Structural Geotechnical Report

Retaining Wall #6
SN: W099-1004
I-55 at IL 59 Diverging Diamond Interchange
Station 4013+65 to 4015+80
IDOT PTB 189-011
Will County, Illinois
Prepared for

Illinois Department of Transportation
Contract Number: D-91-368-18

Project Design Engineer Team
Alfred Benesch & Company

Geotechnical Consultant:
GSG Consultants, Inc.

October 29, 2020

GSG CONSULTANTS, INC.
ENGINEERS • SCIENTISTS • CONSTRUCTION MANAGERS

623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612
www.gsg-consultants.com

623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612

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October 29, 2020

Mr. Kurt Naus, P.E., S.E.
Alfred Benesch & Company
1230 East Diehl Rd. Suite 109
Naperville, IL 60563

Structural Geotechnical Report
Retaining Wall #6 – SN: W099-1004
Seil Road STA 4013+65 to 4015+80
PTB 189-011

Dear Mr. Naus:

Attached is a copy of the Structural Geotechnical Report for the above referenced project. This report provides a brief description of the site conditions based on the Phase I site investigation previously completed by Wang Engineering, and GSG's recommendations for foundation design and construction. The site investigation by Wang Engineering included five (5) soil borings to depths between 20 and 33 feet.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

Suhaib Ibrahim
Project Engineer

Ala E Sassila, Ph.D., P.E.
Principal

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1.0 INTRODUCTION

This Structural Geotechnical Report (SGR) presents GSG Consultants' engineering analyses and design recommendation for the proposed retaining wall #6 (SN W099-1004). The wall is required for widening of Seil Road, adjacent to the intersection with Illinois Route 59 (IL 59), along the south side of Seil Road in the Village of Shorewood, Will County, Illinois. Wang Engineering completed five (5) borings during the Phase I investigation. GSG completed a geotechnical engineering analyses as part of the Phase II design between Station 4013+65 and 4015+80, along the south side of Seil Road. The purpose of this Phase II investigation was to evaluate subsurface soil conditions and to develop final design and construction recommendations for Wall #6 (SN W099-1004.)

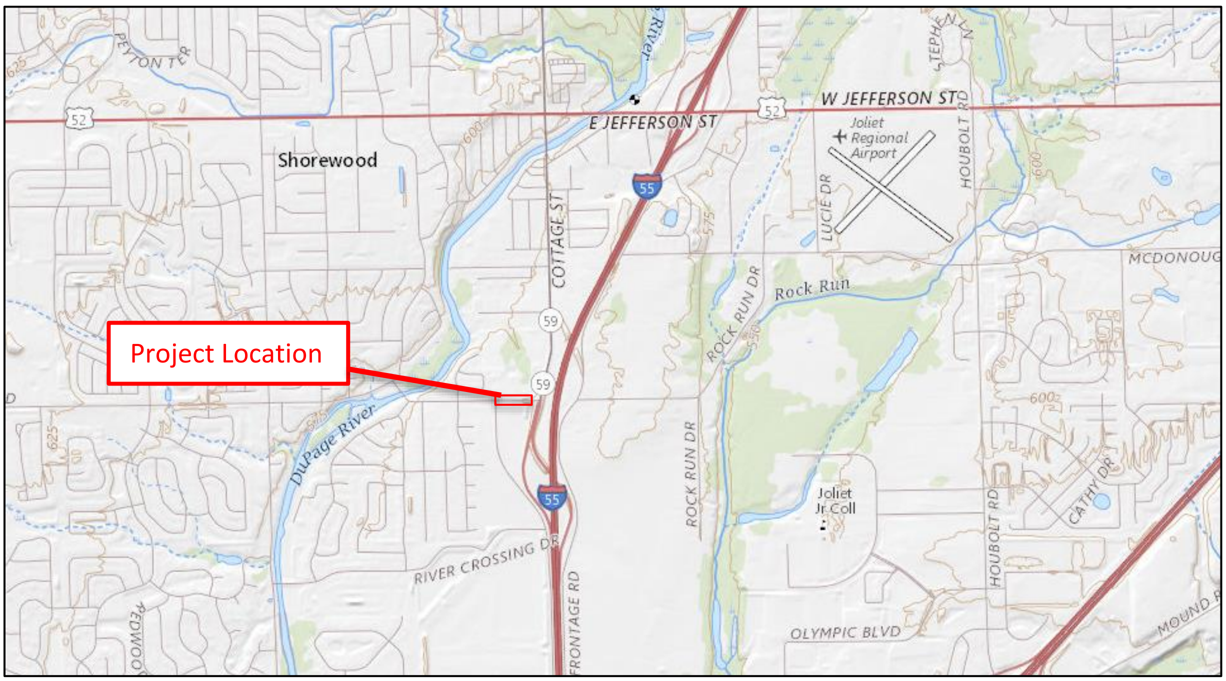


Exhibit 1 – Project Location Map
(Source: USGS Topographic Maps, usgs.gov)

The general scope of the overall project is the conversion of a partial access interchange to a full access interchange at I-55 and IL 59. This will include the construction of a Diverging Diamond Interchange (DDI) and associated auxiliary lanes at the intersection of I-55 and IL 59. Two new ramps are proposed to provide access and include a southbound exit and northbound entrance from/to I-55. An auxiliary lane between IL 59 and US 52 along I-55 is also proposed in each direction along the mainline. In proximity to the DDI, the existing I-55 East Frontage Road will be realigned further east. This report pertains to Wall #6 (SN W009-1004), which will be located along the south side of Seil Road.

1.1 Existing Site Conditions

The proposed Wall #6 will be located on the south side of the Seil Road just west of the intersection of Seil Road and IL 59. The area where the proposed improvements are to be built will be on existing IDOT right-of-way (ROW). There is an existing cast-in-place concrete retaining wall that was built in 2008. The wall length is 153 feet and the maximum height of the wall is approximately 12 feet. Based on the provided GPE for the new structure, the existing retaining wall will be partially removed near the surface, to a depth of 1 foot below the new pavement, while the remaining portion of the wall will remain buried behind the proposed wall. **Exhibit 2** generally shows the existing conditions where the proposed retaining wall will be constructed.

Exhibit 2 – Existing Site Conditions at Proposed Wall Location, Looking East

1.2 Proposed Retaining Wall Information

Based on the design information and drawings provided by Benesch (dated March 6, 2020), the proposed improvements will include widening Seil Road, and construction of a new MSE wall on the south side of Seil Road. According to the plans provided, the proposed retaining wall will mainly have “fill” sections. An existing gas line is located along the frontage road south of Seil Road, and will remain in place in front of the proposed retaining wall. **Table 1** presents a summary of the proposed wall

Table 1 –Retaining Wall Summary

Wall Name	Wall Stations*	Proposed Wall Type	Approximate Length (ft)	Maximum Anticipated Retained Wall Height **(ft)
SN: W099-1004	4013+65 to 4015+80	MSE	215	12

*Based on Seil Road Stationing
** Retained height is measured from the levelling pad

1.3 Regional Geology

GSG reviewed several published documents in an effort to determine the regional geological setting in the area of the site. The site is located in western Will County, near Shorewood, Illinois. The surficial geologic deposits in this area are typically glacial drift deposited during the Wisconsin Glacial Age and river sediments deposited by the Des Plaines River. The subsurface profile in the area of the site consists of deposits of silty clay, sand, silt, and gravel extending to depths of approximately 20 to 60 feet below ground surface, at which point bedrock is generally encountered. Deposits in the area of the site are primarily from the Yorkville Member of the Lemont Formation of the Wedron Group deposited during the Wisconsin Period. The Lemont Formation typically consists of calcareous, gray, fine to coarse textured diamiction units (silty clay to sandy loam) that contain lenses of gravel, sand, silt, and clay. Underlying the surficial deposits, the bedrock consists of the Silurian System, Niagaran Series, which consist of dolomite that varies from extremely argillaceous, silty and cherty to exceptionally pure.

2.0 SITE SUBSURFACE CONDITIONS

This section describes the subsurface conditions based on the borings drilled by Wang Engineering as part of the Phase I geotechnical investigation.

2.1 Subsurface Exploration and Laboratory Testing

All soil borings for this retaining wall were drilled by Wang Engineering between September 25 and October 3, 2018. **Table 2** presents a list of the borings used for the proposed retaining wall analysis.

Table 2 – Summary of Subsurface Exploration Borings

Boring ID	Station *	Offset (ft)/ Direction	Depth (ft)	Surface Elevation (ft)
RW-03	4012+94.30	48.25 RT	33.0(1)	591.7
RW-04	4013+69.24	43.72 RT	23.5(1)	591.6
RW-05	4014+40.04	42.71 RT	33.0(1)	591.5
RW-06	4015+11.86	45.56 RT	20.5(1)	592.1
RW-07	4015+90.36	64.49 RT	25.5(1)	592.5

* Based on existing Seil Road Stationing

(1) Soil Borings completed by Wang in September 2018

Soil Boring Location Plan shows the as-drilled locations of the soil borings (**Appendix B**). Copies of the Soil Boring Logs are provided in **Appendix C**.

Wang also collected one (1) rock core sample each from Borings RW-03, RW-05, and RW-07. Bedrock cores were obtained from the borings in either 5- or 10-foot runs with an NWD4-sized core barrel. Photographs of each bedrock core are attached in **Appendix C**.

2.2 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the borings performed in the vicinity of the proposed retaining wall. Detailed descriptions of the subsurface soils are provided in the Soil Boring Logs (**Appendix C**). The soil boring logs provide specific conditions encountered at each boring location, including soil descriptions, stratifications, penetration resistance, elevations, location of the samples, water levels (when encountered. Its assumed that stratifications shown on the boring logs represent the conditions only at the actual boring locations and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

The surface elevations of the borings ranged between 591.5 and 592.5 feet. All the borings noted silty clay fill to depths between 2 and 3 feet with the exception of RWB-03 and RWB-05. Sandy gravel and gravely loam fill was encountered in borings RW-03 and RW-04 to depths between 1 and 1.5 feet. Under the fill layer, all borings, with exception of RW-04 and RW-05, encountered medium stiff to hard brown and gray silty clay to depths of 13 to 19 feet, followed by medium dense to very dense gray silt and silty loam to depths of 20 to 23 feet, where auger refusal was encountered. Boring RW-04 encountered a layer of loose to medium dense brown and gray sandy gravel between depths of 3 and 8 feet. Boring RW-05 encountered a layer of medium dense brown gravelly loam between depths of 3 and 6 feet. Borings RW-04 Thru RW-07 encountered a layer of medium stiff to very stiff gray silt to between depths of 14 and 16 feet. All the borings were terminated when auger refusal was encountered.

