Structural Geotechnical Report

Proposed Retaining Wall #3
IDOT PTB 198-003
FAI-80 over Des Plaines River Bridge
Will County, Illinois

Prepared for

Illinois Department of Transportation
Contract Number: D-91-204-19

Project Design Engineer Team
WSP USA

Geotechnical Consultant

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June 7, 2024

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Proposed Retaining Wall #3
FAI-80 over Des Plaines River Bridge
Will County, IL
PTB 198-003

Dear Mr. Skaleski:

Attached is a copy of the Structural Geotechnical Report for the above referenced project. The report provides a description of the site investigation, site conditions, and foundation and construction recommendations. The site investigation for the proposed retaining wall included advancing three (3) soil borings to depths between 13 and 14.5 feet.

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

Sincerely,

Rachel Miller, P.E.
Project Engineer

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

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1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for the proposed retaining wall #3 as part of the FAI-80 over Des Plaines project in the City of Joliet in Will County, Illinois. The purpose of the investigation was to explore the subsurface conditions, to determine engineering properties of the subsurface soil, and develop design and construction recommendations for the proposed retaining wall. **Exhibit 1** shows the general project location.

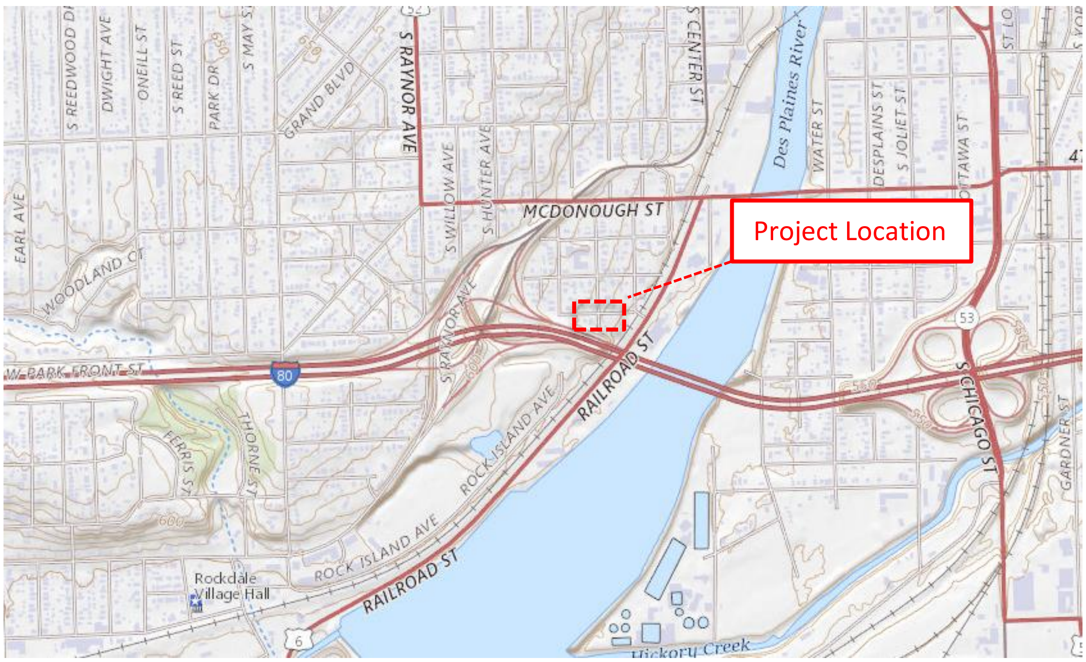


Exhibit 1 – Project Location Map

1.1 Existing Conditions

The proposed Retaining Wall #3 will support a new embankment that creates a cul-de-sac at Market Street and Shelby Street. According to the Center Street Ramp C Roadway Profile and Cross Sections drawings provided, the proposed Retaining Wall #3 will primarily be a fill section for the newly constructed Ramp C embankment. The proposed wall will be constructed within the residential area to the north of I-80 where there is a lack of right of way for the new embankment due to the proximity of the residences. Some utilities and sewer manholes were observed in the existing streets that will be near the proposed new embankment and wall alignment. **Exhibits 2a and 2b** show the existing conditions where the proposed retaining wall will be constructed.

Exhibit 2a – Existing Shelby Street, Looking West

Exhibit 2b – Proposed Project Area, Aerial

1.2 Proposed Retaining Wall Information

Based on the TSL provided by WSP, dated February 7, 2024 (see **Appendix A**) and a review of site topography, the proposed wall will be in a fill section along the newly constructed Ramp C embankment. It is understood the Ramp C embankment and Ret Wall #3 will be constructed during the same construction stage. Retaining Wall #3 will have a maximum total wall height of up to approximately 25.93 feet, bearing at about 3.5 feet below grade with a maximum exposed height of 22.43 feet. The proposed retaining wall will be approximately 217 feet in length and is anticipated to be a MSE wall with two kink points. **Table 1** presents a summary of the proposed structure.

Table 1 – Preliminary Retaining Wall Summary

Wall Name	Wall Stations*	Approximate Length (ft)	Maximum Anticipated Wall Height (ft)
Retaining Wall #3	Sta. 5+73 to Sta. 7+75	217	25.93

* Based on Ramp C stationing

A separate Roadway Geotechnical Report will be prepared for the design and construction recommendations of the new Ramp C embankment.

2.0 SITE SUBSURFACE CONDITIONS

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The proposed locations and depths of the soil borings were selected in accordance with IDOT requirements and reviewed with WSP based on the preliminary Phase 1 plans. Based on the final wall height and length in the TSL, two additional soil borings are needed along the retaining wall alignment and will be completed once access is available. The borings were completed in the field based on field conditions and accessibility.

2.1 Subsurface Exploration and Laboratory Testing

The site subsurface exploration for the proposed retaining wall structure was conducted between October 19 and 26, 2022. The investigation included advancing three (3) borings along the proposed alignment to depths between 13.0 and 14.5 feet, including 10-foot rock cores. Borings RWB-25, RWB-26 and RWB-27 were terminated upon encountering difficult drilling conditions and auger refusal. The locations of these soil borings were adjusted in the field as necessary based on utilities and access. Elevations and as-drilled locations for the borings were gathered by GSG's field crew using GPS surveying equipment. The approximate as-drilled locations of the soil borings are shown on the Soil Boring Location Plan & Subsurface Profiles **(Appendix B)**. **Table 2** presents a summary of the borings completed to date for the proposed retaining wall analysis. Additional borings will be completed when access is available.

Table 2 – Summary of Subsurface Exploration Borings

Boring ID	Station †	Offset (ft) †	Northing	Easting	Depth (ft)	Surface Elevation (ft)
RWB-25	6+98.27	23.50 RT	1765334.588	1049599.915	14.5*	564.79
RWB-26	6+68.54	8.90 RT	1765312.931	1049624.975	13.0**	562.55
RWB-27	6+12.11	46.92 RT	1765335.402	1049689.205	14.5*	559.51

* Depth includes Bedrock Core (10 feet)

** Terminated upon encountering practical auger refusal

† Based on the proposed I-80 Stationing

Copies of the Soil Boring Logs are provided in **Appendix C**.

The soil borings were drilled using truck mounted Diedrich D-50 (hammer efficiency 96%), and Mobile B-57 (hammer efficiency 89%) drill rigs, each equipped with 3¼-inch I.D. hollow stem augers and an automatic hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to the boring termination depths or auger refusal on bedrock. Water level measurements were made in each boring when evidence of free groundwater was detected on the drill rods or in the samples. The boreholes were also checked for free water immediately after auger removal, and before filling the open boreholes with soil cuttings and surface patching with asphalt where necessary to match the existing pavement.

GSG's field representative inspected, visually classified, and logged the soil samples during the subsurface exploration activities and performed unconfined compressive strength tests on cohesive soil samples using a calibrated Rimac compression tester and a calibrated hand penetrometer in accordance with IDOT procedures and requirements. Representative soil samples were collected from each sample interval and were placed in jars and returned to the laboratory for further testing and evaluation.

2.2 Subsurface Bedrock Conditions

GSG collected rock core runs from two of the soil borings with the use of either a five-foot or a ten-foot, diamond bit, NX-5 split core barrel during the investigation. The bedrock cores were evaluated in the field for texture, physical condition, recovery percentage, and Rock Quality Designation (RQD). The extracted bedrock cores were visually inspected, classified and the Rock Quality Designation (RQD) was determined according to ASTM D 6032, "Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core" and as per the IDOT geotechnical manual by totaling all sections with a length in excess of four inches (4") and dividing it by the total length of the core run. The RQD is given a classification based upon the numeric value as indicated in **Table 3**. Photographs of the rock cores are included with the respective soil borings in **Appendix C**.

Table 3 – Rock Quality Designation Summary

Rock Quality Designation (RQD)	Descriptions
< 25%	Very Poor
25 – 50%	Poor
51 – 75%	Fair
76 – 90%	Good
91 – 100%	Excellent

Table 4 provides the RQD values of the rock cores extracted during the site investigation. Photographs of the cores are included with the boring logs in **Appendix C**.

Table 4 – Rock Core Summary and Classification

Boring Number	Length (ft)	Core Depth (feet)	Type of Rock	RQD (%)	RQD Description	Depth (ft)/ Compressive Strength (psi)
RWB-25	10	4.5 – 14.5	Limestone	37.1	Poor	6.5-7.0/11,044
RWB-27	5	4.5 – 9.5	Limestone	20.8	Very Poor	N/A
	5	9.5 – 14.5	Limestone	70.0	Fair	11.5-12.0/18,882

2.3 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area. The following laboratory tests were performed on representative soil and rock samples:

- Moisture Content – ASTM D2216 / AASHTO T-265
- Unconfined Compression Strength on Rock – ASTM D2938

The laboratory tests were performed in accordance with test procedures outlined in the most current IDOT Geotechnical Manual, and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are shown along with the field test results in the Soil Boring Logs **(Appendix C)** and in the Laboratory Results (**Appendix D)**.

2.4 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. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the soil boring logs and are shown graphically in the Boring Location Plan & Subsurface Profiles. The soil boring logs provide specific conditions encountered at each boring location and include soil descriptions, stratifications, penetration resistance, elevations, location of the samples, and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The 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 559.5 and 564.8 feet. The borings initially encountered between 3 and 9 inches of asphalt pavement underlain by 3 to 9 inches of aggregate subbase. Beneath the surficial pavement, sand fill or silty clay was encountered, which may be a utility backfill for nearby trenches.

Beneath the sand fill, silty clay, and pavement materials, the borings encountered light brown sand with gravel or gravel with sand to the top of weathered limestone bedrock at 3.5 to 10.5 feet (El. 552.1 to 561.3 feet). Approximately 0.5 to 2.5 feet of weathered limestone was encountered at each boring location. Bedrock was encountered upon encountering auger refusal at depths ranging from 4.5 to 13 feet (El. 549.6 to 560.3 feet).

2.5 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed. Groundwater was not encountered during or immediately after drilling in the three soil borings. None of the borings were left open after the completion of drilling.

Based on the observed lack of water within the boreholes, it is anticipated that the long-term groundwater level may be at an approximate elevation of 561.3 and 552.0 feet or deeper, within the bedrock. Perched water may also be present within the fill materials observed at the surface of the borings. Water level readings were made in the boreholes at times and under conditions shown on the boring logs and stated in the text of this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in the 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 for the design of the proposed retaining wall and embankment based on the results of the field exploration, laboratory testing, and geotechnical analysis. Subsurface conditions between borings 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 Settlement

Based on the Center Street Ramp C Cross Sections drawings, it is anticipated that up to about 32.5 feet of new fill may be required to construct the new Ramp C embankment between Ramp C Station 5+73 to 7+75.

Based on the proposed new Ramp C embankment fill of up to 32.5 feet, an analysis was performed at the boring locations to evaluate the anticipated amount of total settlement in the area behind Retaining Wall #3. The maximum estimated settlement for the proposed retaining wall within the native soils was calculated as shown in **Table 5.** The settlement estimates below do not include the settlement within the new embankment fill itself, only the settlement within the existing soils (caused by adding embankment fill). Settlement of the new embankment will be discussed further in a separate Roadway Geotechnical Report.

Table 5 – Anticipated Embankment Settlement

Assumed Embankment Length Along Wall (ft)	Assumed Embankment Width (ft)	Max. Embankment Height (ft)	Max. Anticipated Settlement (in)	Differential Settlement (in)
217	100	32.5	0.58	0.40

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 D. 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 2020 AASHTO Guide Specifications as shown in **Table 6**. Given the site location and materials encountered, the potential for liquefaction is minimal.

