois Department of Transportation Bridge Manual 2012 edition, the structure should be designed to a design earthquake with a 7 percent Probability of Exceedance (PE) over a 75-year exposure period (i.e. a 1,000-year design earthquake). The 1,000-year design earthquake has a Moment Magnitude (Mw) of 7.70 and a Peak Ground Acceleration (PGA) of 0.12g, as determined from data provided by the United States Geological Survey (USGS) National Seismic Hazard Mapping Project and procedures outlined in the Bridge Manual.

3.1.2 Site Class Determination

The seismic site soil classification for the bridge site was determined from the design earthquake data, the subsurface data, and the procedures described in AGMU Memo 09.1, *Seismic Site Class Definition*, of the IDOT Bridge Manual Design Guides. The Site Class was evaluated using methods defined as B and C, which include evaluating the SPT N-values separately. The following result ranges were calculated for deep foundations sized between 12 inches and 60 inches:

- Method B using N: 18 to 42 bpf (Site Class D)
- Method C using N_{ch}: 18 to 38 bpf (Site Class D)

The AGMU states for bridges with overall lengths more than 750 feet, each abutment or pier location should be evaluated, and the weaker soil determination should be used for design. Based on the span and overall bridge lengths and the guidelines in the AGMU, SCI recommends that Site Class D be used for the project. Based on Table 3.15.2-1 the Seismic Performance Zone is 2. Seismic design parameters for the site are summarized in Table 3.1.

Table 3.1 – Seismic Design Parameters

Seismic Design Parameters	
Site Class	D
PGA	0.091
M_W	7.70
Source-to-Site Distance (km)	188.3
F_{pga}	1.60
F_a	1.52
F_v	2.40
A_S	0.145
Design Spectral Acceleration at 0.2 sec. (S_{DS})	0.54g
Design Spectral Acceleration at 1.0 sec.(S_{D1})	0.24g
Seismic Performance Zone	Zone 2

3.1.3 Liquefaction Potential Analysis

The liquefaction potential analysis for the site was conducted using available boring data and the techniques outlined in the IDOT Liquefaction Guideline (AGMU 10.1). For seismic hazard evaluations, it is generally not prescribed to assume that earthquakes would coincide with other extreme loading events, (i.e. reoccurring flood events) unless the structure is considered critical, at which time engineering judgment may be used to provide additional conservatism to the analysis, if necessary. The groundwater depth was estimated from the end of boring conditions and was varied from 18 feet to 43.5 feet to evaluate the sensitivity of the analysis to groundwater elevations. The 18-foot depth would be considered conservative. Sands located above the groundwater table are not susceptible to liquefaction.

Based on our analyses, the majority of the soils have sufficient strength and/or a plasticity index that make the threat of liquefaction minimal during the design earthquake. However, isolated relatively thin (<5 feet) layers of loose sands encountered at various depths ranging from El. 386 to El. 382 feet may be susceptible to liquefaction during high water events. The potentially liquefiable soils were encountered within one of the six bridge borings evaluated (BB-302). The results of the liquefaction analyses are presented in Appendix B as well as summarized below. In addition to the elevated groundwater table, considerations such as sampling affects immediately below the groundwater table and presence of disturbed fill soils within the potentially liquefiable area was also considered. Unfavorable ground

conditions were encountered at this location between the depths of 20 and 30 feet (El. 396 to 386) which SCI estimates is likely related to the presence of uncontrolled fill.

It is anticipated that all of the piles will extend through the potentially liquefiable soils and bear on the underlying bedrock. SCI evaluated the potential densification of the liquefiable soils immediately surrounding the piles due to the installation, as part of the overall seismic hazard analysis. Additionally, the unbraced length of the piles during liquefaction should not be a concern as the potentially liquefiable layers are relatively thin (less than 5 feet thick) and do not uniformly occur across the site.

While the amount of the seismically-induced settlement is dependent on the magnitude and distance from the seismic event, SCI estimates that the settlements from the design earthquake will be negligible and relatively uniform in nature so liquefaction mitigation techniques are not required.

3.2 Settlement

Based on the provided preliminary plans and discussions with M&M, SCI understands that minimal grade changes are anticipated on the western abutment. Although primarily cuts to the existing grades are anticipated at the eastern abutment, based on the planned retaining wall and the potential for loading that may exceed the current load due to the embankment, SCI recommends that bond breakers be used for the abutment piles on the east abutment. Bond breakers may consist of using metal shells through the embankment section to prevent downdrag from affecting the piles. These two abutments are further discussed in subsequent sections below.

3.3 Embankment Approaches

Based on our understanding, the existing embankment approaches at the western and eastern abutments will be relatively unchanged, excepting the installation of H-piles and the construction of the retaining wall currently planned at the eastern abutment. Detailed plans indicating the proposed wall configuration were not available at the time of this report and will be addressed in a separate SGR specifically for the wall.

SCI anticipates that cuts will be made to install the H-piles. Cuts created in the existing slopes steeper than 5 horizontal to 1 vertical (5H:1V) should be benched to provide a level surface prior to placing any new fill material. Benching will provide level surfaces for compaction and reduce the development of inclined planes of potential weakness between the existing soil and the fill material. SCI recommends the benches be spaced such that the maximum height of cut at the up-slope end of the bench is 5 feet.

3.3.1 Approach Slabs

The approach slabs should be designed to bear on existing, low plastic structural fill. In evaluating the bearing resistance of the slabs, SCI recommends using a modulus of subgrade reaction of 150 pounds per square inch per inch of deflection (pci). SCI anticipates that the approach slabs will be constructed entirely on compacted structural fill, detailed evaluation of the bearing capacity of the slab was neglected and is considered to not be an issue for the project.

3.4 Slope Stability

Side slopes at the eastern abutment will not be required as a retaining wall is currently planned at this location. Slope stability analyses for the retaining wall will be provided under a separate cover. For the western abutment, configurations regarding the proposed side slopes were not available at the time of this report and are assumed to remain unchanged. The current western end-slope for the existing structure carrying MLK Drive is cut to an inclination of approximately 2.0H:1V. Based on the location of the bridge relative to the existing approach fill, no analysis is required. For purposes of analyses, SCI assumed that the existing slopes will not be altered. If these slopes will be changed or steeper slopes are required, SCI should be retained to review our recommendations.

3.5 Scour

As no bodies of water are associated with the structure, scour was not evaluated, nor should it affect the project during the lifespan of the structure.

3.6 Mining Activity

Based on the Illinois Coal Resource Shapefile GIS data provided by the Illinois State Geological Survey, dated July 2012, the site is not undermined. In addition, the subject site is more than 5 miles away from the nearest mapped mine. The listed disclaimer in the Directory states, “Locations of some features on the mine maps may be offset by 500 or more feet due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors.” Therefore, a study of the effects of mining activity on the project is not considered necessary.

3.7 Bridge Foundations

The foundation supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loads. Preliminary loads are shown in Table 3.2 below. Four potential foundation options were considered for supporting the new bridge structure that include driven steel H-piles, metal shell piles, large diameter open-ended pipe piles, and drilled shaft foundations.

Metal shell piles and H-Piles, while technically can be installed, based on our discussions with the design team SCI understands that due to interferences with existing foundations, limited space, shoring requirements for IL Route 3 and the railroad, additional utility/deep well conflicts, metal shell and H-piles are not recommended for the interior bent locations. They can be considered for the abutment locations if appropriate. Recent projects nearby favored similar foundation systems. Drilled shafts are also technically feasible, however, when compared to the open-ended pipe piles, the drilled shafts were considered to be less economical and would also take longer to construct. However, drilled shaft capacities are provided in Appendix F.

Existing urban fill was encountered in all of the borings, and could cause damage to the pile tips during driving. To prevent damage during driving, SCI recommends that pile shoes be installed prior to pile installation and precoring be performed prior to installing the pipe piles. To prevent damage to the piles, SCI recommends that the pile locations at the piers be precored and backfilled with clean sand. The diameter of the precored locations should be sized larger than the nominal outside diameter of the pile. On average the precoring should extend down to a depth of approximately 10 feet below the existing ground surface. The exception would be for Pier 1 where the minimum tip elevation of 385 should be used.

Table 3.2 – Preliminary Loads

Location	Unfactored Service Loads (kips)	Factored Loads (kips)
Western Abutment	2,700	3,730
Pier 1	5,610	7,820
Pier 2	5,240	7,350
Pier 3	4,920	6,920
Pier 4	5,350	7,470
Eastern Abutment	2,700	3,720

For the H-Piles at each abutment, SCI recommends a minimum of one test pile be installed to verify capacity and overall pile length. Based on Section 3.10.1.8 of the 2012 Bridge Manual, pile shoes may be specified when piles are driven into rock at a steep batter when there is concern for the piles to either bend a flange or not bite into the rock surface. SCI anticipates that end bearing and refusal for driven piles will be achieved within the gravel and boulders or bedrock encountered during our investigation, so pile shoes should be fitted to the H-Piles. For the large diameter open-ended pipe piles, SCI recommends a

minimum of one Pile Driving Analyzer (PDA) test be performed for each pier to verify capacity and overall pile length. Recommendations for all the potential foundation options are provided below.

3.7.1 Driven H-Piles

The structural capacity of driven piles depends on the allowable stress and cross sectional areas of steel or steel and concrete. The pile recommendations in this report assume that Steel H-piles will conform to AASHTO M270 Grade 50 (ASTM 709 Grade 50) or equivalent with a minimum yield stress of 50 kips per square inch (ksi).

Based on the Bridge Manual, a geotechnical resistance factor (φ_G) of 0.55 was used for the design of the H-pile foundations. Due to the minor proposed grade changes and recommendations for bond breakers on the east abutment piles, geotechnical losses associated with down-drag due to settlement were not considered during the static and seismic pile design for the abutment piles. Although isolated liquefaction is a potential concern at the site, geotechnical losses due to liquefaction were not considered in the seismic pile design (see discussion presented in Section 3.1.3 Liquefaction Potential Analysis). During the seismic event, the Bridge Manual allows the use of a Geotechnical Resistance Factor (φ_G) of 1.0. All estimates of capacity were calculated using the "Modified IDOT Static Method" spreadsheet associated with the Bridge Manual and assume construction verification will follow the "WSDOT" formula outlined in the Bridge Manual. The top elevations of the piles were obtained from the information provided by M&M by email on July 19, 2016. The tip elevations were calculated from the Modified IDOT Static Method spreadsheets based on the available factored resistance.

SCI recommends a minimum driven pile center-to-center spacing of three pile diameters, as recommended by the Bridge Manual. The maximum spacing shall be limited to 3.5 times the effective footing thickness plus 1 foot, but not to exceed 8 feet. Once the final spacing is determined, the piles should be evaluated for group effects.

A summary of the design capacities, or factored resistance available (R_F), seismic factored resistance (R_{Fseis}), and nominal required bearing (RN) is presented in Appendix D for each steel pile size. The pile lengths, as shown in Appendix D, were estimated from the embedment depth estimates from the IDOT design spreadsheet and the top elevations estimated from the email dated July 19, 2016. SCI recommends a minimum of two test piles be driven to verify pile lengths. A test pile should be installed near both abutments. The estimated pile lengths should be adjusted based on the test pile results.

Obstructions to driven piles should be located prior to construction. It is known that the West Abutment has a row of battered piles installed at a 1 horizontal to 3 vertical (1H:3V). This information should be disseminated on the construction plans and located in the field prior to driving piles in the vicinity. At the existing East Abutment, no conflict of pile location is believed to exist because the new abutment is offset from the old abutment.

3.7.2 Large Diameter, Open-Ended Pipe Piles

The structural capacity of driven piles depends on the allowable stress and cross sectional areas of steel or steel and concrete. The pile recommendations in this report assume that the pipe piles will conform to ASTM A252 Grade 3 Modified (or equivalent) with a minimum yield stress of 50 ksi.

The open-ended pipe piles were designed using the 2014 AASHTO LRFD Bridge Design Specifications manual and the American Petroleum Institute Recommended Practice 2A-WSD. A geotechnical resistance factor (φ_G) of 0.65 was used for the design of the driven pile foundations in soil and rock. The resistance factor and subsequent capacities are based on a construction control method utilizing an appropriate number of Wave Equation Analysis of Piles (WEAP) for the hammer-pile system and performing Pile Dynamic Analyzer (PDA) testing with signal matching on a minimum of one pile per bent. It is anticipated that the piles will be installed to bedrock or on the dense gravel and boulders immediately above. However, should it occur, for piles terminating in soil, a restrike will be required in accordance with AASHTO section 10.7.3.4.3 on all piles dynamically tested. For piles terminating directly on, or in, the underlying limestone bedrock, restrikes will not be required. The WEAP analysis should be performed prior to driving of the piles, and additional WEAP analyses may be required during driving of the remaining piles. An IDOT special provision for the installation of large diameter, open-ended pipe piles should be included in the contract documents. The special provision should be followed during construction.

Due to the minor proposed grade changes at the pier locations, geotechnical losses associated with down-drag due to settlement were not considered during the static and seismic pile design for the pier piles. Although isolated liquefaction is a potential concern at the site, geotechnical losses due to liquefaction were not considered in the seismic pile design (see discussion presented in Section 3.1.3 Liquefaction Potential Analysis). For Pier 1 (Boring BB-302) consideration for pre-coring was provided to a nominal elevation of 385. During the seismic event, a Geotechnical Resistance Factor (φ_G) of 1.0 was utilized. The top elevations of the piles were obtained from the information provided in email dated July 19, 2016.

It is anticipated that the piles will drive unplugged. If this is the case, soil inside the pipe pile will need to be removed to the elevation required for structural purposes, and replaced by concrete. If a plug develops and moves the top of the soil in the pipe pile below this elevation, the difference can be made up by adding sand, clean rock, or lean concrete.

To limit the potential for settlement of the adjacent soils and structures if a vibrating hammer is used to initially install the pile to depth, SCI recommends limiting the use of the vibrating hammer to an advancement rate no less than 2-inches per minute. If advancement rates drop below that point the vibrating hammer should be removed and installation completed with an impact hammer.

A summary of the design capacities, or factored resistance available (R_F), seismic factored resistance (R_{Fseis}), and nominal required bearing (R_N) is presented in Appendix D for each pipe pile size evaluated.

3.7.3 Drilled Shafts

For the purpose of determining the feasibility of drilled shafts, we have provided the following values to be used in the design. Drilled shafts should be spaced no closer than three shaft diameters, center to center. Due to the observed groundwater table, and the sands and gravels encountered during our exploration, casing will be required in the soil to prevent collapsing of the side wall during installation. Alternatively, a slurry mix could be utilized during drilling. Drilled shafts for the interior bents should be socketed into bedrock. It is not anticipated that drilled shafts would be used at that abutment locations.

Drilled shafts should be socketed into competent bedrock and should be designed using the factored tip resistance and/or a factored skin friction, as further detailed in Appendix F. The values presented in Appendix F reflect a geotechnical resistance factor (φ_G) of 0.50 for tip resistance and 0.55 for skin friction, for strength limit design. For seismic considerations, a (φ_G) of 1.0 should be used to calculate the seismic factored resistance available (R_{fseis}).

3.7.3.1 Drilled Shaft QA/QC and Construction Considerations

If drilled shafts are used for bridge support, a construction method using a casing or polymer slurry will be required due to the various sand layers that were encountered during the investigation. The auger cuttings should be observed as the shafts are drilled to document that competent materials are present. QA/QC for the drilled shafts should include a combination of using a shaft inspection device (SID camera) to ensure the bottom is clean and the socket is uniform and stable. This will also verify that

the estimated uplift capacities are present. Crosshole Sonic Logging (CSL) testing should be performed to verify the integrity of the concrete.

3.7.4 Temporary Soil Retention System

During installation of the H-Piles for the western abutment, it will be necessary to provide a temporary soil retention system on the north and south sides of MLK Drive. SCI anticipates that the adjacent lanes will continue to operate. Based on information provided by M&M, the top of shoring is approximately elevation 450 and will have a supported height of 18 feet. The length of the shoring along the north side of the abutment is to be 30 feet. It appears that temporary sheeting will not be a feasible option according to *Section 3.13.1 - Temporary Sheet Piling Design.* As such, a temporary soil retention system installed by the contractor will likely be required.

3.8 Lateral Pile Response

A representation of the shaft response under lateral loading exceeding 3 kips per pile is required for design of the bridge superstructure per Section 3.10.1.10 of the 2012 Bridge Manual. The lateral response can be developed by modeling the soil/shaft interaction with the computer program LPILE. Discrete elements are used in LPILE to represent the shaft and non-linear soil using springs. The non-linear soil springs are commonly referred to as P-Y curves.

Based on the encountered subsurface conditions, tables for borings BB-301 through BB-306 summarizing approximate soil modulus parameters (k) for the LPILE analyses are included in Appendix C (Reference: LPILE User's Manual, Ensoft, Inc., July 2012). When pile/shaft design details and load information are refined in the development of the structure plans, LPILE analyses, if warranted, can be performed.

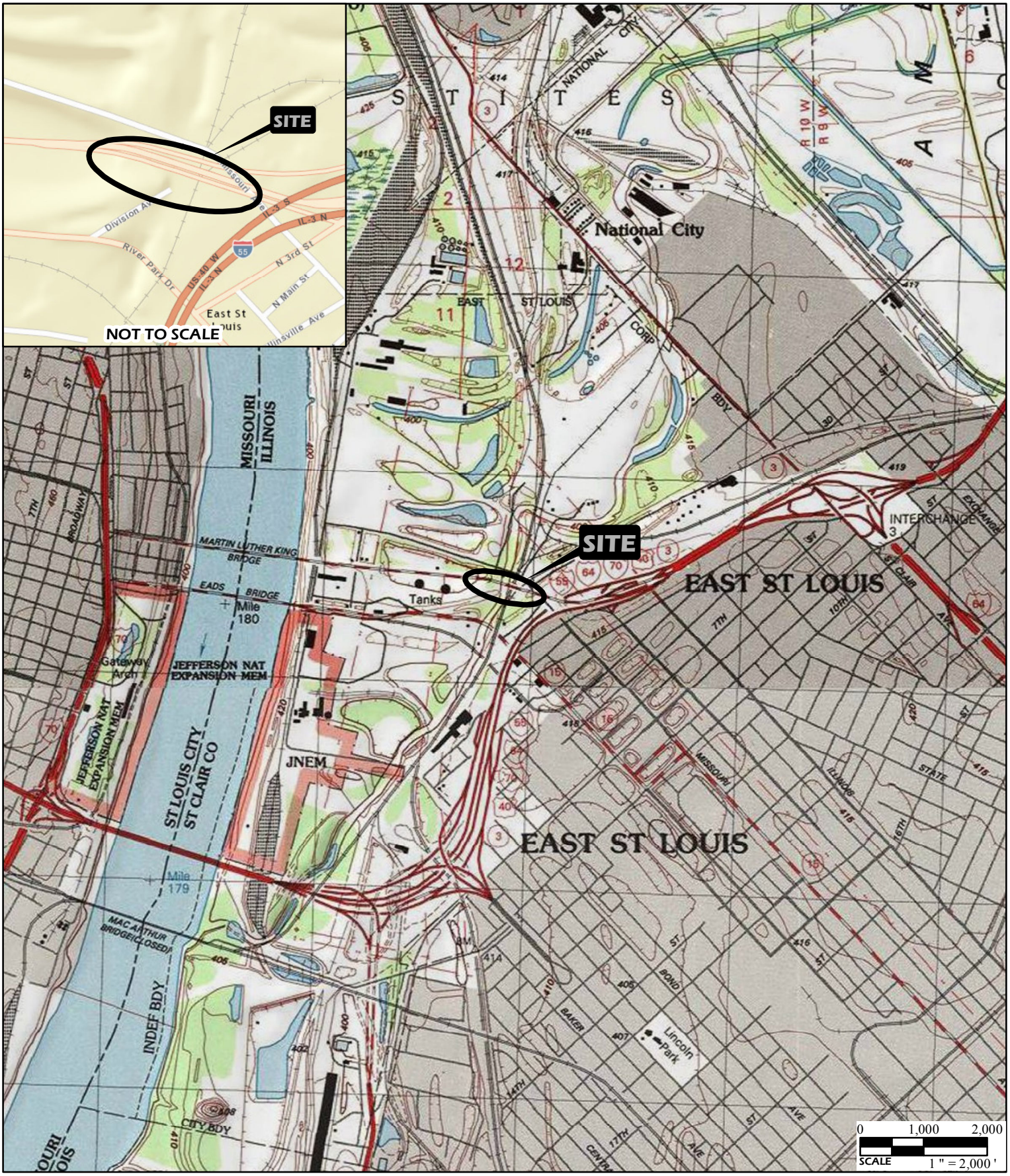
4.0 CONSTRUCTION CONSIDERATIONS

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

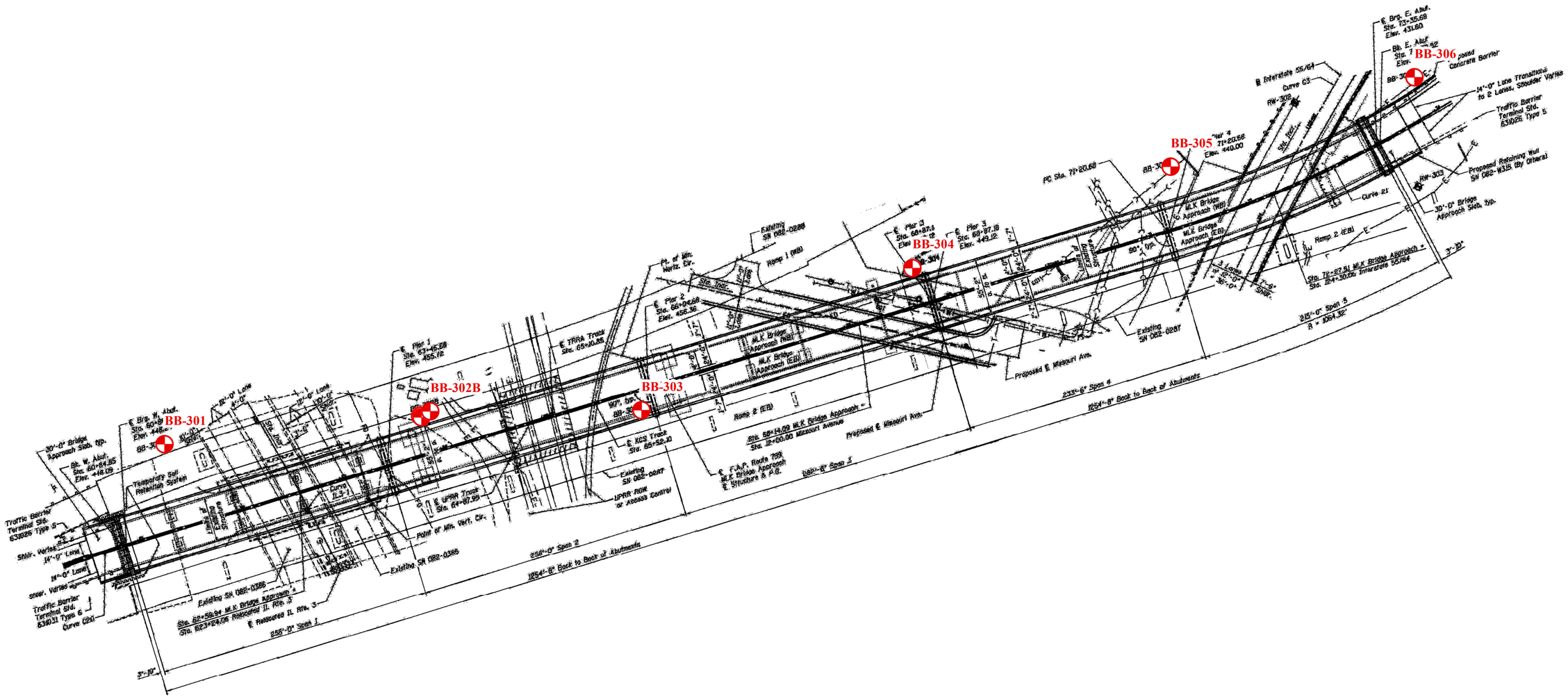
As previously discussed, based on observations during drilling, the existing fill observed in the borings may cause difficulty with pile installation for the piers. To prevent damage to the piles, SCI recommends that a combination of pile shoes and the pile locations at the piers be precored and backfilled with clean sand. The diameter of the precored locations should be sized larger than nominal outside diameter of the pile. On average the precoring should extend down to a depth of approximately 10 feet below the existing ground surface. The exception would be for Pier 1 where the minimum tip elevation of 385 should be used.

5.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of Modjeski and Masters, Inc. and IDOT. They are specific only to the project described, and are based on subsurface information obtained at six boring locations within the bridge area, our understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. SCI should be contacted if conditions encountered during construction are not consistent with those described.



PROJECT NAME PTB 172, ITEM 22 - MLK APPROACH EAST SAINT LOUIS, ILLINOIS				GENERAL NOTES/LEGEND USGS TOPOGRAPHIC MAP GRANITE CITY, ILLINOIS - MISSOURI QUADRANGLE CAHOKIA, ILLINOIS - MISSOURI QUADRANGLE DATED 1998 10' CONTOURS STREET MAP http://goto.arcgisonline.com/maps/World_Street_Map
VICINITY AND TOPOGRAPHIC MAP				N W E S
DRAWN BY	RCV	DATE	JOB NUMBER	FIGURE
CHECKED BY	BLB	01/2017	2014-3149.51	1



0 50 100

SCALE 1 " = 100 '

GENERAL NOTES/LEGEND

INDICATES APPROXIMATE SOIL BORING LOCATION.

UNDATED PLAN RECEIVED 8/05/2016 FROM MODJESKI AND MASTERS, INC.
DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

PROJECT NAME

PTB 172, ITEM 22 - MLK APPROACH
EAST SAINT LOUIS, ILLINOIS

SITE PLAN

JOB NUMBER 2014-3149.51

DATE 01/2017

DRAWN BY RCV

CHECKED BY BLB

FIGURE 2

APPROXIMATE PROPOSED BRIDGE BENT LOCATIONS (TYPICAL)

PROPOSED BRIDGE DECK

APPROXIMATE WEST ABUTMENT LOCATION

APPROXIMATE EAST ABUTMENT LOCATION

BB-301

FILL: silty clay, A-4
FILL: Crushed Rock, A-1
FILL: silty clay, A-4
CLAY: A-7
LOAM: A-4
SAND: A-3
LOAM: A-4
SAND: A-3
SILTY SAND: A-3
CLAY LOAM: A-5
SILTY LOAM: A-4
SAND: A-3
SANDY LOAM: A-4
SAND: A-3
SAND: A-3
SANDY CLAY: A-6
SAND: A-3
SAND w/ GRAVEL: A-1
SAND: A-3
SAND w/ GRAVEL: A-1
GRAVEL w/ SAND: A-1
LIMESTONE
61+50
80 ft LT

BB-302

FILL
Concrete Rubble FILL
SAND: A-3
CLAY: A-6
SILTY SAND: A-3
SAND: A-3
WOOD and ORGANICS
SAND: A-3
CLAY: A-7
SAND: A-3
SAND w/ GRAVEL: A-1
SAND: A-3
GRAVEL: A-1
SAND: A-3
GRAVEL w/ COBBLE: A-1
SAND: A-3
LIMESTONE
63+91
36 ft LT

BB-303

FILL: clay, A-6
FILL: silty clay, A-6
FILL: clay, A-6
FILL: clay, A-7
SANDY LOAM: A-4
LOAM: A-4
SANDY LOAM: A-4
SAND: A-3
SILT: A-6
SAND: A-3
SILTY CLAY LOAM: A-4
SAND: A-3
SAND: A-1
SAND: A-3
SAND: A-3
COBBLE/GRAVEL: A-1
COBBLE/GRAVEL: A-1
LIMESTONE
LIMESTONE
65+93
20 ft RT

BB-304

FILL
FILL
FILL
FILL
FILL
FILL
CLAY: A-7
SAND: A-3
SAND: A-3
SAND: A-1
SAND: A-3
SAND: A-1
COBBLE w/ GRAVEL: A-1
SANDSTONE
LIMESTONE
68+79
35 ft LT

BB-305

CRUSHED ROCK
FILL
CLAY: A-7
CLAY: A-6
CLAY: A-7
SAND: A-3
CLAY: A-6
SANDY LOAM: A-4
CLAY: A-6
SANDY LOAM: A-4
SAND: A-3
SAND: A-3
SANDY LOAM: A-4
SAND: A-3
GRAVEL: A-1
SAND: A-3
GRAVEL: A-1
SAND: A-3
SANDY LOAM: A-4
SAND: A-3
GRAVEL: A-1
SAND: A-3
GRAVEL: A-1
SAND: A-3
COBBLE w/ GRAVEL: A-1
GRAVEL
SANDSTONE
LIMESTONE
71+43
55 ft LT

BB-306

TOPSOIL
FILL
FILL
FILL
FILL
FILL
CLAY: A-7
SILTY LOAM: A-4
CLAY: A-7
SAND: A-3
SAND: A-1
SAND: A-3
SAND: A-1
SAND: A-1
WEATHERED LIMESTONE w/ CLAY LOAM: A-1
LIMESTONE
SANDSTONE
LIMESTONE
SANDSTONE
74+00
31 ft LT

460 450 440 430 420 410 400 390 380 370 360 350 340 330 320 310 300 290 280 270

0 59+00 60+00 61+00 62+00 63+00 64+00 65+00 66+00 67+00 68+00 69+00 70+00 71+00 72+00 73+00 74+00 75+00 76+00 77+00 78+00 79+00

General Notes/Legend

VARIATIONS IN SUBSURFACE CONDITIONS MAY AND LIKELY EXIST BETWEEN BORINGS. DASHED HORIZONS ARE INTERPRETED AND ARE SHOWN FOR ILLUSTRATION ONLY.