The native brown and gray silty clay had unconfined compressive strength values ranging between 0.8 and 5.58 tsf, with most values between 2.0 and 4.5 tsf. The gray silty clay had unconfined compressive strength values ranging between 0.82 and 2.05 tsf. The gray silty loam had SPT blow counts (N) ranging from 15 to 100 bpf. The gravelly loam or the sandy gravel had SPT N values ranging from 6 to 13 bpf.

Rock was encountered in borings RW-03, RW-05, and RWB-07 at depths between 22 feet. **Table 3** provides the RQD value of the rock cores extracted during the site investigation and the classification.

Table 3 – Rock Core Summary and Classification

Boring Number	Core Run	Core Depth (feet)	Type of Rock	RQD (%)	RQD Classification
RW-03	1	23.0-33.0	Dolostone	70	Good
RW-05	1	23.0-33.0	Dolostone	58	Fair
RW-07	1	23.0-25.5	Dolostone	17	Very Poor

2.3 Groundwater Conditions

Based on the boring logs, groundwater was encountered while drilling in all borings at elevations between 572.5 and 588.6 feet. Groundwater was encountered after drilling in boring RW-04 at elevation 581.1 feet. No delayed groundwater readings were shown in the boring logs.

Based on the color change from brown and gray to gray, it is anticipated that the long-term groundwater level could range between elevations 572 and 583 feet. Water level readings were made in the boreholes at times and under conditions shown on the boring logs. It should be noted that fluctuations in groundwater level may occur due to variations in rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSES

This section provides GSG's geotechnical analysis and recommendations for the design of the proposed retaining wall based on the available boring logs and geotechnical analysis. Subsurface conditions in unexplored locations may vary from those encountered at the boring locations. If structure locations, loadings, or elevations are changed, we request that GSG be contacted so that we may re-evaluate our recommendations.

3.1 Derivation of Soil Parameters for Design

Based on the boring logs provided by Wang Engineering, generalized soil parameters for the soils in the project area for use in design are presented in **Table 4**.

Table 4 – Soil Parameters Table

Elevation Range (feet)	Soil Description	Blow Counts N_{60}	In situ Unit Weight γ (pcf)	Undrained		Drained	
				Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	NA	120	1,000	0	50	25
	New Engineered Granular Fill	NA	125	0	30	0	30
592-589	Brown and Gray Silty Clay Fill	11	134	2,800	0	280	25
589-578	Brown and Gray Medium Stiff to Hard Silty Clay	15	136	3,400	0	340	30
578-568	Gray Medium Dense to Very Dense Silty Loam	43	142	0	45	0	45
589-583*	Brown and Gray Sandy Gravel/Gravelly Loam	12	132	0	38	0	38
578-573**	Gray Medium Stiff Silty Clay	7	135	1,400	0	140	28

* Layer only noted in RW-04 and RW-05

** layer noted in all the borings except RW-03

3.2 Seismic Parameters

The seismic hazard for the site was analyzed per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications.

The Seismic Soil Site Class was determined per the requirements of "All Geotechnical Manual Users" (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the "Seismic Site Class Determination" Excel spreadsheet provided by IDOT. A global Site Class Definition was determined for this project, and was found to be Soil Site Class C. The Seismic Performance Zone (SPZ) was determined using Figure 2.3.10-2 in the IDOT Bridge Manual and was found to be Seismic Performance Zone 1.

The AASHTO Seismic Design Parameters program was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for each of the proposed structures. For this section of the project, the S_{DS} and the S_{D1} were determined using 2017 AASHTO Guide Specifications as shown in **Table 5**. Given the site location and materials encountered, the potential for liquefaction is minimal.

Table 5 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2017 AASHTO Guide for LRFD Seismic Bridge Design	0.049g	0.127g	0.068g

4.0 GEOTECHNICAL RECOMMENDATIONS

This section provides GSG's geotechnical recommendations for the design of the proposed retaining wall based on the results of the field exploration, laboratory testing, and geotechnical analyses, and information provided by the designer. If there are any significant changes to the project characteristics or if significantly different subsurface conditions are encountered during construction, GSG should be consulted so that the recommendations of this report can be reviewed.

4.1 Retaining Wall Type Recommendations

There are several types of retaining walls that could be utilized for retaining earth embankments in fill areas or excavation slopes in cut areas. Based on the proposed grading, it appears that the proposed wall is located within a fill area. Possible wall types may include cast-in-place concrete cantilever, Mechanically Stabilized Earth (MSE), prefabricated modular gravity, and soldier-pile and lagging.

The type of wall selected for design should be selected based on soil conditions, construction schedule, and cost. The following provides a brief description of each type of wall that could be considered at this location.

A. CIP Concrete Cantilever Walls

CIP concrete cantilever retaining walls are typically used in fill areas. They are constructed with a footing that extends laterally both in front of and behind the wall. They can be designed to resist horizontal loading with or without tie-backs by changing the geometry of the foundation. This type of wall typically requires that the area behind the wall be excavated to facilitate construction or are constructed where new fill embankments are necessary.

The advantages of a CIP wall include that it is a conventional system with well-established design procedures and performance characteristics; it is durable; and it has the ability to easily be formed, textured, or colored to meet aesthetic requirements. Disadvantages include a relatively long construction period due to undercutting, excavation, form work, steel placement, and curing of the concrete. This wall system is also sensitive to total and differential settlements.

B. Mechanically Stabilized Earth Walls

An MSE wall is typically associated with fill wall construction and consists of facing such as segmental precast units, dry block concrete or CIP concrete facing units connected to horizontal steel strips, bars or geosynthetic to create a reinforced soil mass. The reinforcement is typically placed in horizontal layers between successive layers of granular backfill. A free draining backfill is required to provide adequate performance of the wall. MSE walls can be used in cut situations as well. The additional cost of the excavations for an MSE wall is usually offset by the savings in construction costs and schedule as compared to a CIP wall on spread footings.

Advantages of the MSE wall include a relatively rapid construction schedule that does not require specialized labor or equipment, provided excavation for the reinforcement is not extensive. This type of retaining wall can accommodate relatively large total and differential settlements without distress, and the reinforcement materials are light and easy to handle. Facing panels can be designed for various architectural finishes.

The design of MSE walls for internal stability is normally the Contractor's responsibility and will need to be designed by a licensed Structural Engineer in the State of Illinois. The length of the reinforced soil mass from the outside face should be a minimum of 8 feet, but not less than 70% of the wall height. The length should be determined to satisfy eccentricity and sliding criteria and provide adequate length to prevent structural failure with respect to pullout and rupture of reinforcement. The MSE wall could be designed using a unit weight of 120 pcf and a minimum friction angle of 34 degrees for the reinforced backfill soil.

C. Prefabricated Modular Gravity Walls

This type of wall typically consists of interlocking soil or rock-filled concrete, steel, or wire modules or bins (such as gabions). The combined weight of the wall materials resists the lateral loads from the soil embankment being retained. This type of wall may be used where conventional reinforced concrete walls are also being considered but are typically selected when the overall wall height will be less than 25 feet.

The advantage of this type of wall is that less select fill is required for the backfill behind the wall and the construction is relatively more economical compared to other wall types; however, this type of wall may require additional soil excavation for placement of the modules. The additional cost of the excavations could be offset by the savings in construction costs and schedule as compared to other walls.

D. Soldier Pile and Lagging Walls

Soldier pile and lagging walls are typically used in cut areas where the existing ground surface needs to be maintained during construction or when a near vertical excavation is needed. The wall may be constructed with driven steel piles or steel piles placed in drilled holes and backfilled with concrete. The depth of the soldier pile is normally estimated to be two times the wall exposed height. Soldier piles are typically spaced at 8 to 10 foot on center and are faced with cast-in-place or precast concrete. Tie backs may be used to provide additional lateral resistance, if required. The installation of soldier pile walls requires the use of specialty equipment to drive the piles into the ground. To provide lateral resistance against the retained soil, the walls can be designed to act as a cantilever or can use tie backs behind the wall. The walls maintain the existing site conditions with minimal disturbance to existing structures and can be installed relatively quickly in most situations.

E. Recommended Wall Type

The retaining wall is considered a “fill” wall. GSG concurs with Benesch’ design selection of a MSE wall for this wall. GSG evaluated the global and external stability and settlement to determine the suitability of the retaining wall for this section of the project. The wall section should be analyzed to determine that adequate factors of safety relative to overturning failure. The contractor is responsible for providing detailed internal stability design for the wall. The wall should be designed, and constructed, in accordance with the proprietary contractor’s construction manual. The final wall design should be submitted to the structural design team for review prior to commencing construction of the wall.

4.2 Retaining Wall Design Recommendations

The engineering analyses performed for evaluation of the retaining wall options followed the current AASHTO Load and Resistance Factor Design (LRFD) Methodology as required by IDOT. LRFD methodology incorporates the use of load factors and resistance factors to account for uncertainty in applied loads and load resistance of structure elements separately. The AASHTO LRFD Bridge Design Specifications outline load factors and combinations for various strength, extreme event, service, and fatigue limit states. Section 11, which outlines geotechnical criteria for retaining walls, of the AASHTO specifications requires the evaluation of bearing resistance failure, lateral sliding, and overturning at the strength limit state and excessive vertical displacement, excessive lateral displacement, and overall stability at the service limit state. The selected wall should be also evaluated with respect to the collision load. **Table 6** outlines the load factors used in evaluation of the retaining wall in accordance with AASHTO Specification Tables 3.4.1-1 and 3.4.1-2.

Table 6 - LRFD Load Factors for Retaining Wall Analyses

	Type of Load	Sliding and Eccentricity Strength I	Bearing Resistance Strength I	Sliding and Eccentricity Extreme II	Bearing Resistance Extreme II	Settlement Service I
Load Factors for Vertical Loads	Dead Load of Structural Components (DC)	0.90	1.25	1.00	1.00	1.00
	Vertical Earth Pressure Load (EV)	1.00	1.35	1.00	1.00	1.00
	Earth Surcharge Load (ES)		1.50			
	Live Load Surcharge (LS)		1.75		0.50	1.00
Load Factors for Horizontal Loads	Horizontal Earth Pressure Load (EH) Active At-Rest AEP for anchored walls	1.50	 1.50 1.35 1.35	1.00	1.00	1.00
	Earth Surcharge (ES)	1.50	1.50			
	Live Load Surcharge (LS)	1.75	1.75	0.50	0.50	1.00
Load Factor for Vehicular Collision				1.00	1.00	

4.2.1 Lateral Earth Pressures and Loading

The wall should be designed to withstand earth and live lateral earth pressures. The lateral earth pressures on MSE walls should be determined in accordance with AASHTO 3.11.5.8. Earth loads of retained soils behind the MSE wall may be calculated using an active earth pressure coefficient, K_a, calculated using the Rankine Theory. **Table 7** presents soil design properties for the retaining wall for the anticipated soil types at this site.