Table 6 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2020 AASHTO Guide for LRFD Seismic Bridge Design	0.049g	0.167g	0.095g

4.0 GEOTECHNICAL WALL DESIGN RECOMMENDATIONS

This section provides retaining wall design parameters including recommendations on foundation type, bearing capacity, settlement, and lateral earth pressures. The foundations for the proposed retaining wall must provide sufficient support to resist the dead and live loads, as well as seismic loading.

4.1 Retaining Wall Type Recommendations

It is anticipated that the proposed new Ramp C embankment will be a new fill area. The new Retaining Wall #3 will be constructed along a portion of Ramp C embankment where there is insufficient right of way available to be sloped. A new cul-de-sac for the residential area will be located in front of the wall. A MSE wall, prefabricated modular gravity wall, and CIP concrete cantilever wall are feasible options for Wall #3.

Based on the wall height and the location of the wall within a fill area, GSG concurs with the design plan to use a MSE wall for Wall # 3. 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.

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 are achieved relative to sliding and overturning failure.

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 also be evaluated with respect to the collision load. **Table 7** outlines the load factors used in the evaluation of the retaining wall in accordance with AASHTO Specification Tables 3.4.1-1 and 3.4.1-2.

Table 7 - LRFD Load Factors for Retaining Wall Analyses

	Type of Load	Sliding and Eccentricity Strength	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 retaining walls depend on the type of wall (i.e., restrained or unrestrained), the type of backfill and the method of placement against the wall, and the magnitude of surcharge weight on the ground surface adjacent to the wall. The active earth pressure coefficients (Ka), and the passive earth pressure coefficients (Kp) were determined in accordance with AASHTO Section 3.11.5.3 and 3.11.5.4. **Table 8** presents the soil design properties for the retaining wall for the anticipated soil types at the site and provide recommended lateral soil modulus and soil strain parameters that can be used for laterally loaded pile analysis via the p-y curve method based on the encountered subsurface conditions. Additional soil parameters for the site are included in **Appendix F**.

Table 8 – Lateral Soil Parameters

Depth Range, Elevation Range (feet)	Soil Description	Long-term/Drained		
		Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)
	New Engineered Clay Fill	0.41	2.46	0.58
	New Engineered Granular Fill	0.33	3.00	0.50
2-5.5 (560.5-557) (554.55-552.05 RWB-26)	Light Brown Very Dense Sand with Gravel / Gravel with Sand	0.17	5.82	0.29
5.5-6.5 (557-556)	Gray Very Dense Weathered Limestone	0.17	5.82	0.29
0-8 (562.5-554.5) **RWB-26 only**	Fill Gray Sand with Gravel	0.33	3.00	0.50
3-6 (559.5-556.5) **RWB-27 only**	Fill Brown Stiff Silty Clay	0.41	2.46	0.58

*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.

Although not anticipated, 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. The live load surcharge may be estimated as a uniform horizontal earth pressure due to an equivalent height (H_{eq}) of soil. **Table 9** provides the equivalent heights of soil for vehicular loadings on retaining walls.

Table 9 - Equivalent Height of Soil for Vehicular Loading on Retaining Walls Parallel to Traffic

Retaining Wall Height (ft)	H_{eq} Distance from Wall Back face to Edge of Traffic	
	0 feet	1.0 feet or Further
5	5.0 feet	2.0 feet
10	3.5 feet	2.0 feet
≥20	2.0 feet	2.0 feet

Reference: AASHTO LRFD Table 3.11.6.4-2

The retaining wall 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 over the entire length of the back face of the wall connected to a perforated drainpipe 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 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.

4.3 MSE Wall Bearing Resistance Recommendations

It is anticipated that the MSE wall will bear on new engineered fill or suitable, very dense native sand or gravel. Bearing resistance for the retaining wall shall be evaluated at the strength limit state using load factors (See **Table 7**), and factored bearing resistance. The bearing resistance factor, ϕ_b, for a 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 10** presents the proposed bearing elevation and recommended bearing resistance of suitable materials to support the wall system.

Table 10 – Recommended Bearing Resistance

Approximate Bearing Elevation (feet)	Nominal Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)	Anticipated Bearing Soil
574.2 – 562.2	19.2	12.5	12.5	Engineered Fill over Native Very Dense Sand and Gravel

The minimum depth of the leveling pad should be 3.5 feet below the final exterior grade to alleviate the effects of frost.

4.3.1 Subgrade Undercut Areas

The subgrade soils at bearing grade should be evaluated per the guidelines provided in Section 8.9 of IDOT Geotechnical Manual (2020) for suitability/workability prior to placing any portion of the proposed structures. According to Section 540, IDOT SSRBC (2022) a minimum of 6-inches of porous granular material should be provided as bedding material, which will serve as a working platform.

For Retaining Wall #3, GSG recommends undercutting any remaining existing fill soils. Undercuts to depths of up to 6.0 feet below the assumed bearing elevation may be anticipated to reach the very dense native sand and gravel. The undercut depth should be verified in the field during construction and backfilled with compacted granular engineered fill to support the proposed retaining wall. Anticipated undercut depths along the wall are presented in **Table 11**. Additional undercuts may be necessary along the west section of the wall; the final undercuts and locations will be determined when the final soil borings are completed in those areas.

Table 11 – Recommended Undercuts

Soil Borings	Undercut Depth Below Existing Ground Elevation (Elevation, feet)	Approximate Bearing Elevation (feet)*	Comments
RWB-25	N/A	563.5	N/A
RWB-26	8.0 (554.5)	562.0	Existing unsuitable fill **
RWB-27	3.0 (556.5)	574.2 to 563.6	Existing unsuitable fill Low strength ≤1.5 tsf

*Assumed bearing elevation at about El. 574.2 to El. 562.0 feet based on the TSL drawings

** Should be field verified due to proximity of existing utility trenches

Settlement generally depends on the foundation size and bearing resistance, as well as the strength and compressibility characteristics of the underlying bearing soil.

Undercut areas should be replaced with structural fill in accordance with IDOT Standard Specifications for Road and Bridge Construction. The lateral limit of the structural fill should extend a minimum of 1 foot beyond the edge of the MSE wall leveling pad, then an additional 1 foot laterally for every 2 feet of structural fill depth as depicted in **Exhibit 3**. The 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 Soil and Soil-Aggregate Mixtures (ASTM D1557) in accordance with IDOT standard construction requirements.

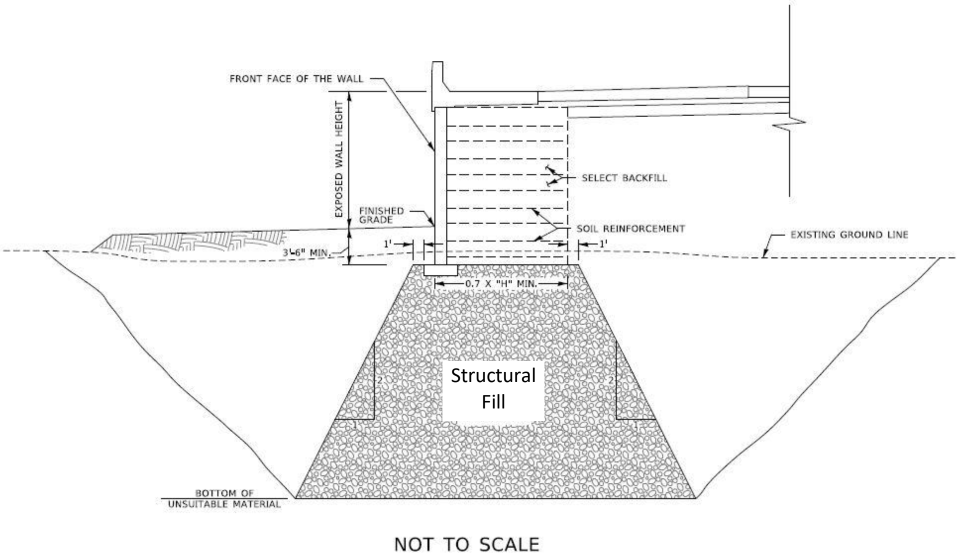


Exhibit 3 - Structural Fill Placement below MSE Wall

4.3.2 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 (tan 28 degrees) 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 forces shall be within the middle two-thirds of the MSE base width. Based on the wall geometry and anticipated loads, the minimum soil reinforcement length may extend beyond the minimum values specified in AASHTO Manual Section 11.10.2.1.

4.4 Overall Stability

Based on the preliminary drawings provided by WSP the parameters in **Table 12** were used to evaluate the overall stability of the wall.

Table 12 – MSE Retaining Wall Description

Maximum height of the retaining wall (H)	25.9 feet
Minimum length of reinforcement 0.7xH	19 feet
Unit weight of the retained soil (embankment)	125 pcf
Unit weight of MSE wall backfill	120 pcf
Assumed embankment width	215 feet
Embankment slope above MSE wall	1V:3H

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.

4.5 Slope Stability Results

Slide2 is a comprehensive slope stability analysis software used to evaluate the global slope stability of the proposed retaining wall based on the limit equilibrium method. Circular failure analyses were evaluated using the simplified Bishop analysis method for the proposed wall and slope geometries.

A circular analysis was evaluated for both short-term (undrained) and long-term (drained) conditions for the proposed retaining wall. Based on the provided project information, the retaining wall will have a maximum height of 25.9 feet. The top of the retaining wall leveling pad is anticipated to be at about 3.5 feet below grade, at about 562.2 feet near station 6+50. The results of the analysis are shown in **Table 13**.

Table 13 – Stability Analysis Results – Retaining Wall #3

Station	Proposed Profile	Failure Type	Factor of Safety	Required Minimum Factor of Safety
6+50	1V:3H Slope over 25.9 ft MSE Wall	Circular – Short-Term	1.7	1.5
		Circular – Long-Term	1.7	1.5

Based on the analyses performed, the proposed retaining wall meets the minimum factor of safety of 1.5. Copies of the Slope Stability analysis exhibits are included in **Appendix E**.

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 (SSRBC) (2022). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Preparation

All trees, pavements, vegetation, landscaping, and surface topsoil should be cleared and removed from the vicinity of the proposed foundations. Where possible, the engineer may require proof-rolling of the subgrade with a 35-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 wall bottom.

5.2 Existing Utilities and Structures

It is anticipated that existing utility trenches exist within the project area on the local streets that fall within the proposed new embankment and retaining wall areas. Before proceeding with construction, all existing underground utility lines or structures that will interfere with construction should be completely relocated from 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 utilities or structure 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 for providing 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 (2021). The fill material should be free of organic matter and debris and should be placed and compacted in accordance with the Construction Manual. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing of softening subgrade soils.

Suitable structural fill materials shall be of a nature that will compact and develop stability satisfactory to the geotechnical engineer. Structural fill shall consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or medium plasticity silty clays. Suitable structural fill should meet the IDOT SSRBC requirements.

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 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

Long-term groundwater may be at elevations of 561.3 and 552.0 feet or deeper, within the bedrock. GSG does not anticipate that groundwater related issues are likely during construction activity, however, perched water may be encountered within the existing fill materials. If rainwater run-off or groundwater is accumulated at the base of excavations, 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 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. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill.

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

TSL

Roadway Profile, Cross Sections

Center Street Ramp C

Benchmark: Chiseled "x" on top of SE bolt of Fire Hydrant at south ROW of Jasper St. (in front of 640 Jasper St. address), Elev. 585.86.

