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DRAFT - GEOTECHNICAL DESIGN MEMORANDUM | November 19, 2021

76K02 - PS&E Package for B&O Bridge

Recommendations for Foundation Rehabilitation (Prefinal Submittal)

WJE PROJECT NO. 2014.6410.U

TO
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FROM
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This memorandum summarizes our recommendations related to the rehabilitation of Structure No. 082-0017 ("B&O Bridge"), specifically the rehabilitation of the above-grade foundation elements (pier caps, pier columns, and crash walls). The work is related to the development of the PS&E package for rehabilitation of this structure and is in accordance with the recommendations noted in our approved Bridge Condition Report (BCR) and Plan Development Outline. A Structure Geotechnical Report (SGR) was outside the scope of this PS&E effort.

Introduction

WJE performed a condition survey and associated analysis of the structure in 2020. "Serious" conditions consisting of multiple fractured column ties, as well as widespread corrosion related deterioration were present in the reinforced concrete foundation elements (piers and pier caps) supporting the steel superstructure. Recommendations for partial- and full-replacement were proposed and approved as part of the BCR process. Any replacement work will require temporary shoring to support the deck and steel structure to remain. Shoring systems will be supported through either shallow or deep foundations, such as piles, depending on the soil conditions.

Also during the BCR analysis, potentially liquefiable soils were identified at the structure site. The available soil investigation records from original construction and from the 1996 survey did not fully characterize the soil conditions to the extent necessary for a full liquefaction analysis. Therefore, to better characterize the risk for liquefaction, as well as to obtain the necessary soil bearing capacity information for shoring design, additional soil borings were recommended.

The following summarizes the structure, available information, rehabilitation design recommendations for substructure elements, and findings from the 2021 soils investigation.

Description of Structure

Structure No. 082-0017 was constructed in 1959. A major rehabilitation was carried out in 1988 that included replacement of the entire deck and the parapets. Seismic retrofits to elements of both the superstructure and the substructure were installed in 1998. In 2017, a limited repair scope was completed

to re-seal the expansion joints as well as perform partial depth repairs of the bridge deck and approach pavements.

The substructure consists of reinforced concrete abutments and piers. The West Abutment and Piers 1 through 9 are skewed at varying degrees. Piers 1 through 7 are oriented at a 41 degree skew while Piers 8 and 9 are oriented at a 17 degree skew to accommodate the horizontal clearances required by the five railroad tracks in operation under the structure at Spans 5, 7, 8, and 9.

The piers consist of either five or six reinforced concrete columns at each of two aligned piers that support each direction of roadway deck. A concrete pier cap with concrete bearing pads supports the individual girders. The concrete pier cap is stepped at some locations, and the pier cap at Pier 6 changes elevation to accommodate the transition from rolled to built-up superstructure girders. Per the construction drawings, the piers and abutments are founded on concrete piles. Piers 4 through 9 have crash walls which vary in height by pier location and six rectangular columns while the remaining piers are constructed of five cylindrical columns and without a crash wall at their base. The rectangular columns are 3 foot by 3 foot 3 inches at Piers 4 through 9. Piers 1 through 3 and Piers 10 through 18 are comprised of five circular columns that are 3 foot in diameter. Substructure reinforcement consists of uncoated rebar with 2 inches of clear cover.

Foundation Rehabilitation

The deteriorated substructure elements were selected for either partial- and full-replacement (pier reconstruction). Full replacement includes removal of the pier caps and all pier columns, down to the footing/pile cap. Partial replacement includes replacement of the pier caps and only the outer pier columns, down to the footing/pile cap. No below grade work was planned, and the existing footings and deep piles are to remain in place. The concrete crash walls at Pier Nos. 6, 7, 8, and 9 are larger elements relative to the columns, and local repairs were deemed a more cost-effective rehabilitation alternative than full replacement; thus, the replacement at these locations terminates at the top of the crash wall with no additional below grade excavations or removals.

As outlined below, the replacement design was such that the loading on the existing deep foundations would be relatively unchanged and thus, load testing or other investigation of the deep foundations is not required.

Substructure Analysis - Structural

For the substructure evaluation, an Abbreviated Analysis was performed. The Abbreviated Analysis consisted of verifying several aspects of the existing structure and the planned modifications (e.g., seat width extension as noted in the Abbreviated Seismic Analysis). The analysis also included determination of load conditions at the foundations to remain to confirm that the proposed service dead load is not greater than 115% of the original design service dead load.

The superstructure bearing conditions will not be changed; however, the bearings and steel bolsters will be replaced as part of the broader rehabilitation program. Replacing these elements necessitates a change in the height of the pier caps to accommodate the shallower profile for the new bearings. The pier cap widths will also increase to accommodate seismic requirements. MDX was used to analyze the superstructure and record each beam load at all the substructures. Using those loads and the volume of

concrete of each pier, the existing and proposed dead loads on the foundations were compared. After performing this analysis, it was determined that an Abbreviated Analysis was appropriate, and the existing foundations were suitable for reuse.

Abbreviated Seismic Analysis

An Abbreviated Seismic Evaluation was performed, based on the conditions in IDOT's "BCR Procedures & Practices Manual". To satisfy this evaluation, three required items were reviewed: substructure seat widths; bearing capacity; and liquefaction potential. At the reconstructed pier caps, the substructure seat widths will be modified to meet the current policy outlined in the IDOT Bridge Manual. Note, the abutments were retrofit in 1998 with seat extensions, and these elements were found to be adequate and can remain in-place with only local concrete repairs. No other seismic restraint or retrofit is deemed necessary at this time. Existing bearings and bolsters under all joints will be replaced with elastomeric bearings or fixed bearings that can withstand 20 percent of the total dead load and allowable capacity as stated in the Bridge Manual T.3.7.3-1 & 2.

A cursory review of the available soil data indicated a risk for soils liquefaction. In order to perform a more detailed analysis, additional soils testing was warranted. The existing soil data and findings from the 2021 investigation are summarized below.

Summary of Existing Soil Logs

Two geotechnical investigations were previously conducted at the B&O Bridge. Neither WJE nor EFK were involved in these previous investigations. The first investigation was completed as part of the original 1959 design and construction of the bridge. The second investigation was completed as part of the 1998 seismic analysis and retrofit program. The relevant findings from each of these investigations are summarized below.

Original Soil Borings - 1957 Investigation

Boring logs for this investigation are provided on a drawing titled *Borings and Soil Analysis* (drawings dated 1957, see Attachment 1). Borings completed beneath the western portion of the bridge generally showed approximately 3 to 7 feet of fill consisting of coal cinders and sand and clay. A brown and gray silty clay was found beneath the fill extending to approximately 9 to 18 feet depth, except for one location where the clay extended to approximately 30 feet depth. Blow counts indicated the clay was generally medium stiff to stiff with some soft clays in the middle portion of the bridge near Pier 10. The clay was underlain by a predominantly fine sand that was gray to brown in color. The sand ranged from loose to dense and extended to the bottom of the borings at 40 to 75 feet depth. Groundwater was encountered in three of the borings at 22 to 30 feet depth.

The ground surface at the borings completed east of Pier 10 was generally about 12 to 17 feet lower than the ground surface at the west borings. The east boring logs generally showed a gray silty clay from the ground surface to about 20 to 33 feet depth; no fill materials are indicated on these boring logs. The clay was generally soft with many blow count values of 1. The clay was generally underlain by a gray sand that was fine to coarse grained, and that was generally medium dense to dense with some loose intervals. The sand extended to the bottom of the borings at 40 to 60 feet depth. Groundwater was encountered in the majority of the borings at 3 to 19 feet depth.

Additional Soil Borings (Seismic Analysis) - 1996 Investigation

The geotechnical investigation that was conducted in 1996 for the seismic retrofit included three borings beneath the west portion of the bridge, and three beneath the east portion of the bridge (drawings dated 1997, see Attachment 2). Logs for borings completed beneath the west portion of the bridge showed zero to 17 feet of fill consisting of silty clay with cinders and rubble. A brown and gray silty clay was logged beginning at the ground surface to 17 feet depth, extending down to 7 to 23 feet depth. Blow counts indicated the clay was generally soft to stiff. The clay was underlain by a predominantly fine sand that was gray to brown in color. The sand was generally medium dense to dense and extended to the bottom of the borings at 75 to 81 feet depth. Groundwater was encountered in each of the three borings at 12 to 35 feet depth.

Logs for borings completed beneath the east portion of the bridge in 1996 showed fill described as "*ROCK AND CONSTRUCTION RUBBLE*" over gray silty clay loam to silty clay. The thickness of the fill is not indicated on the logs. The silty clay loam to silty clay extended to 32 to 38 feet depth. The clay was generally soft with several blow count values of zero reported. The clay was underlain by a fine to coarse gray sand that was generally medium dense to very dense. The sand extended to the bottom of the borings at 80 to 95 feet depth. Groundwater was encountered in two of the three borings at depths of 3.5 and 7 feet.

Need for Additional Soils Investigation

Though the previous soils investigations were comprehensive and provided sufficient information to complete the associated design tasks, a more detailed soils investigation was deemed appropriate given the planned rehabilitation program. Based on review of the available information, the subsurface conditions are variable across the site. Furthermore, based on review of the soil borings and Standard Penetration Tests (SPTs), potentially liquefiable soils are present at the bridge site. The available laboratory test results, soils classifications, and groundwater information were lacking detail to adequately characterize the risk for liquefaction. Additionally, to determine appropriate soil bearing capacities and soil profiles for the shoring design, borings at a closer spacing and with closer sampling intervals in the shallow depths were required.

Data collected through the previous investigations was combined with data obtained from the additional borings. Together this data serves as the basis for a more detailed investigation, which is summarized in the following section.

Summary of 2021 Soils Investigation

The relevant findings from this investigation are provided in the sections below. Also provided at the end of this report are several attachments related to the investigation and analyses. Attachment 3 provides a detailed report prepared by TSi outlining the findings of the soils investigation, including boring logs, and results from laboratory analysis; a plan view and boring locations were excerpted from the report and provide in the figures below. Attachment 4 provides excerpts from the PSE rehabilitation drawings. Attachment 5 provides a liquefaction analysis performed by WJE, in accordance with IDOT procedures.

Soil Profiles

The soil profiles were generally consistent with previous investigations, consisting of 5 to 10 feet of shallow fill overlying 20 to 30 feet of cohesive silts and clays, all of which is underlain by medium to very dense sands. The fill material is highly variable, consisting of a mixture of clay, cinders, and other miscellaneous debris that does not appear to be uniformly placed or compacted. The cohesive material underlying the fills has varying proportions of clay, silt, and sand, which resulted in SPT blow counts ranging from weight of hammer (WH) to 30 blows per foot (bpf). In some locations, this cohesive layer contains as much as 30 feet of WH soil. At depths below about 30 to 40 feet, relatively clean sands (4 to 6% fines) were encountered with blow counts as high as 67 bpf, but generally greater than about 17 bpf at a minimum.

Additionally, the extent of the site variability was better documented during this investigation as compared to previous investigations. Within the generalized layers described above, there were soil seams of varying thickness, consistency, and composition which were not encountered in all boreholes. Further, the location of the groundwater table fluctuated during the course of this investigation. During drilling, groundwater was encountered in 11 boreholes (at depths ranging between 5 and 20 feet) and was not encountered in the remaining three boreholes. After a 14-day delay, groundwater was encountered at depths between the ground surface and about 7 feet at select boring locations; borings within the areas requiring permit access were not re-evaluated. Due to the highly localized variability in the soil profile encountered in each borehole, either SPT/split-spoon or Shelby Tube samples were collected every 5 feet to depths of about 70 feet, after which samples were collected every 10 feet.

Liquefaction Potential

A detailed liquefaction analysis was performed in accordance with the IDOT Liquefaction Analysis design guide (Nov 2018), the IDOT Geotechnical Manual (Dec 2020), and the excel spreadsheet developed by IDOT to perform the liquefaction calculations, and the supporting documentation is provided in Attachment 5. In brief, a liquefaction analysis was performed for every location and depth where an SPT test was performed in the field. This field data was supplemented by additional laboratory tests (percent fines, Atterberg limits, and water content) to complete the analysis.

Ultimately, only two locations, a low plasticity silt (15-foot depth) at Pier 7 and a very loose sand (10-foot depth) at Pier 10, had a factory of safety less than 1.0; these were 0.994 and 0.936, respectively. Given that the structure is founded on deep foundations terminating approximately 24 to 45 feet below these layers and given that the factory of safety was not “substantially” less than 1.0, the foundation systems appear to meet IDOT’s requirements for seismic performance.

Temporary Support Systems

A bearing capacity and settlement analysis was performed by TSi as outlined in Attachment 3. The findings of their analysis indicate that a support foundation consisting of only a shallow footing would not be adequate to support the structure under live load due to both low bearing capacity and excessive settlement. Instead, a deep foundation (i.e., micro-piles or helical piles) will be required for the temporary support during pier reconstruction. A schematic design and estimated cost for these systems is provided

in the PS&E package for the structure. These systems are proprietary and will need to be designed by the specialty firm retained by the Contractor performing the work.

The following are additional considerations related to the use of deep foundations for the temporary support systems:

- The ground water levels in this region are high relative to the depths of the foundations, and thus de-watering of the excavations may be required during the work.
- Slope stability around any excavation should also be considered; sheet piling or other controls may be required.
- The very soft clays and potentially liquefiable soils at the near surface of the structure will contribute to the unbraced length of the piles and pose a risk for buckling. This detail could likely be mitigated through pile casings in these marginal layers or by implementing deeper excavations for the foundation.
- Bearing of the temporary shoring on the existing pile caps and foundation piles could be implemented; however, the Engineer will need to consider the effects of eccentric loading. In-situ load testing or other foundation assessments would likely be required to utilize the existing foundations for the shoring system.

Recommendations

WJE's recommendations are to proceed with the pier reconstruction utilizing a temporary support system founded on a deep foundation system. The system, selected by the Contractor, will need to be designed and sealed by a licensed Structural Engineer.

No foundation retrofit or further analysis of the structure is warranted based on the liquefaction analysis performed. During the next major rehabilitation of this structure (i.e., re-decking and/or superstructure replacement), a seismic analysis should be performed for the entire structure.

ATTACHMENT 1

"Borings and Soils Analysis" – Sheet 4 from 1955 Plans

BOND ISSUE & ROUTE NO.	SEC	COUNTY	TOTAL SHEETS	SHEET NO.
FAI 7	82-5-1B	ST. CLAIR	43	9
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

NO. B 2-19

GROUND SURFACE ELEV. 412.8 — 0'-0"

COAL, CINDERS & CLAY FILL	5	3'-0"
BROWN SILTY CLAY	7	
	6	9'-0"
BROWN FINE SAND	6	12'-0"
BROWN FINE SAND TR. CLAY	17	16'-6"
GREY FURRY SILTY FINE SAND	10	19'-0"
GREY FINE SAND	21	22'-0"
GREY VERY FINE TO COARSE SAND	63	27'-0"
	*	
	31	WL
GREY FINE TO COARSE SAND	33	
	33	40'-0"

BORING STOPPED BY CLIENT

USED 39' OF 2½" CASING

WATER LEVEL IS 31' BELOW GROUND SURFACE ½ HR. AFTER COMPLETION

4/19/56

NO. B 2-20

GROUND SURFACE ELEV. 414.0 — 0'-0"

CINDERS, SAND & COAL FILL	4	
	2	7'-0"
NOTE A	8	A'-0"
BROWN & GREY CLAY	9	
		15'-6"
BROWN FINE SAND	9	*
	24	
		25'-0"
GREY VERY FINE SILTY SAND	9	*
		27'-0"
	26	*
BROWN FINE SAND	28	
	31	
	28	
	32	
	31	50'-0"

NOTE A: BROWN & GREY SILTY CLAY TR. CINDERS

BORING STOPPED BY CLIENT

USED 24' OF 2½" CASING

BORING BAILED TO 43' BORING CAVED DRY AS 40'-6" 1 HR. AFTER COMPLETION

4/11/56

NO. B 2-21

GROUND SURFACE ELEV. 418.0 — 0'-0"

CINDERS & SAND FILL	3	
	1	7'-0"
NOTE A	4	8'-0"
BROWN & GREY CLAY	9	
		18'-0"
BROWN VERY FINE SILTY SAND	3	
		21'-0"
	16	*
BROWN	18	
	26	
FINE	25	
	28	
SAND	28	
	27	60'-0"

NOTE A: CINDERS & SAND FILL TRACE CLAY

BORING STOPPED BY CLIENT

USED 20' OF 2½" CASING

BORING CAVED DRY AS 40'-6" 18 HRS. AFTER COMPLETION

4/14/56

NO. B 2-22

GROUND SURFACE ELEV. 417.0 — 0'-0"

CINDER & CLAY FILL	3	5'-0"
BROWN SILTY CLAY W/VERY FINE SAND	8	
	13	9'-0"
	3	*
GREY SILTY CLAY	6	
		16'-0"
BROWN FINE SAND	9	
	21	
	29	
GREY FINE SAND	26	
	21	
	21	
	21	46'-0"

BORING STOPPED BY CLIENT

USED 44' OF 2½" CASING

5/4/56

NO. B 2-23

GROUND SURFACE ELEV. 407.5 — 0'-0"

CINDER FILL	3	3'-0"
GREY SILTY CLAY	9	
	10	9'-0"
BROWN FINE SAND	9	
		15'-0"
GREY VERY FINE SILTY SAND	3	
		19'-0"
BROWN FINE SAND	18	
		25'-0"
GREY FINE TO COARSE SAND	40	
	41	WL
		35'-0"
GREY FINE SAND	20	
	22	40'-0"

BORING STOPPED BY CLIENT

USED 39' OF 2½" CASING

WATER LEVEL IS 29' BELOW GROUND SURFACE 3 HR. AFTER COMPLETION

5/2/56

NO. B 2-24

GROUND SURFACE ELEV. 405.9 — 0'-0"

CINDER & CLAY FILL	5	4'-0"
BROWN SILTY CLAY W/VERY FINE SAND	4	8'-0"
GREY VERY FINE SAND	4	12'-0"
GREY SILTY CLAY	3	15'-6"
NOTE A	5	17'-0"
GREY VERY FINE SAND TRACE SILT	10	22'-0"
GREY FINE TO COARSE SAND	28	WL
		27'-0"
GREY SILTY CLAY, TRACE SAND	5	
		34'-0"
GREY FINE SAND	8	
		38'-0"
GREY FINE TO MEDIUM SAND	18	
	36	
	20	
		55'-0"
GREY MEDIUM TO COARSE SAND TRACE SMALL GRAVEL	9	
	21	60'-0"

BORING STOPPED BY CLIENT

NOTE ST. #2 (CONT'D) 17'-2" TOTAL 3 1/2" REC. 20

NOTE A: GREY FINE TO MEDIUM SAND

NO. B 2-25

GROUND SURFACE ELEV. 416.3 — 0'-0"

CINDER	8	
	3	
FILL	3	
	3	12'-0"
GREY CLAYEY SILT W/VERY FINE SAND	2	
		17'-0"
GREY	6	WL
SILTY	2	
CLAY		
VERY FINE SAND	4	32'-0"
GREY FINE TO MEDIUM SAND	6	
TRACE SILT & CLAY	5	
	7	46'-6"
GREY	49	
FINE		
SAND	47	
		58'-6"
GREY FINE TO COARSE SAND TR. SMALL GRAVEL & WOOD	9	
	12	71'-0"
GREY FINE TO MEDIUM SAND TRACE SILT	44	75'-0"

BORING STOPPED BY CLIENT

NOTE A: GREY FINE TO COARSE SAND, TRACE SMALL GRAVEL

NO. B 2-26

GROUND SURFACE ELEV. 416.9 — 0'-0"

CINDERS & SAND FILL	10	
	4	6'-0"
BROWN SILTY CLAY & CINDER FILL	4	
	4	13'-0"
BROWN SILTY CLAY	3	
		19'-0"
GREY SILTY CLAY W/VERY FINE SAND	3	
	4	26'-0"
GREY VERY FINE TO FINE SILTY SAND TRACE CLAY	4	
	11	
	4	
		45'-0"
GREY SILTY CLAY & VERY FINE SAND	4	47'-0"
GREY FINE TO MEDIUM SAND	29	
	28	
TRACE SILT		
NOTE A	22	69'-0"

BORING STOPPED BY CLIENT

NOTE A: GREY FINE TO COARSE SAND, TRACE SMALL GRAVEL

NO. B 2-27

GROUND SURFACE ELEV. 400.3 — 0'-0"

GREY SILTY CLAY TR. SAND	9	5'-6"
	9	8'-0"
BROWN & GREY SILTY CLAY & SILT	12	11'-0"
GREY CLAYEY SILT & VERY FINE SAND	7	13'-0"
GREY CLAYEY SILT W/VERY FINE SAND	2	22'-0"
	14	24'-0"
GREY CLAY	1	27'-0"
	2	
GREY FINE TO COARSE SAND TRACE SMALL GRAVEL	17	38'-0"
	35	40'-0"

BORING STOPPED BY CLIENT

NOTE ST. #8 (CONT'D) 33'-8" TOTAL 37'-10" REC. 12

NOTE A: GREY FINE SAND TR. SMALL GRAVEL & SILT

NO. B 2-28

GROUND SURFACE ELEV. 402.9 — 0'-0"

BROWN SILTY CLAY	11	
NOTE A	7	8'-0"
BROWN SILTY CLAY & VERY FINE SAND	3	11'-0"
WL		
GREY FINE SAND	5	WL
		18'-0"
GREY SILTY CLAY	4	
NOTE B	11	
GREY SILTY CLAY & VERY FINE SAND	4	
GREY CLAY	1	
NOTE C	2	
	25	*
GREY FINE TO COARSE SAND TRACE SMALL GRAVEL	38	
	11	
	35	50'-0"

BORING STOPPED BY CLIENT

NOTE A: BROWN SILTY CLAY TRACE SAND

NOTE B: GREY SILTY SANDY CLAY

NOTE C: GREY SILTY SANDY CLAY

NO. B 2-29

GROUND SURFACE ELEV. 400.0 — 0'-0"

BRO. & GR. SILTY CLAY WITH VERY FINE SAND	10	5'-6"
BRO. & GR. SILTY CLAY & VERY FINE SAND	21	8'-6"
GREY FINE SAND TR. SILT & CLAY	6	12'-0"
	2	16'-0"
GREY	2	
SILTY	2	
CLAY	6	27'-0"
	1	32'-0"
GREY FINE TO COARSE SAND TRACE SMALL GRAVEL	11	
	9	41'-0"
GREY FINE SAND	34	45'-0"

BORING STOPPED BY CLIENT

USED 14' OF 2½" CASING

WATER LEVEL IS 11' BELOW GROUND SURFACE 3 HR. AFTER COMPLETION

6/18-19/56

NO. B 2-30

GROUND SURFACE ELEV. 399.4 — 0'-0"

BRO. & GR. CLAYEY SILT & VERY FINE SAND	7	3'-0"
GREY SILTY CLAY TRACE WOOD	2	
	1	9'-0"
GREY SILTY CLAY VERY FINE SAND	3	12'-0"
WL		
GREY	1	
CLAYEY	1/10	
SILT	1	20'-0"
GREY FINE SILTY SAND TRACE CLAY	7	32'-0"
GREY FINE TO MEDIUM SAND	14	WL
		38'-0"
GREY MEDIUM TO COARSE SAND TRACE SILT	11	
	21	
	37	
		54'-0"
NOTE A	28	57'-0"
GREY FINE SAND	34	60'-0"

BORING STOPPED BY CLIENT

NOTE A: GREY FINE TO COARSE SAND TRACE SMALL GRAVEL

NO. B 2-31

GROUND SURFACE ELEV. 399.2 — 0'-0"

BLACK SILTY CLAY FILL & GRAY SILTY CLAY FINE SAND	4	2'-6"
		WL
GREY	3	
SILTY	2	
CLAY	2/16	
TRACE SHELL		18'-0"
BRO. & GREY SILTY CLAY & VERY FINE SAND	2	8'-0"
GREY VERY FINE SILTY SAND TRACE CLAY	1	12'-0"
GREY	2	16'-0"
SILTY CLAY	6	18'-0"
	3	20'-0"
GREY VERY FINE TO FINE SAND TRACE SILT	8	28'-0"
GREY SILTY CLAY	1	29'-0"
	2/18	32'-0"
GREY FINE TO COARSE SAND TRACE SMALL GVL.	9	38'-0"
GREY FINE SAND TRACE CLAY	24	41'-0"
GRAY FINE TO COARSE SAND	7	43'-6"
GREY FINE SAND	30	47'-0"
GREY MEDIUM TO COARSE SAND	13	
	6	57'-0"
FINE GREY SAND TRACE SILTY CLAY	27	60'-0"

BORING STOPPED BY CLIENT

NO. B 2-32

GROUND SURFACE ELEV. 399.8 — 0'-0"

BROWN SILTY CLAY FINE VERY FINE SAND	4	2'-6"
		WL
BRO. & GREY SILTY CLAY & VERY FINE SAND	2	8'-0"
GREY VERY FINE SILTY SAND TRACE CLAY	1	12'-0"
GREY	2	16'-0"
SILTY CLAY	4	18'-0"
	2	20'-0"
GREY VERY FINE TO FINE SAND TRACE SILT	8	28'-0"
GREY FINE SAND	23	32'-0"
GREY FINE TO COARSE SAND TRACE SMALL GRAVEL	9	39'-0"
NOTE A	22	40'-6"
GREY MEDIUM TO COARSE SAND	9	43'-6"
GREY FINE TO MEDIUM SAND TRACE SILT & CLAY	23	
	24	
	26	57'-0"
NOTE B	13	60'-0"

BORING STOPPED BY CLIENT

NOTE A: GREY FINE SAND

NOTE B: GREY FINE TO COARSE SAND TRACE CLAY

USED 60' OF 2½" CASING

WATER LEVEL IS 4' BELOW GROUND SURFACE 3 HRS. AFTER COMPLETION

6/20/56

NO. B217

GR. ELEV. 414.0 — 0'-0"

CINDERS & CLAY FILL	10	3'-0"
BROWN SILTY CLAY TRACE VERY FINE SAND	16	
	11	11'-0"
	6	
	16	
BROWN	19	
FINE	20	
SAND	32	WL
		34'-0"
GREY FINE TO MEDIUM SAND	22	
		39'-0"
NOTE A	22	40'-0"

BORING STOPPED BY CLIENT

NOTE A: GREY FINE TO COARSE SAND

USED 39' OF 2½" CASING

WATER LEVEL IS 30' BELOW GROUND SURFACE 1½ HRS. AFTER COMPLETION

4/18/56

NO. B2-18

GR. ELEV. 415.0 — 0'-0"

CINDER FILL	3	3'-5"
BROWN & GREY SILTY CLAY FILL	8	
	12	8'-6"
BROWN SILT CLAY & VERY FINE SAND	5	
		13'-2"
BROWN VERY	16	
FINE TO		
FINE SAND	18	
TR. SILT		21'-5"
GREY VERY FINE TO FINE SAND TR. SILT	25	28'-4"
GREY &	30	
BROWN FINE	40	
TO MEDIUM		
SAND	45	
TRACE		
SILT	53	45'-0"

BORING STOPPED BY CLIENT

USED 44' OF 2½" CASING

4/22/56

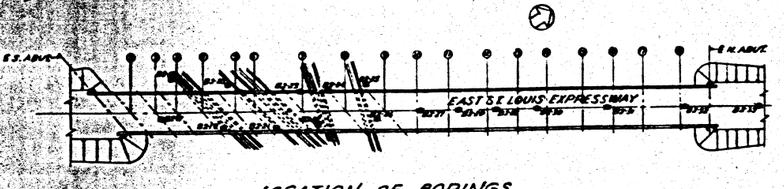
KEY:-
W.L. - WATER LEVEL
@ - INDICATES WATER LOSS IN STRATA
ST. - INDICATES SHELBY TUBE

NOTES
CLASSIFICATIONS ARE MADE BY VISUAL INSPECTION.
WATER LEVELS (W.L.) FIGURE INDICATES TIME OF READING (HOURS) AFTER COMPLETION OF BORING.
WATER LEVELS INDICATED ARE THOSE OBSERVED WHEN BORINGS WERE MADE, OR AS NOTED. POROSITY OF THE SOIL STRATA, VARIATIONS OF RAINFALL, SITE TOPOGRAPHY, ETC., MAY CAUSE CHANGES IN THESE LEVELS.
FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2'O.D. SAMPLING PIPE ONE FOOT, USING 140-LB. WEIGHT FALLING 30 INCHES

SHELBY TUBE SAMPLES
Minutes — Recovery (inches) / Seconds / Weight (pounds)
STATIC PENETRATION RECORD

X / Y — Number of Blows using 140 pound weight falling 30 inches. / Resulting Penetration in inches for X Blows.
DYNAMIC PENETRATION RECORD

CLASSIFICATION OF SOIL CONTAINED IN SHELBY TUBES IS BASED ON OBSERVATION OF THE SOIL AT THE ENDS OF THE TUBES.



LOCATION OF BORINGS

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BLDGS.
DIVISION OF HIGHWAYS
&
CITY OF EAST ST. LOUIS

EAST ST. LOUIS EXPRESSWAY

BORINGS AND SOIL ANALYSIS

H. W. LOCHNER, INC.
ENGINEERS
CHICAGO, ILLINOIS

ATTACHMENT 2

"Boring Logs" – Sheets 19 to 27 from 1997 Plans

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
Yo	82-5VBR-I	ST. CLAIR	27	19
STA.	TO STA.			
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 1

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #1
Station: 5+133.8
O/S: 20.42 M Rt.

CPT Date: 10/22/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.31
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT'	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	7.14	0.58	7.84	0.02	clay	UNDFN	UNDF	7	0.5
0.50	1.64	7.88	0.63	8.00	0.06	clay	UNDFN	UNDF	7	UNDEFINED
0.75	2.46	8.20	0.61	7.41	0.10	clay	UNDFN	UNDF	8	0.8
1.00	3.28	10.24	0.65	6.37	0.14	clay	UNDFN	UNDF	10	0.8
1.25	4.10	11.74	0.70	5.93	0.18	clay	UNDFN	UNDF	11	0.9
1.50	4.92	6.90	0.46	6.72	0.22	clay	UNDFN	UNDF	7	0.5
1.75	5.74	8.58	0.52	6.11	0.26	clay	UNDFN	UNDF	8	0.6
2.00	6.56	7.62	0.06	1.10	0.30	clayey silt to silty clay	UNDFN	UNDF	7	0.5
2.25	7.38	9.00	0.44	4.84	0.33	clay	UNDFN	UNDF	9	0.7
2.50	8.20	40.16	0.48	1.20	0.34	silty sand to sandy silt	50-90	44-46	48	UNDEFINED
2.75	9.02	51.30	0.38	0.74	0.36	silty sand to sandy silt	60-70	44-46	48	UNDEFINED
3.00	9.84	86.70	0.87	1.01	0.37	sand to silty sand	70-80	>48	>50	UNDEFINED
3.25	10.66	73.12	0.68	0.93	0.38	sand to silty sand	70-80	46-48	>50	UNDEFINED
3.50	11.48	80.22	0.79	1.31	0.41	silty sand to sandy silt	60-70	44-46	>50	UNDEFINED
3.75	12.30	81.16	0.60	0.74	0.42	sand to silty sand	70-80	46-48	>50	UNDEFINED
4.00	13.12	82.40	0.70	0.85	0.44	sand to silty sand	70-80	46-48	>50	UNDEFINED
4.25	13.94	33.54	0.23	0.70	0.45	silty sand to sandy silt	40-50	40-42	32	UNDEFINED
4.50	14.76	11.74	0.10	0.85	0.47	sandy silt to clayey silt	UNDFN	UNDF	11	0.9
4.75	15.58	25.44	0.33	1.31	0.48	sandy silt to clayey silt	UNDFN	UNDF	24	2.0
5.00	16.40	90.52	0.77	0.86	0.50	sand to silty sand	70-80	46-48	>50	UNDEFINED
5.25	17.22	147.86	1.32	0.89	0.51	sand	80-90	>48	>50	UNDEFINED
5.50	18.04	152.14	1.42	0.94	0.53	sand	>90	>48	>50	UNDEFINED
5.75	18.86	178.18	1.64	0.92	0.54	sand	>90	>48	>50	UNDEFINED
6.00	19.69	211.52	1.82	0.86	0.56	sand	>90	>48	>50	UNDEFINED
6.25	20.51	147.14	1.35	0.92	0.56	sand	80-90	>48	>50	UNDEFINED
6.50	21.33	100.42	1.04	1.03	0.59	sand to silty sand	70-80	46-48	>50	UNDEFINED
6.75	22.15	152.72	1.13	0.74	0.61	sand	80-90	>48	>50	UNDEFINED
7.00	22.97	186.78	1.06	0.56	0.62	sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 1

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #2
Station: 5+128
O/S: 12.19 M Lt.

CPT Date: 10/22/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.61 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT'	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	11.38	0.91	8.00	0.02	clay	UNDFN	UNDF	11	UNDEFINED
0.50	1.64	11.36	0.91	8.00	0.06	clay	UNDFN	UNDF	13	UNDEFINED
0.75	2.46	13.50	1.08	8.00	0.10	clay	UNDFN	UNDF	15	1.2
1.00	3.28	15.21	1.09	7.15	0.14	clay	UNDFN	UNDF	15	1.2
1.25	4.10	15.63	0.50	3.22	0.18	silty clay to clay	UNDFN	UNDF	5	0.4
1.50	4.92	5.37	0.18	3.27	0.22	clay	UNDFN	UNDF	16	1.3
1.75	5.74	16.52	0.21	1.27	0.26	sandy silt to clayey silt	UNDFN	UNDF	18	1.5
2.00	6.56	18.96	0.19	0.98	0.30	sandy silt to clayey silt	UNDFN	UNDF	19	1.6
2.25	7.38	20.15	0.35	1.72	0.33	sandy silt to clayey silt	UNDFN	UNDF	35	3.0
2.50	8.20	37.25	0.71	1.92	0.34	sandy silt to clayey silt	70-80	46-48	>50	UNDEFINED
2.75	9.02	66.59	0.86	1.29	0.36	silty sand to sandy silt	70-80	46-48	>50	UNDEFINED
3.00	9.84	72.24	0.98	1.36	0.37	silty sand to sandy silt	70-80	46-48	>50	UNDEFINED
3.25	10.66	67.32	0.91	1.35	0.39	silty sand to sandy silt	60-70	46-48	>50	UNDEFINED
3.50	11.48	61.99	0.89	1.43	0.41	silty sand to sandy silt	60-70	44-46	49	UNDEFINED
3.75	12.30	51.62	0.76	1.47	0.42	silty sand to sandy silt	60-70	44-46	>50	UNDEFINED
4.00	13.12	99.96	0.85	0.85	0.44	sand to silty sand	70-80	46-48	>50	UNDEFINED
4.25	13.94	108.09	1.02	0.95	0.45	sand to silty sand	80-90	>48	>50	UNDEFINED
4.50	14.76	52.96	0.85	1.61	0.47	silty sand to sandy silt	50-60	42-44	>50	UNDEFINED
4.75	15.58	134.40	1.32	0.98	0.48	sand to silty sand	80-90	>48	>50	UNDEFINED
5.00	16.40	119.47	1.36	1.16	0.50	sand to silty sand	80-90	>48	>50	UNDEFINED
5.25	17.22	86.30	1.15	1.34	0.51	sand to silty sand	70-80	46-48	>50	UNDEFINED
5.50	18.04	65.15	0.78	1.19	0.53	silty sand to sandy silt	60-70	44-46	>50	UNDEFINED
5.75	18.86	121.38	1.14	0.94	0.54	sand to silty sand	80-90	46-48	>50	UNDEFINED
6.00	19.69	196.54	1.68	0.90	0.56	sand	>90	>48	>50	UNDEFINED
6.25	20.51	288.75	3.24	1.12	0.58	sand	>90	>48	>50	UNDEFINED
6.50	21.33	201.06	1.87	0.93	0.59	sand	>90	>48	>50	UNDEFINED
6.75	22.15	117.56	1.82	1.54	0.61	sand to silty sand	70-80	46-48	>50	UNDEFINED
7.00	22.97	170.67	1.44	0.84	0.62	sand	80-90	>48	>50	UNDEFINED
7.25	23.79	255.32	2.40	0.94	0.64	sand	>90	>48	>50	UNDEFINED
7.50	24.61	337.89	3.03	0.90	0.65	sand	>90	>48	>50	UNDEFINED
7.75	25.43	329.98	3.51	1.06	0.67	sand				

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 1

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #5
Station: 5+219.3
O/S: 22.6 M Rt.

CPT Date: 11/15/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 128.84 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT'	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	11.57	0.12	1.04	0.02	sandy silt to clayey silt	UNDFN	UNDF	11	0.9
0.50	1.64	10.75	0.29	2.67	0.06	silty clay to clay	UNDFN	UNDF	10	0.8
0.75	2.46	11.00	0.42	3.81	0.10	clay	UNDFN	UNDF	10	0.8
1.00	3.28	7.83	0.61	8.00	0.14	clay	UNDFN	UNDF	7	UNDEFINED
1.25	4.10	8.28	0.62	8.00	0.18	clay	UNDFN	UNDF	8	UNDEFINED
1.50	4.92	8.70	0.69	7.98	0.22	clay	UNDFN	UNDF	8	UNDEFINED
1.75	5.74	8.88	0.71	8.00	0.26	clay	UNDFN	UNDF	9	UNDEFINED
2.00	6.56	9.50	0.76	8.00	0.30	clay	UNDFN	UNDF	8	UNDEFINED
2.25	7.38	8.38	0.67	8.00	0.33	clay	UNDFN	UNDF	9	UNDEFINED
2.50	8.20	9.00	0.72	8.00	0.34	clay	UNDFN	UNDF	10	0.8
2.75	9.02	10.94	0.84	7.66	0.36	clay	UNDFN	UNDF	11	0.8
3.00	9.84	11.43	0.71	6.18	0.37	clay	UNDFN	UNDF	12	0.9
3.25	10.66	12.72	0.72	5.62	0.39	clay	UNDFN	UNDF	6	0.4
3.50	11.48	6.43	0.38	5.97	0.41	clay	UNDFN	UNDF	10	0.8
3.75	12.30	10.68	0.40	3.73	0.42	clay	UNDFN	UNDF	10	0.8
4.00	13.12	10.66	0.32	3.04	0.44	silty clay to clay	UNDFN	UNDF	28	2.3
4.25	13.94	29.65	0.42	1.43	0.45	sandy silt to clayey silt	UNDFN	UNDF	28	2.3
4.50	14.76	44.76	0.45	1.01	0.47	silty sand to sandy silt	50-60	42-44	42	UNDEFINED
4.75	15.58	46.49	0.43	0.92	0.48	silty sand to sandy silt	50-60	42-44	44	UNDEFINED
5.00	16.40	34.27	0.29	0.86	0.50	silty sand to sandy silt	40-50	40-42	32	UNDEFINED
5.25	17.22	11.93	0.17	1.42	0.51	clayey silt to silty clay	UNDFN	UNDF	11	0.9
5.50	18.04	15.57	0.45	2.90	0.53	clayey silt to silty clay	UNDFN	UNDF	15	1.2
5.75	18.86	95.07	0.88	0.92	0.54	sand to silty sand	70-80	46-48	>50	UNDEFINED
6.00	19.69	76.72	1.18	1.54	0.56	silty sand to sandy silt	60-70	44-46	>50	UNDEFINED
6.25	20.51	90.87	0.77	0.95	0.58	sand to silty sand	70-80	46-48	>50	UNDEFINED
6.50	21.33	113.91	1.09	0.96	0.59	sand to silty sand	70-80	46-48	>50	UNDEFINED
6.75	22.15	172.71	1.81	1.05	0.61	sand	80-90	>48	>50	UNDEFINED
7.00	22.97	183.88	1.99	1.21	0.62	sand to silty sand	80-90	>48	>50	UNDEFINED
7.25	23.79	146.13	1.61	1.10	0.64	sand to silty sand	80-90	>48	>50	UNDEFINED
7.50	24.61	107.11	1.36	1.27	0.65	sand to silty sand	70-80	46-48	>50	UNDEFINED
7.75	25.43	65.03	1.01	1.56	0.67	silty sand to sandy silt	60-70	42-44	>50	UNDEFINED
8.00	26.25	23.55	0.53	2.25	0.68	sandy silt to clayey silt	UNDFN	UNDF	22	1.8
8.25	27.07	14.40	0.53	3.71	0.70	silty clay to clay	UNDFN	UNDF	13	1.0
8.50	27.89	77.09	0.63	0.81	0.71	sand to silty sand	60-70	42-44	>50	UNDEFINED
8.75	28.71	98.72	2.56	2.65	0.73	sandy silt to clayey silt	UNDFN	UNDF	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 1

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #6
Station: 5+212
O/S: 20.42 M Lt.

CPT Date: 10/23/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 127.35 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT'	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	10.14	0.38	3.71	0.02	clay	UNDFN	UNDF	8	UNDEFINED
0.50	1.64	8.00	0.64	8.00	0.06	clay	UNDFN	UNDF	8	UNDEFINED
0.75	2.46	8.09	0.64	8.00	0.10	clay	UNDFN	UNDF	8	UNDEFINED
1.00	3.28	9.25	0.74	8.00	0.14	clay	UNDFN	UNDF	11	0.9
1.25	4.10	11.26	0.87	7.71	0.18	clay	UNDFN	UNDF	16	UNDEFINED
1.50	4.92	10.25	0.82	8.00	0.22	clay	UNDFN	UNDF	11	0.8
1.75	5.74	11.22	0.81	7.20	0.26	clay	UNDFN	UNDF	10	0.8
2.00	6.56	10.52	0.70	6.65	0.30	clay	UNDFN	UNDF	8	0.6
2.25	7.38	8.60	0.46	8.91	0.33	clay	UNDFN	UNDF	8	0.6
2.50	8.20	8.38	0.46	5.44	0.34	clay	UNDFN	UNDF	10	0.8
2.75	9.02	10.46	0.17	1.61	0.36	clayey silt to silty clay	UNDFN	UNDF	8	0.6
3.00	9.84	8.82	0.11	1.27	0.37	clayey silt to silty clay	UNDFN	UNDF	5	0.4
3.25	10.66	5.94	0.14	2.38	0.39	silty clay to clay	UNDFN	UNDF	15	1.2
3.50	11.48	16.60	0.42	2.72	0.41	clayey silt to silty clay	UNDFN	UNDF	15	1.2
3.75	12.30	64.00	0.65	1.01	0.42	silty sand to sandy silt	60-70	44-46	>50	UNDEFINED
4.00	13.12	25.12	0.41	1.64	0.44	sandy silt to clayey silt	UNDFN	UNDF	24	2.0
4.25	13.94	103.32	0.91	0.88	0.45	sand to silty sand	70-80	46-48	>50	UNDEFINED
4.50	14.76	140.60	1.22	0.87	0.47	sand	80-90	>48	>50	UNDEFINED
4.75	15.58	142.72	1.23	0.86	0.48	sand	80-90	>48	>50	UNDEFINED
5.00	16.40	153.56	1.38	0.90	0.50	sand	80-90	>48	>50	UNDEFINED
5.25	17.22	89.16	0.80	0.90	0.51	sand to silty sand	70-80	46-48	>50	UNDEFINED
5.50	18.04	49.16	0.52	1.06	0.53	silty sand to sandy silt	50-60	42-44	>50	UNDEFINED
5.75	18.86	54.28	0.43	0.80	0.54	silty sand to sandy silt	50-60	42-44	>50	UNDEFINED
6.00	19.69	33.68	0.62	1.83	0.56	sandy silt to clayey silt	UNDFN	UNDF	32	2.6
6.25	20.51	14.04	0.35	2.49	0.58	clayey silt to silty clay	UNDFN	UNDF	13	1.0
6.50	21.33	83.94	0.96	1.15	0.59	sand to silty sand	60-70	44-46	>50	UNDEFINED
6.75	22.15	135.86	1.32	0.97	0.61	sand to silty sand	80-90	46-48	>50	UNDEFINED
7.00	22.97	130.28	1.15	0.89	0.62	sand to silty sand	80-90	46-48	>50	UNDEFINED
7.25	23.79	116.28	1.03	0.89	0.64	sand to silty sand	80-90	46-48	>50	UNDEFINED
7.50	24.61	140.56	1.11	0.79	0.65	sand	80-90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 1

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #8 West
Station: 5+294
O/S: 17.66 M Rt.

CPT Date: 11/12/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 125.73 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT'	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	10.32	0.07	0.69	0.02	sandy silt to clayey silt	UNDFN	UNDF	10	0.8
0.50	1.64	9.66	0.16	1.64	0.06	clayey silt to silty clay	UNDFN	UNDF	9	0.7
0.75	2.46	11.24	0.34	3.01	0.10	silty clay to clay	UNDFN	UNDF	9	0.8
1.00	3.28	10.10	0.37	3.62	0.14	clay	UNDFN	UNDF	7	0.5
1.25	4.10	7.32	0.26	3.56	0.18	clay	UNDFN	UNDF	10	0.9
1.50	4.92	11.54	0.20	1.74	0.22	clayey silt to silty clay	UNDFN	UNDF	5	0.4
1.75	5.74	6.16	0.15	2.41	0.26	silty clay to clay	UNDFN	UNDF	8	0.6
2.00	6.56	8.46	0.52	6.13	0.30	clay	UNDFN	UNDF	8	0.7
2.25	7.38	9.56	0.48	5.01	0.33	clay	UNDFN	UNDF	8	0.6
2.50	8.20	8.90	0.45	5.02	0.34	clay	UNDFN	UNDF	8	0.7
2.75	9.02	9.26	0.41	4.43	0.36	clay	UNDFN	UNDF	8	0.6
3.00	9.84	8.62	0.40	4.58	0.37	clay	UNDFN	UNDF	9	0.7
3.25	10.66	9.62	0.56	5.69	0.39	clay	UNDFN	UNDF	10	0.8
3.50	11.48	10.88	0.63	5.75	0.41	clay	UNDFN	UNDF	9	0.5
3.75	12.30	8.94	0.45	6.48	0.42	clay	UNDFN	UNDF	5	0.3
4.00	13.12	5.48	0.28	5.14	0.44	clay	UNDFN	UNDF	5	0.4
4.25	13.94	5.88	0.24	4.09	0.46	clay	UNDFN	UNDF	7	0.5
4.50	14.76	7.54	0.19	2.57	0.47	silty clay to clay	70-80	46-48	>50	UNDEFINED
4.75	15.58	91.86	0.72	0.78	0.48	sand to silty sand	80-90	44-46	>50	UNDEFINED
5.00	16.40	77.12	0.92	1.19	0.50	sand to silty sand	UNDFN	UNDF	31	2.7
5.25	17.22	34.80	0.67	1.94	0.51	sandy silt to clayey silt	50-60	42-44	43	UNDEFINED
5.50	18.04	47.90	0.67	1.40	0.53	silty sand to sandy silt	UNDFN	UNDF	30	2.7
5.75	18.86	34.14	0.64	1.88	0.54	sandy silt to clayey silt	UNDFN	UNDF	25	2.2
6.00	19.69	28.32	0.48	1.69	0.56	sandy silt to clayey silt	UNDFN	UNDF	21	1.8
6.25	20.51	23.28	0.44	1.88	0.58	sandy silt to clayey silt	UNDFN	UNDF	20	1.7
6.50	21.33	22.28	0.41	1.86	0.59	sandy silt to clayey silt	UNDFN	UNDF	34	UNDEFINED
6.75	22.15	38.60	0.30	0.78	0.61	silty sand to sandy silt	40-50	40-42	39	UNDEFINED
7.00	22.97	43.66	0.36	0.86	0.62	silty sand to sandy silt	40-50	40-42	>50	UNDEFINED
7.25	23.79	67.36	0.58	0.87	0.64	sand to silty sand	60-70	42-44	>50	UNDEFINED
7.50	24.61	124.62	0.96	0.77	0.65	sand to silty sand	70-80	46-48	>50	UNDEFINED
7.75	25.43	169.32	1.12	0.66	0.67	sand	80-90	>48	>50	UNDEFINED
8.00	26.25	123.86	1.02	0.83	0.68	sand to silty sand	70-80	46-48	>50	UNDEFINED
8.25	27.07	39.42	0.71	1.81	0.70	sandy silt to clayey silt	UNDFN	UNDF	35	3.1
8.50	27.89	59.34	0.51	0.86	0.71	sand to silty sand	50-60	42-44	>50	UNDEFINED
8.75	28.71	176.18	1.42	0.81	0.73	sand	80-90	>48	>50	UNDEFINED
9.00	29.53	132.54	1.44	1.09	0.75	sand to silty sand	70-80	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/blogs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-I	ST CLAIR	27	20
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

CPT Date: 10/23/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 436TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #8 East
Station: 5+306.56
O/S: 18.9 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.83 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
0.25	0.82	8.22	0.41	6.57	0.02	clay	UNDFN	UNDF	6	0.5
0.50	1.64	12.13	0.36	3.00	0.08	silty clay to clay	UNDFN	UNDF	11	0.9
0.75	2.46	40.05	0.69	1.73	0.10	sandy silt to clayey silt	UNDFN	UNDF	38	3.2
1.00	3.28	7.69	0.36	4.69	0.14	clay	UNDFN	UNDF	7	0.6
1.25	4.10	4.96	0.21	4.36	0.18	clay	UNDFN	UNDF	5	0.3
1.50	4.92	11.49	0.27	2.36	0.22	clayey silt to silty clay	UNDFN	UNDF	11	0.9
1.75	5.74	11.60	0.24	2.03	0.26	clayey silt to silty clay	UNDFN	UNDF	11	0.9
2.00	6.56	14.42	0.25	1.73	0.30	clayey silt to silty clay	UNDFN	UNDF	14	1.1
2.25	7.38	6.77	0.08	1.26	0.33	sensitive fine grained	UNDFN	UNDF	6	0.5
2.50	8.20	7.22	0.10	1.35	0.34	clayey silt to silty clay	UNDFN	UNDF	7	0.5
2.75	9.02	8.33	0.17	2.03	0.36	silty clay to clay	UNDFN	UNDF	8	0.6
3.00	9.84	4.80	0.21	4.30	0.37	clay	UNDFN	UNDF	5	0.3
3.25	10.66	4.65	0.26	5.63	0.39	clay	UNDFN	UNDF	4	0.3
3.50	11.48	5.37	0.28	5.26	0.41	clay	UNDFN	UNDF	5	0.3
3.75	12.30	16.69	0.43	2.56	0.42	clayey silt to silty clay	UNDFN	UNDF	18	1.3
4.00	13.12	3.61	0.28	7.82	0.44	organic material	UNDFN	UNDF	3	0.2
4.25	13.94	5.37	0.33	6.21	0.45	clay	UNDFN	UNDF	5	0.3
4.50	14.76	4.84	0.32	6.64	0.47	clay	UNDFN	UNDF	5	0.3
4.75	15.58	8.28	0.27	3.29	0.48	clay	UNDFN	UNDF	8	0.6
5.00	16.40	5.56	0.16	2.82	0.50	clay	UNDFN	UNDF	5	0.3
5.25	17.22	4.86	0.22	4.60	0.51	clay	UNDFN	UNDF	5	0.3
5.50	18.04	5.84	0.14	2.45	0.53	silty clay to clay	UNDFN	UNDF	5	0.4
5.75	18.86	6.65	0.17	2.54	0.54	silty clay to clay	UNDFN	UNDF	6	0.4
6.00	19.69	19.20	0.16	0.83	0.56	sandy silt to clayey silt	UNDFN	UNDF	18	1.4
6.25	20.51	7.69	0.23	2.99	0.58	silty clay to clay	UNDFN	UNDF	7	0.5
6.50	21.33	2.25	0.19	8.00	0.59	organic material	UNDFN	UNDF	2	UNDEFINED
6.75	22.15	14.95	0.26	1.71	0.61	clayey silt to silty clay	UNDFN	UNDF	14	1.1
7.00	22.97	14.46	0.40	2.74	0.62	clayey silt to silty clay	UNDFN	UNDF	14	1.0
7.25	23.79	5.10	0.17	3.28	0.64	clay	UNDFN	UNDF	5	0.3
7.50	24.61	5.33	0.32	6.05	0.65	clay	UNDFN	UNDF	5	0.3
7.75	25.43	5.22	0.20	3.89	0.67	clay	UNDFN	UNDF	5	0.3
8.00	26.25	3.57	0.20	5.48	0.68	clay	UNDFN	UNDF	3	0.1
8.25	27.07	12.32	0.30	2.47	0.70	clayey silt to silty clay	UNDFN	UNDF	11	0.8
8.50	27.89	6.97	0.19	2.78	0.71	silty clay to clay	UNDFN	UNDF	7	0.4
8.75	28.71	18.98	0.41	2.18	0.73	clayey silt to silty clay	UNDFN	UNDF	18	1.4
9.00	29.53	26.21	0.43	1.66	0.75	sandy silt to clayey silt	UNDFN	UNDF	25	2.0
9.25	30.35	19.66	0.20	1.01	0.76	sandy silt to clayey silt	UNDFN	UNDF	19	1.4
9.50	31.17	29.43	0.09	0.30	0.78	silty sand to sandy silt	<40	36-38	28	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

CPT Date: 10/23/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 436TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #8 East
Station: 5+306.56
O/S: 18.9 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.83 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
9.75	31.99	33.89	0.49	1.43	0.79	sandy silt to clayey silt	UNDFN	UNDF	32	2.8
10.00	32.81	52.69	0.42	0.80	0.81	silty sand to sandy silt	50-60	40-42	>50	UNDEFINED
10.25	33.63	31.43	0.36	1.15	0.82	silty sand to sandy silt	<40	36-38	30	UNDEFINED
10.50	34.45	28.73	0.38	1.31	0.84	sandy silt to clayey silt	UNDFN	UNDF	27	2.2
10.75	35.27	34.85	0.32	0.90	0.85	silty sand to sandy silt	<40	36-38	33	UNDEFINED
11.00	36.09	24.78	0.48	1.93	0.87	sandy silt to clayey silt	UNDFN	UNDF	23	1.8
11.25	36.91	10.94	0.30	2.74	0.88	silty clay to clay	UNDFN	UNDF	10	0.7
11.50	37.73	6.90	0.16	2.29	0.90	silty clay to clay	UNDFN	UNDF	6	0.4
11.75	38.55	6.05	0.27	4.43	0.92	clay	UNDFN	UNDF	6	0.3
12.00	39.37	7.50	0.25	3.38	0.93	clay	UNDFN	UNDF	7	0.4
12.25	40.19	8.68	0.28	3.22	0.95	clay	UNDFN	UNDF	8	0.5
12.50	41.01	7.71	0.23	3.02	0.96	clay	UNDFN	UNDF	7	0.4
12.75	41.83	10.70	0.26	2.59	0.98	silty clay to clay	NDFND	NDFD	10	0.7
13.00	42.65	11.98	0.37	3.10	0.99	silty clay to clay	NDFND	NDFD	11	0.8
13.25	43.47	143.02	0.93	0.65	1.01	sand	70-80	44-46	>50	UNDEFINED
13.50	44.29	220.34	1.37	0.62	1.02	sand	80-90	46-48	>50	UNDEFINED
13.75	45.11	192.31	1.45	0.76	1.04	sand	80-90	46-48	>50	UNDEFINED
14.00	45.93	213.49	1.43	0.67	1.06	sand	80-90	46-48	>50	UNDEFINED
14.25	46.75	152.84	1.25	0.82	1.07	sand	70-80	44-46	>50	UNDEFINED
14.50	47.57	207.33	1.06	0.51	1.09	sand	80-90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

CPT Date: 11/12/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 436TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #9
Station: 5+322
O/S: 19.2 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.31 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg	SPT* N	Su kg/cm^2
0.25	0.82	38.20	0.21	0.56	0.02	silty sand to sandy silt	>90	>48	36	UNDEFINED
0.50	1.64	28.04	0.14	0.55	0.05	silty sand to sandy silt	60-70	>48	25	UNDEFINED
0.75	2.46	12.38	0.07	0.53	0.10	sandy silt to clayey silt	UNDFN	UNDF	12	1.0
1.00	3.28	4.96	0.15	2.94	0.14	clay	UNDFN	UNDF	5	0.3
1.25	4.10	10.56	0.23	2.16	0.18	clayey silt to silty clay	UNDFN	UNDF	10	0.8
1.50	4.92	20.34	0.15	0.75	0.22	sandy silt to clayey silt	UNDFN	UNDF	19	1.6
1.75	5.74	16.56	0.24	1.43	0.26	sandy silt to clayey silt	UNDFN	UNDF	16	1.3
2.00	6.56	12.00	0.23	1.95	0.30	clayey silt to silty clay	UNDFN	UNDF	11	0.9
2.25	7.38	8.00	0.10	1.27	0.33	clayey silt to silty clay	UNDFN	UNDF	8	0.6
2.50	8.20	9.12	0.08	0.90	0.34	clayey silt to silty clay	UNDFN	UNDF	9	0.7
2.75	9.02	8.66	0.09	1.02	0.36	clayey silt to silty clay	UNDFN	UNDF	8	0.6
3.00	9.84	8.48	0.09	1.06	0.37	clayey silt to silty clay	UNDFN	UNDF	8	0.6
3.25	10.66	27.52	0.54	1.98	0.39	sandy silt to clayey silt	UNDFN	UNDF	26	2.2
3.50	11.48	39.10	1.08	2.75	0.41	sandy silt to clayey silt	UNDFN	UNDF	37	3.1
3.75	12.30	6.94	0.46	6.60	0.42	clay	UNDFN	UNDF	7	0.5
4.00	13.12	5.50	0.36	6.91	0.44	clay	UNDFN	UNDF	5	0.3
4.25	13.94	6.10	0.41	6.69	0.45	clay	UNDFN	UNDF	6	0.4
4.50	14.76	5.26	0.34	6.43	0.47	clay	UNDFN	UNDF	5	0.3
4.75	15.58	4.92	0.25	5.00	0.48	clay	UNDFN	UNDF	4	0.3
5.00	16.40	4.52	0.27	6.02	0.50	clay	UNDFN	UNDF	5	0.3
5.25	17.22	5.38	0.24	4.39	0.51	clay	UNDFN	UNDF	4	0.3
5.50	18.04	4.88	0.26	5.56	0.53	clay	UNDFN	UNDF	4	0.2
5.75	18.86	4.50	0.29	6.44	0.54	clay	UNDFN	UNDF	5	0.3
6.00	19.69	5.02	0.31	6.18	0.56	clay	UNDFN	UNDF	5	0.3
6.25	20.51	5.28	0.28	5.34	0.58	clay	UNDFN	UNDF	4	0.2
6.50	21.33	3.90	0.19	4.92	0.59	clay	UNDFN	UNDF	5	0.3
6.75	22.15	5.66	0.27	4.75	0.61	clay	UNDFN	UNDF	5	0.3
7.00	22.97	5.16	0.20	3.86	0.62	clay	UNDFN	UNDF	7	0.5
7.25	23.79	7.28	0.15	2.01	0.64	silty clay to clay	UNDFN	UNDF	4	0.2
7.50	24.61	4.68	0.12	2.65	0.65	clay	UNDFN	UNDF	8	0.5
7.75	25.43	8.58	0.25	2.94	0.67	silty clay to clay	UNDFN	UNDF	6	0.4
8.00	26.25	5.58	0.16	2.75	0.68	silty clay to clay	UNDFN	UNDF	5	0.3
8.25	27.07	5.74	0.10	1.67	0.70	silty clay to clay	UNDFN	UNDF	6	0.4
8.50	27.89	6.34	0.18	2.81	0.71	clay	UNDFN	UNDF	6	0.4
8.75	28.71	5.68	0.14	2.51	0.73	silty clay to clay	UNDFN	UNDF	5	UNDEFINED
9.00	29.53	5.76	0.14	2.36	0.75	silty clay to clay	UNDFN	UNDF	5	0.3
9.25	30.35	7.16	0.18	2.51	0.76	silty clay to clay	UNDFN	UNDF	7	0.4
9.50	31.17	71.72	0.54	0.76	0.78	sand to silty sand	60-70	42-44	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

CPT Date: 11/12/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 436TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #9
Station: 5+322
O/S: 19.2 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 126.31 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
9.75	31.99	38.68	0.69	1.79	0.79	sandy silt to clayey silt	UNDFN	UNDF	37	3.0
10.00	32.81	11.90	0.22	1.85	0.81	clayey silt to silty clay	UNDFN	UNDF	11	0.8
10.25	33.63	8.08	0.13	1.56	0.82	clayey silt to silty clay	UNDFN	UNDF	8	0.5
10.50	34.45	28.50	0.40	1.52	0.84	sandy silt to clayey silt	UNDFN	UNDF	25	2.0
10.75	35.27	25.40	0.27	1.08	0.85	sandy silt to clayey silt	UNDFN	UNDF	24	1.9
11.00	36.09	13.66	0.28	2.02	0.87	clayey silt to silty clay	UNDFN	UNDF	13	0.9
11.25	36.91	14.14	0.34	2.40	0.88	clayey silt to silty clay	UNDFN	UNDF	14	1.0
11.50	37.73	13.89	0.42	3.06	0.90	silty clay to clay	UNDFN	UNDF	13	0.9
11.75	38.55	11.28	0.29	2.61	0.92	silty clay to clay	UNDFN	UNDF	11	0.7
12.00	39.37	12.46	0.27	2.20	0.93	clayey silt to silty clay	UNDFN	UNDF	12	0.8
12.25	40.19	4.72	0.26	3.84	0.95	clay	UNDFN	UNDF	6	0.3
12.50	41.01	13.76	0.45	3.30	0.96	silty clay to clay	UNDFN	UNDF	13	0.9
12.75	41.83	8.00	0.25	3.13	0.98	clay	UNDFN	UNDF	8	0.4
13.00	42.65	8.02	0.19	2.39	0.99	silty clay to clay	UNDFN	UNDF	7	0.4
13.25	43.47	7.52	0.18	2.34	1.01	silty clay to clay	UNDFN	UNDF	7	0.4
13.50	44.29	7.50	0.17	2.32	1.02	silty clay to clay	UNDFN	UNDF	7	0.4

