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INNOVATIVE IDEAS
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March 3, 2025

Mr. James G. Silliman III, P.E.
County Engineer
Oldham County Fiscal Court
100 West Jefferson Street
La Grange, Kentucky 40031

RE: Addendum
Subsurface Investigation (Roadway & Bridge) for
Underpass of CSX Railroad Connecting Commerce Pairkway and KY 146
Oldham County, Kentucky
Item #5-434.00
DLZ Project No. 0631-0006.02

Mr. Silliman:

The above-referenced project consists of lowering the existing Allen Lane at the CSX railroad crossing, and relocating the existing Allen Lane to provide a grade separation at the Allen Lane/CSX railroad intersection. A new CSX bridge will also be constructed over the lowered Allen Lane, and a temporary railroad diversion track (railroad runaround) will be installed north of the existing track to maintain railroad traffic during the Allen Lane/CSX railroad construction. The findings of the subsurface exploration performed in 2014 and associated recommendations were presented in the Report of Subsurface Investigation (Roadway) for Underpass of CSX Railroad Connecting Commerce Parkway and KY 146, Oldham County, Kentucky, dated September 4, 2015 and the Report of Subsurface Investigation (Bridge) for Underpass of CSX Railroad Connecting Commerce Parkway and KY 146, Oldham County, Kentucky, dated September 4, 2015. To finalize the design of the project, an additional geotechnical exploration was performed in 2024 at the proposed CSX railroad runaround to evaluate the stability of the proposed railroad embankment as well as to address the review comments on both September 2015 reports. This letter report includes the findings of the additional geotechnical exploration along with associated engineering analyses recommended in the review comments. The geotechnical exploration has been performed essentially in accordance with DLZ's proposal dated May 23, 2024. A summary of the general scope of work as indicated in the proposal is as follows:

- Perform a total of ten borings, B-03 through B-12, along the proposed runaround alignment.
- Perform dynamic cone penetration tests at boring locations B-01, B-02, B-13, and B-14.
- Perform a boring B-32C with rock coring at Station 1528+55 of the proposed railroad bridge (near Pier 1) to an elevation of approximately 805 to confirm the bedrock type and quality for the drilled shaft support of the proposed railroad bridge.
- Install an observation well at each of boring B-5 and B-12 locations.

- Perform slope stability, settlement, and bearing capacity analyses for railroad runaround Stations 1518+00, 1528+00, and 1538+00.
- Perform a stability analysis at CSXT Mainline Station 1526+00 where the existing railroad embankment is widening and will have a proposed embankment height of 28 feet. The subsurface conditions at a previous boring B-22 drilled in 2014 is used for the analysis.

FIELD EXPLORATION

DLZ prepared the scope of field exploration based on the proposed work of the additional exploration. The field exploration plan was reviewed and subsequently approved by the Kentucky Transportation Cabinet (KYTC) Geotechnical Branch.

The field exploration originally consisted of drilling elevation borings (B-03 through B-12 and B-32C), performing five dynamic cone penetration (DCP) tests at borings B-01, B-02, B-04, B-13, and B-14), and installing two observation wells at borings B-5 and B-12. Originally, DCP tests were planned at four boring locations (B-01, B-02, B-13, and B-14). Because of the site constraints, boring B-04 could not be drilled at the originally planned location at the toe of the existing railroad embankment. A DCP test was performed instead at the originally planned location of B-04 and boring B-04 was drilled offset approximately 35 feet north of its original location. During the field exploration, some of the borings were also drilled offset from the originally planned boring locations to accommodate the site conditions. The field exploration were performed between November 11 and 15, 2024. The borings were drilled using an all-terrain-vehicle (ATV) mounted rotary-type drill rig, which had hammer calibrated on June 13, 2023 (hammer efficiency of 74.7 percent). A drawing showing the as-drilled boring locations with respect to the existing features is presented in Appendix I. The stations and offsets and latitude and longitudes of the as-drilled boring locations are on the boring logs in Appendix I. The as-drilled locations and elevations of the borings were determined in the field by representatives of DLZ, except that the boring stake for B-11 could not be located at the time of survey, and the ground surface elevation at boring B-11 was estimated based on Google Earth imagery.

Standard Penetration Tests were performed generally in 1.5-foot increments at intervals not exceeding 5 feet through the overburden to the top of bedrock. A Shelby tube sample was collected from each of borings B-03, B-05, and B-7. Five feet of rock cores were obtained from borings B-05, B-8, and B-12 and 32 feet of rock cores from boring B-32C. NQ size diamond coring tools were used with water as the circulating fluid. All drilling and sampling were performed in general accordance with the current KYTC Geotechnical Manual, Section GT-300. Information concerning the general drilling procedures is presented in Appendix I.

The present field investigation was undertaken to develop engineering information to meet the purposes as described above. The intent of these services was not to uncover or identify any contaminated subsurface material that may contain hazardous or flammable substances. Identification of such substances requires specialized exploration techniques and analyses that were not employed in this investigation.

A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as an interpolation of the subsurface conditions between samples. Final logs, included in Appendix I, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thicknesses, and the locations where samples were obtained. Ground surface elevations at the borings are presented on the final logs.

GENERALIZED SURFACE CONDITIONS

The following sections present the generalized subsurface conditions encountered by borings B-03 through B-12 drilling along the proposed railroad runaround location. For more detailed information, please refer to the boring logs presented in the Appendix I. Please note that the strata contact lines shown on the boring logs represent approximate boundaries between soil and rock layers. In the field, the actual transitions between soil and bedrock layers might be different both vertically and laterally.

Generally, the subsurface conditions encountered in the borings drilled in this additional field exploration are similar to those encountered in the borings previously drilled for the project.

Surface Material

The surface materials encountered in borings B-03 through B-11 generally consisted of 3 to 9 inches of topsoil. No topsoil was reported in boring B-12.

Fill

Fill soils consisting of silty sand and low plasticity lean clay with cinders/slag were encountered at depths of between 0.5 and 13.5 feet in boring B-03.

Lean Clays and Fat Clays

Beneath the ground surface, fill soils or topsoil, the overburden soils consisted mostly of low to high plasticity clays with isolated layers of silty sands. The top of bedrock was encountered at depths varying from 0.3 to 18.5 feet below the existing ground surface. The upper portion of the clay soils occasionally contained trace organics. Fat clays (AASHTO A-7-6) were encountered in five (B-03, B-05, B-07, B-08, and B-09) of the ten borings drilled. Hand penetrometer strength test values in the clay soils generally varied from 1.0 to 4.5+ tons per square foot (tsf), indicating medium stiff to hard consistency.

Auger Refusal

Auger refusal, indicative of top of bedded material, was encountered in all of the borings at depths ranging from 0.0 (ground surface) to 18.5 feet below the existing ground surface (i.e., elevations ranging from 868.7 to

831.8 feet). While the depths to the auger refusal conditions varied across the site, the top of rock elevations generally increased from the west to the east along the railway runaround alignment.

Bedrock

Rock coring was performed in borings B-05, B-08, B-10, and B-12. The rock core samples generally consisted of a Rock Disintegration Zone (RDZ) and very fine to fine grained, brown and gray dolomite. Rock recovery ranged between 90 and 96 percent and the Rock Quality Designation (RQD) values were mostly greater than 50 percent, ranging between 54 and 78 percent, which corresponds to a Rock Quality Description of fair to good according to Table 39 of FHWA-IF-02-034 *Geotechnical Engineering Circular No. 5 Evaluation of Soil and Rock Properties*. The RQD value of the rock core obtained from boring B-08 was 14, which corresponds to a Rock Quality Description of very poor according to Table 39 of FHWA-IF-02-034.

Observation Wells and Groundwater Levels

During the field exploration, immediate groundwater levels were reported in some of the borings. Observation wells were installed in borings B-05 and B-12. The following table, Table 1, presents the elevations where groundwater was encountered during drilling (immediate water level) and where the groundwater level was encountered after the completion of drilling. Boring locations without reported groundwater levels are not included in the table below except for B-12 where an observation well was installed at the boring location.

Table 1 – Groundwater Observations Summary

Boring Location	Depth (Elevation) to Immediate Water Level, ft[1]	Static Water Depth (Elevation), ft	In Observation Well, Depth/ Elevation, ft (Date Measured)[3]	Depth (Elevation) to Bedrock, ft
B-03 (850.5)	3.5 (847.0)	NR[1]	N/A[2]	18.5 (832.0)
B-05 (848.8)	NR[1]	NR[1]	14.0/834.8 (01-22-2025)	17.0 (831.8)
B-07 (851.4)	13.5 (837.9)	NR[1]	N/A[4]	18.5 (832.9)
B-08 (856.4)	13.5 (842.9)	NR[1]	N/A[4]	13.5 (842.9)
B-09 (860.8)	13.7 (847.1)	NR[1]	N/A[4]	13.5 (847.3)
B-10 (864.7)	8.0 (856.7)	NR[1]	N/A[4]	8.5 (856.2)
B-12 (868.5)	NR[2]	NR[1]	NR[1]	0.0 (868.5)

[1]NR: Measured, but none reported.
[2]N/A: No observation well was installed.
[3]Measured from the ground surface.

It should be noted that groundwater levels may fluctuate with seasonal variations and following periods of heavy or prolonged precipitation and, therefore, the readings indicated on the boring logs may not be representative of the long-term groundwater level. Long-term monitoring would be needed to obtain a more accurate estimate of the groundwater table elevation. Consequently, during construction or at other times during the project life, water levels may be higher or lower than observed at the time of this investigation.

LABORATORY TESTING AND RESULTS

Laboratory tests were performed in accordance with applicable AASHTO or Kentucky Methods of soil and rock testing specifications (KM) as specified in the KYTC Geotechnical Guidance Manual, dated June 2005. Where both AASHTO and KM standards are designated in the guidance manual, the KM procedure was used. The results of the laboratory tests are shown on a laboratory test summary tables in Appendix II and on the appropriate soil profile sheets in Appendix IV.

The laboratory testing program consisted of visual classifications of all collected soil and decomposed rock samples, and soil classification tests on selected Standard Penetration Test samples. The types of soils resulting from laboratory classification testing were primarily either lean clay (CL or A-6, A-7-6) or fat clay (CH or A-7-6), which is in general agreement with the results of visual classification of all collected soil. The in-place moisture contents of tested samples varied approximately from 3 to 59 percent with an average of approximately 21 percent.

RESULTS OF DYNAMIC CONE PENETRATION TESTS

Dynamic cone penetration (DCP) tests were performed between the existing railroad tracks at boring locations B-01, B-02, B-13, and B-14 to determine the materials of the existing embankment. High blows per 6 inches of penetration (ranging from 15 to over 50 blows) and refusal were generally encountered at depths of less than four feet below the top of the existing railroad embankment, indicating hard or very dense materials immediately below the embankment crest. Based on the conversations between field personnel from DLZ and CSX, the upper 6 feet of the existing railroad embankment generally consisted of granular material (stone), which is consistent with the results of the DCP tests at the boring locations B-01, B-02, B-13, and B-14.

ENGINEERING ANALYSES

For this additional geotechnical exploration, the following engineering analyses were performed:

- Slope stability, settlement, and bearing capacity analyses for railroad runaround Stations 1518+00, 1528+00, and 1538+00.
- Stability analysis at CSXT Mainline Station 1526+00 where the existing railroad embankment is widening and will have a proposed embankment height of 28 feet. The subsurface conditions at a previous boring B-22 is used for the analysis.

The cross-sections of each station analyzed along with the results of the analyses are included in the Appendix III.

Soil and Rock Parameter Selections

The subsurface profile for the analyses used the stratigraphy disclosed by the borings and material properties were estimated from normalized Standard Penetration Test blow counts (N_{60}-values), visual classification, index properties, unconfined compressive strengths, and engineering judgment. The federal government's Naval Facilities Design Manual (NAVFAC DM-7.2) and the FHWA's Soils and Foundations Workshop Manual were used as guide in estimating the soil and rock parameters used for the analyses. Additional published engineering literatures were also used, wherever applicable, to provide additional references for the soil and rock parameters. Generally, the subsurface conditions encountered in the borings drilled in this additional field exploration are similar to those encountered in the borings previously drilled for the project. Consequently, the soil and rock parameters used in the above-mentioned 2015 report were used for the present engineering

analyses. The soil and rock properties used for the stability analyses are included with the analysis output appended to this letter report.

The soil and rock profiles used for the engineering analyses are the subsurface conditions encountered in the boring(s) near the section/station analyzed; hence, boring B-03 for Station 1518+00, boring B-07 for Station 1528+00, boring B-12 for Station 1538+00, and previous boring B-22 drilled in 2014 for Station 1526+00. In the analyses, the groundwater level was assumed to be 2 feet above the soil-rock interface where groundwater was not encountered in the boring used for the analysis. A vertical live load surcharge of 1,880 psf (distributed over a standard length of a railroad tie, 8'-6") was used based on the recommendation indicated in the appendix of the "*CSXT Public Project Information*", last revised on August 10, 2012. This vertical railroad surcharge was applied in the stability analysis for both short-term (undrained) and long-term (drained) conditions.

Given the results of the DCP tests and the conversations between field personnel from DLZ and CSX, the upper 6 feet of the existing railroad embankment was assumed to be granular material. Beneath the granular embankment fill, cohesive embankment fill was assumed in the stability analyses. As recommended by American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapter 1, Part 1.3.7.5.6, granular new fill was also assumed to be used in the upper 6 feet of the new embankment area to minimize slope stability concerns associated with drainage issue immediately beneath the railroad tracks. In the analyses, a friction angle of 34^{o} was used for the granular embankment fill in reference to Tables 8-20-0 and 8-20-3 of the AREMA manual (medium clean sand) and Table 10.4.6.2.4-1 of the AASHTO 9th Edition.

Slope Stability Analyses

The global stability analyses were performed for the above-mentioned stations, considering the short term, long-term as well as near term conditions, where applicable. The short term analyses considered undrained shear strength parameters; whereas long-term analyses considered drained shear strength parameters. The global slope stability analyses were performed utilizing limit equilibrium methodology (Spencer method of slices) with the computer program SLIDE 2D v9, by Rocscience, assuming potential circular failure surfaces. Furthermore, it was assumed that potential failure surfaces did not extend below the bottom of the rock disintegration zone, if applicable, or top of bedrock. The following table, Tables 2, summarizes the results of the stability analyses.

Table 2 - Summary of Summary of Embankment Stability Analyses (Railroad Runaround)

Station	F.S/Target F.S. Short-term (Undrained)	F.S./Target F.S. Intermediate-term	Long-term (Drained)
1518+00	1.4 (new granular fill)/ 1.1-1.3	1.9 (existing granular fill)/ ***	1.3 (new granular fill)/1.4-1.6 1.4 (new granular fill with 5' undercut)/1.4-1.6
1526+00	1.8 (new granular fill)/ 1.1-1.3	1.8 (existing granular fill)/ ***	1.3 (new granular fill)/1.4-1.6 1.5 (new granular fill with NO RR surcharge)/1.4-1.6
1528+00	2.3 (new granular fill)/ 1.1-1.3 2.6 (new cohesive fill)/ 1.1-1.3	--[1]	1.5 (new granular fill)/1.4-1.6 1.5 (new cohesive fill)1.4-1.6
1538+00	2.1 (new cohesive fill)/ 1.1-1.3 2.1 (new granular fill)/ 1.1-1.3	--[1]	1.8 (new cohesive fill)/ 1.4-1.6 1.8 (new granular fill)/ 1.4-1.6

[1]Not needed.

Settlement Analyses

Based on the anticipated amounts of new embankment fill shown in the cross-section of each station analyzed, the settlement analyses were performed in general accordance with the FHWA's Soils and Foundation Workshop Manual (NHI-00-045, July 2000). The following table, Tables 3, summarizes the results of the settlement analyses.

Table 3 - Summary of Results of Settlement Analyses

Station	Settlement, inch
1518+00	0.9 (no undercut) 0.1 (5' undercut)[1]
1528+00	1.3 (no undercut) 1.0 (5' undercut)[1]
1538+00	--[2]

[1]Five feet of undercut is necessary to meet the required target factor of safety for stability (see Table 2 above).

[2]New embankment height is less than 5 feet and the embankment is founded on RDZ.

Bearing Capacity of the Runaround Railroad Embankment

FHWA guidelines suggest that if the pressure exerted by the weight of the embankment exceeds three times the undrained shear strength of the foundation soils, the potential for lateral squeeze exists. Based on the cross-section of the proposed embankment fill at Station 1528+00, the new embankment will be approximately 8.6 feet high with side slopes of 2H:1V. Boring B-07 is located near the new embankment and encountered very stiff to hard fat clay in the upper portion of the foundations soils. In the analysis, an undrained shear strength of 1,000 psf was used for the existing very stiff to hard clay and a unit weight of 130 pcf for the new embankment fill. Using the FHWA guidelines, the pressure increases applied by the new fill are less than three times the undrained shear strength of the foundation soils, indicative of unlikeliness of lateral squeeze.

Evaluations of bearing capacity for the railroad track foundations were performed in general accordance with AASHTO LRFD Bridge Design Specifications 9th Edition, Section 10.6.3.1.2c "Considerations for Footings on Slopes". The following table, Table 4, summarizes the results of the bearing capacity evaluations.

Table 4 - Summary of Results of Bearing Capacity Evaluations

Station	Estimated Factored Bearing Resistance, psf	Railrod Surchage, psf
1518+00	11,790 (new granular fill)	3,760 (two tracks)
1528+00	3,550 (new cohesive fill) 5,700 (new granular fill)	1,880
1538+00	3,780 (new cohesive fill) 7,640 (new granular fill)	1,880

ADDITIONAL BORING AT THE PROPOSED BRIDGE LOCATION

Boring B-32C was drilled approximately at Station 1528+55 of the proposed railroad bridge (near Pier 1). The boring encountered dolomite rock fragments at a depth of approximately 18.5 feet (elevation 838.4). Rock coring began at the depth of 20 feet (elevation 836.9) and was terminated at the depth of of 52 feet (elevation 804.9). The rock cores consisted primarily of dolomite. Shale (claystone) was embedded with the dolomite at depths of between 47 feet (elevation 809.9) and 49.3 (elevation 49.3). A log of the boring is included with this report in Appendix I.

CLOSING

This addendum should be attached to DLZ' September 4, 2015 subsurface investigation reports for the project and made a part thereof.

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning this report.

Respectfully submitted,

DLZ

Eric W. Tse, P.E.
Senior Geotechnical Engineer

Samuel Bollinger, E.I.
Geotechnical Engineer

Timothy A. Hampshire, P.E.
Vice President/Geotechnical Engineering

Attachments: As noted.

Appendix I

General Information
Boring Plan
Boring Logs
DCP Logs
Well Installation Forms

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

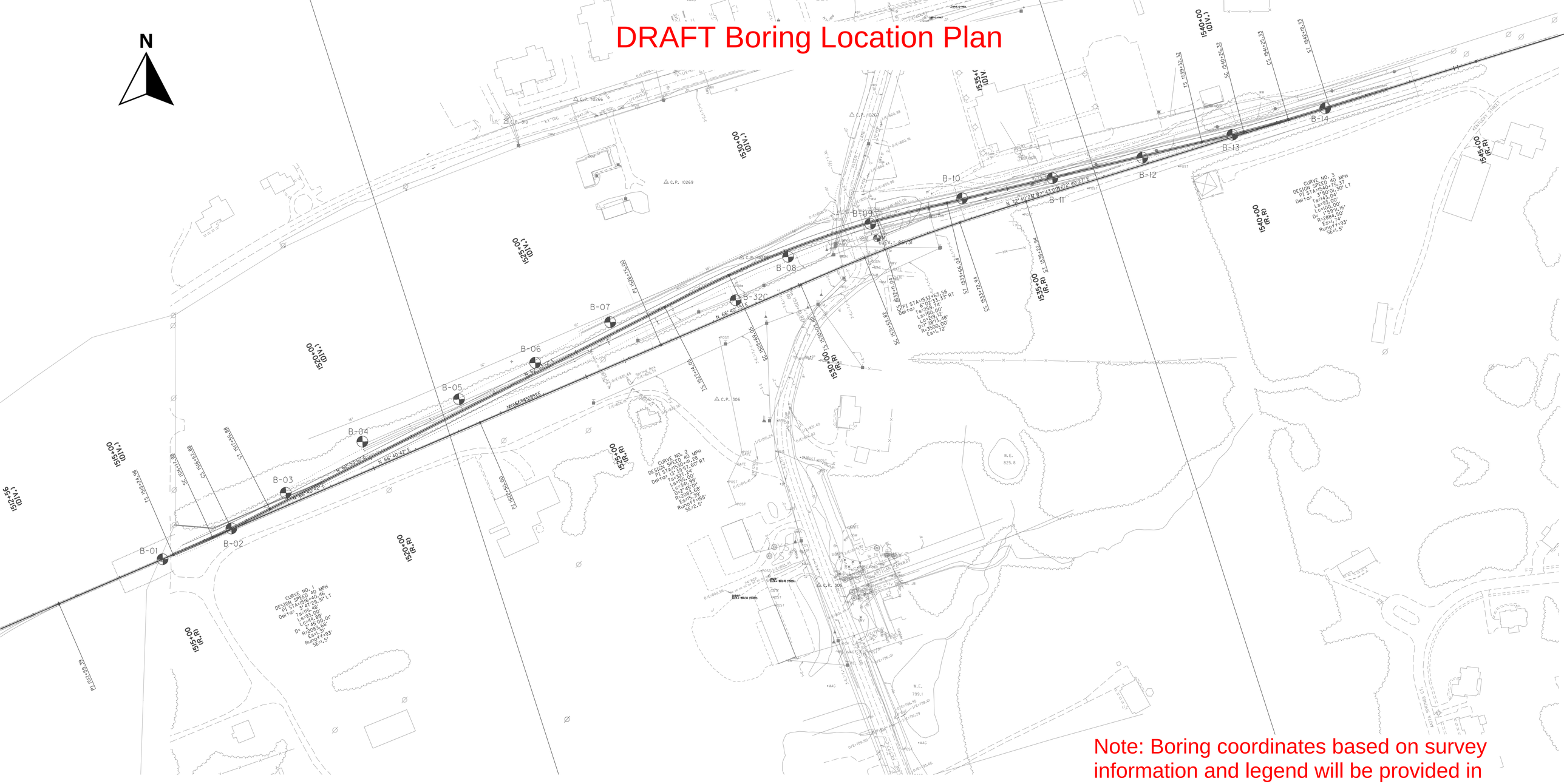
In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period of six months. After this period of time, they will be discarded, unless notified to the contrary by the client.

DRAFT Boring Location Plan



Note: Boring coordinates based on survey information and legend will be provided in the final report.

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-03***	Immediate Water Depth ***3.5 (11/15/25)***	Start Date ***11/15/2024***	Hole Type ***sample***
Surface Elevation ***850.5'***	Static Water Depth ***NA***	End Date ***11/15/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***18.7'***	Driller ***Keith Conrad***	Latitude(83) ***38.399870***	
Location ***1518+02.60 15.8' Lt.***		Longitude(83) ***-85.401240***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No.	Depth (ft) Run (ft)	Rec. (ft) Rec (ft)	SPT Blows Rec (%)	Sample Type SDI (JS)	Remarks
			Std/Ky RQD					
850.0	0.5	Topsoil (6").						**Offset 15' South @ 0**
		Very loose, black, wet, silty sand with cinders or slag (FILL, A-4/SM).	S-1	3.5-5.0	0.6	1-0-1	SPT	
844.5	6.0							
			ST-1	6.0-8.0	1.6		ST	
		Very stiff, reddish brown and black, moist, lean clay with cinders (FILL, A-6/CL).	S-2	8.5-10.0	1.5	5-5-6	SPT	**HP = 2.75 tsf @ 8.5-10**
837.0	13.5							
			S-3	13.5-15.0	1.5	5-5-6	SPT	**HP = 2.0 tsf @ 13.5-15**
		Stiff to very stiff, reddish brown, moist, fat clay (A-7-6/CH).						
832.0	18.5							
831.8	18.7	Very dense, brown, rock fragments (Decomposed dolomite).	S-4	18.5-18.7	0.2	50/0.20'	SPT	
		(Bottom of Hole 18.7') (Refusal @ 18.5)						

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-04***	Immediate Water Depth ***NA***	Start Date ***11/14/2024***	Hole Type ***sample***
Surface Elevation ***848.8'***	Static Water Depth ***NA***	End Date ***11/14/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***13.6'***	Driller ***Keith Conrad***	Latitude(83) ***38.400180***	
Location ***1520+00.20 38.9' Lt.***		Longitude(83) ***-85.400670***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. (Std/Ky RQD)	Depth (ft) (Run (ft))	Rec. (ft) (Rec (ft))	SPT Blows (Rec (%))	Sample Type (SDI (JS))	Remarks
848.2	0.6	Topsoil (7").						**Offset 35' North @ 0**
			S-1	3.5-5.0	0.3	3-6-9	SPT	**HP = 4.5+ tsf @ 3.5**
		Hard, brown, damp, lean clay (A-6/CL).						
			S-2	8.5-10.0	1.3	4-8-9	SPT	**HP = 4.5+ tsf @ 8.5**
835.3	13.5							
835.2	13.6	Very dense, light gray, rock fragments (Decomposed dolomite).	S-3	13.5-13.6	0.1	50/0.10'	SPT	
		(Bottom of Hole 13.6') (Refusal @ 13.5)						

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

GEOLOGIST'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-05***	Immediate Water Depth ***NA***	Start Date ***11/14/2024***	Hole Type ***core and sample***
Surface Elevation ***848.8'***	Static Water Depth ***14.0 (01/22/25)***	End Date ***11/14/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***22.0'***	Driller ***Keith Conrad***	Latitude(83) ***38.400440***	***GQ-1075 Laurel***
Location ***1522+27.90 25.4' Lt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.399950***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. (Std/Ky RQD)	Depth (ft) Run (ft)	Rec. (ft) Rec (ft)	SPT Blows Rec (%)	Sample Type SDI (JS)	Remarks
848.1	0.7	**Overburden**: *Topsoil - 8".*						**Offset 29' North @ 0**
		Overburden: *Hard reddish brown LEAN CLAY (A-6/CL), contains trace organics, damp.*	S-1	3.5-5.0	1.5	6-9-10	SPT	**HP = 4.5+ tsf @ 3.5-5**
			ST-1	6.0-8.0	1.5		ST	
840.3	8.5	**Overburden**: *Hard reddish brown FAT CLAY (A-7-6/CH), moist.*	S-2	8.5-10.0	1.5	5-8-10	SPT	**HP = 4.5+ tsf @ 8.5-10**
835.3	13.5	**Overburden**: *Light brown medium dense silty SAND (A-2-4/SM) with gravel and dolomite fragments, damp, [@17', auger refusal.* (Begin Core)	S-3	13.5-15.0	1.0	5-2-15	SPT	
831.8	17.0	**Dolomite**: *Gray and brown, moderately strong, fine grained, highly weathered, fossilferous, vuggy and pitted, thinly bedded, highly fractured to broken.*	54 / 54	5.0	4.6	92		**Occasional low angle fractures with dissolution on surfaces @ 17.4-21.9 Zone of core loss (suspected void) @ 18.5-19.2**
828.8	20.0	**Dolomite**: *Bluish gray, strong, fine grained, slightly weathered, pitted, pyritic, medium bedded, moderately fractured.*						
826.8	22.0	(Bottom of Hole 22.0')						22.0

Top of Rock = 17.0' Elevation = 831.8'
Base Weathered Rock = 20.0 Elevation = 828.8'
RDZ = 20.0' Elevation = 828.8'
Laurel Dolomite
Laurel Dolomite

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-06***	Immediate Water Depth ***NA***	Start Date ***11/12/2024***	Hole Type ***sample***
Surface Elevation ***849.1'***	Static Water Depth ***NA***	End Date ***11/12/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***13.7'***	Driller ***Keith Conrad***	Latitude(83) ***38.400670***	
Location ***1524+10.30 20.7' Lt.***		Longitude(83) ***-85.399380***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. (Std/Ky)	Depth (ft) (Run)	Rec. (ft) (Rec)	SPT Blows (Rec %)	Sample Type (SDI JS)	Remarks
848.5	0.6	Topsoil (7").						**Offset 20' Northwest @ 0**
			S-1	3.5-5.0	1.3	4-8-8	SPT	**HP = 4.5+ tsf @ 3.5-5**
		Hard, brown, damp to moist, lean clay with trace organics (A-6/CL).						
			S-2	8.5-10.0	1.5	3-5-6	SPT	**HP = 4.5+ tsf @ 8.5-10**
835.6	13.5							
835.4	13.7	Very dense, light brown, rock fragments (dolomite fragments).	S-3	13.5-13.7	0.2	50/0.20'	SPT	
		(Bottom of Hole 13.7') (Refusal @ 13.5)						

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-07***	Immediate Water Depth ***13.5 (11/12/24)***	Start Date ***11/12/2024***	Hole Type ***sample***
Surface Elevation ***851.4'***	Static Water Depth ***NA***	End Date ***11/12/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***22.6'***	Driller ***Keith Conrad***	Latitude(83) ***38.400910***	
Location ***1525+94.50 24.8' Lt.***		Longitude(83) ***-85.398820***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No.	Depth (ft) Run (ft)	Rec. (ft) Rec (ft)	SPT Blows Rec (%)	Sample Type SDI (JS)	Remarks
850.6	0.8	Topsoil (9").						**Offset 15' Northwest @ 0**
			S-1	3.5-5.0	1.5	3-7-8	SPT	**HP = 4.5+ tsf @ 3.5-5**
		Very stiff to hard, reddish brown, damp to moist, fat clay with gravel (A-7-6/CH).	ST-1	6.0-8.0	2.0		ST	
			S-2	8.5-10.0	1.5	4-5-5	SPT	**HP = 3.5 tsf @ 8.5-10**
837.9	13.5							
		Loose, brown, wet, silty sand (A-2-4/SM).	S-3	13.5-15.0	0.5	6-3-6	SPT	
832.9	18.5							
		Very dense, brown and light gray, rock fragments (dolomite fragments).	S-4	18.5-20.0	1.5	20-34-39	SPT	
828.8	22.6							
			S-5	22.5-22.6	0.1	50/0.10'	SPT	
		(Bottom of Hole 22.6') (Refusal @ 18.5)						