Table 7 – Lateral Soil Parameters

Elevation Range (feet)	Soil Description	Long-term/Drained			Soil Parameters used in L-Pile		
		Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)	Coefficient of Lateral Modulus of Subgrade Reaction (k_{py}, pci)*	Soil Strain (ε_{50})	L-Pile Soil Type
	New Engineered Clay Fill	0.41	2.46	0.58	500	0.01	Stiff Clay w/o free water (Reese)
	New Engineered Granular Fill	0.33	3.00	0.50	90	N/A	Sand (Reese)
592-589	Brown and Gray Silty Clay Fill	0.41	2.46	0.58	1,400	0.005	Stiff Clay w/o free water (Reese)
589-578	Brown and Gray Medium Stiff to Hard Silty Clay	0.33	3.00	0.50	1,700	0.005	Stiff Clay w/o free water (Reese)
578-568	Gray Medium Dense to Very Dense Silty Loam	0.17	5.82	0.29	125	N/A	Sand (Reese)
589-583	Brown and Gray Sandy Gravel/Gravelly Loam	0.24	4.20	0.38	25	N/A	Sand (Reese)
578-573	Gray Medium Stiff Silty Clay	0.36	2.77	0.53	700	0.007	Stiff Clay w/o free water (Reese)

*The initial p-y modulus, E_{py} , varies linearly with depth. To obtain E_{py} use the equation $E_{py} = k_{py} * z$, where k_{py} is the coefficient of lateral Modulus of subgrade reaction given in the table and z is the distance from the surface to the center point of the layer in inches.

Traffic and other surcharge loads should be included in the retaining wall design as applicable. A live load surcharge shall be applied where vehicular load is expected to act on the surface of the backfill within a distance equal to one-half the wall height behind the back face of the wall in accordance with AASHTO 3.11.6.4. An equivalent height (H_{eq}) of two (2) feet of soil should be used for vehicular loadings on retaining walls.

The retaining walls design should include a drainage system to allow movement of any water behind the wall, and not allowing hydrostatic (seepage) pressures to develop in the active soil wedge behind the wall. This could be accomplished by placing a Geocomposite Wall Drain or open grade stone over the entire length of the back face of the wall connected to 4-inch diameter perforated drain pipe and backfilling a minimum of 2 feet of free draining materials, Porous Granular Embankment, as measured laterally from the back of the wall. The backfill should be placed in accordance with the IDOT Standard Specifications of Road and Bridge Construction (SSRBC). Heavy compaction equipment should not be allowed closer than five (5) feet to the retaining wall to prevent inducing high lateral earth pressures and causing wall yielding and/or other damage. The passive lateral earth pressure coefficient (Kp) from the upper 3.5 feet of level backfill at the toe of the wall should be neglected, unless the soil is confined or protected by a concrete slab or well drained pavement. The passive lateral earth pressure coefficient from the upper 3.5 feet of soil for a descending slope at the wall toe should also be neglected, regardless of any surface protection.

4.2.2 Bearing Resistance

It is anticipated that the MSE wall will bear on native clays, sand/gravel or suitable existing fill materials. Bearing resistance for the retaining wall founded shall be evaluated at the strength limit state using load factors (See **Table 6**), and factored bearing resistance. The bearing resistance factor, ϕ_b, for an MSE wall is 0.65 per AASHTO Table 11.5.7-1. The bearing resistance shall be checked for the extreme limit state with a resistance factor of 1.0. **Table 8** presents the proposed bearing elevation and recommended bearing resistances of suitable materials to support the wall system.

Table 8– Recommended Bearing Resistance

Station*	Elevation (feet)**	Nominal Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)	Bearing Resistance for 2-inch Settlement Service Limit (ksf)	Anticipated Bearing Soil
Sta. 4013+65 to Sta. 4015+80	584 to 590	10.7	7.0	1.7	4.6	Native Silty Clay/Existing Fill/Sandy Gravel /Granular Structural Fill

* Based on Seil Road Stationing

** Elevations estimated from GP&E dated 02/05/2020

The minimum depth of the wall leveling pad should be four (4) feet below the final exterior grade to alleviate the effects of frost. The subgrade soils encountered at the bearing elevation should be cleared of any unsuitable material, such as topsoil. Based on the results of the subsurface exploration, we anticipate the wall would be supported upon the soil types noted in **Table 8.**

4.2.3 Subgrade Undercut Areas

Based on the soil conditions along the wall alignment, it is anticipated that native silty clay with low unconfined compressive strength will be encountered near the bearing elevation between Station 4014+75 and 4015+50. When encountered, these soils are not generally considered suitable for foundation bearing and should be removed during construction. Cohesive materials exhibiting moisture contents greater than 27% and unconfined compressive strengths less than 1.0 tsf, if encountered should be removed during construction.

Table 9 – Potential Remedial Treatment Summary for Wall No.6

Station		Wall Height (feet)	Soil Description	Remedial Undercut		Reason for Undercut
From	To			Top Elevation (feet)	Depth (feet)	
4014+75	4015+50	12	Native Silty Clay	586.5	2.5	Qu < 1 tsf

Undercut areas should be replaced with granular structural fill in accordance with IDOT standard construction requirements. The lateral limit of the structural fill should extend a minimum of 1 foot beyond the edge of the MSE wall footing, then an additional 1 foot laterally for every 2 feet of structural fill depth as depicted in **Exhibit 3**. The granular structural fill should be placed and compacted to a minimum of 95% of the maximum dry density, as determined by AASHTO T-180: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures (ASTM D1557) in accordance with IDOT standard construction requirements.

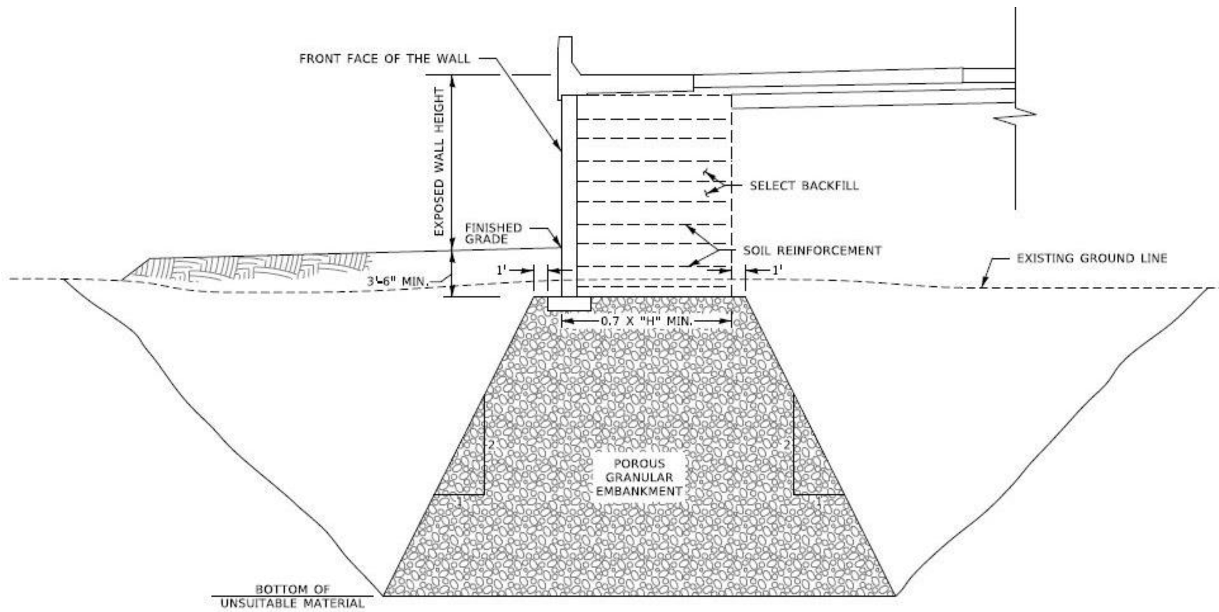


Exhibit 3 - Structural Fill Placement below MSE Wall

4.2.4 Sliding and Overturning Stability

The wall base width should be sufficient to resist sliding. The frictional resistance shall include the friction between granular backfill for the wall and supportive cohesive or granular soils, and the friction between the wall foundation and bearing soils.

The factored resistance against sliding should be calculated using equation 10.6.3.4-1 in the AASHTO LRFD manual. A sliding resistance factor, ϕ, of 1.0 (Table 11.5.7-1) shall be applied to the nominal sliding resistance of soil-on-soil beneath the MSE wall. A maximum frictional coefficient of 0.53 could be used for determining the sliding resistance for the soil to soil interfaces. The width of the MSE wall (length of the reinforcing) must be wide enough to resist overturning forces. The location of the resultant of the forces shall be within the middle two-thirds of the MSE base width.

4.2.5 Wall Embankment Settlement

Settlement of the MSE wall depends on the foundation size and bearing resistance, as well as the strength and compressibility characteristics of the underlying bearing soil. Assuming the foundation subgrade has been prepared as recommended above and the service bearing resistances for different station ranges as mentioned in **Table 8** are used, the settlement of the MSE wall will be on the order of 1 to 2 inches. Differential settlement between two points of 100 feet apart along the length of the wall will be 1 inch or less. AASHTO 11.10.4.1 provides guidelines regarding the maximum total and differential tolerable settlements for various facing of MSE walls. If appropriate facing is selected, no settlement issues are anticipated.

4.2.6 Overall Stability

The MSE wall should be designed for external stability of the wall system as well as the internal stability of the reinforced soil mass behind the wall facing. The wall contractor should confirm stability requirements based on the final wall configurations. The following parameters were used to evaluate the wall.

