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Geotechnical Design Memorandum

Date: October 12, 2022

To: Mr. Andrew Keaschall, P.E., S.E.,VMA
Senior Vice President
Benesch
35 W. Wacker Drive, Suite 3300
Chicago, IL 60601

From: Matt D. Masterson, P.E.

RE: I-39/US 20 Ramp BD
F.A.I. Route 39
Section (201-3)K & (4-1,5)R
S.N. 101-0215
Winnebago County, Illinois
Job No. D-92-064-19
KEG No. 19-1138.00

LICENSED PROFESSIONAL ENGINEER
MATT D. MASTERSON
NO. 062-061885
STATE OF ILLINOIS

10/12/2022
Exp. 11/30/2023

1.0 INTRODUCTION

The geotechnical study summarized in this design memo was performed for the proposed bridge replacement F.A.I. 39 (I-39) Ramp BD over US-20 in Winnebago County, Illinois. See Exhibit A, Location Map. The purpose of this memo is to present supplemental design and construction recommendations for the proposed three-span structure.

Prior designs by others have been considered for this structure, as summarized in the original abbreviated Structure Geotechnical Report (SGR) completed by Hanson Professional Services, Inc. (Hanson), titled, *FAI Route 39 – Section (201-3)K & (4-1,5)R, Winnebago County, Illinois*, dated Revised April 2017.

2.0 PROJECT DESCRIPTION

Based on the approved Type, Size, and Location Plan (TS&L), Exhibit C, developed by Hanson, a new three-span structure is planned as a replacement for the existing three-span bridge of I-39 over the US-20. Foundations are currently anticipated to be pile supported stub abutments and straddle-bent piers. The proposed U-shaped MSE walls that the abutments will be built on will wrap around the abutments and extend out past the limits of the bridge. The new Ramp BD alignment will be built with a 65º-27'-44" skew relative to US 20. The proposed centerline stations are 2581+12.79 (US-20) and Station 147+59.66 (I-39). The overall length is 484 ft. – 0 in., back-to-back of abutments, and the width is 54 ft. - 10 in., out to out.

The existing structure (SN 101-1036), constructed in 1981, consists of a three-span concrete deck supported by curved steel girders, on pile bent concrete abutments, with piers supported on pile foundations. The existing structure has a length of 397 ft.-8.5 in., back-to-back of abutments, a deck width of 28'-0", with a skew of 56º-25'-55".

3.0 SUBSURFACE EXPLORATION AND GENERALIZED SUBSURFACE CONDITIONS

Recommendations provided in this design memo are based on eight (8) supplemental borings obtained by the Illinois Department of Transportation (IDOT) District 9 in 2020, including two Shelby Tube borings. Additional borings obtained in 2016 and utilized in the Abbreviated SGR dated April 2017, were also given cursory review as part of our analysis. The locations of the supplemental borings are shown on Exhibit B, Boring Plan. The locations of the existing borings are shown on the TS&L, Exhibit C.

Table 3.0 - Boring Depth and Location

Designation	Boring Depth (ft.)	Station	Offset
B-1i	41.0	143+50	11.0 RT
B-2i	39.5	144+00	11.0 RT
B-4i	36.0	144+65	24.0 LT
B-5iST	36.0	144+25	43.0 LT
B-5iSTa*	24.5	144+25	43.0 LT
B-13i	35.5	149+39	0.0 CL
B-14iST	30.5	149+75	11.0 RT
B-14iSTb*	17.0	149+75	11.0 RT

*Shelby Tube Borings

The overburden soils were predominantly medium-stiff to stiff silty clays, silty loams, sandy loams, sandy loam tills, or loose-to-dense sands all the way to termination/refusal in weathered limestone. Detailed information regarding the nature and thickness of the soils and rock encountered are shown on the Boring Logs, Exhibit D and Subsurface Profiles, Exhibit E.

3.1 BEDROCK

Elevations of top of limestone for Borings B-2i, B-4i, B-5iST, B-13i, and B-14iST are shown in Table 3.1 below:

Table 3.1 - Elevation of Top of Limestone

Designation	Nearest Substructure	Station	Offset	Top of Rock Elevation (ft.)
B-2i	E Abut	144+00	11.0 RT	781.7
B-4i	E Abut	144+65	24.0 LT	782.8
B-5iST	E Abut	144+25	43.0 LT	783.2
B-13i	W Abut	149+39	0.0 CL	787.2
B-14iST	W Abut	149+75	11.0 RT	788.6

4.0 GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS

4.1 SETTLEMENT

Due to obtaining supplemental borings and the nature of the soils encountered in the borings, additional estimates of settlement with respect to the East and West MSE wall-supported abutment embankments, were necessary. Although the existing soils encountered have most likely consolidated and settled over time in response to the current loading conditions, the proposed new MSE wall-supported abutment configurations will result in potential settlements during and after construction completion.

Borings B-1i, B-2i, B-4i and B-5iST/5iSTa were drilled near the proposed footprint of the East Abutment MSE wall embankment and Borings B-13i and B-14iST/14iSTb were drilled near the proposed footprint of the West Abutment MSE wall embankment.

Boring B-5iSTa was drilled specifically to obtain Shelby tube samples to better estimate the settlement for the East abutment embankment and Boring B-14iSTb was drilled specifically to obtain Shelby tube samples to better estimate the settlement for the West abutment embankment. The consolidation data provided by the IDOT Central Laboratory, from both of these borings, were used to estimate the magnitude and time rate of settlement for the abutment embankments. Settlement was generally estimated to occur within the upper 15 ft. of the existing soils for the East and West Abutments.

The consolidation test data provided specifically, in Table 1 and Table 2 of the IDOT Shelby Tube Test Results Memo, dated July 27, 2021, and all the supporting data, were utilized for review of the settlement of the embankments. See Laboratory Test Results, Exhibit F. The properties provided were used in conjunction with the supplement borings obtained, and the 2016 borings provided in the Abbreviated SGR dated April 2017, at the respective locations.

For the East Abutment embankment, up to approximately 31 ft. of new MSE walls and structural fill were estimated utilizing nominal densities ranging from 120 pcf to 125 pcf for the fill, including the recommended crushed stone fill for uniform support of the MSE walls as recommended in the Abbreviated SGR. For the West Abutment embankment, up to 37 feet of MSE walls and structural fill were estimated.

4.1.1 EAST ABUTMENT

Beneath the East Abutment embankment fill, the upper 15 feet of existing soils in supplemental Boring B-4i and 2016 Boring B-6i were chosen for a cursory check of the settlement due to proximity to the portion of the embankment comprising the greatest amount of fill estimated within the embankment, from the face of the abutment. Boring B-4i was considered to have a permeable layer and Boring 6i no permeable layer, so both single and double drainage were considered when calculating the time rate of settlement for the East embankment. Groundwater was observed at a depth of 22 ft., approximately El 798.4 in Boring 6i.

Settlement ranging from 4.2 to 4.5 in. was calculated for the East Abutment embankment using the consolidation data obtained in B-5iSTa in conjunction with the same soil types as interpreted in Borings B-4i and B-6i. This settlement included two layers as being slightly to moderately over-consolidated relative to the overburden pressure plus the load from the new fill. The time for 50 percent consolidation (t50) was calculated as ranging from about 1.5 to 4.8 months, and the time for 90 percent consolidation (t90) ranging from 6 to 20 months. Times were also calculated utilizing wick drains on a 5-ft. triangular spacing, assuming that the drains were extended to a maximum depth of 30 ft. below the base of the new fill. With the wick drains, t50 was calculated to range from 18 to 26 days and t90 ranging from 2.6 to 3.6 months. While the wick drains will help to reduce the time for consolidation, they will not reduce the magnitude of settlement.

As such, if about 4.5 in. of settlement is not acceptable for the East Abutment MSE wall-supported embankment, its backfill, or the structures it will support, then ground improvement methods will need to be considered, such as those previously recommended in the Abbreviated SGR, or discussed in Ground Improvement Recommendations, below.

4.1.2 WEST ABUTMENT

Beneath the West Abutment embankment fill, the upper 15 feet of existing soils in supplemental Boring B-13i and 2016 Borings B-11i, B-12i and B-15i were chosen for a cursory check of the settlement due to proximity to the portion of the embankment comprising the greatest amount of fill estimated within the embankment, from the face of the abutment. Borings B-11i, B-12i and B-13i were considered to have a permeable layer and Boring 15i no permeable layer, so both single and double drainage were considered when calculating the time rate of settlement for the South embankment. Groundwater was observed at a depth of 9.5 ft., approximately El 802.2.

Settlement ranging from 1.5 to 4.8 in. was calculated for the West Abutment embankment using the consolidation data obtained in B-14iSTb in conjunction with the same soil types as interpreted in Borings B-11i, B-12i, B-13i and B-15i. This settlement included layers as being normally consolidated in the deeper soils to slightly and moderately over-consolidated in the upper soils relative to the overburden pressure plus the load from the new fill. The time for 50 percent consolidation (t50) was calculated as ranging from about 1.7 to 13.5 months, and the time for 90 percent consolidation (t90) ranging from 7.1 to 56 months. Times were also calculated utilizing wick drains on a 5-ft. triangular spacing, assuming that the drains were extended to a maximum depth of 25 ft. below the base of the new fill. With the wick drains, t50 was calculated to range from 28 days to 1.6 months and t90 ranging from 6 to 6.5 months. While the wick drains will help to reduce the time for consolidation, they will not reduce the magnitude of settlement.

As such, if about 4.8 in. of settlement is not acceptable for the West Abutment MSE wall-supported embankment, its backfill, or the structures it will support, then ground improvement methods will need to be considered, such as those previously recommended in the Abbreviated SGR, or discussed in Ground Improvement Recommendations, below.

4.2 STABILITY ANALYSIS

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Borings B-13i and B-2i. A short-term scenario was modeled for the steepest proposed undercut slopes for both the West and East Abutments. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.3 for slope stability on a short-term basis. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

In order to model the short-term condition, full cohesion and a friction angle of 0 degrees were assumed for all cohesive soils. The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 4.2. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit I.

Table 4.2 – Slope Stability Critical FOS

Location (1V:1.5H Slope)	Critical FOS
	End-of-Construction
West Abutment (B-13i)	1.4
East Abutment (B-2i) – Left Slope	1.9
East Abutment (B-2i) – Right Slope	1.5

4.3 BEARING RESISTANCE

The foundations supporting the proposed walls and fill embankments must provide sufficient support to resist dead and live loads, including seismic loadings. In our opinion, bearing resistance with respect to the overall project was sufficiently evaluated and discussed in the Abbreviated SGR.

Based on review of the available information, combined with the supplemental information obtained for this addendum, we have reviewed the bearing resistance as it applies to the 235.1-foot long MSE wall supporting the left side of the East Abutment approach from Sta. 144+66.16 to Sta. 142+27.00. Our approach in review of this wall was to see if at least a portion of the wall could be sufficiently supported on new structural fill and/or existing fill near Boring 6i and Boring 7i, without the need for ground improvement, based on its orientation and bearing on the existing south end-slope of the current Ramp bridge alignment.

The allowable bearing resistance, using AASHTO LRFD methods with a Bearing Resistance Factor of 0.5, at the approximate bottom elevation of the wall as it progresses from south to north

(El. 820 to El. 841), with an estimated range of cohesion from 700 psf (Boring B-7i) to 2,000 psf (Boring B-6i), was estimated to range from 2,000 psf to 5,350 psf and the applied pressures from the wall and embankment did not exceed this estimated range along the wall.

Depending upon the maximum applied pressures of the wall, the allowable bearing resistance, calculated above, may be exceeded as indicated in the Abbreviated SGR at the taller sections of this wall. Post construction settlements are anticipated because the subsurface materials consist of cohesive materials which will consolidate over time due to the weight of the proposed MSE wall-supported embankments. Our settlement estimates indicate that settlement of 4-inches or less will begin to occur for this MSE wall beginning near Boring 6i (Sta. 143+75) and continuing to be within suitable tolerances to its terminus at Sta. 142+27. Therefore, improvement of the subsurface soils below this proposed section of embankment and MSE wall, utilizing ground improvement from Sta. 143+75 to Sta. 142+27, should not be necessary. A slip-joint should be considered for incorporation into the MSE Wall facing design at Sta. 143+75 to aid in the reducing the impact of the differential settlement that may occur as the wall transitions from an improved soil to the existing soils and/or new structural fill pad.

4.4 DRIVEN PILES

Based on obtaining supplemental borings near each abutment, KEG has reviewed the pile support of the proposed East and West Abutments, accordingly. Due to the settlement issues, downdrag is a concern for the piles and support of the abutments, depending upon the use and application of ground improvement, similar to as discussed in the Abbreviated SGR.

The preliminary design loads for the abutments, as provided by Benesch, are shown in the Table below.

Table 4.4 - Preliminary Design Load

Substructure Unit	Factored Reactions (kips)
Abutments	3,864

The estimated pile lengths for the H-pile types are shown in Tables 4.4.1 thru 4.4.6 below. The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings. Piles are estimated to bear on limestone bedrock, relying on end-bearing only. The tables below show the Maximum Factored Bearing Resistance of the various pile types. The Pile Length input sheets are included as Pile Length/Pile Type, Exhibit G. In addition to the information below; refer to the original Abbreviated SGR for information related to driven pile support of the Abutments and Piers, including the use of pile sleeves at the abutments, due to down drag concerns, and the recommended use of pile shoes.

Table 4.4.1 - Estimated Pile Lengths for HP 10x42 H-Pile

	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD Criteria) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	335	185	51	836.52
East Abutment	335	185	59	839.61

Table 4.4.2 - Estimated Pile Lengths for HP 12x53 H-Pile

	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD Criteria) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	418	230	51	836.52
East Abutment	418	230	59	839.61

Table 4.4.3 - Estimated Pile Lengths for HP 12x63 H-Pile

	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD Criteria) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	497	273	51	836.52
East Abutment	497	273	60	839.61

Table 4.4.4 - Estimated Pile Lengths for HP 14x73 H-Pile

	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD Criteria) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	578	318	51	836.52
East Abutment	578	318	60	839.61

Table 4.4.5 - Estimated Pile Lengths for HP 14x89 H-Pile

	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD Criteria) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
West Abutment	705	388	51	836.52
East Abutment	705	388	60	839.61

4.5 GROUND IMPROVEMENT RECOMMENDATIONS

Ground improvement is recommended in consideration of the overall project; based upon the proposed fill heights and associated loads, the subsurface conditions, estimated settlement, bearing resistance, down drag, and the anticipated construction schedule.

Various types of ground improvement are available, including wick drains; a combination of surcharge and wick drains; removal and replacement; aggregate column ground improvement (ACGI); rigid inclusion ground improvement (RIGI); a hybrid combination of ACGI and RIGI; or a combination of wick drains and ACGI, including different methods of wall installation and/or MSE wall face type/units used in the design.

4.5.1 WICK DRAINS

Wick drains, as discussed earlier in this report, are recommended to significantly reduce the amount of anticipated post-construction settlement, particularly for the remainder of the embankments outside the limits of the recommended improved areas under the retained zones of the walls, including where the embankments come together, as necessary. Based on our estimates, a maximum spacing of 5 feet center to center is recommended, in order to accelerate anticipated settlements of up to 4.8 inches in less than 6.5 months. We recommend contacting a qualified contractor to discuss their recommended spacing, etc., based on the subsurface conditions summarized in this report and the Abbreviated SGR. Where other applications are utilized for ground improvement, it is recommended that wick drains be installed prior to installation of the other improvements.

4.5.2 EMBANKMENT SURCHARGE

If the construction schedule allows, the ground improvement program could include surcharging the MSE wall-supported embankment fill areas before the abutments and walls are constructed. If the site's layout is such that the embankments and surcharge fills cannot be placed or if the construction schedule will not allow for an estimated 3.6 month surcharge duration for the east abutment or a 6.5-month surcharge duration for the west abutment in combination with wick drains, other improvement methods will need to be considered, as discussed below.

4.5.3 REMOVAL AND REPLACEMENT

Removal and replacement could be a cost-effective option, provided recommended depths of up to 12 feet of the existing soils below the east and west approaches and abutments can be effectively removed and replaced without adversely affecting the adjacent existing structures and/or roadbeds during construction. Based on the results of our settlement and slope stability analysis, we recommend removal and replacement extend to a minimum elevation of El. 807.5 at the East Approach and Abutment and extend to a minimum elevation of El. 805.0 at the West Approach and Abutment of the Ramp BD improvements. The existing soils could be reconditioned and recompacted back into place in the undercut areas, or other approved structural fill materials could be considered for backfill, such as crushed stone. Backfill materials should be compacted to a minimum of 95 percent of a Standard Proctor maximum dry density (ASTM D698). The advantage of reusing the site soils would be savings on having to import structural fill materials, including crushed stone fill. One disadvantage to re-use of the site soils, would be the efforts required for moisture reconditioning to acceptable moisture contents during replacement and compaction, which could increase time to construction completion. Imported fill materials could essentially run into the same situations depending upon the moisture condition of the import materials and weather conditions at the time of construction. In our opinion, re-use of site soils to any extent, would help in the overall construction duration and costs, even if considered in combination to using imported fill materials, for some of the fill areas. Crushed stone used for backfill of overexcavations should have fines or have a significant "minus gradation" to the matrix, such as CA-2, CA-4, CA-6, CA-9 and CA-10. Larger shot-rock in general accordance with IDOT RR-1 gradation may be appropriate, provided it has sufficient fines, such that no open voids remain in the matrix after placement and compaction. Shot rock could be blended with site soils to bulk up the backfill materials and also provide sufficient fines to choke off any porous shot rock materials. Asphalt millings may also be considered, provided they also have a gradation with sufficient fines content. Crushed stone backfill of overexcavations should <u>not</u> consist of porous granular gradations. Porous granular gradations could result in accumulation of groundwater within the backfill matrix over time and/or cause uncontrolled migration of soil fines into the porous backfill zones and induce potential uncontrolled subsidence and settlement over time.

4.5.4 AGGREGATE COLUMN GROUND IMPROVEMENT

Based on the results of our settlement analysis as discussed above, ACGI could be an option within the proposed MSE wall retained zone, including the face and an additional distance in front of the walls, as discussed below. However, ACGI may not be suitable due to potential installation issues below the groundwater table.

For the East Abutment MSE wall-supported embankment and the associated fill, the ACGI should extend to a depth of 30 ft. and limit settlement to no more than 2 in. at an applied bearing pressure of 2,497 psf. For the West Abutment MSE wall-supported embankment and the associated fill, the ACGI should extend to a depth of 25 ft., or bedrock at a shallower depth and limit settlement to no more than 2 in. at an applied bearing pressure of 3,038 psf. Higher applied pressures may need to be addressed beneath the walls themselves.

For wall/embankment heights of 15 to 27 feet, the ACGI should extend a minimum of 5 feet laterally in front of the walls. For walls greater than 27 feet tall, the ACGI should extend a minimum of 15 feet in front of the walls. Below the remainder of the retained zone and embankments for walls greater than 27 feet tall, ACGI elements will be required. For the walls at each of the proposed bridge abutments, the ACGI need to extend a minimum of 15 feet in front of the walls that pass in front of the abutments and to the back of the retained zone determined by the wall designer on the backside of the abutments. ACGI elements need to be maintained a minimum of 3 ft. away from any new pile locations to avoid interference with pile installation and/or 5 ft. away from any existing foundations to avoid interference during installations. See Recommended Ground Improvement Locations, Exhibit H, based on the approved TS&L.

Based on discussions with aggregate pier contractors, differential settlements of up to 1½ inches, with total settlements of up to 4 inches over a length of 100 feet are typical for MSE walls constructed over ACGI treated soils. In our opinion, the ACGI should be designed to limit settlement from the proposed loads to no more than 2 in., and differential settlements along the wall face to no more than 1 in. in 100 lineal ft. It is anticipated that this will result in an approximate spacing of 8 to 10 ft., center-to-center, for the ACGI elements.

4.5.5 RIGID INCLUSION GROUND IMPROVEMENT

RIGI is also an option to be considered and is typically installed in a similar fashion to ACGI elements, with the only difference being that cement grout or concrete is used in the columns versus crushed aggregates. A working platform or pad of compacted crushed stone is also usually required over the top of the improved soils and RIGI elements to act as a load transfer pad for support of the structures proposed. Such a platform is not necessary in an ACGI application in many cases.

RIGI is more applicable for very weak soils, such as peat, organic silts, or very soft clays or any soil where there is little to no confinement from the surrounding matrix, such as soils with very low blow counts or N-values, or as referenced as weight-of-hammer (WH) on boring logs. Site soils impacted by significant shallow water table issues, such as fluvial soils in flood plains, or poorly drained areas also fall into this category.

The soils impacted by settlement, as discussed in this report, are moderately soft and have been subjected to some consolidation over time, and the groundwater table encountered in the borings is primarily shown to be below the depth of the settlement impacted soils or up to the bottom of the settlement zone in underlying sand deposits. The groundwater levels are somewhat higher in the soils near the West Abutment versus the soils in the East Abutment, as noted in the boring logs. The settlement estimated for this site is primarily due to the height of the proposed embankments and MSE walls and the estimated pressures from this additional loading, not necessarily due to an overly weak or soft nature of the impacted soils.

If RIGI is considered as an improvement option for this site, the layout and depths should be the same as recommended above for the ACGI option, and as indicated on the Recommended Ground Improvement Locations, Exhibit H; with the exception that a working platform will be required as part of the design over these elements, as discussed above. With the RIGI application, wick drains would not need to be used in conjunction, as could be considered with an ACGI application.

4.5.6 HYBRID ACGI AND RIGI IMPROVEMENT

An additional option to consider is using a combination of both of the above recommended column improvement options, typically labeled as a "Hybrid" application. The same contractor that performs the ACGI installations should also be familiar with and able to perform the RIGI installations with subtle differences in the equipment required for grout backfill versus aggregate backfill. Where the hybrid application may come into benefit on this project, is with concerns with the groundwater table elevations during construction. As indicated above, the RIGI application may be more conducive to the West Abutment improvements versus the East Abutment improvements simply due to anticipated groundwater impacts during installation of the elements. A cost savings advantage of the hybrid may result in such a case, versus simply using the RIGI application for the entire site. This goes for any of the improvement options recommended above, in that <u>any combination</u> of the above methods of ground improvement could be used across this site, depending upon logistics, site constraints or construction schedule, in order to produce the most cost-efficient approach for ground improvement for this project.

4.5.7 CONTRACTOR DESIGNED GROUND IMPROVEMENTS

We recommend contacting qualified contractors to discuss the methods of ground improvement recommended above, including, the specific depths, number, and spacing of elements, for the ACGI, RIGI, or Wick Drain improvement options, and the anticipated post-construction settlements that could be expected with each application. Any other specialized ground improvement techniques or contractors may only provide designs based on their specific patented methods or product that could result in unexpected delays in obtaining contract design plans.

Regardless of the improvement options chosen, in addition to placement of settlement plates where feasible within the embankment fills; we recommend that survey benchmarks/settlement points be established along each of the three faces of the MSE Walls around both abutments near critical points such as corners or large steps in the wall alignments to monitor the magnitude and rate of settlement as the new fills are placed and the walls are constructed.

5.0 MSE WALL CONSTRUCTION

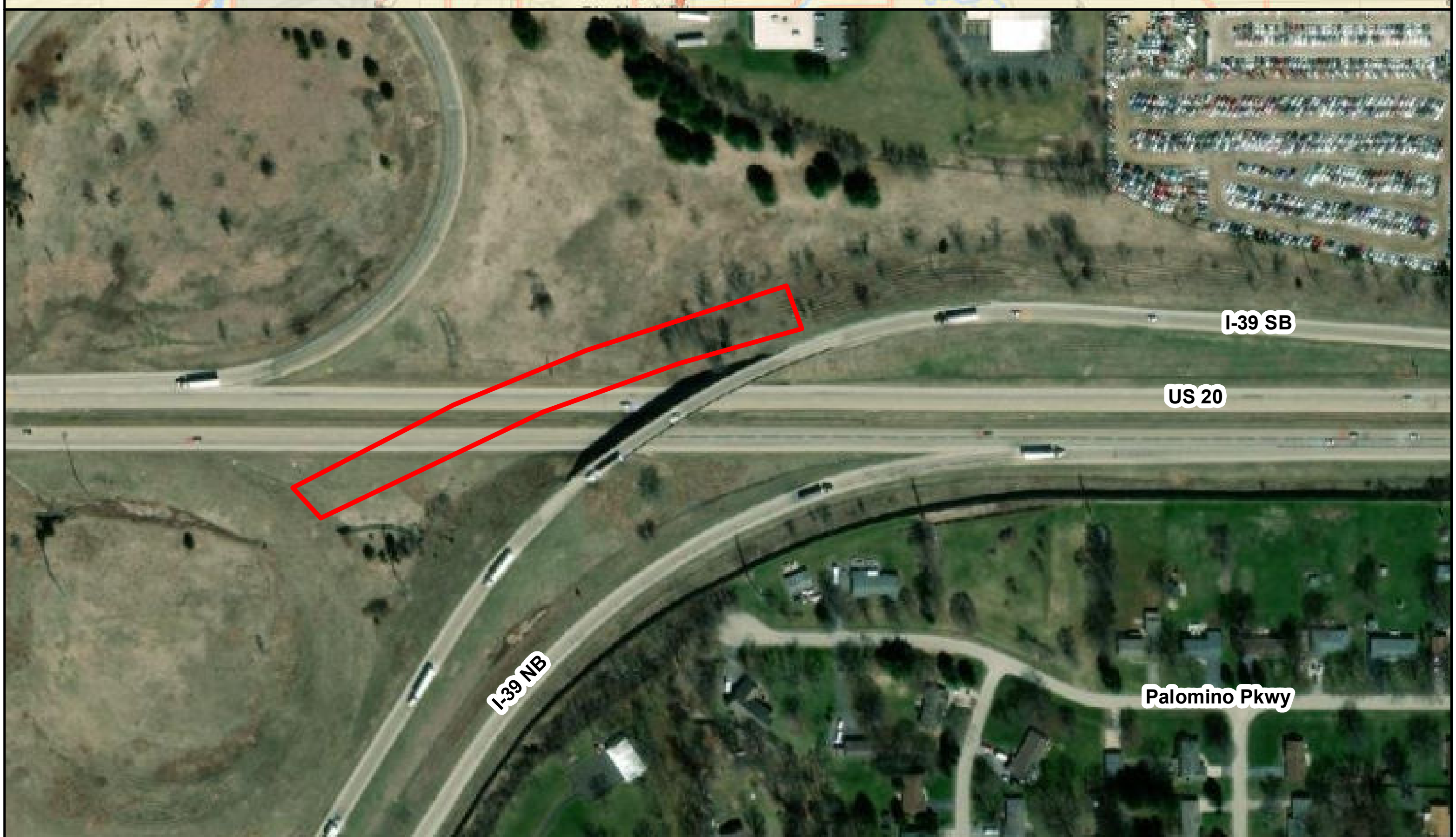
MSE wall and embankment construction may proceed simultaneously, provided that ground improvement techniques are utilized as recommended in this report. Permanent MSE wall facing units may be installed as construction proceeds provided slip-joints or MSE facing units capable of handling differential and total settlements are used in the design.

6.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of Benesch and IDOT. They are specific only to the project described and are based on the subsurface information as presented in the original Abbreviated SGR prepared by Hanson, dated Revised April 2017; and six supplemental borings obtained by IDOT in August and September of 2020; KEG's understanding of the project as described herein; and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

EXHIBIT A

LOCATION MAP



LOCATION MAP

I-39/US 20 Ramp BD (FAI Route 39)
Section (201-3)K & (4-1, 5) R
SN 101-0215
Winnebago County, Illinois

Kaskaskia Engineering Group, LLC

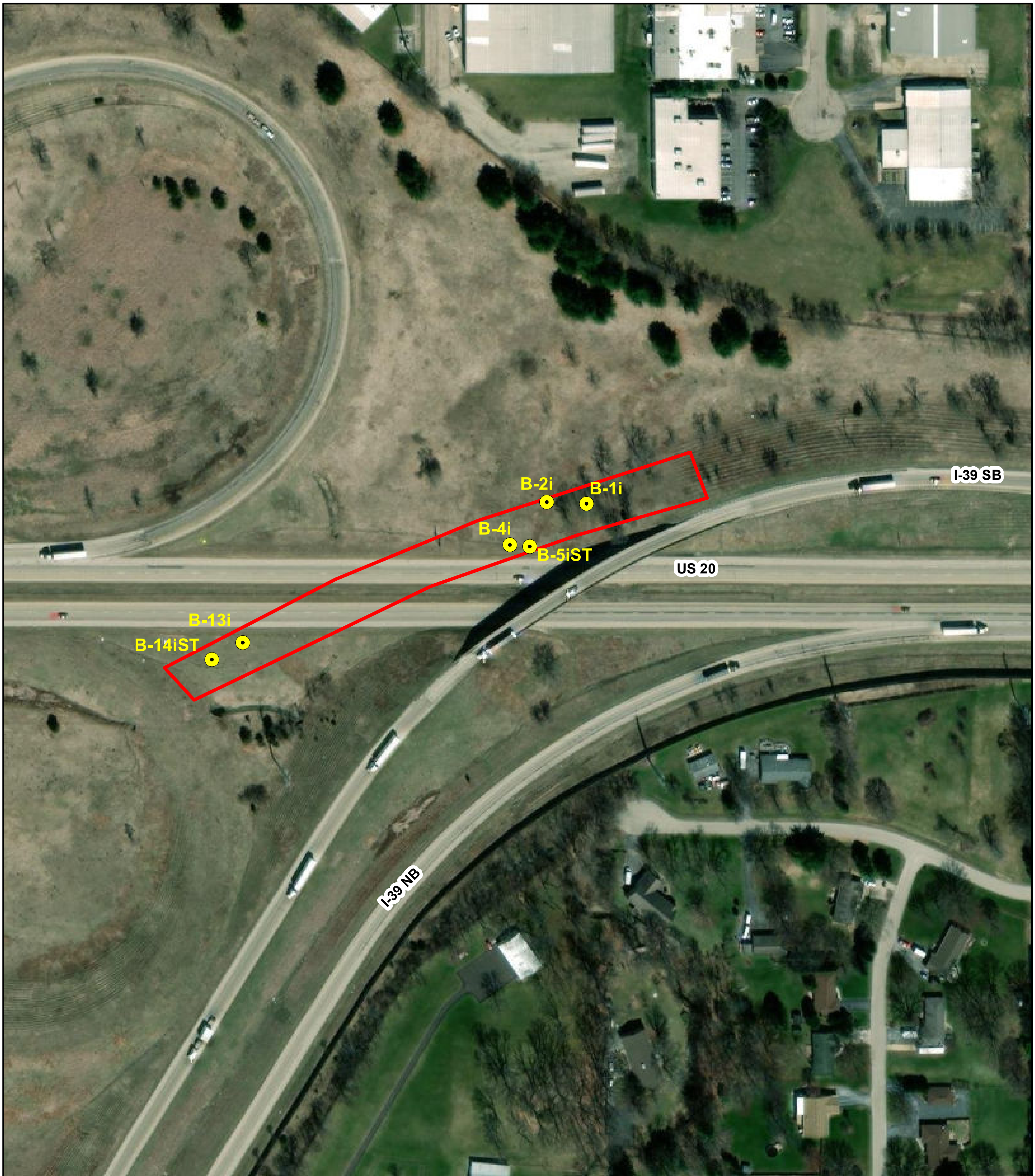
Exhibit No.