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

GEOLOGIST'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-08***	Immediate Water Depth ***13.5 (11/12/24)***	Start Date ***11/12/2024***	Hole Type ***core and sample***
Surface Elevation ***856.4'***	Static Water Depth ***NA***	End Date ***11/12/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***20.0'***	Driller ***Keith Conrad***	Latitude(83) ***38.401310***	***GQ-1075 Laurel***
Location ***1530+02.60 13.4' Rt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.397480***	

Lithology Elevation	Lithology Depth	Description	Sample No.	Depth (ft)	Rec. (ft)	SPT Blows	Sample Type	Remarks
		Overburden						
855.8	0.6	**Overburden**: *Topsoil - 7".*						
		Overburden: *Stiff to very stiff reddish brown sandy LEAN CLAY (A-7-6/CL), contains trace organics, moist.*	S-1	3.5-5.0	1.5	4-4-6	SPT	**HP = 2.0 tsf @ 3.5-5**
847.9	8.5							
		Overburden: *Stiff reddish brown FAT CLAY (A-7-6/CH), moist.*	S-2	8.5-10.0	1.5	3-4-5	SPT	**HP = 1.5 tsf @ 8.5-10**
842.9	13.5							**Auger Chatter @ 12-13.5**
841.4	15.0	**Overburden**: *Light gray rock (dolomite) fragments [@13.5', auger refusal].* (Begin Core)	S-3	13.5-13.6	0.1	50/0.10'	SPT	
		Rock Core	Std/Ky RQD	Run (ft)	Rec (ft)	Rec (%)	SDI (JS)	
		Dolomite: *Brown and gray, moderately strong, fine to medium grained, moderately to highly weathered, fossilferous, vuggy, thinly bedded, highly fractured to broken, contain zones of dissolution and openings.*	14 / 14	5.0	4.8	96		**Zone of suspected loss @ 15-15.5 Vertical fracture @ 16.4-16.9 Occasional high angle fractures @ 18.6-19.8**
836.4	20.0							20.0
		(Bottom of Hole 20.0')						

Top of Rock = 13.5' Elevation = 842.9'
Base Weathered Rock = 16.0 Elevation = 840.4'
RDZ = 16.0' Elevation = 840.4'
Laurel Dolomite
Laurel Dolomite

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-09***	Immediate Water Depth ***13.7 (11/11/24)***	Start Date ***11/11/2024***	Hole Type ***sample***
Surface Elevation ***860.8'***	Static Water Depth ***NA***	End Date ***11/11/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***14.2'***	Driller ***Keith Conrad***	Latitude(83) ***38.401510***	
Location ***1531+94.40 2.8' Rt.***		Longitude(83) ***-85.396870***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. / Std/Ky RQD	Depth (ft) / Run (ft)	Rec. (ft) / Rec (ft)	SPT Blows / Rec (%)	Sample Type / SDI (JS)	Remarks
860.5	0.3	Topsoil (3").						
		Medium stiff to stiff, dark brown to reddish brown, moist, lean clay with sand (A-6/CL).	S-1	3.5-5.0	0.4	2-4-4	SPT	**HP = 1.0 tsf @ 3.5-5**
852.3	8.5							
		Stiff, dark brown to reddish brown, moist, fat clay (A-7-6/CH).	S-2	8.5-10.0	1.5	2-3-5	SPT	**HP = 1.5 tsf @ 8.5-10**
847.3	13.5							
846.6	14.2	Very dense, light brown, rock fragments (Decomposed dolomite).	S-3	13.5-14.2	0.7	30-50/0.20'	SPT	
		(Bottom of Hole 14.2') (Refusal @ 13.5)						

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

GEOLOGIST'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-10***	Immediate Water Depth ***8.0 (11/11/24)***	Start Date ***11/11/2024***	Hole Type ***core and sample***
Surface Elevation ***864.7'***	Static Water Depth ***NA***	End Date ***11/11/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***18.5'***	Driller ***Keith Conrad***	Latitude(83) ***38.401670***	***GQ-1075***
Location ***1534+00.30 2.3' Lt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.396180***	***Laurel***

Lithology Elevation	Lithology Depth	Description	Sample No.	Depth (ft)	Rec. (ft)	SPT Blows	Sample Type	Remarks
			Std/Ky RQD	Run (ft)	Rec (ft)	Rec (%)	SDI (JS)	
863.9	0.8	**Overburden**: *Topsoil - 9".*						
		Overburden: *Stiff to very stiff reddish brown LEAN CLAY (A-6/CL), moist.*	S-1	3.5-5.0	0.7	2-2-4	SPT	**Chatter @ 1.5-9.3** **HP = 2.0 tsf @ 3.5-5**
856.2	8.5							
854.7	10.0	**Overburden**: *Light gray rock (dolomite) fragments [@8.5', auger refusal].* (Begin Core)	S-2	8.5-9.3	0.8	45-50/0.30'	SPT	
		Dolomite: *Brown, strong, very fine grained, moderately weathered, slightly vuggy, thinly bedded, highly fractured.*	23 / 23	3.5	1.2	34		**No recovery (void), suspected calcite deposits in void opening @ 10.1-12.9**
851.2	13.5							13.5
		Dolomite: *Gray, strong, fine to very fine grained, moderately weathered, very vuggy and pitted, thinly bedded, highly fractured, contains karstic openings and calcite deposits, dissolutioned beds.*	62 / 62	5.0	4.5	90		**Occasional disintegrated bedding @ 14.5-15.9** **vertical fracture @ 17.5-18.5**
846.2	18.5							18.5
		(Bottom of Hole 18.5')						

Top of Rock = 8.5'	Base Weathered Rock = 12.9	RDZ = 12.9'	
Elevation = 856.2'	Elevation = 851.8'	Elevation = 851.8'	Laurel Dolomite
			Laurel Dolomite

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-11***	Immediate Water Depth ***NA***	Start Date ***11/14/2024***	Hole Type ***sample***
Surface Elevation ***869.0'***	Static Water Depth ***NA***	End Date ***11/14/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***3.6'***	Driller ***Keith Conrad***	Latitude(83) ***38.401802***	
Location ***1536+00.00 CL***		Longitude(83) ***-85.395498***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. (Std/Ky RQD)	Depth (ft) (Run (ft))	Rec. (ft) (Rec (ft))	SPT Blows (Rec (%))	Sample Type (SDI (JS))	Remarks
868.7	0.3	Topsoil (4").						**Auger Chatter @ 0.3-3.6**
		Very dense, light gray, rock fragments (dolomite fragments).						
865.4	3.6		S-1	3.5-3.6	0.1	50/0.10'	SPT	
		(Bottom of Hole 3.6') (Refusal @ 0.3)						

5 10 15 20 25 30 35 40 45 50

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

GEOLOGIST'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-12***	Immediate Water Depth ***NA***	Start Date ***11/14/2024***	Hole Type ***core and sample***
Surface Elevation ***868.5'***	Static Water Depth ***NA***	End Date ***11/14/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***9.0'***	Driller ***Keith Conrad***	Latitude(83) ***38.401930***	***GQ-1075*** ***Laurel***
Location ***1537+99.30 2.9' Rt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.394820***	

Lithology Elevation	Lithology Depth	Description	Sample No.	Depth (ft)	Rec. (ft)	SPT Blows	Sample Type	Remarks
		Overburden						
		Rock Core	Std/Ky RQD	Run (ft)	Rec (ft)	Rec (%)	SDI (JS)	
864.5	4.0	**Overburden**: *Light gray and black rock (dolomite) fragments, [@0', auger refusal].* (Begin Core)	S-1	3.5-3.8	0.3	50/0.30'	SPT	**Chatter @ 1-3.5**
859.5	9.0	**Dolomite**: *Light gray, strong, fine grained, slightly to moderately weathered, iron staining, contains few vugs, very pitted, medium bedded, moderately to highly fractured.*	78 / 78	5.0	4.8	96		**Occasional low angle fractures with weathering @ 5-8.5**
		(Bottom of Hole 9.0')						

Top of Rock	Base Weathered Rock	RDZ	
0.0'	4.6'	4.6'	Laurel Dolomite
Elevation = 868.5'	Elevation = 863.9'	Elevation = 863.9'	Laurel Dolomite

Drilling Firm: DLZ Ohio
For: Division of Structural Design
Geotechnical Branch

GEOLOGIST'S SUBSURFACE LOG

Printed: 3/2/25

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-32C***	Immediate Water Depth ***NA***	Start Date ***11/13/2024***	Hole Type ***core and sample***
Surface Elevation ***856.9'***	Static Water Depth ***NA***	End Date ***11/13/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***52.0'***	Driller ***Keith Conrad***	Latitude(83) ***38.401050***	***GQ-1075***
Location ***1528+59.10 55.0' Rt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.397870***	***Laurel***

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. / Std/Ky RQD	Depth (ft) / Run (ft)	Rec. (ft) / Rec (ft)	SPT Blows / Rec (%)	Sample Type / SDI (JS)	Remarks
856.4	0.5	**Overburden**: *Topsoil - 6".*						
		Overburden: *Stiff to very stiff reddish brown LEAN CLAY (A-6/CL), trace organics, damp to moist.*	S-1	3.5-5.0	1.5	2-3-6	SPT	**HP = 2.0 tsf @ 3.5-5**
848.4	8.5	**Overburden**: *Very stiff reddish brown FAT CLAY (A-7-6/CH), moist.*	S-2	8.5-10.0	1.5	3-8-10	SPT	**HP = 3.5 tsf @ 8.5-10**
843.4	13.5	**Overburden**: *Stiff reddish brown ELASTIC SILT (A-7-5/MH), moist.*	S-3	13.5-15.0	1.5	1-2-3	SPT	**HP = 1.5 tsf @ 13.5-15**
838.4	18.5	**Overburden**: *Light gray (dolomite), rock fragments [@20', auger refusal].* (Begin Core)	S-4	18.5-18.7	0.2	50/0.20'	SPT	
836.9	20.0	**Limestone**: *Light brown, strong, fine to coarse grained, highly weathered, fossilferous, thin bedded, highly fractured to broken.*	30 / 30	4.0	3.4	85		**Zone of suspected loss @ 20-20.9**
833.6	23.3	**Dolomite**: *Gray, strong, fine grained, moderately weathered, pitted, medium bedded, highly fractured.*	68 / 68	5.0	5.0	100		**Occasional low angle fractures @ 25.6-46**
830.6	26.3	**Dolomite**: *Gray, moderately strong, (60%) interbedded with SILTSTONE (40%); fine grained, slightly weathered, thinly bedded, highly fractured to broken.*	46 / 46	5.0	5.0	100		
828.7	28.2	**Dolomite**: *Gray to greenish gray, strong, fine grained, slightly weathered, argillaceous, medium bedded, moderately fractured.*	70 / 70	5.0	5.0	100		
			80 / 80	5.0	5.0	100		
			13 / 13	3.0	2.8	93		
809.9	47.0	**Shale (claystone)**: *Gray, moderately strong, fine grained, highly weathered, thickly bedded, highly fractured to broken.*	56 / 56	5.0	5.0	100		**Zone of suspected loss, clay filled seams**
807.6	49.3							

24.0 29.0 34.0 39.0 44.0 47.0

Top of Rock = 18.5'	Base Weathered Rock = 21.6'	RDZ = 21.6'
Elevation = 838.4'	Elevation = 835.3'	Elevation = 835.3'
Laurel Dolomite	Laurel Dolomite	

GEOLOGIST'S SUBSURFACE LOG

Project ID: ***0631-000602***	***Oldham - CSX Runaround***	Project Type: ***Railroad Runaround***
Item Number: ***5-434.00***	***CSX Runaround***	Project Manager: ***Erik Scott***

Hole Number ***B-32C***	Immediate Water Depth ***NA***	Start Date ***11/13/2024***	Hole Type ***core and sample***
Surface Elevation ***856.9'***	Static Water Depth ***NA***	End Date ***11/13/2024***	Rig_Number ***CME-55 (NEW)***
Total Depth ***52.0'***	Driller ***Keith Conrad***	Latitude(83) ***38.401050***	***GQ-1075***
Location ***1528+59.10 55.0' Rt.***	Geologist ***Jonah Conley***	Longitude(83) ***-85.397870***	***Laurel***

Lithology Elevation	Lithology Depth	Description	Sample No.	Depth (ft)	Rec. (ft)	SPT Blows	Sample Type	Remarks
		Overburden						
		Rock Core	Std/Ky RQD	Run (ft)	Rec (ft)	Rec (%)	SDI (JS)	
804.9	52.0	**Dolomite**: *Gray to greenish gray, strong, fine grained, slightly weathered, medium bedded, highly fractured.*	56 / 56	5.0	5.0	100		52.0 **@ 46.7-47 Occasional low angle fractures @ 50.4-51.4**
		(Bottom of Hole 52.0')						

Top of Rock = 18.5' Elevation = 838.4'
Base Weathered Rock = 21.6' Elevation = 835.3'
RDZ = 21.6' Elevation = 835.3'
Laurel Dolomite
Laurel Dolomite

Drilling Firm: DLZ
For: Division of Structural Design
Geotechnical Branch

DRILLER'S SUBSURFACE LOG

Printed: 1/17/15

Project ID: ***0631-000602***	***Oldham - Allen Lane***	Project Type: ***Roadway Railroad Bridge***
Item Number: ***5-434.00***	***Allen Lane***	Project Manager: ***Eric Scott***

Hole Number ***B-22***	Immediate Water Depth ***NA***	Start Date ***12/29/2014***	Hole Type ***sample***
Surface Elevation ***856.2'***	Static Water Depth ***NA***	End Date ***12/29/2014***	Rig_Number ***CME-45C***
Total Depth ***13.3'***	Driller ***Keith Conrad***	Latitude(83) ***38.401131***	
Location ***170+99.59 262.4' Lt.***		Longitude(83) ***-85.398705***	

Lithology Elevation	Lithology Depth	Description (Overburden / Rock Core)	Sample No. / Std/Ky RQD	Depth (ft) / Run (ft)	Rec. (ft) / Rec (ft)	SPT Blows / Rec (%)	Sample Type / SDI (JS)	Remarks
			1	1.0-2.5	1.1	2-2-3	SPT	
		Very stiff, red, moist, fat clay ((A-7)/(CH); @1.0'-2.5', HP=2.5 tsf, @3.5'-5.0', HP=3.75 tsf, @6.0'-7.5', HP=3.0 tsf).						
5			2	3.5-5.0	1.0	4-4-5	SPT	5
			3	6.0-7.5	1.5	3-4-6	SPT	
847.7	8.5							
10			4	8.5-10.0	0.8	8-8-9	SPT	10
		Very stiff, red, moist, fat clay with rock fragments ((A-7)/(CH); @8.5'-10', HP=2.5 tsf).						
843.2	13.0							
842.9	13.3	Very dense, brown, rock fragments (decomposed dolomite).	5	13.0-13.3	0.2	50/0.30'	SPT	
15								15
		(Bottom of Hole 13.3') (Refusal @ 13)						
20								20
25								25
30								30
35								35
40								40
45								45
50								50

B-01 Dynamic Cone Penetrometer Log

B-01 Number of Blows (Cumulative)	Penetration between Readings (in)	Penetration between Readings (mm)	Cumulative Penetration (in)	Cumulative Penetration (mm)
1	1	25.4	1	25.4
2	0.5	12.7	1.5	38.1
3	0.5	12.7	2	50.8
3-10	0.5	12.7	2.5	63.5
11-15	0.5	12.7	3	76.2
16-20	0.5	12.7	3.5	88.9
21-25	1.25	31.75	4.75	120.65
26-30	0.5	12.7	5.25	133.35
31-35	0.5	12.7	5.75	146.05
36-40	0.5	12.7	6.25	158.75
41-45	0	0	6.25	158.75
46-50	0.25	6.35	6.5	165.1
51-55	0.25	6.35	6.75	171.45
56-60	0	0	6.75	171.45
61-65	0.5	12.7	7.25	184.15
66-70	0	0	7.25	184.15
71-75	0.25	6.35	7.5	190.5
76-80	0.25	6.35	7.75	196.85
81-85	0	0	7.75	196.85
86-90	0.25	6.35	8	203.2
91-100	0	0	8	203.2

B-02 Dynamic Cone Penetrometer

B-02 Number of Blows (Cumulative)	Penetration between Readings (in)	Penetration between Readings (mm)	Cumulative Penetration (in)	Cumulative Penetration (mm)
1-5	2	50.8	2	50.8
6-10	0	0	2	50.8
11-15	2.5	63.5	4.5	114.3
16-20	1	25.4	5.5	139.7
21-25	1	25.4	6.5	165.1
26-30	1	25.4	7.5	190.5
31-35	0.5	12.7	8	203.2
36-40	0.5	12.7	8.5	215.9
41-45	0.5	12.7	9	228.6
46-65	0	0	9	228.6

B-04 Dynamic Cone Penetration Log

B-04 Number of Blows (Cumulative)	Penetration between Readings (in)	Penetration between Readings (mm)	Cumulative Penetration (in)	Cumulative Penetration (mm)
1-5	2	50.8	2	2
6	1	25.4	3	3
7	2	50.8	5	5
8	1.5	38.1	6.5	6.5
9	2	50.8	8.5	8.5
10	2	50.8	10.5	10.5
11	2	50.8	12.5	12.5
12	2	50.8	14.5	14.5
13	1.5	38.1	16	16
14	2	50.8	18	18
15	1.75	44.45	19.75	19.75
16	1	25.4	20.75	20.75
17	1	25.4	21.75	21.75
18	1	25.4	22.75	22.75
19	1	25.4	23.75	23.75
20	1	25.4	24.75	24.75
21	0.5	12.7	25.25	25.25
22	0.75	19.05	26	26
23	0.5	12.7	26.5	26.5
24	0.5	12.7	27	27
25	0.75	19.05	27.75	27.75
26	0.5	12.7	28.25	28.25
27	0.5	12.7	28.75	28.75
28	0.5	12.7	29.25	29.25
29	0.75	19.05	30	30
30	0.75	19.05	30.75	30.75
31	0.5	12.7	31.25	31.25
32	0.25	6.35	31.5	31.5
33	0.25	6.35	31.75	31.75
34	0.25	6.35	32	32
35	0.5	12.7	32.5	32.5
36	0.75	19.05	33.25	33.25
37	0.75	19.05	34	34
38	0.5	12.7	34.5	34.5
39	0.5	12.7	35	35
40	0.5	12.7	35.5	35.5
41	0.25	6.35	35.75	35.75
42	0.25	6.35	36	36
43	0.25	6.35	36.25	36.25

44	0.5	12.7	36.75	36.75
45	0.5	12.7	37.25	37.25
46	0.5	12.7	37.75	37.75
47	0.5	12.7	38.25	38.25
48	0.75	19.05	39	39
49	0.5	12.7	39.5	39.5
50	0.75	19.05	40.25	40.25
51	0.75	19.05	41	41
52	0.5	12.7	41.5	41.5
53	0.5	12.7	42	42
54	0.5	12.7	42.5	42.5
55	0.5	12.7	43	43
56	0.25	6.35	43.25	43.25
57	0.5	12.7	43.75	43.75
58	0.25	6.35	44	44
59	0.5	12.7	44.5	44.5
60	0.5	12.7	45	45
61-65	1	25.4	46	46
65-70	1	25.4	47	47
71-75	1	25.4	48	48
76-80	2	50.8	50	50
81-85	1	25.4	51	51
86-90	2	50.8	53	53
91-95	1	25.4	54	54
96-100	1	25.4	55	55
101-105	1	25.4	56	56
106-110	1	25.4	57	57
111-115	2	50.8	59	59
116-120	1	25.4	60	60

B-13 Dynamic Cone Penetrometer Log

B-13 Number of Blows (Cumulative)	Penetration between Readings (in)	Penetration between Readings (mm)	Cumulative Penetration (in)	Cumulative Penetration (mm)
1	0.3	7.62	0.3	7.62
2	0.5	12.7	0.8	20.32
3	0.5	12.7	1.3	33.02
4	0.4	10.16	1.7	43.18
5-8	0.4	10.16	2.1	53.34
9	0.2	5.08	2.3	58.42
10	0.2	5.08	2.5	63.5
11-17	0.4	10.16	2.9	73.66
18	0.25	6.35	3.15	80.01
19	0.25	6.35	3.4	86.36
20	0.5	12.7	3.9	99.06
21	0.5	12.7	4.4	111.76
22	0.5	12.7	4.9	124.46
23	0.5	12.7	5.4	137.16
24	0.25	6.35	5.65	143.51
25-30	0.5	12.7	6.15	156.21
31	0.25	6.35	6.4	162.56
32	0.25	6.35	6.65	168.91
33	0.5	12.7	7.15	181.61
34	0.1	2.54	7.25	184.15
35	0.25	6.35	7.5	190.5
36	0.25	6.35	7.75	196.85
37	0.25	6.35	8	203.2
38-40	1	25.4	9	228.6
41-45	0.5	12.7	9.5	241.3
46-50	0.5	12.7	10	254
51-55	0.5	12.7	10.5	266.7
56-60	1	25.4	11.5	292.1
61-65	1	25.4	12.5	317.5
66-70	0.5	12.7	13	330.2
71-75	0.5	12.7	13.5	342.9
76-80	0	0	13.5	342.9
81-85	0.5	12.7	14	355.6
86-90	0.5	12.7	14.5	368.3
91-95	0	0	14.5	368.3
96-100	0.5	12.7	15	381
101-105	1	25.4	16	406.4
106-110	0.5	12.7	16.5	419.1
111-115	0.5	12.7	17	431.8

116-120	1	25.4	18	457.2
121-125	1	25.4	19	482.6
126-130	1	25.4	20	508
131-135	0	0	20	508
136-140	0.5	12.7	20.5	520.7
141-145	0.5	12.7	21	533.4
146-150	0.5	12.7	21.5	546.1
151-155	0.5	12.7	22	558.8
156-165	0	0	22	558.8

B-14 Dynamic Cone Penetrometer Log

B-14 Number of Blows (Cumulative)	Penetration between Readings (in)	Penetration between Readings (mm)	Cumulative Penetration (in)	Cumulative Penetration (mm)
1	0.5	12.7	0.5	12.7
2	0.5	12.7	1	25.4
3	0.25	6.35	1.25	31.75
4	0.25	6.35	1.5	38.1
5	0.25	6.35	1.75	44.45
6	0.25	6.35	2	50.8
7	0.25	6.35	2.25	57.15
8	0.25	6.35	2.5	63.5
9	1	25.4	3.5	88.9
10	1	25.4	4.5	114.3
11	0.25	6.35	4.75	120.65
12	0.25	6.35	5	127
13	0.25	6.35	5.25	133.35
14	0.25	6.35	5.5	139.7
15	0.25	6.35	5.75	146.05
16	0.25	6.35	6	152.4
17-24	0.6	15.24	6.6	167.64
25	0.5	12.7	7.1	180.34
26	0.5	12.7	7.6	193.04
27-29	1	25.4	8.6	218.44
30	1	25.4	9.6	243.84
31	2	50.8	11.6	294.64
32	4	101.6	15.6	396.24
33	4	101.6	19.6	497.84
34	5	127	24.6	624.84
35	4	101.6	28.6	726.44
36	6	152.4	34.6	878.84
37	7	177.8	41.6	1056.64
38	2	50.8	43.6	1107.44
39	1	25.4	44.6	1132.84
40-50	0	0	44.6	1132.84

MONITORING WELL INSTALLATION REPORT

PROJECT: Oldham CO. KY CSX

PROJECT NO: 0631-0006.02

GROUND SURFACE ELEVATION: -

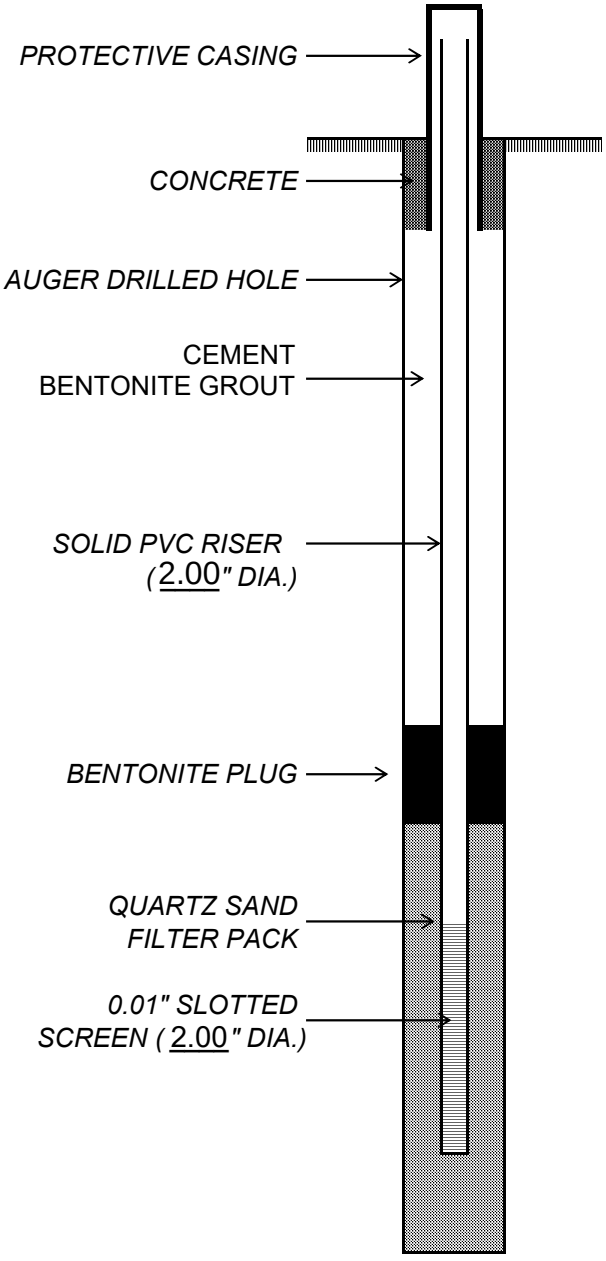
TOP OF RISER ELEVATION: 3.2'

BORING NO.: B-05

DATE INSTALLED: 11/13/24

LOGGED BY: Jonah Conley

GROUND WATER LEVEL AT COMPLETION: 13.0



DEPTH BELOW GROUND SURFACE		REMARKS AND NOTES
8.0	TOP OF PLUG	
10.0	TOP OF SAND	
12.0	TOP OF SCREEN	
22.0	BOTTOM OF SCREEN	
22.0	BOTTOM OF SAND PACK	

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SURVEYING • CONSTRUCTION SERVICES
INNOVATIVE IDEAS
EXCEPTIONAL DESIGN
UNMATCHED CLIENT SERVICE

MONITORING WELL INSTALLATION REPORT

PROJECT: Oldham CO. KY CSX

PROJECT NO: 0631-0006.02

GROUND SURFACE ELEVATION: -

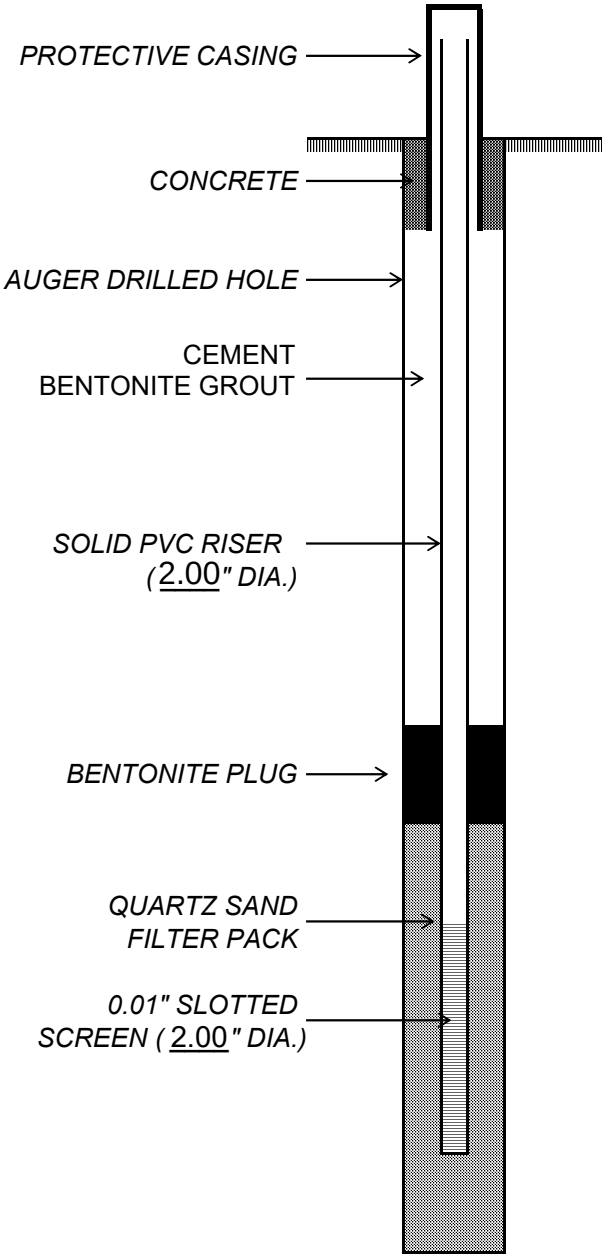
TOP OF RISER ELEVATION: 3.1'

BORING NO.: B-12

DATE INSTALLED: 11/14/24

LOGGED BY: Jonah Conley

GROUND WATER LEVEL AT COMPLETION: 4.8



DEPTH BELOW GROUND SURFACE	
0.0	*TOP OF PLUG*
1.0	*TOP OF SAND*
1.0	*TOP OF SCREEN*
9.0	*BOTTOM OF SCREEN*
9.0	*BOTTOM OF SAND PACK*

REMARKS AND NOTES

Drilled rock in borehole quicker than anticipated. Screen extends to plug. plug was shortened.

