gonzalez

Structure Geotechnical Report for Proposed Slope Embankment Retaining Wall for Multi-use Path at IL 53 (FAP 342) over US 12 (Rand Road) (FAU Rte. 334)

IDOT Contract Number	62N91
IDOT Job Number	D-91-144-21
Section	2018-100-BR
County	Cook
Proposed Retaining Wall SN	016-W2503
Existing Bridge SN	016-0973 and 016-0371 (IL 53 northbound and southbound)
Route	IL 53 (FAP 342)
Feature Crossed	US 12 (Rand Road) (FAU Rte. 334)

Illinois Department of Transportation
District 1
Region 1

Gonzalez Project Number 23-1003

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Rev 4

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1. PROJECT DESCRIPTION AND SCOPE

1.1 Project Description

Gonzalez Companies, LLC (Gonzalez) performed a geotechnical investigation for the establishment of a multiuse path along US 12 (Rand Road), which will pass between the south abutment and Pier 1 at IL 53. To accommodate the multiuse path's footprint, a portion of the existing slope-wall must be removed and retained. A slope-wall cutback retaining wall is proposed for the IL 53 bridge over US 12. The project site is within Cook County, Illinois, and lies within the limits of the Third Principal Meridian (SE ¼, Section 12, T42N, R10E and SW¼, Section 7, T42N, R11E). The project location is shown on the Project Location Map in **Appendix A**. This report presents the depth and characteristics of the soils along the proposed improvement and geotechnical recommendations for the proposed project. Logs from four borings (B-1, B-2, B-5, and B-6) drilled around 1965 were provided by IDOT.

1.2 Existing Conditions

According to the Wall Feasibility study (Strand, 2023), there is no existing sidewalk under the structures or along the shoulders. The existing concrete slope-wall is at 2H:1V (2 horizontal to 1 vertical) slope. The proposed cross section of IL 62 and bridge structures from the 1965 plans are included in **Appendix B**, along with the boring logs from the plans.

1.3 Proposed Improvements

The proposed multiuse path will be 14 feet in width (including 10 ft paved path and two 2 ft shoulders). The existing paved slope will be cut back, creating the need for earth retention. Three alternatives for retaining walls have been considered: solder pile and lagging wall, cast-in-place (CIP) concrete inverted T-wall, and drilled soil nail wall. The Wall Feasibility study (Strand, 2023) recommends the CIP inverted T-wall, which would have an estimated bottom of footing elevation of approximately 716. The bridge superstructures are anticipated to be replaced while the substructures will be repaired and rehabilitated for reuse. The basic cross-section of the three alternatives and the recommended wall is included as **Appendix C**.

2. GENERAL GEOLOGY

The project area is located in northeastern Illinois about 10 miles northwest of Chicago O'Hare International Airport within the Wheaton Morainal Country within the Great Lake section of the Central Lowland Province. Based on historical borings and publications, the subsurface profile includes interbedded glacial deposits (medium stiff to stiff), and bedrock. In the area of IL 53 at US 12, bedrock is expected around El. 560 (Stumpf, 2006), which is over 150 feet below the existing ground surface. Historical topographic maps indicate the project area is on the edge of a marsh (USGS, 1923 and 1960).

3. FIELD EXPLORATION

3.1 Subsurface Exploration and Testing

3.1.1 Field Investigation

Between May 2 and May 9, 2023, Gonzalez drilled and logged five conventional soil borings near the proposed wall. The boring locations are shown on the Boring Plan in **Appendix D** and coordinates are provided in **Table 1**. Ground surface elevations at the boring locations were determined in the field by GPS survey equipment (Virtual Reference Station (VRS) utilizing a Trimble R8 receiver). Gonzalez subcontracted the conventional soil borings to Rubino Engineering, Inc. A Gonzalez geotechnical specialist observed and coordinated the field investigation.

Table 1. Boring Locations and Elevations

Boring ID	Date Drilled	Boring Depth (ft)	Surface Elevation[1] (ft)	Latitude	Longitude
GC-06	May 2, 2023	55	738.3	42.12909124	-88.00464949
GC-08	May 3, 2023	55	738.6	42.12938597	-88.00504214
GC-34	May 9, 2023	25	719.2	42.12970740	-88.00510809
GC-35	May 9, 2023	12	720.2	42.12930806	-88.00459569
GC-36	May 9, 2023	25	720.2	42.12930806	-88.00459569

1. **North American Vertical Datum 1983; vertical precision is within 0.1 feet.**

The borings were advanced with a Geoprobe 7822DT drill rig using hollow stem augers to completion depths ranging from 12 to 55 feet below existing ground surface. Borings were terminated at planned termination depths. Soil samples were obtained under the direction of a Gonzalez engineer using a 2-inch outer diameter split spoon sampler driven with an automatic hammer in accordance with the standard penetration test (AASHTO T 206). The samples were logged for soil type and the unconfined compressive strength was determined with a Rimac or pocket penetrometer, as appropriate. Thin-walled 3-inch diameter Shelby tube (AASHTO T 207) samples were obtained in GC-35, in cohesive materials, at select depths. The soil samples were contained in a thin-wall sleeve 30 inches in height. Upon completion, each boring was backfilled with auger cuttings and capped with pavement patch. The Subsurface Data Profile Plot is included as **Appendix E** as a graphical record of the subsurface explorations, and the Soil Boring Logs are included as **Appendix F**.

3.1.2 Laboratory Testing

Soil samples were taken to the laboratory of Gonzalez subcontractor Rubino to determine the moisture content (AASTHO T265), grain size (T88), unit weight, and Atterberg Limits (T89 / T90) in general accordance with the referenced AASHTO Standards. The results of the laboratory testing are summarized on the boring logs at the corresponding sample depths and in **Appendix G**.

3.2 Subsurface Conditions

The near-surface materials in the project area generally consist of glacial materials overlain by fill placed for the IL 53 embankments. Some variations in subsurface materials between individual borings was observed, and caution should be taken with extrapolating soil properties beyond limits of the investigation. Fill material may vary in depth across the project site as a result of previous construction activities.

Bedrock was not encountered during the field investigation. The deepest boring was advanced to 55 feet below existing ground surface (bottom of boring at EL 683.3).

A summary of fill and naturally-deposited soils encountered during the field exploration are described in the following subsections. The summary results of their associated field and laboratory testing are also included in **Table 2**.

Table 2. Summary of Field and Laboratory Tests

Field/Lab Test	Embankment Fill Material			Natural Deposits		
Index/General Properties:	***# tests***	**Range**	**Average**	***# tests***	**Range**	**Average**
Moisture Content (%)	*22*	6 – 30	17	*33*	11 – 30	17
Atterberg Limits (%)				*2*		
Liquid Limit					23 – 24	24
Plastic Limit					16 – 16	16
Plasticity Index					7 – 8	8
Wet Unit Weight (pcf)				*1*		127
Rimac Unconfined Compressive Strength (tsf)	*16*	1.3 – 5.6	2.9	*24*	0.1 – 4.4	1.8

3.2.1 Embankment Fill Material

Observed fill material consists predominately of clay that was brown, moist, low plastic. Fill material was encountered in all borings to an average elevation of 715, but varies in depth across the project site as a result of previous construction activities. SPT N-values in the fill materials ranged between 3 and 14 blows per foot (bpf) with an average near 9 bpf, indicating medium stiff to stiff cohesive deposits.

3.2.2 Natural Deposits (Glacial)

Observed natural deposits generally consist of cohesive soil (clay and sandy loam) that was brown, dry to wet, low plastic, with varying amounts of sand and gravel. Occasional layers of sand and silt were encountered as well. Soft to medium stiff, wet soils were encountered near the footing elevation of 716 in the borings northeast of the proposed wall as observed in borings GC-35 and GC-36. SPT N-values in the natural deposits ranged between 1 and 21 bpf with an average near 12 bpf, indicating a soft to stiff deposit.

3.2.3 Groundwater

Groundwater was encountered in the borings at the time of field exploration at depths/elevations shown in **Table 3**.

Table 3. Groundwater Observations

Boring ID	During Drilling		After Drilling	
	Groundwater Depth (ft)	**Groundwater Elevation (ft)**	**Groundwater Depth (ft)**	**Groundwater Elevation (ft)**
GC-06	39	699.3	Dry	-
GC-08	Dry	-	27	711.6
GC-34	3.5	715.7	Dry	-
GC-35	Dry	-	Dry	-
GC-36	Dry	-	Dry	-

Delayed groundwater levels were not measured, because the borings were backfilled upon completion due to safety reasons. The values in **Table 3** may not represent the long-term groundwater levels. Groundwater is not expected to be present within the embankment fill, but may be present in the natural soils. Since the historical topographic maps indicate the project area was in a marsh, groundwater may be present near the natural ground surface elevation.

4. GEOTECHNICAL EVALUATIONS

4.1 Settlement

No significant settlement was observed by Gonzalez during field work. Gonzalez is not aware of any settlement issues at the structure. It is our understanding that this project will not include additional fill heights, so overall embankment settlement is not expected.

4.2 Global Slope Stability Analysis

Since we do not anticipate changes to the North abutment slopes, the North abutment was not analyzed for global slope stability. The South abutment, however, was analyzed since the slope-wall will be cut back.

Slope stability is influenced by various factors including: (1) the geometry of the soil mass and subsurface materials; (2) the weight of soil materials overlying the failure surface; (3) the shear strength of soils along the failure surface; and (4) the hydrostatic pressure (groundwater levels) present within the landslide mass and along the failure surface.

The stability of a slope is expressed in terms of the factor of safety, FS, which is defined as the ratio of resisting forces to driving forces. At equilibrium, the FS is equal to 1.0, and the driving forces are balanced by the resisting forces. Failure occurs when the driving forces exceed the resisting forces, or a factor of safety less than 1.0. In order to increase the factor of safety above 1.0, you must increase the resisting forces or decrease the driving forces; this reflects a corresponding increase in the stability of the mass. The actual factor of safety may differ from the calculated factor of safety due to variations in soil strengths, subsurface geometry, failure surface location and orientation, groundwater levels, and other factors that are not completely known or understood.

Soil strength values obtained from laboratory testing on Shelby tube samples, field Rimac testing, and published correlations were used in the slope stability analyses. The cross-sections presented in **Appendix C** were used to conduct the slope stability analyses on the proposed profiles. The Drained case was analyzed for the two geometries: the proposed slope with the multiuse path, and during construction of the CIP concrete inverted T-wall. The critical factor of safety was calculated to be approximately 2.3 (post construction geometry) and 1.3 (temporary construction geometry) for the two drained cases. The slope stability results are included in **Appendix H** of this report.

Water runoff from the reconstructed slope and deck drains should be channeled away from the wall and not allowed to infiltrate the wall backfill.

4.3 Seismic Considerations

Seismic Site Class was determined based on IDOT Design Guide: AGMU Memo 09.1-LRFD Seismic Site Class Definition (2009) and the IDOT spreadsheet BBS 149 “Seismic Site Class Determination” (November 01, 2016). Based on a weighted average N-value of 11 bpf and weighted average undrained shear strength (su) of 1.6 kips per square foot (ksf), the global site soil class is defined as Seismic Site Class D. The results of the seismic site class determination are included in **Appendix I**.

Seismic analysis based IDOT Geotechnical Manual (IDOT, 2020) and the AASHTO Seismic Acceleration Coefficient Map provided by USGS Hazard Design Tool (USGS, 2022) for AASHTO-2009 indicated the Peak Ground Acceleration (PGA) is 0.041g during the earthquake based on the hazard of 7% probability of exceedance in 75 years (an approximate 1000-year return period event). Based on the site coordinates, the mapped MCE (Maximum Considered Earthquake) spectral response accelerations were obtained at

0.2 second (S_{DS}) and 1 second (S_{D1}). The site Seismic Performance Zone (SPZ) was assigned to the site to establish a level of seismic risk which is used for structure design criteria based on Table 3.10.6-1 of the "AASHTO LRFD Bridge Design Specifications" (AASHTO, 2020). The design criteria in **Table 4** were developed using the USGS Hazard Design Tool for AASHTO-2009 for reference coordinates 42.129456, -88.004841.

Table 4. Seismic Soil Site Class and Parameters

Seismic Soil Site Class	Seismic Performance Zone (SPZ)	Site-Specific Design Spectral Acceleration Parameters	
		S_{DS}	S_{D1}
D	1	0.14g	0.081g

Note: SPZ 1: $S_{D1} = F_V S_1 \leq 0.15g$

Based on site's seismic performance zone, seismic slope stability and liquefaction analysis are not required.

5. RETAINING WALL RECOMMENDATIONS

Three alternatives for retaining walls have been considered: cast-in-place (CIP) concrete cantilever (inverted T-wall), soldier pile and lagging wall, and soil nail wall. The Wall Feasibility Study (WFS) prepared by the wall designer (Strand 2023) is included as **Appendix J**. The CIP inverted T-wall was the recommended alternative in the WFS.

5.1 Cast-in-Place Concrete Cantilever Wall (Inverted T-wall)

Cast-in-Place (CIP) concrete cantilever retaining walls are typically used in areas without access/site constraints. The wall is constructed with a footing that extends laterally both in front of and behind the wall. The wall 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.

A shallow spread footing foundation was considered for support at the CIP T-wall with an estimated bottom of footing elevation of approximately 716. The existing embankment and native soils observed in the borings (soft to stiff clay) will support construction of a CIP T-wall with modification.

5.1.1 Removal and Replacement

Soft to medium stiff, wet soils were encountered near the footing elevation of 716 in the borings northeast of the proposed wall as observed in borings GC-35 and GC-36. Soft materials should be removed between Station 71+50 and 73+50, to an Elevation of 709. The horizontal limits of removal and replacement should be extended 2 ft beyond the footing's footprint. The IDOT Geotechnical Manual (2020) recommends the excavated, weak material be replaced by a coarse, clean, crushed stone or gravel. If a clean gravel backfill is placed on cohesive soils, a geotextile filter fabric, such as Mirafi 1100N (or equivalent) should be placed below the clean gravel.

With removal and replacement, we estimate the foundation soils will have a nominal bearing resistance of 3,500 psf and a factored bearing resistance of 1,925 psf based on a geotechnical resistance factor of 0.55. For the footings, we recommend the following:

- Minimum footing width of 3 feet.
- Minimum footing depth of 4 feet for frost protection.
- Subgrade and foundation excavations should be evaluated prior to construction by a geotechnical engineer to verify that acceptable materials are exposed and have an acceptable density. If very soft or soft soil is encountered at the bottom of the excavation, we recommend one of the following:
    - o Remove the soft soil down to at least medium stiff (i.e., firm) lean cohesive soils and replace with engineered fill.
    - o If medium stiff (i.e., firm) clay (CL) or medium dense sand (SP, SC, SM) is not encountered below any encountered soft soil, a graded engineered fill can be used to stabilize the soil subgrade. Graded engineered fill may include the placement of a 2- to 3-foot-thick layer of 6-inch diameter clean rock, followed by a 1-foot-thick layer of 3-inch diameter clean rock that is capped with a 6-inch-thick layer of 1-inch minus gravel (with up to 12 percent fines). A geogrid or geotextile can be used as a separation layer between the soft soil and the largest rock fill.
- Water should not be allowed to stand in excavations at any time during construction. Small amounts of groundwater seepage are anticipated and can likely be handled by sump pumps or other standard means.
- Footings should be inspected and poured in the same day as they are excavated to protect subgrade materials. Subgrade materials are prone to strength loss, volume change, and increased compressibility with exposure to freezing conditions, moisture, and high temperatures (i.e. drying).

5.1.2 Aggregate Piers

Ground improvement via aggregate piers could be considered as an alternative to removal and replacement of soft soils under the CIP wall. Aggregate piers are a proprietary product that licensed contractors design and construct. The contractor should design the rammed piers for a bearing pressure of 4,000 psf or the estimated wall bearing pressure, with an estimated settlement of less than 1 inch. The wall foundation could then be constructed on a rock pad constructed above the aggregate piers.

5.2 Soldier Pile and Lagging Wall

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 due to site constraints. The walls maintain the existing site conditions with minimal disturbance to existing structures and can be installed relatively quickly in most situations. 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 wall may be constructed with driven steel piles or steel piles placed in drilled holes and backfilled with concrete. Resistance to lateral movement or overturning of the soldier piles is furnished by passive resistance of the soil below the depth of excavation. The depth of the soldier pile is normally estimated to be two times the wall exposed height. Soldier piles are typically spaced at 6 to 14-foot on center and are faced with cast-in-place or precast concrete. The maximum horizontal spacing between anchors is based on allowable individual anchor loads and flexural capacity of individual soldier beams.

Solider pile and lagging wall system should be designed in accordance with the IDOT Bridge Manual. Soil parameters in Tables 5 and 6 can be used to design solder pile and lagging wall system. The passive resistance of a solider pile wall is developed in combination from the soldier pile and the soil between the solider pile. Soil arching allows for additional passive resistance of the solider pile wall to be developed and accounted for in the design. Note that the effective width of the solider pile element, in determination of passive resistance, is typically assumed to be equal to the solider pile and the concrete drilled shaft combined (i.e., the effective element diameter is equal to the drilled shaft diameter). Based on site soil conditions and guidance presented in the IDOT Bridge Manual, AASHTO LRFD Bridge Design

Specifications, and the Caltrans Trenching and Shoring Manual, we recommend limiting pile spacing to a maximum of 8 feet for competent soils (i.e., granular (sandy) soils and hard to firm clayey soils. In addition, we would recommend limiting the pile spacing to a maximum of 6 feet for piles are embedded in soft fine-grained soils (clay/silt) to ensure that soil arching is achieved between the solider piles. Pile space can be adjusted along the wall based on encountered soils. Note, soft clay soils were only encountered in borings GC-36 and GC-36. It is our opinion that the soft clay soils are likely isolated to the area approximately within 50 feet of GC-35 and GC-36 based on review of available information.

Construction soldier piles wall typically requires relatively large equipment with unrestricted vertical and horizontal site access to install the wall system. Given the geometry and close proximity of the existing bridge abutment, if tie backs and or deadman anchors are used as part of the design, these items may need to be installed with specialty equipment. The location and alignment of the wall will need to be reviewed to ensure that the permanent ground anchors do not interfere with existing structures.

5.3 Soil Nail Wall

Soil nails are reinforcing, passive elements that are drilled and grouted sub-horizontally in the ground to support excavations in soil, or in soft and weathered rock to create earth retention system. Soil nail walls are constructed using a “top-down” construction sequence, where the ground is excavated in lifts of limited height. Soil nails and an initial shotcrete facing are installed at each excavation lift to provide support. Subsequently, a final shotcrete or cast-in-place concrete (CIP) facing is installed. Nails are most often installed at a vertical spacing of 4 to 6 ft. The nail vertical spacing is comparable to the typical height of a stable, excavation lift, which is commonly 3 to 5 ft and could be more in some soils. The horizontal spacing of nails is often also in the range of 4 to 6 ft.

Soil conditions (i.e., stiff cohesive soils) are present with a low water table which are conditions favorable for a soil nail design. Construction methodology of soil nail wall allows for the easy adjustments to nail inclination and location can be made when obstructions are encountered, such as boulders, piles or underground utilities. In addition, soil nail wall installation is not as restricted by overhead limitation as in the case of soldier pile installation. The existing abutment foundation comprises of battered piles along the front row. The plan for the 62N91 Bridge Rehabilitation contract is to convert the abutments to Semi-Integral configurations. The feasibility of placing the soil nails will need to be considered given multiple site constraints. Should the design length of the nails cross through the pile groups of the existing abutment it is our understanding that the Bridge Office finds this type of interaction to be undesirable and will likely exclude this wall system from further consideration.

5.4 Lateral Resistance

The following table is a summary of lateral soil parameters to be used for design of the earth retention structures. Unit weights, friction angles and shear strength parameters were estimated using standard penetration test (SPT) using published correlations for N values results. **Table 5** presents generalized soil parameters to be used based for designs on the laboratory and in-situ testing data.

Table 5. Lateral Earth Pressure Design Parameters

Stratum	Material Type	Total Unit Weight (pcf)	Drained Peak Friction Angle, Ø	Undrained Shear Strength, psf	Active Earth Pressure Coefficient, Ka		Passive Earth Pressure Coefficient, Kp		Soil Modulus, k (pci)	Strain, e50
					Level backslope	2H:1V Backslope	Level backslope	2H:1V Backslope		
Embankment Fill	Clay	120	32	1,500	0.31	0.46	3.3	1.72	500	0.005
Soft Clay	Clay	120	26	800	0.39	0.9	2.6	0.9	500	0.010
Stiff Natural Deposits (Glacial)	Clay, Sandy Loam	125	30	2,500	0.33	0.54	3.0	1.49	1000	0.006

Note:
1. Active and passive earth pressure coefficients based on Rankine theory equations with a level ground surface and a 2H:1V backslope. Designer should consider the influence of sloping backslope and surcharge loading and adjust coefficients as needed.

Allowances should be made for any surcharge loads adjacent to the retaining structure. Proper drainage should be provided behind the walls to reduce development of hydrostatic forces from groundwater. For the long-term active case (permanent case), cohesion in the clay layers should be ignored and the effective stress condition (drained conditions) should be used. For the long-term passive case, the undrained cohesion should be used at undisturbed depths below the frost line (greater than 4 feet below the ground line).

The wall can be designed for Equivalent Fluid Pressures (EFP) as shown in **Table 6**. The passive resistance should be ignored above the frost depth and above any depth of construction disturbance. The Drained Conditions can be utilized for backfill behind the wall, above the bottom elevation of the wall drainage system (clean granular backfill and/or pipe underdrain that daylights). Sloping ground can be modeled as an equivalent additional surcharge load located at the top of the structure.

Table 6. Equivalent Fluid Pressures (pcf)

Stratum	Approximate Elevation (ft)	Level Ground Backslope				2H:1V Backslope			
		Drained Conditions		Undrained Conditions		Drained Conditions		Undrained Conditions	
		Active	Passive	Active	Passive	Active	Passive	Active	Passive
Embankment Fill (Existing)	Above 717	45	400	80	250	55	200	90	160
Soft Clay (GC-35 and GC-36)	710 to 717	55	300	85	210	110	110	115	115
Stiff Natural Deposits (Glacial)	Below 710	50	375	83	250	70	190	100	155
Compacted Granular Backfill (New Gravel)		40	460	82	302	50	255	90	200
Compacted Fine-grained Backfill (New Clay)		45	345	83	222	80	150	100	130

Notes:
1. EFP values are unfactored, for level ground and 2H:1V backslope, and do not include surcharge loads.
2. New granular backfill is assumed to have a unit weight of 130 pcf and friction angle of 34 degrees.

New structural backfill is assumed to have a unit weight of 120 pcf and friction angle of 28 degrees.

6. CONSTRUCTION CONSIDERATIONS

We do not anticipate the need for other special construction monitoring for the earthwork except as normally required by the IDOT Standard Specifications, Special Provisions and Contract Plans. During construction, an experienced geotechnical engineer or soil technician should be retained to perform the following tasks:

- Monitor earthwork operations
- Evaluate the suitability of the soils for subgrade support
- Observe excavation
- Check soil materials, compaction, moisture content, and stability for compliance with project specifications
- Monitor locations and depths of undercuts
- Advise the IDOT Resident Engineer of any conditions not apparent during the subsurface exploration

6.1 Temporary Excavations

All excavations must comply with applicable local, state and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. Temporary excavations should have a slope as required to provide a stable side slope and the potential effect of ground movements upon open roadway and utilities should also be taken into consideration. All temporary cut excavation should be analyzed on an individual basis. In general, we recommend that temporary construction slopes be no steeper than 1 Horizontal to 1 Vertical (1H:1V) and comply with OSHA requirements for Soil Type B.