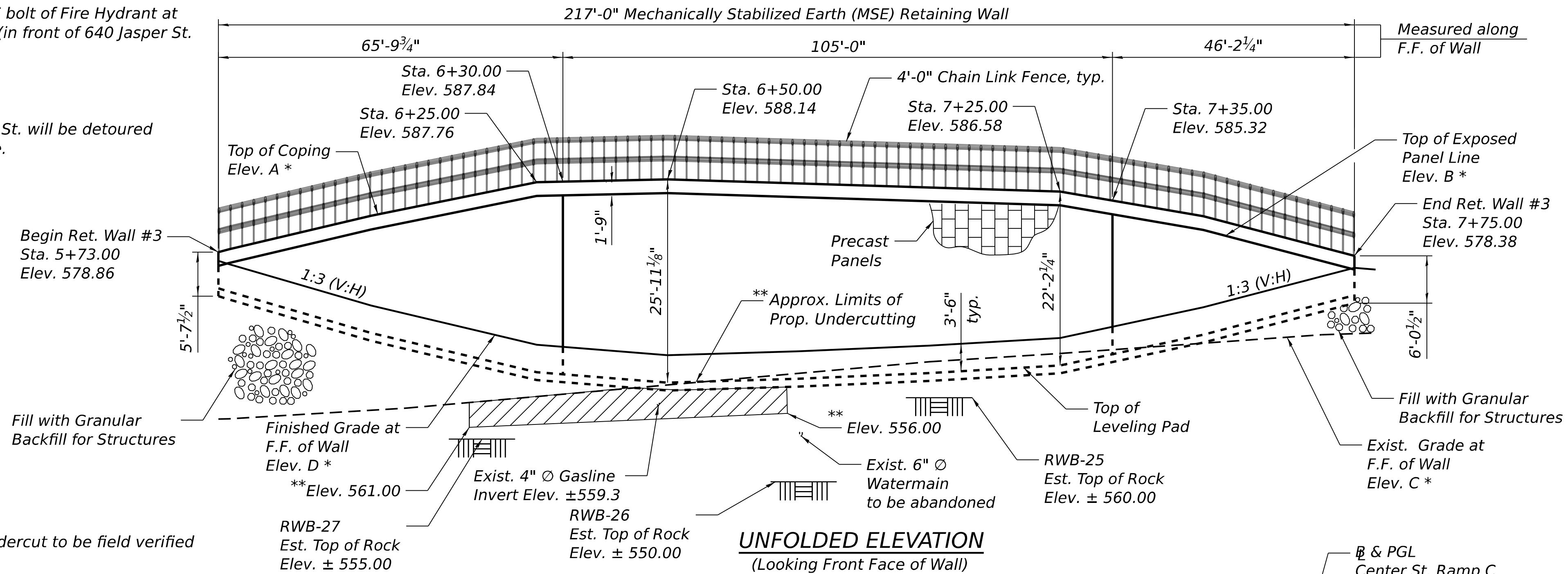
Existing Structure: None.

Traffic Control: WB I-80 traffic to Center St. will be detoured to the west at Larkin Ave.

Salvage: None.

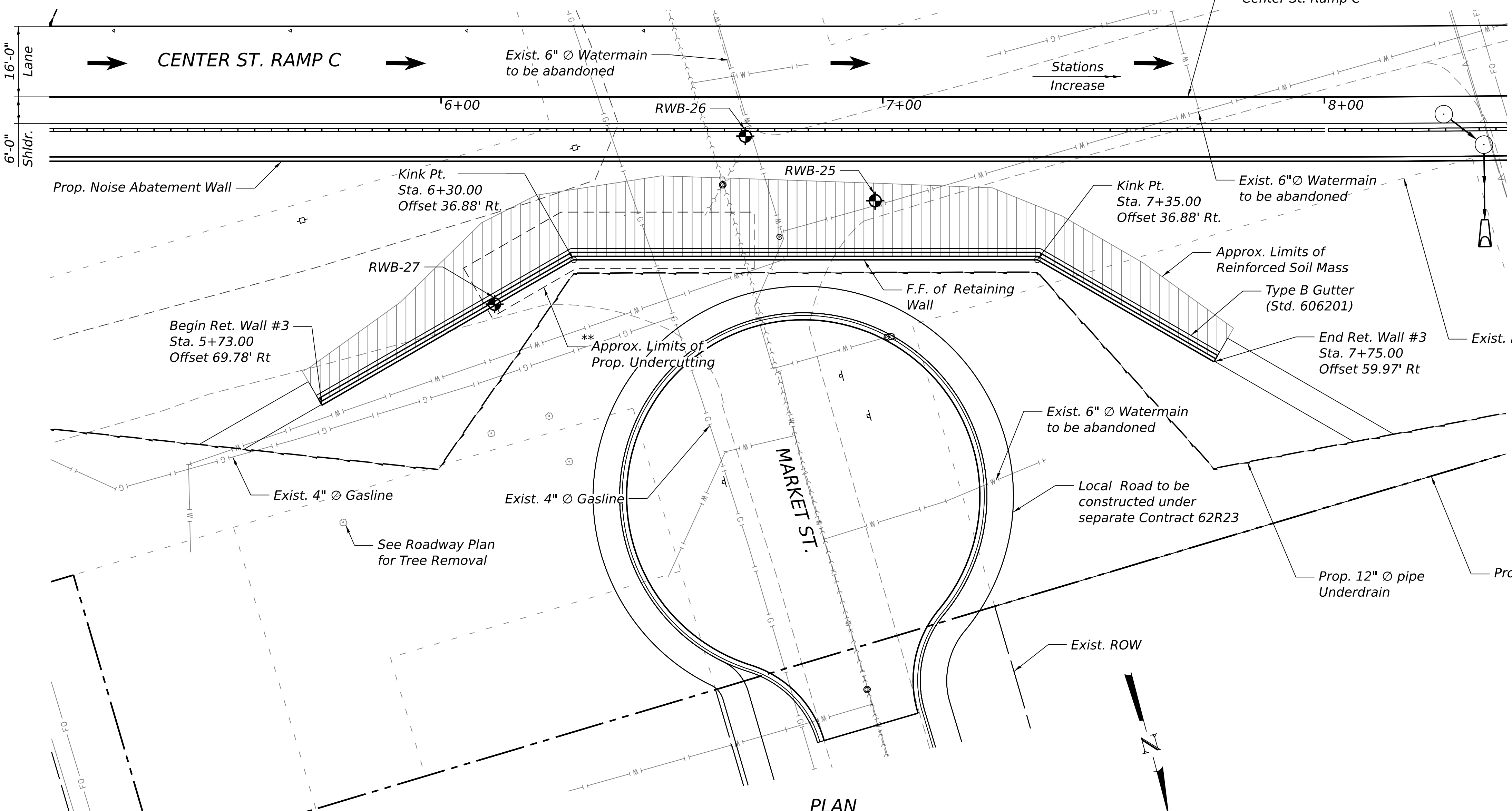
* See Note 2

** Limits and depth of undercut to be field verified



UNFOLDED ELEVATION

(Looking Front Face of Wall)



PLAN

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi

fy = 60,000 psi (Reinforcement)

PRECAST UNITS

f'c = 4,500 psi

HIGHWAY SPECIFICATION

Center Street Ramp C

Functional Class: Interstate

ADT: 4,550 (2017); 6,220 (2040)

ADTT: 228 (2017); 311 (2040)

DHV: 684 (2040)

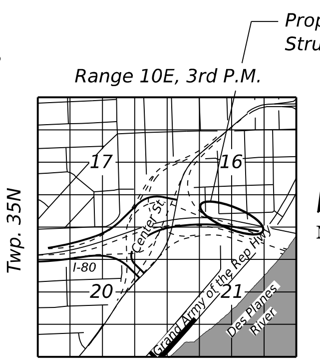
Design Speed: 40 m.p.h.

Posted Speed: 40 m.p.h.

1-Way Traffic

LEGEND

	Exist. Fence
	Exist. Storm Sewer
	Exist. Light Pole
	Prop. Storm Sewer
	Tree
	Soil Boring
	Approx. Limits of Reinforced Soil Mass
	Approx. Limits of Prop. Undercutting
	Prop. ROW
	Prop. Pipe Underdrain
	Exist. Underground Gasline
	Exist. Underground Waterline
F.F.	Front Face
B.F.	Back Face



LOCATION SKETCH

GENERAL PLAN & ELEVATION
RETAINING WALL 3
ALONG CENTER STREET RAMP C
F.A.I. ROUTE 80
SECTION FAI 80 21 INTERCHANGE
WILL COUNTY
STA. 5+73.00 TO STA. 7+75.00
STRUCTURE NO. 099-W124

HBM ENGINEERING GROUP, LLC

USER NAME =	DESIGNED - PG	REVISED -	
	CHECKED - MI	REVISED -	
PLOT SCALE =	DRAWN - PG	REVISED -	
PLOT DATE =	CHECKED - MI	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
80	FAI 80 21 INTERCHANGE	WILL	2	1

CONTRACT NO. 62R22

ILLINOIS FED. AID PROJECT

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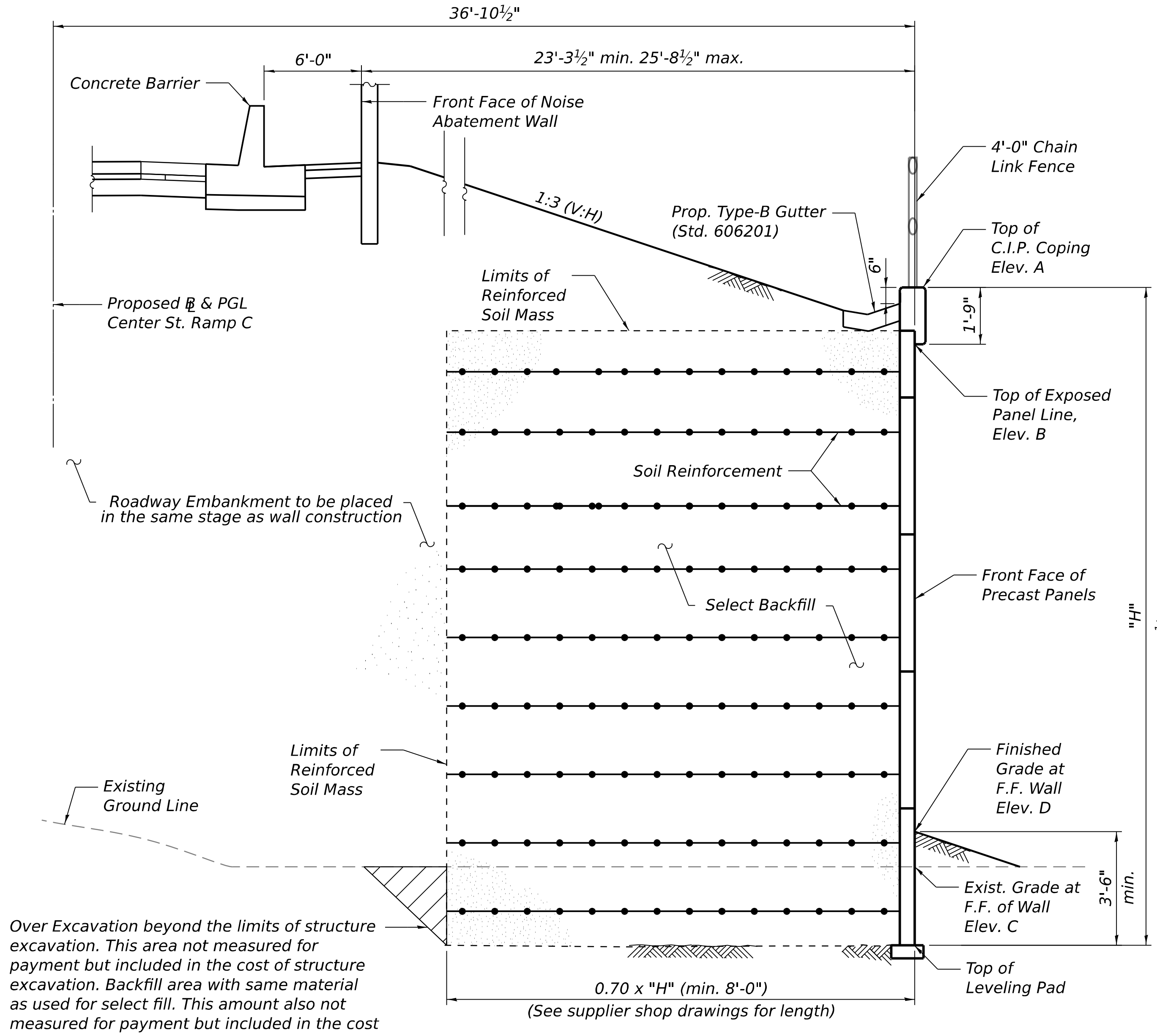
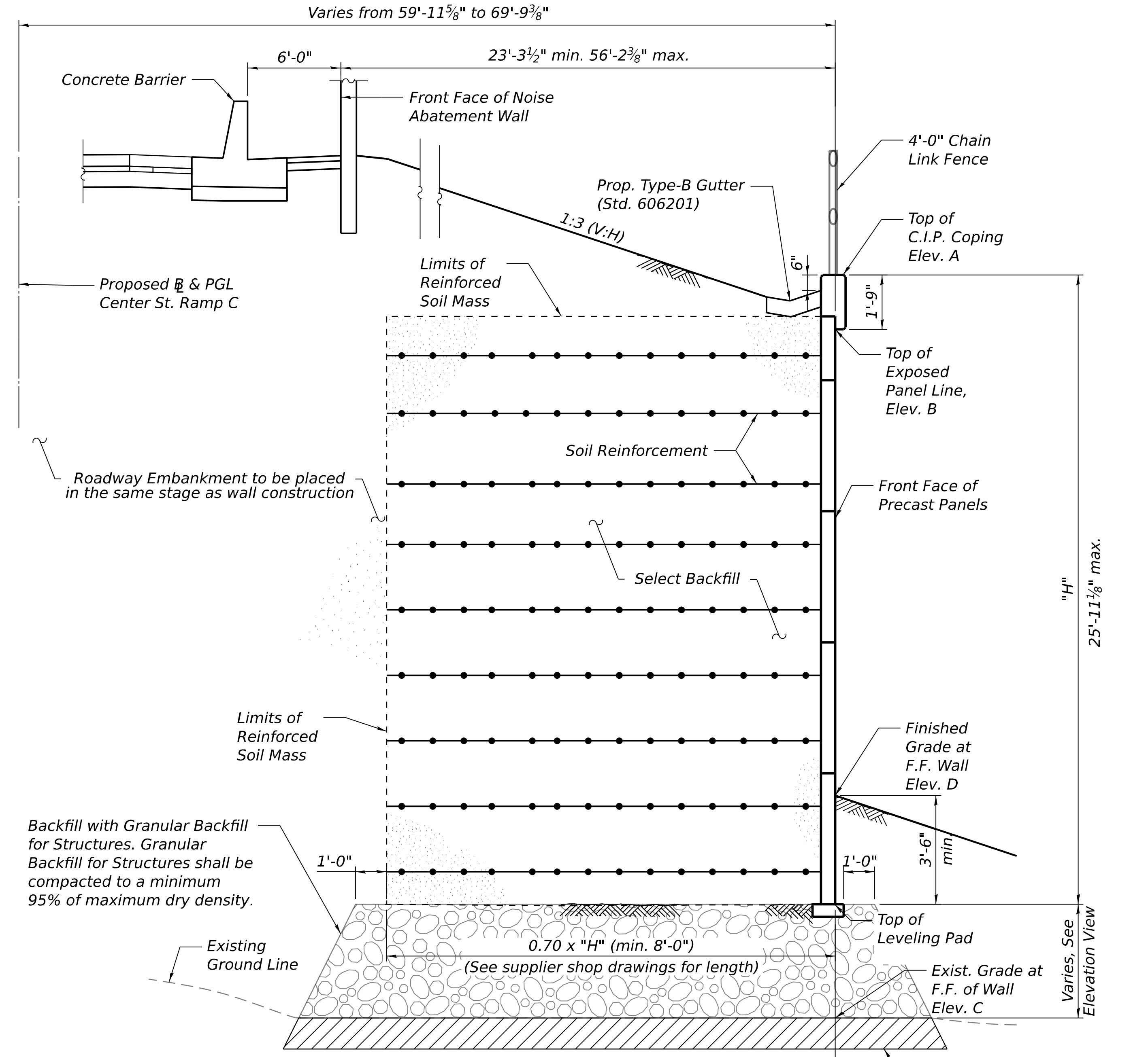