A

KEG JOB #19-1138.00

EXHIBIT B

BORING PLAN



Kaskaskia Engineering Group, LLC

BORING PLAN

I-39/US 20 Ramp BD (FAI Route 39)
Section (201-3)K & (4-1, 5) R
SN 101-0215
Winnebago County, Illinois

Exhibit No.

B

KEG JOB #19-1138.00

EXHIBIT C

TYPE, SIZE AND LOCATION PLAN

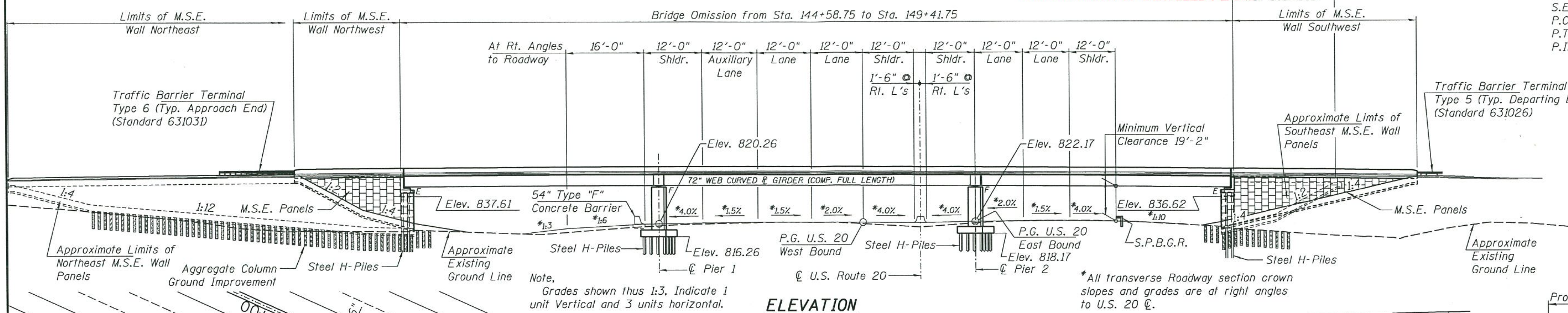
BM: #454 - Cut Square South side of Westerly sign base for a 30MPH ramp 0.1 miles North of the Centerline of Linden Rd. - West side of I-39 Elevation = 850.53
#455 - Cut Square South side of Easterly sign base for a 30MPH ramp 0.1 miles North of the Centerline of Linden Rd. - East side of I-39 Elevation = 851.37

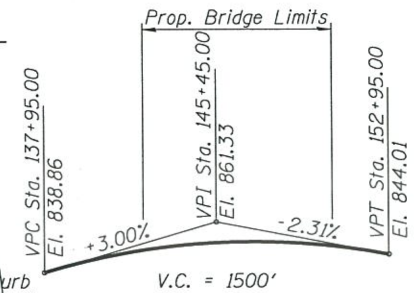
Existing Structure (SN 101-0136)
Originally constructed in 1981 as F.A. Route 194, Section 201-3HB-2.
The structure consists of a 3 Span, 56°-25'-55" Rt Fwd. Skewed, concrete deck on curved steel girders, supported on pile bent concrete abutments and 2 (4 Trapazoidal columns) concrete piers on pile supported foundations. The deck width is 28'-0", and the span lengths are 86'-0", 143'-6" and 155'-0" developing a back to back length of 397'-8½".
Traffic shall be maintained on the existing structure during construction of the new structure. See Maintenance of Traffic Plans for more staging information.
No Salvage.

APPROVED
APR 11 2017
AS A BASIS FOR PREPARATION OF DETAILED PLANS

CURVE DATA - I-39 SBL

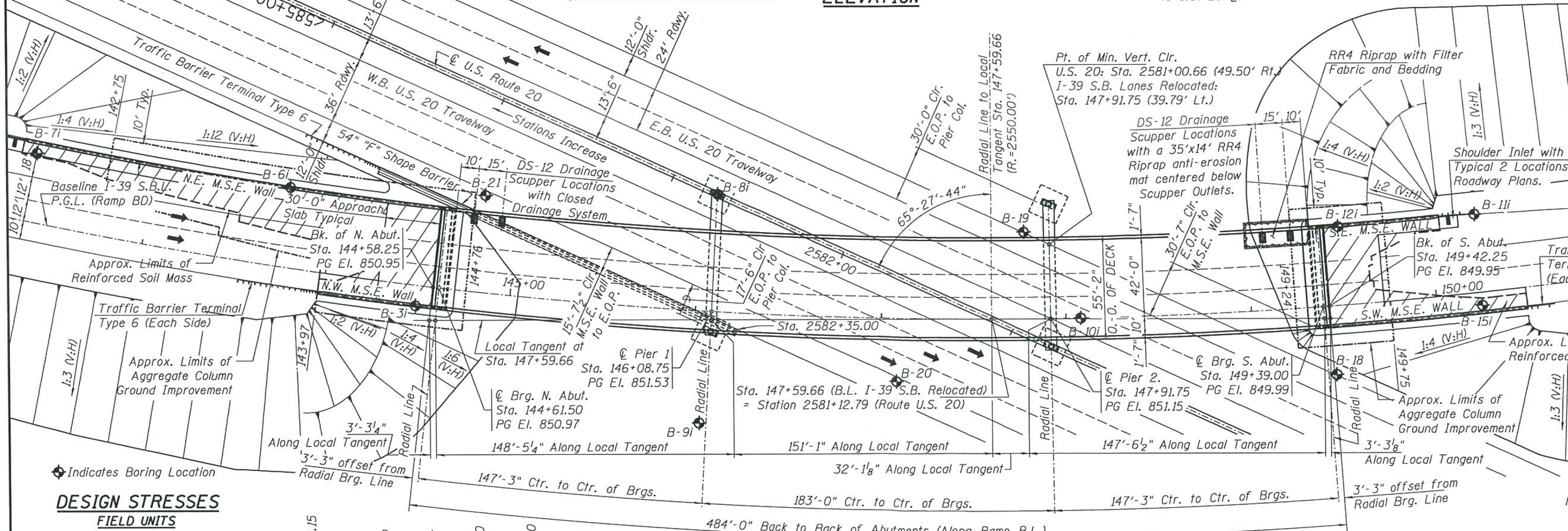
Δ = 107°00'-24" (Lt.)
D = 2°-14'-49"
T = 3446.54'
L = 4762.42'
E = 1737.32'
R = 2550.00'
S.E. = 5.75%
P.C. = Sta. 134+63.52
P.T. = Sta. 182+25.95
P.I. = Sta. 169+10.06

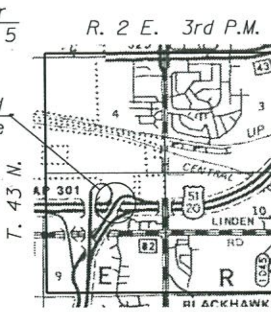




PROPOSED PROFILE

Along B.L. I-39 S.B.L. Relocated.
The Profile Grade shows the Final Elevations after grinding.





LOCATION SKETCH

Notes: All Structural Steel shall be Metalized. Up to ¼" may be ground off of the bridge deck and the approach slab.

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

PRECAST UNITS

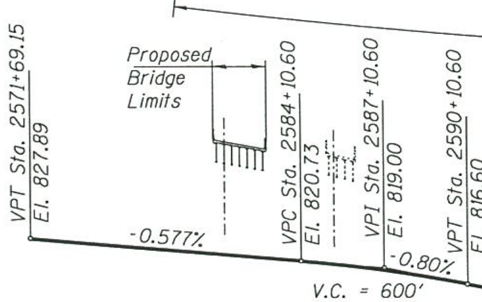
f'c = 4,500 psi (Precast Panels)

LOADING HL-93

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

DESIGN SPECIFICATIONS

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



PROPOSED PROFILE

Along US-20 Inside E.O.P.

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.056
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.101
Soil Site Class = C

HIGHWAY CLASSIFICATION

F.A.I. Rte. 39 - I-39 S.B. Lanes
Functional Class: Interstate
ADT: 10,000 (2013); 28,000 (2040)
ADTT: 4,200 (2013); 11,700 (2040)
DHV: 2250 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
1 -Way Traffic

HIGHWAY CLASSIFICATION

FAP Rte 301 - U.S. Route 20
Functional Class: Freeway and Expressway (Urban)
ADT: 33,400 (2013); 50,050 (2040)
ADTT: 6,000 (2013); 9,000 (2040)
DHV: 5970 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
2 -Way Traffic
Directional Distribution: 50:50

GENERAL PLAN
I-39 S.B.L. (Ramp BD) over U.S.20
F.A.I. 39 - SECTION (201-3)K & (4-1, 5)R
WINNEBAGO COUNTY
STA. 147+59.66
STRUCTURE NUMBER - 101-0215

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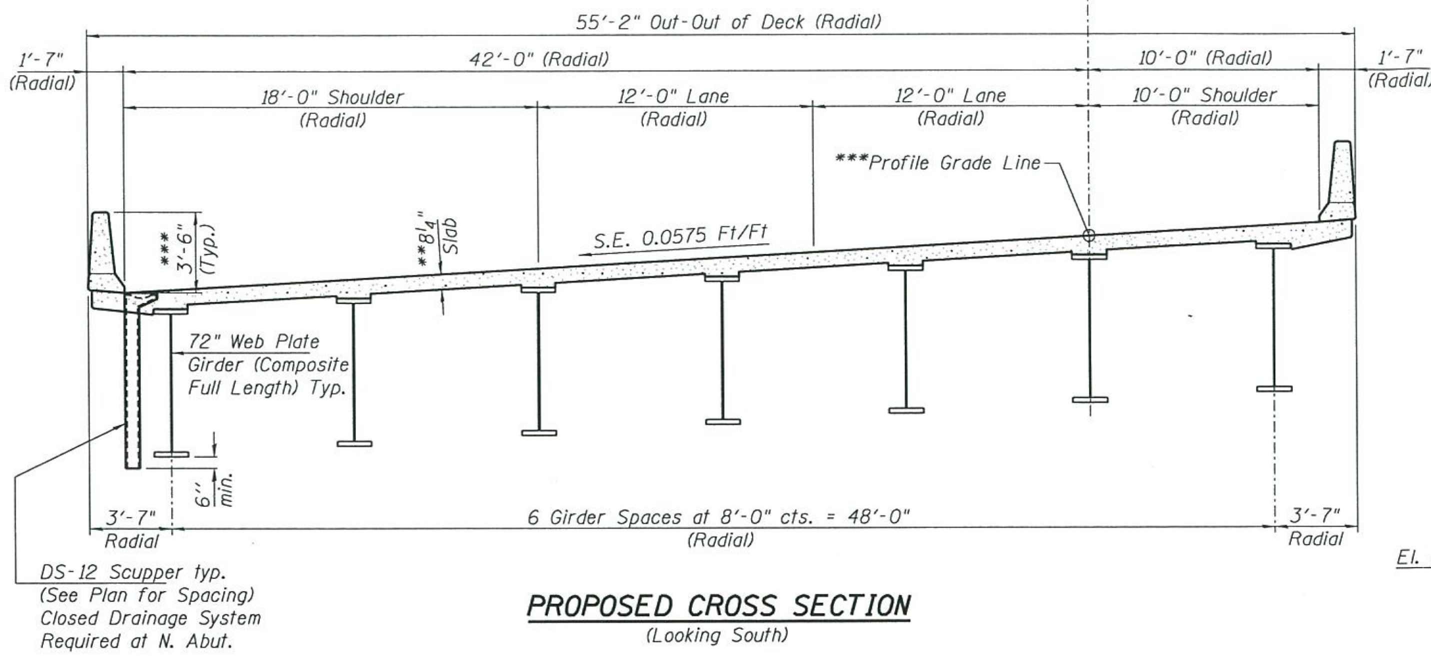
HANSON	USER NAME =	DESIGNED - MNM	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	STRUCTURE NO. 101-0215
		CHECKED - TEH	REVISED -		
	PLOT SCALE =	DRAWN - ROD	REVISED -		
	PLOT DATE =	CHECKED - MNM	REVISED -		SHEET NO. 01 OF 04 SHEETS

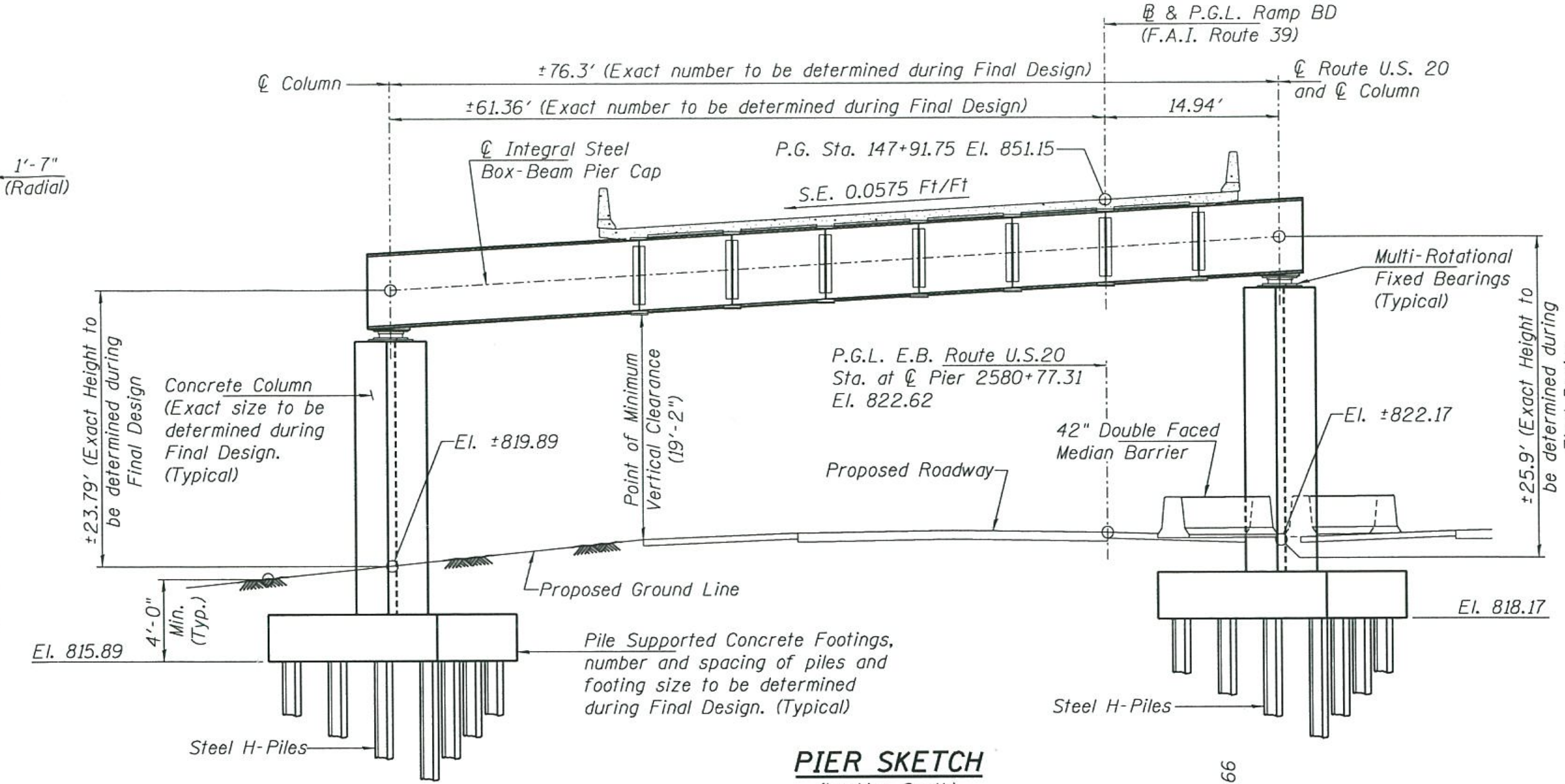
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
39	(201-3)K & (4-1, 5)R	WINNEBAGO	4	1
		CONTRACT NO. 64C62		
	ILLINOIS FED. AID PROJECT			

DESIGNED DRAWN REVIEWED

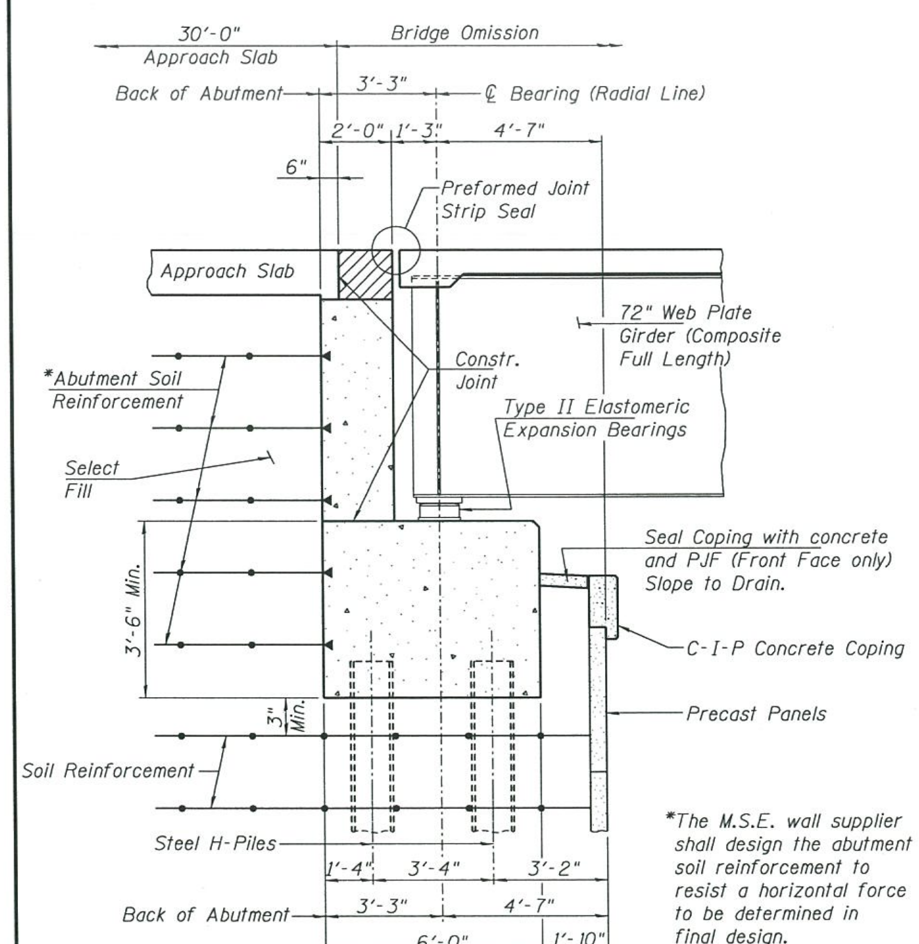
** Prior to Grinding
*** After Grinding



PROPOSED CROSS SECTION
(Looking South)

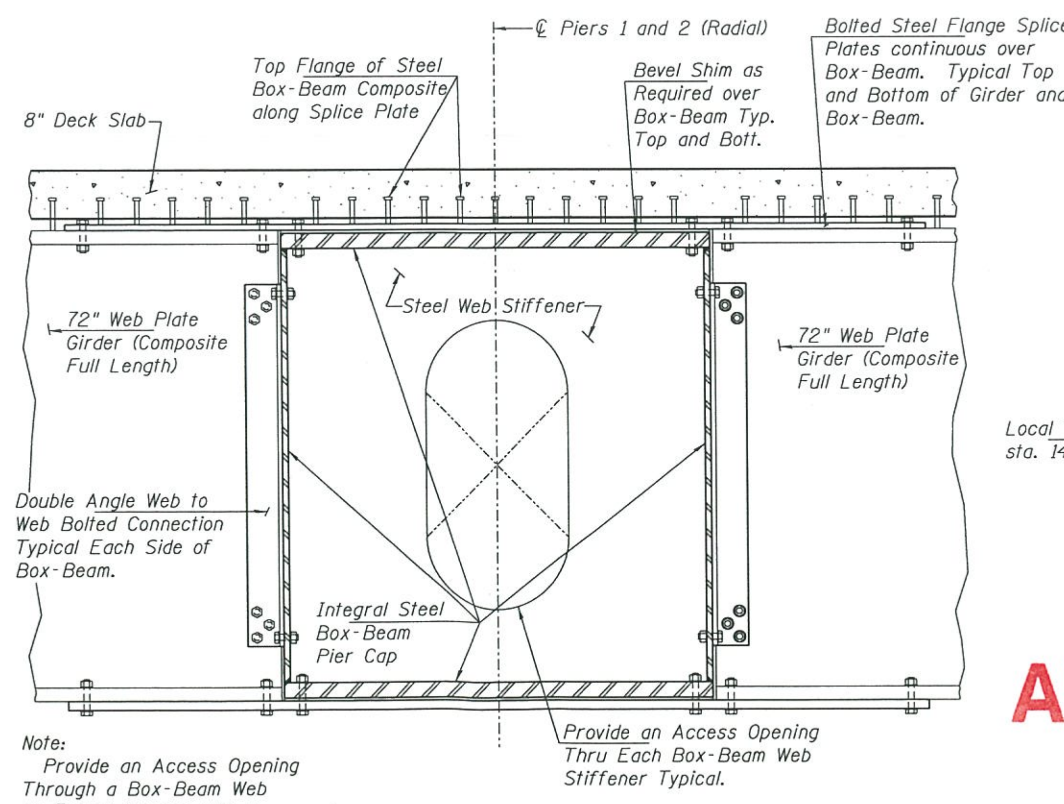


PIER SKETCH
(Looking South)
(Pier No. 2 Dimensions and Elevations Shown, Pier No. 1 Similar)



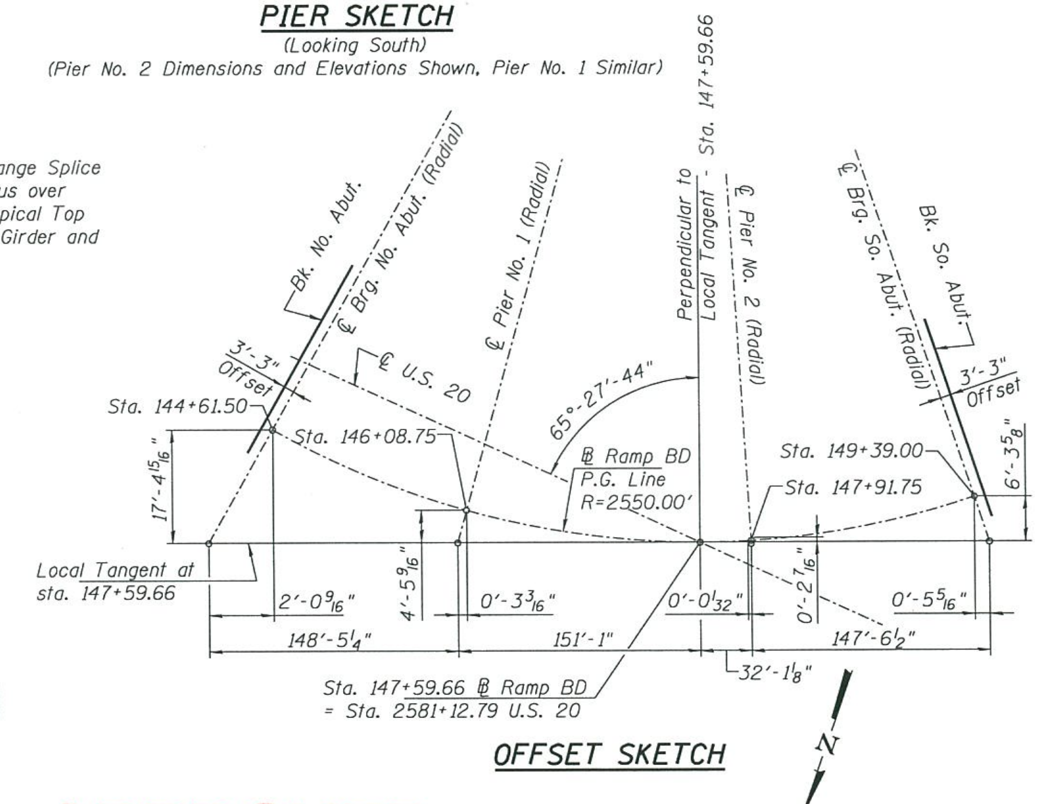
*The M.S.E. wall supplier shall design the abutment soil reinforcement to resist a horizontal force to be determined in final design.

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



Note:
Provide an Access Opening Through a Box-Beam Web or Flange Member with a Bolted and Sealed Cover.
Provide Drain Hole in the Bottom Flange of the Box-Beam at the low end. Bird screens are required over the drain hole.