7. LIMITATIONS

This report is based on Gonzalez Companies' understanding of the project as described and was prepared to provide recommendations for retaining wall construction. The boring logs depict subsurface conditions for the specific locations and dates. Depth to groundwater levels recorded on our boring logs are subject to many variables and may not be indicative of long-term equilibrium conditions. These variables include puncture of perched horizons and inadequate time for equilibration of groundwater pressure.

The analyses and recommendations submitted in this report are based in part upon the subsurface data collected and our experience with similar projects. The nature and extent of variations across the site may not become evident until construction. If variations then become apparent that could affect the proposed project, it may be necessary to re-evaluate some of the recommendations of this report. The recommendations and observations presented in the report assume that significant variations do not occur. Non-uniform conditions, however, often cannot be determined by the procedures described. Such conditions may necessitate additional expenditures to obtain a properly constructed project. We recommend that a contingency fund be budgeted to accommodate such possible expenditures.

8. REFERENCES

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APPENDIX A Project Location Map

LEGEND KEY:

PROJECT LOCATION

gonzalez COMPANIES, LLC

ILLINOIS DEPARTMENT OF TRANSPORTATION
IL 53 BRIDGES, 62N91, PTB 203-021
COOK COUNTY, IL

PROJECT NO. 23-1003

IL 53 OVER US 12 (RAND RD)
PROJECT LOCATION MAP

APPENDIX A

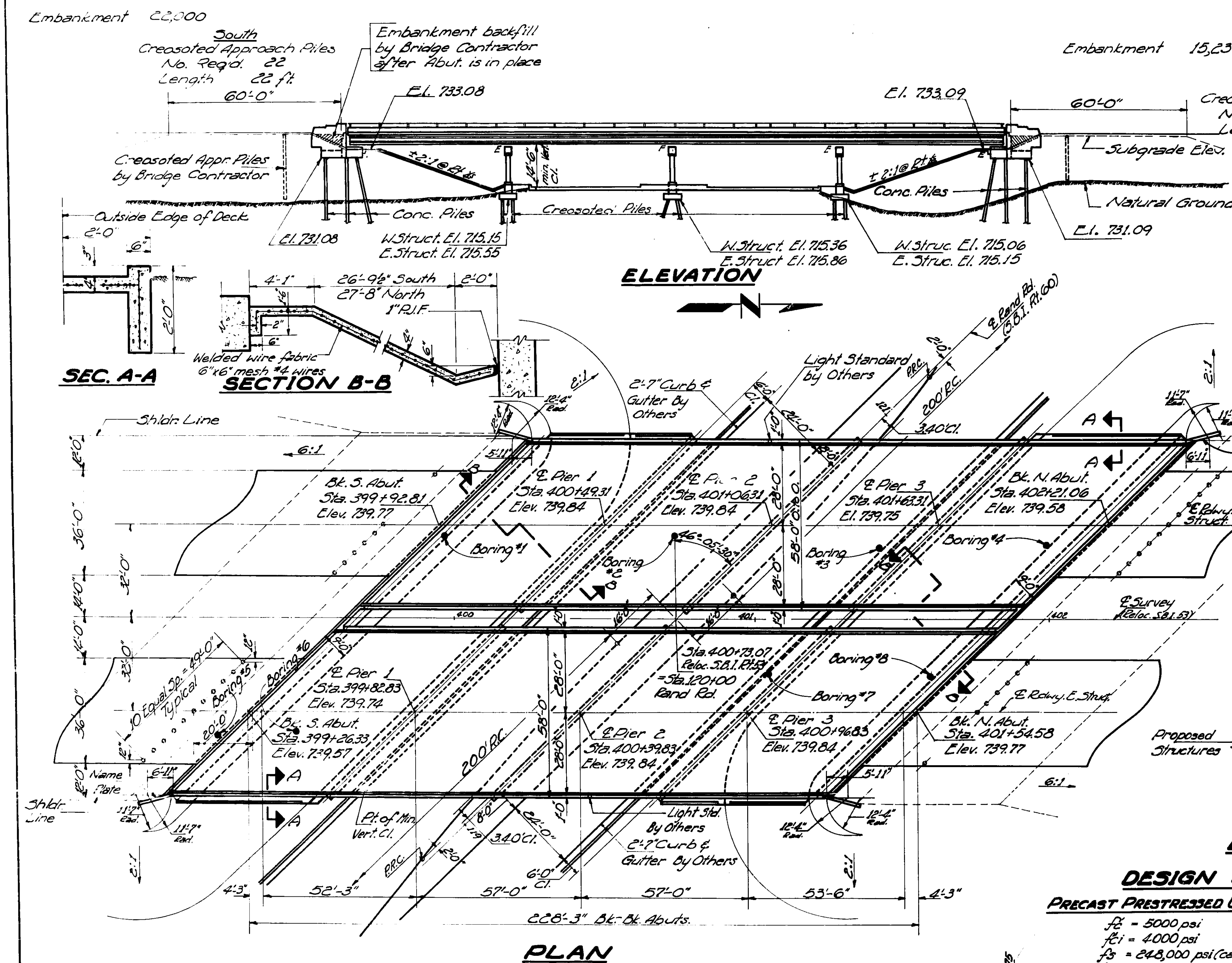
APPENDIX B Pages from 1965 Plans

3.M. - R.R. Spike in S. face P.P. on North side Rand Rd. 130'± E. of intersection Wilke & Rand Rd. Elev. 723.52

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

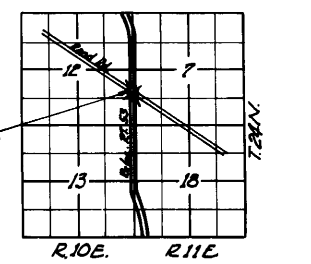
ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
S.B.I. 53 F.A. 61	531-3HB-2	COOK	25	7
FED. ROAD DIST. NO. 7	ILLINOIS	FED. AID PROJECT: F-184(41)		

SHEET NO. 1
16 SHEETS



STATION 400+73.07
BUILT 196 BY
STATE OF ILLINOIS
S.B.I. RT. 53 SEC. 531-3HB2
F.A. PROJ. F-184(41)
LOADING HS20

NAME PLATE
See Std. 2113-1



LOCATION SKETCH

GENERAL NOTES

Class X Concrete shall be used throughout.

Coarse aggregate to be used in parapet handrails and end post must be absolutely free of chert, flint, limonite, lignite and soft sandstone.

The concrete floor slab shall be finished in accordance with Art. 51.19 of the Standard Specifications.

Slope wall shall be reinforced with welded wire fabric. 6"x6" mesh, weighing 58 Lbs. per sq. ft.

All reinforcement bars shall be lapped a minimum of 20 diameters unless otherwise shown.

All structural steel shall comply with the Specifications for Structural Steel A.S.T.M. Designation A-36.

Roadway expansion guards shall be assembled in the shop in proper position with the ends in place and shall be left assembled for shop inspection.

The exposed surfaces of the expansion guard shall be given two shop coats of red lead paint, the contact surfaces shall be given one coat of red lead paint. Anchor studs shall not be painted.

Expansion guards are included in the quantity of Structural Steel. Estimated weight 20,960 lbs.

The Contractor shall drive 2 concrete test piles, one at each abutment in a permanent location; 2 timber test piles, one in the vicinity of Pier 1 E. Structure and one in the vicinity of Pier 3 W. Structure as directed by the Engineer before ordering the remainder of piles.

Concrete piles at abutments shall be driven in holes precored through the embankment in accordance with Art. 60.9 (c) of the Standard Specifications.

Permanent forms will not be permitted in forming the concrete floor.

Excavation for slope wall shall be considered as incidental to the cost of the slope wall.

TOTAL BILL OF MATERIAL

Item		Super.	Sub.	Total
Embankment	Cu. Yds.			37,230
Class "A" Exc. for Struct.	Cu. Yds.			560
Structural Steel	Lbs.	27,460		27,460
Furnishing and Erecting Precast Prestressed Concrete I-Beam, 42"	Lin. Ft.	3962		3962
Class X Concrete	Cu. Yds.	873.4	1017.6	1891.0
Protective Coat	Sq. Yds.			3,158
Aluminum Handrail	Lin. Ft.	891		891
Reinforcement Bars	Lbs.	184,470	109,180	293,650
Creosoted Piles	Lin. Ft.		5732	5732
Test Piles (Timber)	Ea.		2	2
Concrete Piles	Lin. Ft.		4,000	4,000
Test Piles (Concrete)	Ea.		2	2
Name Plates	Ea.		2	2
Slope Wall (4")	Sq. Yds.			1,516

DESIGN STRESSES

PRECAST PRESTRESSED UNITS

f'_c = 5000 psi
f'_{ci} = 4000 psi
f'_s = 248,000 psi (cables)
f_{si} = 173,600 psi

FIELD UNITS

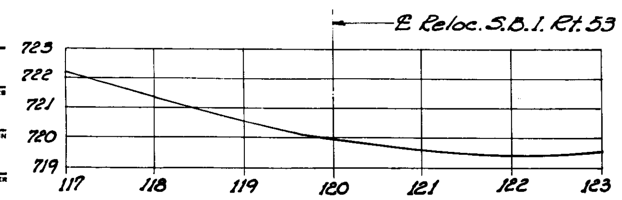
f'_c = 1400 psi Sub. & Super
vc = 75 psi Ftgs.
f_s = 20,000 psi Reinf.
f_s = 20,000 psi Struct. (A-36)
n = 10

LOADING HS20-44

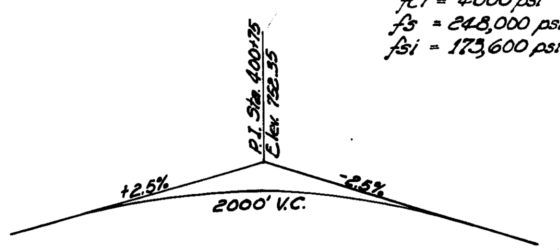
DESIGNED	D.E. Sponsler
CHECKED	R. Sander
DRAWN	A. Barraza
CHECKED	R.S.

JULY 15 1964

EXAMINED W. G. Baumann — ENGINEER OF BRIDGE AND TRAFFIC STRUCTURES
PASSED — ENGINEER OF DESIGN
APPROVED V. E. — CHIEF HIGHWAY ENGINEER



RAND RD. PROFILE



RELOC. S.B.I. RT. 53 PROFILE

PROJ. F-184 (41)
GENERAL PLAN & ELEVATION
S.B.I. RT. 53 SEC. 531-3HB-2
COOK COUNTY
STA. 400+73.07

Revised 6/28/65 Added in Total Bill of Mtl. items Earth Exc. & Porous Granular Emb.
In ELEVATION added note D.S./A.B.

Rev. 6-28-65

ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
S.B.I. F.A. 61	531-3HB-2	COOK	25	22

FED. ROAD DIST. NO. 7 · ILLINOIS · FED. AID PROJECT

SHEET NO. 15 · 16 SHEETS

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

Boring No. B-1 · **Station** 399 + 95 · **Offset** 27' W of C. L. of 53 · **Ground Surface** 716.0

	Elevation	N	Qu t/s.f.	w (%)
	0			
BLACK ORG CLAY				
BROWN SANDY CLAY				
BROWN SILTY CLAY		8 / 11	1.63	S
	-5			
BROWN SILTY GRAVELLY		10	1.17	
GRAY GRITTY CLAY		6	2.13	B
H2O	-10			
GRAY GRITTY CLAY		5 / 8	2.54	B
GRAY GRITTY CLAY		5 / 8	2.54	B
	-15			
GRAY GRITTY CLAY		5 / 10	2.54	B
GRAY GRITTY CLAY		7 / 10	2.54	S
	-20			
GRAY CLAY		6 / 9	2.54	B
GRAY GRITTY CLAY		7	2.72	B
	-25			
GRAY CLAYEY SILTY GRAVEL		8		
GRAY CLAYEY SILTY GRAVEL		16 / 18		
	-30			
GRAY CLAYEY SILTY GRAVEL		15 / 20	----	
GRAY CLAY		7 / 8	2.50	P
	-35			
GRAY CLAY		6 / 7	2.00	P
END OF BORING				

Surface Water El. ___
Groundwater El. at Completion 10'
After 2 Hours

Boring No. B-2 · **Station** 400 + 74 · **Offset** 27' W of C. L. of 53 · **Ground Surface** 718.0

	Elevation	N	Qu t/s.f.	w (%)
	0			
BLACK ORGANIC CLAY				
BOULDERS				
BROWN GRAVELLY CLAY		6 / 7	2.75	S / B
	-5			
BROWN GRAVELLY CLAY		6 / 6	2.75	S
GRAY GRITTY CLAY		4 / 7	2.91	B
	-10			
GRAY GRITTY CLAY		5 / 7	2.91 / 2.13	B / B
4-20-64				
GRAY GRITTY CLAY		7 / 10	1.63 / 3.10	B / B
	-15			
GRAY GRITTY CLAY		8 / 10	2.72 / 3.10	B / B
GRAY GRITTY CLAY		6 / 8	2.72	B
	-20			
GRAY GRITTY CLAY		4 / 9	2.74	B
GRAY CLAYEY GRAVELLY SILT		7 / 11	----	
	-25			
GRAY STONEY CLAY		6 / 10	2.13	B
GRAY STONEY SANDY SILT		5 / 7	----	
	-30			
GRAY STONEY SANDY SILT		4 / 18	----	
GRAY STONEY SANDY SILT		8 / 14	----	
	-35			
GRAY CLAYEY SANDY SILT		18 / 21	----	
GRAY STONEY SANDY SILTY CLAY		7 / 8	1.63	B
(STONEY)	-40			
GRAY CLAYEY SANDY SILT		9 / 12	----	
END OF BORING				

Surface Water El. ___
Groundwater El. at Completion 21 1/2'
After 20 Hours 2'

Boring No. B-3 · **Station** 401 + 43 · **Offset** 23' W of C. L. of 53 · **Ground Surface** 718

	Elevation	N	Qu t/s.f.	w (%)
	0			
BROWN GRAVELLY CLAY				
H2O				
BROWN SANDY GRAVELLY CLAY		9	1.54	S
	-5			
PINK SANDY CLAY		5 / 7	1.50	P
BROWN SANDY GRAVEL				
GRAY GRAVELLY CLAY		5 / 5	1.43	B
	-10			
GRAY GRAVELLY CLAY		7	1.43	B
GRAY GRITTY CLAY		2 / 6	1.43	B
	-15			
GRAY GRITTY CLAY		5	1.63	B
GRAY GRITTY CLAY		6 / 8	2.50	P
	-20			
GRAY GRITTY CLAY		7 / 10	2.13 / 2.72	B / B
GRAY GRITTY CLAY				
GRAY GRAVEL H2O		2 / 5	1.50	B
	-25			
GRAY CLAYEY SILTY GRAVEL		9 / 11	----	
GRAY CLAYEY SILTY GRAVEL		10 / 12	----	
	-30			
GRAY CLAYEY SILTY GRAVEL		12 / 14	----	
GRAY CLAYEY SILTY GRAVEL		12 / 14	--	
	-35			
GRAY CLAY		6	2.00	B / P
GRAY CLAY		4 / 5	2.50	P
	-40			
GRAY CLAYEY SILTY GRAVEL		5 / 7	----	
GRAY CLAYEY SILTY GRAVEL		7 / 9	----	
	-45			
GRAY CLAYEY GRAVEL		7 / 10	----	
END OF BORING				

Surface Water El. ___
Groundwater El. at Completion 2 1/2
After ___ Hours

Boring No. B-4 · **Station** 401 + 99 · **Offset** 25' W of C. L. of 53 · **Ground Surface** 721.0

	Elevation	N	Qu t/s.f.	w (%)
	0			
BLACK ORG CLAY				
BROWN SANDY CLAY				
BROWN SAND				
BROWN SANDY GRAVELLY CLAY		3 / 4	----	
	-5			
BROWN GRAVELLY CLAY		3 / 5	----	
BROWN GRAVELLY CLAY (LIVERY)				
GRAY (FINE SANDY) SILTY CLAY		7 / 8	1.39	S
	-10			
GRAY GRAVELLY CLAY		5 / 8	2ton	P
GRAY GRITTY CLAY		6 / 9	2.13	B
	-15			
GRAY GRITTY CLAY		5 / 10	3.10	B
GRAY GRITTY CLAY		7 / 11	1.63	B
STONEY	-20			
GRAY GRITTY CLAY		6 / 10	2.91	B
GRAY GRITTY CLAY		8 / 13	2.13	B
	-25			
GRAY GRITTY CLAY		7 / 14	2.13	B
GRAY SANDY GRAVEL		10 / 13	----	
	-30			
GRAY SANDY GRAVEL		10 / 12	----	
GRAY SANDY GRAVEL		7 / 13	----	
	-35			
GRAY CLAY		5 / 7	2.91	B
GRAY GRAVEL				
GRAY CLAY		5 / 8	2.33	B
	-40			
GRAY CLAY		4 / 8	2.72	B
GRAY CLAY W/ LAYER OF SAND		10 / 25	2.33 / 4.50	B / P
	-45			
GRAY CLAY W/Stones		7 / 12	4.50	P
END OF BORING				

Boring No. B-5 · **Station** 399 + 15 · **Offset** 40' E. of C. L. of 53 · **Ground Surface** 716.00

	Elevation	N	Qu t/s.f.	w (%)
	0			
BLACK ORG CLAY				
BROWN GRITTY CLAY		3 / 3	1.63	B
PEATY	-5			
GRAY SANDY SILT CLAY				
GRAY GRAVEL		5 / 6	.65	S
(LIVERERY)				
GRAY STRATAIFIED SAND				
SILT AND SILTY CLAY		4 / 7	.98	B
(LIVERERY)	-10			
GRAY SILTY CLAY TO		6	.98	B
GRAY GRAVELLY CLAY		7	1.30	B
GRAY GRITTY CLAY		4 / 7	2.13	B
	-15			
GRAY SILTY CLAY				
GRAY CLAY		5 / 9	1.65 / 2.72	B / B
GRAY CLAY		8 / 9	2.13	B
	-20			
GRAY GRAVEL		6 / 9	--	
GRAY GRITTY CLAY		6 / 8	1.63 / 2.74	B / B
	-25			
GRAY GRAVEL		5 / 9	--	
4-23-64				
GRAY CLAY		7 / 8	1.17	B
GRAY CLAY	H2O -30			
GRAY GRAVELLY SILT		7 / 8	1.00	PE
GRAY GRAVELLY SILT		6 / 9	--	
	-35			
GRAY GRAVELLY SILT		6 / 10	---	
GRAY GRAVELLY SILT		6 / 10	---	
	-40			
GRAY GRAVELLY SILT		5 / 10	--	
GRAY GRAVELLY SILT		11 / 15	----	
	-45			
GRAY GRAVELLY CLAY		6 / 7	---	
GRAY CLAY		7 / 8	1.17	B
GRAY GRITTY CLAY	-50			
LAYER OF SAND		10 / 8	2ton	P
GRAY CLAY				
END OF BORING				

N - Standard Penetration Test - Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu - Unconfined Compressive Strength - t/sf
w - Water Content - percentage of oven dry weight - %.

Type failure:
B - Bulge Failure
S - Shear Failure
E - Estimated Value

Surface Water El. ___
Groundwater El. at Completion 2 1/2'
After 18 Hours 1

DESIGNED D.L. Gonzalez
CHECKED P. Sander
DRAWN D.L.
CHECKED P.G.

July 15 1964
EXAMINED W. Baumann — ENGINEER OF BRIDGES AND TRAFFIC STRUCTURES
PASSED [signature] — ENGINEER OF DESIGN
APPROVED V.E. Claff — CHIEF HIGHWAY ENGINEER

BORINGS
S.B.I. RT. 53 SEC. 531-3HB-2
COOK COUNTY
STA. 400+73.07

Route No.	Section	County	Total Sheets	Sheet No.
S.B.I. F.A. 61	531-3HB-2	COOK	25	23
Fed. Road Dist. No. 7	Illinois	Fed. Aid Project-		

SHE NO. 16
16 EETS

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

Boring No. B-6
Station 399 + 42
Offset 38' E of Cl of 53
Ground Surface 718.0

Elevation	Description	N	Qu t/s.f.	w (%)
0	BLACK ORGANIC CLAY			
	BROWN CLAY BLACK MUCK	1 1	---	
H20 5	BROWN CLAY GRAY GRAVELLY CLAY	1 10	--	
	BROWN TO GRAY GRITTY CLAY	5 9	2.13	B
-10	GRAY GRITTY CLAY	6 7	2.13	B
	GRAY GRITTY CLAY	4 7	1.37	B
-15	GRAY GRITTY CLAY	3 6	1.37	B
	GRAY GRITTY CLAY	7 10	1.63	B
H 20 -20	GRAY CLAYEY GRAVELLY SILT	5 9		
	GRAY CLAYEY GRAVELLY SILT	5 8	---	
-25	GRAY GRITTY CLAY	7 11	1.30	B
	GRAY CLAY	6 10	1.60	B
	4-17-64			
-30	GRAY CLAY	7 11	1.63	B
	GRAY CLAYEY GRAVELLY SILT	6 7	---	
-35	GRAY CLAYEY GRAVELLY SILT	9 14	---	
	GRAY CLAY	7 14	2.25	B P
-40	GRAY CLAY	18 17	3.10	B
	END OF BORING			

Surface Water El. ____
Groundwater El. at Completion 5'
After ___ Hours ____

Boring No. B-7
Station 401 + 05
Offset 19' E. of C. L. of 53
Ground Surface 716.7

Elevation	Description	N	Qu t/s.f.	w (%)
0	BROWN GRAVELLY CLAY			
H20	BROWN GRAVELLY CLAY	9 11	---	
-5	BROWN SILTY CLAY	7 10	1.63 3.30	B B
	GRAY GRITTY CLAY	7 10	2.91	B
-10	GRAY GRITTY CLAY	6 10	3.30	B
	GRAY GRITTY CLAY	6 7	2.91	B
-15	GRAY GRITTY CLAY	6 9	2.91	B
	GRAY GRITTY CLAY	5 9	2.91	B
-20	GRAY GRITTY CLAY GRAY SAND H 20	6 10	2.91	B
	GRAY SAND			
	GRAY CLAY	8 10	2.13	B
-25	GRAY CLAY	4 7	2.13	B
	GRAY CLAYEY GRAVELLY SILT	6 9	---	
-30	GRAY CLAY	5 9	2.91	B
	GRAY CLAYEY GRAVELLY SILT	10 13	---	
-35	GRAY CLAYEY GRAVELLY SILT	7 8	--	
	GRAY CLAYEY GRAVELLY SILT	6 8	---	
-40	GRAY CLAYEY GRAVELLY SILT	40 8	---	
	END OF BORING			

Surface Water El. ____
Groundwater El. at Completion 2 1/2'
After ___ Hours ____

Boring No. B-8
Station 401 + 60
Offset 19' E of C. L of 53
Ground Surface 720.0

Elevation	Description	N	Qu t/s.f.	w (%)
0	BLACK ORGANIC CLAY			
	BROWN SANDY CLAY	12 13	2.50	P
-5	BROWN SANDY CLAY	8 9	2.50	P
	BROWN SANDY GRAVELLY CLAY	6 7	1.24	S
-10	GRAY CLAY	5 9	2.91	B
	GRAY SILTY CLAY	7 9	2.25	P
-15	GRAY GRITTY CLAY	5 9	3.30	B
H20	GRAY GRITTY CLAY	7 9	2.91	B
-20	GRAY GRITTY CLAY	5 10	2.91 3.88	B B
H 20	GRAY SANDY GRAVEL GRAY CLAY	3 7	1.33	P
-25	GRAY SILTY GRAVEL	5 7	----	
	GRAY SANDY SILT	7 6	----	
-30	GRAY CLAY W/STONES	7 11	2.33	B
	GRAY CLAY	11 16	3.88	B
-35	GRAY CLAY	6 9	2.33	B
	4-10-64			
	GRAY CLAY W/STONES	9 9	1.30	B
-40	GRAY GRITTY SILTY CLAY	7 8	1.50	B
	GRAY GRITTY SILTY CLAY	5 7	..98	B
	END OF BORING			
-45				

Surface Water El. ____
Groundwater El. at Completion 5'
After ___ Hours ____

N—Standard Penetration Test—Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu—Unconfined Compressive Strength—t/sf

w—Water Content—percentage of oven dry weight—%.