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/blogs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-1	ST CLAIR	27	21
STA.	TO STA.			
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/28/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #10
Station: 5+357.41
O/S: 23.77 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.39 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT' N	Su kg/cm^2
0.25	0.82	6.09	0.05	0.82	0.02	sensitive fine grained	UNDFN	UNDF	6	0.4
0.50	1.64	14.57	0.15	1.03	0.06	sandy silt to clayey silt	UNDFN	UNDF	14	1.1
0.75	2.46	4.91	0.30	6.16	0.10	clay	UNDFN	UNDF	5	0.3
1.00	3.28	8.54	0.25	2.97	0.14	silty clay to clay	UNDFN	UNDF	8	0.6
1.25	4.10	4.55	0.22	4.76	0.18	clay	UNDFN	UNDF	4	0.3
1.50	4.92	3.76	0.13	3.56	0.22	clay	UNDFN	UNDF	4	0.2
1.75	5.74	14.02	0.17	1.20	0.26	sandy silt to clayey silt	UNDFN	UNDF	13	1.1
2.00	6.56	7.47	0.17	2.31	0.30	silty clay to clay	UNDFN	UNDF	7	0.5
2.25	7.38	7.43	0.18	2.39	0.33	silty clay to clay	UNDFN	UNDF	7	0.5
2.50	8.20	5.54	0.15	2.70	0.34	clay	UNDFN	UNDF	5	0.4
2.75	9.02	5.16	0.13	2.49	0.36	clay	UNDFN	UNDF	5	0.3
3.00	9.84	10.11	0.20	2.00	0.37	clayey silt to silty clay	UNDFN	UNDF	10	0.7
3.25	10.66	10.07	0.21	2.05	0.39	clayey silt to silty clay	UNDFN	UNDF	9	0.7
3.50	11.48	4.63	0.14	3.05	0.41	clay	UNDFN	UNDF	4	0.3
3.75	12.30	2.63	0.18	6.71	0.42	organic material	UNDFN	UNDF	2	0.1
4.00	13.12	8.11	0.25	3.04	0.44	silty clay to clay	UNDFN	UNDF	8	0.6
4.25	13.94	6.05	0.27	3.34	0.45	clay	UNDFN	UNDF	8	0.6
4.50	14.76	2.46	0.16	6.60	0.47	organic material	UNDFN	UNDF	2	0.1
4.75	15.58	7.07	0.27	3.86	0.48	clay	UNDFN	UNDF	7	0.5
5.00	16.40	3.02	0.19	6.41	0.50	clay	UNDFN	UNDF	3	0.1
5.25	17.22	2.04	0.15	7.28	0.51	organic material	UNDFN	UNDF	2	9.8
5.50	18.04	3.33	0.20	5.90	0.53	clay	UNDFN	UNDF	3	0.2
5.75	18.86	3.72	0.19	5.21	0.54	clay	UNDFN	UNDF	4	0.2
6.00	19.69	2.38	0.14	5.74	0.56	organic material	UNDFN	UNDF	2	0.1
6.25	20.51	2.44	0.14	5.80	0.58	organic material	UNDFN	UNDF	2	0.1
6.50	21.33	2.44	0.13	5.53	0.59	clay	UNDFN	UNDF	2	0.1
6.75	22.15	1.72	0.12	7.14	0.61	organic material	UNDFN	UNDF	2	5.2
7.00	22.97	2.21	0.13	5.81	0.62	organic material	UNDFN	UNDF	2	8.9
7.25	23.79	2.53	0.14	5.54	0.64	clay	UNDFN	UNDF	2	0.1
7.50	24.61	2.63	0.15	5.63	0.65	clay	UNDFN	UNDF	2	0.1
7.75	25.43	2.74	0.15	5.32	0.67	clay	UNDFN	UNDF	3	0.1
8.00	26.25	3.82	0.17	4.33	0.68	clay	UNDFN	UNDF	4	0.2
8.25	27.07	3.29	0.15	4.48	0.70	clay	UNDFN	UNDF	3	0.1
8.50	27.89	2.95	0.15	5.08	0.71	clay	UNDFN	UNDF	3	0.1
8.75	28.71	3.46	0.17	4.88	0.73	clay	UNDFN	UNDF	3	0.1
9.00	29.53	3.82	0.16	4.25	0.75	clay	UNDFN	UNDF	4	0.1
9.25	30.35	4.46	0.17	3.79	0.76	clay	UNDFN	UNDF	4	0.2
9.50	31.17	22.68	0.28	1.22	0.78	sandy silt to clayey silt	UNDFN	UNDF	21	1.7

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/28/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #10
Station: 5+357.41
O/S: 23.77 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.39 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT' N	Su kg/cm^2
9.75	31.99	110.14	0.53	0.48	0.79	sand	70-80	44-46	>50	UNDEFINED
10.00	32.81	224.82	1.16	0.52	0.81	sand	>90	>48	>50	UNDEFINED
10.25	33.63	207.96	0.80	0.38	0.82	sand	>90	>48	>50	UNDEFINED
10.50	34.45	145.84	0.51	0.35	0.84	sand	80-90	46-48	>50	UNDEFINED
10.75	35.27	82.06	0.74	0.91	0.85	sand to silty sand	60-70	42-44	>50	UNDEFINED
11.00	36.09	184.40	1.62	0.88	0.87	sand	80-90	46-48	>50	UNDEFINED
11.25	36.91	207.28	0.85	0.41	0.88	sand	80-90	>48	>50	UNDEFINED
11.50	37.73	231.90	1.10	0.47	0.90	sand	>90	>48	>50	UNDEFINED
11.75	38.55	306.34	-1.37	0.45	0.92	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.00	39.37	222.48	0.58	0.26	0.93	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.25	40.19	137.24	0.46	0.35	0.95	sand	70-80	44-46	>50	UNDEFINED
12.50	41.01	161.22	0.30	0.19	0.96	sand	80-90	46-48	>50	UNDEFINED
12.75	41.83	102.80	0.38	0.37	0.96	sand	60-70	42-44	>50	UNDEFINED
13.00	42.65	176.76	0.57	0.32	0.99	sand	80-90	46-48	>50	UNDEFINED
13.25	43.47	285.36	1.40	0.49	1.01	gravelly sand to sand	>90	>48	>50	UNDEFINED
13.50	44.29	342.94	1.39	0.40	1.02	gravelly sand to sand	>90	>48	>50	UNDEFINED
13.75	45.11	346.68	1.19	0.34	1.04	gravelly sand to sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/29/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #11
Station: 5+381.79
O/S: 19.2 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.18 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT' N	Su kg/cm^2
0.25	0.82	2.13	0.18	8.00	0.02	organic material	UNDFN	UNDF	2	UNDEFINED
0.50	1.64	5.22	0.37	7.12	0.06	clay	UNDFN	UNDF	5	0.4
0.75	2.46	3.70	0.26	7.09	0.10	organic material	UNDFN	UNDF	4	0.2
1.00	3.28	4.80	0.30	6.19	0.14	clay	UNDFN	UNDF	5	0.3
1.25	4.10	5.16	0.33	6.33	0.18	clay	UNDFN	UNDF	5	0.4
1.50	4.92	5.14	0.31	6.10	0.22	clay	UNDFN	UNDF	5	0.4
1.75	5.74	6.56	0.32	4.81	0.26	clay	UNDFN	UNDF	6	0.5
2.00	6.56	4.10	0.19	4.67	0.30	clay	UNDFN	UNDF	4	0.3
2.25	7.38	14.36	0.18	1.24	0.33	sandy silt to clayey silt	UNDFN	UNDF	14	1.1
2.50	8.20	5.96	0.22	3.62	0.34	clay	UNDFN	UNDF	6	0.4
2.75	9.02	8.06	0.23	3.86	0.36	clay	UNDFN	UNDF	6	0.4
3.00	9.84	31.48	0.21	0.66	0.37	silty sand to sandy silt	40-50	42-44	30	UNDEFINED
3.25	10.66	30.48	0.23	0.75	0.39	silty sand to sandy silt	40-50	40-42	29	UNDEFINED
3.50	11.48	16.18	0.27	1.69	0.41	sandy silt to clayey silt	UNDFN	UNDF	15	1.2
3.75	12.30	17.34	0.27	1.55	0.42	sandy silt to clayey silt	UNDFN	UNDF	16	1.3
4.00	13.12	5.76	0.20	3.40	0.44	clay	UNDFN	UNDF	5	0.4
4.25	13.94	3.84	0.13	3.55	0.45	clay	UNDFN	UNDF	3	0.2
4.50	14.76	6.62	0.19	2.94	0.47	clay	UNDFN	UNDF	6	0.4
4.75	15.58	5.94	0.18	3.01	0.48	clay	UNDFN	UNDF	6	0.4
5.00	16.40	4.26	0.15	3.47	0.50	clay	UNDFN	UNDF	4	0.2
5.25	17.22	2.68	0.10	3.56	0.51	clay	UNDFN	UNDF	2	0.1
5.50	18.04	4.06	0.15	3.65	0.53	clay	UNDFN	UNDF	4	0.2
5.75	18.86	3.84	0.11	2.74	0.54	clay	UNDFN	UNDF	4	0.2
6.00	19.69	4.14	0.10	2.45	0.56	clay	UNDFN	UNDF	4	0.2
6.25	20.51	4.10	0.09	2.18	0.58	clay	UNDFN	UNDF	4	0.2
6.50	21.33	4.50	0.09	1.96	0.59	silty clay to clay	UNDFN	UNDF	4	0.2
6.75	22.15	4.02	0.09	2.30	0.61	clay	UNDFN	UNDF	4	0.2
7.00	22.97	4.16	0.10	2.49	0.62	clay	UNDFN	UNDF	4	0.2
7.25	23.79	4.30	0.11	2.53	0.64	clay	UNDFN	UNDF	5	0.3
7.50	24.61	4.94	0.09	1.76	0.65	silty clay to clay	UNDFN	UNDF	5	0.3
7.75	25.43	4.96	0.12	2.46	0.67	clay	UNDFN	UNDF	5	0.3
8.00	26.25	5.96	0.12	1.96	0.68	silty clay to clay	UNDFN	UNDF	6	0.3
8.25	27.07	5.18	0.10	1.86	0.70	silty clay to clay	UNDFN	UNDF	5	0.3
8.50	27.89	5.08	0.11	2.19	0.71	silty clay to clay	UNDFN	UNDF	5	0.3
8.75	28.71	5.94	0.11	1.94	0.73	silty clay to clay	UNDFN	UNDF	6	0.3
9.00	29.53	5.36	0.11	2.08	0.75	silty clay to clay	UNDFN	UNDF	5	0.3
9.25	30.35	83.88	0.42	0.50	0.76	sand to silty sand	60-70	42-44	>50	UNDEFINED
9.50	31.17	217.86	1.02	0.47	0.78	sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/29/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #11
Station: 5+381.79
O/S: 19.2 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.18 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT' N	Su kg/cm^2
9.75	31.99	318.12	1.39	0.44	0.79	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.00	32.81	315.90	1.45	0.46	0.81	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.25	33.63	310.10	0.98	0.32	0.82	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.50	34.45	213.00	0.94	0.44	0.84	sand	>90	>48	>50	UNDEFINED
10.75	35.27	199.50	1.03	0.52	0.85	sand	80-90	>48	>50	UNDEFINED
11.00	36.09	202.14	1.05	0.52	0.87	sand	80-90	>48	>50	UNDEFINED
11.25	36.91	219.82	1.00	0.45	0.88	sand	>90	>48	>50	UNDEFINED
11.50	37.73	319.14	1.80	0.56	0.90	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.75	38.55	227.18	1.11	0.49	0.92	sand	>90	>48	>50	UNDEFINED
12.00	39.37	144.64	0.68	0.61	0.93	sand	70-80	44-46	>50	UNDEFINED
12.25	40.19	182.06	1.00	0.55	0.95	sand	80-90	46-48	>50	UNDEFINED
12.50	41.01	153.36	0.44	0.29	0.96	sand	70-80	44-46	>50	UNDEFINED
12.75	41.83	195.98	0.60	0.30	0.98	sand	80-90	46-48	>50	UNDEFINED
13.00	42.65	164.30	0.45	0.28	0.99	sand	80-90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/blcgs01.dgn LV:I-63

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-I	ST CLAIR	27	22
STA.	TO STA.			
FED. ROAD DIST. NO.		STATE	FED. AID PROJECT	

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT Date: 10/28/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

CPT. Boring: Pier #12
Station: 5+412.27
O/S: 25.0 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.24 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
0.25	0.82	5.35	0.18	3.37	0.02	clay	UNDFN	UNDF	5	0.4
0.50	1.64	3.42	0.10	2.92	0.06	clay	UNDFN	UNDF	3	0.2
0.75	2.46	1.50	0.12	8.00	0.10	organic material	UNDFN	UNDF	1	UNDEFINED
1.00	3.28	1.95	0.10	5.14	0.14	organic material	UNDFN	UNDF	2	0.1
1.25	4.10	1.25	0.10	8.00	0.18	organic material	UNDFN	UNDF	1	UNDEFINED
1.50	4.92	1.25	0.10	8.00	0.22	organic material	UNDFN	UNDF	1	UNDEFINED
1.75	5.74	2.65	0.18	6.80	0.26	organic material	UNDFN	UNDF	3	0.1
2.00	6.56	14.23	0.30	2.11	0.30	clayey silt to silty clay	UNDFN	UNDF	13	1.1
2.25	7.38	8.86	0.18	2.03	0.33	clayey silt to silty clay	UNDFN	UNDF	8	0.6
2.50	8.20	14.33	0.18	1.26	0.34	sandy silt to clayey silt	UNDFN	UNDF	14	1.1
2.75	9.02	2.97	0.14	4.72	0.36	clay	UNDFN	UNDF	3	0.2
3.00	9.84	1.40	0.04	2.86	0.37	clay	UNDFN	UNDF	1	0.0
3.25	10.66	23.32	0.20	0.86	0.39	sandy silt to clayey silt	UNDFN	UNDF	22	1.8
3.50	11.48	25.53	0.22	0.86	0.41	silty sand to sandy silt	40-50	40-42	24	UNDEFINED
3.75	12.30	8.64	0.28	3.24	0.42	clay	UNDFN	UNDF	8	0.6
4.00	13.12	4.91	0.16	3.26	0.44	clay	UNDFN	UNDF	5	0.3
4.25	13.94	11.23	0.16	1.43	0.48	clayey silt to silty clay	UNDFN	UNDF	11	0.8
4.50	14.76	3.27	0.16	5.51	0.47	clay	UNDFN	UNDF	3	0.2
4.75	15.58	2.46	0.10	4.07	0.48	clay	UNDFN	UNDF	2	0.1
5.00	16.40	6.82	0.20	2.93	0.50	clay	UNDFN	UNDF	6	0.4
5.25	17.22	9.28	0.34	3.66	0.51	clay	UNDFN	UNDF	9	0.6
5.50	18.04	6.75	0.20	2.96	0.53	clay	UNDFN	UNDF	6	0.4
5.75	18.86	4.63	0.16	3.46	0.54	clay	UNDFN	UNDF	4	0.3
6.00	19.68	8.52	0.34	5.21	0.56	clay	UNDFN	UNDF	6	0.4
6.25	20.51	22.81	0.38	1.67	0.58	sandy silt to clayey silt	UNDFN	UNDF	22	1.7
6.50	21.33	8.07	0.36	4.46	0.59	clay	UNDFN	UNDF	8	0.5
6.75	22.15	17.16	0.34	1.96	0.61	clayey silt to silty clay	UNDFN	UNDF	16	1.3
7.00	22.97	4.84	0.22	4.55	0.62	clay	UNDFN	UNDF	5	0.3
7.25	23.79	2.89	0.14	4.84	0.64	clay	UNDFN	UNDF	3	0.1
7.50	24.61	3.91	0.16	4.09	0.65	clay	UNDFN	UNDF	4	0.2
7.75	25.43	3.55	0.12	3.38	0.67	clay	UNDFN	UNDF	3	0.1
8.00	26.25	3.69	0.14	3.80	0.68	clay	UNDFN	UNDF	3	0.1
8.25	27.07	3.50	0.16	4.58	0.70	clay	UNDFN	UNDF	3	0.1
8.50	27.89	4.93	0.20	4.05	0.71	clay	UNDFN	UNDF	5	0.2
8.75	28.71	4.78	0.20	4.16	0.73	clay	UNDFN	UNDF	5	0.2
9.00	29.53	4.04	0.14	3.46	0.75	clay	UNDFN	UNDF	4	0.2
9.25	30.35	3.99	0.14	3.51	0.76	clay	UNDFN	UNDF	4	0.1
9.50	31.17	3.84	0.18	4.69	0.78	clay	UNDFN	UNDF	4	0.1

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT Date: 10/28/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

CPT. Boring: Pier #12
Station: 5+412.27
O/S: 25.0 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 124.24 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
9.75	31.99	4.42	0.20	4.52	0.79	clay	UNDFN	UNDF	4	0.2
10.00	32.81	4.38	0.20	4.56	0.81	clay	UNDFN	UNDF	4	0.2
10.25	33.63	6.24	0.22	3.53	0.82	clay	UNDFN	UNDF	6	0.3
10.50	34.45	135.02	0.48	0.36	0.84	sand	70-80	46-48	>50	UNDEFINED
10.75	35.27	280.80	1.20	0.43	0.85	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.00	36.09	317.10	0.90	0.28	0.87	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.25	36.91	269.59	0.80	0.30	0.88	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.50	37.73	140.71	0.70	0.50	0.90	sand	70-80	44-46	>50	UNDEFINED
11.75	38.55	57.56	0.64	1.11	0.92	silty sand to sandy silt	50-60	40-42	>50	UNDEFINED
12.00	39.37	117.26	0.84	0.55	0.93	sand	70-80	44-46	>50	UNDEFINED
12.25	40.19	177.13	0.78	0.44	0.95	sand	80-90	46-48	>50	UNDEFINED
12.50	41.01	212.51	1.14	0.54	0.96	sand	80-90	46-48	>50	UNDEFINED
12.75	41.83	225.65	1.24	0.55	0.96	sand	>90	>48	>50	UNDEFINED
13.00	42.65	203.63	1.14	0.56	0.99	sand	80-90	46-48	>50	UNDEFINED
13.25	43.47	287.83	1.52	0.57	1.01	sand	>90	>48	>50	UNDEFINED
13.50	44.29	264.24	2.52	0.89	1.02	sand	>90	>48	>50	UNDEFINED
13.75	45.11	162.56	0.40	0.25	1.04	sand	80-90	44-46	>50	UNDEFINED
14.00	45.93	101.78	0.30	0.29	1.06	sand	60-70	42-44	>50	UNDEFINED
14.25	46.75	111.87	0.36	0.32	1.07	sand	60-70	42-44	>50	UNDEFINED
14.50	47.57	235.49	0.56	0.24	1.09	gravelly sand to sand	>90	46-48	>50	UNDEFINED
14.75	48.39	211.47	0.90	0.43	1.10	sand	80-90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT Date: 10/25/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

CPT. Boring: Pier #13
Station: 5+438.44
O/S: 18.59 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.29 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
0.25	0.82	15.52	0.33	2.16	0.02	clayey silt to silty clay	UNDFN	UNDF	14	1.2
0.50	1.64	5.25	0.45	8.00	0.06	clay	UNDFN	UNDF	5	UNDEFINED
0.75	2.46	3.98	0.28	7.14	0.10	clay	UNDFN	UNDF	4	0.3
1.00	3.28	3.50	0.29	8.00	0.14	organic material	UNDFN	UNDF	3	UNDEFINED
1.25	4.10	2.38	0.21	8.00	0.18	organic material	UNDFN	UNDF	2	UNDEFINED
1.50	4.92	2.63	0.18	8.00	0.22	organic material	UNDFN	UNDF	2	UNDEFINED
1.75	5.74	3.50	0.30	8.00	0.26	organic material	UNDFN	UNDF	3	UNDEFINED
2.00	6.56	3.13	0.27	8.00	0.30	organic material	UNDFN	UNDF	3	UNDEFINED
2.25	7.38	14.52	0.22	1.48	0.33	sandy silt to clayey silt	UNDFN	UNDF	13	1.1
2.50	8.20	6.30	0.20	3.23	0.34	clay	UNDFN	UNDF	6	0.4
2.75	9.02	2.62	0.10	3.80	0.36	clay	UNDFN	UNDF	3	0.1
3.00	9.84	2.39	0.19	7.83	0.37	organic material	UNDFN	UNDF	2	UNDEFINED
3.25	10.66	3.88	0.32	8.00	0.39	organic material	UNDFN	UNDF	4	UNDEFINED
3.50	11.48	3.75	0.32	8.00	0.41	organic material	UNDFN	UNDF	4	UNDEFINED
3.75	12.30	4.50	0.38	8.00	0.42	organic material	UNDFN	UNDF	4	UNDEFINED
4.00	13.12	11.38	0.28	2.46	0.44	clayey silt to silty clay	UNDFN	UNDF	10	0.8
4.25	13.94	5.42	0.27	4.97	0.45	clay	UNDFN	UNDF	5	0.3
4.50	14.76	5.02	0.30	6.07	0.47	clay	UNDFN	UNDF	4	0.3
4.75	15.58	8.92	0.20	2.27	0.48	silty clay to clay	UNDFN	UNDF	8	0.6
5.00	16.40	1.86	0.16	8.00	0.50	silty clay to clay	UNDFN	UNDF	2	UNDEFINED
5.25	17.22	1.86	0.14	7.57	0.51	organic material	UNDFN	UNDF	2	8.3
5.50	18.04	5.38	0.25	4.63	0.53	clay	UNDFN	UNDF	5	0.3
5.75	18.86	2.42	0.17	6.98	0.54	organic material	UNDFN	UNDF	2	0.1
6.00	19.69	4.72	0.22	4.56	0.56	clay	UNDFN	UNDF	4	0.3
6.25	20.51	2.32	0.18	7.72	0.58	organic material	UNDFN	UNDF	2	0.1
6.50	21.33	1.75	0.15	8.00	0.59	organic material	UNDFN	UNDF	2	UNDEFINED
6.75	22.15	2.96	0.15	5.13	0.61	clay	UNDFN	UNDF	3	0.1
7.00	22.97	3.12	0.18	5.73	0.62	clay	UNDFN	UNDF	3	0.1
7.25	23.79	2.68	0.15	5.52	0.64	clay	UNDFN	UNDF	2	0.1
7.50	24.61	2.38	0.14	5.97	0.65	organic material	UNDFN	UNDF	2	9.6
7.75	25.43	2.50	0.16	6.46	0.67	organic material	UNDFN	UNDF	2	0.1
8.00	26.25	3.02	0.16	5.25	0.68	clay	UNDFN	UNDF	3	0.1
8.25	27.07	3.62	0.17	4.62	0.70	clay	UNDFN	UNDF	3	0.1
8.50	27.89	3.14	0.15	4.66	0.71	clay	UNDFN	UNDF	3	0.1
8.75	28.71	3.64	0.16	4.40	0.73	clay	UNDFN	UNDF	3	0.1
9.00	29.53	4.24	0.17	4.00	0.75	clay	UNDFN	UNDF	4	0.2
9.25	30.35	3.88	0.17	4.30	0.76	clay	UNDFN	UNDF	4	0.1
9.50	31.17	4.50	0.21	4.76	0.78	clay	UNDFN	UNDF	4	0.2

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT Date: 10/25/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

CPT. Boring: Pier #13
Station: 5+438.44
O/S: 18.59 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.29 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
9.75	31.99	92.40	0.33	0.36	0.79	sand	60-70	44-46	>50	UNDEFINED
10.00	32.81	157.54	0.60	0.38	0.81	sand	80-90	46-48	>50	UNDEFINED
10.25	33.63	147.58	0.75	0.51	0.82	sand	80-90	46-48	>50	UNDEFINED
10.50	34.45	286.34	0.66	0.25	0.84	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.75	35.27	325.06	1.20	0.37	0.85	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.00	36.09	240.44	1.04	0.43	0.87	sand	>90	>48	>50	UNDEFINED
11.25	36.91	98.16	0.75	0.77	0.88	sand to silty sand	60-70	42-44	>50	UNDEFINED
11.50	37.73	65.92	0.44	0.67	0.90	sand to silty sand	50-60	40-42	>50	UNDEFINED
11.75	38.55	109.18	0.58	0.53	0.92	sand	70-80	44-46	>50	UNDEFINED
12.00	39.37	226.28	1.05	0.46	0.93	sand	>90	>48	>50	UNDEFINED
12.25	40.19	245.78	1.25	0.51	0.95	sand	>90	>48	>50	UNDEFINED
12.50	41.01	254.98	1.25	0.49	0.96	sand	>90	>48	>50	UNDEFINED
12.75	41.83	254.36	1.17	0.46	0.98	sand	>90	>48	>50	UNDEFINED
13.00	42.65	273.46	1.35	0.49	0.99	sand	>90	>48	>50	UNDEFINED
13.25	43.47	223.92	0.95	0.42	1.01	sand	80-90	46-48	>50	UNDEFINED
13.50	44.29	151.38	0.78	0.51	1.02	sand	70-80	44-46	>50	UNDEFINED
13.75	45.11	180.20	0.76	0.42	1.04	sand	80-90	46-48	>50	UNDEFINED
14.00	45.93	276.46	0.79	0.29	1.06	gravelly sand to sand	>90	>48	>50	UNDEFINED
14.25	46.75	365.46	1.64	0.45	1.07	gravelly sand to sand	>90	>48	>50	UNDEFINED
14.50	47.57	211.20	2.70	1.28	1.09	sand	80-90	46-48	>50	UNDEFINED
14.75	48.39	202.14	0.83	0.46	1.10	sand	80-90	46-48	>50	UNDEFINED
15.00	49.21	296.74	1.16	0.39	1.12	gravelly sand to sand	>90	>48	>50	UNDEFINED
15.25	50.03	417.38	3.10	0.74	1.13	gravelly sand to sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

REVISIONS NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/b ogs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-1	ST CLAIR	27	23
STA.	TO STA.			
FED. ROAD INST. NO.	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation

District 8
Project Implementation
Materials

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/25/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #15
Station: 5+491.52
O/S: 19.2 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 121.98 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT*	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	28.48	0.70	2.46	0.02	sandy silt to clayey silt	UNDFN	UNDF	25	2.3
0.50	1.64	6.62	0.51	7.89	0.06	clay	UNDFN	UNDF	6	0.5
0.75	2.46	6.25	0.53	8.00	0.10	organic material	UNDFN	UNDF	6	UNDEFINED
1.00	3.28	4.88	0.41	8.00	0.14	organic material	UNDFN	UNDF	5	UNDEFINED
1.25	4.10	2.25	0.24	8.00	0.18	organic material	UNDFN	UNDF	2	UNDEFINED
1.50	4.92	3.63	0.30	8.00	0.22	organic material	UNDFN	UNDF	3	UNDEFINED
1.75	5.74	2.88	0.24	8.00	0.26	organic material	UNDFN	UNDF	3	UNDEFINED
2.00	6.56	1.75	0.15	8.00	0.30	organic material	UNDFN	UNDF	2	UNDEFINED
2.25	7.38	1.13	0.09	8.00	0.33	organic material	UNDFN	UNDF	1	UNDEFINED
2.50	8.20	3.74	0.16	4.30	-0.34	clay	UNDFN	UNDF	3	0.2
2.75	9.02	6.14	0.21	3.43	0.36	clay	UNDFN	UNDF	5	0.4
3.00	9.84	4.00	0.12	3.06	0.37	clay	UNDFN	UNDF	4	0.2
3.25	10.66	3.22	0.10	3.07	0.39	clay	UNDFN	UNDF	3	0.2
3.50	11.48	4.76	0.23	4.81	0.41	clay	UNDFN	UNDF	4	0.3
3.75	12.30	6.44	0.23	3.52	0.42	clay	UNDFN	UNDF	6	0.4
4.00	13.12	7.68	0.28	3.70	0.44	clay	UNDFN	UNDF	7	0.5
4.25	13.94	3.86	0.24	6.32	0.45	clay	UNDFN	UNDF	3	0.2
4.50	14.76	12.98	0.41	3.17	0.47	silty clay to clay	UNDFN	UNDF	12	1.0
4.75	15.58	1.38	0.16	8.00	0.48	organic material	UNDFN	UNDF	2	UNDEFINED
5.00	16.40	1.74	0.11	6.38	0.50	organic material	UNDFN	UNDF	2	7.7
5.25	17.22	2.16	0.14	6.43	0.51	organic material	UNDFN	UNDF	2	0.1
5.50	18.04	3.46	0.16	4.74	0.53	clay	UNDFN	UNDF	3	0.2
5.75	18.86	1.88	0.15	8.00	0.54	organic material	UNDFN	UNDF	1	UNDEFINED
6.00	19.69	7.84	0.30	3.80	0.56	clay	UNDFN	UNDF	7	0.5
6.25	20.51	3.00	0.19	6.20	0.58	clay	UNDFN	UNDF	3	0.1
6.50	21.33	3.84	0.20	5.29	0.59	clay	UNDFN	UNDF	3	0.2
6.75	22.15	2.94	0.19	6.63	0.61	organic material	UNDFN	UNDF	3	0.1
7.00	22.97	3.08	0.17	5.49	0.62	clay	UNDFN	UNDF	3	0.1
7.25	23.79	2.64	0.16	6.21	0.64	organic material	UNDFN	UNDF	2	0.1
7.50	24.61	3.06	0.16	5.11	0.65	clay	UNDFN	UNDF	3	0.1
7.75	25.43	2.68	0.18	6.57	0.67	organic material	UNDFN	UNDF	2	0.1
8.00	26.25	3.28	0.20	5.96	0.68	clay	UNDFN	UNDF	3	0.1
8.25	27.07	3.36	0.17	5.12	0.70	clay	UNDFN	UNDF	3	0.1
8.50	27.89	3.48	0.17	4.90	0.71	clay	UNDFN	UNDF	3	0.1
8.75	28.71	3.92	0.18	4.67	0.73	clay	UNDFN	UNDF	4	0.2
9.00	29.53	3.26	0.18	5.55	0.75	clay	UNDFN	UNDF	3	0.1
9.25	30.35	5.10	0.22	4.35	0.76	clay	UNDFN	UNDF	5	0.2
9.50	31.17	95.56	0.44	0.46	0.78	sand to silty sand	60-70	44-46	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/25/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #15
Station: 5+491.52
O/S: 19.2 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 121.98 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT*	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
9.75	31.99	133.64	1.12	0.84	0.79	sand to silty sand	70-80	46-48	>50	UNDEFINED
10.00	32.81	297.50	0.79	0.26	0.81	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.25	33.63	282.22	1.10	0.39	0.82	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.50	34.45	279.98	0.91	0.32	0.84	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.75	35.27	243.52	1.61	0.66	0.85	sand	>90	>48	>50	UNDEFINED
11.00	36.09	299.74	1.34	0.45	0.87	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.25	36.91	155.12	0.56	0.36	0.88	sand	80-90	46-48	>50	UNDEFINED
11.50	37.73	83.70	0.55	0.66	0.90	sand to silty sand	60-70	42-44	>50	UNDEFINED
11.75	38.55	87.30	0.65	0.75	0.92	sand to silty sand	60-70	42-44	>50	UNDEFINED
12.00	39.37	101.50	0.63	0.62	0.93	sand to silty sand	60-70	42-44	>50	UNDEFINED
12.25	40.19	179.14	0.94	0.53	0.95	sand	80-90	46-48	>50	UNDEFINED
12.50	41.01	302.64	1.57	0.52	0.96	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.75	41.83	262.96	1.24	0.47	0.98	sand	>90	>48	>50	UNDEFINED
13.00	42.65	200.54	0.82	0.41	0.99	sand	80-90	46-48	>50	UNDEFINED
13.25	43.47	174.76	0.81	0.46	1.01	sand	80-90	46-48	>50	UNDEFINED
13.50	44.29	181.80	0.69	0.38	1.02	sand	80-90	46-48	>50	UNDEFINED
13.75	45.11	149.68	0.48	0.32	1.04	sand	70-80	44-46	>50	UNDEFINED
14.00	45.93	147.56	0.56	0.38	1.06	sand	70-80	44-46	>50	UNDEFINED
14.25	46.75	172.12	0.70	0.41	1.07	sand	80-90	46-48	>50	UNDEFINED
14.50	47.57	156.00	0.73	0.47	1.09	sand	70-80	44-46	>50	UNDEFINED
14.75	48.39	190.48	0.82	0.43	1.10	sand	80-90	46-48	>50	UNDEFINED
15.00	49.21	215.76	0.91	0.42	1.12	sand	80-90	46-48	>50	UNDEFINED
15.25	50.03	193.04	0.86	0.45	1.13	sand	80-90	46-48	>50	UNDEFINED
15.50	50.85	206.58	0.85	0.41	1.15	sand	80-90	46-48	>50	UNDEFINED
15.75	51.67	255.42	1.08	0.42	1.16	sand	>90	46-48	>50	UNDEFINED
16.00	52.49	262.64	1.10	0.42	1.18	gravelly sand to sand	>90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/24/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #16
Station: 5+515.86
O/S: 20.73 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.38 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT*	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
0.25	0.82	4.94	0.11	2.31	0.02	clay	UNDFN	UNDF	4	0.4
0.50	1.64	16.62	0.11	0.65	0.06	sandy silt to clayey silt	UNDFN	UNDF	15	1.3
0.75	2.46	15.46	0.16	1.02	0.10	sandy silt to clayey silt	UNDFN	UNDF	14	1.2
1.00	3.28	7.26	0.19	2.62	0.14	silty clay to clay	UNDFN	UNDF	7	0.5
1.25	4.10	4.20	0.14	3.40	0.18	clay	UNDFN	UNDF	4	0.3
1.50	4.92	4.40	0.17	3.90	0.22	clay	UNDFN	UNDF	4	0.3
1.75	5.74	4.84	0.19	3.96	0.26	clay	UNDFN	UNDF	4	0.3
2.00	6.56	4.30	0.18	4.18	0.30	clay	UNDFN	UNDF	4	0.3
2.25	7.38	7.34	0.22	3.06	0.33	clay	UNDFN	UNDF	7	0.5
2.50	8.20	10.46	0.26	2.44	0.34	silty clay to clay	UNDFN	UNDF	9	0.8
2.75	9.02	7.46	0.25	3.30	0.36	clay	UNDFN	UNDF	7	0.5
3.00	9.84	50.06	0.38	0.77	0.37	silty sand to sandy silt	60-70	44-46	45	UNDEFINED
3.25	10.66	38.82	0.54	1.38	0.39	silty sand to sandy silt	50-60	42-44	35	UNDEFINED
3.50	11.48	3.74	0.10	2.75	0.41	clay	UNDFN	UNDF	3	0.2
3.75	12.30	2.64	0.08	3.02	0.42	clay	UNDFN	UNDF	2	0.1
4.00	13.12	3.58	0.10	2.80	0.44	clay	UNDFN	UNDF	3	0.2
4.25	13.94	9.02	0.23	2.56	0.45	silty clay to clay	UNDFN	UNDF	8	0.6
4.50	14.76	6.62	0.23	3.45	0.47	clay	UNDFN	UNDF	6	0.4
4.75	15.58	4.28	0.18	4.15	0.48	clay	UNDFN	UNDF	4	0.2
5.00	16.40	3.44	0.12	3.62	0.50	clay	UNDFN	UNDF	3	0.2
5.25	17.22	4.16	0.16	3.78	0.51	clay	UNDFN	UNDF	4	0.2
5.50	18.04	5.26	0.15	2.91	0.53	clay	UNDFN	UNDF	5	0.3
5.75	18.86	3.84	0.10	2.81	0.54	clay	UNDFN	UNDF	3	0.2
6.00	19.69	3.80	0.12	3.11	0.56	clay	UNDFN	UNDF	3	0.2
6.25	20.51	4.28	0.12	2.89	0.58	clay	UNDFN	UNDF	4	0.2
6.50	21.33	4.42	0.13	3.03	0.59	clay	UNDFN	UNDF	4	0.2
6.75	22.15	3.98	0.11	2.74	0.61	clay	UNDFN	UNDF	3	0.2
7.00	22.97	3.80	0.12	3.15	0.62	clay	UNDFN	UNDF	3	0.2
7.25	23.79	4.36	0.12	2.87	0.64	clay	UNDFN	UNDF	4	0.2
7.50	24.61	4.04	0.12	3.02	0.65	clay	UNDFN	UNDF	4	0.2
7.75	25.43	5.02	0.15	2.91	0.67	clay	UNDFN	UNDF	5	0.3
8.00	26.25	74.52	0.39	0.53	0.68	sand to silty sand	60-70	42-44	>50	UNDEFINED
8.25	27.07	110.42	0.53	0.48	0.70	sand	70-80	44-46	>50	UNDEFINED
8.50	27.89	184.84	0.76	0.41	0.71	sand	80-90	>48	>50	UNDEFINED
8.75	28.71	209.30	1.03	0.49	0.73	sand	>90	>48	>50	UNDEFINED
9.00	29.53	126.44	0.64	0.50	0.75	sand	70-80	46-48	>50	UNDEFINED
9.25	30.35	152.20	0.59	0.39	0.76	sand	80-90	46-48	>50	UNDEFINED
9.50	31.17	202.84	0.53	0.26	0.78	sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT Date: 10/24/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #16
Station: 5+515.86
O/S: 20.73 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.38 M
Water table: 2 Meters

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOR TYPE	Eq - Dr	PHI	SPT*	Su
meters	feet	kg/cm^2	kg/cm^2	%	kg/cm^2		%	deg.	N	kg/cm^2
9.75	31.99	307.74	1.41	0.46	0.79	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.00	32.81	310.18	1.14	0.37	0.81	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.25	33.63	256.52	1.08	0.41	0.82	gravelly sand to sand	>90	>48	>50	UNDEFINED
10.50	34.45	224.22	1.12	0.50	0.84	sand	>90	>48	>50	UNDEFINED
10.75	35.27	241.36	1.28	0.52	0.86	sand	>90	>48	>50	UNDEFINED
11.00	36.09	253.26	1.36	0.54	0.87	sand	>90	>48	>50	UNDEFINED
11.25	36.91	263.20	1.13	0.43	0.88	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.50	37.73	186.22	0.56	0.30	0.90	sand	80-90	46-48	>50	UNDEFINED
11.75	38.55	253.20	0.78	0.31	0.92	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.00	39.37	279.46	0.72	0.26	0.93	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.25	40.19	373.64	1.92	0.51	0.95	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.50	41.01	357.88	2.21	0.62	0.96	gravelly sand to sand	>90	>48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/boqs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-1	ST CLAIR	27	24
STA.	TO STA.			
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

CPT Date: 10/24/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #17
Station: 5+540.3
O/S: 18.9 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.50 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
0.25	0.82	19.04	0.63	3.32	0.02	clayey silt to silty clay	UNDFN	UNDF	18	1.5
0.50	1.64	18.94	0.44	2.35	0.06	clayey silt to silty clay	UNDFN	UNDF	18	1.5
0.75	2.46	7.25	0.58	8.00	0.10	clay	UNDFN	UNDF	7	UNDEFINED
1.00	3.28	4.50	0.36	8.00	0.14	organic material	UNDFN	UNDF	4	UNDEFINED
1.25	4.10	5.38	0.43	8.00	0.18	clay	UNDFN	UNDF	5	UNDEFINED
1.50	4.92	5.25	0.42	8.00	0.22	clay	UNDFN	UNDF	4	UNDEFINED
1.75	5.74	4.38	0.35	8.00	0.26	organic material	UNDFN	UNDF	4	UNDEFINED
2.00	6.56	4.38	0.35	8.00	0.30	organic material	UNDFN	UNDF	4	UNDEFINED
2.25	7.38	4.00	0.32	8.00	0.33	organic material	UNDFN	UNDF	3	UNDEFINED
2.50	8.20	3.38	0.27	8.00	0.34	organic material	UNDFN	UNDF	3	UNDEFINED
2.75	9.02	2.75	0.22	8.00	0.36	organic material	UNDFN	UNDF	4	UNDEFINED
3.00	9.84	4.50	0.36	8.00	0.37	organic material	UNDFN	UNDF	4	UNDEFINED
3.25	10.66	3.88	0.31	8.00	0.39	organic material	UNDFN	UNDF	2	UNDEFINED
3.50	11.48	2.50	0.20	8.00	0.41	organic material	UNDFN	UNDF	2	UNDEFINED
3.75	12.30	2.00	0.16	8.00	0.42	organic material	UNDFN	UNDF	2	UNDEFINED
4.00	13.12	2.00	0.16	8.00	0.44	organic material	UNDFN	UNDF	2	UNDEFINED
4.25	13.94	1.75	0.14	8.00	0.45	organic material	UNDFN	UNDF	2	7.7
4.50	14.76	1.66	0.12	7.23	0.47	organic material	UNDFN	UNDF	1	UNDEFINED
4.75	15.58	1.13	0.09	8.00	0.48	organic material	UNDFN	UNDF	1	UNDEFINED
5.00	16.40	1.13	0.09	8.00	0.50	organic material	UNDFN	UNDF	1	UNDEFINED
5.25	17.22	0.88	0.07	8.00	0.51	organic material	UNDFN	UNDF	1	UNDEFINED
5.50	18.04	0.63	0.05	8.00	0.53	organic material	UNDFN	UNDF	1	UNDEFINED
5.75	18.86	1.13	0.09	8.00	0.54	organic material	UNDFN	UNDF	2	0.3
6.00	19.69	4.88	0.17	3.40	0.56	clay	UNDFN	UNDF	2	UNDEFINED
6.25	20.51	1.63	0.13	8.00	0.58	organic material	UNDFN	UNDF	1	UNDEFINED
6.50	21.33	1.38	0.11	8.00	0.59	organic material	UNDFN	UNDF	1	UNDEFINED
6.75	22.15	1.38	0.11	8.00	0.61	organic material	UNDFN	UNDF	2	UNDEFINED
7.00	22.97	1.75	0.14	8.00	0.62	organic material	UNDFN	UNDF	1	UNDEFINED
7.25	23.79	1.25	0.10	8.00	0.64	organic material	UNDFN	UNDF	1	UNDEFINED
7.50	24.61	1.00	0.08	8.00	0.65	organic material	UNDFN	UNDF	1	UNDEFINED
7.75	25.43	1.38	0.11	8.00	0.67	organic material	UNDFN	UNDF	1	UNDEFINED
8.00	26.25	1.38	0.11	8.00	0.68	organic material	UNDFN	UNDF	2	UNDEFINED
8.25	27.07	1.63	0.13	8.00	0.70	organic material	UNDFN	UNDF	2	UNDEFINED
8.50	27.89	1.63	0.13	8.00	0.71	organic material	UNDFN	UNDF	2	UNDEFINED
8.75	28.71	1.75	0.14	8.00	0.73	organic material	UNDFN	UNDF	2	2.5
9.00	29.53	1.76	0.14	7.86	0.75	organic material	UNDFN	UNDF	2	UNDEFINED
9.25	30.35	1.88	0.15	8.00	0.76	organic material	UNDFN	UNDF	2	UNDEFINED
9.50	31.17	33.10	0.21	0.62	0.78	silty sand to sandy silt	<40	36-38	31	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

CPT Date: 10/24/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #17
Station: 5+540.3
O/S: 18.9 M Rt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.50 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
9.75	31.99	91.84	0.37	0.40	0.79	sand to silty sand	60-70	44-46	>50	UNDEFINED
10.00	32.81	105.72	0.41	0.38	0.81	sand	70-80	44-46	>50	UNDEFINED
10.25	33.63	107.06	0.55	0.51	0.82	sand	70-80	44-46	>50	UNDEFINED
10.50	34.45	127.48	0.74	0.58	0.84	sand	70-80	44-46	>50	UNDEFINED
10.75	35.27	212.38	0.78	0.37	0.85	sand	>90	>48	>50	UNDEFINED
11.00	36.09	202.62	0.56	0.28	0.87	sand	80-90	>48	>50	UNDEFINED
11.25	36.91	170.78	0.84	0.49	0.88	sand	80-90	46-48	>50	UNDEFINED
11.50	37.73	74.54	0.20	0.27	0.90	sand to silty sand	50-60	42-44	>50	UNDEFINED
11.75	38.55	95.14	0.38	0.40	0.92	sand	60-70	42-44	>50	UNDEFINED
12.00	39.37	145.78	0.65	0.45	0.93	sand	70-80	44-46	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 1 of 2

CPT Date: 10/23/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #18
Station: 5+570.72
O/S: 20.42 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.23 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
0.25	0.82	19.54	0.55	2.84	0.02	clayey silt to silty clay	UNDFN	UNDF	18	1.5
0.50	1.64	14.22	0.54	3.77	0.06	silty clay to clay	UNDFN	UNDF	13	1.1
0.75	2.46	11.44	0.45	3.97	0.10	clay	UNDFN	UNDF	11	0.9
1.00	3.28	7.54	0.29	3.79	0.14	clay	UNDFN	UNDF	7	0.6
1.25	4.10	15.04	0.23	1.53	0.18	sandy silt to clayey silt	UNDFN	UNDF	14	1.2
1.50	4.92	13.00	0.20	1.55	0.22	clayey silt to silty clay	UNDFN	UNDF	12	1.0
1.75	5.74	7.10	0.11	1.58	0.26	clayey silt to silty clay	UNDFN	UNDF	7	0.5
2.00	6.56	3.12	0.08	2.56	0.30	clay	UNDFN	UNDF	3	0.2
2.25	7.38	3.10	0.16	5.03	0.33	clay	UNDFN	UNDF	3	0.2
2.50	8.20	4.74	0.18	3.86	0.34	clay	UNDFN	UNDF	4	0.3
2.75	9.02	11.60	0.19	1.60	0.36	clayey silt to silty clay	UNDFN	UNDF	11	0.9
3.00	9.84	30.60	0.21	0.70	0.37	silty sand to sandy silt	40-50	40-42	29	UNDEFINED
3.25	10.66	14.10	0.23	1.62	0.39	clayey silt to silty clay	UNDFN	UNDF	13	1.1
3.50	11.48	6.14	0.19	3.09	0.41	clay	UNDFN	UNDF	6	0.4
3.75	12.30	12.28	0.18	1.45	0.42	clayey silt to silty clay	UNDFN	UNDF	12	0.9
4.00	13.12	21.98	0.27	1.25	0.44	sandy silt to clayey silt	UNDFN	UNDF	21	1.7
4.25	13.94	6.10	0.18	3.02	0.45	clay	UNDFN	UNDF	6	0.4
4.50	14.76	3.06	0.11	3.73	0.47	clay	UNDFN	UNDF	3	0.2
4.75	15.58	3.30	0.12	3.64	0.48	clay	UNDFN	UNDF	3	0.1
5.00	16.40	2.00	0.11	4.38	0.50	clay	UNDFN	UNDF	6	0.4
5.25	17.22	6.68	0.20	2.99	0.51	clay	UNDFN	UNDF	4	0.3
5.50	18.04	4.68	0.18	3.89	0.53	clay	UNDFN	UNDF	3	0.1
5.75	18.86	2.92	0.13	4.45	0.54	clay	UNDFN	UNDF	4	0.2
6.00	19.69	4.50	0.13	2.89	0.56	clay	UNDFN	UNDF	3	0.1
6.25	20.51	3.36	0.11	3.21	0.58	clay	UNDFN	UNDF	3	0.1
6.50	21.33	3.44	0.10	2.97	0.59	clay	UNDFN	UNDF	3	0.1
6.75	22.15	3.44	0.11	3.20	0.61	clay	UNDFN	UNDF	3	0.1
7.00	22.97	2.96	0.10	3.45	0.62	clay	UNDFN	UNDF	4	0.2
7.25	23.79	3.82	0.13	3.30	0.64	clay	70-80	46-48	>50	UNDEFINED
7.50	24.61	128.28	0.81	0.63	0.65	sand	>90	>48	>50	UNDEFINED
7.75	25.43	261.36	1.93	0.74	0.67	sand	>90	>48	>50	UNDEFINED
8.00	26.25	193.54	1.30	0.67	0.68	sand	>90	>48	>50	UNDEFINED
8.25	27.07	210.74	1.42	0.67	0.70	sand	>90	>48	>50	UNDEFINED
8.50	27.89	246.80	1.68	0.68	0.71	sand	80-90	46-48	>50	UNDEFINED
8.75	28.71	160.54	1.13	0.70	0.73	sand	70-80	46-48	>50	UNDEFINED
9.00	29.53	122.30	0.79	0.64	0.75	sand	70-80	44-46	>50	UNDEFINED
9.25	30.35	112.86	0.75	0.66	0.76	sand to silty sand	70-80	46-48	>50	UNDEFINED
9.50	31.17	131.26	0.54	0.41	0.78	sand	70-80	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

Illinois Department of Transportation

District 8
Project Implementation
Materials

Structure Carrying FAI 70 Over TRRA
CSX and Conrail R.R.

CPT. Bridge Foundation
Boring Log
Sheet 2 of 2

CPT Date: 10/23/96
Bored By: L. Ford
Check By: M. Lamie
Cone Used: 438TC

Project:
Route: FAI 70
Section 82-5VBR-1
County: St. Clair Co.

CPT. Boring: Pier #18
Station: 5+570.72
O/S: 20.42 M Lt.

Total Unit Weight (Ave.): 16kN/m^3
Ground Surface: 123.23 M
Water table: 2 Meters

DEPTH meters	DEPTH feet	Qc (avg) kg/cm^2	Fs (avg) kg/cm^2	Rf (avg) %	SIGV' kg/cm^2	SOIL BEHAVIOR TYPE	Eq - Dr %	PHI deg.	SPT* N	Su kg/cm^2
10.00	32.81	133.12	0.85	0.49	0.81	sand	70-80	46-48	>50	UNDEFINED
10.25	33.63	150.54	1.09	0.72	0.82	sand	80-90	46-48	>50	UNDEFINED
10.50	34.45	213.80	0.54	0.25	0.84	sand	>90	>48	>50	UNDEFINED
10.75	35.27	206.10	0.61	0.30	0.85	sand	80-90	>48	>50	UNDEFINED
11.00	36.09	156.78	0.55	0.35	0.87	sand	80-90	46-48	>50	UNDEFINED
11.25	36.91	222.38	1.56	0.71	0.88	sand	>90	>48	>50	UNDEFINED
11.50	37.73	298.92	1.37	0.46	0.90	gravelly sand to sand	>90	>48	>50	UNDEFINED
11.75	38.55	223.96	1.21	0.54	0.92	sand	>90	>48	>50	UNDEFINED
12.00	39.37	199.98	1.02	0.51	0.93	sand	80-90	46-48	>50	UNDEFINED
12.25	40.19	230.80	1.29	0.56	0.95	sand	>90	>48	>50	UNDEFINED
12.50	41.01	339.92	2.07	0.61	0.96	gravelly sand to sand	>90	>48	>50	UNDEFINED
12.75	41.83	250.02	0.83	0.33	0.98	gravelly sand to sand	>90	>48	>50	UNDEFINED
13.00	42.65	183.60	0.66	0.36	0.99	sand	80-90	46-48	>50	UNDEFINED
13.25	43.47	174.18	0.65	0.37	1.01	sand	80-90	46-48	>50	UNDEFINED
13.50	44.29	176.86	0.40	0.22	1.02	sand	80-90	46-48	>50	UNDEFINED
13.75	45.11	220.08	1.11	0.51	1.04	sand	80-90	46-48	>50	UNDEFINED
14.00	45.93	351.00	1.72	0.49	1.06	gravelly sand to sand	>90	>48	>50	UNDEFINED
14.25	46.75	306.60	0.84	0.27	1.07	gravelly sand to sand	>90	>48	>50	UNDEFINED
14.50	47.57	237.86	0.60	0.25	1.09	gravelly sand to sand	>90	46-48	>50	UNDEFINED
14.75	48.39	251.56	0.92	0.36	1.10	gravelly sand to sand	>90	46-48	>50	UNDEFINED

Blowcounts based on 63% hammer efficiency

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 12

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS
F.A.I. ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

01/29/97
Wed Jan 29 10:14:19 1997
/usr/project/md06796/bicgs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO
70	82-5VBR-1	ST. CLAIR	27	25
STA.	TO STA.			
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials Depth Increment = 152.5mm
NW 1/4, SE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M.
Bridge Foundation Boring Log
Sh. 1 of 2

PROJECT D-98-067-96 BRIDGE FAI 55/70 OVER TRRA, CSX, AND CONRAIL Date 11/20/96
ROUTE FAI 70 RAILROAD 5+349 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 4
Sta 5+154
O/S 18.29m Lt. C.L.

Surf Wat El. ____
Groundwater El. at Compl ____
At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 27.44 0m			
BROWN AND GRAY SILTY CLAY	1 2 5	143.58	31
124.54	3		
BROWN SILT LOAM	1 2 2	S/10 84.27	35
123.78			
BROWN FINE SAND (DRY)			
SEE GRADATION *1	4 6 6	NC	29
122.26	-5		
GRAY SAND LOAM			
121.19	3 5 9	S/10 21.07 NC	

El.	N	Qu kPa	W %
BROWN AND GRAY FINE SAND (DRY)			
SEE GRADATION *1	5 9 14	NC	
118.75 F.W.	9		
BEGIN ROTARY MUD	3 8 14	NC	
	11 16 18	NC	
	13		
	12 20 20	NC	

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials Depth Increment = 152.5mm
NW 1/4, SE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M.
Bridge Foundation Boring Log
Sh. 1 of 2

PROJECT D-98-067-96 BRIDGE FAI 55/70 OVER TRRA, CSX, AND CONRAIL Date 11/19/96
ROUTE FAI 70 RAILROAD 5+349 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 6
Sta 5+239.4
O/S 19.2m Rt. C.L.

Surf Wat El. ____
Groundwater El. at Compl ____
At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 26.80 0m			
BLACK CINDERS	1 2 1	NC	37
124.67	-3		
BROWN SILTY CLAY	1 3 3	S/15 126.02	39
	1 1 1	S/15 99.49	37
121.62	-5		
FINE BROWN SAND (DRY)			
SEE GRADATION *4	6 10 12	NC	

El.	N	Qu kPa	W %
(WITH CLAY LENSE)	1 1 8	10 NC	
118.11 F.W.	9		
SAND CAME UP IN AUGERS 200mm BEGIN ROTARY MUD DRILLING	1 2 5	NC	
	13 14 19	NC	
	11		
	14 16 17	NC	
	13		
	1 8 7	NC	

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials Depth Increment = 152.5mm
NW 1/4, SE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M.
Bridge Foundation Boring Log
Sh. 1 of 2

PROJECT D-98-067-96 BRIDGE FAI 55/70 OVER TRRA, CSX, AND CONRAIL Date 11/18/96
ROUTE FAI 70 RAILROAD 5+349 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 8
Sta 5+289.7
O/S 19.51m Lt. C.L.

Surf Wat El. ____
Groundwater El. at Compl ____
At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 26.31 0m			
GRAY AND BROWN SILTY CLAY WITH CINDERS ROCK AND RUBBLE	1 2 4	S/20 68.67	28
124.18	-3		
BROWN AND BLACK CINDERS	2 1 1	NC	37
122.96			
122.65 F.W.			
BROWN SILTY SAND WITH LOTS OF RUBBLE AND BRICKS	1 2 2	NR	
121.13	-5		
GRAY SILTY CLAY	1 1 3	S/10 49.16	40
119.60			

El.	N	Qu kPa	W %
GRAY FINE SAND WITH CLAY LENSES	4 5 4	NC	
SEE GRADATION *8			
BEGIN ROTARY MUD	3 4 3	NC	
	10 14 11	NC	
114.73			
GRAY SILTY CLAY		S/15	
114.12	0 14 15	43.11 NC	41
GRAY FINE SAND			
SEE GRADATION *9	13		

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

Project D-98-067-96
Route FAI 70
Sec. 82-5VBR-1
County St. Clair
Sh. 2 of 2

Boring No. 4
Sta 5+154
O/S 18.29m Lt. C.L.

El. m	N	Qu kPa	W %
113.27	14		
COARSE TO FINE SAND			
SEE GRADATION *2	8 9 8	NC	
111.90			
BROWN AND GRAY FINE SAND	16		
SEE GRADATION *3	22 29 32	NC	
	25		
	18 6 12 16	NC	
	27		
	10 10 10	NC	
	20		
	2 2 3	NC	

El. m	N	Qu kPa	W %
	13 13 20	NC	
104.58 END OF BORING	23		
	25		

Project D-98-067-96
Route FAI 70
Sec. 82-5VBR-1
County St. Clair
Sh. 2 of 2

Boring No. 6
Sta 5+239.4
O/S 19.2m Rt. C.L.

El. m	N	Qu kPa	W %
	14		
111.26			
GRAY FINE TO COARSE SAND	16		
SEE GRADATION *5	11 10 14	NC	
	18 10 12 17	NC	
108.26			
GRAY FINE SAND			
SEE GRADATION *6	10 20 22	NC	
106.68	20		
GRAY FINE TO COARSE SAND			
SEE GRADATION *7	20 21 23	NC	

El. m	N	Qu kPa	W %
	10 17 24	NC	
102.87 END OF BORING	23		
	25		
	27		

Project D-98-067-96
Route FAI 70
Sec. 82-5VBR-1
County St. Clair
Sh. 2 of 2

Boring No. 8
Sta 5+289.7
O/S 19.51m Lt. C.L.

El. m	N	Qu kPa	W %
	5 11 14 16	NC	
	16		
	10 16 31	NC	
	23 28 29	NC	
107.41	18		
GRAY FINE TO COARSE SAND WITH SOME LIGNITE	14 20 19	NC	
SEE GRADATION *10	9 20 10 15	NC	

El. m	N	Qu kPa	W %
	5 5 7	NC	
104.36			
GRAY FINE SAND			
SEE GRADATION *11	6 23 10	NC	
	10 13 16	NC	
101.62 END OF BORING	25		
	27		

02/05/97
Wed Feb 5 11:45:37 1997
/usr/project/md0796/blogs01.dgn LV=1-63

REVISIONS NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS

FAI ROUTE 70
SECTION 82-5VBR-1
ST. CLAIR COUNTY

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
70	82-5VBR-1	ST. CLAIR	27	28
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

ILLINOIS DEPARTMENT OF TRANSPORTATION — Bridge Foundation Boring Log
District Eight Materials — Depth Increment = 152.5mm
NW 1/4, SE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M. — Sh. 1 of 2

PROJECT D-98-067-96 — BRIDGE FAI 55/70 OVER TRRA, CSX, AND CONRAIL RAILROAD — Date 11/21/96
ROUTE FAI 70 — Bored By LARRY FORD
SEC. 82-5VBR-1 — STA. 81+42.68 (ENGLISH) 5+349 — Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 12
Sta 5+411.3
O/S 18.90m RT. C.L.

Surf Wat El. ____ Groundwater El. at Compl ____ At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 124.24 0m			
GRAY SILTY CLAY WITH CONSTRUCTION RUBBLE CONCRETE AND ROCK (FILL)			
123.17 F.W.	1 3 4	S/5 155.67	22
122.11			
GRAY SILTY CLAY LOAM	0 1 1	S/15 26.53	34
	0 0 0	S/10 59.69	41
	0 1 3	S/5 51.89	52
117.99		NC	37
GRAY SILT LOAM			

El.	N	Qu kPa	W %
117.23			
GRAY SILTY CLAY	0 1 1	S/20 37.46	59
	0 0 0	S/10 45.65	58
	0 0 0	S/15 26.53	54
112.66 BEGIN ROTARY MUD			
GRAY FINE TO COARSE SAND			
SEE GRADATION #12			
	11 12 11		NC

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

ILLINOIS DEPARTMENT OF TRANSPORTATION — Bridge Foundation Boring Log
District Eight Materials — Depth Increment = 152.5mm
SW 1/4, NE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M. — Sh. 1 of 2

PROJECT D-98-067-96 — BRIDGE FAI 55/70 OVER TRRA, CSX & CONRAIL RR — Date 10/31/96
ROUTE FAI 70 — Bored By LARRY FORD
SEC. 82-5VBR-1 — STA. 81+42.68 (ENGLISH) 5+349 — Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 14
Sta 5+461
O/S 19.5m LT. C.L.

Surf Wat El. ____ Groundwater El. at Compl ____ At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 124.30 0m			
ROCK AND CONSTRUCTION RUBBLE (FILL)			
GRAY LOAM	0 1 2	S/10 59.69	26
A-4(3)			
	0 1 2	S/15 71.79	30
	0 1 2	S/15 39.80	32
	0 1 2	S/15 43.11	35

El.	N	Qu kPa	W %
117.44			
GRAY SILTY CLAY	0 0 0	S/10 31.60	54
A-7-6(37)			
(W/ SILTY CL LENSES)	0 0 0	S/15 43.11	51
	0 0 0	S/15 46.43	59
112.72 SAND CAME UP IN AUGERS			
BEGIN ROTARY MUD			
FINE TO COARSE SAND			
SEE GRADATION #15			
	5 7 5		NC

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

ILLINOIS DEPARTMENT OF TRANSPORTATION — Bridge Foundation Boring Log
District Eight Materials — Depth Increment = 152.5mm
SW 1/4, NE 1/4, SECTION 7, T 2 N, R 9 W, 3RD P.M. — Sh. 1 of 2

PROJECT D-98-067-96 — BRIDGE FAI 55/70 OVER TRRA, CSX & CONRAIL RR — Date 10/30/96
ROUTE FAI ROUTE 70 — Bored By LARRY FORD
SEC. 82-5VBR-1 — STA. 81+42.68 (ENGLISH) 5+349 — Checked By MARY LAMIE

COUNTY St. Clair
Strct. No. 082-0017
Boring No. 18
Sta 5+568.28
O/S 18.59m RT. CL.