SECTION THRU BOX-BEAM PIER CAP
(Horiz. dim. @ Rt. L's)



OFFSET SKETCH

APPROVED
APR 11 2017
AS A BASIS FOR PREPARATION OF DETAILED PLANS

DETAILS
I-39 S.B.L. (Ramp BD) over U.S.20
F.A.I. 39 - SECTION (201-3)K & (4-1, 5)R
WINNEBAGO COUNTY
STA. 147+59.66
STRUCTURE NUMBER - 101-0215

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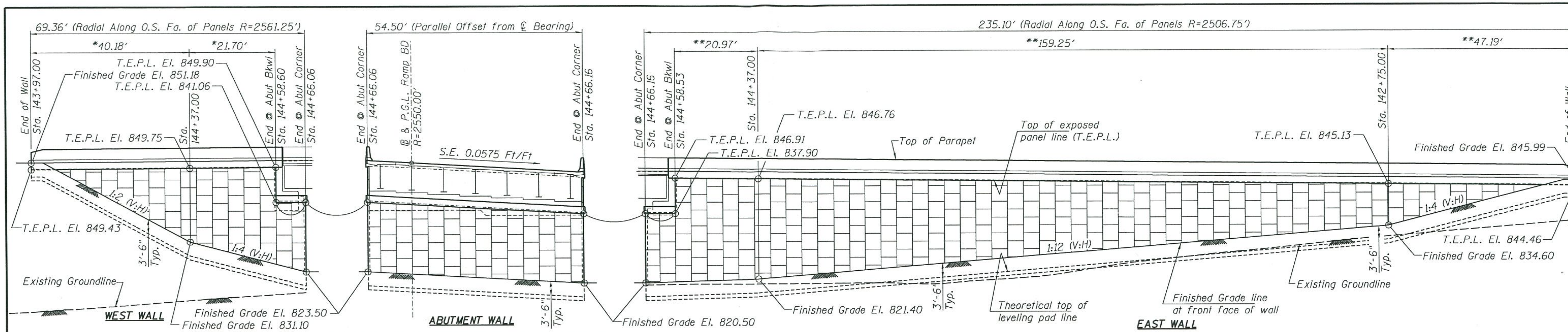
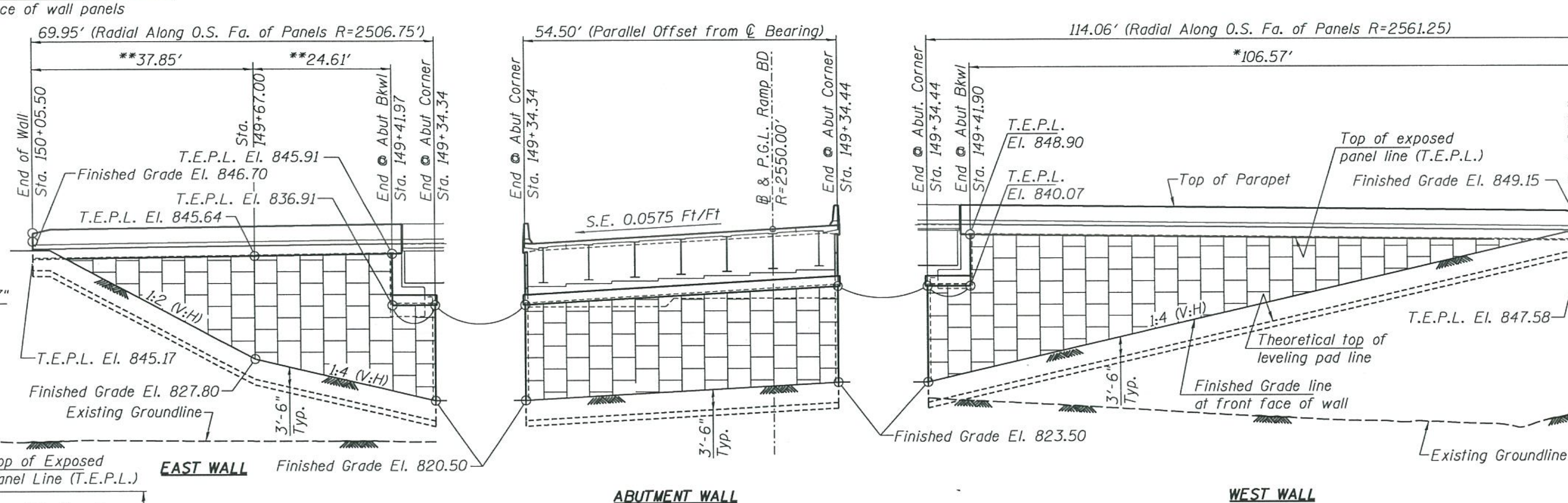
HANSON	USER NAME =	DESIGNED - MNM	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	STRUCTURE NO. 101-0215	F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CHECKED - TEH	REVISED -			39	(201-3)K & (4-1, 5)R	WINNEBAGO	4	2
	PLOT SCALE =	DRAWN - ROD	REVISED -					CONTRACT NO. 64C62		
	PLOT DATE =	CHECKED - MNM	REVISED -		SHEET NO. 02 OF 04 SHEETS		ILLINOIS FED. AID PROJECT			

DESIGNED DRAWN REVIEWED



NORTH ABUTMENT WALL ELEVATIONS

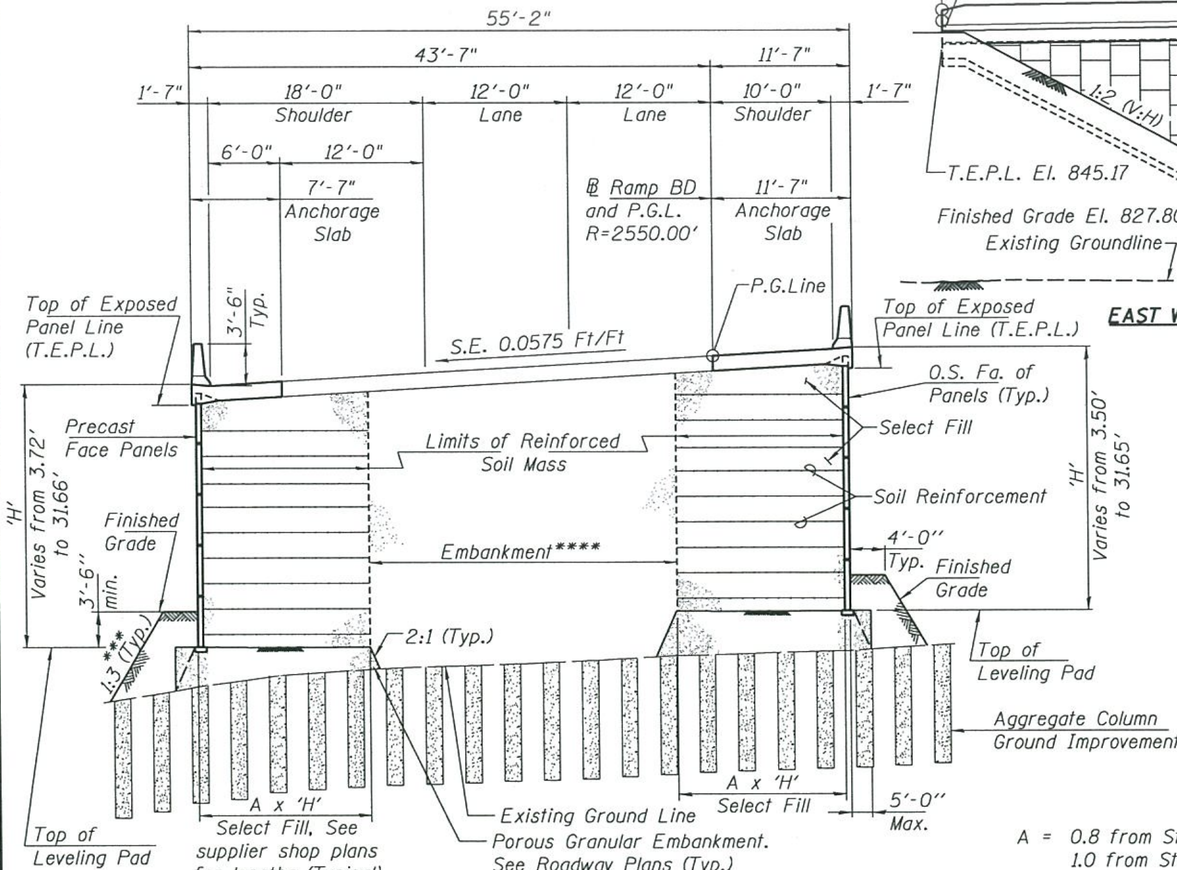
Developed along front face of wall panels



SOUTH ABUTMENT WALL ELEVATIONS

Developed along front face of wall panels

* Radial along O.S. Face - R=2561.25'
** Radial along O.S. Face - R=2506.75'
*** 1:2 max. Near End of Wall
**** Embankment Material between MSE Walls from Sta. 143+97 to Sta. 150+05.50 Shall be Restricted to the same material as used for select fill in MSE Wall.



CROSS SECTION at MSE WALLS BEYOUND APPROACH SLAB

Looking South - Upstation
(Horizontal Dimensions Measured Radially)

A = 0.8 from Sta. 142+27 to 143+50
1.0 from Sta. 143+50 to 149+67
0.8 from Sta. 149+67 to 150+48

APPROVED
APR 11 2017
AS A BASIS FOR PREPARATION OF DETAILED PLANS

M.S.E. WALL DETAILS
I-39 S.B.L. (Ramp BD) over U.S.20
F.A.I. 39 - SECTION (201-3)K & (4-1, 5)R
WINNEBAGO COUNTY
STA. 147+59.66
STRUCTURE NUMBER - 101-0215

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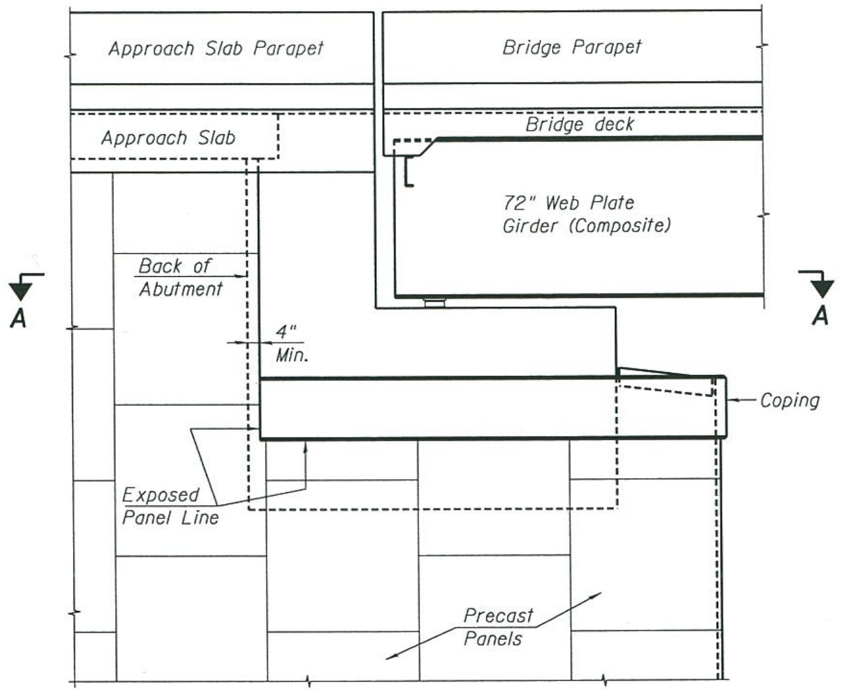
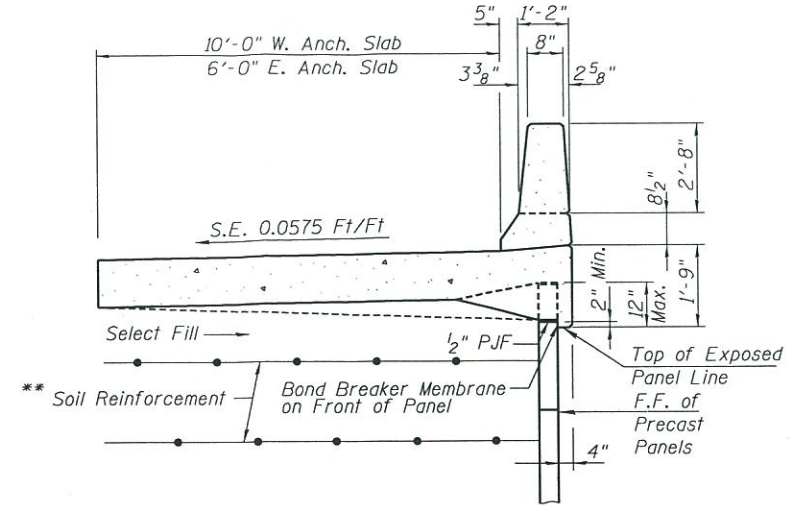
HANSON	USER NAME =	DESIGNED - MNM	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	STRUCTURE NO. 101-0215
		CHECKED - TEH	REVISED -		
	PLOT SCALE =	DRAWN - ROD	REVISED -		
	PLOT DATE =	CHECKED - MNM	REVISED -		SHEET NO. 03 OF 04 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
39	(201-3)K & (4-1, 5)R	WINNEBAGO	4	3
		CONTRACT NO. 64C62		
		ILLINOIS FED. AID PROJECT		

DESIGNED DRAWN REVIEWED

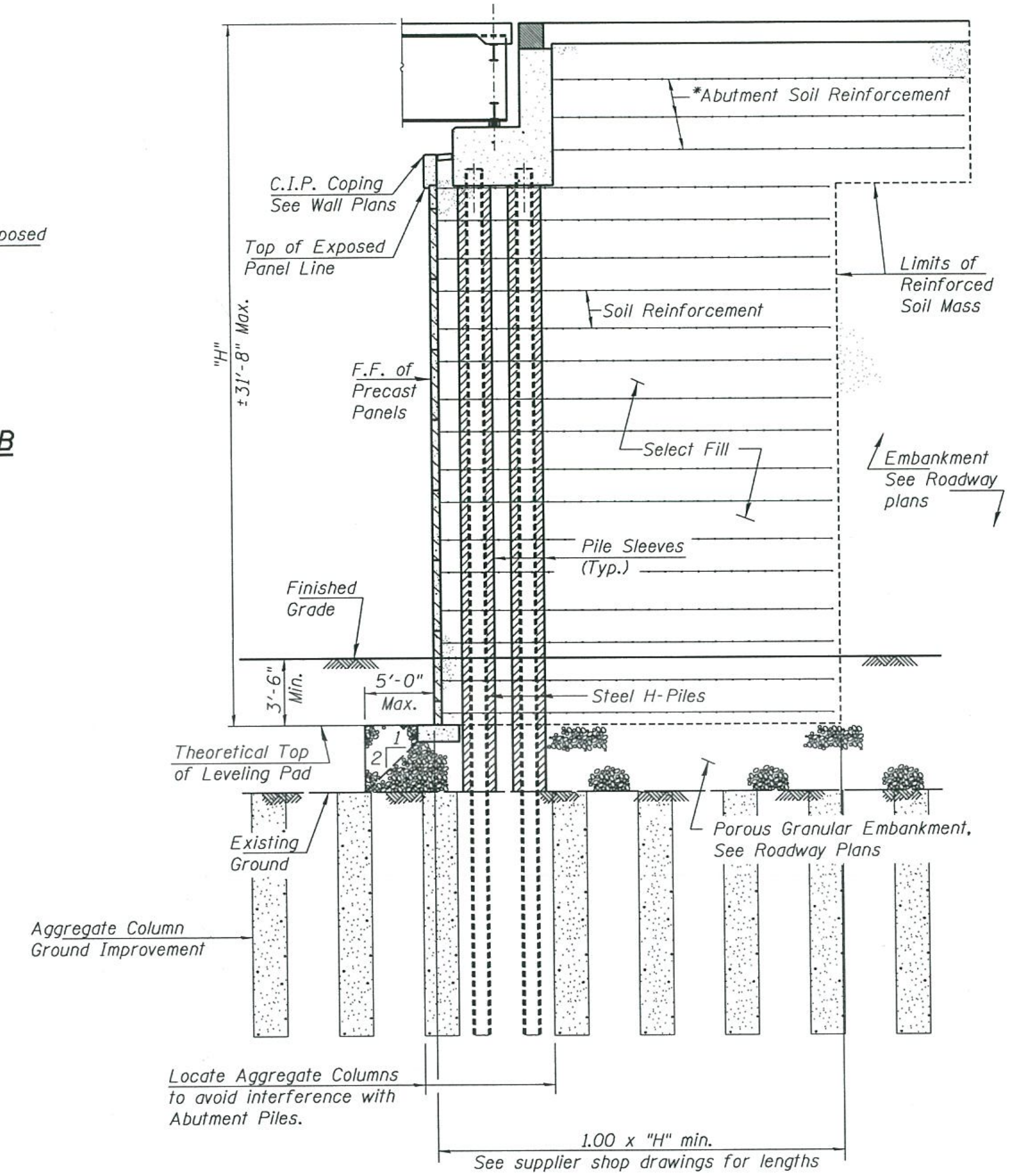


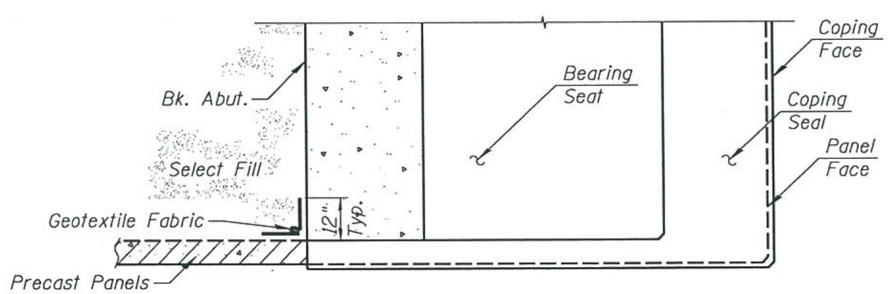
ABUTMENT END VIEW



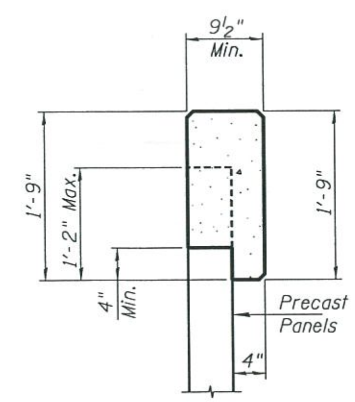
SECTION THRU C.I.P. PARAPET AND ANCHORAGE SLAB

** The M.S.E. Wall supplier's internal stability design shall account for the anchorage slab's bearing pressure surcharge of 1.0 ksf and horizontal sliding force of 0.5 kips/ft. of wall.





SECTION A-A



SECTION THRU C.I.P. COPING

TYPICAL M.S.E. WALL SECTION AT ABUTMENT

(Section at Rt. L's)

* The MSE wall supplier shall design the abutment soil reinforcement to resist a horizontal force to be determined during final design.

APPROVED

APR 11 2017

AS A BASIS FOR PREPARATION OF DETAILED PLANS

M.S.E. WALL DETAILS

I-39 S.B.L. (Ramp BD) over U.S.20

F.A.I. 39 - SECTION (201-3)K & (4-1, 5)R

WINNEBAGO COUNTY

STA. 147+59.66

STRUCTURE NUMBER - 101-0215

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HANSON

USER NAME =	DESIGNED - MNM	REVISED -
	CHECKED - TEH	REVISED -
PLOT SCALE =	DRAWN - ROD	REVISED -
PLOT DATE =	CHECKED - MNM	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

STRUCTURE NO. 101-0215

SHEET NO. 04 OF 04 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
39	(201-3)K & (4-1, 5)R	WINNEBAGO	4	4
		CONTRACT NO. 64C62		
		ILLINOIS FED. AID PROJECT		

DESIGNED DRAWN REVIEWED

EXHIBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/19/20

ROUTE	I-39/Bypass 20	**DESCRIPTION**	P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd.
LOGGED BY	W. Garza	**SECTION**	(201-3)K & (4-1,5)R
LOCATION	Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E	**COUNTY**	Winnebago
DRILLING METHOD	Hollow Stem Auger	**HAMMER TYPE**	CME-45 Automatic
STRUCT. NO.	Proposed Ramp BD	**Station**	
Latitude	36° 24' 39.76"	**Longitude**	-97° 57' 52.73"
Northing	42.2206	**Easting**	-89.0064
BORING NO.	B-1i	**Station**	143+50
Offset	11.00ft Rt	**Ground Surface Elev.**	820.98 ft
Surface Water Elev.	ft	**Stream Bed Elev.**	ft
Groundwater Elev.: First Encounter	794.0 ft ▼	**Upon Completion**	Dry ft
After ___ Hrs.	ft		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	818.98				
HARD brown SILTY CLAY LOAM	817.48		7 8 9	4.0 P	14.0
HARD brown SILTY CLAY LOAM	814.98	-5	6 8 10	4.3 P	17.0
STIFF tan SILTY LOAM	812.48		4 4 7	1.4 P	20.0
MEDIUM tan SILT	809.98	-10	2 3 6	0.8 B	23.0
VERY STIFF tan SILTY LOAM	807.48		2 4 6	2.5 B	23.0
STIFF light brown SILTY CLAY LOAM TILL	804.98	-15	2 4 6	1.7 B	23.0
MEDIUM gray SILTY CLAY LOAM TILL	802.48		0 2 3	0.9 B	24.0
MEDIUM light gray SILTY LOAM		-20	0		
MEDIUM light gray SILTY LOAM *(continued)*	799.98		2 5	0.8 B	21.0
STIFF light gray SILTY LOAM	796.48		1 4 6	1.1 B	21.0
MEDIUM tan FINE SAND 5' Run	794.98	-25	3 10 14		
▼					
DENSE tan WELL-CEMENTED SAND 5' Run	786.48	-30	4 11 30		
HARD tan SANDY LOAM TILL 5' Run	784.98	-35	13 18 17	4.2 S	9.0
No Recovery		-40	4		

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/19/20

ROUTE I-39/Bypass 20 DESCRIPTION P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. LOGGED BY W. Garza

SECTION (201-3)K & (4-1,5)R LOCATION Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"

Northing 42.2206
Easting -89.0064

BORING NO. B-1i
Station 143+50
Offset 11.00ft Rt
Ground Surface Elev. 820.98 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 794.0 ft ▼
Upon Completion Dry ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
No Recovery *(continued)*		4		
779.98		5		
End of Boring				
	-45			
	-50			
	-55			
	-60			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/18/20

ROUTE I-39/Bypass 20 **DESCRIPTION** P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. **LOGGED BY** W. Garza

SECTION (201-3)K & (4-1,5)R **LOCATION** Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76" **Longitude** -97° 57' 52.73"
Northing 42.2206 **Easting** -89.0066

BORING NO. B-2i
Station 144+00
Offset 11.00ft Rt
Ground Surface Elev. 818.65 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 796.7 ft ▼
Upon Completion Dry ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM brown SILTY CLAY LOAM	816.65			Dry	15.0
VERY STIFF brown SILTY CLAY LOAM	815.15		4 5 8	2.0 P	23.0
STIFF tan SILTY LOAM	812.65	-5	2 3 4	1.0 B	22.0
STIFF tan SILT	810.15		3 5 7	1.4 B	22.0
VERY STIFF dark brown SILTY CLAY LOAM	807.65	-10	3 6 5	2.7 B	25.0
STIFF gray SILTY CLAY LOAM	805.15		2 4 6	1.3 B	22.0
MEDIUM tan/gray SILTY LOAM	801.65	-15	1 2 3	0.6 B	24.0
LOOSE tan MOIST DIRTY SAND	800.15		1 2 3		11.0
		-20	1		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM/LOOSE tan DIRTY SAND with MEDIUM GRAVEL *(continued)*	796.65 ▼		2 5	0.5 P	13.0
VERY STIFF tan SANDY LOAM TILL	795.15		6 12 14	3.3 B	10.0
VERY STIFF tan SANDY LOAM TILL 5' Run	792.65	-25	5 8 13	3.1 B	11.0
STIFF gray SANDY LOAM TILL 5' Run	787.65	-30	2 3 5	1.1 B	13.0
MEDIUM gray SANDY LOAM TILL	781.65	-35	1 3 6	0.5 P	10.0
VERY DENSE tan WEATHERED LIMESTONE	779.15		100 for 1"		
End of Boring		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/27/20

ROUTE I-39/Bypass 20 DESCRIPTION P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. LOGGED BY W. Garza

SECTION (201-3)K & (4-1,5)R LOCATION Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"

Northing 42.2204
Easting -89.0068

BORING NO. B-4i
Station 144+65
Offset 24.00ft Lt
Ground Surface Elev. 817.30 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None ft
Upon Completion Dry ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY STIFF brown SILTY CLAY LOAM				2.0 P	23.0
	815.30				
STIFF brown SILTY CLAY LOAM			2 3 4	1.3 B	13.0
	813.80				
MEDIUM tan SILTY LOAM		-5	1 2 4	0.6 B	23.0
	811.30				
STIFF tan SILTY LOAM			3 5 8	1.9 B	22.0
	808.80				
VERY STIFF brown SILTY CLAY		-10	2 4 7	2.3 B	25.0
	806.30				
MEDIUM gray SILTY CLAY LOAM			1 2 4	0.8 B	24.0
	802.80				
LOOSE tan DIRTY SAND AND GRAVEL 5' Run		-15	1 2 4		19.0
	797.80				
		-20	2		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY STIFF tan SANDY LOAM TILL	796.30		6 9	3.0 P	11.0
5' Run *(continued)*					
HARD tan WELL-CEMENTED SANDY LOAM TILL 5' Run	791.30	-25	10 17 21	4.5 P	8.0
STIFF gray SANDY LOAM TILL 5' Run		-30	8 10 14	1.7 B	9.0
	782.80				
VERY DENSE gray WEATHERED LIMESTONE	781.30	-35	100 for 2"		
End of Boring					
		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

SOIL BORING LOG

Illinois Department of Transportation
Division of Highways
IDOT

Date 8/27/20

ROUTE I-39/Bypass 20 DESCRIPTION P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. LOGGED BY W. Garza

SECTION (201-3)K & (4-1,5)R LOCATION Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"
Northing 42.2204
Easting -89.0067

BORING NO. B-5iST
Station 144+25
Offset 43.00ft Lt
Ground Surface Elev. 817.65 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 795.7 ft ▼
Upon Completion Dry ft
After ___ Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY STIFF light brown SILTY CLAY LOAM				2.0 P	20.0
	815.65				
SOFT light brown SILTY CLAY LOAM			2 3 4	0.5 B	26.0
	814.15				
VERY SOFT tan SILT		-5	2 2 4	0.2 P	24.0
	811.65				
VERY STIFF light gray SILTY CLAY			3 4 7	2.1 B	24.0
	809.15				
STIFF gray CLAY LOAM		-10	2 4 6	1.7 B	26.0
	806.65				
STIFF gray SILTY CLAY LOAM TILL			2 3 5	1.1 B	23.0
	804.15				
MEDIUM light gray SILTY LOAM		-15	1 3 5	0.8 P	24.0
	800.65				
MEDIUM tan DIRTY SAND			0 2 4	0.6 P	12.0
	799.15				
		-20	6		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM tan SANDY LOAM WITH GRAVEL *(continued)*			8 8	0.9 B	11.0
	795.65 ▼				
MEDIUM tan SANDY LOAM WITH GRAVEL			9 8 11	0.8 P	11.0
	794.15				
VERY STIFF tan SANDY LOAM TILL		-25	5 9 34	2.8 S	10.0
	791.65				
VERY STIFF tan SANDY LOAM TILL			5 14 16	3.3 B	10.0
	789.15				
VERY STIFF tan SANDY LOAM TILL		-30	2 6 9	2.5 B	10.0
	786.65				
STIFF gray SANDY LOAM TILL with DIRTY SAND LENS			4 6 7	1.9 P	10.0
	783.15				
VERY DENSE tan WEATHERED LIMESTONE		-35	3 100 for 4"		
	781.65				
End of Boring					
		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/16/20

ROUTE I-39/Bypass 20 DESCRIPTION P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. LOGGED BY W. Garza

SECTION (201-3)K & (4-1,5)R LOCATION Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Shelby Tubes HAMMER TYPE CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"

Northing 42.2204
Easting -89.0066

BORING NO. B-5iSTa
Station 144+25
Offset 43.00ft Lt
Ground Surface Elev. 817.65 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Auger to 2.5'	815.15				
30" Push 24" Rec	812.65	-5			
30" Push 20" Rec	810.15				
Auger to 14.5'	803.15	-10			
30" Push 27" Rec	800.65	-15			
30" Push 30" Rec	798.15				
	795.65	-20			
12" Push 12" Rec	793.15				
End of Boring		-25			
		-30			
		-35			
		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/13/20

ROUTE	I-39/Bypass 20	**DESCRIPTION**	P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd.	**LOGGED BY**	N. White
SECTION	(201-3)K & (4-1,5)R	**LOCATION**	Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E		
COUNTY	Winnebago	**DRILLING METHOD**	Hollow Stem Auger	**HAMMER TYPE**	CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"
Northing 42.2200
Easting -89.0084

BORING NO. B-13i
Station 149+39
Offset 0.00ft CL
Ground Surface Elev. 819.18 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 802.2 ft ▼
Upon Completion 796.7 ft ▽
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM brown SILTY CLAY LOAM				0.5 P	13.0
	817.18				
STIFF brown SILTY CLAY LOAM			5 5 6	1.8 B	13.0
	815.68				
STIFF brown SANDY LOAM		-5	3 5 7	1.4 B	13.0
	813.18				
STIFF brown SANDY LOAM			5 7 8	1.0 B	14.0
	810.68				
VERY STIFF gray SILTY LOAM		-10	2 4 6	3.7 P	18.0
	808.18				
MEDIUM gray SILTY LOAM			0 1 2	0.5 B	29.0
	805.68				
STIFF gray SANDY LOAM		-15	2 3 6	1.1 B	17.0
	803.18	▼			
MEDIUM tan SANDY LOAM TILL			2 2 3	0.5 B	13.0
	800.68				
MEDIUM tan SANDY LOAM TILL		-20	2		
MEDIUM tan SANDY LOAM TILL *(continued)*			3 4	0.5 B	13.0
	797.18				
VERY DENSE dark brown MEDIUM DIRTY SAND		▽	3 5 59		
	794.68				
STIFF tan SANDY LOAM TILL		-25	3 6 12	1.5 B	11.0
	792.18				
VERY STIFF tan SANDY LOAM TILL			7 10 13	2.4 B	19.0
	789.68				
DENSE tan FINE-MEDIUM SAND AND GRAVEL		-30	6 14 21		
	787.18				
VERY DENSE tan WEATHERED LIMESTONE			6 100 for 6"		
	785.68				
VERY DENSE tan WEATHERED LIMESTONE		-35	100 for 4"		
	783.68				
End of Boring					
		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/13/20

ROUTE I-39/Bypass 20 **DESCRIPTION** P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. **LOGGED BY** W. Garza

SECTION (201-3)K & (4-1,5)R **LOCATION** Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"

Northing 42.2199
Easting -89.0086

BORING NO. B-14iST
Station 149+75
Offset 11.00ft Rt
Ground Surface Elev. 818.12 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 801.1 ft ▼
Upon Completion 794.6 ft ▽
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM brown SILTY CLAY LOAM	816.12			0.8 P	13.0
VERY STIFF light brown SILTY LOAM	814.62		3 5 6	2.0 S	11.0
VERY STIFF brown SANDY CLAY LOAM	812.12	-5	3 5 8	2.9 B	15.0
STIFF gray SANDY LOAM	809.62		4 3 3	1.3 P	18.0
STIFF gray SILTY LOAM	807.12	-10	3 4 5	1.1 B	27.0
MEDIUM gray SILTY LOAM	804.62		0 0 3	0.8 B	21.0
MEDIUM light gray SILTY LOAM	801.12 ▼	-15	1 1 3	0.5 B	22.0
LOOSE tan SAND with MEDIUM GRAVEL	798.62		0 4 4		
MEDIUM tan SANDY LOAM TILL		-20	0		
MEDIUM tan SANDY LOAM TILL *(continued)*	797.12		3 3	1.0 P	12.0
MEDIUM tan SANDY LOAM TILL	794.62 ▽		1 4 4	0.8 B	12.0
STIFF tan SANDY LOAM TILL	791.12	-25	2 3 5	1.1 B	12.0
VERY LOOSE tan SAND with MEDIUM GRAVEL	788.62		0 0 4		
VERY DENSE tan WEATHERED LIMESTONE	787.62	-30	100 for 4"		
End of Boring					
		-35			
		-40			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 9/16/20

ROUTE I-39/Bypass 20 **DESCRIPTION** P92-111-06 - Proposed retaining wall north and south of US Byp 20, 1.1 mi E of Alpine Rd. **LOGGED BY** W. Garza

SECTION (201-3)K & (4-1,5)R **LOCATION** Cherry Valley, NE9, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago **DRILLING METHOD** Shelby Tubes **HAMMER TYPE** CME-45 Automatic