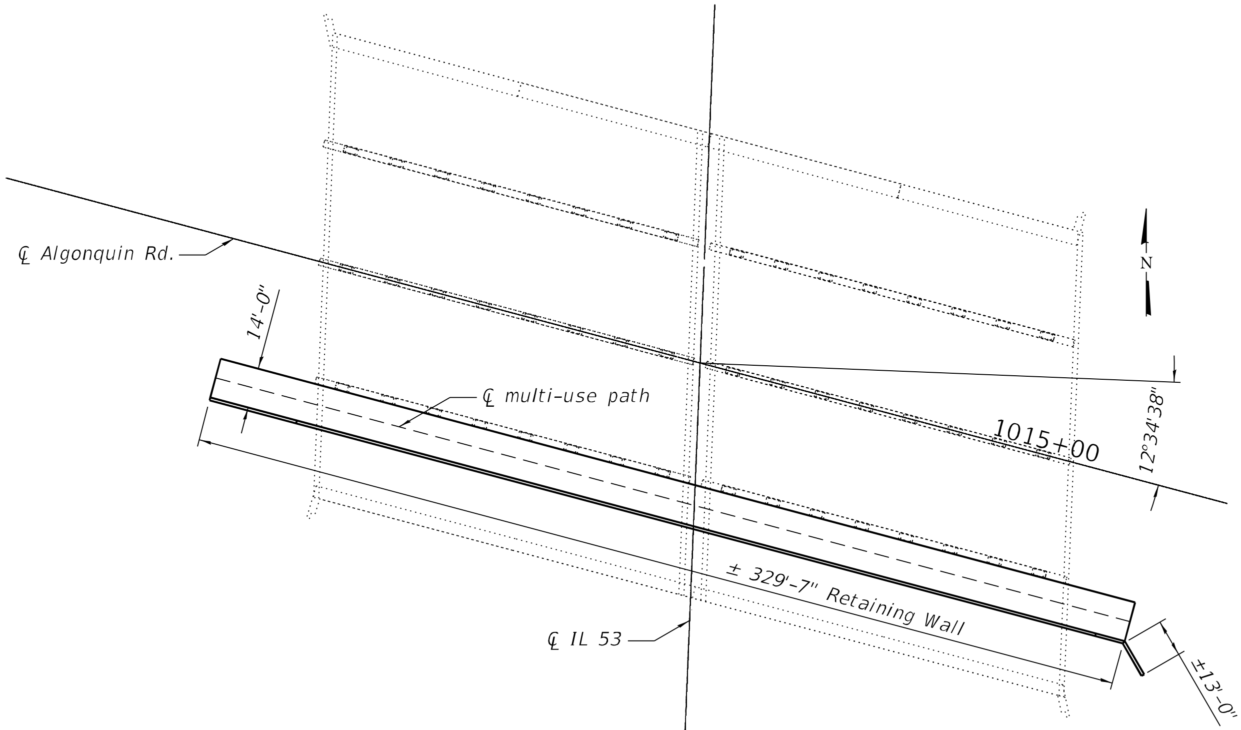
Type failure:
B—Bulge Failure
S—Shear Failure
E—Estimated Value

DESIGNED	D.E. Sponcler
CHECKED	[signature]
DRAWN	[signature]
CHECKED	[signature]

July 15 1964
EXAMINED W. E. Baumann
ENGINEER OF BRIDGE AND TRAFFIC STRUCTURES
PASSED [signature]
ENGINEER OF DESIGN
APPROVED V. E. Olaff
CHIEF HIGHWAY ENGINEER

BORINGS
S.B.I. RT. 53 SEC. 531-3HB-2
COOK COUNTY
STA. 400+73.07

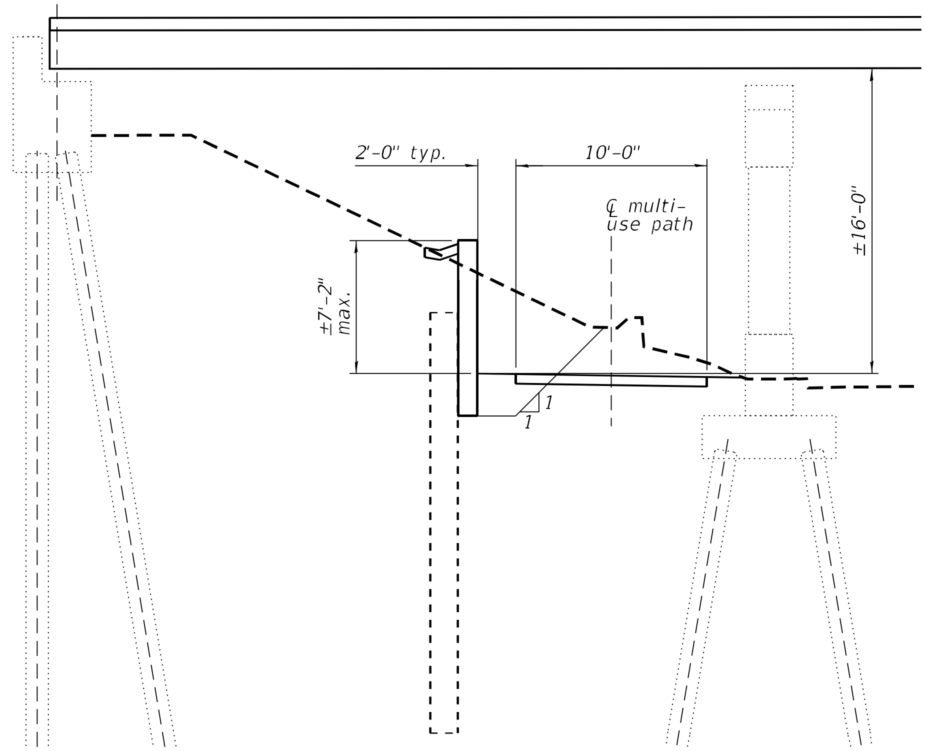
APPENDIX C Proposed Cross-Section



PLAN PROPOSED WALL

Notes:

The horizontal and vertical clearances are subject to refinement in the TSL Phase.



SOLDIER PILE AND LAGGING WALL - TYPICAL SECTION

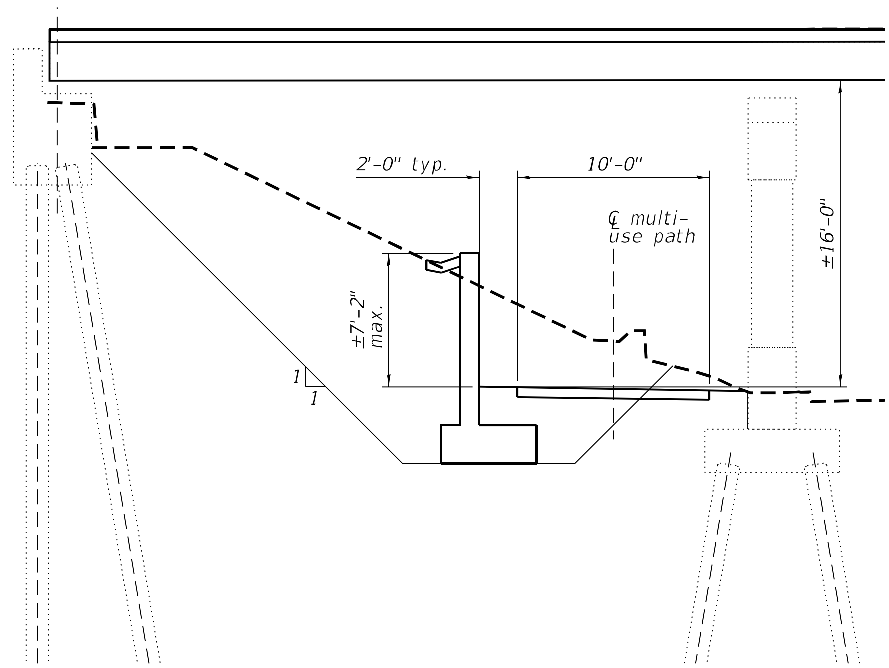
ALGONQUIN RD. PROPOSED S.N. TBD
RETAINING WALL

STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION

STRAND ASSOCIATES®

FIGURE NO. 1

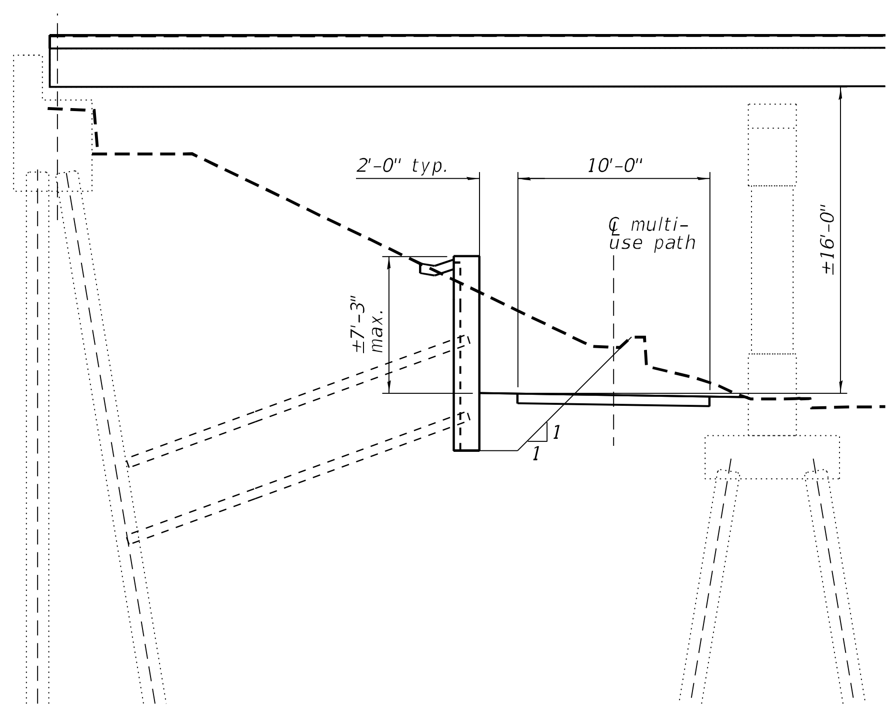
JOB # 62N91 IL53



CAST-IN-PLACE CONCRETE INVERTED T-WALL – TYPICAL SECTION

Notes:

The horizontal and vertical clearances are subject to refinement in the TSL Phase.



DRILLED SOIL NAIL WALL – TYPICAL SECTION

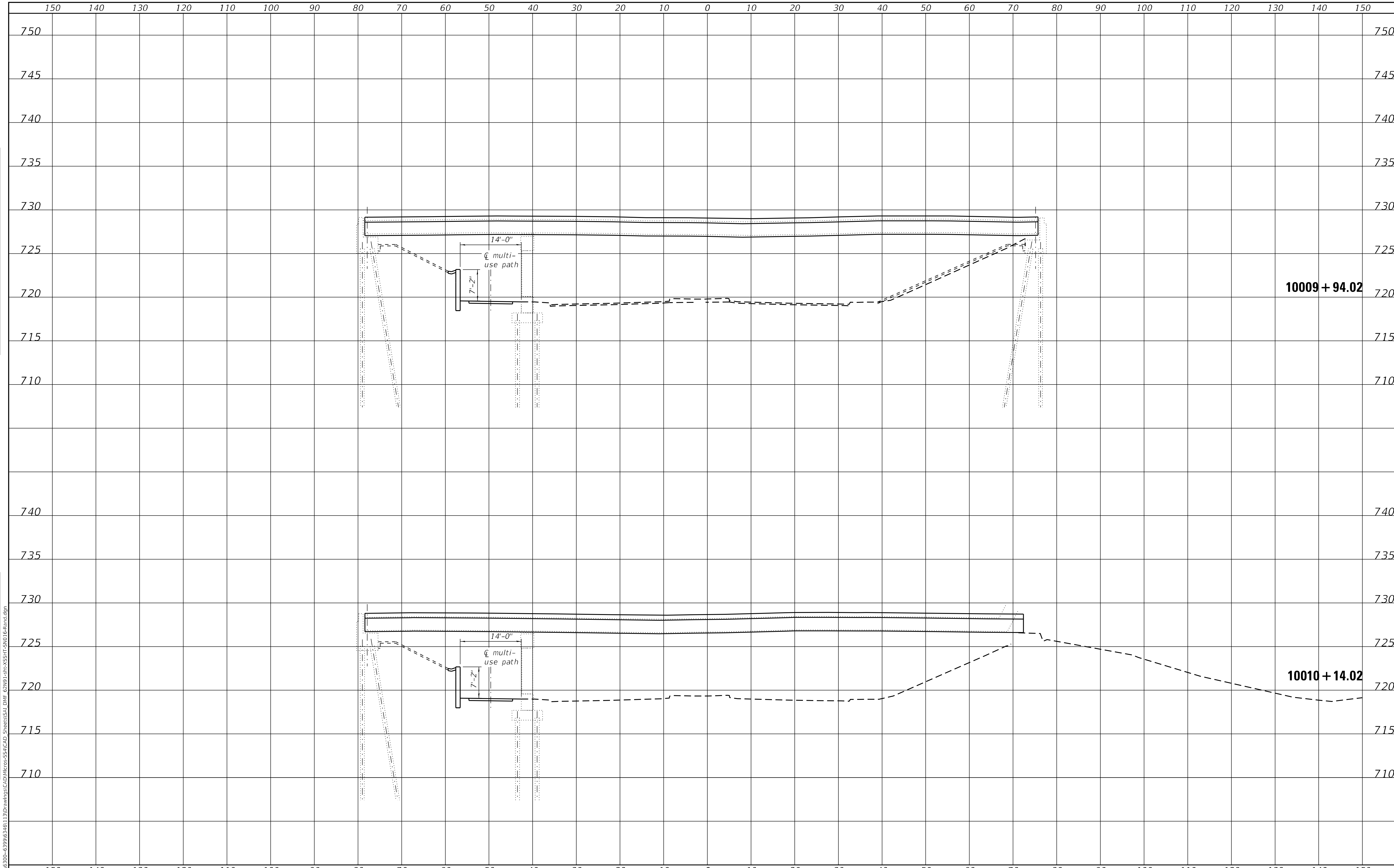
ALGONQUIN RD. PROPOSED S.N. TBD
RETAINING WALL

STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION

STRAND ASSOCIATES®

FIGURE NO. 2

JOB # 62N91 IL53



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

MODEL: Default
FILE NAME: S:\JOL\6300--6399\6346\113\Drawings\CAD\Micros-SS4\CAD_Sheets\SAI_DMF_62N91-sht-XSSHT-SN016-Rand.dgn

STRAND ASSOCIATES
1170 SOUTH HOUBOLT ROAD
JOLIET, ILLINOIS 60431
(815) 744-4200

USER NAME = $USER$	DESIGNED - BRL	REVISED -	
	DRAWN - DMF	REVISED -	
PLOT SCALE = $SCALE$	CHECKED - NDR	REVISED -	
PLOT DATE = 1/25/2023	DATE -	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

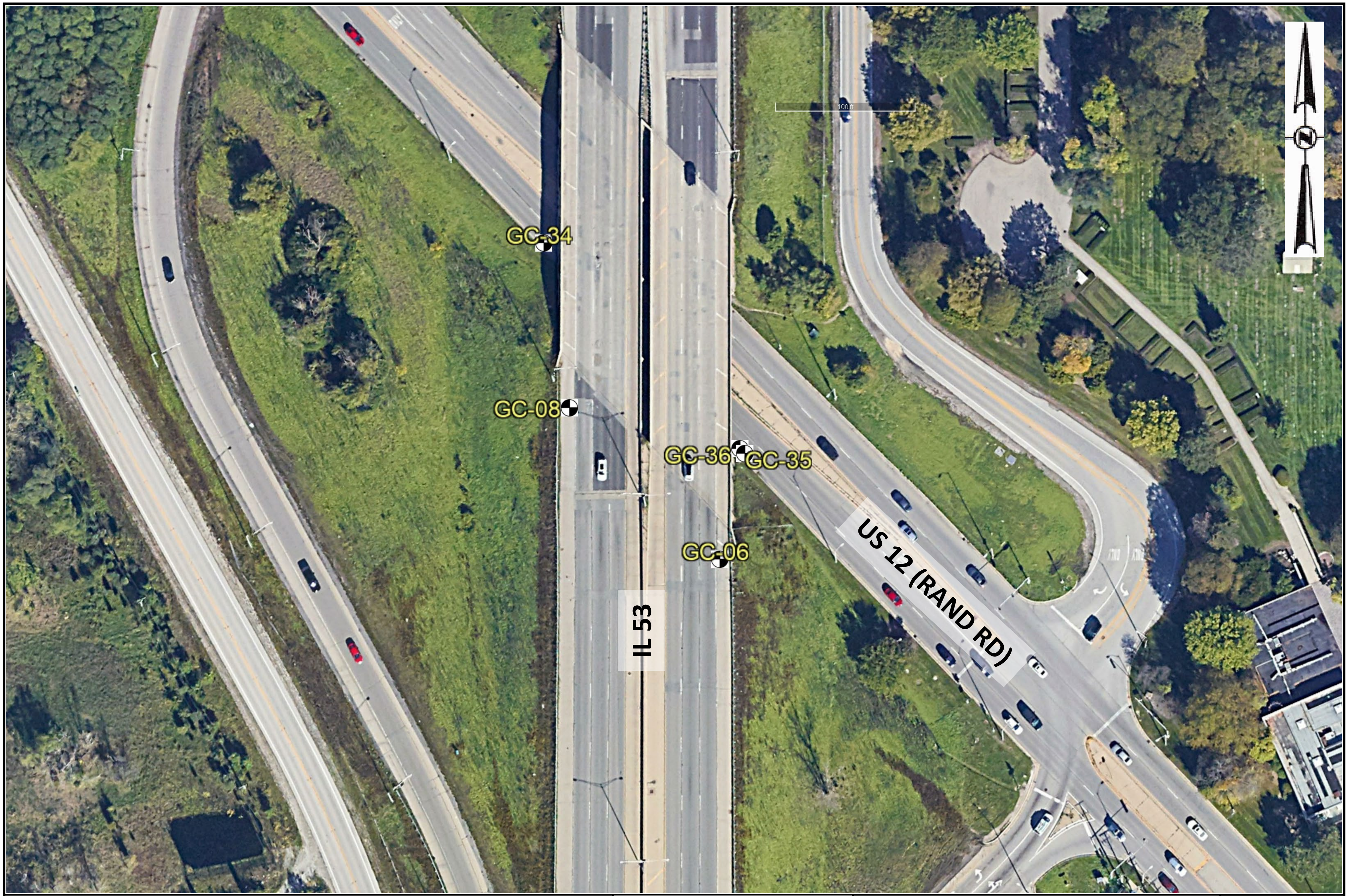
US 12 RAND ROAD – WFS: ATTACHMENT B
PROPOSED ROADWAY SECTION 3 OF 3

SCALE: | SHEET OF SHEETS | STA. 10010+14.02 TO STA. 10009+94.02

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

CONTRACT NO.
ILLINOIS FED. AID PROJECT

APPENDIX D Boring Location Map



LEGEND KEY:

APPROXIMATE BORING LOCATION

gonzalez COMPANIES, LLC

ILLINOIS DEPARTMENT OF TRANSPORTATION IL 53 BRIDGES, 62N91, PTB 203-021 COOK COUNTY, IL	PROJECT NO. 23-1003
IL 53 OVER US 12 (RAND RD) RETAINING WALL BORING LOCATION MAP	APPENDIX D

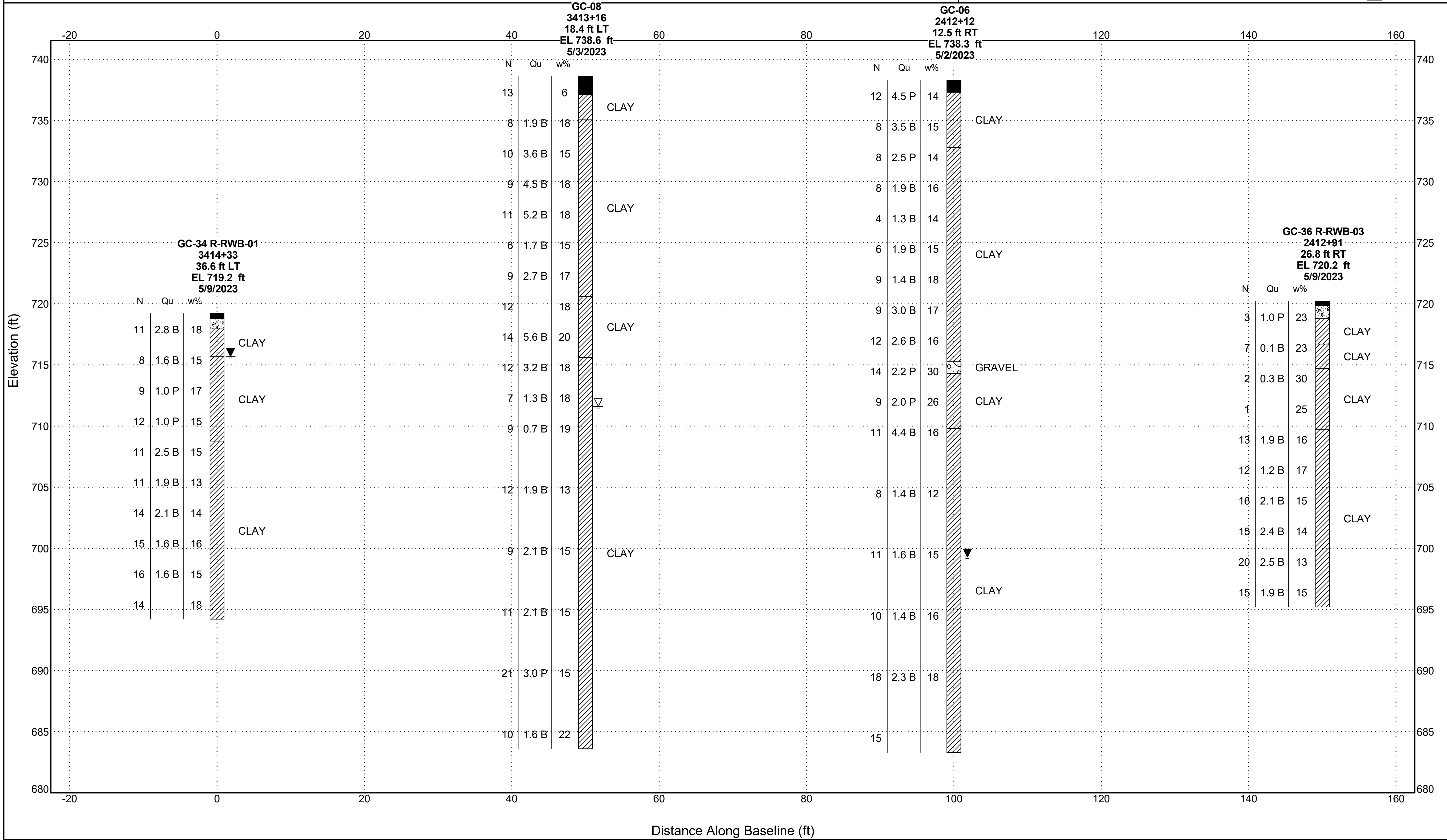
APPENDIX E Subsurface Data Profile Plot

ROUTE FAP 342
SECTION 2018-100-BR
COUNTY Cook
PROJECT LOCATION IL 53 from IL 62 (Algonquin Rd) to US 12 (Rand Rd)