Table 10 – Wall Description: Sta. 4013+65 to Sta. 4015+80

*Based on GPE plan dated 02/05/2020

Maximum total retained height of the retaining wall (H)*	12.0 feet
Minimum length of reinforcement (0.7 *H)	9.0 feet
Unit weight of the retained soil (embankment)	120 pcf
Unit weight of the reinforced soil mass	120 pcf

*retained height is measured from the levelling pad

The actual wall width, and total height of the wall should be based on structural analysis performed by a Licensed Structural Engineer in the State of Illinois. The presence of the existing concrete retaining wall that is to remain in place should also be considered when determining the internal and global stability. The proximity of the wall and the impact on the required reinforcement length should be evaluated.

Slide 2018 is a comprehensive slope stability analysis software used to evaluate the proposed wall for the project based on the limit equilibrium method. The proposed wall was analyzed based on the preliminary grading and the soils encountered while drilling. A circular failure analyses were evaluated using the simplified Bishops analyses methods for the proposed wall geometry. The analyses were performed using the soil parameters in **Table 3**. Based on the proposed geometry and the soil borings, global stability analyses were performed.

4.2.7 Global Slope Stability Results

A circular failure analyses was evaluated for both a short term (undrained) and long term (drained) condition based on the proposed geometry for the proposed retaining wall and embankment. The analyses were performed at Station 4015+10 where the highest section of the wall is. The results of the analyses are shown in **Table 11**.

Table 11 – Retaining Wall Global Slope Stability Analyses Results

Analysis Exhibit	Station*	Analysis Type	Factor of Safety	Minimum Factor of Safety
Exhibit 4a	4015+10	Circular – Short Term	9.2	1.5
Exhibit 4b		Circular – Long Term	3.0	1.5

* Based on Seil Road Stationing

4.3 Drainage Recommendations

The wall should be designed to prevent the buildup of hydrostatic forces. This can be done with the construction of a base drain and back drain to collect and remove surface water away from the face of the wall. Geocomposite Wall Drain or open graded stone with a geotextile fabric system should be placed over the entire length of the back face of the wall.

5.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (2016). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Preparation

Based on the existing site conditions at the proposed wall location, it is anticipated that the existing retaining wall will be partially removed near the surface, to a depth of 1 foot below the new pavement and the remaining portion of the wall will be buried within the new embankment. All vegetation, landscaping, and surface topsoil should be cleared and removed from the vicinity of the proposed foundations. It is anticipated that topsoil stripping depths could be on the order of about 12 inches, with thicker areas possible in the lower lying areas. Where possible, the engineer may require proof-rolling of the subgrade with a 20 to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. The purpose of the proof-rolling is to locate soft, weak, or excessively wet soils present at the time of construction. Proof-rolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. Any unsuitable materials observed during the evaluation and proof-rolling operations should be undercut and replaced with compacted structural fill and/or stabilized in-place. The possible need for, and extent of, undercutting and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction. Once the site has been properly prepared, at grade construction may proceed.

Foundation aggregate fill should not be placed upon wet or frozen subgrade soils. If the subgrade or structural fill becomes frozen, desiccated, wet, disturbed, softened, or loose, the affected materials should be scarified, dried and moisture conditioned, and compacted to the full depth of the affected area or the soils should be removed. Rainfall and runoff can soften soils and affect the load bearing capacity of the soils. All water entering foundation excavation should be removed prior to placement backfill materials above the footings.

5.2 Existing Utilities

Before proceeding with construction, any existing utility lines that will interfere with construction should be completely relocated from beneath the proposed construction areas. Where possible, existing utility lines that are to be abandoned in place should be removed and/or plugged with a minimum of 2 feet of cement grout. All excavations resulting from underground utility removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

5.3 Site Excavation

Site excavations are expected to encounter various types of soils as described in the Subsurface Exploration section of this report. The contractor will be responsible to provide a safe excavation during the construction activities of the project. All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health Administration (OSHA) excavation safety standards. Excavation stability and soil pressures on temporary shoring are dependent on soil conditions, depth of excavations, installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures. Excavations should not extend below the level of adjacent existing foundations or utilities unless underpinning or other support is installed. It is the responsibility of the contractor for field determinations of applicable conditions and providing adequate shoring (if needed) for all excavation activities.

5.4 Borrow Material and Compaction Requirements

If borrow material is to be used for onsite construction, it should conform to Section 204 "Borrow and Furnish Excavations" of the IDOT Construction Manual (2016). The fill material should be free of organic matter and debris. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing of softening subgrade soils.

Structural fill shall consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or medium plasticity silty clays. Structural fill should be placed in lifts not to exceed 8 inches in loose thickness and compacted to a minimum of 95% of the material's standard proctor maximum dry density obtained according to the ASTM D698/AASHTO T 99 method.

Materials unsatisfactory for use as structural fill include soils classified as silt or organic silt (ML, MH, PT, OL, and OH) in the Unified Classification System (ASTM D2487). Soils with these classifications may be used for general purpose landscaping and in areas where uncontrolled settlement is acceptable.

Should fill be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult. If water seepage while excavating and backfilling procedures, or where wet conditions are encountered such that the water cannot be removed with conventional sump and pump procedures, GSG recommends placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation. The CA-7 stone should be placed to 12 inches above the water level, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation should be backfilled using approved engineered fill.

GSG recommends that foundation excavations, subgrade preparation, and structural fill placement and compaction be inspected by a GSG geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.

5.5 Groundwater Management

It is anticipated that the long-term water table could range between 572 and 583 feet. GSG does not anticipate groundwater related issues during construction activity; however, water may become perched in the fill material and granular layers encountered near the surface. If rainwater run-off or perched water is accumulated at the base of excavation, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.

If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed to 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation (IDOT) and its Design Section Engineer consultant. The recommendations provided in the report are specific to the project described herein and are based on the information obtained at the soil boring locations within the proposed retaining wall area. The analyses have been performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report may not reflect all variations that may occur between boring locations or at some other time, the nature and extent of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

APPENDIX A

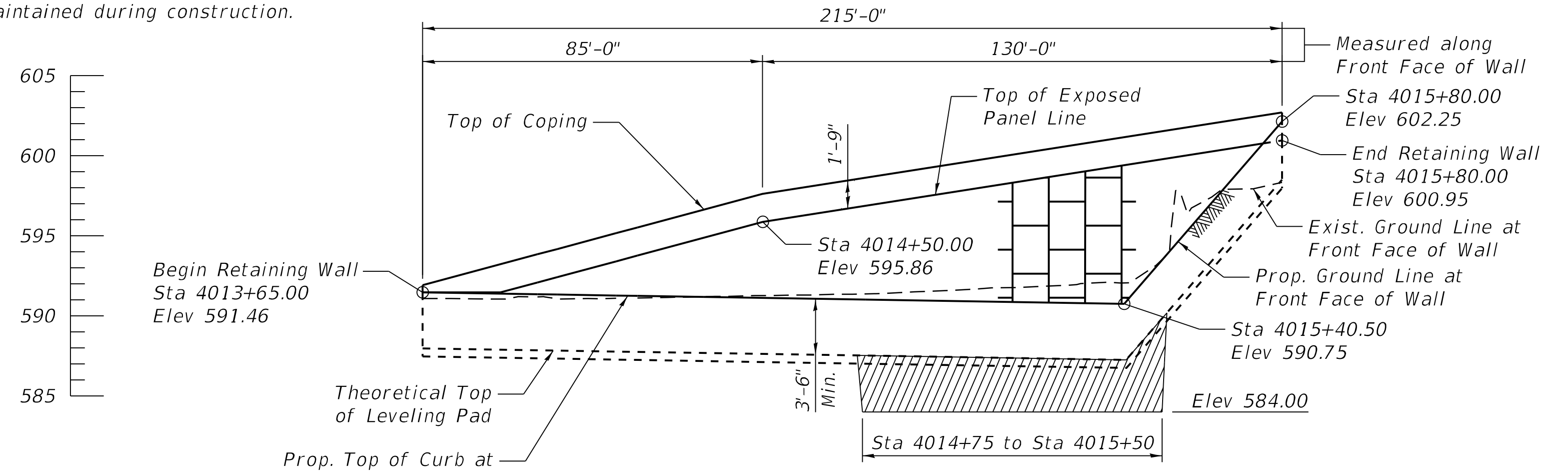
General Plans, Elevations, and Details

Benchmark: BM 302 set 2" diameter aluminum disc in bridge wall at NW corner of existing NB IL-59 ramp bridge over I-55. EL. 625.225.

Existing Structure: Existing Retaining Wall S.N. 099-W023 was constructed in 2008 under Project ACIM-055-6(232)255, Section (26, 26HB-1&114) R-2. The cantilevered, cast-in-place concrete retaining wall on spread footing is 153'-0" long and has a maximum height of 12'-10⅞" measured from top of wall to bottom of footing. The existing retaining wall is to be partially removed and buried behind the proposed wall.

Traffic on Seil Road is to be maintained during construction.

No Salvage.



ELEVATION

(Looking North at Front Face of Wall)

Indicates Zone of Removal and Disposal of Unsuitable Material for Structures and Replacement with Granular Backfill for Structures.

NOTES:

1. Stations and Offsets are Measured from Exist. ℄ Seil Road to the Front Face of the Retaining Wall.
2. See Sheet 2 for Typical Wall Section.