STRUCT. NO. Proposed Ramp BD
Station

Latitude 36° 24' 39.76"
Longitude -97° 57' 52.73"

Northing 42.2199
Easting -89.0086

BORING NO. B-14iSTb
Station 149+75
Offset 11.00ft Rt
Ground Surface Elev. 818.12 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

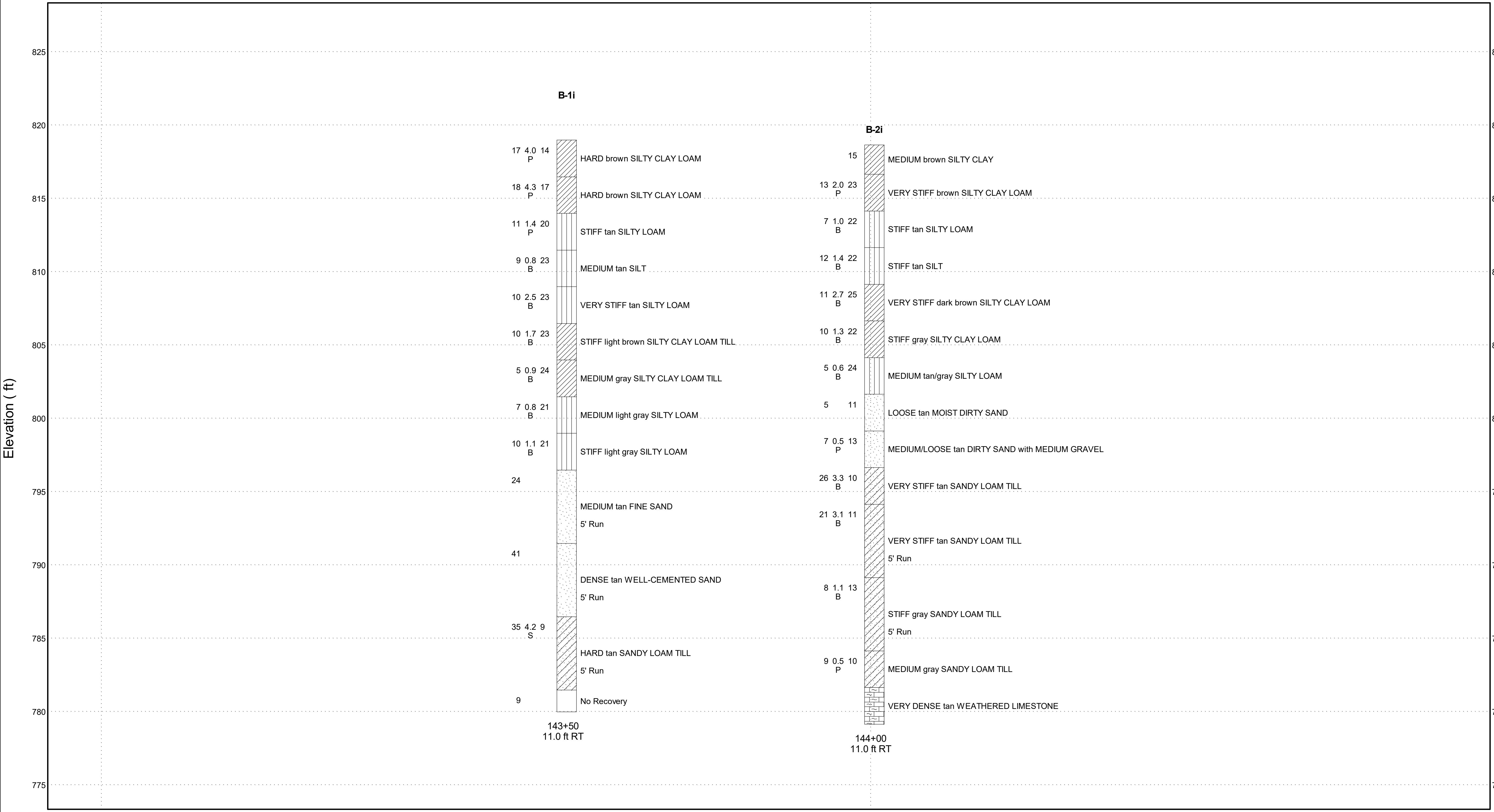
Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
30" Push 27.5" Rec	815.62				
30" Push 30" Rec	813.12	-5			
36" Push 24.0" Rec	810.12				
Auger to 11.0'	807.12	-10			
36" Push 29.0" Rec	804.12				
26" Push 26.0" Rec	801.12	-15			
End of Boring		-20			

Northing and Easting were calculated using the ILHP-WF coordinate system

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

EXHIBIT E

SUBSURFACE PROFILE



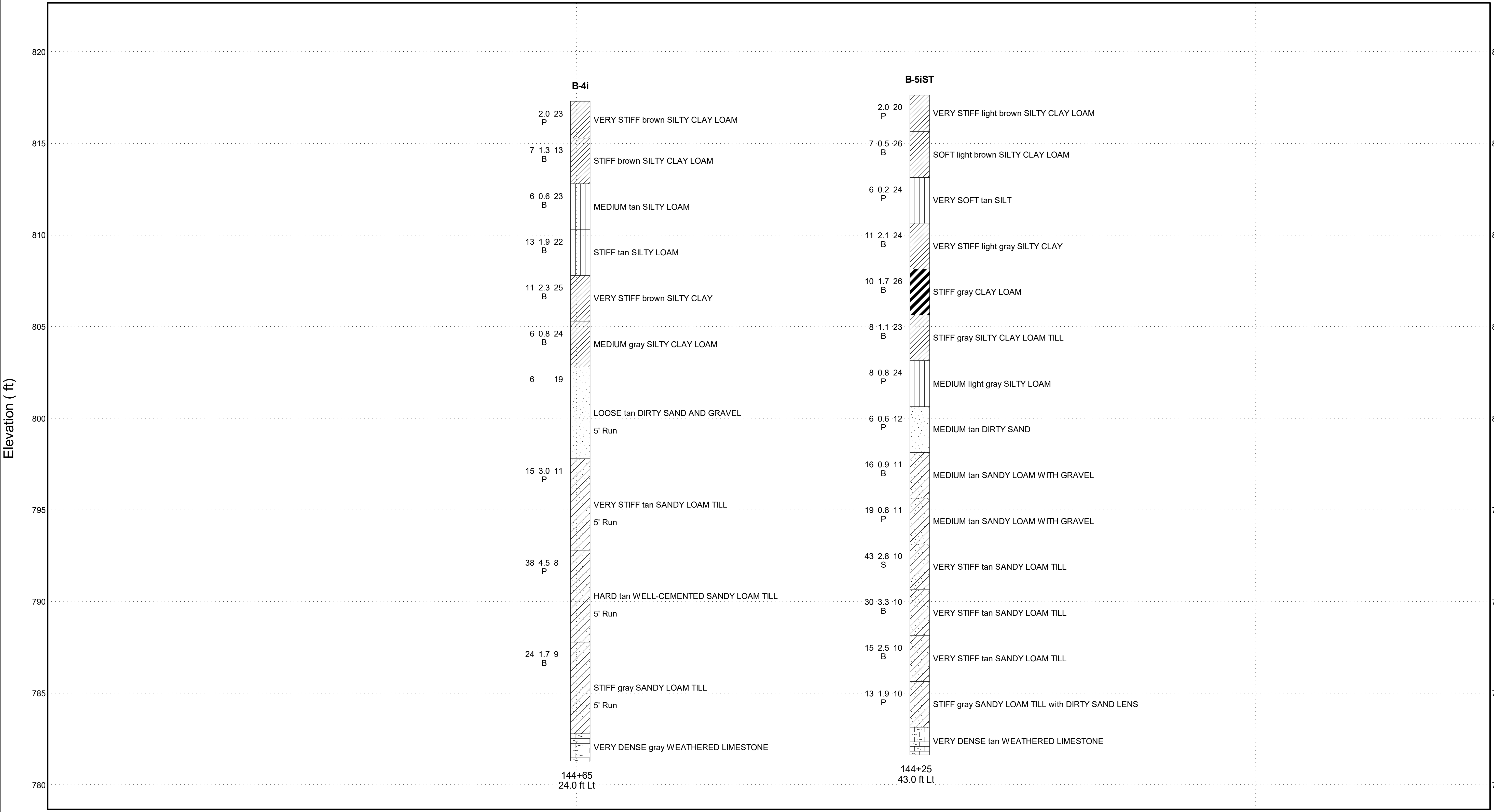
PRINTERMOD 11X17 19-1138.00 - RAMP BD I-39.GPJ IL_DOT.GDT 8/18/21

Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

SUBSURFACE DATA PROFILE

Route: I-39/Bypass 20
Section: (201-3)K & (4-1,5)R
County: Winnebago



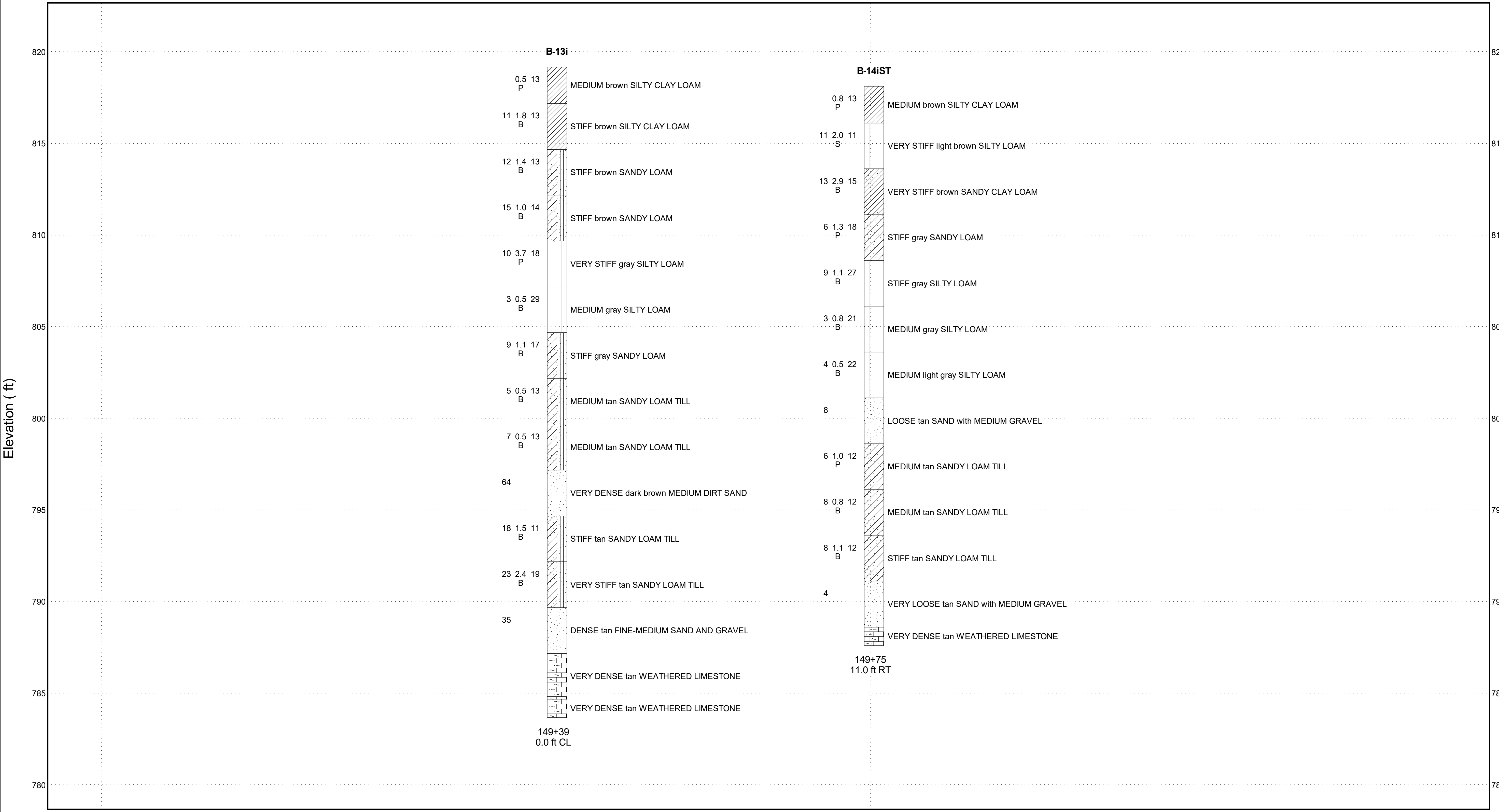
PRINTERMOD 11X17 19-1138.00 - RAMP BD I-39.GPJ IL_DOT.GDT 8/18/21

Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

SUBSURFACE DATA PROFILE

Route: I-39/Bypass 20
Section: (201-3)K & (4-1,5)R
County: Winnebago

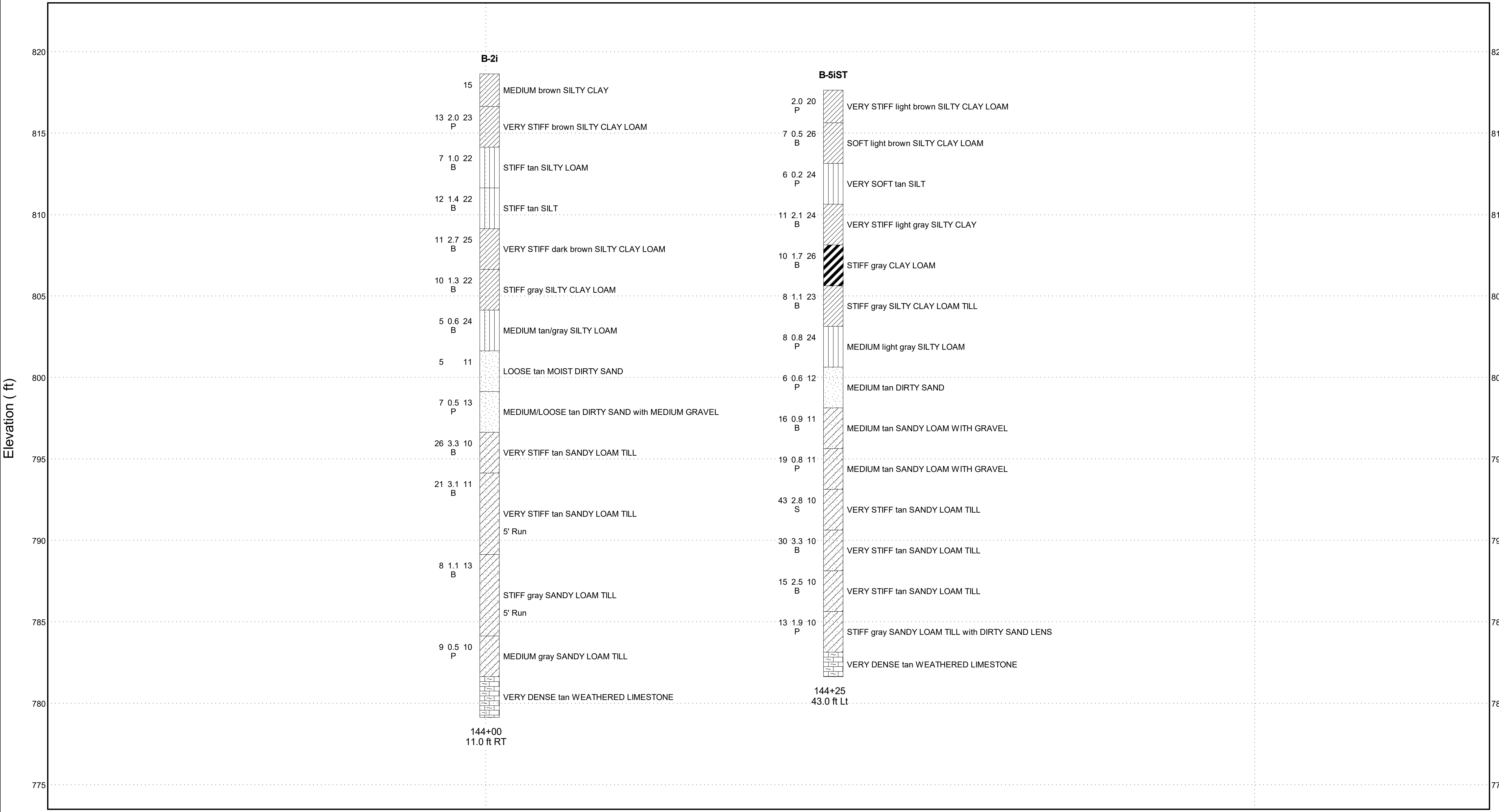


NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways

SUBSURFACE DATA PROFILE

Route: I-39/Bypass 20
Section: (201-3)K & (4-1,5)R
County: Winnebago



PRINTERMOD 11X17 19-1138.00 - RAMP BD I-39.GPJ IL_DOT.GDT 8/18/21

Illinois Department of Transportation
Division of Highways

NOT TO HORIZONTAL SCALE

SUBSURFACE DATA PROFILE

Route: I-39/Bypass 20
Section: (201-3)K & (4-1,5)R
County: Winnebago

EXHIBIT F

LABORATORY TEST DATA

Illinois Department of Transportation
Memorandum

To:	Masood Ahmad	Attn: Amy Harms (Byron Wetzell)
From:	Brian A. Pfeifer	By: Daniel H. Tobias
Subject:	Shelby Tube Test Results	
Date:	July 27, 2021	

Route: FAI 39 (I-39/US 20 Ramp BD)
Section: (201-3)K & (4-1,5)R
County: Winnebago
Job No.: P-92-111-06
BMPR Lab No.: 20203 & 20204
SN: 101-0215

The Central Bureau of Materials (CBM) Geotechnical Sub-unit has conducted laboratory testing, as requested by District 2 for the above referenced project on Shelby Tubes taken near Station 144+25, 43.0 ft. LT and Station 149+75, 11.0 ft. RT on proposed Ramp BD. The laboratory test results for Borings B-5iSTa and B-14iSTb are presented in Attachments A and B, respectively. The Shelby Tube Test Results form summarizes the test results for the unconfined compression test, moisture content, density, and unconsolidated-undrained triaxial with pore water measurements. Results of the grain size analysis and Atterberg limits are summarized on BMPR 508a forms, IDH textural classification charts, IDH grain size distribution graphs, and Atterberg limits' results plots. Additionally, a summary of the consolidation test results is presented in Tables 1 and 2.

Table 1. Consolidation Test Summary for B-5iSTa. Lab Project No. 20204

Sample No.	Depth (ft.)	e_o	P'_o (tsf)	P'_c (tsf)	c_r	c_c	OCR
7-2	6.04	0.796	0.376	1.654	0.024	0.249	4.4
8-3	16.17	0.746	1.021	1.198	0.014	0.179	1.2

Table 2. Consolidation Test Summary for B-14iSTb. Lab Project No. 20203

Sample No.	Depth (ft.)	e_o	P'_o (tsf)	P'_c (tsf)	c_r	c_c	OCR
2-3	4.08	0.370	0.272	1.783	0.004	0.069	6.6
4-3	12.67	0.683	0.816	1.108	0.008	0.155	1.4
5-2	14.88	0.748	0.924	0.924	0.007	0.192	1.0

The variables in Tables 1 and 2 are as follows: e_O = initial void ratio, P'_O = effective overburden pressure at the center of the compressible soil layer, P'_C = preconsolidation pressure (maximum past overburden effective pressure, P'_{max}), c_r = recompression index, c_C = compression index, and OCR = Over Consolidation Ratio (P'_C / P'_O).

If you have any questions or need further assistance, please contact Heather Shoup at (217)785-9972 or Kurt Schmuck at (217)782-0870 of the CBM Geotechnical Sub-Unit.

Attachments

cc: Heather Shoup
Kurt Shmuck

ATTACHMENT A

LABORATORY TEST RESULTS

Boring B-5iSTa
(Lab Project No. 20204)

Illinois Department of Transportation

Shelby Tube Test Results

Boring No.:	B-5iSTa NE Abut.	Route:	I-39/US BYP 20	Tube Length/Diameter:	36-in./3.0-in.	Page:	1 of 2
Station:	144+25 Ramp BD	Section:	(201-3)K & (4-1,5)R	Ground Surface Elev.:	817.65 ft.	Date:	6-18-2021
Offset:	43.0 ft. Lt.	County:	Winnebago	Begin Sampling Depth:	815.15 ft.	Job No.:	P-92-111-06
Latitude:	42.2204° (boring)	Structure No.:	101-0215 PR	Ground Water Elev.:	795.7 ft.	Soils Lab Project No.:	20204
Longitude:	-89.0066° (boring)	Contract No.:	64C62	Drilled by:	W. Garza	Prepared by:	Kurt Schmuck

Sample No.	Depth (ft)	Elev. (ft)	Qu (tsf)	Moist. (%)	Unit Wt. (pcf)	c (psf)	Φ (deg)	c' (psf)	Φ' (deg)	Soil Type, Description and Observations
	0.00	817.7								Not Sampled
	↓	↓								↓
	↓	↓								↓
	2.50	815.2								Not Sampled
6-1	3.12	814.5	0.79	20.5	120.8					Dark Gray Silty Clay Loam w/ hair roots, top ½, to Brown Silty Clay
6-2	3.75	813.9	1.35	27.3	121.7					Brown Silty Clay w/ oxidized Silty Loam pockets
6-3	4.38	813.3	UU Tx	24.0	123.3	873	4.0	829	13.7	Brown oxidized Silty Clay Loam w/ Silty Clay streaks
6-4	5.00	812.7	---	---	---					No Recovery
7-1	5.42	812.2	---	24.5	---					Brown Silty Clay
7-2	6.04	811.6	Cons.	23.2	124.7					Brown Silty Clay, top ½, to Tan Silt (cons. from top ½)
7-3	6.67	811.0	UU Tx	22.7	126.8	984	26.8	333	33.0	Tan Silt
7-4	7.50	810.2	---	---	---					No Recovery
	↓	↓								Not Sampled
	↓	↓								↓
	↓	↓								↓
	14.50	803.2								Not Sampled
8-1	14.92	802.7	---	23.5	---					Mixture of Gray Silty clay Loam, Brown Silty Loam, Silty Clay Loam & Silty Clay
8-2	15.54	802.1	UU Tx	23.2	124.1	763	3.7	619	17.4	Gray Silty Clay to gray Silty Clay Loam w/ oxidized Silty Loam pockets
8-3	16.17	801.5	Cons.	22.7	126.1					Gray Silty Clay Loam w/ small gravel & Sand pockets
8-4	16.79	800.9	1.52	18.4	134.1					Gray Silt w/ Sandy Loam pockets – small & large gravel
9-1	17.42	800.2	---	19.3	126.3					Gray Silty Clay, top ¾, to Gray Sandy Loam
9-2	18.04	799.6	0.36	10.4	142.4					Tan Sandy Loam w/ Sandy Clay Loam pockets – stones & gravel
9-3	18.67	799.0	UU Tx	9.9	143.3	626	21.0	187	33.8	Tan Sandy Loam w/ Sandy Clay Loam pockets – stones & gravel
9-4	19.29	798.4	0.36	9.9	141.1					Tan Sandy Loam w/ Sand layers & Sandy Clay Loam pockets – stones & gravel

The Unit Wt. column represents the Moist Unit Weight.
The Qu column represents the Unconfined Compressive Strength using AASHTO T 208.
The c and Φ column represents cohesion and friction angle for total stress using AASHTO T 296 (unconsolidated-undrained triaxial testing).
The c' and Φ' column represents cohesion and friction angle for effective stress using either AASHTO T 297 (consolidated-undrained triaxial testing), or AASHTO T 296 with pore pressure measurement.

Illinois Department of Transportation

Shelby Tube Test Results

Boring No.:	B-5iSTa NE Abut.	Route:	I-39/US BYP 20	Tube Length/Diameter:	36-in./3.0-in.	Page:	2 of 2
Station:	144+25 Ramp BD	Section:	(201-3)K & (4-1,5)R	Ground Surface Elev.:	817.65 ft.	Date:	6-18-2021
Offset:	43.0 ft. Lt.	County:	Winnebago	Begin Sampling Depth:	815.15 ft.	Job No.:	P-92-111-06
Latitude:	42.2204° (boring)	Structure No.:	101-0215 PR	Ground Water Elev.:	795.7 ft.	Soils Lab Project No.:	20204
Longitude:	-89.0066° (boring)	Contract No.:	64C62	Drilled by:	W. Garza	Prepared by:	Kurt Schmuck

Sample No.	Depth (ft)	Elev. (ft)	Qu (tsf)	Moist. (%)	Unit Wt. (pcf)	c (psf)	Φ (deg)	c' (psf)	Φ' (deg)	Soil Type, Description and Observations
	19.50	798.2								Not Sampled
	↓	↓								↓
	↓	↓								↓
	22.00	795.7								Not Sampled
10-1	22.33	795.3	---	14.8	---					Tan Sandy Clay Loam w/ small stones
10-2	22.96	794.7	1.06	10.8	141.2					Tan Sandy Clay Loam w/ Sandy Loam pockets – stones & gravel – large rocks
10-3	23.58	794.1	---	---	---					No Recovery
10-4	24.50	793.2	---	---	---					No Recovery
										End of Shelby Tube Sampling

The Unit Wt. column represents the Moist Unit Weight.
The Qu column represents the Unconfined Compressive Strength using AASHTO T 208.
The c and Φ column represents cohesion and friction angle for total stress using AASHTO T 296 (unconsolidated-undrained triaxial testing).
The c' and Φ' column represents cohesion and friction angle for effective stress using either AASHTO T 297 (consolidated-undrained triaxial testing), or AASHTO T 296 with pore pressure measurement.

Illinois Department of Transportation

Soil Test Data

Route I-39/Bypass 20

Section (201-3)K & (4-1,5)R

County Winnebago

Location

Job No.

Lab. No.		20204 6-2	20204 7-2	20204 7-3	20204 8-3
Station		144+25	144+25	144+25	144+25
Offset		43.00ft Lt	43.00ft Lt	43.00ft Lt	43.00ft Lt
Depth	ft	3.75	6.04	6.67	16.17
AASHTO Classification (AASHTO M 145)		A-7-6(26)	A-7-6(23)	A-4(3)	A-6(9)
Illinois Textural Classification		Silty Clay	Silty Clay	Silt	Silty Clay Loam
Gradation Passing - 1"	%	100	100	100	100
3/4"	%	100	100	100	100.00
1/2"	%	100	100	100	99.42
No. 4	%	100	100	100	99.23
No. 10	%	100.00	100.00	100.00	98.98
No. 20	%	99.99	99.99	99.99	98.06
No. 40	%	99.80	99.85	99.88	96.87
No. 100	%	97.97	98.07	98.96	90.73
No. 200	%	97.28	97.35	97.40	87.83
Sand (AASHTO T 88)	%	2.7	2.6	2.6	12.2
Silt (AASHTO T 88)	%	63.8	63.2	86.8	64.6
CLAY (AASHTO T 88)	%	33.4	34.1	10.6	23.3
Liquid Limit (AASHTO T 89)	%	45	42	24	29
Plasticity Index (AASHTO T 90)	%	25	22	4	12
Organic Matter Content	pcf				
Std. Dry Density (IL Mod AASHTO T 99)	%				
Optimum Moisture (IL Mod AASHTO T 99)					
Subgrade Support Rating	%	FAIR	FAIR	POOR	POOR
In situ Moisture		27	23	23	23

Illinois Department of Transportation

Soil Test Data

Route I-39/Bypass 20

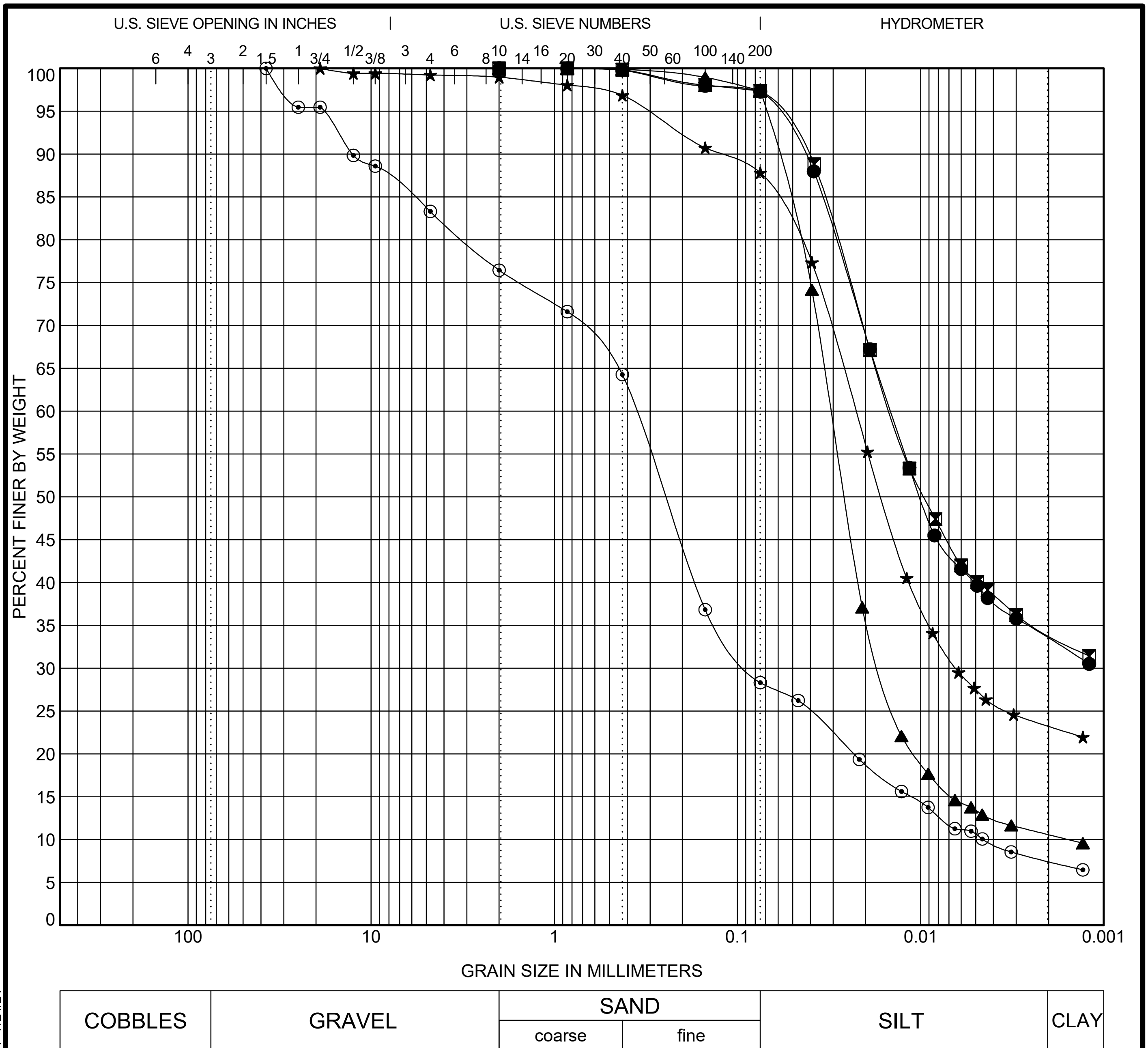
Section (201-3)K & (4-1,5)R

County Winnebago

Location

Job No.