Surf Wat El. ____ Groundwater El. at Compl ____ At ____ Hrs ____

El.	N	Qu kPa	W %
Ground Surface 123.38 0m			
ROCK & CONSTRUCTION RUBBLE (FILL) GRAY SILTY CLAY LOAM W/ ROCK			
121.25 F.W.	3 5 4	S/5 66.72	21
GRAY SILTY CLAY	0 1 2	S/10 77.23	45
	0 0 1	S/5 18.53	52
	0 0 0	S/10 35.11	52

El.	N	Qu kPa	W %
	0 0 0	S/5 29.65	70
	0 0 0	S/10 38.63	71
113.47 BEGIN ROTARY MUD SAND CAME UP AUGERS 460mm			
GRAY FINE TO COARSE SAND			
SEE GRADATION #19			
	4 6 8		NC
110.58			
GRAY FINE SAND			
SEE GRADATION #20			
	11 13 14		NC

N 50 mm OD Sampler, Driven 305 mm
63.5Kg Hammer, 760 mm Fall (F.W.-Free Water B-Bulge S-Shear)

Project D-98-067-96
Route FAI 70
Sec. 82-5VBR-1
County St. Clair — Sh. 2 of 2

Boring No. 12
Sta 5+411.3
O/S 18.30m RT. C.L.

El. m	N	Qu kPa	W %
110.22	14		
GRAY FINE SAND	8 13 27		NC
SEE GRADATION #13	16		
	13 19 25		NC
	18		
	32 33 35		NC
	7 9 10		NC
	20		
	14 23 25		NC

El. m	N	Qu kPa	W %
102.60			
FINE TO COARSE SAND	15 16 11		NC
SEE GRADATION #14	23		
100.01	17 14 10		NC
END OF BORING	25		
	27		

Project D-98-067-96
Route FAI 70
Sec. 82-5VBR-1
County St. Clair — Sh. 2 of 2

Boring No. 14
Sta 5+461
O/S 19.5m LT. C.L.

El. m	N	Qu kPa	W %
110.28	14		
GRAY FINE TO MEDIUM SAND	5 6 6		NC
SEE GRADATION #16	16		
	9 9 12		NC
105.71	18		
FINE GRAY SAND	8 10 15		NC
SEE GRADATION #17	20		
	28 24 20		NC
	10 13 16		NC

El. m	N	Qu kPa	W %
102.05			
GRAY FINE TO COARSE SAND WITH SOME GRAVEL	14 16 16		NC
SEE GRADATION #18	23		
	11 12 13		NC
	25		
	14 23 27		NC
95.50 END OF BORING	27		
	13 16 18		NC
	10 17 21		NC

Project D-98-067-96
Route FAI ROUTE 70
Sec. 82-5VBR-1
County St. Clair — Sh. 2 of 2

Boring No. 18
Sta 5+568.28
O/S 18.59m RT. CL.

El. m	N	Qu kPa	W %
109.36	14		
GRAY FINE TO MEDIUM SAND	6 8 11		NC
SEE GRADATION #21	16		
107.53			
GRAY FINE SAND	13 13 17		NC
SEE GRADATION #22	18		
	10 12 14		NC
104.48	20		
GRAY FINE TO MEDIUM SAND	8 7 7		NC
SEE GRADATION #23			
	15 25 30		NC

El. m	N	Qu kPa	W %
SOME COBBLES	23		
	18 15 13		NC
	25		
	14 17 19		NC
	27		
	13 11 12		NC
94.42 END OF BORING	10 10 10		NC

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS

FAI ROUTE 70
SECTION 82-5VBR-I
ST. CLAIR COUNTY

02/05/97
Wed Feb 5 11:45:37 1997
/usr/project/rm006796/blogs01.dgn LV=1-63

FAI ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
70	82-5VBR-1	ST. CLAIR	27	27
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials

Bridge Foundation
Boring Logs

PROJECT D-98-067-96 BRIDGE FAI 70 OVER TRRA, CSX, AND CONRAIL RAILROADS 5+349.03 (METRIC)= Date 11/20/96
ROUTE FAI 70 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE
COUNTY ST. CLAIR
Struct. No. 082-0017

SOIL BORING SAND GRADATIONS

Boring No.	4	4	4
Sta.	5+154	5+154	5+154
O/S	18.29m LT. CL.	18.29m LT. CL.	18.29m LT. CL.
Gradation #	1	2	3
Depth:	3.65m - 14.17m	14.17m - 15.54m	15.54m - 22.9m

SIEVE	% PASSING	% PASSING	% PASSING
#20	98.5	70.2	92.3
#40	88.6	45.1	72.4
#60	63.0	25.3	53.6
#100	35.2	10.0	13.4
#200	10.7	2.7	4.8

Boring No.	6	6	6
Sta.	5+239.40	5+239.40	5+239.40
O/S	19.2m RT. CL.	19.2m RT. CL.	19.2m RT. CL.
Gradation #	4	5	6
Depth:	5.18m - 14.63m	15.5m - 18.59m	18.59m - 20.1m

SIEVE	% PASSING	% PASSING	% PASSING
#20	99.1	70.9	89.0
#40	97.5	38.0	60.1
#60	90.7	27.6	26.0
#100	50.3	9.3	14.8
#200	13.5	3.6	5.4

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials

Bridge Foundation
Boring Logs

PROJECT D-98-067-96 BRIDGE FAI 70 OVER TRRA, CSX, AND CONRAIL RAILROADS 5+349.03 (METRIC)= Date 11/20/96
ROUTE FAI 70 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE
COUNTY ST. CLAIR
Struct. No. 082-0017

SOIL BORING SAND GRADATIONS

Boring No.	12	12	14
Sta.	5+41[.3	5+41[.3	5+461
O/S	18.3m RT. CL.	18.3m RT. CL.	19.5m LT. CL.
Gradation #	13	14	15
Depth:	14.02m - 21.64m	21.64m - 24.25m	11.58m - 14.0m

SIEVE	% PASSING	% PASSING	% PASSING
#20	95.6	57.0	54.2
#40	77.9	25.5	30.1
#60	55.3	10.6	14.1
#100	14.3	5.2	9.5
#200	9.2	3.0	7.1

Boring No.	14	14	14
Sta.	5+461	5+461	5+461
O/S	19.5m LT. CL.	19.5m LT. CL.	19.5m LT. CL.
Gradation #	16	17	18
Depth:	14.02m - 18.59m	18.59m - 22.25m	22.25m - 28.8m

SIEVE	% PASSING	% PASSING	% PASSING
#20	64.2	93.9	76.8
#40	17.9	88.8	24.5
#60	9.0	81.1	14.4
#100	4.2	48.3	8.6
#200	2.4	10.5	4.8

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials

Bridge Foundation
Boring Logs

PROJECT D-98-067-96 BRIDGE FAI 70 OVER TRRA, CSX, AND CONRAIL RAILROADS 5+349.03 (METRIC)= Date 11/20/96
ROUTE FAI 70 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE
COUNTY ST. CLAIR
Struct. No. 082-0017

SOIL BORING SAND GRADATIONS

Boring No.	6	8	8
Sta.	5+239.40	5+289.7	5+289.7
O/S	19.2m LT. CL.	19.51m LT. CL.	19.51m LT. CL.
Gradation #	7	8	9
Depth:	20.12m - 23.93m	6.71m - 11.58m	12.19m - 18.9m

SIEVE	% PASSING	% PASSING	% PASSING
#20	72.7	99.3	99.6
#40	45.5	97.0	98.3
#60	25.8	87.6	89.3
#100	12.2	54.1	40.7
#200	8.0	20.7	10.3

Boring No.	8	8	12
Sta.	5+289.7	5+289.7	5+41[.3
O/S	19.51m LT. CL.	19.51m LT. CL.	18.3m RT. CL.
Gradation #	10	11	12
Depth:	18.90m - 21.95m	21.95m - 24.65m	11.58m - 14.0m

SIEVE	% PASSING	% PASSING	% PASSING
#20	46.1	84.8	52.6
#40	15.8	53.6	33.3
#60	9.3	43.6	29.9
#100	5.3	15.5	10.6
#200	3.1	3.5	4.9

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Eight Materials

Bridge Foundation
Boring Logs

PROJECT D-98-067-96 BRIDGE FAI 70 OVER TRRA, CSX, AND CONRAIL RAILROADS 5+349.03 (METRIC)= Date 11/20/96
ROUTE FAI 70 Bored By LARRY FORD
SEC. 82-5VBR-1 STA. 81+42.68 (ENGLISH) Checked By MARY LAMIE
COUNTY ST. CLAIR
Struct. No. 082-0017

SOIL BORING SAND GRADATIONS

Boring No.	18	18	18
Sta.	5+568.28	5+568.28	5+568.28
O/S	18.59m RT. CL.	18.59m RT. CL.	18.59m RT. CL.
Gradation #	19	20	21
Depth:	9.91m - 12.80m	12.80m - 14.02m	14.02m - 15.9m

SIEVE	% PASSING	% PASSING	% PASSING
#20	56.8	94.8	78.8
#40	27.5	84.8	56.4
#60	15.5	62.7	51.1
#100	3.7	16.3	11.7
#200	1.7	4.6	2.3

Boring No.	18	18	
Sta.	5+568.28	5+568.28	
O/S	18.59m RT. CL.	18.59m RT. CL.	
Gradation #	22	23	
Depth:	15.85m - 18.90m	18.90m - 28.96m	

SIEVE	% PASSING	% PASSING	% PASSING
#20	99.1	62.3	
#40	98.3	29.1	
#60	91.1	14.0	
#100	13.5	5.0	
#200	3.9	2.7	

Boring No.	
Sta.	
O/S	
Gradation #	
Depth:	

SIEVE	% PASSING
#20	
#40	
#60	
#100	
#200	

REVISIONS	
NAME	DATE

ILLINOIS DEPARTMENT OF TRANSPORTATION

BORING LOGS

FAI ROUTE 70
SECTION 82-5VBR-1
ST. CLAIR COUNTY

02/05/97
Wed Feb 5 11:45:38 1997
/usr/project/md06796/blogs01.dgn LV:1-63

ATTACHMENT 3

TSi Report and Boring Logs – 2021 Evaluation

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

I-55/I-70 BRIDGE OVER RAILROAD YARD IN
ST. CLAIR COUNTY
ST. CLAIR COUNTY, ILLINOIS
TSI PROJECT NO. 20211176.00

WISS, JANNEY, ELSTNER ASSOCIATES, INC.
300 Pfingsten Rd.
Northbrook, Illinois 60062

1340 North Price Road
St. Louis, MO 63132

November 18, 2021

TSi geotechnical, inc.

1340 North Price Road
St. Louis, MO 63132
314.373.4000 T
314.227.6622 F

www.tsigeotech.com

November 18, 2021

Mr. Stephen Garrett, PE
WISS, JANNEY, ELSTNER ASSOCIATES, INC.
330 Pfingsten Rd.
Northbrook, Illinois 60062

Re: Subsurface Exploration and Geotechnical Engineering Evaluation
I-55/I-70 Bridge over Railroad Yard in St. Clair County
St. Clair County, Illinois
TSi Project No. 20211176.00

Dear Mr. Garrett:

TSi Geotechnical, Inc. (TSi) has completed the authorized Subsurface Exploration and Geotechnical Engineering Evaluation for the referenced project and is pleased to submit our findings to Wiss, Janney, Elstner Associates, Inc. (WJE). The purpose of our work was to assess subsurface conditions at specific test boring location in order to prepare geotechnical recommendations for use in the design and construction of the foundations and retaining structures for improvements of I-55/I-70 Bridge over Railroad Yard in St. Clair County, Illinois. This report presents the field and laboratory data, and includes our evaluations and recommendations relative to the geotechnical engineering aspects of the project.

We appreciate the opportunity to assist you with this project. If you have any questions, or if we may be of further service to you, please call us.

Respectfully submitted,
TSI GEOTECHNICAL, INC.

Fred H. Held III
Project Manager

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PROFESSIONAL SERVICES SINCE 1989

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SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION
I-55/I-70 BRIDGE OVER RAILROAD YARD IN ST. CLAIR COUNTY
ST. CLAIR COUNTY, ILLINOIS

1.0 SCOPE OF WORK

This report summarizes the results of a geotechnical study performed for use in the design and construction of the foundations for improvements of I-55/I-70 Bridge over Railroad Yard in St. Clair County, Illinois. Based on TSi's understanding of the project, the following items have been identified for inclusion in this study report:

- subsurface conditions at the bridge locations, including material types at each boring location;
- laboratory test results for soil samples;
- recommended foundation support for the bridge temporary support structures, as appropriate for the anticipated design loads and site conditions, and specific project requirements;
- design capacities for generalized soil profiles;
- estimated settlement of the foundations, based on the general character of the supporting materials and anticipated structural loads;
- a general assessment of regional seismicity and seismic site class;
- LPILE parameters for the design of laterally loaded deep foundations; and
- the influence of groundwater on the project;

2.0 SITE AND PROJECT DESCRIPTIONS

The following project understanding is based on the information received and discussions with WJE, and a site reconnaissance by an engineer from TSi. The project will consist of restoration work on the existing bridge piers on I-55/I70 bridge in St. Clair County, Illinois. The existing bridge carries a large amount of traffic on I-55/I-70. Based on the discussion with WJE, we understand that the bridge deck is planned to be uplifted and supported over a temporary support system consisting of hydraulic jacks, steel truss, and columns. We understand the lifting and temporary support tolerances are approximately one eighth to one half inch for a duration of approximately 40 days. The support structure is planned to be placed on an approximate 2 foot thick concrete footing constructed at the existing grades. However, ground improvements or deep foundations will likely be required to support these footings. The preliminary dimensions of the footings are provided as approximately 10 feet wide and 50 feet long. We understand the contact pressure of the footings may vary based on the pier loads and in the extreme case scenarios, it could range from approximately 1,000 to 2,000 pounds per square feet (psf) over the 10 foot by 50 foot footing.

We understand the existing bridge foundation elements are concrete piles extending to depths of 30 to 60 feet, based on provided information. After the bridge deck is supported by temporary shoring, some of the bridge piers will be excavated to the tops of the footings or pier caps for inspection and restoration.

The project site is generally located in the extended flood plain of the Mississippi River approximately 2 miles east of the main river channel. The general location of the project interchanges are shown on the Vicinity Map, Figures 1 in Appendix A of this report. The approximate locations of the borings drilled by TSi are indicated on the Site and Boring Location Plans, Figures 2.1, 2.2, and 2.3, in Appendix A.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

Through August 11 to September 29, 2021, TSi conducted a subsurface exploration at the project site consisting of fourteen (14) test borings. The borings were designated as Borings 1N, 1S, 2N, 2S, 2.5, 3N, 3S, 3.5, 4N, 4S, 5N, 5S, 6N, and 6S. The boring locations were selected by WJE, and were staked in the field by TSi at the time of drilling. Some of the borings were offset from their planned locations due to utility or railroad conflicts. The approximate locations of the borings are shown on Figures 2.1, 2.2, and 2.3 in Appendix A. The boring locations were surveyed and the elevations and coordinates were provided to TSi by WJE and are shown on the Logs of Boring in Appendix B.

The borings were drilled with a Diedrich D-50 all-terrain drill rig or Geoprobe 7822DT all-terrain drill rig using hollow stem auger and mud rotary drilling methods. The borings were drilled to the predetermined depths ranging from 20 to 100 feet. The borings were backfilled with grout to the ground surface and topped with native soils. Split-spoon and Shelby tube samples were recovered from the borings. Split-spoon samples were recovered using a 2-inch outside-diameter, split-barrel sampler, driven by an automatic hammer, in accordance with ASTM D 1586. The split-spoon samples were placed in glass jars for later testing in the laboratory. Shelby tube samples were obtained in general accordance with ASTM D 1587. The Shelby tube samples were preserved by sealing the entire sample in the tube. The sampling sequences for each boring are summarized on the Logs of Boring in Appendix B.

The results of the geotechnical field tests and measurements were recorded on field logs and appropriate data sheets. Those data sheets and logs contain information concerning the exploration methods, samples attempted and recovered, indications of the presence of various subsurface materials, and the observation of groundwater. The field logs and data sheets contain the field engineer's interpretations of the conditions between samples, based on the performance of the exploration equipment and the cuttings brought to the surface by the drilling tools.

3.2 LABORATORY TESTING

A laboratory testing program was conducted by TSi to determine selected engineering properties of the obtained soil samples. The following laboratory tests were performed on the samples recovered from the borings in general accordance with the appropriate ASTM standards:

- visual descriptions by color and texture of each sample;
- hand penetrometer measurements on cohesive samples;
- natural moisture content of each cohesive sample;
- unit weights of selected samples;
- minus #200 washed sieves of selected samples;
- sieve particle size analysis of selected samples;
- hydrometer test;
- consolidation tests of selected Shelby tube samples;
- Atterberg limit tests on selected cohesive samples; and
- Unconsolidated undrained triaxial compressive strength of selected soil samples.

Data and observations from laboratory tests were recorded on laboratory data sheets during the course of the testing program. The results of the tests are summarized on the Logs of Boring in Appendix B and on the Laboratory Test Reports in Appendix C. The boring logs are an interpretation of the subsurface conditions based on the field and laboratory data. Only data pertinent to the objectives of this report have been included on the logs; therefore, these logs should not be used for other purposes.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the boring locations are shown on the Logs of Boring. The general subsurface conditions encountered and their pertinent engineering characteristics are described in the following paragraphs. Conditions represented by the borings should be considered applicable only at the location drilled on the dates shown; the reported conditions may be different at other locations or at other times.

4.1 GENERAL GEOLOGY

The general area of the project site is underlain by Ste. Genevieve Limestone of Mississippian system, of the Chesterian Series at an estimated depth between 100 and 200 feet. This limestone formation may contain layers of dolomite, limestone breccia, shale and chert. The upper few feet of bedrock is typically weathered and highly weathered in some areas. The limestone is susceptible to solution activity, resulting in sinkholes that may be filled with more recent sediments, an irregular bedrock surface, and widened joints with variable degrees of weathering. Some calcareous sandstone layers and local cherts can be found. The Ste. Genevieve Limestone has been heavily eroded in this area during the Pennsylvanian by alluvial action. Expected thicknesses vary from 0 to 150 feet.

Based on the Illinois Geological Survey the native surface soil deposits consist of alluvial sediments from the Cahokia Formation extending to a depth of over 100 feet. The Cahokia Formation typically consist of bedded silts, clays, loams, and sand and gravel deposited in the floodplains and channels of modern rivers and streams. The project site is situated in the apparent oxbow remnant of the Mississippi River where sediments slowly filled the river meander until it was completely cut off from the main channel. Remnant lakes, ponds, creeks, and canals are present throughout the general area.

4.2 GENERALIZED SUBSURFACE PROFILE

The generalized subsurface profile of the borings consists of highly variable fills overlying cohesive soils consisting of silts and clays, all of which is underlain by native sands.

The surficial fill soils consist of approximately 5 to 10 feet of highly variable material with consistency ranging from very soft to hard. Fill materials consist of cinders, clay, silty loams, loams, sandy loams, sandy clays, and sands (as per IDOT IDH soil classification system) with variable amounts of secondary clays, silts, sands, gravel, brick, glass, and limestone fragments. SPT (Standard Penetration Test) N-values ranged from WH (weight of hammer) to >50 bpf (blows per foot). Moisture contents in the fill range from about 4 to 56%. Dry densities in the fill ranged from about 87 to 106 pcf (pounds per cubic foot). Atterberg limits in the fill range from 55 to 114 liquid limits and 36 to 86 plastic indices. Undrained shear strengths in the fill range from about 0.38 to 0.66 tsf (tons per square foot). Percent fines passing a #200 sieve range from about 15 to 98%.

The upper cohesive materials which underlie the fills appear to be relatively recently deposited sediments from the Mississippi River, previous oxbow remnants, creeks, or canals. These cohesive native soils varied from depths of about 5 to 40 feet and consist of clays, silts, silty clays, clay loams, silty clay loams, loams, sandy clays, and sandy clay loams with consistencies ranging from very soft to stiff. N-values range from WH to 30 bpf. N-values were generally lower on the northern half of the project area. Moisture contents in the cohesive soils ranged from about 22 to 75%. Dry densities in the cohesive soils range from about 75 to 101 pcf. Atterberg limits in the cohesive soils range from 22 to 99 liquid limits and 3 to 86 plastic indices. Undrained shear strengths in the tested cohesive soils range from about 0.45 to 0.71 tsf. Percent fines passing a #200 sieve range from about 50 to 99% in selected samples.

Some of the very soft clays present in the surface fill materials and upper cohesive sediment soils could not be recovered in Shelby tube or SPT samples to produce reliable testing specimens due to the very soft and wet characteristics. These include soils with weight of hammer SPT values and high moisture contents, some near their liquid limit values. These very soft soils are likely softer and weaker than the tested lab specimens.

Below depths of about 30 to 40 feet, native sands were encountered of generally medium dense to dense consistency. SPT N-values ranged from WH to 67 bpf, generally being above 8 bpf. Moisture contents in sands ranged from about 6 to 32%. Percentage of fines ranged from about 4 to 6% in selected samples.

4.3 GROUNDWATER

Groundwater was encountered during drilling at depths of 5 to 20 feet, except in Borings B-1N, B-4N, and B-6N. Selected borings were observed for groundwater after a 14 day delay. Groundwater was encountered on delayed readings between the ground surface and 6.8 feet. The depths of groundwater for each boring are presented on Table 1 below. The presence or absence of groundwater at a particular location does not necessarily mean that groundwater will be present or absent at that location at other times. Groundwater levels may vary significantly over time due to the effect of seasonal variations in precipitation or other factors not evident at the time of exploration.

TABLE 1.
GROUNDWATER DEPTHS AND ELEVATIONS

		During Drilling		14-Day Delay	
Boring	**Ground Elevation (ft.)**	**Depth (ft.)**	**Elevation (ft.)**	**Depth (ft.)**	**Elevation (ft.)**
B-1N	416.0	NE	NE	0.0	416.0
B-1S	413.6	18	395.6	-	-
B-2N	418.6	20	398.6	-	-
B-2S	422.6	18	404.6	-	-
B-2.5	415.7	13	402.7	-	-
B-3N	414.2	18	396.2	-	-
B-3S	414.5	8	406.5	-	-
B-3.5	410.3	18	392.3	-	-
B-4N	407.9	NE	NE	-	-
B-4S	406.8	18	388.8	4.5	402.3
B-5N	407.6	5.5	402.1	6.8	400.9
B-5S	404.5	13	391.5	-	-
B-6N	409.0	NE	NE	-	-
B-6S	407.3	5	402.3	4.3	403.0
NE = Not Encountered					

5.0 DESIGN RECOMMENDATIONS

5.1 EXISTING FILL MATERIALS

Existing fill materials were encountered at the boring locations extending to depths ranging from approximately 5 to 10 feet below the existing ground surface. The existing fill materials generally consisted on clay or cinders, a burnt coal byproduct, with varying percentages of miscellaneous debris such as brick, asphalt, glass, and concrete fragments. It does not appear that all of the fill was placed and compacted in a controlled manner. As a result, the engineering properties of the fill cannot be predicted with certainty, and there is a risk for excessive total or differential settlement or other performance problems if any structures are supported on the existing fill. Fill materials with greater variability and thickness could also be present between or away from the boring locations.

Several options are available for mitigating the risks associated with the old fill material, the most common of which are described below. It will ultimately be the decision of the owner to decide which course of action to take, based on a comparison of risks that result from the presence of the fill with the costs associated with reducing or eliminating the risks.

Complete Removal and Replacement – The risks associated with building upon the existing fill may not be acceptable to owner and designers. In order to eliminate the risk to the proposed shoring project, the existing fill could be removed entirely from the planned development areas and replaced with compacted, suitable fill. The excavation bases should be widened by a minimum of one half foot in each direction larger than the proposed footing for every foot of excavation below surface grade. Old fill that proves to be relatively uniform in composition and free of deleterious materials may be reused as new fill. See Section 6.4, *Fill and Backfill Materials*.

Additional Options – TSi understands that complete fill removal and replacement may not be practical or economically feasible due to the depths of fill and surrounding structures, utilities, and railroads to remain. Other options for mitigating the presence of the old fill include deep foundations and ground improvement. Deep foundations could include drilled shafts or driven piles.

Ground improvements, such as rammed aggregate piers, GeoPiers or vibro-replacement/vibro-compaction (stone columns), are possibilities to improve the ground for temporary shoring for the lighter loaded structures for the project. These technologies could be effective at mitigating the uncertainties associated with the existing fill and reduce the potential for differential settlements. The performance of the improvement columns is dependent on the proprietary system used for installation. The design of these systems is normally accomplished by the specialty subcontractor awarded the installation, based on a performance specification for

allowable bearing capacity and settlement of the foundations. However, as previously mentioned the vibrations induced by these ground improvement methods could cause settlement and damage to the existing foundations.

5.2 Bearing Capacity

Very soft clayey soils were encountered below the fill materials at this site. In addition, existing fill materials at some areas do not appear to have a proper compaction based on their relatively low Standard Penetration Resistance (N-value) and high moisture contents near the soils liquid limits. Based on the encountered soil materials, the most probable mode of failure for a footing at this site is expected to be the local or punching shear failures. In these modes of failure, the shear strength mostly generates from a limited wedge of failure and as a result a lower bearing capacity is associated with these types of failure. A conventional approach to address this issue is to reduce the shear strength parameters of the soil to two-third of their estimated values. The bearing capacity equation used in our evaluation are provided below:

$q_{\text{net,allowable}} = (\pi+2)\times 0.67\times \text{Cu/SF}$

In the above equation "SF" is the Safety Factor. The safety factor for bearing capacity is typically 3 or more for permanent structures. For temporary structures the safety factor could be as low as 1.5 to 2.0 due to the short term duration of this project; however, excessive settlements would likely result. The "Cu" in the equation is the undrained cohesion or shear strength of the underlying clays.

The fill materials encountered to depths of 5 to 10 feet in the borings exhibited tested shear strengths as low as about 640 psf. The native cohesive soils encountered at depths of 5 to 40 feet exhibited tested shear strengths as low as about 900 psf of the tested samples. However, as previously indicated, very soft fill and native soils were encountered with in-situ SPT N-values of weight of hammer which indicate very soft soils. Laboratory tests also verify very high moisture contents near their liquid limit values in some of these very soft soils. Penetration tests of some of these samples indicate shear strengths as low as 250 psf. The drilling and laboratory tests results are consistent with anticipated sediments of the Cahokia Formation and indicate layers of these very soft soils are present in many areas of the project site where foundations are planned.

The lower range Cu of some of the soils within the bearing strata below the foundation bases are estimated to be about 250 psf. As a result, the net allowable bearing capacity of the underlying soft clays is about 435 to 580 psf using safety factors of 1.5 and 2.0, respectively. Since, in the clayey soils, the embedment depth of foundation does not have an influence on the bearing capacity, the above estimated capacity would be valid for both 5 and 10 feet removal and replacement of the materials with crushed limestone. The transferred stresses to the bottom of the

crushed limestone layer should be compared against the provided net allowable bearing capacity. The transferred load to the underlying layers could be estimated by the 2 to 1 method. In this approach the contact pressure at deeper depths is calculated over an enlarged area which is expanded by a 2 Vertical:1 Horizontal (2H:1V) line from the perimeter of the strip footings. It should be noted that the difference in unit weight of crushed limestone and the underlying clays (about 20 pcf) should also be added to the calculated values. Therefore, the estimated contact pressure at the bottom of the crushed limestone layer is estimated to be approximately 1,300 and 1,000 psf for 5 and 10 feet thick crushed limestone pads, respectively.

As it is evident, these estimated contact pressure magnitudes are much greater than the net allowable bearing capacity provided in the previous paragraphs and as a result the proposed footings at this site are subject to failure under the provided loading conditions. Local bearing failure may not occur in all portions of planned footings, but the potential for failure in some portions are high. This also applies to the lighter structures with an approximate surface contact pressure of 1,000 psf if these very soft clays are present in the upper cohesive layer from depths of 10 to 20 feet. However, if these soft soils are not present below any part of the 10 foot by 50 foot footing as encountered in some of the borings, the local bearing capacities may not be exceeding under the design loadings, but excessive total or differential settlement could result. The following section evaluates these potential total and differential settlements.

5.3 Settlement Analysis

A variable range of conditions including fill to depths of 5 to 10 feet with very soft to stiff consistencies underlain by very soft to medium stiff clays, silty clays, loams to depths of 15 to 20 feet. Present in some of the borings are a very soft clay with moisture contents from about 40 to 90%. Below depths of about 30 to 40 feet sands were encountered in all the borings to the termination depths of 60 to 100 feet. Due to the large range of variability in the soil profiles, a conservative soil profile was established for settlement analysis. The following analysis represents the potential maximum settlements under the highest loadings.

TSi performed settlement analysis using UniSettle 4.0 software developed by UniSoft Geotechnical Solutions for this site. The soil layers and properties utilized in our analyses were generalized based on the field and laboratory results of the borings drilled at this site. A discussion of the field and laboratory tested strength values are presented in the previous section, 5.2 Bearing Capacity. Other soil parameters used for the settlement analysis were derived from the consolidation tests, moisture contents, and Atterberg limit index properties. A composite soil profile of conservative soil conditions are presented below in Table 2.

TABLE 2.
SETTLEMENT ANALYSIS LAYERS

Material	General Depth Ranges Encountered in Borings (ft.)	Depth Ranges for Settlement Analysis (ft.)
Fill	5 to 10	0 to 10
Loam and Silty Clay	5 to 20	10 to 15
Clay	15 to 40	15 to 40
Sand	30 to 100	40 to 100

The estimated immediate and consolidation settlements and total and differential settlements for a footing 10 feet wide, 50 feet long with a contact stress of 2,000 psf are provided in the below Table 3. Settlements of foundations with a lower contact stress of 1,000 psf are estimated to be over half of the settlements in Table 3. Immediate settlements of properly compacted crushed stone should be negligible in comparison to the settlement of the existing fills and underlying native soils.

TABLE 3.
SETTLEMENT ANALYSIS RESULTS

Improvements	Potential Immediate Settlement (in.)	Potential Consolidation Settlement (in.)	Consolidation Settlement within 40 Days (20 to 40%) (in.)	Total Amount of Settlement within 40 Days (in.)	Differential Amount of Settlement within 40 Days (in.)
None (footing support over the subgrade)	3.5 to 6.5	12 to 15	2.5 to 6	6 to 13	7 to 9
5-ft thick crushed limestone pad	3 to 6	9 to 11	2 to 4.5	5 to 10.5	5.5 to 7
10-ft thick crushed limestone pad	2.5 to 5.5	7.5 to 9.5	1.5 to 4	4 to 9	5 to 5.5

If the local bearing capacities are not exceeded that produce a local shear failure and complete foundation failure the above ranges of total and differential settlement could result. The total settlement is measured at the center of the 10 ft. and 50 ft. pad and the differential compares this center with the ends of the pad. Some of these total and differential settlements could be actively managed with active jacking systems that could require constant adjustment over the construction period. However, the differential settlement could cause the pad to crack and potentially fail unless it is reinforced and designed to deflect. Potential continued settlement could also make it difficult to actively support the bridge decks with a jacking system within the tolerance of about 1/8 inch to 1/2 inch.

5.4 Foundation Recommendations

Based on our engineering evaluations, the proposed foundations could undergo a catastrophic bearing capacity failure and the amount of differential settlement may not be able to be tolerated by a 2 foot thick concrete footing at the ground surface or underlain by 5 to 10 feet of newly compacted crushed limestone backfill. Therefore, we do not recommend the proposed structure at this site be supported over a shallow foundation system. TSi recommends a deep foundation system, such as micropiles or helical piles, be utilized for this project bearing in sands underlying the weak clays at depths below about 30 to 40 feet.

Since, very soft clay materials were encountered in most of our borings, we recommend a rigid foundation element be considered, since the very soft materials encountered in our borings do not provide a sufficient lateral resistance and may subject a slender deep foundation element to buckling or significant axial deflections.

Other deep foundation systems such as drilled shaft or driven piles could be used for foundation support; however, limited access under the bridges and very close proximity to the railroad tracks greatly limit or preclude the constructability of these foundation types. Other ground improvements such as rammed aggregate piers may be able to provide sufficient foundation support, but the vibrations required to install these elements could cause subsidence and potential damage to the existing pile support system.

5.5 Micropile / Helical Pile Foundations

As previously discussed, micropiles and helical piles could be considered to support the temporary shoring for the bridge decks, considering the confined work space and close proximity to railroad tracks. The installation of micropiles and helical piles is proprietary, where a specialty contractor designs and installs the foundations and is the engineer-of-record for the foundation system. The specialty contractors should be contacted for the design details regarding micropiles and helical piles. We suggest the deep foundation systems be designed to a performance criteria applicable to the project requirements. We anticipate a grid of deep foundation elements would be installed into the existing ground and structural cast into the planned concrete foundation pad.

Assuming that the micropiles are pressure-grouted and based on the borings, we recommend a preliminary allowable axial side resistance (grout-to-ground bond resistance) average value of 50 to 100 psf for the upper cohesive soils and 600 to 800 psf for the underlying sands. Uplift resistance for individual piles may be taken as two thirds of the allowable axial side resistance. These values include a Factor of Safety of 2.5. The success of the micropile installation is dependent on the experience and skill of the contractor. As such, and because of the limited subsurface at the site, the specialty contractor should determine the appropriate skin friction value, spacing, diameter, configuration and length of pile to achieve the required capacity at each shoring location.

Helical piles are used for foundation support, they should be turned into the ground until they achieve the required design capacity for each element generally associated to the required installation torque. The high capacity elements required for this project will likely be pipe piles with multiple helices turned into the sands below depths of 30 to 40 feet and then possibly grouted for additional lateral load capacity.

The allowable group uplift capacity should be compared to the allowable uplift capacity of a single pile multiplied by the number of piles in the group and the design should be based on the lesser group capacity where applicable.

One potential issue with single-element micropiles or helical pile is that they can have limited lateral capacity, due to the threads in micropile or helical pile extension sections. If that is the case, then battered micropiles or helical piles can be utilized to accommodate the lateral capacity. A single section micropile or helical pile without threads between the sections could also provide lateral capacity. TSi recommends that at least two micropiles be performance-tested to verify the grout-to-ground bond strength. Only the design bond length of the bar should be grouted for testing of the micropile. At least two helical piles should also be tested to confirm the design capacities.

We recommend that the micropile testing and installation be performed in accordance with the Federal Highway Administration Micropile Design and Construction Manual, FHWA-SA-97-070. The piles should be installed to the required embedment depth using sufficient equipment to penetrate through the upper variable fill and cohesive soils. Spacing of the piles should be at least 3 diameters center to center to avoid stress overlap and to avoid impacting the adjacent pile. The 28-day compressive strength of the grout should be at least 4,000 psi. Actual grout volumes in excess of the predicted volumes should be anticipated due to the highly variable fill and very soft clays noted on the boring logs, as well as the potential for voids within the fill.

5.6 Lateral Load

The lateral load capacity of the deep foundations will vary based on their width, depth, and variable material penetrated. For a lateral load analysis, we recommend using the LPILE program from

Ensoft, Inc. For the LPILE analyses, recommended geotechnical parameters for the soil are provided in the following table:

TABLE 4
LPILE PARAMETERS

Depth (feet)	LPILE Material Type	Effective Unit Weight* γ', pcf	Undrained Cohesion psf	E_{50} Value	Static p-y Modulus, k (pci)
0 to 10	Soft Clay (Matlock)	120	250	0.020	30
10 to 15	Stiff Clay w/o free water	52.6	750	0.01	100
15 to 40	Soft Clay (Matlock)	57.6	250	0.020	30
60 to 100	Sand (Reese)	47.6	36 deg.**	NA	97

* Assumed groundwater at 10 ft., ** Internal friction angle.
pcf = pounds per cubic foot, psf = pounds per square foot, pci = pounds per cubic inch

5.7 REGIONAL SEISMICITY

Although several significant areas of seismic activity exist in the central United States, the St. Louis area is most directly affected by the New Madrid and the Wabash Valley Seismic Zones. The New Madrid zone has its northern limits located in the bootheel area of southeast Missouri and the southern tip of Illinois. The zone is essentially defined by the Mississippi Embayment, an area where deep sedimentary deposits have accumulated above basement rock. The zone continues to be active, with small tremors (micro-earthquakes) occurring regularly. The seismic history of the zone is dominated by a series of strong earthquakes that occurred from 1811 through 1812. Studies indicate the major shocks from these events resulted in an energy release equivalent to a body wave Magnitude 7.5 event. The Wabash Valley zone, located in the southern and central portions of eastern Illinois and western Indiana, is also considered to be capable of generating major seismic events.

Based on the general soil characteristics as determined by field and laboratory tests and the estimated depth to bedrock, the project area is designated as Site Class E, in accordance with the ASCE 7.0 if the soils are not subject to liquefaction. N-values suggest that some of the soils do not have adequate density and cohesion to resist liquefaction in consideration of the distance to known seismic sources. Thus, some of the site soils could be considered to be susceptible to liquefaction, or to substantial settlement or loss in strength when subject to the design earthquake loading. We understand that WJE is conducting a liquefaction analysis of the site soils in

accordance with IDOT design procedures. This analysis can be used to determine the potential liquefaction effects and design considerations.

6.0 Site Preparation and Excavation Considerations

Earthwork tasks should be performed in accordance with the Illinois IDOT Specifications for Construction.

6.1 Subgrade Preparation

Construction areas should be stripped of existing pavement, organic soil, and any deleterious materials prior to site excavation and grading. Care should be taken during stripping to prevent excessive disturbance of the underlying soil. After the removal of these materials, and where further excavation is not required, the exposed subgrade should be proofrolled. Proofrolling is accomplished by passing over the subgrade with proper equipment such as a fully loaded tandem-axle dump truck or scraper and observing the subgrade for areas of excessively soft, wet, disturbed, or otherwise unsuitable soils. Any unacceptable materials encountered should be excavated and either recompacted or replaced with new structural fill. However, soft soils could be deeper than the planned excavations. A geotextile grid sized for the backfill and support requirements could be used to bridge soft soils to allow proper compaction of the backfill materials.

Some excavations to depths of 5 to 10 feet could encounter groundwater that would require dewatering prior to placement of materials. Depending on the local weather, precipitation and groundwater levels, removal of the water may be accomplished using sump and pump arrangements. The use of well points could be required to dewater the excavations if high groundwater flows are encountered during construction. Use of a thin mud mat consisting of 1 to 2 inches of concrete may be placed in the base of the excavations to provide a protective layer prior to placing fill and to reduce disturbance of the subgrades.

Prior to placing fill in any area not previously stabilized by a mud mat or geogrid, the subgrade should be scarified to a depth of about 6 inches, the moisture content adjusted to near its optimum moisture content, and the subgrade recompacted in accordance with recommendations made in subsequent sections of this report. The recommended proofrolling and/or scarification and recompaction may be waived if, in the opinion of TSi, this procedure would be detrimental or unnecessary. Following the satisfactory preparation of the subgrade, controlled fill material may be placed.

6.2 Temporary Excavation Support

Trenching and bracing for any temporary excavations should be performed in accordance with the Occupational Safety and Health Administration (OSHA) regulations, and other applicable regulatory agencies. In accordance with the OSHA excavation regulations, the soils that will be encountered in the excavations are classified as Type C, which requires a side slope for the

trench excavation no steeper than 1.5 horizontal to 1.0 vertical (1.5H:1V). However, worker safety and classification of the excavated soil is the responsibility of the contractor.

Excavation support such as timber sheeting and bracing, or sheet piling, may be utilized in lieu of sloping back the sides of the excavations. Also, according to OSHA requirements, any excavation extending to a depth of more than 20 feet must be designed by a registered professional engineer.

Where the excavations lie within the zone of influence of utilities, railroads, or other structures, the integrity of those elements should be maintained by a properly designed earth retention system, underpinning, or other suitable means. The existing structures located adjacent to the development area must not be undermined or otherwise compromised by the excavation activities.

6.3 Subgrade Protection

Construction areas should be properly drained in order to reduce or prevent surface runoff from collecting on the exposed subgrade. Any ponded water on the exposed subgrade should be removed immediately.

To prevent unnecessary disturbance of the subgrade soils, heavy construction vehicles should be restricted from traveling through the finished subgrade. Temporary subgrade support such a surface layer of crushed stone up to 3 inches in maximum particle size could be required to provide access to heavy construction equipment during deep foundation installations. If areas of disturbed subgrade develop, they should be properly repaired in accordance with the recommendations in this report.

6.4 Fill and Backfill Materials

All fill materials and fill placement methods at the replacement bridge sites must be completed according to Illinois Department of Transportation standards and specifications. Some of the soils encountered at the borings would be acceptable fill materials according to these specifications. Soil with decayable material such as cinders, wood, trash, metal, or vegetation is not acceptable.

Some of the fill material may require the addition of moisture prior to compaction. This should be performed in a controlled manner using a tank truck with a spray bar, and the moistened soil should be thoroughly blended with a disk or pulverizer to produce a uniform moisture content. Repeated passages of the equipment may be required to achieve a uniform moisture content. If fill is placed during the winter season, fill materials should be carefully observed to see that no ice or frozen soils are placed as fill or remain in the base materials upon which fill is placed.

Some of the fill material may require moisture reduction prior to compaction. During warm weather, moisture reduction can generally be accomplished by disking, or otherwise aerating the soil. When air-drying is not possible, a moisture-reducing chemical additive, such as lime or Class C fly ash, may be used as a drying agent. These additions should be thoroughly mixed prior to compaction.

6.5 Fill and Backfill Placement

Cohesive fill should be compacted to a dry density of at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the soil. Cohesive fill placed in areas where fill depths are greater than 5 feet should be compacted to a dry density of at least 98% of the standard Proctor maximum dry density. Granular material, such as crushed limestone, placed for structure or pavement support, should be compacted to at least 100% of the standard Proctor maximum dry density. The moisture content of clay or granular fill at the time of compaction should be up to 3% above optimum moisture content as determined by the standard Proctor compaction test. Fill should be placed in loose lifts not in excess of 8 inches thick, and compacted to the aforementioned criterion. However, it may be necessary to place fill in thinner lifts to achieve the recommended compaction when using small hand-operated equipment. Heavy compaction equipment should be avoided and light equipment should be used for compacting the backfill materials close to the bridge structures.

7.0 CONSTRUCTION OBSERVATION AND TESTING

It is recommended that TSi be retained during construction to perform testing and observation services for the following items:

- proofrolling, recompaction, and preparation of the soil subgrade that will support new fill;
- evaluation of the suitability of fill and backfill materials;
- placement and compaction of fill and backfill;
- observation and documentation of the installation of ground improvement or deep foundations; and
- quality assurance testing for concrete materials.

These quality assurance services should help to verify the design assumptions and maintain construction procedures in accordance with the project plans, specifications, and good engineering practice.

8.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of **WISS, JANNEY, ELSTNER ASSOCIATES, INC.** for the specific application to the subject project. The recommendations contained in this report have been made in accordance with generally accepted soil and foundation engineering practices; no other warranties are implied or expressed.

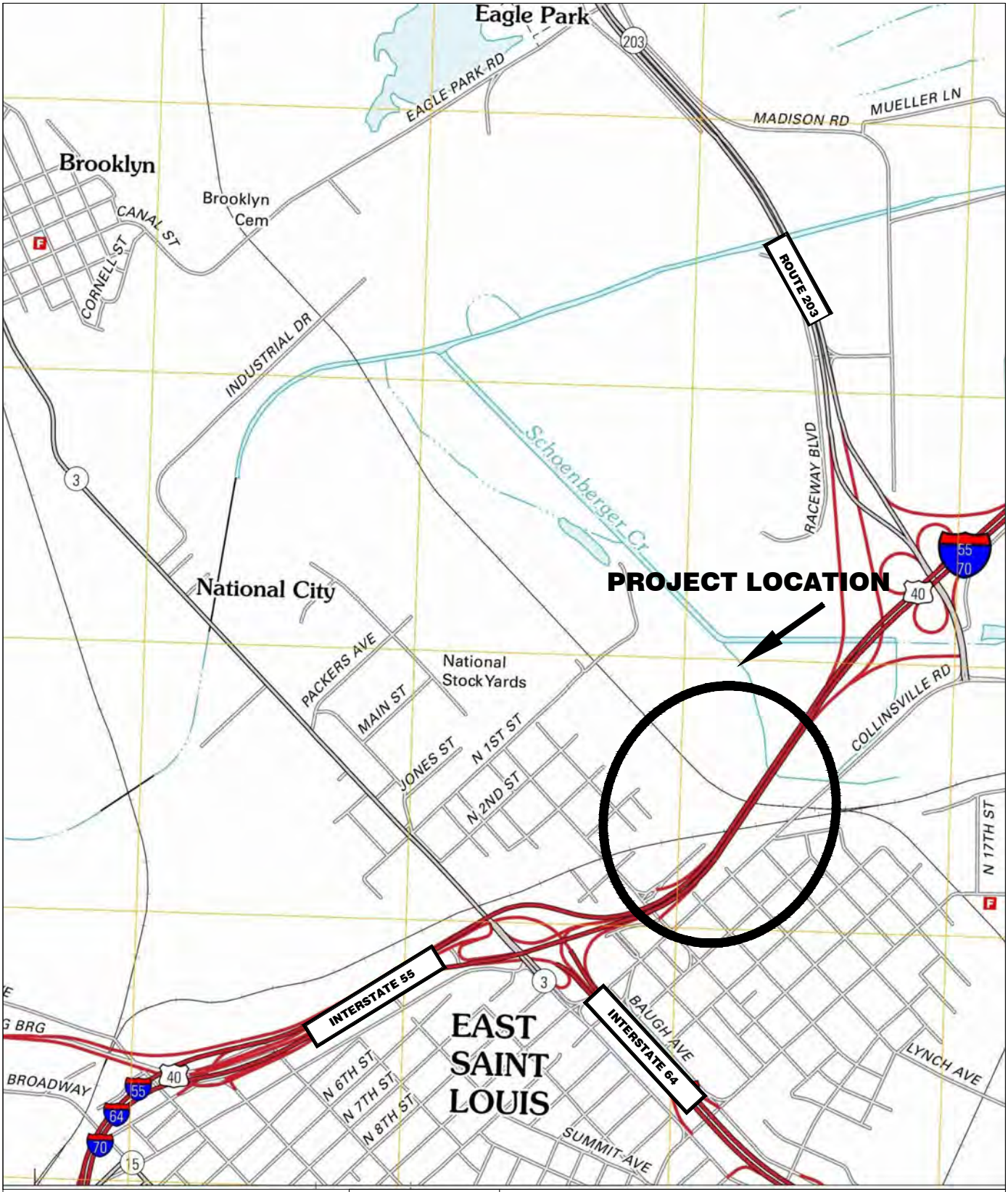
The analyses and recommendations submitted in this report are based in part upon the data obtained from the test borings. The nature and extent of variations between the borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

We emphasize that this report was prepared for design purposes only and may not be sufficient to prepare an accurate construction bid. Contractors reviewing this report should acknowledge that the information and recommendations contained herein are for design purposes.

If conditions at the site have changed due to natural causes or construction operations, this report should be reviewed by TSi to determine the applicability of the analyses and recommendations considering the changed conditions. The report should also be reviewed by TSi if changes occur in the structure locations, sizes, and types, or in the planned loads, elevations, or project concepts.

TSi requests the opportunity to review the final plans and specifications for the project prior to construction to verify that the recommendations in this report are properly interpreted and incorporated in the design and construction documents. If TSi is not accorded the opportunity to make this recommended review, we can assume no responsibility for the misinterpretation of our recommendations.

APPENDIX A



NOT TO SCALE

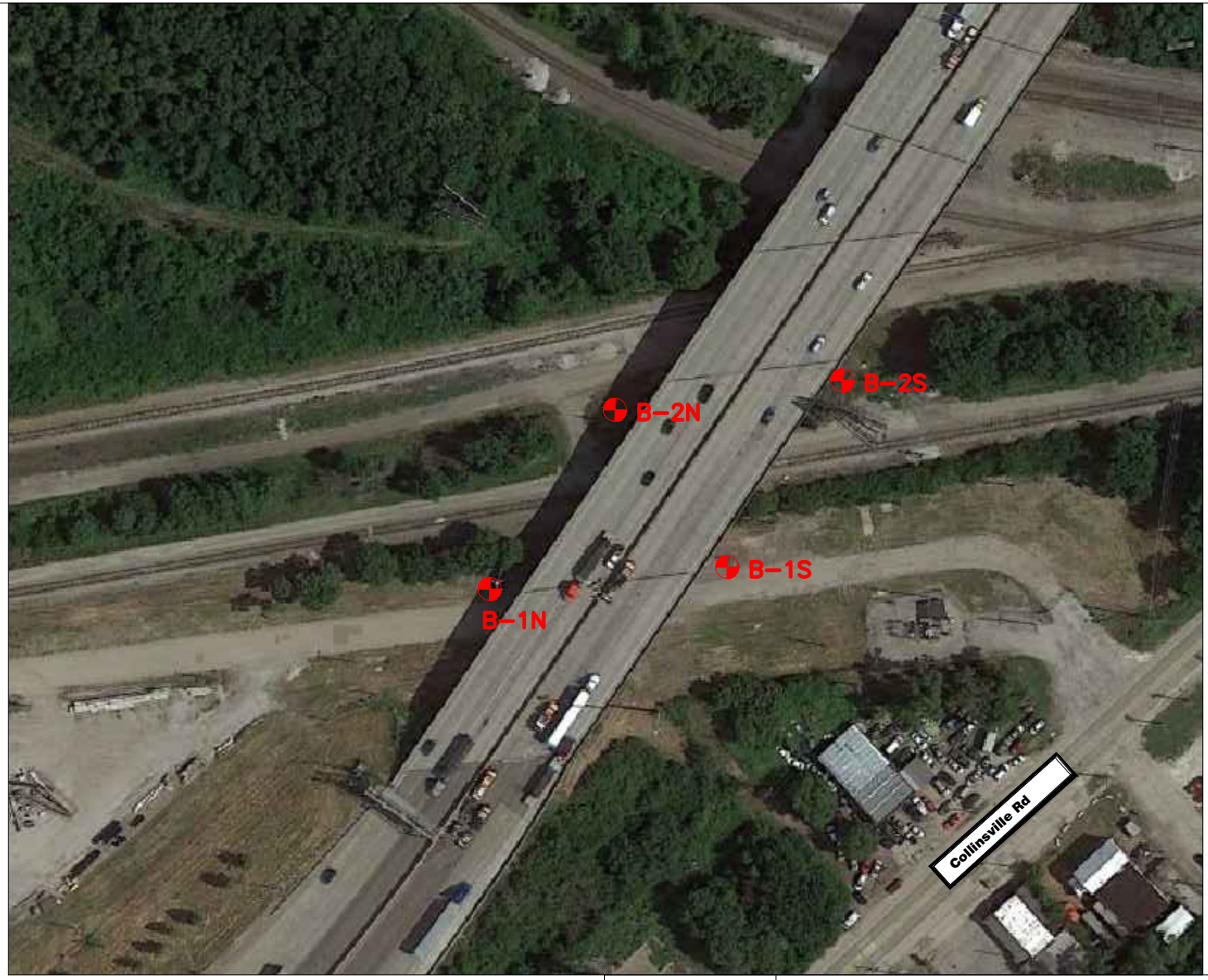
NOTE:
DRAWING PREPARED FROM AN IMAGE OBTAINED FROM USGS.COM ON 10/04/21

TSI geotechnical, inc.
1340 NORTH PRICE ROAD
ST. LOUIS, MISSOURI 63132

VICINITY MAP

I-55/I-70 BRIDGE OVER RAILROAD YARD
ST. CLAIR COUNTY, ILLINOIS

Drawn By: SA	Checked By: FH
Project No. 20211176.00	Date: 10/04/21 Figure 1



LEGEND

B-1 APPROXIMATE BORING LOCATION AND NUMBER

NOTE: THIS PLAN WAS PREPARED FROM AN IMAGE OBTAINED FROM GOOGLE EARTH ON 10/04/21.

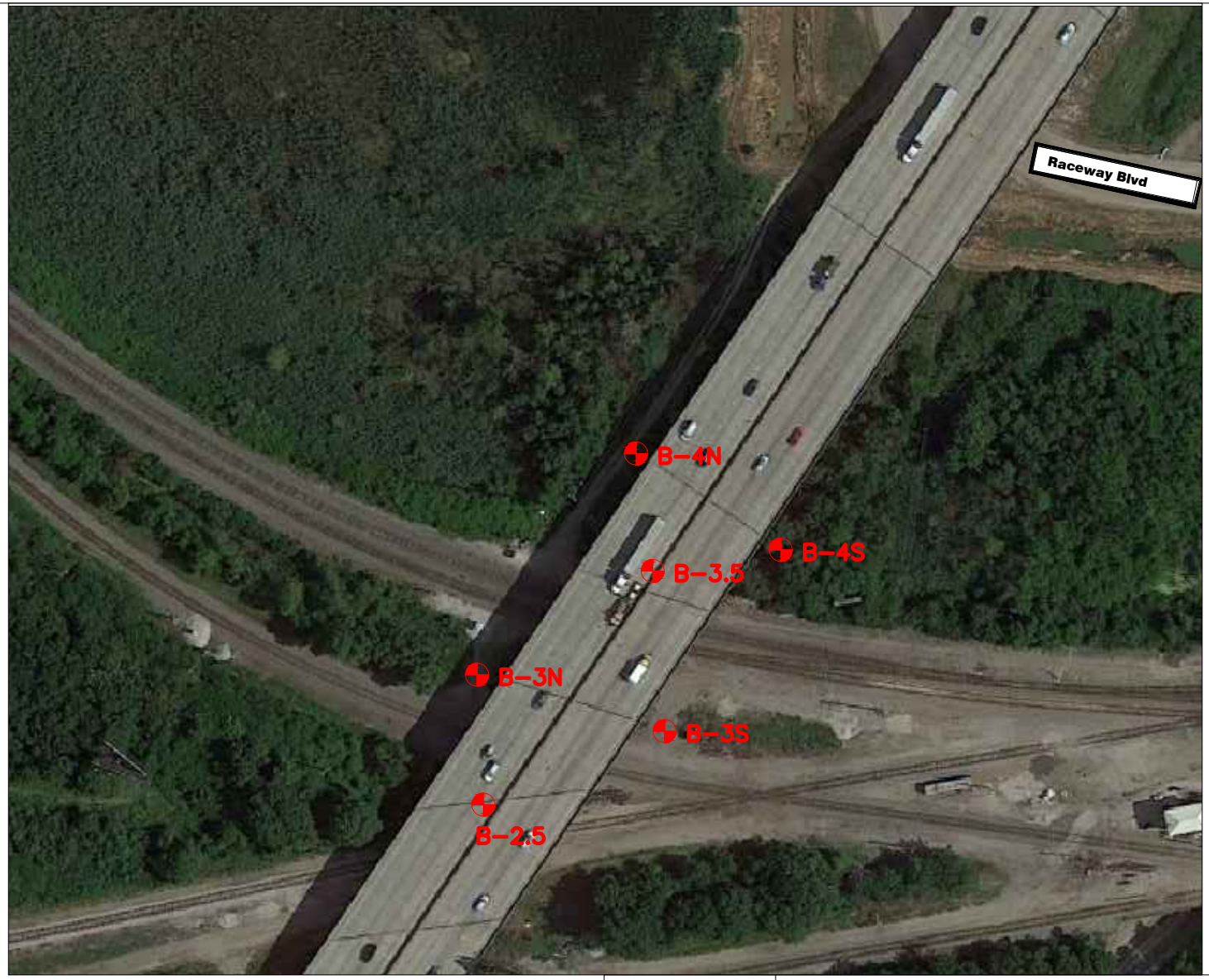
NOT TO SCALE

TSI geotechnical, inc.
1340 NORTH PRICE ROAD
ST. LOUIS, MISSOURI 63132

SITE AND BORING LOCATION PLAN

I-55/I-70 BRIDGE OVER RAILROAD YARD
ST. CLAIR COUNTY, ILLINOIS

Drawn By: SA	Checked By: FH	
Project No. 20211176.00	Date: 10/04/21	Figure 2.1



LEGEND

B–1 APPROXIMATE BORING LOCATION AND NUMBER

NOTE: THIS PLAN WAS PREPARED FROM AN IMAGE OBTAINED FROM GOOGLE EARTH ON 10/04/21.

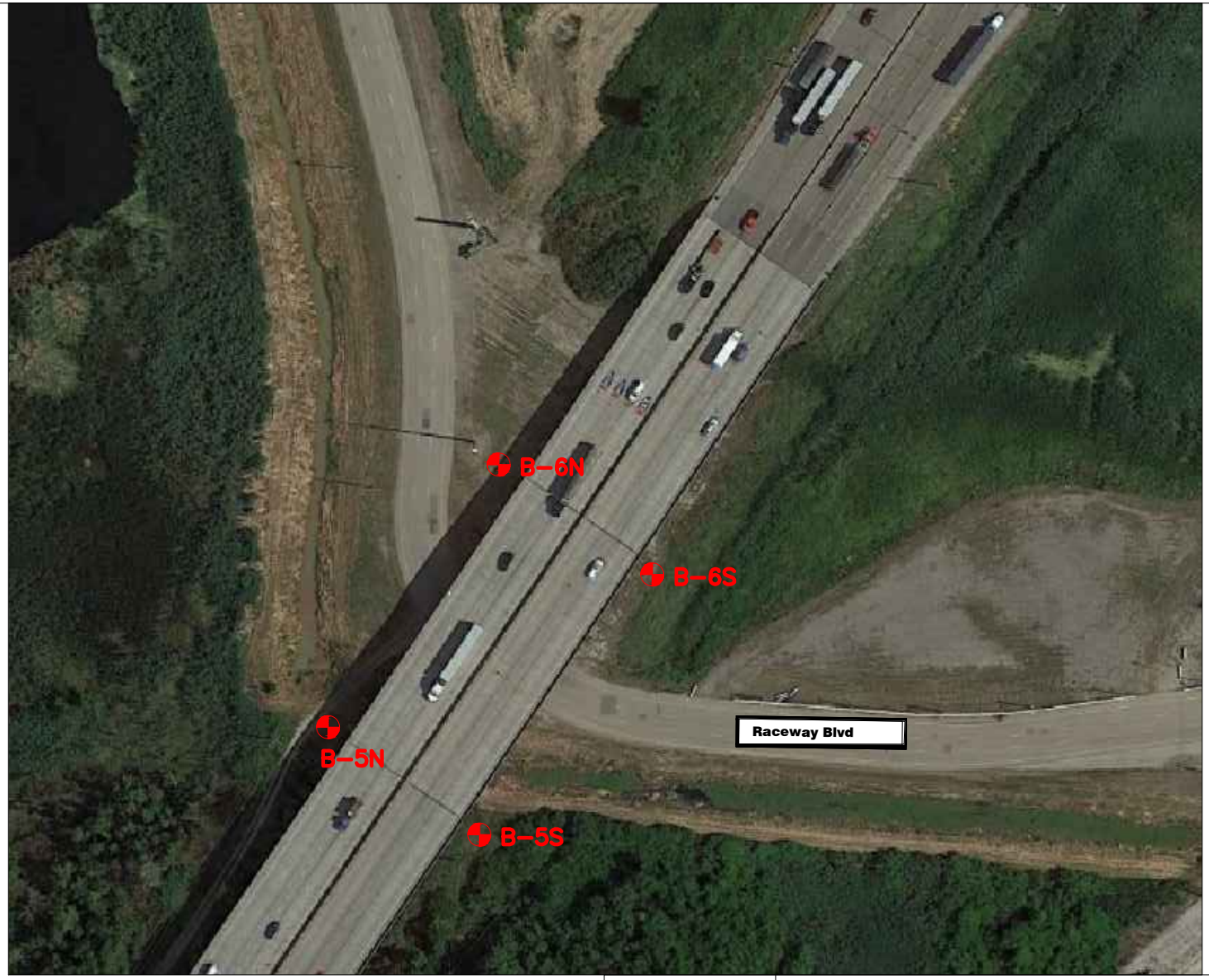
NOT TO SCALE

TSI geotechnical, inc.
1340 NORTH PRICE ROAD
ST. LOUIS, MISSOURI 63132

SITE AND BORING LOCATION PLAN

I–55/I–70 BRIDGE OVER RAILROAD YARD
ST. CLAIR COUNTY, ILLINOIS

Drawn By: SA	Checked By: FH	
Project No. 20211176.00	Date: 10/04/21	Figure 2.2



LEGEND

B-1 APPROXIMATE BORING LOCATION AND NUMBER

NOTE: THIS PLAN WAS PREPARED FROM AN IMAGE OBTAINED FROM GOOGLE EARTH ON 10/04/21.