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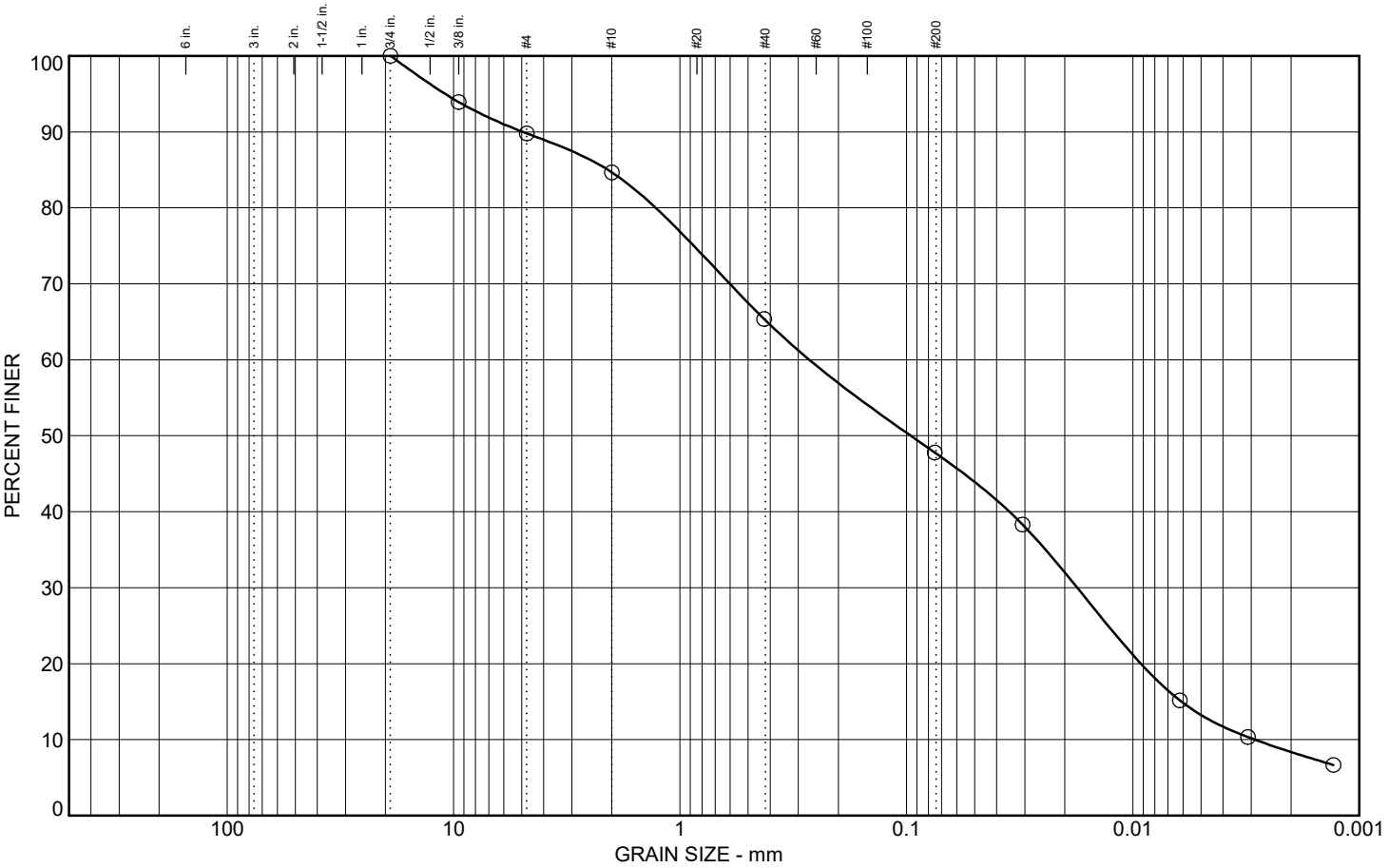
Appendix II

Grain Size Cures
Summary of Laboratory Testing Results

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	10.2	5.1	19.3	17.6		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19	100.0		
9.5	93.9		
4.75	89.8		
2	84.7		
0.425	65.4		
0.075	47.8		

* SPECIFICATION :

Soil Description

fine to medium sand, low plasticity silt

General Characteristics

Moisture Content = 32.2%

Atterberg Limits

LL= 25 PL= 24 PI= 1

Coefficients

D_{85}= 2.118 D_{60}= 0.25 D_{50}= 0.093
D_{30}= 0.017 D_{15}= 0.006 D_{10}= 0.003
C_u= 87.53 C_c= 0.42

Classification

USCS = SM AASHTO = A-4

Remarks

Group Index = 0

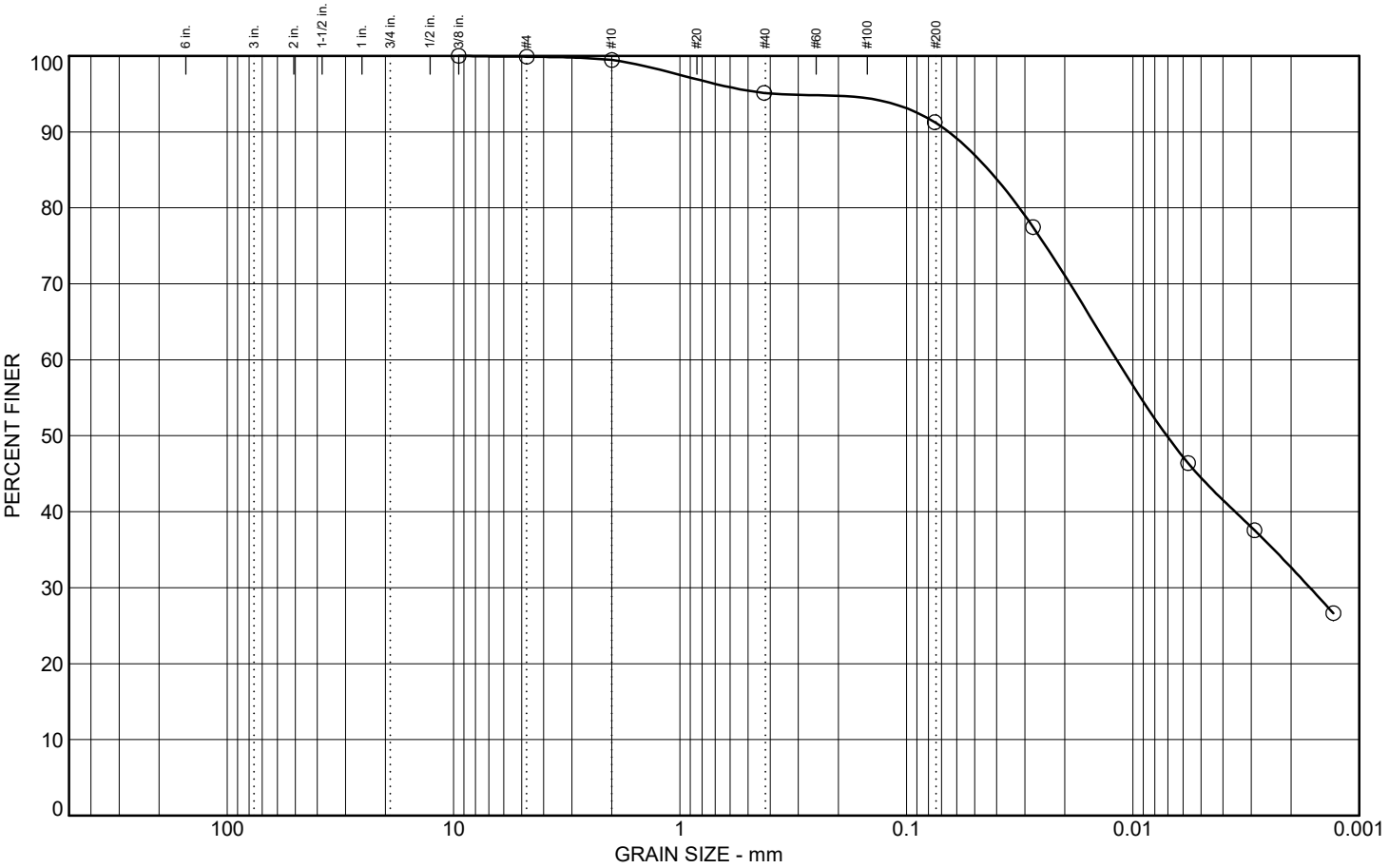
Sample No.: **Source of Sample:** B-03 **Date:**
Location: - **Depth / Elev:** 3.5' / 846.96'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:38 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.1	0.4	4.3	3.9		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.9		
2	99.5		
0.425	95.1		
0.075	91.3		

* SPECIFICATION :

Soil Description

moderate plasticity clay

General Characteristics

Moisture Content = 22.8%

Atterberg Limits

LL= 37 PL= 17 PI= 20

Coefficients

D_{85}= 0.048 D_{60}= 0.011 D_{50}= 0.007
D_{30}= 0.002 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 18

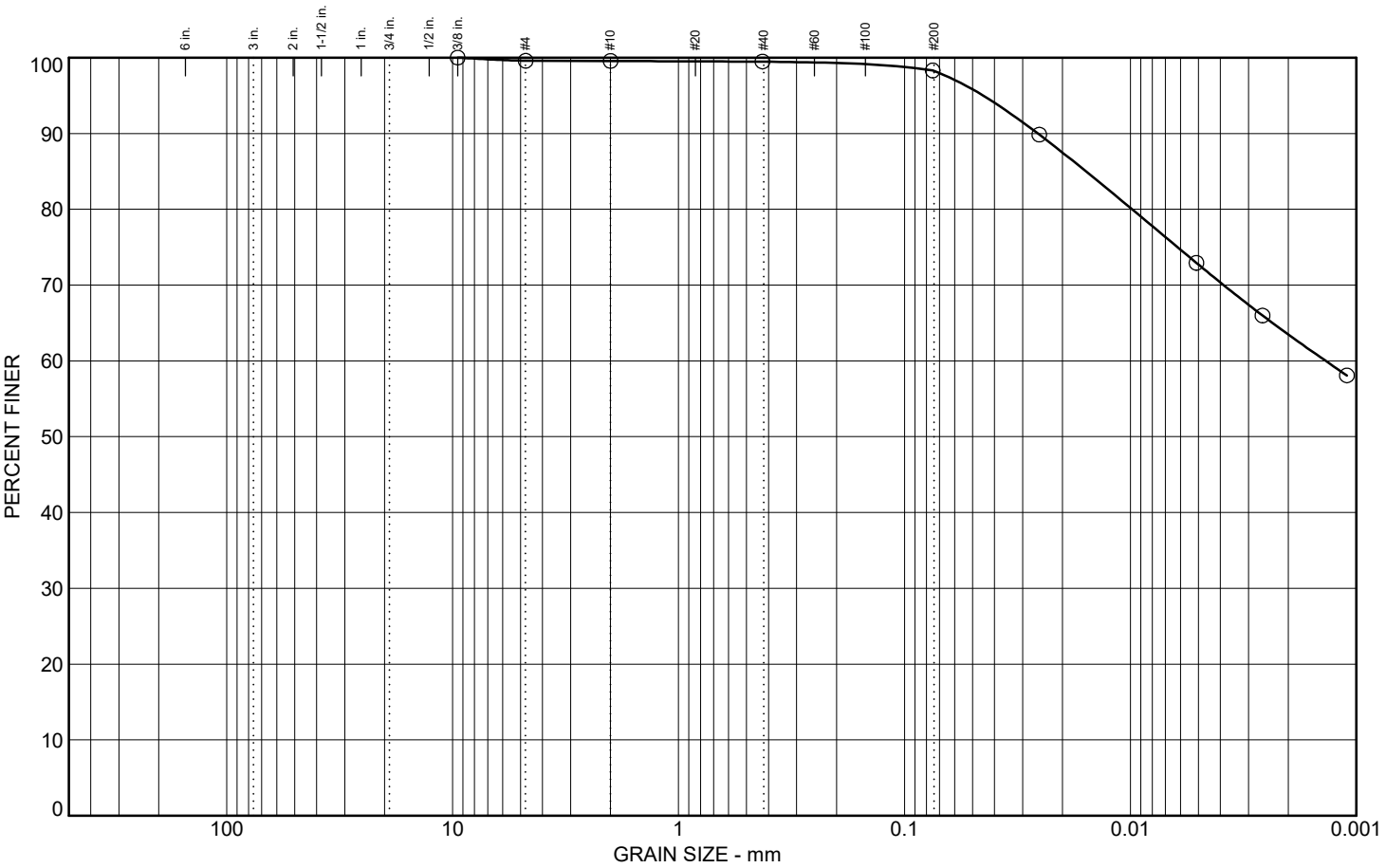
Sample No.: **Source of Sample:** B-03 **Date:**
Location: - **Depth / Elev:** 8.5' / 841.96'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:38 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.4	0.0	0.1	1.2		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.6		
2	99.6		
0.425	99.5		
0.075	98.3		

* SPECIFICATION :

Soil Description

high plasticity clay

General Characteristics

Moisture Content = 29.1%

Atterberg Limits

LL= 71 PL= 22 PI= 49

Coefficients

D_{85}= 0.016 D_{60}= 0.001 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 55

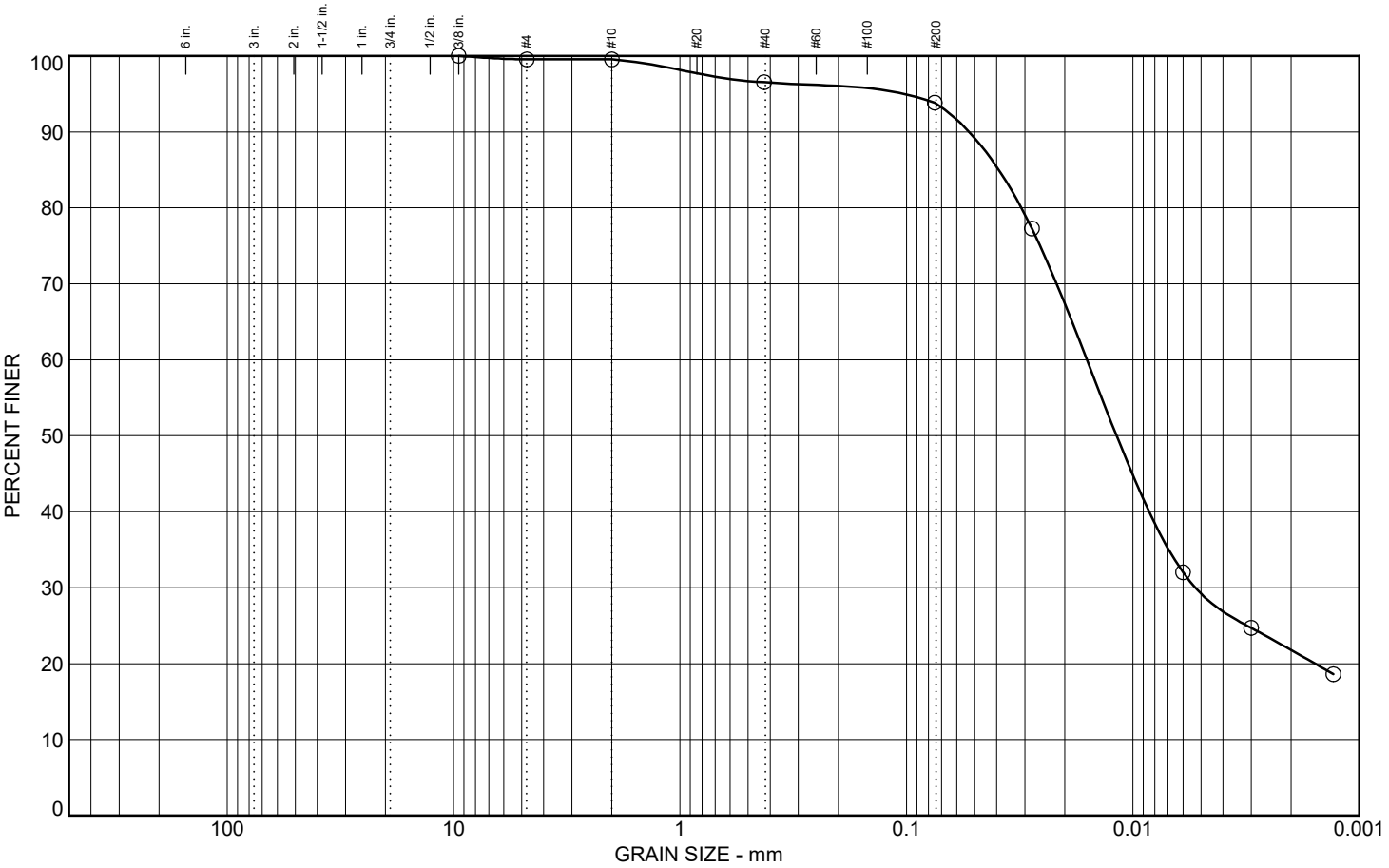
Sample No.: **Source of Sample:** B-03 **Date:**
Location: - **Depth / Elev:** 13.5' / 836.96'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.5	0.0	3.0	2.7		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.5		
2	99.5		
0.425	96.5		
0.075	93.8		

* SPECIFICATION :

Soil Description

low plasticity clay

General Characteristics

Moisture Content = 12.6%

Atterberg Limits

LL= 33 PL= 20 PI= 13

Coefficients

D_{85}= 0.044 D_{60}= 0.016 D_{50}= 0.011
D_{30}= 0.005 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 12

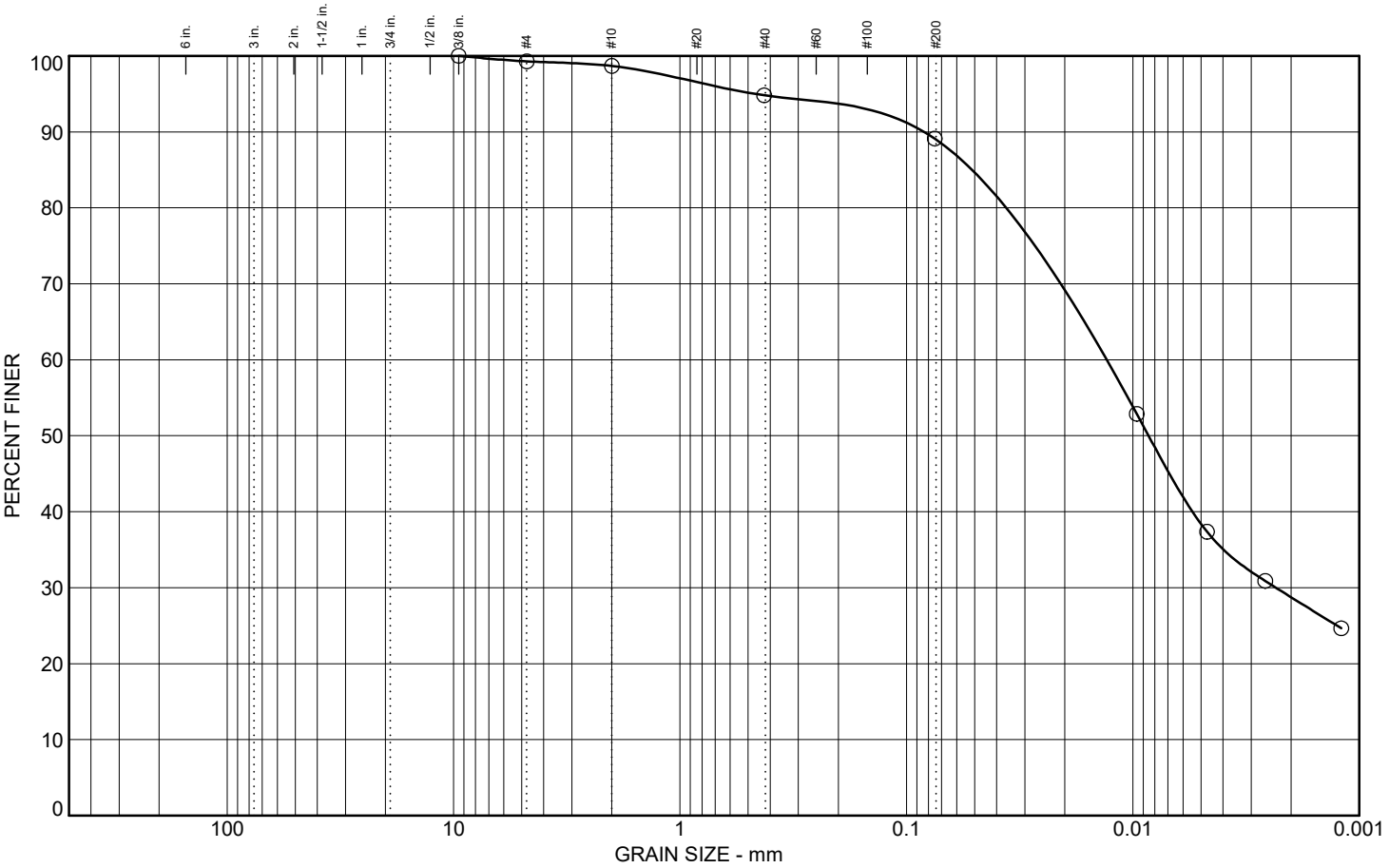
Sample No.: **Source of Sample:** B-04 **Date:**
Location: - **Depth / Elev:** 3.5' / 845.25'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.7	0.6	3.9	5.7		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.3		
2	98.7		
0.425	94.8		
0.075	89.1		

* SPECIFICATION :

Soil Description

moderate plasticity clay

General Characteristics

Moisture Content = 14.9%

Atterberg Limits

LL= 37 PL= 18 PI= 19

Coefficients

D_{85}= 0.059 D_{60}= 0.014 D_{50}= 0.008
D_{30}= 0.002 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 17

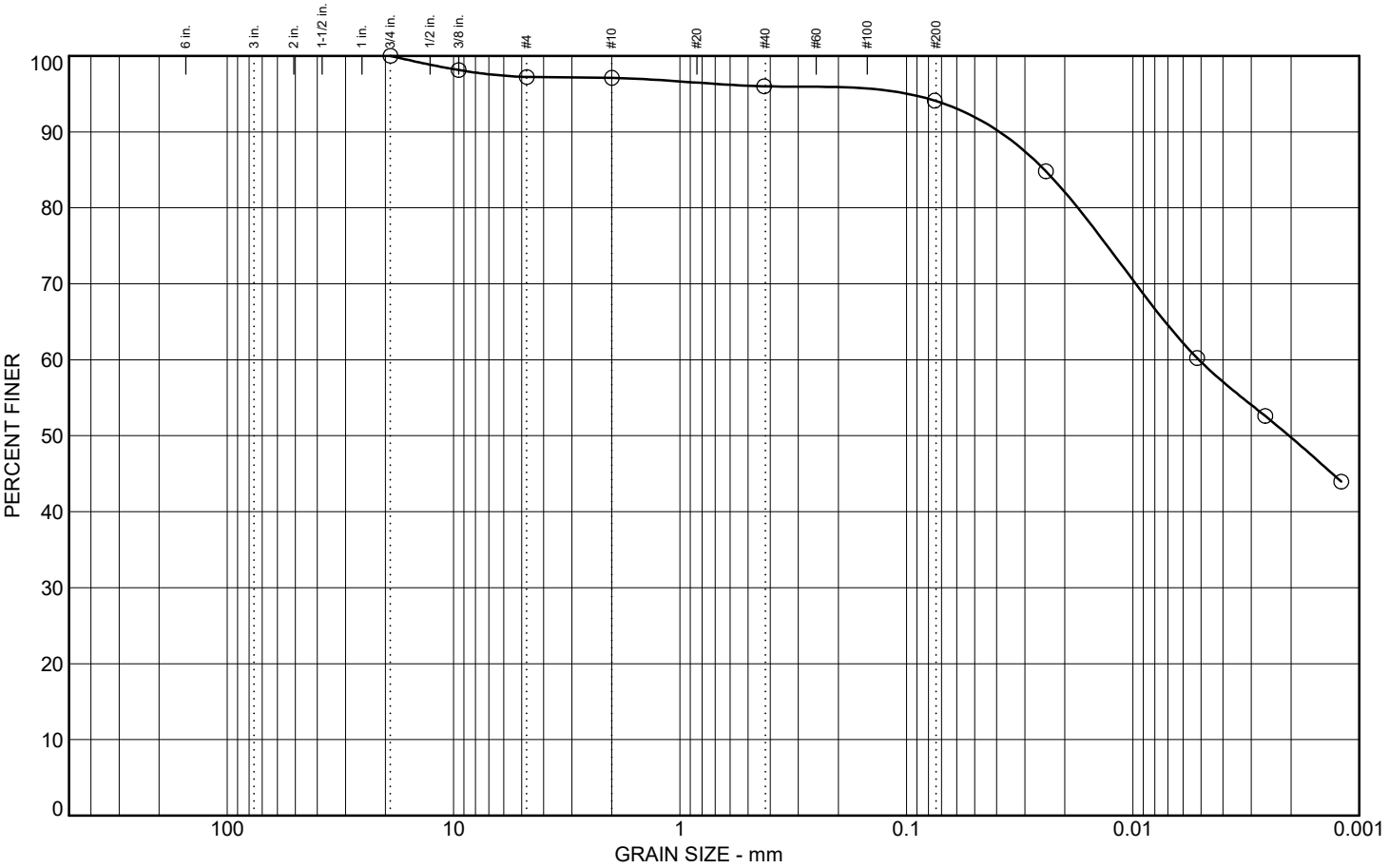
Sample No.: **Source of Sample:** B-05 **Date:**
Location: - **Depth / Elev:** 3.5' / 845.32'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	2.8	0.1	1.1	1.9		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19	100.0		
9.5	98.1		
4.75	97.2		
2	97.1		
0.425	96.0		
0.075	94.1		

* SPECIFICATION :

Soil Description

high plasticity clay

General Characteristics

Moisture Content = 22.1%

Atterberg Limits

LL= 54 PL= 19 PI= 35

Coefficients

D_{85}= 0.025 D_{60}= 0.005 D_{50}= 0.002
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 36

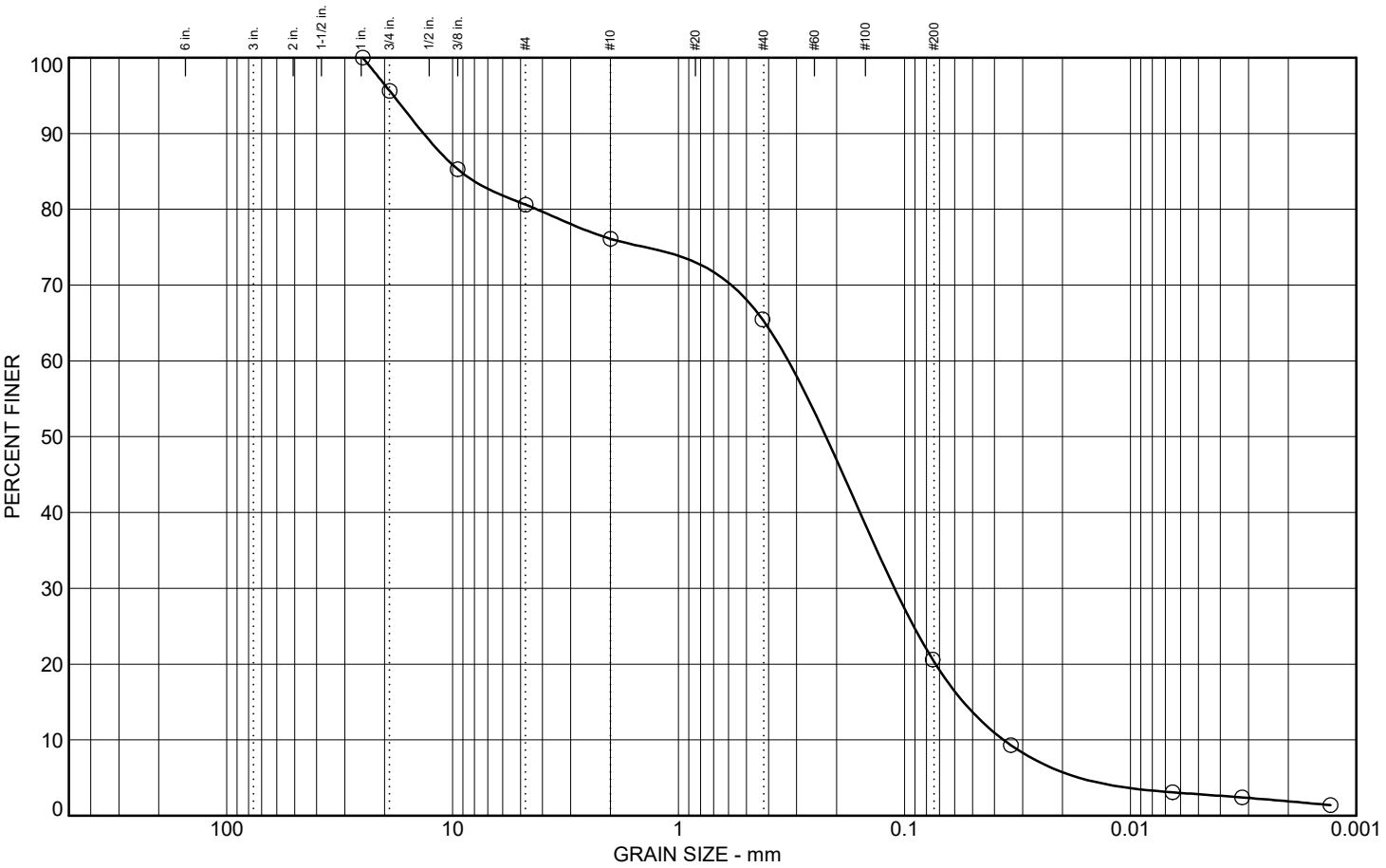
Sample No.: **Source of Sample:** B-05 **Date:**
Location: - **Depth / Elev:** 8.5' / 840.32'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	4.4	15.0	4.5	10.6	44.9		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
25	100.0		
19	95.6		
9.5	85.3		
4.75	80.6		
2	76.1		
0.425	65.5		
0.075	20.6		

* SPECIFICATION :