PROJECT NAME

PTB 172, ITEM 22 - MLK APPROACH
EAST SAINT LOUIS, ILLINOIS

SUBSURFACE PROFILE

SCALE	1" = 20' V 1" = 150' H
JOB NUMBER	2014-3149.51
DATE	08/2016
DRAWN BY	RCV
CHECKED BY	BLB
FIGURE	3

Appendix A

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/15/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-301
Station 61+50
Offset 80.0 ft LT
Ground Surface Elev. 417.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 395.5 ft ▼
Upon Completion N/A ft
After 16 **Hrs.** 393.0 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				FILL: Dark brown and brown, silty clay, with cinders and brick, A-4
	2 4 6	2.8 P	18	
				413.0
	10 18 14	3.3 P >4.5 P	17 13	FILL: Crushed Rock and Brick, A-1
-5				412.3 FILL: Dark brown and brown, silty clay, trace cinders and brick, A-4
				410.8
	2 1 2	0.3 B/20	33	CLAY: Brown and gray, trace iron stains, A-7
	ST	1.1 S/2.8	36	
-10				
	WOH 2 2	1.2 S/15	32	
	1 2 4	1.6 S/15	34	
-15				
				401.5 LOAM: Brown, A-4
	1 2 5	1.0 P N/C	30	
				400.0 SAND: Brown, A-3
				399.0 LOAM: Brown, A-4
				398.0
	1 5 9	0.5 B/20 N/C	31	SAND: Brown, A-3
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SAND: Brown, A-3 *(continued)*
▼	4 9 11	N/C		
				394.0 SILTY SAND: Brown, A-3
▽	4 5 5	N/C		Begin Mud Rotary at 23 feet.
-25				
				391.5 CLAY LOAM: Gray, A-5
	5 5 6	--		
				389.0 SILTY LOAM: Gray, A-4
	3 2 5	N/C		
-30				
				385.0 SAND: Brown, A-3
	7 8 10	N/C		
-35				
				380.0 SANDY LOAM: Brown, A-4
	8 7 7	N/C		
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/15/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-301
Station 61+50
Offset 80.0 ft LT
Ground Surface Elev. 417.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 395.5 ft ▼
Upon Completion N/A ft
After 16 **Hrs.** 393.0 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY LOAM: Brown, A-4 *(continued)*				SAND: Brown, A-3 *(continued)*			
	5 5	N/C			10 13	N/C	
With clay nodules and gravel -45	10			Becomes gray, fine to medium sand -65	10		
370.0							
SAND: Brown, A-3							
	7 8	N/C			8 15	N/C	
STOP: 6/9/2016 at 3:25pm -50	10			Trace organics, with gravel -70	9		
START: 6/10/2016 at 7:00am							
				345.5 SAND: Gray, A-3			
				Rough Drilling ~ 72.0'			
	9 17	N/C		342.8	7 10	N/C	
Becomes brownish-gray -55	21			SANDY CLAY: Gray, A-6 342.5 -75	11		
				SAND: Gray, A-3			
	17 19	N/C			10 11	N/C	
-60	24			With medium to large gravel -80	11		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/15/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-301
Station 61+50
Offset 80.0 ft LT
Ground Surface Elev. 417.0 ft

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

Groundwater Elev.:
First Encounter 395.5 ft ▼
Upon Completion N/A ft
After 16 **Hrs.** 393.0 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, A-3 *(continued)*			
	5 6	N/C	
-85	7		
330.0			
SAND w/ GRAVEL: Gray, A-1			
	50/6"	N/C	
	23		
-90	13		
325.0			
SAND: Gray, A-3			
STOP: 6/10/2016 at 2:15pm START: 6/13/2016 at 9:45am			
	22	N/C	
-95	31		
	36		
Set Casing			
	23	N/C	
317.0 -100	25		
SAND w/ GRAVEL: Gray, with fractured rock, A-1	27		
	36	N/C	
-105	29		
	32		
308.0			
GRAVEL w/ SAND: Gray, trace weathered sandstone, A-1	50/5"	--	
-110			
	41	N/C	
-115	50/6"		
	50/6"		
298.0			
Borehole continued with rock coring. -120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 6/9-6/15/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 **in**
Top of Rock Elev. 296.50 **ft**
Begin Core Elev. 296.14 **ft**

BORING NO. BB-301
Station 61+50
Offset 80.0 ft LT
Ground Surface Elev. 417.0 **ft**

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE: Light gray, moderately hard, very finely crystalline, thin to medium bedded, trace chert nodules, trace styolites With chert nodules 5.8" closed vertical fracture 2.75" closed vertical fracture, no chert nodules 3.25" closed vertical fracture Becomes argillaceous Trace chert nodules No chert nodules	-125	1	100	94	3.07	634.3
2.5" closed vertical fracture		2	100	95	2.6	
Becomes medium to thickly bedded Trace chert nodules	-130					1129.7
		3	100	88	3.3	
Becomes medium bedded						1214.6
Becomes thinly bedded	-135					1096.3
	280.14					
Boring terminated at 136.9 ft. Boring grouted to 136.86 ft.	-140					

Color pictures of the cores Yes
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
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302
Station 63+91
Offset 36.0 ft LT
Ground Surface Elev. 416.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown, clay, A-6				
415.3				
FILL: Brown and gray, crushed limestone, concrete fragments and cinders, A-1		2 7 17	2.2 S/5	16
412.5				
FILL: Brown, clay, A-6		2 3 10	1.8 P	13
411.5	-5			
FILL: Brown and gray, clay, with crushed limestone and cinders, A-1				
410.0				
FILL: Brown to dark brown, sandy clay loam, A-4		3 2 3	N/C	10
407.5				
FILL: Brown, sand, with crushed limestone, A-3		1 1 2	N/C	12
406.0	-10			
FILL: Brown, clay, with brick and crushed rock, A-6		1 1 2	0.5 P	17
402.5				
FILL: Gray, concrete fragments		13 7 2	N/C	21
402.0				
FILL: Brown, clay, with cinders, trace slag and concrete, A-6	-15			
400.0				
FILL: Brown, sandy clay, trace concrete fragments, A-6		1 2 6	0.2 S/5	24
Some concrete fragments		2 3 5	1.5 P	20
	-20			

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
395.5				
FILL: Dark brown, sandy clay, trace fine gravel, A-1 ▼		2 1 1	N/C	39
Begin Mud Rotary at 23.5 feet.		3 1 3	N/C	
No Sample Recovery	-25			
No Sample Recovery		1 0 1	N/C	
388.0				
FILL: Gray, clay, A-6		1 1 1	0.4 B/20	
386.0	-30			
Boring terminated at 30ft. Driller had to offset hole due to hitting wood or a possible railroad tie, that kicked the auger off and made the hole crooked. Boring terminated at 30.0 ft.				
Boring grouted to 30 ft.	-35			
	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302A
Station 63+91
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
▼			
-25			
-30			
-35			
-40			

Offset 2.0ft South of BB-302
No sampling performed

Stopped: 6/9/2016 at 13.5ft and switched over to Mud Rotary

Driller noted wood pieces in Mud wash

Terminated drilling at 23.5ft. Tried to advance casing and could not get alignment straight.
Boring terminated at 23.5 ft.

Boring grouted to 23.5 ft.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302B
Station 64+01
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Offset 10.0ft East of BB-302A. No sampling performed to 33.5ft. Drilled with HSA down to 5.0ft, then switched to mud rotary and began advancing casing.				Concrete Rubble			
				395.0 ▼			
				FILL (driller noted)			
-5				-25			
-10				-30			
Began losing large quantities of mud into the hole.							
				382.5			
				SAND: Gray, A-3	7 15 15	N/C	
-15				-35			
				STOP: 6/10/2016			
					10 8 12	N/C	
-20				-40			
				Trace silt			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302B
Station 64+01
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, A-3 *(continued)*
	9 10 13	N/C		
-45				
367.5				
367.0	4 7 7	0.5 B/20 N/C		CLAY: Gray, A-6 SILTY SAND: Gray, A-3
-50				
363.5				
	9 11 13	N/C		SAND: Gray, A-3
-55				
	6 5 6	N/C		Becomes brown, trace fine gravel
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, A-3 *(continued)*
	10 17 26	N/C		Becomes gray
-65				
	14 16 20	N/C		
-70				
342.5				
342.0	6 12 17	N/C		WOOD and ORGANICS SAND: Gray, trace fine gravel, A-3
-75				
	8 13 8	N/C 1.0		
336.3 -80				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Illinois Department of Transportation
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SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302B
Station 64+01
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, A-7 336.0		P		SAND: Gray, few fine gravels, A-3 *(continued)*			
SAND: Gray, trace fine gravel, A-3							
				312.5			
	7			GRAVEL: Gray, A-1	42		
	12	N/C		311.5	50/6"	N/C	
-85	14			SAND: Gray, trace clay, A-3 -105	36		
	8				19		
	10	N/C			24	N/C	
No gravel -90	10			-110	30		
				305.0			
324.5				GRAVEL w/ COBBLE: Gray, A-1			
SAND w/ GRAVEL: Gray, A-1							
322.5				302.5			
SAND: Gray, few fine gravels, A-3	14			SAND: Gray, trace silt, A-3	50/5"	--	
	17	N/C					
-95	14			-115			
	15				21	--	
	27	N/C			50/3"		
-100	27			-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-302B
Station 64+01
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 394.9 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, trace silt, A-3 *(continued)*				
Limestone cuttings in mud wash from 119.3' to 122.8'				
293.2				
Borehole continued with rock coring.				
	-125			
	-130			
	-135			
	-140			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 6/9-6/16/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 in
Top of Rock Elev. 296.70 ft
Begin Core Elev. 293.20 ft

BORING NO. BB-302B
Station 64+01
Offset 34.0 ft LT
Ground Surface Elev. 416.0 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
293.20 LIMESTONE: Gray, moderately hard, very finely crystalline, thinly bedded, slightly weathered	1	95	66	5.5	
Becomes medium bedded					766.2
Becomes thinly bedded, trace chert nodules, trace styolites -125					
Becomes massively bedded	2	100	93	4.4	1128.7
With chert nodules					
Trace chert nodules					
Becomes thickly bedded					
4.5" open vertical fracture -130					
	3	99	78	3.8	
No chert nodules					897.9
5" closed vertical fracture					908.5
Trace chert nodules -135					
Becomes thin to medium bedded, trace styolites	4	100	76	4.5	
No chert nodules					
278.00					853.7
Boring terminated at 122.8 ft.					
Boring grouted to 122.8 ft. -140					

Color pictures of the cores Yes
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
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/2-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-303
Station 65+93
Offset 20.0 ft RT
Ground Surface Elev. 416.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 386.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DESCRIPTION	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Dark brown and black, clay, with limestone and crushed rock, A-6				
		3 8 11	N/C	15
		8 7 3	N/C	11
	-5			
409.5				
FILL: Gray, silty clay, A-6		6 3 2	0.3 S/15	30
408.5				
FILL: Gray, clay, with cinders, A-6				
		2 3 2	N/C	17
	-10			
405.0				
FILL: Brownish-gray, clay, A-7		1 1 3	1.1 S/20	32
		3 6 6	0.8 P	27
	-15			
400.5				
SANDY LOAM: Brown, A-4		3 4 6	N/C	
398.0				
LOAM: Brown, A-4				
		1 3 5	N/C	18
	-20			
LOAM: Brown, A-4 *(continued)*				
395.5				
SANDY LOAM: Brown, A-4		4 8 8	N/C	
393.0				
SAND: Brown, A-3		4 6 10	N/C	
391.5				
SILT: Brown, A-6	-25			
391.3				
SAND: Brown, A-3				
		3 4 9	N/C 0.5 P	28
387.5				
SILTY CLAY LOAM: Gray, A-4		1 1 9	0.3 S/15 N/C	34
386.5 ▼				
SAND: Orangish-brown, A-3	-30			
Begin Mud Rotary at 30.5 feet.				
		5 4 4	N/C	
Becomes brown, trace silt	-35			
		3 8 13	N/C	
Becomes gray with brown	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/2-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-303
Station 65+93
Offset 20.0 ft RT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 386.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Orangish-brown, A-3 *(continued)*				
Trace fine gravel	-45	4 12 17	N/C	
	-50	14 18 19	N/C	
	-55	21 19 17	N/C	
	-60	7 12 16	N/C	
SAND: Orangish-brown, A-3 *(continued)*				
	-65	9 17 18	N/C	
	-70	8 11 15	N/C	
	-75	19 20 18	N/C	
	-80	25 25 22	N/C	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/2-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-303
Station 65+93
Offset 20.0 ft RT
Ground Surface Elev. 416.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 386.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
STOP: 6/2/2016			
SAND: Orangish-brown, A-3 *(continued)*			
START: 6/3/2016			
	20	N/C	
	33		
-85	36		
327.3			
SAND w/ LIMESTONE COBBLE: Gray, A-1	38	N/C	
326.8	38		
SAND: Gray, A-3 326.3			
-90	20		
SAND: Gray, A-3			
With limestone fragments ~93.5'	21	N/C	
	19		
-95	20		
Rough Drilling from 96.0' to 98.0'			
	1	N/C	
	3		
-100	12		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, A-3 *(continued)*			
	9	N/C	
	17		
-105	30		
307.7			
COBBLE w/ GRAVEL: Brown and gray, A-1	50/5"	--	
STOP: 6/3/2016			
START: 6/6/2016	50/5"	--	
-110	50/3"	--	
305.2			
Borehole continued with rock coring.			
-115			
-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 6/2-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 in
Top of Rock Elev. 305.20 ft
Begin Core Elev. 305.20 ft

BORING NO. BB-303
Station 65+93
Offset 20.0 ft RT
Ground Surface Elev. 416.0 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
ROCK CORE from 110.8'-115.1' - Recovered cobble fragments and fractured gravels	305.20		1	14	0	4.42	
	300.90	-115					
ROCK CORE from 115.1'-116.1' - Recovered cobble fragments and fractured gravel			2	25	0	3	
	299.90						
COBBLE w/ GRAVEL: Brown and gray, A-1			SS-31				
			SS-32				
	296.50						
LIMESTONE: Dark and light gray, very hard, aphanitic to coarsely crystalline, highly fractured, moderately weathered		-120	3	69	33	7.7	
Becomes light gray, moderately hard, finely crystalline, thinly bedded, slightly weathered							
5.5" open vertical fracture							1243.8
Becomes banded Becomes medium bedded Becomes cherty, hard			4	100	100	4	1053.5
		-125	5	100	72	5	263.5
0.6" open vertical fracture							
0.9" open vertical fracture							
13.6 open vertical fracture, becomes thinly bedded							
Becomes thickly bedded		-130	6	95	88	4.9	
	285.25						

Color pictures of the cores Yes
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
SCI Engineering, Inc.

ROCK CORE LOG

Date 6/2-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 in
Top of Rock Elev. 305.20 ft
Begin Core Elev. 305.20 ft

BORING NO. BB-303
Station 65+93
Offset 20.0 ft RT
Ground Surface Elev. 416.0 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE: Light gray, moderately hard, finely crystalline, thickly bedded, slightly weathered, cherty *(continued)*					121.6
-135					519.5
279.50					
Boring terminated at 136.5 ft. Boring grouted to 136.5 ft.					
-140					
-145					
-150					

Color pictures of the cores Yes
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
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/6-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-304
Station 68+79
Offset 35.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 389.0 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown and black, sandy clay, with cinders, A-6				
414.5		3 4 4	N/C	16
FILL: Brown, sand, A-3				
413.0				
FILL: Brown with red and gray, sand, with brick and cinders, A-2	-5			
409.5		4 4 4	--	
FILL: Red, brick, A-1 409.0				
FILL: Brown, sand, A-3				
408.0				
CLAY: Dark gray, trace iron stains, A-7		WOH 2 1	1.2 B/20	38
	-10			
		2 3 4	1.5 S/15	36
	-15	ST	0.9 S/5.2	33
		1 3 3	1.5 B/20	33
398.0				
SAND: Brown, A-3				
Begin Mud Rotary at 19.0 feet.	-20	4 5 9	N/C	

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Brown, A-3 *(continued)*				
		4 6 8	N/C	
	-25	3 7 7	N/C	
	▼	4 5 5	N/C	
387.3		4 4 7	--	
SILTY SAND: Gray, A-3	-30			
386.0				
SAND: Gray, A-3				
	-35	5 6 8	N/C	
With medium sand	-40	6 7 7	N/C	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/6-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-304
Station 68+79
Offset 35.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 389.0 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, A-3 *(continued)*
-45	11 12 14	N/C		
				Trace gravel
-50	7 12 13	N/C		
-55	9 13 14	N/C		
-60	9 13 14	N/C		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, A-3 *(continued)*
-65	12 13 16	N/C		
				Trace gravel
				349.0
				SAND: Gray, coarse, with gravel, A-1
-70	16 15 15	N/C		
-75	26 35 31	N/C		
				339.0
				SAND: Gray, A-3
-80	26 37 37	N/C		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 6/6-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-304
Station 68+79
Offset 35.0 ft LT
Ground Surface Elev. 416.0 ft

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

Groundwater Elev.:
First Encounter 389.0 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, A-3 *(continued)*
				Rough drilling from 81.0'-82.0'
	10 13	N/C		
-85	14			
				Rough drilling from 85.5'-88.5'
329.0				
				SAND: Gray, medium to coarse, with gravel, A-1
				Advance with casing at 88.5'
-90	17 24 28	N/C		
-95	14 21 27	N/C		
-100	22			
	23 26	N/C		SAND: Gray, medium to coarse, with gravel, A-1 *(continued)*
				Intermittent hard drilling from 101.0'-104.0'
312.0				
				COBBLE w/ GRAVEL: Gray and brown, A-1
-105	25 33 50/5"	N/C		
				Rock fragments in sample
-110	18 37 50/5"	N/C		
				STOP: 6/7/2016 at 3:55pm START: 6/8/2016 at 7:00am
-115	50/5"	--		
296.4				
-120	50/0"			Borehole continued with rock coring.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 6/6-6/8/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 in
Top of Rock Elev. 296.38 ft
Begin Core Elev. 296.38 ft

BORING NO. BB-304
Station 68+79
Offset 35.0 ft LT
Ground Surface Elev. 416.0 ft

DESCRIPTION		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE: Gray, soft, very fine grained, medium bedded, slightly weathered, calcareous, argillaceous	296.38	-120	1	100	80	1.1	
1.5" clay seam, becomes parted to banded							6.2
Becomes thin to medium bedded							
Becomes banded to thinly bedded							
Becomes thickly bedded	292.65						
LIMESTONE: Light gray, moderately hard, very finely crystalline, medium bedded, slightly weathered							
		-125					647.0
2.6" clay seam			2	100	87	2.55	
Becomes massively bedded, finely crystalline, with chert							
2.1" open fracture, becomes thickly bedded			3	100	86	3.2	
							396.9
2.5" clay seam, becomes banded to thinly bedded							
Becomes thinly bedded		-130					
0.5" clay seam, becomes thickly bedded							
Becomes massively bedded							1236.4
Becomes argillaceous							
Becomes medium bedded	281.38						303.6
Boring terminated at 134.6 ft.		-135					
Boring grouted to 134.62 ft.							

Color pictures of the cores Yes
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
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/25-5/31/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-305
Station 71+43
Offset 55.0 ft LT
Ground Surface Elev. 415.0 ft

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

Groundwater Elev.:
First Encounter 377.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CRUSHED ROCK: Gray, 3-inch minus			
414.0			
FILL: Black, clay, with cinders and brick, limestone gravel, A-6	4 9 7	>4.5 P	
	2 3 3	--	
-5 Limestone gravel in shoe, no other recovery			
	1 1 1	0.5 P	
407.0			
CLAY: Gray, A-7	1 1 2	1.5 P	
-10		0.9 S/20	
	1 2 2	1.6 S/20	
Becomes brownish-gray			
	1 1 2	0.8 S/20	
-15			
399.5			
SAND: Brown, A-3	3 5 7	N/C	
396.5			
CLAY: Brown, A-6 396.0	2 2 6	0.2 S/20	
SANDY LOAM: Brown, A-4			
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY LOAM: Brown, A-4 *(continued)*			
	2 4 5	N/C	
	1 4 5	N/C	
-25			
	3 5 6	N/C	
385.9			
CLAY: Brown, trace fine sand, A-6	5 5 9	N/C 0.3 P	
-30			
383.5			
SANDY LOAM: Brown, A-4	6 9 11	N/C	
-35			
378.0			
SAND: Brown, A-3 ▼	3 5 13	N/C	
-40 Becomes gray			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/25-5/31/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-305
Station 71+43
Offset 55.0 ft LT
Ground Surface Elev. 415.0 ft

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

Groundwater Elev.:
First Encounter 377.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Brown, A-3 *(continued)*
				Begin Mud Rotary at 40.0 feet.
	12	N/C		
	12			
-45	12			
				368.0
				SANDY LOAM: Gray, A-4
	10	N/C		
	18			
-50	18			
				363.0
				SAND: Gray, A-3
	9	N/C		
	14			
-55	16			
	9	N/C		
	8			
-60	13			
				SAND: Gray, A-3 *(continued)*
	14	N/C		
	12			
-65	10			
				348.0
				GRAVEL: Gray, A-1
				346.5
	11	N/C		SAND: Gray, A-3
	16			
-70	17			345.0
				GRAVEL: Gray, A-1
				341.5
	14	N/C		SAND: Gray, A-3
	16			
-75	23			
				336.5
	11	N/C		SANDY LOAM: Gray, A-4 335.9
	15			SAND: Gray, A-3 335.3
-80	17			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/25-5/31/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-305
Station 71+43
Offset 55.0 ft LT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter 377.5 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				GRAVEL: Gray, A-1 *(continued)*
				Rough drilling from 80.0'-82.0'
331.5				
	13 9	N/C		SAND: Gray, A-3
-85	12			
	20 22	N/C		Coarse sand and rock fragments
-90	21			
				Hard drilling from 92.0'-93.0'
	14 15	N/C		
-95	14			
	8 18	N/C		
315.0 -100	23			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				GRAVEL: Gray, A-1
311.5				
	14 27	N/C		SAND: Brownish-gray, trace gravel, A-3
-105	36			
				Rough drilling from 105.0'-107.8'
	48 50/4"	--		
				Weathered limestone and granite fragments in shoe; set casing at 109.3'
305.0 -110				STOP: 5/26/2016
	50/5"	--		START: 5/27/2016
				COBBLE w/ GRAVEL: Gray and brown, A-1
				No sample recovery
302.7	50/3"	--		
				Borehole continued with rock coring.
-115				
-120				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 5/25-5/31/2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** TC (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 **in**
Top of Rock Elev. 298.50 **ft**
Begin Core Elev. 302.70 **ft**

BORING NO. BB-305
Station 71+43
Offset 55.0 ft LT
Ground Surface Elev. 415.0 **ft**

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
GRAVEL: Limestone and granite cobbles and boulders 302.70		1	12	0		
	-115					
		2	69	56	5	
298.50						
SANDSTONE: Gray, moderately hard, very fine grained, banded, slightly weathered, calcareous Becomes medium bedded						94.1
Becomes thickly bedded	-120	3	95	82	2.8	
3.2" open vertical fracture, becomes thin to medium bedded 2.2" open vertical fracture						85.7
Becomes banded to thinly bedded, trace styolites	-125	4	100	74	2.4	157.0
287.15						
LIMESTONE: Light gray, moderately hard, very finely crystalline, medium bedded, slightly weathered		5	86	54	4	230.1
	-130					
1.75" open vertical fracture 284.50						
Boring terminated at 130.5 ft. Boring grouted to 130.5 ft.						