LEGEND

- A — Exist. Aerial Line
- G — Exist. Gas Line
- W — Exist. Water Line
- L — Exist. Lighting Line
- E — Exist. Electric Line
- FO — Exist. Fiber Optic Line
- T — Exist. Telephone Line
- CTV — Exist. Cable Television Line
- Exist. Sanitary Sewer
- Exist. Strom Sewer
- x — x — Exist. Fence
- Prop. Storm Sewer
- Prop. Inlet
- Prop. Catch Basin
- Prop. Manhole
- Prop. Soil Boring

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

IDOT Bridge Manual dated January 2012

HIGHWAY CLASSIFICATION

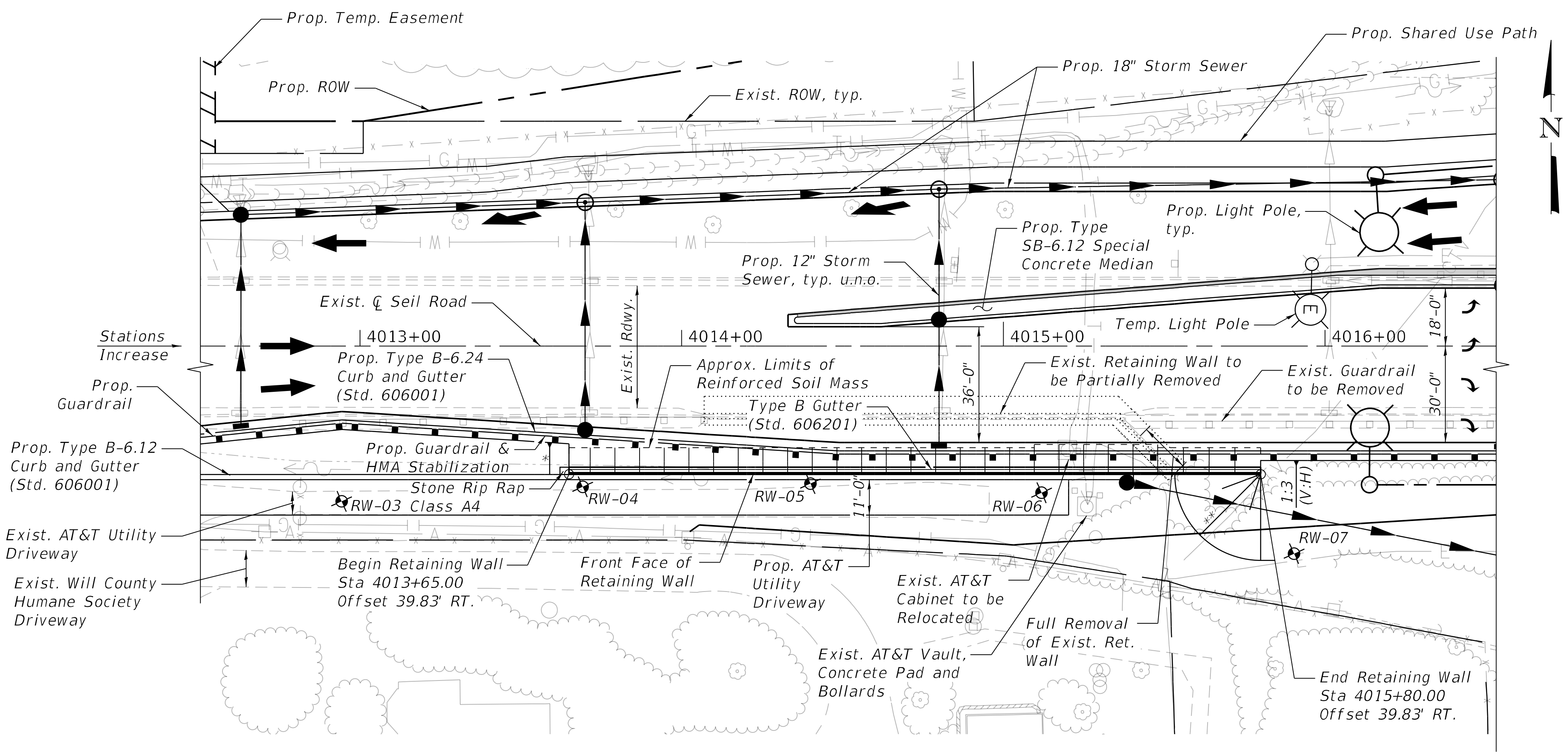
F.A.U. Route 403 – Seil Road
Functional Class: Major Collector
ADT: 10,900 (2016); 23,000 (2040)
DHV: 1,470 (2040)
ADTT: 10% (7% MU, 3% SU)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.

DESIGN STRESSES

FIELD UNITS	PRECAST UNITS
f'c = 3,500 psi	f'c = 4,500 psi
fy = 60,000 psi (Reinforcement)	

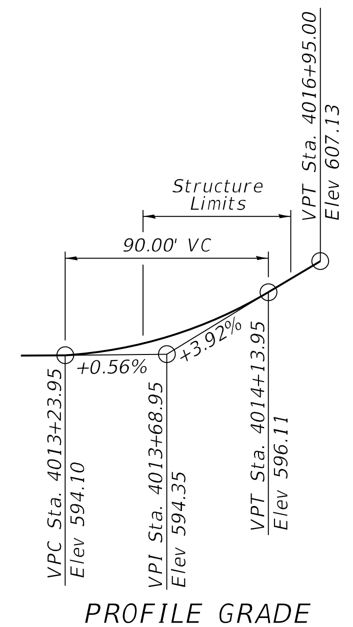
SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.068
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.127
Soil Site Class = C



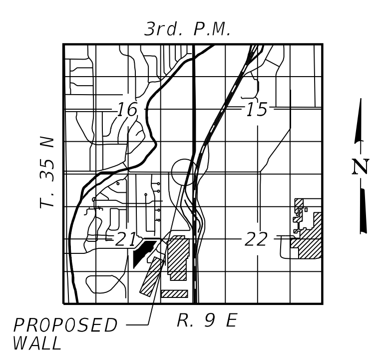
* 1:8 (V:H) & Var.
** ±1:3 (V:H)

PLAN



PROFILE GRADE

(6' Rt. Exist. ℄ Seil Road)



LOCATION SKETCH

GENERAL PLAN & ELEVATION
SEIL ROAD
F.A.U. RTE. 403 – SEC. 2018-075-R
WILL COUNTY
STATION 4013+65.00 TO 4015+80.00
STRUCTURE NO. W099-1004

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benesch
Alfred Benesch & Company
35 W Wacker Drive, Suite 3300
Chicago, Illinois 60601
312-565-0450 Job No. 10740

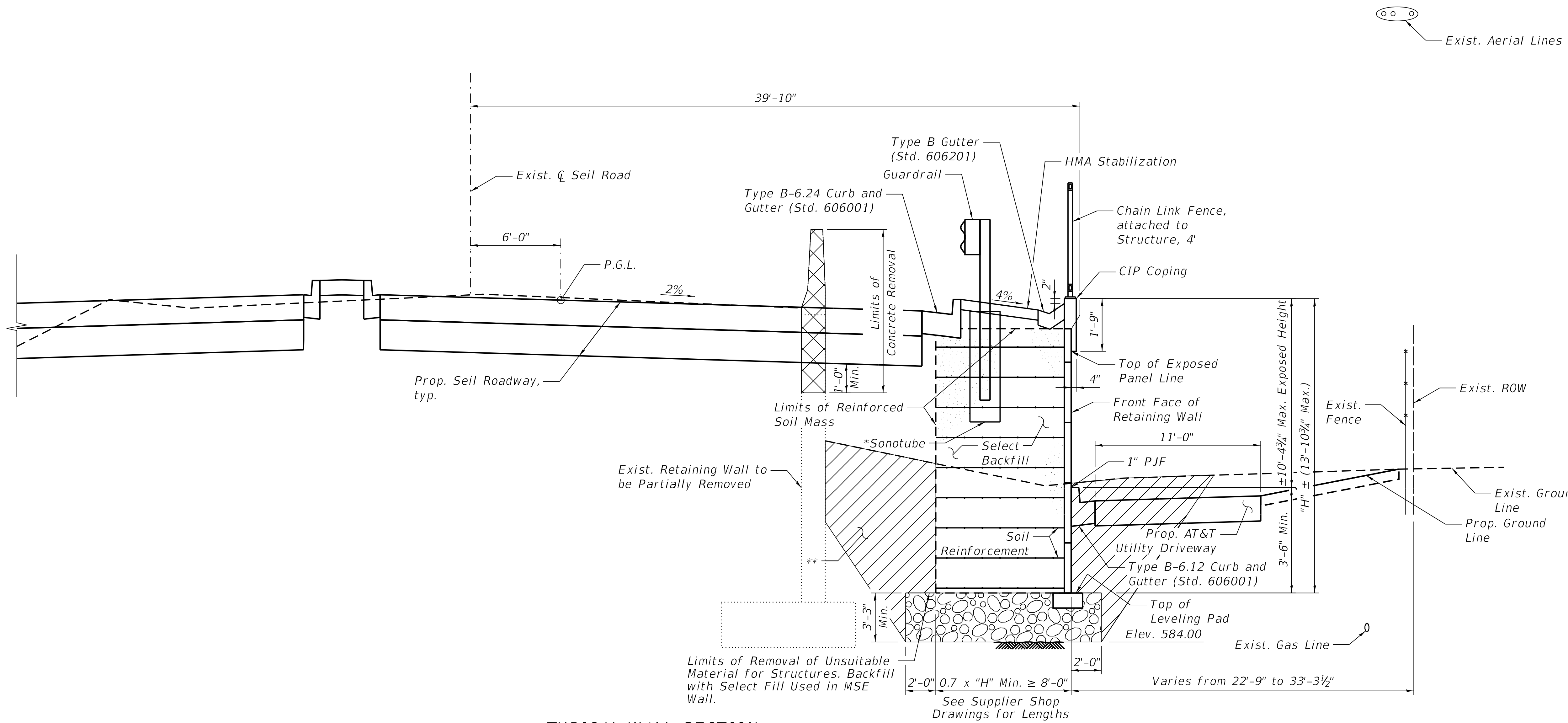
USER NAME = svaicik	DESIGNED - SLV	REVISED -
	CHECKED - KJN	REVISED -
PLOT SCALE =	DRAWN - SLV	REVISED -
PLOT DATE = 10/30/2020	CHECKED - KJN	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.I./P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
•	2018-075-R	WILL		
		CONTRACT NO. 62H15		

• FAI 55, FAP 338 | ILLINOIS | FED. AID PROJECT



TYPICAL WALL SECTION
(Looking East)

* Sonotubes shall be placed during the backfilling of the reinforced soil zone to allow for the installation of guardrail without damaging the soil reinforcement. Coordinate with roadway plans for location of guardrail post locations.

** Overexcavation beyond structure excavation and removal of unsuitable material. This area not measured for payment. Backfill overexcavation with same material used for select fill used in MSE wall, typ.

TYPICAL WALL SECTION
SEIL ROAD
F.A.U. RTE. 403 - SEC. 2018-075-R
WILL COUNTY
STATION 4013+65.00 TO 4015+80.00
STRUCTURE NO. W099-1004

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benesch Alfred Benesch & Company 35 W Wacker Drive, Suite 3300 Chicago, Illinois 60601 312-565-0450 Job No. 10740	USER NAME = svaicik	DESIGNED - SLV	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
		CHECKED - KJN	REVISED -	
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	PLOT DATE = 10/30/2020	CHECKED - KJN	REVISED -	

SHEET NO. 2 OF 2 SHEETS

F.A.I./P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
•	2018-075-R	WILL		
		CONTRACT NO. 62H15		
• FAI 55, FAP 338		ILLINOIS FED. AID PROJECT		

APPENDIX B

SOIL BORING LOCATION PLAN AND SUBSURFACE PROFILE

LEGEND

IDOT RETAINING WALL BORINGS BY WANG

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USER NAME	=	anieves		

GSG CONSULTANTS, INC.