SUBSURFACE PROFILE
IL 53 OVER US 12 (RAND RD)

LEGEND
EL = Elevation (ft)
D = Depth Below Existing Ground Surface (ft)
N = SPT N-Value (AASHTO T206)
Qu = Unconfined compressive Strength (tsf)
Failure Mode (B= Bulge, S= shear, P= penetrometer)
w% = Moisture Content Percentage

WATER TABLE LEGEND
▼ = First Encountered
▽ = Upon Completion
▽ = After __ hours



ROADWAY PROFILE - BETA 23-1003 IL 53 CHICAGO.GPJ GINT STD US.GDT 07/19/23

APPENDIX F Soil Boring Logs

gonzalez COMPANIES, LLC

SOIL BORING LOG

Date 05/02/23

ROUTE FAP 342 **DESCRIPTION** IL 53 over US 12 (Rand Rd) **LOGGED BY** Gonzalez (BR)

SECTION 2018-100-BR **LOCATION** SW 1/4, **SEC.** 7, **TWP.** 42N, **RNG.** 11E, 3rd **PM**, **Latitude** 42.12909124, **Longitude** 88.00464949

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE 105

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-06
Station 2412+12
Offset 12.5 ft RT
Ground Surface Elev. 738.3 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 699.3 ft ▼
Upon Completion Dry ft
After Hrs. Filled ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT - 12" (737.3)				
Stiff, Brown and Gray, Moist, CLAY, Trace Sand		16		
		6	4.5	14
		6	P	
		3		
		4	3.5	15
	-5	4	B	
(732.8) Medium Stiff to Stiff, Brown, Moist, CLAY, Trace Gravel		2		
		3	2.5	14
		5	P	
		3		
		3	1.9	16
	-10	5	B	
		1		
		2	1.3	14
		2	B	
		WH		
		2	1.9	15
	-15	4	B	
		2		
		4	1.4	18
		5	B	
		3		
		3	3.0	17
	-20	6	B	

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium Stiff to Stiff, Brown, Moist, CLAY, Trace Gravel *(continued)*		3		
		4	2.6	16
		8	B	
(715.3) Loose, Gray, Dry, Course GRAVEL (714.3)		8		
Stiff, Dark Brown, Moist, CLAY, Trace Sand		8	2.2	30
	-25	6	P	
		6		
		4	2.0	26
		5	P	
(709.8) Stiff to Very Stiff, Brown, Moist to Wet, CLAY, Trace Gravel		3		
		3	4.4	16
	-30	8	B	
		4		
1.5" Silt Seam		3	1.4	12
	-35	5	B	
▼		2		
		5	1.6	15
	-40	6	B	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, M-Modified SPT)
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)

gonzalez COMPANIES, LLC

SOIL BORING LOG

Date 05/02/23

ROUTE FAP 342 **DESCRIPTION** IL 53 over US 12 (Rand Rd) **LOGGED BY** Gonzalez (BR)

SECTION 2018-100-BR **LOCATION** SW 1/4, **SEC.** 7, **TWP.** 42N, **RNG.** 11E, 3rd **PM**, **Latitude** 42.12909124, **Longitude** 88.00464949

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE 105

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-06
Station 2412+12
Offset 12.5 ft RT
Ground Surface Elev. 738.3 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 699.3 ft ▼
Upon Completion Dry ft
After Hrs. Filled ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff to Very Stiff, Brown, Moist to Wet, CLAY, Trace Gravel *(continued)*					
			3		
			4	1.4	16
		-45	6	B	
			7		
			9	2.3	18
		-50	9	B	
			5		
			5		
	683.3	-55	10		
Boring terminated at 55 feet.					
		-60			

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

gonzalez COMPANIES, LLC

SOIL BORING LOG

Date 05/03/23

ROUTE FAP 342 **DESCRIPTION** IL 53 over US 12 (Rand Rd) **LOGGED BY** Gonzalez (BR)

SECTION 2018-100-BR **LOCATION** SE 1/4, **SEC.** 12, **TWP.** 42N, **RNG.** 10E, 3rd **PM**,
Latitude 42.12938597, **Longitude** 88.00504214

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE 105

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-08
Station 3413+16
Offset 18.4 ft LT
Ground Surface Elev. 738.6 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion 711.6 ft ▽
After Hrs. Filled ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT - 18"	737.1		25		
Stiff, Black, Moist, CLAY			6 7		6
	735.1				
Stiff to Medium Stiff, Brown, Dry to Moist, CLAY, Trace Gravel		-5	2 4 4	1.9 B	18
			2 5 5	3.6 B	15
Some Dark Brown		-10	3 4 5	4.5 B	18
Some Black Streaks			3 5 6	5.2 B	18
		-15	3 2 4	1.7 B	15
			2 4 5	2.7 B	17
	720.6				
Stiff, Dark Brown to Brown, Moist, CLAY, Trace Gravel		-20	6 5 7		18

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff, Dark Brown to Brown, Moist, CLAY, Trace Gravel *(continued)*			4 6 8	5.6 B	20
	715.6				
Medium Stiff to Very Stiff, Brown, Moist to Wet, CLAY, Trace Gravel (till)		-25	3 5 7	3.2 B	18
▽			2 3 4	1.3 B	18
		-30	3 4 5	0.7 B	19
		-35	8 6 6	1.9 B	13
		-40	3 4 5	2.1 B	15

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, M-Modified SPT)
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)

SOIL BORING LOG

Date 05/03/23

ROUTE FAP 342 **DESCRIPTION** IL 53 over US 12 (Rand Rd) **LOGGED BY** Gonzalez (BR)

SECTION 2018-100-BR **LOCATION** SE 1/4, **SEC.** 12, **TWP.** 42N, **RNG.** 10E, 3rd **PM**, **Latitude** 42.12938597, **Longitude** 88.00504214

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE 105

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-08
Station 3413+16
Offset 18.4 ft LT
Ground Surface Elev. 738.6 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion 711.6 ft ▽
After Hrs. Filled ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium Stiff to Very Stiff, Brown, Moist to Wet, CLAY, Trace Gravel (till) *(continued)*					
		-45	2 5 6	2.1 B	15
Some Silt Seams		-50	10 10 11	3.0 P	15
	683.6	-55	3 4 6	1.6 B	22
Boring terminated at 55 feet.		-60			

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

gonzalez COMPANIES, LLC

SOIL BORING LOG

Date 05/09/23

ROUTE FAP 342 **DESCRIPTION** US 12 (Rand Rd) **LOGGED BY** Gonzalez (AL)

SECTION 2018-100-BR **LOCATION** SE 1/4, **SEC.** 12, **TWP.** 42N, **RNG.** 10E, 3rd **PM**, **Latitude** 42.1297074, **Longitude** 88.00510809

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-34 (R-RWB-01)
Station 3414+33
Offset 36.6 ft LT
Ground Surface Elev. 719.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 715.7 ft ▼
Upon Completion Dry ft
After ___ Hrs. Filled ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT - 5"	718.8				
CONCRETE - 10"	718.0				
Stiff, Brown, Moist, CLAY, Trace Organics			6 5 6	2.8 B	18
▼	715.7				
Stiff, Brown, Moist, CLAY, Some Sand, Some Gravel		-5	4 3 5	1.6 B	15
			3 3 6	1.0 P	17
		-10	6 7 5	1.0 P	15
	708.7				
Stiff, Gray, Moist, CLAY, Some Gravel			3 4 7	2.5 B	15
		-15	4 5 6	1.9 B	13
			4 6 8	2.1 B	14
		-20	6 6 9	1.6 B	16
Stiff, Gray, Moist, CLAY, Some Gravel *(continued)*			5 7 9	1.6 B	15
	694.2	-25	7 7 7		18
Boring terminated at 25 feet.					
		-30			
		-35			
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, M-Modified SPT)
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)

SOIL BORING LOG

Date 05/09/23

ROUTE FAP 342 **DESCRIPTION** US 12 (Rand Rd) **LOGGED BY** Gonzalez (AL)

SECTION 2018-100-BR **LOCATION** SW 1/4, **SEC.** 7, **TWP.** 42N, **RNG.** 11E, 3rd **PM**, **Latitude** 42.12930806, **Longitude** 88.00459569

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-35 (R-RWB-02)
Station 2412+88
Offset 30.4 ft RT
Ground Surface Elev. 720.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	-5			
Soft, Brown, Wet, SILTY CLAY, Trace Sand, Trace Gravel			0.2 P	
Soft, Brown, Moist, GRAVELLY SANDY LOAM (A-4) LL=23, PL=16, PI=7 33%Gravel, 32%Sand, 22%Silt, 13%Clay	-10		0.5 P	15
Soft, Brown, Moist, SANDY LOAM (A-4), Some Gravel LL=24, PL=16, PI=8, Wet Unit Wt=127pcf 15%Gravel, 37%Sand, 31%Silt, 17%Clay			3.0 P	11
Boring terminated at 12 feet.				
	-15			
	-20			

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

gonzalez COMPANIES, LLC

SOIL BORING LOG

Date 05/09/23

ROUTE FAP 342 **DESCRIPTION** US 12 (Rand Rd) **LOGGED BY** Gonzalez (AL)

SECTION 2018-100-BR **LOCATION** SW 1/4, **SEC.** 7, **TWP.** 42N, **RNG.** 11E, 3rd **PM**, **Latitude** 42.12930806, **Longitude** 88.00459569

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto 140 lb HE

STRUCT. NO. 016W2503 (Proposed)
Station

BORING NO. GC-36 (R-RWB-03)
Station 2412+91
Offset 26.8 ft RT
Ground Surface Elev. 720.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT - 4"	719.9				
CONCRETE - 13"	718.8		3		
Stiff, Brown, Moist, CLAY, Trace Organics			2 1	1.0 P	23
	716.7				
Soft to Medium Stiff, Black, Moist, CLAY, Trace Gravel			3		
		-5	3 4	0.1 B	23
	714.7				
Very Soft, Gray, Wet, CLAY			0		
			0 2	0.3 B	30
			0		
		-10	0 1		25
	709.7				
Stiff to Very Stiff, Brown and Gray, Moist, CLAY, Some Gravel			4		
			5 8	1.9 B	16
			4		
		-15	5 7	1.2 B	17
			4		
			6 10	2.1 B	15
			5		
		-20	6 9	2.4 B	14
Stiff to Very Stiff, Brown and Gray, Moist, CLAY, Some Gravel *(continued)*			7		
			9 11	2.5 B	13
			5		
	695.2	-25	6 9	1.9 B	15
Boring terminated at 25 feet.					
		-30			
		-35			
		-40			

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

APPENDIX G Laboratory Test Results

RUBINO ENGINEERING INC.

Laboratory Shelby Tube Log

GC-35

Shelby Tube: ~~R-RWB-02~~ ST-2

Project No. G23.027

Project Name: IL-53 Bridges

Date Opened: 5/18/2023

Depth: 8 - 10 feet

Recovery: 13 inches

Tube Diameter: 3 inches

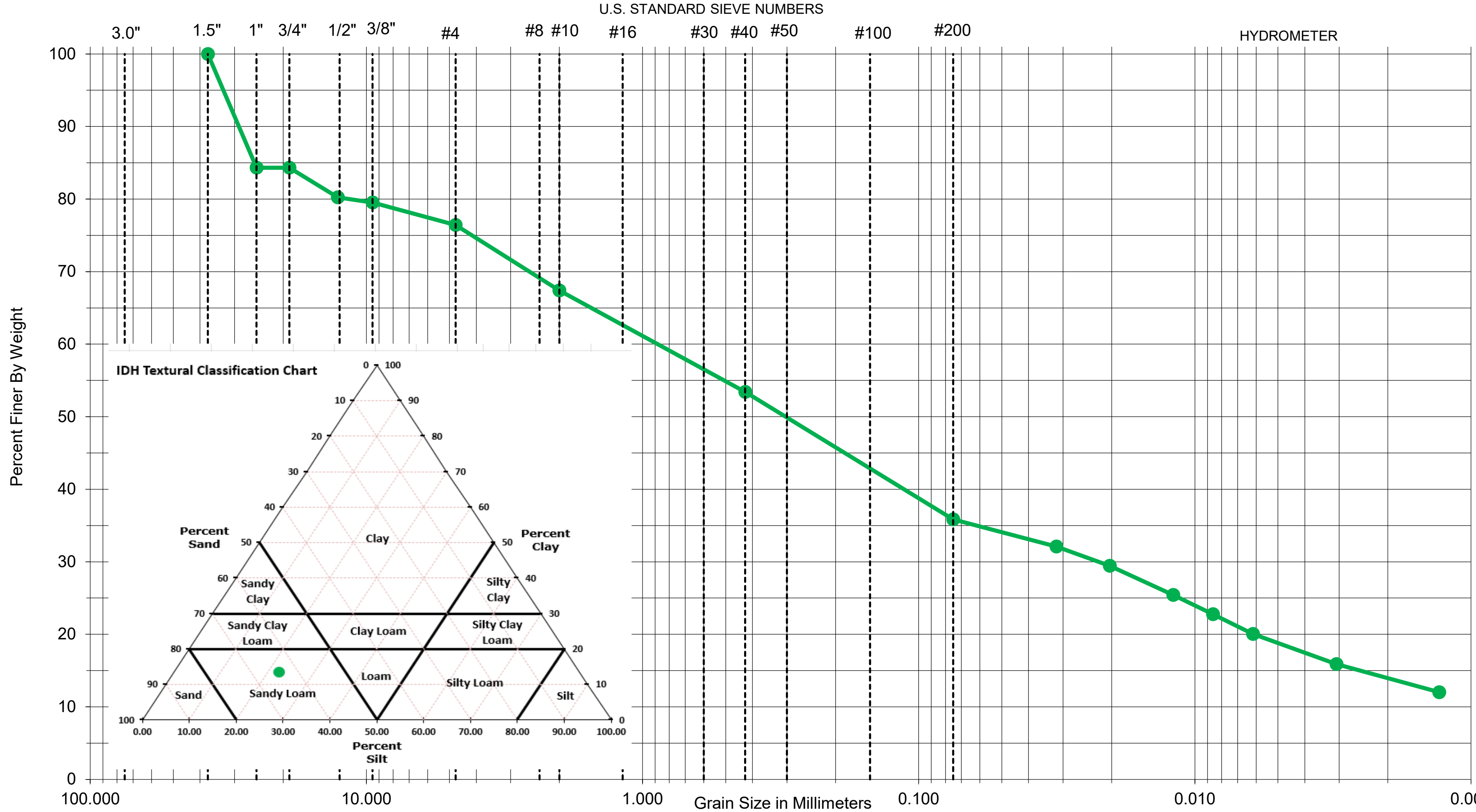
Sample Condition: GOOD FAIR POOR DISTURBED

Tube Conditions: Slightly dented, minor trimming required to extrude the specimen.

DEPTH (Inches) From/ To	DESCRIPTION OF MATERIAL
0 - 6	Wet brown silty clay trace sand and gravel Qp= 0.25 tsf
6 - 13	Moist bown sandy loam, some gravel (One cobble greater than approximately 2 inches in diameter visible in the sample) Qp=0.5 tsf LL=23% PL=16%

rubino ENGINEERING INC.

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL



GC-35

Key	Boring No.	Depth	IDH Textural Classification			Cc	Cu	%Gravel	%Sand	%Silt	%Clay	D60	D30	D10
●	~~R-RWB-02~~ ST-2	8 - 10	SANDY LOAM					32.6	31.7	22.3	13.5	1.167	0.023	

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL | **IL-53 Bridges** | File No. **G23.027**

Rubino Engineering Inc 425 Shepard Drive● Elgin, IL 60123 ● 847-931-1555 ● 847-931-1560 (Fax) LL=23, PI=7, A-4

rubino ENGINEERING INC.

Laboratory Shelby Tube Log

Project No. G23.027

Shelby Tube: ~~R-RWB-02~~ GC-35 ST-3

Project Name: IL-53 Bridges

Tube Conditions: Tube had one dent, trimming was required to extrude the specimen.

Date Opened: 5/18/2023

Depth: 10 - 12 feet

Recovery: 8 inches

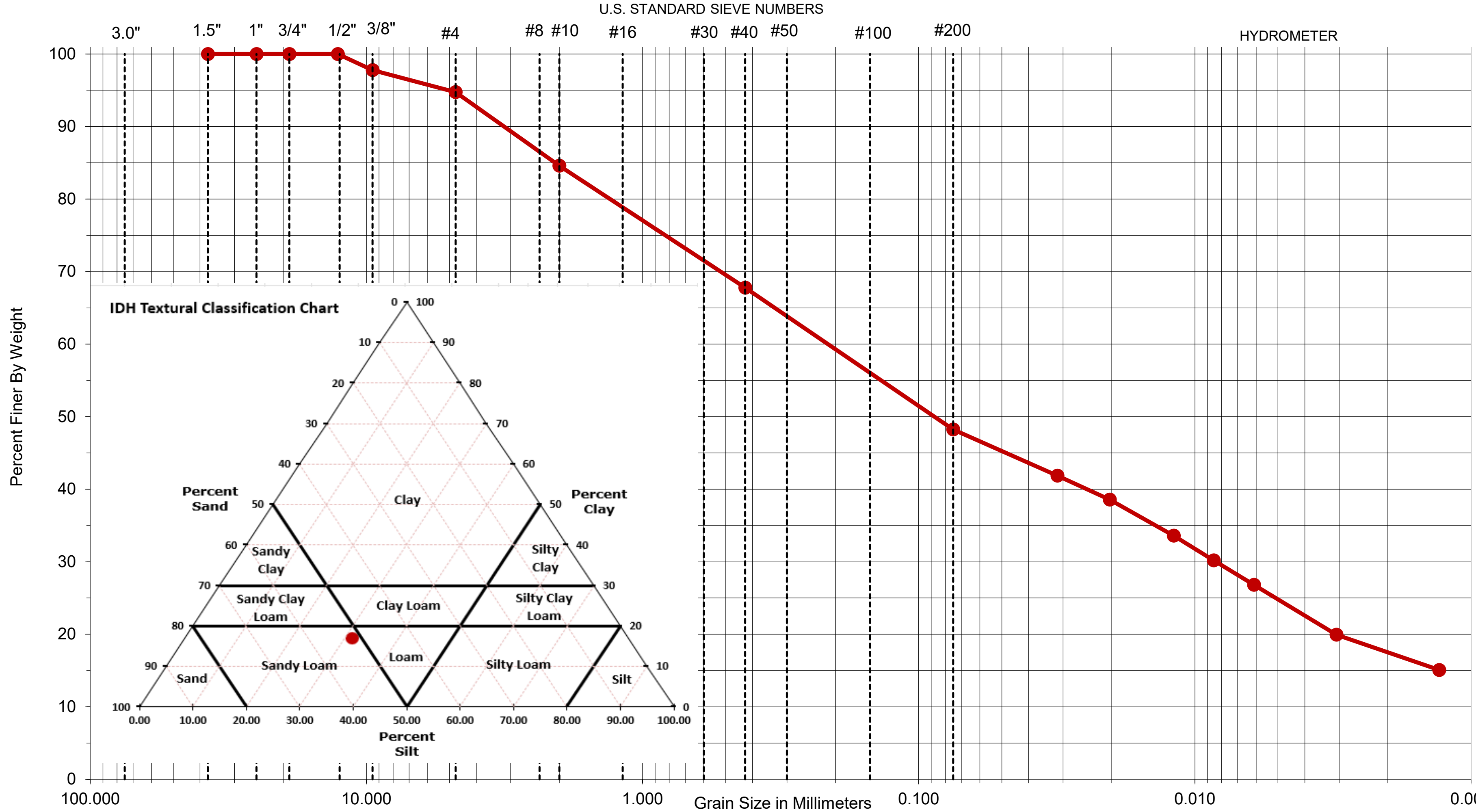
Tube Diameter: 3 inches

Sample Condition: GOOD FAIR POOR DISTURBED

DEPTH (Inches) From/ To	DESCRIPTION OF MATERIAL
0 - 8	Moist brown sandy loam, little gravel Qp= 3.0 tsf LL=24% PL=16%

rubino ENGINEERING INC.