TYPICAL SECTION THRU M.S.E WALL

Sta. 6+55.60 to Sta. 7+40.77
(Looking West)

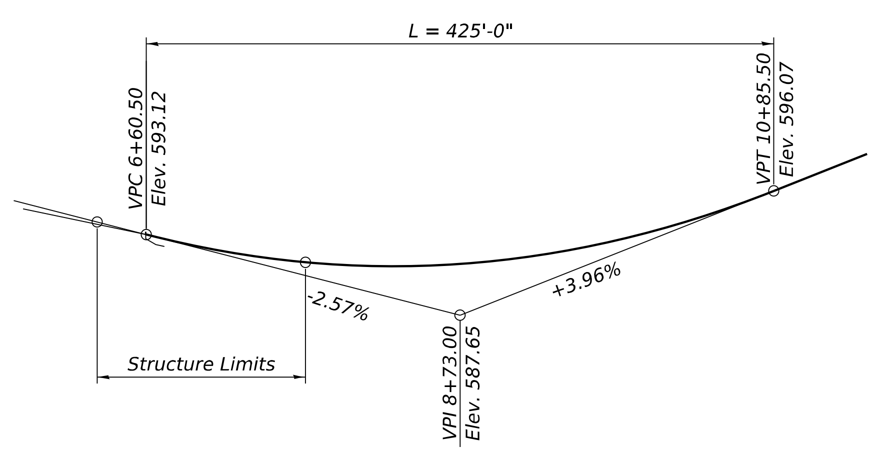


TYPICAL SECTION THRU M.S.E WALL

Sta. 5+73.00 to Sta. 6+55.60
Sta. 7+40.77 to Sta. 7+75.00
(Looking West)

PR CURVE CENTER RAMP C (CENTER C1)

PI Sta. = 9+07.47
Δ = 03° 49' 25" (LT)
D = 01° 46' 54"
R = 3,216.00'
T = 107.35'
L = 214.63'
E = 1.79'
e = 3.20%
T.R. = 64.0'
S.E. RUN = 102.4'
P.C. STA. = 8+00.12
P.T. STA. = 10+14.75



CENTER ST. RAMP C PROFILE GRADE

(Along ℄ Roadway)

TABLE 1- WALL ELEVATIONS

Station	A	B	C	D
	Top of C.I.P. Coping	Top of Exposed Panel Line	Exist. Grade at FF Wall	T/Prop Ground FF Wall
05+73.00	578.86	577.11	557.57	577.74
05+75.00	579.20	577.45	557.95	577.32
06+00.00	583.49	581.74	558.94	572.03
06+25.00	587.76	586.01	560.45	567.05
06+50.00	588.14	586.39	561.98	565.71
06+75.00	587.57	585.82	563.43	566.20
07+00.00	587.02	585.27	564.88	566.92
07+25.00	586.58	584.83	565.94	567.89
07+50.00	583.44	581.69	567.20	571.81
07+75.00	578.38	576.63	568.45	576.84

DETAILS
RETAINING WALL 3
ALONG CENTER STREET RAMP C
F.A.I. ROUTE I-80
SECTION C-91-109-22
WILL COUNTY
STA. 5+73.00 TO STA. 7+75.00
STRUCTURE NO. 099-W124

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HBM ENGINEERING GROUP, LLC

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STATE OF ILLINOIS
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SHEET 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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CONTRACT NO. 62R22
ILLINOIS FED. AID PROJECT

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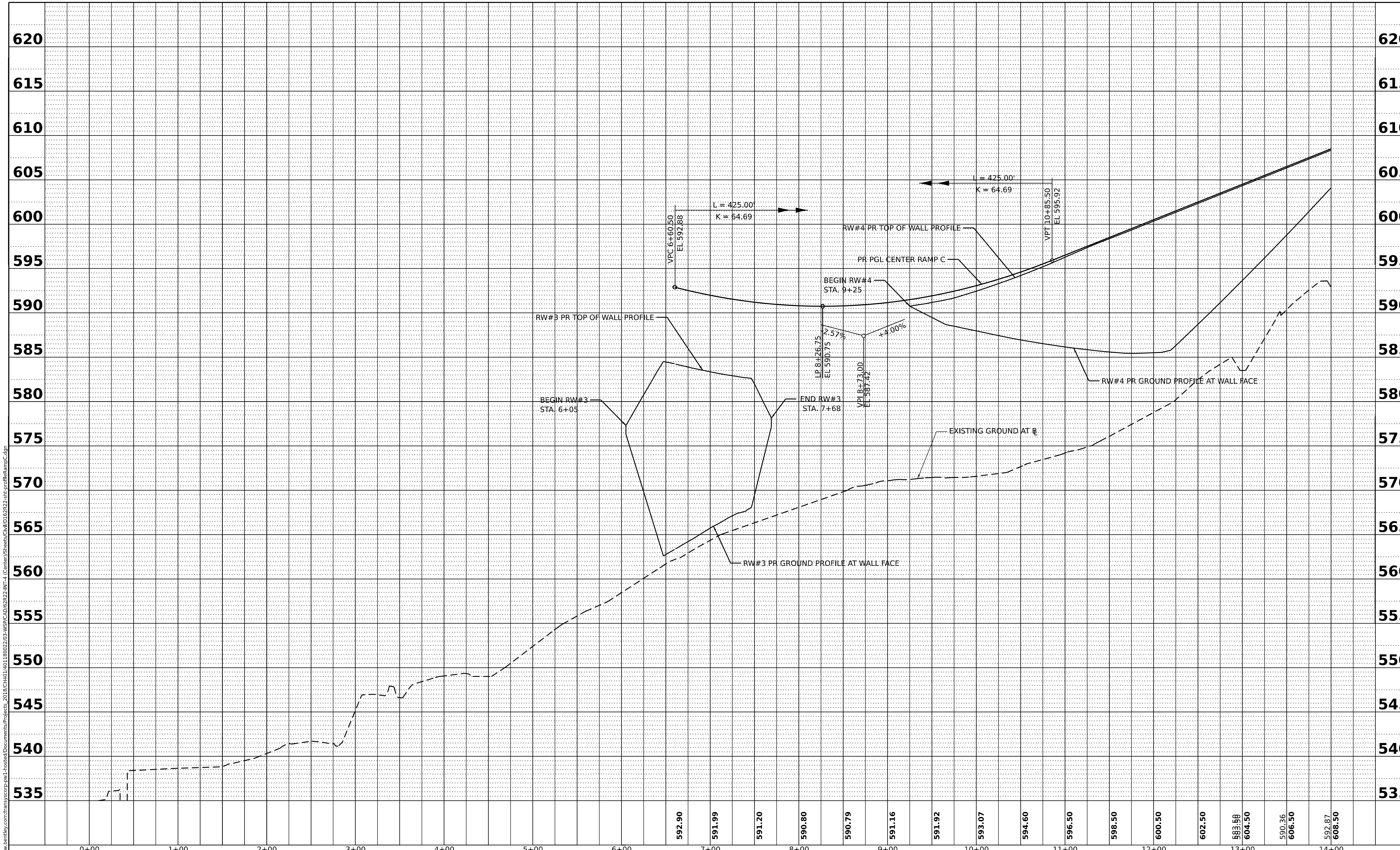

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PROFILE | NOTE BOOK | NO. | SURVEYED | PLOTTED | GRADES CHECKED | B.M. NOTED | STRUCTURE NOTATNS CHKD | BY | DATE

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WSP USA Inc.
30 N. LASALLE STREET
SUITE 4200
CHICAGO, IL 60602
TEL: (312) 782-8150

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	DRAWN -	REVISED -
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ROADWAY PROFILE
CENTER STREET RAMP C

SCALE: HORIZ: 1"=50' VERT: 1"=5' | SHEET | OF | SHEETS | STA. | TO STA.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

ROADWAY PROFILE
CENTER STREET RAMP C

SCALE: HORIZ: 1"=50' VERT: 1"=5' | SHEET OF SHEETS | STA. TO STA.