USER NAME	=	anieves	DESIGNED	-	SI
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PLOT SCALE	=	1200.0000 ' / ft.	CHECKED	-	DE
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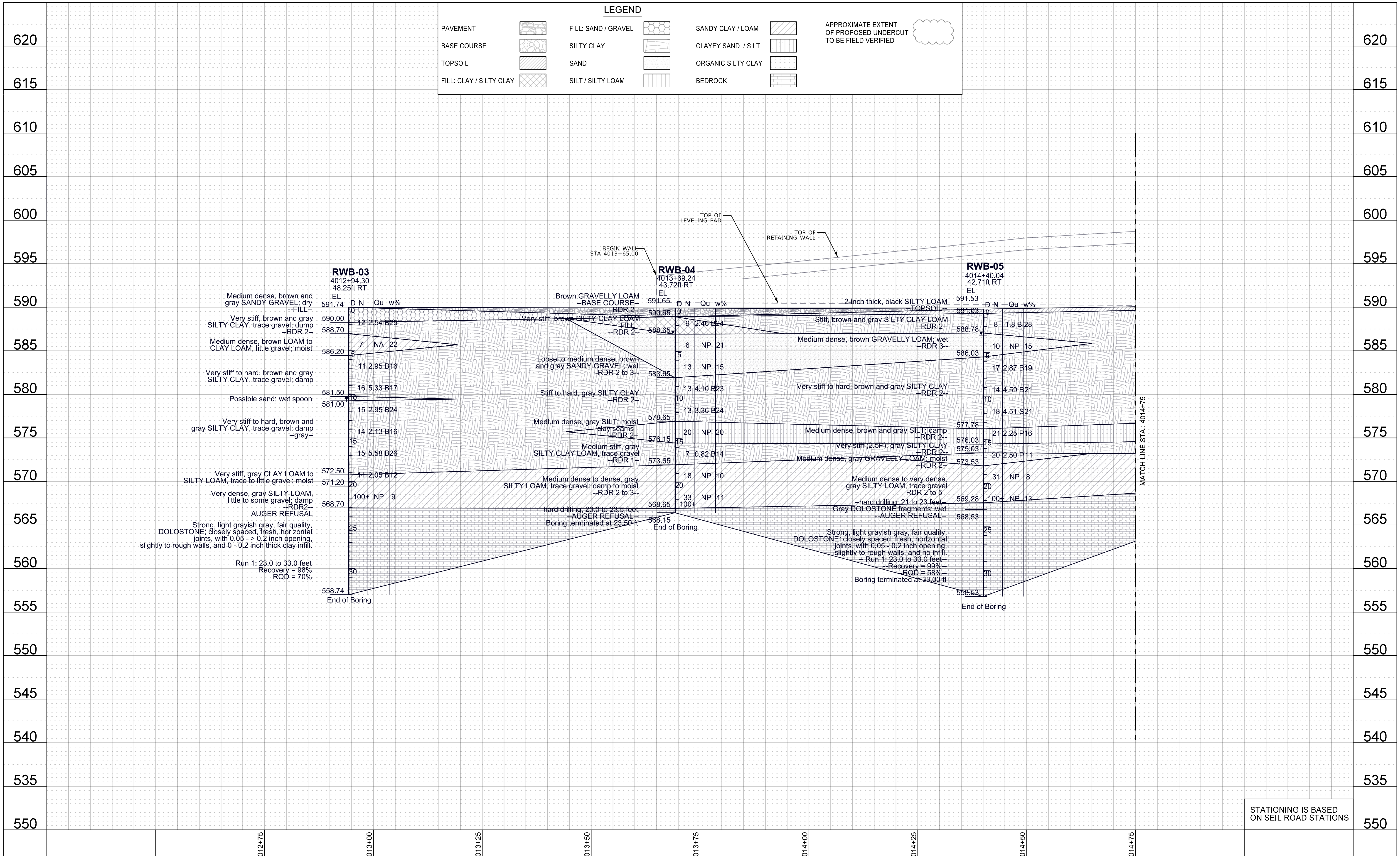
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CONTRACT NO. 189-011

I-55/ROUTE 59 WILL COUNTY
RETAINING WALL NO. 6 - SN: W099-1004 BORING LOCATION PLAN

SCALE: AS NOTED | SHEET 1 OF 1 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
I-55		WILL	3	1
		CONTRACT NO. 189-011		
	ILLINOIS	FED. AID PROJECT		



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GSG CONSULTANTS, INC.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CONTRACT NO. 189-011
I-55/ROUTE 59 WILL COUNTY
RETAINING WALL NO. 6 - SN: W099-1004 BORING LOCATION PROFILE
SCALE: AS NOTED | SHEET 1 OF 2 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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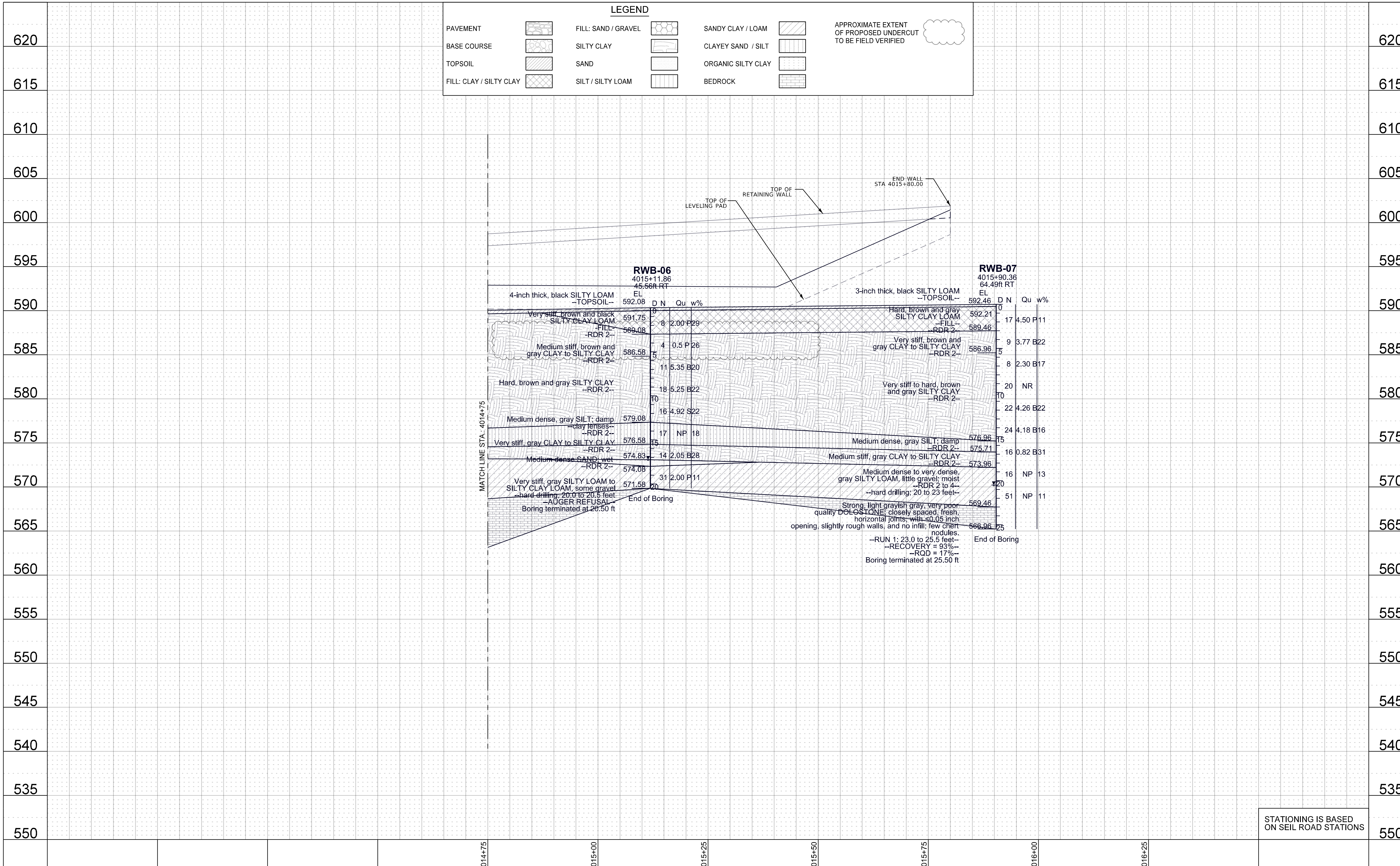
		ILLINOIS	FED. AID PROJECT	



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GSG CONSULTANTS, INC.
Engineers, Scientists & Construction Managers

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PLOT DATE = 10/29/2020		DATE - 04/15/2020	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CONTRACT NO. 189-011
I-55/ROUTE 59 WILL COUNTY
RETAINING WALL NO. 6 - SN: W099-1004 BORING LOCATION PROFILE

SCALE: AS NOTED | SHEET 2 OF 2 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
I-55		WILL	3	3
		CONTRACT NO. 189-011		

ILLINOIS | FED. AID PROJECT

APPENDIX C

SOIL BORING LOGS

Wang Engineering

wangeng@wangeng.com
1145 N MAin Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG RW-03

WEI Job No.: 555-16-04

Client: **IDOT**
Project: **I-55 at IL 59**
Location: **Will County, IL**

Datum: NAVD 88
Elevation: 591.74 ft
North: 1762916.40 ft
East: 1020464.67 ft
Station: 4012+94.30
Offset: 48.25 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	Medium dense, brown and gray SANDY GRAVEL; dry --FILL--					
590.0	Very stiff, brown and gray SILTY CLAY, trace gravel; damp --RDR 2--		1	5 6 6	2.54 B	25
588.7	Medium dense, brown LOAM to CLAY LOAM, little gravel; moist	5	2	3 3 4	NA	22
586.2	Very stiff to hard, brown and gray SILTY CLAY, trace gravel; damp --RDR 2--		3	3 5 6	2.95 B	16
		10	4	3 6 10	5.33 B	17
581.5	Possible sand; wet spoon					
581.0	Very stiff to hard, brown and gray SILTY CLAY, trace gravel; damp --RDR 2--		5	3 6 9	2.95 B	24
	--gray--	15	6	3 6 8	2.13 B	16
	--1 to 3-inch thick silt lenses--		7	7 7 8	5.58 B	26
572.5	Very stiff, gray CLAY LOAM to SILTY LOAM, trace to little gravel; moist	20	8	3 4 10	2.05 B	12
571.2	Very dense, gray SILTY LOAM, little to some gravel; damp --RDR 2--		9	14 15 50/3"	NP	9
568.7	--AUGER REFUSAL--					
	Strong, light grayish gray, fair quality, DOLOSTONE; closely spaced, fresh, horizontal joints, with 0.05 - > 0.2 inch opening, slightly to rough walls, and 0 - 0.2 inch thick clay infill. --RUN 1: 23.0 to 33.0 feet-- --RECOVERY = 98%-- --RQD = 70%--	25, 30	10	CORE		
558.7	Boring terminated at 33.00 ft	35, 40, 45, 50				