Soil Description

fine sand, non-plastic silt, fine gravel

General Characteristics

Moisture Content = 13.6%

Atterberg Limits

LL= 0 PL= 0 PI= 0

Coefficients

D_{85}= 9.113 D_{60}= 0.344 D_{50}= 0.234
D_{30}= 0.108 D_{15}= 0.051 D_{10}= 0.035
C_u= 9.69 C_c= 0.95

Classification

USCS = SM AASHTO = A-2-4

Remarks

Group Index = 0

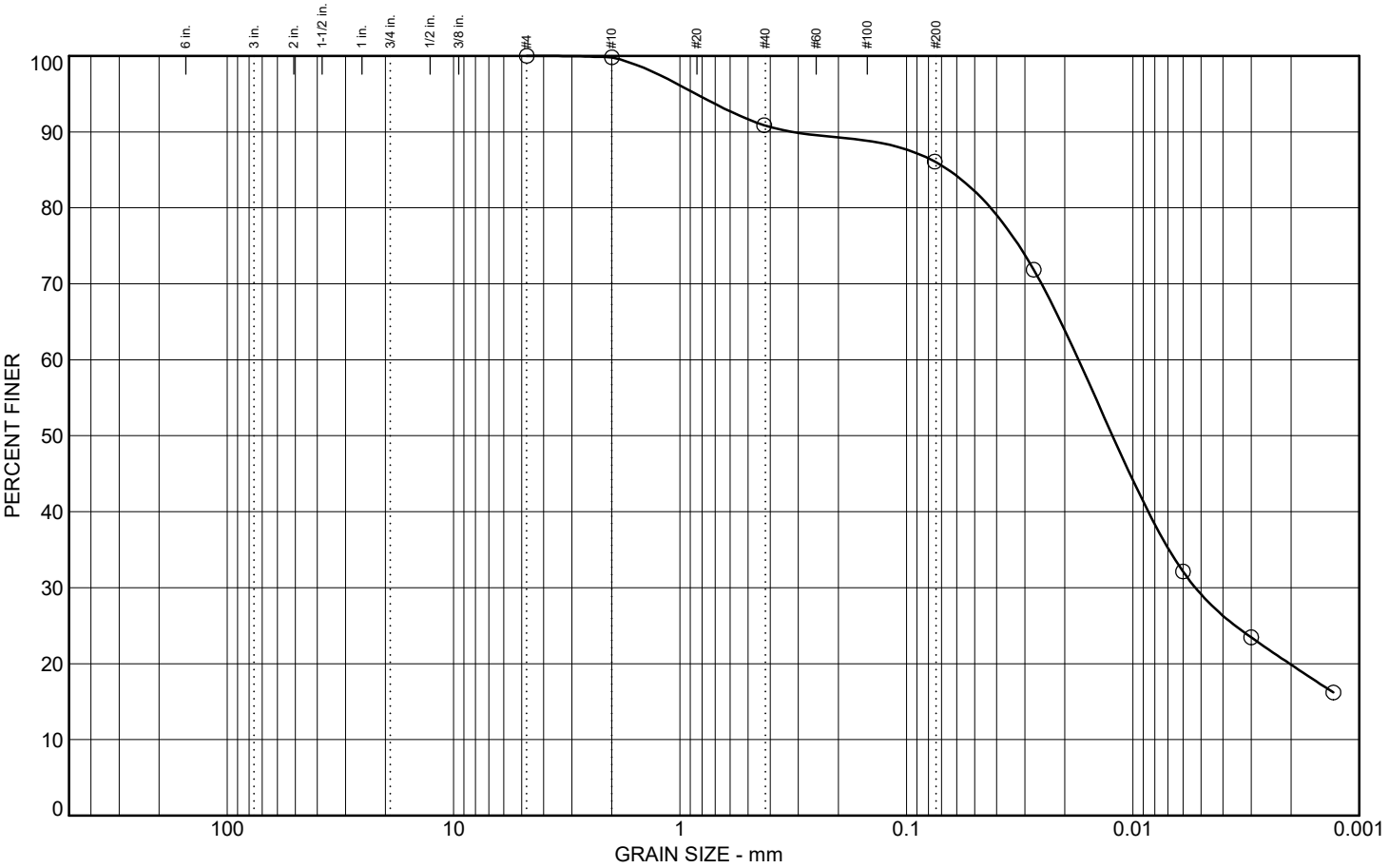
Sample No.: **Source of Sample:** B-05 **Date:**
Location: - **Depth / Elev:** 13.5' / 835.32'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.2	8.9	4.8		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4.75	100.0		
2	99.8		
0.425	90.9		
0.075	86.1		

* SPECIFICATION :

Soil Description

low plasticity clay

General Characteristics

Moisture Content = 14.6%

Atterberg Limits

LL= 31 PL= 18 PI= 13

Coefficients

D_{85}= 0.069 D_{60}= 0.017 D_{50}= 0.012
D_{30}= 0.005 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 10

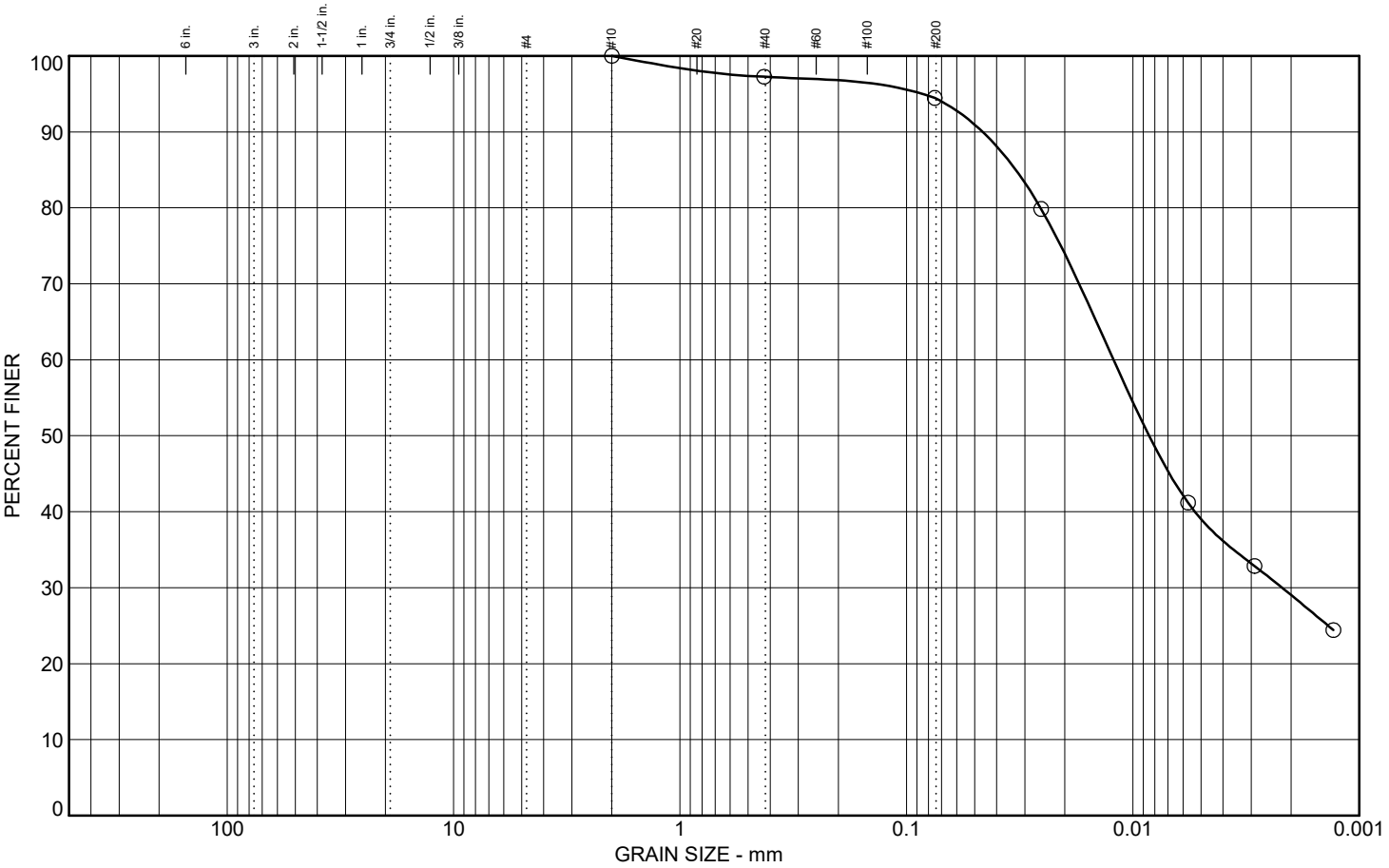
Sample No.: **Source of Sample:** B-06 **Date:**
Location: - **Depth / Elev:** 3.5' / 845.64'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	2.7	2.8		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
0.425	97.3		
0.075	94.5		

* SPECIFICATION :

Soil Description

moderate plasticity clay

General Characteristics

Moisture Content = 22.0%

Atterberg Limits

LL= 36 PL= 21 PI= 15

Coefficients

D_{85}= 0.037 D_{60}= 0.012 D_{50}= 0.008
D_{30}= 0.002 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 15

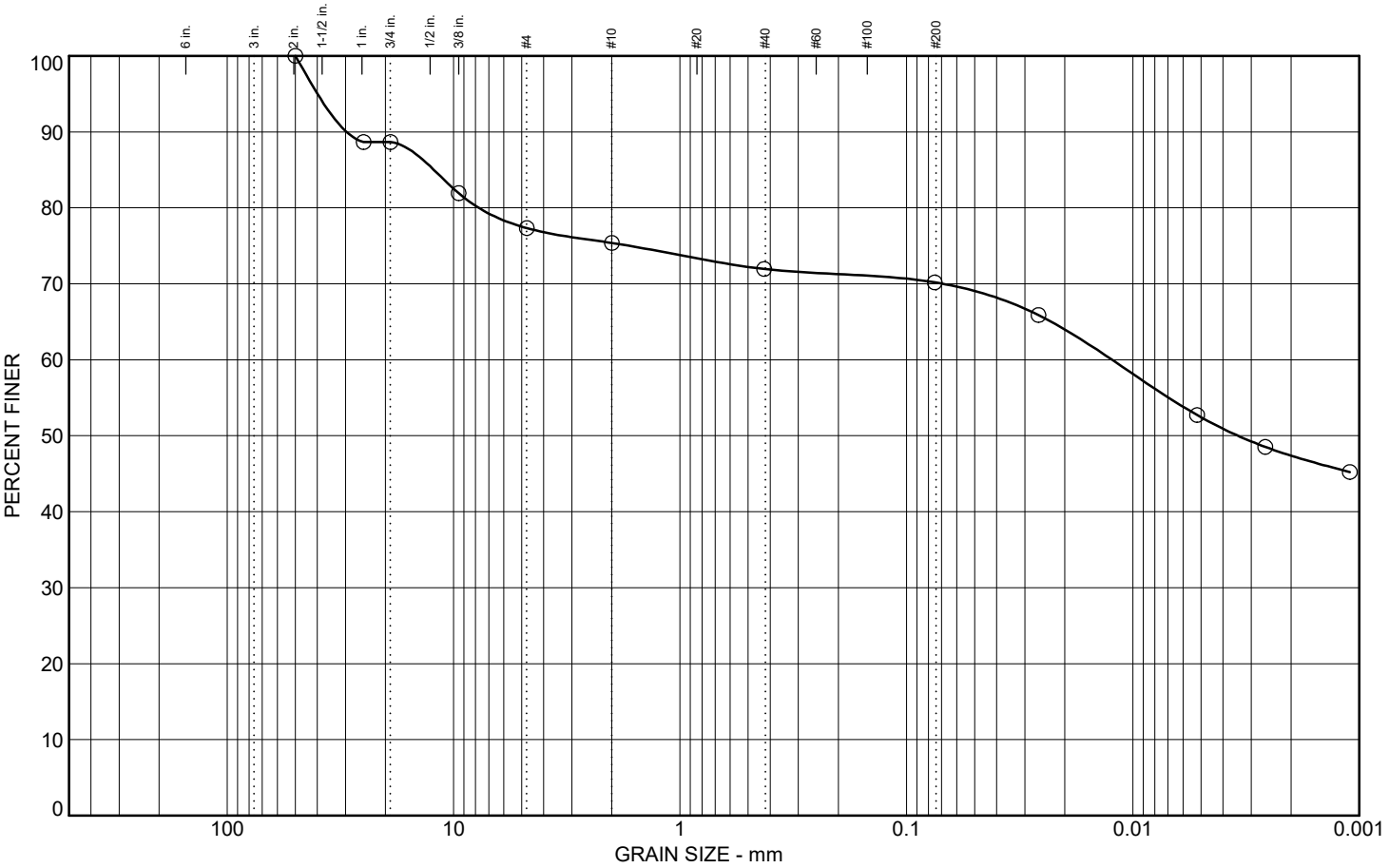
Sample No.: **Source of Sample:** B-06 **Date:**
Location: - **Depth / Elev:** 8.5' / 840.64'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	11.3	11.3	2.0	3.4	1.8		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
50	100.0		
25	88.7		
19	88.7		
9.5	81.9		
4.75	77.3		
2	75.4		
0.425	72.0		
0.075	70.2		

* SPECIFICATION :

Soil Description

high plasticity clay, fine to coarse gravel

General Characteristics

Moisture Content = 25.1%

Atterberg Limits

LL= 84 PL= 24 PI= 60

Coefficients

D_{85}= 13.035 D_{60}= 0.013 D_{50}= 0.003
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 42

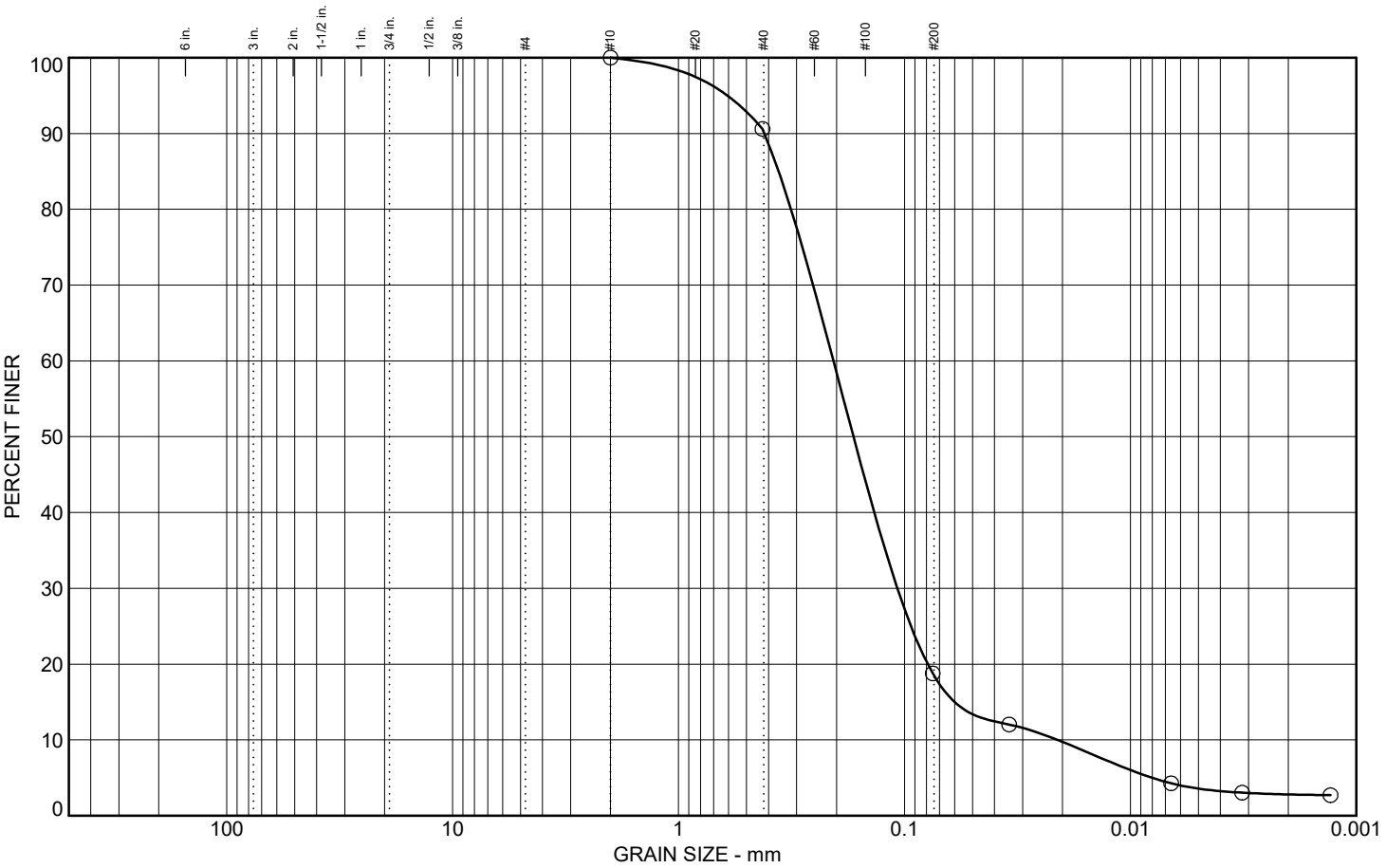
Sample No.: **Source of Sample:** B-07 **Date:**
Location: - **Depth / Elev:** 8.5' / 842.85'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	9.4	71.8		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
0.425	90.6		
0.075	18.8		

* SPECIFICATION :

Soil Description

fine sand, non-plastic silt

General Characteristics

Moisture Content = 20.2%

Atterberg Limits

LL= 0 PL= 0 PI= 0

Coefficients

D_{85}= 0.371 D_{60}= 0.203 D_{50}= 0.159
D_{30}= 0.098 D_{15}= 0.048 D_{10}= 0.022
C_u= 9.09 C_c= 2.13

Classification

USCS = SM AASHTO = A-2-4

Remarks

Group Index = 0

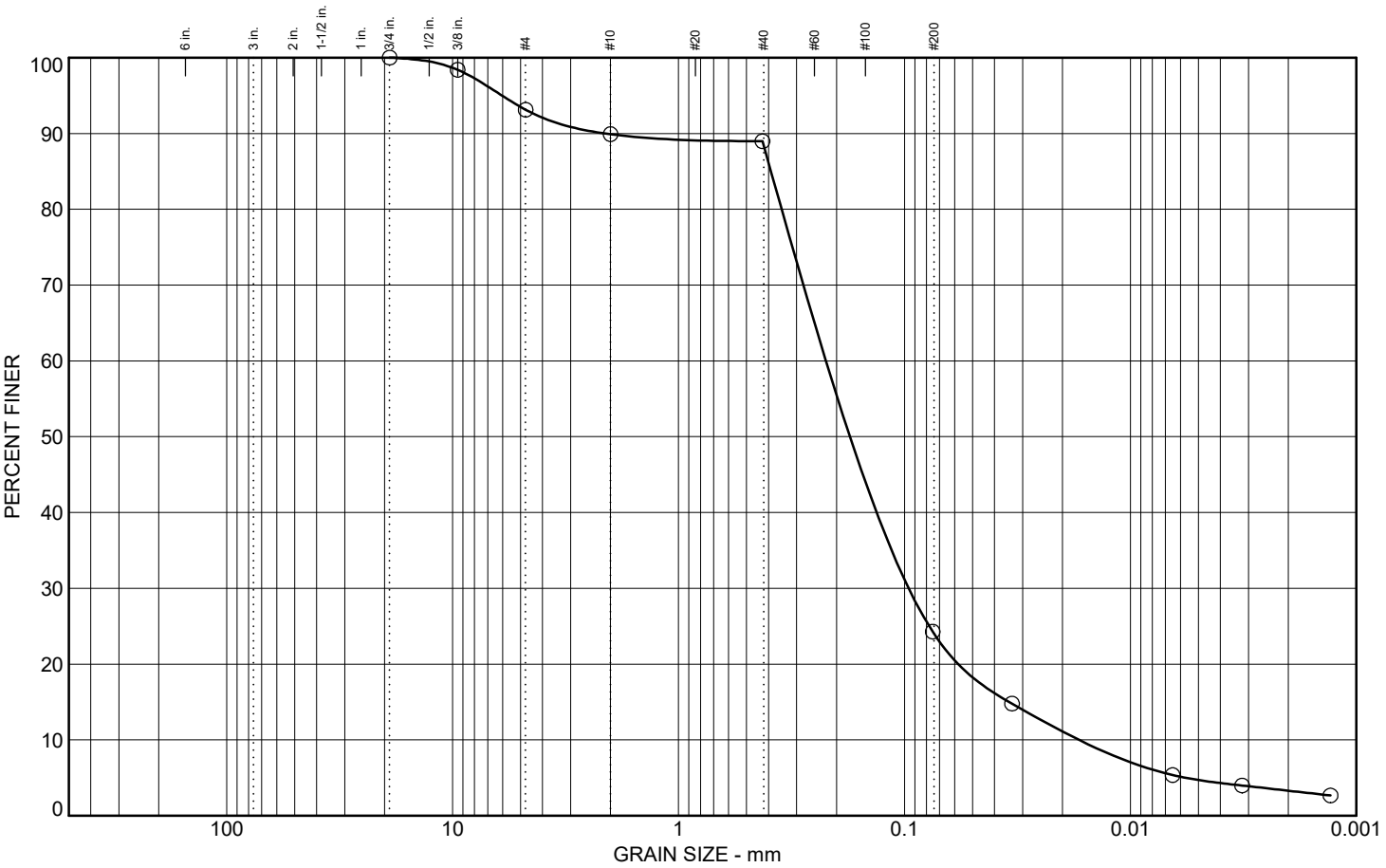
Sample No.: **Source of Sample:** B-07 **Date:**
Location: - **Depth / Elev:** 13.5' / 837.85'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	6.9	3.2	0.9	64.7		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19	100.0		
9.5	98.4		
4.75	93.1		
2	89.9		
0.425	89.0		
0.075	24.3		

* SPECIFICATION :

Soil Description

fine sand, non-plastic silt

General Characteristics

Moisture Content = 15.2%

Atterberg Limits

LL= 0 PL= 0 PI= 0

Coefficients

D_{85}= 0.382 D_{60}= 0.195 D_{50}= 0.149
D_{30}= 0.087 D_{15}= 0.034 D_{10}= 0.015
C_u= 13.43 C_c= 2.69

Classification

USCS = SM AASHTO = A-2-4

Remarks

Group Index = 0

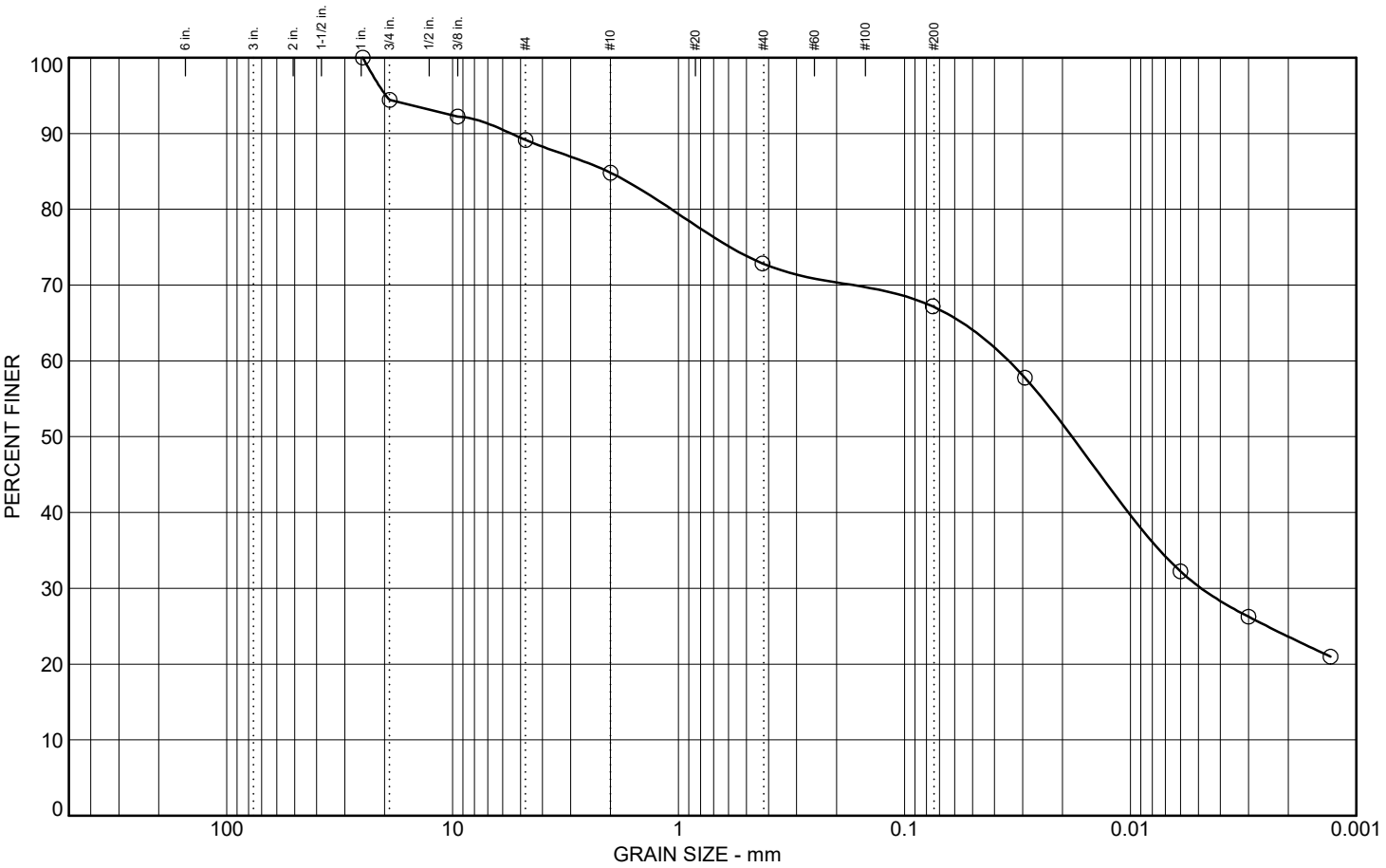
Sample No.: **Source of Sample:** B-07 **Date:**
Location: - **Depth / Elev:** 18.5' / 832.85'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	5.6	5.3	4.3	12.0	5.7		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
25	100.0		
19	94.4		
9.5	92.2		
4.75	89.1		
2	84.8		
0.425	72.8		
0.075	67.2		

* SPECIFICATION :

Soil Description

moderate plasticity clay, fine to medium sand

General Characteristics

Moisture Content = 20.7%

Atterberg Limits

LL= 41 PL= 19 PI= 22

Coefficients

D_{85}= 2.075 D_{60}= 0.037 D_{50}= 0.018
D_{30}= 0.005 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-7-6

Remarks

Group Index = 13

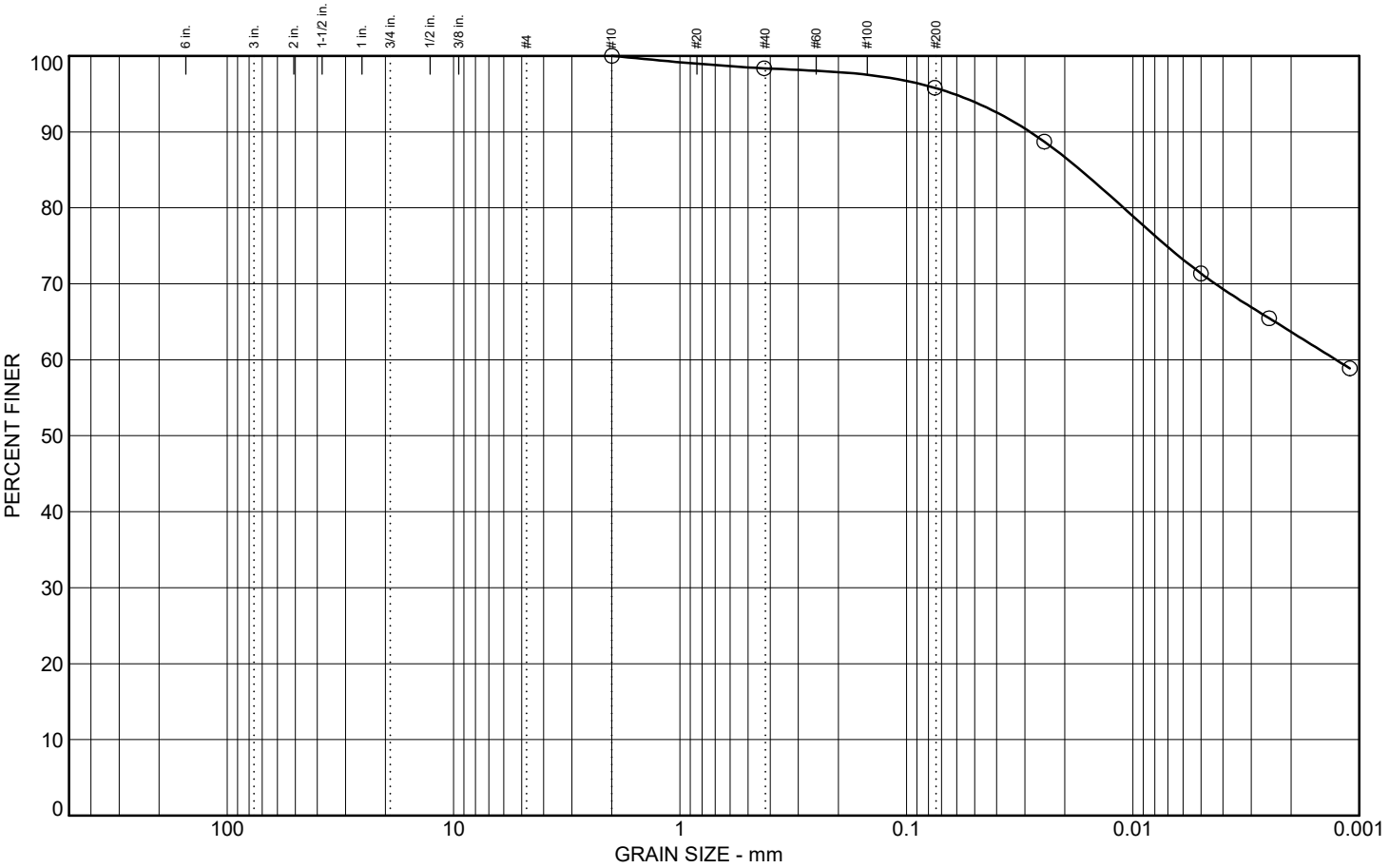
Sample No.: **Source of Sample:** B-08 **Date:**
Location: - **Depth / Elev:** 3.5' / 852.88'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	1.6	2.6		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
0.425	98.4		
0.075	95.8		