NOT TO SCALE

TSI geotechnical, inc.
1340 NORTH PRICE ROAD
ST. LOUIS, MISSOURI 63132

SITE AND BORING LOCATION PLAN

I-55/I-70 BRIDGE OVER RAILROAD YARD
ST. CLAIR COUNTY, ILLINOIS

Drawn By: SA	Checked By: FH	
Project No. 20211176.00	Date: 10/04/21	Figure 2.3

APPENDIX B

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/18/21 Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-1N Logged by: J. Urton

Station: 74+50.95
Offset: -71.13
Latitude: N38°38'11.64467"
Longitude: W90°08'15.24356"
Ground Surface El.: 416.04 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: NE ft
Upon Completion: ft
After 336 Hours 416.0 ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Brown, CLAY			3	1.75	33.9
			3	P	
			4		
ST-2: FILL: Dark gray, CLAY, with gravel and cinders			-	3.0	16.7
			-		
			-		
		-5	-		
	(410.54)				
SS-3: FILL: Brown and gray, LOAM, trace brick			WH	0.25	34.7
			WH	P	
			WH		
	(408.04)				
SS-4: FILL: Reddish brown and gray, SANDY LOAM, with gravel			5	0.5	23.5
			6	P	
		-10	4		
	(404.04)				
SS-5: Brown, LOAM			7	-	14.1
			7	-	
		-15	7	-	
	(399.04)				
SS-6: Brown, very fine SAND			6	-	6.9
			9	-	
Boring terminated at 20 ft.	(396.04)	-20	10	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/17/21 Page: 1 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-1S Logged by: J. Urton

Station: 75+68.11
Offset: 66.91
Latitude: N38°38'11.83629"
Longitude: W90°08'12.97491"
Ground Surface El.: 413.59 ft

Surface Water Elev.: ____ ft
Groundwater Elev.
First Encounter: 395.6 ft
Upon Completion: ____ ft
After ____ Hours ____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: Fill: Dark gray, CLAY, trace gravel, cinders, brick fragments, and roots			3 2 1	0.75 P	39.6
SS-2: Dark gray, CLAY, trace gravel			WH 2 1	0.25 P	55.9
		-5			
ST-3: Dark gray, CLAY			- - - -	2.25 P	32.4
SS-4: Gray, with brown and black, CLAY (8.5'-9.1')	(404.49)		WH 2	1.25 P	31.4
Brown, fine SANDY CLAY (9.1'-10')		-10	4		
	(401.59)				
SS-5: Brown, SANDY LOAM			9 6 9	0.25 P	27.5
		-15			
	(396.59)				
SS-6: Brown, CLAY LOAM			4 4 4	0.25 P	31.9
		-20			

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
	(391.59)				
SS-7: Dark brown to brown, fine LOAMY SAND			9 8 6	- - -	25.6
		-25			
	(386.59)				
SS-8: Brown, fine to medium SAND, trace coarse sand			13 16 16	- - -	17.7
		-30			
SS-9: Brown and gray, fine to medium SAND, trace coarse sand			10 11 14	- - -	23.5
		-35			
	(376.59)				
SS-10: Gray, fine to medium SAND, trace gravel			14 11 12	- - -	22.4
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40 Structure No.: 082-0017 (Exist.) Date: 8/17/21 Page: 2 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-1S Logged by: J. Urton

Station: 75+68.11
Offset: 66.91
Latitude: N38°38'11.83629"
Longitude: W90°08'12.97491"
Ground Surface El.: 413.59 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 395.6 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
(371.59)					
SS-11: Gray, fine SAND			9	-	25.0
			10	-	
		-45	15	-	
SS-12: Gray, fine SAND, trace gravel			10	-	22.0
			11	-	
		-50	10	-	
SS-13: Gray, fine SAND (53.5'-54.3')			12	-	15.7
Gray, fine to coarse SAND, trace			10	-	
gravel (54.3'-55') (359.29)		-55	16	-	
(356.59)					
SS-14: Gray, fine SAND, trace gravel			17	-	19.8
			33	-	
		-60	29	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
(349.59)					
		-65			
SS-15: Gray, well-graded medium to			12	-	19.8
coarse SAND			17	-	
		-70	15	-	
(335.59)					
SS-16: Gray, LIMESTONE fragments,			31	-	15.1
with sand			18	-	
		-80	13	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/17/21 Page: 3 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-1S Logged by: J. Urton

Station: 75+68.11
Offset: 66.91
Latitude: N38°38'11.83629"
Longitude: W90°08'12.97491"
Ground Surface El.: 413.59 ft

Surface Water Elev.: ____ ft
Groundwater Elev.
First Encounter: 395.6 ft
Upon Completion: ____ ft
After ____ Hours ____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
(332.59)					
		-85			
SS-17: Brown, medium to coarse SAND,			14	-	17.1
trace gravel			18	-	
SHALE fragments at 90.0 ft.		-90	22	-	
		-95			
SS-18: Brown, medium to coarse SAND,			22	-	18.1
trace gravel			25	-	
Boring terminated at 100.0 ft. (313.59)		-100	42	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-105			
		-110			
		-115			
		-120			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/21/21 Page: 1 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railyard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-2N Logged by: J. Urton

Station: 76+73.61
Offset: -90.14
Latitude: N38°38'13.57596"
Longitude: W90°08'13.87480"
Ground Surface El.: 418.64 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 398.6 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Dark gray and brown, CLAY, sand lenses and cinders from 1.75 ft. to 2.0 ft.			3 2 2	1.75 P	27.2
SS-2: FILL: Dark gray, CLAY with cinders and sandy loam lenses			1 2 2	- - -	27.9
		-5			
ST-3: FILL: Dark gray, CLAY			- - -	2.0 P	23.0
	(410.64)		-		
SS-4: Brown and gray, CLAY			2 2 5	2.0 P	34.7
		-10			
ST-5: Brown, CLAY			- - - -	- - - -	22.0
		-15			
	(401.64)				
SS-6: Brown, SANDY CLAY LOAM			3 7 9	- - -	26.3
		-20			
	(396.64)				
SS-7: Dark gray, CLAY LOAM			3 2 1	0.25 P	28.6
		-25			
	(391.64)				
SS-8: Brown, SANDY LOAM			8 8 9	- - -	24.2
		-30			
SS-9: Brown and gray, SANDY LOAM			11 11 14	- - -	26.1
		-35			
	(381.64)				
SS-10: Dark gray, SANDY LOAM, trace gravel			11 14 16	- - -	19.7
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/21/21 Page: 2 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railyard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-2N Logged by: J. Urton

Station: 76+73.61
Offset: -90.14
Latitude: N38°38'13.57596"
Longitude: W90°08'13.87480"
Ground Surface El.: 418.64 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 398.6 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
(376.64)					
SS-11: Gray, fine grained SAND			10	-	21.8
			12	-	
		-45	12	-	
SS-12: Gray, fine grained SAND			10	-	29.4
			12	-	
		-50	23	-	
SS-13: Gray, fine grained SAND			24	-	26.7
			27	-	
		-55	29	-	
(361.64)					
SS-14: Brown, fine to medium grained SAND			29	-	30.4
			27	-	
Boring Terminated at 60.0 ft. (358.64)		-60	26	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-65			
		-70			
		-75			
		-80			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F,A,I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/20/21 Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railyard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-2S Logged by: J. Urton

Station: 77+56.51
Offset: 88.16
Latitude: N38°38'13.25899"
Longitude: W90°08'11.41976"
Ground Surface El.: 422.55 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 404.6 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1:FILL: Brown, CLAY			3	0.75	32.5
			6	P	
			7	-	
	(419.55)				
SS-2: FILL: Gray, SAND			1	1.5	38.0
			1	P	
		-5	1	-	
	(417.05)				
SS-3: FILL: Brown and gray, SILTY CLAY			WH	1.75	23.5
			1	P	
			3	-	
	(414.55)				
ST-4: FILL: Dark gray, CLAY			-	2.0	34.0
			-	P	
			-	-	
		-10	-	-	
	(410.55)				
SS-5: Dark gray and brown, CLAY, sand lenses present at the bottom of sampler			2	2.5	40.5
			3	P	
		-15	4	-	
	(405.55)				
SS-6: Brown, CLAY			1	0.25	36.7
			1	P	
Boring terminated at 20.0 ft.	(402.55)	-20	2	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/29/21 Page: 1 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-2.5 Logged by: J. Urton

Station: 78+71.77
Offset: -0.87
Latitude: N38°38'14.69592"
Longitude: W90°08'11.53205"
Ground Surface El.: 415.65 ft

Surface Water Elev.: ____ ft
Groundwater Elev.
First Encounter: 402.7 ft
Upon Completion: ____ ft
After ____ Hours ____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Black, CINDERS, trace glass, gravel and sand			5 5 4	-	15.6
SS-2: FILL: Black, CINDERS, trace glass, gravel and sand			1 1 1	-	28.1
		-5			
SS-3: FILL: Black, CINDERS, trace glass, gravel and sand (6.0'-6.3')	(409.35)		WH 2 2	1.25 P	27.8
FILL: Brown, SILTY CLAY, trace gravel (6.3'-7.5')	(407.65)				
ST-4: FILL: Brown, CLAY			- - -	2.0 P	36.0
		-10	-		
	(403.65)				
	(401.85)				
SS-5: Dark gray, CLAY (13.5'-13.8')			WH	0.25	43.1
Brown, SILTY CLAY (13.8'-15')			1 1	P	
		-15			
	(397.65)				
ST-6: Brown, fine SAND			-	-	5.6
Note: Appeared cohesive material in upper sample			- -		
		-20			

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
	(391.55)				
SS-7: Brown, fine SAND (23.5'-24.1')			10	-	30.6
Brown, SANDY LOAM (24.1'-25')			8		
		-25	8		
	(388.65)				
SS-8: Dark gray, fine SAND			5 6	-	26.4
		-30	8		
	(383.65)				
SS-9: Brown, LOAMY SAND			4	-	32.3
(33.5'-33.8')			10		
Dark-gray, fine SAND (33.8'-40')		-35	13		
SS-10: Dark gray, fine SAND			12 17	-	22.1
		-40	22		

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/29/21 Page: 2 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-2.5 Logged by: J. Urton

Station: 78+71.77
Offset: -0.87
Latitude: N38°38'14.69592"
Longitude: W90°08'11.53205"
Ground Surface El.: 415.65 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 402.7 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-11: Dark gray, fine SAND			15	-	25.9
			17	-	
		-45	15	-	
	(368.65)				
SS-12: Dark gray, LOAMY SAND			12	-	25.5
			16	-	
		-50	18	-	
	(363.65)				
SS-13: Dark gray, fine SAND			14	-	27.7
			10	-	
		-55	6	-	
	(358.65)				
SS-14: Dark gray, fine SAND, trace medium and coarse sand			22	-	18.8
			32	-	
Boring terminated at 60.0 ft.	(355.65)	-60	29	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/29/21 Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-3N Logged by: J. Urton

Station: 79+59.16
Offset: -75.38
Latitude: N38°38'15.82428"
Longitude: W90°08'11.69032"
Ground Surface El.: 414.19 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 396.2 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Dark gray, CLAY, trace sand, gravel and cinders			4 5 5	2.0 P	22.3
	(411.19)				
SS-2: FILL: Brown, SANDY CLAY, trace cinders and gravel			1 2 4	1.75 P	20.5
	(408.69)	-5			
SS-3: FILL: Dark gray, CLAY, trace sand and cinders			WH 5 50/0.5	1.75 P	36.2
	(406.19)				
ST-4: Brown, SILTY CLAY			- - -	2.0 P	23.1
	(402.19)	-10	-		
SS-5: Dark gray with brown, CLAY			WH WH WH	1.0 P	35.8
SS-6: Dark gray, CLAY, silty sand lenses at bottom sampler		-15			
			WH WH WH	1.0 P	46.5
Boring terminated at 20.0 ft.	(394.19)	-20			

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/28/21 Page: 1 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-3S Logged by: J. Urton

Station: 79+72.88
Offset: 77.62
Latitude: N38°38'15.08697"
Longitude: W90°08'09.99794"
Ground Surface El.: 414.52 ft

Surface Water Elev.: ____ ft
Groundwater Elev.
First Encounter: 406.5 ft
Upon Completion: ____ ft
After ____ Hours ____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Black, CINDERS, trace gravel and clay			4 2 1	0.75 P	12.3
SS-2: FILL: Black, CINDERS, trace to with gravel, trace clay and brick			2 2 4	- - -	17.3
		-5			
ST-3: FILL: Black, CINDERS, trace to with gravel, trace clay and brick			- - - -	- - - -	13.9
SS-4: FILL: Black, CINDERS, trace gravel and clay (8.5'-9.3')	(405.20)		1 WH	- -	45.2
Brown, SILT (9.3'-10')		-10	WH	-	
	(402.50)				
ST-5: Gray, CLAY, trace sand and gravel			- - - -	1.5 P	34.5
		-15			
	(397.50)				
SS-6: Dark gray, CLAY, sand lenses throughout			WH WH WH	1.25 P	42.8
		-20			

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
	(392.50)				
SS-7: Dark gray, SILTY CLAY			WH WH WH	0.5 P	42.9
		-25			
SS-8: Dark gray, SILTY CLAY (28.5'-29.4')	(385.10)		1 1	0.25 P	33.8
Dark-gray, fine SAND (29.4'-30')		-30	9		
SS-9: Dark gray, fine SAND			9 16 12	- -	25.9
		-35			
	(377.50)				
SS-10: Dark gray, SANDY LOAM			7 9 8	- -	27.1
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US4-_ Structure No.: 082-0017 (Exist.) Date: 9/28/21 Page: 2 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-3S Logged by: J. Urton

Station: 79+72.88
Offset: 77.62
Latitude: N38°38'15.08697"
Longitude: W90°08'09.99794"
Ground Surface El.: 414.52 ft

Surface Water Elev.: _____ ft
Groundwater Elev.
First Encounter: 406.5 ft
Upon Completion: _____ ft
After _____ Hours _____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-11: Gray, fine SANDY LOAM			9	-	29.3
			9	-	
		-45	9	-	
	(367.50)				
SS-12: Gray, fine SAND			9	-	21.8
			22	-	
		-50	20	-	
SS-13: Gray, fine SAND			15	-	22.1
			17	-	
		-55	18	-	
	(357.50)				
SS-14: Gray, fine SANDY LOAM			6	-	26.3
			5	-	
		-60	5	-	
	(352.50)				
SS-15: Gray, fine SAND, trace medium sand and gravel			21	-	20.6
			17	-	
		-65	13	-	
	(347.50)				
SS-16: Gray, well-graded SAND, trace gravel			12	-	18.2
			17	-	
		-70	20	-	
		-75			
SS-17: Gray, well-graded SAND, trace organics at bottom of sampler			9	-	16.2
			9	-	
		-80	12	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 9/28/21 Page: 3 of 3

Section: 85-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-3S Logged by: J. Urton

Station: 79+72.88
Offset: 77.62
Latitude: N38°38'15.08697"
Longitude: W90°08'09.99794"
Ground Surface El.: 414.52 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 406.5 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-85			
SS-18: Gray, well-graded SAND, trace gravel			13	-	17.2
			17	-	
		-90	17	-	
		-95			
SS-19: Gray, well-graded SAND, trace gravel (98.5'-98.8')			22	-	15.7
			27	-	
Brown, fine SAND (98.8'-100')		-100	35	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
Boring terminated at 100 ft.	(314.50)				

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70(I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/25/21 Page: 1 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-3.5 Logged by: J. Urton

Station: 81+04.54
Offset: -6.07
Latitude: N38°38'16.62834"
Longitude: W90°08'09.93853"
Ground Surface El.: 410.34 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 392.3 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Dark gray and brown, CLAY, trace gravel			1 2 3	2.75 P	23.0
	(407.34)				
SS-2: FILL: Gray, crushed LIMESTONE fragments, trace clay, silt, sand, and cinders (3.5'-4.6')			45 20 12	- - -	6.3
	(405.74)	-5			
Brown, SAND (4.6'-5.0')	(404.84)				
SS-3: FILL: Dark gray, SANDY LOAM			10 10 14	0.75 P	17.2
ST-4: FILL: Dark gray, SANDY LOAM, trace gravel and cinders			- - -	0.75 P	31.7
		-10	-		
SS-5: FILL: Dark gray, SANDY LOAM, trace brick, gravel, and cinders			1 3 4	- - -	13.3
		-15			
	(393.34)				
SS-6: FILL: Dark gray, SILT LOAM, with cinders (18.5'-19.0')			WH 2	- -	29.1
	(391.34)				
Dark gray, CLAY, trace gravel		-20	1	-	
(19.0'-19.2') Dark gray, LOAM					
(19.2'-20.0')					
	(388.34)				
SS-7: Dark gray, CLAY			WH 2 2	0.75 P	36.2
		-25			
SS-8: Dark gray, CLAY			WH WH WH	0.75 P	68.1
		-30			
SS-9: Dark gray, CLAY			WH WH WH	0.25 P	71.8
		-35			
	(373.34)				
SS-10: Dark gray, SANDY CLAY LOAM			WH	0.5	60.2
(38.5'-38.9')	(371.44)		WH	P	
Dark gray, CLAY (38.9'-40.0')		-40	WH		

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/25/21 Page: 2 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-3.5 Logged by: J. Urton

Station: 81+04.54
Offset: -6.07
Latitude: N38°38'16.62834"
Longitude: W90°08'09.93853"
Ground Surface El.: 410.34 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 392.3 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-11: Dark gray, CLAY (43.5'-44.7')			WH	0.25	74.6
	(365.64)		WH	P	
Dark gray, fine SAND (44.7'-45.0')		-45	3		
	(363.34)				
SS-12: Dark gray, fine to medium SAND			6	-	19.5
			11	-	
		-50	16	-	
	(358.34)				
SS-13: Dark gray, well-graded SAND, trace gravel			11	-	12.2
			16	-	
		-55	18	-	
SS-14: Dark gray, well-graded SAND, trace gravel			9	-	17.5
			6	-	
Boring terminated at 60.0 ft.	(350.34)	-60	6	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/16/21 Page: 1 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-4N Logged by: Shawn Abrahamsen

Station: 81+40.08
Offset: -71.27
Latitude: N38°38'17.28093"
Longitude: W90°08'10.36679"
Ground Surface El.: 407.90 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: NE ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: Brown and gray, CLAY, with gravel			2	1.25	6.0
			3	P	
			3		
	(404.90)				
SS-2: Brown and gray, CLAY LOAM, with gravel and crushed limestone			1	1.0	23.4
			3	P	
		-5	2		
	(402.40)				
SS-3: Brown and gray, SAND, trace gravel			1	-	17.9
			1	-	
			2	-	
SS-4: Brown, SAND			WH	-	13.7
			WH	-	
		-10	1	-	
	(395.90)				
SS-5: Brown and gray, SILTY CLAY			4	2.0	24.6
			4	P	
		-15	4		
	(390.90)				
SS-6: Gray, CLAY			WH	1.0	59.1
			2	P	
		-20	2		
SS-7: Gray, CLAY			WH	0.25	45.1
			WH	P	
		-25	WH		
SS-8: Gray, CLAY			WH	0.25	57.7
			WH	P	
		-30	WH		
SS-9: Gray, CLAY			WH	0.25	87.9
			WH	P	
		-35	WH		
SS-10: Gray, CLAY			WH	0.25	59.8
			WH	P	
		-40	WH		

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: (Exist.) Date: 8/16/21 Page: 2 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-4N Logged by: Shawn Abrahamsen

Station: 81+40.08
Offset: -71.27
Latitude: N38°38'17.28093"
Longitude: W90°08'10.36679"
Ground Surface El.: 407.90 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: NE ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-11: Gray, CLAY (43.5-44.2)			8	0.25	65.1
Gray, SAND, trace gravel (44.2-45.0)	(363.70)	-45	12 5	P	
	(360.90)				
SS-12: Gray, medium to coarse SAND			10	-	17.1
			14	-	
		-50	12	-	
SS-13: Brown, SAND			10	-	26.7
			7	-	
		-55	4	-	
SS-14: Gray, medium to coarse SAND, trace gravel			8	-	19.2
			8	-	
Boring terminated at 60.0 ft.	(347.90)	-60	9	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-65			
		-70			
		-75			
		-80			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/12/21 Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-4S Logged by: J. Urton

Station: 81+74.75
Offset: 72.84
Latitude: N38°38'16.76434"
Longitude: W90°08'08.61872"
Ground Surface El.: 406.82 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 388.8 ft
Upon Completion: ft
After 336 Hours 402.3 ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Dark brown, CLAY, with gravel			16 44 42	- - -	9.7
SS-2: FILL: Brown, CLAY, with gravel, (3.5'-4.3')	(402.50)		33 50	1.25 P	10.4
Gray, LIMESTONE fragments, (4.3'-5')	(401.30)	-5	7		
SS-3: Dark gray, CLAY, trace organics and gravel			1 1 2	1.25 P	41.2
ST-4: Dark gray and brown, CLAY, trace organics			- - - -	- - - -	43.9
	(394.80)	-10			
SS-5: Dark gray and brown, CLAY, (13.5'-14.4')			WH 1	1.0 P	28.8
Dark gray, CLAY LOAM, (14.4'-14.6')		-15	2		
Dark gray and brown, CLAY, (14.6'-15')					
SS-6: Brown, CLAY, (18.5'-18.7')	(388.10)				
Gray, SANDY LOAM, (18.7'-19.7')			1	-	31.4
Dark gray, CLAY, (19.7'-20')	(387.10)		2	-	
Boring terminated at 20.0 ft.	(386.80)	-20	1	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/11/21 Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-5N Logged by: J. Urton

Station: 84+31.68
Offset: -77.51
Latitude: N38°38'19.70022"
Longitude: W90°08'08.36751"
Ground Surface El.: 407.61 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 402.1 ft
Upon Completion: ft
After 336 Hours 400.9 ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Dark brown, SILTY LOAM, trace cinders, gravel, and organics			6 8 9	3.0 P	7.3
(404.60)					
SS-2: FILL: Dark brown, CLAY LOAM, trace gravel			2 4 3	2.25 P	9.9
		-5			
(402.10)					
SS-3: Brown, CLAY			1 1 2	- - -	27.0
SS-4: Dark gray, CLAY			1 2 1	1.25 P	30.8
		-10			
(395.60)					
SS-5: Dark gray, SILT			1 1 1	0.25 P	33.8
		-15			
(390.60)					
ST- 6: Gray, CLAY			- - -	0.5 P	46.0
Boring terminated at 20.0 ft. (387.60)		-20	-		

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/18/21 Page: 1 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-5S Logged by: J. Urton

Station: 84+45.67
Offset: 73.93
Latitude: N38°38'18.97370"
Longitude: W90°08'06.68945"
Ground Surface El.: 404.45 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 391.5 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Brown and gray, CLAY, trace brick, gravel, and organics			4 4 6	1.5 P	26.4
SS-2: FILL: Dark gray and brown, CLAY, trace gravel and bricks			3 2 3	1.5 P	29.3
		-5			
ST-3: FILL: Dark gray, CLAY, with gravel			- - - -	1.25 P	32.4
SS-4: FILL: Dark gray and brown, CLAY, trace brick			WH WH 1	2.0 P	33.1
		-10			
	(392.50)				
SS-5: Dark gray, SILTY CLAY LOAM			WH WH WH	0.5 P	32.0
		-15			
	(387.50)				
SS-6: Dark gray, CLAY			WH WH WH	0.25 P	67.2
		-20			
	(382.50)				
SS-7: Dark gray, SILTY CLAY			WH WH WH	0.25 P	23.8
SANDY CLAY LOAM seam at 24.0'		-25			
	(377.50)				
SS-8: Dark gray, CLAY			WH WH WH	0.5 P	75.2
		-30			
	(367.50)				
SS-9: Dark gray, CLAY			WH WH WH	0.5 P	66.2
		-35			
SS-10: Gray, well-graded SAND, trace gravel			WH 1 4	- - -	14.7
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/19/21 Page: 2 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-5S Logged by: J. Urton

Station: 84+45.67
Offset: 73.93
Latitude: N38°38'18.97370"
Longitude: W90°08'06.68945"
Ground Surface El.: 404.45 ft

Surface Water Elev.: ____ ft
Groundwater Elev.
First Encounter: 391.5 ft
Upon Completion: ____ ft
After ____ Hours ____ ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
	(362.50)				
SS-11: Dark gray, fine to medium SAND, trace gravel			9	-	20.8
			18	-	
Coal fragments parting at 44.5'		-45	16	-	
	(357.50)				
SS-12: Dark gray, well graded SAND, trace gravel			7	-	12.1
			6	-	
		-50	5	-	
	(352.50)				
SS-13: Dark gray, fine SAND			15	-	23.2
			19	-	
		-55	17	-	
	(347.50)				
SS-14: Dark gray, fine to medium SAND, trace gravel			9	-	17.1
			10	-	
		-60	12	-	
	(342.50)				
SS-15: Dark gray, fine SAND			13	-	24.8
			12	-	
		-65	11	-	
	(337.50)				
SS-16: Gray, fine to medium SAND, trace gravel			14	-	15.9
			14	-	
		-70	15	-	
	(332.50)				
SS-17: Gray, well-graded SAND, trace gravel			15	-	16.4
			17	-	
		-75	7	-	
SS-18: Gray, well-graded SAND, trace gravel			25	-	17.5
			24	-	
		-80	21	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/20/21 Page: 3 of 3

Section: 82-5VB-R-2 Description: I-55 I-70 over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-5S Logged by: J. Urton

Station: 84+45.67
Offset: 73.93
Latitude: N38°38'18.97370"
Longitude: W90°08'06.68945"
Ground Surface El.: 404.45 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 391.5 ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-19: Gray, well-graded SAND			16	-	17.4
			18	-	
		-85	18	-	
	(317.50)				
SS-20: Gray, fine SAND, trace gravel			18	-	20.4
			23	-	
		-90	25	-	
	(312.50)				
SS-21: Gray, fine to medium SAND, trace coarse sand and gravel			15	-	19.3
			23	-	
		-95	17	-	
	(307.50)				
SS-22: Gray, well-graded SAND, with gravel			23	-	11.3
			16	-	
Boring terminated at 100.0 ft.	(304.50)	-100	12	-	

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/12/21 Page: 1 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-6N Logged by: S. Abrahamsen

Station: 86+96.41
Offset: -70.21
Latitude: N38°38'21.82453"
Longitude: W90°08'06.41735"
Ground Surface El.: 409.01 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: NE ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Brown, CLAY, trace gravel and glass			2 3 3	2.5 P	24.4
	(405.00)				
SS-2: FILL: Brown and gray, CLAY, trace glass and plastic (3.5'-4')			3 19	4.5 P	17.3
Gray, crushed LIMESTONE (4'-4.42')	(404.60)	-5	19		
Brown, SILTY LOAM (4.42'-5.8')	(403.00)		9	4.5	18.7
SS-3: FILL: Brown and gray, SILTY LOAM (6'-6.9')	(402.10)		10 16	P	
FILL: Gray, crushed LIMESTONE (6.92'-7.50')	(405.00)				
			5 5	2.75 P	15.4
SS-4: Gray, CLAY, trace gravel		-10	4		
	(398.50)				
ST-5: Brown, CLAY LOAM			- - - -	1.25 P	21.2
	(396.00)				
	(395.30)				
SS-6: Gray, CLAY, trace gravel (13.5'-13.67')			1 1	0.25 P	29.2
Gray, SILTY LOAM (13.67'-15.0')		-15	1		
	(392.00)				
SS-7: Gray, CLAY LOAM (18.5'-19.5)			WH	1.0	60.6
Gray, SANDY LOAM (19.5'-20')			WH	P	
	(389.50)	-20	WH		

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
	(387.00)				
SS-8: Gray, CLAY LOAM			WH WH	- -	38.5
		-25	WH	-	
	(382.00)				
SS-9: Gray, CLAY			1 WH	- -	65.8
		-30	1	-	
SS-10: Gray, CLAY			WH WH	0.25 P	66.4
		-35	WH		
SS-11: Gray, CLAY			WH WH	1.0 P	66.7
		-40	WH		

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: 8/12/21 Page: 2 of 2

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" and Mud Rotary Hammer Type: **Auto SPT**

Boring No.: B-6N Logged by: Shawn Abrahamsen

Station: 86+91.75
Offset: 74.80
Latitude: N38°38'21.82453"
Longitude: W90°08'06.41735"
Ground Surface El.: 409.01 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: NE ft
Upon Completion: ft
After Hours ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
(367.00)					
SS-12: Gray, SAND, trace gravel			WH	-	15.8
			WH	-	
		-45	WH	-	
SS-13: Gray, SAND			9	-	20.9
			10	-	
		-50	16	-	
SS-14: Gray, SAND, trace gravel			8	-	12.4
			9	-	
		-55	12	-	
(352.00)					
SS-15: Gray, SANDY LOAM, trace gravel			14	-	18.0
			6	-	
Boring terminated at 60.0 ft. (349.00)		-60	5	-	

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-65			
		-70			
		-75			
		-80			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Soil Boring Log

Route: F.A.I 70 (I-55/I-64/US40) Structure No.: 082-0017 (Exist.) Date: Page: 1 of 1

Section: 82-5VB-R-2 Description: I-55 I-70 Over Railroad Yard in St. Clair County

County: St. Clair Drilling Method: HSA 3 1/4" Hammer Type: **Auto SPT**

Boring No.: B-6S Logged by: J. Urton

Station: 86+96.41
Offset: -70.21
Latitude: N38°38'20.98122"
Longitude: W90°08'04.93834"
Ground Surface El.: 407.26 ft

Surface Water Elev.: ft
Groundwater Elev.
First Encounter: 402.3 ft
Upon Completion: ft
After 336 Hours 403.0 ft

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
SS-1: FILL: Brown, SILTY LOAM, with gravel			7 7 4	2.5 P	4.4
SS-2: FILL: Dark gray, SILTY LOAM, with gravel		-5	22 42 17	2.75 P	8.2
	(401.80)				
SS-3: FILL: Dark brown, SANDY CLAY			11 12 2	2.75 P	15.4
	(399.30)				
SS-4: Gray, CLAY		-10	WH WH WH	1.25 P	30.8
	(395.30)				
ST-5: Gray, CLAY LOAM		-15	- - -	0.75 P	30.8
	(390.30)				
SS-6: Gray, SILTY CLAY, trace gravel		-20	WH WH WH	0.75 P	38.3
Boring terminated at 20.0 ft.	(387.30)				

Soil Type, Description & Observations	ELEV. (ft)	DEPTH (ft)	BLOWS /6 in.	U.C.S. Qu (tsf)	MOIST. (%)
		-25			
		-30			
		-35			
		-40			

The U.C.S. Qu column represents the Unconfined Compressive Strength using either the IDOT Rimac Test Procedure or AASHTO 208.
The Qu failure mode is indicated by B for Bulge or S for Shear. P is shown when sample disturbance only allows Penetrometer testing.
The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

GENERAL NOTES

The number of borings is based on: topographic and geologic factors; the magnitude of structure loading; the size, shape, and value of the structure; consequences of failure; and other factors. The type and sequence of sampling are selected to reduce the possibility of undiscovered anomalies and maintain drilling efficiency. Attempts are made to detect and/or identify occurrences during drilling and sampling such as the presence of water, boulders, gas, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation in resistance to driving split-spoon samplers, unusual odors, etc. However, lack of notation regarding these occurrences does not preclude their presence.

Although attempts are made to obtain stabilized groundwater levels, the levels shown on the Logs of Boring may not have stabilized, particularly in more impermeable cohesive soils. Consequently, the indicated groundwater levels may not represent present or future levels. Groundwater levels may vary significantly over time due to the effects of precipitation, infiltration, or other factors not evident at the time indicated.

Unless otherwise noted, soil classifications indicated on the Logs of Boring are based on visual observations and are not the result of classification tests. Although visual classifications are performed by experienced technicians or engineers, classifications so made may not be conclusive.

Generally, variations in texture less than one foot in thickness are described as layers within a stratum, while thicker zones are logged as individual strata. However, minor anomalies and changes of questionable lateral extent may appear only in the verbal description. The lines indicating changes in strata on the Logs of Boring are approximate boundaries only, as the actual material change may be between samples or may be a gradual transition.

Samples chosen for laboratory testing are selected in such a manner as to measure selected physical characteristics of each material encountered. However, as samples are recovered only intermittently and not all samples undergo a complete series of tests, the results of such tests may not conclusively represent the characteristics of all subsurface materials present.

NOTATION USED ON BORING LOGS

APPROXIMATE PROPORTIONS

TRACE	<15%
WITH	15-30%
MODIFIER	>30%

Clay or clayey may be used as major material or modifier, regardless of relative proportions, if the clay content is sufficient to dominate the soil properties.

PARTICLE SIZE

BOULDERS		>12 Inches
COBBLES		12 Inches – 3 Inches
GRAVEL		
	Coarse	3 Inches – ¾ Inch
	Fine	¾ Inch – No. 4 Sieve (4.750 mm)
SAND		
	Coarse	No. 4 – No. 10 Sieve (2.000 mm)
	Medium	No. 10 – No. 40 Sieve (0.420 mm)
	Fine	No. 40 – No. 200 Sieve (0.074 mm)
SILT		No. 200 Sieve - 0.002 mm
CLAY		< 0.002 mm

PENETRATION – BLOWS

Number of impacts of a 140-pound hammer falling a distance of 30 inches to cause a standard split-barrel sampler, 1 3/8 inches I.D., to penetrate a distance of 6 inches. The number of impacts for the first 6 inches of penetration is known as the seating drive. The sum of the impacts for the last 12 inches of penetration is the Standard Penetration Test Resistance or "N" value, blows per foot. For example, if blows = 6-8-9, "N" = 8+9 or 17.

OTHER NOTATIONS

Recovery % – length of recovered soil divided by length of sample attempted.

50/2"	Impacts of hammer to cause sampler to penetrate the indicated number of inches
WR	Sampler penetrated under the static loading of the weight of the drill rods
WH	Sampler penetrated under the static loading the weight of the hammer and drill rods
HSA	Hollow stem auger drilling method
FA	Flight auger drilling method
RW	Rotary wash drilling methods with drilling mud
AH	Automatic hammer used for Standard Penetration Test sample
SH	Safety hammer with rope and cathead used for Standard Penetration Test sample

GRAPHIC SYMBOLS


Depth at which groundwater was encountered during drilling


Depth at which groundwater was measured after drilling


Standard Penetration Test Sample, ASTM D1586


3-inch diameter Shelby Tube Sample, ASTM D1587

Sample grabbed from auger


NX Size rock core sample

APPENDIX C

TSi geotechnical, inc.

SUMMARY OF LABORATORY TESTING

PROJECT NAME: I-55/I-70 over Railroad Yard | Prepared By: SLY

CLIENT: Wiss, Janney, Elstner Associates | Checked By: AD

PROJECT NUMBER: 20211176.00

Boring Number	Sample Type and Number	Depth (feet)	Description and IDH Classification	Water Content (%)	Dry Density (pcf)	Undrained Shear Strength (tsf)	Atterberg Limits (LL/PI)	Passing #200 (%)	Additional Tests Performed / Comments
1N	SS-1	1.0 - 2.5	Brown, clay [Fill]	33.9					
-	ST-2	3.0 - 5.0	Dark gray, clay [Fill]	16.7		Disturbed	55/36		
-	SS-3	6.0 - 7.5	Brown and gray, loam [Fill]	34.7					
-	SS-4	8.5 - 10.0	Reddish-brown and gray, sandy loam [Fill]	23.5					
-	SS-5	13.5 - 15.0	Brown, loam	14.1				45.4	
-	SS-6	18.5 - 20.0	Brown, sand	6.9					
1S	SS-1	1.0 - 2.5	Dark gray, clay [Fill]	39.6					
-	SS-2	3.5 - 5.0	Dark gray, clay	55.9			104/77		
-	ST-3	6.0 - 8.0	Dark gray, clay	32.4	88.87	0.66			UU-triaxial
-	SS-4	8.5 - 10.0	Gray, clay	31.4			87/62		
-	SS-5	13.5 - 15.0	Brown, sandy loam	27.5				40.2	
-	SS-6	18.5 - 20.0	Brown, clay loam	31.9				59.8	
-	SS-7	23.5 - 25.0	Brown, loamy sand	25.6					
-	SS-8	28.5 - 30.0	Brown, sand	17.7					
-	SS-9	33.5 -35.0	Brown and gray, sand	23.5				6.1	
-	SS-10	38.5 - 40.0	Gray, sand	22.4					
-	SS-11	43.5 - 45.0	Gray, sand	25.0					
-	SS-12	48.5 - 50.0	Gray, sand	22.0					
-	SS-13	53.5-55.0	Gray, sand	15.7				5.9	
-	SS-14	58.5-60.0	Gray, sand	19.8					
-	SS-15	68.5-70.0	Gray, sand	19.8					
-	SS-16	78.5-80.0	Gray, limestone fragments	15.1					
-	SS-17	88.5-90.0	Brown, sand	17.1					
-	SS-18	98.5-100.0	Brown, sand	18.1					
2N	SS-1	1.0-2.5	Brown, clay (Fill)	27.2					
-	SS-2	3.5-5.0	Dark gray, clay (Fill)	27.9				62.8	
-	ST-3	6.0-8.0	Dark gray, clay (Fill)	23.0	91.6	0.44	94/71		UU-triaxial
-	SS-4	8.5-10.0	Brown and gray, clay	34.7				99.7	
-	ST-5	13.0-15.0	Brown, clay	22.0	88.4	0.53	85/63	99.3	UU-triaxial
-	SS-6	18.5-20.0	Brown, sandy clay loam	26.3				38.1	
-	SS-7	23.5-25.0	Dark gray, clay loam	28.6			27/7	69.4	
-	SS-8	28.5-30.0	Brown, sandy loam	24.2					
-	SS-9	33.5-35.0	Brown and gray, sandy loam	26.1				6.2	
-	SS-10	38.5-40.0	Dark gray, sandy loam	19.7					
-	SS-11	43.5-45.0	Gray, sand	21.8					
-	SS-12	48.5-50.0	Gray, sand	29.4				5.9	
-	SS-13	53.5-55.0	Gray, sand	26.7					
-	SS-14	58.5-60.0	Brown, sand	30.4					
2S	SS-1	1.0 - 2.5	Brown, clay (Fill)	32.5					
-	SS-2	3.5 - 5.0	Gray, sand (Fill)	38.0				17.2	
-	SS-3	6.0 - 7.5	Brown and gray, silty clay (Fill)	23.5				94.7	
-	ST-4	8.0-10.0	Dark gray, clay (Fill)	43.0	75.7	0.38	83/57		UU-triaxial
-	SS-5	13.5 - 15.0	Dark gray and brown, clay	40.5			99/77	98.8	
-	SS-6	18.5 - 20.0	Brown ,clay	36.7				76.9	

TSi geotechnical, inc.

SUMMARY OF LABORATORY TESTING

PROJECT NAME: I-55/I-70 over Railroad Yard | Prepared By: SLY

CLIENT: Wiss, Janney, Elstner Associates | Checked By: AD

PROJECT NUMBER: 20211176.00

Boring Number	Sample Type and Number	Depth (feet)	Description and IDH Classification	Water Content (%)	Dry Density (pcf)	Undrained Shear Strength (tsf)	Atterberg Limits (LL/PI)	Passing #200 (%)	Additional Tests Performed / Comments
2.5	SS-1	1.0-2.5	Black, cinders (Fill)	15.6					
-	SS-2	3.5-5.0	Black, cinders (Fill)	28.1				98.2	
-	SS-3	6.0-7.5	Brown, silty clay (Fill)	27.8				75.3	
-	ST-4	8.0-10.0	Brown, clay (Fill)	36.0	87.39	0.65	114/86		UU- triaxial
-	SS-5	13.5-15.0	Dark gray, clay	43.1			30/5	81.2	
-	ST-6	18.0-20.0	Brown, sand	5.6					
-	SS-7	23.5-25.0	Brown, sandy loam	30.6					
-	SS-8	28.5-30.0	Dark gray, sand	26.4					
-	SS-9	33.5-35.0	Brown, loamy sand	32.3					
-	SS-10	38.5-40.0	Dark gray, sand	22.1					
-	SS-11	43.5-45.0	Dark gray, sand	25.9					
-	SS-12	48.5-50.0	Dark gray, loamy sand	25.5					
-	SS-13	53.5-55.0	Dark gray, sand	27.7					
-	SS-14	58.0-60.0	Dark gray, sand	18.8					
3N	SS-1	1.0 - 2.5	Dark gray, clay (Fill)	22.3					
-	SS-2	3.5 - 5.0	Brown, sandy clay (Fill)	20.5					
-	SS-3	6.0 - 7.5	Dark gray, clay (Fill)	36.2					
-	ST-4	8.0-10.0	Brown, silty clay	23.1	102.99	0.32	30/9	85.8	UU-triaxial
-	SS-5	13.5 - 15.0	Dark gray, clay	35.8				97.7	
-	SS-6	18.5 - 20.0	Dark gray, clay	46.5				96.3	
3S	SS-1	1.0-2.5	Black, cinders	12.3					
-	SS-2	3.5-5.0	Black, cinders	17.3					
-	ST-3	6.0-8.0	Black, cinders	13.9		Disturbed			
-	SS-4	8.5-10.0	Brown, silt	45.2				50.2	
-	ST-5	13.0-15.0	Gray, clay	34.5	88.3	0.71	91/70	95.8	UU-triaxial
-	SS-6	18.5-20.0	Dark gray, clay	42.8				98.9	
-	SS-7	23.5-25.0	Dark gray, silty clay	42.9			45/25	91.8	
-	SS-8	28.5-30.0	Dark gray, silty clay	33.8					
-	SS-9	33.5-35.0	Dark gray, sand	25.9					
-	SS-10	38.5-40.0	Dark gray, sandy loam	27.1					
-	SS-11	43.5-45.0	Gray, sandy loam	29.3					
-	SS-12	48.5-50.0	Gray, sand	21.8					
-	SS-13	53.5-55.0	Gray, sand	22.1					
-	SS-14	58.5-60.0	Gray, sandy loam	26.3					
-	SS-15	63.5-65.0	Gray, sand	20.6					
-	SS-16	68.5-70.0	Gray, sand	18.2					
-	SS-17	78.5-80.0	Gray, sand	16.2					
-	SS-18	88.5-90.0	Gray, sand	17.2					
-	SS-19	98.5-100.0	Gray, sand	15.7					

TSi geotechnical, inc.

SUMMARY OF LABORATORY TESTING

PROJECT NAME: I-55/I-70 over Railroad Yard — Prepared By: SLY

CLIENT: Wiss, Janney, Elstner Associates — Checked By: AD

PROJECT NUMBER: 20211176.00

Boring Number	Sample Type and Number	Depth (feet)	Description and IDH Classification	Water Content (%)	Dry Density (pcf)	Undrained Shear Strength (tsf)	Atterberg Limits (LL/PI)	Passing #200 (%)	Additional Tests Performed / Comments
3.5	SS-1	1.0 - 2.5	Dark gray and brown, clay [Fill]	23.0					
-	SS-2	3.5 - 5.0	Gray, crushed limestone [Fill]	6.3				14.7	
-	SS-3	6.0 - 7.5	Dark gray, sandy loam [Fill]	17.2					
-	ST-4	8.0-10.0	Dark gray, sandy loam [Fill]	31.7		Disturbed		20.4	
-	SS-5	13.5 - 15.0	Dark gray, sandy loam [Fill]	13.3					
-	SS-6	18.5 - 20.0	Dark gray, loam [Fill]	29.1				50.5	
-	SS-7	23.5-25.0	Dark gray, clay	36.2					
-	SS-8	28.5-30.0	Dark gray, clay	68.1			64/46		Hydrometer
-	SS-9	33.5-35.0	Dark gray, clay	71.8					
-	SS-10	38.5-40.0	Dark gray, clay	60.2				87.5	
-	SS-11	43.5-45.0	Dark gray, clay	74.6					
-	SS-12	48.5-50.0	Dark gray, sand	19.5					
-	SS-13	53.5-55.0	Dark gray, sand	12.2					
-	SS-14	58.5-60.0	Dark gray, sand	17.5					
4N	SS-1	1.0 - 2.5	Brown and gray, clay	6.0					
-	SS-2	3.5 - 5.0	Brown and gray, clay loam	23.4			29/13		
-	SS-3	6.0-7.5	Brown and gray, sand	17.9				19.1	
-	SS-4	8.5-10.0	Brown, sand	13.7				13.3	
-	SS-5	13.5-15.0	Brown and gray, silty clay	24.6					
-	SS-6	18.5-20.0	Gray, clay	59.1					
-	SS-7	23.5-25.0	Gray, clay	45.1			49/30		
-	SS-8	28.5-30.0	Gray, clay	57.7					
-	SS-9	33.5-35.0	Gray, clay	87.9					
-	SS-10	38.5-40.0	Gray, clay	59.8			63/42		
-	SS-11	43.5-45.0	Gray, clay	65.1					
-	SS-12	48.5-50.0	Gray, sand	17.1					
-	SS-13	53.5-55.0	Brown, sand	26.7				6.4	
-	SS-14	58.5-60.0	Gray, sand	19.2					
4S	SS-1	1.0 - 2.5	Dark brown, clay (Fill)	9.7					
-	SS-2	3.5 - 5.0	Brown, clay [Fill]	10.4					
-	SS-3	6.0 - 7.5	Dark gray, clay	41.2				94.4	
-	ST-4	8.0-10.0	Dark gray and brown, clay	43.9	78.4		22/0		Consol
-	SS-5	13.5 - 15.0	Dark gray and brown, clay	28.8				98.1	
	SS-6	18.5 - 20.0	Gray, sandy loam	31.4				32.8	

TSI geotechnical, inc.

SUMMARY OF LABORATORY TESTING

PROJECT NAME: I-55/I-70 over Railroad Yard | Prepared By: SLY

CLIENT: Wiss, Janney, Elstner Associates | Checked By: AD

PROJECT NUMBER: 20211176.00

Boring Number	Sample Type and Number	Depth (feet)	Description and IDH Classification	Water Content (%)	Dry Density (pcf)	Undrained Shear Strength (tsf)	Atterberg Limits (LL/PI)	Passing #200 (%)	Additional Tests Performed / Comments
5N	SS-1	1.0 - 2.5	Dark brown, silty loam (Fill)	7.3					
-	SS-2	3.5 - 5.0	Dark brown, clay loam (Fill)	9.9				57.5	
-	SS-3	6.0-7.5	Brown, clay	27.0				73.3	
-	SS-4	8.5-10.0	Dark gray, clay	30.8				77.5	
-	SS-5	13.5-15.0	Dark gray, silt	33.8			25/2	88.4	
-	ST-6	18.0-20.0	Gray, clay	46.0	75.1		54/38		Consol
5S	SS-1	1.0 - 2.5	Brown and gray, clay (Fill)	26.4					
-	SS-2	3.5 -5.0	Brown and dark gray, clay (Fill)	29.3			57/41		
-	ST-3	6.0-8.0	Dark gray, clay(Fill)	32.4	88.87	0.66			UU-triaxial
-	SS-4	8.5 - 10.0	Brown and dark gray, clay (Fill)	33.1				89.1	
-	SS-5	13.5 - 15.0	Dark gray, silty clay loam	32.0				79.4	
-	SS-6	18.5 - 20.0	Dark gray, clay	67.2					
-	SS-7	23.5 - 25.0	Dark gray, silty clay	23.8					
-	SS-8	28.5 - 30.0	Dark gray, clay	75.2					
-	SS-9	33.5 - 35.0	Dark gray, clay	66.2				99.1	
-	SS-10	38.5-40.0	Gray, sand	14.7					
-	SS-11	43.5 - 45.0	Dark gray, sand	20.8					
-	SS-12	48.5 - 50.0	Dark gray, sand	12.1					
-	SS-13	53.5 - 55.0	Dark gray, sand	23.2				5.5	
-	SS-14	58.5 - 60.0	Dark gray, sand	17.1					
-	SS-15	63.5 - 65.0	Dark gray, sand	24.8					
-	SS-16	68.5 - 70.0	Gray, sand	15.9					
-	SS-17	73.5 - 75.0	Gray, sand	16.4					
-	SS-18	78.5 - 80.0	Gray, sand	17.5				3.9	
-	SS-19	83.5 - 85.0	Gray, sand	17.4					
-	SS-20	88.5 - 90.0	Gray, sand	20.4					
-	SS-21	93.5 - 95.0	Gray, sand	19.3					
-	SS-22	98.5 - 100.0	Gray, sand	11.3					

TSi geotechnical, inc.

SUMMARY OF LABORATORY TESTING

PROJECT NAME: I-55/I-70 over Railroad Yard | Prepared By: SLY

CLIENT: Wiss, Janney, Elstner Associates | Checked By: AD

PROJECT NUMBER: 20211176.00

Boring Number	Sample Type and Number	Depth (feet)	Description and IDH Classification	Water Content (%)	Dry Density (pcf)	Undrained Shear Strength (tsf)	Atterberg Limits (LL/PI)	Passing #200 (%)	Additional Tests Performed / Comments
6N	SS-1	1.0 - 2.5	Brown, clay (Fill)	24.4					
-	SS-2	3.5 - 5.0	Brown, silty loam (Fill)	17.3					
-	SS-3	6.0 - 7.5	Brown and gray, silty loam	18.7			24/3	62.4	
-	SS-4	8.5-10.0	Gray, clay	15.4					
-	ST-5	8.0-10.1	Brown, clay loam	21.2	100.97	0.45			UU-triaxial
-	SS-6	13.5 - 15.0	Gray, silty loam	29.2			24/3	95.4	
-	SS-7	18.5 - 20.0	Gray, clay loam	60.6				66.1	
-	SS-8	23.5-25.0	Gray, clay loam	38.5				70.6	
-	SS-9	28.5-30.0	Gray, clay	65.8					
-	SS-10	33.5-35.0	Gray, clay	66.4			62/42		
-	SS-11	38.5-40.0	Gray, clay	66.7					
-	SS-12	43.5-45.0	Gray, sand	15.8					
-	SS-13	48.5-50.0	Gray, sand	20.9					
-	SS-14	53.5-55.0	Gray, sand	12.4				6.1	
-	SS-15	58.5-60.0	Gray, sandy loam	18.0					
6S	SS-1	1.0 - 2.5	Brown, silty loam (Fill)	4.4					
-	SS-2	3.5 - 5.0	Dark gray, silty loam (Fill)	8.2					
-	SS-3	6.0-7.5	Dark brown, sandy clay (Fill)	15.4					
-	SS-4	8.5-10.0	Gray, clay	30.8			40/24		
-	ST-5	13.0 - 15.0	Gray, clay loam	30.8	87.31	0.45			UU-triaxial
-	SS-6	18.5-20.0	Gray, silty clay	38.3				88.4	

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

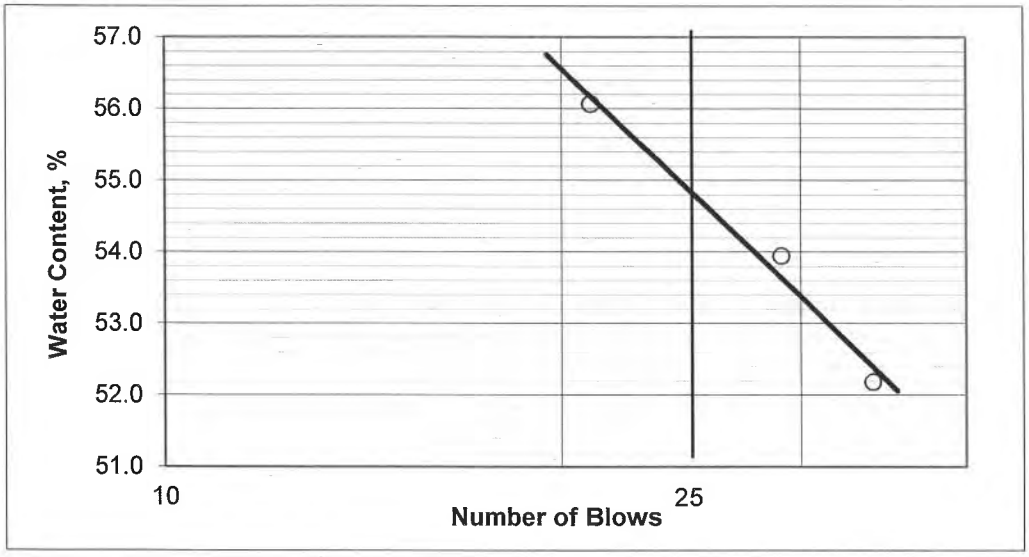
Project Number 20211176 Date:

Boring # B-1 N Sample # ST-2-2 Depth 3.5 - 4.0

Visual Classification: _Brown, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	KW7	IK3	D64	
Tare Plus Wet Soil, g	12.61	11.34	10.87	
Tare Plus Dry Soil, g	8.36	7.65	7.41	
Water, g	4.25	3.69	3.46	
Tare, g	0.78	0.81	0.78	
Dry Soil, g	7.58	6.84	6.63	
Water content, %	56.07	53.95	52.19	
Number of Blows	21	29	34	



LL 55.0
PL 19.0
PI 36

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	ZN1	AD3					
Tare Plus Wet Soil, g	6.48	6.51					
Tare Plus Dry Soil, g	5.56	5.59					
Water, g	0.92	0.92					
Tare, g	0.74	0.79					
Dry Soil, g	4.82	4.80					
Water content, %	19.09	19.17					
Plastic Limit	19						

Remarks

Technician JC Computed By SY Checked By AD

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-1N Sample: SS-5
Depth: 13.5 - 15.0
Visual: Brown, LOAM
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

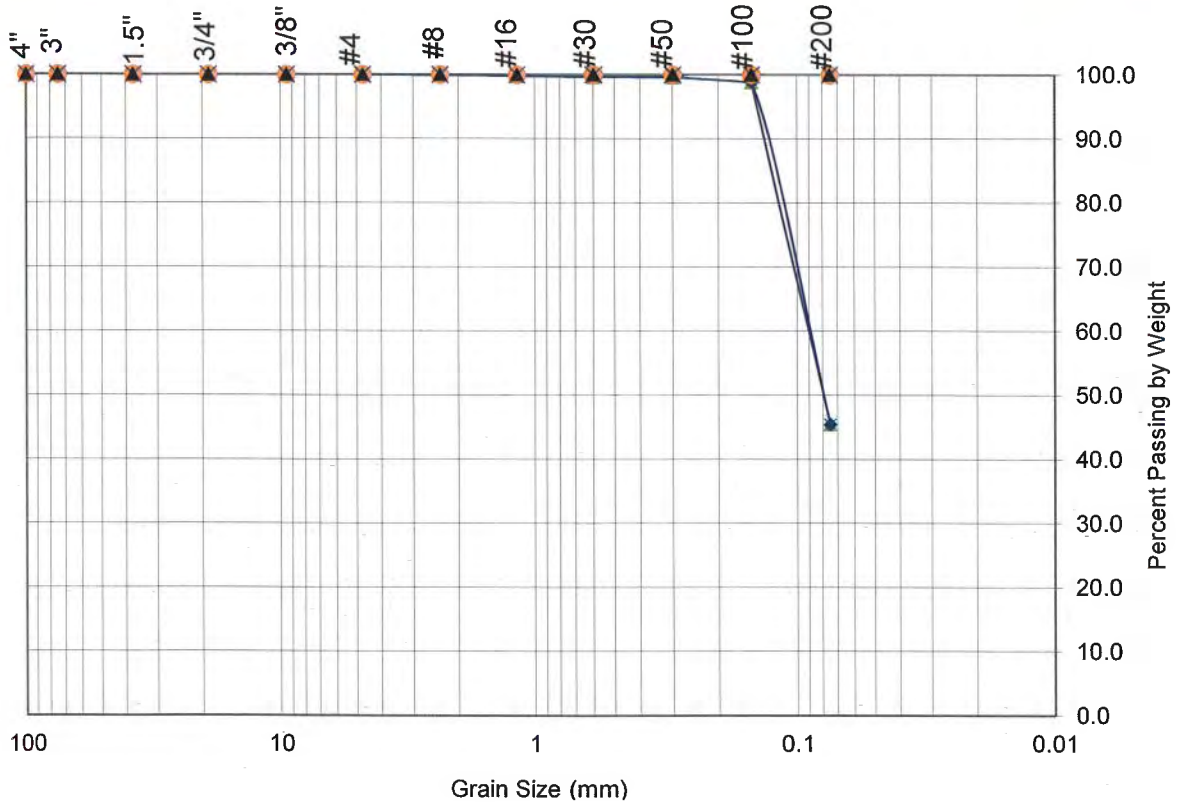
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.12**	**0.12**	**99.9**
16	0.00	0.00	**0.14**	**0.26**	**99.8**
30	0.00		**0.15**	**0.41**	**99.7**
50	0.00	0.00	**0.07**	**0.48**	**99.6**
100	0.00	0.00	**0.90**	**1.38**	**98.8**
200	0.00	0.00	**63.17**	**64.55**	**45.4**
PAN	0.00	0.00	**11.06**	**75.61**	

Moisture Content

Tare No.	
Wet Wt.	204.56
Dry Wt.	192.89
Tare Wt.	74.56
%	9.9

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	204.56	150.43
Tare	74.56	74.56
Sample Wt.	**130.00**	**75.87**
Minus 200 Wt		**42.46**
Dry Weight	**118.33**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

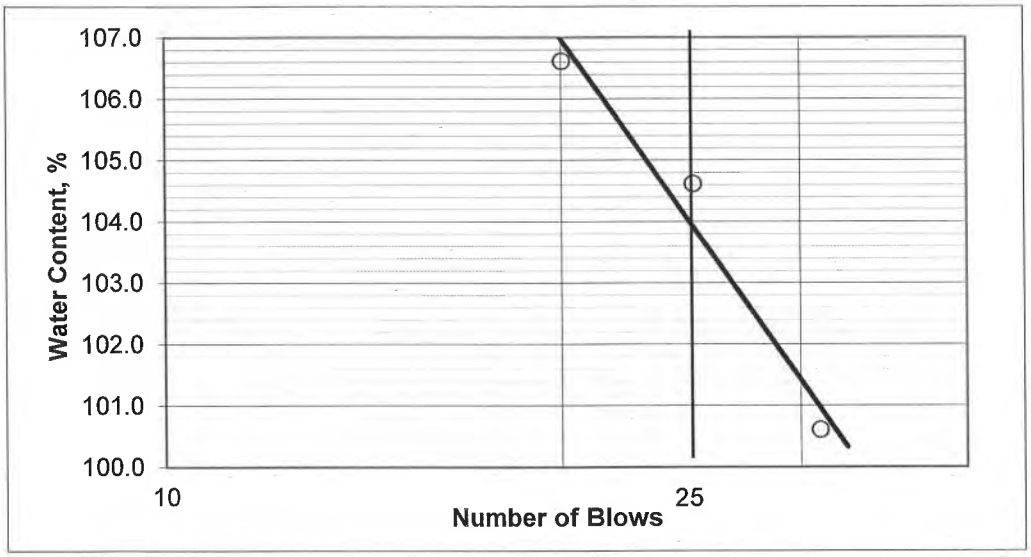
Project Number 20211176 Date:

Boring # B-1 S Sample # SS-2 Depth 3.5 - 5.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	A03	JM4	JC5	
Tare Plus Wet Soil, g	10.68	11.85	12.36	
Tare Plus Dry Soil, g	5.72	6.19	6.40	
Water, g	4.96	5.66	5.96	
Tare, g	0.79	0.78	0.81	
Dry Soil, g	4.93	5.41	5.59	
Water content, %	100.61	104.62	106.62	
Number of Blows	31	25	20	



LL 104.0
PL 27.0
PI 77

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	QX1	FME5					
Tare Plus Wet Soil, g	6.29	6.31					
Tare Plus Dry Soil, g	5.13	5.11					
Water, g	1.16	1.20					
Tare, g	0.83	0.77					
Dry Soil, g	4.30	4.34					
Water content, %	26.98	27.65					
Plastic Limit	27						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD 9-10-2021
Boring No.	B-1S	Sample No.	ST-3
Depth	7.0 - 7.5		

Soil Description **Gray, CLAY**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	33.15	gm
Dry & Tare	25.66	gm
Tare	2.57	gm
Water Content	32.4	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	71.92	mm
Height	146.36	mm
Wet Weight	1121.52	gm
Volume	594.58	cc
L:D Ratio	2.04	
Wet Density	117.70	pcf
Dry Density	88.87	pcf
Water Content	32.4	%
Saturation	98	%
Void Ratio	0.90	

Instrument Constants

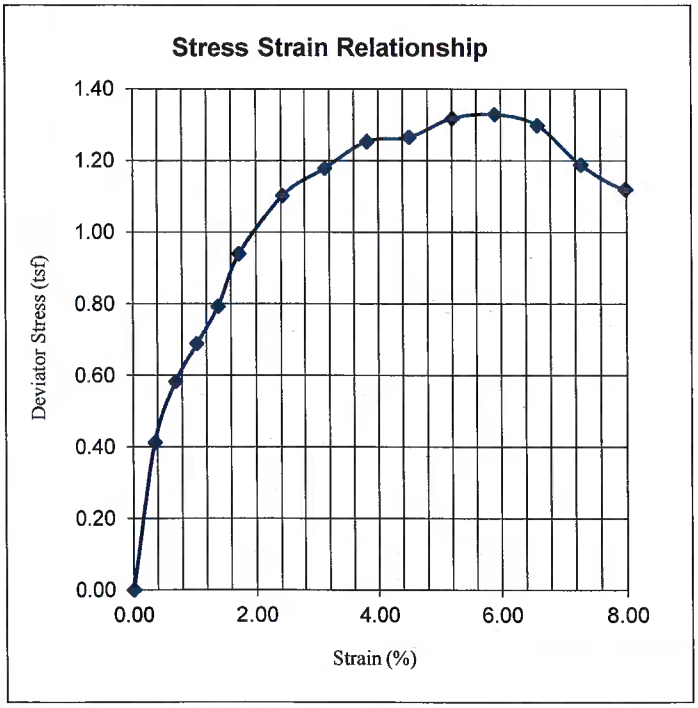
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Confining Pressure (psi): 5.0