GENERAL NOTES

Begin Drilling **10-03-2018** Complete Drilling **10-03-2018**
Drilling Contractor **Wang Testing Services** Drill Rig **17D50T [81%]**
Driller **J&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" ID HSA; auto hammer; boring grouted backfilled**

WATER LEVEL DATA

While Drilling **10.75 ft**
At Completion of Drilling **23.00 ft**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

BORING LOG RW-04

Wang Engineering
wangeng@wangeng.com
1145 N MAin Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

WEI Job No.: 555-16-04

Client: **IDOT**
Project: **I-55 at IL 59**
Location: **Will County, IL**

Datum: NAVD 88
Elevation: 591.65 ft
North: 1762921.55 ft
East: 1020539.57 ft
Station: 4013+69.24
Offset: 43.72 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	Brown GRAVELLY LOAM --BASE COURSE--					
590.6	--RDR 2-- Very stiff, brown SILTY CLAY LOAM		1	2 4 5	2.46 B	24
588.6	--FILL-- --RDR 2-- Loose to medium dense, brown and gray SANDY GRAVEL; wet --RDR 2 to 3--	5	2	2 2 4	NP	21
			3	5 6 7	NP	15
583.6	Stiff to hard, gray SILTY CLAY --RDR 2--	10	4	3 5 8	4.10 B	23
	--silt lenses--		5	5 5 8	3.36 B	24
578.6	Medium dense, gray SILT; moist --clay seams-- --RDR 2--	15	6	4 8 12	NP	20
576.1	Medium stiff, gray SILTY CLAY LOAM, trace gravel --RDR 1--		7	2 3 4	0.82 B	14
573.6	Medium dense to dense, gray SILTY LOAM, trace gravel; damp to moist --RDR 2 to 3--	20	8	3 7 11	NP	10
			9	11 16 17	NP	11
568.1	--hard drilling, 23.0 to 23.5 feet-- --AUGER REFUSAL-- Boring terminated at 23.50 ft	25	10	50/1"	NR	

GENERAL NOTES

Begin Drilling **10-03-2018** Complete Drilling **10-04-2018**
Drilling Contractor **Wang Testing Services** Drill Rig **13CME55T [85%]**
Driller **N&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" ID HSA; auto hammer; boring grouted backfilled**

WATER LEVEL DATA

While Drilling ▽ **3.00 ft**
At Completion of Drilling ▼ **10.50 ft**
Time After Drilling **24 hours**
Depth to Water ▼ **4.50 ft**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering

wangeng@wangeng.com
1145 N MAin Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG RW-05

WEI Job No.: 555-16-04

Client: **IDOT**
Project: **I-55 at IL 59**
Location: **Will County, IL**

Datum: NAVD 88
Elevation: 591.53 ft
North: 1762923.14 ft
East: 1020610.35 ft
Station: 4014+40.04
Offset: 42.71 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
591.4	2-inch thick, black SILTY LOAM --TOPSOIL--					
	Stiff, brown and gray SILTY CLAY LOAM --RDR 2--		1	3 4 4	1.80 B	28
588.8	Medium dense, brown GRAVELLY LOAM; wet --RDR 3--		2	4 5 5	NP	15
		5				
586.0	Very stiff to hard, brown and gray SILTY CLAY --RDR 2--		3	4 7 10	2.87 B	19
			4	3 6 8	4.59 B	21
		10				
	--silt lenses--		5	4 7 11	4.51 S	21
577.8	Medium dense, brown and gray SILT; damp --RDR 2--	15	6	4 8 13	2.25 P	16
576.0	Very stiff (2.5P), gray SILTY CLAY --RDR 2--					
575.0	Medium dense, gray GRAVELLY LOAM; moist --RDR 2--		7	3 11 9	2.50 P	11
573.5	Medium dense to very dense, gray SILTY LOAM, trace gravel --RDR 2 to 5--	20	8	10 12 19	NP	8
	--hard drilling; 21 to 23 feet--		9	5 31 50/4"	NP	13
569.2	Gray DOLOSTONE fragments; wet --AUGER REFUSAL--					
568.5	Strong, light grayish gray, fair quality, DOLOSTONE; closely spaced, fresh, horizontal joints, with 0.05 - 0.2 inch opening, slightly to rough walls, and no infill. -- Run 1: 23.0 to 33.0 feet-- --Recovery = 99%-- --RQD = 58%--	25	1	CORE		
		30				
558.5	Boring terminated at 33.00 ft					
		35				
		40				
		45				
		50				

GENERAL NOTES

Begin Drilling **10-03-2018** Complete Drilling **10-03-2018**
Drilling Contractor **Wang Testing Services** Drill Rig **13CME55T [85%]**
Driller **N&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" ID HSA; auto hammer; boring grouted backfilled**

WATER LEVEL DATA

While Drilling ∇ **3.00 ft**
At Completion of Drilling ▼ **16.00 ft**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types: the actual transition may be gradual.

Wang Engineering
wangeng@wangeng.com
1145 N MAin Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG RW-06

WEI Job No.: 555-16-04

Client: **IDOT**
Project: **I-55 at IL 59**
Location: **Will County, IL**

Datum: NAVD 88
Elevation: 592.08 ft
North: 1762920.90 ft
East: 1020682.20 ft
Station: 4015+11.86
Offset: 45.56 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
591.7	4-inch thick, black SILTY LOAM --TOPSOIL--					
	Very stiff, brown and black SILTY CLAY LOAM --FILL-- --RDR 2--		1	3 3 5	2.00 P	29
589.1	Medium stiff, brown and gray CLAY to SILTY CLAY --RDR 2--	5	2	4 2 2	0.50 P	26
586.6	Hard, brown and gray SILTY CLAY --RDR 2--		3	3 4 7	5.35 B	20
		10	4	4 8 10	5.25 B	22
			5	2 6 10	4.92 S	22
579.1	Medium dense, gray SILT; damp --clay lenses-- --RDR 2--	15	6	3 8 9	NP	18
576.6	Very stiff, gray CLAY to SILTY CLAY --RDR 2--		7	3 3 11	2.05 B	28
574.8	Medium dense SAND; wet --RDR 2--					
574.1	Very stiff, gray SILTY LOAM to SILTY CLAY LOAM, some gravel	20	8	4 6 25	2.00 P	11
571.6	--hard drilling, 20.0 to 20.5 feet-- --AUGER REFUSAL-- Boring terminated at 20.50 ft	25				

GENERAL NOTES

Begin Drilling **10-03-2018** Complete Drilling **10-03-2018**
Drilling Contractor **Wang Testing Services** Drill Rig **13CME55T [85%]**
Driller **N&K** Logger **F. Bozga** Checked by **C. Marin**
Drilling Method **3.25" ID HSA; auto hammer; boring grouted backfilled**

WATER LEVEL DATA

While Drilling ▽ **17.25 ft**
At Completion of Drilling ▼ **DRY**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering

wangeng@wangeng.com
1145 N MAin Street
Lombard, IL 60148
Telephone: (630) 953-9928
Fax: (630) 953-9938

BORING LOG RW-07

WEI Job No.: 555-16-04

Client: **IDOT**
Project: **I-55 at IL 59**
Location: **Will County, IL**

Datum: NAVD 88
Elevation: 592.46 ft
North: 1762902.62 ft
East: 1020760.85 ft
Station: 4015+90.36
Offset: 64.49 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
592.2	3-inch thick, black SILTY LOAM --TOPSOIL--					
	Hard, brown and gray SILTY CLAY LOAM --FILL-- --RDR 2--		1	8 9 8	> 4.50 P	11
589.5	Very stiff, brown and gray CLAY to SILTY CLAY --RDR 2--	5	2	3 4 5	3.77 B	22
587.0	Very stiff to hard, brown and gray SILTY CLAY --RDR 2--		3	2 3 5	2.30 B	17
		10	4	6 9 11	NR	
			5	6 9 13	4.26 B	22
	-- silt lenses; moist--	15	6	7 10 14	4.18 B	16
577.0	Medium dense, gray SILT; damp --RDR 2--					
575.7	Medium stiff, gray CLAY to SILTY CLAY --RDR 2--		7	10 8 8	0.82 B	31
574.0	Medium dense to very dense, gray SILTY LOAM, little gravel; moist --RDR 2 to 4-- --hard drilling, 20 to 23 feet--	20	8	4 10 6	NP	13
			9	5 11 40	NP	11
569.5	Strong, light grayish gray, very poor quality DOLOSTONE; closely spaced, fresh, horizontal joints, with <0.05 inch opening,	25	1	COR		
567.0	slightly rough walls, and no infill; few chert nodules. --RUN 1: 23.0 to 25.5 feet-- --RECOVERY = 93%-- --RQD = 17%--			E		
	Boring terminated at 25.50 ft	30				

GENERAL NOTES

Begin Drilling: **09-25-2018** Complete Drilling: **09-25-2018**
Drilling Contractor: **Wang Testing** Drill Rig: **D25 ATV [93%]**
Driller: **N&K** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **3.25" ID HSA; auto hammer; boring grouted backfilled**

WATER LEVEL DATA

While Drilling: **20.50 ft**
At Completion of Drilling: **21.50 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

0 6 inches

Boring RW-03:
Run #1, 23.0' to 33.0'
RECOVERY=98%
RQD=70%

BEDROCK CORE: I-55 AT IL-59 INTERCHANGE IMPROVEMNETS, WILL COUNTY, ILLINOIS		
SCALE: GRAPHICAL	APPENDIX B-6	DRAWN BY: J. Rowells CHECKED BY: M. Kothawala
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR IDOT, DISTRICT ONE		555-16-04