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	ILLINOIS	FED. AID PROJECT		

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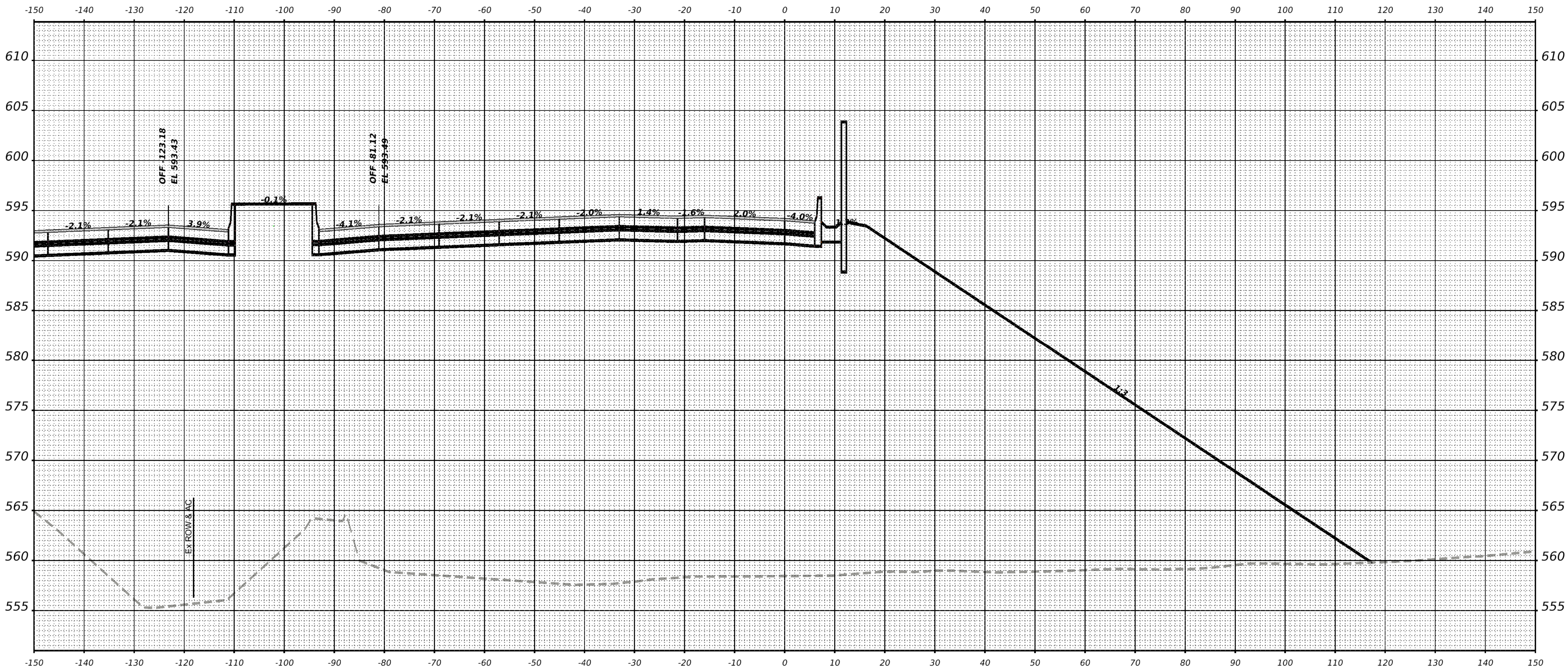

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

SCALE: SCALE | SHEET 0 OF 1 SHEETS | STA.

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CONTRACT NO.

ILLINOIS | FED. AID PROJECT

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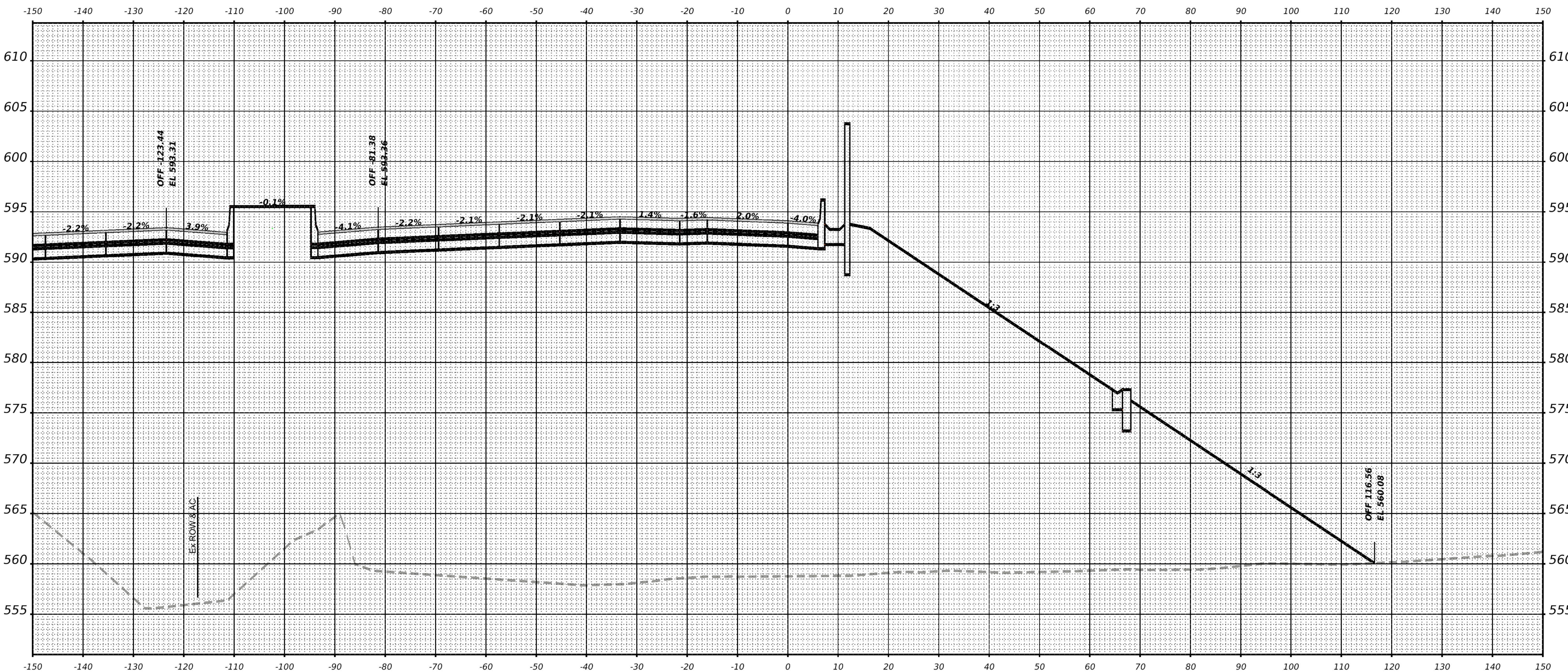

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STATE OF ILLINOIS
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CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

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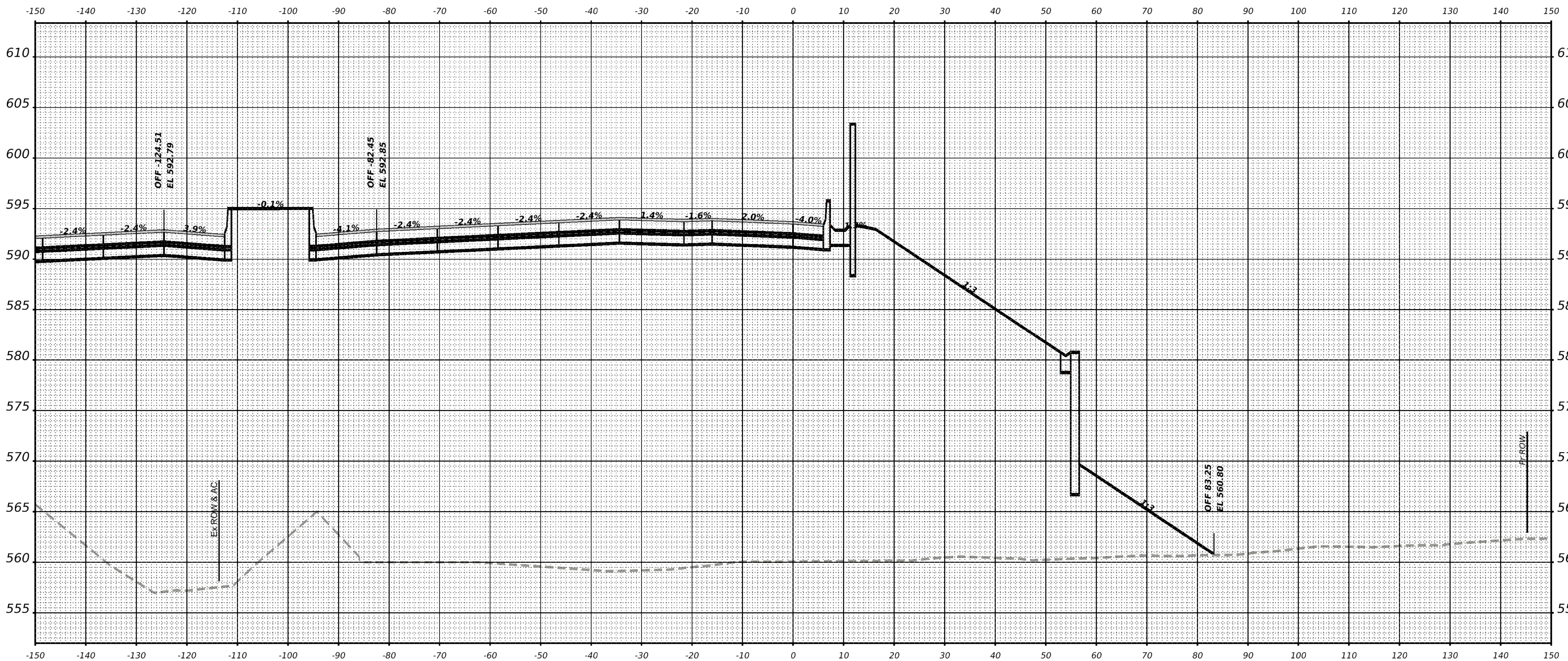

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STATE OF ILLINOIS
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CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

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F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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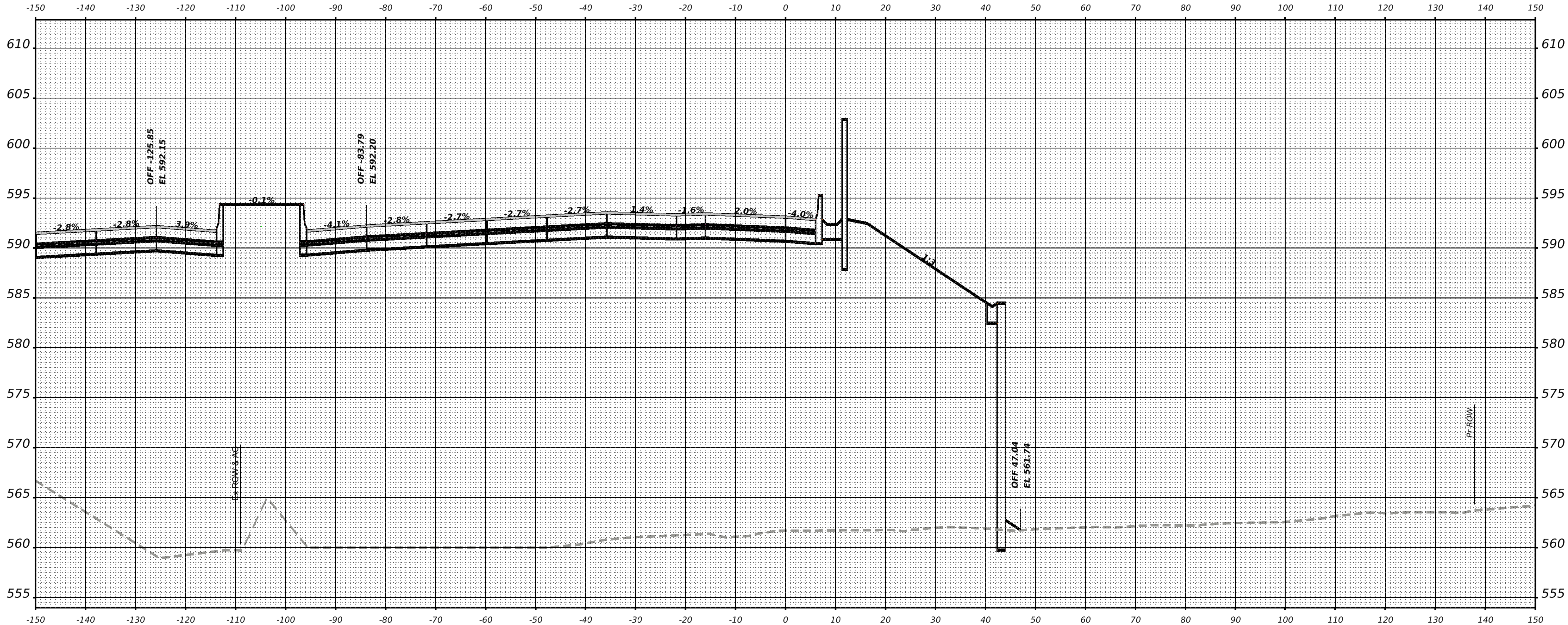