Lab. No.		20204 9-2			
Station		144+25			
Offset		43.00ft Lt			
Depth	ft	18.04			
AASHTO Classification (AASHTO M 145)		A-2-4(0)			
Illinois Textural Classification		Sandy Loam			
Gradation Passing - 1"	%	95.46			
3/4"	%	95.46			
1/2"	%	89.84			
No. 4	%	83.31			
No. 10	%	76.45			
No. 20	%	71.61			
No. 40	%	64.26			
No. 100	%	36.83			
No. 200	%	28.31			
Sand (AASHTO T 88)	%	71.7			
Silt (AASHTO T 88)	%	20.8			
CLAY (AASHTO T 88)	%	7.5			
Liquid Limit (AASHTO T 89)	%	13			
Plasticity Index (AASHTO T 90)	%	2			
Organic Matter Content	pcf				
Std. Dry Density (IL Mod AASHTO T 99)	%				
Optimum Moisture (IL Mod AASHTO T 99)					
Subgrade Support Rating	%	GRANULAR			
In situ Moisture		10			



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B-5iSTa	3.75	**A-7-6 (26) SILTY CLAY**	45	20	25		
⧗ B-5iSTa	6.04	**A-7-6 (23) SILTY CLAY**	42	20	22		
▲ B-5iSTa	6.67	**A-4 (3) SILT**	24	20	4	5.66	19.72
★ B-5iSTa	16.17	**A-6 (9) SILTY CLAY LOAM**	29	17	12		
⊙ B-5iSTa	18.04	**A-2-4 (0) SANDY LOAM**	13	11	2	4.53	79.92

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-5iSTa	3.75	2	0.015			0.00	2.72	63.84	33.45
⧗ B-5iSTa	6.04	2	0.015			0.00	2.65	63.25	34.11
▲ B-5iSTa	6.67	2	0.031	0.016	0.002	0.00	2.60	86.83	10.57
★ B-5iSTa	16.17	19	0.023	0.006		1.02	11.15	64.56	23.27
⊙ B-5iSTa	18.04	37.5	0.361	0.086	0.005	23.55	48.14	20.85	7.46

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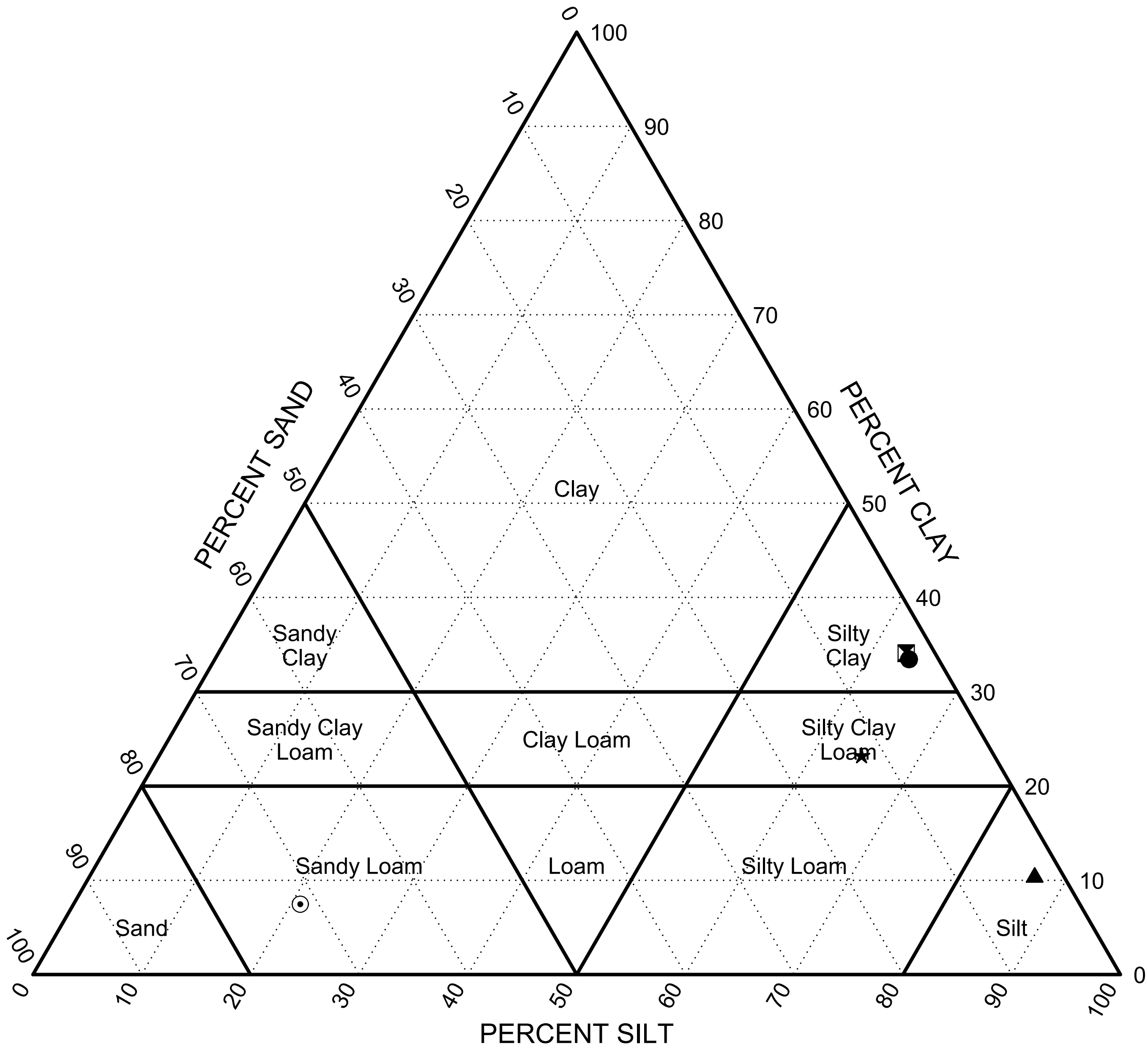
IDH GRAIN SIZE DISTRIBUTION

Route: I-39/Bypass 20

Section: (201-3)K & (4-1,5)R

County: Winnebago

GRAIN SIZE IDH 3-18-11 P92-111-06 US BYPASS 20 RETAINING WALL.GPJ IL DOT.GDT 7/24/21



	Borehole	Station	Offset	Depth (ft)	Classification
●	**B-5iSTa**	**144+25**	**43.00ft Lt**	**3.75**	**A-7-6 (26) SILTY CLAY**
⧗	**B-5iSTa**	**144+25**	**43.00ft Lt**	**6.04**	**A-7-6 (23) SILTY CLAY**
▲	**B-5iSTa**	**144+25**	**43.00ft Lt**	**6.67**	**A-4 (3) SILT**
★	**B-5iSTa**	**144+25**	**43.00ft Lt**	**16.17**	**A-6 (9) SILTY CLAY LOAM**
⊙	**B-5iSTa**	**144+25**	**43.00ft Lt**	**18.04**	**A-2-4 (0) SANDY LOAM**

Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation

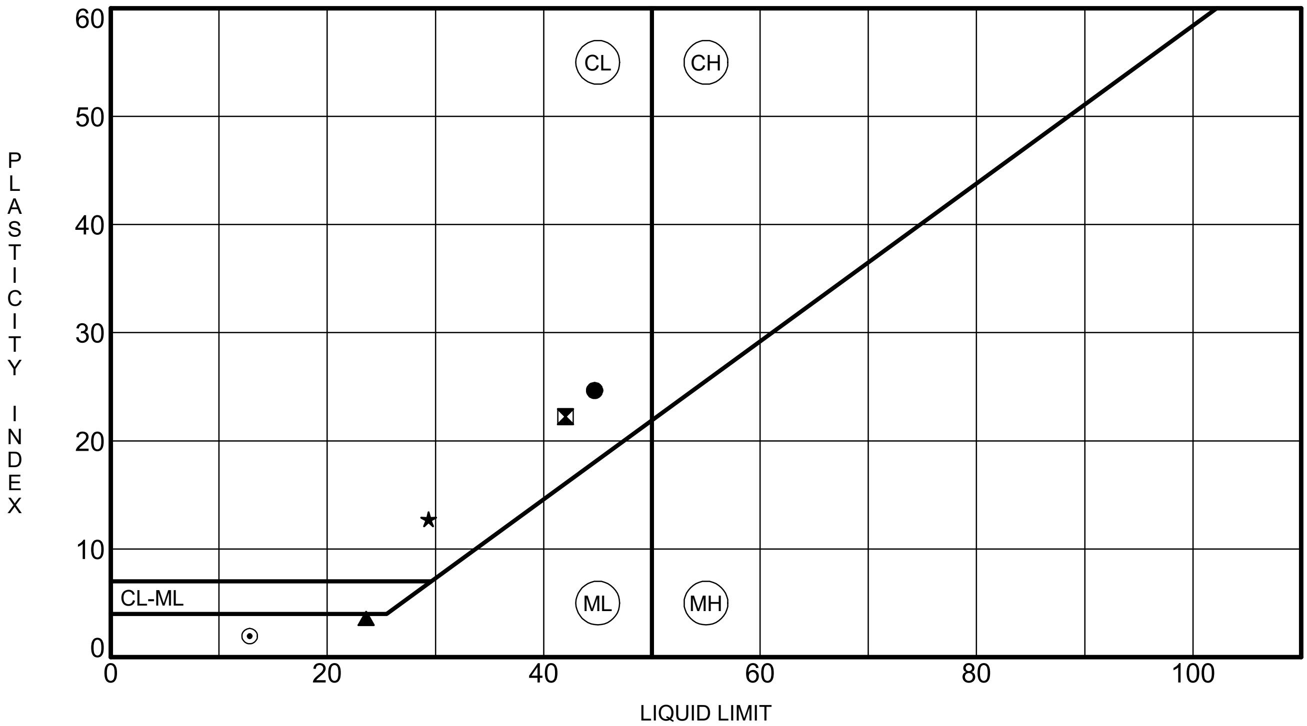
IDH Textural Classification Chart

Route: I-39/Bypass 20

Section: (201-3)K & (4-1,5)R

County: Winnebago

TEXTURAL CLASSIFICATION P92-111-06 US BYPASS 20 RETAINING WALL.GPJ IL_DOT.GDT 7/23/21



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-5iSTa	3.75	45	20	25	97	A-7-6 (26) SILTY CLAY
⧗	B-5iSTa	6.04	42	20	22	97	A-7-6 (23) SILTY CLAY
▲	B-5iSTa	6.67	24	20	4	97	A-4 (3) SILT
★	B-5iSTa	16.17	29	17	12	88	A-6 (9) SILTY CLAY LOAM
⊙	B-5iSTa	18.04	13	11	2	28	A-2-4 (0) SANDY LOAM

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ATTERBERG LIMITS' RESULTS

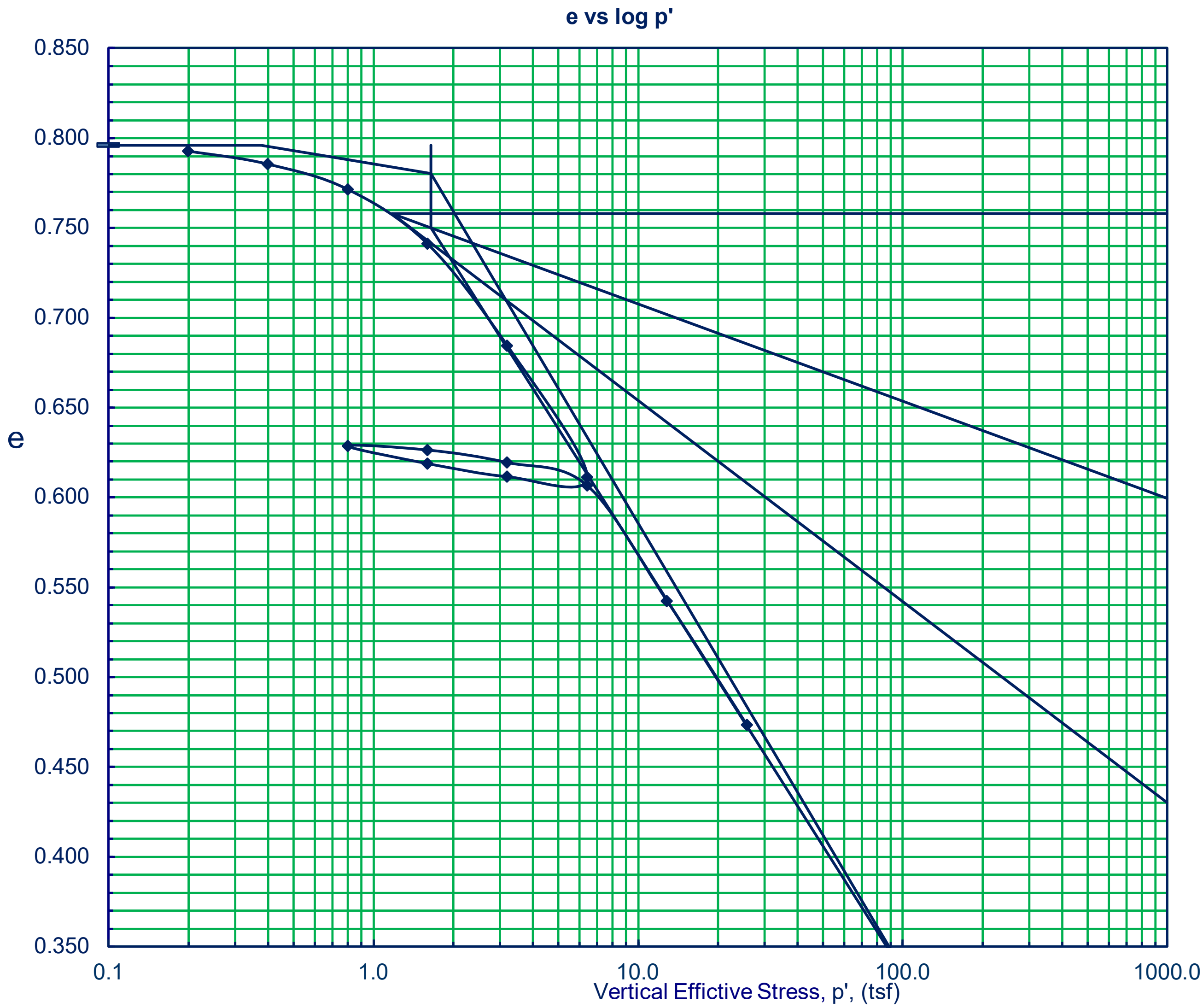
Route: I-39/Bypass 20

Section: (201-3)K & (4-1,5)R

County: Winnebago

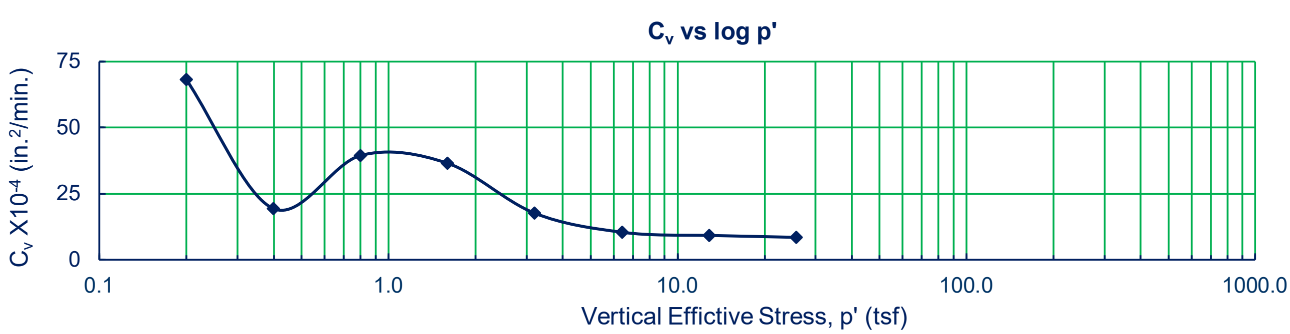
ATTERBERG LIMITS P92-111-06 US BYPASS 20 RETAINING WALL.GPJ IL DOT.GDT 7/23/21

District	2	Lab Project Number	20204
County	Winnebago	Sample Number	7-2
Route	I-39/US BYP 20	Boring ID	B-5iSTa NE Abut.
Section	(201-3)K & (4-1,5)R	Boring Station	144+25
Project Number	P-92-111-06	Boring Offset	43 ft LT of BL



Layer 1

$P'_0 =$ 0.376 tsf $P_c =$ 1.654 tsf $c_r =$ 0.024 $c_c =$ 0.249 $e_o =$ 0.796



Lab Project **20204**

Layer 1 Worksheet

Sample Number	7-2	Boring Station	144+25
Machine Number	4	Boring Offset	43 ft LT of BL
District	2	Boring ID	B-5iSTa NE Abut.
County	Winnebago	Project Number	P-92-111-06
Route	I-39/US BYP 20	Structure Number	101-0215 PR
Section	(201-3)K & (4-1,5)R	Contract number	64C62

C_v calculations curve	square root	e calculations curve	square root

e Calculations

Increment	Increment duration min.	Loading tsf	Ht. in.	MD in.	Adjusted ht.** inches	V cm^3	V/V_s	e V/V_s-1	C_v X 10^{-4} $in.^2/min$
Seating load	N/A	0.050	0.7500	0.0000	0.7500	60.3	1.796	0.796	
1	409	0.200	0.7487	0.0019	0.7487	60.2	1.793	0.793	68
2	781	0.400	0.7457	0.0028	0.7457	60.0	1.785	0.785	19
3	416	0.800	0.7398	0.0038	0.7398	59.5	1.771	0.771	39
4	857	1.600	0.7272	0.0051	0.7272	58.5	1.741	0.741	36
5	407	3.200	0.7035	0.0065	0.7035	56.6	1.685	0.685	18
6	916	6.430	0.6730	0.0085	0.6730	54.1	1.611	0.611	10
7*	1466	3.200	0.6730	0.0074	0.6730	54.1	1.611	0.611	
8*	1390	1.600	0.6761	0.0064	0.6761	54.4	1.619	0.619	
9*	1346	0.800	0.6802	0.0055	0.6802	54.7	1.629	0.629	
10	411	1.600	0.6792	0.0061	0.6792	54.6	1.626	0.626	
11	971	3.200	0.6763	0.0071	0.6763	54.4	1.619	0.619	
12	1481	6.430	0.6709	0.0086	0.6709	54.0	1.606	0.606	
13	1292	12.880	0.6442	0.0108	0.6442	51.8	1.542	0.542	9
14	1380	25.790	0.6153	0.0140	0.6153	49.5	1.473	0.473	8
15*	0	12.880		0.0000					
16*	0	6.430		0.0000					
17*	0	3.200		0.0000					
18*	0	1.600		0.0000					
19*	0	0.800		0.0000					
20*	0	0.200		0.0000					
				0.0000					
				0.0000					
				0.0000					
Final reading	N/A	0.200	0.6134	0.0000	0.6134	50.0	1.489	0.489	

Lab Sample Test Results

Tare	76.4	gr.
Wet+Tare	190.6	gr.
Cons+Tare	182.4	gr.
Dry+Tare	166.0	gr.
W_s	89.6	gr.
$W_w = V_w$	24.5	cm^3
V_s	33.6	cm^3

	Initial	Final
Moisture content	27.4	18.3
Dry Unit Wt.	92.7	111.8

Lab Test Procedures

Test Method	T 216 B
Sample Condition	inundated
Inundation pressure	.050 tsf
Test Preparation	Trimmed with cutting shoe

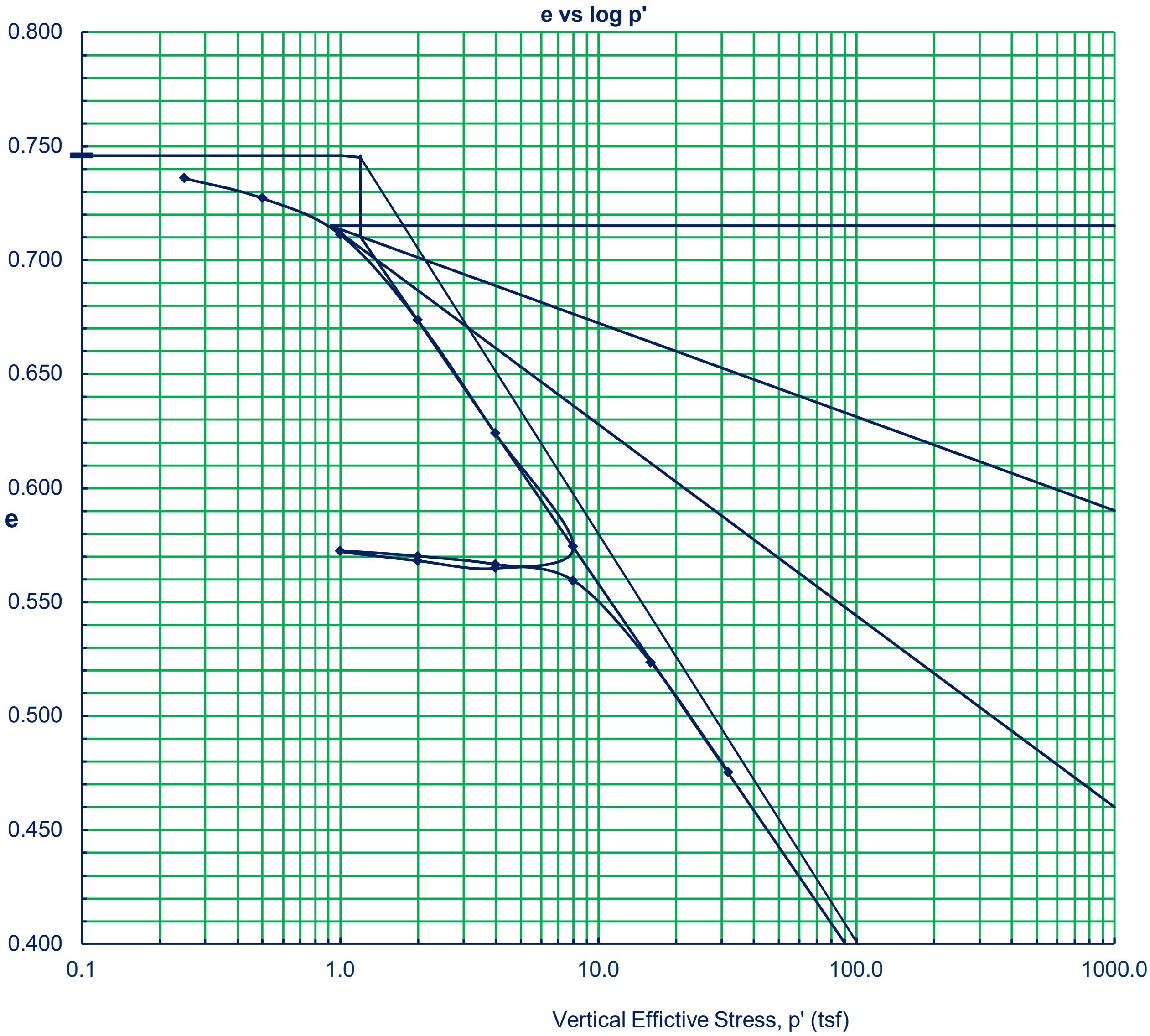
Lab Comments:

COMMENTS:

* For unload sequences, the sample height at the end of the load sequence is used instead of H_{100}.

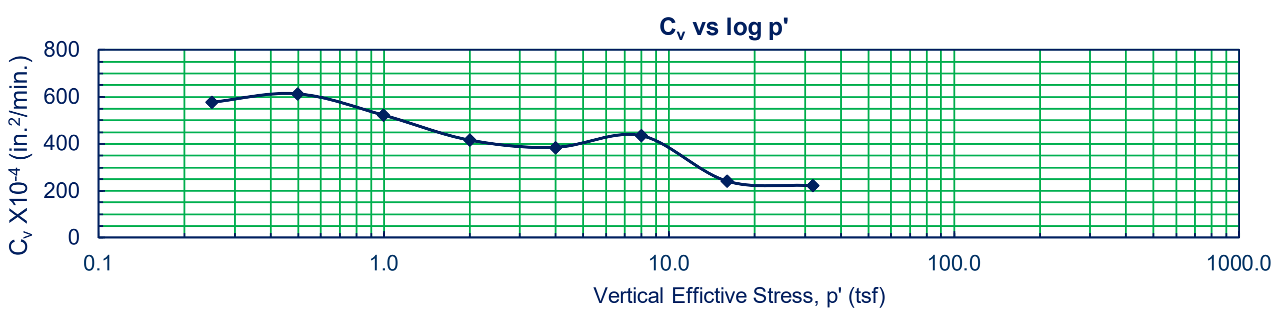
** Machine deflection was accounted for in the development of the load verses deformation curves.

District	2	Lab Project Number	20204
County	Winnebago	Sample Number	8-3
Route	I-39/US BYP 20	Boring ID	B-5iSTa NE Abut.
Section	(201-3)K & (4-1,5)R	Boring Station	144+25
Job Number	P-92-111-06	Boring Offset	43 ft LT of BL



Layer 2

P'_0 = 1.021 tsf P_c = 1.198 tsf c_r = 0.014 c_c = 0.179 e_o = 0.746



Lab Project **20204**

Layer 2 Worksheet

Sample Number	8-3	Boring Station	144+25
Machine Number	3	Boring Offset	43 ft LT of BL
District	2	Boring ID	B-5iSTa NE Abut.
County	Winnebago	Project Number	P-92-111-06
Route	I-39/US BYP 20	Structure Number	101-0215 PR
Section	(201-3)K & (4-1,5)R	Contract number	64C62

C_v calculations curve	square root	e calculations curve	square root

e Calculations

Increment	Increment Duration min.	Loading tsf	Ht. inches	MD inches	Adjusted Ht.** inches	V cm^3	V/V_s	e V/V_s-1	C_v X 10^{-4} in^2/min
Initial	N/A	0.050	0.7500	0.0000	0.7500	60.3	1.746	0.746	
1	409	0.250	0.7457	0.0012	0.7457	60.0	1.736	0.736	578
2	781	0.500	0.7419	0.0020	0.7419	59.7	1.727	0.727	613
3	415	1.000	0.7351	0.0030	0.7351	59.1	1.711	0.711	521
4	857	2.000	0.7189	0.0042	0.7189	57.8	1.674	0.674	416
5	407	4.000	0.6976	0.0057	0.6976	56.1	1.624	0.624	384
6	915	8.000	0.6763	0.0076	0.6763	54.4	1.574	0.574	434
7*	1466	4.000	0.6722	0.0064	0.6722	54.1	1.565	0.565	
8*	1390	2.000	0.6736	0.0053	0.6736	54.2	1.568	0.568	
9*	1345	1.000	0.6754	0.0044	0.6754	54.3	1.572	0.572	
10	411	2.000	0.6745	0.0050	0.6745	54.3	1.570	0.570	
11	970	4.000	0.6729	0.0060	0.6729	54.1	1.566	0.566	
12	1480	8.000	0.6698	0.0075	0.6698	53.9	1.559	0.559	
13	1291	16.000	0.6544	0.0102	0.6544	52.6	1.523	0.523	241
14	1378	32.000	0.6338	0.0144	0.6338	51.0	1.475	0.475	223
15*	0	16.000		0.0000					
16*	0	8.000		0.0000					
17*	0	4.000		0.0000					
18*	0	2.000		0.0000					
19*	0	0.500		0.0000					
20*	0	0.250		0.0000					
				0.0000					
				0.0000					
				0.0000					
Final	N/A	0.250	0.6291	0.0000	0.6291	51.3	1.485	0.485	

Lab Sample Test Results

Tare	75.6 gr.	
Wet+Tare	192.2 gr.	
Cons+Tare	184.6 gr.	
Dry+Tare	167.9 gr.	
W_s	92.2 gr.	
$W_w = V_w$	24.3 cm^3	
V_s	34.6 cm^3	
	Initial	Final
Moisture content	26.4	18.3
Dry Unit Wt.	95.4	111.8

Lab Test Procedures

Test Method: T 216 B
Sample Condition: inundated
Inundation Pressure: .050 tsf
Test Preparation: Trimmed with cutting shoe

Lab Comments:

COMMENTS:
* For unload sequences, the sample height at the end of the load sequence is used instead of H_{100}.
** Machine deflection was accounted for in the development of the load verses deformation curves.