* SPECIFICATION :

Soil Description

high plasticity clay

General Characteristics

Moisture Content = 42.8%

Atterberg Limits

LL= 69 PL= 23 PI= 46

Coefficients

D_{85}= 0.018 D_{60}= 0.001 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 50

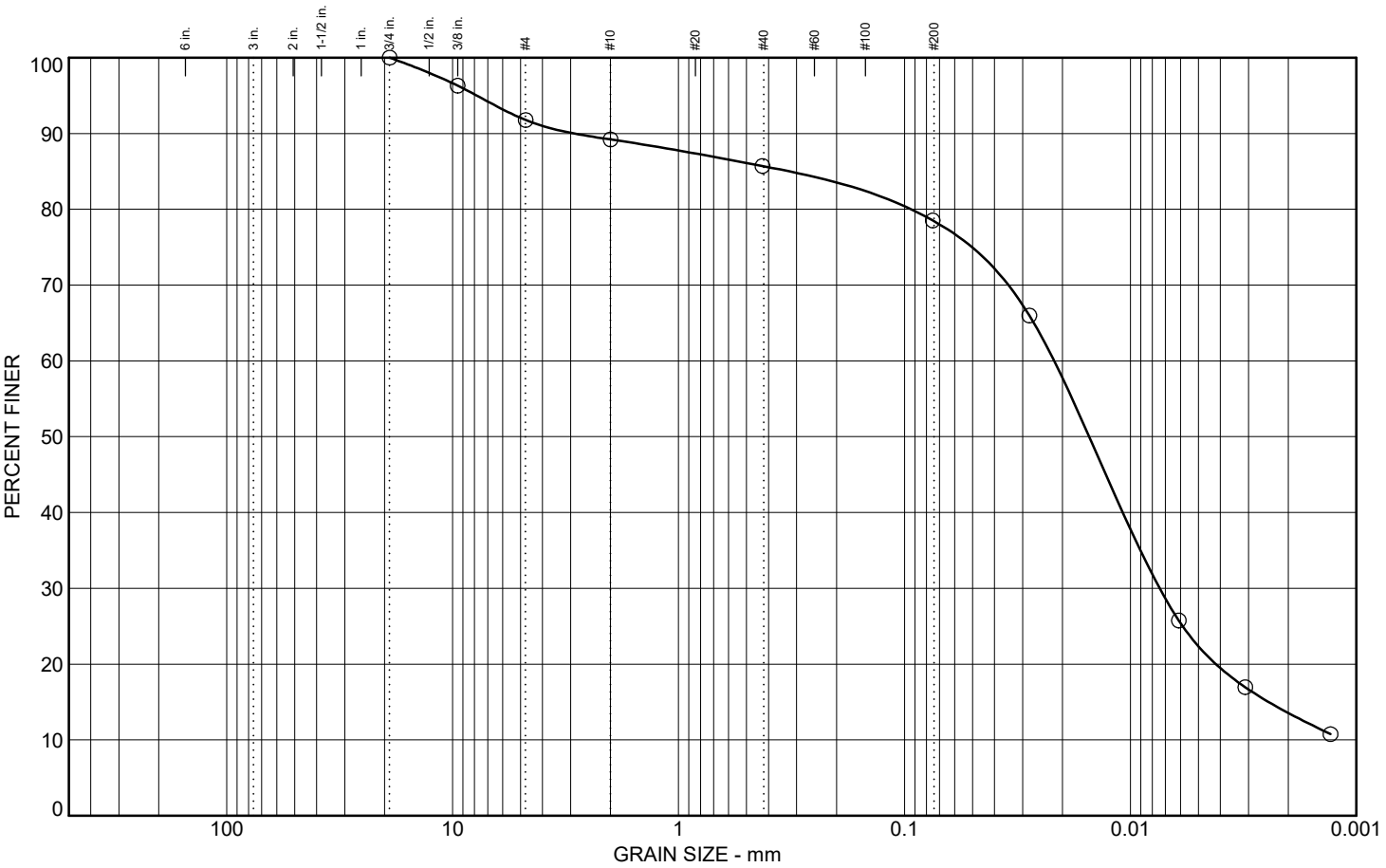
Sample No.: **Source of Sample:** B-08 **Date:**
Location: - **Depth / Elev:** 8.5' / 847.88'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	8.2	2.6	3.5	7.2		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19	100.0		
9.5	96.3		
4.75	91.8		
2	89.2		
0.425	85.7		
0.075	78.5		

* SPECIFICATION :

Soil Description

low plasticity clay, fine to medium sand

General Characteristics

Moisture Content = 27.2%

Atterberg Limits

LL= 34 PL= 23 PI= 11

Coefficients

D_{85}= 0.359 D_{60}= 0.022 D_{50}= 0.015
D_{30}= 0.007 D_{15}= 0.002 D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 8

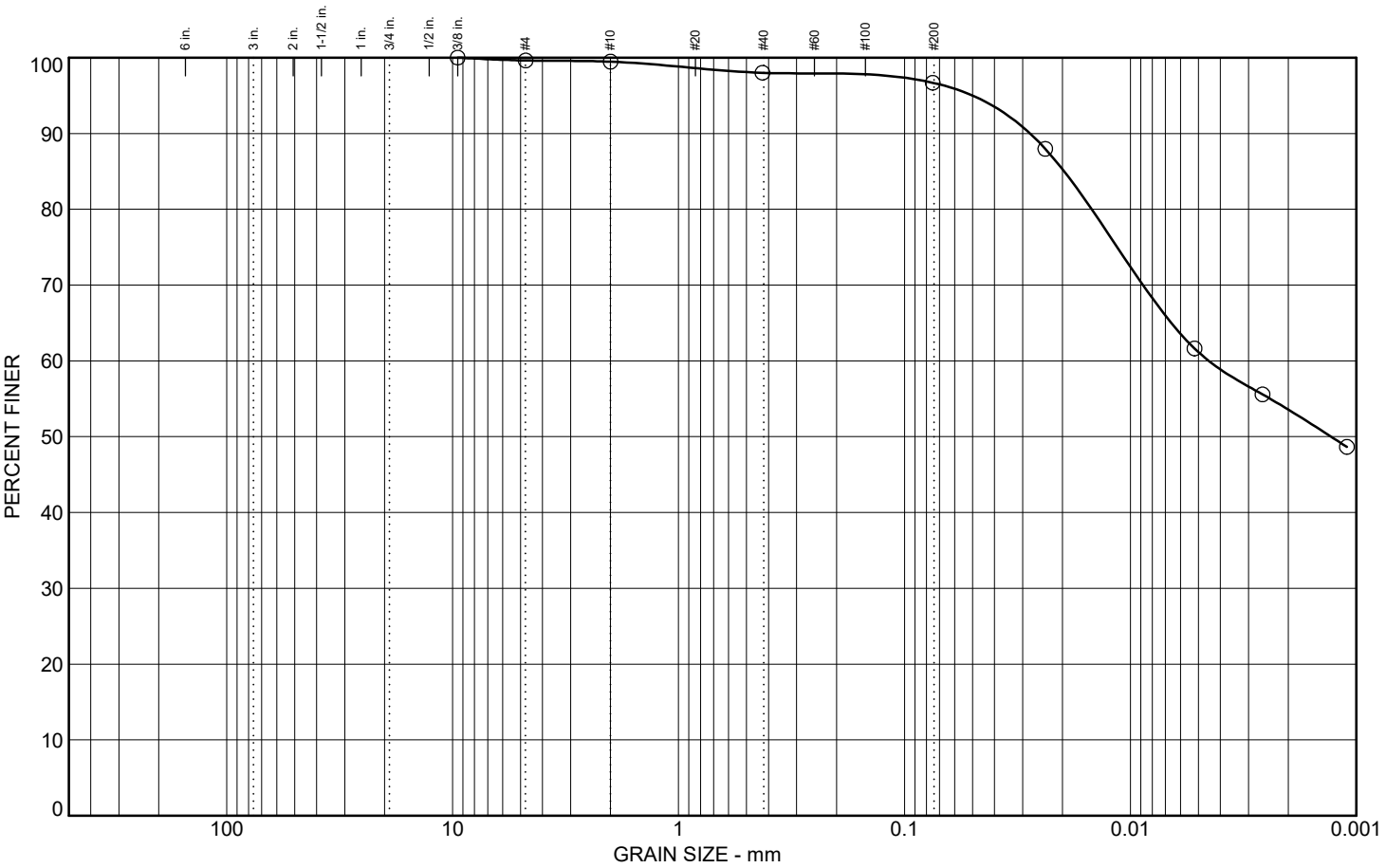
Sample No.: **Source of Sample:** B-09 **Date:**
Location: - **Depth / Elev:** 3.5' / 857.28'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.4	0.2	1.5	1.3		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.6		
2	99.5		
0.425	98.0		
0.075	96.7		

* SPECIFICATION :

Soil Description

high plasticity clay

General Characteristics

Moisture Content = 32.1%

Atterberg Limits

LL= 59 PL= 21 PI= 38

Coefficients

D_{85}= 0.02 D_{60}= 0.004 D_{50}= 0.001
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 41

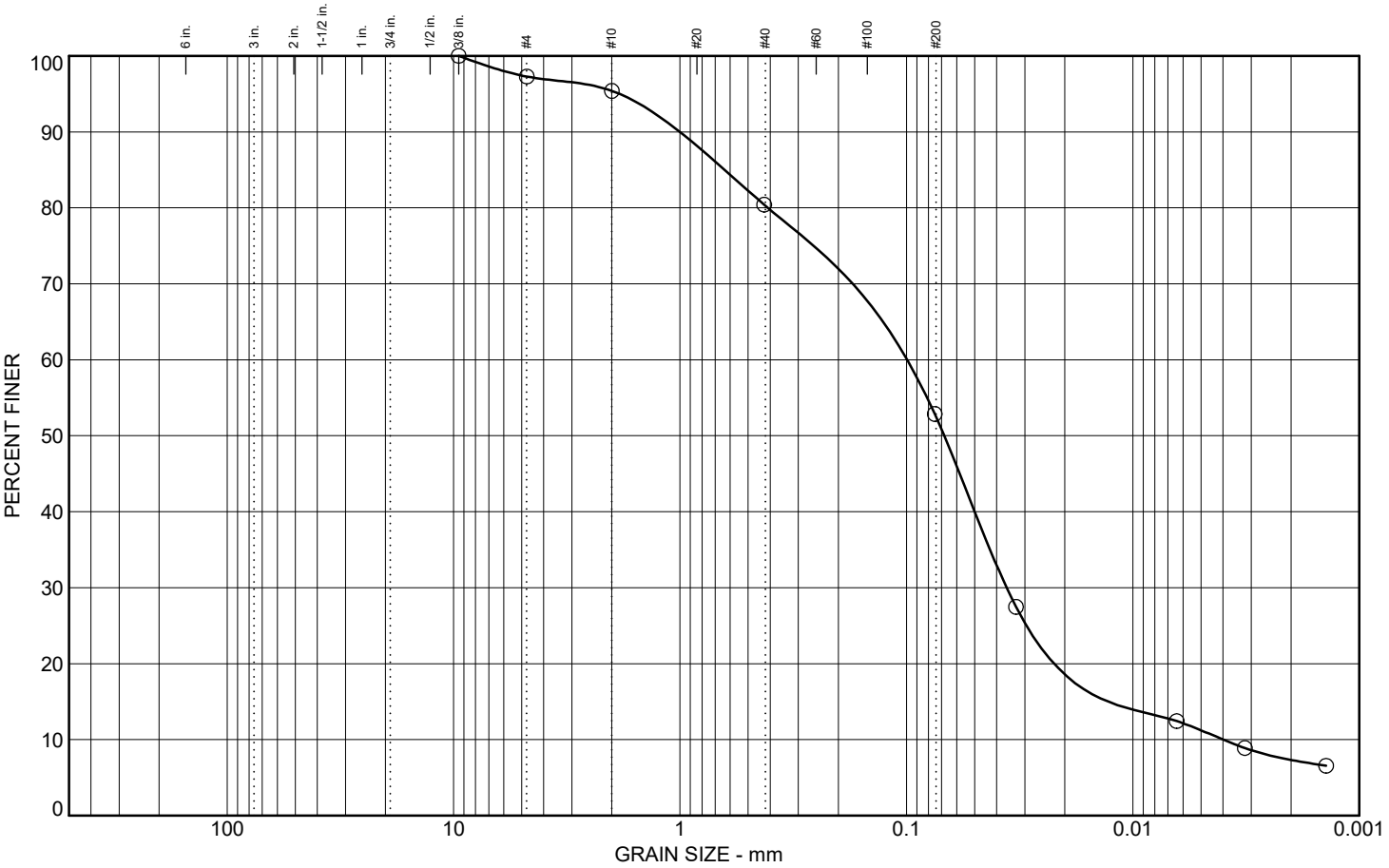
Sample No.: **Source of Sample:** B-09 **Date:**
Location: - **Depth / Elev:** 8.5' / 852.28'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	2.7	1.9	15.0	27.5		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	97.3		
2	95.4		
0.425	80.4		
0.075	52.9		

* SPECIFICATION :

Soil Description

non-plastic silt, fine to medium sand

General Characteristics

Moisture Content = %

Atterberg Limits

LL= 0 PL= 0 PI= 0

Coefficients

D_{85}= 0.683 D_{60}= 0.118 D_{50}= 0.068
D_{30}= 0.036 D_{15}= 0.008 D_{10}= 0.004
C_u= 29.58 C_c= 2.72

Classification

USCS = ML AASHTO = A-4

Remarks

Group Index = 0

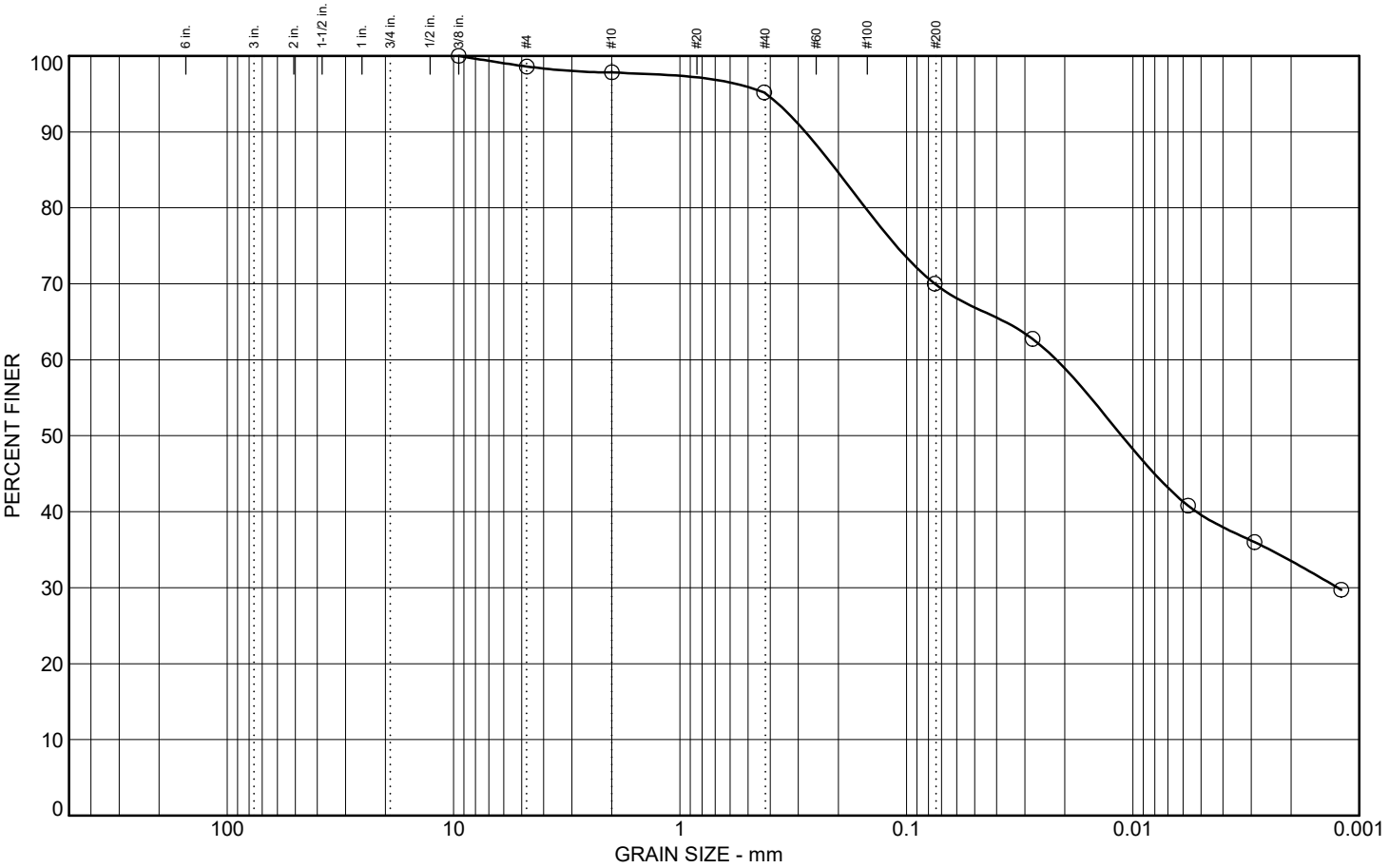
Sample No.: **Source of Sample:** B-09 **Date:**
Location: - **Depth / Elev:** 13.5' / 847.28'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	1.4	0.8	2.6	25.2		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	98.6		
2	97.8		
0.425	95.2		
0.075	70.0		

* SPECIFICATION :

Soil Description

moderate plasticity clay, fine sand

General Characteristics

Moisture Content = 27.0%

Atterberg Limits

LL= 45 PL= 16 PI= 29

Coefficients

D_{85}= 0.211 D_{60}= 0.023 D_{50}= 0.011
D_{30}= 0.001 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-7-6

Remarks

Group Index = 18

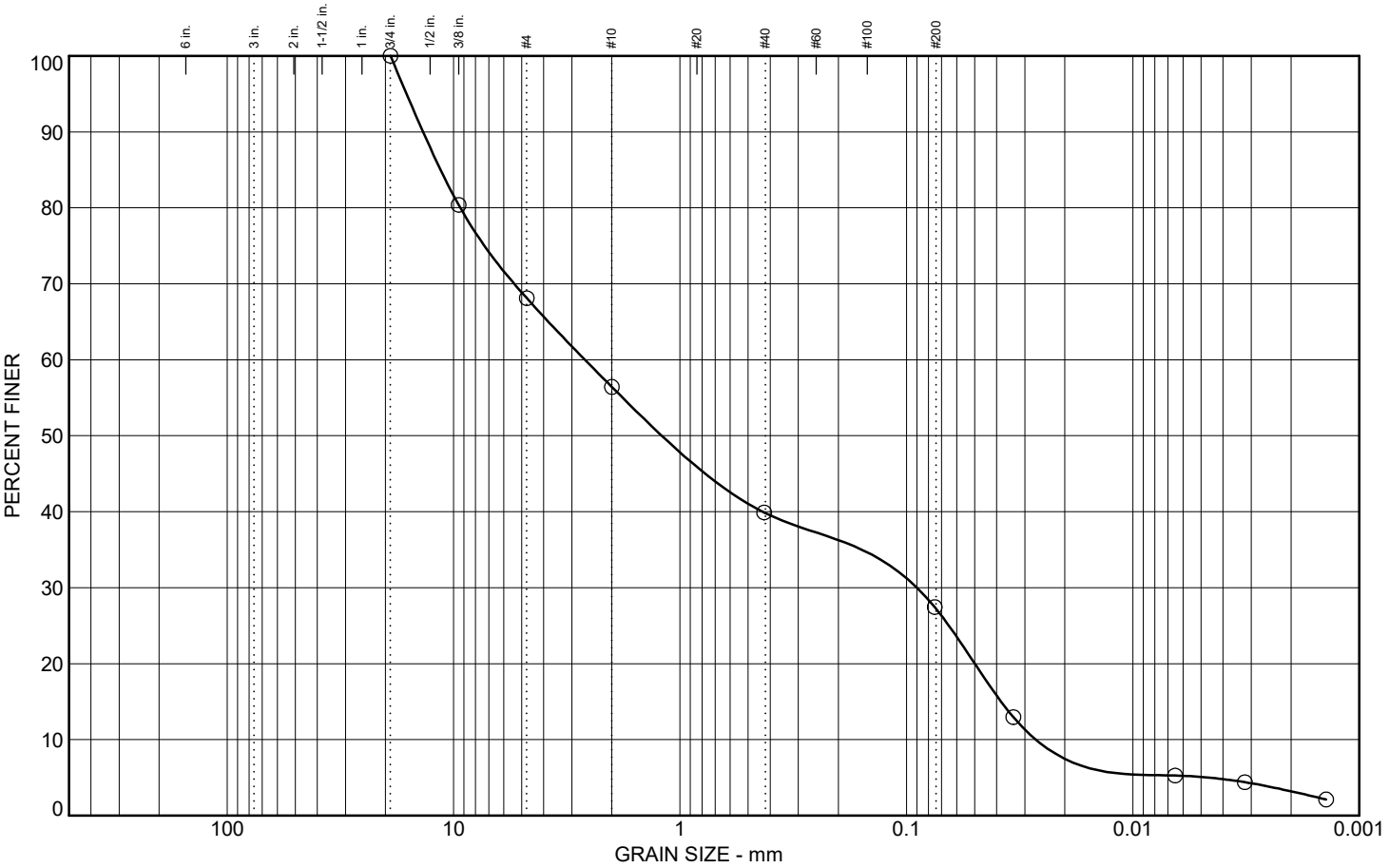
Sample No.: **Source of Sample:** B-10 **Date:**
Location: - **Depth / Elev:** 3.5' / 861.2'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	31.9	11.7	16.5	12.5		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19	100.0		
9.5	80.4		
4.75	68.1		
2	56.4		
0.425	39.9		
0.075	27.4		

* SPECIFICATION :

Soil Description

fine to medium sand, non-plastic silt, fine gravel

General Characteristics

Moisture Content = 1.9%

Atterberg Limits

LL= 0 PL= 0 PI= 0

Coefficients

D_{85}= 11.182 D_{60}= 2.607 D_{50}= 1.095
D_{30}= 0.107 D_{15}= 0.038 D_{10}= 0.018
C_u= 145.92 C_c= 0.25

Classification

USCS = SM AASHTO = A-2-4

Remarks

Group Index = 0

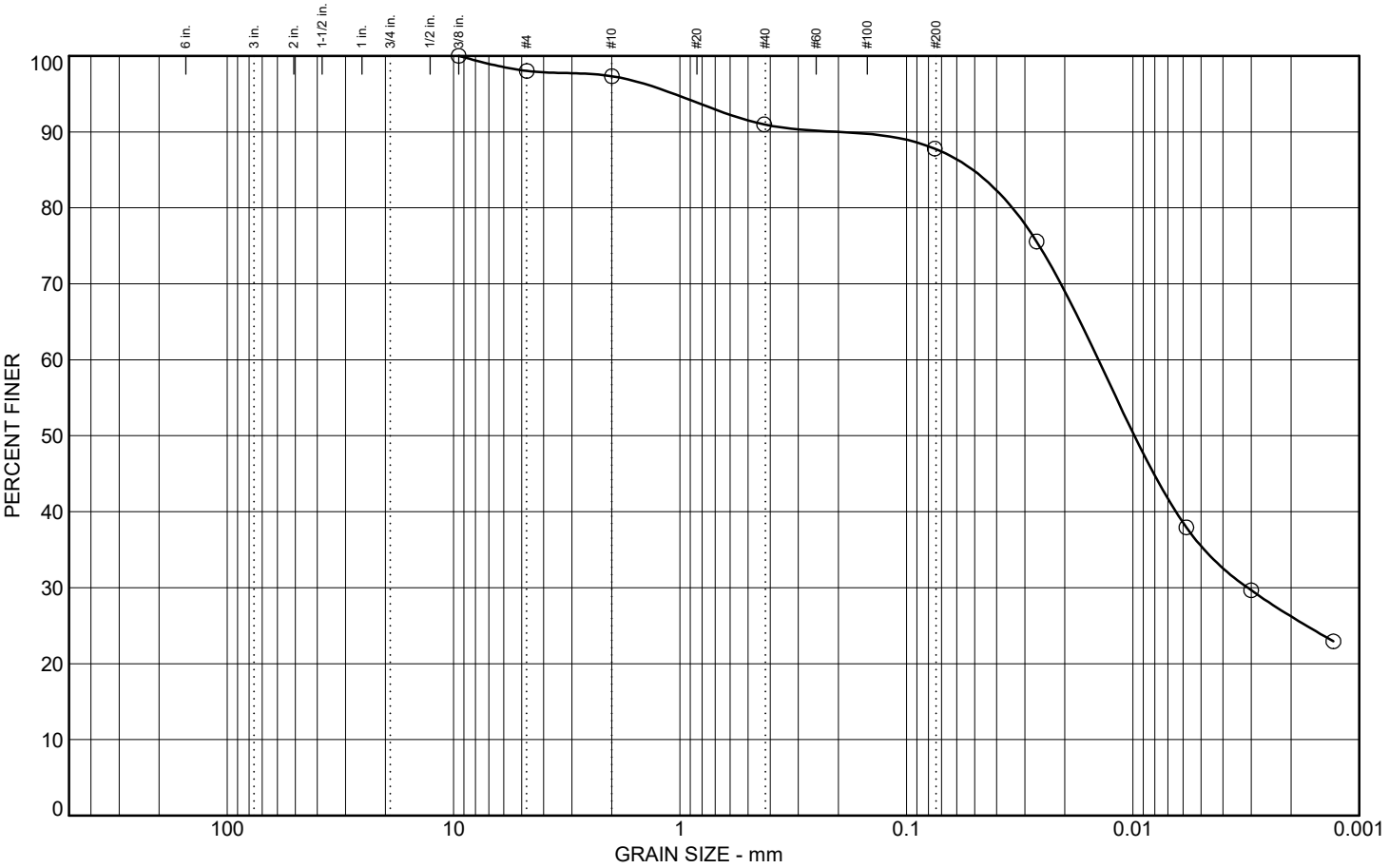
Sample No.: **Source of Sample:** B-10 **Date:**
Location: - **Depth / Elev:** 8.5' / 856.2'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	2.0	0.7	6.3	3.2		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	98.0		
2	97.3		
0.425	91.0		
0.075	87.8		

* SPECIFICATION :

Soil Description

moderate plasticity clay

General Characteristics

Moisture Content = 19.3%

Atterberg Limits

LL= 35 PL= 20 PI= 15

Coefficients

D_{85}= 0.059 D_{60}= 0.014 D_{50}= 0.009
D_{30}= 0.003 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CL AASHTO = A-6

Remarks

Group Index = 13

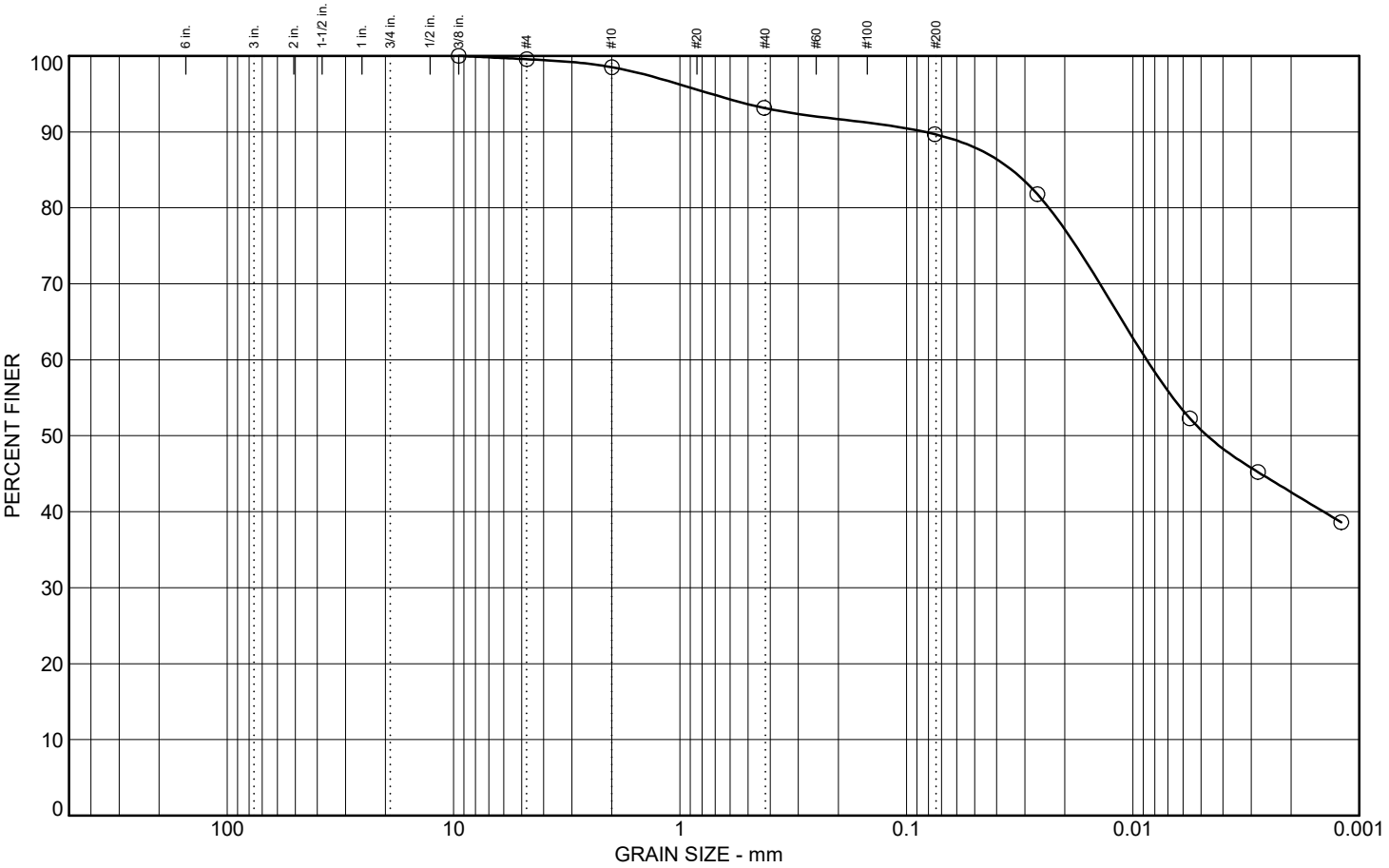
Sample No.: **Source of Sample:** B-32C **Date:**
Location: - **Depth / Elev:** 3.5' / 853.37'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.4	1.1	5.4	3.5		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5	100.0		
4.75	99.6		
2	98.5		
0.425	93.1		
0.075	89.7		