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CENTER STREET RAMP C CROSS SECTIONS
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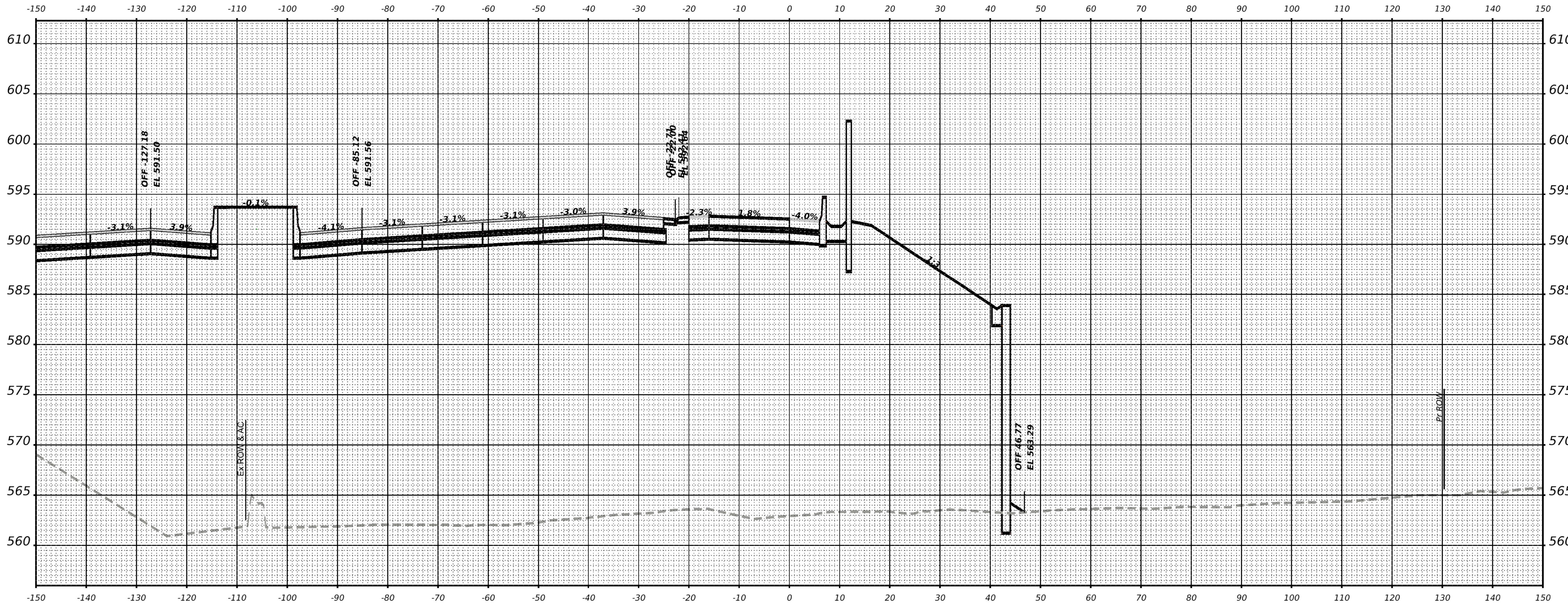

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STATE OF ILLINOIS
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CENTER STREET RAMP C CROSS SECTIONS
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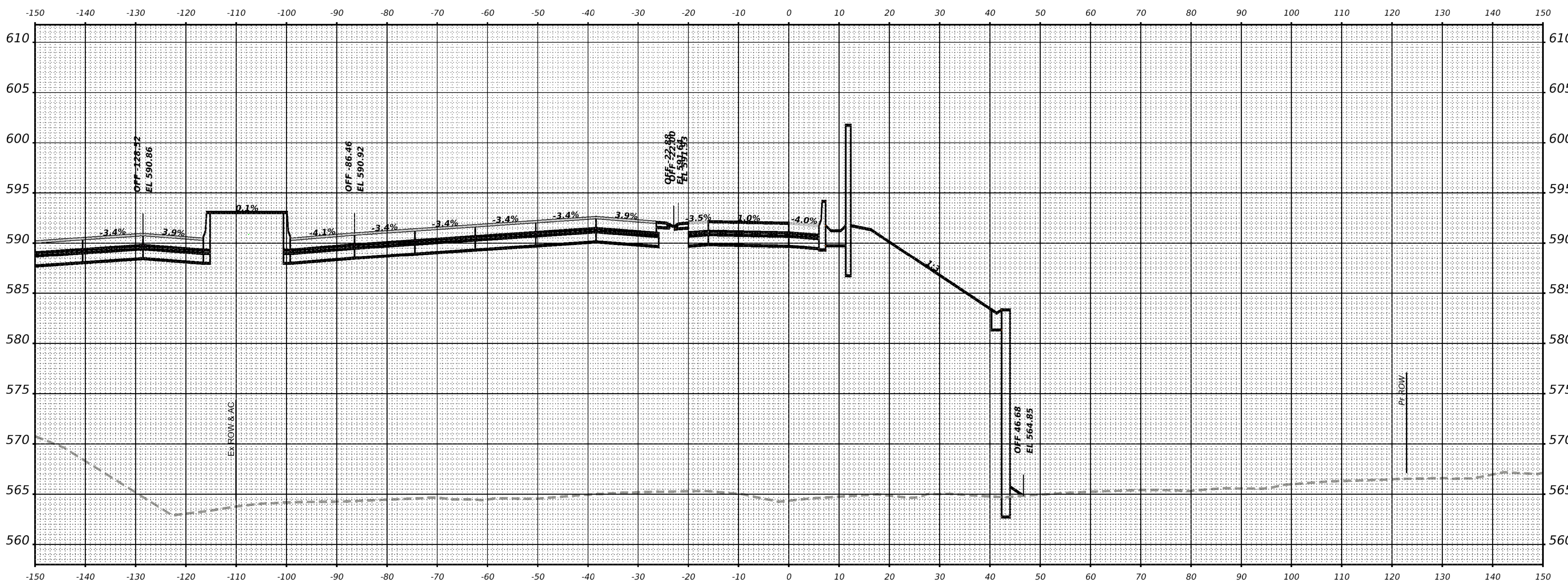
ILLINOIS | FED. AID PROJECT



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

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SCALE: SCALE | SHEET 0 OF 1 SHEETS | STA.

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
ROUTE	SECTION	COUNTY	1	1

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

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ROUTE	SECTION	COUNTY	1	1

CONTRACT NO. ____

ILLINOIS | FED. AID PROJECT

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

SCALE: SCALE SHEET 0 OF 1 SHEETS STA.

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CONTRACT NO.

ILLINOIS FED. AID PROJECT

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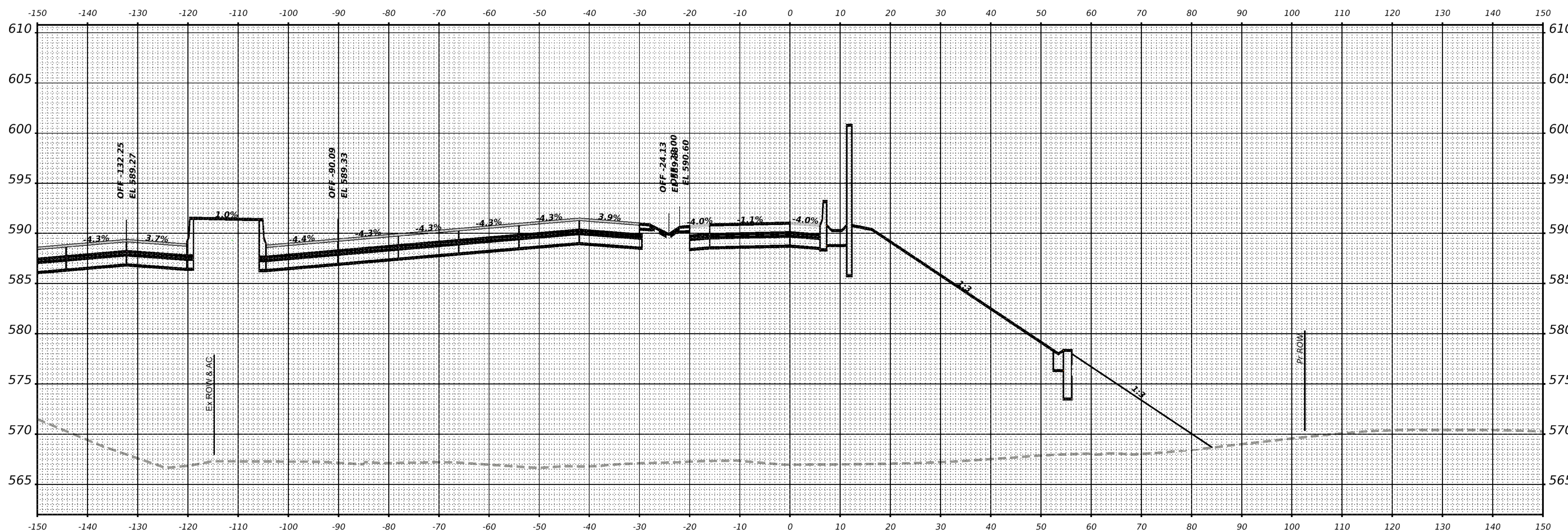

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

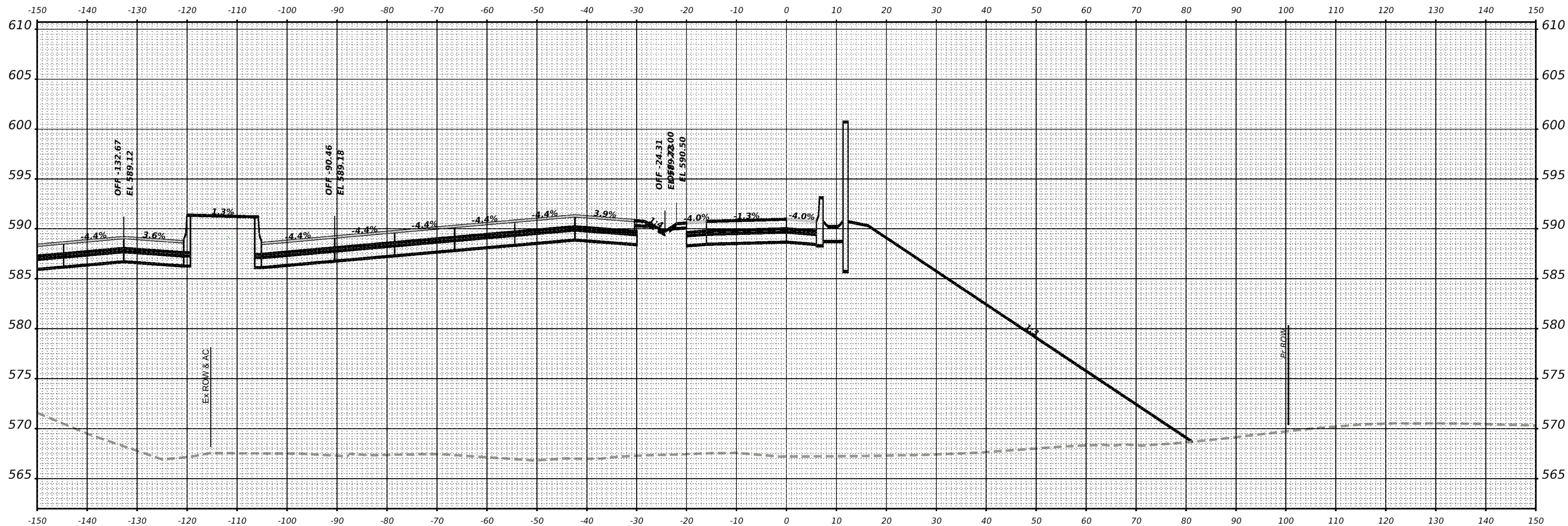
CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

SCALE: SHEET OF SHEETS STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

CONTRACT NO.