Color pictures of the cores Yes
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
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/26-6/2-2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-306
Station 74+00
Offset 31.0 ft LT
Ground Surface Elev. 427.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft
Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
426.8				3" TOPSOIL
	2 4 4	>4.5 P	24	FILL: Brown and gray, clay, trace fine sand and cinders, A-6
424.0				FILL: Brown, sandy clay, A-6
	2 3 3	0.5 P	38	
422.5				FILL: Brown, sand, A-3
-5 422.0				FILL: Brown, clay, with cinders, trace sand, A-6
420.5	2 5 5	N/C		FILL: Brown, sand, A-3
	4 5 6	N/C		
-10				Trace clay lumps
	3 4 6	N/C		
	4 6 8	N/C		
-15				
	7 9 12	N/C		
407.5				
-20	6 7 4	N/C N/C	36	FILL: Black, cinders, A-4

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				FILL: Black, cinders, A-4 *(continued)*
	2	N/C	30	Rough drilling at 20.5'
405.0	2 2	1.5 P	32	CLAY: Gray, with iron stains and nodules, A-7
	1 2	0.8 P	28	Trace iron stains
-25	2			
401.5				SILTY LOAM: Gray, A-4
	ST	0.5 S/10.6	33	
	2	0.9	28	
	5	S/15		
-30	7	N/C	29	
395.0				CLAY: Gray, A-7
	WOH 1	0.9 B/20	49	
-35	2			
390.0				SAND: Brown, A-3
	6 8	N/C		
-40	10			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/26-6/2-2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-306
Station 74+00
Offset 31.0 ft LT
Ground Surface Elev. 427.0 ft

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

Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Brown, A-3 *(continued)* Begin Mud Rotary at 40.0 feet.
-45	10 12 15	N/C		
-50	5 7 12	N/C		
				Becomes brownish-gray
-55	10 11 12	N/C		
-60	4 6 10	N/C		
-65	10 19 21	N/C		SAND: Brown, A-3 *(continued)*
				359.5 SAND: Brown and gray, A-1 358.8
-70	6 11 12	N/C		SAND: Gray, A-3
				Trace gravel
-75	8 8 7	N/C		
-80	12 10 7	N/C		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/26-6/2-2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-306
Station 74+00
Offset 31.0 ft LT
Ground Surface Elev. 427.0 ft

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

Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, A-3 *(continued)*			
	10 14	N/C	
-85	16		
Rough drilling from 87.0'-88.5'			
	15 14	N/C	
-90	12		
	12	N/C	
332.5	50/5"		
SAND: Gray, A-1			
-95			
	16 22	N/C	
-100	16		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, A-1 *(continued)*			
Advance with casing at 100.0'			
	29 38	N/C	
-105	50/4"		
With gravel			
	23 44	N/C	
-110	47		
No gravel			
	27 33	N/C	
-115	37		
309.0			
WEATHERED LIMESTONE w/ CLAY LOAM: Brown and gray, with chert gravel, A-1	50/5"	--	
-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 5/26-6/2-2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **DRILLING METHOD** CME 550 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. 082-6003(E), 082-0374(P)
Station

BORING NO. BB-306
Station 74+00
Offset 31.0 ft LT
Ground Surface Elev. 427.0 ft

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

Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
WEATHERED LIMESTONE w/ CLAY LOAM: Brown and gray, with chert gravel, A-1 *(continued)*			
	30 41 50/5"	N/C	
-125			
300.3	50/1"	--	
Borehole continued with rock coring.			
-130			
-135			
-140			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

ROCK CORE LOG

Date 5/26-6/2-2016

ROUTE Interstate 64 **DESCRIPTION** PTB 172, Item 22 - FAP 799 (MLK Drive) **LOGGED BY** BDG (SCI)

SECTION 1BR-1-1 **LOCATION** East Saint Louis, Illinois, **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY Saint Clair **CORING METHOD**

STRUCT. NO. 082-6003(E), 082-0374(P) **CORING BARREL TYPE & SIZE** NX Wireline
Station

Core Diameter 2 in
Top of Rock Elev. 300.28 ft
Begin Core Elev. 300.28 ft

BORING NO. BB-306
Station 74+00
Offset 31.0 ft LT
Ground Surface Elev. 427.0 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
LIMESTONE: Light gray, hard, very finely crystalline, thin to medium bedded, moderately weathered, with interbedded clay seams 300.28	1	100	73	2.22	
Becomes thinly bedded					820.6
-130					
Becomes fractured Becomes thinly bedded 296.05	2	100	89	1.3	
SANDSTONE: Gray, hard, very fine grained, thickly bedded, slightly weathered, calcareous					228.6
-135					
289.50					225.4
LIMESTONE: Light gray, moderately hard, very finely crystalline, thickly bedded, slightly weathered					
Becomes banded, with 0.3" clay seam					211.5
-140					
286.55	3	100	67	1	
SANDSTONE: Gray, hard, very fine grained, banded to thinly bedded, slightly weathered 1.3" interbedded limestone 0.65" clay seam, becomes medium bedded					
284.68					
Boring terminated at 142.3 ft. Boring grouted to 142.32 ft.					
-145					

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

BORING BB-301

DEPTH
120.86 ft.

DEPTH
130.86 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	120.86-125.41	100	94
2	125.41-130.41	100	95

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-301

DEPTH
130.86 ft.

DEPTH
136.86 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
3	130.86-136.86	100	88

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	PTB 172, Item 22 - FAP 799 (MLK Drive)
	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-302B

DEPTH
122.8 ft.

Scale in Inches

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	122.8-125.2	95	66
2	125.2-130.2	100	93

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	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-302B

DEPTH
130.2 ft.

DEPTH
138 ft.

Scale in Inches

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
3	130.2-135.2	99	78
4	135.2-138	100	76

SCI	SCI ENGINEERING, INC. www.sciengineering.com
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	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-303

DEPTH
110.8 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	110.8-115.1	14	0
2	115.1-116.1	25	0

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	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-303

DEPTH
119.5 ft.

DEPTH
129.5ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
3	119.5-123	69	33
4	123-124.5	100	100
5	124.5-129.5	100	72

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	PTB 172, Item 22 - FAP 799 (MLK Drive)
	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-303

DEPTH
129.5 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
6	129.5-136.5	95	88

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-304

DETH
119.62 ft.

DEPTH
129.62 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	119.62-125.09	100	80
2	125.09-127.44	100	87
3	127.44-134.62	100	86

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-304

DEPTH
129.62 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
3	127.44-134.62	100	86

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-305

DEPTH
112 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	112-115.5	12	0

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-305

DEPTH
115.5 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
2	115.5-119.5	69	56
3	119.5-124.5	95	82

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	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-305

DEPTH
124.5 ft.

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
4	124.5-127.9	100	74

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	PTB 172, Item 22 - FAP 799 (MLK Drive)
	ROCK CORE PHOTOGRAPH
	June 2016 SCI No. 2014-3149.51

BORING BB-306

DEPTH
126.72 ft.

DEPTH
136.72 ft.

Scale in Inches

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
1	126.72-130.32	100	73
2	130.32-140.32	100	89

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PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

BORING BB-306

DEPTH
136.72 ft.

DEPTH
142.32 ft.

Scale in Inches

RUN NO.	DEPTH, FT.	RECOVERY %	RQD %
2	130.32-140.32	100	89
3	140.32-142.32	100	67

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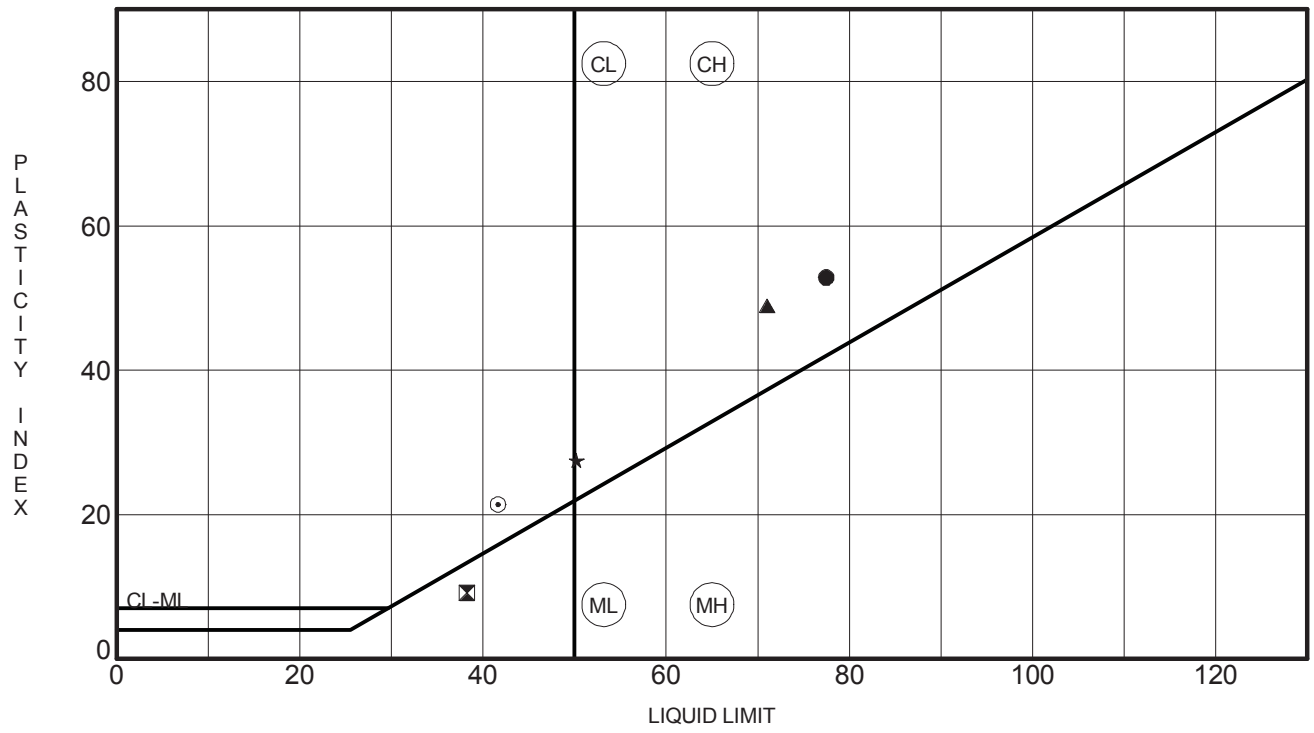
PTB 172, Item 22 - FAP 799 (MLK Drive)

ROCK CORE PHOTOGRAPH

June 2016 SCI No. 2014-3149.51

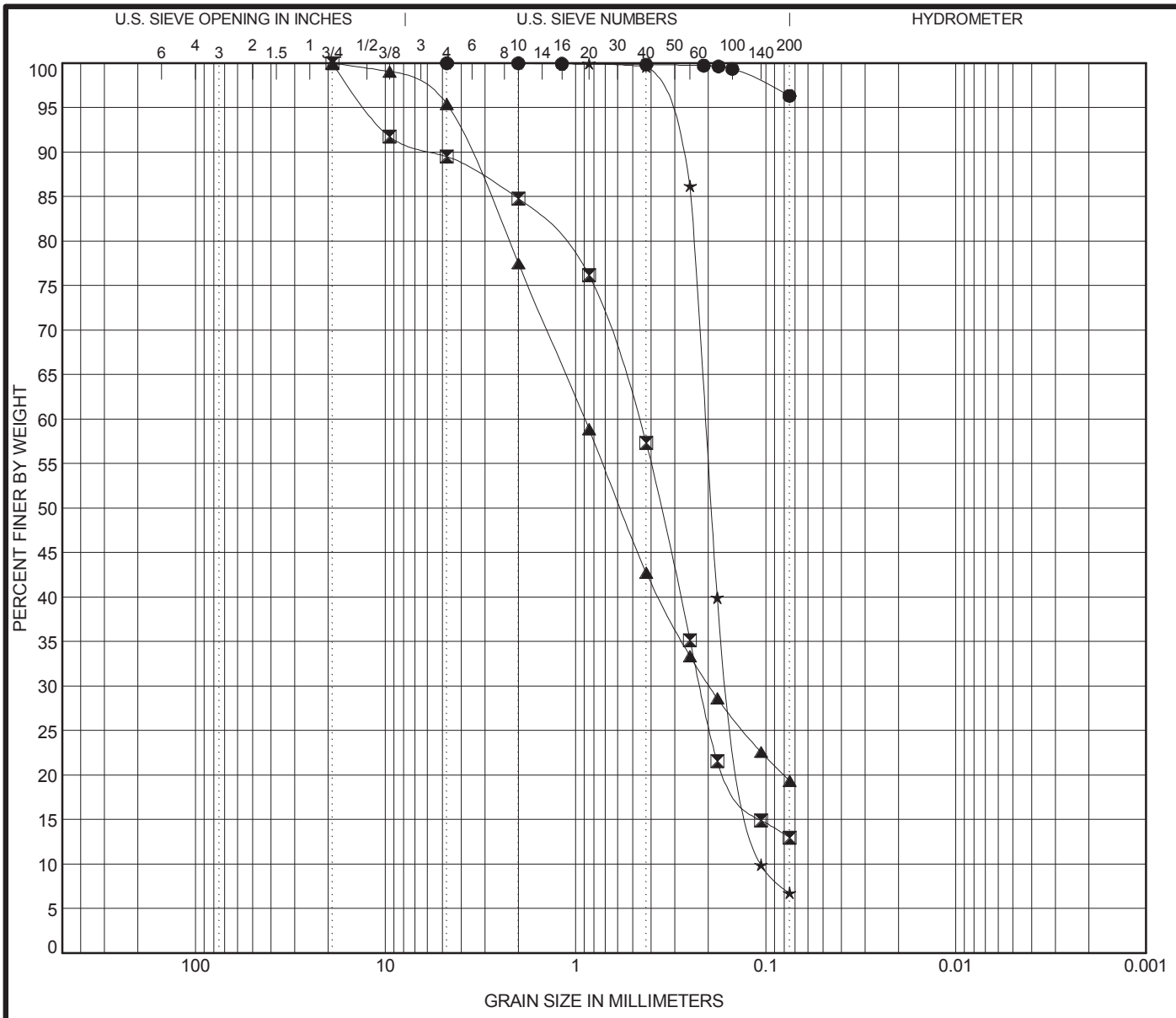


	Specimen Identification		LL	PL	PI	Fines	Classification
●	BB-301	8.5	77	25	52		
⧓	BB-302B	49.0	38	29	9		
▲	BB-304	13.5	71	22	49		
★	BB-305	13.5	50	23	27		
⊙	BB-306	28.5	42	20	22	93	LEAN CLAY(CL)

SCI Engineering, Inc.
130 Point West Blvd.
St.Charles, Missouri 63301
Telephone: 636-949-8200

ATTERBERG LIMITS' RESULTS

Project Name: MLK Connector
Location: St. Clair County
SCI Project No.: 2014-3149.51



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

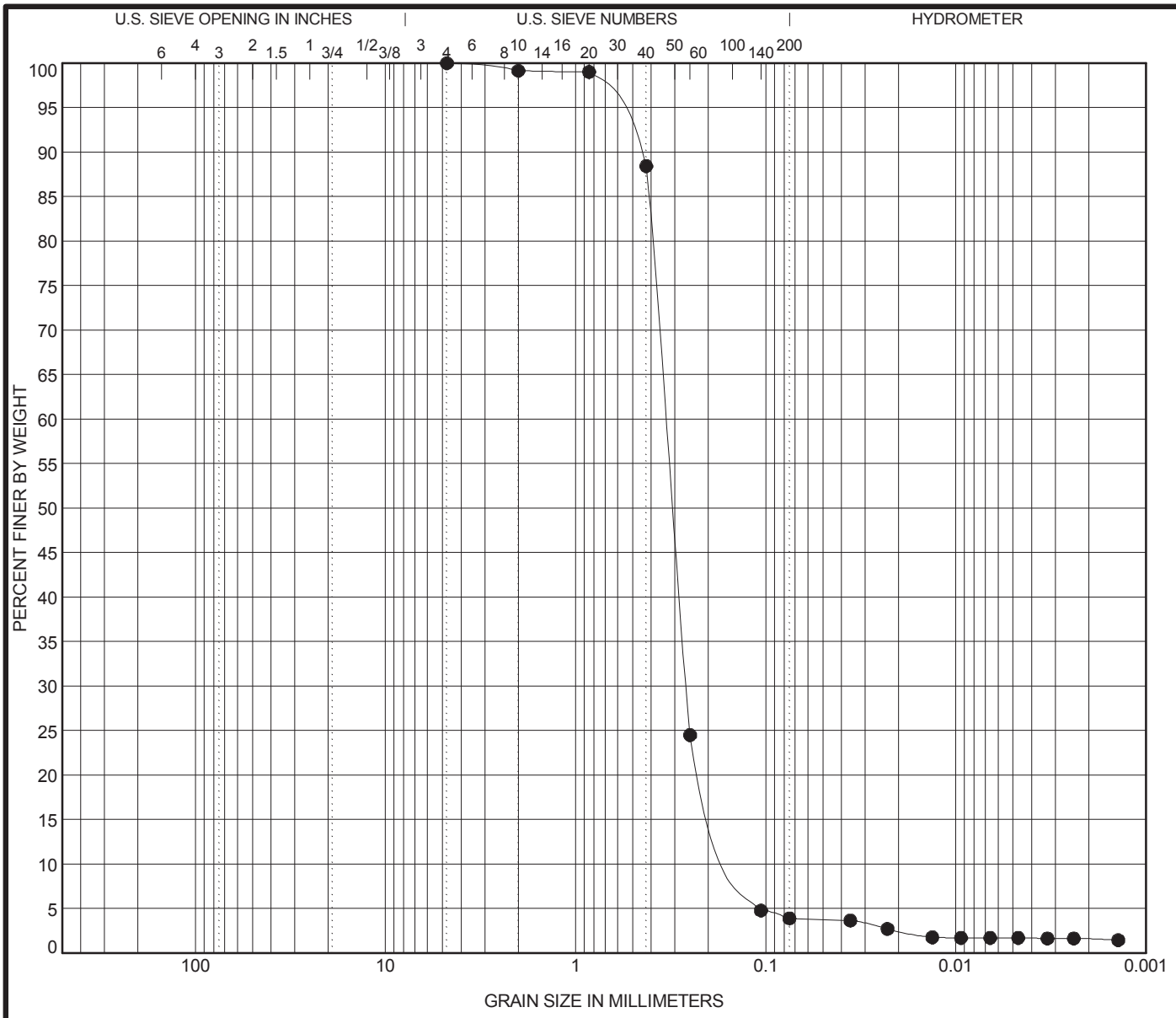
	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**BB-301**	**6.0**						
⊠	**BB-302**	**8.5**						
▲	**BB-302**	**21.0**						
★	**BB-302B**	**68.5**					**1.04**	**1.96**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BB-301**	**6.0**	**4.75**				**0.0**	**3.7**	**96.3**	
⊠	**BB-302**	**8.5**	**19**	**0.469**	**0.221**		**10.5**	**76.5**	**13.0**	
▲	**BB-302**	**21.0**	**19**	**0.894**	**0.198**		**4.6**	**76.0**	**19.4**	
★	**BB-302B**	**68.5**	**4.75**	**0.208**	**0.151**	**0.106**	**0.0**	**93.2**	**6.8**	

SCI Engineering, Inc.
650 Pierce Blvd.
O'Fallon, Illinois 62269
Telephone: 618-624-6969

GRAIN SIZE DISTRIBUTION - ASTM

Project Name: PTB 172-022 W06 FAP 799 (MLK Drive)
Location: East St. Louis, Illinois
SCI Project No.: 2014-3149.51



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

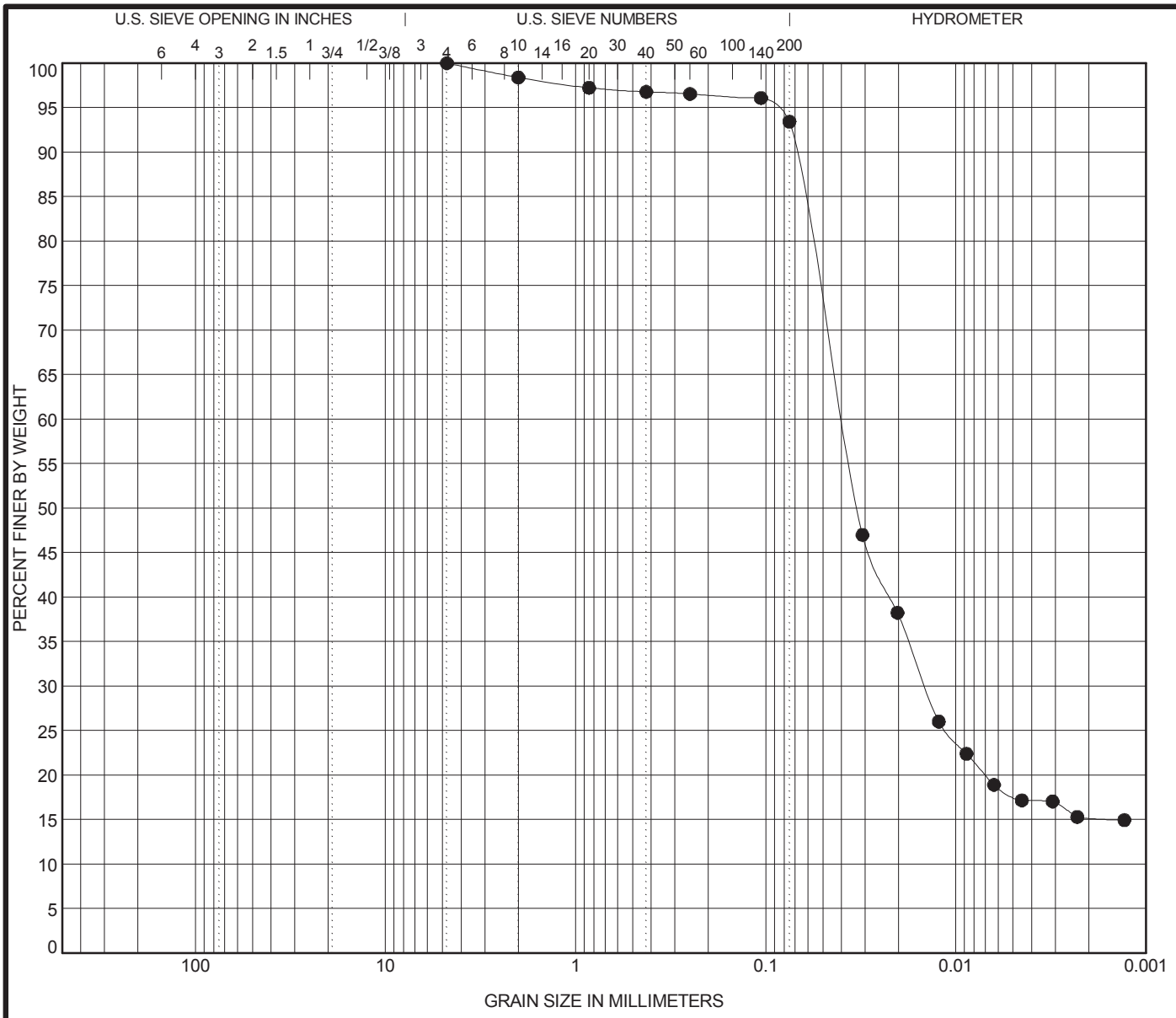
	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**BB-301**	**28.5**	**POORLY GRADED SAND(SP)**				**1.53**	**2.52**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BB-301**	**28.5**	**4.75**	**0.336**	**0.262**	**0.133**	**0.0**	**96.1**	**2.2**	**1.7**

SCI Engineering, Inc.
650 Pierce Blvd.
O'Fallon, Illinois 62269
Telephone: 618-624-6969

GRAIN SIZE DISTRIBUTION - ASTM

Project Name: PTB 172-022 W06 FAP 799 (MLK Drive)
Location: East St. Louis, Illinois
SCI Project No.: 2014-3149.51



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**BB-306**	**28.5**	**SILTY CLAY**	**42**	**20**	**22**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BB-306**	**28.5**	**4.75**	**0.04**	**0.014**		**0.0**	**6.6**	**75.7**	**17.7**

SCI Engineering, Inc.
650 Pierce Blvd.
O'Fallon, Illinois 62269
Telephone: 618-624-6969

GRAIN SIZE DISTRIBUTION - ASTM

Project Name: PTB 172-022 W06 FAP 799 (MLK Drive)
Location: East St. Louis, Illinois
SCI Project No.: 2014-3149.51

Unconfined Compression Test

SCI Engineering, Inc.

PROJECT NAME: **PTB 172-022 FAP 799 (MLK Drive)**
PROJECT No.: **2014-3149.51**

Boring Number	BB-301
Sample Number	ST-4
Sample Depth (ft)	8.5-10.5
Visual Description	
CLAY: Brown and gray, trace iron stains, A-7	

Specifications

Unconfined Compression	ASTM D2166
Liquid & Plastic Limits	ASTM D4318
Soil Classification	ASTM D2487
Visual Description	ASTM D2488

Initial Test Data

Average Diameter (inches)	**2.989**
Average Height (inches)	**6.014**
Height to Diameter Ratio	**2.0**
Ave. Rate of Strain (%/min)	**0.075**

Tested	7/11/2016
Calculated	7/12/2016
Checked	7/25/2016

Failure Sketch

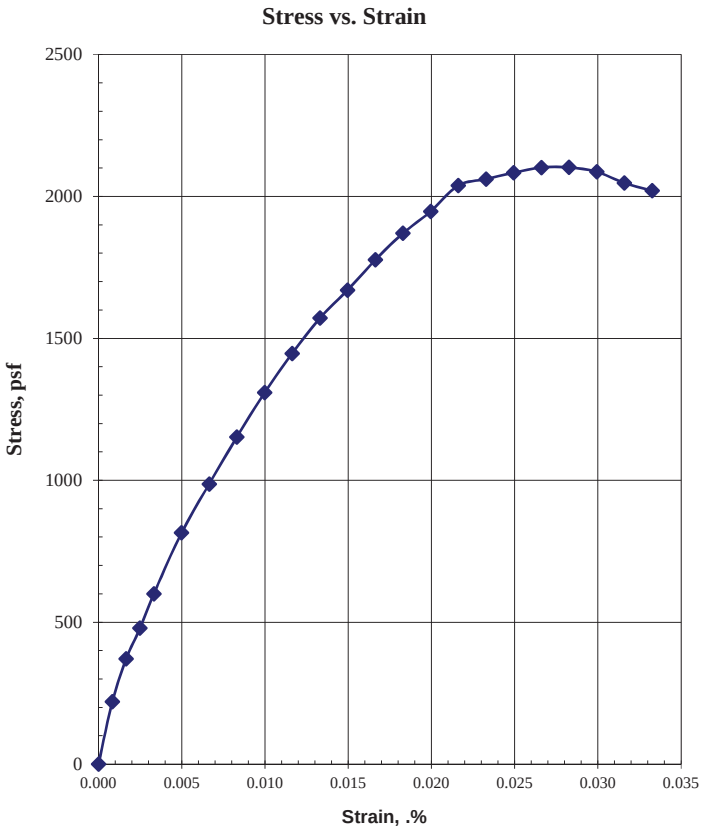
Remarks:

Test Results

Liquid Limit	
Plastic Limit	
Plasticity Index	
Classification	

Wet unit weight (pcf)	**104.8**
Moisture content (%)	**36.3**
Dry unit weight (pcf)	**76.9**

Unconfined Strength q_u (psf)	**2102**
Unconfined Strength q_u (ksf)	**2.10**
Strain at q_u	**0.03**
% Strain at q_u	**2.8**
Undrained Shear Strength S_u (ksf)	**1.05**



Unconfined Compression Test

SCI Engineering, Inc.