* SPECIFICATION :

Soil Description

high plasticity clay

General Characteristics

Moisture Content = 21.4%

Atterberg Limits

LL= 56 PL= 19 PI= 37

Coefficients

D_{85}= 0.04 D_{60}= 0.008 D_{50}= 0.004
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = CH AASHTO = A-7-6

Remarks

Group Index = 36

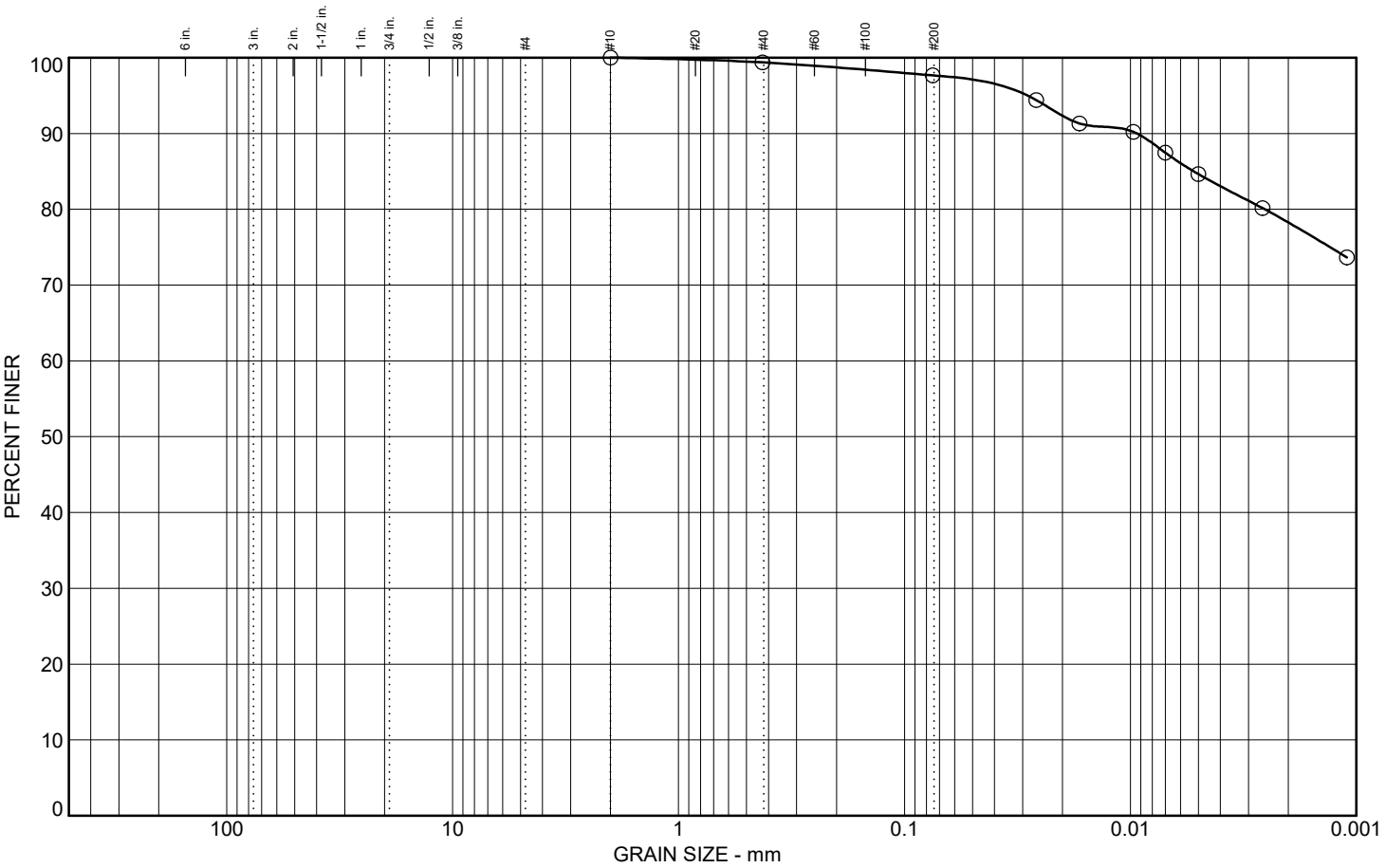
Sample No.: **Source of Sample:** B-32C **Date:**
Location: - **Depth / Elev:** 8.5' / 848.37'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.6	1.7		

SIEVE SIZE (mm)	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
0.425	99.4		
0.075	97.7		

* SPECIFICATION :

Soil Description

high plasticity silt

General Characteristics

Moisture Content = 58.9%

Atterberg Limits

LL= 74 PL= 49 PI= 25

Coefficients

D_{85}= 0.005 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS = MH AASHTO = A-7-5

Remarks

Group Index = 36

Sample No.: **Source of Sample:** B-32C **Date:**
Location: - **Depth / Elev:** 13.5' / 843.37'

DLZ

Client:
Project:
Project No: **Figure**

GRAIN SIZE II - DLZ MOD - DLZ TEMPLATE VER 2-2.GDT - 1/31/25 11:39 - X:\SHARED\DISCIPLINE\GEOTECH\GINT_COLUMBUS\PROJECTS\0631-0006.02 CSX OLDHAM CO. RUNAROUND.GPJ

Summary of Laboratory Test Results - Index Properties

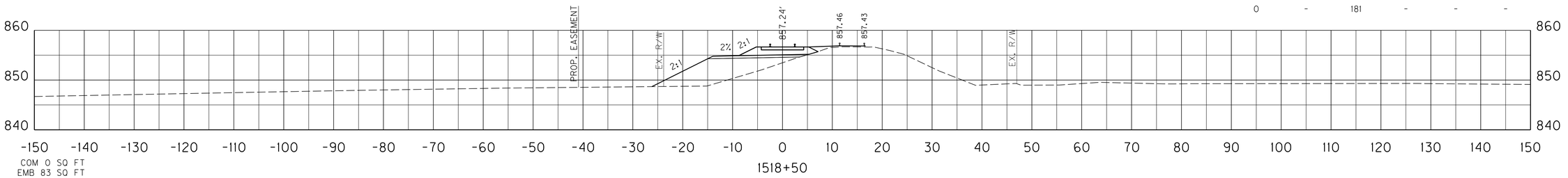
Boring Number	Sample Number	Depth (feet)	USCS Class.	AASHTO Class.	N Value	N60 Value	% AGG	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	LL	PL	PI	Moisture Content %	Liquidity Index	Soil Activity
B-03	S-1	3.5	SM	A-4 (0)	1	1	10.2	5.1	19.3	17.6	39.3	8.5	25	24	1	32.2	8.18	0.12
B-03	ST-1	6	--	--	--	--	--	--	--	--	--	--	--	--	--	27.6	--	--
B-03	S-2	8.5	CL	A-6 (18)	11	14	0.1	0.4	4.3	3.9	58.8	32.5	37	17	20	22.8	0.29	0.62
B-03	S-3	13.5	CH	A-7-6 (55)	11	14	0.4	0.0	0.1	1.2	34.7	63.6	71	22	49	29.1	0.15	0.77
B-03	S-4	18.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	27.2	--	--
B-04	S-1	3.5	CL	A-6 (12)	15	19	0.5	0.0	3.0	2.7	72.1	21.8	33	20	13	12.6	-0.57	0.60
B-04	S-2	8.5	--	--	17	21	--	--	--	--	--	--	--	--	--	19.0	--	--
B-04	S-3	13.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	7.0	--	--
B-05	S-1	3.5	CL	A-6 (17)	19	24	0.7	0.6	3.9	5.7	60.3	28.8	37	18	19	14.9	-0.16	0.66
B-05	ST-1	6	--	--	--	--	--	--	--	--	--	--	--	--	--	17.0	--	--
B-05	S-2	8.5	CH	A-7-6 (36)	18	22	2.8	0.1	1.1	1.9	44.4	49.7	54	19	35	22.1	0.09	0.70
B-05	S-3	13.5	SM	A-2-4 (0)	17	21	19.4	4.5	10.6	44.9	18.7	1.9	0	0	0	13.6	--	--
B-06	S-1	3.5	CL	A-6 (10)	16	20	0.0	0.2	8.9	4.8	66.1	19.9	31	18	13	14.6	-0.26	0.65
B-06	S-2	8.5	CL	A-6 (15)	11	14	0.0	0.0	2.7	2.8	65.5	28.9	36	21	15	22.0	0.06	0.52
B-06	S-3	13.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	11.5	--	--
B-07	S-1	3.5	--	--	15	19	--	--	--	--	--	--	--	--	--	14.4	--	--
B-07	ST-1	6	--	--	--	--	--	--	--	--	--	--	--	--	--	22.2	--	--
B-07	S-2	8.5	CH	A-7-6 (42)	10	12	22.7	2.0	3.4	1.8	22.7	47.5	84	24	60	25.1	0.02	1.26
B-07	S-3	13.5	SM	A-2-4 (0)	9	11	0.0	0.0	9.4	71.8	15.9	2.9	0	0	0	20.2	--	--
B-07	S-4	18.5	--	--	73	91	--	--	--	--	--	--	--	--	--	15.2	--	--
B-07	S-5	22.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	--	--	--
B-08	S-1	3.5	CL	A-7-6 (13)	10	12	10.9	4.3	12.0	5.7	43.5	23.7	41	19	22	20.7	0.08	0.93
B-08	S-2	8.5	CH	A-7-6 (50)	9	11	0.0	0.0	1.6	2.6	32.1	63.7	69	23	46	42.8	0.43	0.72
B-08	S-3	13.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	10.9	--	--
B-09	S-1	3.5	CL	A-6 (8)	8	10	8.2	2.6	3.5	7.2	64.7	13.8	34	23	11	32.1	0.83	0.80
B-09	S-2	8.5	CH	A-7-6 (41)	8	10	0.4	0.2	1.5	1.3	43.2	53.5	59	21	38	27.2	0.16	0.71
B-09	S-3	13.5			50+	50+											--	--
B-10	S-1	3.5	CL	A-7-6 (18)	6	7	1.4	0.8	2.6	25.2	36.7	33.4	45	16	29	27.0	0.38	0.87
B-10	S-2	8.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	--	--	--
B-11	S-1	3.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	5.1	--	--
B-12	S-1	3.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	22.7	--	--
B-32C	S-1	3.5	CL	A-6 (13)	9	11	2.0	0.7	6.3	3.2	61.4	26.4	35	20	15	19.3	-0.05	0.57
B-32C	S-2	8.5	CH	A-7-6 (36)	18	22	0.4	1.1	5.4	3.5	47.1	42.6	56	19	37	21.4	0.07	0.87
B-32C	S-3	13.5	MH	A-7-5 (36)	5	6	0.0	0.0	0.6	1.7	19.5	78.2	74	49	25	58.9	0.39	0.32
B-32C	S-4	18.5	--	--	50+	50+	--	--	--	--	--	--	--	--	--	3.4	--	--
Minimum moisture content,%=			3.4			Maximum moisture content,%=			58.9	Average moisture content,%=			20.73					

Appendix III

Cross-sections
Calculations

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	X47

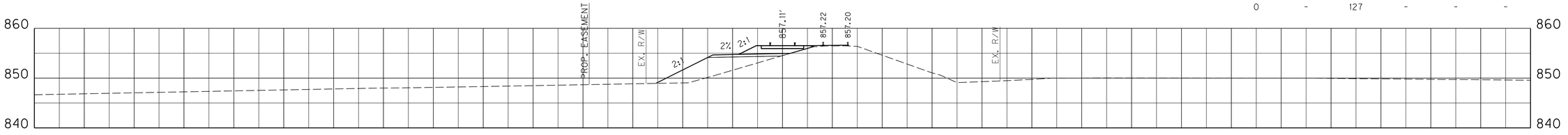
COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
0	-	181	-	-	-



COM 0 SQ FT
EMB 83 SQ FT

1518+50

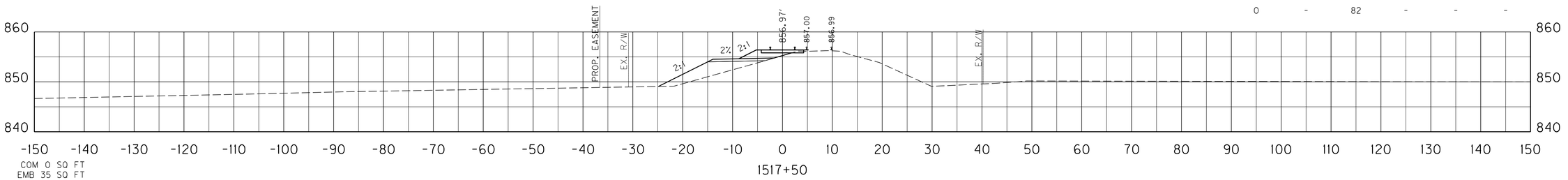
COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
0	-	127	-	-	-



COM 0 SQ FT
EMB 54 SQ FT

1518+00

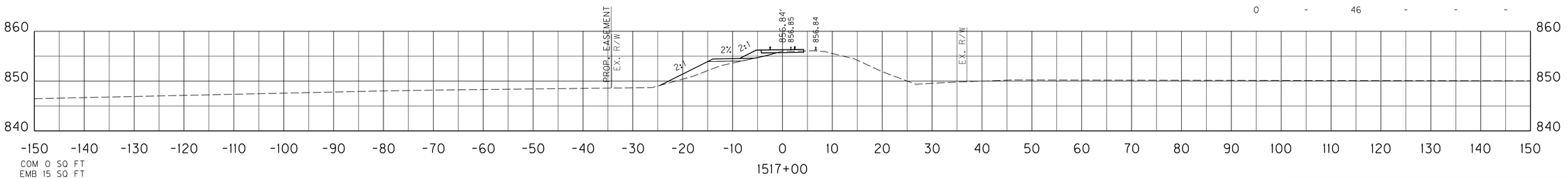
COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
0	-	82	-	-	-



COM 0 SQ FT
EMB 35 SQ FT

1517+50

COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
0	-	46	-	-	-



COM 0 SQ FT
EMB 15 SQ FT

1517+00

SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CSX RUNAROUND
STA.1517+00 TO STA.1518+50

FILE NAME: X:\PROJECTS\LEX\PROJ\063I\0006 OLDHAM COUNTY OVERPASS-UNDERPASS\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\CONTRACT PLAN SHEET\R

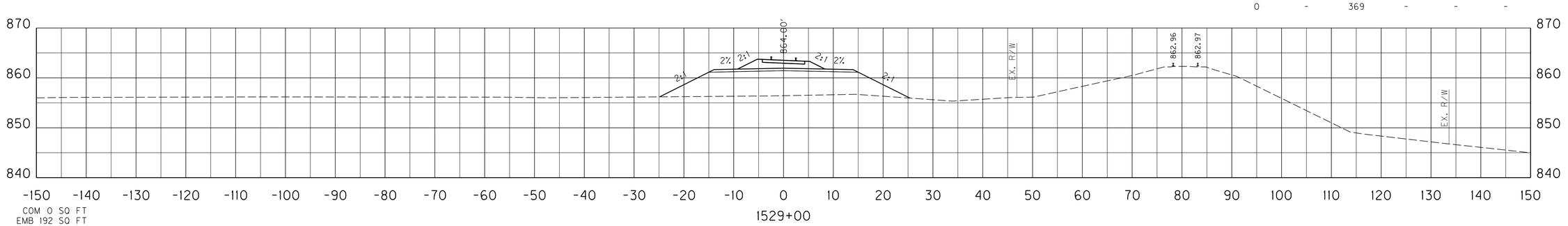
USER: lstoggs
DATE PLOTTED: November 13, 2019

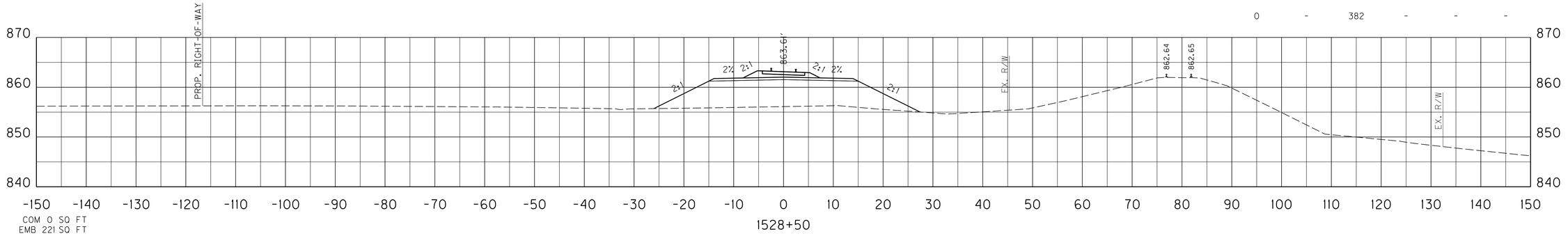
E-SHEET NAME: X0470OXS

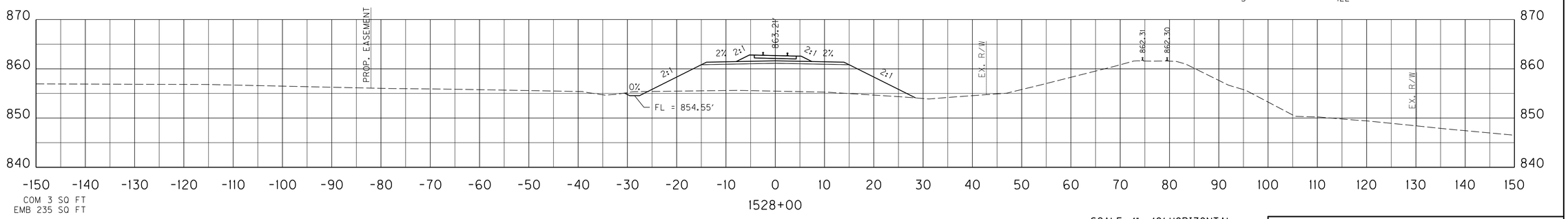
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	X54

	COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
1529+00	0	-	369	-	-	-
1528+50	0	-	382	-	-	-
1528+00	3	-	422	-	-	-







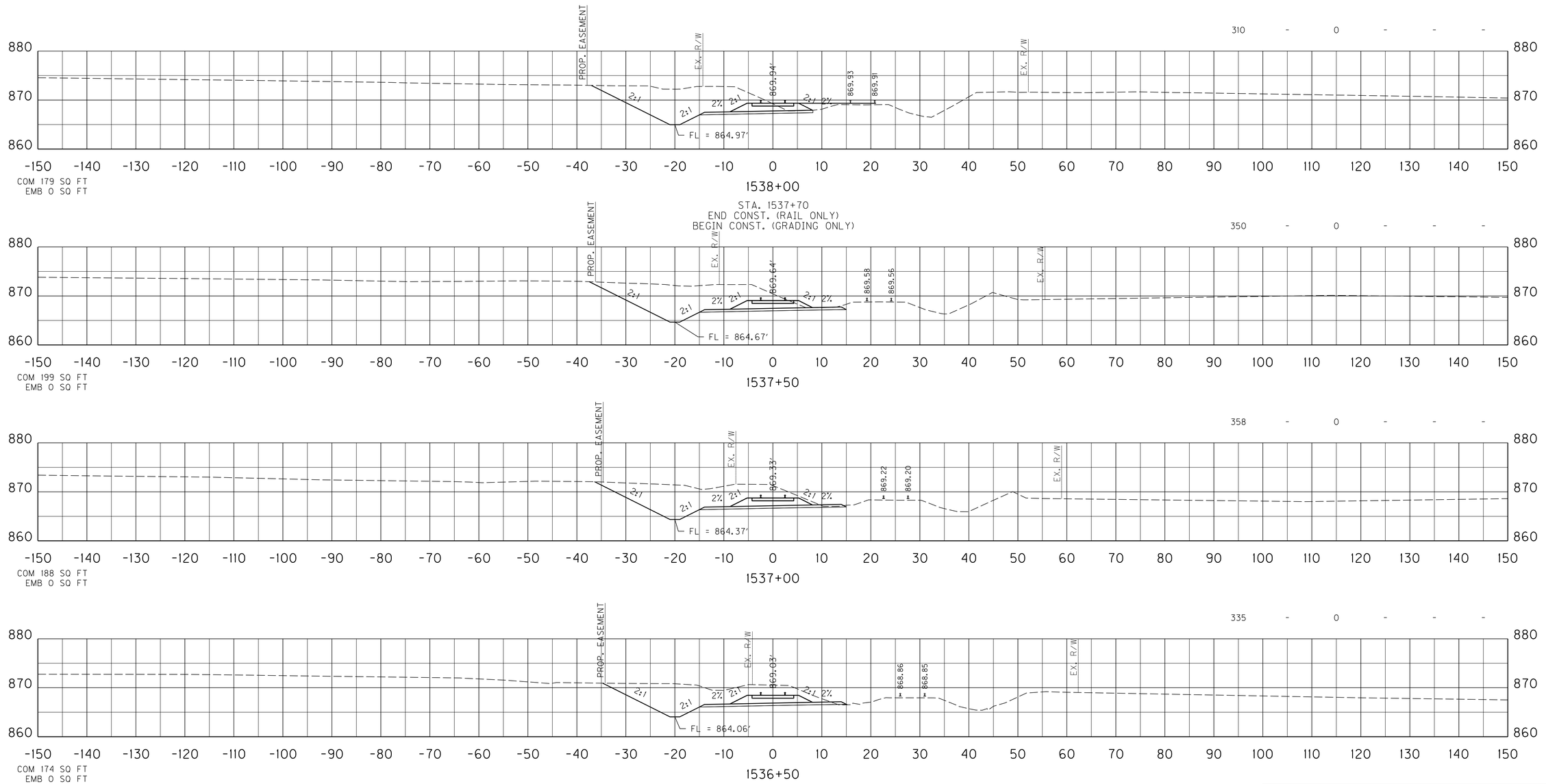
SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CSX RUNAROUND
STA.1528+00 TO STA.1529+00

FILE NAME: X:\PROJECTS\LEX\PROJ\063I\0006 OLDHAM COUNTY OVERPASS-UNDERPASS\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\CONTRACT PLAN SHEET\RU
USER: lstaggs
DATE PLOTTED: November 13, 2019
E-SHEET NAME: X05400XS
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	X58

	COM	ROCK	EMB	BENCH	DT. LT.	DT. RT.
1538+00	310	-	0	-	-	-
1537+50	350	-	0	-	-	-
1537+00	358	-	0	-	-	-
1536+50	335	-	0	-	-	-



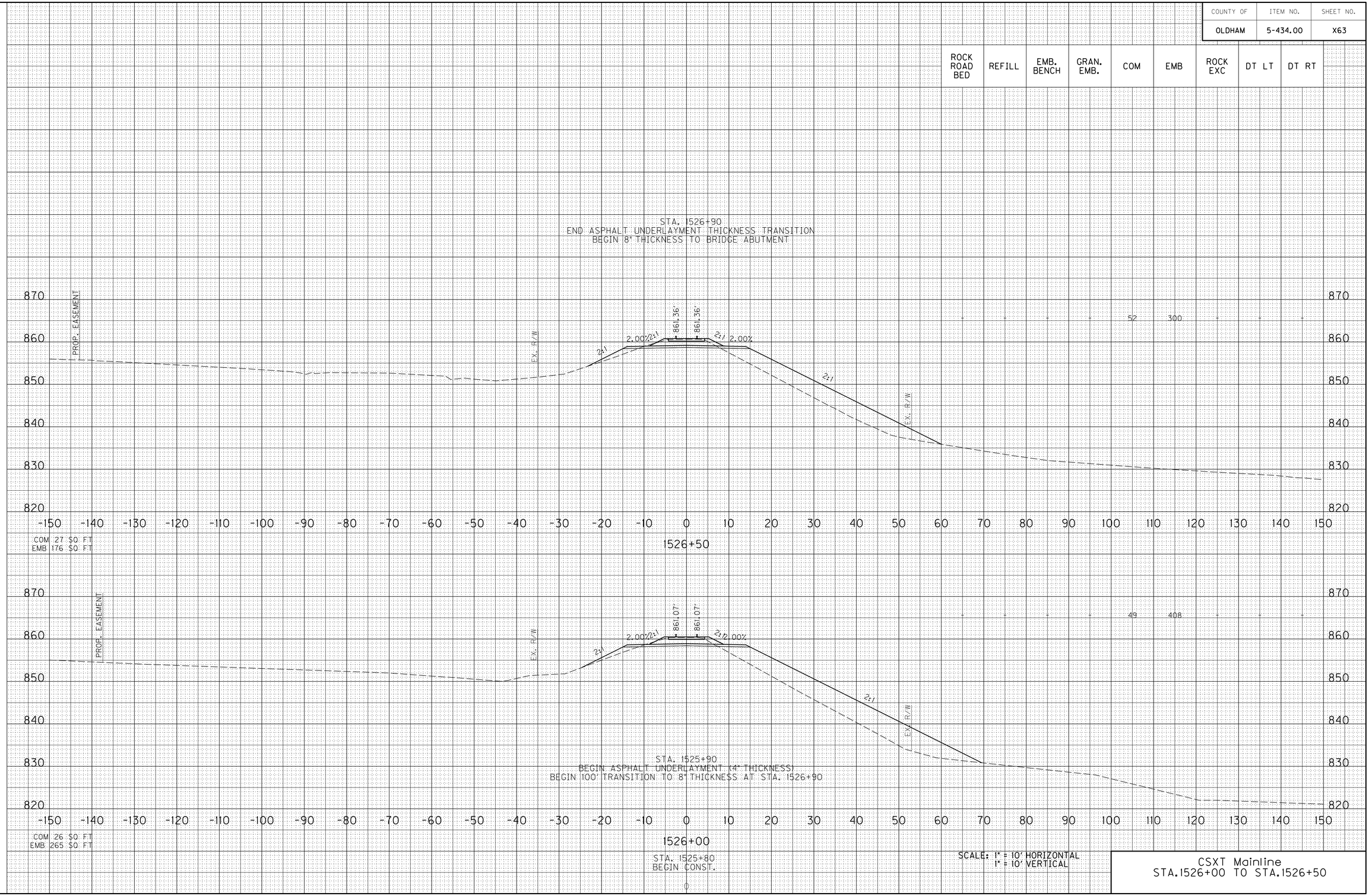
SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CSX RUNAROUND
STA.1536+50 TO STA.1538+00

FILE NAME: X:\PROJECTS\LEX\PROJ\063I\0006 OLDHAM COUNTY OVERPASS-UNDERPASS\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\CONTRACT PLAN SHEET\RU
USER: lstoggs
DATE PLOTTED: November 13, 2019
E-SHEET NAME: X0580OXS
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	X63

ROCK ROAD BED	REFILL	EMB. BENCH	GRAN. EMB.	COM	EMB	ROCK EXC	DT LT	DT RT
-	-	-	-	52	300	-	-	-
-	-	-	-	49	408	-	-	-



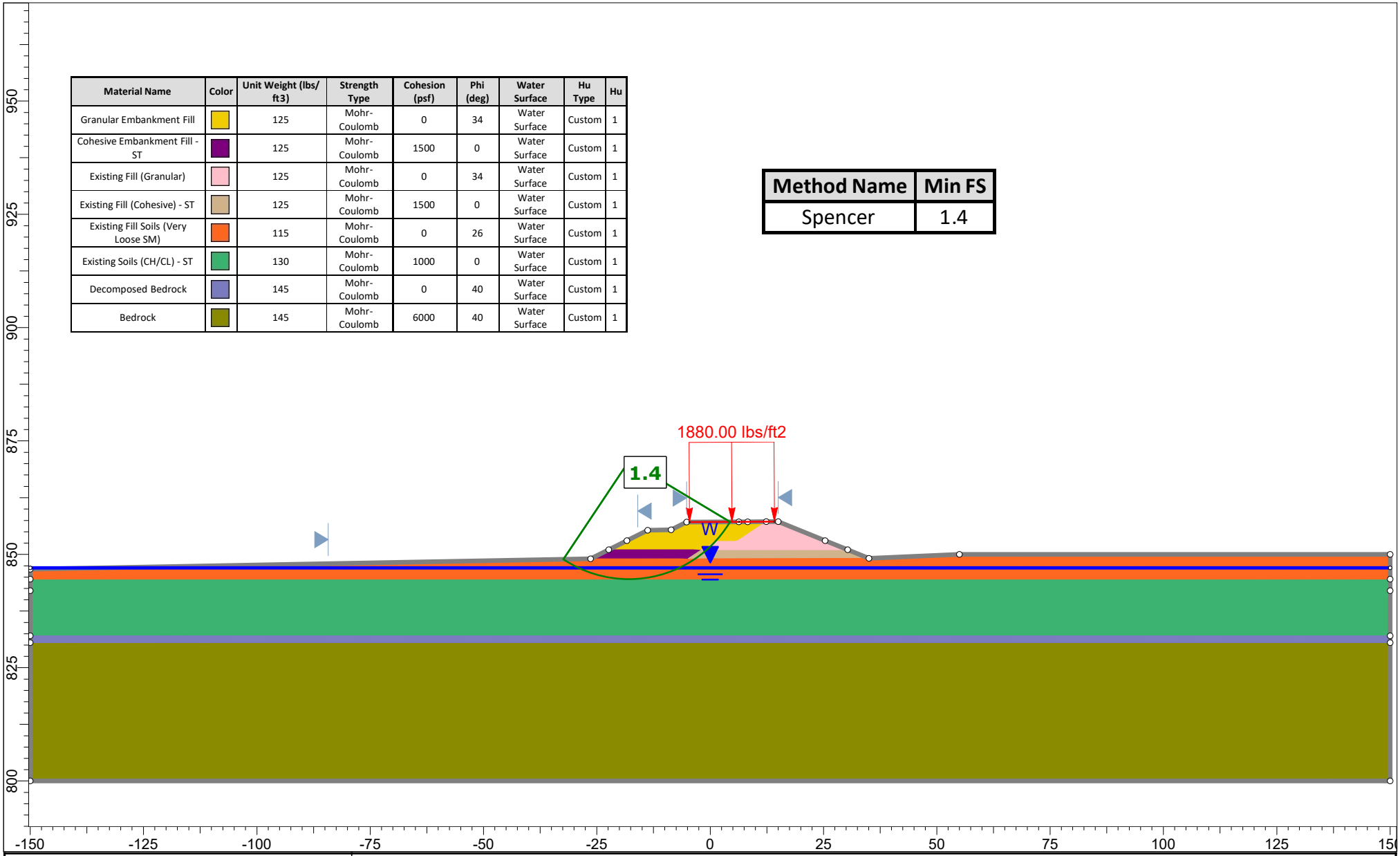
SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CSXT Mainline
STA.1526+00 TO STA.1526+50