ATTACHMENT B

LABORATORY TEST RESULTS

Boring B-14iSTb
(Lab Project No. 20203)

Illinois Department of Transportation

Shelby Tube Test Results

Boring No.:	B-14iSTb SW Abut.	Route:	I-39/US BYP 20	Tube Length/Diameter:	30 & 36-in./3.0-in.	Page:	1 of 2
Station:	149+75 Ramp BD	Section:	(201-3)K & (4-1,5)R	Ground Surface Elev.:	818.12 ft.	Date:	6-18-2021
Offset:	11.0 ft. Rt.	County:	Winnebago	Begin Sampling Depth:	818.12 ft.	Job No.:	P-92-111-06
Latitude:	42.2199° (boring)	Structure No.:	101-0215 PR	Ground Water Elev.:	801.1 ft.	Soils Lab Project No.:	20203
Longitude:	-89.0086° (boring)	Contract No.:	64C62	Drilled by:	W. Garza	Prepared by:	Kurt Schmuck

Sample No.	Depth (ft)	Elev. (ft)	Qu (tsf)	Moist. (%)	Unit Wt. (pcf)	c (psf)	Φ (deg)	c' (psf)	Φ' (deg)	Soil Type, Description and Observations
1-1	0.25	817.9	---	17.5	132.3					Brown Silty Clay Loam w/ small stones – hair roots
1-2	0.88	817.2	0.94	15.9	130.4					Brown Silty Clay Loam w/ small stones
1-3	1.50	816.6	1.79	14.0	135.7					Gray-brown Silty Clay Loam w/ oxidized Sand seams & pockets
1-4	2.12	816.0	2.99	14.6	136.5					Gray-brown Silty Clay Loam w/ oxidized Sand pockets
2-1	2.83	815.3	---	13.5	---					Gray Silty Clay Loam w/ Silt seams & pockets
2-2	3.46	814.7	UU Tx	13.2	135.2	2275	14.0	2333	16.1	Brown Silty Clay Loam w/ Silt pockets & seams, Sand pockets, isolated small gravel
2-3	4.08	814.0	Cons.	15.1	132.9					Brown Silty Clay Loam w/ Silt pockets & numerous Sand pockets – sm. gravel – lg. rock
2-4	4.71	813.4	2.63	12.6	133.8					Brown Silty Clay w/ small stones – small oxidized Sandy Clay Loam layers
3-1	5.62	812.5	1.01	17.4	126.9					Gray-brown Silty Clay Loam w/ isolated Sand pockets
3-2	6.25	811.9	1.92	14.0	133.7					Same, top ¾, to reddish-brown Silty Clay Till
3-3	6.88	811.2	3.34	14.4	137.4					Reddish-brown Silty Clay Till
3-4	7.50	810.6	---	---	---					No Recovery
3-5	8.00	810.1	---	---	---					No Recovery
	↓	↓								Not Sampled
	↓	↓								↓
	↓	↓								↓
	↓	↓								↓
	11.00	807.1								Not Sampled
4-1	11.42	806.7	---	16.0	---					Reddish-brown Silty Clay w/ Sandy Clay pockets & isolated stones
4-2	12.04	806.1	0.81	23.5	123.3					Dark gray Silty Clay, top ½, to dark gray clayey Silty Loam
4-3	12.67	805.5	Cons.	25.5	119.9					Dark gray clayey Silty Loam
4-4	13.29	804.8	UU Tx	19.9	127.8	395	3.0	338	17.7	Dark gray clayey Silty Loam w/ Silt streaks – Sand pockets lower ½
4-5	14.00	804.1	---	---	---					No Recovery
5-1	14.25	803.9	---	34.8	---					Gray-brown Silty Clay Loam - soft

The Unit Wt. column represents the Moist Unit Weight.
The Qu column represents the Unconfined Compressive Strength using AASHTO T 208.
The c and Φ column represents cohesion and friction angle for total stress using AASHTO T 296 (unconsolidated-undrained triaxial testing).
The c' and Φ' column represents cohesion and friction angle for effective stress using either AASHTO T 297 (consolidated-undrained triaxial testing), or AASHTO T 296 with pore pressure measurement.

Illinois Department of Transportation

Shelby Tube Test Results

Boring No.:	B-14iSTb SW Abut.	Route:	I-39/US BYP 20	Tube Length/Diameter:	30 & 36-in./3.0-in.	Page:	2 of 2
Station:	149+75 Ramp BD	Section:	(201-3)K & (4-1,5)R	Ground Surface Elev.:	818.12 ft.	Date:	6-18-2021
Offset:	11.0 ft. Rt.	County:	Winnebago	Begin Sampling Depth:	818.12 ft.	Job No.:	P-92-111-06
Latitude:	42.2199° (boring)	Structure No.:	101-0215 PR	Ground Water Elev.:	801.1 ft.	Soils Lab Project No.:	20203
Longitude:	-89.0086° (boring)	Contract No.:	64C62	Drilled by:	W. Garza	Prepared by:	Kurt Schmuck

Sample No.	Depth (ft)	Elev. (ft)	Qu (tsf)	Moist. (%)	Unit Wt. (pcf)	c (psf)	Φ (deg)	c' (psf)	Φ' (deg)	Soil Type, Description and Observations
5-2	14.88	803.2	Cons.	30.5	111.1					Dark gray clayey Silty Loam – very soft – oxidized pockets & isolated organics
5-3	15.50	802.6	UU Tx	22.6	125.7	255	1.0	196	15.5	Dark gray clayey Silty Loam w/ Silt streaks, isolated Sand pockets – sm. stones bot ½
5-4	16.12	802.0	0.65	19.5	128.0					Blue-gray Silty Clay Loam, top ¾, to brown Clay Loam Till
5-5	17.00	801.1	---	---	---					No Recovery
										End of Shelby Tube Sampling

The Unit Wt. column represents the Moist Unit Weight.
The Qu column represents the Unconfined Compressive Strength using AASHTO T 208.
The c and Φ column represents cohesion and friction angle for total stress using AASHTO T 296 (unconsolidated-undrained triaxial testing).
The c' and Φ' column represents cohesion and friction angle for effective stress using either AASHTO T 297 (consolidated-undrained triaxial testing), or AASHTO T 296 with pore pressure measurement.

Illinois Department of Transportation

Soil Test Data

Route I-39/Bypass 20

Section (201-3)K & (4-1,5)R

County Winnebago

Location

Job No.

Lab. No.		20203 1-2	20203 2-3	20203 3-3	20203 4-3
Station		149+75	149+75	149+75	149+75
Offset		11.00ft Rt	11.00ft Rt	11.00ft Rt	11.00ft Rt
Depth	ft	0.88	4.08	6.88	12.67
AASHTO Classification (AASHTO M 145)		A-6(7)	A-4(3)	A-6(5)	A-4(8)
Illinois Textural Classification		Silty Clay Loam	Loam	Clay Loam	Silty Loam
Gradation Passing - 1"	%	100	100	100	100
3/4"	%	100	100	100.00	100
1/2"	%	100	100	98.39	100
No. 4	%	99.87	99.81	96.02	100
No. 10	%	99.50	99.74	94.47	100.00
No. 20	%	98.81	99.59	92.40	99.94
No. 40	%	95.85	95.91	86.79	99.31
No. 100	%	77.01	67.06	60.07	95.04
No. 200	%	72.64	62.23	53.17	93.76
Sand (AASHTO T 88)	%	27.4	37.8	46.8	6.2
Silt (AASHTO T 88)	%	50.9	43.7	27.5	75.6
CLAY (AASHTO T 88)	%	21.8	18.5	25.6	18.2
Liquid Limit (AASHTO T 89)	%	28	23	29	29
Plasticity Index (AASHTO T 90)	%	13	9	15	9
Organic Matter Content	pcf				
Std. Dry Density (IL Mod AASHTO T 99)	%				
Optimum Moisture (IL Mod AASHTO T 99)					
Subgrade Support Rating	%	POOR	POOR	POOR	POOR
In situ Moisture		16	15	14	25

Illinois Department of Transportation

Soil Test Data

Route: I-39/Bypass 20

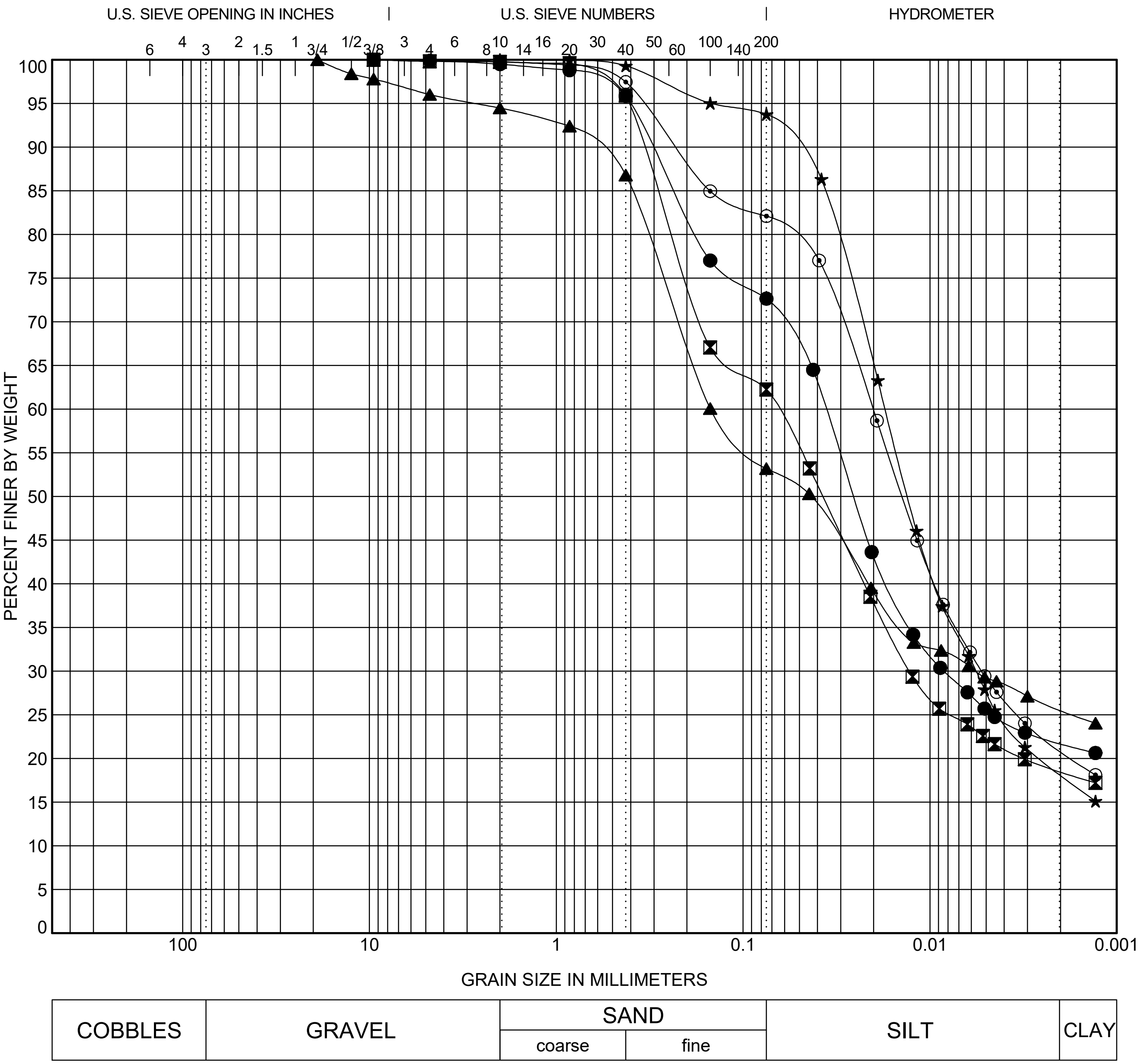
Section: (201-3)K & (4-1,5)R

County: Winnebago

Location:

Job No.:

Lab. No.		20203 5-2			
Station		149+75			
Offset		11.00ft Rt			
Depth	ft	14.88			
AASHTO Classification (AASHTO M 145)		A-4(7)			
Illinois Textural Classification		Silty Clay Loam			
Gradation Passing - 1"	%	100			
3/4"	%	100			
1/2"	%	100			
No. 4	%	99.91			
No. 10	%	99.78			
No. 20	%	99.42			
No. 40	%	97.46			
No. 100	%	84.95			
No. 200	%	82.10			
Sand (AASHTO T 88)	%	17.9			
Silt (AASHTO T 88)	%	61.1			
CLAY (AASHTO T 88)	%	21.0			
Liquid Limit (AASHTO T 89)	%	28			
Plasticity Index (AASHTO T 90)	%	10			
Organic Matter Content	pcf				
Std. Dry Density (IL Mod AASHTO T 99)	%				
Optimum Moisture (IL Mod AASHTO T 99)					
Subgrade Support Rating	%	POOR			
In situ Moisture		31			



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**B-14iSTb**	**0.88**	**A-6 (7) SILTY CLAY LOAM**	**28**	**15**	**13**		
⧗	**B-14iSTb**	**4.08**	**A-4 (3) LOAM**	**23**	**14**	**9**		
▲	**B-14iSTb**	**6.88**	**A-6 (5) CLAY LOAM**	**29**	**14**	**15**		
★	**B-14iSTb**	**12.67**	**A-4 (8) SILTY LOAM**	**29**	**20**	**9**		
⊙	**B-14iSTb**	**14.88**	**A-4 (7) SILTY CLAY LOAM**	**28**	**18**	**10**		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-14iSTb**	**0.88**	**9.5**	**0.036**	**0.008**		**0.50**	**26.85**	**50.86**	**21.78**
⧗	**B-14iSTb**	**4.08**	**9.5**	**0.066**	**0.013**		**0.26**	**37.51**	**43.69**	**18.54**
▲	**B-14iSTb**	**6.88**	**19**	**0.149**	**0.006**		**5.53**	**41.30**	**27.55**	**25.63**
★	**B-14iSTb**	**12.67**	**2**	**0.017**	**0.006**		**0.00**	**6.24**	**75.58**	**18.18**
⊙	**B-14iSTb**	**14.88**	**9.5**	**0.02**	**0.005**		**0.22**	**17.68**	**61.06**	**21.04**

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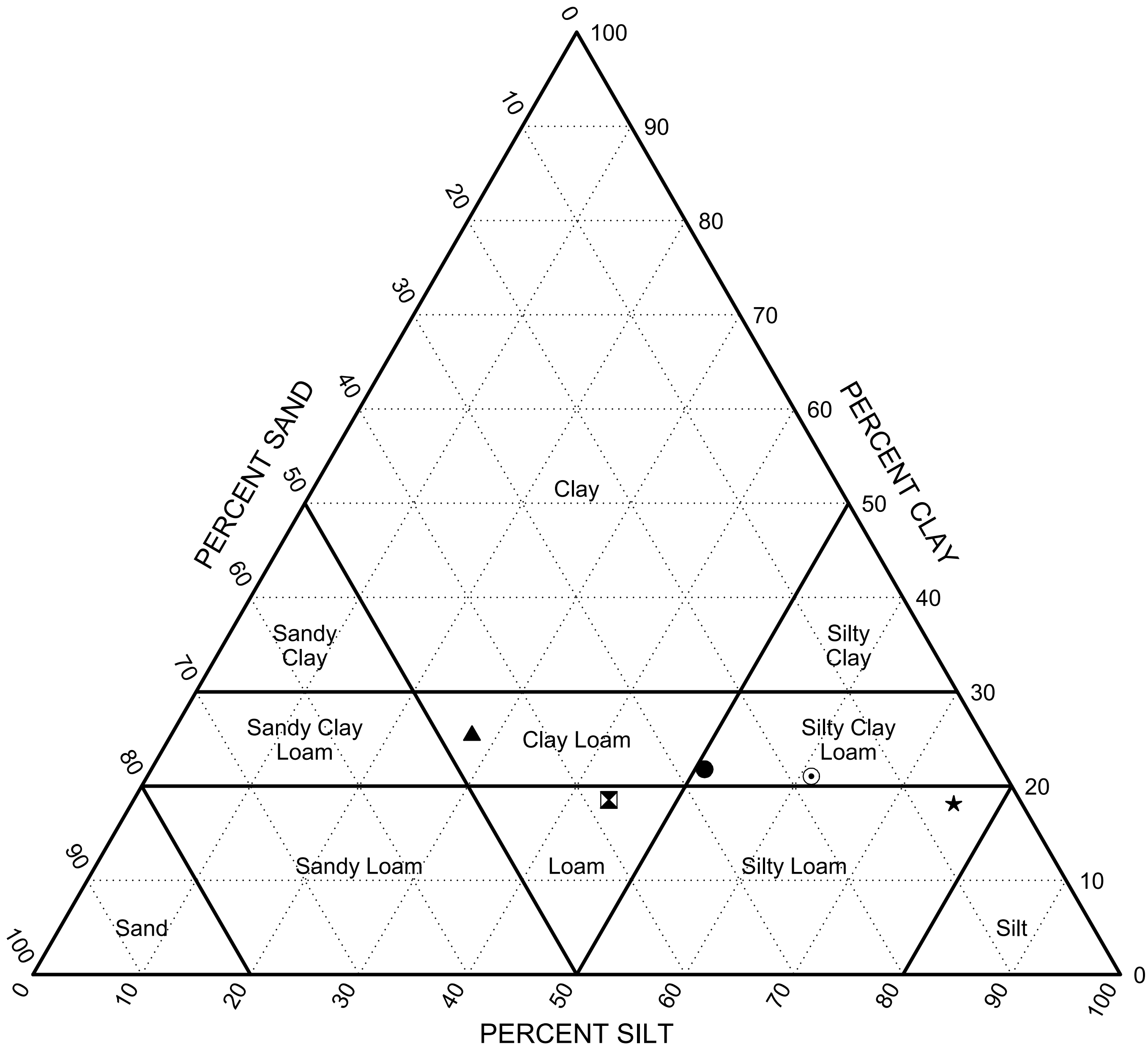
IDH GRAIN SIZE DISTRIBUTION

Route: I-39/Bypass 20
Section: (201-3)K & (4-1,5)R
County: Winnebago



	Borehole	Station	Offset	Depth (ft)	Classification
●	**B-14iSTb**	**149+75**	**11.00ft Rt**	**0.88**	**A-6 (7) SILTY CLAY LOAM**
⧗	**B-14iSTb**	**149+75**	**11.00ft Rt**	**4.08**	**A-4 (3) LOAM**
▲	**B-14iSTb**	**149+75**	**11.00ft Rt**	**6.88**	**A-6 (5) CLAY LOAM**
★	**B-14iSTb**	**149+75**	**11.00ft Rt**	**12.67**	**A-4 (8) SILTY LOAM**
⊙	**B-14iSTb**	**149+75**	**11.00ft Rt**	**14.88**	**A-4 (7) SILTY CLAY LOAM**

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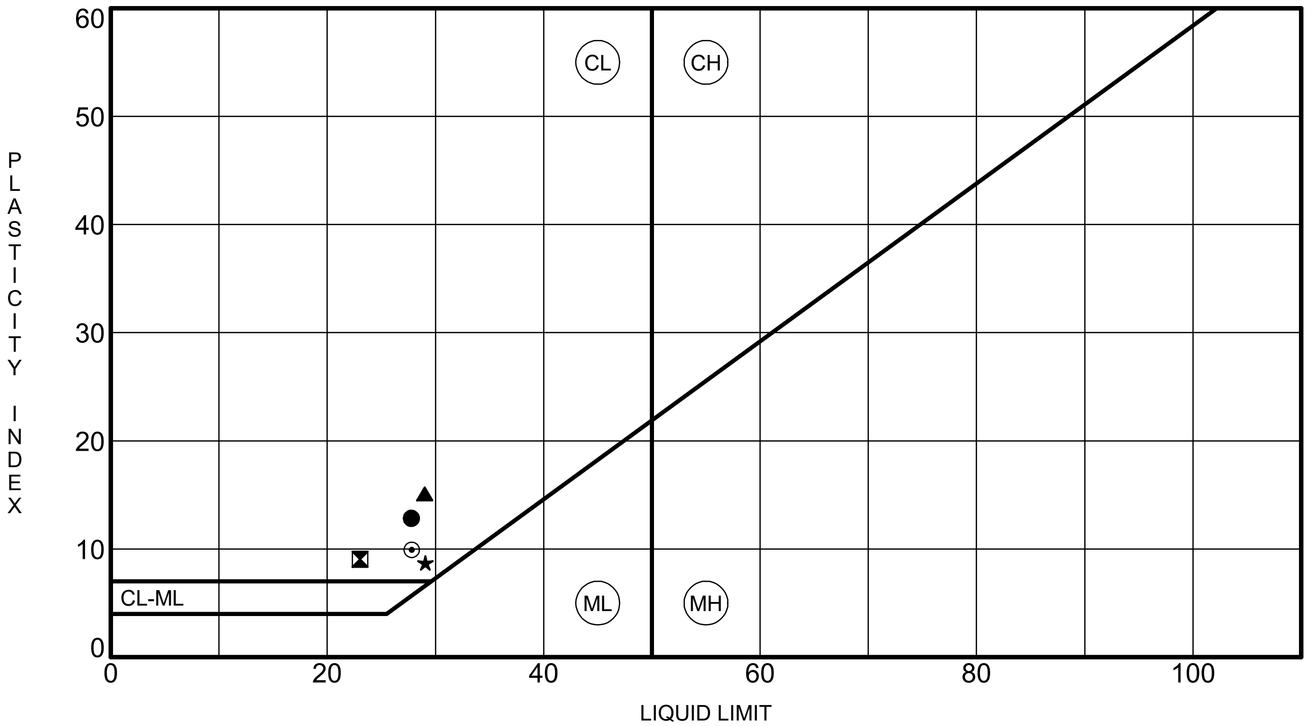
IDH Textural Classification Chart

Route: I-39/Bypass 20

Section: (201-3)K & (4-1,5)R

County: Winnebago

TEXTURAL CLASSIFICATION P92-111-06 US BYPASS 20 RETAINING WALL.GPJ IL_DOT.GDT 7/23/21



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-14iSTb**	**0.88**	**28**	**15**	**13**	**73**	**A-6 (7) SILTY CLAY LOAM**
⧗	**B-14iSTb**	**4.08**	**23**	**14**	**9**	**62**	**A-4 (3) LOAM**
▲	**B-14iSTb**	**6.88**	**29**	**14**	**15**	**53**	**A-6 (5) CLAY LOAM**
★	**B-14iSTb**	**12.67**	**29**	**20**	**9**	**94**	**A-4 (8) SILTY LOAM**
⊙	**B-14iSTb**	**14.88**	**28**	**18**	**10**	**82**	**A-4 (7) SILTY CLAY LOAM**

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ATTERBERG LIMITS' RESULTS

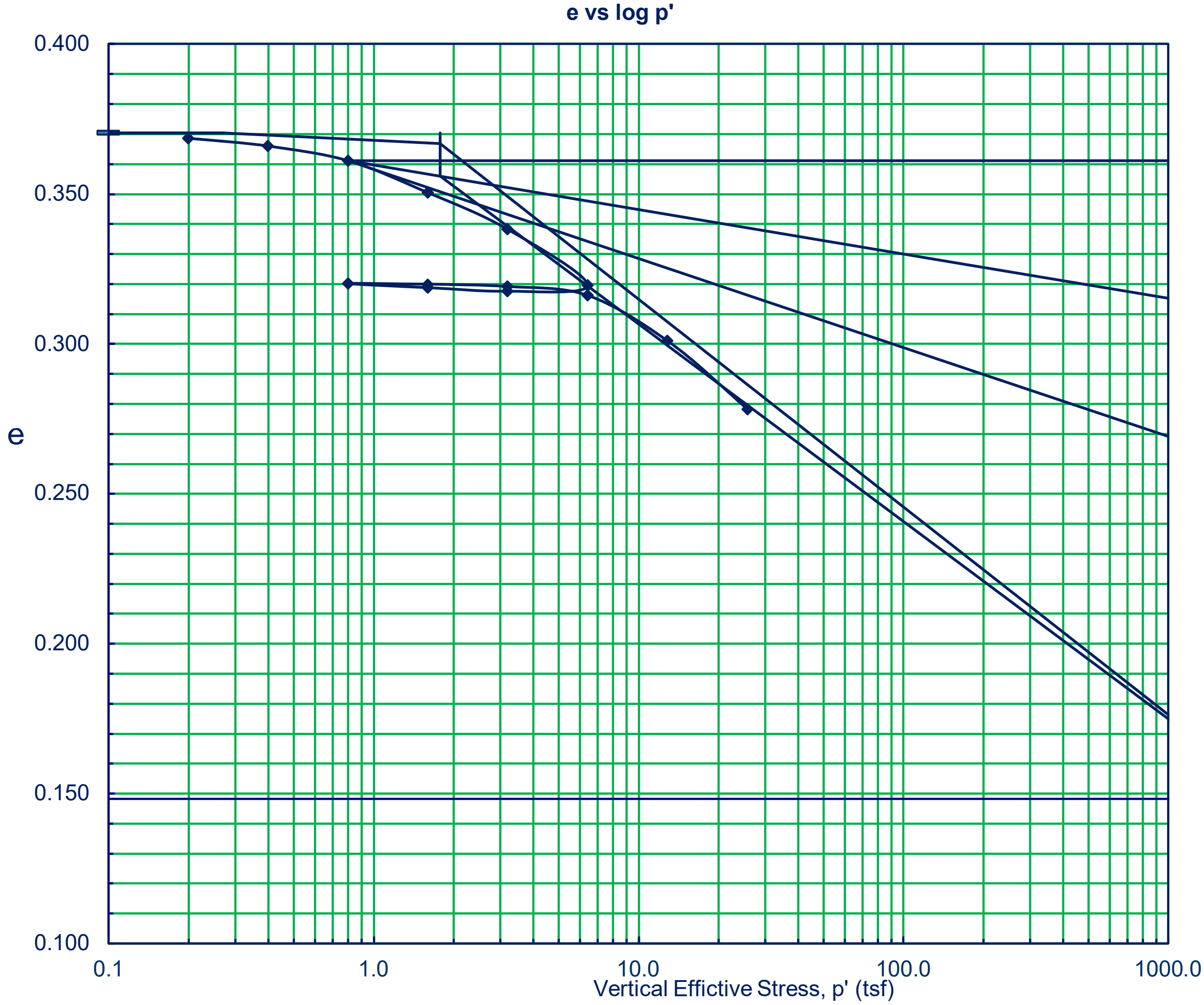
Route: I-39/Bypass 20

Section: (201-3)K & (4-1,5)R

County: Winnebago

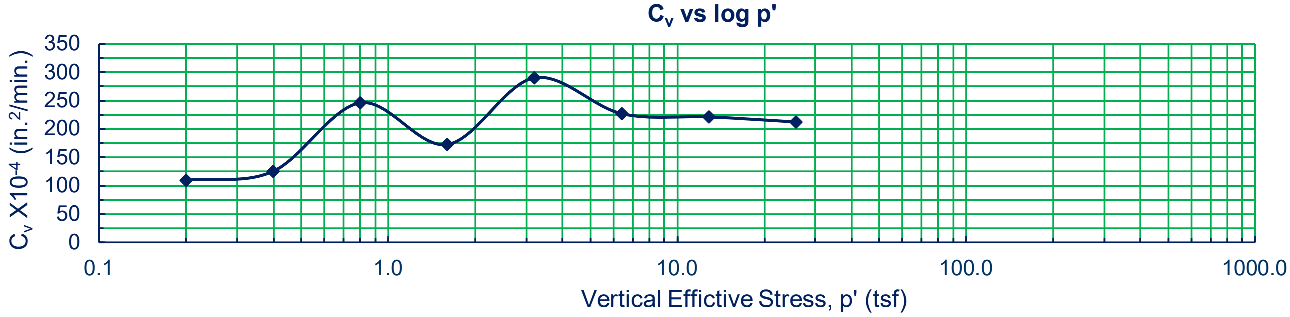
ATTERBERG LIMITS P92-111-06 US BYPASS 20 RETAINING WALL.GPJ IL DOT.GDT 7/23/21

District	2	Lab Project Number	20203
County	Winnebago	Sample Number	2-3
Route	I-39/US BYP 20	Boring ID	B-14iSTb SW Abut.
Section	(201-3)K & (4-1,5)R	Boring Station	149+75
Project Number	P-92-111-06	Boring Offset	11 ft RT of BL



Layer 1

P'_0 = 0.272 tsf P_c = 1.783 tsf c_r = 0.004 c_c = 0.069 e_o = 0.370



Lab Project **20203**

Layer 1 Worksheet

Sample Number	2-3	Boring Station	149+75
Machine Number	5	Boring Offset	11 ft RT of BL
District	2	Boring ID	B-14iSTb SW Abut.
County	Winnebago	Project Number	P-92-111-06
Route	I-39/US BYP 20	Structure Number	101-0215 PR
Section	(201-3)K & (4-1,5)R	Contract number	64C62