ILLINOIS | FED. AID PROJECT



STA 7+75.00

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	DRAWN -	REVISED -
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PLOT DATE = 8/16/2022	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CENTER STREET RAMP C CROSS SECTIONS
RETAINING WALL #3

SCALE: ____ SHEET __ OF __ SHEETS STA. ________

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

CONTRACT NO. ____

ILLINOIS | FED. AID PROJECT

MODEL: RW3 - 7+75.00 [Sheet]
FILE NAME: D162R22-XS-RW3.dgn

FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

Appendix B
Soil Boring Location Plan and Subsurface Profile

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PEN TABLE = $PENTBL$
PLOT DATE = $DATE$
TIME = $TIME$
SHEET SIZE = $SHEETSIZE$
PLOT SCALE = $SCALE$
USER NAME = $USER$

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= $USER$	DESIGNED	- RM
SHEET SIZE	= $SHEETSIZE$	DRAWN	- NN
PLOT SCALE	= $SCALE$	CHECKED	- DE
PLOT DATE	= $DATE$	DATE	- 11/03/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

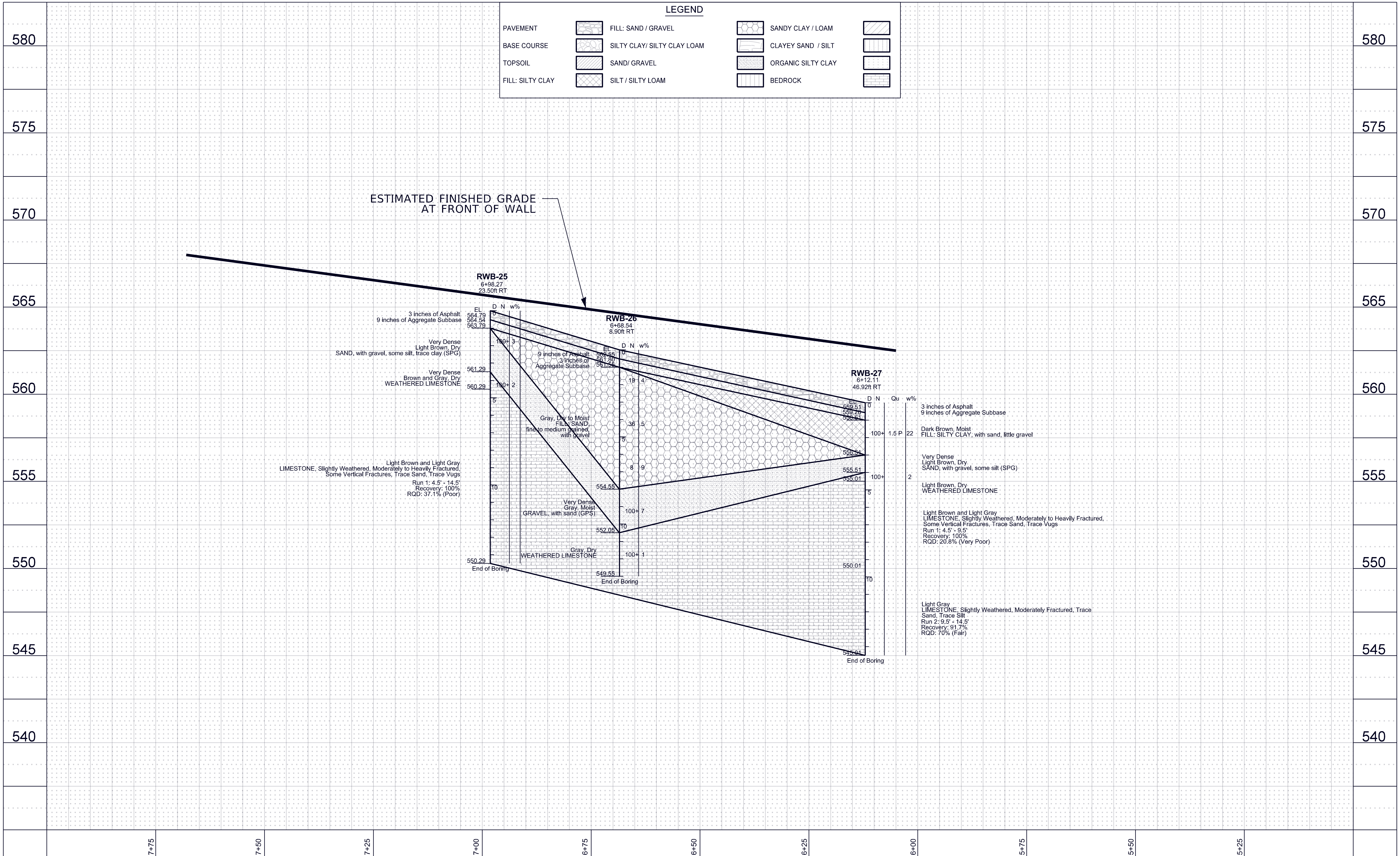
RETAINING WALL NO. 3
SOIL BORING LOCATION PLAN
JOLIET, ILLINOIS

SCALE: 1:50 | SHEET 1 OF 1 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	2	1

CONTRACT NO. PTB-198-003

ILLINOIS | FED. AID PROJECT



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TIME = 1:34:52 PM
SHEET SIZE = 1.41667x0.916667 (ft.)
PLOT SCALE = 1200:0.0000 ":" / ft.
USER NAME = nnano

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME = nnano		DESIGNED -	RM
SHEET SIZE = 1.41667x0.916667 (ft.)		DRAWN -	NN
PLOT SCALE = 1200:0.0000 ":" / ft.		CHECKED -	DE
PLOT DATE = 12/5/2022		DATE -	11/03/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

RETAINING WALL NO. 3
SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 1 OF 1 SHEETS | STA. 7+75 TO STA. 5+25

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	2	2

CONTRACT NO. PTB- 198-003
ILLINOIS | FED. AID PROJECT

Appendix C
Soil Boring Logs

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 10/26/22

ROUTE I-80 **DESCRIPTION** Retaining Wall No. 3 **LOGGED BY** AA

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E, **Latitude** , **Longitude**

COUNTY Will **DRILLING RIG** Mobile B-57 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 89

STRUCT. NO.
Station

BORING NO. RWB-25
Station 6+98.2745
Offset 23.50ft RT
Ground Surface Elev. 564.79 ft

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

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	564.54				
9 inches of Aggregate Subbase	563.79				
Very Dense Light Brown, Dry SAND, with gravel, some silt, trace clay (SPG)			9 17 50/4"		3
	561.29				
Very Dense Brown and Gray, Dry WEATHERED LIMESTONE			50/2"		2
	560.29	-5			
Light Brown and Light Gray LIMESTONE, Slightly Weathered, Moderately to Heavily Fractured, Some Vertical Fractures, Trace Sand, Trace Vugs Run 1: 4.5' - 14.5' Recovery: 100% RQD: 37.1% (Poor)		-10			
	550.29				
End of Boring		-15			
		-20			

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

Retaining Wall #3
RWB-25
Will County, IL

Top

Depth =4.5 ft
Elev. = 560.29

Depth = 14.5 ft
Elev. = 550.29

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
RWB-25	1	4.5' – 14.5'	100.0	37.1	Poor	11,044	Light Brown and Light Gray Limestone Slightly Weathered, Moderately to Heavily Fractured, Some Vertical Fractures, Trace Sand, Trace Vugs

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 10/19/22

ROUTE I-80 **DESCRIPTION** Retaining Wall No. 3 **LOGGED BY** AA

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E,
Latitude , Longitude

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 96

STRUCT. NO.
Station

BORING NO. RWB-26
Station 6+68.5434
Offset 8.90ft RT
Ground Surface Elev. 562.55 **ft**

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

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
9 inches of Asphalt 3 inches of Aggregate Subbase	561.80 561.55				
Gray, Dry to Moist FILL: SAND, fine to medium grained, with gravel			11 10 9		4
			8 8 28		5
		-5			
			6 3 5		9
Clay seam at 7 feet	554.55				
Very Dense Gray, Moist GRAVEL, with sand (GPS)			4 5 50/3"		7
	552.05	-10			
Gray, Dry WEATHERED LIMESTONE			50/2"		1
	549.55				
Auger refusal at 13 feet End of Boring					
		-15			
		-20			

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

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 10/26/22

ROUTE I-80 **DESCRIPTION** Retaining Wall No. 3 **LOGGED BY** AA

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E, **Latitude** , **Longitude**

COUNTY Will **DRILLING RIG** Mobile B-57 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 89

STRUCT. NO.
Station

BORING NO. RWB-27
Station 6+12.1069
Offset 46.92ft RT
Ground Surface Elev. 559.51 ft

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

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

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	559.26				
9 inches of Aggregate Subbase	558.51				
Dark Brown, Moist FILL: SILTY CLAY, with sand, little gravel			3		
			10	1.5	22
			50/3"	P	
	556.51				
Very Dense Light Brown, Dry SAND, with gravel, some silt (SPG)	555.51		50/3"		
	555.01				2
Light Brown, Dry WEATHERED LIMESTONE		-5			
Light Brown and Light Gray LIMESTONE, Slightly Weathered, Moderately to Heavily Fractured, Some Vertical Fractures, Trace Sand, Trace Vugs Run 1: 4.5' - 9.5' Recovery: 100% RQD: 20.8% (Very Poor)	550.01				
Light Gray LIMESTONE, Slightly Weathered, Moderately Fractured, Trace Sand, Trace Silt Run 2: 9.5' - 14.5' Recovery: 91.7% RQD: 70% (Fair)	545.01	-10			
End of Boring		-15			
		-20			

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

BBS, form 137 (Rev. 8-99)

Retaining Wall #3
RWB-27
Will County, IL

Top

Depth = 4.5 ft
Elev. = 555.01

Depth = 9.5 ft
Elev. = 550.01

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
RWB-27	1	4.5’ – 9.5’	100.0	20.8	Very Poor	Light Brown and Light Gray Limestone Slightly Weathered, Moderately to Heavily Fractured, Some Vertical Fractures, Trace Sand, Trace Vugs

Retaining Wall #3
RWB-27
Will County, IL

Top

Depth = 9.5 ft
Elev. = 550.01

Bottom

Depth = 14.5 ft
Elev. = 545.01

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
RWB-27	2	9.5' – 14.5'	91.7	70.0	Fair	18,882	Light Gray Limestone Slightly Weathered, Moderately Fractured, Trace Sand, Trace Silt

Appendix D
Laboratory Test Results

Order # 944

Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP 198-003 I-80	Project No:	21-2007
Boring ID:	RWB-25	Bulk/Prep	MC/CS
Sample Depth (ft):	6.5-7	Tester: AJ	Tester: AJ
Lithological Description:	Limestone	Date: 10/27/22	Date: 10/27/22
Formation Name:		Load Direction: Vertical	Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):	holes		

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.2320	4.2280	4.2325	4.2308
Diameter, *in.*	1.9830	1.9840	1.9800	1.9823

Specimen Mass, *g*	563.2	Ratio (2.0-2.5)	
Bulk Density, *pcf*	164.3		2.13

Moisture Condition - D2216

Container ID	CHEETO
container, *g*	226.4
container + wet rock, *g*	782.2
container + dry soil, *g*	770.2
moisture content, *w%*	2.2

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

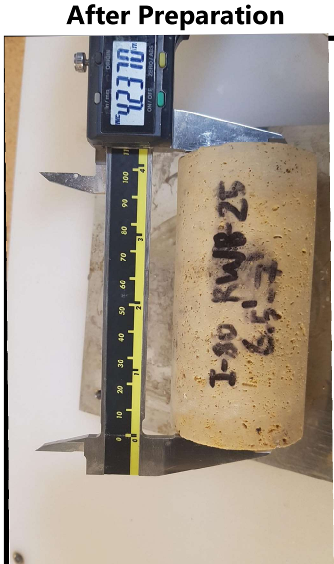
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	2 min 23 sec
Load @ Failure, *lbf*	34,086
Uniaxial Compressive Strength, *psi*	11,044

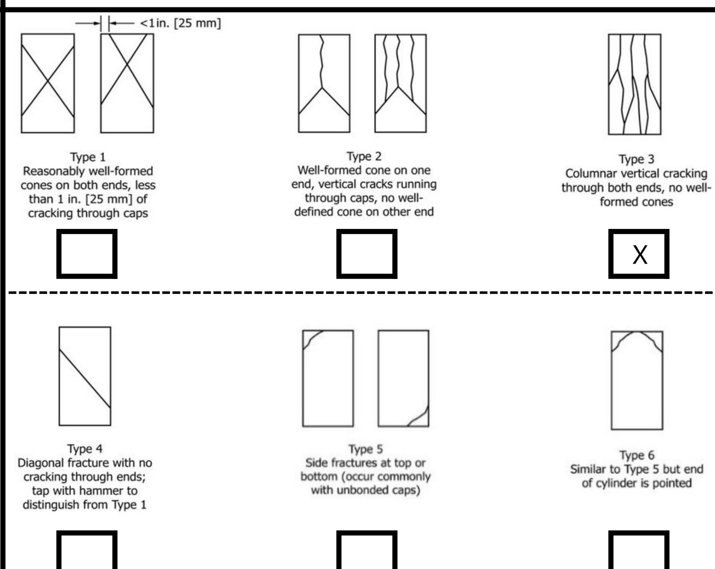
Remarks

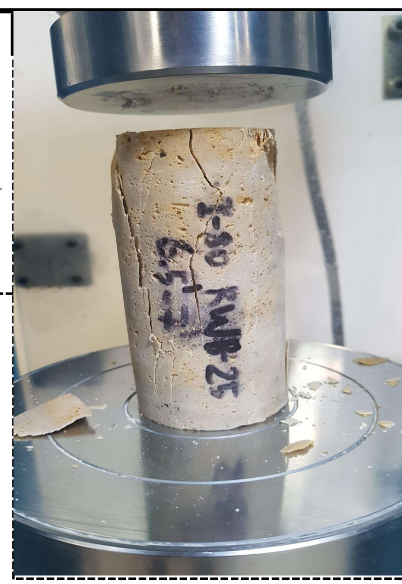
Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation



After Break (check applicable appearance)





Order # 944

Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP 198-003 I-80	Project No:	21-2007
Boring ID:	RWB-27	Bulk/Prep	MC/CS
Sample Depth (ft):	11.5-12	Tester: SM	Tester: SM
Lithological Description:	Limestone	Date: 10/27/22	Date: 10/27/22
Formation Name:		Load Direction: Vertical	Angle Drilled: Vertical
Appearance (e.g. cracks, shearing, spalling):			

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.7100	4.7265	4.7145	4.7170
Diameter, *in.*	1.9900	1.9935	1.9955	1.9930
Specimen Mass, *g*	656.3		Ratio (2.0-2.5)	
Bulk Density, *pcf*	169.9		2.37	

Moisture Condition - D2216

Container ID	SPREE
container, *g*	226.7
container + wet rock, *g*	805.2
container + dry soil, *g*	798.1
moisture content, *w%*	1.2

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

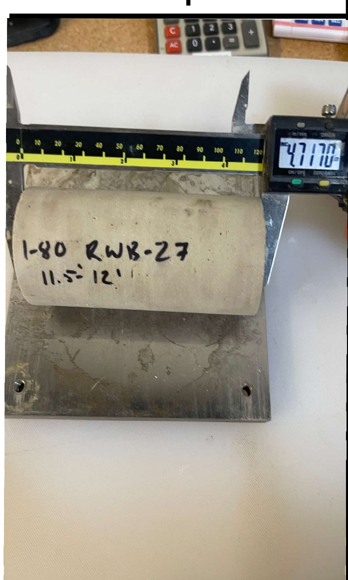
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	3 min 59 sec
Load @ Failure, *lbf*	58,906
Uniaxial Compressive Strength, *psi*	18,882

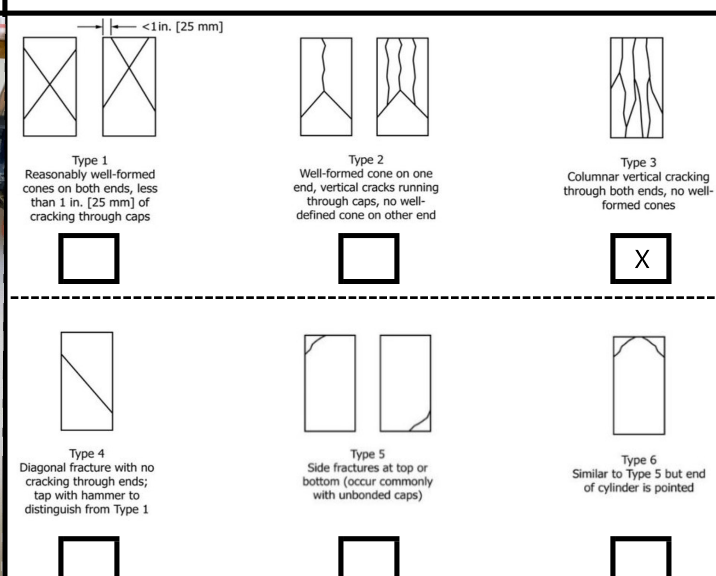
Remarks

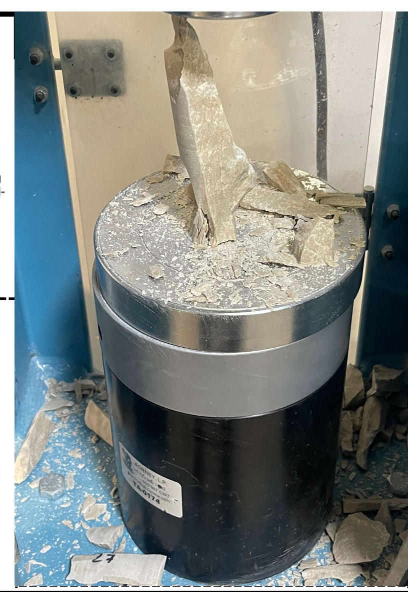
Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation



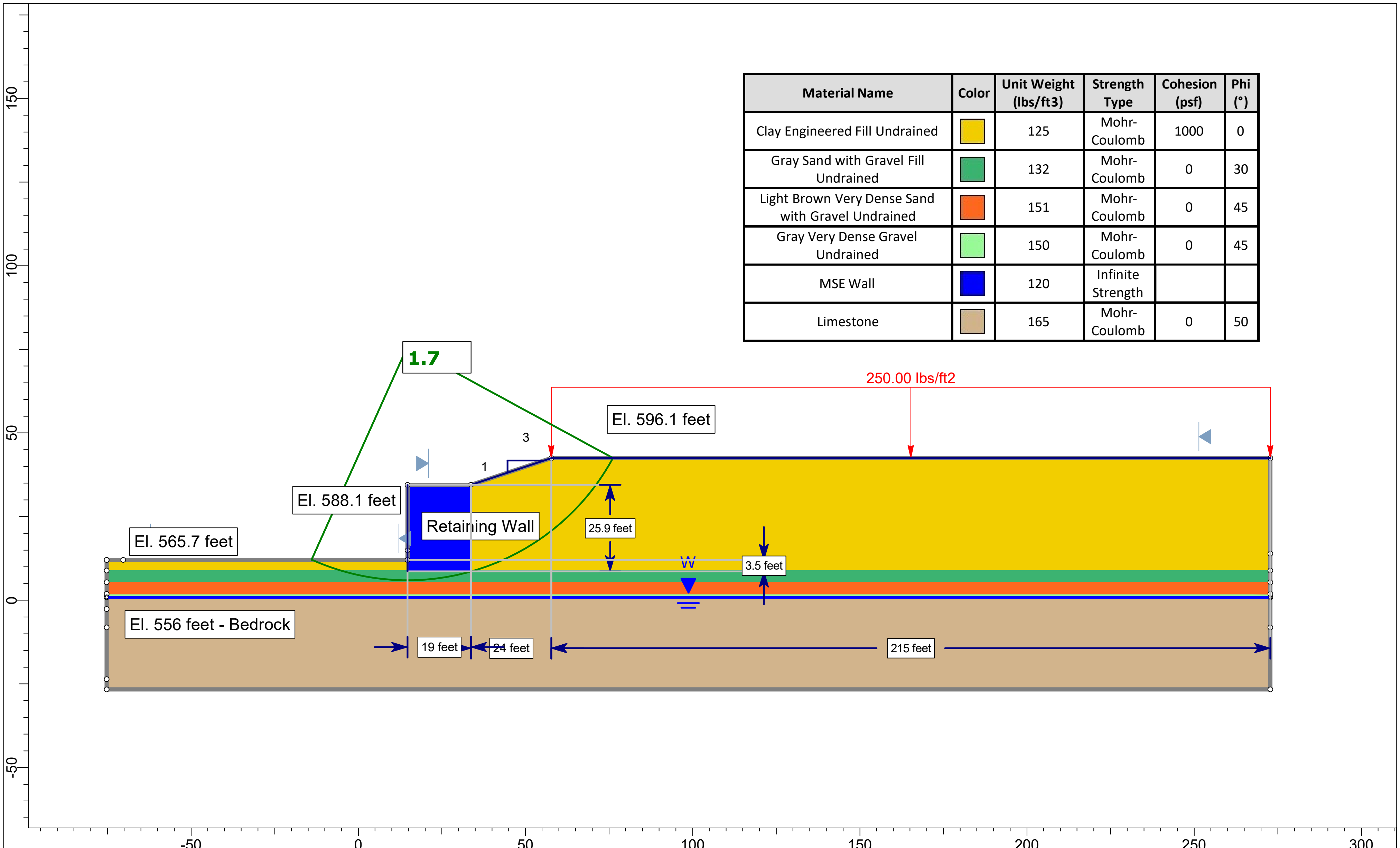
After Break (check applicable appearance)





Appendix E

Slope Stability Analysis Exhibits



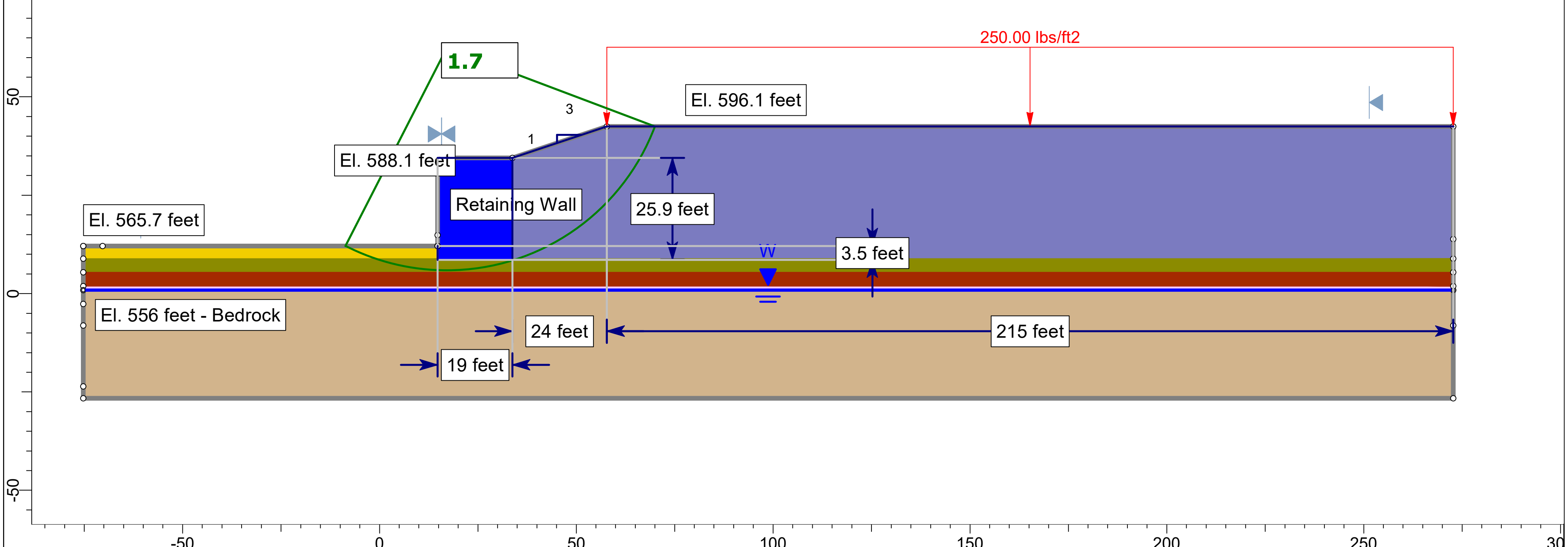
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Clay Engineered Fill Undrained		125	Mohr-Coulomb	1000	0
Gray Sand with Gravel Fill Undrained		132	Mohr-Coulomb	0	30
Light Brown Very Dense Sand with Gravel Undrained		151	Mohr-Coulomb	0	45
Gray Very Dense Gravel Undrained		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite Strength		
Limestone		165	Mohr-Coulomb	0	50

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

SLIDEINTERPRET 9.031

Project	IDOT PTB 198-003 - Retaining Wall #3		
Group	Group 1	*Scenario*	Short Term Stability - Water El. 556
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	7/15/2021, 12:22:18 PM	*File Name*	Retaining Wall #3.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Clay Engineered Fill Drained		125	Mohr-Coulomb	50	25
Gray Sand with Gravel Fill Drained		132	Mohr-Coulomb	0	30
Light Brown Very Dense Sand with Gravel Drained		151	Mohr-Coulomb	0	45
Gray Very Dense Gravel Drained		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite Strength		
Limestone		165	Mohr-Coulomb	0	50



GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

SLIDEINTERPRET 9.031

Project	IDOT PTB 198-003 - Retaining Wall #3		
Group	Group 1	*Scenario*	Long Term Stability - Water El. 556
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	7/15/2021, 12:22:18 PM	*File Name*	Retaining Wall #3.slmd

Appendix F

Summary of Soil Parameters

Table F-1 – Summary of Soil Parameters

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
2-5.5 (560.5-557) (554.55-552.05 RWB-26)	Light Brown Very Dense Sand with Gravel / Gravel with Sand	151	0	45	0	45
5.5-6.5 (557-556)	Gray Very Dense Weathered Limestone	150	0	45	0	45
0-8 (562.5-554.5) **RWB-26 only**	Fill Gray Sand with Gravel	132	0	30	0	30
3-6 (559.5-556.5) **RWB-27 only**	Fill Brown Stiff Silty Clay	135	1,500	0	150	25