PROJECT NAME: **PTB 172-022 FAP 799 (MLK Drive)**
PROJECT No.: **2014-3149.51**

Boring Number	BB-304
Sample Number	ST-5
Sample Depth (ft)	13.5-15.5'
Visual Description	
CLAY: Dark gray, trace iron stains, A-7	

Specifications

Unconfined Compression	ASTM D2166
Liquid & Plastic Limits	ASTM D4318
Soil Classification	ASTM D2487
Visual Description	ASTM D2488

Initial Test Data

Average Diameter (inches)	**2.893**
Average Height (inches)	**6.003**
Height to Diameter Ratio	**2.1**
Ave. Rate of Strain (%/min)	**0.09**

Tested	7/11/2016
Calculated	7/12/2016
Checked	7/25/2016

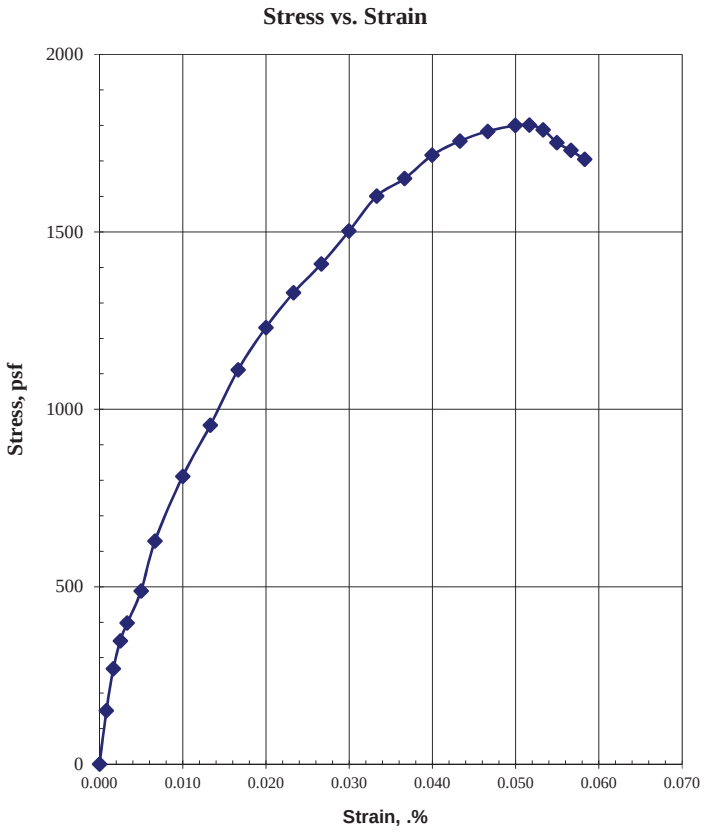
Failure Sketch

Test Results

Liquid Limit	
Plastic Limit	
Plasticity Index	
Classification	

Wet unit weight (pcf)	**114.6**
Moisture content (%)	**20.3**
Dry unit weight (pcf)	**95.3**

Unconfined Strength q_u (psf)	**1801**
Unconfined Strength q_u (ksf)	**1.80**
Strain at q_u	**0.05**
% Strain at q_u	**5.2**
Undrained Shear Strength S_u (ksf)	**0.90**



Remarks:

UNCONFINED COMPRESSION DATA

PROJECT NAME: **PTB 172-022 FAP 799 (MLK Drive)**

PROJECT No.: **2014-3149.51**

Load Cell

BORING NO.	BB-306
SAMPLE NO.	ST-11
SAMPLE DEPTH (ft)	26-28'
VISUAL DESCRIPTION	
SILTY LOAM: Gray, A-4	

Specimen Wt,g	1178.22
Average Diameter (inches)	2.870
Average Height (inches)	6.012
Height to Diametr Ratio	**2.1**
Initial Area A_o(ft^2)	**0.0449**
Volume (ft^3)	**0.0225**

Weight- Soil + Tare (wet),g	354.90
Weight- Soil + Tare (dry),g	288.26
Weight- Tare,g	87.62

Wet unit weight (pcf)	**115.4**
Moisture content (%)	**33.2**
Specific Gravity (estimated)	**2.68**
Void Ratio	**0.93**
Dry unit weight (pcf)	**86.7**

Liquid Limit	
Plastic Limit	
Plasticity Index	
CLASSIFICATION	

Unconfined Strength q_u (psf)	**959**
Unconfined Strength q_u (ksf)	**0.96**
Strain at q_u	**0.11**
% Strain at q_u	**10.6%**
Undrained Shear Strength S_u (ksf)	**0.48**

		Date
Tested	**JLB**	7/11/2016
Calculated	**JLB**	7/11/2016
Checked	**KAW**	7/25/2016

Rate of Strain (%/min)

Deformation (inches)	Load (div)	Strain (.%)	Corr. Area (ft^2)	Stress psf
0.000	0.0	0.0000	0.0449	0.0
0.005	1.0	0.0008	0.0450	22.2
0.010	1.4	0.0017	0.0450	31.1
0.015	1.9	0.0025	0.0450	42.2
0.020	2.1	0.0033	0.0451	46.6
0.030	2.9	0.0050	0.0451	64.2
0.050	4.3	0.0083	0.0453	94.9
0.070	6.0	0.0116	0.0454	132.0
0.090	7.6	0.0150	0.0456	166.7
0.110	9.1	0.0183	0.0458	198.9
0.130	10.6	0.0216	0.0459	230.9
0.150	12.5	0.0249	0.0461	271.4
0.170	14.4	0.0283	0.0462	311.5
0.200	17.0	0.0333	0.0465	365.9
0.240	21.1	0.0399	0.0468	451.0
0.280	25.6	0.0466	0.0471	543.4
0.320	29.4	0.0532	0.0474	619.7
0.360	33.0	0.0599	0.0478	690.7
0.400	36.3	0.0665	0.0481	754.4
0.440	39.4	0.0732	0.0485	813.0
0.480	42.0	0.0798	0.0488	860.4
0.520	45.0	0.0865	0.0492	915.2
0.560	46.9	0.0931	0.0495	946.9
0.600	47.8	0.0998	0.0499	958.0
0.640	48.2	0.1064	0.0503	958.9
0.680	48.4	0.1131	0.0506	955.7
0.720	47.5	0.1198	0.0510	930.9
0.740	46.7	0.1231	0.0512	911.8

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-301	Depth	124.6	ft	Rock Type:	Limestone, v. f. crystalline, w/ styolites and chert nodes				
	Moisture Content		Lengths (in):	3.856	3.85	3.861	Sample Weight	448.85	Load (div):	23759	Load Constant
	Wet Wt.(g)		Average Length	3.856							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.856	1.851	1.852	Wet Density (pcf)	164.4	Load (lbs):	23759.0	1 / 0
	Tare		Average Diameter	1.853			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	8810.2	
	MC %	#DIV/0!	Area (in2)	2.70					Peak Strength (ksf):	1268.7	
2	Boring	BB-301	Depth	129.2	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.917	3.914	3.926	Sample Weight	457.84	Load (div):	42068	Load Constant
	Wet Wt.(g)		Average Length	3.919							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.851	1.846	1.846	Wet Density (pcf)	166.0	Load (lbs):	42068.0	1 / 0
	Tare		Average Diameter	1.848			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	15689.7	
	MC %	#DIV/0!	Area (in2)	2.68					Peak Strength (ksf):	2259.3	
3	Boring	BB-301	Depth	131.4	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.927	3.921	3.928	Sample Weight	465.46	Load (div):	45673	Load Constant
	Wet Wt.(g)		Average Length	3.925							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.856	1.859	1.855	Wet Density (pcf)	166.8	Load (lbs):	45673.0	1 / 0
	Tare		Average Diameter	1.857			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	16869.5	
	MC %	#DIV/0!	Area (in2)	2.71					Peak Strength (ksf):	2429.2	
4	Boring	BB-301	Depth	135.3	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.949	3.941	3.95	Sample Weight	469.14	Load (div):	41374	Load Constant
	Wet Wt.(g)		Average Length	3.947							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.859	1.861	1.86	Wet Density (pcf)	166.7	Load (lbs):	41374.0	1 / 0
	Tare		Average Diameter	1.860			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	15226.9	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	2192.7	

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-302B	Depth	123.8	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.942	3.937	3.947	Sample Weight	468.97	Load (div):	28927	Load Constant
	Wet Wt.(g)		Average Length	3.942							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.86	1.860	1.861	Wet Density (pcf)	166.7	Load (lbs):	28927.0	1 / 0
	Tare		Average Diameter	1.860			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	10642.2	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	1532.5	
2	Boring	BB-302B	Depth	125.5	ft	Rock Type:	Limestone, very finely crystalline, trace chert				
	Moisture Content		Lengths (in):	3.899	3.897	4.005	Sample Weight	462.28	Load (div):	42624	Load Constant
	Wet Wt.(g)		Average Length	3.934							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.86	1.861	1.861	Wet Density (pcf)	164.6	Load (lbs):	42624.0	1 / 0
	Tare		Average Diameter	1.861			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	15675.7	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	2257.3	
3	Boring	BB-302B	Depth	131.2	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.955	3.953	3.952	Sample Weight	476.4	Load (div):	34018	Load Constant
	Wet Wt.(g)		Average Length	3.953							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.863	1.862	1.866	Wet Density (pcf)	168.3	Load (lbs):	34018.0	1 / 0
	Tare		Average Diameter	1.864			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	12470.5	
	MC %	#DIV/0!	Area (in2)	2.73					Peak Strength (ksf):	1795.7	
4	Boring	BB-302B	Depth	133.8	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.95	3.94	3.945	Sample Weight	469	Load (div):	34483	Load Constant
	Wet Wt.(g)		Average Length	3.945							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.865	1.866	1.865	Wet Density (pcf)	165.7	Load (lbs):	34483.0	1 / 0
	Tare		Average Diameter	1.865			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	12618.4	
	MC %	#DIV/0!	Area (in2)	2.73					Peak Strength (ksf):	1817.0	
5	Boring	BB-302B	Depth	137.4	ft	Rock Type:	Limestone, very finely crystalline				
	Moisture Content		Lengths (in):	3.986	3.992	3.987	Sample Weight	473.41	Load (div):	32227	Load Constant
	Wet Wt.(g)		Average Length	3.988							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.861	1.859	1.861	Wet Density (pcf)	166.4	Load (lbs):	32227.0	1 / 0
	Tare		Average Diameter	1.860			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	11856.3	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	1707.3	

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-303	Depth	122.25	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.631	3.629	3.633	Sample Weight	424.04	Load (div):	46771	Load Constant
	Wet Wt.(g)		Average Length	3.631							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.856	1.857	1.857	Wet Density (pcf)	164.3	Load (lbs):	46771.0	1 / 0
	Tare		Average Diameter	1.857			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	17275.0	
	MC %	#DIV/0!	Area (in2)	2.71					Peak Strength (ksf):	2487.6	
2	Boring	BB-303	Depth	123.8	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.628	3.635	3.631	Sample Weight	428.22	Load (div):	39529	Load Constant
	Wet Wt.(g)		Average Length	3.631							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.854	1.855	1.855	Wet Density (pcf)	166.3	Load (lbs):	39529.0	1 / 0
	Tare		Average Diameter	1.855			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	14631.7	
	MC %	#DIV/0!	Area (in2)	2.70					Peak Strength (ksf):	2107.0	
3	Boring	BB-303	Depth	124.8	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.664	3.659	3.661	Sample Weight	426.25	Load (div):	9871	Load Constant
	Wet Wt.(g)		Average Length	3.661							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.853	1.853	1.854	Wet Density (pcf)	164.4	Load (lbs):	9871.0	1 / 0
	Tare		Average Diameter	1.853			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	3659.0	
	MC %	#DIV/0!	Area (in2)	2.70					Peak Strength (ksf):	526.9	
4	Boring	BB-303	Depth	130.85	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.701	3.701	3.702	Sample Weight	438.17	Load (div):	4589	Load Constant
	Wet Wt.(g)		Average Length	3.701							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.859	1.86	1.861	Wet Density (pcf)	166.0	Load (lbs):	4589.0	1 / 0
	Tare		Average Diameter	1.860			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	1688.9	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	243.2	
5	Boring	BB-303	Depth	134.7	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.586	3.587	3.586	Sample Weight	425.9	Load (div):	19597	Load Constant
	Wet Wt.(g)		Average Length	3.586							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.858	1.86	1.861	Wet Density (pcf)	166.6	Load (lbs):	19597.0	1 / 0
	Tare		Average Diameter	1.860			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	7214.9	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	1038.9	

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-304	Depth	120.5	ft	Rock Type:		SANDSTONE			
	Moisture Content		Lengths (in):	3.241	3.236	3.237	Sample Weight	330.88	Load (div):	232	Load Constant
	Wet Wt.(g)		Average Length	3.238							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.855	1.857	1.855	Wet Density (pcf)	143.9	Load (lbs):	232.0	1 / 0
	Tare		Average Diameter	1.856			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	85.8	
	MC %	#DIV/0!	Area (in2)	2.70					Peak Strength (ksf):	12.4	
2	Boring	BB-304	Depth	124.25	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	4.068	4.066	4.077	Sample Weight	482.67	Load (div):	24399	Load Constant
	Wet Wt.(g)		Average Length	4.070							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.859	1.859	1.86	Wet Density (pcf)	166.4	Load (lbs):	24399.0	1 / 0
	Tare		Average Diameter	1.859			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	8986.0	
	MC %	#DIV/0!	Area (in2)	2.72					Peak Strength (ksf):	1294.0	
3	Boring	BB-304	Depth	127.9	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	4.015	4.016	4.019	Sample Weight	476.15	Load (div):	15184	Load Constant
	Wet Wt.(g)		Average Length	4.017							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.873	1.871	1.874	Wet Density (pcf)	164.0	Load (lbs):	15184.0	1 / 0
	Tare		Average Diameter	1.873			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	5512.8	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	793.8	
4	Boring	BB-304	Depth	132.25	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.997	3.996	3.989	Sample Weight	478.73	Load (div):	47281	Load Constant
	Wet Wt.(g)		Average Length	3.994							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.872	1.872	1.873	Wet Density (pcf)	165.8	Load (lbs):	47281.0	1 / 0
	Tare		Average Diameter	1.872			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	17172.4	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	2472.8	
5	Boring	BB-304	Depth	134.35	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	4.003	4.002	4.006	Sample Weight	482.07	Load (div):	11609	Load Constant
	Wet Wt.(g)		Average Length	4.004							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.873	1.872	1.872	Wet Density (pcf)	166.6	Load (lbs):	11609.0	1 / 0
	Tare		Average Diameter	1.872			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	4216.4	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	607.2	

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-305	Depth	118.7	ft	Rock Type:		SANDSTONE			
	Moisture Content		Lengths (in):	3.998	4.005	4.006	Sample Weight	411.65	Load (div):	3590	Load Constant
	Wet Wt.(g)		Average Length	4.003							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.874	1.866	1.871	Wet Density (pcf)	142.6	Load (lbs):	3590.0	1 / 0
	Tare		Average Diameter	1.870			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	1306.7	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	188.2	
2	Boring	BB-305	Depth	121.75	ft	Rock Type:		SANDSTONE			
	Moisture Content		Lengths (in):	3.978	3.976	3.974	Sample Weight	383.7	Load (div):	3270	Load Constant
	Wet Wt.(g)		Average Length	3.976							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.868	1.8714	1.873	Wet Density (pcf)	133.7	Load (lbs):	3270.0	1 / 0
	Tare		Average Diameter	1.871			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	1189.6	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	171.3	
3	Boring	BB-305	Depth	126	ft	Rock Type:		SANDSTONE			
	Moisture Content		Lengths (in):	4.049	4.046	4.043	Sample Weight	406.77	Load (div):	5976	Load Constant
	Wet Wt.(g)		Average Length	4.046							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.872	1.868	1.865	Wet Density (pcf)	139.7	Load (lbs):	5976.0	1 / 0
	Tare		Average Diameter	1.868			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	2179.8	
	MC %	#DIV/0!	Area (in2)	2.74					Peak Strength (ksf):	313.9	
4	Boring	BB-305	Depth	128.95	ft	Rock Type:		DOLOMITE			
	Moisture Content		Lengths (in):	3.802	3.801	3.798	Sample Weight	406	Load (div):	8796	Load Constant
	Wet Wt.(g)		Average Length	3.800							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.872	1.872	1.872	Wet Density (pcf)	147.9	Load (lbs):	8796.0	1 / 0
	Tare		Average Diameter	1.872			Dry Density (pcf)	#DIV/0!	Peak Strength (psi):	3195.8	
	MC %	#DIV/0!	Area (in2)	2.75					Peak Strength (ksf):	460.2	

Project: PTB 172.022 WO6 FAP 799 (MLK Drive) Project No. 2014-3149.51

1	Boring	BB-306	Depth	139.5	ft	Rock Type:		SANDSTONE			
	Moisture Content		Lengths (in):	3.929	3.926	3.933	Sample Weight	405.75	Load (div):	7981	Load Constant
	Wet Wt.(g)		**Average Length**	**3.929**							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.862	1.861	1.856	**Wet Density (pcf)**	**144.8**	**Load (lbs):**	**7981.0**	1 / 0
	Tare		**Average Diameter**	**1.860**			**Dry Density (pcf)**	**#DIV/0!**	**Peak Strength (psi):**	**2938.3**	
	MC %	**#DIV/0!**	**Area (in2)**	**2.72**					**Peak Strength (ksf):**	**423.1**	
2	Boring	BB-306	Depth	133.7	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.945	3.951	3.952	Sample Weight	434.73	Load (div):	8590	Load Constant
	Wet Wt.(g)		**Average Length**	**3.949**							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.855	1.857		**Wet Density (pcf)**	**155.0**	**Load (lbs):**	**8590.0**	1 / 0
	Tare		**Average Diameter**	**1.856**			**Dry Density (pcf)**	**#DIV/0!**	**Peak Strength (psi):**	**3175.0**	
	MC %	**#DIV/0!**	**Area (in2)**	**2.71**					**Peak Strength (ksf):**	**457.2**	
3	Boring	BB-306	Depth	136.9	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.902	3.899	3.897	Sample Weight	470.81	Load (div):	8499	Load Constant
	Wet Wt.(g)		**Average Length**	**3.899**							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.86	1.859	1.859	**Wet Density (pcf)**	**169.4**	**Load (lbs):**	**8499.0**	1 / 0
	Tare		**Average Diameter**	**1.859**			**Dry Density (pcf)**	**#DIV/0!**	**Peak Strength (psi):**	**3130.1**	
	MC %	**#DIV/0!**	**Area (in2)**	**2.72**					**Peak Strength (ksf):**	**450.7**	
4	Boring	BB-306	Depth	127.65	ft	Rock Type:		LIMESTONE			
	Moisture Content		Lengths (in):	3.958	3.961	3.96	Sample Weight	470.43	Load (div):	30855	Load Constant
	Wet Wt.(g)		**Average Length**	**3.960**							Multiplier / Base
	Dry Wt. (g)		Diameters (in):	1.857	1.857	1.856	**Wet Density (pcf)**	**167.2**	**Load (lbs):**	**30855.0**	1 / 0
	Tare		**Average Diameter**	**1.857**			**Dry Density (pcf)**	**#DIV/0!**	**Peak Strength (psi):**	**11396.4**	
	MC %	**#DIV/0!**	**Area (in2)**	**2.71**					**Peak Strength (ksf):**	**1641.1**	

PERCENT FINER THAN NO. 200 SIEVE

PROJECT MLK Drive PTB 172-022 WO6 FAP 799

JOB NO. 2014-3149.51 Task 300

PAGE 1

Tested by/date: EC 6/10/2016

Checked by/date: EC 6/11/2016

	Boring	Sample	Moisture Content				Before WASH			After WASH			Percent Passing
			Wet & Tare	Dry & Tare	Tare	%	Soil & Tare	Tare	Dry Weight	Soil & Tare	Tare	Dry Weight	
1	BB-305	S-7	246.28	246.28	87.97	0.00	246.28	87.97	158.31	239.64	87.97	151.67	4.2
2													
3													
4													
5													
6													
7													
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Appendix B

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ========== BB-301
ELEVATION OF BORING GROUND SURFACE ========== 417.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 42.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 30.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.145
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 25.00 FT. (Fill Height)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 6 IN.
SAMPLING METHOD========== Sampler w/out Liners

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

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **508** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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
414.5	2.5	10						0.118	0.295	18.326	18.326	0.196	0.118	3.295	3.295	0.882	**0.164**	0.736	**0.070**	**N.L. (1)**
412	5	32						0.132	0.625	58.661	58.661	0.389	0.132	3.625	3.625	0.807	**0.298**	0.707	**0.067**	**N.L. (1)**
409.5	7.5	3		12	22	55		0.105	0.888	4.325	6.016	0.080	0.043	3.733	3.889	0.890	**0.067**	0.681	**0.067**	**N.L. (2)**
407	10	3		12	22	55		0.105	1.150	4.338	6.028	0.080	0.043	3.840	4.152	0.884	**0.067**	0.658	**0.067**	**N.L. (2)**
404	13	4		12	12	24		0.108	1.474	5.660	7.392	0.091	0.046	3.978	4.477	0.873	**0.075**	0.635	**0.068**	**N.L. (2)**
402	15	6		10				0.113	1.700	8.275	9.324	0.107	0.051	4.080	4.704	0.862	**0.088**	0.622	**0.068**	**1.294 (C)**
399.5	17.5	7						0.114	1.985	9.291	9.291	0.107	0.052	4.210	4.990	0.856	**0.087**	0.608	**0.068**	**1.279 (C)**
397	20	14						0.122	2.290	18.306	18.306	0.195	0.060	4.360	5.296	0.815	**0.151**	0.597	**0.068**	**2.221 (D)**
394.5	22.5	20						0.126	2.605	25.888	25.888	0.311	0.064	4.520	5.612	0.778	**0.229**	0.587	**0.069**	**N.L. (3)**
392	25	10						0.118	2.900	11.509	11.509	0.127	0.056	4.660	5.908	0.827	**0.099**	0.580	**0.069**	**1.435 (C)**
389.5	27.5	11						0.119	3.198	12.086	12.086	0.132	0.057	4.803	6.207	0.819	**0.102**	0.574	**0.070**	**1.457 (C)**
387	30	7		3				0.114	3.483	7.366	7.366	0.091	0.052	4.933	6.493	0.834	**0.072**	0.570	**0.071**	**1.014 (C)**
382	35	18						0.125	4.108	17.706	17.706	0.189	0.063	5.248	7.120	0.776	**0.139**	0.563	**0.072**	**1.931 (D)**
377	40	14						0.122	4.718	12.398	12.398	0.135	0.060	5.548	7.732	0.789	**0.101**	0.554	**0.073**	**1.384 (C)**
372	45	15						0.065	5.043	12.786	12.786	0.139	0.065	5.873	8.369	0.776	**0.102**	0.547	**0.074**	**1.378 (C)**
367	50	18						0.066	5.373	14.855	14.855	0.159	0.066	6.203	9.011	0.755	**0.114**	0.540	**0.074**	**1.541 (D)**
362	55	38						0.073	5.738	33.018	33.018	1.259	0.073	6.568	9.688	0.654	**0.781**	0.533	**0.074**	**N.L. (3)**
357	60	43						0.074	6.108	36.359	36.359	-0.159	0.074	6.938	10.370	0.625	**-0.094**	0.526	**0.074**	**N.L. (3)**
352	65	23						0.068	6.448	17.015	17.015	0.181	0.068	7.278	11.022	0.712	**0.122**	0.519	**0.074**	**1.649 (D)**
347	70	24						0.069	6.793	17.109	17.109	0.182	0.069	7.623	11.679	0.703	**0.121**	0.512	**0.074**	**1.635 (D)**
342	75	21						0.068	7.133	14.212	14.212	0.152	0.068	7.963	12.331	0.711	**0.103**	0.505	**0.074**	**1.392 (C)**
337	80	22						0.068	7.473	14.425	14.425	0.154	0.068	8.303	12.983	0.702	**0.103**	0.498	**0.074**	**1.392 (C)**
332	85	13		16				0.063	7.788	8.247	11.459	0.126	0.063	8.618	13.610	0.714	**0.085**	0.491	**0.073**	**1.164 (C)**
327	90	36						0.073	8.153	23.201	23.201	0.260	0.073	8.983	14.287	0.635	**0.157**	0.484	**0.073**	**2.151 (D)**
322	95	67						0.079	8.548	46.132	46.132	0.254	0.079	9.378	14.994	0.552	**0.133**	0.477	**0.072**	**N.L. (3)**
317	100	52						0.076	8.928	32.070	32.070	0.751	0.076	9.758	15.686	0.569	**0.405**	0.470	**0.071**	**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

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ========== BB-302
ELEVATION OF BORING GROUND SURFACE ========== 416.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 21.10 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 21.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.145
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
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) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **420** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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

	DATA REQUIRED																				
	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
413.5	2.5	24						0.128	0.320	48.681	48.681	0.288	0.128	0.320	0.320	1.500	**0.409**	0.976	**0.092**	**N.L. (1)**
411	5	13						0.121	0.623	21.859	21.859	0.240	0.121	0.623	0.623	1.454	**0.331**	0.948	**0.090**	**N.L. (1)**
408.5	7.5	5						0.111	0.900	7.183	7.183	0.089	0.111	0.900	0.900	1.201	**0.102**	0.917	**0.087**	**N.L. (1)**
406	10	3		10				0.105	1.163	4.323	5.286	0.074	0.105	1.163	1.163	1.129	**0.079**	0.881	**0.083**	**N.L. (1)**
403	13	3						0.105	1.478	4.241	4.241	0.067	0.105	1.478	1.478	1.075	**0.068**	0.836	**0.079**	**N.L. (1)**
401	15	9						0.117	1.712	12.380	12.380	0.135	0.117	1.712	1.712	1.054	**0.135**	0.804	**0.076**	**N.L. (1)**
398.5	17.5	8						0.116	2.002	10.580	10.580	0.118	0.116	2.002	2.002	1.014	**0.114**	0.765	**0.072**	**N.L. (1)**
396	20	8						0.116	2.292	10.134	10.134	0.114	0.116	2.292	2.292	0.982	**0.106**	0.726	**0.069**	**N.L. (1)**
393.5	22.5	2		19				0.048	2.412	2.505	6.121	0.081	0.048	2.412	2.505	0.974	**0.074**	0.690	**0.068**	**1.088 (C)**
391	25	4		19				0.053	2.544	4.926	8.718	0.102	0.053	2.544	2.794	0.960	**0.093**	0.656	**0.068**	**1.368 (C)**
388.5	27.5	2		19				0.048	2.664	2.423	6.033	0.080	0.048	2.664	3.070	0.954	**0.072**	0.627	**0.068**	**1.059 (C)**
386	30	2	0.4		12	25		0.049	2.787	2.379	2.379	0.055	0.049	2.787	3.348	0.947	**0.049**	0.601	**0.068**	**N.L. (2)**
381	35	30						0.071	3.142	38.198	38.198	0.040	0.071	3.142	4.015	0.854	**0.032**	0.561	**0.068**	**N.L. (3)**
376	40	20						0.067	3.477	22.429	22.429	0.248	0.067	3.477	4.662	0.858	**0.202**	0.534	**0.068**	**2.971 (D)**
371	45	23						0.068	3.817	24.844	24.844	0.289	0.068	3.817	5.314	0.826	**0.226**	0.517	**0.068**	**3.324 (D)**
366	50	14						0.064	4.137	13.617	13.617	0.146	0.064	4.137	5.946	0.844	**0.117**	0.506	**0.069**	**1.696 (D)**
361	55	24						0.069	4.482	23.475	23.475	0.265	0.069	4.482	6.603	0.790	**0.198**	0.499	**0.069**	**2.870 (D)**
356	60	11						0.062	4.792	9.796	9.796	0.111	0.062	4.792	7.225	0.829	**0.087**	0.495	**0.071**	**1.225 (C)**
351	65	43						0.074	5.162	41.794	41.794	0.177	0.074	5.162	7.907	0.701	**0.117**	0.489	**0.071**	**N.L. (3)**
346	70	36		6.8				0.073	5.527	32.027	32.370	0.849	0.073	5.527	8.584	0.701	**0.564**	0.482	**0.071**	**N.L. (3)**
341	75	29						0.071	5.882	23.754	23.754	0.269	0.071	5.882	9.251	0.723	**0.185**	0.475	**0.071**	**2.606 (D)**
336	80	21						0.068	6.222	15.867	15.867	0.169	0.068	6.222	9.903	0.749	**0.120**	0.468	**0.070**	**1.714 (D)**
331	85	26						0.069	6.567	19.267	19.267	0.206	0.069	6.567	10.560	0.721	**0.141**	0.461	**0.070**	**2.014 (D)**
326	90	20						0.067	6.902	13.878	13.878	0.149	0.067	6.902	11.207	0.739	**0.104**	0.454	**0.070**	**1.486 (C)**
321	95	31						0.071	7.257	21.627	21.627	0.237	0.071	7.257	11.874	0.688	**0.154**	0.447	**0.069**	**2.232 (D)**
316	100	54						0.076	7.637	38.641	38.641	0.066	0.076	7.637	12.566	0.599	**0.038**	0.440	**0.068**	**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