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL



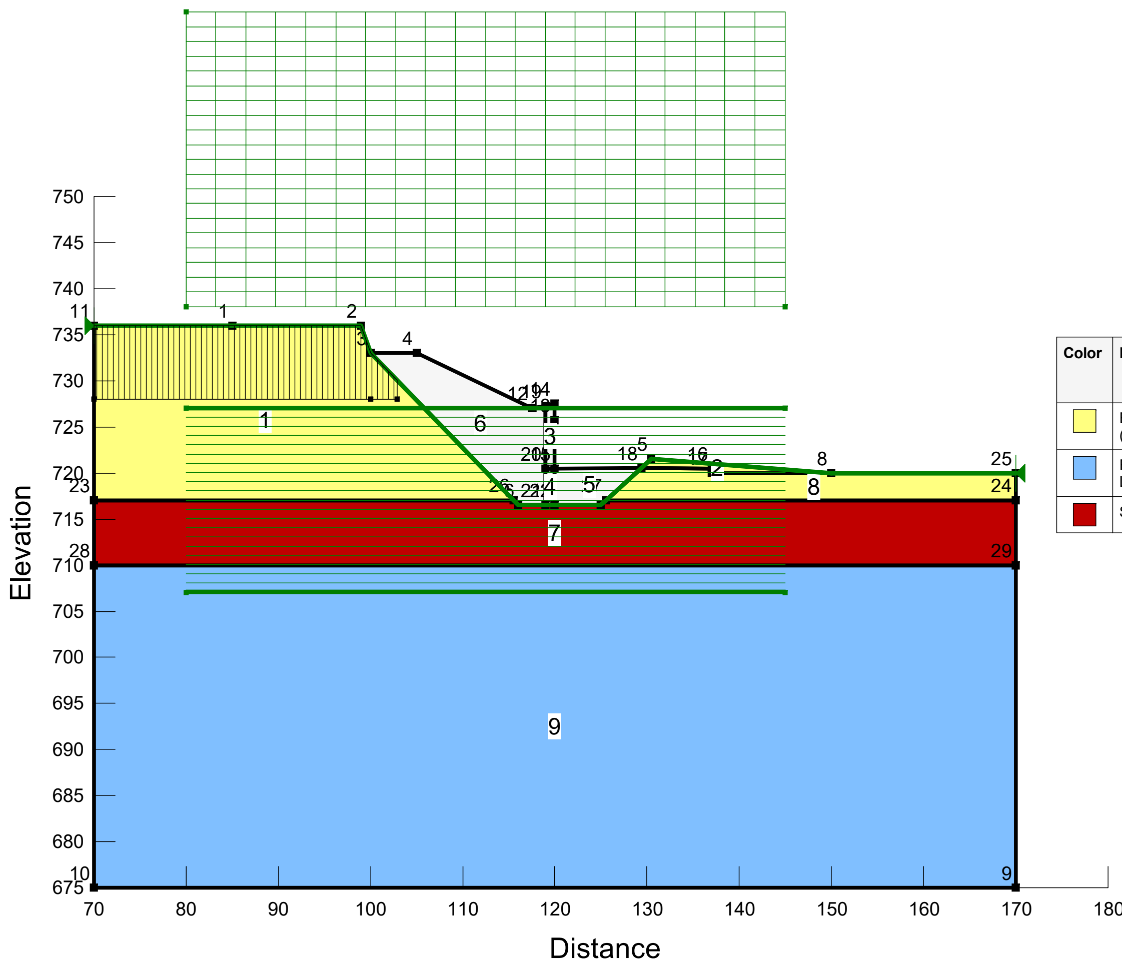
GC-35

Key	Boring No.	Depth	IDH Textural Classification			Cc	Cu	%Gravel	%Sand	%Silt	%Clay	D60	D30	D10
●	~~R-RWB-02~~ ST-3	10 - 12	SANDY LOAM					15.4	36.5	31.2	16.9	0.286	0.008	

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL	IL-53 Bridges	File No.	G23.027

Rubino Engineering Inc 425 Shepard Drive• Elgin, IL 60123 • 847-931-1555 • 847-931-1560 (Fax) LL=24, PI=8, A-4

APPENDIX H Slope Stability Analysis



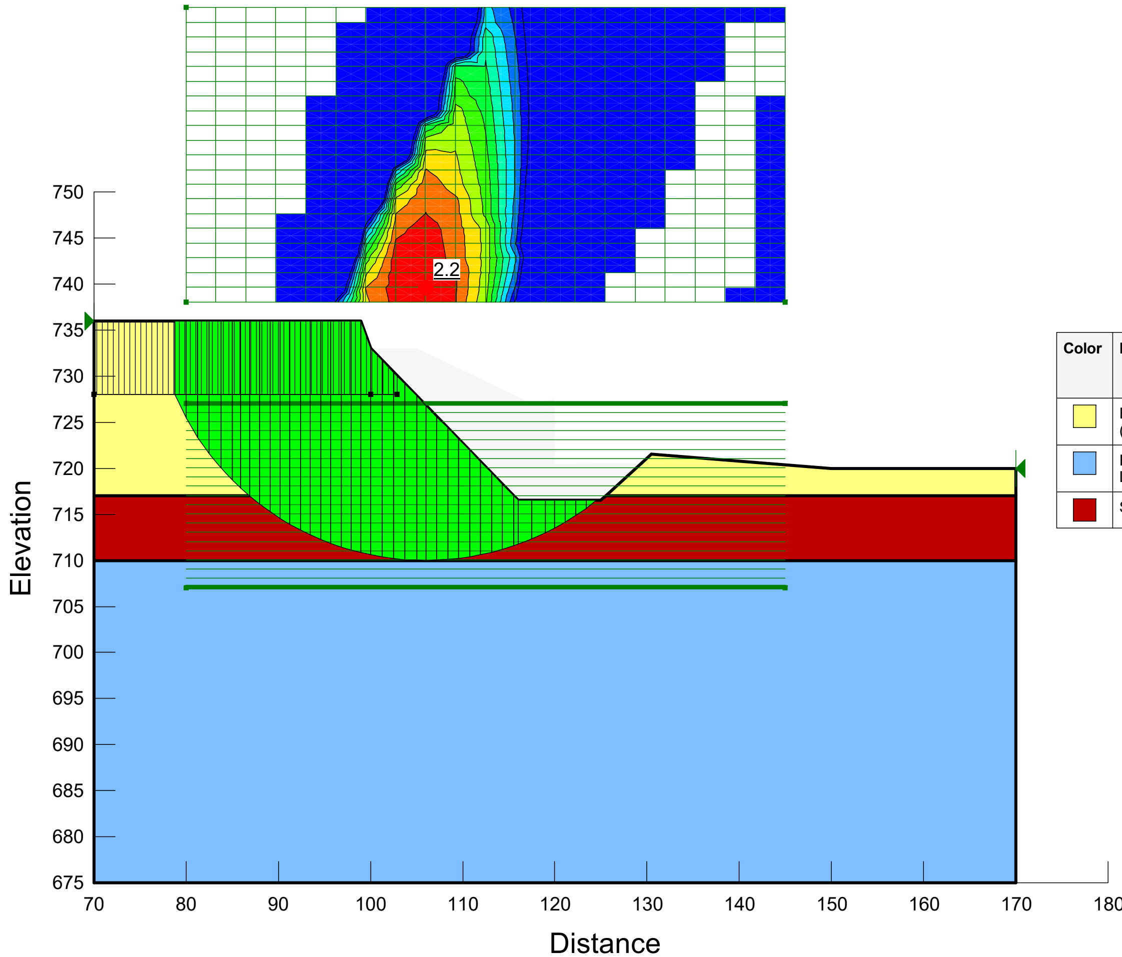
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)
Yellow	Embankment - Clay (undrained)	Undrained (Phi=0)	120	1,500
Blue	Foundation Soil - Clay, Silty Loam (undrained)	Undrained (Phi=0)	125	2,500
Red	Soft Clay (undrained)	Undrained (Phi=0)	120	800

gonzalez

Slope Stability - During Construction - Undrained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250



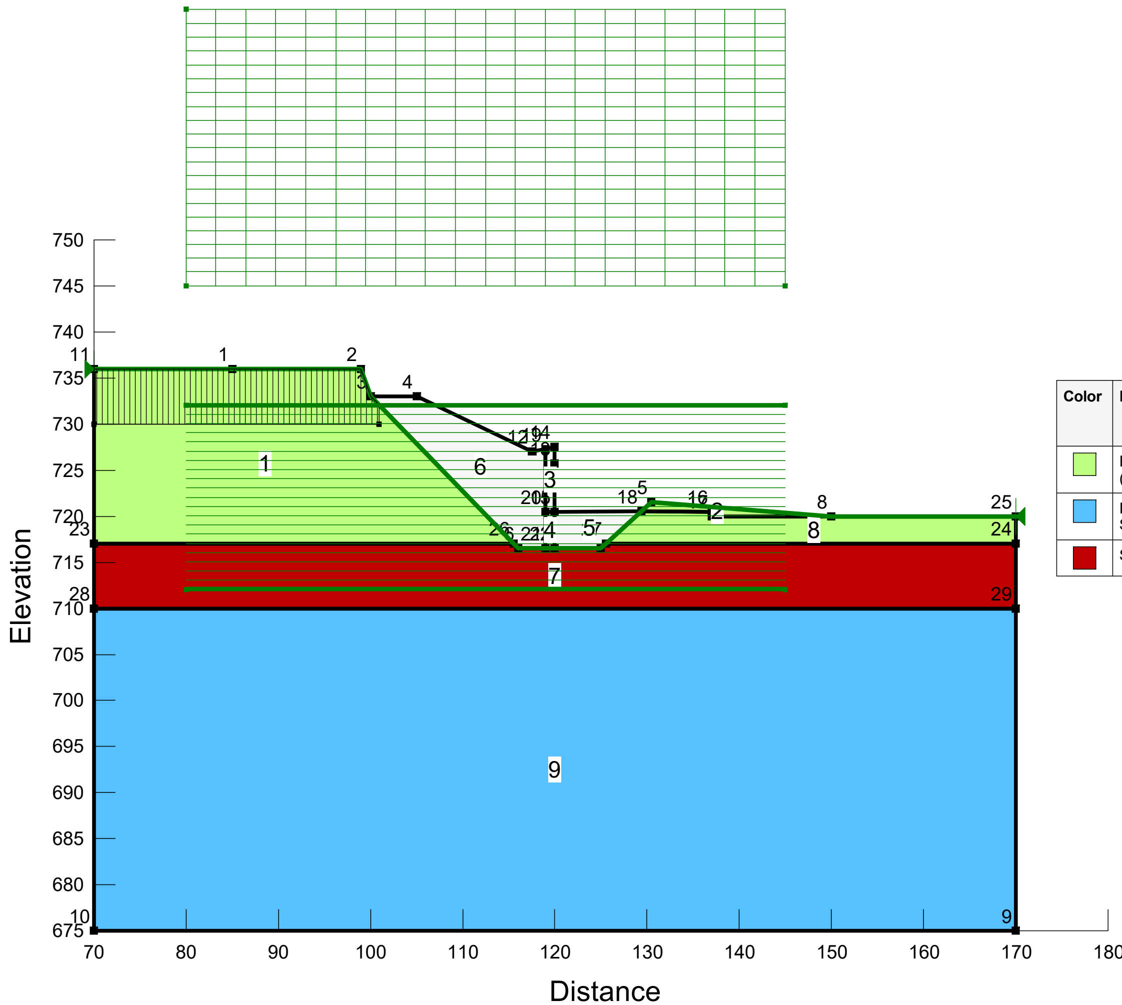
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)
Yellow	Embankment - Clay (undrained)	Undrained (Phi=0)	120	1,500
Blue	Foundation Soil - Clay, Silty Loam (undrained)	Undrained (Phi=0)	125	2,500
Red	Soft Clay (undrained)	Undrained (Phi=0)	120	800

gonzalez

Slope Stability - During Construction - Undrained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250



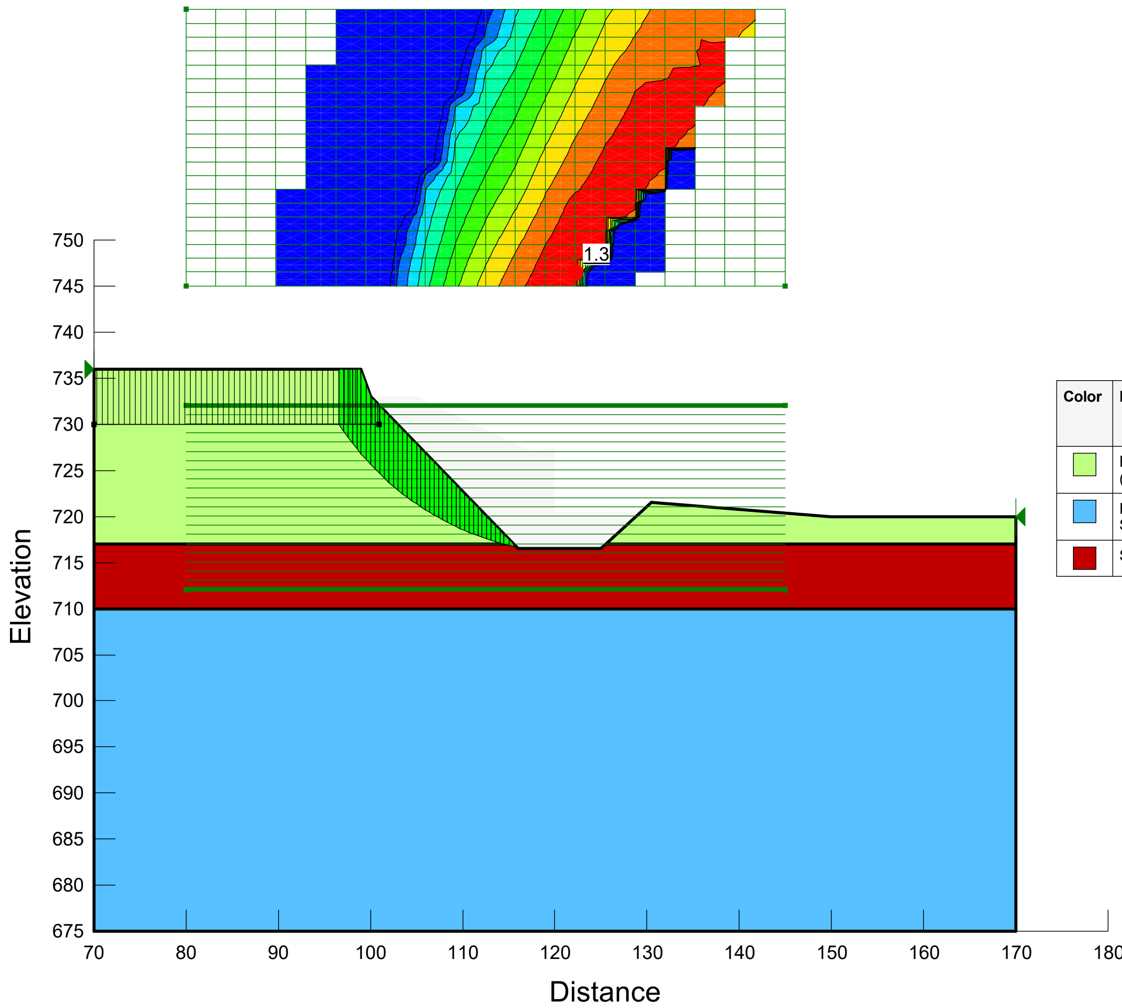
Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Embankment - Clay (drained)	Mohr-Coulomb	120	125	32
	Foundation Soil - Clay, Silty Loam (drained)	Mohr-Coulomb	125	100	30
	Soft Clay (drained)	Mohr-Coulomb	120	100	26

gonzalez

Slope Stability - During Construction - Drained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250



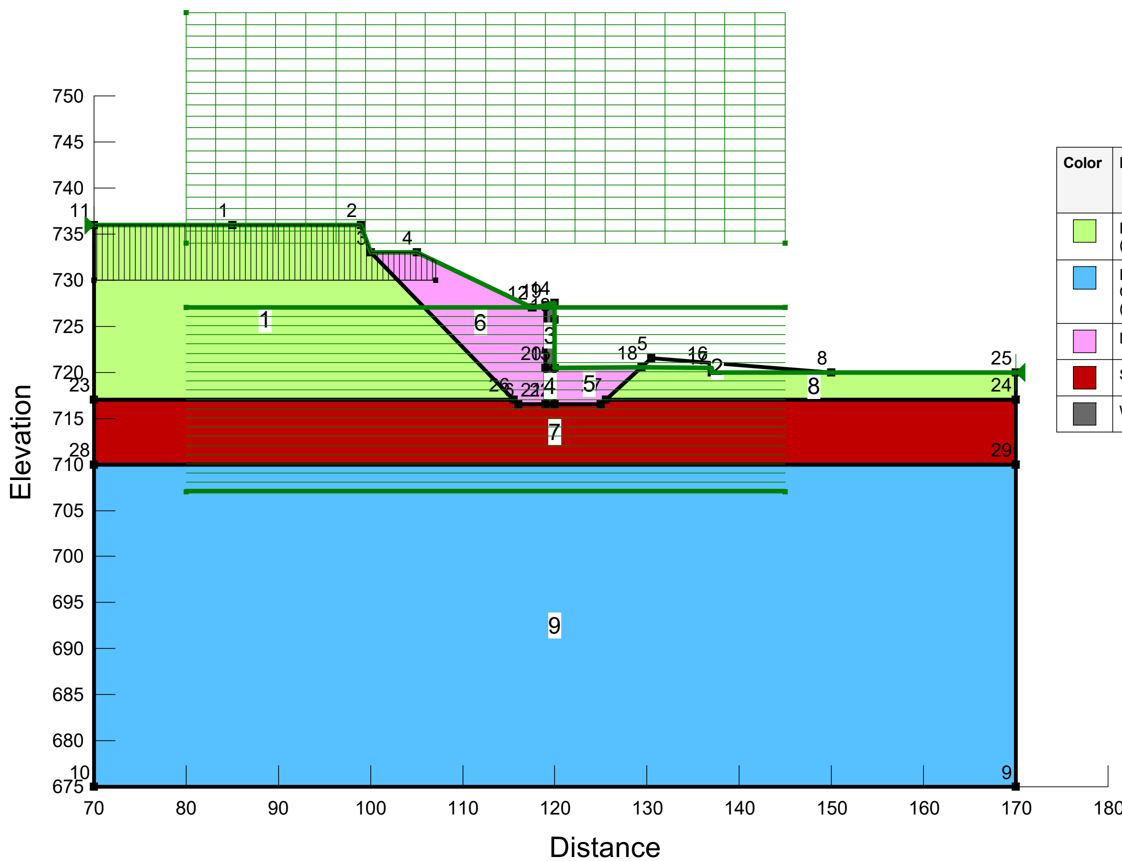
Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Embankment - Clay (drained)	Mohr-Coulomb	120	125	32
	Foundation Soil - Clay, Silty Loam (drained)	Mohr-Coulomb	125	100	30
	Soft Clay (drained)	Mohr-Coulomb	120	100	26

gonzalez

Slope Stability - During Construction - Drained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250

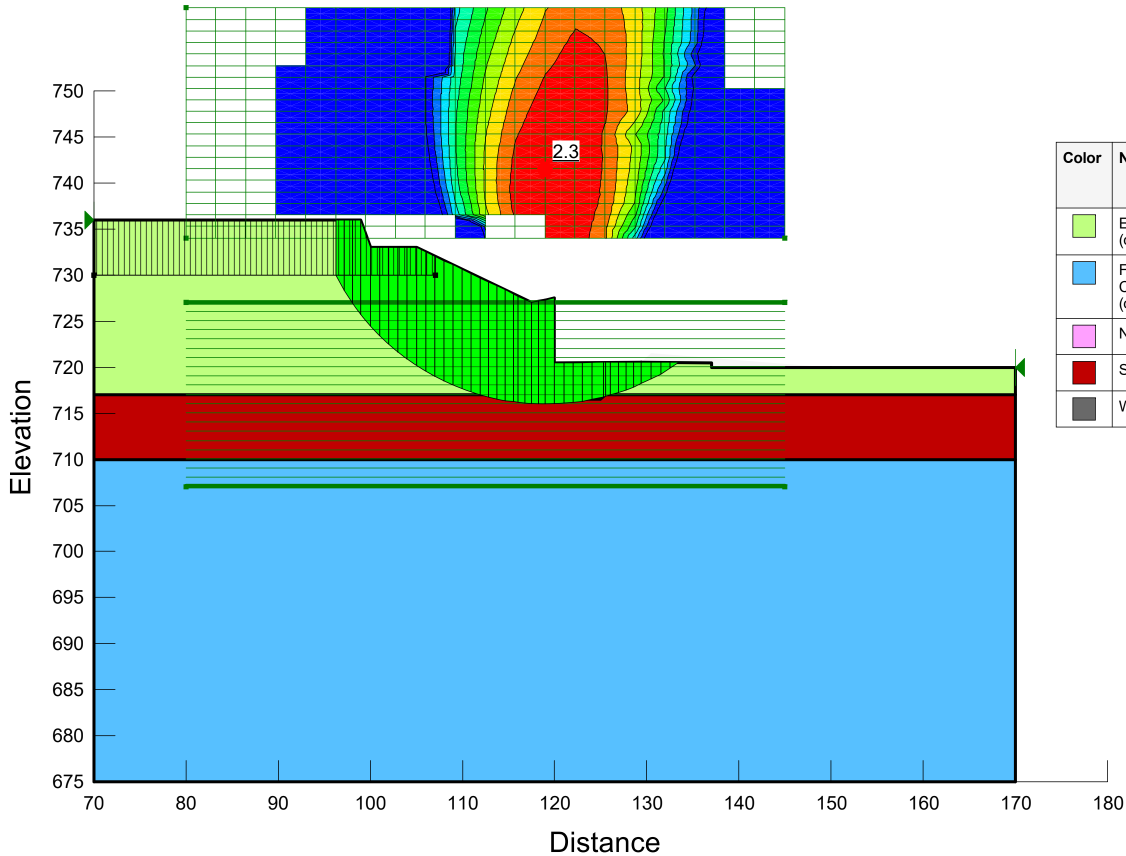


Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Embankment - Clay (drained)	Mohr-Coulomb	120	125	32
	Foundation Soil - Clay, Silty Loam (drained)	Mohr-Coulomb	125	100	30
	New Fill (drained)	Mohr-Coulomb	125	100	30
	Soft Clay (drained)	Mohr-Coulomb	120	100	26
	Walll	High Strength	150		

Slope Stability - Long Term - Drained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Embankment - Clay (drained)	Mohr-Coulomb	120	125	32
	Foundation Soil - Clay, Silty Loam (drained)	Mohr-Coulomb	125	100	30
	New Fill (drained)	Mohr-Coulomb	125	100	30
	Soft Clay (drained)	Mohr-Coulomb	120	100	26
	Walll	High Strength	150		

gonzalez

Slope Stability - Long Term - Drained

IL-53 Rand Ret Wall ejg.gsz

11/10/2023 1:250

APPENDIX I Seismic Analysis

SEISMIC SITE CLASS DETERMINATION

Illinois Department of Transportation

PROJECT TITLE===== IL 53 over US 12 (Rand Rd) - PTB 203-021 - 62N91

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	716	ft.
Pile or Shaft Dia.		inches
Boring Number	GC-06	
Top of Boring Elev.	738.3	ft.

Approximate Fixity Elev. 716 ft.

Individual Site Class Definition:

N (bar): 9 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 1.65 (ksf) Soil Site Class D <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	736.8	1.50	12	4.50	
	732.8	4.00	8	3.50	B
	730.3	2.50	8	2.50	
	727.8	2.50	8	1.90	
	725.3	2.50	4	1.30	
	722.8	2.50	6	1.90	
	720.3	2.50	9	1.40	
	717.8	2.50	9	3.00	
1.7	714.3	3.50	12	2.60	
3.7	712.3	2.00	14	2.20	
6.2	709.8	2.50	9	2.00	B
8.7	707.3	2.50	11	4.40	
13.7	702.3	5.00	8	1.40	
18.7	697.3	5.00	11	1.60	
23.7	692.3	5.00	10	1.40	
28.7	687.3	5.00	18	2.30	
32.7	683.3	4.00	15		
37.7	678.3	5.00	8	1.40	
42.7	673.3	5.00	8	1.40	
47.7	668.3	5.00	8	1.40	
52.7	663.3	5.00	8	1.40	
57.7	658.3	5.00	8	1.40	
62.7	653.3	5.00	8	1.40	
67.7	648.3	5.00	8	1.40	
72.7	643.3	5.00	8	1.40	
77.7	638.3	5.00	8	1.40	
82.7	633.3	5.00	8	1.40	
87.7	628.3	5.00	8	1.40	
92.7	623.3	5.00	8	1.40	
97.7	618.3	5.00	8	1.40	
100.0	616.0	2.30	8	1.40	B

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	716	ft.
Pile or Shaft Dia.		inches
Boring Number	GC-08	
Top of Boring Elev.	738.6	ft.

Approximate Fixity Elev. 716 ft.