C_v calculations curve	square root	e calculations curve	square root

e Calculations

Increment	Increment duration min.	Loading tsf	Ht. in.	MD in.	Adjusted ht.** inches	V cm^3	V/V_s	e V/V_s-1	C_v X 10^{-4} in.^{2}/min
Seating load	N/A	0.050	0.7500	0.0000	0.7500	60.3	1.370	0.370	
1	410	0.200	0.7491	0.0019	0.7491	60.3	1.369	0.369	109
2	782	0.400	0.7476	0.0028	0.7476	60.1	1.366	0.366	125
3	416	0.800	0.7450	0.0038	0.7450	59.9	1.361	0.361	246
4	858	1.600	0.7392	0.0051	0.7392	59.5	1.350	0.350	172
5	407	3.200	0.7325	0.0065	0.7325	58.9	1.338	0.338	290
6	916	6.430	0.7223	0.0085	0.7223	58.1	1.320	0.320	226
7*	1467	3.200	0.7211	0.0074	0.7211	58.0	1.317	0.317	
8*	1391	1.600	0.7218	0.0064	0.7218	58.1	1.319	0.319	
9*	1348	0.800	0.7225	0.0055	0.7225	58.1	1.320	0.320	
10	411	1.600	0.7224	0.0061	0.7224	58.1	1.320	0.320	
11	972	3.200	0.7220	0.0071	0.7220	58.1	1.319	0.319	
12	1483	6.430	0.7203	0.0086	0.7203	57.9	1.316	0.316	
13	1293	12.880	0.7121	0.0108	0.7121	57.3	1.301	0.301	221
14	1382	25.790	0.6996	0.0140	0.6996	56.3	1.278	0.278	213
15*	0	12.880		0.0000					
16*	0	6.430		0.0000					
17*	0	3.200		0.0000					
18*	0	1.600		0.0000					
19*	0	0.800		0.0000					
20*	0	0.200		0.0000					
				0.0000					
				0.0000					
				0.0000					
Final reading	N/A	0.200	0.6973	0.0000	0.6973	56.9	1.292	0.292	

Lab Sample Test Results

Tare	76.3	gr.
Wet+Tare	206.4	gr.
Cons+Tare	204.5	gr.
Dry+Tare	191.7	gr.
W_s	115.4	gr.
$W_w = V_w$	14.7	cm^3
V_s	44.0	cm^3

	Initial	Final
Moisture content	12.7	11.1
Dry Unit Wt.	119.4	126.7

Lab Test Procedures

Test Method	T 216 B
Sample Condition	inundated
Inundation pressure	.050 tsf
Test Preparation	Trimmed with cutting shoe

Lab Comments:

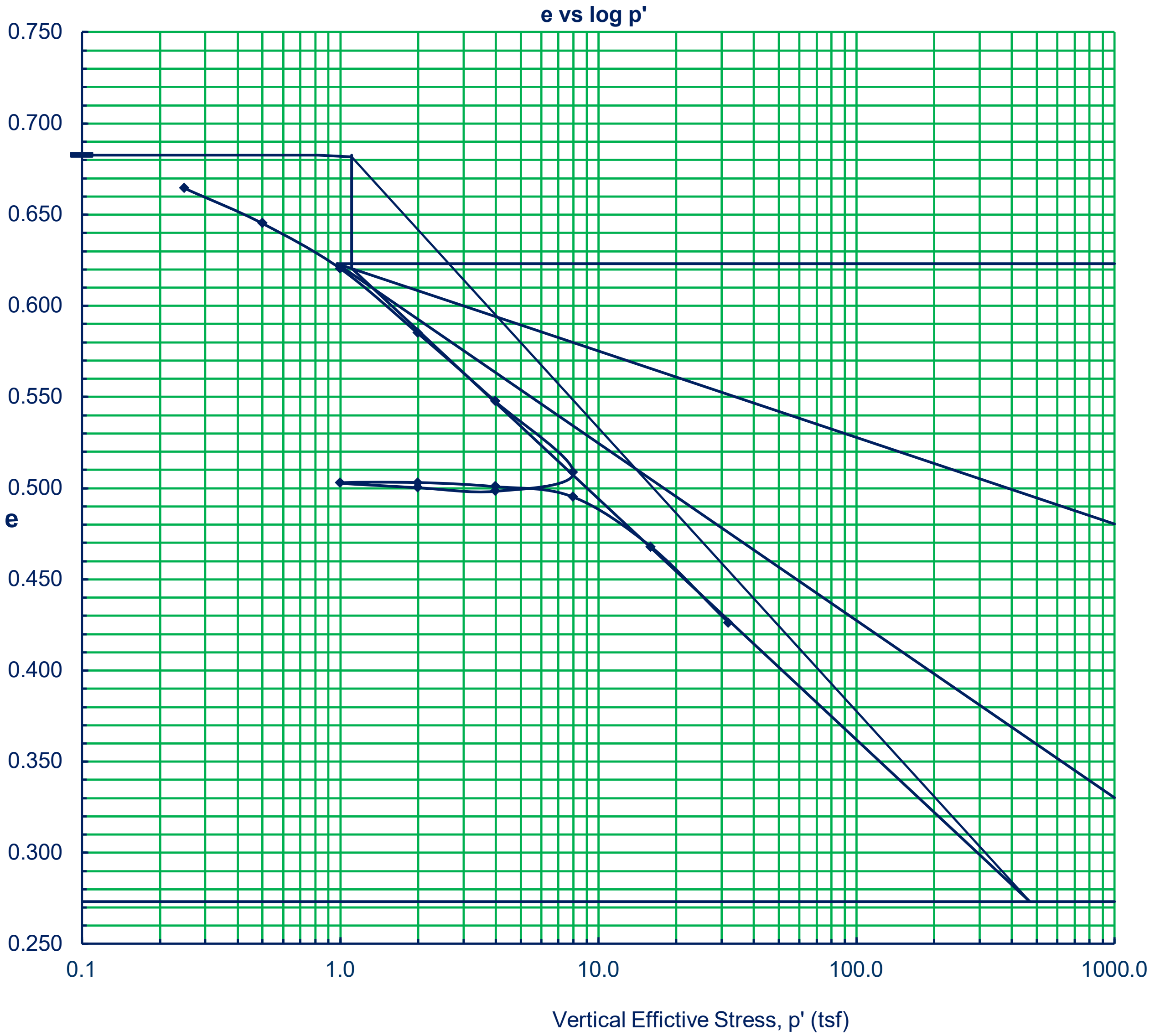
COMMENTS:

* For unload sequences, the sample height at the end of the load sequence is used instead of H_{100}.

** Machine deflection was accounted for in the development of the load verses deformation curves.

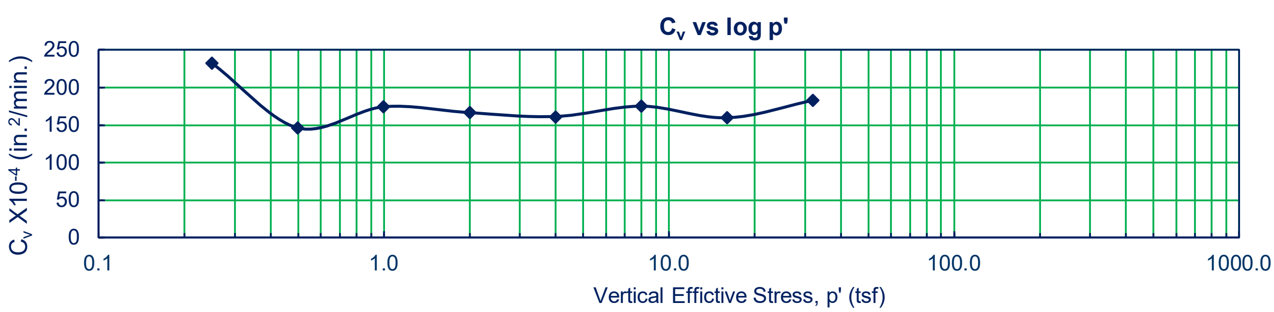
*** Water table was assumed to be at about an elevation of 804 ft.

District	2	Lab Project Number	20203
County	Winnebago	Sample Number	4-3
Route	I-39/US BYP 20	Boring ID	B-14iSTb SW Abut.
Section	(201-3)K & (4-1,5)R	Boring Station	149+75
Job Number	P-92-111-06	Boring Offset	11 ft RT of BL



Layer 2

P'_0 = 0.816 tsf P_c = 1.108 tsf c_r = 0.008 c_c = 0.155 e_o = 0.683



Lab Project **20203**

Layer 2 Worksheet

Sample Number	4-3	Boring Station	149+75
Machine Number	1	Boring Offset	11 ft RT of BL
District	2	Boring ID	B-14iSTb SW Abut.
County	Winnebago	Project Number	P-92-111-06
Route	I-39/US BYP 20	Structure Number	101-0215 PR
Section	(201-3)K & (4-1,5)R	Contract number	64C62

C_v calculations curve	log	e calculations curve	square root

e Calculations

Increment	Increment Duration min.	Loading tsf	Ht. inches	MD inches	Adjusted Ht.** inches	V cm^3	V/V_s	e V/V_s-1	C_v X 10^{-4} in^2/min
Initial	N/A	0.050	0.7500	0.0000	0.7500	60.3	1.683	0.683	
1	408	0.250	0.7419	0.0012	0.7419	59.7	1.664	0.664	233
2	781	0.500	0.7333	0.0020	0.7333	59.0	1.645	0.645	146
3	414	1.000	0.7222	0.0030	0.7222	58.1	1.620	0.620	174
4	857	2.000	0.7065	0.0042	0.7065	56.8	1.585	0.585	166
5	406	4.000	0.6898	0.0057	0.6898	55.5	1.548	0.548	161
6	913	8.000	0.6724	0.0076	0.6724	54.1	1.508	0.508	175
7*	1466	4.000	0.6678	0.0064	0.6678	53.7	1.498	0.498	
8*	1314	2.000	0.6687	0.0053	0.6687	53.8	1.500	0.500	
9*	1314	1.000	0.6698	0.0044	0.6698	53.9	1.503	0.503	
10	409	2.000	0.6699	0.0050	0.6699	53.9	1.503	0.503	
11	969	4.000	0.6690	0.0060	0.6690	53.8	1.501	0.501	
12	1466	8.000	0.6664	0.0075	0.6664	53.6	1.495	0.495	
13	1288	16.000	0.6542	0.0102	0.6542	52.6	1.468	0.468	160
14	1390	32.000	0.6356	0.0144	0.6356	51.1	1.426	0.426	183
15*	0	16.000		0.0000					
16*	0	8.000		0.0000					
17*	0	4.000		0.0000					
18*	0	2.000		0.0000					
19*	0	0.500		0.0000					
20*	0	0.250		0.0000					
				0.0000					
				0.0000					
				0.0000					
Final	N/A	0.250	0.6301	0.0000	0.6301	51.4	1.434	0.434	

Lab Sample Test Results

Tare	76.6 gr.		
Wet+Tare	191.1 gr.		
Cons+Tare	185.3 gr.		
Dry+Tare	169.8 gr.		
W_s	93.2 gr.		
$W_w = V_w$	21.3 cm^3		
V_s	35.9 cm^3		
	Initial	Final	
Moisture content	22.9	11.1	
Dry Unit Wt.	96.4	126.7	

Lab Test Procedures

Test Method:	T 216 B
Sample Condition:	inundated
Inundation Pressure:	.050 tsf
Test Preparation:	Trimmed with cutting shoe

Lab Comments:

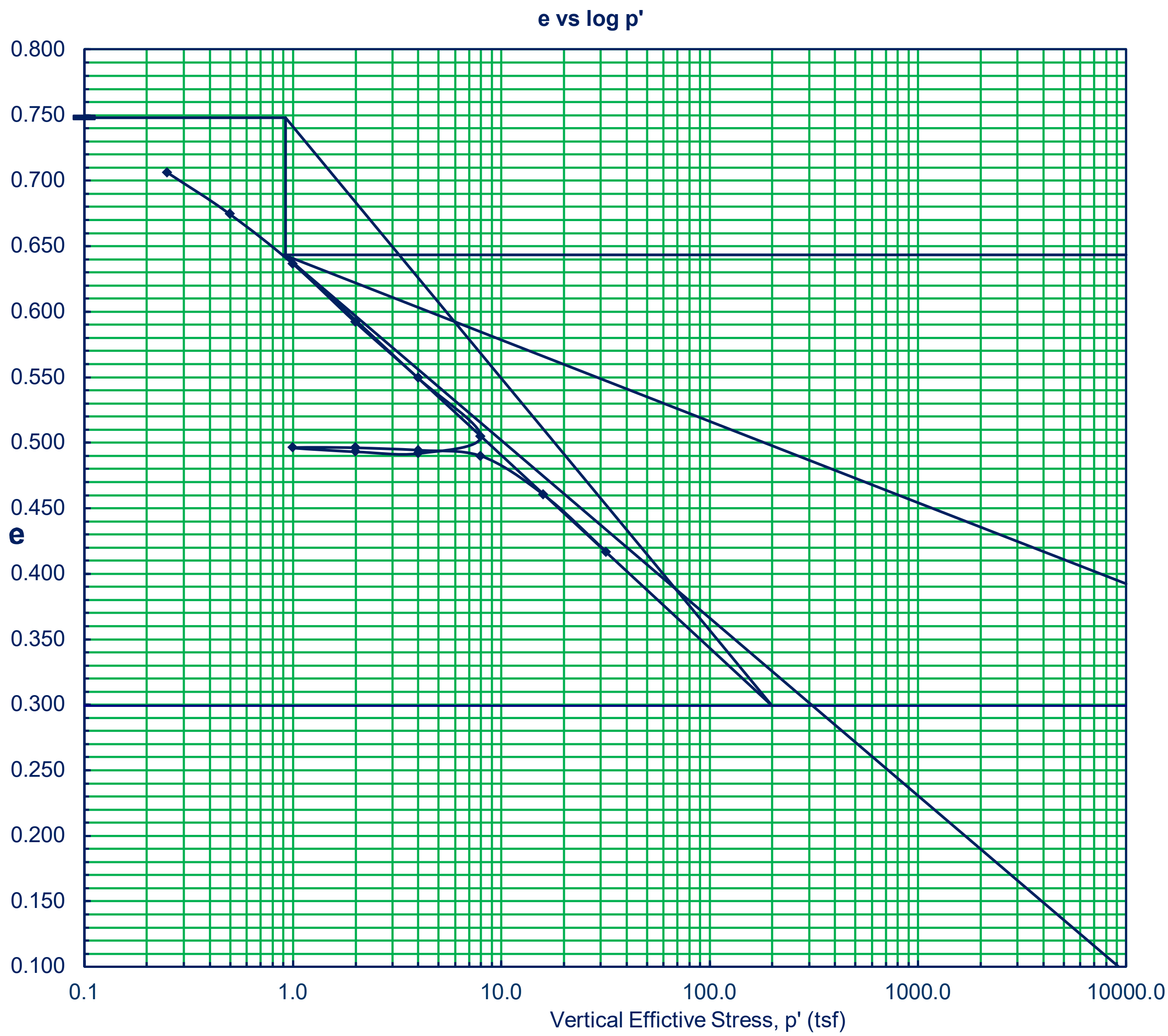
COMMENTS:

* For unload sequences, the sample height at the end of the load sequence is used instead of H_{100}.

** Machine deflection was accounted for in the development of the load verses deformation curves.

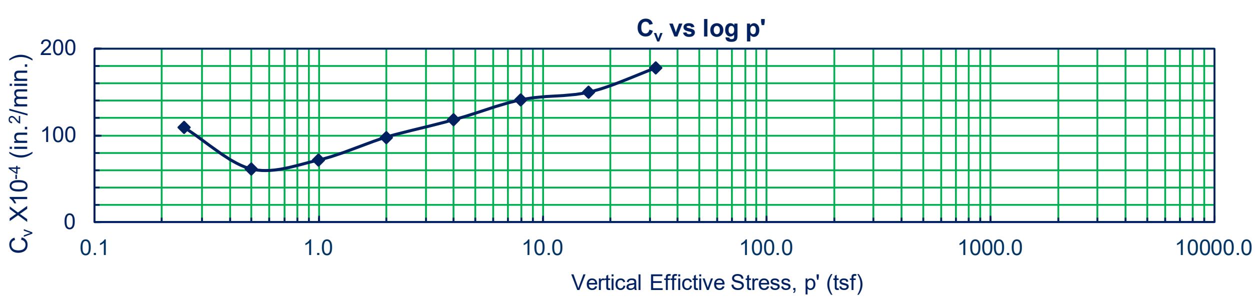
*** Water table was assumed to be at about an elevation of 804 ft.

District	2	Lab Project Number	20203
County	Winnebago	Sample Number	5-2
Route	I-39/US BYP 20	Boring ID	B-14iSTb SW Abut.
Section	(201-3)K & (4-1,5)R	Boring Station	149+75
Project Number	P-92-111-06	Boring Offset	11 ft RT of BL



Layer 3

P'_0 = 0.924 tsf P_c = 0.924 tsf c_r = 0.007 c_c = 0.192 e_o = 0.748



Lab Project **20203**

Layer 3 Worksheet

Sample Number	5-2	Boring Station	149+75
Machine Number	2	Boring Offset	11 ft RT of BL
District	2	Boring ID	B-14iSTb SW Abut.
County	Winnebago	Project Number	P-92-111-06
Route	I-39/US BYP 20	Structure Number	101-0215 PR
Section	(201-3)K & (4-1,5)R	Contract number	64C62

C_v calculations curve	log	e calculations curve	square root

e Calculations

Increment	Increment duration (min.)	Loading (tsf)	Height (inches)	Machine deflection (inches)	Adjusted height** (inches)	V (cm^3)	V/V_s	e V/V_s-1	C_v X 10^{-4} (in^2/min.)
Initial		0.050	0.7500	0.0000	0.7500	60.3	1.748	0.748	
1	408	0.250	0.7320	0.0017	0.7320	58.9	1.706	0.706	109
2	781	0.500	0.7184	0.0028	0.7184	57.8	1.674	0.674	61
3	415	1.000	0.7022	0.0040	0.7022	56.5	1.637	0.637	71
4	857	2.000	0.6830	0.0056	0.6830	54.9	1.592	0.592	98
5	406	4.000	0.6647	0.0076	0.6647	53.5	1.549	0.549	118
6	914	8.000	0.6456	0.0099	0.6456	51.9	1.505	0.505	141
7*	1466	4.000	0.6400	0.0084	0.6400	51.5	1.492	0.492	
8*	1314	2.000	0.6406	0.0070	0.6406	51.5	1.493	0.493	
9*	1344	1.000	0.6419	0.0059	0.6419	51.6	1.496	0.496	
10	410	2.000	0.6419	0.0067	0.6419	51.6	1.496	0.496	
11	970	4.000	0.6410	0.0080	0.6410	51.6	1.494	0.494	
12	1479	8.000	0.6391	0.0099	0.6391	51.4	1.490	0.490	
13	1290	16.000	0.6265	0.0128	0.6265	50.4	1.460	0.460	150
14	1377	32.000	0.6077	0.0168	0.6077	48.9	1.416	0.416	178
15*	0	16.000		0.0000					
16*	0	8.000		0.0000					
17*	0	4.000		0.0000					
18*	0	2.000		0.0000					
19*	0	0.500		0.0000					
20*	0	0.250		0.0000					
				0.0000					
				0.0000					
				0.0000					
Final	N/A		0.6973	0.0000	0.6973	49.3	1.429	0.429	

Lab Sample Test Results

Tare	76.2	gr.	
Wet+Tare	190.7	gr.	
Cons+Tare	179.6	gr.	
Dry+Tare	164.8	gr.	
W_s	88.6	gr.	
$W_w = V_w$	25.9	cm^3	
V_s	34.5	cm^3	
	Initial		Final
Moisture content	29.2		16.7
Dry Unit Wt.	91.7		112.1

Lab Test Procedures

Test Method:	T 216 B
Sample Condition:	inundated
Inundated Pressure:	.050 tsf
Test Preparation:	Trimmed with cutting shoe

Lab Comments:

COMMENTS:

* For unload sequences, the sample height at the end of the load sequence is used instead of H_{100}.

** Machine deflection was accounted for in the development of the load verses deformation curves.

*** Water table was assumed to be at about an elevation of 804 ft.

ATTACHMENT C

KEG
SETTLEMENT CALCULATIONS

I39 RAMP BD SETTLEMENT CALCULATIONS

Boring B4i

MSE	
B (ft)=	26.41
L (ft)=	119.60
H (ft)=	26.41
γ (pcf)=	125.00
ΔP (psf)=	2496.70

Granular Embankment	
H(ft)=	5
γ (pcf)=	120
GWT (ft)=	

0.02	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	5	2.5	SILTY LOAM+SILTY CLAY	120	4.4	300.00	2234.10	2534.10	1320	OC-II	0.796	0.249	0.024	0.24
2	5	7.5	SILTY LOAM+SILTY CLAY	120	4.4	900.00	1829.75	2729.75	3960	OC-I	0.796	0.249	0.024	0.03
3	4	12	SILTY CLAY LOAM	125	1.2	1450.00	1560.15	3010.15	1740	OC-II	0.746	0.179	0.014	0.10
													Sp (ft)=	0.37
													Sp (in)=	4.46

Boring B6i

MSE	
B (ft)=	14.26
L (ft)=	119.60
H (ft)=	17.83
γ (pcf)=	125.00
ΔP (psf)=	2012.18

Granular Embankment	
H(ft)=	5
γ (pcf)=	120
GWT (ft)=	22

Layer	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	3.75	1.875	SILTY CLAY LOAM+ SILTY LOAM	120	4.4	225.00	1750.96	1975.96	990	OC-II	0.796	0.249	0.024	0.19
2	3.75	5.625	SILTY CLAY LOAM+ SILTY LOAM	120	4.4	675.00	1378.27	2053.27	2970	OC-I	0.796	0.249	0.024	0.02
3	3.75	9.375	SILTY CLAY LOAM+SILTY CLAY TILL	120	1.2	1125.00	1125.91	2250.91	1350	OC-II	0.746	0.179	0.014	0.09
4	3.75	13.125	SILTY CLAY LOAM+SILTY CLAY TILL	125	1.2	1584.38	944.30	2528.68	1901.25	OC-II	0.746	0.179	0.014	0.05
													Sp (ft)=	0.35
													Sp (in)=	4.20

Boring B11i

MSE	
B (ft)=	17.13
L (ft)=	71.16
H (ft)=	25.41
γ (pcf)=	125.00
ΔP (psf)=	2688.13

Granular Embankment	
H(ft)=	5.0
γ (pcf)=	120.0
GWT (ft)=	9.5

Additional Fill	
H(ft)=	4.0
γ (pcf)=	125.0

Layer	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	3.75	1.875	SILTY CLAY LOAM+SILTY LOAM	135	6.6	253.125	2360.69	2613.81	1670.63	OC-II	0.37	0.069	0.004	0.05
2	3.75	5.625	SILTY CLAY LOAM+SILTY LOAM	135	6.6	759.375	1875.33	2634.70	5011.88	OC-I	0.37	0.069	0.004	0.01
3	4	9.5	SANDY LOAM	120	1.4	1252.5	1525.44	2777.94	1753.50	OC-II	0.683	0.155	0.008	0.08
													Sp (ft)=	0.13
													Sp (in)=	1.54

I39 RAMP BD SETTLEMENT CALCULATIONS

Boring B12i

MSE	
B (ft)=	17.13
L (ft)=	71.16
H (ft)=	25.41
γ (pcf)=	125.00
ΔP (psf)=	2588.13

Granular Embankment	
H(ft)=	5.0
γ (pcf)=	120.0
GWT (ft)=	9.5

Additional Fill	
H(ft)=	3.2
γ (pcf)=	125.0

Layer	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	3	1.5	SILTY LOAM + SANDY LOAM	135	6.6	202.5	2330.59	2533.09	1336.50	OC-II	0.37	0.069	0.004	0.05
2	3	4.5	SILTY LOAM + SANDY LOAM	135	6.6	607.5	1927.73	2535.23	4009.50	OC-I	0.37	0.069	0.004	0.01
3	3	7.5	SILTY LOAM	135	1.4	1012.5	1628.34	2640.84	1417.50	OC-II	0.683	0.155	0.008	0.08
4	3	10.5	SILTY LOAM	120	1.4	1395	1398.20	2793.20	1953.00	OC-II	0.683	0.155	0.008	0.05
													Sp (ft)=	0.18
													Sp (in)=	2.12

Boring B13i

MSE	
B (ft)=	17.12
L (ft)=	114.50
H (ft)=	25.40
γ (pcf)=	125.00
ΔP (psf)=	2187.50

Granular Embankment	
H(ft)=	5.0
γ (pcf)=	120.0
GWT (ft)=	9.5

Layer	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	4	2	SILTY CLAY LOAM + SANDY LOAM	135	6.6	270	1925.06	2195.06	1782.00	OC-II	0.37	0.069	0.004	0.03
2	4	6	SILTY CLAY LOAM + SANDY LOAM	135	1.4	810	1539.16	2349.16	1134.00	OC-II	0.683	0.155	0.008	0.12
3	4	10	SAND LOAM + SILTY LOAM	120	1.4	1320	1269.98	2589.98	1848.00	OC-II	0.683	0.155	0.008	0.06
4	4	14	SAND LOAM + SILTY LOAM	125	1.0	1810	1072.30	2882.30	1810.00	NC	0.748	0.192	0.007	0.09
5	4	18	SANDY LOAM + SANDY LOAM TILL	125	1.0	2185.2	921.48	3106.68	2185.20	NC	0.748	0.192	0.007	0.07
													Sp (ft)=	0.36
													Sp (in)=	4.32

Boring B15i

MSE	
B (ft)=	17.12
L (ft)=	114.50
H (ft)=	25.40
γ (pcf)=	125.00
ΔP (psf)=	3037.50

Granular Embankment	
H(ft)=	5.0
γ (pcf)=	120.0
GWT (ft)=	9.5

Additional Fill	
H(ft)=	6.8
γ (pcf)=	125.0

Layer	Hc (ft)	zcl (ft)	Descriptions	γ (pcf)	OCR	p'o (psf)	Δp (psf)	p'o + Δp (psf)	p'c (psf)	CASE	eo	Cc	Cs	δ(ft)
1	3.5	1.75	LOAM +SANDY LOAM	135	6.6	236.25	2714.32	2950.57	1559.25	OC-II	0.37	0.069	0.004	0.06
2	3.5	5.25	LOAM +SANDY LOAM	135	6.6	708.75	2222.72	2931.47	4677.75	OC-I	0.37	0.069	0.004	0.01
3	3	8.5	SILT + SAND+ SANDY LOAM	120	1.4	1125	1889.48	3014.48	1575.00	OC-II	0.683	0.155	0.008	0.08
4	3	11.5	SILT + SAND+ SANDY LOAM	120	1.4	1360.2	1651.15	3011.35	1904.28	OC-II	0.683	0.155	0.008	0.06
5	3.5	14.75	SANDY LOAM TILL	125	1.0	1556.15	1445.48	3001.63	1556.15	NC	0.748	0.192	0.007	0.11
6	3.5	18.25	SANDY LOAM TILL	125	1.0	1775.25	1268.11	3043.36	1775.25	NC	0.748	0.192	0.007	0.09
													Sp (ft)=	0.40
													Sp (in)=	4.80

I39 RAMP BD TIME RATE OF CONSOLIDATION CALCULATION

Boring B4i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	5	120	300.00	0.15	7.00E-03
2	5	120	900.00	0.45	1.88E-03
3	4	125	1450.00	0.73	5.50E-02

Time Rate of consolidation

Without wick drains

Cv (in²/min)= 2.13E-02
H (ft)= 7

	days	months	years
t50	46.03	1.53	0.13
t90	191.01	6.37	0.52

With wick drains

Cv hor. (in²/min)= 4.26E-02
Triangular spacing(ft)= 5.0
de(ft)= 5.3

	days	months	years
t50	25.9	0.86	0.07
t90	107.4	3.58	0.29

Boring B11i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	3.75	135	253.125	0.13	1.13E-02
2	3.75	135	759.375	0.38	1.25E-02
3	4	120	1252.5	0.63	1.50E-02

Time Rate of consolidation

Without wick drains

Cv (in²/min)= 1.29E-02
H (ft)= 5.75

	days	months	years
t50	51.19	1.71	0.14
t90	212.45	7.08	0.58

With wick drains

Cv hor. (in²/min)= 2.58E-02
Triangular spacing(ft)= 5.0
de(ft)= 5.3

	days	months	years
t50	42.7	1.42	0.12
t90	177.1	5.90	0.49

Boring B6i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	3.75	120	225.00	0.11	7.00E-03
2	3.75	120	675.00	0.34	2.50E-03
3	3.75	120	1125.00	0.56	6.00E-02
4	3.75	125	1584.38	0.79	5.50E-02

Time Rate of consolidation

Without wick drains

Cv (in²/min)= 3.11E-02
H (ft)= 15

	days	months	years
t50	144.58	4.82	0.40
t90	600.00	20.00	1.64

With wick drains

Cv hor. (in²/min)= 6.23E-02
Triangular spacing(ft)= 5.0
de(ft)= 5.3

	days	months	years
t50	17.7	0.59	0.05
t90	73.5	2.45	0.20

Boring B12i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	3	135	202.5	0.10	1.13E-02
2	3	135	607.5	0.30	1.13E-02
3	3	135	1012.5	0.51	1.50E-02
4	3	120	1395	0.70	1.55E-02

Time Rate of consolidation

Without wick drains

Cv (in²/min)= 1.33E-02
H (ft)= 6

	days	months	years
t50	54.29	1.81	0.15
t90	225.30	7.51	0.62

With wick drains

Cv hor. (in²/min)= 2.65E-02
Triangular spacing(ft)= 5.0
de(ft)= 5.3

	days	months	years
t50	41.6	1.39	0.11
t90	172.5	5.75	0.47

I39 RAMP BD TIME RATE OF CONSOLIDATION CALCULATION

Boring B13i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	4	135	270	0.14	1.13E-02
2	4	135	810	0.41	1.70E-02
3	4	120	1320	0.66	1.50E-02
4	4	125	1810	0.91	6.50E-03
5	4	125	2185.2	1.09	8.00E-03