MicroStation v8.11.9.832
E-SHEET NAME: X06300XS
USER: lstoggs
DATE PLOTTED: November 13, 2019
FILE NAME: X:\PROJECTS\LEX\PROJ\063\0006 OLDHAM COUNTY OVERPASS-UNDERPASS\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\CONTRACT PLAN SET\R

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Fill Soils (Very Loose SM)		115	Mohr-Coulomb	0	26	Water Surface	Custom	1
Existing Soils (CH/CL) - ST		130	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.4



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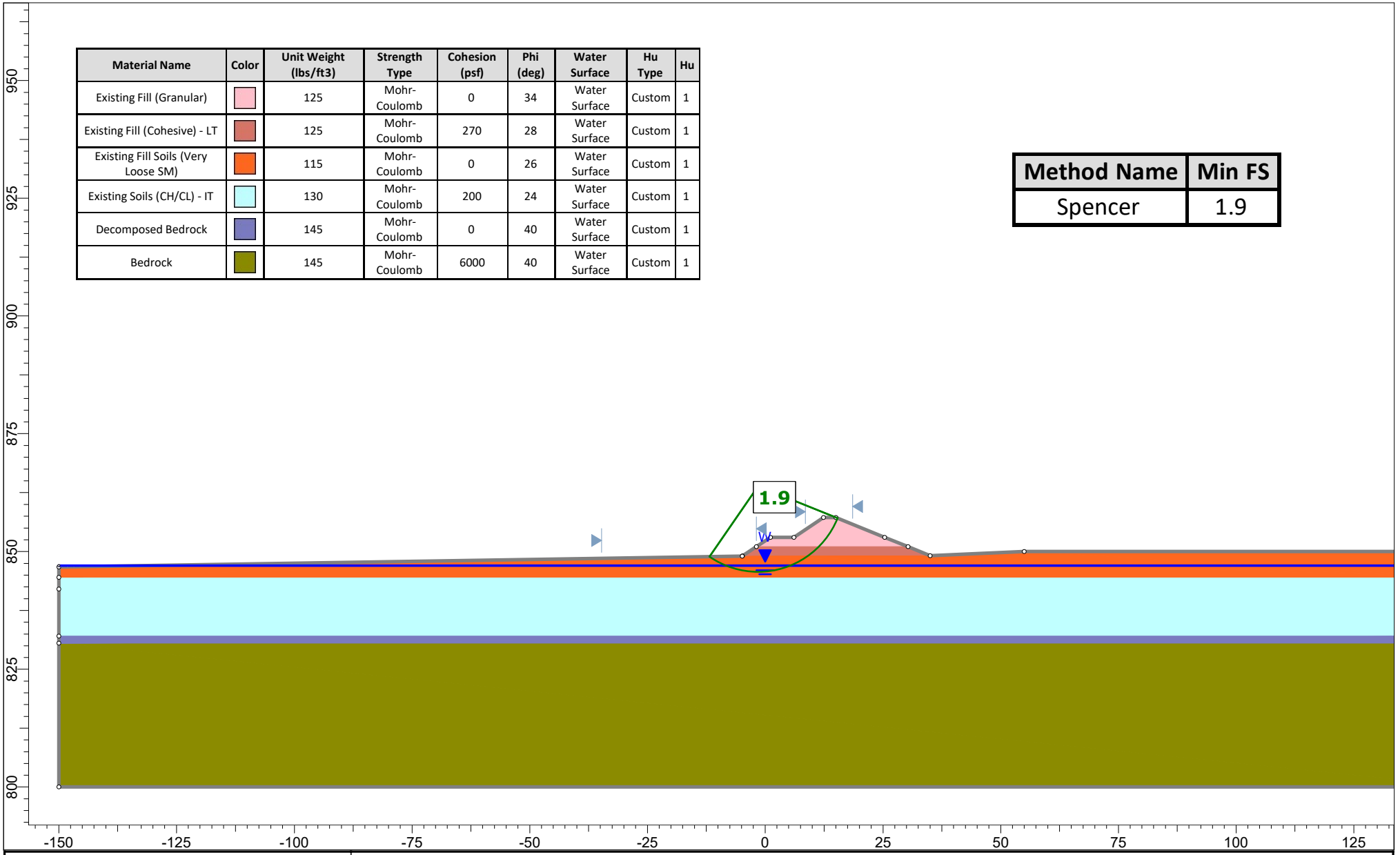
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Short Term (Undrained)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1518+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Existing Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill Soils (Very Loose SM)		115	Mohr-Coulomb	0	26	Water Surface	Custom	1
Existing Soils (CH/CL) - IT		130	Mohr-Coulomb	200	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.9



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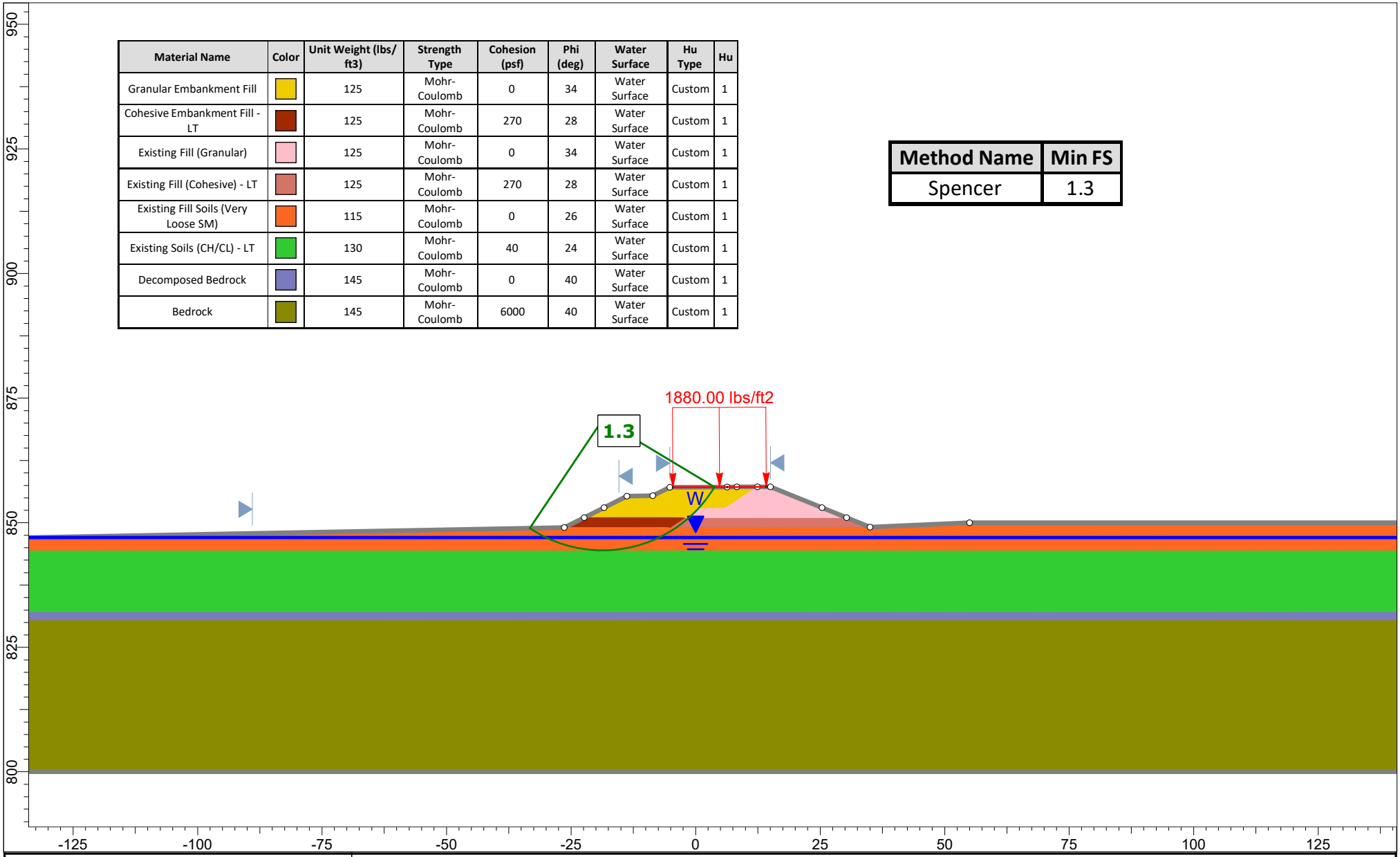
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Intermediate Term	Scenario	Master Scenario
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1518+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill Soils (Very Loose SM)		115	Mohr-Coulomb	0	26	Water Surface	Custom	1
Existing Soils (CH/CL) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.3



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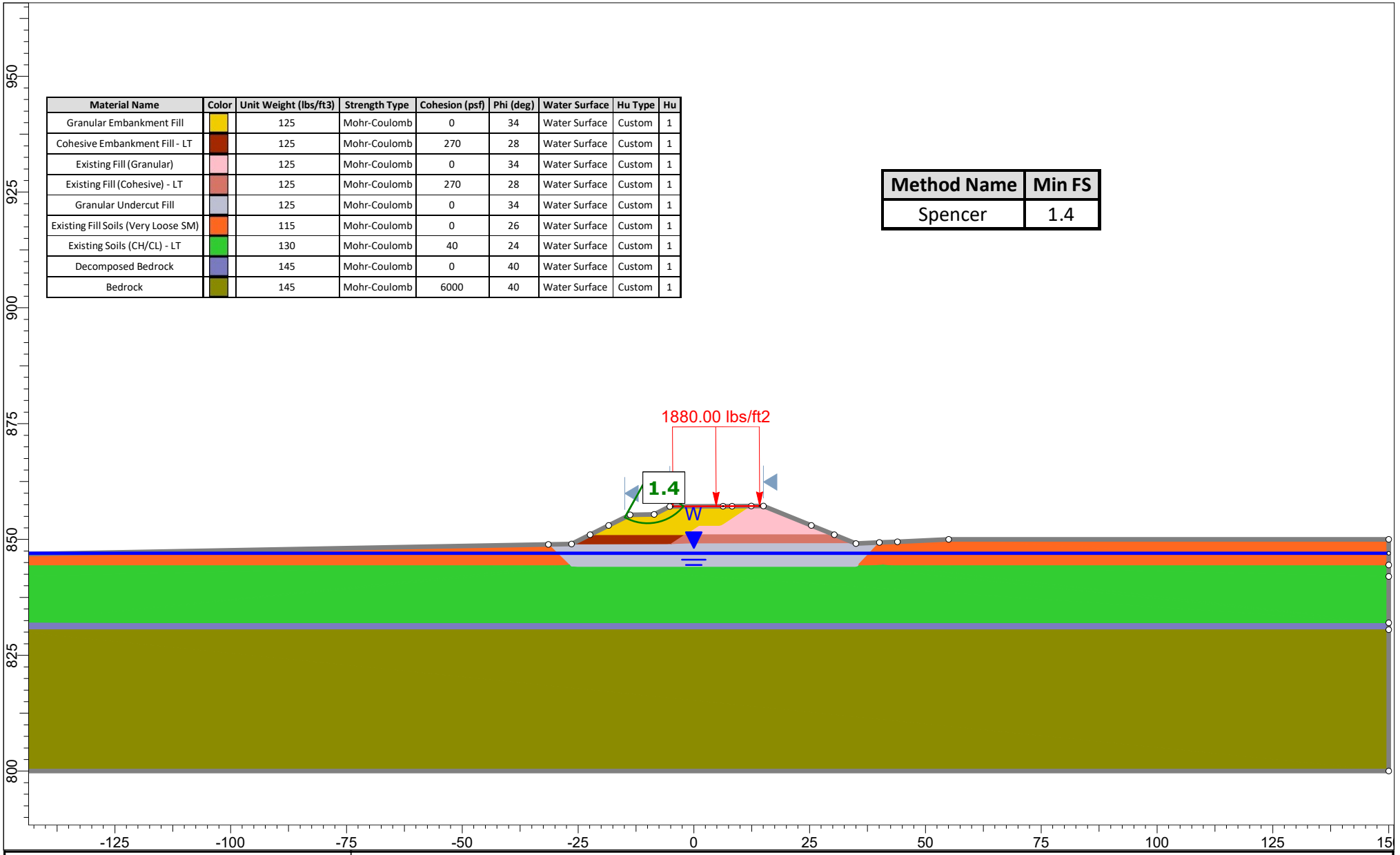
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1518+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Granular Undercut Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Fill Soils (Very Loose SM)		115	Mohr-Coulomb	0	26	Water Surface	Custom	1
Existing Soils (CH/CL) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.4



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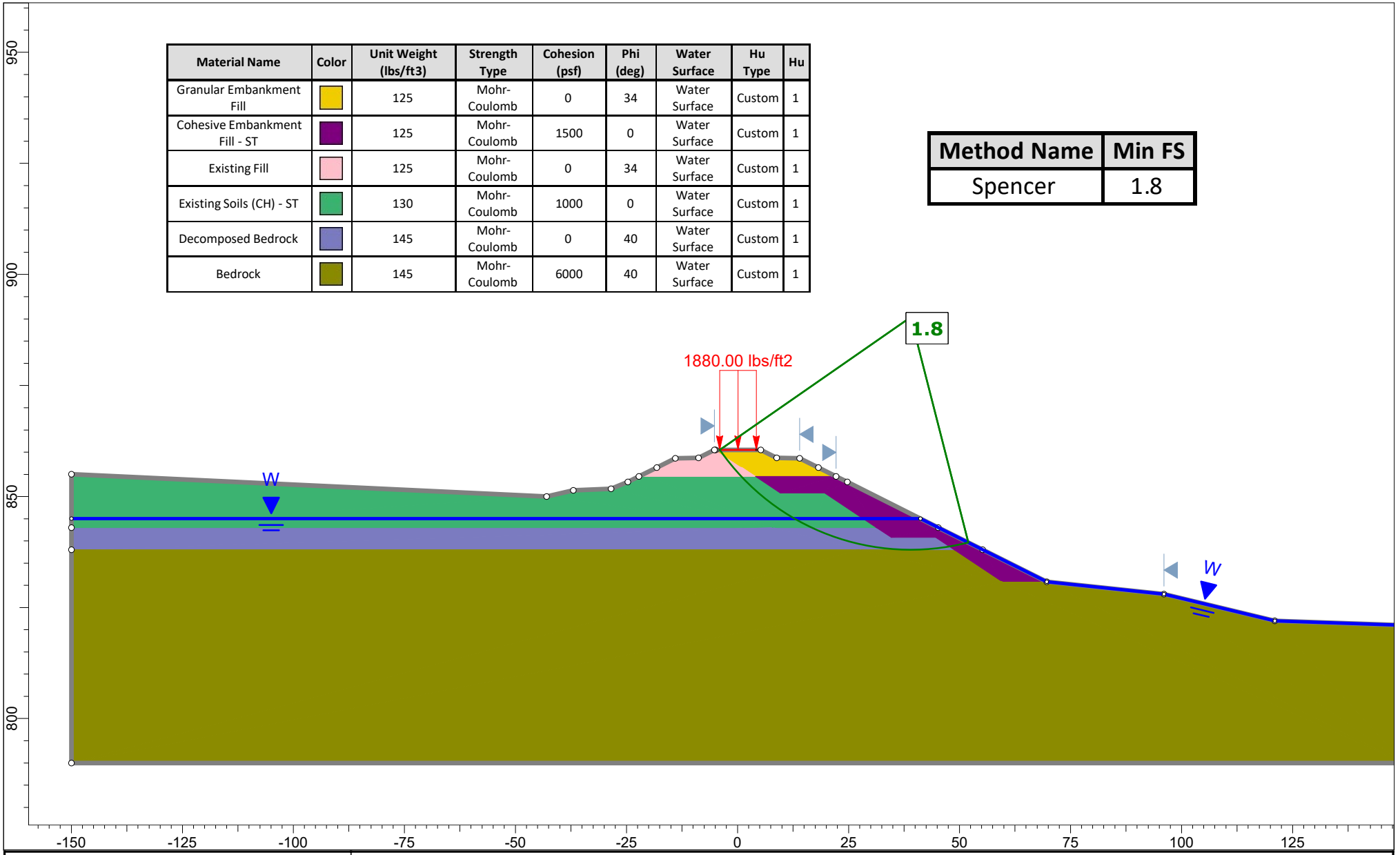
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained, 5 ft Undercut)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1518+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Soils (CH) - ST		130	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.8



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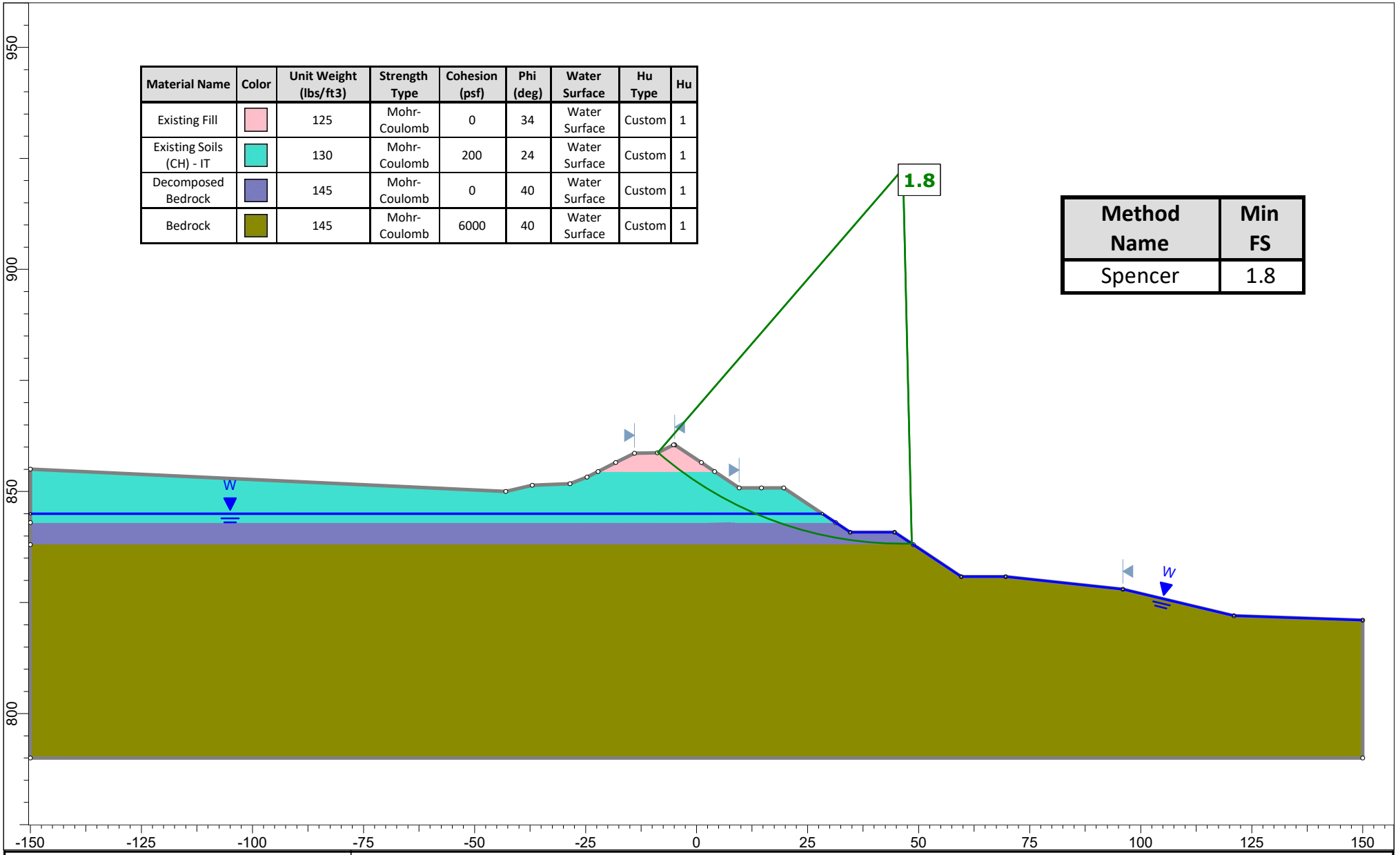
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Short Term (Undrained)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1526+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Existing Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Soils (CH) - IT		130	Mohr-Coulomb	200	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.8



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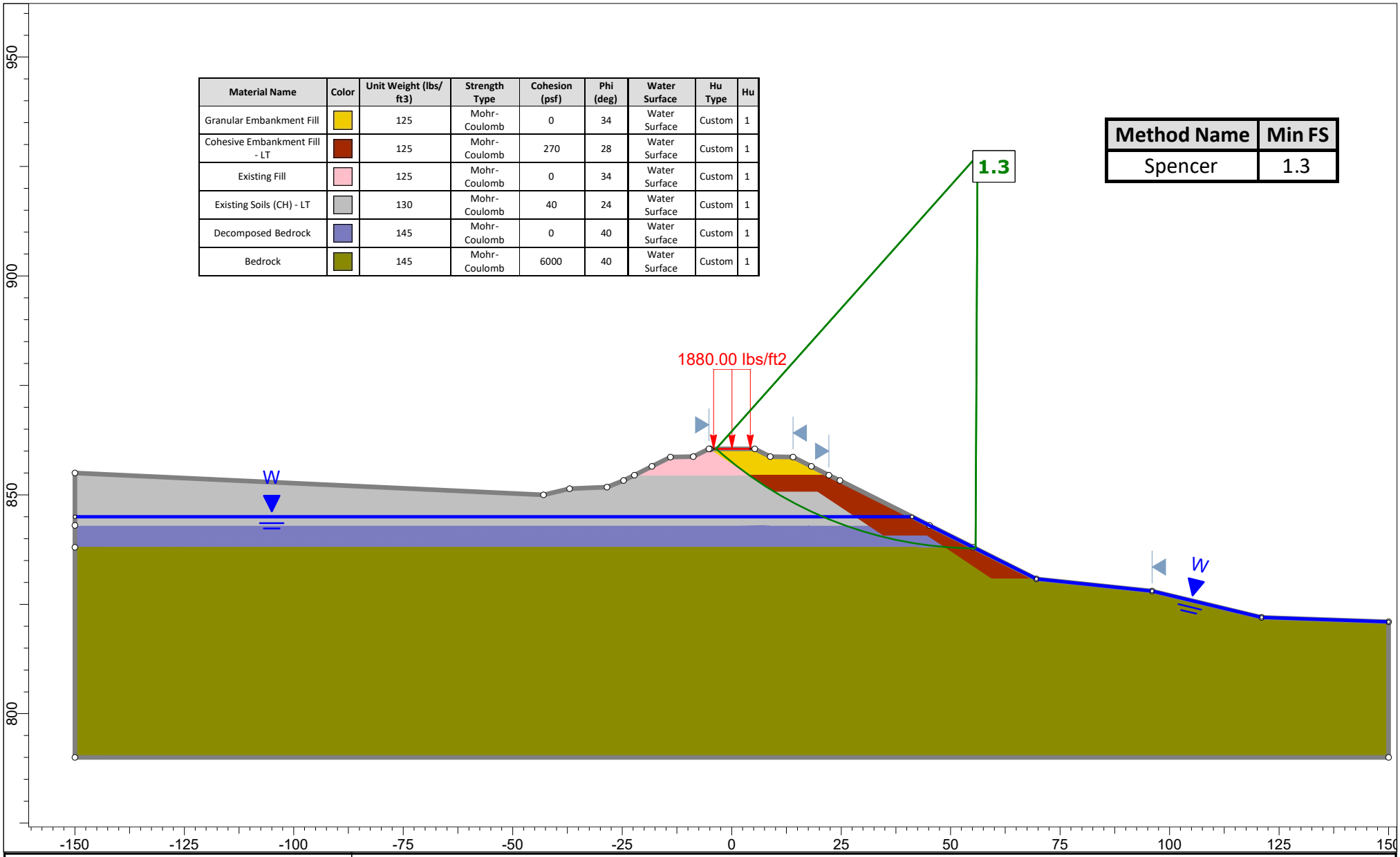
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Intermediate Term	Scenario	Master Scenario
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1526+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Soils (CH) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.3



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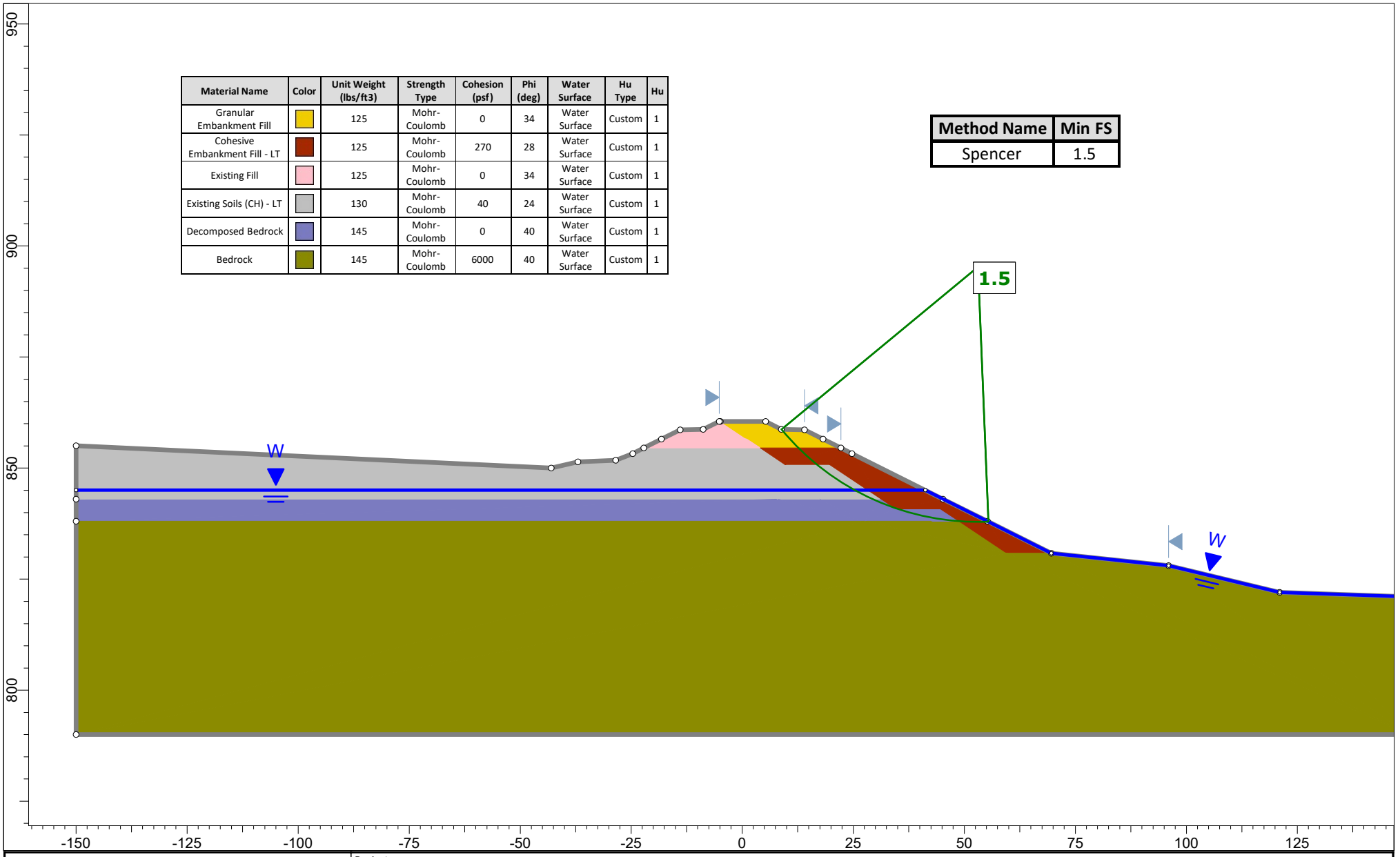
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained)	*Scenario*	Granular Embankment Fill
Drawn By	SEB	*Company*	DLZ
Date	1/27/2025, 1:53:17 PM	*File Name*	Sta. 1526+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Granular Embankment Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Cohesive Embankment Fill - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Existing Soils (CH) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.5