Individual Site Class Definition:

N (bar): 11 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 1.75 (ksf) Soil Site Class D <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	735.1	3.50	13		
	733.1	2.00	8	1.90	
	730.6	2.50	10	3.60	
	728.1	2.50	9	4.50	
	725.6	2.50	11	5.20	
	723.1	2.50	6	1.70	
	720.6	2.50	9	2.70	B
	718.1	2.50	12		
0.4	715.6	2.50	14	5.60	B
2.9	713.1	2.50	12	3.20	
5.4	710.6	2.50	7	1.30	
7.9	708.1	2.50	9	0.70	
12.9	703.1	5.00	12	1.90	
17.9	698.1	5.00	9	2.10	
22.9	693.1	5.00	11	2.10	
27.9	688.1	5.00	21	3.00	
32.4	683.6	4.50	10	1.60	
37.4	678.6	5.00	10	1.60	
42.4	673.6	5.00	10	1.60	
47.4	668.6	5.00	10	1.60	
52.4	663.6	5.00	10	1.60	
57.4	658.6	5.00	10	1.60	
62.4	653.6	5.00	10	1.60	
67.4	648.6	5.00	10	1.60	
72.4	643.6	5.00	10	1.60	
77.4	638.6	5.00	10	1.60	
82.4	633.6	5.00	10	1.60	
87.4	628.6	5.00	10	1.60	
92.4	623.6	5.00	10	1.60	
97.4	618.6	5.00	10	1.60	
100.0	616.0	2.60	10	1.60	B

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	716	ft.
Pile or Shaft Dia.		inches
Boring Number	GC-34	
Top of Boring Elev.	719.4	ft.

Approximate Fixity Elev. 716 ft.

Individual Site Class Definition:

N (bar): 12 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 1.97 (ksf) Soil Site Class D <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
0.1	715.9	3.50	11	2.80	B
2.6	713.4	2.50	8	1.60	
5.1	710.9	2.50	9	1.00	
7.3	708.7	2.20	12	1.00	B
9.8	706.2	2.50	11	2.50	
12.3	703.7	2.50	11	1.90	
14.8	701.2	2.50	14	2.10	
17.3	698.7	2.50	15	1.60	
19.8	696.2	2.50	16	16.00	
21.8	694.2	2.00	14		
26.8	689.2	5.00	11	1.90	
31.8	684.2	5.00	11	1.90	
36.8	679.2	5.00	11	1.90	
41.8	674.2	5.00	11	1.90	
46.8	669.2	5.00	11	1.90	
51.8	664.2	5.00	11	1.90	
56.8	659.2	5.00	11	1.90	
61.8	654.2	5.00	11	1.90	
66.8	649.2	5.00	11	1.90	
71.8	644.2	5.00	11	1.90	
76.8	639.2	5.00	11	1.90	
81.8	634.2	5.00	11	1.90	
86.8	629.2	5.00	11	1.90	
91.8	624.2	5.00	11	1.90	
96.8	619.2	5.00	11	1.90	
100.0	616.0	3.20	11	1.90	B

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	716	ft.
Pile or Shaft Dia.		inches
Boring Number	GC-36	
Top of Boring Elev.	720.2	ft.

Approximate Fixity Elev. 716 ft.

Individual Site Class Definition:

N (bar): 10 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 1.04 (ksf) Soil Site Class D <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	716.7	3.50	3	1.00	B
1.3	714.7	2.00	7	0.10	B
3.8	712.2	2.50	2	0.30	
6.3	709.7	2.50	1		B
8.8	707.2	2.50	13	1.90	
11.3	704.7	2.50	12	1.20	
13.8	702.2	2.50	16	2.10	
16.3	699.7	2.50	15	2.40	
18.8	697.2	2.50	20	2.50	
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85.8	630.2	5.00	12	1.20	
90.8	625.2	5.00	12	1.20	
95.8	620.2	5.00	12	1.20	
100.0	616.0	4.20	12	1.20	B

Global Site Class Definition: Substructures 1 through 4

N (bar): 11 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 1.6 (ksf) Soil Site Class D <----Controls

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Save Copy Collapse All Expand All Filter JSON

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APPENDIX J Wall Feasibility Study

Wall Feasibility Study

REGION:	One
DISTRICT:	One
ROUTE:	US Route 12 (Rand Road) FAP 334
COUNTY:	Cook
SECTION NUMBER:	2018-100-BR
JOB NUMBER:	62N91
STRUCTURE NUMBER:	To be Determined
LOCATION:	US Route 12 Rand Road under IL 53

PREPARED BY:	Strand Associates, Inc.®
PREPARED FOR:	Illinois Department of Transportation
DATE:	February 10, 2023

TABLE OF CONTENTS

ATTACHMENTS:

1. PROJECT BACKGROUND

As part of a Phase I study to improve the condition of multiple structures along Illinois (IL) 53 (FAP 342), the establishment of a multiuse path along United States (US) 12 (Rand Road) was proposed. This multiuse path is to pass through span 1 of the existing bridge structures at the IL 53 overpass of US 12 between the south abutment and Pier 1. To accommodate the multiuse path's footprint, a portion of the existing slope-wall must be removed and retained.

Additional multiuse path improvements are proposed at IL 62 Algonquin and Palatine Roads as part of this project. These locations will require a similar solution to retain slope-wall embankment within the path footprint.

2. EXISTING CONDITIONS

Structure Numbers 016-0973 and 016-0371 (IL 53 northbound and southbound over US 12 Rand Road, respectively) are located at the northern end of the IL 53 corridor limits of Illinois Department of Transportation (IDOT) Project Number 62N91. US 12 runs east to west and provides for two lanes of traffic in each direction. There is no existing sidewalk located under the structures or along the shoulders.

An existing concrete slope-wall at a two-to-one horizontal to vertical (2H:1V) slope establishes the grade separation between US 12 and IL 53. The existing vertical clearance was measured as approximately 14'-4" at US 12. Attachment A contains an overview of the project location. Attachment B presents the existing cross sections of US 12 and existing bridge structures.

3. RECOMMENDED IMPROVEMENT

The proposed multiuse path will run east to west through span 1 of the existing bridge structures at the IL 53 overpass of US 12. To construct this multiuse path, an existing paved slope wall will be cut back creating the need for earth retention. This path is to be 14' in width (two 2' shoulders and a 10' paved path) and will pass between the existing south abutments and Pier 1 on the south side of US 12.

As part of the overall contract corridor improvements, the superstructure of each bridge is anticipated to be replaced while the substructures will be repaired and rehabilitated for reuse.

A. Reason for Retaining Wall

A retaining wall is required to stabilize the abutment embankment removed to accommodate the proposed multiuse path through span 1. Wall construction may be planned concurrently with the replacement of the bridge superstructure or may occur as part of an advanced work contract.

B. Retaining Wall Design Criteria

The retaining wall design will meet standards and criteria set forth in the following manuals: American Association of State Highway and Transportation Officials Load and Factor Design Bridge Specifications 9th Edition (2020), IDOT Bridge Manual (BM) (2023) with applicable All Bridge Designer memorandums. The IDOT Geotechnical Manual (2020) will outline structure geotechnical parameters for design and stability while the Bureau of Design and

Environment (BDE) Manual (2022) will establish bicycle and pedestrian accommodations. The following table highlights select criteria used for the development of the Wall Feasibility Study.

Retaining Wall Design Criteria Table

Description	Criteria	Reference
Bicycle and Pedestrian Traffic	Low Volume	Phase I Report Vol. 1 of 4; Table 12-2; BDE 17-2.03(b) Figure 17-2.T.
Multiuse Path Width	10' (minimum), 14' (desirable: 2', 10', and 2')	BDE 17-2.03(b) Figure 2.U
Road Separation	5' from face of curb; 2' vertical clear distance or use Rub Rail	BDE 17-2.03(c); Figure 17-2.W
Road Separation with Barrier	Minimum offset not required when a 3' barrier is provided.	BDE 17-2.KK
Bicycle Railing Height	4'-0" minimum	BDE 17-2.03(d)
Vertical Clearance Under Bridge	8'-0" minimum, 10'-0" desirable	BDE 17-2.03(d)
Drainage–Cross Slope and Superelevation	Recommended 1 to 1.5 percent, 2 percent maximum	BDE 17-2.03(g)
Multiuse Path Approach to Bridge	Match proposed path width; provide clear view through structures	BDE 17-2.03(I)
Slope Wall Cutback Pier to Wall Width	10'-0" minimum	BDE 17-2.03(I) and Figure 17-2.HH
Profile	Maximum 5 percent to match roadway, 2 percent maximum of path, 1.5 percent is desirable	BDE 17-2.03(h)
Cast-in-Place (CIP) Wall Footing Depth	4'-0"	IDOT BM 2.3.12.2
CIP Wall	28 degrees. Internal friction backfill	IDOT BM 3.11.2
Solider Pile Wall	Coulomb's Earth Coefficients	IDOT BM 3.11.3
Top of Wall Drainage	Type B Gutter	IDOT BM Figures. 3.11.2.3-2 and 3.11.3.2.1-1

4. PRELIMINARY ALTERNATIVES CONSIDERED

Three retaining wall alternatives have been considered for earth retention at this grade separation. Descriptions of each alternative are provided in the following. Attachment C provides a conceptual exhibit for each wall alongside a plan layout. All wall types considered have a minimum anticipated service life of 50 years to coincide with the remaining bridge life cycle.

A. Alternative 1–Soldier Pile and Lagging Wall

A soldier pile and lagging retaining wall allows for a top-down construction approach. A pile is driven or drilled into the existing ground from overhead, timber lagging placed between, drainage system, and the earth is excavated at the front face in a top-down manner. Implementation of this system will require a coordinated sequence with the bridge superstructure reconstruction for overhead access. Selection of a top-down construction method has the potential to reduce the earthwork involved in the walls placement but will require temporary shoring between removals of the existing superstructure.

A sheet pile system could also be used in top-down construction but was dropped from consideration because of gravelly soils identified in the historic soil boring logs.

B. Alternative 2–CIP Concrete Inverted T-Wall

A traditional CIP earth retaining wall would be proposed to be placed by means of an open cut excavation through span 1. Removal of the slope wall and soil between the abutment and pier occurs to the required elevation for installation of the retaining wall. Engineered fill is placed behind the retaining wall along with a drainage system.

C. Alternative 3–Drilled Soil Nail Wall

A soil nail wall allows for a top-down construction but offers constructability of low head room, in situations such as this, which separates itself from the bridge construction. As soil nails are installed shotcrete is applied as earthwork is excavated before a final concrete facing is cast. The system needs to have competent soil above the groundwater table. The system is not favorable for design in granular, organic, or cobbly soils. Design life of soil nail walls is 50 to 75 years, based on ground corrosion potential.

5. PRELIMINARY ALTERNATIVES COMPARISON

The preliminary alternatives are compared in the following, based on the various retaining wall criteria identified in the IDOT BM (2023). Each criteria item is selected to provide comparison of costs and construction methods.

A. Opinion of Construction Cost (OPCC)

For each alternative, an OPCC was generated to reflect the cost. There are pay items that are common across all alternatives; however, some details vary slightly, therefore, all pay items and quantities are reflected in the cost. The multiuse path pay items are not considered in the OPCCs, as noted on each. Attachment D provides the base breakdown for each alternative, as well as additions of contingency, mobilization, escalation, and additional cost for remobilization (if applicable) considering the multi-stage maintenance of traffic (MOT) scheme for the project. Alternatives 1 and 2 are similar in cost, but Alternative 2, the CIP T-wall, is slightly less because it is independent of the MOT. The third alternative is considered cost-prohibitive and was removed from consideration. A direct comparison of the overall base cost to exposed square footage results in the following for Alternatives 1, 2, and 3 respectively: $231 per square foot (sq ft), $219 per sq ft, and $295 per sq ft.

B. Geometrics

The multiuse path's profile and alignment are not established at this time. This will be determined during the Type, Size, and Location (TS&L) Phase. The proposed alignment will follow the curb line of the US 12 through span 1. The multiuse path has a proposed width of 14' face-to-face of the retaining wall to existing pier. This configuration is for a 10' path and two 2' shoulders. Infills are proposed between the existing pier columns to a height of 4'-6" above the path. A minimum of 10' vertical clearance will be obtained. The path cross slope is proposed as 1.5 percent, draining from the front face of the wall to the back of curb. The geometric criteria are identified in the table of Section 3.

C. Geotechnical

A Structural Geotechnical Report (SGR) has been scoped for this wall and new borings are considered forthcoming. Historic boring logs was available and can be found within Attachment E. The historic data indicates that the soil is primarily clay, with a bearing pressure of approximately 2.0 tons square foot. This data will not capture what was used for the embankment material and the fill under the existing slope-walls. For the purposes of this study, the selected alternatives were developed that are less sensitive to variance in bearing strata.

The additional structural borings required for the preparation of the SGR will be taken to depths and spacing, as recommended by the IDOT Geotechnical Manual. See Attachment E for more information.

D. Structural Feasibility

A solider pile and lagging wall, a CIP concrete inverted T-wall, and drilled soil nail wall were selected as appropriate wall types to meet the specific project demands for soil retention. See Attachment C for reference to the conceptual wall exhibits for each type selected.

1. Alternative 1–Soldier Pile and Lagging Wall

This wall system is adaptable to meet geotechnical parameters at a given site. While a driven soldier pile wall may be feasible, it is recommended that a drilled soldier pile system be considered. This is reflected in the OPCC for Alternative 1. The existing pier and abutment are both pile-supported. To prevent issues with disturbing the existing foundations, augured placement of these piles will create less disturbance to the bearing strata. This alternative will require the removal of the existing bridge superstructure before placement and must be scheduled for completion before placement of new superstructure beams. For OPCC quantity generation, a 1/3 exposed 2/3 embedment was used to determine the length of the drilled soldier pile. The common 8' spacing was used across the wall length. Temporary soil retention is required for retention of slope-wall embankment between stages of the bridge construction.

2. Alternative 2–CIP Inverted T-Wall

To place this type of wall, removal of the entire slope wall and open cut of the embankment is required. This excavation may be feasible while the existing superstructure is still in place. The base of the foundation must be set below a frost depth of 4' from proposed grade. The backfill behind the wall may be lightweight cellular concrete fill to reduce loads on the wall. A shear key can be introduced below the footing to aid in sliding resistance if the driving load is an issue in design.

3. Alternative 3–Drilled Soil Nail Wall

A soil nail wall is commonly used in cut back wall situations. The wall system is most often designated through a performance specification requiring involvement with the construction contractor to complete final design based on a basic plan and elevation layout. Resistance is developed through soil interaction with the drilled and grouted nails that are then mechanically secured to the wall facing. This layout requires a specific grid layout will varying lengths of soil nail. The soil nails are often assumed to have a maximum length of 2.5 times the exposed height of the finished wall. Using this approximation, the final nail position will intersect the plane of resistance of the front battered row of abutment piles. The location of the columns of the existing piers may also interfere with the layout, but placement is possible through the column bays. Adequate clearance from the existing piles and proposed soil nail location must be considered in all layouts.

This type of retaining wall system is most often applied at locations where low overhead clearance is a constraint. The construction of this type of wall may be able to progress as an advance work contract at this location while the existing bridge decks remain in service.

The system also typically requires the presence of cohesive soils in the retained embankment. If the presence of granular soils in the grade separation is discovered during exploratory borings for the drafting of the project SGR, this wall system may no longer be feasible.

E. Aesthetics

To prevent the creation of a hazard to bicycle riders, a smooth finish to all vertical exposed concrete wall surfaces is anticipated. Thus, this item will have no bearing on the wall selection process and is dropped from consideration.

F. MOT

The Phase I Concept MOT scheme identifies two construction stages for IL 53 bridges over US 12. The soldier pile and lagging wall is dependent on MOT staging and construction schedule of the bridge superstructure replacements as it requires top-down construction. Alternative 2, the CIP inverted T-wall, may be placed while the existing superstructure is still in service if the contractor has the proper excavation equipment available. Alternative 3, soil nail wall, can be placed completely as an advanced work contract, but may impact US 12 more than the other alternates. Lane closure along US 12 will be required for all wall types selected for study to provide haul away and material delivery under the bridge.

G. Construction Duration

The construction duration of the alternatives identified is critical for Alternative 1, which connects the bridge and retaining wall construction schedules. Alternative 1 needs the bridge superstructure removed for construction. The bridge superstructure replacement cannot proceed without the completion of that wall portion for each stage. Alternative 2 may be able to be constructed independent of the superstructure replacement, but it will depend on the stability of the grade separation embankment and the contractor’s available excavation equipment. Alternative 3 may be completely constructed independent of the bridge superstructure MOT and it is possible that the wall can be constructed in a contract before the bridge contract letting.

H. Constructability

The developed alternatives each represent a different method of construction while providing flexibility to address work zone and scheduling constraints. Alternative 1 will need to be scheduled with the bridge work, Alternative 3 can be placed independent of the bridge work, and Alternative 2 could go either way depending on the results of the SGR. All three wall types are structurally common and can be placed without the need of highly specialized or uncommon equipment.

I. Long-Term Maintenance

Each proposed alternative is anticipated to have a similar design life with an exposed reinforced concrete facing requiring similar maintenance.

J. Right-of-Way (ROW)

The three alternatives under the proposed grading limits stay within IDOT ROW. There is no difference across the alternatives that provides an advantage or disadvantage. Adjacent to the proposed retaining wall location, there is existing bridge embankment cone fencing that will be removed.

K. Drainage

Under the criteria established in IDOT BDE Chapter 17, a cross slope of 1.5 percent is proposed for the multiuse path. The drainage at the face of the wall will traverse the path to the curb line of the roadway. The profile of the multiuse path is so the longitudinal grade provides a positive drainage along the length of the wall in a west direction.

Drainage from the slope wall is captured by the Type B gutter at the top of the retaining wall, where it is then conveyed at the top of the wall, along its length, before it empties into a surrounding drainage area or will enter a catch basin. A geocomposite wall drain will be proposed on the wall back face to convey water behind the wall down to the bottom of the face and then daylight out or enter an adjacent storm sewer system.

There is no difference across the alternatives caused by drainage. The outlet drainage structures for the bridge structures will need to be adjusted because of revised grading limits and drainage.

L. Utility

Existing utility relocation is not anticipated as part of this wall construction. There are nearby light pole and traffic signal boxes that are not anticipated to be impacted by excavation to place the wall foundations.

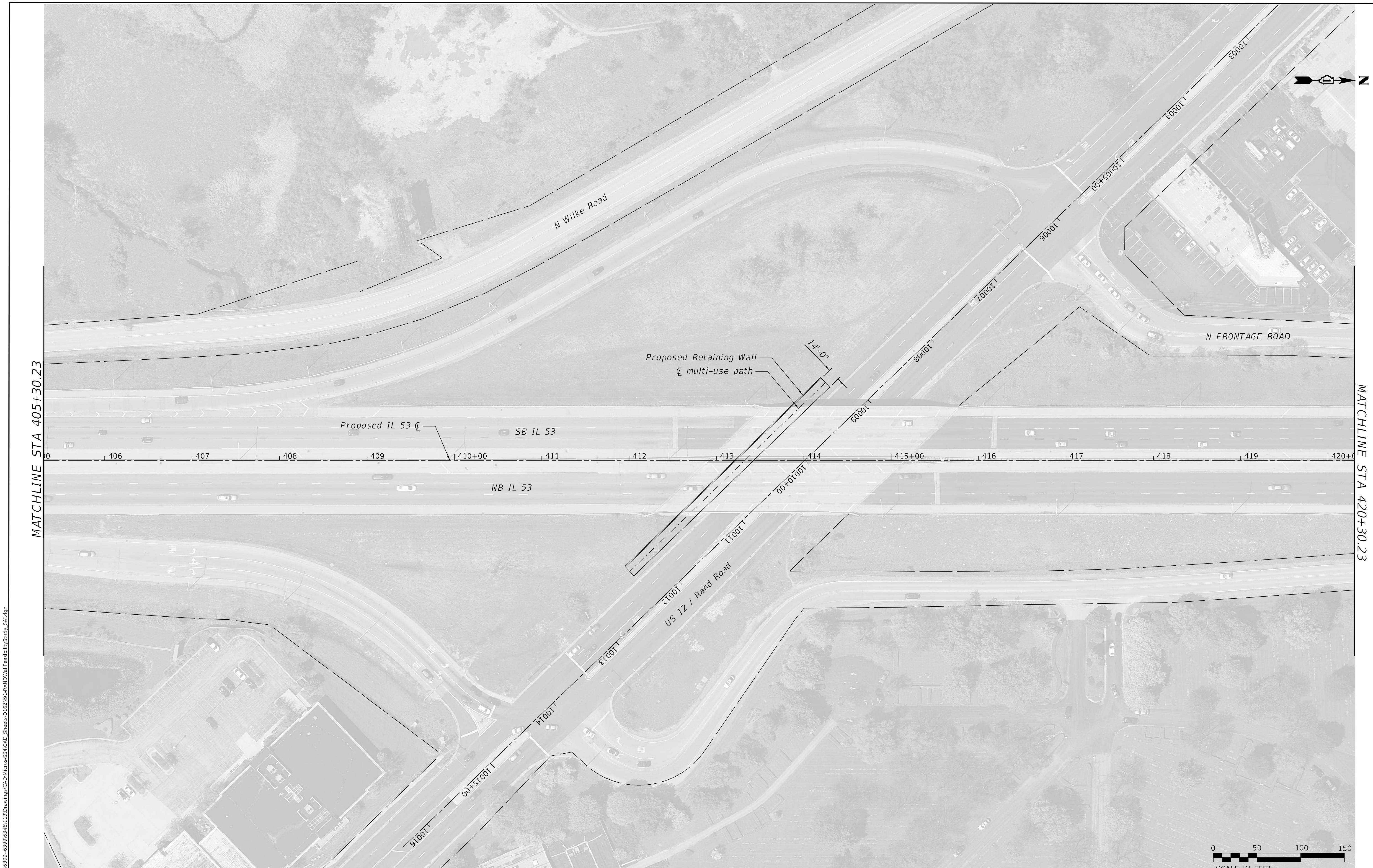
RECOMMENDATION

The IDOT retaining wall selection process is designed to arrive at an appropriate retaining wall solution for the project's identified design constraints. Consideration is given to initial construction cost, constructability, feasibility, schedule and more to arrive at this recommendation.

Under the considerations in this study, it is recommended that Alternative 2, the CIP inverted T-wall, be implemented. This wall alternative provides a cost-effective wall system while allowing the potential for a construction sequence that is independent of the staged bridge superstructure replacement. Selection of this alternative may allow for this work to be completed as part of an advanced construction package.

Based on Strand Associates, Inc.®'s evaluation of the existing and proposed grades with the desired multiuse path configuration, it is anticipated that the exposed height of this retaining wall will exceed the seven feet. A TS&L will be developed with the recommended retaining wall alternative in accordance with the criteria set forth in the IDOT BM Section 2.3.5.5.