Undrained Shear Strength (tsf): 0.66

Axial Strain (%): 5.9



PROJECT NAME: I-55/I-70 over railroad yard

PROJECT No.: 20211176.00

BORING NO.	B-1S
SAMPLE NO.	ST-3-3
SAMPLE DEPTH (ft)	7.0 - 7.5
RECOVERY (%)	0
VISUAL CLASS. (USCS)	CLAY

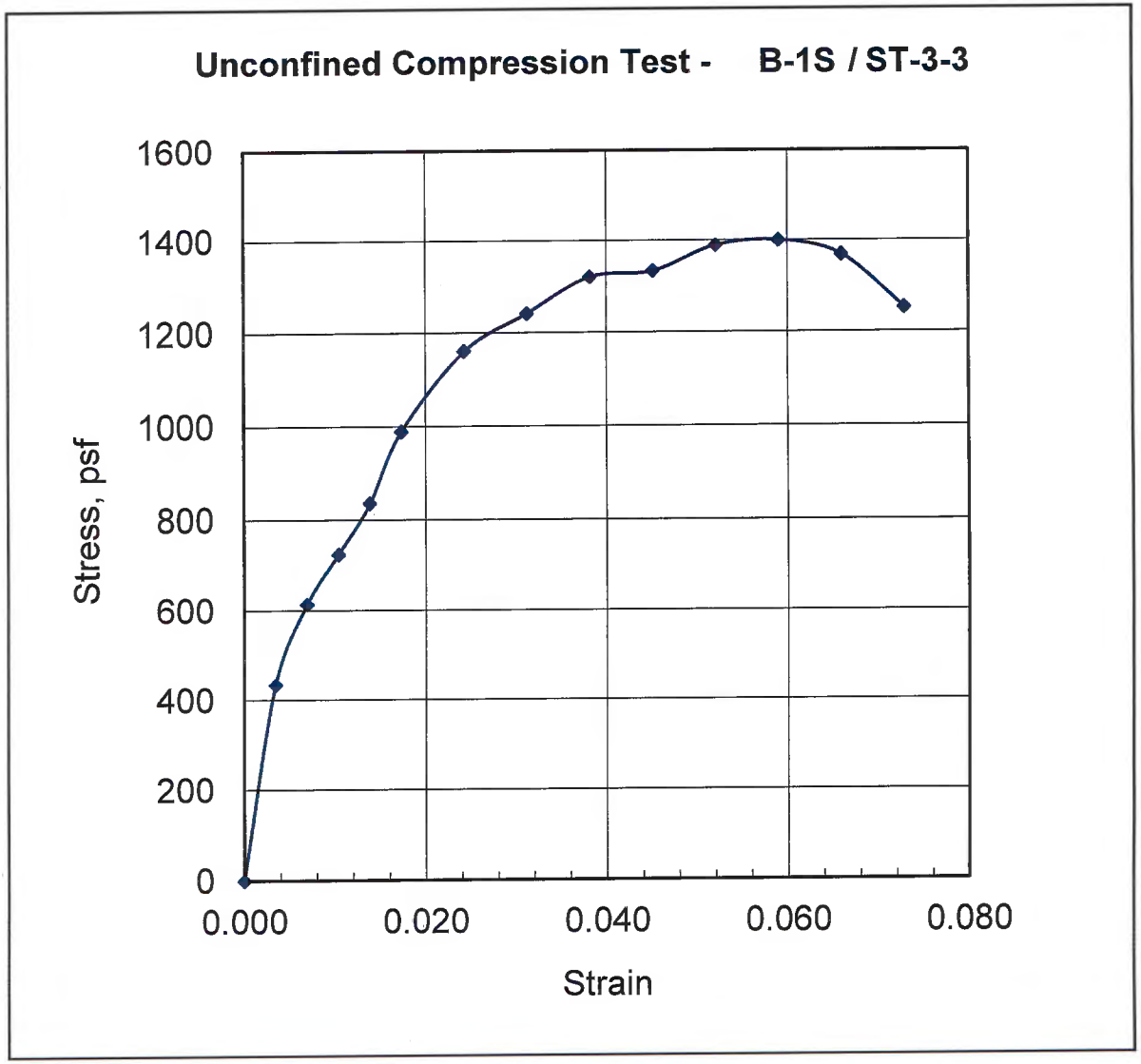
SPECIFICATIONS	
Unconfined Compression	ASTM D2166
Atterberg Limits	ASTM D4318
VISUAL CLASS. (USCS)	ASTM D2488

ATTERBERG LIMITS	
Liquid Limit	
Plastic Limit	
Plasticity Index	
CLASSIFICATION. (USCS)	

DENSITY & MOISTURE	
Wet unit weight (pcf)	117.9
Moisture content (%)	32.8
Dry unit weight (pcf)	88.8

STRENGTH	
Undrained Shear Strength S_u (tsf)	0.35
% Strain at q_u	5.9%

Tested by: SY	1/0/1900
Calculated by: SY	9/10/2021
Checked by: AD	



Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

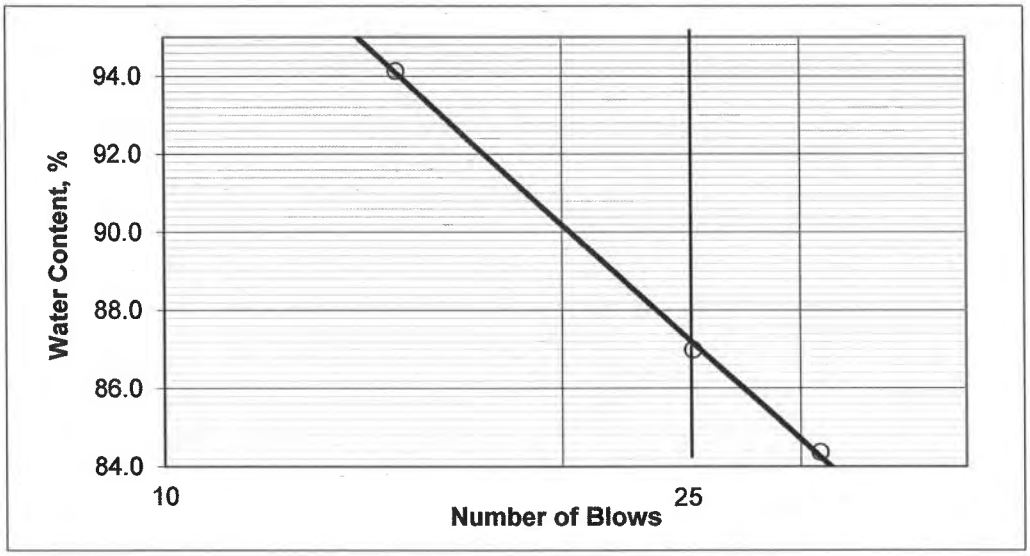
Project Number 20211176 Date:

Boring # B-1 S Sample # SS-4 Depth 8.5 - 10.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	74	5	54	
Tare Plus Wet Soil, g	10.22	11.44	12.74	
Tare Plus Dry Soil, g	5.90	6.49	6.96	
Water, g	4.32	4.95	5.78	
Tare, g	0.78	0.80	0.82	
Dry Soil, g	5.12	5.69	6.14	
Water content, %	84.38	86.99	94.14	
Number of Blows	31	25	15	



LL 87.0
PL 25.0
PI 62

Symbol from plasticity chart
CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	60	65					
Tare Plus Wet Soil, g	6.21	6.23					
Tare Plus Dry Soil, g	5.13	5.15					
Water, g	1.08	1.08					
Tare, g	0.80	0.79					
Dry Soil, g	4.33	4.36					
Water content, %	24.94	24.77					
Plastic Limit	25						

Remarks

Technician JC Computed By SY Checked By AD

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-1S Sample: SS-5
Depth: 13.5-15
Visual: Brown, SANDY LOAM
Tested by: PCS- 9/13/2021
Checked by:

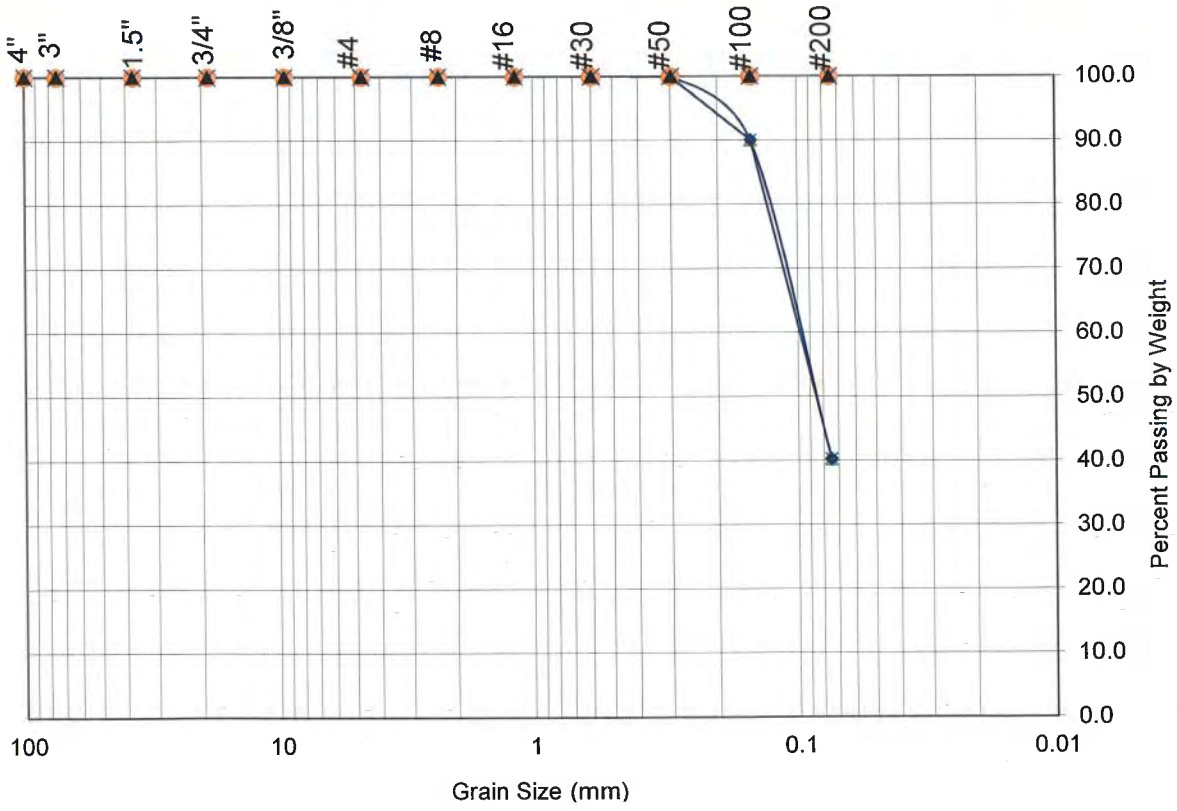
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.00**	**0.00**	**100.0**
30	0.00	0.00	**0.01**	**0.01**	**100.0**
50	0.00	0.00	**0.11**	**0.12**	**99.9**
100	0.00	0.00	**16.32**	**16.44**	**90.0**
200	0.00	0.00	**82.24**	**98.68**	**40.2**
PAN	0.00	0.00	**5.45**	**104.13**	

Moisture Content

Tare No.	
Wet Wt.	282.74
Dry Wt.	252.30
Tare Wt.	87.15
%	18.4

No. 200 Sieve Washing Data

	before-wet	**after-dry**
Sample & Tare	282.74	191.28
Tare	87.15	87.15
Sample Wt.	**195.59**	**104.13**
Minus 200 Wt		**61.02**
Dry Weight	**165.15**	



TSi Geotechnical, Inc.

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-1S Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Brown, clay loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.31	271.41	227.48	141.83	85.65	143.17	59.8%

Comments:

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-1S Sample: SS-9
Depth: 33.5-35
Visual: Brown and gray, SAND
Tested by: PCS - 9/13/2021
Checked by:

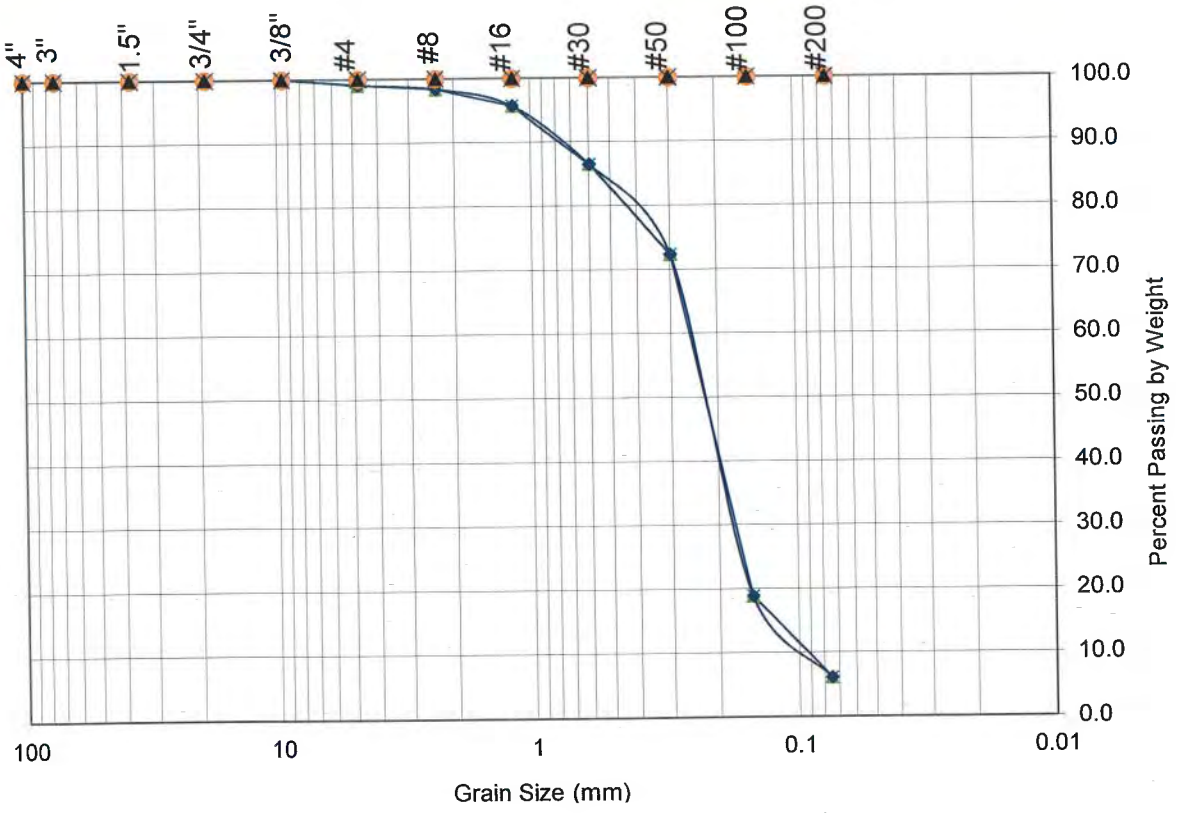
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**2.44**	**2.44**	**99.1**
8	0.00	0.00	**1.79**	**4.23**	**98.4**
16	0.00	0.00	**6.98**	**11.21**	**95.7**
30	0.00	0.00	**24.13**	**35.34**	**86.5**
50	0.00	0.00	**37.22**	**72.56**	**72.3**
100	0.00	0.00	**140.38**	**212.94**	**18.8**
200	0.00	0.00	**33.44**	**246.38**	**6.1**
PAN	0.00	0.00	**0.96**	**247.34**	

Moisture Content

Tare No.	
Wet Wt.	405.69
Dry Wt.	347.71
Tare Wt.	85.34
%	22.1

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	405.69	333.09
Tare	85.34	85.34
Sample Wt.	**320.35**	**247.75**
Minus 200 Wt		**14.62**
Dry Weight	**262.37**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-1S
Sample: SS-13
Depth: 53.5-55
Visual: Gray, SAND
Tested by: PCS- 9/13/2021
Checked by:

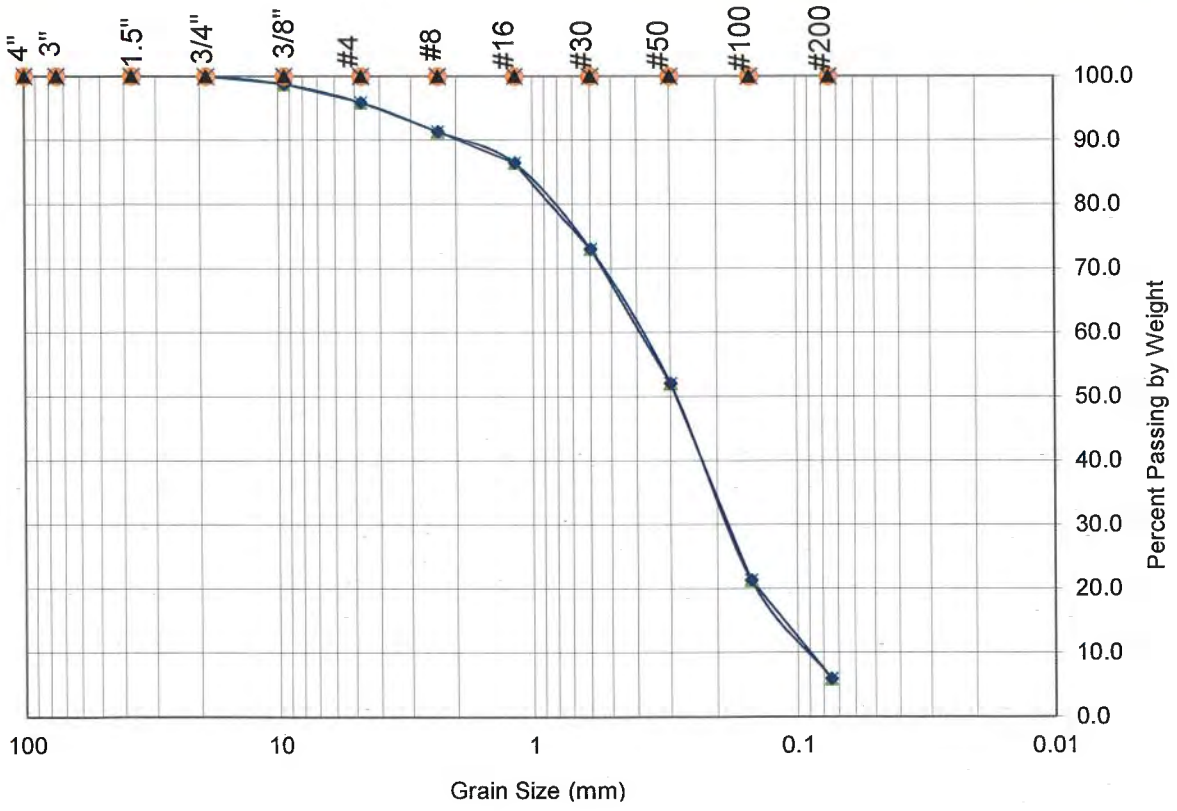
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**2.56**	**2.56**	**98.8**
4	0.00	0.00	**5.88**	**8.44**	**95.9**
8	0.00	0.00	**9.44**	**17.88**	**91.4**
16	0.00	0.00	**10.11**	**27.99**	**86.5**
30	0.00	0.00	**27.72**	**55.71**	**73.1**
50	0.00	0.00	**43.47**	**99.18**	**52.0**
100	0.00	0.00	**63.55**	**162.73**	**21.3**
200	0.00	0.00	**31.82**	**194.55**	**5.9**
PAN	0.00	0.00	**0.10**	**194.65**	

Moisture Content

Tare No.	
Wet Wt.	332.74
Dry Wt.	292.09
Tare Wt.	85.25
%	19.7

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	332.74	280.11
Tare	85.25	85.25
Sample Wt.	**247.49**	**194.86**
Minus 200 Wt		**11.98**
Dry Weight	**206.84**	



TSi Geotechnical, Inc.

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2N Sample No.: SS-2
Depth: 3.5 - 5.0
Visual: Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.88	148.67	136.95	104.88	32.07	51.07	62.8%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

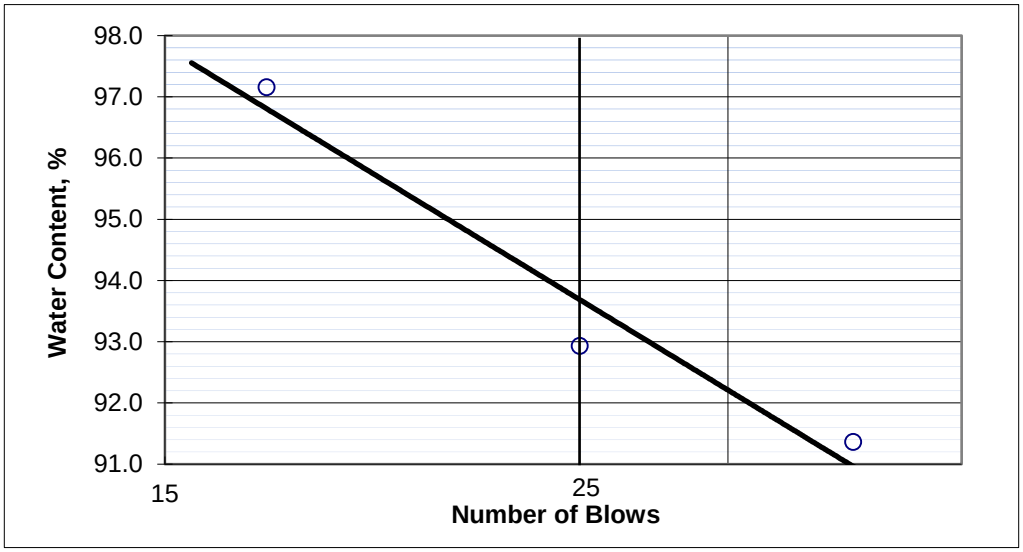
Project Number 20211176 Date:

Boring # B2N Sample # ST-3-3 Depth 7.0-7.5

Visual Classification: _Gray_

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	MUJ3	LK3	CP3	
Tare Plus Wet Soil, g	10.34	11.45	12.56	
Tare Plus Dry Soil, g	5.79	6.32	6.75	
Water, g	4.55	5.13	5.81	
Tare, g	0.81	0.80	0.77	
Dry Soil, g	4.98	5.52	5.98	
Water content, %	91.37	92.93	97.16	
Number of Blows	35	25	17	



LL	94.0
PL	23.0
PI	71
Symbol from plasticity chart	CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	MK4	GE2					
Tare Plus Wet Soil, g	6.13	6.14					
Tare Plus Dry Soil, g	5.11	5.16					
Water, g	1.02	0.98					
Tare, g	0.81	0.83					
Dry Soil, g	4.30	4.33					
Water content, %	23.72	22.63					
Plastic Limit	23						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD
Boring No.	B2N	Sample No.	ST-3-3
Depth	7.0-7.5		

Soil Description **Brow&Gray,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	44.38	gm
Dry & Tare	35.55	gm
Tare	2.58	gm
Water Content	26.8	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	70.79	mm
Height	144.71	mm
Wet Weight	1059.95	gm
Volume	569.55	cc
L:D Ratio	2.04	
Wet Density	116.13	pcf
Dry Density	91.60	pcf
Water Content	26.8	%
Saturation	86	%
Void Ratio	0.84	

Instrument Constants

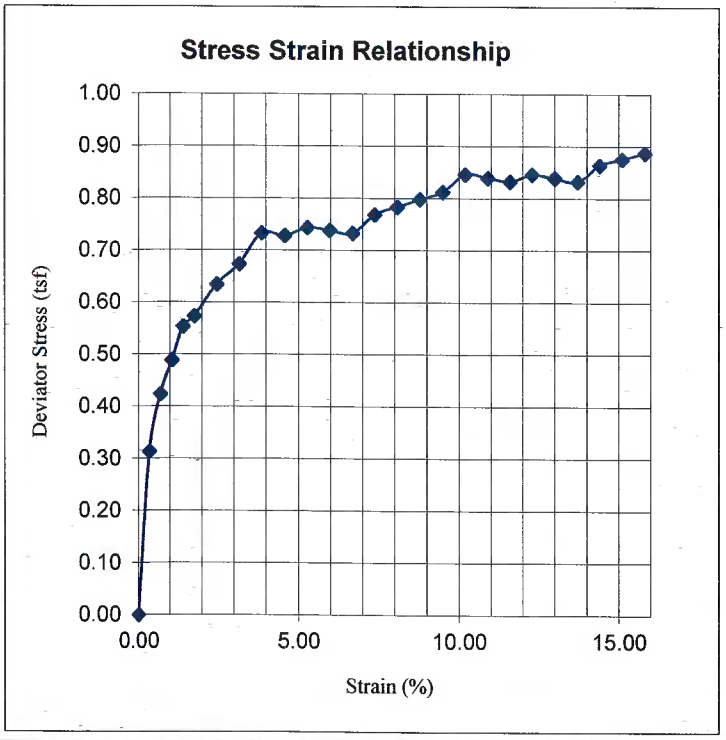
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.99	%/min

Failure Mode: Bulge

Confining Pressure (psi): 5.8

Undrained Shear Strength (tsf): 0.44

Axial Strain (%): 15.0



TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2N Sample No.: SS-4
Depth: 8.5 - 10.0
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
87.43	244.45	199.77	87.76	112.01	112.34	99.7%

Comments:

TSi geotechnical.inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B2N Sample No.: ST-5-2
Depth: 13.5-14.0
Visual: Brown&Gray

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
86.27	267.95	216.35	87.21	129.14	130.08	99.3%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

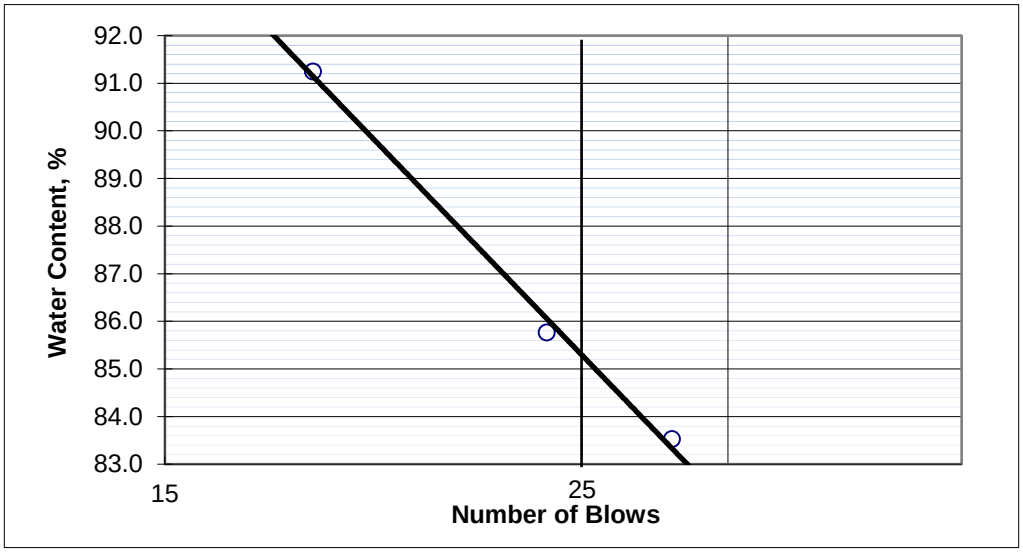
Project Number 20211176 Date:

Boring # B2N Sample # ST-5-2 Depth 13.5-14.0

Visual Classification: _Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	MI6	IK3	XOQ	
Tare Plus Wet Soil, g	10.35	11.39	12.63	
Tare Plus Dry Soil, g	5.99	6.51	7.00	
Water, g	4.36	4.88	5.63	
Tare, g	0.77	0.82	0.83	
Dry Soil, g	5.22	5.69	6.17	
Water content, %	83.52	85.76	91.25	
Number of Blows	28	24	18	



LL	85.0
PL	22.0
PI	63
Symbol from plasticity chart	CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	HF4	DA2					
Tare Plus Wet Soil, g	6.37	6.35					
Tare Plus Dry Soil, g	5.34	5.38					
Water, g	1.03	0.97					
Tare, g	0.78	0.80					
Dry Soil, g	4.56	4.58					
Water content, %	22.59	21.18					
Plastic Limit	22						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name: I-55/I-70 over railroad yard | Tested By: SLY

Project No.: 20211176.00 | Checked By: AD

Boring No.: B2N | Sample No.: ST-5-2 | Depth: 13.5-14.0

Soil Description: **Brow&Gray,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	40.86	gm
Dry & Tare	31.83	gm
Tare	2.60	gm
Water Content	30.9	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	72.59	mm
Height	145.61	mm
Wet Weight	1117.52	gm
Volume	602.61	cc
L:D Ratio	2.01	
Wet Density	115.72	pcf
Dry Density	88.41	pcf
Water Content	30.9	%
Saturation	92	%
Void Ratio	0.91	

Instrument Constants

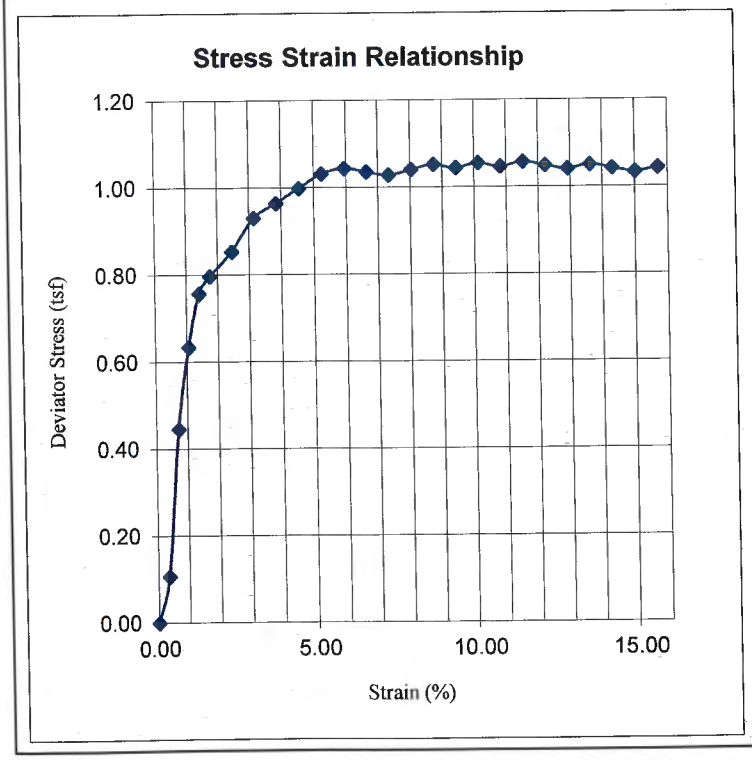
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.99	%/min

Failure Mode: Bulge

Confining Pressure (psi): 11.6

Undrained Shear Strength (tsf): 0.53

Axial Strain (%): 11.5



TSi Geotechnical, Inc.

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2N Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Brown, sandy clay loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.48	273.52	241.62	182.17	59.45	156.14	38.1%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2N Sample No.: SS-7
Depth: 23.5 - 25.0
Visual: Brown, clay loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
82.9	290.22	234.59	129.39	105.20	151.69	69.4%

Comments:

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

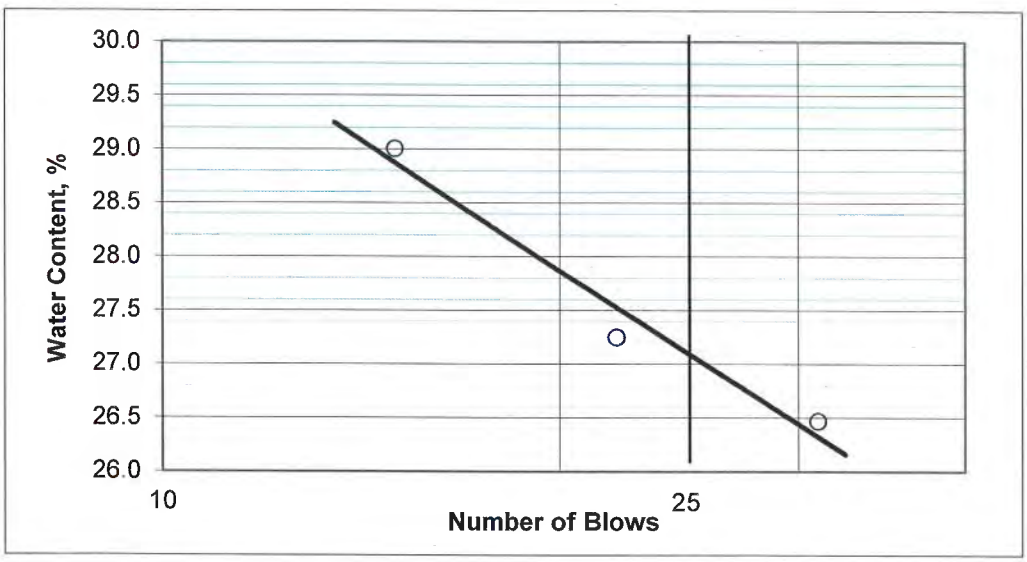
Project Number 20211176 Date:

Boring # B-2N Sample # SS-7 Depth 23.5 - 25.0

Visual Classification: _Brown,

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	CT4	DV2	VP-19	
Tare Plus Wet Soil, g	10.75	11.48	12.70	
Tare Plus Dry Soil, g	8.68	9.21	10.02	
Water, g	2.07	2.27	2.68	
Tare, g	0.86	0.88	0.78	
Dry Soil, g	7.82	8.33	9.24	
Water content, %	26.47	27.25	29.00	
Number of Blows	31	22	15	



LL 27.0
PL 20.0
PI 7

Symbol from plasticity chart

CL-ML

PLASTIC LIMIT

Run No.	1	2					
Tare No.	HTF4	VG3					
Tare Plus Wet Soil, g	6.62	6.60					
Tare Plus Dry Soil, g	5.62	5.69					
Water, g	1.00	0.91					
Tare, g	0.78	0.79					
Dry Soil, g	4.84	4.90					
Water content, %	20.66	18.57					
Plastic Limit	20						

Remarks

Technician JC Computed By SY Checked By AD

TSi geotechnical.inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B2N Sample No.: SS-9
Depth: 33.5 - 35.0
Visual: Gray

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.5	325.33	277.95	266.09	11.86	192.45	6.2%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B2N Sample No.: SS-12
Depth: 48.5 - 50.0
Visual: Brown

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
86	300.29	256.48	246.43	10.05	170.48	5.9%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2S Sample No.: SS-2
Depth: 3.5 - 5.0
Visual: Gray, loamy sand

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.19	173.33	154.77	142.79	11.98	69.58	17.2%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2S Sample No.: SS-3
Depth: 6.0 - 7.5
Visual: Brown and gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
83.23	179.98	151.67	86.87	64.80	68.44	94.7%

Comments:

Atterberg Limits (ASTM D4318)

1340 North Price Rd
St. Louis, MO
geotechnical, inc.

Project Name: I-55/I-70 over Railroad Yard

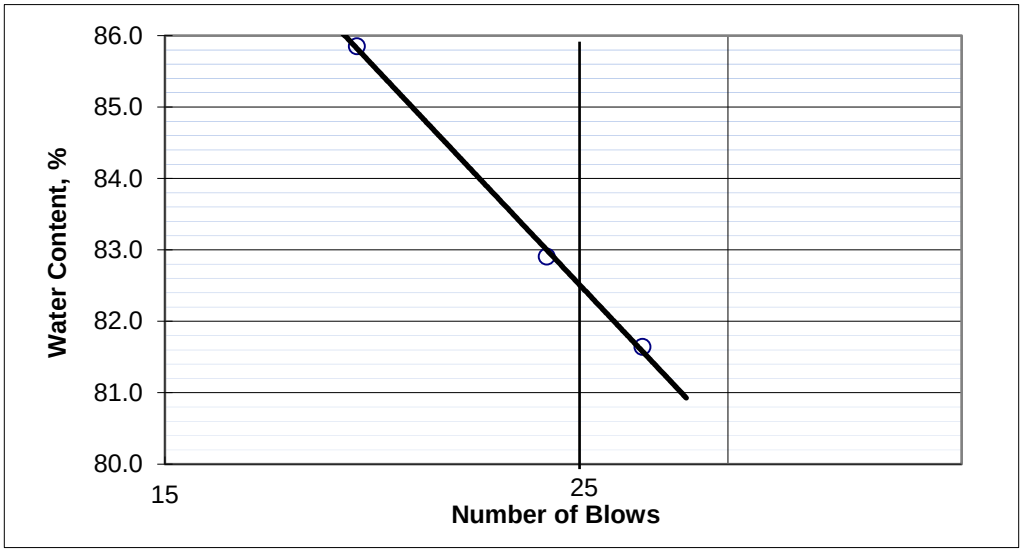
Project Number 20211176 Date:

Boring # B2S Sample # ST-4-2 Depth 8.5-9.0

Visual Classification: _Dark Gray_____

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	FME5	TV2	AD2	
Tare Plus Wet Soil, g	10.22	11.52	12.36	
Tare Plus Dry Soil, g	5.97	6.67	7.02	
Water, g	4.25	4.85	5.34	
Tare, g	0.76	0.82	0.80	
Dry Soil, g	5.21	5.85	6.22	
Water content, %	81.64	82.91	85.85	
Number of Blows	27	24	19	



LL	83.0
PL	26.0
PI	57

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	AB3					
Tare No.	DW3	6.54					
Tare Plus Wet Soil, g	6.53	5.10					
Tare Plus Dry Soil, g	5.07	5.38					
Water, g	1.46	0.82					
Tare, g	0.81	0.80					
Dry Soil, g	4.26	4.58					
Water content, %	34.27	17.90					
Plastic Limit	26						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD
Boring No.	B2S	Sample No.	ST-4-2
Depth	8.25-9.0		

Soil Description **Gray,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	42.46	gm
Dry & Tare	30.46	gm
Tare	2.57	gm
Water Content	43.0	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	71.72	mm
Height	146.17	mm
Wet Weight	1024.59	gm
Volume	590.51	cc
L:D Ratio	2.04	
Wet Density	108.27	pcf
Dry Density	75.70	pcf
Water Content	43.0	%
Saturation	95	%
Void Ratio	1.23	

Instrument Constants

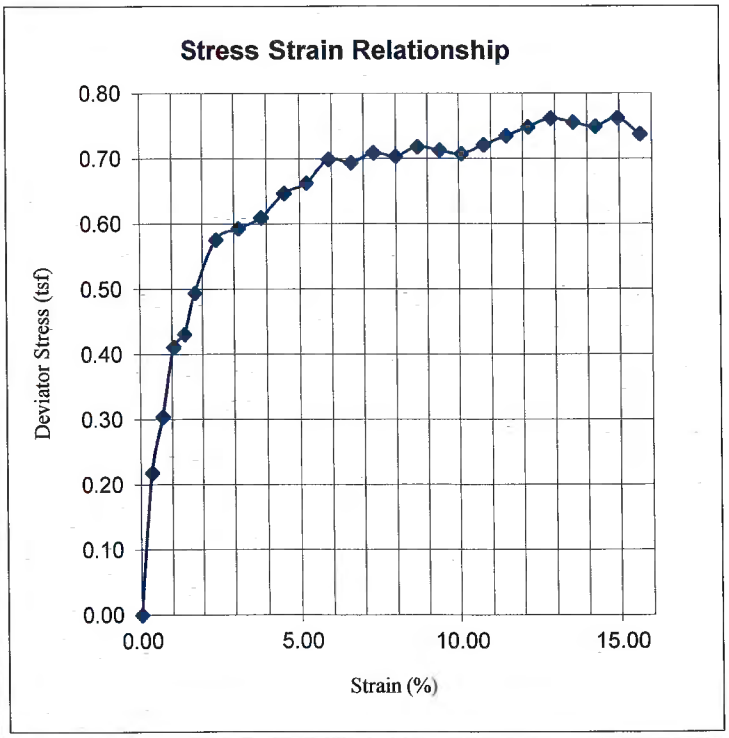
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Confining Pressure (psi): 7.5

Undrained Shear Strength (tsf): 0.38

Axial Strain (%): 14.9



TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2S Sample No.: SS-5
Depth: 13.5 - 15.0
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85	136.17	122.48	85.45	37.03	37.48	98.8%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

Project Number 20211176 Date:

Boring # B2S Sample # SS-5 Depth 13.5-15

Visual Classification: _Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	IOU2	GV1	TK3	
Tare Plus Wet Soil, g	10.27	11.64	12.43	
Tare Plus Dry Soil, g	5.67	6.10	6.39	
Water, g	4.60	5.54	6.04	
Tare, g	0.87	0.80	0.86	
Dry Soil, g	4.80	5.30	5.53	
Water content, %	95.83	104.53	109.22	
Number of Blows	27	21	15	

LL	99.0
PL	22.0
PI	77
Symbol from plasticity chart	CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	4L5	DG3					
Tare Plus Wet Soil, g	6.23	6.21					
Tare Plus Dry Soil, g	5.25	5.21					
Water, g	0.98	1.00					
Tare, g	0.83	0.79					
Dry Soil, g	4.42	4.42					
Water content, %	22.17	22.62					
Plastic Limit	22						

Remarks

Technician JC Computed By SY Checked By AD

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2S Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Brown, LOAM

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
83.52	291.71	238	119.24	118.76	154.48	76.9%

Comments:

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2.5 Sample No.: SS-2
Depth: 3.5 - 5.0
Visual: Brown and gray, cinders

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
89.19	183.13	156.4	90.43	65.97	67.21	98.2%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2.5 Sample No.: SS-3
Depth: 6.0 - 7.5
Visual: Brown and gray, silty clay with cinders

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.32	257.46	218.93	117.63	101.30	134.61	75.3%

Comments:

Atterberg Limits (ASTM D4318)

1340 North Price Rd
St. Louis, MO
geotechnical, inc.

Project Name: I-55/I-70 over Railroad Yard

Project Number 20211176 Date:

Boring # B-2.5 Sample # ST-4-3 Depth 9.0 - 9.5

Visual Classification: _Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	GE2	WYM5	GE2	
Tare Plus Wet Soil, g	10.28	11.28	12.57	
Tare Plus Dry Soil, g	5.32	5.66	6.15	
Water, g	4.96	5.62	6.42	
Tare, g	0.81	0.81	0.82	
Dry Soil, g	4.51	4.85	5.33	
Water content, %	109.98	115.88	120.45	
Number of Blows	33	21	16	

LL	114.0
PL	28.0
PI	86
Symbol from plasticity chart	CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	QX1	KWO					
Tare Plus Wet Soil, g	6.20	6.21					
Tare Plus Dry Soil, g	5.03	5.06					
Water, g	1.17	1.15					
Tare, g	0.83	0.83					
Dry Soil, g	4.20	4.23					
Water content, %	27.86	27.19					
Plastic Limit	28						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	PCS
Project No.	20211176.00	Checked By	AD
Boring No.	B-2.5	Sample No.	ST-4-2
Depth	8.5 - 9.0		

Soil Description **Brow&Gray,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	37.59	gm
Dry & Tare	28.32	gm
Tare	2.57	gm
Water Content	36.0	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	67.35	mm
Height	146.17	mm
Wet Weight	991.83	gm
Volume	520.74	cc
L:D Ratio	2.17	
Wet Density	118.85	pcf
Dry Density	87.39	pcf
Water Content	36.0	%
Saturation	105	%
Void Ratio	0.93	

Instrument Constants

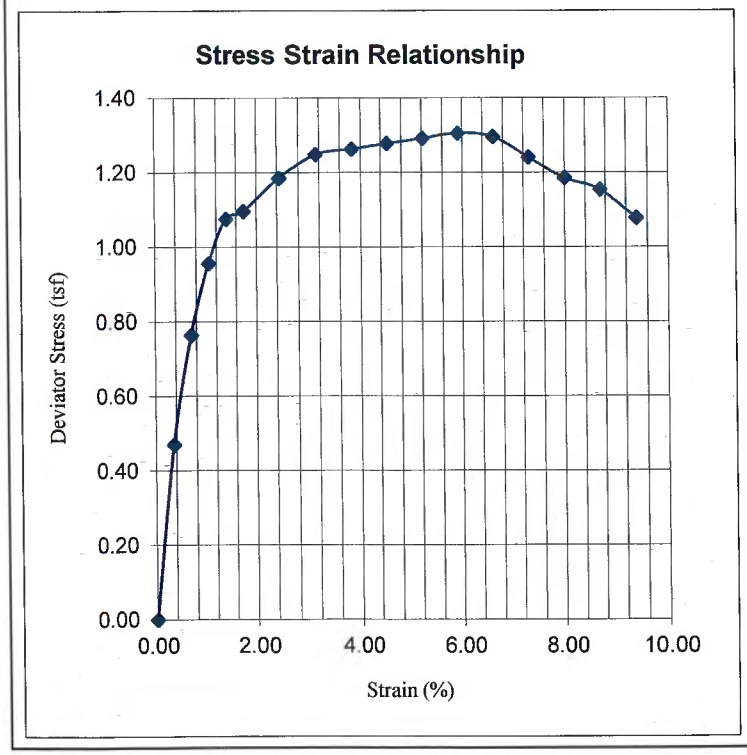
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Undrained Shear Strength (tsf): 0.65

Confining Pressure (psi): 6.8

Axial Strain (%): 5.9



TSi Geotechnical, Inc.

TSi geotechnical,inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-2.5 Sample No.: SS-5
Depth: 13.5 - 15.0
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.04	311.89	251.12	116.23	134.89	166.08	81.2%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

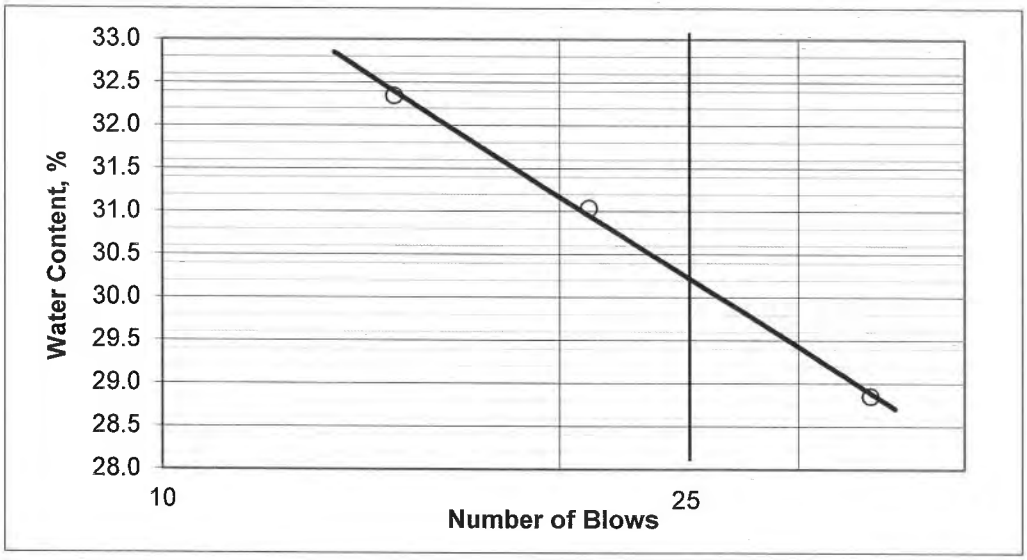
Project Number 20211176 Date:

Boring # B-2.5 Sample # SS-5 Depth 13.5 - 15.0

Visual Classification: _Brown,

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	GW5G	QX1	GE2	
Tare Plus Wet Soil, g	10.54	11.67	12.43	
Tare Plus Dry Soil, g	8.35	9.10	9.59	
Water, g	2.19	2.57	2.84	
Tare, g	0.76	0.82	0.81	
Dry Soil, g	7.59	8.28	8.78	
Water content, %	28.85	31.04	32.35	
Number of Blows	34	21	15	



LL 30.0
PL 25.0
PI 5

Symbol from plasticity chart

ML

PLASTIC LIMIT

Run No.	1	2					
Tare No.	IY2	WYU-3					
Tare Plus Wet Soil, g	6.68	6.70					
Tare Plus Dry Soil, g	5.50	5.54					
Water, g	1.18	1.16					
Tare, g	0.79	0.79					
Dry Soil, g	4.71	4.75					
Water content, %	25.05	24.42					
Plastic Limit	25						

Remarks

Technician JC Computed By SY Checked By AD

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3N Sample No.: ST-4-3
Depth: 9.0-9.5
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.4	411.92	349.3	122.88	226.42	263.90	85.8%

Comments:

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

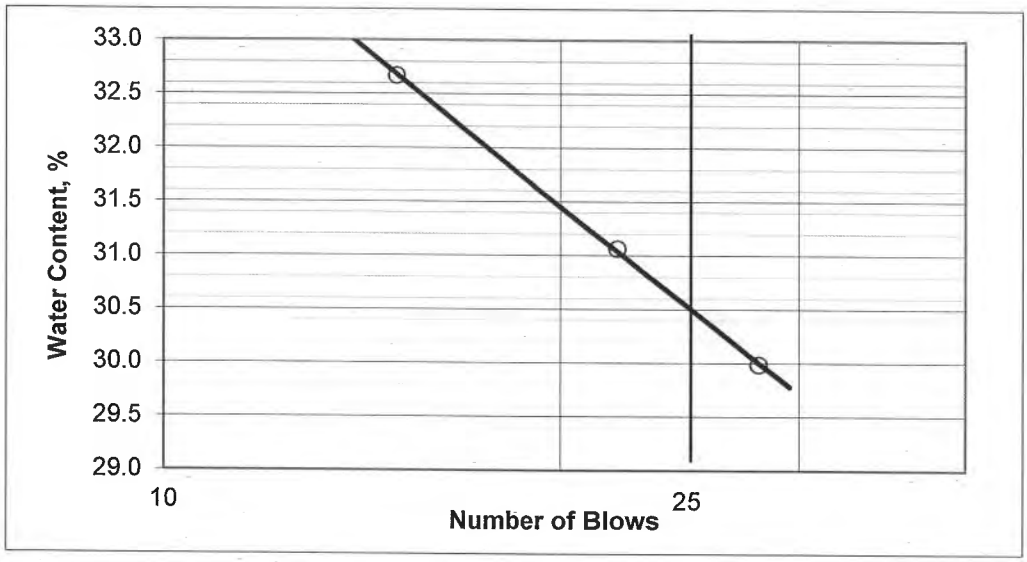
Project Number 20211176 Date:

Boring # B-3N Sample # ST-4-3 Depth 9.0-9.5

Visual Classification: Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	WYM-S	GEL	AP14	
Tare Plus Wet Soil, g	10.25	11.40	12.14	
Tare Plus Dry Soil, g	8.07	8.89	9.34	
Water, g	2.18	2.51	2.80	
Tare, g	0.80	0.81	0.77	
Dry Soil, g	7.27	8.08	8.57	
Water content, %	29.99	31.06	32.67	
Number of Blows	28	22	15	



LL 30.0
PL 21.0
PI 9

Symbol from plasticity chart
CL

PLASTIC LIMIT

Run No.	1	2					
Tare No.	CP7	Sno					
Tare Plus Wet Soil, g	6.40	6.40					
Tare Plus Dry Soil, g	5.43	5.43					
Water, g	0.97	0.97					
Tare, g	0.80	0.77					
Dry Soil, g	4.63	4.66					
Water content, %	20.95	20.82					
Plastic Limit	21						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD
Boring No.	B-3N	Sample No.	ST-4-3
Depth	9.0 - 9.5		

Soil Description **Brown,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	44.00	gm
Dry & Tare	36.23	gm
Tare	2.54	gm
Water Content	23.1	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	73.06	mm
Height	145.39	mm
Wet Weight	1237.97	gm
Volume	609.52	cc
L:D Ratio	1.99	
Wet Density	126.74	pcf
Dry Density	102.99	pcf
Water Content	23.1	%
Saturation	98	%
Void Ratio	0.64	

Instrument Constants

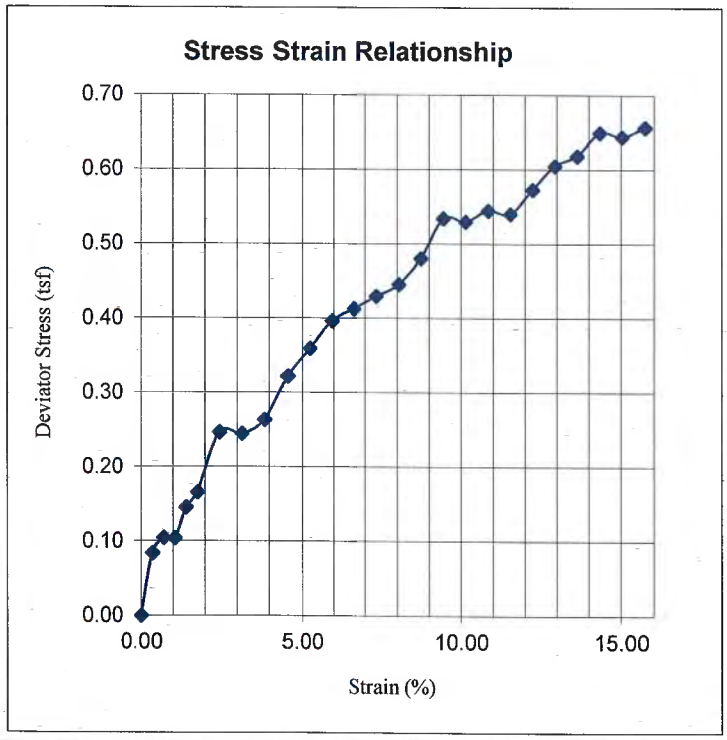
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.99	%/min

Failure Mode: Bulge

Confining Pressure (psi): 7.5

Undrained Shear Strength (tsf): 0.32

Axial Strain (%): 15.0



TSI geotechnical.inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3N Sample No.: SS-5
Depth: 13.5 - 15.0
Visual: Brown and gray, silty clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
83.42	182.82	154.75	85.03	69.72	71.33	97.7%

Comments:

TSi geotechnical.inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3N Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.2	188.65	158.42	86.96	71.46	74.22	96.3%

Comments:

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3S Sample No.: SS-4
Depth: 8.5 - 10.0
Visual: Black, cinders

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
82.95	183.12	154.46	118.57	35.89	71.51	50.2%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3S Sample No.: ST-5-2
Depth: 13.5-14.0
Visual: Brown&Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.11	271.33	229.14	90.15	138.99	145.03	95.8%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

Project Number 20211176 Date:

Boring # B-3S Sample # ST-5-3 Depth 14.0 - 14.5

Visual Classification: _Gray_

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	NK1	4L5	HFY	
Tare Plus Wet Soil, g	10.39	11.64	12.61	
Tare Plus Dry Soil, g	5.97	6.46	6.80	
Water, g	4.42	5.18	5.81	
Tare, g	0.79	0.92	0.78	
Dry Soil, g	5.18	5.54	6.02	
Water content, %	85.33	93.50	96.51	
Number of Blows	37	25	15	

LL 91.0
PL 21.0
PI 70

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	AD2	DA2					
Tare Plus Wet Soil, g	6.49	6.48					
Tare Plus Dry Soil, g	5.35	5.33					
Water, g	1.14	0.79					
Tare, g	0.79	0.79					
Dry Soil, g	4.56	4.54					
Water content, %	25.00	17.40					
Plastic Limit	21						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	PCS
Project No.	20211176.00	Checked By	AD
Boring No.	B-3S	Sample No.	ST-5-2
Depth	13.5 - 14.0		

Soil Description **Grayish-Brown,**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	35.39	gm
Dry & Tare	27.00	gm
Tare	2.65	gm
Water Content	34.5	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	72.75	mm
Height	146.15	mm
Wet Weight	1155.83	gm
Volume	607.51	cc
L:D Ratio	2.01	
Wet Density	118.72	pcf
Dry Density	88.30	pcf
Water Content	34.5	%
Saturation	102	%
Void Ratio	0.91	

Instrument Constants

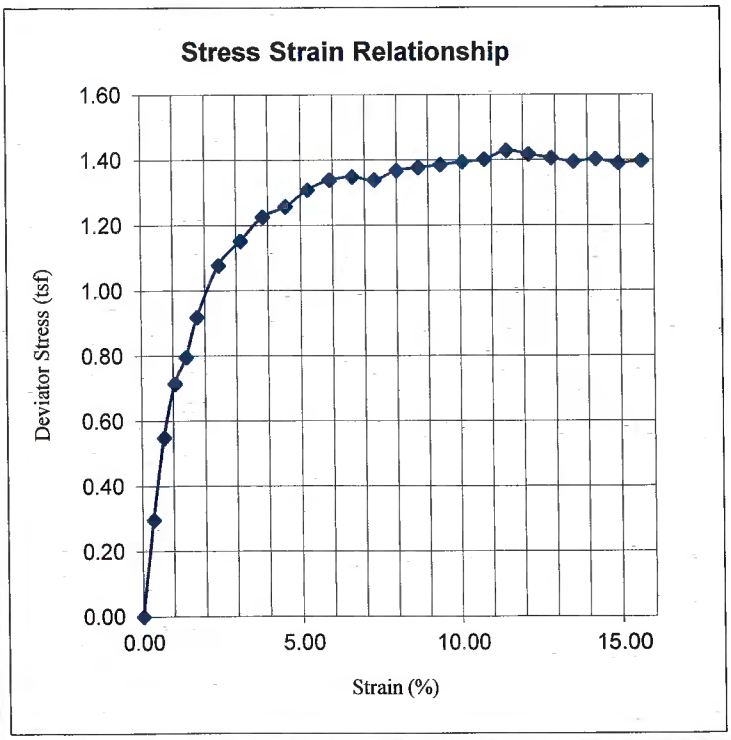
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Undrained Shear Strength (tsf): 0.71

Axial Strain (%): 11.5

Confining Pressure (psi): 5.8



TSi Geotechnical, Inc.