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ==========: BB-303
ELEVATION OF BORING GROUND SURFACE ==========: 416.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ==========: 29.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==========: 25.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) =====: 0.145
EARTHQUAKE MOMENT MAGNITUDE ==========: 7.7
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) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **541** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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
413.5	2.5	19						0.126	0.315	38.607	38.607	0.064	0.126	0.315	0.315	1.500	**0.091**	0.992	**0.094**	**N.L. (1)**
411	5	10						0.118	0.610	16.263	16.263	0.173	0.118	0.610	0.610	1.401	**0.230**	0.981	**0.093**	**N.L. (1)**
408.5	7.5	5						0.111	0.888	7.209	7.209	0.089	0.111	0.888	0.888	1.205	**0.102**	0.969	**0.092**	**N.L. (1)**
406	10	5						0.111	1.165	7.201	7.201	0.089	0.111	1.165	1.165	1.137	**0.096**	0.953	**0.090**	**N.L. (1)**
403	13	4						0.108	1.489	5.639	5.639	0.077	0.108	1.489	1.489	1.075	**0.078**	0.931	**0.088**	**N.L. (1)**
401	15	12						0.120	1.729	16.901	16.901	0.180	0.120	1.729	1.729	1.058	**0.180**	0.914	**0.086**	**N.L. (1)**
398.5	17.5	10						0.118	2.024	13.185	13.185	0.142	0.118	2.024	2.024	1.012	**0.137**	0.890	**0.084**	**N.L. (1)**
396	20	8						0.116	2.314	10.087	10.087	0.114	0.116	2.314	2.314	0.980	**0.106**	0.864	**0.082**	**N.L. (1)**
393.5	22.5	16						0.124	2.624	19.992	19.992	0.215	0.124	2.624	2.624	0.939	**0.192**	0.836	**0.079**	**N.L. (1)**
391	25	16						0.124	2.934	18.903	18.903	0.202	0.124	2.934	2.934	0.911	**0.175**	0.807	**0.076**	**N.L. (1)**
388.5	27.5	13						0.121	3.237	14.250	14.250	0.153	0.059	3.082	3.238	0.908	**0.131**	0.778	**0.077**	**1.701 (D)**
386	30	10						0.061	3.389	10.688	10.688	0.119	0.061	3.234	3.546	0.905	**0.102**	0.750	**0.078**	**1.308 (C)**
381	35	8						0.059	3.684	8.209	8.209	0.098	0.059	3.529	4.153	0.894	**0.083**	0.699	**0.078**	**1.064 (C)**
376	40	21						0.068	4.024	21.479	21.479	0.235	0.068	3.869	4.805	0.833	**0.185**	0.660	**0.077**	**2.403 (D)**
371	45	29						0.071	4.379	29.438	29.438	0.433	0.071	4.224	5.472	0.784	**0.322**	0.631	**0.077**	**N.L. (3)**
366	50	37						0.073	4.744	37.089	37.089	-0.054	0.073	4.589	6.149	0.734	**-0.037**	0.612	**0.078**	**N.L. (3)**
361	55	36						0.073	5.109	34.000	34.000	2917.915	0.073	4.954	6.826	0.723	**2001.632**	0.600	**0.078**	**N.L. (3)**
356	60	28						0.070	5.459	24.168	24.168	0.276	0.070	5.304	7.488	0.746	**0.195**	0.593	**0.079**	**2.468 (D)**
351	65	35						0.072	5.819	29.725	29.725	0.450	0.072	5.664	8.160	0.706	**0.301**	0.581	**0.079**	**N.L. (3)**
346	70	26						0.069	6.164	20.217	20.217	0.218	0.069	6.009	8.817	0.735	**0.152**	0.574	**0.080**	**1.900 (D)**
341	75	38						0.073	6.529	29.772	29.772	0.452	0.073	6.374	9.494	0.676	**0.290**	0.567	**0.080**	**N.L. (3)**
336	80	47						0.075	6.904	36.511	36.511	-0.133	0.075	6.749	10.181	0.631	**-0.079**	0.560	**0.080**	**N.L. (3)**
331	85	39						0.073	7.269	28.069	28.069	0.372	0.073	7.114	10.858	0.659	**0.232**	0.553	**0.080**	**N.L. (3)**
326	90	58						0.077	7.654	42.876	42.876	0.200	0.077	7.499	11.555	0.603	**0.115**	0.546	**0.079**	**N.L. (3)**
321	95	39						0.073	8.019	25.787	25.787	0.308	0.073	7.864	12.232	0.649	**0.190**	0.539	**0.079**	**N.L. (3)**
316	100	18						0.066	8.349	10.616	10.616	0.119	0.066	8.194	12.874	0.727	**0.082**	0.532	**0.079**	**1.038 (C)**

* FACTOR OF SAFETY DESCRIPTIONS

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

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ========== BB-304
ELEVATION OF BORING GROUND SURFACE ========== 416.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 27.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 15.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.145
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
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) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **529** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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

	DATA REQUIRED																				
	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
413.5	2.5	8						0.116	0.290	14.275	14.275	0.153	0.116	0.290	0.290	1.500	**0.217**	0.991	**0.094**	**N.L. (1)**
411	5	8						0.116	0.580	12.810	12.810	0.139	0.116	0.580	0.580	1.381	**0.182**	0.979	**0.093**	**N.L. (1)**
408.5	7.5	8						0.116	0.870	11.691	11.691	0.128	0.116	0.870	0.870	1.241	**0.151**	0.965	**0.091**	**N.L. (1)**
406	10	3	1.2					0.124	1.180	4.303	4.303	0.067	0.124	1.180	1.180	1.124	**0.071**	0.948	**0.090**	**N.L. (1)**
403	13	7	1.5					0.126	1.558	9.702	9.702	0.110	0.126	1.558	1.558	1.073	**0.112**	0.924	**0.087**	**N.L. (1)**
401	15	7	0.9					0.120	1.798	9.437	9.437	0.108	0.120	1.798	1.798	1.038	**0.107**	0.906	**0.086**	**N.L. (1)**
398.5	17.5	6	1.5					0.126	2.113	7.745	7.745	0.094	0.064	1.958	2.114	1.017	**0.090**	0.880	**0.090**	**1.000 (C)**
396	20	14						0.122	2.418	17.779	17.779	0.189	0.060	2.108	2.420	1.002	**0.180**	0.852	**0.092**	**1.957 (D)**
393.5	22.5	14						0.122	2.723	16.858	16.858	0.179	0.060	2.258	2.726	0.983	**0.167**	0.823	**0.094**	**1.777 (D)**
391	25	14						0.122	3.028	15.988	15.988	0.170	0.060	2.408	3.032	0.966	**0.156**	0.793	**0.094**	**1.660 (D)**
388.5	27.5	10						0.061	3.181	11.020	11.020	0.122	0.061	2.561	3.341	0.956	**0.111**	0.763	**0.094**	**1.181 (C)**
386	30	11						0.062	3.336	11.864	11.864	0.130	0.062	2.716	3.652	0.942	**0.116**	0.735	**0.093**	**1.247 (D)**
381	35	14						0.064	3.656	14.501	14.501	0.155	0.064	3.036	4.284	0.911	**0.134**	0.685	**0.091**	**1.473 (D)**
376	40	14						0.064	3.976	13.811	13.811	0.148	0.064	3.356	4.916	0.889	**0.125**	0.646	**0.089**	**1.404 (D)**
371	45	26						0.069	4.321	26.201	26.201	0.318	0.069	3.701	5.573	0.831	**0.250**	0.619	**0.088**	**N.L. (3)**
366	50	25						0.069	4.666	23.796	23.796	0.270	0.069	4.046	6.230	0.814	**0.208**	0.601	**0.087**	**2.391 (D)**
361	55	27						0.070	5.016	24.697	24.697	0.286	0.070	4.396	6.892	0.790	**0.214**	0.589	**0.087**	**2.460 (D)**
356	60	27						0.070	5.366	23.500	23.500	0.265	0.070	4.746	7.554	0.775	**0.195**	0.582	**0.088**	**2.216 (D)**
351	65	29						0.071	5.721	24.265	24.265	0.278	0.071	5.101	8.221	0.755	**0.199**	0.571	**0.087**	**2.287 (D)**
346	70	30						0.071	6.076	24.044	24.044	0.274	0.071	5.456	8.888	0.740	**0.192**	0.564	**0.087**	**2.207 (D)**
341	75	66						0.078	6.466	56.632	56.632	0.370	0.078	5.846	9.590	0.667	**0.234**	0.557	**0.086**	**N.L. (3)**
336	80	74						0.080	6.866	60.905	60.905	0.409	0.080	6.246	10.302	0.649	**0.252**	0.550	**0.086**	**N.L. (3)**
331	85	27						0.070	7.216	18.611	18.611	0.199	0.070	6.596	10.964	0.723	**0.136**	0.543	**0.085**	**1.600 (D)**
326	90	52						0.076	7.596	37.866	37.866	0.017	0.076	6.976	11.656	0.621	**0.010**	0.536	**0.085**	**N.L. (3)**
321	95	48						0.075	7.971	32.992	32.992	1.231	0.075	7.351	12.343	0.627	**0.732**	0.529	**0.084**	**N.L. (3)**
316	100	49						0.075	8.346	31.795	31.795	0.684	0.075	7.726	13.030	0.622	**0.403**	0.522	**0.083**	**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

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ========== BB-305
ELEVATION OF BORING GROUND SURFACE ========== 422.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 37.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 20.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.145
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
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) = **0.948**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **480** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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
419.5	2.5	16						0.124	0.310	31.603	31.603	0.647	0.124	0.310	0.310	1.500	**0.920**	0.986	**0.093**	**N.L. (1)**
417	5	6						0.113	0.593	9.403	9.403	0.108	0.113	0.593	0.593	1.337	**0.137**	0.968	**0.091**	**N.L. (1)**
414.5	7.5	2						0.101	0.845	2.920	2.920	0.058	0.101	0.845	0.845	1.202	**0.066**	0.947	**0.090**	**N.L. (1)**
412	10	3						0.105	1.108	4.388	4.388	0.068	0.105	1.108	1.108	1.139	**0.073**	0.923	**0.087**	**N.L. (1)**
409	13	4						0.108	1.432	5.720	5.720	0.078	0.108	1.432	1.432	1.084	**0.080**	0.890	**0.084**	**N.L. (1)**
407	15	3						0.105	1.642	4.196	4.196	0.066	0.105	1.642	1.642	1.052	**0.066**	0.865	**0.082**	**N.L. (1)**
404.5	17.5	12						0.120	1.942	16.445	16.445	0.175	0.120	1.942	1.942	1.024	**0.170**	0.833	**0.079**	**N.L. (1)**
402	20	8						0.116	2.232	10.261	10.261	0.115	0.116	2.232	2.232	0.988	**0.108**	0.799	**0.076**	**N.L. (1)**
399.5	22.5	9						0.117	2.524	11.023	11.023	0.122	0.055	2.369	2.525	0.974	**0.113**	0.765	**0.077**	**1.468 (C)**
397	25	9						0.117	2.817	10.519	10.519	0.118	0.055	2.507	2.819	0.961	**0.107**	0.732	**0.078**	**1.372 (C)**
394.5	27.5	11						0.119	3.114	12.265	12.265	0.134	0.057	2.649	3.117	0.947	**0.120**	0.701	**0.078**	**1.538 (D)**
392	30	14						0.122	3.419	15.017	15.017	0.160	0.060	2.799	3.423	0.930	**0.141**	0.673	**0.078**	**1.808 (D)**
387	35	20						0.126	4.049	20.117	20.117	0.217	0.064	3.119	4.055	0.892	**0.184**	0.626	**0.077**	**2.390 (D)**
382	40	18						0.066	4.379	17.043	17.043	0.181	0.066	3.449	4.697	0.875	**0.150**	0.593	**0.076**	**1.974 (D)**
377	45	24						0.069	4.724	22.403	22.403	0.248	0.069	3.794	5.354	0.835	**0.196**	0.570	**0.076**	**2.579 (D)**
372	50	36						0.073	5.089	33.988	33.988	80.955	0.073	4.159	6.031	0.773	**59.369**	0.555	**0.076**	**N.L. (3)**
367	55	30						0.071	5.444	26.160	26.160	0.317	0.071	4.514	6.698	0.778	**0.234**	0.546	**0.077**	**N.L. (3)**
362	60	21						0.068	5.784	16.736	16.736	0.178	0.068	4.854	7.350	0.797	**0.135**	0.541	**0.077**	**1.753 (D)**
357	65	22						0.068	6.124	16.868	16.868	0.179	0.068	5.194	8.002	0.782	**0.133**	0.532	**0.078**	**1.705 (D)**
352	70	33						0.072	6.484	25.428	25.428	0.301	0.072	5.554	8.674	0.729	**0.208**	0.525	**0.078**	**N.L. (3)**
347	75	39						0.073	6.849	29.472	29.472	0.435	0.073	5.919	9.351	0.696	**0.287**	0.518	**0.077**	**N.L. (3)**
342	80	32						0.071	7.204	22.550	22.550	0.250	0.071	6.274	10.018	0.714	**0.169**	0.511	**0.077**	**2.195 (D)**
337	85	21						0.068	7.544	13.644	13.644	0.147	0.068	6.614	10.670	0.749	**0.104**	0.504	**0.077**	**1.351 (C)**
332	90	43						0.074	7.914	29.197	29.197	0.420	0.074	6.984	11.352	0.658	**0.262**	0.497	**0.076**	**N.L. (3)**
327	95	29						0.071	8.269	17.979	17.979	0.192	0.071	7.339	12.019	0.705	**0.128**	0.490	**0.076**	**1.684 (D)**
322	100	41						0.074	8.639	25.073	25.073	0.293	0.074	7.709	12.701	0.657	**0.183**	0.483	**0.075**	**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

SCI LIQUEFACTION ANALYSIS

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ========== BB-306
ELEVATION OF BORING GROUND SURFACE ========== 432.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 39.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 32.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ========== 0.145
EARTHQUAKE MOMENT MAGNITUDE ========== 7.7
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) = **0.948**

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

PGA CALCULATOR
Earthquake Moment Magnitude = 7.7
Source-To-Site Distance, R (km) = 188.3
Ground Motion Prediction Equations = NMSZ
PGA = **0.091**

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
429.5	2.5	8						0.116	0.290	14.275	14.275	0.153	0.116	0.290	0.290	1.500	**0.217**	0.984	**0.093**	**N.L. (1)**
427	5	6						0.113	0.573	9.464	9.464	0.108	0.113	0.573	0.573	1.348	**0.139**	0.966	**0.091**	**N.L. (1)**
424.5	7.5	10						0.118	0.868	14.987	14.987	0.160	0.118	0.868	0.868	1.265	**0.192**	0.944	**0.089**	**N.L. (1)**
422	10	11						0.119	1.165	16.393	16.393	0.174	0.119	1.165	1.165	1.176	**0.195**	0.918	**0.087**	**N.L. (1)**
419	13	10						0.118	1.519	14.181	14.181	0.152	0.118	1.519	1.519	1.090	**0.157**	0.883	**0.083**	**N.L. (1)**
417	15	14						0.122	1.763	19.919	19.919	0.214	0.122	1.763	1.763	1.056	**0.215**	0.857	**0.081**	**N.L. (1)**
414.5	17.5	21						0.127	2.081	30.073	30.073	0.473	0.127	2.081	2.081	1.007	**0.451**	0.824	**0.078**	**N.L. (1)**
412	20	11						0.119	2.378	13.742	13.742	0.148	0.119	2.378	2.378	0.971	**0.136**	0.789	**0.075**	**N.L. (1)**
409.5	22.5	4						0.108	2.648	4.782	4.782	0.070	0.108	2.648	2.648	0.956	**0.064**	0.755	**0.071**	**N.L. (1)**
407	25	4						0.108	2.918	4.588	4.588	0.069	0.108	2.918	2.918	0.938	**0.061**	0.721	**0.068**	**N.L. (1)**
404.5	27.5	4					33	0.108	3.188	4.402	4.402	0.068	0.108	3.188	3.188	0.922	**0.059**	0.690	**0.065**	**N.L. (1)**
402	30	12					28	0.120	3.488	12.615	12.615	0.137	0.120	3.488	3.488	0.884	**0.115**	0.662	**0.063**	**N.L. (1)**
397	35	3	0.9	10	12	40	49	0.120	4.088	2.891	3.823	0.064	0.058	3.778	3.965	0.891	**0.054**	0.616	**0.061**	**N.L. (2)**
392	40	18						0.066	4.418	16.937	16.937	0.180	0.066	4.108	4.607	0.834	**0.142**	0.584	**0.062**	**2.290 (D)**
387	45	27						0.070	4.768	25.447	25.447	0.301	0.070	4.458	5.269	0.784	**0.224**	0.562	**0.063**	**N.L. (3)**
382	50	19						0.067	5.103	16.377	16.377	0.174	0.067	4.793	5.916	0.801	**0.132**	0.548	**0.064**	**2.063 (D)**
377	55	23						0.068	5.443	19.361	19.361	0.208	0.068	5.133	6.568	0.774	**0.152**	0.539	**0.065**	**2.338 (D)**
372	60	16						0.065	5.768	12.575	12.575	0.137	0.065	5.458	7.205	0.791	**0.102**	0.534	**0.067**	**1.522 (C)**
367	65	40						0.074	6.138	33.262	33.262	1.597	0.074	5.828	7.887	0.683	**1.035**	0.526	**0.067**	**N.L. (3)**
362	70	23						0.068	6.478	16.953	16.953	0.180	0.068	6.168	8.539	0.746	**0.127**	0.519	**0.068**	**1.868 (D)**
357	75	15						0.065	6.803	10.498	10.498	0.118	0.065	6.493	9.176	0.769	**0.086**	0.512	**0.068**	**1.265 (C)**
352	80	17						0.066	7.133	11.512	11.512	0.127	0.066	6.823	9.818	0.755	**0.091**	0.505	**0.069**	**1.319 (C)**
347	85	30						0.071	7.488	20.303	20.303	0.219	0.071	7.178	10.485	0.697	**0.145**	0.498	**0.069**	**2.101 (D)**
342	90	26						0.069	7.833	16.673	16.673	0.177	0.069	7.523	11.142	0.707	**0.119**	0.491	**0.069**	**1.725 (D)**
337	95	62						0.078	8.223	43.524	43.524	0.213	0.078	7.913	11.844	0.590	**0.119**	0.484	**0.068**	**N.L. (3)**
332	100	38						0.073	8.588	23.110	23.110	0.259	0.073	8.278	12.521	0.652	**0.160**	0.477	**0.068**	**2.353 (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

Appendix C

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== BB301
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 434.36 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 433.36 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 2700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 45.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 480.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 180.00 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	**381** KIPS	**210** KIPS	**112** 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.)
417.00	16.36	1.00			46.1		70.6	67.4		***70.1***	70	0	0	39	17
414.50	2.50		10	Medium Sand	1.8	24.5	126.3	2.6	2.7	***78.6***	79	0	0	43	20
412.00	2.50		32	Sandy Gravel	8.9	78.4	***64.2***	13.1	8.6	83.9	64	0	0	35	22
409.50	2.50		3	Fine Sand	0.5	7.3	***67.7***	0.7	0.8	85.0	68	0	0	37	25
407.00	2.50	0.75			5.5	10.3	***72.7***	8.1	1.1	93.0	73	0	0	40	27
404.50	2.50		4	Fine Sand	0.7	9.8	***78.3***	1.0	1.1	94.6	78	0	0	43	30
402.00	2.50		6	Medium Sand	1.1	14.7	***81.8***	1.6	1.6	96.4	82	0	0	45	32
399.50	2.50		7	Medium Sand	1.3	17.1	100.2	1.8	1.9	***100.1***	100	0	0	55	35
397.00	2.50		14	Medium Sand	2.5	34.3	117.5	3.7	3.8	***105.5***	105	0	0	58	37
394.50	2.50		20	Medium Sand	3.6	49.0	***96.6***	5.3	5.4	108.1	97	0	0	53	40
392.00	2.50		10	Medium Sand	1.8	24.5	***100.8***	2.6	2.7	111.0	101	0	0	55	42
389.50	2.50		11	Medium Sand	2.0	26.9	***93.0***	2.9	2.9	112.8	93	0	0	51	45
387.00	2.50		7	Medium Sand	1.3	17.1	121.2	1.8	1.9	***117.6***	118	0	0	65	47
382.00	5.00		18	Medium Sand	6.5	44.1	***117.9***	9.5	4.8	126.0	118	0	0	65	52
377.00	5.00		14	Medium Sand	5.1	34.3	***125.4***	7.4	3.8	133.7	125	0	0	69	57
372.00	5.00		15	Medium Sand	5.4	36.7	***138.2***	7.9	4.0	142.4	138	0	0	76	62
367.00	5.00		18	Medium Sand	6.5	44.1	193.7	9.5	4.8	***157.3***	157	0	0	87	67
362.00	5.00		38	Clean Coarse Sand	19.1	93.1	225.0	27.9	10.2	***186.5***	187	0	0	103	72
357.00	5.00		43	Clean Coarse Sand	23.9	105.3	***199.9***	34.9	11.5	216.0	200	0	0	110	77
352.00	5.00		23	Clean Coarse Sand	9.1	56.3	***211.4***	13.3	6.2	229.6	211	0	0	116	82
347.00	5.00		24	Clean Coarse Sand	9.5	58.8	***213.6***	13.9	6.4	242.7	214	0	0	117	87
342.00	5.00		21	Clean Coarse Sand	8.3	51.4	***224.3***	12.1	5.6	255.1	224	0	0	123	92
337.00	5.00		22	Clean Coarse Sand	8.7	53.9	***211.0***	12.7	5.9	265.4	211	0	0	116	97
332.00	5.00		13	Clean Coarse Sand	5.1	31.8	***272.5***	7.5	3.5	279.1	272	0	0	150	102
327.00	5.00		36	Clean Coarse Sand	17.4	88.2	365.8	25.4	9.7	***312.8***	313	0	0	172	107
322.00	5.00		67	Clean Coarse Sand	52.4	164.1	***381.5***	76.7	18.0	385.4	381	0	0	210	112
317.00	5.00		52	Clean Coarse Sand	34.2	127.4	***437.7***	50.0	13.9	437.8	~~438~~	~~0~~	~~0~~	~~241~~	~~117~~
312.00	5.00		61	Sandy Gravel	66.7	149.4	600.0	97.5	16.4	***545.8***	~~546~~	~~0~~	~~0~~	~~300~~	~~122~~
307.00	5.00		100	Sandy Gravel	139.0	245.0	***738.9***	203.2	26.8	749.0	~~739~~	~~0~~	~~0~~	~~406~~	~~127~~
302.00	5.00		100	Sandy Gravel	139.0	245.0	***877.9***	203.2	26.8	952.2	~~878~~	~~0~~	~~0~~	~~483~~	~~132~~
301.00	1.00			Limestone	98.8	245.0	***976.7***	144.5	26.8	1096.7	~~977~~	~~0~~	~~0~~	~~537~~	~~133.4~~
300.00	1.00			Limestone	98.8	245.0	***1075.6***	144.5	26.8	1241.3	~~1076~~	~~0~~	~~0~~	~~592~~	~~134.4~~
299.00	1.00			Limestone		245.0			26.8						

Pile Design Table for West Abutment utilizing Boring #BB301

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
196	108	45
Metal Shell 12"Φ w/.25" walls		
323	178	62
Metal Shell 14"Φ w/.25" walls		
318	175	52
349	192	57
394	217	62
Metal Shell 14"Φ w/.312" walls		
318	175	52
349	192	57
394	217	62
Steel HP 8 X 36		
265	146	117
Steel HP 10 X 42		
300	165	112

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
307	169	112
352	194	117
Steel HP 12 X 53		
313	172	107
381	210	112
Steel HP 12 X 63		
320	176	107
386	212	112
443	243	117
Steel HP 12 X 74		
326	179	107
392	216	112
450	248	117
566	312	122
Steel HP 12 X 84		
285	157	102
331	182	107
399	219	112
458	252	117
574	316	122

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
257	141	97
337	186	102
379	209	107
466	256	112
529	291	117
Steel HP 14 X 89		
260	143	97
343	189	102
388	213	107
474	261	112
539	296	117
675	371	122
Steel HP 14 X 102		
263	145	97
347	191	102
394	216	107
479	263	112
545	300	117
684	376	122
Steel HP 14 X 117		
267	147	97
352	194	102
402	221	107
487	268	112
553	304	117
696	383	122
Timber Pile		
145	80	35

Pile Design Table for West Abutment utilizing Boring #BB301

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
151	151	32
190	190	35
195	195	40
196	196	45
Metal Shell 12"Φ w/.25" walls		
151	151	32
190	190	35
195	195	40
196	196	45
255	255	47
261	261	52
286	286	57
323	323	62
Metal Shell 14"Φ w/.25" walls		
171	171	30
183	183	32
235	235	45
315	315	47
318	318	52
349	349	57
394	394	62
Metal Shell 14"Φ w/.312" walls		
171	171	30
183	183	32
235	235	45
315	315	47
318	318	52
349	349	57
394	394	62
Steel HP 8 X 36		
166	166	102
210	210	107
231	231	112
265	265	117
Steel HP 10 X 42		
171	171	97
214	214	102
261	261	107
300	300	112

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
175	175	97
220	220	102
268	268	107
307	307	112
352	352	117
Steel HP 12 X 53		
157	157	67
187	187	72
200	200	77
211	211	97
272	272	102
313	313	107
381	381	112
Steel HP 12 X 63		
161	161	67
191	191	72
202	202	77
213	213	97
276	276	102
320	320	107
386	386	112
443	443	117
Steel HP 12 X 74		
164	164	67
194	194	72
205	205	77
216	216	97
280	280	102
326	326	107
392	392	112
450	450	117
566	566	122
Steel HP 12 X 84		
167	167	67
198	198	72
209	209	77
219	219	97
285	285	102
331	331	107
399	399	112
458	458	117
574	574	122

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
172	172	62
191	191	67
226	226	72
249	249	77
257	257	97
337	337	102
379	379	107
466	466	112
529	529	117
Steel HP 14 X 89		
175	175	62
196	196	67
232	232	72
253	253	77
260	260	97
343	343	102
388	388	107
474	474	112
539	539	117
675	675	122
Steel HP 14 X 102		
177	177	62
199	199	67
235	235	72
256	256	77
263	263	97
347	347	102
394	394	107
479	479	112
545	545	117
684	684	122
Steel HP 14 X 117		
180	180	62
203	203	67
240	240	72
260	260	77
267	267	97
352	352	102
402	402	107
487	487	112
553	553	117
696	696	122
Timber Pile		
145	145	35

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== BB-302 w/ Precore
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 439.82 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING 416.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========= 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 8000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 36.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 1777.78 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 666.67 KIPS

GWT = 20
Soil Unit Weight = 110

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
5005 KIPS	**5005** KIPS	**3253** KIPS	**144** FT.