0 6 inches

Boring RW-05:
Run #1, 23.0' to 33.0'
RECOVERY=99%
RQD=58%

BEDROCK CORE: I-55 AT IL-59 INTERCHANGE IMPROVEMENTS, WILL COUNTY, ILLINOIS		
SCALE: GRAPHICAL	APPENDIX B-7	DRAWN BY: J. Rowells CHECKED BY: M. Kothawala
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR IDOT, DISTRICT ONE		555-16-04

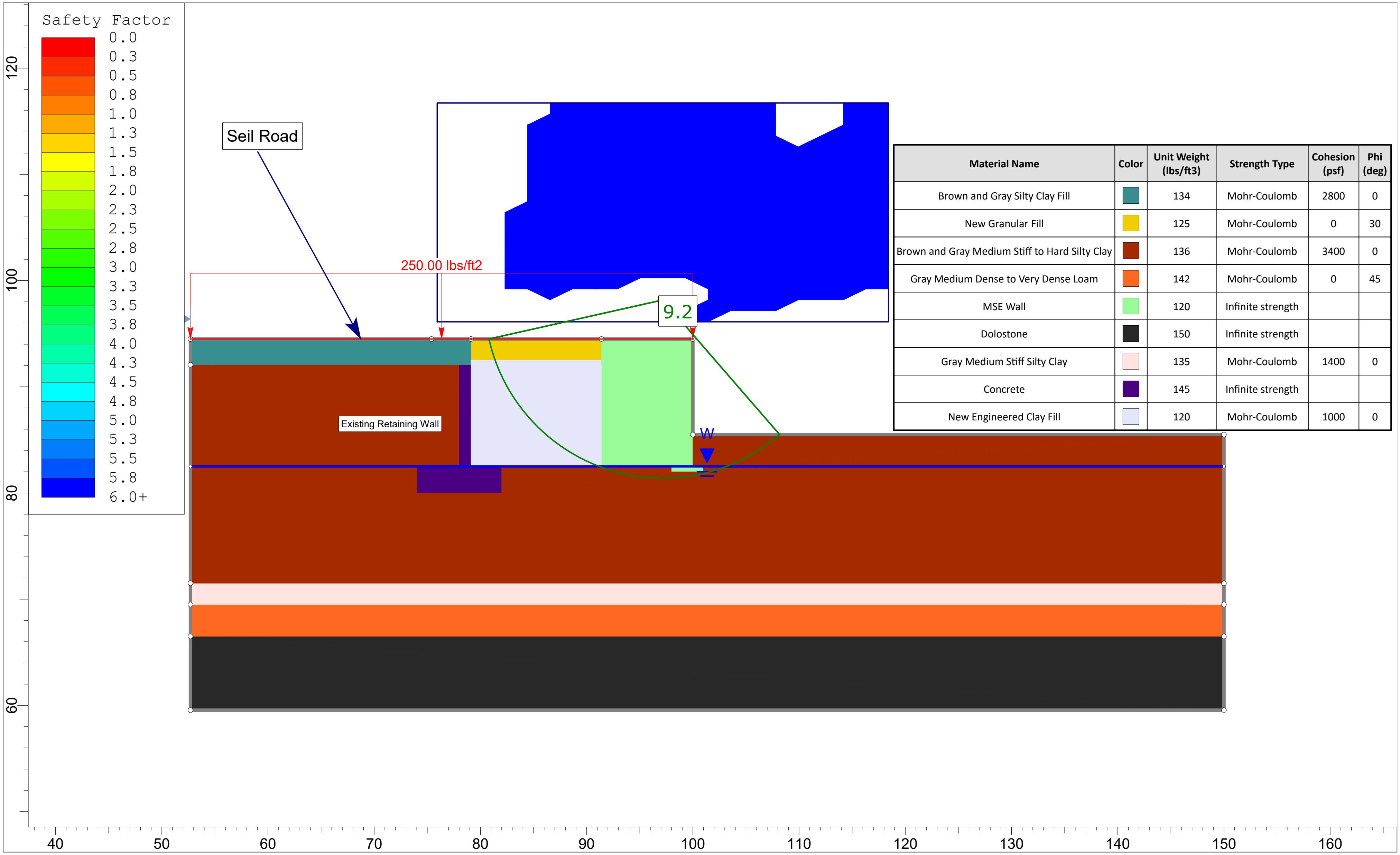
0 6 inches

Boring RW-07:
Run #1, 23.0' to 25.5'
RECOVERY=93%
RQD=17%

BEDROCK CORE: I-55 AT IL-59 INTERCHANGE IMPROVEMENTS, WILL COUNTY, ILLINOIS		
SCALE: GRAPHICAL	APPENDIX B-8	DRAWN BY: J. Rowells CHECKED BY: M. Kothawala
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR IDOT, DISTRICT ONE		555-16-04

APPENDIX D

SLOPE STABILTY ANALYSIS

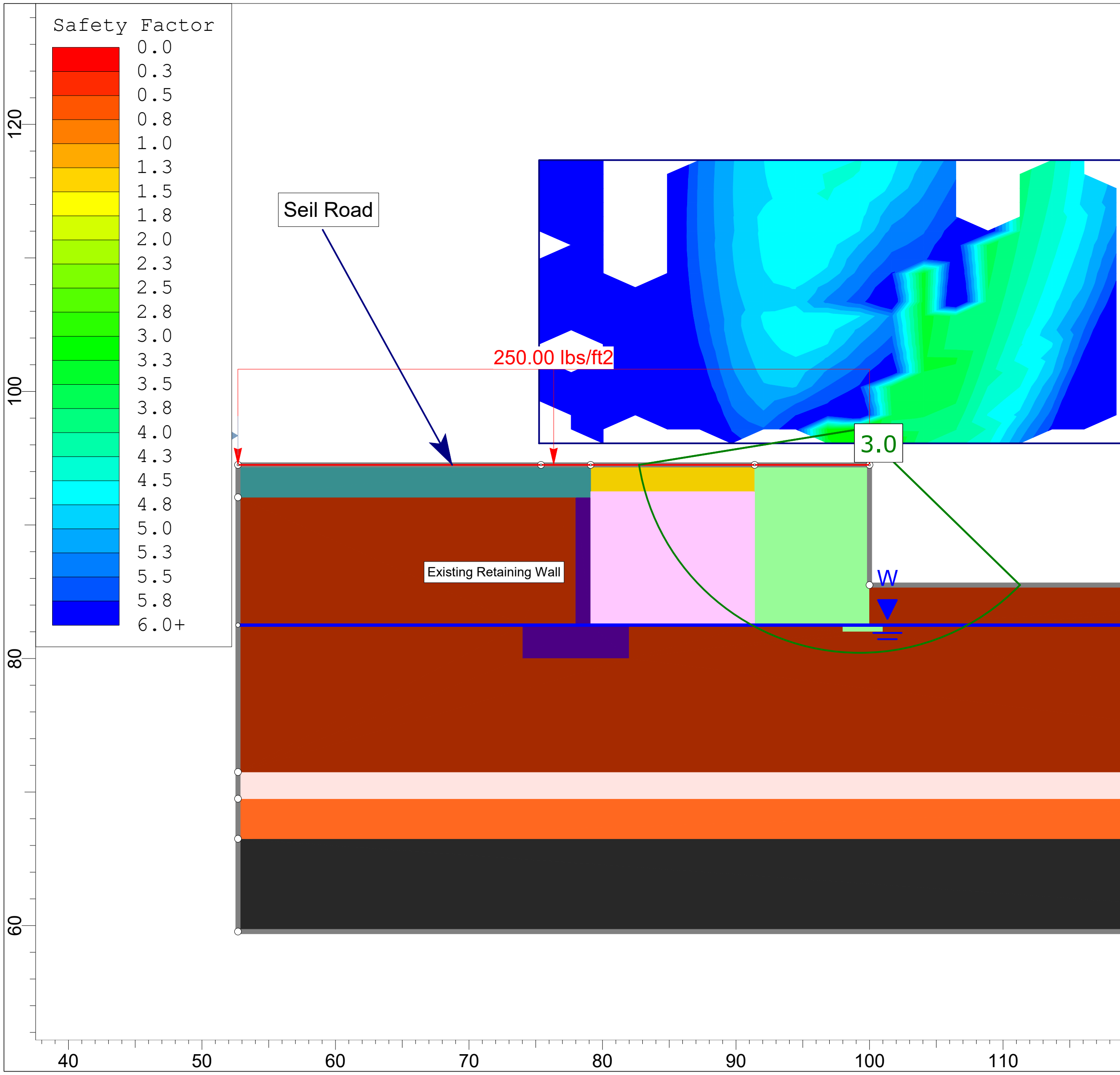


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Brown and Gray Silty Clay Fill		134	Mohr-Coulomb	2800	0
New Granular Fill		125	Mohr-Coulomb	0	30
Brown and Gray Medium Stiff to Hard Silty Clay		136	Mohr-Coulomb	3400	0
Gray Medium Dense to Very Dense Loam		142	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		
Dolostone		150	Infinite strength		
Gray Medium Stiff Silty Clay		135	Mohr-Coulomb	1400	0
Concrete		145	Infinite strength		
New Engineered Clay Fill		120	Mohr-Coulomb	1000	0

GSG CONSULTANTS, INC.
ENGINEERS • SCIENTISTS • CONSTRUCTION MANAGERS
623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612
www.gsg-consultants.com

SLIDEINTERPRET 8.021

Project	Contract IDOT\189-011 Wall #6
Analysis Description	Exhibit 4a: Circular Failure Short Term - Undrained
Drawn By	SI
Scale	1:150
Company	GSG Consultants, Inc.
Date	03/27/2020
File Name	Wall 6 short term4015+10



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Brown and Gray Silty Clay Fill		134	Mohr-Coulomb	280	25
New Engineered Granular Fill		125	Mohr-Coulomb	0	30
Brown and Gray Medium Stiff to Hard Silty Clay		136	Mohr-Coulomb	340	30
Gray Medium Dense to Very Dense Loam		142	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		
Dolostone		150	Infinite strength		
Gray Medium Stiff Silty Clay		135	Mohr-Coulomb	140	28
Concrete		145	Infinite strength		
New Engineered Clay FIll		120	Mohr-Coulomb	100	25

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SLIDEINTERPRET 8.021

Project	Contract IDOT\189-011 Wall #6
Analysis Description	Exhibit ba: Circular Failure long Term - Drained
Drawn By	SI
Scale	1:150
Company	GSG Consultants, Inc.
Date	04/13/2020
File Name	Wall 6 long term4015+10