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3S Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Gray, silty clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
82.97	166.34	139.16	83.61	55.55	56.19	98.9%

Comments:

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-3S Sample No.: SS-7
Depth: 23.5 - 25.0
Visual: Gray, silty clay loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.31	174.31	145.72	90.24	55.48	60.41	91.8%

Comments:

Atterberg Limits (ASTM D4318)

1340 North Price Rd
St. Louis, MO
geotechnical, inc.

Project Name: I-55/I-70 over Railroad Yard

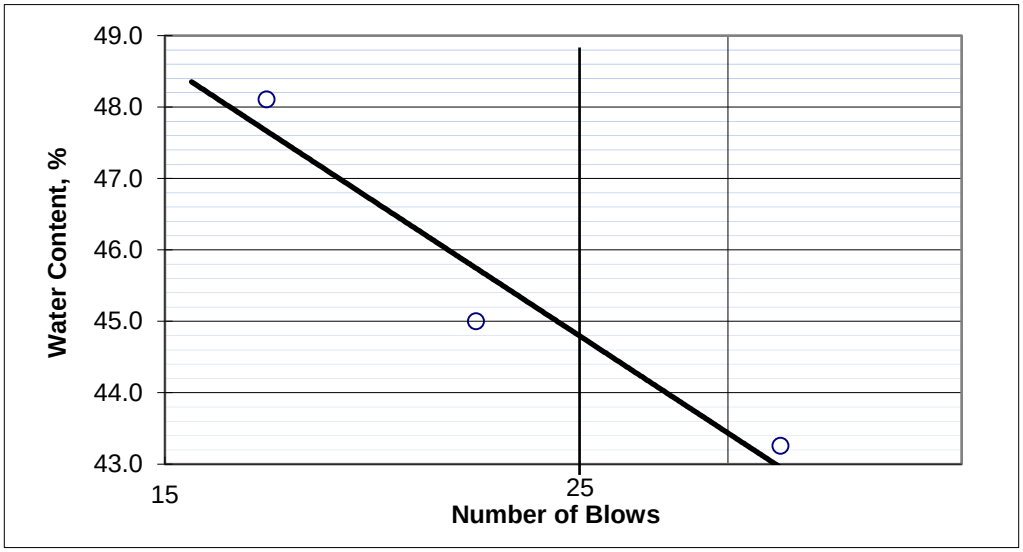
Project Number 20211176 Date:

Boring # B-3S Sample # SS-7 Depth 23.5 - 25

Visual Classification: _Gray_

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	MI6	DV2	CT4	
Tare Plus Wet Soil, g	10.45	11.24	12.53	
Tare Plus Dry Soil, g	7.53	8.00	8.72	
Water, g	2.92	3.24	3.81	
Tare, g	0.78	0.80	0.80	
Dry Soil, g	6.75	7.20	7.92	
Water content, %	43.26	45.00	48.11	
Number of Blows	32	22	17	



LL 45.0
PL 20.0
PI 25

Symbol from plasticity chart

CL

PLASTIC LIMIT

Run No.	1	2					
Tare No.	W5	CP10					
Tare Plus Wet Soil, g	6.62	6.63					
Tare Plus Dry Soil, g	5.65	5.65					
Water, g	0.97	0.98					
Tare, g	0.77	0.79					
Dry Soil, g	4.88	4.86					
Water content, %	19.88	20.16					
Plastic Limit	20						

Remarks

Technician JC Computed By SY Checked By AD

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-3.5 Sample: SS-2
Depth: 3.5 - 5.0
Visual: Brown, LOAMY SAND
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

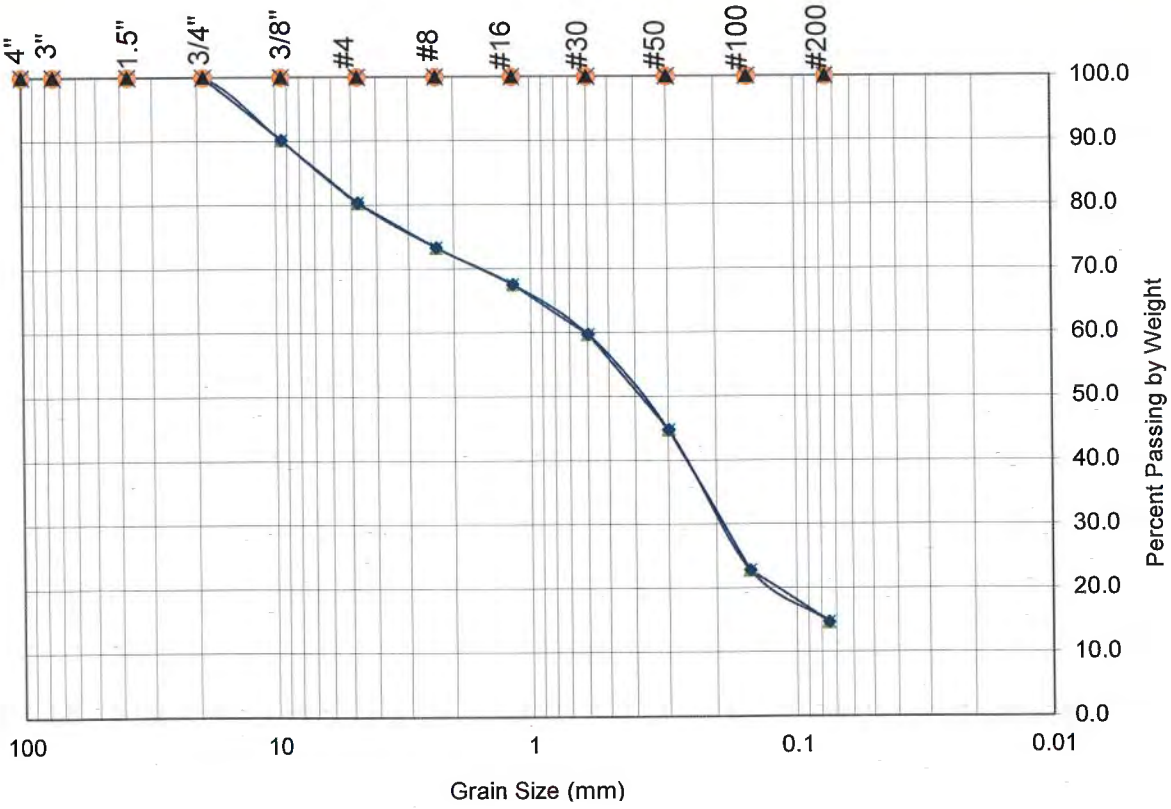
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**14.94**	**14.94**	**90.2**
4	0.00	0.00	**14.95**	**29.89**	**80.4**
8	0.00	0.00	**10.69**	**40.58**	**73.3**
16	0.00	0.00	**8.77**	**49.35**	**67.6**
30	0.00		**11.87**	**61.22**	**59.8**
50	0.00	0.00	**22.79**	**84.01**	**44.8**
100	0.00	0.00	**33.45**	**117.46**	**22.8**
200	0.00	0.00	**12.35**	**129.81**	**14.7**
PAN	0.00	0.00	**0.73**	**130.54**	

Moisture Content

Tare No.	
Wet Wt.	252.66
Dry Wt.	235.28
Tare Wt.	83.12
%	11.4

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	252.66	213.92
Tare	83.12	83.12
Sample Wt.	**169.54**	**130.80**
Minus 200 Wt		**21.36**
Dry Weight	**152.16**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard Job No.: 20211176.00

Boring: B-3.5 Sample: ST-4-1 Depth: 8.0-8.5

Visual: Black, SANDY LOAM Tested by: PCS- 9/21/2021

Checked by: AD 9/27/2021

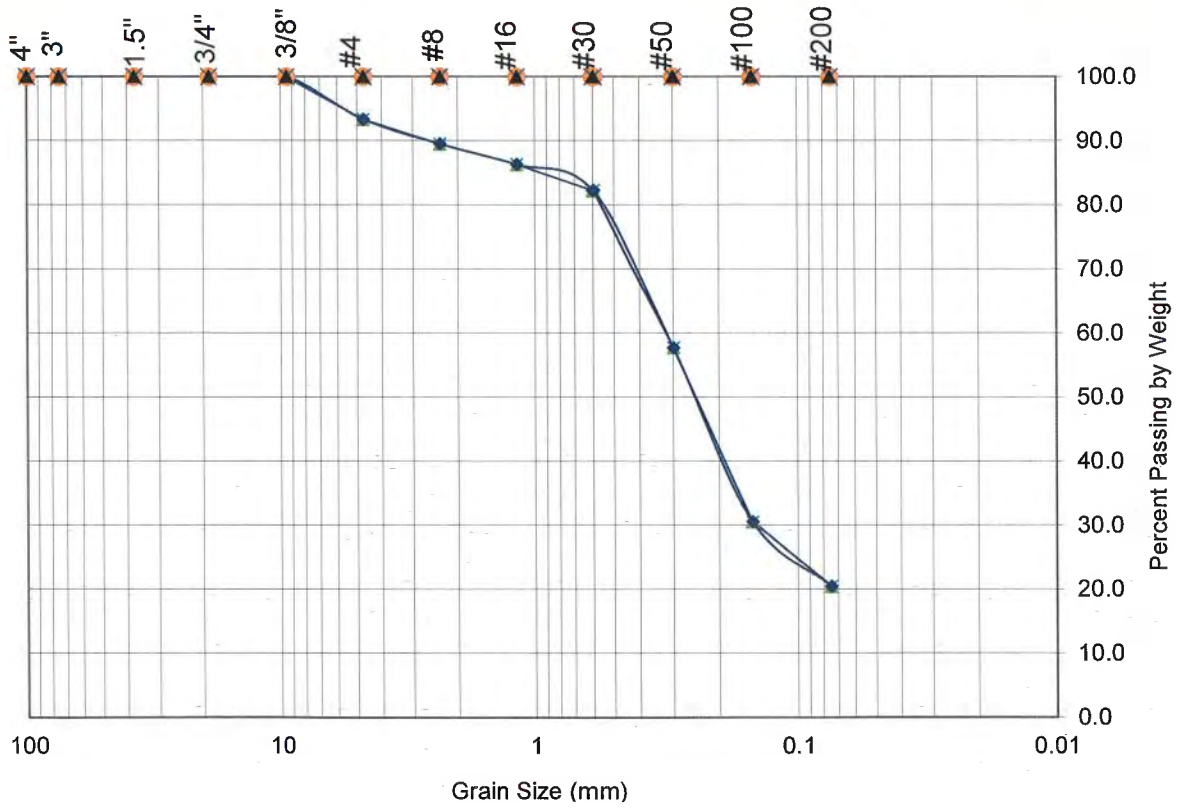
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**7.07**	**7.07**	**93.3**
8	0.00	0.00	**4.04**	**11.11**	**89.5**
16	0.00	0.00	**3.41**	**14.52**	**86.3**
30	0.00		**4.32**	**18.84**	**82.2**
50	0.00	0.00	**25.99**	**44.83**	**57.7**
100	0.00	0.00	**28.80**	**73.63**	**30.6**
200	0.00	0.00	**10.75**	**84.38**	**20.4**
PAN	0.00	0.00	**0.34**	**84.72**	

Moisture Content

Tare No.	
Wet Wt.	222.58
Dry Wt.	188.99
Tare Wt.	82.96
%	31.7

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	222.58	137.61
Tare	82.96	82.96
Sample Wt.	**139.62**	**54.65**
Minus 200 Wt		**51.38**
Dry Weight	**106.03**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-3.5 Sample: SS-6
Depth: 18.5 - 20.0
Visual: Gray, LOAM
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

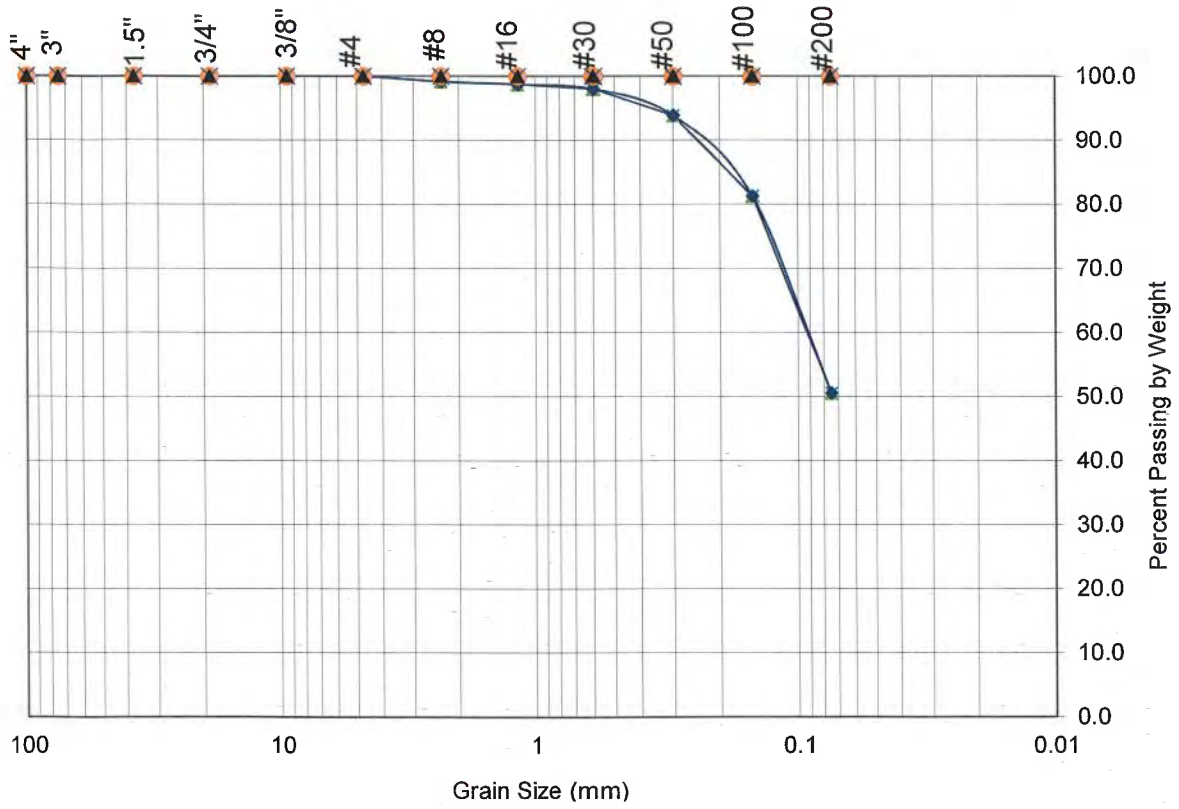
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.90**	**0.90**	**99.2**
16	0.00	0.00	**0.46**	**1.36**	**98.7**
30	0.00		**0.73**	**2.09**	**98.0**
50	0.00	0.00	**4.41**	**6.50**	**93.9**
100	0.00	0.00	**13.33**	**19.83**	**81.3**
200	0.00	0.00	**32.62**	**52.45**	**50.5**
PAN	0.00	0.00	**1.90**	**54.35**	

Moisture Content

Tare No.	
Wet Wt.	222.58
Dry Wt.	188.99
Tare Wt.	82.96
%	31.7

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	222.58	137.61
Tare	82.96	82.96
Sample Wt.	**139.62**	**54.65**
Minus 200 Wt		**51.38**
Dry Weight	**106.03**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

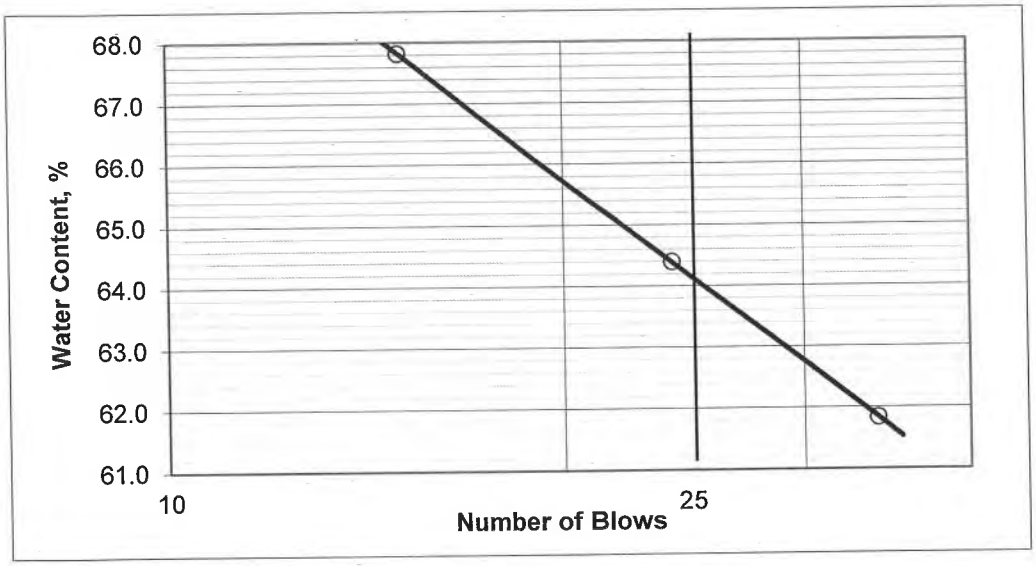
Project Number 20211176 Date:

Boring # B-3.5 Sample # SS-8 Depth 28.5 - 30

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	JM4	AD2	DG3	
Tare Plus Wet Soil, g	10.31	11.40	12.41	
Tare Plus Dry Soil, g	6.68	7.24	7.71	
Water, g	3.63	4.16	4.70	
Tare, g	0.81	0.78	0.78	
Dry Soil, g	5.87	6.46	6.93	
Water content, %	61.84	64.40	67.82	
Number of Blows	34	24	15	



LL 64.0
PL 18.0
PI 46

Symbol from plasticity chart
CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	Hd2	PK4					
Tare Plus Wet Soil, g	6.41	6.40					
Tare Plus Dry Soil, g	5.54	5.54					
Water, g	0.87	0.86					
Tare, g	0.80	0.82					
Dry Soil, g	4.74	4.72					
Water content, %	18.35	18.22					
Plastic Limit	18						

Remarks

Technician JC Computed By SY Checked By AD

Form Revised 12/11/20

TSi Geotechnical, Inc.
HYDROMETER ANALYSIS (ASTM D422)

Project Name:	I-55/70 over Railroad Yard	**Project Number:**	20211176.00
Boring Number:	B-3.5	**Tested by:**	SLY 9/27/2021
Sample Number:	SS-8	**Calculated by:**	SLY 9/27/2021
Sample Depth:	28.5-30.0	**Checked by:**	AD 9/27/21
Visual Description:	Brown and gray, SILTY CLAY		

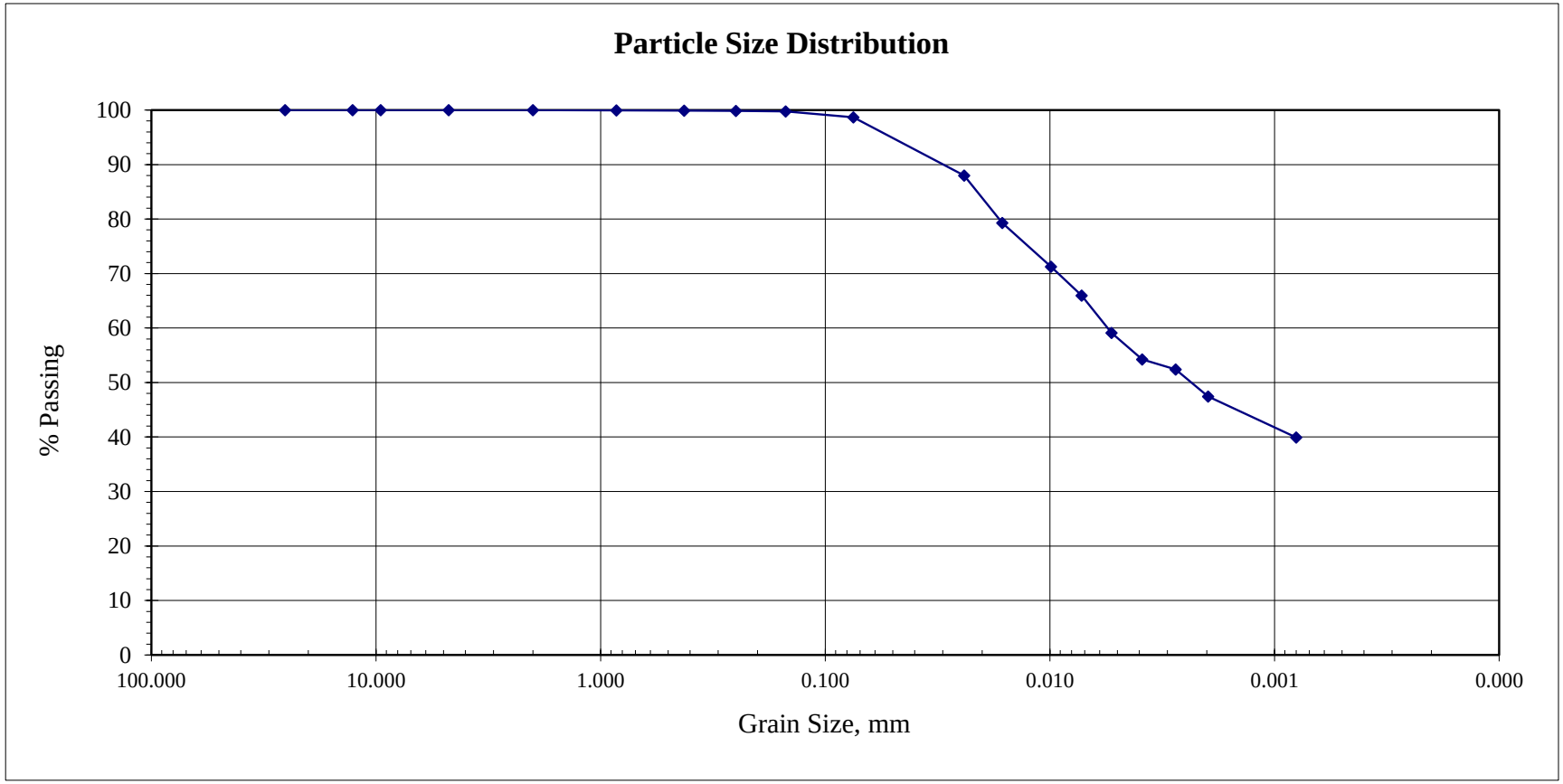
Sieve	Particle Size, mm	Percent Finer
1"	25.40	100
1/2"	12.70	100
3/8"	9.53	100
No.4	4.75	100
No.10	2.00	100
No.20	0.85	100
No.40	0.425	100
No.60	0.250	100
No.100	0.150	100
No.200	0.075	99
Hydrometer Analysis	0.0241	88
	0.0163	79
	0.0099	71
	0.0072	66
	0.0053	59
	0.0039	54
	0.0028	52
	0.0020	47
	0.0012	40

Particle Size Description
IDH Soil Classification System

Particle	Size Range, mm	Percent of Specimen
Gravel	4.75 to 76.4	0
Fine Gravel	2.00 to 4.75	0
Medium Sand	0.43 to 2.00	0
Fine Sand	0.075 to 0.43	1
Silt	0.002 to 0.075	52
Clay	<0.002	47

TSi Geotechnical, Inc.
HYDROMETER ANALYSIS (ASTM D422)

Project Name:	I-55/70 over Railroad Yard	**Project Number:**	20211176.00
Boring Number:	B-3.5	**Tested by:**	SLY 9/27/2021
Sample Number:	SS-8	**Calculated by:**	SLY 9/27/2021
Sample Depth:	28.5-30.0	**Checked by:**	AD 9/27/21
Visual Description:	Brown and gray, SILTY CLAY		



GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-3.5 Sample: SS-10
Depth: 38.5-40
Visual: Gray, CLAY
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

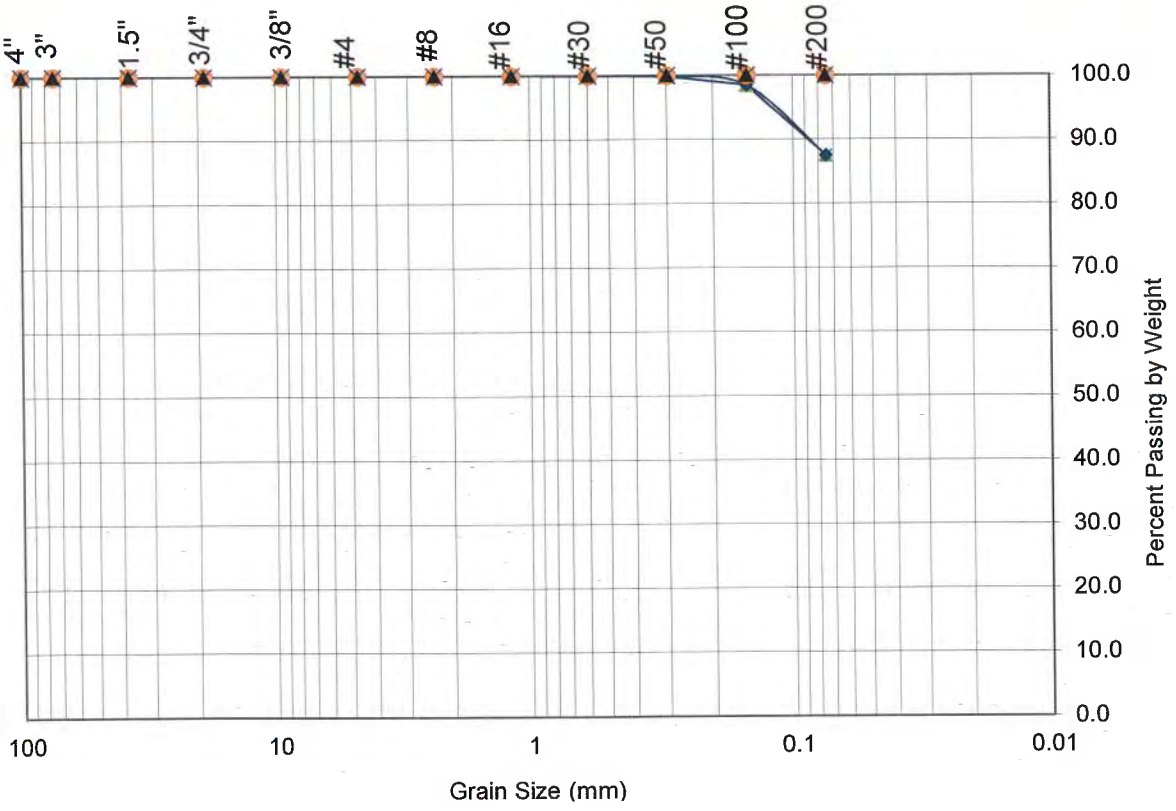
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.01**	**0.01**	**100.0**
30	0.00		**0.02**	**0.03**	**100.0**
50	0.00	0.00	**0.10**	**0.13**	**99.9**
100	0.00	0.00	**1.20**	**1.33**	**98.5**
200	0.00	0.00	**9.60**	**10.93**	**87.5**
PAN	0.00	0.00	**0.04**	**10.97**	

Moisture Content

Tare No.	
Wet Wt.	218.95
Dry Wt.	173.46
Tare Wt.	85.92
%	52.0

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	218.95	97.13
Tare	85.92	85.92
Sample Wt.	**133.03**	**11.21**
Minus 200 Wt		**76.33**
Dry Weight	**87.54**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

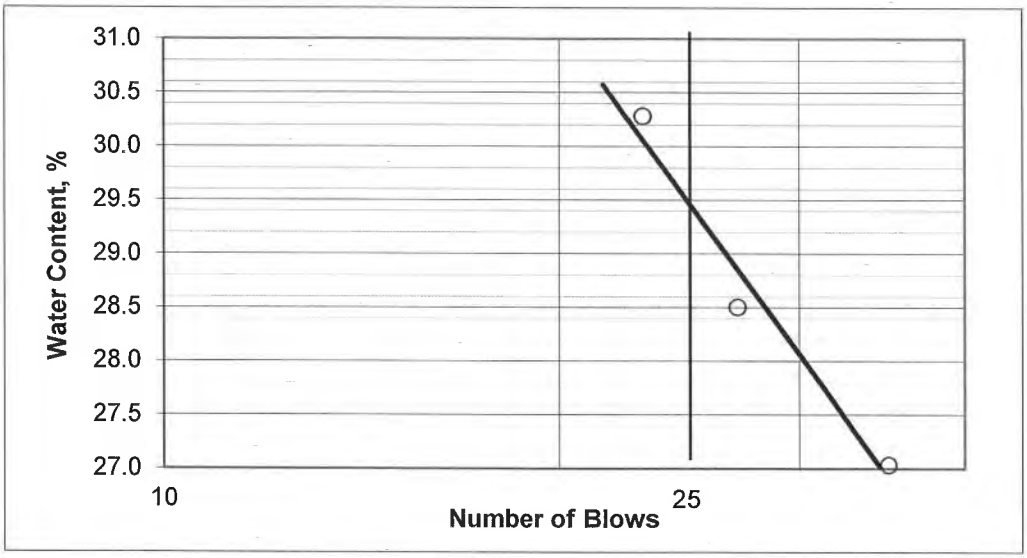
Project Number 20211176 Date:

Boring # B-4 N Sample # SS-2 Depth 3.5 - 5.0

Visual Classification: Brown and gray, CLAY LOAM

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	HT-2	GV3	KW5	
Tare Plus Wet Soil, g	10.88	11.76	12.35	
Tare Plus Dry Soil, g	8.72	9.32	9.67	
Water, g	2.16	2.44	2.68	
Tare, g	0.73	0.76	0.82	
Dry Soil, g	7.99	8.56	8.85	
Water content, %	27.03	28.50	30.28	
Number of Blows	35	27	23	



LL 29.0
PL 16.0
PI 13

Symbol from plasticity chart

CL

PLASTIC LIMIT

Run No.	1	2					
Tare No.	AJ3	GV1					
Tare Plus Wet Soil, g	6.13	6.13					
Tare Plus Dry Soil, g	5.40	5.40					
Water, g	0.73	0.73					
Tare, g	0.75	0.76					
Dry Soil, g	4.65	4.64					
Water content, %	15.70	15.73					
Plastic Limit	16						

Remarks

Technician JC Computed By SY Checked By AD

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-4N Sample No.: SS-3
Depth: 6.0 - 7.5
Visual: Brown, sandy loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.99	243.95	217.78	192.38	25.40	132.79	19.1%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-4N Sample No.: SS-4
Depth: 8.5 - 10.0
Visual: Brown, loamy sand

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
83.48	106.11	102.64	100.1	2.54	19.16	13.3%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

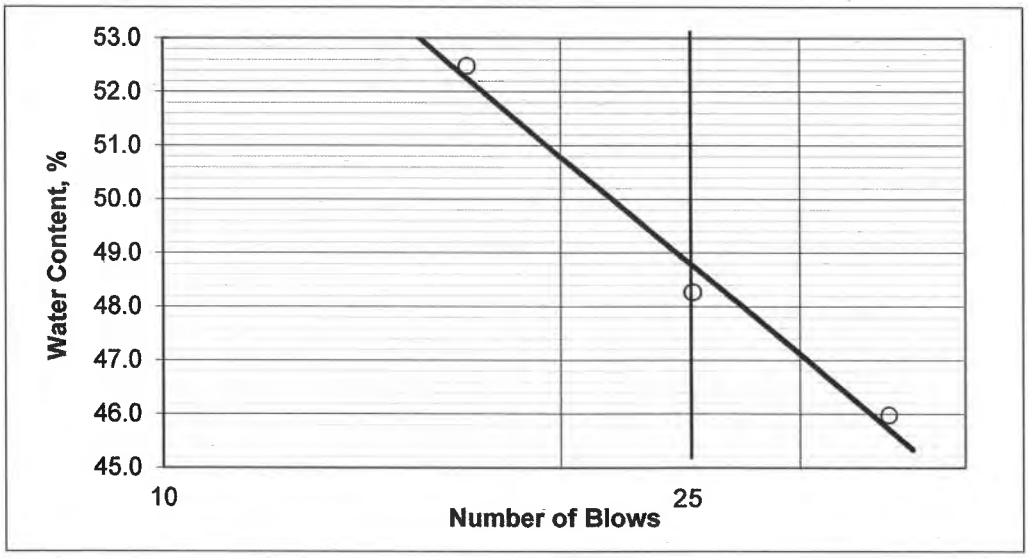
Project Number 20211176 Date:

Boring # B-4 N Sample # SS-7 Depth 23.5 - 25.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	MK4	DG3	BM5	
Tare Plus Wet Soil, g	10.61	11.51	12.77	
Tare Plus Dry Soil, g	7.52	8.02	8.65	
Water, g	3.09	3.49	4.12	
Tare, g	0.80	0.79	0.80	
Dry Soil, g	6.72	7.23	7.85	
Water content, %	45.98	48.27	52.48	
Number of Blows	35	25	17	



LL 49.0
PL 19.0
PI 30

Symbol from plasticity chart

CL

PLASTIC LIMIT

Run No.	1	2					
Tare No.	IF2	2C0					
Tare Plus Wet Soil, g	6.66	6.65					
Tare Plus Dry Soil, g	5.72	5.71					
Water, g	0.94	0.94					
Tare, g	0.75	0.79					
Dry Soil, g	4.97	4.92					
Water content, %	18.91	19.11					
Plastic Limit	19						

Remarks

Technician JC Computed By SY Checked By AD

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

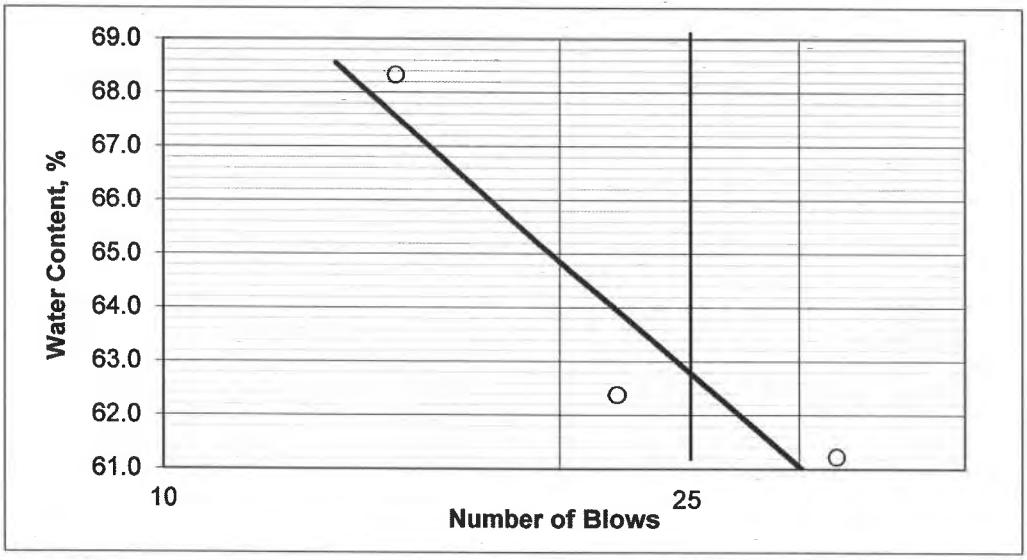
Project Number 20211176 Date:

Boring # B-4 N Sample # SS-10 Depth 38.5 - 40.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	IV2	PD5	AB3	
Tare Plus Wet Soil, g	10.81	11.54	12.26	
Tare Plus Dry Soil, g	7.02	7.41	7.62	
Water, g	3.79	4.13	4.64	
Tare, g	0.83	0.79	0.83	
Dry Soil, g	6.19	6.62	6.79	
Water content, %	61.23	62.39	68.34	
Number of Blows	32	22	15	



LL 63.0
PL 21.0
PI 42

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	MI5	DA2					
Tare Plus Wet Soil, g	6.29	6.31					
Tare Plus Dry Soil, g	5.34	5.37					
Water, g	0.95	0.94					
Tare, g	0.78	0.83					
Dry Soil, g	4.56	4.54					
Water content, %	20.83	20.70					
Plastic Limit	21						

Remarks

Technician JC Computed By SY Checked By AD

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-4N
Sample: SS-13
Depth: 53.5-55.0
Visual: Brown, SAND
Tested by: PCS- 9/14/2021
Checked by:

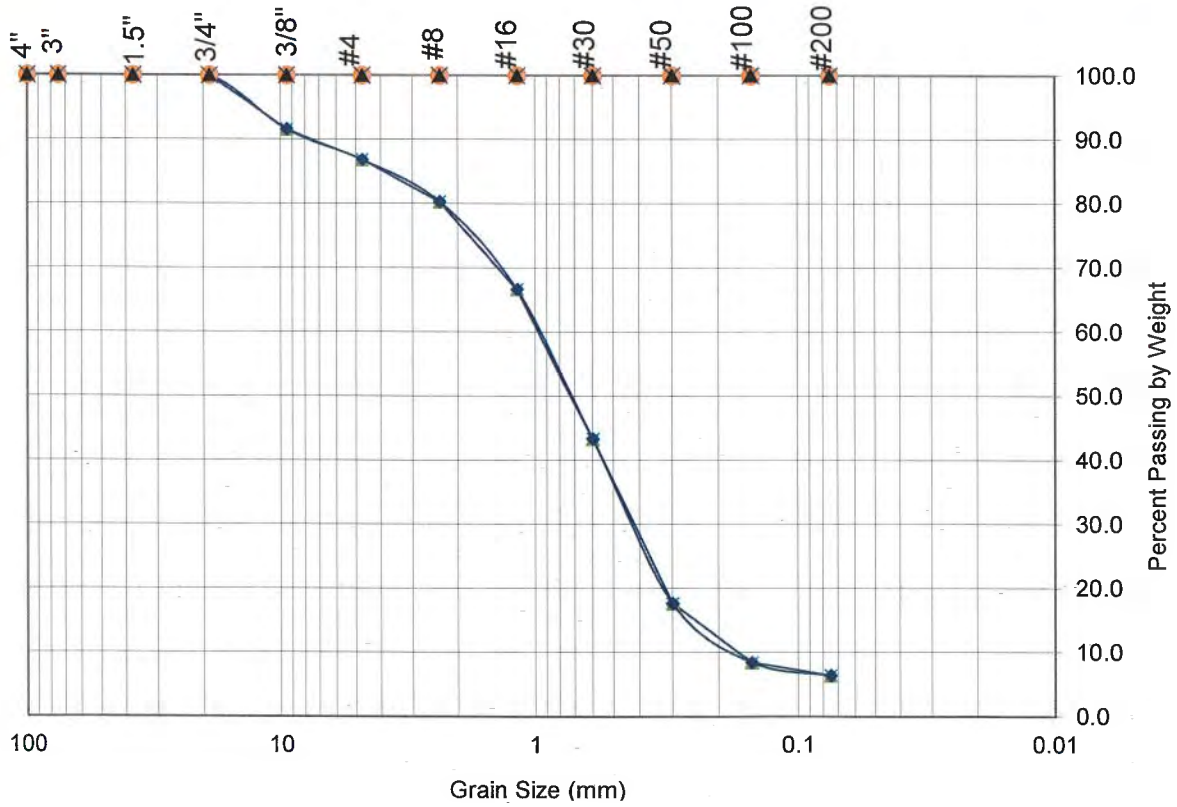
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**8.32**	**8.32**	**91.6**
4	0.00	0.00	**4.66**	**12.98**	**86.8**
8	0.00	0.00	**6.46**	**19.44**	**80.3**
16	0.00	0.00	**13.47**	**32.91**	**66.6**
30	0.00	0.00	**22.98**	**55.89**	**43.3**
50	0.00	0.00	**25.35**	**81.24**	**17.6**
100	0.00	0.00	**9.11**	**90.35**	**8.4**
200	0.00	0.00	**2.03**	**92.38**	**6.4**
PAN	0.00	0.00	**0.10**	**92.48**	

Moisture Content

Tare No.	
Wet Wt.	200.58
Dry Wt.	182.79
Tare Wt.	84.14
%	18.0

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	200.58	176.63
Tare	84.14	84.14
Sample Wt.	**116.44**	**92.49**
Minus 200 Wt		**6.16**
Dry Weight	**98.65**	



TSi Geotechnical, Inc.

TSI
geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-4S Sample No.: SS-3
Depth: 6.0 - 7.5
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
87.17	258.55	208.5	93.96	114.54	121.33	94.4%

Comments:

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

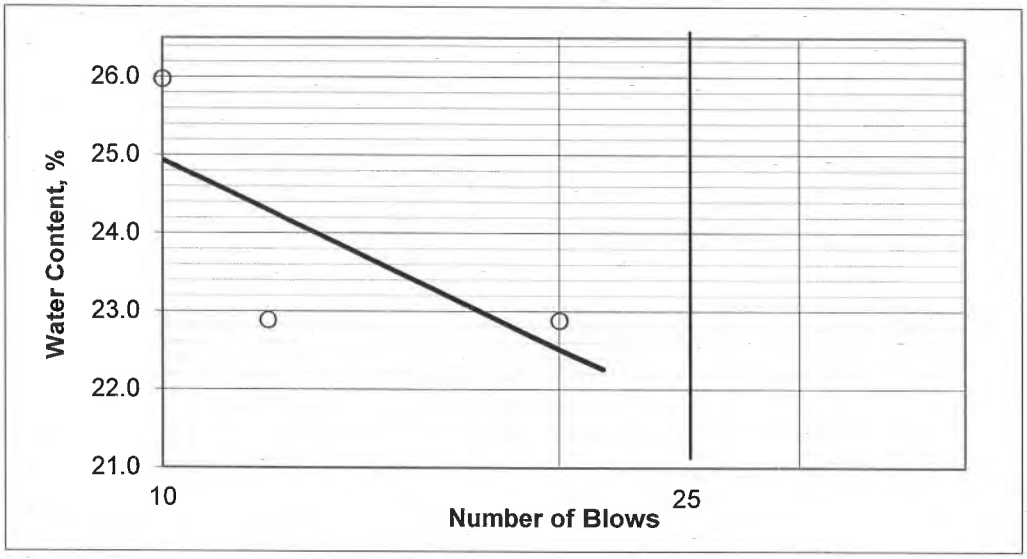
Project Number 20211176 Date:

Boring # B-4S Sample # ST-4-2 Depth 8.5-9.0

Visual Classification: _Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	AA3	PW2	L	
Tare Plus Wet Soil, g	10.07	11.69	12.44	
Tare Plus Dry Soil, g	8.34	9.66	10.04	
Water, g	1.73	2.03	2.40	
Tare, g	0.78	0.79	0.80	
Dry Soil, g	7.56	8.87	9.24	
Water content, %	22.88	22.89	25.97	
Number of Blows	20	12	10	



LL 22.0
PL 23.0
PI -1

Symbol from plasticity chart

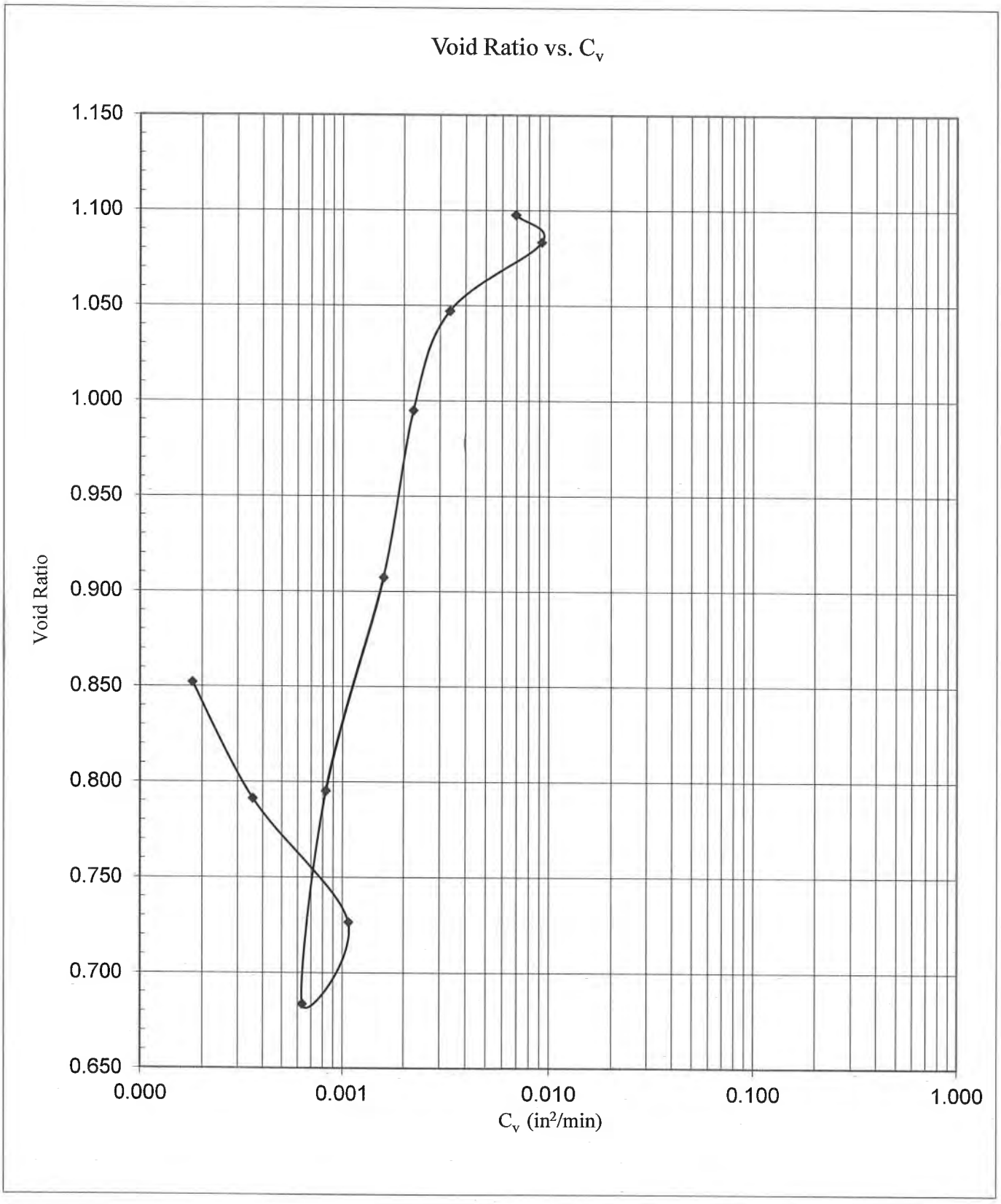
NP

PLASTIC LIMIT

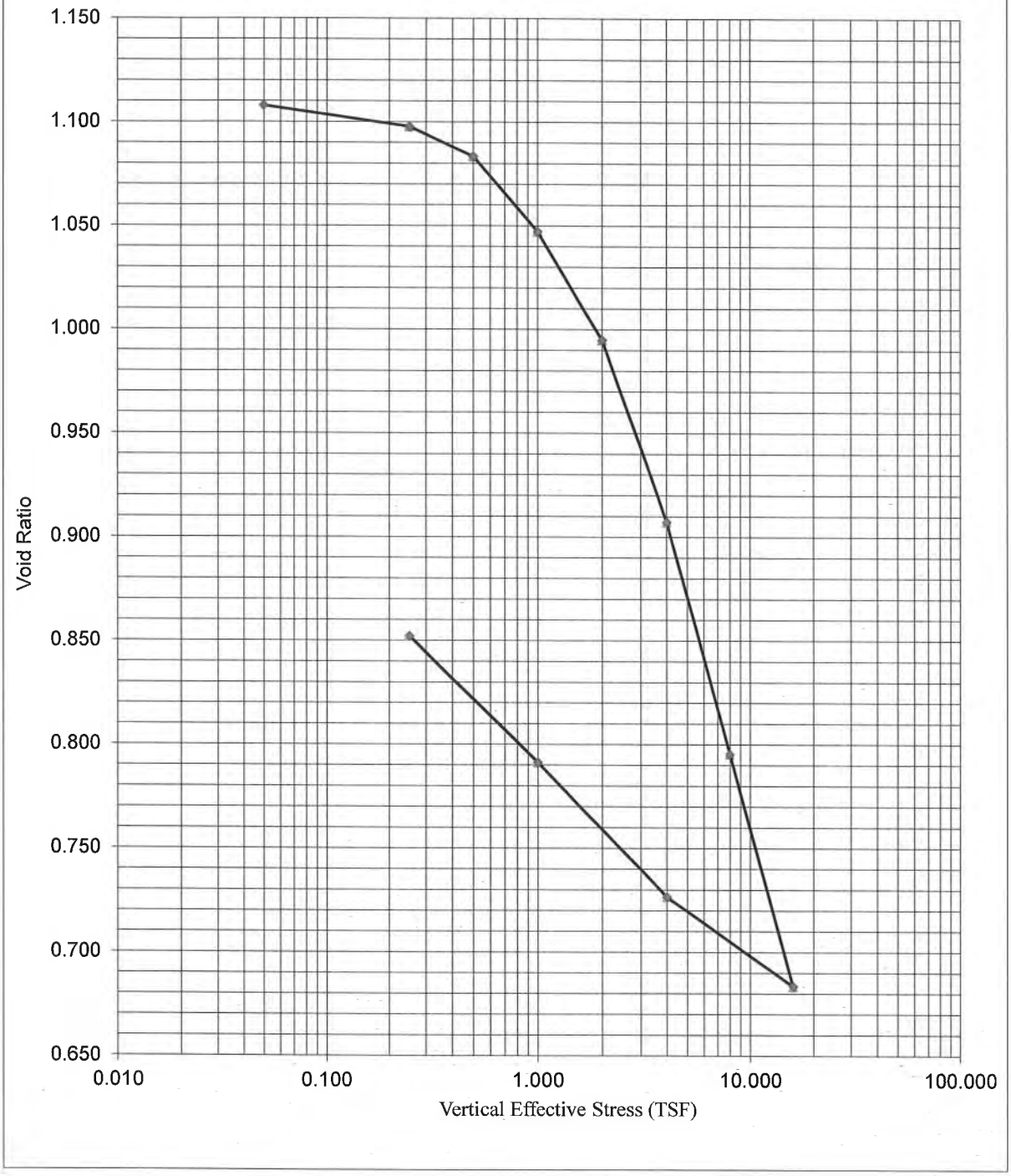
Run No.	1	2					
Tare No.	IY2	FK3					
Tare Plus Wet Soil, g	6.58	6.41					
Tare Plus Dry Soil, g	5.48	5.35					
Water, g	1.10	1.06					
Tare, g	0.80	0.81					
Dry Soil, g	4.68	4.54					
Water content, %	23.50	23.35					
Plastic Limit	23						

Remarks

Technician JC Computed By SY Checked By AD


Void Ratio vs. C_v
1.150
1.100
1.050
1.000
0.950
0.900
0.850
0.800
0.750
0.700
0.650
Void Ratio
0.000
0.001
0.010
0.100
1.000
C_v (in²/min)

Consolidation Test Summary



Boring No. B-4S Sample ST-4-2 Depth 8.5-9.0

Soil Description : Brown and gray, CLAY

Initial Moisture Content (%): 43.9 Specific Gravity: 2.7 (assumed)

Initial Dry Density(pcf): 78.4

Project Name: I-55/70 over Railroad Yard

Project Number: 20211176.00

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-4S Sample No.: SS-5
Depth: 13.5 - 15.0
Visual: Brownish-Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
86.1	281.34	220.51	88.66	131.85	134.41	98.1%

Comments:

TSi geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-4S Sample No.: SS-6
Depth: 18.5 - 20.0
Visual: Brown & Gray, sandy loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.64	251.81	214.63	172	42.63	129.99	32.8%

Comments:

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-5N Sample: SS-2
Depth: 3.5-5.0
Visual: Brown, CLAY LOAM
Tested by: PCS- 9/13/2021
Checked by:

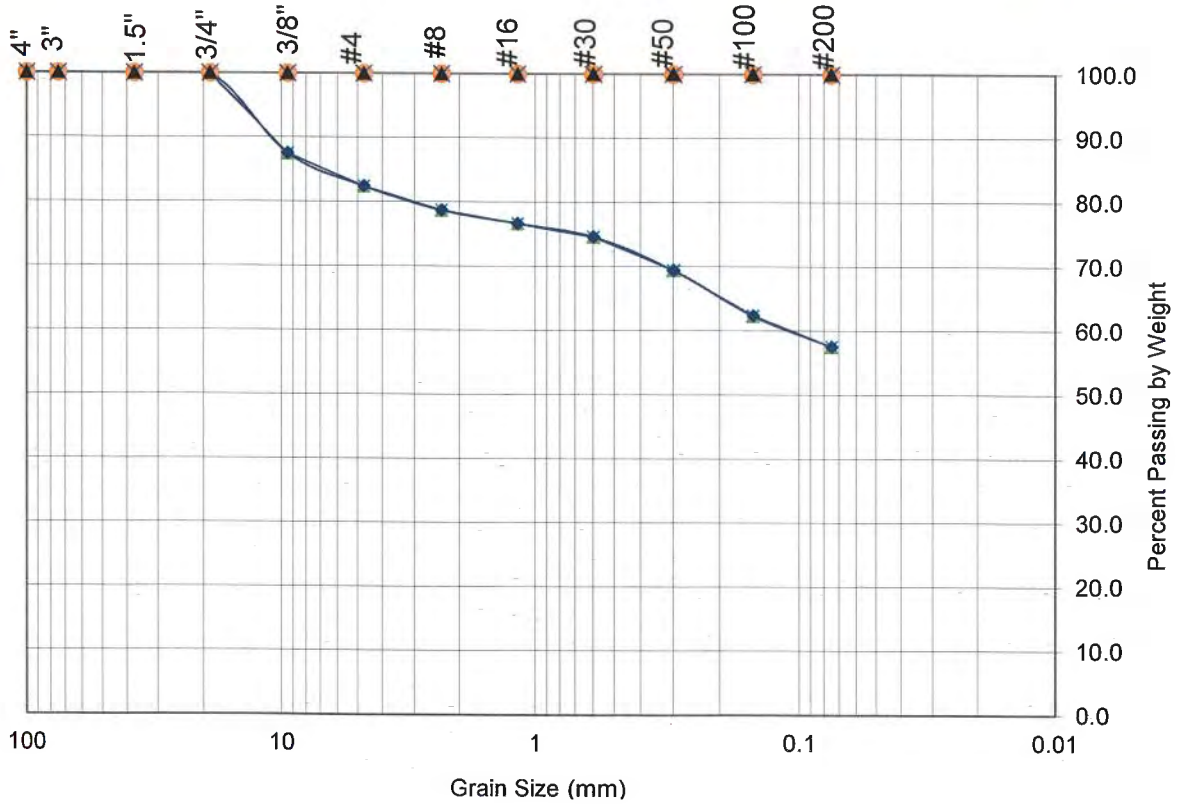
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**9.45**	**9.45**	**87.5**
4	0.00	0.00	**3.89**	**13.34**	**82.4**
8	0.00	0.00	**2.80**	**16.14**	**78.7**
16	0.00	0.00	**1.55**	**17.69**	**76.7**
30	0.00	0.00	**1.56**	**19.25**	**74.6**
50	0.00	0.00	**3.93**	**23.18**	**69.4**
100	0.00	0.00	**5.36**	**28.54**	**62.4**
200	0.00	0.00	**3.66**	**32.20**	**57.5**
PAN	0.00	0.00	**0.04**	**32.24**	

Moisture Content

Tare No.	
Wet Wt.	170.83
Dry Wt.	159.95
Tare Wt.	84.14
%	14.4

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	170.83	116.38
Tare	84.14	84.14
Sample Wt.	**86.69**	**32.24**
Minus 200 Wt		**43.57**
Dry Weight	**75.81**	



TSi Geotechnical, Inc.

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-5N Sample No.: SS-3
Depth: 6.0 - 7.5
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.21	102.9	99.39	89	10.39	14.18	73.3%

Comments:

TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-5N Sample No.: SS-4
Depth: 8.5 - 10.0
Visual: Brown, silty clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
85.89	183.32	159.7	102.52	57.18	73.81	77.5%

Comments:

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Boring: B-5N Sample: SS-5
Visual: Brown, SILT

Job No.: 20211176.00
Depth: 13.5-15.0
Tested by: PCS- 9/14/2021
Checked by:

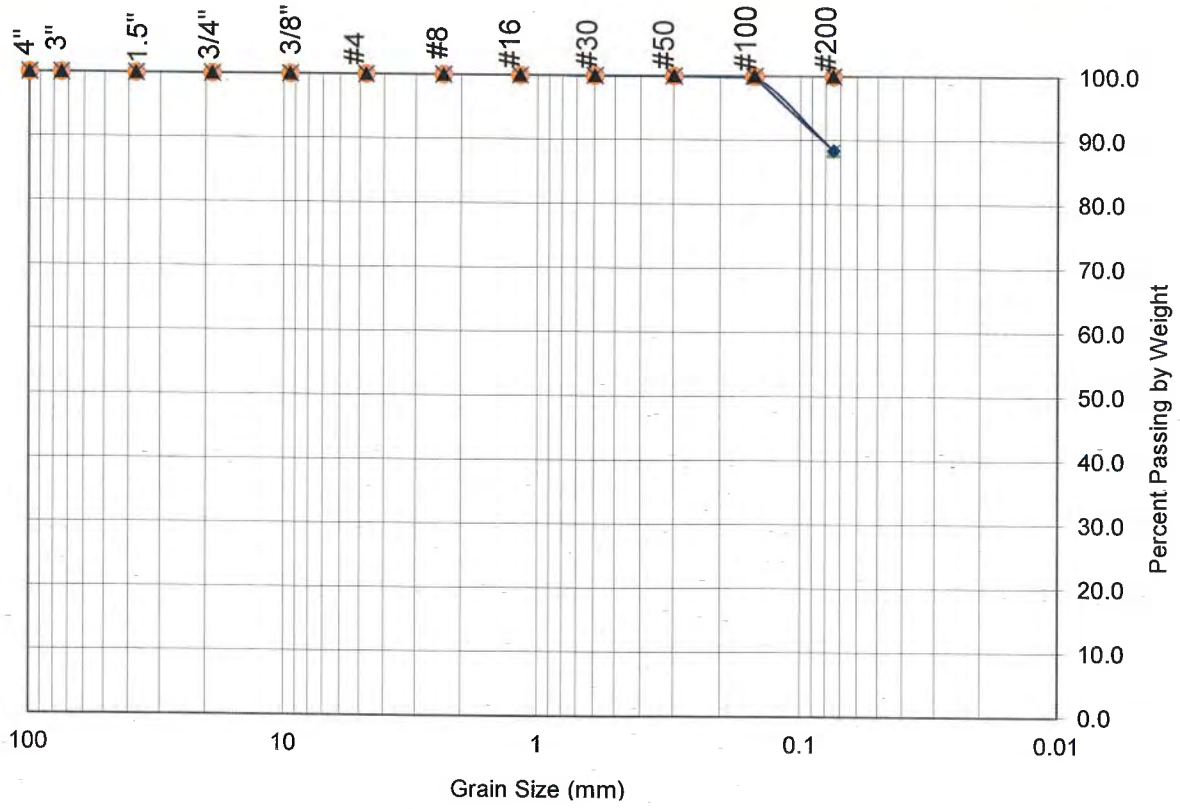
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.00**	**0.00**	**100.0**
30	0.00	0.00	**0.04**	**0.04**	**100.0**
50	0.00	0.00	**0.03**	**0.07**	**99.9**
100	0.00	0.00	**0.25**	**0.32**	**99.8**
200	0.00	0.00	**14.74**	**15.06**	**88.4**
PAN	0.00	0.00	**13.80**	**28.86**	

Moisture Content

Tare No.	
Wet Wt.	262.78
Dry Wt.	212.69
Tare Wt.	82.81
%	38.6

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	262.78	111.67
Tare	82.81	82.81
Sample Wt.	**179.97**	**28.86**
Minus 200 Wt		**101.02**
Dry Weight	**129.88**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSI geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

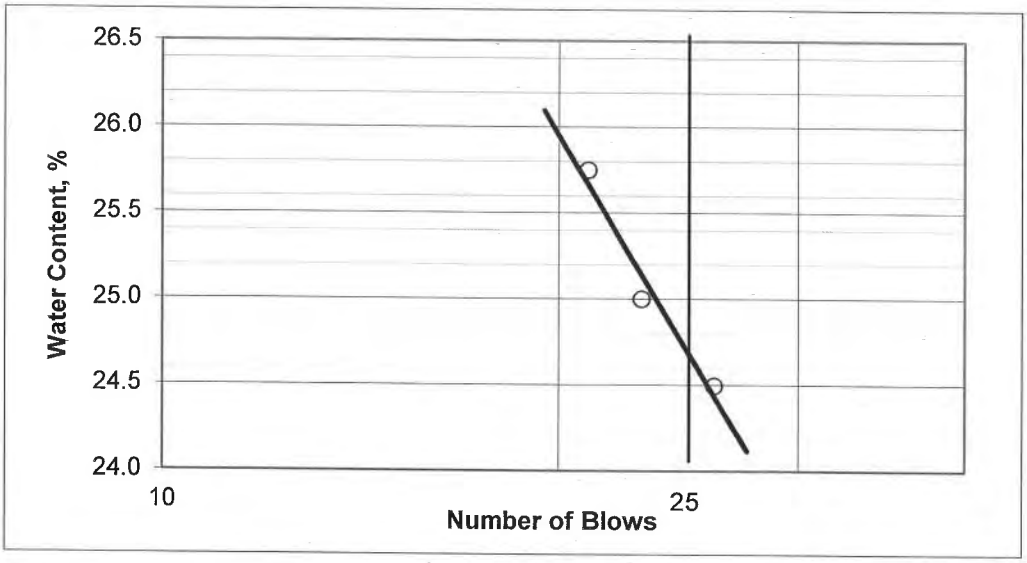
Project Number 20211176 Date:

Boring # B-5 N Sample # SS-5 Depth 13.5 - 15.0

Visual Classification: Gray, SILT

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	XD0	CP3	VP19	
Tare Plus Wet Soil, g	4.49	4.48	4.96	
Tare Plus Dry Soil, g	3.76	3.74	4.10	
Water, g	0.73	0.74	0.86	
Tare, g	0.78	0.78	0.76	
Dry Soil, g	2.98	2.96	3.34	
Water content, %	24.50	25.00	25.75	
Number of Blows	26	23	21	



LL 25.0
PL 23.0
PI 2

Symbol from plasticity chart

ML

PLASTIC LIMIT

Run No.	1	2					
Tare No.	IY2	FK3					
Tare Plus Wet Soil, g	6.58	6.41					
Tare Plus Dry Soil, g	5.48	5.35					
Water, g	1.10	1.06					
Tare, g	0.80	0.81					
Dry Soil, g	4.68	4.54					
Water content, %	23.50	23.35					
Plastic Limit	23						

Remarks

Technician PCS Computed By SY Checked By AD

Atterberg Limits (ASTM D4318)

1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

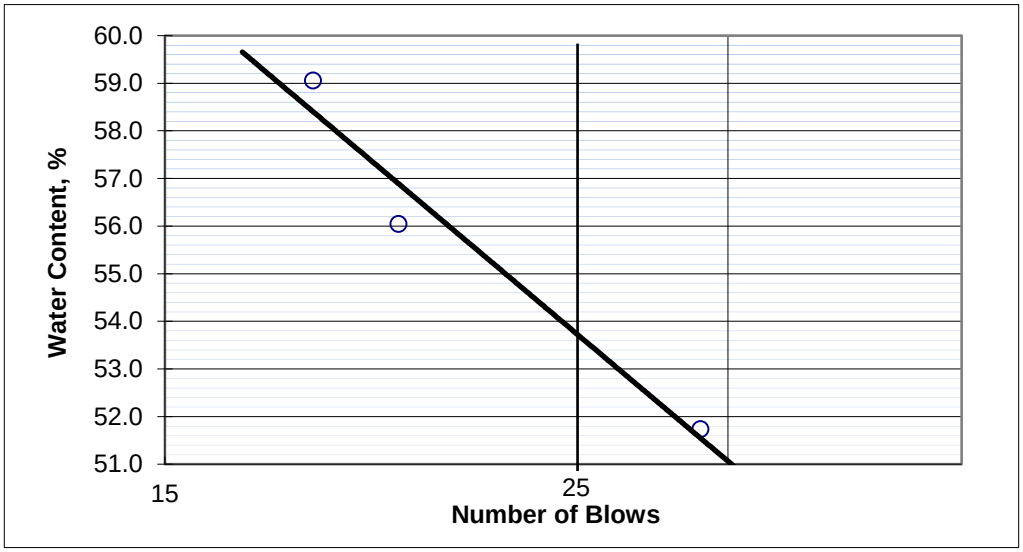
Project Number 20211176 Date:

Boring # B5N Sample # ST-6-2 Depth 18.5 - 19.0

Visual Classification: _Brown

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	AL3	ED3	MO3	
Tare Plus Wet Soil, g	10.38	11.34	12.67	
Tare Plus Dry Soil, g	7.10	7.54	8.27	
Water, g	3.28	3.80	4.40	
Tare, g	0.76	0.76	0.82	
Dry Soil, g	6.34	6.78	7.45	
Water content, %	51.74	56.05	59.06	
Number of Blows	29	20	18	