PILE TYPE AND SIZE ========== 60" Diameter Pipe
Plugged Pile Perimeter========== 15.708 FT. Unplugged Pile Perimeter========== 30.892 FT.
Plugged Pile End Bearing Area========== 19.635 SQFT. Unplugged Pile End Bearing Area======== 1.287 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.)
413.00	3.00		4	Fine Sand	5.8		265.0	11.4		***28.4***	28	0	0	18	27
410.00	3.00		4	Fine Sand	11.6	259.2	384.6	22.8	17.0	***58.3***	58	0	0	38	30
407.50	2.50		4	Fine Sand	13.7	367.2	506.3	26.9	24.1	***92.3***	92	0	0	60	32
405.00	2.50		4	Fine Sand	17.7	475.2	632.0	34.9	31.1	***134.3***	134	0	0	87	35
402.50	2.50		4	Fine Sand	21.8	583.2	761.7	42.8	38.2	***184.1***	184	0	0	120	37
400.00	2.50		4	Fine Sand	25.8	691.2	895.5	50.7	45.3	***241.9***	242	0	0	157	40
397.50	2.50		4	Fine Sand	29.8	799.1	1008.8	58.6	52.4	***306.0***	306	0	0	199	42
395.00	2.50		4	Fine Sand	32.9	882.6	1088.5	64.8	57.9	***373.8***	374	0	0	243	45
392.50	2.50		4	Fine Sand	34.7	929.4	1169.9	68.2	60.9	***445.1***	445	0	0	289	47
390.00	2.50		4	Fine Sand	36.4	976.1	1299.7	71.6	64.0	***522.8***	523	0	0	340	50
385.00	5.00		30	Medium Sand	78.5	1069.6	1471.7	156.9	70.1	***685.9***	686	0	0	446	55
380.00	5.00		20	Medium Sand	78.5	1163.0	1643.7	169.9	76.2	***861.9***	862	0	0	560	60
375.00	5.00		23	Medium Sand	78.5	1256.5	1815.7	169.9	82.4	***1037.9***	1038	0	0	675	65
370.00	5.00		14	Fine Sand	78.5	1349.9	1987.7	169.9	88.5	***1214.0***	1214	0	0	789	70
365.00	5.00		24	Fine Sand	78.5	1443.4	2159.8	169.9	94.6	***1390.0***	1390	0	0	904	75
360.00	5.00		11	Fine Sand	78.5	1536.9	2331.8	169.9	100.8	***1566.0***	1566	0	0	1018	80
355.00	5.00		43	Fine Sand	78.5	1630.3	2503.8	169.9	106.9	***1742.1***	1742	0	0	1132	85
350.00	5.00		36	Fine Sand	78.5	1723.8	2685.1	169.9	113.0	***1918.7***	1919	0	0	1247	90
344.50	5.50		29	Clean Coarse Sand	86.4	1826.6	2865.0	186.9	119.7	***2111.8***	2112	0	0	1373	95
339.50	5.00		21	Clean Coarse Sand	78.5	1920.1	2986.9	169.9	125.9	***2284.5***	2285	0	0	1485	100
334.50	5.00		26	Clean Coarse Sand	78.5	1963.5	3065.5	169.9	128.7	***2454.4***	2454	0	0	1595	105
329.50	5.00		20	Clean Coarse Sand	78.5	1963.5	3144.0	169.9	128.7	***2624.3***	2624	0	0	1706	110
324.50	5.00		31	Clean Coarse Sand	78.5	1963.5	3222.6	169.9	128.7	***2794.2***	2794	0	0	1816	115
319.50	5.00		54	Sandy Gravel	78.5	1963.5	3301.1	169.9	128.7	***2964.1***	2964	0	0	1927	120
314.50	5.00		86	Sandy Gravel	78.5	1963.5	3379.6	169.9	128.7	***3134.1***	3134	0	0	2037	125
309.50	5.00		54	Sandy Gravel	78.5	1963.5	3458.2	169.9	128.7	***3304.0***	3304	0	0	2148	130
304.50	5.00		100	Sandy Gravel	78.5	1963.5	3536.7	169.9	128.7	***3473.9***	3474	0	0	2258	135
299.50	5.00		100	Sandy Gravel	78.5	1963.5	***3615.3***	169.9	128.7	3643.8	3615	0	0	2350	140
297.00	2.50		100	Sandy Gravel	39.3	1963.5	8524.0	85.0	128.7	***4943.8***	4944	0	0	3213	143
296.00	1.00			Limestone	78.8	6833.0	8649.5	154.9	1343.8	***5107.9***	~~5108~~	~~0~~	~~0~~	~~3320~~	~~144~~
295.00	1.00			Limestone	79.3	6879.7	8775.5	155.9	1353.0	***5273.0***	~~5273~~	~~0~~	~~0~~	~~3427~~	~~145~~
294.00	1.00			Limestone	79.8	6926.4		157.0	1362.2						

Pipe Pile Design Table for Pier 1 utilizing Boring #BB-302 w/ Precore

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1604	1042	130
1651	1073	135
1698	1104	140
2880	1872	143
2969	1930	144
48" Diameter Pipe		
2452	1594	130
2515	1635	135
2578	1676	140
3867	2514	143
3987	2591	144
54" Diameter Pipe		
2936	1908	130
3006	1954	135
3077	2000	140
4361	2834	143
4496	2922	144

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
3304	2148	130
3474	2258	135
3615	2350	140
4854	3155	143
5005	3253	144

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3976	2584	130
4180	2717	135
4385	2850	140
5842	3797	143
6022	3915	144

Pipe Pile Design Table Extreme Event for Pier 1 utilizing Boring #BB-302 w/ Precore

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1604	1604	130
1651	1651	135
1698	1698	140
2880	2880	143
2969	2969	144
48" Diameter Pipe		
2452	2452	130
2515	2515	135
2578	2578	140
3867	3867	143
3987	3987	144
54" Diameter Pipe		
2936	2936	130
3006	3006	135
3077	3077	140
4361	4361	143
4496	4496	144

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
3304	3304	130
3474	3474	135
3615	3615	140
4854	4854	143
5005	5005	144

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3976	3976	130
4180	4180	135
4385	4385	140
5842	5842	143
6022	6022	144

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 2
REFERENCE BORING ========== BB-303
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 440.46 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING 416.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========= 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 7000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 45.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 1244.44 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 466.67 KIPS

GWT = 20
Soil Unit Weight = 110

PILE TYPE AND SIZE ========== 60" Diameter Pipe
Plugged Pile Perimeter========== 15.708 FT.
Plugged Pile End Bearing Area========== 19.635 SQFT.
Unplugged Pile Perimeter========== 30.892 FT.
Unplugged Pile End Bearing Area======== 1.287 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
5005 KIPS	**5005** KIPS	**3253** KIPS	**138** 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.)
413.50	2.50		19	Fine Sand	4.0		220.0	7.9		***22.1***	22	0	0	14	27
411.00	2.50		10	Fine Sand	8.1	216.0	336.1	15.8	14.2	***45.0***	45	0	0	29	29
408.50	2.50		5	Fine Sand	12.1	324.0	456.1	23.8	21.2	***75.9***	76	0	0	49	32
406.00	2.50		5	Fine Sand	16.1	432.0	217.0	31.7	28.3	***90.8***	91	0	0	59	34
403.50	2.50	1.00	4		9.2	176.7	226.2	18.1	11.6	***108.9***	109	0	0	71	37
401.00	2.50	1.00	12		10.1	176.7	815.5	19.8	11.6	***166.7***	167	0	0	108	39
398.50	2.50		10	Fine Sand	28.2	755.9	951.7	55.5	49.6	***229.3***	229	0	0	149	42
396.00	2.50		8	Fine Sand	32.2	863.9	1030.7	63.4	56.6	***295.7***	296	0	0	192	44
393.50	2.50		16	Fine Sand	34.0	910.7	1111.4	66.8	59.7	***365.6***	366	0	0	238	47
391.00	2.50		16	Fine Sand	35.7	957.4	1193.8	70.2	62.8	***438.9***	439	0	0	285	49
388.50	2.50		13	Fine Sand	37.5	1004.1	1278.0	73.7	65.8	***515.6***	516	0	0	335	52
386.00	2.50		10	Fine Sand	39.2	1050.9	1410.7	77.1	68.9	***598.9***	599	0	0	389	54
381.00	5.00		8	Fine Sand	78.5	1144.3	1582.7	167.9	75.0	***772.9***	773	0	0	502	59
376.00	5.00		21	Fine Sand	78.5	1237.8	1754.7	169.9	81.1	***948.9***	949	0	0	617	64
371.00	5.00		29	Fine Sand	78.5	1331.2	1926.7	169.9	87.3	***1125.0***	1125	0	0	731	69
366.00	5.00		37	Medium Sand	78.5	1424.7	2098.7	169.9	93.4	***1301.0***	1301	0	0	846	74
361.00	5.00		36	Medium Sand	78.5	1518.2	2270.7	169.9	99.5	***1477.0***	1477	0	0	960	79
356.00	5.00		28	Medium Sand	78.5	1611.6	2442.7	169.9	105.7	***1653.1***	1653	0	0	1074	84
351.00	5.00		35	Medium Sand	78.5	1705.1	2614.7	169.9	111.8	***1829.1***	1829	0	0	1189	89
346.00	5.00		26	Medium Sand	78.5	1798.6	2786.7	169.9	117.9	***2005.1***	2005	0	0	1303	94
341.00	5.00		38	Medium Sand	78.5	1892.0	2936.7	169.9	124.0	***2179.7***	2180	0	0	1417	99
336.00	5.00		47	Medium Sand	78.5	1963.5	3015.3	169.9	128.7	***2349.6***	2350	0	0	1527	104
331.00	5.00		39	Medium Sand	78.5	1963.5	3093.8	169.9	128.7	***2519.5***	2520	0	0	1638	109
326.00	5.00		58	Sandy Gravel	78.5	1963.5	3172.3	169.9	128.7	***2689.5***	2689	0	0	1748	114
321.00	5.00		39	Sandy Gravel	78.5	1963.5	3250.9	169.9	128.7	***2859.4***	2859	0	0	1859	119
316.00	5.00		15	Sandy Gravel	78.5	1963.5	3329.4	169.9	128.7	***3029.3***	3029	0	0	1969	124
311.00	5.00		47	Sandy Gravel	78.5	1963.5	3408.0	169.9	128.7	***3199.2***	3199	0	0	2079	129
306.00	5.00		100	Sandy Gravel	78.5	1963.5	7935.4	169.9	128.7	***4501.5***	4501	0	0	2926	134
305.00	1.00			Limestone	73.9	6412.4	8056.0	145.3	1261.1	***4656.0***	4656	0	0	3026	136
304.00	1.00			Limestone	74.4	6459.1	8177.2	146.4	1270.3	***4811.6***	4812	0	0	3128	137
303.00	1.00			Limestone	75.0	6505.8	8298.9	147.5	1279.5	***4968.3***	4968	0	0	3229	138
302.00	1.00			Limestone	75.5	6552.6	8421.2	148.5	1288.7	***5126.0***	~~5126~~	~~0~~	~~0~~	~~3332~~	~~139~~
301.00	1.00			Limestone	76.1	6599.3		149.6	1297.9						

Pipe Pile Design Table for Pier 2 utilizing Boring #BB-303

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1479	962	119
1526	992	124
1574	1023	129
2670	1736	134
2969	1930	138
48" Diameter Pipe		
2278	1481	119
2349	1527	124
2412	1568	129
3586	2331	134
3987	2591	138
54" Diameter Pipe		
2569	1670	119
2721	1769	124
2874	1868	129
4044	2628	134
4496	2922	138

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
2859	1859	119
3029	1969	124
3199	2079	129
4501	2926	134
5005	3253	138

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3441	2237	119
3645	2370	124
3850	2502	129
5417	3521	134
6022	3915	138

Pipe Pile Design Table Extreme Event for Pier 2 utilizing Boring #BB-303

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1479	1479	119
1526	1526	124
1574	1574	129
2670	2670	134
2969	2969	138
48" Diameter Pipe		
2278	2278	119
2349	2349	124
2412	2412	129
3586	3586	134
3987	3987	138
54" Diameter Pipe		
2569	2569	119
2721	2721	124
2874	2874	129
4044	4044	134
4496	4496	138

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
2859	2859	119
3029	3029	124
3199	3199	129
4501	4501	134
5005	5005	138

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3441	3441	119
3645	3645	124
3850	3850	129
5417	5417	134
6022	6022	138

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 3
REFERENCE BORING ========== BB-304
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 433.22 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING 416.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========= 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 7000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 36.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 1555.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 583.33 KIPS

GWT = 20
Soil Unit Weight = 110

PILE TYPE AND SIZE ========== 60" Diameter Pipe
Plugged Pile Perimeter========== 15.708 FT.
Plugged Pile End Bearing Area========== 19.635 SQFT.
Unplugged Pile Perimeter========== 30.892 FT.
Unplugged Pile End Bearing Area======== 1.287 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
5005 KIPS	**5005** KIPS	**3253** KIPS	**136** 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.)
411.50	4.50		8	Fine Sand	13.1		225.1	25.7		***39.6***	40	0	0	26	22
409.00	2.50	1.20	3		7.0	212.1	285.2	13.8	13.9	***56.9***	57	0	0	37	24
406.50	2.50	1.50	7		7.2	265.1	380.7	14.1	17.4	***76.8***	77	0	0	50	27
404.00	2.50	2.00	7		7.1	353.4	299.4	13.9	23.2	***84.9***	85	0	0	55	29
401.50	2.50	1.50	6		8.1	265.1	776.8	15.9	17.4	***131.6***	132	0	0	86	32
399.00	2.50		14	Fine Sand	27.4	734.3	912.2	53.9	48.1	***192.6***	193	0	0	125	34
396.50	2.50		14	Fine Sand	31.4	842.3	1002.6	61.8	55.2	***258.2***	258	0	0	168	37
394.00	2.50		14	Fine Sand	33.6	901.3	1082.9	66.1	59.1	***327.4***	327	0	0	213	39
391.50	2.50		10	Fine Sand	35.4	948.1	1165.0	69.6	62.2	***400.0***	400	0	0	260	42
389.00	2.50		11	Fine Sand	37.1	994.8	1295.6	73.0	65.2	***479.1***	479	0	0	311	44
384.00	5.00		14	Medium Sand	78.5	1088.2	1467.6	159.7	71.3	***644.9***	645	0	0	419	49
379.00	5.00		14	Medium Sand	78.5	1181.7	1639.6	169.9	77.5	***821.0***	821	0	0	534	54
374.00	5.00		26	Medium Sand	78.5	1275.2	1811.6	169.9	83.6	***997.0***	997	0	0	648	59
369.00	5.00		25	Medium Sand	78.5	1368.6	1983.6	169.9	89.7	***1173.0***	1173	0	0	762	64
364.00	5.00		27	Medium Sand	78.5	1462.1	2155.6	169.9	95.8	***1349.1***	1349	0	0	877	69
359.00	5.00		27	Medium Sand	78.5	1555.6	2327.6	169.9	102.0	***1525.1***	1525	0	0	991	74
354.00	5.00		29	Medium Sand	78.5	1649.0	2499.6	169.9	108.1	***1701.2***	1701	0	0	1106	79
349.00	5.00		30	Clean Coarse Sand	78.5	1742.5	2671.6	169.9	114.2	***1877.2***	1877	0	0	1220	84
344.00	5.00		66	Clean Coarse Sand	78.5	1835.9	2843.6	169.9	120.4	***2053.2***	2053	0	0	1335	89
339.00	5.00		74	Clean Coarse Sand	78.5	1929.4	2956.2	169.9	126.5	***2225.4***	2225	0	0	1446	94
334.00	5.00		27	Clean Coarse Sand	78.5	1963.5	3034.8	169.9	128.7	***2395.3***	2395	0	0	1557	99
329.00	5.00		52	Clean Coarse Sand	78.5	1963.5	3113.3	169.9	128.7	***2565.2***	2565	0	0	1667	104
324.00	5.00		48	Clean Coarse Sand	78.5	1963.5	3191.9	169.9	128.7	***2735.1***	2735	0	0	1778	109
319.00	5.00		49	Sandy Gravel	78.5	1963.5	3270.4	169.9	128.7	***2905.0***	2905	0	0	1888	114
314.00	5.00		83	Sandy Gravel	78.5	1963.5	3348.9	169.9	128.7	***3074.9***	3075	0	0	1999	119
309.00	5.00		87	Sandy Gravel	78.5	1963.5	3427.5	169.9	128.7	***3244.8***	3245	0	0	2109	124
304.00	5.00		100	Sandy Gravel	78.5	1963.5	3506.0	169.9	128.7	***3414.7***	3415	0	0	2220	129
299.50	4.50		100	Sandy Gravel	70.7	1963.5	8329.4	152.9	128.7	***4759.8***	4760	0	0	3094	134
298.50	1.00			Limestone	77.4	6716.1	8453.5	152.2	1320.8	***4921.2***	4921	0	0	3199	135
297.50	1.00			Limestone	77.9	6762.9	8578.2	153.3	1330.0	***5083.7***	~~5084~~	~~0~~	~~0~~	~~3304~~	~~136~~
296.50	1.00			Limestone	78.5	6809.6	8703.4	154.3	1339.2	***5247.2***	~~5247~~	~~0~~	~~0~~	~~3411~~	~~137~~
295.50	1.00			Limestone	79.0	6856.3	8829.1	155.4	1348.4	***5411.8***	~~5412~~	~~0~~	~~0~~	~~3518~~	~~138~~
294.50	1.00			Limestone	79.6	6903.1		156.5	1357.6						

Pipe Pile Design Table for Pier 3 utilizing Boring #BB-304

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1538	1000	119
1585	1030	124
1632	1061	129
2824	1835	134
2969	1930	136
48" Diameter Pipe		
2365	1537	119
2428	1578	124
2491	1619	129
3792	2465	134
3987	2591	136
54" Diameter Pipe		
2762	1795	119
2908	1890	124
2979	1936	129
4276	2779	134
4496	2922	136

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
3075	1999	119
3245	2109	124
3415	2220	129
4760	3094	134
5005	3253	136

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3700	2405	119
3905	2538	124
4109	2671	129
5728	3723	134
6022	3915	136

Pipe Pile Design Table Extreme Event for Pier 3 utilizing Boring #BB-304

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1538	1538	119
1585	1585	124
1632	1632	129
2824	2824	134
2969	2969	136
48" Diameter Pipe		
2365	2365	119
2428	2428	124
2491	2491	129
3792	3792	134
3987	3987	136
54" Diameter Pipe		
2762	2762	119
2908	2908	124
2979	2979	129
4276	4276	134
4496	4496	136

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
3075	3075	119
3245	3245	124
3415	3415	129
4760	4760	134
5005	5005	136

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3700	3700	119
3905	3905	124
4109	4109	129
5728	5728	134
6022	6022	136

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 4
REFERENCE BORING ========== BB-305
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 424.09 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING 415.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========= 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 7000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 44.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 1272.73 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 477.27 KIPS

GWT = 15
Soil Unit Weight = 115

PILE TYPE AND SIZE ========== 60" Diameter Pipe
Plugged Pile Perimeter========== 15.708 FT.
Plugged Pile End Bearing Area========== 19.635 SQFT.
Unplugged Pile Perimeter========== 30.892 FT.
Unplugged Pile End Bearing Area======== 1.287 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
5005 KIPS	**5005** KIPS	**3253** KIPS	**122** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL 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.)
412.50	2.50		16	Fine Sand	4.2		230.0	8.3		***23.1***	23	0	0	15	12
410.00	2.50		6	Fine Sand	8.4	225.8	351.3	16.6	14.8	***47.1***	47	0	0	31	14
407.50	2.50		2	Fine Sand	12.6	338.7	290.3	24.8	22.2	***67.1***	67	0	0	44	17
405.00	2.50	1.50	3		7.3	265.1	315.4	14.5	17.4	***82.7***	83	0	0	54	19
402.50	2.50	1.60	4		7.6	282.7	181.6	15.0	18.5	***88.5***	88	0	0	57	22
400.00	2.50	0.80	3		11.5	141.4	780.8	22.7	9.3	***149.7***	150	0	0	97	24
397.50	2.50		12	Very Fine Silty Sand	27.2	729.0	859.7	53.5	47.8	***206.5***	207	0	0	134	27
395.00	2.50		8	Very Fine Silty Sand	29.1	780.7	940.4	57.3	51.2	***267.2***	267	0	0	174	29
392.50	2.50		9	Very Fine Silty Sand	31.0	832.3	1023.1	61.1	54.6	***331.6***	332	0	0	216	32
390.00	2.50		9	Very Fine Silty Sand	33.0	884.0	1107.8	64.9	57.9	***399.9***	400	0	0	260	34
387.50	2.50		11	Very Fine Silty Sand	34.9	935.6	1194.3	68.6	61.3	***471.9***	472	0	0	307	37
385.00	2.50		14	Medium Sand	36.8	987.2	1334.4	72.4	64.7	***551.1***	551	0	0	358	39
380.00	5.00		20	Medium Sand	78.5	1090.5	1516.2	160.0	71.5	***717.9***	718	0	0	467	44
375.00	5.00		18	Medium Sand	78.5	1193.8	1698.0	169.9	78.3	***894.6***	895	0	0	581	49
370.00	5.00		24	Medium Sand	78.5	1297.1	1879.9	169.9	85.0	***1071.3***	1071	0	0	696	54
365.00	5.00		36	Medium Sand	78.5	1400.4	2061.7	169.9	91.8	***1247.9***	1248	0	0	811	59
360.00	5.00		30	Medium Sand	78.5	1503.6	2243.5	169.9	98.6	***1424.6***	1425	0	0	926	64
355.00	5.00		21	Clean Coarse Sand	78.5	1606.9	2425.3	169.9	105.3	***1601.3***	1601	0	0	1041	69
350.00	5.00		22	Clean Coarse Sand	78.5	1710.2	2607.1	169.9	112.1	***1778.0***	1778	0	0	1156	74
345.00	5.00		33	Clean Coarse Sand	78.5	1813.5	2789.0	169.9	118.9	***1954.6***	1955	0	0	1271	79
340.00	5.00		39	Clean Coarse Sand	78.5	1916.8	2914.2	169.9	125.7	***2127.6***	2128	0	0	1383	84
335.00	5.00		32	Clean Coarse Sand	78.5	1963.5	2992.8	169.9	128.7	***2297.5***	2298	0	0	1493	89
330.00	5.00		21	Clean Coarse Sand	78.5	1963.5	3071.3	169.9	128.7	***2467.4***	2467	0	0	1604	94
325.00	5.00		43	Sandy Gravel	78.5	1963.5	3149.8	169.9	128.7	***2637.3***	2637	0	0	1714	99
320.00	5.00		29	Sandy Gravel	78.5	1963.5	3228.4	169.9	128.7	***2807.2***	2807	0	0	1825	104
315.00	5.00		41	Sandy Gravel	78.5	1963.5	3306.9	169.9	128.7	***2977.2***	2977	0	0	1935	109
310.00	5.00		63	Sandy Gravel	78.5	1963.5	3385.5	169.9	128.7	***3147.1***	3147	0	0	2046	114
306.50	3.50		98	Sandy Gravel	55.0	1963.5	8050.4	118.9	128.7	***4430.1***	4430	0	0	2880	118
305.50	1.00			Limestone	75.8	6573.5	8177.8	149.0	1292.8	***4589.2***	4589	0	0	2983	119
304.50	1.00			Limestone	76.4	6625.1	8305.8	150.2	1302.9	***4749.5***	4750	0	0	3087	120
303.50	1.00			Limestone	77.0	6676.8	8434.4	151.3	1313.1	***4911.0***	4911	0	0	3192	121
302.50	1.00			Limestone	77.5	6728.4	8563.6	152.5	1323.3	***5073.7***	~~5074~~	~~0~~	~~0~~	~~3298~~	~~122~~
301.50	1.00			Limestone	78.1	6780.0	8693.4	153.7	1333.4	***5237.5***	~~5238~~	~~0~~	~~0~~	~~3404~~	~~123~~
300.50	1.00			Limestone	78.7	6831.7	8823.8	154.8	1343.6	***5402.5***	~~5403~~	~~0~~	~~0~~	~~3512~~	~~124~~
299.50	1.00			Limestone	79.3	6883.3		156.0	1353.7						

Pipe Pile Design Table for Pier 4 utilizing Boring #BB-305

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1466	953	104
1513	983	109
1560	1014	114
2628	1708	118
2969	1930	122
48" Diameter Pipe		
2236	1454	104
2331	1515	109
2394	1556	114
3529	2294	118
3987	2591	122
54" Diameter Pipe		
2522	1639	104
2674	1738	109
2827	1838	114
3980	2587	118
4496	2922	122

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
2807	1825	104
2977	1935	109
3147	2046	114
4430	2880	118
5005	3253	122

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3378	2196	104
3583	2329	109
3787	2462	114
5331	3465	118
6022	3915	122

Pipe Pile Design Table Extreme Event for Pier 4 utilizing Boring #BB-305

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
36" Diameter Pipe		
1466	1466	104
1513	1513	109
1560	1560	114
2628	2628	118
2969	2969	122
48" Diameter Pipe		
2236	2236	104
2331	2331	109
2394	2394	114
3529	3529	118
3987	3987	122
54" Diameter Pipe		
2522	2522	104
2674	2674	109
2827	2827	114
3980	3980	118
4496	4496	122

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
60" Diameter Pipe		
2807	2807	104
2977	2977	109
3147	3147	114
4430	4430	118
5005	5005	122

Nominal Required Bearing (Kips)	Extreme Event Resistance Available (Kips)	Estimated Pile Length (Ft.)
72" Diameter Pipe		
3378	3378	104
3583	3583	109
3787	3787	114
5331	5331	118
6022	6022	122

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment (WB Lane)
REFERENCE BORING ========== BB306
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 417.23 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 416.23 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 2700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 45.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 480.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 180.00 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
810 KIPS	**792** KIPS	**436** KIPS	**95** FT.

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

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.)
414.50	1.73		10	Fine Sand	1.4		19.6	2.1		***4.7***	5	0	0	3	3
412.00	2.50		14	Fine Sand	2.9	18.2	47.7	4.2	2.6	***12.6***	13	0	0	7	5
409.50	2.50		21	Fine Sand	4.3	43.4	39.8	6.3	6.3	***17.2***	17	0	0	9	8
407.00	2.50		11	Fine Sand	2.3	31.2	25.2	3.3	4.5	***18.1***	18	0	0	10	10
404.50	2.50		4	Fine Sand	0.8	14.3	27.8	1.2	2.1	***19.5***	20	0	0	11	13
402.00	2.50	0.80	4		7.1	16.1	***28.9***	10.4	2.3	29.1	29	0	0	16	15
399.50	2.50	0.50			4.7	10.1	41.6	6.9	1.5	***37.1***	37	0	0	20	18
397.00	2.50	0.90	12		7.8	18.1	49.4	11.5	2.6	***48.6***	49	0	0	27	20
392.00	5.00	0.90	3		15.6	18.1	111.5	23.0	2.6	***78.4***	78	0	0	43	25
387.00	5.00		18	Fine Sand	7.4	64.5	151.1	10.9	9.3	***93.9***	94	0	0	52	30
382.00	5.00		27	Fine Sand	11.1	96.8	133.5	16.3	14.0	***106.1***	106	0	0	58	35
377.00	5.00		19	Fine Sand	7.8	68.1	155.7	11.5	9.9	***119.6***	120	0	0	66	40
372.00	5.00		23	Fine Sand	9.5	82.5	140.1	13.9	11.9	***129.9***	130	0	0	71	45
367.00	5.00		16	Fine Sand	6.6	57.4	232.7	9.7	8.3	***152.0***	152	0	0	84	50
362.00	5.00		40	Fine Sand	18.9	143.4	190.7	27.8	20.8	***171.0***	171	0	0	94	55
357.00	5.00		23	Medium Sand	10.1	82.5	***172.0***	14.8	11.9	181.7	172	0	0	95	60
352.00	5.00		15	Medium Sand	6.6	53.8	***185.8***	9.6	7.8	192.4	186	0	0	102	65
347.00	5.00		17	Medium Sand	7.4	60.9	239.8	10.9	8.8	***210.0***	210	0	0	116	70
342.00	5.00		30	Sandy Gravel	19.2	107.5	244.7	28.3	15.6	***236.3***	236	0	0	130	75
337.00	5.00		26	Sandy Gravel	15.3	93.2	525.3	22.5	13.5	***297.1***	297	0	0	163	80
332.00	5.00		100	Sandy Gravel	168.2	358.5	***471.2***	247.3	51.9	512.2	471	0	0	259	85
327.00	5.00		38	Sandy Gravel	30.3	136.2	680.7	44.5	19.7	***582.7***	583	0	0	320	90
322.00	5.00		88	Sandy Gravel	141.3	315.5	832.7	207.7	45.7	***792.0***	792	0	0	436	95
317.00	5.00		91	Sandy Gravel	148.0	326.2	***905.4***	217.6	47.2	998.7	~~905~~	~~0~~	~~0~~	~~498~~	~~100~~
312.00	5.00		70	Sandy Gravel	100.9	250.9	***1113.8***	148.4	36.3	1162.6	~~1114~~	~~0~~	~~0~~	~~613~~	~~105~~
307.00	5.00		100	Sandy Gravel	168.2	358.5	***1249.8***	247.3	51.9	1405.3	~~1250~~	~~0~~	~~0~~	~~687~~	~~110~~
302.00	5.00		91	Sandy Gravel	148.0	326.2	***1430.0***	217.6	47.2	1627.6	~~1430~~	~~0~~	~~0~~	~~787~~	~~115~~
300.00	2.00		100	Sandy Gravel	67.3	358.5	***1497.3***	98.9	51.9	1726.5	~~1497~~	~~0~~	~~0~~	~~824~~	~~117~~
299.00	1.00			Limestone	119.6	358.5	***1616.9***	175.9	51.9	1902.3	~~1617~~	~~0~~	~~0~~	~~889~~	~~118.2~~
298.00	1.00			Limestone	119.6	358.5	***1736.5***	175.9	51.9	2078.2	~~1736~~	~~0~~	~~0~~	~~955~~	~~119.2~~
297.00	1.00			Limestone	119.6	358.5	***1856.0***	175.9	51.9	2254.0	~~1856~~	~~0~~	~~0~~	~~1021~~	~~120.2~~
296.00	1.00			Limestone		358.5			51.9						