ATTACHMENT A
PROPOSED ROADWAY PLAN



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STRAND ASSOCIATES®
1170 SOUTH HOUBOLT ROAD
JOLIET, ILLINOIS 60431
(815) 744-4200

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	DRAWN - JAS	REVISED -	
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PLOT DATE = 1/25/2023	DATE - $PLANDATE$	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US 12 RAND ROAD – WFS: ATTACHMENT A
PROPOSED ROADWAY PLAN

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

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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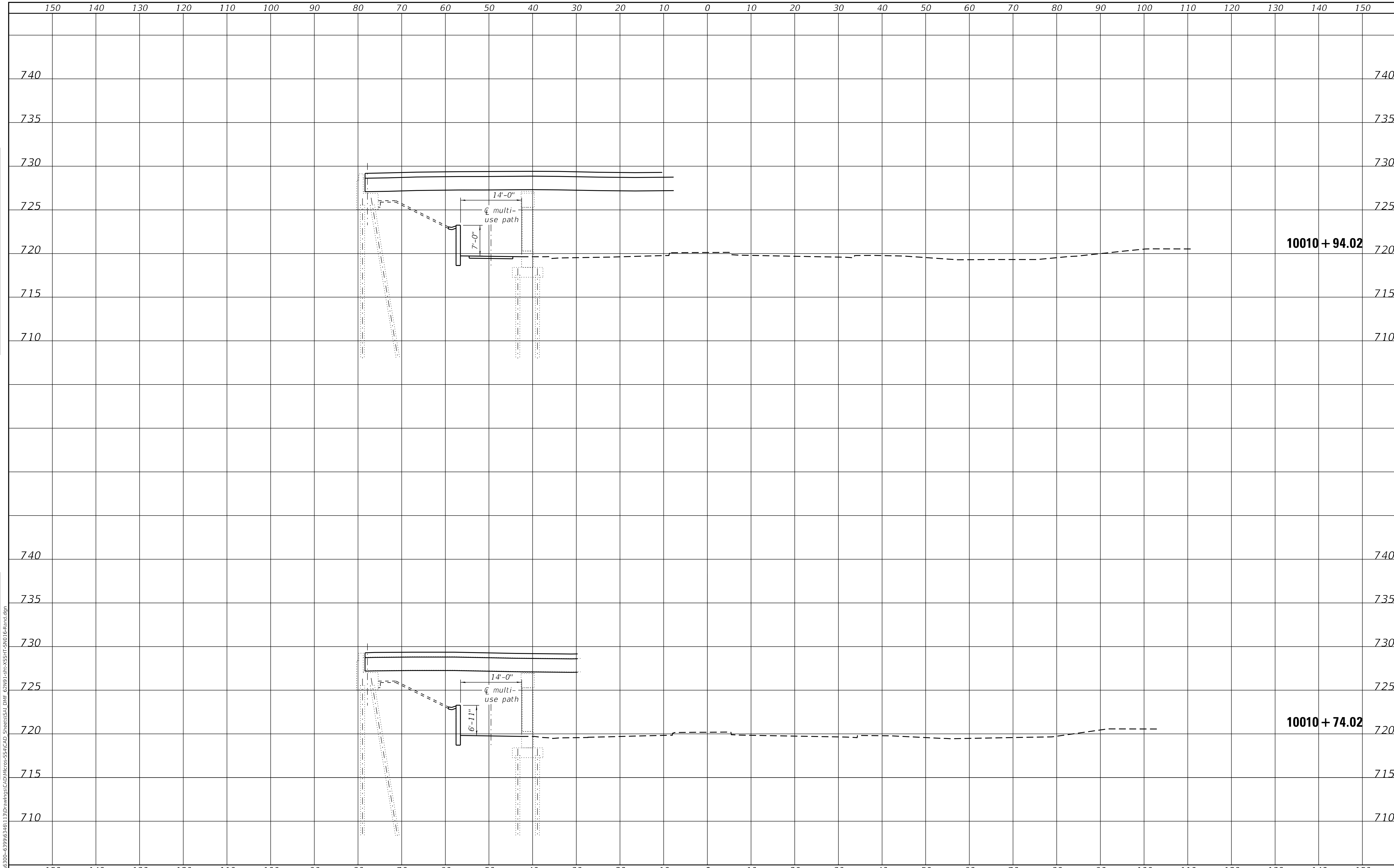
		CONTRACT NO. 62N91		
	ILLINOIS	FED. AID PROJECT		

ATTACHMENT B
PROPOSED ROADWAY CROSS SECTIONS



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1170 SOUTH HOUBOLT ROAD
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(815) 744-4200

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US 12 RAND ROAD – WFS: ATTACHMENT B
PROPOSED ROADWAY SECTION 1 OF 3

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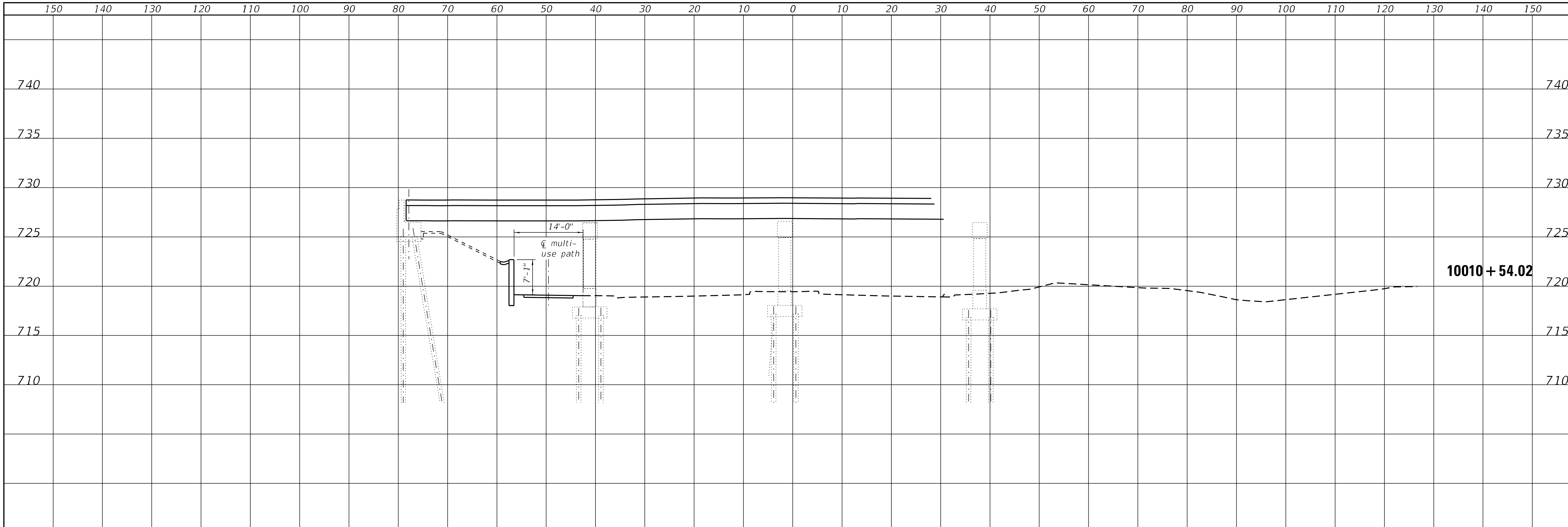
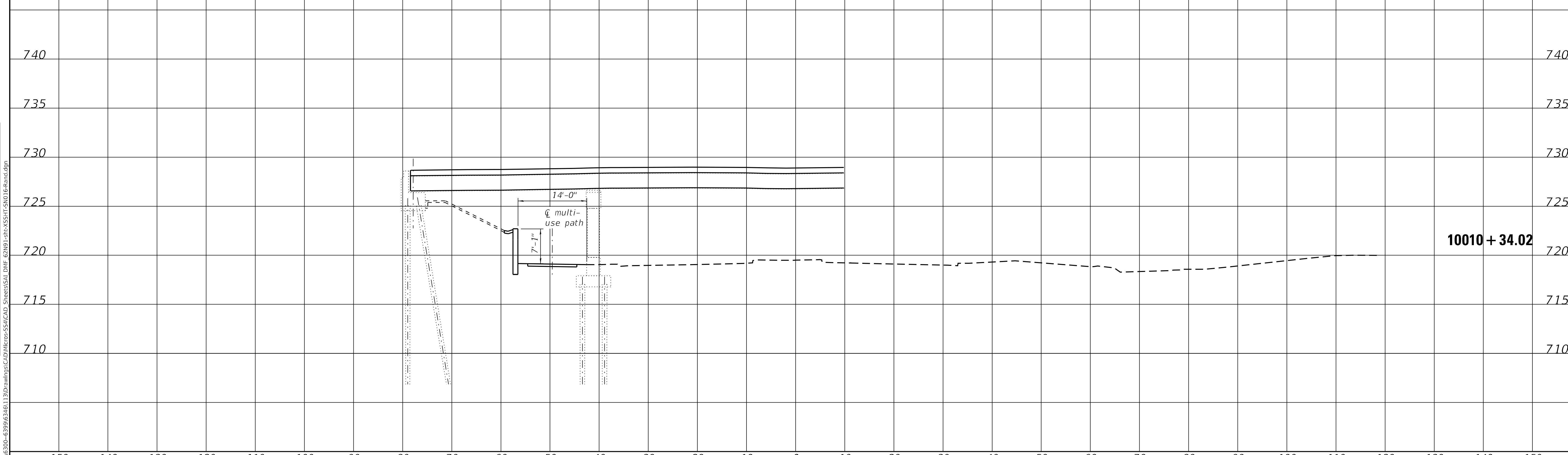
ILLINOIS	FED. AID PROJECT			





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USER NAME = $USER$	DESIGNED - BRL	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
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US 12 RAND ROAD – WFS: ATTACHMENT B
PROPOSED ROADWAY SECTION 2 OF 3

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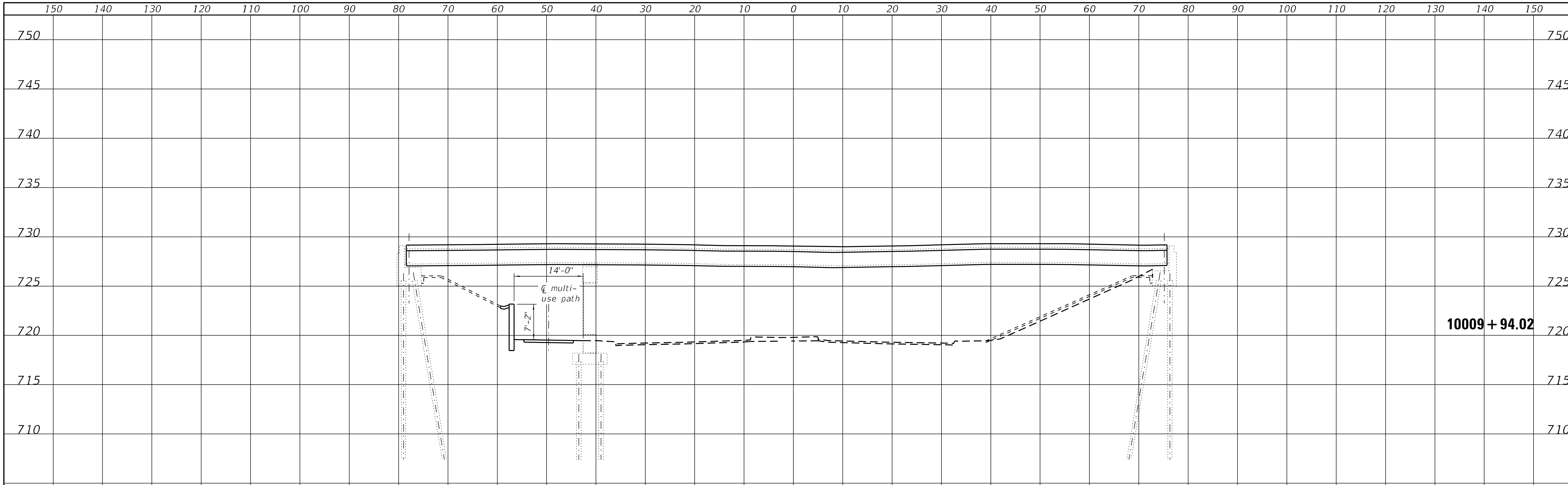

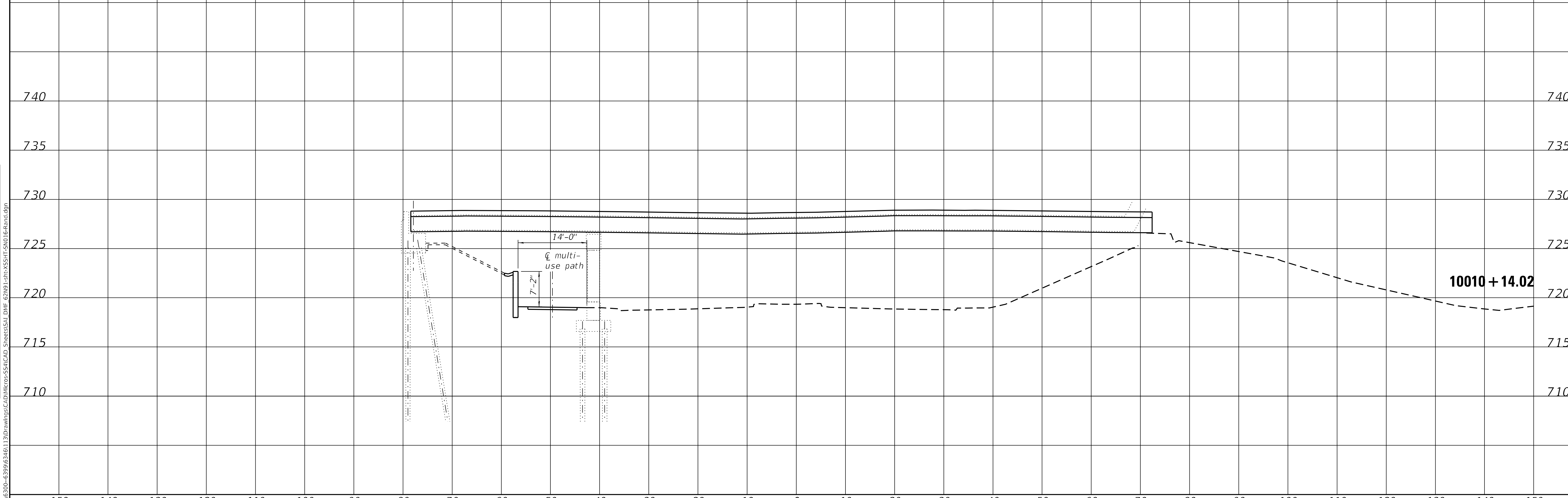

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ORIGINAL SURVEY | NOTE BOOK | NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE

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USER NAME = $USER$	DESIGNED - BRL	REVISED -	
	DRAWN - DMF	REVISED -	
PLOT SCALE = $SCALE$	CHECKED - NDR	REVISED -	
PLOT DATE = 1/25/2023	DATE -	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US 12 RAND ROAD – WFS: ATTACHMENT B
PROPOSED ROADWAY SECTION 3 OF 3

SCALE: | SHEET OF SHEETS | STA. 10010+14.02 TO STA. 10009+94.02

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

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

ATTACHMENT C
PRELIMINARY ALTERNATIVES PLAN AND SECTIONS

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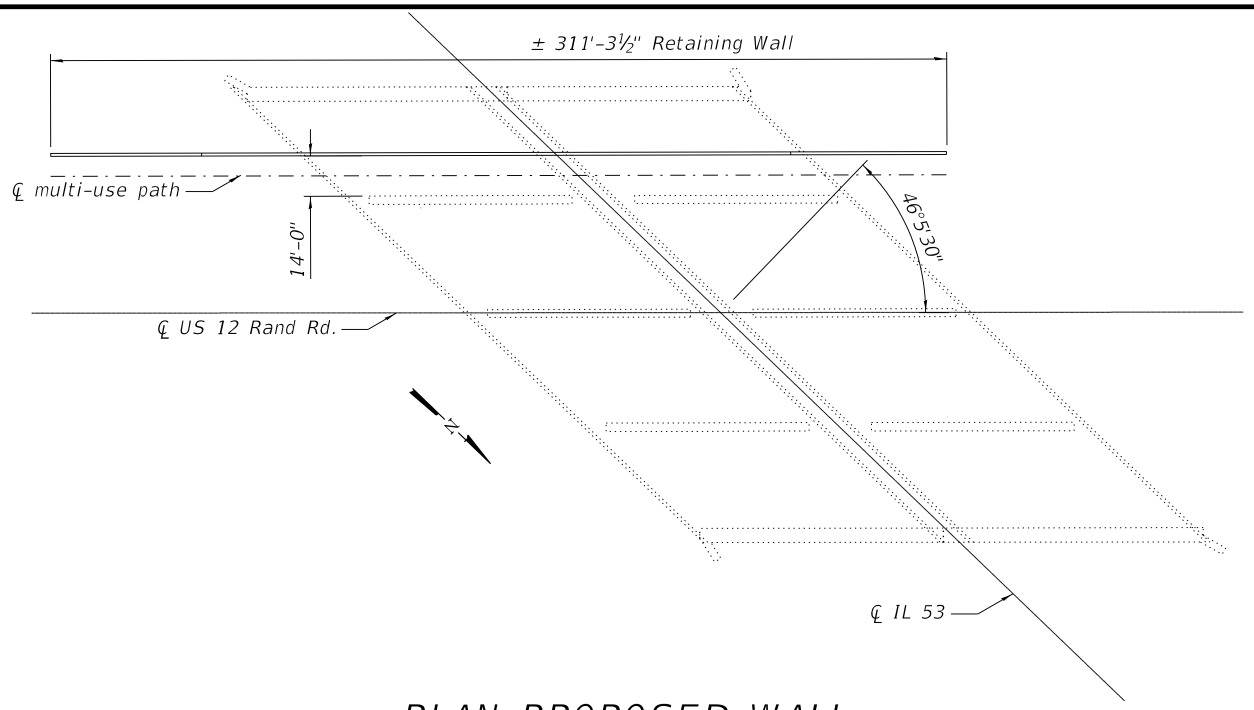
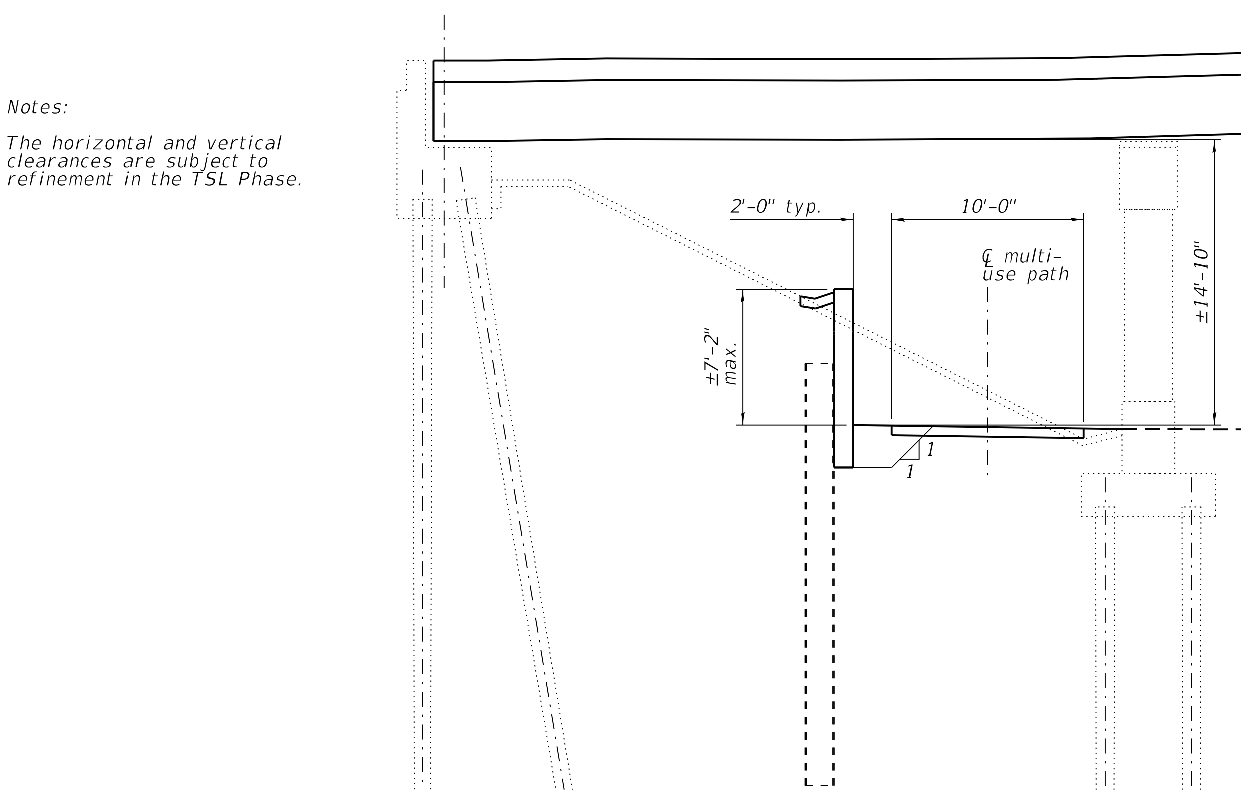


PLAN PROPOSED WALL



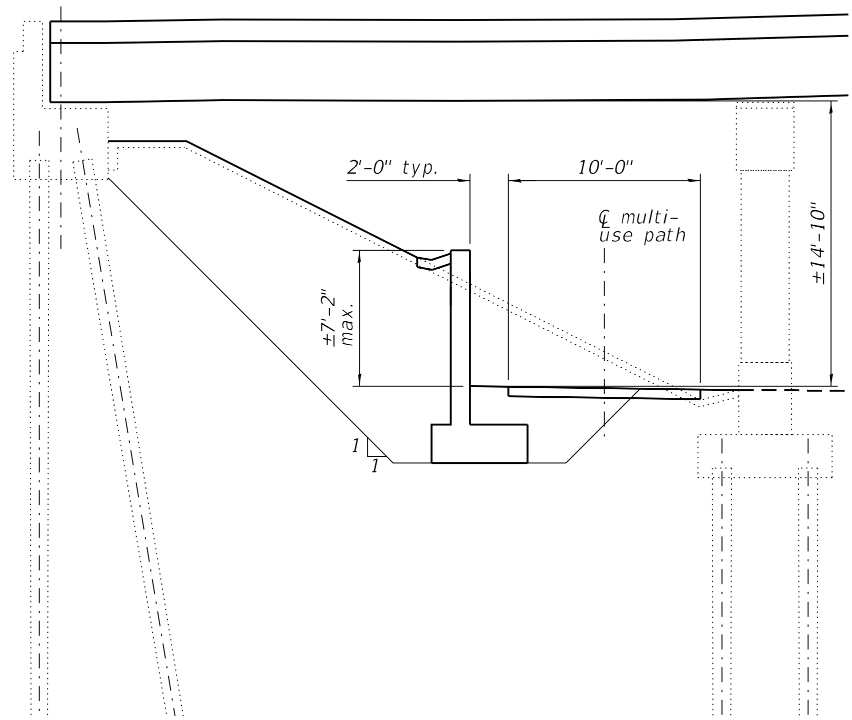
SOLDIER PILE AND LAGGING WALL - TYPICAL SECTION

US 12 RAND RD. PROPOSED S.N. TBD
RETAINING WALL

STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION

STRAND ASSOCIATES®

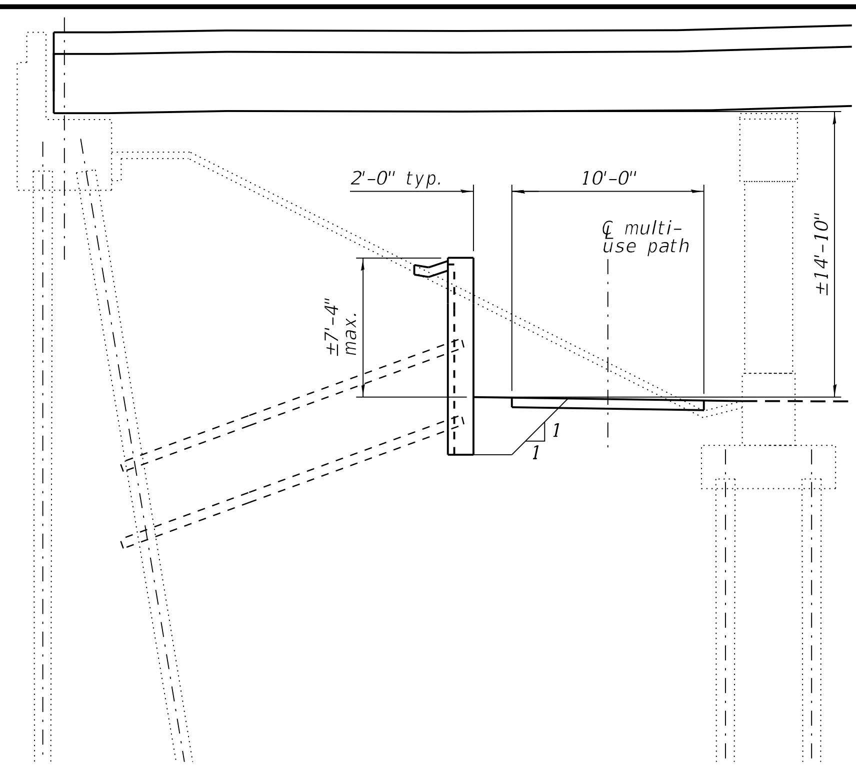
FIGURE NO. 1
JOB # 62N91 IL53



CAST-IN-PLACE CONCRETE INVERTED T-WALL - TYPICAL SECTION

Notes:

The horizontal and vertical clearances are subject to refinement in the TSL Phase.