Time Rate of consolidation

Without wick drains

Cv (in^2/min)= 1.16E-02

H (ft)= 10

	days	months	years
t50	173.16	5.77	0.47
t90	718.61	23.95	1.97

With wick drains

Cv hor. (in^2/min)= 2.31E-02

Triangular spacing(ft)= 5.0

de(ft)= 5.3

	days	months	years
t50	47.7	1.59	0.13
t90	198.1	6.60	0.54

Boring B15i					
Layer	Hc (ft)	γ (pcf)	p'o (psf)	p'o (tsf)	Cv (in2/min)
1	3.5	135	236.25	0.12	1.13E-02
2	3.5	135	708.75	0.35	1.13E-02
3	3	120	1125	0.56	1.88E-02
4	3	120	1360.2	0.68	2.38E-02
5	3.5	125	1556.15	0.78	2.50E-02
6	3.5	125	1775.25	0.89	2.88E-02

Time Rate of consolidation

Without wick drains

Cv (in^2/min)= 1.98E-02

H (ft)= 20

	days	months	years
t50	404.21	13.47	1.11
t90	1677.47	55.92	4.60

With wick drains

Cv hor. (in^2/min)= 3.96E-02

Triangular spacing(ft)= 5.0

de(ft)= 5.3

	days	months	years
t50	27.9	0.93	0.08
t90	115.6	3.85	0.32

EXHIBIT G

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE==================================== North Abutment
REFERENCE BORING =============================== B-02i
LRFD or ASD or SEISMIC ============================= LRFD
PILE CUTOFF ELEV. ================================= 839.61 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 837.61 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 3864 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 48.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 322.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 120.75 KIPS

PILE TYPE AND SIZE ============= Steel HP 12 X 53
Plugged Pile Perimeter========================== 3.967 FT. Unplugged Pile Perimeter============== 5.800 FT.
Plugged Pile End Bearing Area==================== 0.983 SQFT. Unplugged Pile End Bearing Area======== 0.108 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	**418** KIPS	**230** KIPS	**59** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
832.61	5.00	1.50			19.1		39.7	27.9		***30.2***	30	0	0	17	7
827.61	5.00	1.50			19.1	20.7	58.8	27.9	2.3	***58.0***	58	0	0	32	12
822.61	5.00	1.50			19.1	20.7	***77.9***	27.9	2.3	85.9	78	0	0	43	17
818.65	3.96	1.50			15.1	20.7	***99.9***	22.1	2.3	108.8	100	0	0	55	21
815.15	3.50	2.00	13		16.2	27.6	***102.3***	23.6	3.0	130.9	102	0	0	56	24
812.65	2.50	1.00	7		7.0	13.8	***114.8***	10.3	1.5	141.8	115	0	0	63	27
810.15	2.50	1.40	12		9.1	19.3	***141.8***	13.3	2.1	157.1	142	0	0	78	29
807.65	2.50	2.70	11		14.1	37.2	***136.6***	20.6	4.1	175.6	137	0	0	75	32
805.15	2.50	1.30	10		8.6	17.9	***135.6***	12.6	2.0	187.1	136	0	0	75	34
801.65	3.50	0.60	5		6.4	8.3	***142.9***	9.3	0.9	196.5	143	0	0	79	38
800.15	1.50		5	Very Fine Silty Sand	0.5	9.2	***147.1***	0.7	1.0	197.6	147	0	0	81	39
796.65	3.50		7	Very Fine Silty Sand	1.5	12.9	***183.5***	2.2	1.4	203.6	183	0	0	101	43
795.15	1.50		26	Hard Till	1.7	47.8	***176.0***	2.5	5.2	205.1	176	0	0	97	44
792.65	2.50		21	Hard Till	2.3	38.6	***154.4***	3.3	4.2	205.8	154	0	0	85	47
787.65	5.00		8	Hard Till	1.7	14.7	***157.9***	2.5	1.6	208.5	158	0	0	87	52
781.65	6.00		9	Hard Till	2.3	16.5	388.7	3.4	1.8	***237.0***	237	0	0	130	58
781.15	0.50			Limestone	49.4	245.0	438.1	72.3	26.8	***309.2***	309	0	0	170	58.5
780.65	0.50			Limestone	49.4	245.0	487.5	72.3	26.8	***381.5***	381	0	0	210	59
780.15	0.50			Limestone	49.4	245.0	537.0	72.3	26.8	***453.7***	~~454~~	~~0~~	~~0~~	~~250~~	~~59.5~~
779.65	0.50			Limestone	49.4	245.0	586.4	72.3	26.8	***526.0***	~~526~~	~~0~~	~~0~~	~~289~~	~~60~~
779.15	0.50			Limestone	49.4	245.0	635.8	72.3	26.8	***598.2***	~~598~~	~~0~~	~~0~~	~~329~~	~~60.5~~
778.65	0.50			Limestone	49.4	245.0	685.2	72.3	26.8	***670.5***	~~670~~	~~0~~	~~0~~	~~369~~	~~61~~
778.15	0.50			Limestone	49.4	245.0	***734.6***	72.3	26.8	742.7	~~735~~	~~0~~	~~0~~	~~404~~	~~61.5~~
777.65	0.50			Limestone	49.4	245.0	***784.0***	72.3	26.8	815.0	~~784~~	~~0~~	~~0~~	~~431~~	~~62~~
777.15	0.50			Limestone	49.4	245.0	***833.4***	72.3	26.8	887.2	~~833~~	~~0~~	~~0~~	~~458~~	~~62.5~~
776.65	0.50			Limestone		245.0			26.8						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE===================================== South Abutment
REFERENCE BORING ================================= B-13i
LRFD or ASD or SEISMIC ============================= LRFD
PILE CUTOFF ELEV. ================================== 836.52 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 834.52 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 3864 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 48.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 322.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 120.75 KIPS

PILE TYPE AND SIZE ============= Steel HP 12 X 53
Plugged Pile Perimeter========================== 3.967 FT. Unplugged Pile Perimeter============== 5.800 FT.
Plugged Pile End Bearing Area==================== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	**391** KIPS	**215** KIPS	**50** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
829.52	5.00	1.50			19.1		39.7	27.9		***30.2***	30	0	0	17	7
824.52	5.00	1.50			19.1	20.7	58.8	27.9	2.3	***58.0***	58	0	0	32	12
819.52	5.00	1.50			19.1	20.7	***77.9***	27.9	2.3	85.9	78	0	0	43	17
819.18	0.34	1.50			1.3	20.7	***83.3***	1.9	2.3	88.3	83	0	0	46	17
815.68	3.50	1.80	11		15.1	24.8	***92.9***	22.1	2.7	109.8	93	0	0	51	21
813.18	2.50	1.40	12		9.1	19.3	***96.5***	13.3	2.1	122.5	97	0	0	53	23
810.68	2.50	1.00	15		7.0	13.8	140.8	10.3	1.5	***136.8***	137	0	0	75	26
808.18	2.50	3.70	10		17.7	51.0	***114.4***	25.9	5.6	157.9	114	0	0	63	28
805.68	2.50	0.50	3		3.9	6.9	***126.5***	5.7	0.8	164.5	127	0	0	70	31
803.18	2.50	1.10	9		7.6	15.2	***128.1***	11.1	1.7	174.9	128	0	0	70	33
800.68	2.50		5	Hard Till	0.5	9.2	***132.3***	0.8	1.0	176.1	132	0	0	73	36
798.18	2.50		7	Hard Till	0.8	12.9	237.8	1.1	1.4	***188.7***	189	0	0	104	38
795.68	2.50		64	Very Fine Silty Sand	13.9	117.6	***167.2***	20.4	12.9	199.8	167	0	0	92	41
793.18	2.50		18	Hard Till	1.9	33.1	***178.4***	2.8	3.6	203.6	178	0	0	98	43
790.68	2.50		23	Hard Till	2.5	42.3	***180.9***	3.6	4.6	207.3	181	0	0	99	46
789.68	1.00		23	Hard Till	1.0	42.3	225.3	1.5	4.6	***213.5***	213	0	0	117	47
787.18	2.50		35	Sandy Gravel	10.6	85.7	395.2	15.5	9.4	***246.4***	246	0	0	136	49
786.68	0.50			Limestone	49.4	245.0	444.6	72.3	26.8	***318.7***	319	0	0	175	49.8
786.18	0.50			Limestone	49.4	245.0	494.0	72.3	26.8	***390.9***	391	0	0	215	50.3
785.68	0.50			Limestone	49.4	245.0	543.4	72.3	26.8	***463.2***	~~463~~	~~0~~	~~0~~	~~255~~	~~50.8~~
785.18	0.50			Limestone	49.4	245.0	592.8	72.3	26.8	***535.4***	~~535~~	~~0~~	~~0~~	~~294~~	~~51.3~~
784.68	0.50			Limestone	49.4	245.0	642.2	72.3	26.8	***607.7***	~~608~~	~~0~~	~~0~~	~~334~~	~~51.8~~
784.18	0.50			Limestone	49.4	245.0	691.7	72.3	26.8	***679.9***	~~680~~	~~0~~	~~0~~	~~374~~	~~52.3~~
783.68	0.50			Limestone	49.4	245.0	***741.1***	72.3	26.8	752.2	~~741~~	~~0~~	~~0~~	~~408~~	~~52.8~~
783.18	0.50			Limestone	49.4	245.0	***790.5***	72.3	26.8	824.4	~~790~~	~~0~~	~~0~~	~~435~~	~~53.3~~
782.68	0.50			Limestone		245.0			26.8						

EXHIBIT H

RECOMMENDED GROUND IMPROVEMENT LOCATIONS

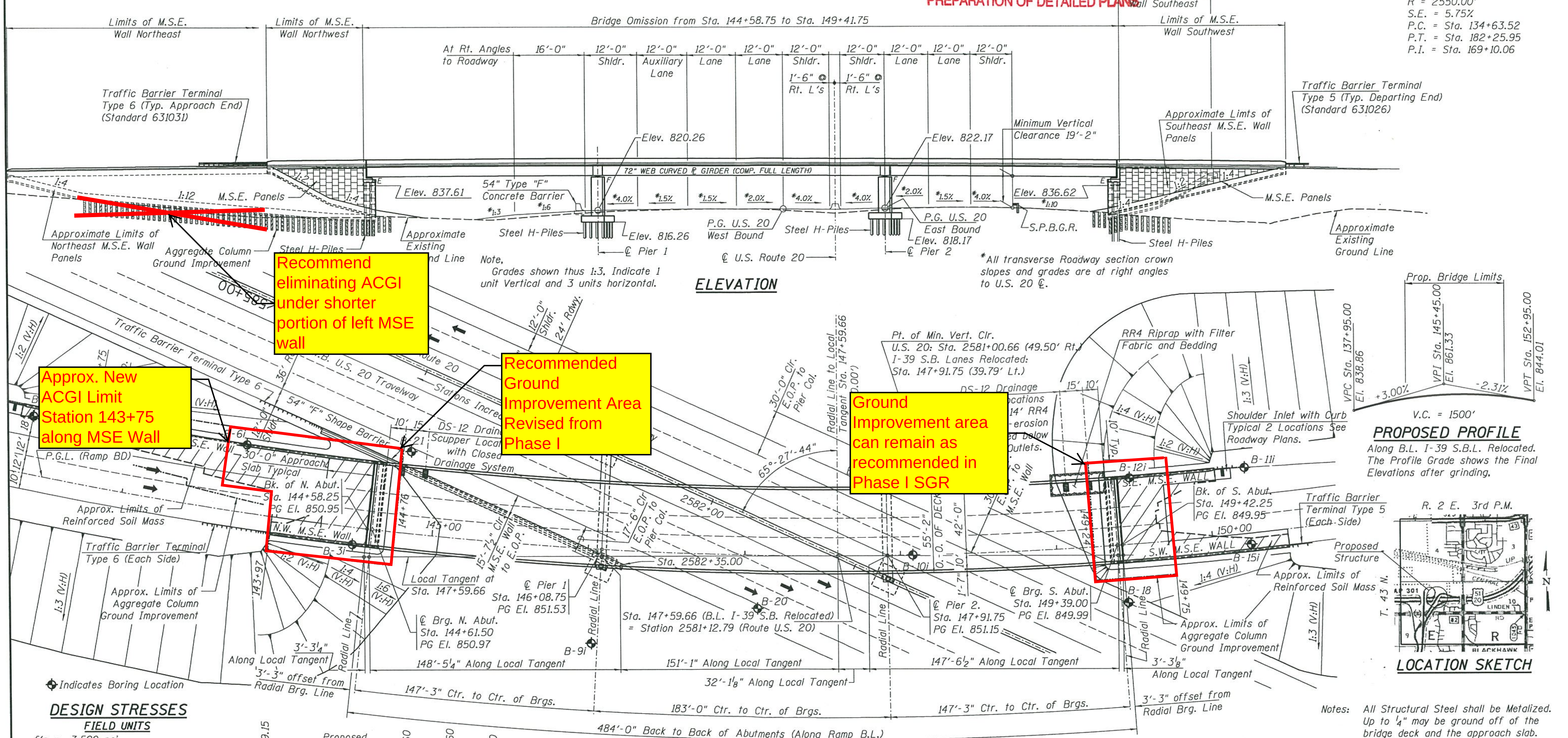
BM: #454 - Cut Square South side of Westerly sign base for a 30MPH ramp 0.1 miles North of the Centerline of Linden Rd. - West side of I-39 Elevation = 850.53
#455 - Cut Square South side of Easterly sign base for a 30MPH ramp 0.1 miles North of the Centerline of Linden Rd. - East side of I-39 Elevation = 851.37

Existing Structure (SN 101-0136)
Originally constructed in 1981 as F.A. Route 194, Section 201-3HB-2.
The structure consists of a 3 Span, 56°-25'-55" Rt Fwd. Skewed, concrete deck on curved steel girders, supported on pile bent concrete abutments and 2 (4 Trapazoidal columns) concrete piers on pile supported foundations. The deck width is 28'-0", and the span lengths are 86'-0", 143'-6" and 155'-0" developing a back to back length of 397'-8½".
Traffic shall be maintained on the existing structure during construction of the new structure. See Maintenance of Traffic Plans for more staging information.
No Salvage.

APPROVED
APR 11 2017
AS A BASIS FOR
PREPARATION OF DETAILED PLANS

CURVE DATA - I-39 SBL

Δ = 107°00'-24" (Lt.)
D = 2°-14'-49"
T = 3446.54'
L = 4762.42'
E = 1737.32'
R = 2550.00'
S.E. = 5.75%
P.C. = Sta. 134+63.52
P.T. = Sta. 182+25.95
P.I. = Sta. 169+10.06



Notes: All Structural Steel shall be Metalized. Up to ¼" may be ground off of the bridge deck and the approach slab.

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

PRECAST UNITS

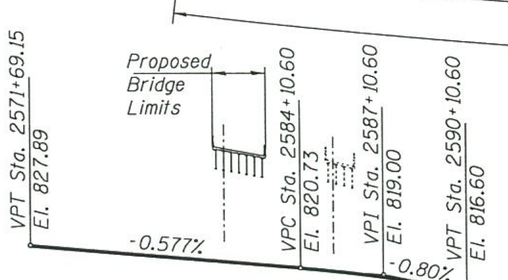
f'c = 4,500 psi (Precast Panels)

LOADING HL-93

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

DESIGN SPECIFICATIONS

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



PROPOSED PROFILE

Along US-20 Inside E.O.P.

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.056
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.101
Soil Site Class = C

HIGHWAY CLASSIFICATION

F.A.I. Rte. 39 - I-39 S.B. Lanes
Functional Class: Interstate
ADT: 10,000 (2013); 28,000 (2040)
ADTT: 4,200 (2013); 11,700 (2040)
DHV: 2250 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
1-Way Traffic

HIGHWAY CLASSIFICATION

FAP Rte 301 - U.S. Route 20
Functional Class: Freeway and Expressway (Urban)
ADT: 33,400 (2013); 50,050 (2040)
ADTT: 6,000 (2013); 9,000 (2040)
DHV: 5970 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
2-Way Traffic
Directional Distribution: 50:50

GENERAL PLAN
I-39 S.B.L. (Ramp BD) over U.S.20
F.A.I. 39 - SECTION (201-3)K & (4-1, 5)R
WINNEBAGO COUNTY
STA. 147+59.66
STRUCTURE NUMBER - 101-0215

I:\06_jobs\06S2055\CADD\Struct\Model\110519_139_SB_Ramp-BD_over_US20_TSL.dgn

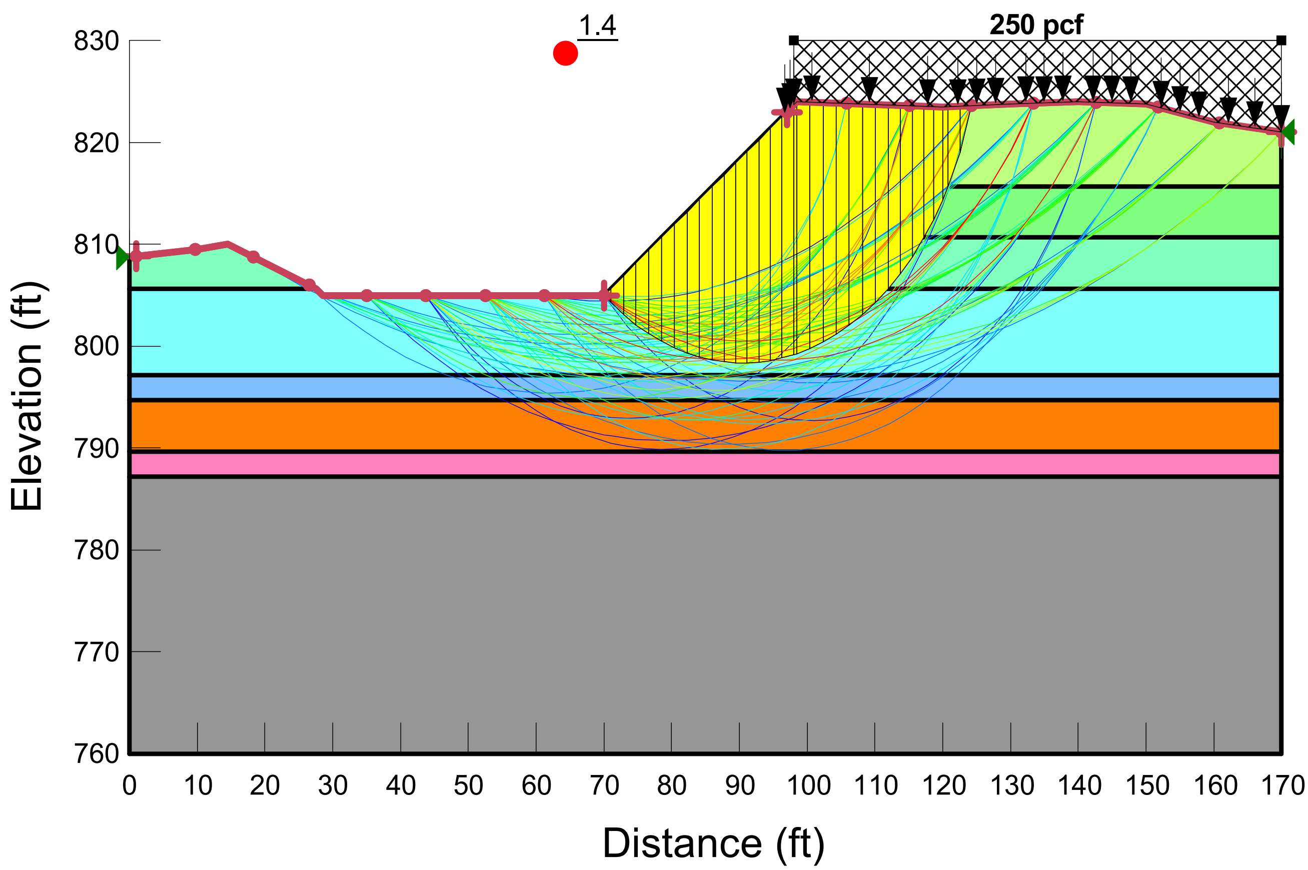
HANSON	USER NAME =	DESIGNED - MNM	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	STRUCTURE NO. 101-0215	F.A.I. RTE. 39	SECTION (201-3)K & (4-1, 5)R	COUNTY WINNEBAGO	TOTAL SHEETS 4	SHEET NO. 1
	PLOT SCALE =	CHECKED - TEH	REVISED -					CONTRACT NO. 64C62		
	PLOT DATE =	DRAWN - ROD	REVISED -		SHEET NO. 01 OF 04 SHEETS			ILLINOIS FED. AID PROJECT		
		CHECKED - MNM	REVISED -							

EXHIBIT I

SLOPE/W SLOPE STABILITY

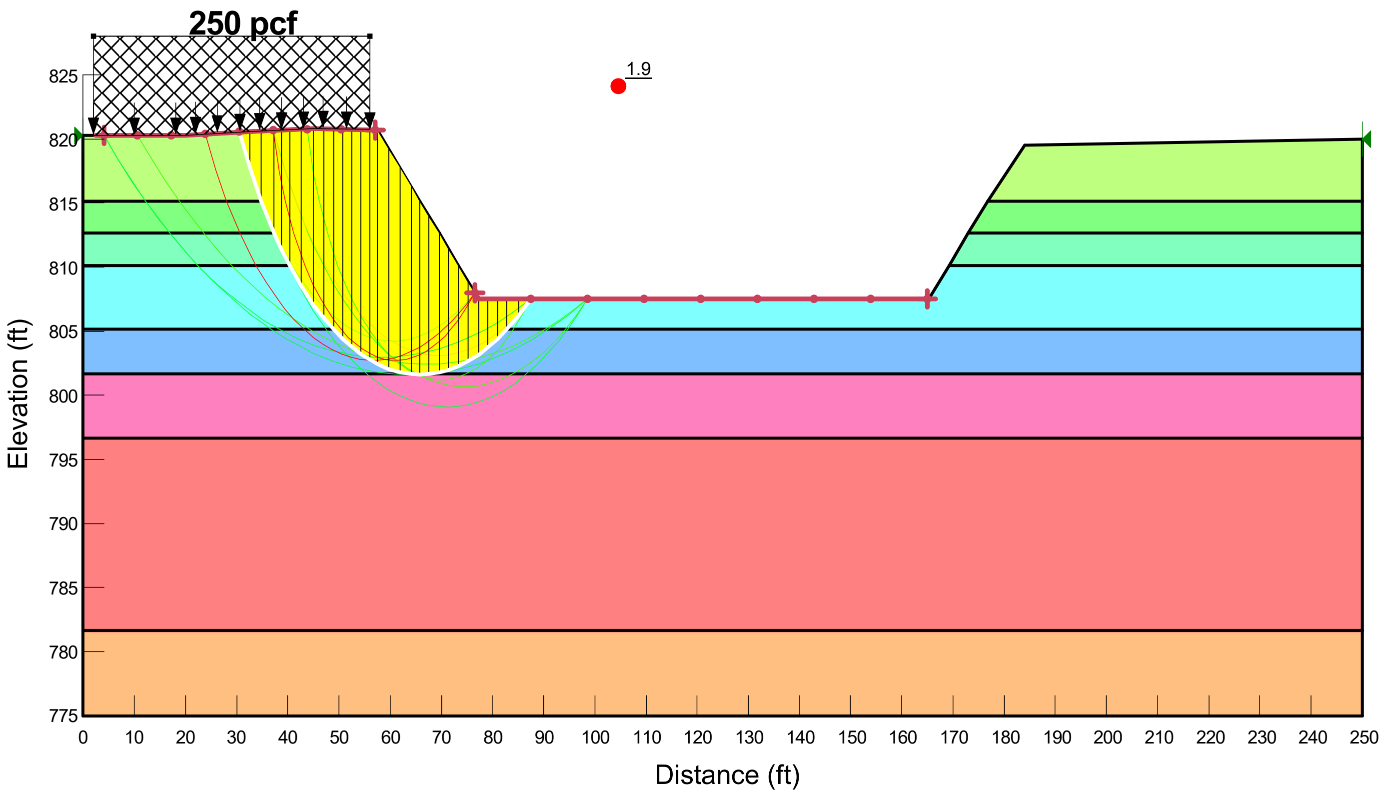
ANALYSIS

I-39 - US 20 Ramp BD
West Abutment Boring B13i (STA 149+34.00)
Short Term Condition (Undrained)



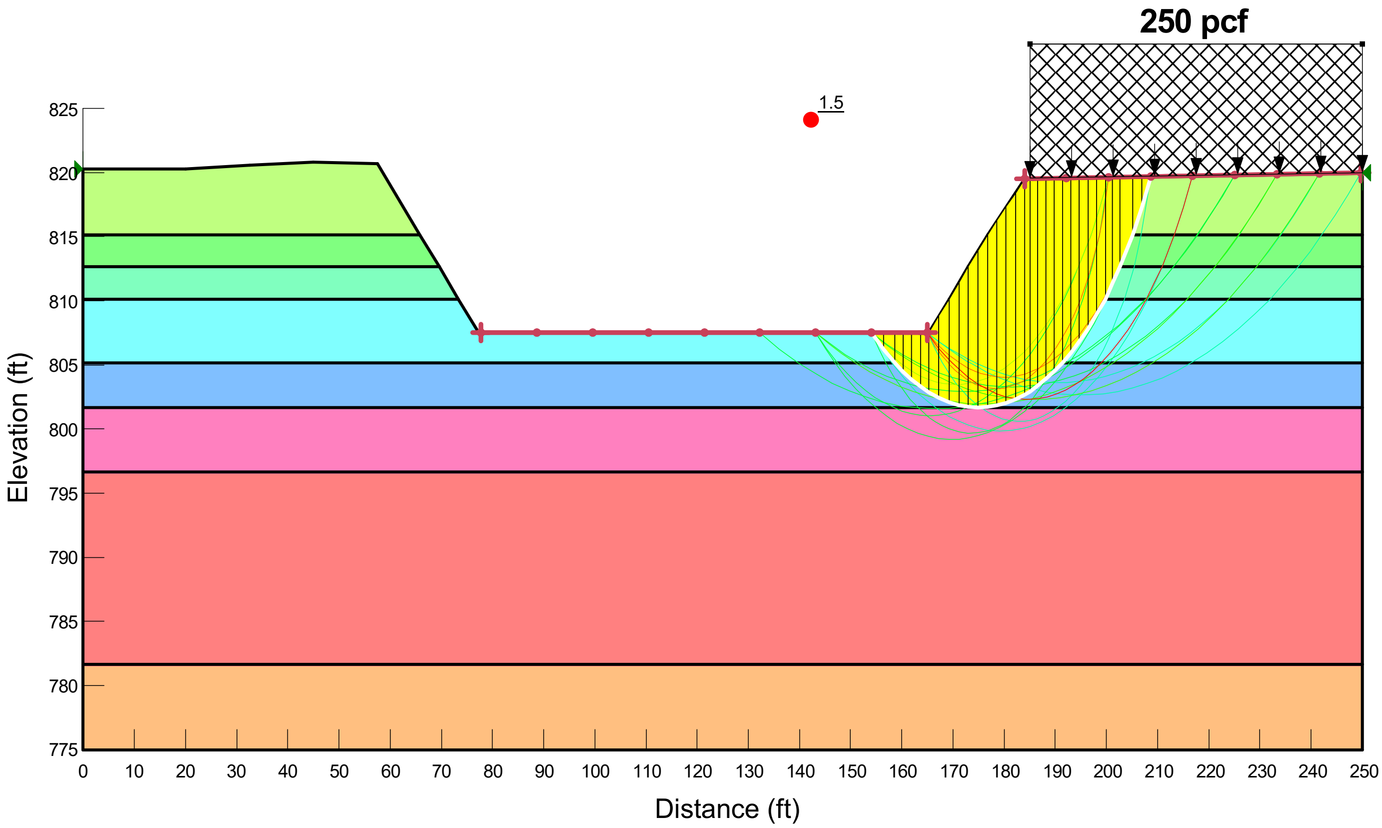
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Gravelly Sand	Mohr-Coulomb	120	0	38
	Limestone	Mohr-Coulomb	150	10,000	45
	Sand	Mohr-Coulomb	115	0	34
	Sandy Loam I	Mohr-Coulomb	120	1,200	0
	Sandy Loam II	Mohr-Coulomb	120	700	0
	Sandy Loam III	Mohr-Coulomb	120	1,900	0
	Silty Clay Loam	Mohr-Coulomb	120	1,150	0
	Silty Loam	Mohr-Coulomb	110	2,100	0

I-39 - US 20 Ramp BD
East Abutment Boring B-2i (STA 144+00.00, Left Slope)
Short Term Condition (Undrained)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Limestone	Mohr-Coulomb	150	10,000	45
	Sand	Mohr-Coulomb	115	500	34
	Sandy Loam Till	Mohr-Coulomb	125	2,000	0
	Silt	Mohr-Coulomb	110	1,400	0
	Silty Clay Loam I	Mohr-Coulomb	120	2,000	0
	Silty Clay Loam II	Mohr-Coulomb	120	2,000	0
	Silty Loam I	Mohr-Coulomb	120	1,000	0
	Silty Loam II	Mohr-Coulomb	120	600	0

I-39 - US 20 Ramp BD
East Abutment Boring B-2i (STA 144+00.00, RIght Slope)
Short Term Condition (Undrained)



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Limestone	Mohr-Coulomb	150	10,000	45
	Sand	Mohr-Coulomb	115	500	34
	Sandy Loam Till	Mohr-Coulomb	125	2,000	0
	Silt	Mohr-Coulomb	110	1,400	0
	Silty Clay Loam I	Mohr-Coulomb	120	2,000	0
	Silty Clay Loam II	Mohr-Coulomb	120	2,000	0
	Silty Loam I	Mohr-Coulomb	120	1,000	0
	Silty Loam II	Mohr-Coulomb	120	600	0