Pile Design Table for East Abutment (WB Lane) utilizing Boring #BB306

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
230	126	35
Metal Shell 12"Φ w/.25" walls		
272	150	45
Metal Shell 14"Φ w/.25" walls		
286	158	35
333	183	45
Metal Shell 14"Φ w/.312" walls		
286	158	35
333	183	45
Steel HP 8 X 36		
231	127	85
Steel HP 10 X 42		
295	162	85

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
302	166	85
397	218	90
Steel HP 12 X 53		
228	126	80
370	203	85
Steel HP 12 X 63		
236	130	80
374	206	85
476	262	90
Steel HP 12 X 74		
243	134	80
380	209	85
483	265	90
Steel HP 12 X 84		
249	137	80
386	212	85
490	269	90

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
279	154	80
459	252	85
563	310	90
Steel HP 14 X 89		
290	159	80
465	256	85
575	316	90
Steel HP 14 X 102		
297	163	80
471	259	85
583	320	90
792	436	95
Steel HP 14 X 117		
307	169	80
478	263	85
594	327	90
805	443	95
918	505	100
Precast 14"x 14"		
101	55	20
Timber Pile		
145	80	30

Pile Design Table for East Abutment (WB Lane) utilizing Boring #BB306

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
164	164	25
230	230	35
Metal Shell 12"Φ w/.25" walls		
164	164	25
230	230	35
272	272	45
Metal Shell 14"Φ w/.25" walls		
79	79	20
208	208	25
286	286	35
333	333	45
Metal Shell 14"Φ w/.312" walls		
79	79	20
208	208	25
286	286	35
333	333	45
Steel HP 8 X 36		
154	154	80
231	231	85
Steel HP 10 X 42		
148	148	75
190	190	80
295	295	85

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
152	152	75
199	199	80
302	302	85
397	397	90
Steel HP 12 X 53		
168	168	70
189	189	75
228	228	80
370	370	85
Steel HP 12 X 63		
172	172	70
191	191	75
236	236	80
374	374	85
476	476	90
Steel HP 12 X 74		
174	174	70
194	194	75
243	243	80
380	380	85
483	483	90
Steel HP 12 X 84		
176	176	70
197	197	75
249	249	80
386	386	85
490	490	90

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
167	167	60
181	181	65
203	203	70
230	230	75
279	279	80
459	459	85
563	563	90
Steel HP 14 X 89		
170	170	60
183	183	65
207	207	70
234	234	75
290	290	80
465	465	85
575	575	90
Steel HP 14 X 102		
172	172	60
186	186	65
210	210	70
236	236	75
297	297	80
471	471	85
583	583	90
792	792	95
Steel HP 14 X 117		
174	174	60
188	188	65
214	214	70
240	240	75
307	307	80
478	478	85
594	594	90
805	805	95
918	918	100
Precast 14"x 14"		
101	101	20
Timber Pile		
145	145	30

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment (EB Lane)
REFERENCE BORING ========== BB306
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 418.40 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 417.40 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 2700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 45.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 480.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 180.00 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	**219** KIPS	**101** 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.)
414.90	2.50	2.20	24		12.3		37.1	17.9		***20.7***	21	0	0	11	4
412.40	2.50	1.80			10.8	24.8	***32.2***	15.8	2.7	34.7	32	0	0	18	6
409.90	2.50		5	Fine Sand	0.8	9.2	***31.3***	1.2	1.0	35.8	31	0	0	17	9
407.40	2.50		3	Fine Sand	0.5	7.3	***31.3***	0.7	0.8	36.4	31	0	0	17	11
404.90	2.50	0.50			3.9	6.9	50.3	5.7	0.8	***43.8***	44	0	0	24	14
402.40	2.50		9	Fine Sand	1.5	22.0	***32.6***	2.2	2.4	43.9	33	0	0	18	16
399.90	2.50	0.20			1.6	2.8	***41.8***	2.4	0.3	47.1	42	0	0	23	19
397.40	2.50	0.75	8		5.5	10.3	***41.9***	8.1	1.1	54.6	42	0	0	23	21
394.90	2.50		2	Fine Sand	0.3	4.9	***47.1***	0.5	0.5	55.6	47	0	0	26	24
392.40	2.50		4	Fine Sand	0.7	9.8	***40.4***	1.0	1.1	55.8	40	0	0	22	26
389.90	2.50		1	Fine Sand	0.2	2.4	***43.7***	0.2	0.3	56.4	44	0	0	24	29
387.40	2.50	0.40			3.1	5.5	114.8	4.6	0.6	***68.4***	68	0	0	38	31
382.40	5.00		30	Fine Sand	10.3	73.5	100.6	15.0	8.0	***80.8***	81	0	0	44	36
377.40	5.00		20	Fine Sand	6.8	49.0	114.7	9.9	5.4	***91.5***	92	0	0	50	41
372.40	5.00		23	Fine Sand	7.8	56.3	***100.5***	11.4	6.2	100.5	100	0	0	55	46
367.40	5.00		14	Medium Sand	5.1	34.3	130.0	7.4	3.8	***110.6***	111	0	0	61	51
362.40	5.00		24	Medium Sand	8.7	58.8	***106.9***	12.7	6.4	119.8	107	0	0	59	56
357.40	5.00		11	Medium Sand	4.0	26.9	189.2	5.8	2.9	***134.2***	134	0	0	74	61
352.40	5.00		43	Sandy Gravel	33.4	105.3	205.4	48.8	11.5	***181.1***	181	0	0	100	66
347.40	5.00		36	Sandy Gravel	22.4	88.2	***210.7***	32.8	9.7	212.0	211	0	0	116	71
342.40	5.00		29	Sandy Gravel	15.0	71.0	***206.1***	21.9	7.8	231.8	206	0	0	113	76
337.40	5.00		21	Sandy Gravel	9.7	51.4	***228.1***	14.2	5.6	247.3	228	0	0	125	81
332.40	5.00		26	Sandy Gravel	12.6	63.7	***226.0***	18.5	7.0	264.2	226	0	0	124	86
327.40	5.00		20	Sandy Gravel	9.3	49.0	***262.3***	13.6	5.4	280.8	262	0	0	144	91
322.40	5.00		31	Sandy Gravel	16.9	75.9	335.5	24.6	8.3	***311.6***	312	0	0	171	96
317.40	5.00		54	Sandy Gravel	53.7	132.3	467.6	78.6	14.5	***398.7***	399	0	0	219	101
312.40	5.00		86	Sandy Gravel	113.0	210.7	***502.2***	165.3	23.1	555.4	~~502~~	~~0~~	~~0~~	~~276~~	~~106~~
307.40	5.00		54	Sandy Gravel	53.7	132.3	668.7	78.6	14.5	***646.3***	~~646~~	~~0~~	~~0~~	~~355~~	~~111~~
302.40	5.00		100	Sandy Gravel	139.0	245.0	***807.7***	203.2	26.8	849.5	~~808~~	~~0~~	~~0~~	~~444~~	~~116~~
297.40	5.00		100	Sandy Gravel	139.0	245.0	***946.6***	203.2	26.8	1052.7	~~947~~	~~0~~	~~0~~	~~521~~	~~121~~
296.40	1.00			Limestone	98.8	245.0	***1045.5***	144.5	26.8	1197.2	~~1045~~	~~0~~	~~0~~	~~575~~	~~122~~
295.40	1.00			Limestone		245.0			26.8						

Pile Design Table for East Abutment (EB Lane) utilizing Boring #BB306

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
233	128	36
Metal Shell 12"Φ w/.25" walls		
275	151	46
Metal Shell 14"Φ w/.25" walls		
290	160	36
337	185	46
Metal Shell 14"Φ w/.312" walls		
290	160	36
337	185	46
Steel HP 8 X 36		
232	127	86
Steel HP 10 X 42		
295	162	86

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
302	166	86
398	219	91
Steel HP 12 X 53		
229	126	81
371	204	86
Steel HP 12 X 63		
237	131	81
375	206	86
477	262	91
Steel HP 12 X 74		
244	134	81
380	209	86
484	266	91
Steel HP 12 X 84		
250	138	81
386	213	86
491	270	91

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
281	154	81
459	253	86
565	311	91
Steel HP 14 X 89		
291	160	81
466	256	86
576	317	91
Steel HP 14 X 102		
299	164	81
472	260	86
584	321	91
793	436	96
Steel HP 14 X 117		
308	170	81
479	263	86
595	327	91
806	444	96
918	505	101
Precast 14"x 14"		
105	58	21
Timber Pile		
148	81	31

Pile Design Table for East Abutment (EB Lane) utilizing Boring #BB306

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
167	167	26
233	233	36
Metal Shell 12"Φ w/.25" walls		
167	167	26
233	233	36
275	275	46
Metal Shell 14"Φ w/.25" walls		
83	83	21
212	212	26
290	290	36
337	337	46
Metal Shell 14"Φ w/.312" walls		
83	83	21
212	212	26
290	290	36
337	337	46
Steel HP 8 X 36		
154	154	81
232	232	86
Steel HP 10 X 42		
149	149	76
191	191	81
295	295	86

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
153	153	76
200	200	81
302	302	86
398	398	91
Steel HP 12 X 53		
169	169	71
190	190	76
229	229	81
371	371	86
Steel HP 12 X 63		
173	173	71
192	192	76
237	237	81
375	375	86
477	477	91
Steel HP 12 X 74		
175	175	71
195	195	76
244	244	81
380	380	86
484	484	91
Steel HP 12 X 84		
178	178	71

Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
168	168	61
182	182	66
205	205	71
231	231	76
281	281	81
459	459	86
565	565	91
Steel HP 14 X 89		
171	171	61
184	184	66
209	209	71
235	235	76
291	291	81
466	466	86
576	576	91
Steel HP 14 X 102		
173	173	61
187	187	66
211	211	71
238	238	76
299	299	81
472	472	86
584	584	91

Appendix D

APPENDIX D

PROJECT: PTB 172, Item 22 – FAP 799 (MLK Drive)
LOCATION: St. Clair County, Illinois
STRUCTURE: **082-6003** (EXISTING)
SCI NO.: 2014-3149.51

Table D.1 – Soil Modulus Parameters (k) for BB-301

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 6.25	408.5 to 402.25	Fill: Silty Clay Loam	117	125	--	90	0.02
6.25 to 19.0	402.3 to 389.5	Soft Clay	117	125	--	100	0.01
19.0 to 24.0	389.5 to 384.5	Sand	110	--	30	90	--
24.0 to 25.5	384.5 to 383.0	Sand	48	--	30	60	--
25.5 to 32.0	389.5 to 383.0	Silty Loam	55	250	--	100	0.01
32.0 to 87.0	383.0 to 321.5	Sand	48	--	30	60	--
87.0 to 119.0	321.5 to 316.5	Sand with Gravel	56	--	32	125	--
119 +	Below 289.5	Limestone	140	5,000	--	2,000	0.004

Table D.2 – Soil Modulus Parameters (k) for BB-302

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 11.5	411.0 to 399.5	Fill: Crushed Rock	120	--	30	25	--
11.5 to 21.1	399.5 to 389.9	Fill: Clay	120	150	--	100	.
21.1 to 30.0	389.9 to 381.0	Fill: Clay	55	150	--	100	0.02
30.0 to 91.5	381.0 to 319.5	Sand	48	--	30	60	--
91.5 to 119.3	319.5 to 291.7	Sand with Gravel	56	--	30	125	--
119.3 +	Below 289.2	Limestone	140	5,000	--	2,000	0.004

APPENDIX D

PROJECT: PTB 172, Item 22 – FAP 799 (MLK Drive)
LOCATION: St. Clair County, Illinois
STRUCTURE: **082-6003** (EXISTING)
SCI NO.: 2014-3149.51

Table D.3 – Soil Modulus Parameters (k) for BB-303

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 15.5	414.5 to 399.0	Clay (A-7)	120	250	--	100	0.01
15.5 to 29.5	399.0 to 385.0	Sandy Loam	117	--	30	25	--
29.5 to 36.5	385.0 to 378.0	Sandy Loam	48	--	30	20	--
36.5 to 82.5	378.0 to 332.0	Sand	48	--	30	60	--
82.5 to 107.0	332.0 to 307.5	Sand	56	--	30	125	--
107.0 to 119.5	307.5 to 295.0	Cobbles with Gravel	56	--	32	125	--
119.5 +	Below 289	Limestone	140	5,000	--	2,000	0.004

Table D.4 – Soil Modulus Parameters (k) for BB-304

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 8.0	412.5 to 402.0	Fill: Sand	120	--	30	25	--
8.0 to 18.0	402.0 to 394.5	Clay	120	250	--	100	.01
18.0 to 27.0	394.5 to 385.5	Sand	110	--	30	25	--
27.0 to 28.0	385.5 to 384.5	Sand	48	--	30	20	--
28.0 to 87.0	384.5 to 325.5	Sand	48	--	30	60	--
87.0 to 104.5	325.5 to 308.5	Sand with Gravel	56	--	32	125	--
104.5 to 119.6	308.5 to 292.9	Cobbles with Gravel	56	--	32	125	--
119.6 +	Below 288.9	Limestone	140	5,000	--	2,000	0.004

APPENDIX D

PROJECT: PTB 172, Item 22 – FAP 799 (MLK Drive)
LOCATION: St. Clair County, Illinois
STRUCTURE: **082-6003** (EXISTING)
SCI NO.: 2014-3149.51

Table D.5 – Soil Modulus Parameters (k) for BB-305

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 15.5	413.5 to 405.5	Fill: Clay	120	250	--	100	0.01
15.5 to 37.5	405.5 to 376.0	Sandy Loam	120	--	28	90	--
37.5 to 67.0	376.0 to 346.5	Sand	48	--	30	60	--
67.0 to 100.0	346.5 to 313.5	Sand	56	--	32	125	--
100.0 to 110.0	313.5 to 303.5	Gravel with sand	56	--	32	125	--
110.0 to 115.5	303.5 to 298.0	Cobble with gravel	56	--	35	225	--
115.5 +	Below 298.0	Limestone	140	5,000	--	2,000	0.004

Table D.6 – Soil Modulus Parameters (k) for BB-306

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0.0 to 6.5	430.0 to 423.5	Fill: Clay	120	250	--	100	0.01
6.5 to 22.0	423.5 to 408.0	Fill: Sand	110	--	30	25	--
22.0 to 37.0	408.0 to 393.0	Clay	117	250	--	100	0.02
37.0 to 102.0	393.0 to 328.0	Sand	48	--	30	60	--
102.0 to 117.0	328.0 to 313.0	Sand with Gravel	56	--	32	125	--
117.0 to 126.6	313.0 to 303.4	Weathered Limestone	56	2,000	35	225	--
126.6 +	Below 303.4	Limestone	140	5,000	--	2,000	0.004

Appendix E

Bench Mark No. 107: Chiseled square on southeast end of the MLK Bridge on southwest corner of concrete slab. Elevation NAVD 88 = 439.628

Existing Structure: S.N. 082-6003 was built in 1950 as part of the original MLK Bridge construction, and underwent major rehabilitation in 1989 with additional work in 1997. The 15-span structure consists of a simply supported, 250'-0" long, steel through truss main span, and an assortment of multi-beam and curved girder spans on the west and east approaches with a total length of 1245'-11½" ctr. to ctr. of abutment bearings and a width of 42'-10" out to out of deck. The substructure units consist of concrete piers and steel bent towers both supported on spread footings with concrete piles, and concrete pile supported stub abutments.

The existing structure is to be removed and replaced.

The structure is to be completely closed to traffic during construction. Traffic is to be maintained by detouring onto adjacent structures.

No salvage.

DRAINAGE SCUPPER STATIONS

WESTBOUND		EASTBOUND	
61+62.00	70+50.00	61+06.00	70+50.00
61+95.00	71+75.00	61+75.00	70+80.00
63+20.00	73+30.00	63+20.00	---
66+70.00	73+45.00	66+20.00	---
69+00.00	---	68+75.00	---

Note: No freefall deck drains will be permitted in the span over the tracks or within 10 ft. of cross arms of a railroad pole line. Closed drainage will be utilitzed for the entire length of the structure.

LOADING HL-93

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

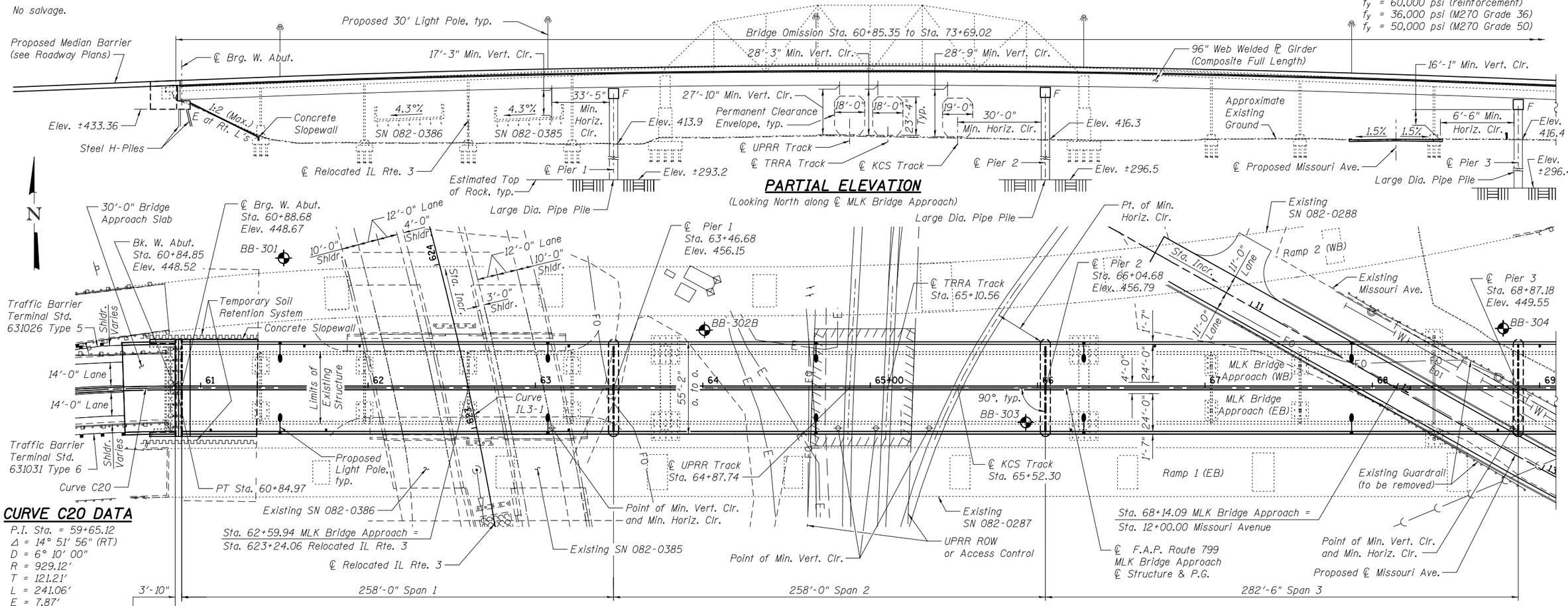
DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 and 2016 Interims

DESIGN STRESSES

FIELD UNITS

f'_c = 3,500 psi
f'_c = 4,000 psi (superstructure concrete)
f_y = 60,000 psi (reinforcement)
f_y = 36,000 psi (M270 Grade 36)
f_y = 50,000 psi (M270 Grade 50)



PARTIAL PLAN

CURVE C20 DATA

P.I. Sta. = 59+65.12
Δ = 14° 51' 56" (RT)
D = 6° 10' 00"
R = 929.12'
T = 121.21'
L = 241.06'
E = 7.87'
e = 4.3%
T.R. = 35'
S.E. Run = 102'
P.C. Sta. = 58+43.91
P.T. Sta. = 60+84.97

CURVE IL3-1 DATA

P.I. Sta. = 620+50.65
Δ = 39° 34' 55" (LT)
D = 2° 45' 00"
R = 2,083.48'
T = 749.73'
L = 1,439.34'
E = 130.79'
e = 4.3%
T.R. = 36'
S.E. Run = 102'
P.C. Sta. = 613+00.92
P.T. Sta. = 627+40.27

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.24 g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.54 g
Soil Site Class = D

HIGHWAY CLASSIFICATION

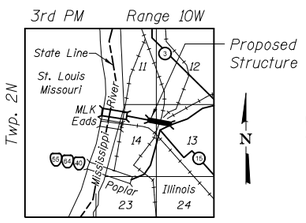
F.A.P. Rte. 799 - MLK Bridge Approach
Functional Class: Other Principal Arterial
ADT: 7,600 (2018); 8,700 (2038)
DHV: 957 (2038)
ADTT: SU = 1.9% MU = 1.5%
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
Two-Way Traffic
Directional Distribution: 57% (WB); 43% (EB)

HIGHWAY CLASSIFICATION

F.A.P. Rte. 788 - Relocated IL Rte. 3
Functional Class: Urban Expressway
ADT: 12,000 (2004); 16,000 (2024)
DHV: 1760 (2024)
ADTT: ---
Design Speed: 50 m.p.h.
Posted Speed: ---
Two-Way Traffic
Directional Distribution: ---

HIGHWAY CLASSIFICATION

Missouri Avenue
Functional Class: Local Road (Urban Local Street)
ADT: 25 (2013)
DHV: ---
ADTT: ---
Design Speed: 25 m.p.h.
Posted Speed: ---
Two-Way Traffic
Directional Distribution: 50% (WB); 50% (EB)



LOCATION SKETCH

GENERAL PLAN - 1
MLK BRIDGE APPROACH OVER RELOCATED IL RTE. 3, VARIOUS RAILROADS, MISSOURI AVE. AND I-55SB/64WB
F.A.P. ROUTE 799 SEC. 1BR-1-1
ST. CLAIR COUNTY
STATION 67+27.18
STRUCTURE NO. 082-0374

MODJESKI and MASTERS
Experience great bridges.

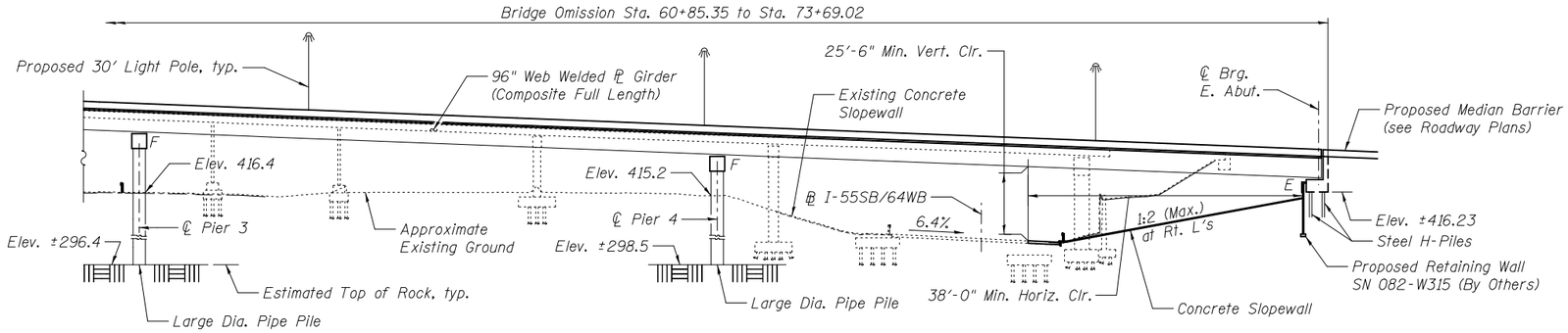
USER NAME =	DESIGNED - JTH	REVISED
	CHECKED - ACK	REVISED
PLOT SCALE =	DRAWN - PRC	REVISED
PLOT DATE = 01/20/2017	CHECKED - JMH	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN – 1

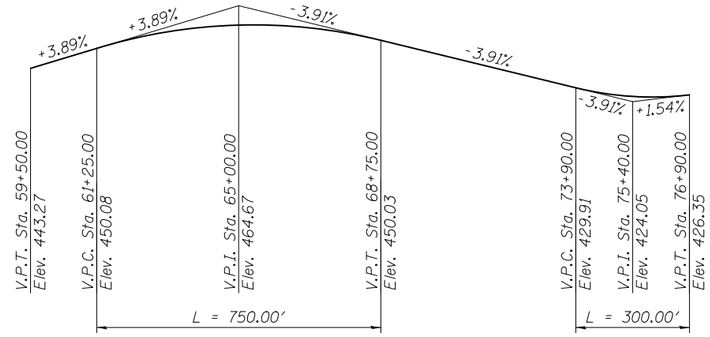
SHEET NO. 1 OF 4 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
799	1BR-1-1	ST. CLAIR		
		CONTRACT NO. 76G39		
ILLINOIS	FED. AID PROJECT			



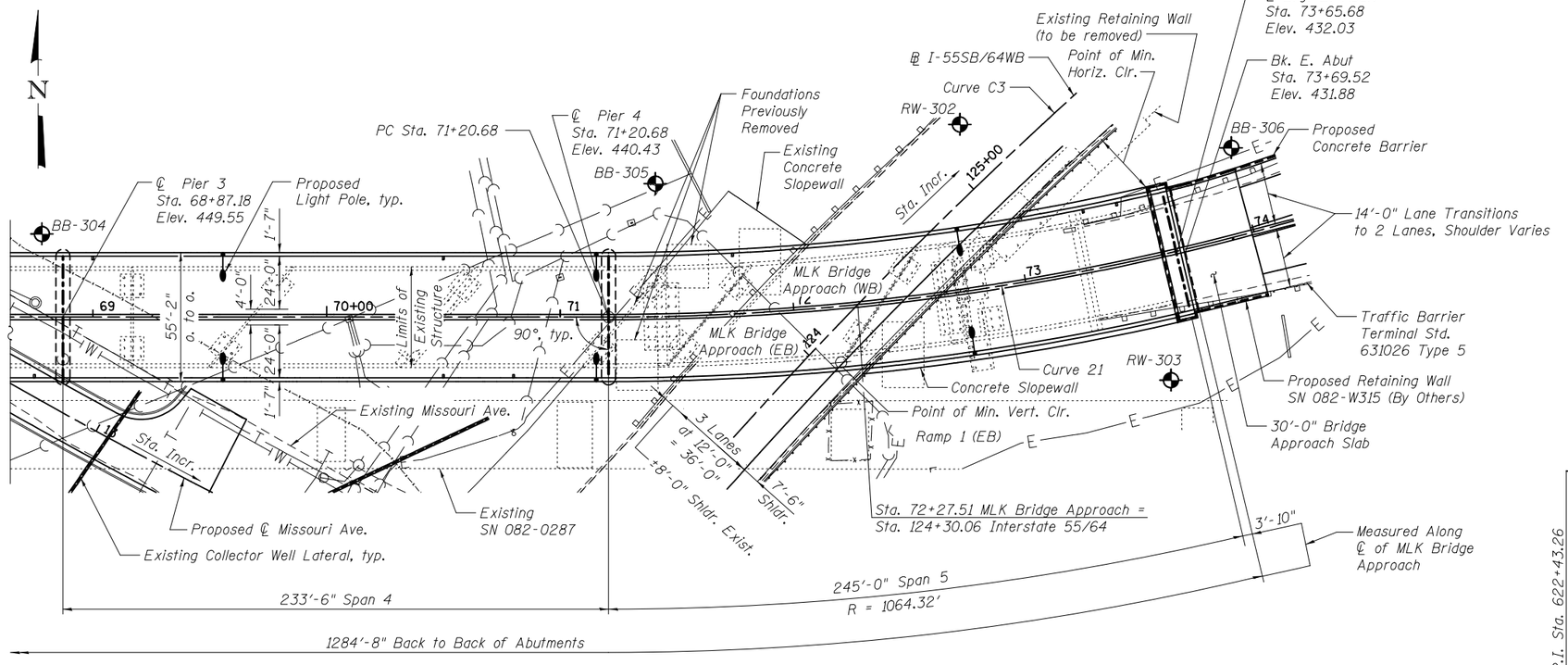
PARTIAL ELEVATION

(Looking North along ℄ MLK Bridge Approach)