DRILLED SOIL NAIL WALL - TYPICAL SECTION

US 12 RAND RD. PROPOSED S.N. TBD
RETAINING WALL

STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION

STRAND ASSOCIATES®

FIGURE NO. 2

JOB # 62N91 IL53

ATTACHMENT D
OPCC

Alternative 1: Soldier Pile and Lagging Wall

The opinion of probable construction cost (OPCC) is based on the criteria identified in the accompanying Wall Feasability Study. This OPCC for Alternative 1 has the following assumptions: a contingency for undeveloped design details, escalation to the anticipated construction year, and additional cost for mobilization of the multi-stage MOT.

Pay Item Number	Description	Quantity	Unit	Unit Cost	Cost
50104650	Slope Wall Removal	365	SQ YD	$ 35.00	$ 12,775.00
50300225	Concrete Structures	93.0	CU YD	$ 1,100.00	$ 102,300.00
50800205	Reinforcement Bars, Epoxy Coated	13,950	POUND	$ 3.25	$ 45,337.50
50200100	Structure Excavation	255	CU YD	$ 30.00	$ 7,650.00
58700300	Concrete Sealer	2,599	SQ FT	$ 2.25	$ 5,847.75
52200020	Temporary Soil Retention System	400	SQ FT	$ 50.00	$ 20,000.00
59100100	Geocomposite Wall Drain	272	SQ YD	$ 30.00	$ 8,160.00
60602800	Concrete Gutter, Type B	313	FOOT	$ 31.00	$ 9,703.00
60146304	Pipe Underdrain for Structures 4"	360	FOOT	$ 28.00	$ 10,080.00
52200100	Furnishing Soldier Piles (HP Section)	784	FOOT	$ 120.00	$ 94,080.00
52200200	Drilled and Setting Soldier Piles (in Soil)	3,846	CU FT	$ 20.00	$ 76,920.00
52200250	Untreated Timber and Lagging	1,561	SQ FT	$ 18.00	$ 28,098.00
50500505	Stud Shear Connectors	208	EACH	$ 4.00	$ 832.00

Structure Cost Baseline:	$ 421,783.25
Note: Multi-use path cost is not included. Cost per exposed square feet:	$ 231.00
Design Contingency for Undeveloped Details:	20%
Construction Mobilization Costs:	10%
Contingency and Mobilization Cost:	$ 126,535.00
Structure Cost with Contingency and Mobilization:	$ 548,318.25
Escalation Percentage:	4%
Year of Escalation (Current Year 2023):	2
Escalation Cost:	$ 44,743.00
Structure Cost with Escalation:	$ 593,061.25

Opinion of Probable Construction Cost for Alternative 1: $ 593,000 (2025 Construction Anticipated)

Alternative 2: Cast-in-Place Concrete Inverted T-Wall

The opinion of probable construction cost (OPCC) is based on the criteria identified in the accompanying Wall Feasability Study. This OPCC for Alternative 2 has the following assumptions: a contingency for undeveloped design details, escalation to the anticipated construction year, and additional cost for mobilization.

Pay Item Number	Description	Quantity	Unit	Unit Cost	Cost
50104650	Slope Wall Removal	705	SQ YD	$ 35.00	$ 24,675.00
52200900	Concrete Structures (Retaining Wall)	205.9	CU YD	$ 850.00	$ 175,015.00
50800205	Reinforcement Bars, Epoxy Coated	30,880	POUND	$ 3.25	$ 100,360.00
50200100	Structure Excavation	1,790	CU YD	$ 30.00	$ 53,700.00
58700300	Concrete Sealer	2,452	SQ FT	$ 2.25	$ 5,517.00
59100100	Geocomposite Wall Drain	313	SQ YD	$ 30.00	$ 9,390.00
60602800	Concrete Gutter, Type B	312	FOOT	$ 31.00	$ 9,678.20
60146304	Pipe Underdrain for Structures 4”	360	FOOT	$ 28.00	$ 10,080.00
58600101	Granular Backfill for Structures	345	CU YD	$ 30.00	$ 10,350.00

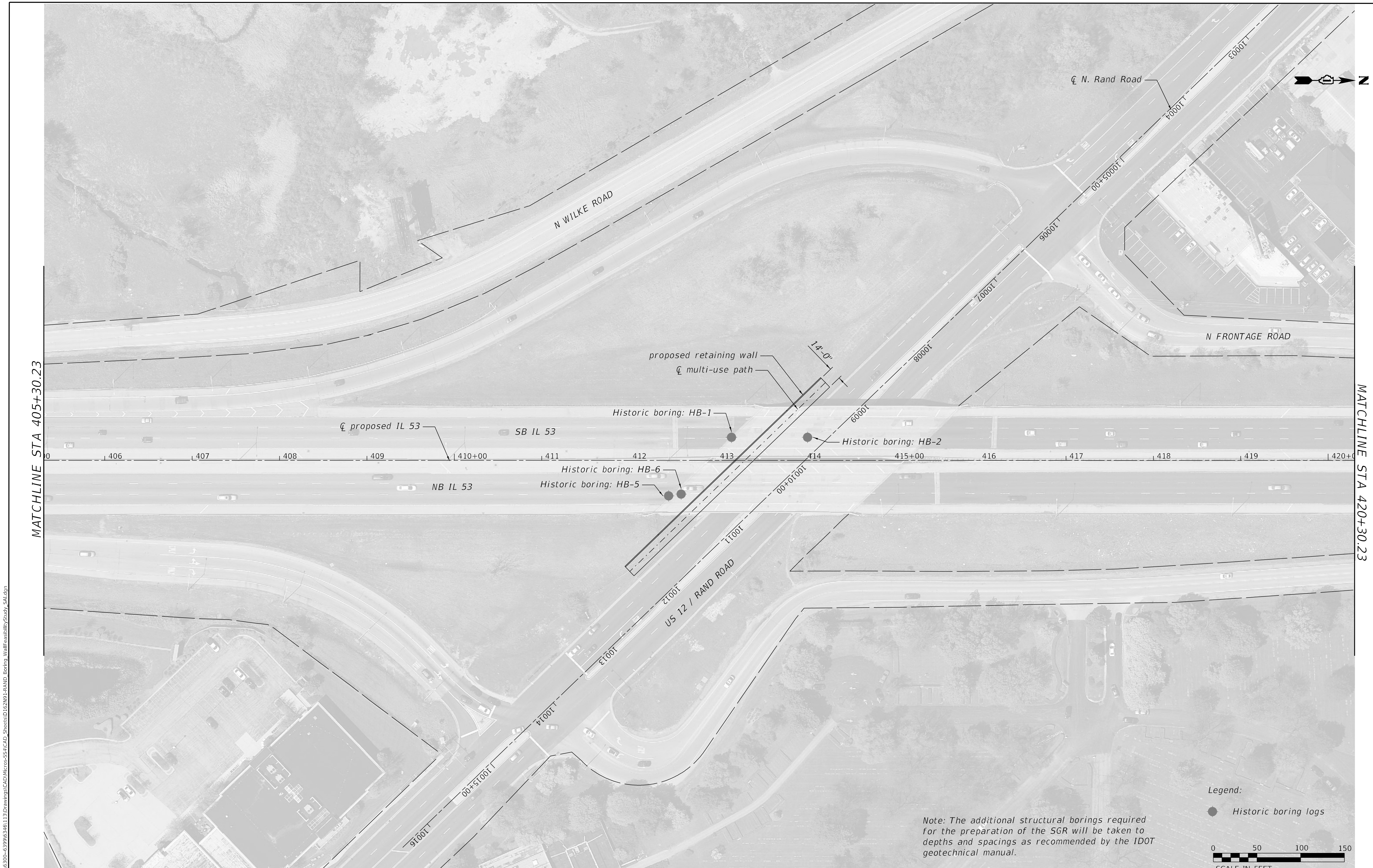
Structure Cost Baseline:	$ 398,765.20
Note: Multi-use path cost is not included. Cost per exposed square feet:	$ 219.00
Design Contingency for Undeveloped Details:	20%
Construction Mobilization Costs:	5%
Contingency and Mobilization Cost:	$ 99,691.00
Structure Cost with Contingency and Mobilization:	$ 498,456.20
Escalation Percentage:	4%
Year of Escalation (Current Year 2023):	1
Escalation Cost:	$ 19,938.00
Structure Cost with Escalation:	$ 518,394.20

Opinion of Probable Construction Cost for Alternative 2: $ 518,000 (2024 Construction Anticipated)

Alternative 3: Drilled Soil Nail Wall					
The opinion of probable construction cost (OPCC) is based on the criteria identified in the accompanying Wall Feasability Study. This OPCC for Alternative 3 has the following assumptions: a contingency for undeveloped design details, escalation to the anticipated construction year, and additional cost for mobilization.					
Pay Item Number	Description	Quantity	Unit	Unit Cost	Cost
50104650	Slope Wall Removal	370	SQ YD	$ 35.00	$ 12,950.00
50200100	Structure Excavation	185	CU YD	$ 30.00	$ 5,550.00
58700300	Concrete Sealer	2,599	SQ FT	$ 2.25	$ 5,847.75
59100100	Geocomposite Wall Drain	272	SQ YD	$ 30.00	$ 8,160.00
60602800	Concrete Gutter, Type B	312	FOOT	$ 31.00	$ 9,678.20
60146304	Pipe Underdrain for Structures 4”	360	FOOT	$ 28.00	$ 10,080.00
X0900067	Soil Nailed Retaining Wall	2,493	SQ FT	$ 200.00	$ 498,600.00
				Structure Cost Baseline:	$ 550,865.95
Note: Multi-use path cost is not included.				Cost per exposed square feet:	$ 295.00
				Design Contingency for Undeveloped Details:	20%
				Construction Mobilization Costs:	5%
				Contingency and Mobilization Cost:	$ 137,716.00
				Structure Cost with Contingency and Mobilization:	$ 688,581.95
				Escalation Percentage:	4%
				Year of Escalation (Current Year 2023):	1
				Escalation Cost:	$ 27,543.00
				Structure Cost with Escalation:	$ 716,124.95

Opinion of Probable Construction Cost for Alternative 3: $ 716,000 (2024 Construction Anticipated)

ATTACHMENT E
HISTORIC SOIL BORING PLAN AND LOGS



Note: The additional structural borings required for the preparation of the SGR will be taken to depths and spacings as recommended by the IDOT geotechnical manual.

MODEL: Plan
FILE NAME: S:\JOL\6300--6399\6346\113\Drawings\CAD\Micro-SS4\CAD_Sheets\D162N91-RAND Boring WallFeasibilityStudy_SAI.dgn

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PLOT DATE = 1/25/2023	DATE - $PLANDATE$	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US 12 RAND ROAD – WFS: ATTACHMENT E
HISTORICAL SOIL BORING PLAN

SCALE: | SHEET 1 OF 3 SHEETS | STA. | TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
342		COOK	TOT	
		CONTRACT NO. 62N91		
	ILLINOIS	FED. AID PROJECT		

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
F.A. 61	531-3HB-2	COOK	25	22

SHEET NO. 15
16 SHEETS

FOR REFERENCE ONLY

HB-1

Boring No. B-1
Station 399 + 95
Offset 27' W. of C. L. of 53
Ground Surface 716.0

- BLACK ORG CLAY
- BROWN SANDY CLAY
- BROWN SILTY CLAY
- BROWN SILTY GRAVELLY
- GRAY GRITTY CLAY (H2O)
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY CLAY
- GRAY GRITTY CLAY
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAY
- GRAY CLAY
- END OF BORING

Surface Water El.
Groundwater El. at Completion 10'
After 2 Hours

HB-2

Boring No. B-2
Station 400 + 74
Offset 27' W of C. L of 53
Ground Surface 718.0

- BLACK ORGANIC CLAY
- BOULDERS
- BROWN GRAVELLY CLAY
- BROWN GRAVELLY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- 4-20-64
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY CLAYEY GRAVELLY SILT
- GRAY STONEY CLAY
- GRAY STONEY SANDY SILT
- GRAY STONEY SANDY SILT
- GRAY STONEY SANDY SILT
- GRAY CLAYEY SANDY SILT
- GRAY STONEY SANDY SILTY CLAY
- (STONEY)
- GRAY CLAYEY SANDY SILT
- END OF BORING

Surface Water El.
Groundwater El. at Completion 21 1/2'
After 20 Hours 21'

Boring No. B-3
Station 401 + 43
Offset 29' W of C. L. of 53
Ground Surface 718

- BROWN GRAVELLY CLAY
- H2O
- BROWN SANDY GRAVELLY CLAY
- PINK SANDY CLAY
- BROWN SANDY GRAVEL
- GRAY GRAVELLY CLAY
- GRAY GRAVELLY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRAVEL (H2O)
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAY
- GRAY CLAY
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY SILTY GRAVEL
- GRAY CLAYEY GRAVEL
- END OF BORING

Surface Water El.
Groundwater El. at Completion 21/2
After ___ Hours

Boring No. B-4
Station 401 + 99
Offset 25' W of C. L of 53
Ground Surface 721.0

- BLACK ORG CLAY
- BROWN SANDY CLAY
- BROWN SAND
- BROWN SANDY GRAVELLY CLAY
- BROWN GRAVELLY CLAY
- BROWN GRAVELLY CLAY
- GRAY(FINE SANDY) SILTY CLAY
- GRAY GRAVELLY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- STONEY GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY GRITTY CLAY
- GRAY SANDY GRAVEL
- GRAY SANDY GRAVEL
- GRAY SANDY GRAVEL
- GRAY CLAY
- GRAY GRAVEL
- GRAY CLAY
- GRAY CLAY
- GRAY CLAY W/ LAYER OF SAND
- GRAY CLAY W/Stones
- END OF BORING

HB-5

Boring No. B-5
Station 399 + 15
Offset 40' E. of C. L. of 53
Ground Surface 716.00

- BLACK ORG CLAY
- BROWN GRITTY CLAY
- PEATY GRAY SANDY SILT CLAY
- GRAY GRAVEL
- (LIVERERY)
- GRAY STRATAIFIED SAND SILT AND SILTY CLAY
- (LIVERERY)
- GRAY SILTY CLAY TO GRAY GRAVELLY CLAY
- GRAY GRITTY CLAY
- GRAY SILTY CLAY
- GRAY CLAY
- GRAY CLAY
- GRAY GRAVEL
- GRAY GRITTY CLAY
- GRAY GRAVEL
- 4-23-64
- GRAY CLAY
- GRAY CLAY (H2O)
- GRAY GRAVELLY SILT
- GRAY GRAVELLY SILT
- GRAY GRAVELLY SILT
- GRAY GRAVELLY SILT
- GRAY GRAVELLY SILT
- GRAY GRAVELLY SILT
- GRAY GRAVELLY CLAY
- GRAY CLAY
- GRAY GRITTY CLAY LAYER OF SAND
- GRAY CLAY
- END OF BORING

Surface Water El.
Groundwater El. at Completion 2 1/2'
After 18 Hours

N – Standard Penetration Test – Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu – Unconfined Compressive Strength – t/sf
w – Water Content – percentage of oven dry weight – %.

Type failure:
B – Bulge Failure
S – Shear Failure
E – Estimated Value

DESIGNED
CHECKED
DRAWN
CHECKED

EXAMINED — ENGINEER OF BRIDGES AND TRAFFIC STRUCTURES
PASSED — ENGINEER OF DESIGN
APPROVED — CHIEF HIGHWAY ENGINEER
July 15 1964

BORINGS
S.B.I. RT. 53 SEC. 531-3HB-2
COOK COUNTY
STA. 400+73.07

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JOLIET, ILLINOIS 60431
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PLOT DATE =	CHECKED -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US 12 RAND ROAD - WFS: ATTACHMENT E
HISTORIC SOIL BORINGS
SHEET 2 OF 3 SHEETS

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

CONTRACT NO.
ILLINOIS FED. AID PROJECT

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DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
S.B.I. F.A. 61	531-3HB-2	COOK	25	23
FED. ROAD DIST. NO. 7	ILLINOIS	FED. AID PROJECT-		

SHE NO. 16
16 SHEETS

HB-6

Boring No. B-6
Station 399 + 42
Offset 38' E of C.L of 53

Description	Elevation	N	Qu t/s.f.	w (%)
Ground Surface 718.0	0			
BLACK ORGANIC CLAY				
BROWN CLAY BLACK MUCK		1 1	---	
BROWN CLAY GRAY GRAVELLY CLAY	H20 -5	1 10	--	
BROWN TO GRAY GRITTY CLAY		5 9	2.13	B
GRAY GRITTY CLAY	-10	6 7	2.13	B
GRAY GRITTY CLAY		4 7	1.37	B
GRAY GRITTY CLAY	-15	3 6	1.37	B
GRAY GRITTY CLAY		7 10	1.63	B
H 20 GRAY CLAYEY GRAVELLY SILT	-20	5 9		
GRAY CLAYEY GRAVELLY SILT		5 8	---	
GRAY GRITTY CLAY	-25	7 11	1.30	B
GRAY CLAY		6 10	1.60	B
4-17-64				
GRAY CLAY	-30	7 11	1.63	B
GRAY CLAYEY GRAVELLY SILT		6 7	---	
GRAY CLAYEY GRAVELLY SILT	-35	9 14	---	
GRAY CLAY		7 14	2.25	P
GRAY CLAY	-40	18 17	3.10	B
END OF BORING				

Surface Water El. ______
Groundwater El. at Completion 5'
After ___ Hours ______

Boring No. B-7
Station 401 + 05
Offset 19' E. of C. L. of 53

Description	Elevation	N	Qu t/s.f.	w (%)
Ground Surface 716.7	0			
BROWN GRAVELLY CLAY				
BROWN GRAVELLY CLAY	H20	9 11	---	
BROWN SILTY CLAY	-5	7 10	1.65 3.30	B B
GRAY GRITTY CLAY		7 10	2.91	B
GRAY GRITTY CLAY	-10	6 10	3.30	B
GRAY GRITTY CLAY		6 7	2.91	B
GRAY GRITTY CLAY	-15	6 9	2.91	B
GRAY GRITTY CLAY		5 9	2.91	B
GRAY GRITTY CLAY GRAY SAND H 20	-20	6 10	2.91	B
GRAY SAND				
GRAY CLAY		8 10	2.13	B
GRAY CLAY	-25	4 7	2.13	B
GRAY CLAYEY GRAVELLY SILT		6 9	---	
GRAY CLAY	-30	5 9	2.91	B
GRAY CLAYEY GRAVELLY SILT		10 13	---	
GRAY CLAYEY GRAVELLY SILT	-35	7 8	--	
GRAY CLAYEY GRAVELLY SILT		6 8	---	
GRAY CLAYEY GRAVELLY SILT	-40	40 8	---	
END OF BORING				

Surface Water El. ______
Groundwater El. at Completion 2 1/2'
After ___ Hours ______

Boring No. B-8
Station 401 + 60
Offset 19' E of C. L of 53

Description	Elevation	N	Qu t/s.f.	w (%)
Ground Surface 720.0	0			
BLACK ORGANIC CLAY				
BROWN SANDY CLAY		12 13	2.50	P
BROWN SANDY CLAY	-5	8 9	2.50	P
BROWN SANDY GRAVELLY CLAY		6 7	1.24	S
GRAY CLAY	-10	5 9	2.91	B
GRAY SILTY CLAY		7 9	2.25	P
GRAY GRITTY CLAY	-15	5 9	3.30	B
GRAY GRITTY CLAY	H20	7 9	2.91	B
GRAY GRITTY CLAY	-20	5 10	2.91 3.88	B B
GRAY SANDY GRAVEL H 20 GRAY CLAY		3 7	1.33	P
GRAY SILTY GRAVEL	-25	5 7	----	
GRAY SANDY SILT		7 6	----	
GRAY CLAY W/STONES	-30	7 11	2.33	B
GRAY CLAY		11 16	3.88	B
GRAY CLAY	-35	6 9	2.33	B
4-10-64				
GRAY CLAY W/STONES		9 9	1.30	B
GRAY GRITTY SILTY CLAY	-40	7 8	1.50	B
GRAY GRITTY SILTY CLAY		5 7	.98	B
END OF BORING	-45			

Surface Water El. ______
Groundwater El. at Completion 5'
After ___ Hours ______

FOR REFERENCE ONLY

N—Standard Penetration Test—Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu—Unconfined Compressive Strength—t/sf

w—Water Content—percentage of oven dry weight—%.

Type failure:
B—Bulge Failure
S—Shear Failure
E—Estimated Value

DESIGNED
CHECKED
DRAWN
CHECKED

JULY 15 1964
EXAMINED W.C. Baumann
ENGINEER OF BRIDGE AND TRAFFIC STRUCTURES
PASSED
ENGINEER OF DESIGN
APPROVED
CHIEF HIGHWAY ENGINEER

BORINGS
S.B.I. RT. 53 SEC. 531-3HB-2
COOK COUNTY
STA. 400+73.07

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1170 SOUTH HOUBOLT ROAD JOLIET, ILLINOIS 60431		CHECKED -	REVISED -							
(815) 744-4200	PLOT SCALE =	DRAWN -	REVISED -			CONTRACT NO.				
IDFPR NO. 184-001273	PLOT DATE =	CHECKED -	REVISED -		SHEET 3 OF 3 SHEETS		ILLINOIS	FED. AID PROJECT		

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