LL	54.0
PL	16.0
PI	38

Symbol from plasticity chart

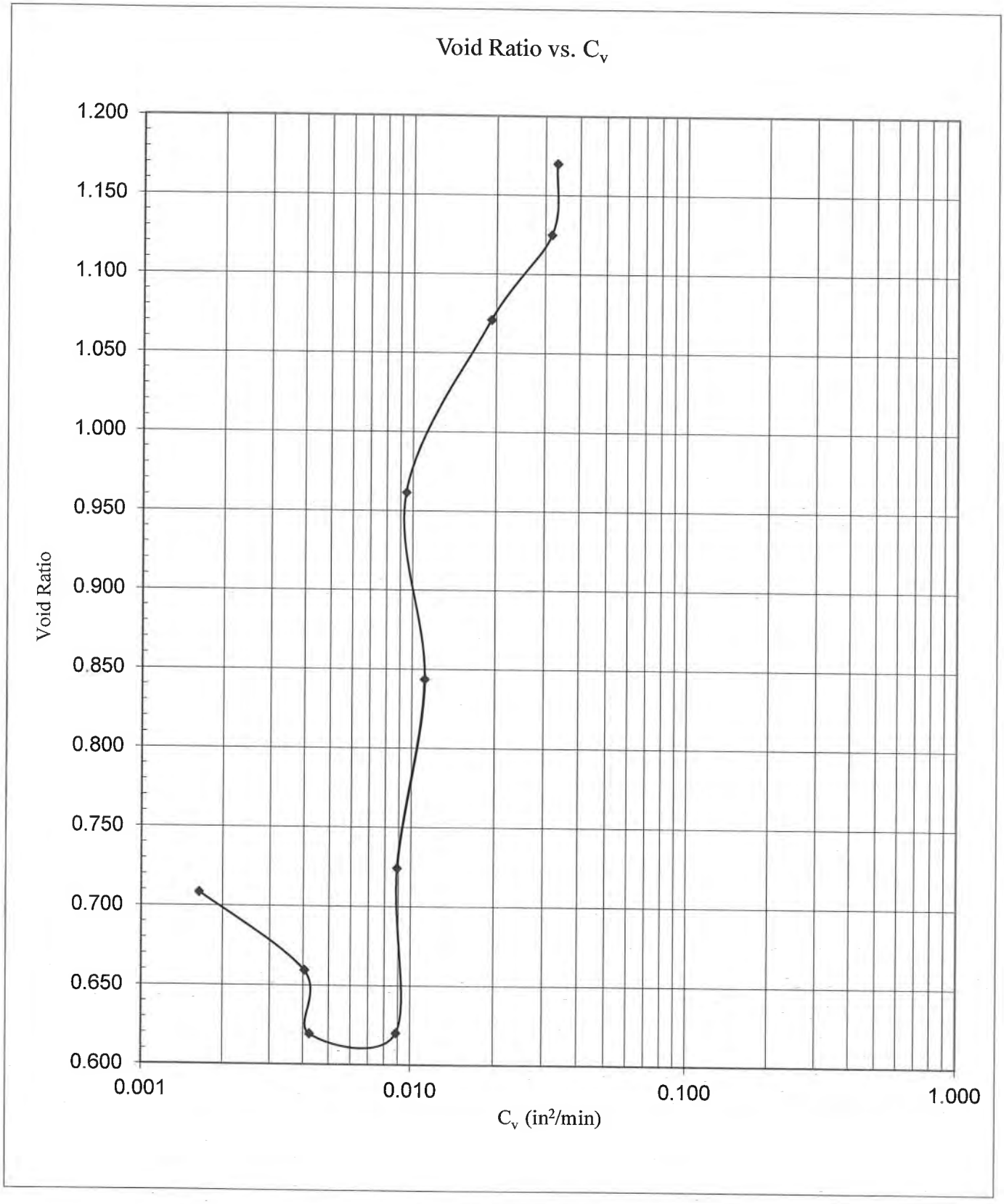
CH

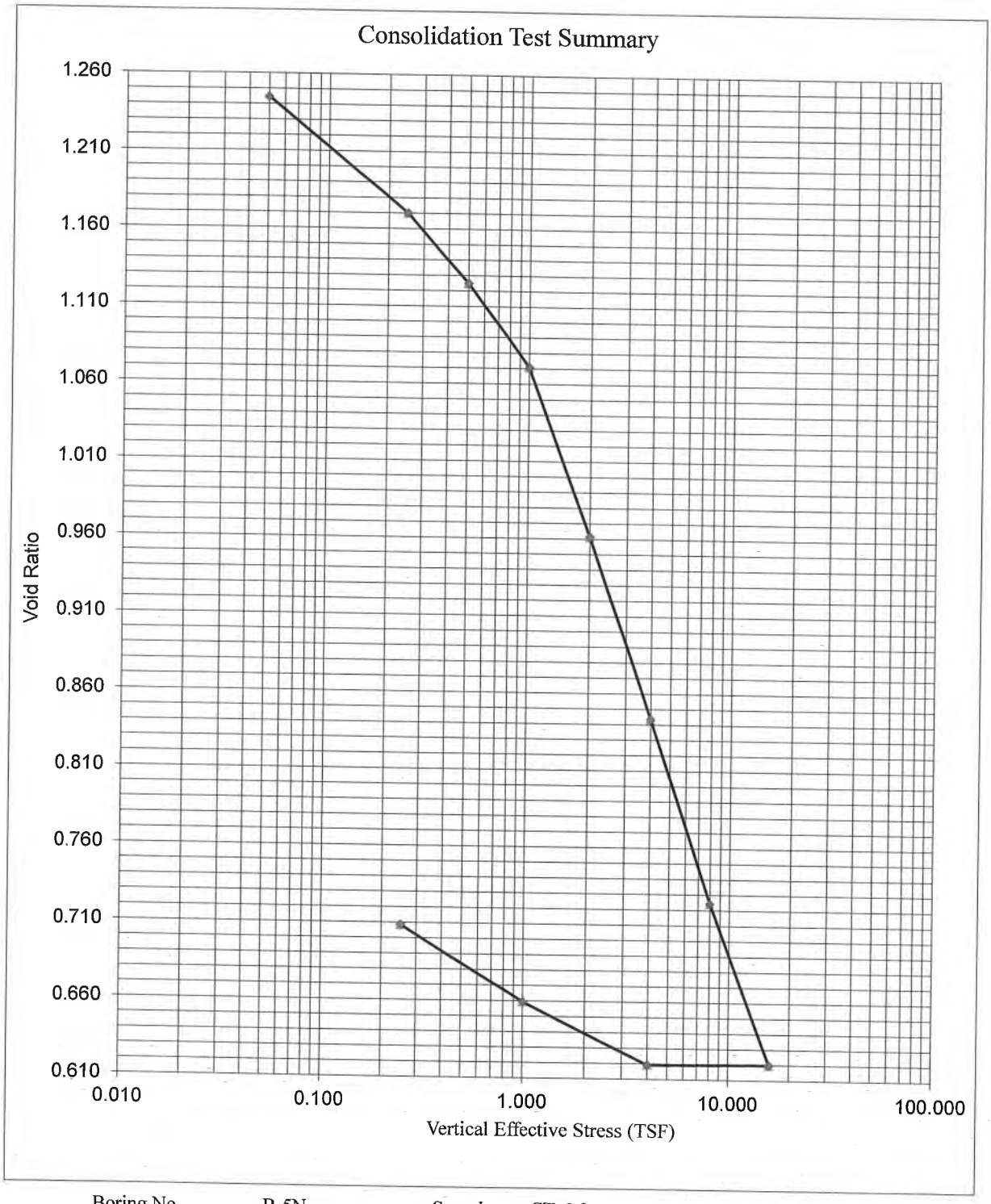
PLASTIC LIMIT

Run No.	1	2					
Tare No.	KIT	JHG					
Tare Plus Wet Soil, g	6.35	6.34					
Tare Plus Dry Soil, g	5.59	5.57					
Water, g	0.76	0.77					
Tare, g	0.77	0.83					
Dry Soil, g	4.82	4.74					
Water content, %	15.77	16.24					
Plastic Limit	16						

Remarks

Technician JC Computed By SY Checked By AD


Void Ratio vs. C_v
1.200
1.150
1.100
1.050
1.000
0.950
0.900
0.850
0.800
0.750
0.700
0.650
0.600
Void Ratio
0.001
0.010
0.100
1.000
C_v (in²/min)



Boring No. B-5N Sample ST-6-2 Depth 18.5-19.0

Soil Description : Gray, CLAY, trace gravel

Initial Moisture Content (%): 46.0 Specific Gravity: 2.7 (assumed)

Initial Dry Density(pcf): 75.1

Project Name: I-55/70 over Railroad Yard

Project Number: 20211176.00

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

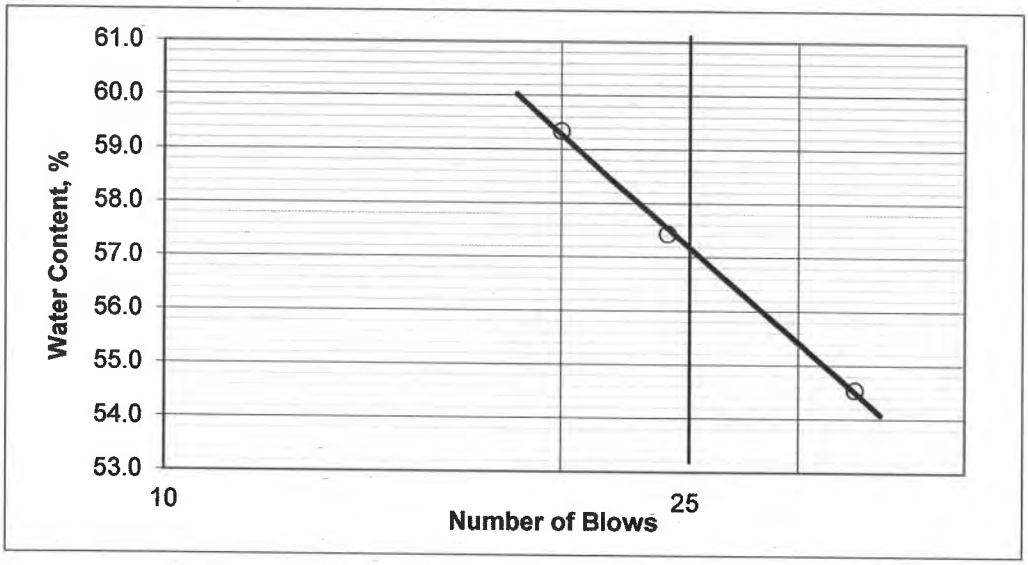
Project Number 20211176 Date:

Boring # B-5 S Sample # SS-2 Depth 3.5 - 5.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	HT3	LW2	IF2	
Tare Plus Wet Soil, g	12.47	11.43	10.61	
Tare Plus Dry Soil, g	8.12	7.57	7.13	
Water, g	4.35	3.86	3.48	
Tare, g	0.79	0.85	0.75	
Dry Soil, g	7.33	6.72	6.38	
Water content, %	59.35	57.44	54.55	
Number of Blows	20	24	33	



LL 57.0
PL 16.0
PI 41

Symbol from plasticity chart
CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	Kv3	DW5					
Tare Plus Wet Soil, g	6.26	6.23					
Tare Plus Dry Soil, g	5.48	5.47					
Water, g	0.78	0.76					
Tare, g	0.78	0.82					
Dry Soil, g	4.70	4.65					
Water content, %	16.60	16.34					
Plastic Limit	16						

Remarks

Technician JC Computed By SLY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD 9-10-2021
Boring No.	B-5 S	Sample No.	ST-3-3
Depth	7.0-7.5		

Soil Description **Brown, CLAY**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	33.15	gm
Dry & Tare	25.66	gm
Tare	2.57	gm
Water Content	32.4	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	71.92	mm
Height	146.36	mm
Wet Weight	1121.52	gm
Volume	594.58	cc
L:D Ratio	2.04	
Wet Density	117.70	pcf
Dry Density	88.87	pcf
Water Content	32.4	%
Saturation	98	%
Void Ratio	0.90	

Instrument Constants

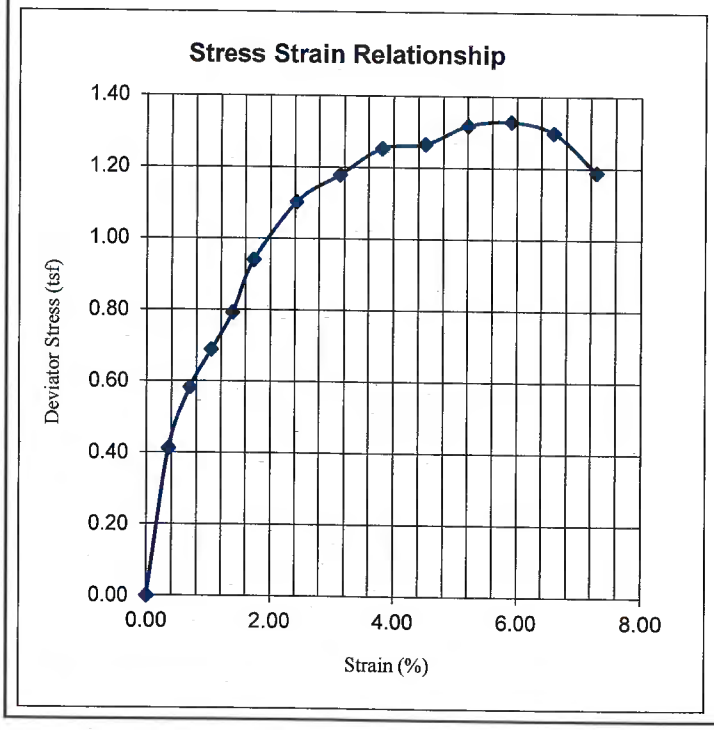
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Confining Pressure (psi): 5.0

Undrained Shear Strength (tsf): 0.66

Axial Strain (%): 5.9



TSI geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-5S Sample No.: SS-4
Depth: 8.5 - 10.0
Visual: Brown & Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
82.89	288.21	229.17	98.82	130.35	146.28	89.1%

Comments:

TSI
geotechnical, inc.

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-5S Sample No.: SS-5
Depth: 13.5 - 15.0
Visual: Brown, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
83.47	231.31	197.43	106.89	90.54	113.96	79.4%

Comments:

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-5S Sample: SS-9
Depth: 33.5 - 35.0
Visual: Gray, CLAY
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

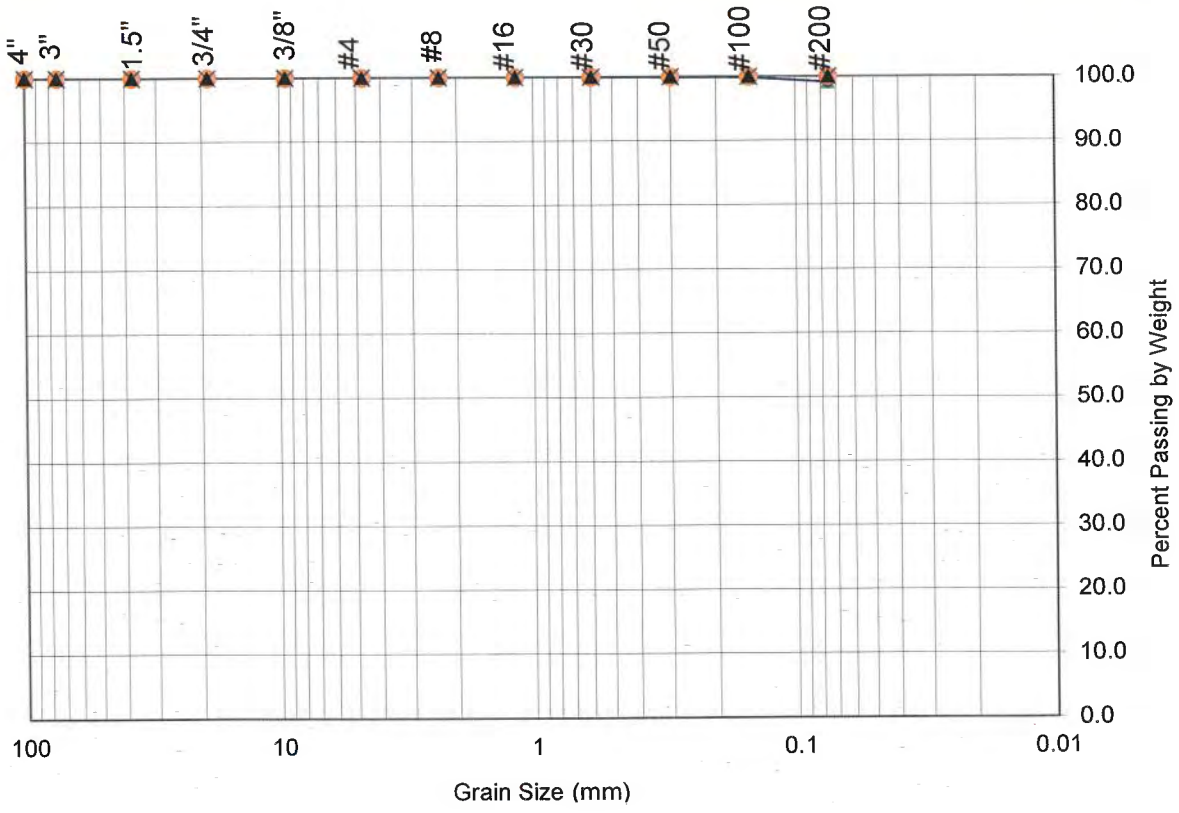
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.00**	**0.00**	**100.0**
30	0.00		**0.01**	**0.01**	**100.0**
50	0.00	0.00	**0.05**	**0.06**	**99.9**
100	0.00	0.00	**0.06**	**0.12**	**99.8**
200	0.00	0.00	**0.51**	**0.63**	**99.1**
PAN	0.00	0.00	**0.01**	**0.64**	

Moisture Content

Tare No.	
Wet Wt.	193.70
Dry Wt.	153.19
Tare Wt.	83.43
%	58.1

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	193.70	84.19
Tare	83.43	83.43
Sample Wt.	**110.27**	**0.76**
Minus 200 Wt		**69.00**
Dry Weight	**69.76**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-5S
Sample: SS-13
Depth: 53.5 - 55.0
Visual: Gray, SAND
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

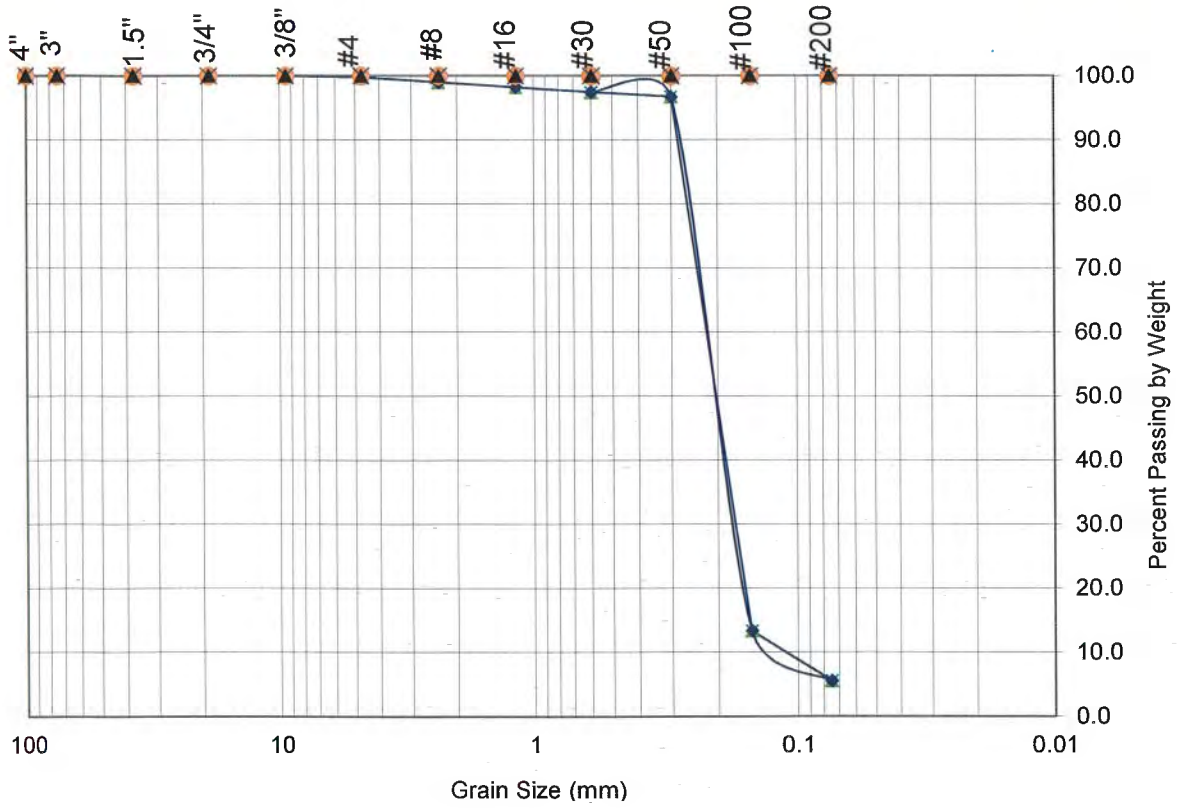
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.43**	**0.43**	**99.8**
8	0.00	0.00	**1.35**	**1.78**	**99.0**
16	0.00	0.00	**1.37**	**3.15**	**98.2**
30	0.00		**1.30**	**4.45**	**97.5**
50	0.00	0.00	**1.27**	**5.72**	**96.7**
100	0.00	0.00	**145.60**	**151.32**	**13.3**
200	0.00	0.00	**13.68**	**165.00**	**5.5**
PAN	0.00	0.00	**0.25**	**165.25**	

Moisture Content

Tare No.	
Wet Wt.	303.00
Dry Wt.	259.86
Tare Wt.	85.25
%	24.7

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	303.00	250.55
Tare	85.25	85.25
Sample Wt.	**217.75**	**165.30**
Minus 200 Wt		**9.31**
Dry Weight	**174.61**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-5S Sample: SS-18
Depth: 78.5 - 80.0
Visual: Brown and black, SAND
Tested by: PCS- 9/21/2021
Checked by: AD 9/27/2021

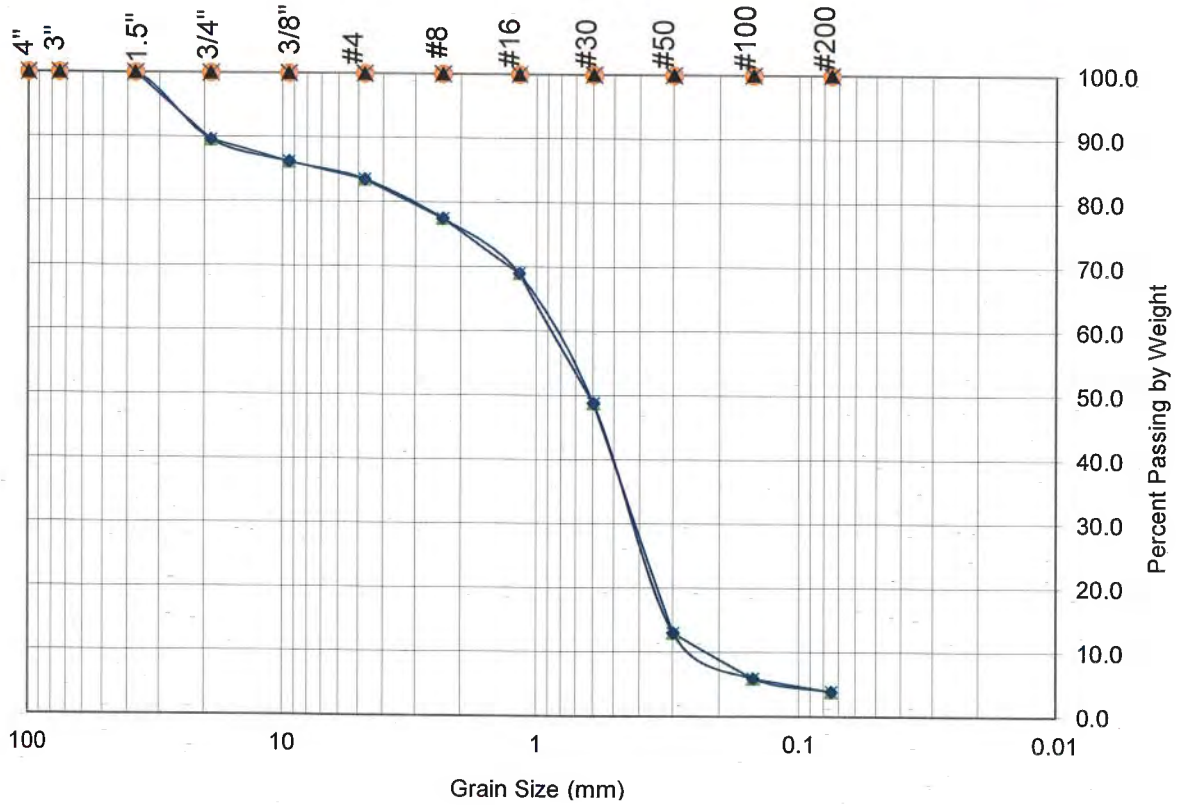
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**14.33**	**14.33**	**89.6**
3/8"	0.00	0.00	**4.70**	**19.03**	**86.2**
4	0.00	0.00	**3.68**	**22.71**	**83.5**
8	0.00	0.00	**8.34**	**31.05**	**77.5**
16	0.00	0.00	**11.70**	**42.75**	**69.0**
30	0.00		**27.82**	**70.57**	**48.8**
50	0.00	0.00	**49.40**	**119.97**	**13.0**
100	0.00	0.00	**9.82**	**129.79**	**5.9**
200	0.00	0.00	**2.75**	**132.54**	**3.9**
PAN	0.00	0.00	**0.10**	**132.64**	

Moisture Content

Tare No.	
Wet Wt.	248.85
Dry Wt.	224.97
Tare Wt.	87.11
%	17.3

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	248.85	220.13
Tare	87.11	87.11
Sample Wt.	**161.74**	**133.02**
Minus 200 Wt		**4.84**
Dry Weight	**137.86**	



TSi Geotechnical, Inc.

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-6N
Sample: SS-3
Depth: 6.0-7.5
Visual: Brown, SILT LOAM with Gravel
Tested by: PCS- 9/14/2021
Checked by:

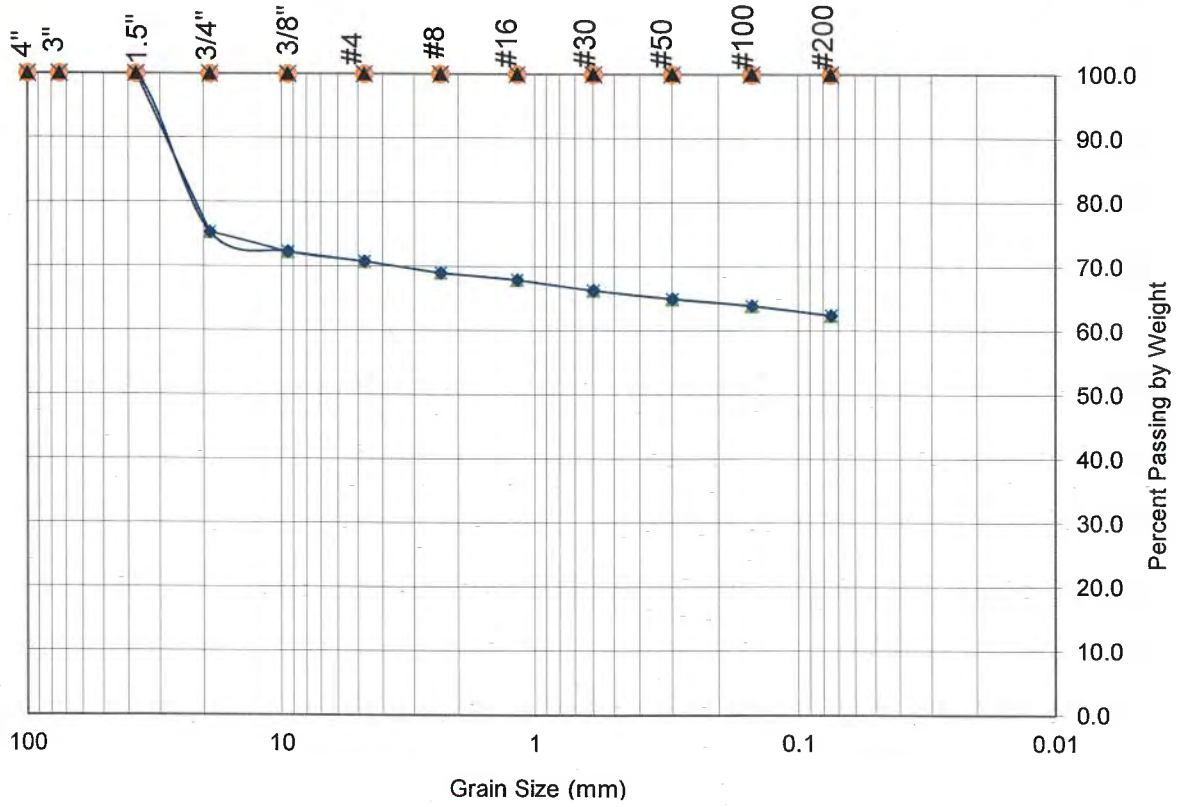
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**31.24**	**31.24**	**75.3**
3/8"	0.00	0.00	**3.93**	**35.17**	**72.2**
4	0.00	0.00	**1.87**	**37.04**	**70.7**
8	0.00	0.00	**2.22**	**39.26**	**69.0**
16	0.00	0.00	**1.38**	**40.64**	**67.9**
30	0.00	0.00	**2.05**	**42.69**	**66.3**
50	0.00	0.00	**1.65**	**44.34**	**65.0**
100	0.00	0.00	**1.36**	**45.70**	**63.9**
200	0.00	0.00	**1.88**	**47.58**	**62.4**
PAN	0.00	0.00	**0.02**	**47.60**	

Moisture Content

Tare No.	
Wet Wt.	407.35
Dry Wt.	360.55
Tare Wt.	84.51
%	17.0

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	211.10	132.11
Tare	84.51	84.51
Sample Wt.	**126.59**	**47.60**
Minus 200 Wt		**78.99**
Dry Weight	**126.59**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

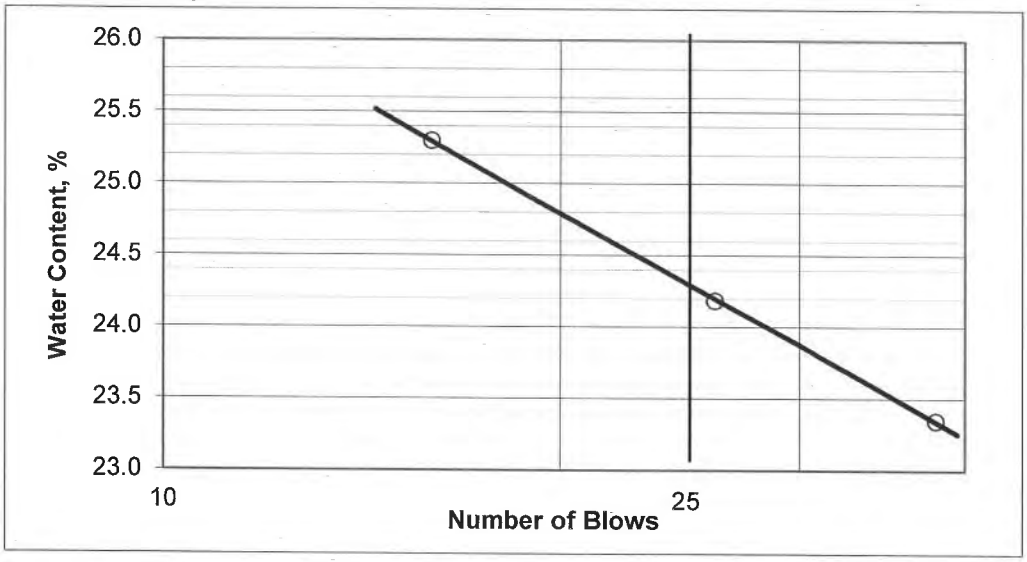
Project Number 20211176 Date:

Boring # B-6N Sample # SS-3 Depth 6.0 - 7.5

Visual Classification: Brown and gray, SILT LOAM

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	2C0	JC5	DKQ	
Tare Plus Wet Soil, g	10.88	11.88	12.33	
Tare Plus Dry Soil, g	8.97	9.73	10.00	
Water, g	1.91	2.15	2.33	
Tare, g	0.79	0.84	0.79	
Dry Soil, g	8.18	8.89	9.21	
Water content, %	23.35	24.18	25.30	
Number of Blows	38	26	16	



LL 24.0
PL 21.0
PI 3

Symbol from plasticity chart
ML

PLASTIC LIMIT

Run No.	1	2					
Tare No.	TK3	FME5					
Tare Plus Wet Soil, g	6.51	6.51					
Tare Plus Dry Soil, g	5.52	5.51					
Water, g	0.99	1.00					
Tare, g	0.80	0.75					
Dry Soil, g	4.72	4.76					
Water content, %	20.97	21.01					
Plastic Limit	21						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name: I-55/I-70 over railroad yard | Tested By: SLY

Project No.: 20211176.00 | Checked By: AD

Boring No.: B-6N | Sample No.: ST-5 | Depth: 8.5 - 9.0

Soil Description: **Brown, CLAY LOAM**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	49.83	gm
Dry & Tare	41.55	gm
Tare	2.56	gm
Water Content	21.2	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	71.00	mm
Height	146.23	mm
Wet Weight	1135.09	gm
Volume	578.95	cc
L:D Ratio	2.06	
Wet Density	122.34	pcf
Dry Density	100.91	pcf
Water Content	21.2	%
Saturation	86	%
Void Ratio	0.67	

Instrument Constants

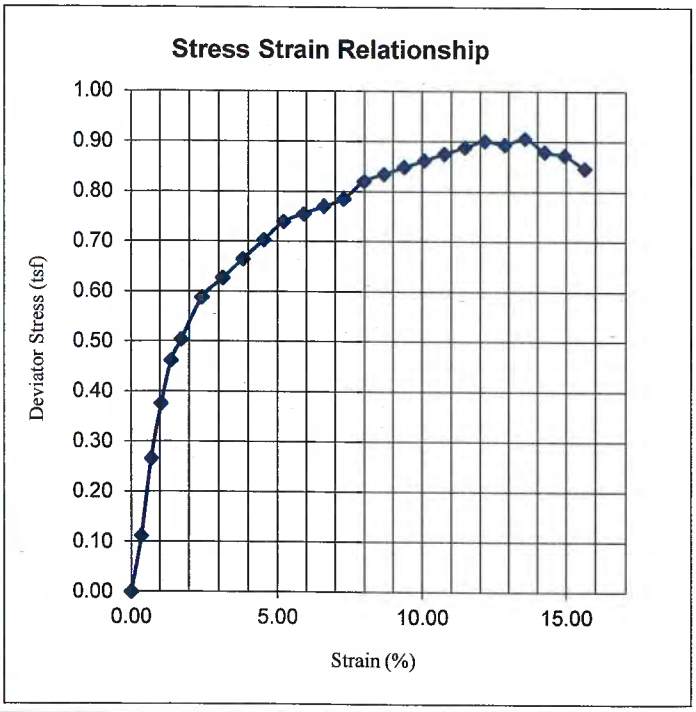
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Confining Pressure (psi): 7.0

Undrained Shear Strength (tsf): 0.45

Axial Strain (%): 13.5



1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-6N Sample No.: SS-6
Depth: 13.5 - 15.0
Visual: Brown & Gray, clay

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.16	217.99	173.33	88.23	85.10	89.17	95.4%

Comments:

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

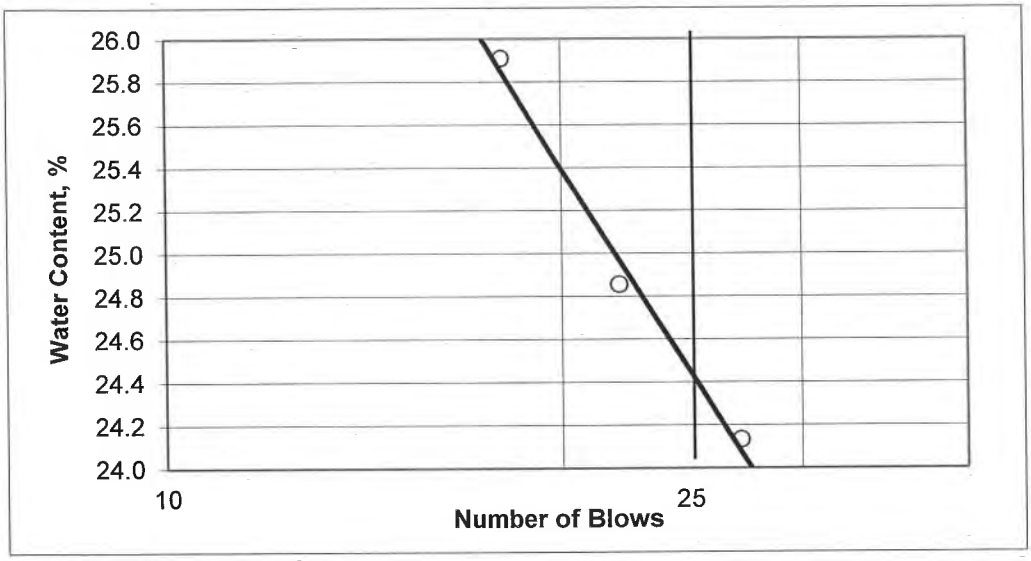
Project Number 20211176 Date:

Boring # B-6N Sample # SS-6 Depth 13.5 - 15.0

Visual Classification: Gray, SILT LOAM

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	DKQ	CP10	LW2	
Tare Plus Wet Soil, g	10.44	11.68	12.54	
Tare Plus Dry Soil, g	8.56	9.51	10.12	
Water, g	1.88	2.17	2.42	
Tare, g	0.77	0.78	0.78	
Dry Soil, g	7.79	8.73	9.34	
Water content, %	24.13	24.86	25.91	
Number of Blows	27	22	18	



LL 24.0
PL 21.0
PI 3

Symbol from plasticity chart
ML

PLASTIC LIMIT

Run No.	1	2					
Tare No.	KV6	QX3					
Tare Plus Wet Soil, g	6.64	6.60					
Tare Plus Dry Soil, g	5.62	5.59					
Water, g	1.02	1.01					
Tare, g	0.85	0.85					
Dry Soil, g	4.77	4.74					
Water content, %	21.38	21.31					
Plastic Limit	21						

Remarks

Technician JC Computed By SY Checked By AD

1340 North Price
St. Louis, MO 63132
(314) 373-4000

Project: I55/70 over Railroad Yard
Project Number: 20211176
Tested by: SLY
Checked by: AD

Boring: B-6N Sample No.: SS-7
Depth: 18.5 - 20.0
Visual: Brown & Gray, clay loam

ASTM D1140: Materials Finer than #200 sieve, by wash method.

Tare Weight (g)	Tare + Before Wet Weight (g)	Tare + Before Dry Weight (g)	Tare + After Dry Weight (g)	Weight Loss (g)	Total Weight (g)	% Passing #200
84.18	86.39	85.89	84.76	1.13	1.71	66.1%

Comments:

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-6N Sample: SS-8
Depth: 23.5-25
Visual: Brown, SILT LOAM
Tested by: PCS- 9/13/2021
Checked by:

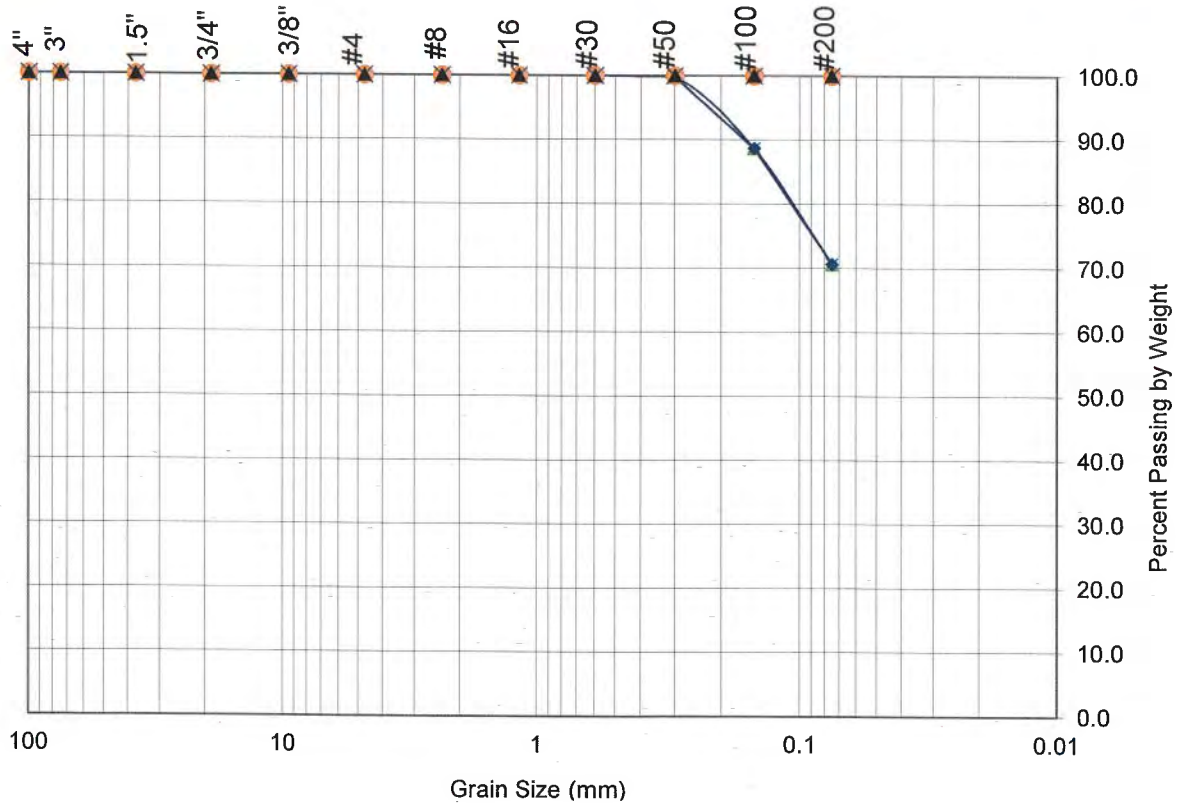
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.00**	**0.00**	**100.0**
30	0.00	0.00	**0.00**	**0.00**	**100.0**
50	0.00	0.00	**0.01**	**0.01**	**99.8**
100	0.00	0.00	**0.61**	**0.62**	**88.7**
200	0.00	0.00	**0.99**	**1.61**	**70.6**
PAN	0.00	0.00	**0.13**	**1.74**	

Moisture Content

Tare No.	
Wet Wt.	92.89
Dry Wt.	90.66
Tare Wt.	85.18
%	40.7

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	92.89	86.93
Tare	85.18	85.18
Sample Wt.	**7.71**	**1.75**
Minus 200 Wt		**3.73**
Dry Weight	**5.48**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

1340 North Price Rd
St. Louis, MO
geotechnical, inc.

Project Name: I-55/I-70 over Railroad Yard

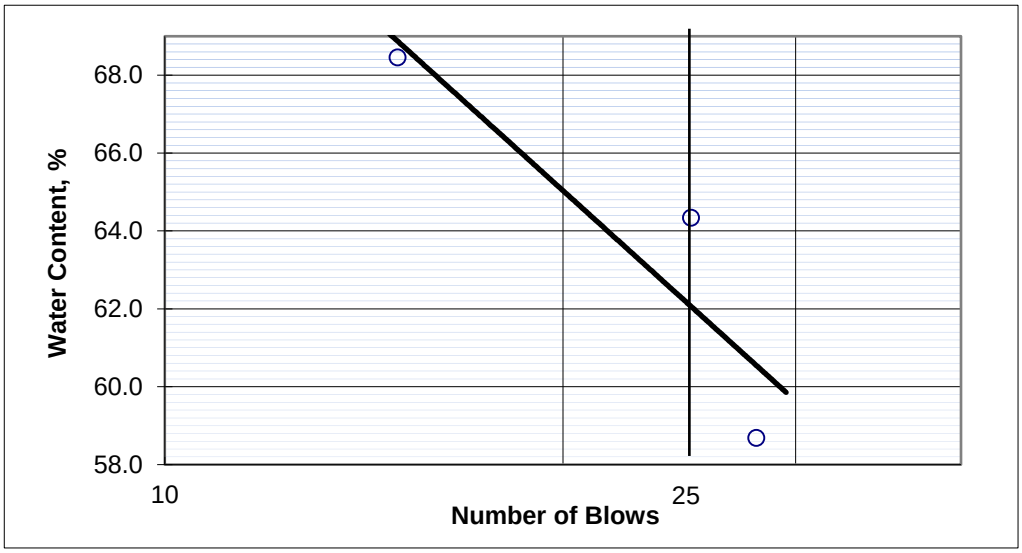
Project Number 20211176 Date:

Boring # B-6N Sample # SS-10 Depth 33.5 - 35.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	KP2	HL4	MU3	
Tare Plus Wet Soil, g	10.19	11.15	10.18	
Tare Plus Dry Soil, g	6.71	7.09	6.36	
Water, g	3.48	4.06	3.82	
Tare, g	0.78	0.78	0.78	
Dry Soil, g	5.93	6.31	5.58	
Water content, %	58.68	64.34	68.46	
Number of Blows	28	25	15	



LL 62.0
PL 20.0
PI 42

Symbol from plasticity chart

CH

PLASTIC LIMIT

Run No.	1	2					
Tare No.	KV4	HT2					
Tare Plus Wet Soil, g	6.75	6.78					
Tare Plus Dry Soil, g	5.76	5.81					
Water, g	0.99	0.97					
Tare, g	0.79	0.80					
Dry Soil, g	4.97	5.01					
Water content, %	19.92	19.36					
Plastic Limit	20						

Remarks

Technician JC Computed By SY Checked By AD

GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard | Job No.: 20211176.00

Boring: B-6N | Sample: SS-14 | Depth: 53.5-55.0

Visual: Gray, SAND | Tested by: PCS- 9/13/2021

Checked by:

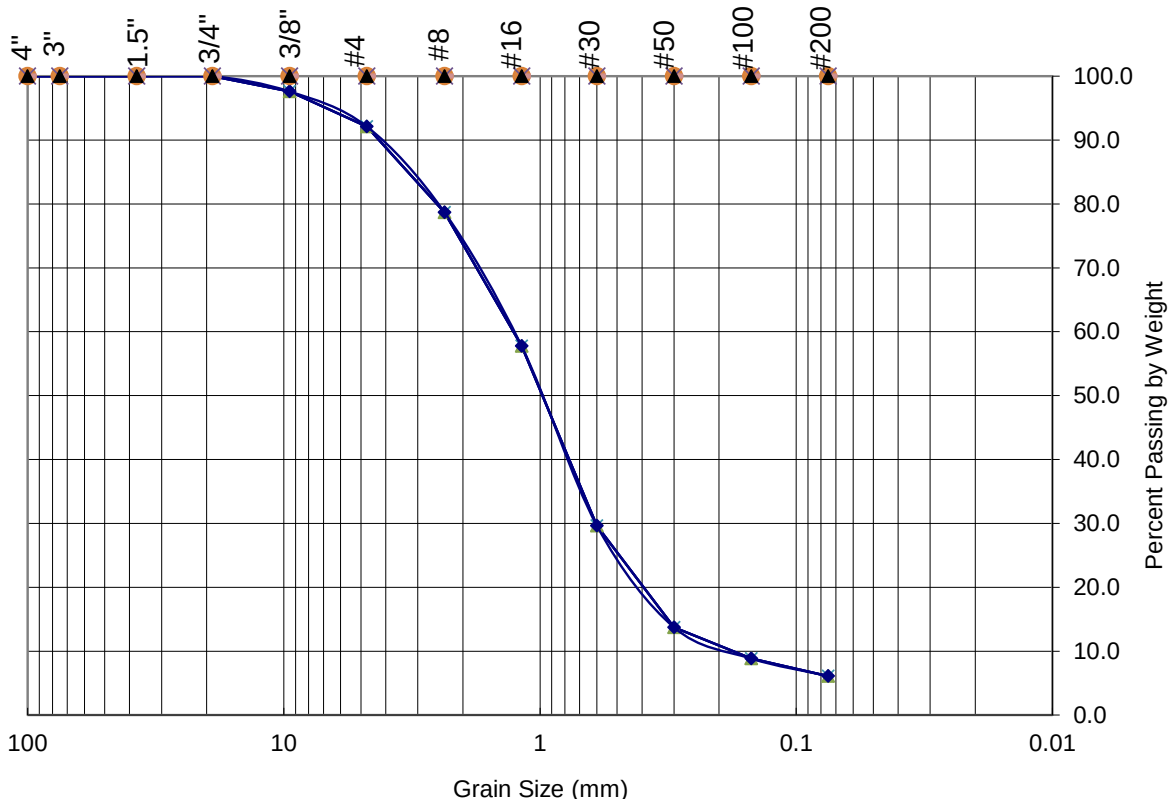
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**6.80**	**6.80**	**97.6**
4	0.00	0.00	**15.55**	**22.35**	**92.1**
8	0.00	0.00	**38.14**	**60.49**	**78.7**
16	0.00	0.00	**59.44**	**119.93**	**57.8**
30	0.00	0.00	**79.82**	**199.75**	**29.6**
50	0.00	0.00	**45.19**	**244.94**	**13.7**
100	0.00	0.00	**13.87**	**258.81**	**8.8**
200	0.00	0.00	**7.81**	**266.62**	**6.1**
PAN	0.00	0.00	**0.24**	**266.86**	

Moisture Content

Tare No.	
Wet Wt.	404.79
Dry Wt.	367.38
Tare Wt.	83.48
%	13.2

No. 200 Sieve Washing Data

	before-wet	**after-dry**
Sample & Tare	404.79	350.34
Tare	83.48	83.48
Sample Wt.	**321.31**	**266.86**
Minus 200 Wt		**17.04**
Dry Weight	**283.90**	



TSi Geotechnical, Inc.

Atterberg Limits (ASTM D4318)

TSi geotechnical, inc.
1340 North Price Rd
St. Louis, MO

Project Name: I-55/I-70 over Railroad Yard

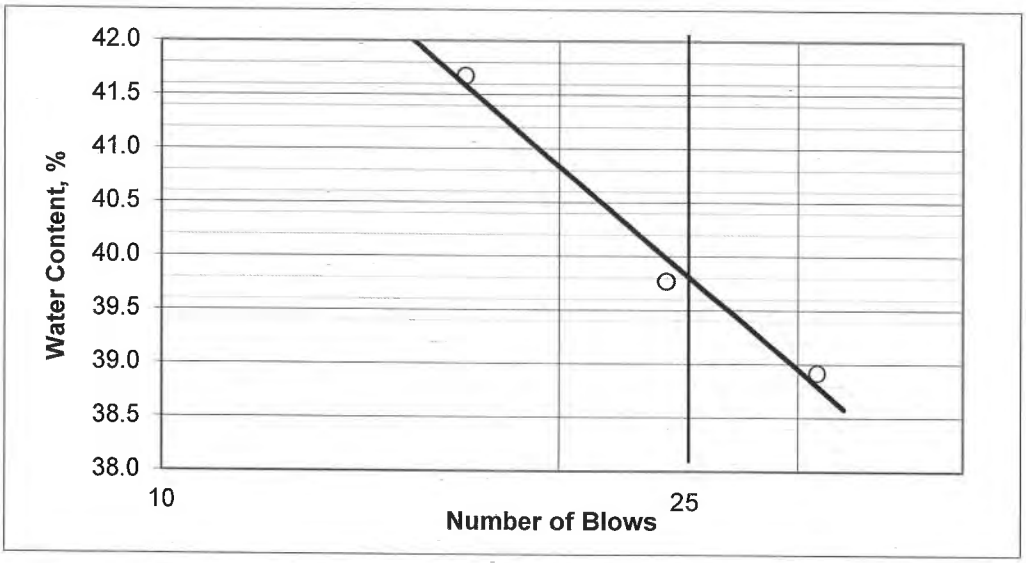
Project Number 20211176 Date:

Boring # B-6S Sample # SS-4 Depth 8.5 - 10.0

Visual Classification: Gray, CLAY

LIQUID LIMIT

Run No.	1 (25-35)	2 (20-30)	3 (15-25)	
Tare No.	HH4	WYM5	D10	
Tare Plus Wet Soil, g	11.10	11.79	12.46	
Tare Plus Dry Soil, g	8.22	8.66	9.03	
Water, g	2.88	3.13	3.43	
Tare, g	0.82	0.79	0.80	
Dry Soil, g	7.40	7.87	8.23	
Water content, %	38.92	39.77	41.68	
Number of Blows	31	24	17	



LL 40.0
PL 16.0
PI 24

Symbol from plasticity chart

CL

PLASTIC LIMIT

Run No.	1	2					
Tare No.	CP14	GV3					
Tare Plus Wet Soil, g	6.46	6.47					
Tare Plus Dry Soil, g	5.68	5.71					
Water, g	0.78	0.76					
Tare, g	0.78	0.79					
Dry Soil, g	4.90	4.92					
Water content, %	15.92	15.45					
Plastic Limit	16						

Remarks

Technician JC Computed By SY Checked By AD

Unconsolidated-Undrained Triaxial Compression Test - Q-test

Project Name	I-55/I-70 over railroad yard	Tested By	SLY
Project No.	20211176.00	Checked By	AD
Boring No.	B-6S	Sample No.	ST-5
Depth	8.5 - 9.0		

Soil Description **Brown, CLAY LOAM**

Liquid Limit		%
Plastic Limit		%
Plasticity Index		%
USCS		
Specific Gravity	2.70	*

*assumed

Water Content Data:

Wet & Tare	49.83	gm
Dry & Tare	41.55	gm
Tare	2.56	gm
Water Content	21.2	%

Moisture content sample taken from: Trimmings

Specimen Data:

Diameter	71.00	mm
Height	146.23	mm
Wet Weight	1135.09	gm
Volume	578.95	cc
L:D Ratio	2.06	
Wet Density	122.34	pcf
Dry Density	100.91	pcf
Water Content	21.2	%
Saturation	86	%
Void Ratio	0.67	

Instrument Constants

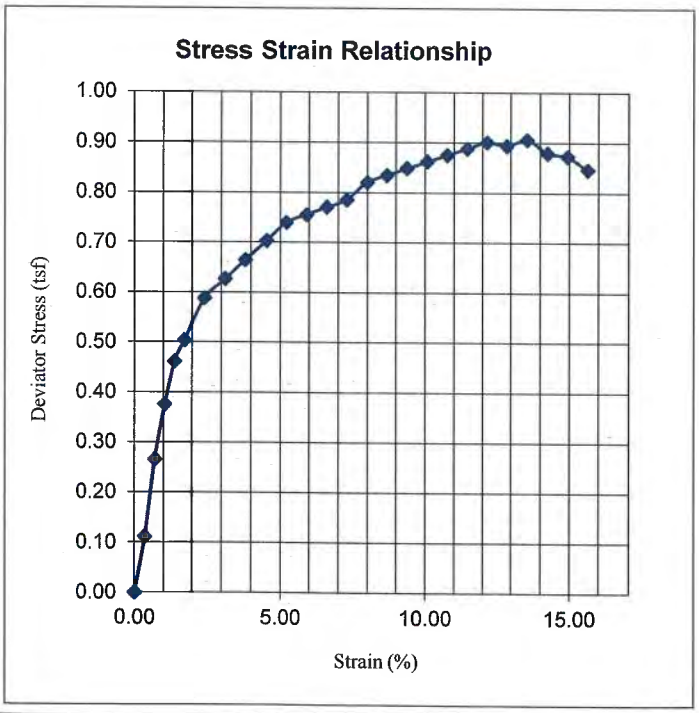
Deformation	0.0001	in/div
Load	1.9	lbs/div
Strain Rate	1.4359	mm/min
	0.98	%/min

Failure Mode: Bulge

Confining Pressure (psi): 7.0

Undrained Shear Strength (tsf): 0.45

Axial Strain (%): 13.5



GRAIN SIZE ANALYSIS

Project: I-55/70 Over Railroad Yard
Job No.: 20211176.00
Boring: B-6S Sample: SS-6
Depth: 18.5-20
Visual: Brown, SILTY CLAY
Tested by: PCS- 9/13/2021
Checked by:

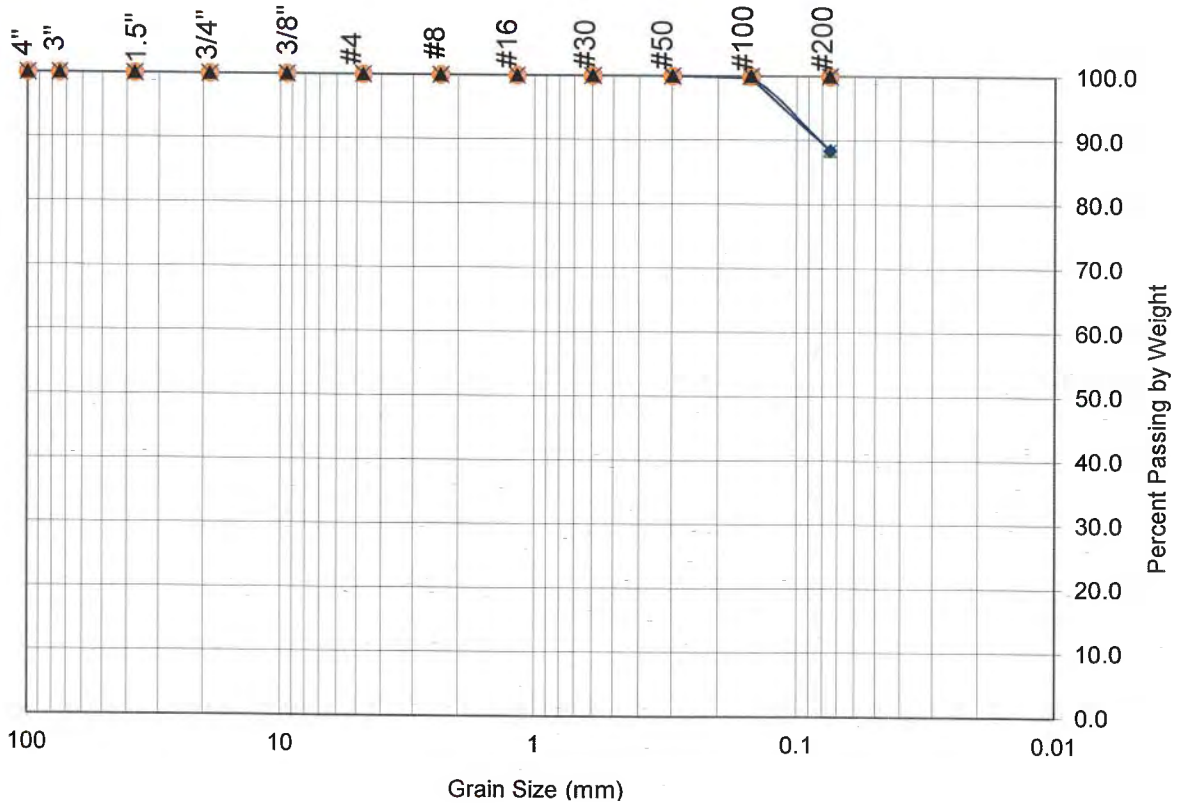
Sieve	Sieve and Sample Weight, g	Sieve Weight, g	Sample Weight, g	Cumul-ative Weight, g	% Passing by Wt.
4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3"	0.00	0.00	**0.00**	**0.00**	**100.0**
1.5"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/4"	0.00	0.00	**0.00**	**0.00**	**100.0**
3/8"	0.00	0.00	**0.00**	**0.00**	**100.0**
4	0.00	0.00	**0.00**	**0.00**	**100.0**
8	0.00	0.00	**0.00**	**0.00**	**100.0**
16	0.00	0.00	**0.00**	**0.00**	**100.0**
30	0.00	0.00	**0.01**	**0.01**	**100.0**
50	0.00	0.00	**0.02**	**0.03**	**100.0**
100	0.00	0.00	**0.30**	**0.33**	**99.7**
200	0.00	0.00	**10.88**	**11.21**	**88.4**
PAN	0.00	0.00	**0.03**	**11.24**	

Moisture Content

Tare No.	
Wet Wt.	232.95
Dry Wt.	182.63
Tare Wt.	85.98
%	52.1

No. 200 Sieve Washing Data

	before-wet	after-dry
Sample & Tare	232.95	97.22
Tare	85.98	85.98
Sample Wt.	**146.97**	**11.24**
Minus 200 Wt		**85.41**
Dry Weight	**96.65**	



TSi Geotechnical, Inc.

ATTACHMENT 4

Excerpts from PreFinal PS&E Package

Benchmark: *BM 207: Cut "□" on top of northeast end of parapet wall on the northeast end of the I-55/70 bridge (SN 082-0017) over RR tracks. Elev. 426.204.*
BM 208: Cut "□" on top southwest side of the southwest concrete overhead signpost foundation over I-55/70, north of I-55/70, just northwest of the I-55/70 bridge over the railroad (SN 082-0017). Elev. 437.486.

Existing Structure: *S.N. 082-0017 originally built in 1959 as Section 82-5VB. The back-to-back length is 1618'-11¾" and out-to-out deck width is 116'-0". The structure is a 19 span multi-unit non-composite steel wide flage beam or built-up riveted plate girder bridge on stub abutments and multi-column spread footing piers founded on metal shell piles. Traffic to be maintained using staged construction.*

Salvage: *None*

DESIGN STRESSES

FIELD UNITS (New Const.)

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (Structural Steel)

FIELD UNITS (Exist. Const.)

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fs = 20,000 psi (Structural Steel 1988 Rehab)
fs = 18,000 psi (Structural Steel 1959 Construction)

LOADING HS20-44 & ALT (New Const.)

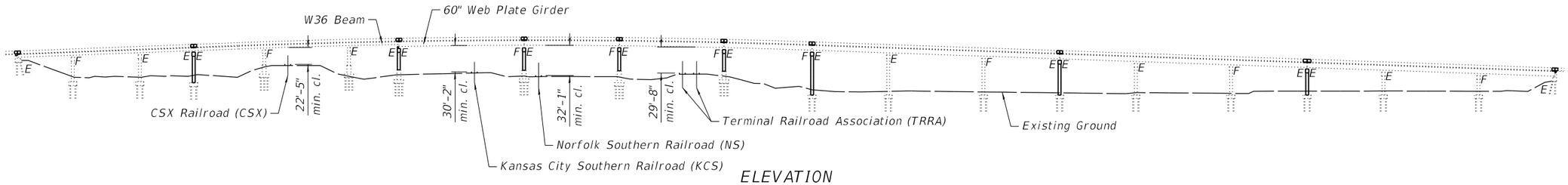
no allowance for future wearing surface.