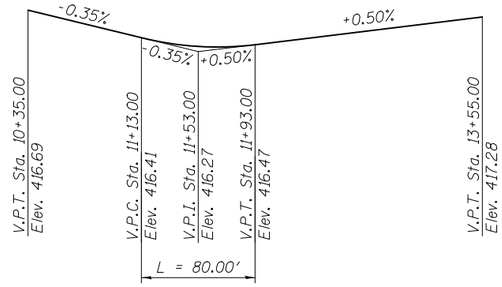


PROFILE GRADE

(Along the ℄ MLK Bridge Approach)

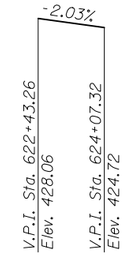


PARTIAL PLAN



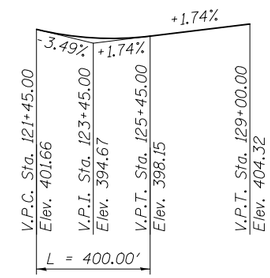
PROFILE GRADE

(Along Missouri Avenue)



PROFILE GRADE

(Along Relocated IL Rte. 3)



PROFILE GRADE

(Along I-55SB/64WB)
(Original Design)

HIGHWAY CLASSIFICATION

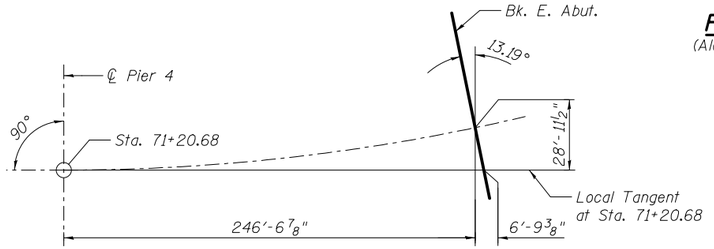
F.A.I. Rte. 55/64
Functional Class: Interstate
ADT: 48,700 (2018); 59,400 (2038)
DHV: 6534 (2038)
ADTT: SU = 2.4% MU = 7.8%
Design Speed: 60 m.p.h.
Posted Speed: 50 m.p.h.
One-Way Traffic

CURVE C3 DATA

P.I. Sta. = 125+66.38
Δ = 21° 41' 42" (RT)
D = 2° 44' 22"
R = 2,091.61'
T = 400.79'
L = 791.99'
E = 38.05'
e = N/A
T.R. = N/A
S.E. Run = N/A
P.C. Sta. = 121+65.59
P.T. Sta. = 129+57.58

CURVE 21 DATA

P.I. Sta. = 74+81.50
Δ = 37° 27' 17" (LT)
D = 5° 23' 00"
R = 1,064.32'
T = 360.82'
L = 695.75'
E = 59.50'
e = 4.7%
T.R. = 31'
S.E. Run = 99'
P.C. Sta. = 71+20.68
P.T. Sta. = 78+16.44



OFFSET SKETCH

GENERAL PLAN - 2
MLK BRIDGE APPROACH OVER RELOCATED IL RTE. 3, VARIOUS RAILROADS, MISSOURI AVE. AND I-55SB/64WB
F.A.P. ROUTE 799 SEC. 1BR-1-1
ST. CLAIR COUNTY
STATION 67+27.18
STRUCTURE NO. 082-0374

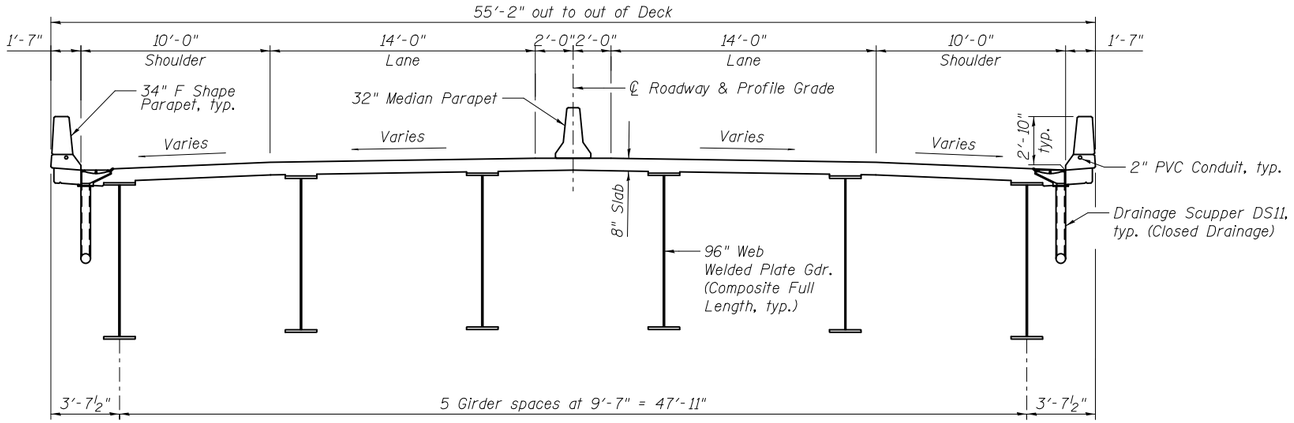
MODJESKI and MASTERS Experience great bridges.	USER NAME =	DESIGNED - JTH	REVISED
		CHECKED - ACK	REVISED
	PLOT SCALE =	DRAWN - PRC	REVISED
	PLOT DATE = 01/20/2017	CHECKED - JMH	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

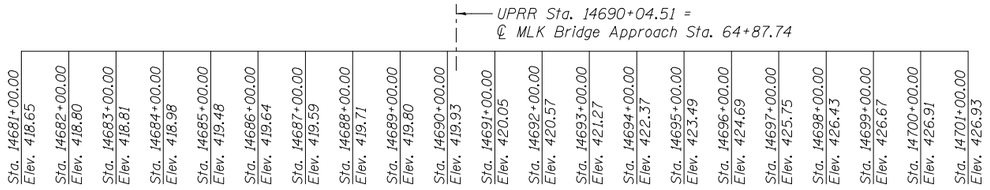
GENERAL PLAN – 2

SHEET NO. 2 OF 4 SHEETS

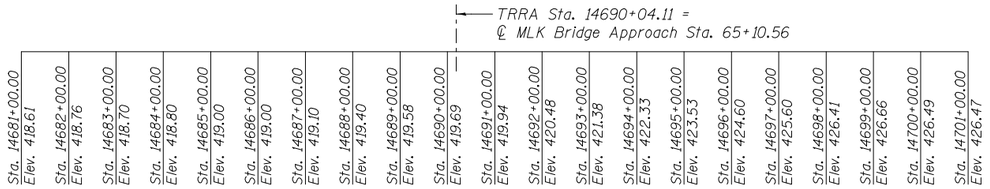
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
799	1BR-1-1	ST. CLAIR		
		CONTRACT NO. 76G39		
	ILLINOIS	FED. AID PROJECT		



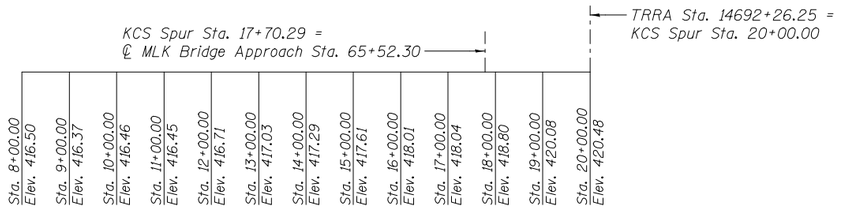
CROSS SECTION
(Looking East)



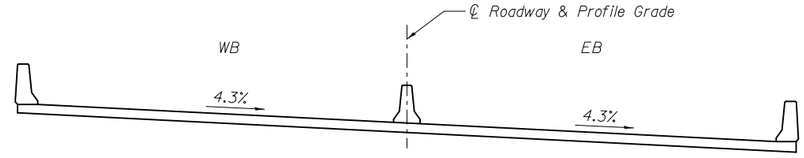
PROFILE GRADE - UPRR
Note: Stations increase from north to south.



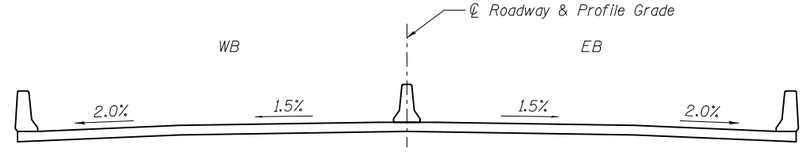
PROFILE GRADE - TRRA
Note: Stations increase from north to south.



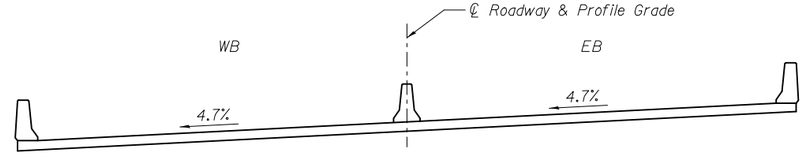
PROFILE GRADE - KCS SPUR
Note: Stations increase from north to south.



STA. 60+50.32

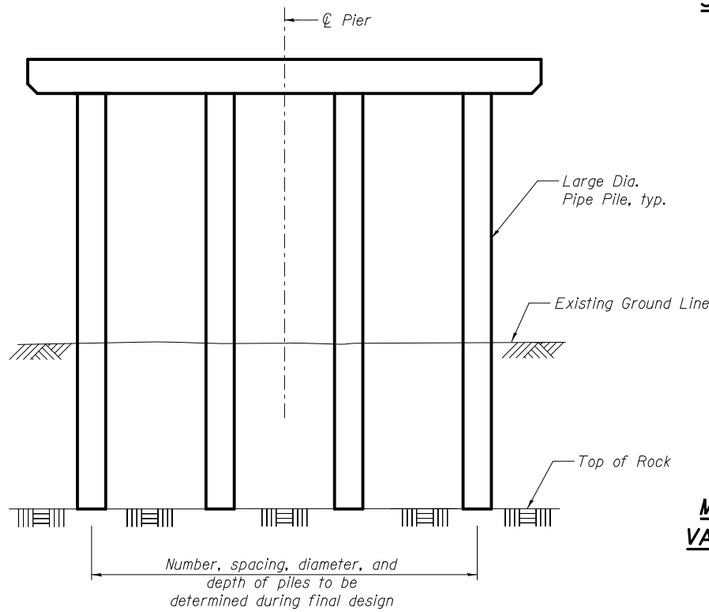


STA. 61+87.32 TO STA. 70+23.02

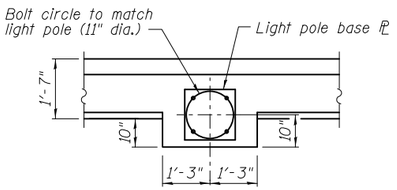


STA. 71+53.02 TO STA. 77+84.10

SUPERELEVATION TRANSITION
(Looking East)



PIER SKETCH



LIGHT POLE BASE DETAIL

DETAILS - 1
MLK BRIDGE APPROACH OVER RELOCATED IL RTE. 3, VARIOUS RAILROADS, MISSOURI AVE. AND I-55SB/64WB
F.A.P. ROUTE 799 SEC. 1BR-1-1
ST. CLAIR COUNTY
STATION 67+27.18
STRUCTURE NO. 082-0374

MODJESKI and MASTERS
Experience great bridges.

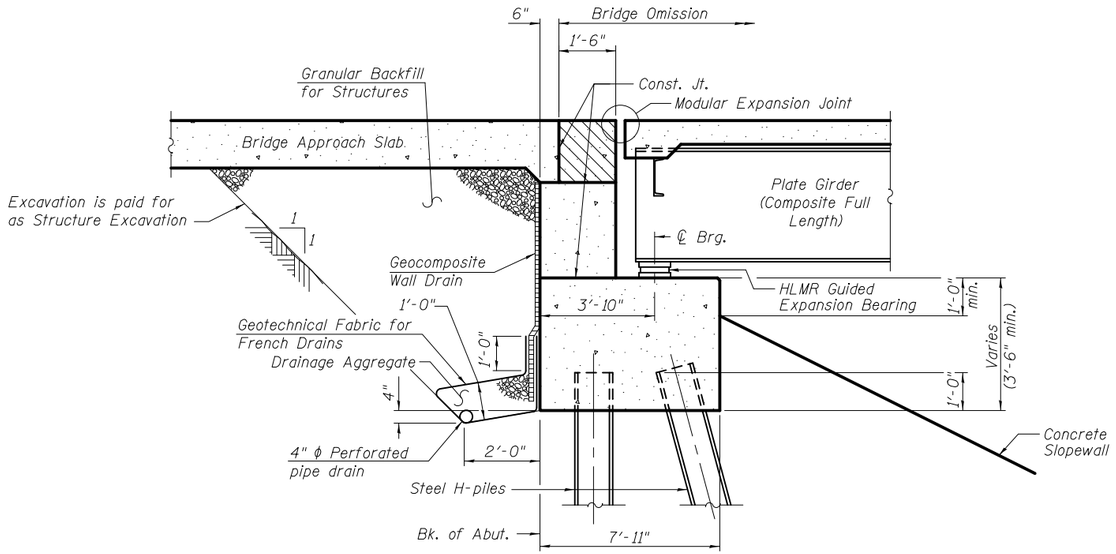
USER NAME =	DESIGNED - JTH	REVISED
	CHECKED - ACK	REVISED
PLOT SCALE =	DRAWN - PRC	REVISED
PLOT DATE = 01/20/2017	CHECKED - JMH	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

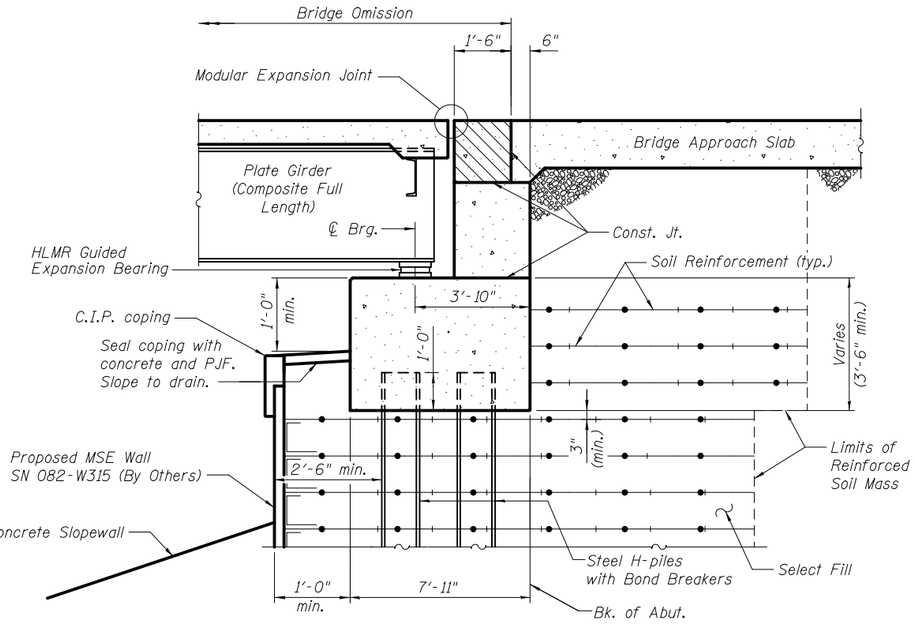
DETAILS – 1

SHEET NO. 3 OF 4 SHEETS

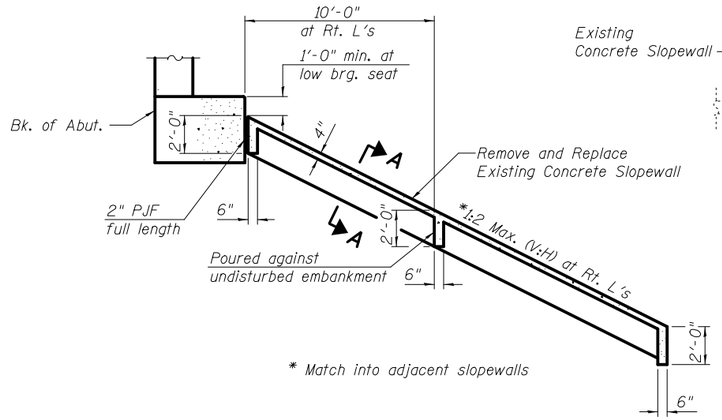
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
799	1BR-1-1	ST. CLAIR		
		CONTRACT NO. 76G39		
	ILLINOIS FED. AID PROJECT			



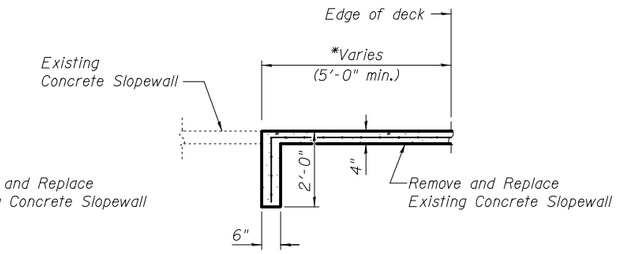
SECTION THRU WEST ABUTMENT



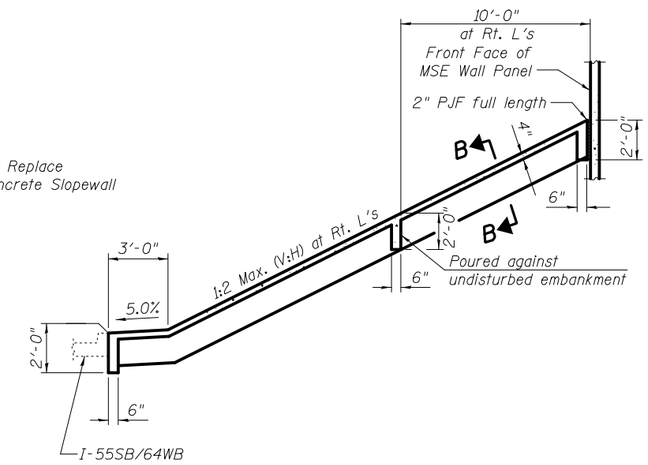
SECTION THRU EAST ABUTMENT



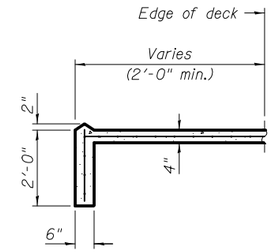
SECTION THRU CONCRETE SLOPEWALL AT WEST ABUTMENT



SECTION A-A



SECTION THRU CONCRETE SLOPEWALL AT EAST ABUTMENT



SECTION B-B

DETAILS - 2
MLK BRIDGE APPROACH OVER RELOCATED IL RTE. 3, VARIOUS RAILROADS, MISSOURI AVE. AND I-55SB/64WB
F.A.P. ROUTE 799 SEC. 1BR-1-1
ST. CLAIR COUNTY
STATION 67+27.18
STRUCTURE NO. 082-0374

MODJESKI and MASTERS Experience great bridges.	USER NAME =	DESIGNED - JTH	REVISED
		CHECKED - ACK	REVISED
	PLOT SCALE =	DRAWN - PRC	REVISED
	PLOT DATE = 01/20/2017	CHECKED - JMH	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DETAILS – 2

SHEET NO. 4 OF 4 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
799	1BR-1-1	ST. CLAIR		
		CONTRACT NO. 76G39		
	ILLINOIS	FED. AID PROJECT		

Appendix F

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for Pier 1, Boring B-302

Estimated Top of Rock Elevation: 293.20

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.)
24 in. Diameter Drilled Shaft							
2	291.2	17730	8865	TIP	--	--	2.552
7	286.2	14104	7052	TIP	--	--	2.544
12	281.2	2635	1449	SIDE	4900	0.249	0.102
15	278.2	3293	1811	SIDE	9133	0.467	0.124
30 in. Diameter Drilled Shaft							
2	291.2	27702	13851	TIP	--	--	3.125
7	286.2	22038	11019	TIP	--	--	3.000
12	281.2	3293	1811	SIDE	4564	0.187	0.111
15	278.2	4117	2264	SIDE	7462	0.304	0.128
36 in. Diameter Drilled Shaft							
2	291.2	11105	5552	TIP	--	--	1.046
7	286.2	31797	15898	TIP	--	--	3.463
12	281.2	3952	2174	SIDE	4591	0.160	0.123
15	278.2	4940	2717	SIDE	7027	0.240	0.137
42 in. Diameter Drilled Shaft							
2	291.2	14778	7389	TIP	--	--	1.163
7	286.2	43340	21670	TIP	--	--	3.915
12	281.2	4611	2536	SIDE	4761	0.146	0.138
15	278.2	5764	3170	SIDE	6997	0.208	0.149
60 in. Diameter Drilled Shaft							
2	291.2	28924	14462	TIP	--	--	1.564
7	286.2	3842	2113	SIDE	2857	0.079	0.166
12	281.2	6587	3623	SIDE	5587	0.131	0.186
15	278.2	8234	4528	SIDE	7710	0.171	0.194
72 in. Diameter Drilled Shaft							
2	291.2	41021	20511	TIP	--	--	1.835
7	286.2	4611	2536	SIDE	3293	0.080	0.196
12	281.2	7904	4347	SIDE	6240	0.129	0.219
15	278.2	9880	5434	SIDE	8430	0.163	0.227

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for Pier 2 - Boring B-303

Estimated Top of Rock Elevation: 296.50

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.)
24 in. Diameter Drilled Shaft							
3	293.5	2791	1396	TIP	--	--	0.549
4.5	292	1547	773	TIP	--	--	0.368
8.5	288	2124	1153	SIDE + TIP	1924	0.106	0.122
11.5	285	2254	1240	SIDE	1514	0.090	0.178
14.5	282	2913	1602	SIDE	2216	0.126	0.193
30 in. Diameter Drilled Shaft							
3	293.5	3978	1989	TIP	--	--	0.636
4.5	292	2218	1109	TIP	--	--	0.424
8.5	288	2835	1532	SIDE + TIP	2275	0.101	0.139
11.5	285	2818	1550	SIDE	1724	0.085	0.209
14.5	282	3641	2003	SIDE	2469	0.113	0.217
36 in. Diameter Drilled Shaft							
3	293.5	5247	2623	TIP	--	--	0.694
4.5	292	2999	1499	TIP	--	--	0.454
8.5	288	3620	1947	SIDE + TIP	2645	0.099	0.156
11.5	285	3381	1860	SIDE	1942	0.082	0.242
14.5	282	4369	2403	SIDE	2728	0.106	0.246
42 in. Diameter Drilled Shaft							
3	293.5	6537	3269	TIP	--	--	0.772
4.5	292	3891	1945	TIP	--	--	0.488
8.5	288	3198	1759	SIDE	1931	0.076	0.221
11.5	285	3945	2170	SIDE	2164	0.082	0.277
14.5	282	5098	2804	SIDE	2995	0.102	0.278
60 in. Diameter Drilled Shaft							
3	293.5	12689	6344	TIP	--	--	0.970
4.5	292	10615	5307	TIP	--	--	0.858
8.5	288	4568	2513	SIDE	2547	0.079	0.307
11.5	285	5636	3100	SIDE	2848	0.084	0.384
14.5	282	7282	4005	SIDE	3832	0.100	0.380
72 in. Diameter Drilled Shaft							
3	293.5	1976	1087	SIDE	1459	0.036	0.124
4.5	292	2964	1630	SIDE	2202	0.058	0.150
8.5	288	5482	3015	SIDE	2964	0.081	0.363
11.5	285	6763	3720	SIDE	3312	0.086	0.455
14.5	282	8739	4806	SIDE	4406	0.101	0.449

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for Pier 3, Boring B-304

Estimated Top of Rock Elevation: 296.40

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.)
24 in. Diameter Drilled Shaft							
3	293.4	2268	1136	SIDE + TIP	16	0.001	0.338
5.5	290.9	5590	2795	TIP	--	--	0.958
8	288.4	6963	3482	TIP	--	--	1.318
10.5	285.9	1622	892	SIDE	647	0.037	0.214
13	283.4	2020	1111	SIDE	798	0.044	0.231
30 in. Diameter Drilled Shaft							
3	293.4	3383	1694	SIDE + TIP	21	0.001	0.393
5.5	290.9	10022	5011	TIP	--	--	1.308
8	288.4	9449	4725	TIP	--	--	1.323
10.5	285.9	2027	1115	SIDE	771	0.036	0.259
13	283.4	2525	1389	SIDE	948	0.042	0.275
36 in. Diameter Drilled Shaft							
3	293.4	5662	2834	SIDE + TIP	26	0.001	0.538
5.5	290.9	12920	6460	TIP	--	--	1.336
8	288.4	1609	885	SIDE	439	0.020	0.413
10.5	285.9	2433	1338	SIDE	894	0.036	0.306
13	283.4	3030	1667	SIDE	1095	0.041	0.322
42 in. Diameter Drilled Shaft							
3	293.4	8452	4230	SIDE + TIP	31	0.001	0.679
5.5	290.9	16117	8058	TIP	--	--	1.402
8	288.4	1878	1033	SIDE	506	0.021	0.480
10.5	285.9	2838	1561	SIDE	1018	0.037	0.355
13	283.4	3536	1945	SIDE	1242	0.041	0.371
60 in. Diameter Drilled Shaft							
3	293.4	15752	7881	SIDE + TIP	47	0.001	0.865
5.5	290.9	1543	849	SIDE	409	0.017	0.720
8	288.4	2682	1475	SIDE	707	0.023	0.681
10.5	285.9	4054	2230	SIDE	1390	0.039	0.501
13	283.4	5051	2778	SIDE	1681	0.043	0.521
72 in. Diameter Drilled Shaft							
3	293.4	205	113	SIDE	25	0.001	3.120
5.5	290.9	1852	1018	SIDE	489	0.018	0.860
8	288.4	3219	1770	SIDE	841	0.024	0.814
10.5	285.9	4865	2676	SIDE	1639	0.041	0.598
13	283.4	6061	3334	SIDE	1975	0.044	0.623

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for Pier 4, Boring B-305

Estimated Top of Rock Elevation: 298.50

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.)
24 in. Diameter Drilled Shaft							
3	295.5	902	459	SIDE + TIP	73	0.007	0.226
5.5	293	1843	941	SIDE + TIP	125	0.010	0.387
8	290.5	765	420	SIDE	155	0.014	0.590
10.5	288	1111	611	SIDE	243	0.017	0.463
30 in. Diameter Drilled Shaft							
3	295.5	1428	724	SIDE + TIP	94	0.008	0.292
5.5	293	2859	1454	SIDE + TIP	167	0.011	0.453
8	290.5	956	526	SIDE	192	0.015	0.734
10.5	288	1389	764	SIDE	299	0.018	0.573
36 in. Diameter Drilled Shaft							
3	295.5	2186	1105	SIDE + TIP	120	0.008	0.348
5.5	293	717	394	SIDE	137	0.011	0.905
8	290.5	1147	631	SIDE	229	0.016	0.878
10.5	288	1667	917	SIDE	355	0.018	0.684
42 in. Diameter Drilled Shaft							
3	295.5	3092	1560	SIDE + TIP	146	0.008	0.399
5.5	293	836	460	SIDE	159	0.012	1.054
8	290.5	1338	736	SIDE	266	0.017	1.021
10.5	288	1945	1070	SIDE	411	0.019	0.795
60 in. Diameter Drilled Shaft							
3	295.5	666	366	SIDE	126	0.008	1.466
5.5	293	1195	657	SIDE	226	0.013	1.496
8	290.5	1911	1051	SIDE	377	0.019	1.450
10.5	288	2779	1528	SIDE	579	0.022	1.129
72 in. Diameter Drilled Shaft							
3	295.5	799	439	SIDE	151	0.008	1.752
5.5	293	1434	789	SIDE	270	0.014	1.789
8	290.5	2294	1261	SIDE	451	0.021	1.734
10.5	288	3334	1834	SIDE	691	0.023	1.350