DESIGN SPECIFICATIONS

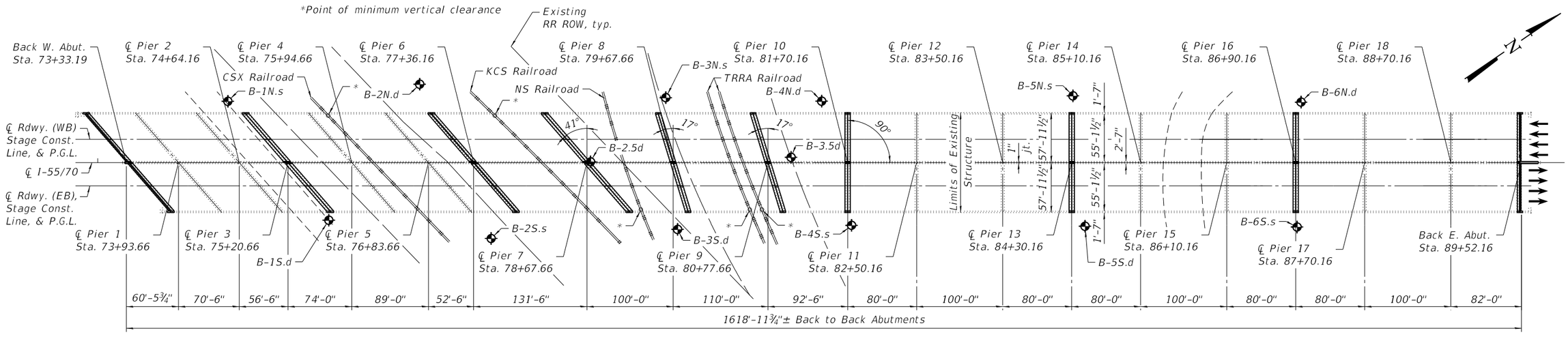
2002 AASHTO Standard Specifications for Highway Bridges, 17th Edition
1995 FHWA Seimic Retrofitting Manual

SEISMIC DATA

Seismic Performance Category (SPC) = B
Horizontal Bedrock Acceleration Coefficient (A) = 0.105g
Site Coefficient (S) = 2.0



ELEVATION



PLAN

SCOPE OF WORK

1. Partial and full depth concrete deck repairs.
2. Repairs to the parapet and replacement of the longitudinal joint along median barriers, between structures.
3. Installation of ten (10) new preformed joint strip seals, including removal and replacement of deck and parapet concrete each side of joint.
4. Installation of asphalt wearing surface with waterproofing system.
5. Replacement of cracked superstructure elements and repairs to local cracks.
6. Steel superstructure section loss repairs.
7. Steel coating on fascia girders and at all girder ends under expansion joints as shown on plans.
8. Replacement of fixed and expansion bearings below expansion joints.
9. Seismic retrofit rehabilitation.
10. Removal and reconstruction of pier caps and all columns for Pier 3, 6, 13, & 16.
11. Removal and reconstruction of pier caps and outside columns for Pier 7 thru 10.
12. Repairs to abutments and concrete pier caps, columns, and crash walls for all piers that are not reconstructed.
13. Drainage System Repair at Pier 9.

LICENSED STRUCTURAL ENGINEER
ALEX C BENZ
081-007814
STATE OF ILLINOIS

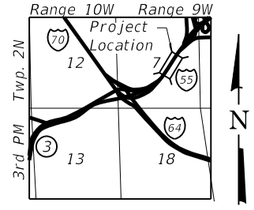
Signed: _____
Date: 11/11/2021
License Expires: 11/30/2022

The seal shown above is valid for the following sheets in these plans which were prepared under my direct supervision: Sheets 1-8, 29, 38-67, & 85-95 of 95.

LICENSED STRUCTURAL ENGINEER
RICHARD A. WALTHER
081.005127
STATE OF ILLINOIS

Signed: _____
Date: 11/11/2021
License Expires: 11/30/2022

The seal shown above is valid for the following sheets in these plans which were prepared under my direct supervision: Sheets 9-28, 30-37, & 68-84 of 95.



LOCATION SKETCH

GENERAL PLAN & ELEVATION
F.A.I. 70 (I-55/I-64/US 40)
OVER CSX, KCS, NS, & TRRA
SEC. 82-5VB-R-2
ST. CLAIR COUNTY
STATION 81+42.68
STRUCTURE NO. 082-0017

EFK•Moen
Civil Engineering Design

USER NAME = ABenz	DESIGNED - ACB	REVISED -	
	CHECKED - CDL	REVISED -	
PLOT SCALE = 0.1667 ' / in.	DRAWN - ACB	REVISED -	
PLOT DATE = 11/11/2021	CHECKED - CDL	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
STRUCTURE NO. 082-0017
SHEET 1 OF 95 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55/70	82-5VB-R-2	ST. CLAIR	186	90
			CONTRACT NO. 76K02	
		ILLINOIS	FED. AID PROJECT	

MODEL: Default
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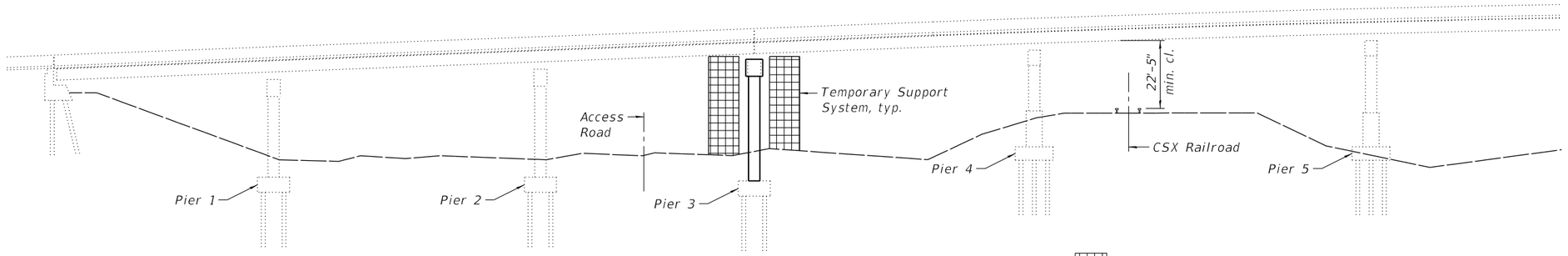
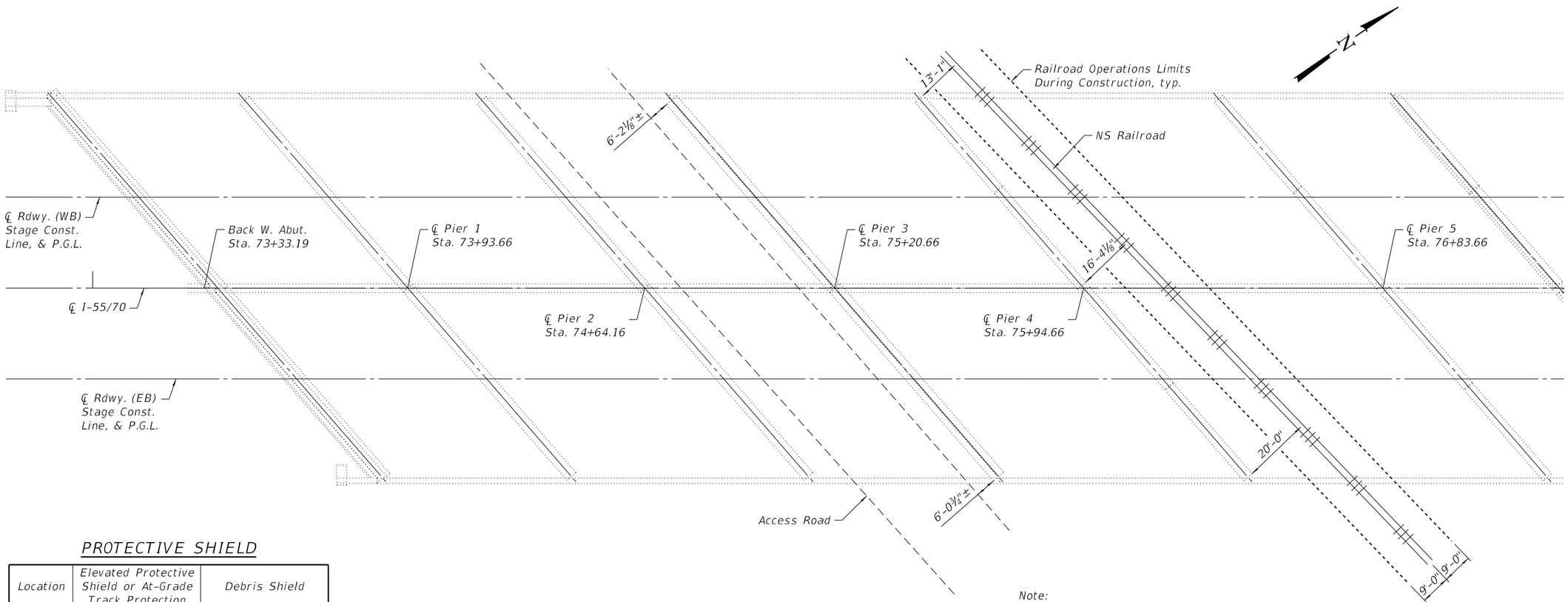
11/11/2021 9:08:37 AM



PARTIAL ELEVATION (SPANS 1 THRU 5)

Approximate Extent of Temporary Support System



PARTIAL PLAN (SPANS 1 THRU 5)

PROTECTIVE SHIELD

Location	Elevated Protective Shield or At-Grade Track Protection	Debris Shield
	(Sq. Yd.)	(Sq. Yd.)
Span 5	151	–
Span 7	–	544
Span 8	–	544
Span 9	–	650
Span 15	25	–

Note:
Provide Protective Shield during all concrete work adjacent to railroad tracks. This includes: pier rehabilitation, pier reconstruction, deck slab repairs, and transverse expansion joint replacement. Refer to Special Provisions and Roadway plans for additional requirements.
Provide Protective Shield in Span 15 if full-depth repairs are required. See Sheet 14 of 95 for additional information.

BILL OF MATERIAL

Item	Unit	Total
Protective Shield	Sq. Yd.	1914

MODEL: Default
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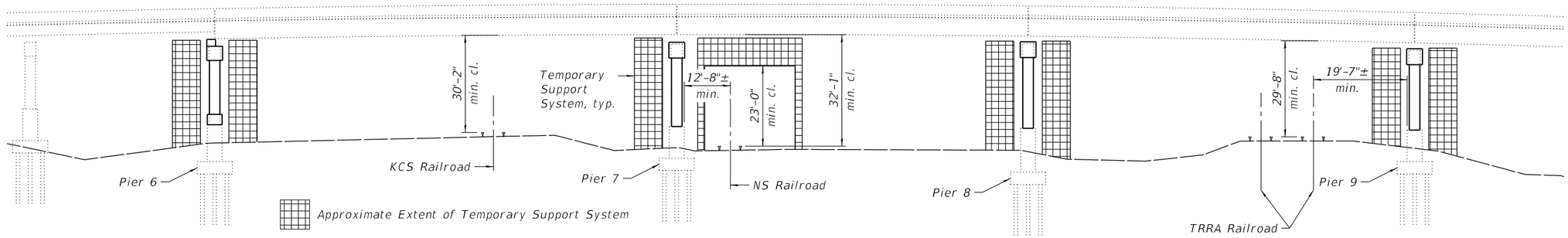
EFK•Moen Civil Engineering Design

USER NAME = ABenz	DESIGNED - ACB	REVISED -	
	CHECKED - CDL	REVISED -	
PLOT SCALE = 0.1667 ' / in.	DRAWN - ACB	REVISED -	
PLOT DATE = 11/11/2021	CHECKED - CDL	REVISED -	

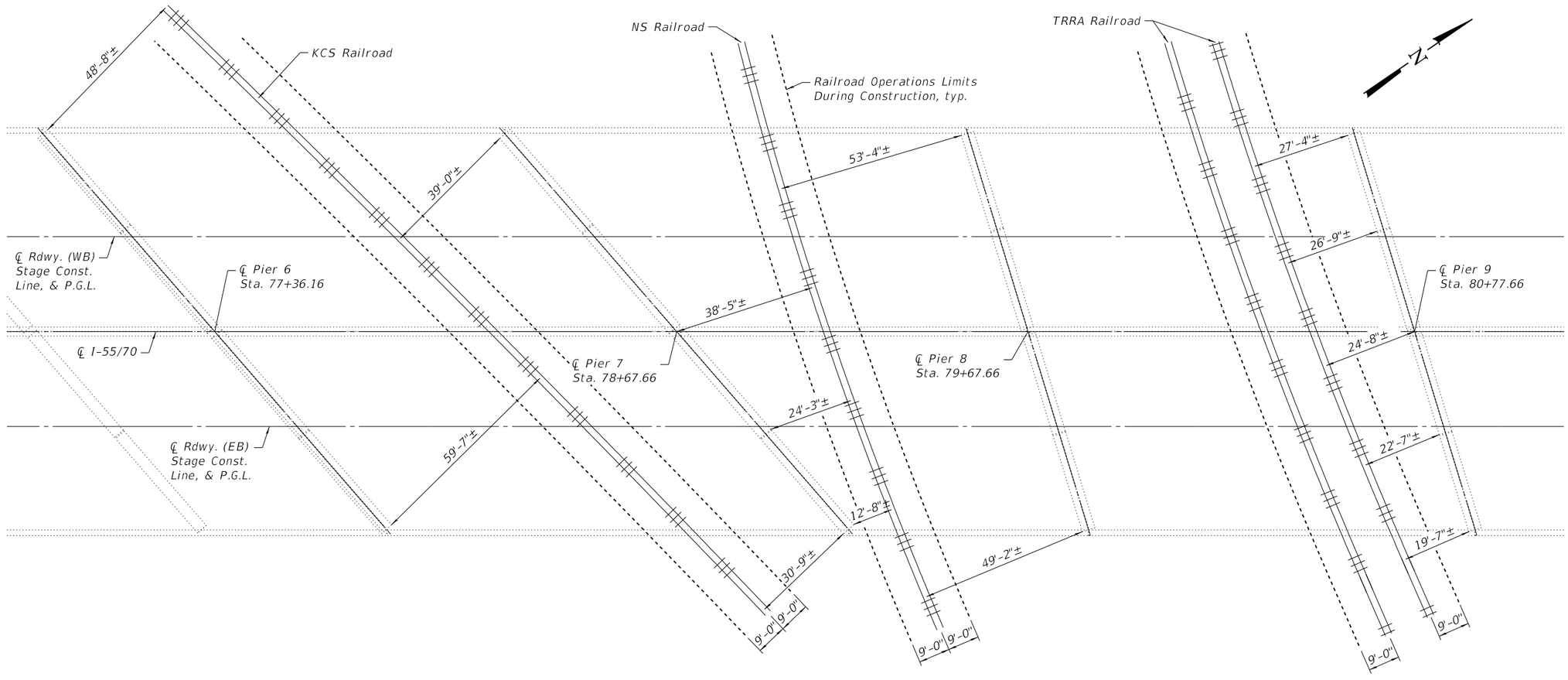
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PARTIAL PLAN AND ELEVATION AT RAILROADS
STRUCTURE NO. 082-0017
SHEET 4 OF 95 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55/70	82-5VB-R-2	ST. CLAIR	186	93
		CONTRACT NO. 76K02		
	ILLINOIS FED. AID PROJECT			

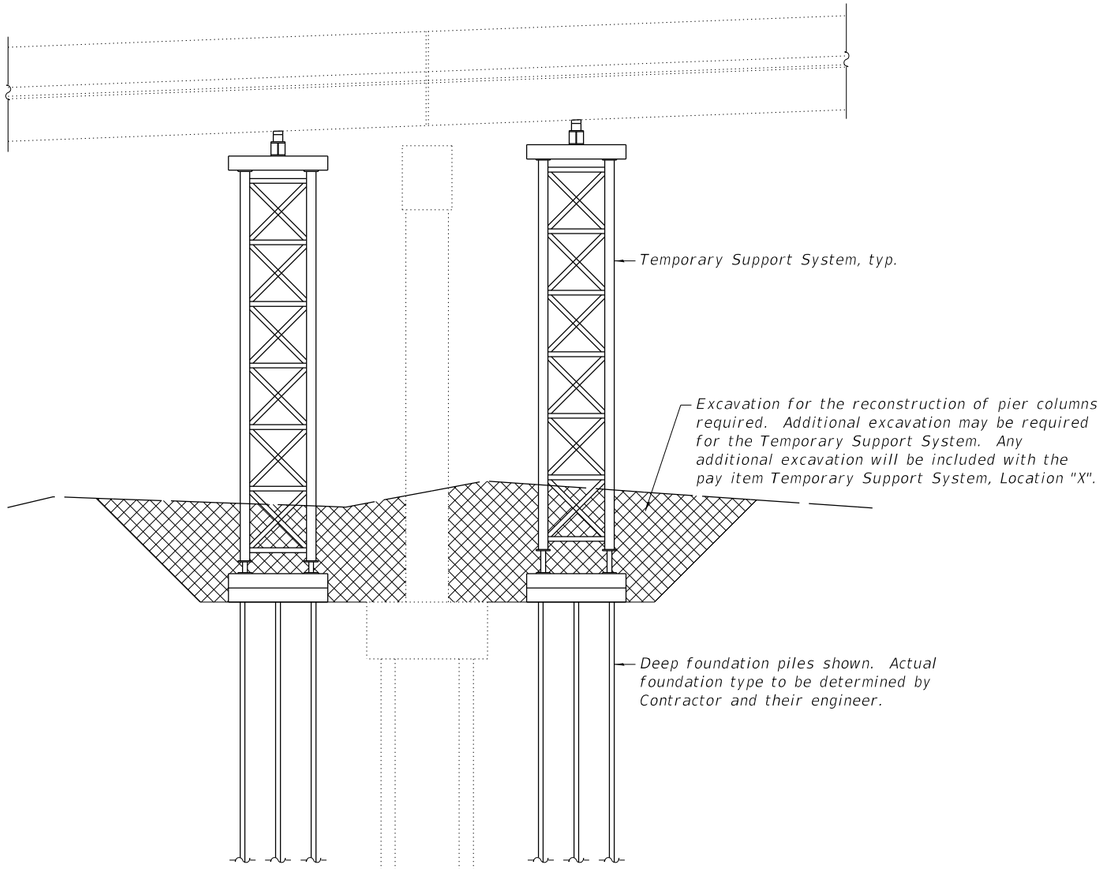


PARTIAL ELEVATION (SPANS 6 THRU 9)

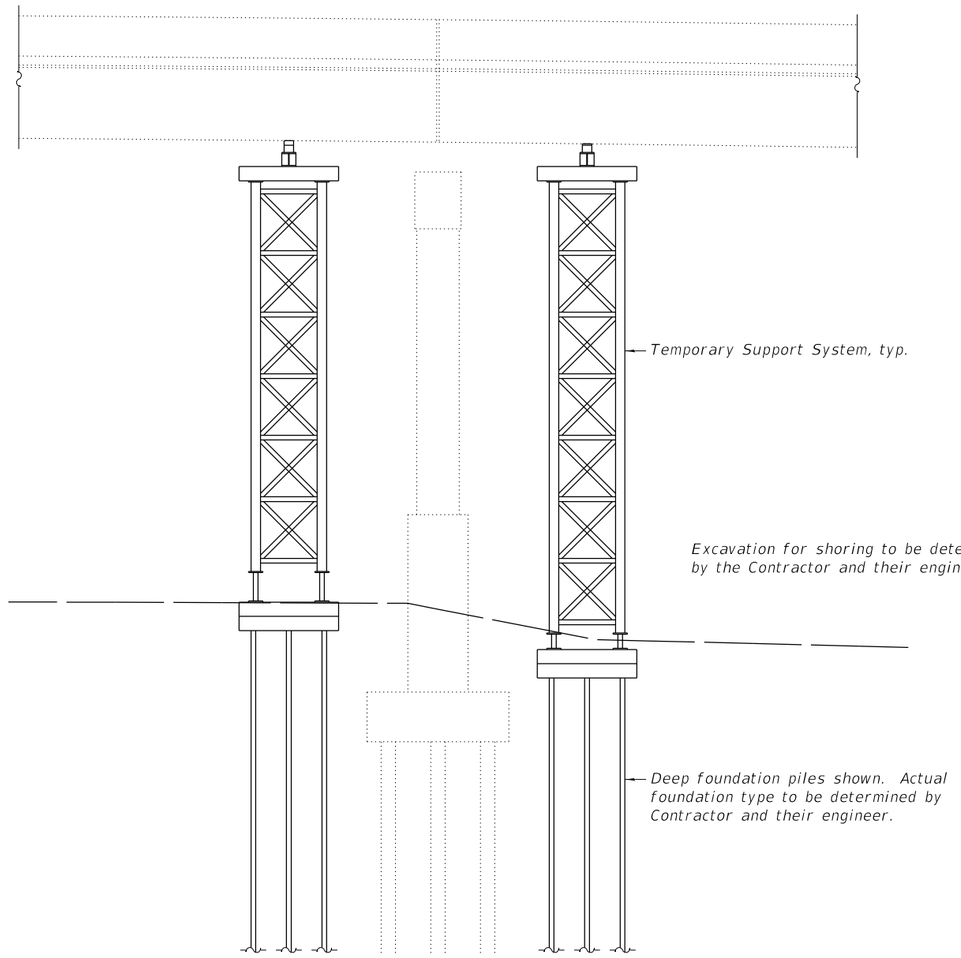


PARTIAL PLAN (SPANS 6 THRU 9)

Note:
Eastbound Pier 7 reconstruction will be staged to reduce live loading on Temporary Support System.



TEMPORARY SUPPORT SYSTEM
(Piers 3, 10, 13, & 16)



TEMPORARY SUPPORT SYSTEM
(Piers 6, 7, 8, & 9)

TEMPORARY SUPPORT SYSTEM REACTION TABLE

Location	Service Reactions *															
	Pier 3		Pier 6		Pier 7		Pier 8		Pier 9		Pier 10		Pier 13		Pier 16	
	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.	W. Brg.	E. Brg.
Dead Load (k)	25.9	35.1	20.7	98.5	103.0	89.8	93.3	70.3	70.3	68.5	68.5	36.9	36.9	36.9	36.9	36.9
Live Load (k)	46.2	45.3	43.6	51.5	51.2	51.4	47.2	46.5	47.5	47.7	46.3	42.9	42.9	42.9	42.9	42.9
Impact (k)	12.8	11.4	12.3	10.1	10.0	11.2	9.5	9.9	10.2	10.9	10.1	10.5	10.5	10.5	10.5	10.5
Total (k)	84.9	91.8	76.6	160.1	164.2	152.4	150.0	126.7	128.0	127.1	124.9	90.3	90.3	90.3	90.3	90.3

* Reactions shown represent the maximum reaction for a single beam.

BILL OF MATERIAL

Location	Item	Unit	Total
Pier 3	Temporary Support System, Location 1	Each	1
Pier 6	Temporary Support System, Location 2	Each	1
Pier 7	Temporary Support System, Location 3	Each	1
Pier 8	Temporary Support System, Location 4	Each	1
Pier 9	Temporary Support System, Location 5	Each	1
Pier 10	Temporary Support System, Location 6	Each	1
Pier 13	Temporary Support System, Location 7	Each	1
Pier 16	Temporary Support System, Location 8	Each	1

Note:
Contractor shall coordinate with railroads regarding whether excavation will require sheet piling.
Ground line shall be returned to its original condition (except Pier 9) after the temporary support system is removed.
Temporary Support System at Pier 7 may require supports over track. Eastbound Pier 7 reconstruction may be staged to reduce live loading on Temporary Support System.

MODEL: Default
FILE NAME: T:\15052.29 B&O RR Bridge\DGN\Bridge\final\Plotsheets\0820017-76K02-006-Shoring Schematics.dgn
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EFK•Moen
Civil Engineering Design

USER NAME = ABenz	DESIGNED - ACB	REVISED -	
	CHECKED - CDL	REVISED -	
PLOT SCALE = 0.1667 ' / in.	DRAWN - ACB	REVISED -	
PLOT DATE = 11/11/2021	CHECKED - CDL	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHORING SCHEMATICS
STRUCTURE NO. 082-0017
SHEET 6 OF 95 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55/70	82-5VB-R-2	ST. CLAIR	186	95
		CONTRACT NO. 76K02		
	ILLINOIS	FED. AID PROJECT		

ATTACHMENT 5

WJE Soils Analysis – Liquefaction

Wiss, Janney, Elstner Associates, Inc.
3609 South Wadsworth Boulevard, Suite 400
Lakewood, Colorado 80235
303.914.4300 tel
www.wje.com

MEMORANDUM | November 5, 2021

WO30 - Soils Investigation for B&O Bridge

Liquefaction Analysis

WJE PROJECT NO. 2014.6410.T

TO FILE

FROM Peter Stauffer, Matthew LeBlanc

This memorandum summarizes the results of WJE's liquefaction analysis related to the rehabilitation of Structure No. 082-0017 ("B&O Bridge"), specifically the rehabilitation of the above-grade foundation elements. The liquefaction analysis followed the procedures outlined in the IDOT Liquefaction Analysis design guide (Nov 2018), the IDOT Geotechnical Manual (Dec 2020), and the excel spreadsheet developed by IDOT to perform the liquefaction calculations. These references can be downloaded from the IDOT website here: https://idot.illinois.gov/doing-business/procurements/engineering-architectural-professional-services/Consultants-Resources/index.

Since portions of Illinois are considered "multi-modal" in that there are multiple earthquake sources that have a significant contribution to the overall hazard, IDOT requires liquefaction potential at the site to be checked for multiple seismic sources to determine the source that results in the highest Peak Ground Acceleration (PGA) at the site. The information needed to determine the controlling source was obtained using the USGS earthquake database (https://earthquake.usgs.gov/hazards/interactive/) and a return period of 1000 years. Note that even though the site is likely Site Class E based on the thickness of the soft clay layer underlying the site (Table 6.12.2.1.1-1; IDOT Geotechnical Manual), the lowest site class that the USGS database will allow the user to select for this site's location based on latitude/longitude is "B/C Boundary (shear wave velocity = 760 m/s)." According to the USGS database, there are five actual earthquake sources of various magnitudes and source-to-site distances that have a contribution to the total hazard greater than 5% (IDOT criteria) at the location of the B&O bridge. The PGA for each earthquake was calculated using ground motion prediction equations in the IDOT liquefaction analysis spreadsheet to determine the worst-case (highest) PGA at the site (summarized below in Table 1).

Table 1. Determination of Highest PGA at the B&O Bridge Site

Source-to-Site Distance (km)	Earthquake Moment Magnitude (M_w)	Ground Motion Prediction Equation[1]	PGA (g)
12.68	4.7	CEUS	0.148
12.68	4.9	CEUS	0.182
12.68	5.1	CEUS	0.222 (worst-case)
190	7.5	NMSZ	0.074
230	7.7	NMSZ	0.070

[1] IDOT requires Central Eastern United States (CEUS) equations for near-site sources and the New Madrid Seismic Zone (NMSZ) equations for distant sources

The IDOT liquefaction analysis spreadsheet also requires the peak horizontal acceleration coefficient at the ground surface, A_s, to compute the factor of safety (FS) against liquefaction. This coefficient is calculated by the equation $A_s = F_{pga} \times PGA$, where F_{pga} is the zero-period site amplification factor. Based on Table 3.10.3.2-1 in AASHTO LRFD Bridge Design Specifications, 9th ed., F_{pga} equals 1.59 for Site Class E and a PGA of 0.222 g. Therefore, the A_s used in the IDOT liquefaction analysis spreadsheet was 0.353 g.

The liquefaction analyses for all boreholes are provided in the attachment. The hammer efficiency is based on SPT calibration reports provided by TSi which were conducted in August and September 2021. Both automatic hammers used by TSi during the drilling program were 94.7% efficient. For boreholes where no groundwater was observed, the depth to groundwater during an earthquake was assumed to be 4.3 ft, the highest elevation observed in 13 of the 14 boreholes. Water was observed at the ground surface at B-1N approximately 14 days after drilling, but this was deemed to be unrepresentative of the site as a whole.

As seen in the attachment, there are some layers where the IDOT spreadsheet expects more data to fully complete the analysis (cells highlighted in red). For example, in boring B-1N at an elevation of 406 ft, the spreadsheet calculated the FS against liquefaction as 3.046 but also automatically highlighted the PI (plasticity index) and LL (liquid limit) values as missing. Were these values available, the spreadsheet would check whether the PI is greater than 12 or the moisture content/liquid limit ratio is less than 0.85. If either case was true, the spreadsheet would determine the layer is "Not Liquefiable" and replace the FS of 3.046 with a statement to this effect. Either answer is acceptable from a liquefaction standpoint, i.e. regardless of whether the FS is 3.046 or the layer is "not liquefiable," the layer is not expected to liquefy in the event of a design earthquake, and the additional PI and LL data provide no added value. Laboratory tests were focused on obtaining data for layers where the initial FS was either less than or close to 1.0.

After all laboratory tests and the liquefaction analyses were complete, there were only two layers where the factor of safety against liquefaction is less than 1.0: B-2.5 at a depth of 15 ft (FS=0.994) and B-4N at a depth of 10 ft (FS=0.936). The soil layers at these locations are a low plasticity silt (PI=5) and a loose sand (N=1), respectively, which are certainly considered potentially liquefiable soils. B-2.5 is closest to Pier 7 which, according to the original 1957 drawings, is founded on concrete piles with tips located approximately 24 ft below the silt layer in a layer of dense sand (N values ranging from 14 to 39). B-4N is located closest to Pier 10 which, again according to the 1957 drawings, is founded on concrete piles with tips approximately 45 ft below the loose sand layer in what is presumably the same layer of dense sand encountered in B-2.5 (N values ranging from 17 to 26).

Since the pile tips terminate in dense sand located much deeper than the potentially liquefiable soils and since "multiple layers…indicating a FS substantially less than 1.0" (IDOT Liquefaction Analysis Design Guide) are not present, WJE does not believe that further liquefaction analysis of the site is required. If these layers do liquefy in an earthquake, we believe the existing pier foundations will still meet the IDOT performance objectives of "no loss of life or loss of span" (IDOT Liquefaction Analysis Design Guide). However, WJE recommends the temporary shoring required during the rehabilitation of the above-grade foundation elements be placed below these potentially liquefiable layers (at least 15 ft below grade).

Attachment: Completed Liquefaction Analysis Spreadsheets for B&O Bridge Boreholes

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-1N
ELEVATION OF BORING GROUND SURFACE ========== 416.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 25.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

Groundwater was not encountered during drilling, but the spreadsheet equations cannot process a non-numerical value in this cell such as "NE." Shallower groundwater depths generally increase the FS in each layer by increasing $(N_1)_{60cs}$, so we selected a value greater than the borehole depth to remove any affect of groundwater on the $(N_1)_{60cs}$ calculation.

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **373** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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	7	1.75				33.9	0.128	0.320	15.032	15.032	0.160	0.066	0.165	0.321	1.500	**0.568**	0.953	**0.426**	**1.333 (D)**
408.5	7.5	1	0.25		36	55	34.7	0.107	0.855	1.798	1.798	0.052	0.045	0.390	0.858	1.403	**0.172**	0.842	**0.425**	**N.L. (2)**
406	10	10	0.5				23.5	0.114	1.140	18.347	18.347	0.196	0.052	0.520	1.144	1.490	**0.689**	0.781	**0.394**	**1.749 (D)**
401	15	14		32			14.1	0.122	1.750	24.694	33.746	4.178	0.060	0.820	1.756	1.435	**14.157**	0.655	**0.322**	**43.966 (D)**
396	20	19					6.9	0.126	2.380	31.325	31.325	0.601	0.064	1.140	2.388	1.254	**1.781**	0.539	**0.259**	**N.L. (3)**

Lab value was 45.4%, but any value here greater than about 32% returns a negative FS. This happens because the correction for clean sand causes $(N_1)_{60cs}$ to be larger than 34. This then causes $CRR_{7.5}$ to be negative (see equation below) which makes CRR negative as well. We used a value of 32% just to show that the FS is very large and that this layer is not likely to liquefy during the design earthquake. This conclusion is also supported by the $(N_1)_{60}$ value of 24.7, which is close to the value of 25 when the spreadsheet determines the layer is non-liquefiable [N.L. (3)].

$$CRR_{7.5} = \frac{1}{34 - (N_1)_{60cs}} + \frac{(N_1)_{60cs}}{135} + \frac{50}{[10(N_1)_{60cs} + 45]^2} - \frac{1}{200}$$

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-1S
ELEVATION OF BORING GROUND SURFACE ========== 413.60 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **572** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
411.1	2.5	3	0.75				39.6	0.118	0.295	6.418	6.418	0.083	0.118	0.295	0.295	1.500	**0.294**	0.991	**0.228**	**N.L. (1)**
408.6	5	3	0.25		77	104	55.9	0.107	0.563	5.865	5.865	0.079	0.045	0.408	0.451	1.404	**0.261**	0.979	**0.249**	**N.L. (2)**
403.6	10	6	1.25		62	87	31.4	0.124	1.183	10.625	10.625	0.119	0.062	0.718	1.073	1.291	**0.362**	0.947	**0.325**	**N.L. (2)**
398.6	15	15	0.25	40.2			27.5	0.107	1.718	26.940	37.328	-0.029	0.045	0.943	1.610	1.383	**-0.094**	0.900	**0.353**	**N.L. (3)**
393.6	20	8	0.25	59.8			31.9	0.044	1.938	13.510	21.211	0.231	0.044	1.163	2.142	1.199	**0.654**	0.838	**0.355**	**1.842 (D)**
388.6	25	14					25.6	0.064	2.258	23.309	23.309	0.262	0.064	1.483	2.774	1.119	**0.692**	0.762	**0.328**	**2.110 (D)**
383.6	30	32					17.7	0.071	2.613	56.992	56.992	0.374	0.071	1.838	3.441	1.059	**0.935**	0.682	**0.293**	**N.L. (3)**
378.6	35	25		6.1			23.5	0.069	2.958	39.529	39.764	0.116	0.069	2.183	4.098	0.988	**0.272**	0.606	**0.261**	**N.L. (3)**
373.6	40	23					22.4	0.068	3.298	33.661	33.661	3.192	0.068	2.523	4.750	0.936	**7.057**	0.544	**0.235**	**N.L. (3)**
368.6	45	25					25	0.069	3.643	34.884	34.884	-0.878	0.069	2.868	5.407	0.890	**-1.845**	0.497	**0.215**	**N.L. (3)**
363.6	50	21					22	0.068	3.983	27.006	27.006	0.339	0.068	3.208	6.059	0.869	**0.695**	0.465	**0.202**	**N.L. (3)**
358.6	55	26		5.9			15.7	0.069	4.328	32.599	32.765	1.048	0.069	3.553	6.716	0.825	**2.040**	0.444	**0.193**	**N.L. (3)**
353.6	60	62					19.8	0.078	4.718	81.440	81.440	0.577	0.078	3.943	7.418	0.780	**1.064**	0.430	**0.186**	**N.L. (3)**
343.6	70	32					19.8	0.071	5.428	34.996	34.996	-0.750	0.071	4.653	8.752	0.737	**-1.306**	0.403	**0.174**	**N.L. (3)**
333.6	80	31					15.1	0.071	6.138	30.658	30.658	0.522	0.071	5.363	10.086	0.716	**0.882**	0.389	**0.168**	**N.L. (3)**
323.6	90	40					17.1	0.074	6.878	37.442	37.442	-0.018	0.074	6.103	11.450	0.655	**-0.028**	0.375	**0.161**	**N.L. (3)**
313.6	100	67					18.1	0.079	7.668	61.545	61.545	0.415	0.079	6.893	12.864	0.624	**0.611**	0.361	**0.155**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-2N
ELEVATION OF BORING GROUND SURFACE ========== 418.60 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 20.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **542** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
416.1	2.5	4	1.75				27.2	0.128	0.320	8.482	8.482	0.100	0.128	0.320	0.320	1.500	**0.354**	0.988	**0.227**	**N.L. (1)**
413.6	5	4		62.8			27.9	0.108	0.590	7.751	14.302	0.153	0.046	0.435	0.479	1.500	**0.542**	0.973	**0.246**	**2.203 (C)**
408.6	10	7	2	99.7			34.7	0.130	1.240	12.208	19.650	0.211	0.068	0.775	1.131	1.341	**0.669**	0.932	**0.312**	**2.144 (D)**
398.6	20	16		38.1			26.3	0.124	2.480	25.165	35.198	-0.579	0.186	2.635	3.615	0.919	**-1.256**	0.801	**0.252**	**N.L. (3)**
393.6	25	3	0.25	69.4	7	27	28.6	0.044	2.700	4.428	10.314	0.116	0.044	2.855	4.147	0.933	**0.255**	0.717	**0.239**	**1.067 (C)**
388.6	30	17					24.2	0.066	3.030	24.812	24.812	0.288	0.066	3.185	4.789	0.876	**0.597**	0.633	**0.219**	**2.726 (D)**
383.6	35	25		6.2			26.1	0.069	3.375	36.288	36.526	-0.130	0.069	3.530	5.446	0.817	**-0.251**	0.559	**0.198**	**N.L. (3)**
378.6	40	30					19.7	0.071	3.730	42.239	42.239	0.187	0.071	3.885	6.113	0.785	**0.346**	0.500	**0.181**	**N.L. (3)**
373.6	45	24					21.8	0.069	4.075	30.790	30.790	0.535	0.069	4.230	6.770	0.779	**0.984**	0.458	**0.168**	**N.L. (3)**
368.6	50	35		5.9			29.4	0.072	4.435	45.160	45.381	0.243	0.072	4.590	7.442	0.734	**0.422**	0.430	**0.160**	**N.L. (3)**
363.6	55	56					26.7	0.077	4.820	72.396	72.396	0.505	0.077	4.975	8.139	0.711	**0.848**	0.412	**0.155**	**N.L. (3)**
358.6	60	53					30.4	0.076	5.200	65.281	65.281	0.447	0.076	5.355	8.831	0.690	**0.728**	0.401	**0.152**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-2S
ELEVATION OF BORING GROUND SURFACE ========== 422.60 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **367** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

	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
420.1	2.5	13					32.5	0.121	0.303	30.585	30.585	0.515	0.121	0.303	0.303	1.500	**1.824**	0.951	**0.218**	**N.L. (1)**
417.6	5	2		17.2			38	0.101	0.555	3.919	7.218	0.089	0.039	0.400	0.444	1.429	**0.302**	0.896	**0.228**	**1.325 (C)**
415.1	7.5	4		94.7			23.5	0.108	0.825	7.257	13.709	0.147	0.046	0.515	0.715	1.434	**0.499**	0.836	**0.266**	**1.876 (C)**
407.6	15	7		98.8	77	99	40.5	0.114	1.680	11.985	19.382	0.208	0.052	0.905	1.573	1.280	**0.628**	0.644	**0.257**	**N.L. (2)**
402.6	20	3		76.9			36.7	0.051	1.935	5.069	11.083	0.123	0.051	1.160	2.140	1.155	**0.335**	0.528	**0.224**	**1.496 (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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-2.5
ELEVATION OF BORING GROUND SURFACE ========== 415.70 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 13.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **468** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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*
413.2	2.5	9					15.6	0.117	0.293	20.110	20.110	0.217	0.117	0.293	0.293	1.500	**0.768**	0.977	**0.224**	**N.L. (1)**
410.7	5	2		98.2			28.1	0.101	0.545	3.932	9.719	0.111	0.039	0.390	0.434	1.475	**0.386**	0.950	**0.243**	**1.588 (C)**
408.2	7.5	4	1.25	75.3			27.8	0.124	0.855	7.193	13.632	0.147	0.062	0.545	0.745	1.412	**0.489**	0.917	**0.288**	**1.698 (C)**
400.7	15	2	0.25	81.2	5	30	43.1	0.044	1.185	3.879	9.654	0.110	0.044	0.875	1.543	1.225	**0.319**	0.792	**0.321**	**0.994 (C)**
390.7	25	16					30.6	0.065	1.835	30.094	30.094	0.474	0.065	1.525	2.817	1.125	**1.260**	0.597	**0.253**	**N.L. (3)**
385.7	30	14					26.4	0.064	2.155	24.168	24.168	0.276	0.064	1.845	3.449	1.045	**0.682**	0.513	**0.220**	**3.100 (D)**
380.7	35	23					32.3	0.068	2.495	39.735	39.735	0.115	0.068	2.185	4.101	0.988	**0.269**	0.448	**0.193**	**N.L. (3)**
375.7	40	39					22.1	0.073	2.860	67.763	67.763	0.467	0.073	2.550	4.778	0.929	**1.025**	0.402	**0.173**	**N.L. (3)**
370.7	45	32					25.9	0.071	3.215	50.818	50.818	0.312	0.071	2.905	5.445	0.882	**0.650**	0.371	**0.160**	**N.L. (3)**
365.7	50	34					25.5	0.072	3.575	51.060	51.060	0.315	0.072	3.265	6.117	0.841	**0.625**	0.352	**0.151**	**N.L. (3)**
360.7	55	16					27.7	0.065	3.900	20.288	20.288	0.219	0.065	3.590	6.754	0.856	**0.443**	0.340	**0.147**	**3.014 (D)**
355.7	60	61					18.8	0.078	4.290	85.139	85.139	0.606	0.078	3.980	7.456	0.777	**1.113**	0.332	**0.143**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-3N
ELEVATION OF BORING GROUND SURFACE ========== 414.20 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **220** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
411.7	2.5	10	2				22.3	0.130	0.325	22.372	22.372	0.247	0.130	0.325	0.325	1.500	**0.877**	0.883	**0.203**	**N.L. (1)**
409.2	5	6	1.75				20.5	0.128	0.645	11.426	11.426	0.126	0.066	0.490	0.534	1.422	**0.423**	0.770	**0.193**	**2.192 (D)**
406.7	7.5	5	1.75				36.2	0.128	0.965	8.710	8.710	0.102	0.066	0.655	0.855	1.300	**0.313**	0.664	**0.199**	**1.573 (C)**
399.2	15	1	1	97.7			35.8	0.122	1.880	1.635	6.962	0.087	0.060	1.105	1.773	1.149	**0.237**	0.410	**0.151**	**1.570 (C)**
394.2	20	1	1	96.3			46.5	0.059	2.175	1.604	6.924	0.087	0.059	1.400	2.380	1.092	**0.225**	0.297	**0.116**	**1.940 (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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-3S
ELEVATION OF BORING GROUND SURFACE ========== 414.50 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 8.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **260** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
412	2.5	3	0.75				12.3	0.118	0.295	6.418	6.418	0.083	0.118	0.295	0.295	1.500	**0.294**	0.905	**0.208**	**N.L. (1)**
409.5	5	6					17.3	0.113	0.578	11.673	11.673	0.128	0.051	0.423	0.466	1.477	**0.447**	0.809	**0.205**	**2.180 (D)**
404.5	10	1		50.2			45.2	0.043	0.793	1.978	7.373	0.091	0.043	0.638	0.993	1.295	**0.277**	0.628	**0.225**	**1.231 (C)**
394.5	20	1	1.25	98.9			42.8	0.062	1.413	1.913	7.295	0.090	0.062	1.258	2.237	1.119	**0.238**	0.362	**0.148**	**1.608 (C)**
389.5	25	1	0.5	91.8	25	45	42.9	0.051	1.668	1.838	7.206	0.089	0.051	1.513	2.804	1.075	**0.227**	0.282	**0.120**	**N.L. (2)**
384.5	30	10	0.25				33.8	0.044	1.888	17.763	17.763	0.189	0.044	1.733	3.336	1.058	**0.473**	0.230	**0.102**	**4.637 (D)**
379.5	35	28					25.9	0.070	2.238	53.510	53.510	0.340	0.070	2.083	3.998	1.007	**0.809**	0.197	**0.087**	**N.L. (3)**
374.5	40	17					27.1	0.066	2.568	27.748	27.748	0.361	0.066	2.413	4.640	0.957	**0.816**	0.177	**0.078**	**N.L. (3)**
369.5	45	18					29.3	0.066	2.898	27.733	27.733	0.360	0.066	2.743	5.282	0.916	**0.780**	0.164	**0.073**	**N.L. (3)**
364.5	50	42					21.8	0.074	3.268	68.566	68.566	0.474	0.074	3.113	5.964	0.858	**0.960**	0.157	**0.069**	**N.L. (3)**
359.5	55	35					22.1	0.072	3.628	52.516	52.516	0.330	0.072	3.473	6.636	0.821	**0.640**	0.152	**0.067**	**N.L. (3)**
354.5	60	10					26.3	0.061	3.933	12.462	12.462	0.135	0.061	3.778	7.253	0.867	**0.277**	0.150	**0.066**	**4.197 (C)**
349.5	65	30					20.6	0.071	4.288	38.846	38.846	0.077	0.071	4.133	7.920	0.766	**0.139**	0.146	**0.064**	**N.L. (3)**
344.5	70	37					18.2	0.073	4.653	46.806	46.806	0.264	0.073	4.498	8.597	0.740	**0.461**	0.139	**0.061**	**N.L. (3)**
334.5	80	21					16.2	0.068	5.333	22.063	22.063	0.243	0.068	5.178	9.901	0.760	**0.436**	0.125	**0.055**	**7.927 (D)**
324.5	90	34					17.2	0.072	6.053	34.486	34.486	-1.809	0.072	5.898	11.245	0.675	**-2.883**	0.111	**0.048**	**N.L. (3)**
314.5	100	62					15.7	0.078	6.833	62.024	62.024	0.419	0.078	6.678	12.649	0.632	**0.625**	0.097	**0.042**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-3.5
ELEVATION OF BORING GROUND SURFACE ========== 410.30 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **270** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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*
407.8	2.5	5	2.75				23	0.134	0.335	10.547	10.547	0.118	0.134	0.335	0.335	1.500	**0.418**	0.910	**0.209**	**N.L. (1)**
405.3	5	32		14.7			6.3	0.132	0.665	71.572	77.303	0.545	0.070	0.510	0.554	1.500	**1.929**	0.819	**0.204**	**N.L. (3)**
402.8	7.5	24	0.75				17.2	0.118	0.960	49.479	49.479	0.297	0.056	0.650	0.850	1.500	**1.052**	0.729	**0.219**	**N.L. (3)**
395.3	15	7					13.3	0.114	1.815	11.613	11.613	0.128	0.052	1.040	1.708	1.188	**0.358**	0.493	**0.186**	**1.925 (D)**
390.3	20	3		50.5			29.1	0.051	2.070	4.921	10.905	0.121	0.051	1.295	2.275	1.124	**0.322**	0.378	**0.152**	**2.118 (C)**
385.3	25	4	0.75				36.2	0.056	2.350	6.327	6.327	0.082	0.056	1.575	2.867	1.064	**0.207**	0.297	**0.124**	**1.669 (C)**
380.3	30	1	0.75		46	64	68.1	0.056	2.630	1.514	1.514	0.051	0.056	1.855	3.459	1.027	**0.123**	0.243	**0.104**	**N.L. (2)**
375.3	35	1	0.25				71.8	0.044	2.850	1.464	1.464	0.051	0.044	2.075	3.991	1.004	**0.120**	0.209	**0.092**	**1.304 (C)**
370.3	40	1	0.5	87.5			60.2	0.051	3.105	1.406	6.688	0.085	0.051	2.330	4.558	0.980	**0.197**	0.188	**0.085**	**2.318 (C)**
365.3	45	3	0.25				74.6	0.044	3.325	4.084	4.084	0.065	0.044	2.550	5.090	0.964	**0.149**	0.175	**0.080**	**1.863 (C)**
360.3	50	27					19.5	0.070	3.675	38.100	38.100	0.034	0.070	2.900	5.752	0.882	**0.070**	0.168	**0.076**	**N.L. (3)**
355.3	55	34					12.2	0.072	4.035	46.968	46.968	0.266	0.072	3.260	6.424	0.842	**0.529**	0.163	**0.074**	**N.L. (3)**
350.3	60	12					17.5	0.063	4.350	14.049	14.049	0.151	0.063	3.575	7.051	0.874	**0.311**	0.160	**0.073**	**4.260 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-4N
ELEVATION OF BORING GROUND SURFACE ========== 407.90 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 70.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **224** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
405.4	2.5	6	1.25				6	0.124	0.310	12.768	12.768	0.138	0.124	0.310	0.310	1.500	**0.490**	0.885	**0.203**	**N.L. (1)**
402.9	5	5	1		13	29	23.4	0.122	0.615	9.612	9.612	0.110	0.060	0.460	0.504	1.419	**0.368**	0.774	**0.195**	**N.L. (2)**
400.4	7.5	3		19.1			17.9	0.105	0.878	5.360	9.206	0.106	0.043	0.568	0.767	1.348	**0.338**	0.669	**0.208**	**1.625 (C)**
397.9	10	1		13.3			13.7	0.095	1.115	1.804	3.859	0.064	0.033	0.650	1.006	1.267	**0.191**	0.574	**0.204**	**0.936 (C)**
392.9	15	8	2				24.6	0.130	1.765	13.426	13.426	0.145	0.068	0.990	1.658	1.212	**0.414**	0.417	**0.160**	**2.588 (D)**
387.9	20	4	1				59.1	0.122	2.375	6.154	6.154	0.081	0.060	1.290	2.270	1.109	**0.212**	0.304	**0.123**	**1.724 (C)**
382.9	25	1	0.25		30	49	45.1	0.107	2.910	1.419	1.419	0.050	0.045	1.515	2.807	1.070	**0.128**	0.228	**0.097**	**N.L. (2)**
377.9	30	1	0.25				57.7	0.107	3.445	1.308	1.308	0.050	0.045	1.740	3.344	1.040	**0.123**	0.179	**0.079**	**1.557 (C)**
372.9	35	1	0.25				87.9	0.107	3.980	1.210	1.210	0.050	0.045	1.965	3.881	1.015	**0.119**	0.149	**0.067**	**1.776 (C)**
367.9	40	1	0.25		42	63	59.8	0.107	4.515	1.126	1.126	0.050	0.045	2.190	4.418	0.994	**0.116**	0.130	**0.060**	**N.L. (2)**
362.9	45	17	0.25				65.1	0.107	5.050	17.958	17.958	0.191	0.045	2.415	4.955	0.964	**0.436**	0.119	**0.056**	**7.786 (D)**
357.9	50	26					17.1	0.129	5.695	26.420	26.420	0.323	0.067	2.750	5.602	0.917	**0.700**	0.112	**0.052**	**N.L. (3)**
352.9	55	11		6.4			26.7	0.119	6.290	10.031	10.149	0.114	0.057	3.035	6.199	0.920	**0.249**	0.108	**0.051**	**4.882 (C)**
347.9	60	17					19.2	0.124	6.910	14.513	14.513	0.155	0.062	3.345	6.821	0.888	**0.326**	0.106	**0.049**	**6.653 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-4S
ELEVATION OF BORING GROUND SURFACE ========== 406.80 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 18.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.50 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **373** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
404.3	2.5	86					9.7	0.145	0.363	######	212.368	1.563	0.145	0.363	0.363	1.500	**5.536**	0.953	**0.219**	**N.L. (1)**
401.8	5	57	1.25				10.4	0.124	0.673	######	127.190	0.926	0.062	0.518	0.549	1.500	**3.282**	0.900	**0.219**	**N.L. (3)**
399.3	7.5	3	1.25	94.4			41.2	0.124	0.983	5.200	11.240	0.124	0.062	0.673	0.860	1.316	**0.386**	0.841	**0.247**	**1.563 (C)**
391.8	15	3	1	98.1			28.8	0.122	1.898	4.885	10.862	0.121	0.060	1.123	1.778	1.163	**0.332**	0.654	**0.238**	**1.395 (C)**
386.8	20	3		32.8			31.4	0.051	2.153	4.834	10.565	0.118	0.051	1.378	2.345	1.107	**0.309**	0.538	**0.210**	**1.471 (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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-5N
ELEVATION OF BORING GROUND SURFACE ========== 407.60 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 5.50 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

Groundwater was observed at 6.7 ft depth approximately 14 days after drilling. However, we believe this shallower value is more representative of the site as a whole (and it is more conservative).

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **324** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
405.1	2.5	17	3				7.3	0.135	0.338	41.535	41.535	0.170	0.135	0.338	0.338	1.500	**0.603**	0.935	**0.215**	**N.L. (1)**
402.6	5	7	2.25	57.5			9.9	0.131	0.665	13.269	20.922	0.227	0.069	0.510	0.554	1.500	**0.805**	0.864	**0.215**	**3.744 (D)**
400.1	7.5	3		73.3			27	0.051	0.793	5.496	11.595	0.127	0.051	0.638	0.837	1.337	**0.402**	0.791	**0.239**	**1.682 (C)**
397.6	10	3	1.25	77.5			30.8	0.062	0.948	5.670	11.804	0.129	0.062	0.793	1.148	1.270	**0.388**	0.717	**0.239**	**1.623 (C)**
392.6	15	2	0.25	88.4	2	25	33.8	0.044	1.168	3.897	9.676	0.110	0.044	1.013	1.680	1.185	**0.309**	0.577	**0.220**	**1.405 (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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-5S
ELEVATION OF BORING GROUND SURFACE ========== 404.50 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 13.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **199** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
402	2.5	10	1.5				26.4	0.126	0.315	22.461	22.461	0.249	0.126	0.315	0.315	1.500	**0.881**	0.869	**0.200**	**N.L. (1)**
399.5	5	5	1.5		41	57	29.3	0.126	0.630	9.567	9.567	0.109	0.064	0.475	0.519	1.408	**0.364**	0.746	**0.187**	**N.L. (2)**
394.5	10	1	2	89.1			33.1	0.130	1.280	1.726	7.071	0.088	0.068	0.815	1.171	1.226	**0.256**	0.532	**0.175**	**1.463 (C)**
389.5	15	1	0.5	79.4			32	0.051	1.535	1.773	7.128	0.089	0.051	1.070	1.738	1.157	**0.242**	0.370	**0.138**	**1.754 (C)**
384.5	20	1	0.25				67.2	0.044	1.755	1.760	1.760	0.052	0.044	1.290	2.270	1.104	**0.135**	0.257	**0.104**	**1.298 (C)**
379.5	25	1	0.25				23.8	0.044	1.975	1.713	1.713	0.052	0.044	1.510	2.802	1.070	**0.130**	0.182	**0.078**	**1.667 (C)**
374.5	30	1	0.5				75.2	0.051	2.230	1.641	1.641	0.051	0.051	1.765	3.369	1.037	**0.126**	0.135	**0.059**	**2.136 (C)**
369.5	35	1	0.5	99.1			66.2	0.051	2.485	1.570	6.884	0.087	0.051	2.020	3.936	1.010	**0.207**	0.106	**0.048**	**4.313 (C)**
364.5	40	5					14.7	0.055	2.760	7.490	7.490	0.092	0.055	2.295	4.523	0.983	**0.213**	0.089	**0.040**	**5.325 (C)**
359.5	45	34					20.8	0.072	3.120	55.808	55.808	0.363	0.072	2.655	5.195	0.914	**0.783**	0.078	**0.035**	**N.L. (3)**
354.5	50	11					12.1	0.062	3.430	14.782	14.782	0.158	0.062	2.965	5.817	0.916	**0.342**	0.072	**0.032**	**10.688 (D)**
349.5	55	36		5.5			23.2	0.073	3.795	52.605	52.768	0.333	0.073	3.330	6.494	0.835	**0.656**	0.068	**0.030**	**N.L. (3)**
344.5	60	22					17.1	0.068	4.135	27.881	27.881	0.365	0.068	3.670	7.146	0.828	**0.715**	0.066	**0.029**	**N.L. (3)**
339.5	65	23					24.8	0.068	4.475	27.735	27.735	0.361	0.068	4.010	7.798	0.804	**0.685**	0.062	**0.028**	**N.L. (3)**
334.5	70	29					15.9	0.071	4.830	34.175	34.175	-5.475	0.071	4.365	8.465	0.759	**-9.810**	0.055	**0.025**	**N.L. (3)**
329.5	75	24					16.4	0.069	5.175	26.156	26.156	0.317	0.069	4.710	9.122	0.767	**0.574**	0.048	**0.021**	**N.L. (3)**
324.5	80	45		3.9			17.5	0.075	5.550	51.530	51.530	0.320	0.075	5.085	9.809	0.705	**0.532**	0.041	**0.018**	**N.L. (3)**
319.5	85	36					17.4	0.073	5.915	37.547	37.547	-0.009	0.073	5.450	10.486	0.685	**-0.014**	0.034	**0.015**	**N.L. (3)**
314.5	90	48					20.4	0.075	6.290	50.135	50.135	0.305	0.075	5.825	11.173	0.667	**0.480**	0.027	**0.012**	**N.L. (3)**
309.5	95	40					19.3	0.074	6.660	38.477	38.477	0.057	0.074	6.195	11.855	0.651	**0.088**	0.020	**0.009**	**N.L. (3)**
304.5	100	28					11.3	0.070	7.010	24.037	24.037	0.274	0.070	6.545	12.517	0.698	**0.452**	0.013	**0.006**	**75.333 (D)**

* FACTOR OF SAFETY DESCRIPTIONS

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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-6N
ELEVATION OF BORING GROUND SURFACE ========== 409.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 65.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

Groundwater was not encountered during drilling, but the spreadsheet equations cannot process a non-numerical value in this cell such as "NE." Shallower groundwater depths generally increase the FS in each layer by increasing $(N_1)_{60cs}$, so we selected a value greater than the borehole depth to remove any affect of groundwater on the $(N_1)_{60cs}$ calculation.

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **217** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
406.5	2.5	6	2.5				24.4	0.133	0.333	12.668	12.668	0.137	0.133	0.333	0.333	1.500	**0.487**	0.881	**0.202**	**N.L. (1)**
404	5	38	4.5				17.3	0.140	0.683	84.531	84.531	0.601	0.078	0.528	0.571	1.500	**2.131**	0.766	**0.191**	**N.L. (3)**
401.5	7.5	26	4.5	62.4	3	24	18.7	0.140	1.033	52.516	68.019	0.470	0.078	0.723	0.922	1.500	**1.663**	0.659	**0.193**	**N.L. (2)**
399	10	9	2.75				15.4	0.134	1.368	15.285	15.285	0.163	0.072	0.903	1.258	1.253	**0.482**	0.563	**0.180**	**2.678 (D)**
394	15	2	0.25	95.4	3	24	29.2	0.107	1.903	3.253	8.903	0.104	0.045	1.128	1.795	1.152	**0.282**	0.404	**0.148**	**1.905 (C)**
389	20	1	1	66.1			60.6	0.122	2.513	1.497	6.796	0.086	0.060	1.428	2.407	1.087	**0.221**	0.291	**0.113**	**1.956 (C)**
384	25	1		70.6			38.5	0.095	2.988	1.399	6.679	0.085	0.033	1.593	2.884	1.062	**0.213**	0.216	**0.090**	**2.367 (C)**
379	30	1					65.8	0.095	3.463	1.304	1.304	0.050	0.033	1.758	3.361	1.038	**0.123**	0.168	**0.074**	**1.662 (C)**
374	35	1	0.25		42	62	66.4	0.107	3.998	1.207	1.207	0.050	0.045	1.983	3.898	1.014	**0.119**	0.138	**0.062**	**N.L. (2)**
369	40	1	1				66.7	0.122	4.608	1.111	1.111	0.050	0.060	2.283	4.510	0.985	**0.115**	0.119	**0.054**	**2.130 (C)**
364	45	1					15.8	0.095	5.083	1.048	1.048	0.049	0.033	2.448	4.987	0.972	**0.113**	0.108	**0.051**	**2.216 (C)**
359	50	26					20.9	0.129	5.728	26.303	26.303	0.320	0.067	2.783	5.634	0.913	**0.691**	0.102	**0.047**	**N.L. (3)**
354	55	21		6.1			12.4	0.127	6.363	19.165	19.298	0.207	0.065	3.108	6.271	0.895	**0.437**	0.098	**0.045**	**9.711 (D)**
349	60	11					18	0.119	6.958	9.344	9.344	0.107	0.057	3.393	6.868	0.899	**0.228**	0.095	**0.044**	**5.182 (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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ========== B-6S
ELEVATION OF BORING GROUND SURFACE ========== 407.30 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 5.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 4.30 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.353
EARTHQUAKE MOMENT MAGNITUDE ========== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 0.00 FT.
HAMMER EFFICIENCY========== 95 %
BOREHOLE DIAMETER========== 2.5 to 4.5 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$\bar{V}_{s,40'}$ = **239** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 12.68
Ground Motion Prediction Equations = CEUS
PGA = **0.222**

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
404.8	2.5	11	2.5				4.4	0.133	0.333	24.878	24.878	0.289	0.133	0.333	0.333	1.500	**1.026**	0.893	**0.205**	**N.L. (1)**
402.3	5	59	2.75				8.2	0.134	0.668	######	131.858	0.962	0.196	0.823	0.866	1.460	**3.317**	0.789	**0.191**	**N.L. (3)**
399.8	7.5	14	2.75				15.4	0.071	0.845	27.378	27.378	0.349	0.071	1.000	1.200	1.291	**1.065**	0.689	**0.190**	**N.L. (3)**
397.3	10	1	1.25		24	40	30.8	0.062	1.000	1.862	1.862	0.052	0.062	1.155	1.511	1.129	**0.139**	0.596	**0.179**	**N.L. (2)**
387.3	20	1	0.75	88.4			38.3	0.056	1.560	1.844	7.213	0.089	0.056	1.715	2.695	1.046	**0.221**	0.328	**0.118**	**1.873 (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