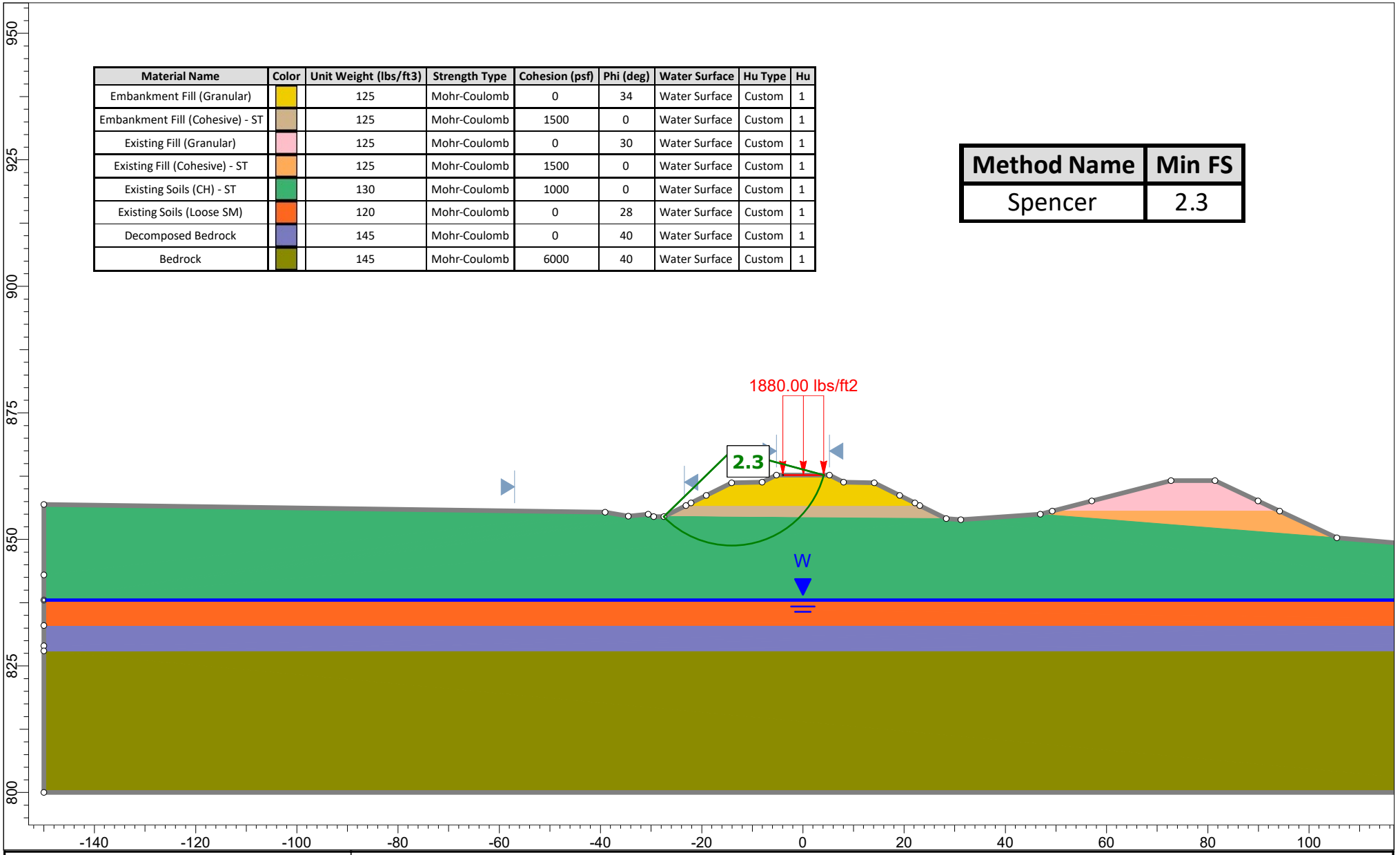
rocscience

SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained)	*Scenario*	Granular Fill (no surcharge)
Drawn By	SEB	*Company*	DLZ
Date	1/27/2025, 1:53:17 PM	*File Name*	Sta. 1526+00 CSX Runaround ET.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Embankment Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Embankment Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	30	Water Surface	Custom	1
Existing Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Soils (CH) - ST		130	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Existing Soils (Loose SM)		120	Mohr-Coulomb	0	28	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	2.3



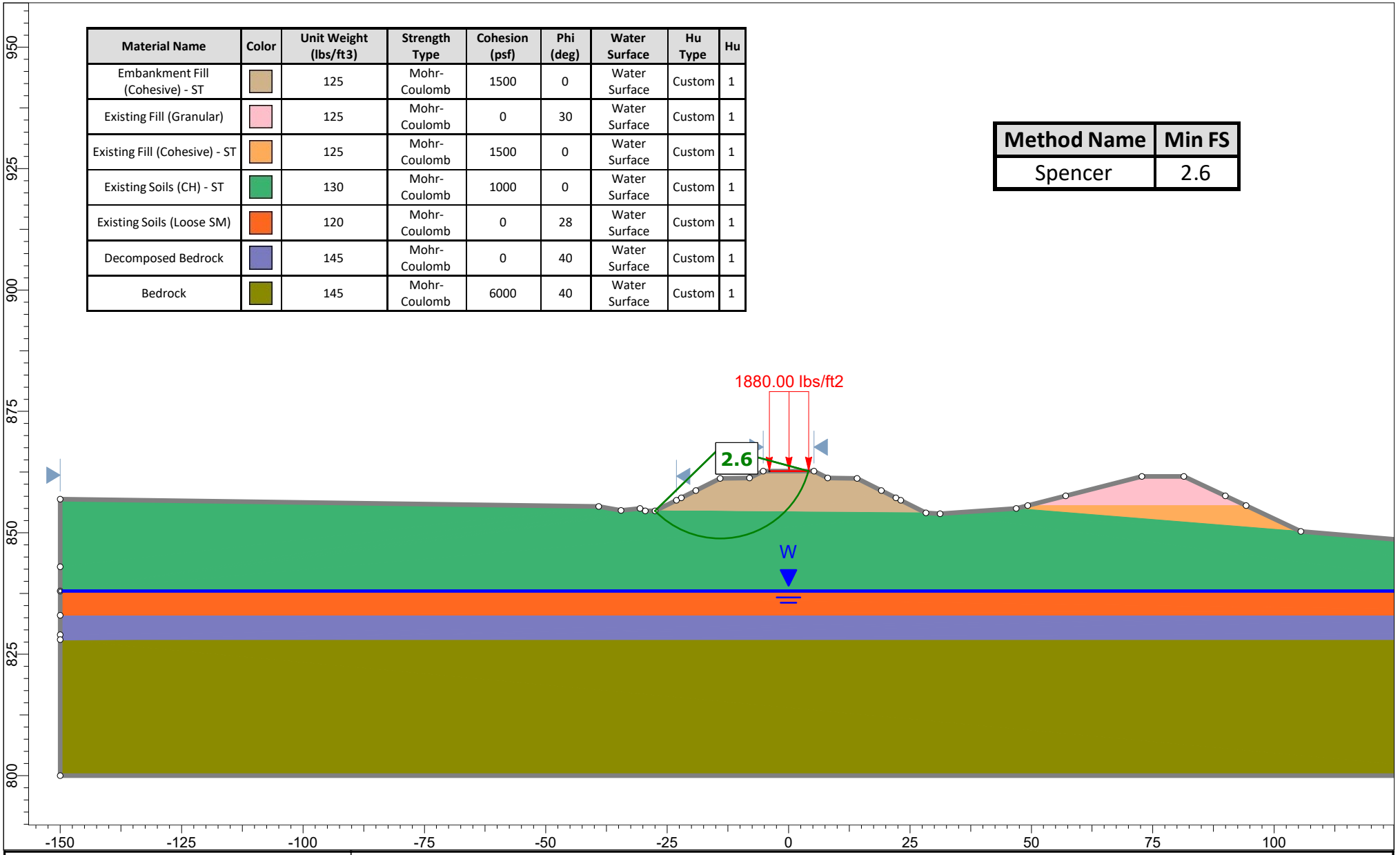
rocscience

SLIDEINTERPRET 9.010

Project	SLIDE - An Interactive Slope Stability Program		
Group	Short Term (Undrained)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	2/11/2025, 11:07:31 AM	File Name	Sta. 1528+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Embankment Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	30	Water Surface	Custom	1
Existing Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	Water Surface	Custom	1
Existing Soils (CH) - ST		130	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Existing Soils (Loose SM)		120	Mohr-Coulomb	0	28	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	2.6



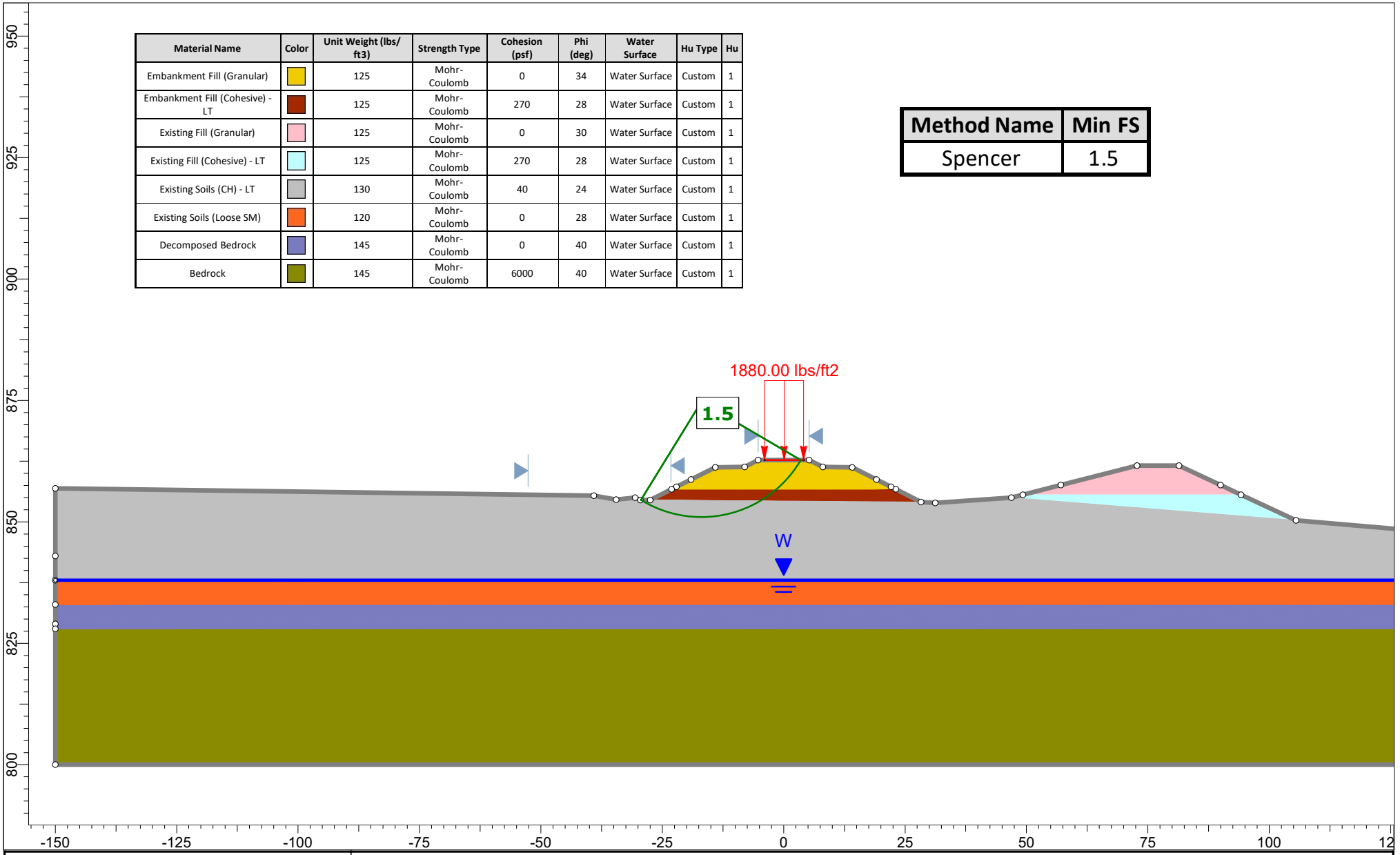
rocscience

SLIDEINTERPRET 9.010

Project	SLIDE - An Interactive Slope Stability Program		
Group	Short Term (Undrained)	Scenario	Cohesive Embankment Fill
Drawn By	SEB	Company	DLZ
Date	2/11/2025, 11:07:31 AM	File Name	Sta. 1528+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Embankment Fill (Granular)		125	Mohr-Coulomb	0	34	Water Surface	Custom	1
Embankment Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	30	Water Surface	Custom	1
Existing Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Soils (CH) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Existing Soils (Loose SM)		120	Mohr-Coulomb	0	28	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.5



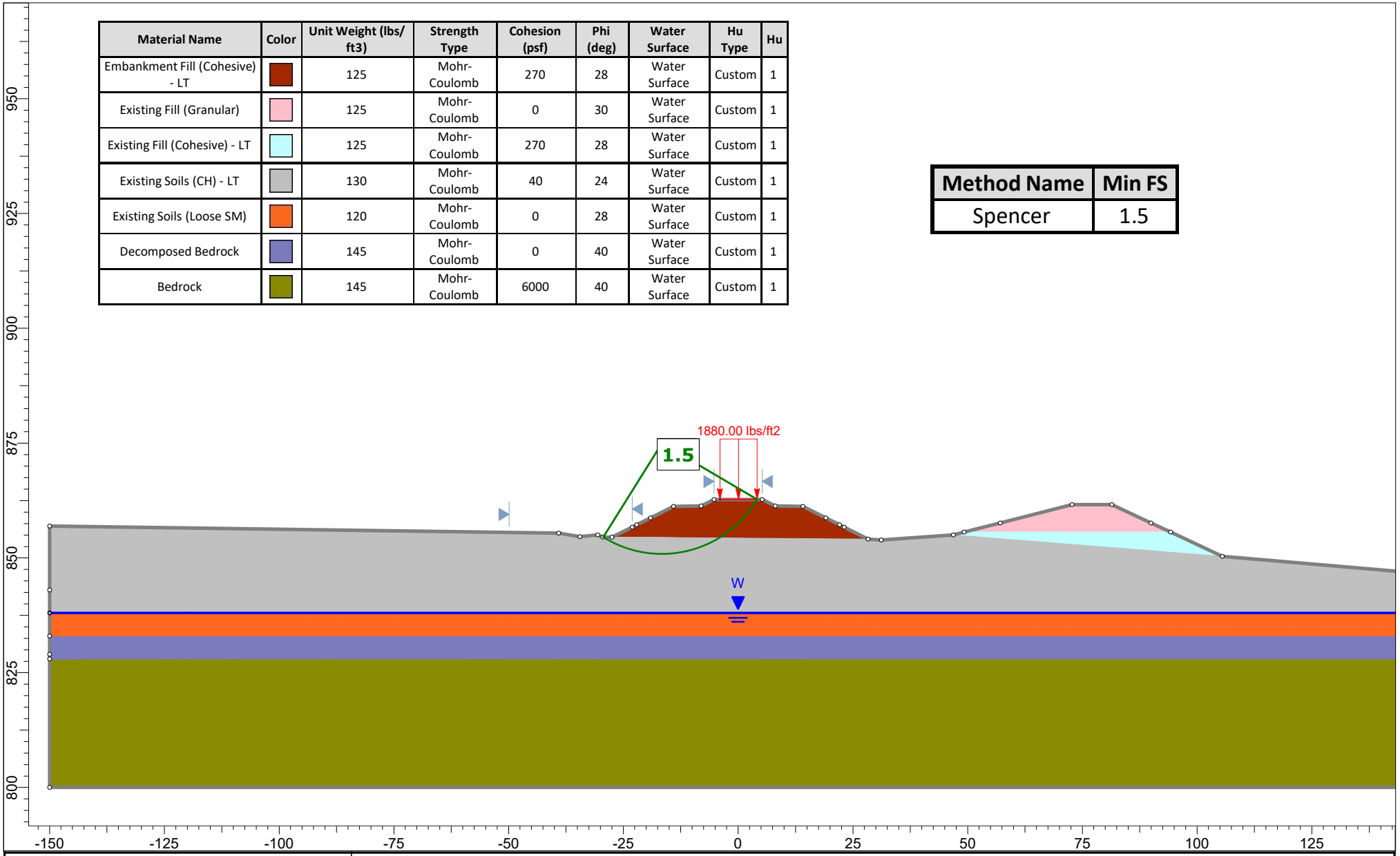
rocscience

SLIDEINTERPRET 9.010

Project	SLIDE - An Interactive Slope Stability Program		
Group	Long Term (Drained)	Scenario	Granular Embankment Fill
Drawn By	SEB	Company	DLZ
Date	2/11/2025, 11:07:31 AM	File Name	Sta. 1528+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Embankment Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Fill (Granular)		125	Mohr-Coulomb	0	30	Water Surface	Custom	1
Existing Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	Water Surface	Custom	1
Existing Soils (CH) - LT		130	Mohr-Coulomb	40	24	Water Surface	Custom	1
Existing Soils (Loose SM)		120	Mohr-Coulomb	0	28	Water Surface	Custom	1
Decomposed Bedrock		145	Mohr-Coulomb	0	40	Water Surface	Custom	1
Bedrock		145	Mohr-Coulomb	6000	40	Water Surface	Custom	1

Method Name	Min FS
Spencer	1.5



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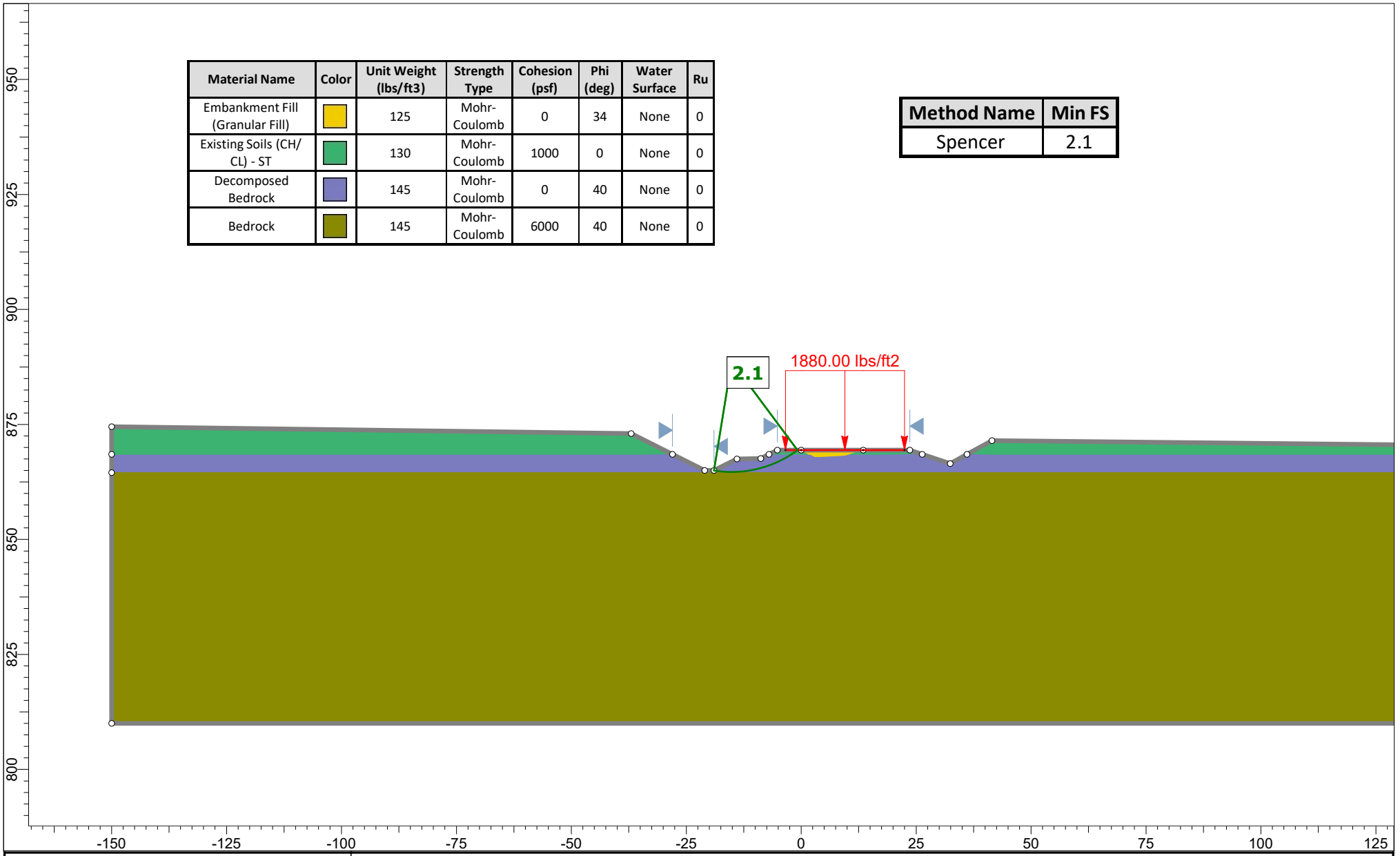
SLIDEINTERPRET 9.010

Project	SLIDE - An Interactive Slope Stability Program		
Group	Long Term (Drained)	Scenario	Cohesive Embankment Fill
Drawn By	SEB	Company	DLZ
Date	2/11/2025, 11:07:31 AM	File Name	Sta. 1528+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment Fill (Granular Fill)		125	Mohr-Coulomb	0	34	None	0
Existing Soils (CH/CL) - ST		130	Mohr-Coulomb	1000	0	None	0
Decomposed Bedrock		145	Mohr-Coulomb	0	40	None	0
Bedrock		145	Mohr-Coulomb	6000	40	None	0

Method Name	Min FS
Spencer	2.1



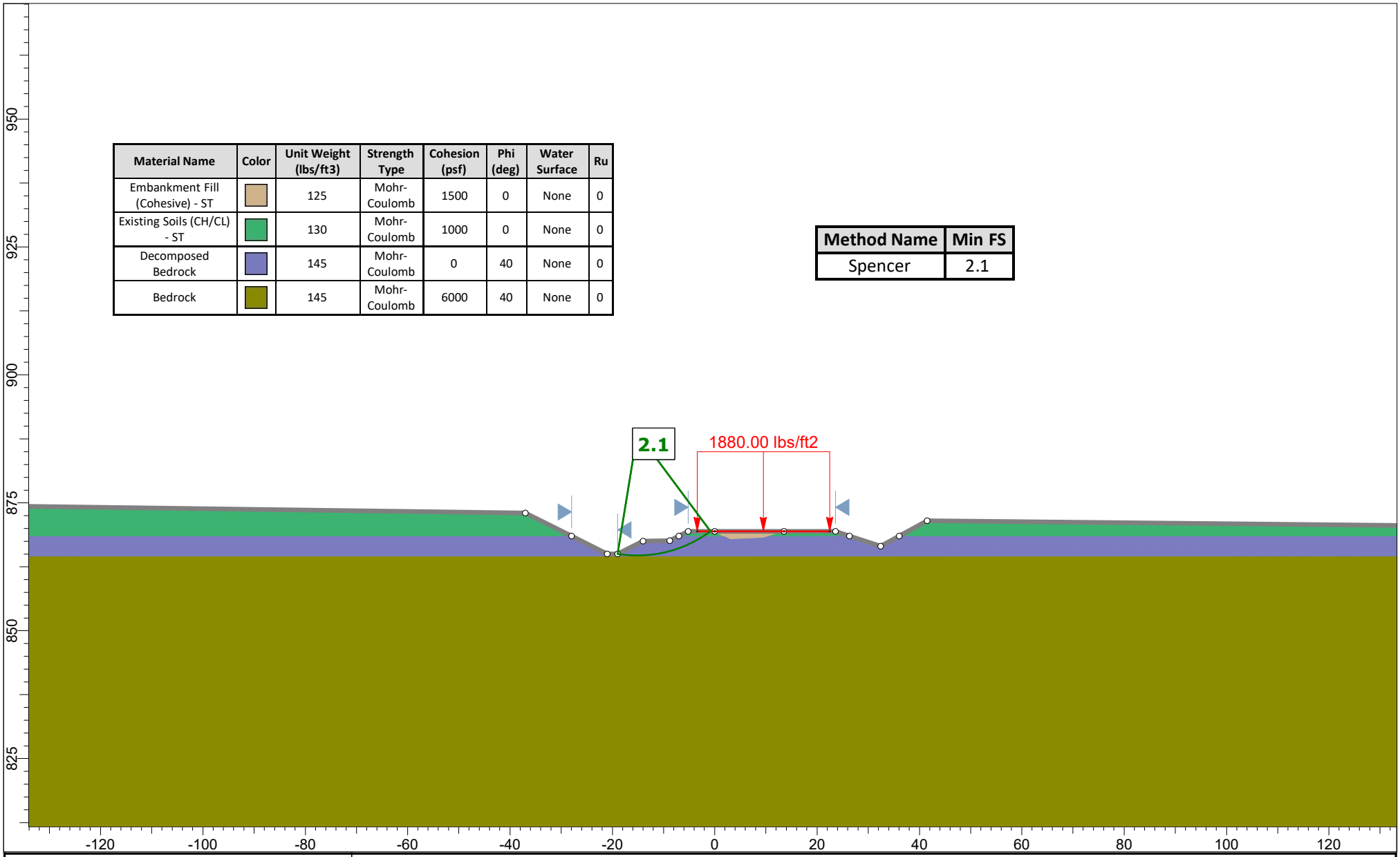
rocscience

SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Short Term (Undrained)	Scenario	Granular Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1538+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment Fill (Cohesive) - ST		125	Mohr-Coulomb	1500	0	None	0
Existing Soils (CH/CL) - ST		130	Mohr-Coulomb	1000	0	None	0
Decomposed Bedrock		145	Mohr-Coulomb	0	40	None	0
Bedrock		145	Mohr-Coulomb	6000	40	None	0

Method Name	Min FS
Spencer	2.1



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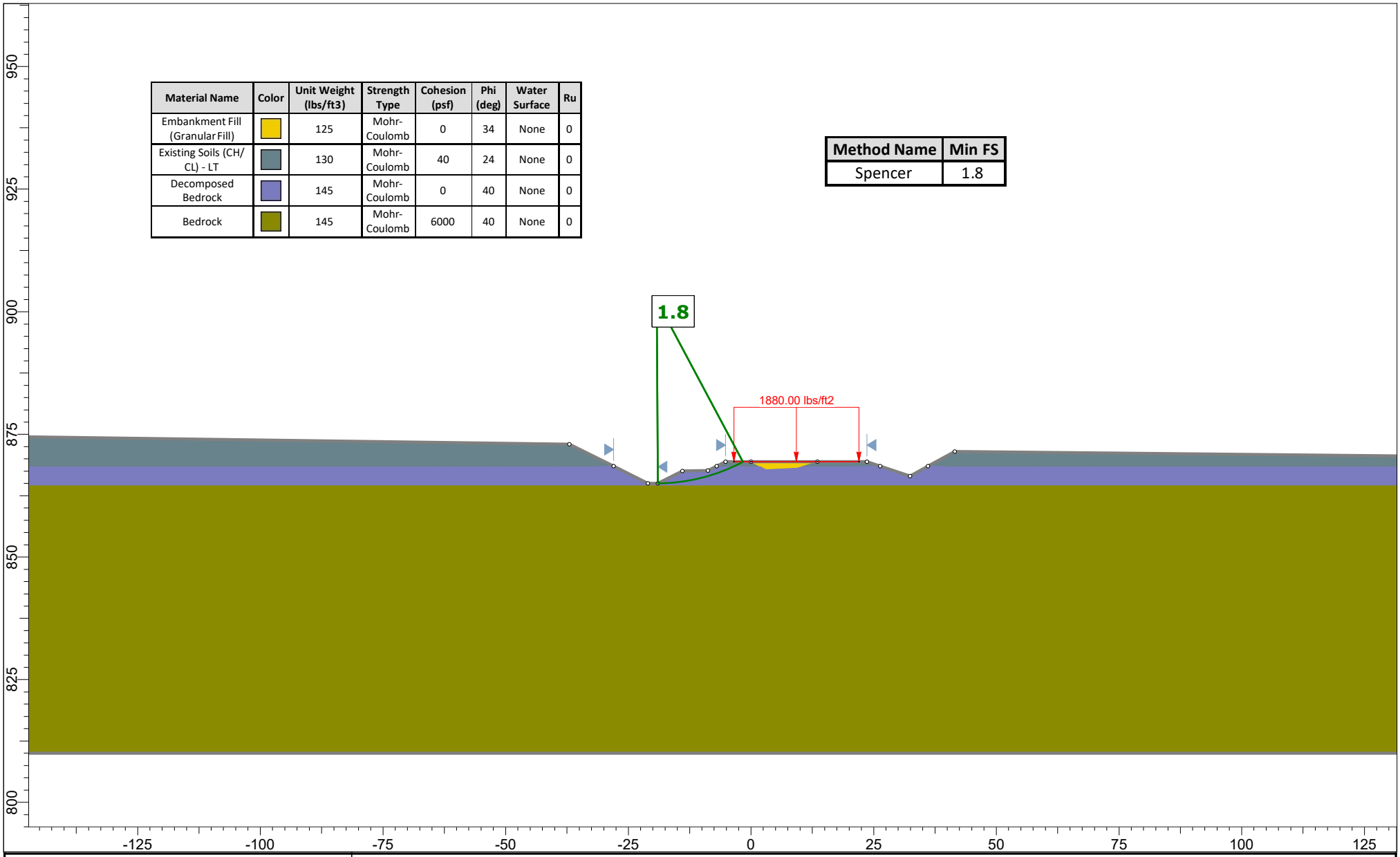
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Short Term (Undrained)	Scenario	Cohesive Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1538+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment Fill (Granular Fill)		125	Mohr-Coulomb	0	34	None	0
Existing Soils (CH/CL) - LT		130	Mohr-Coulomb	40	24	None	0
Decomposed Bedrock		145	Mohr-Coulomb	0	40	None	0
Bedrock		145	Mohr-Coulomb	6000	40	None	0

Method Name	Min FS
Spencer	1.8



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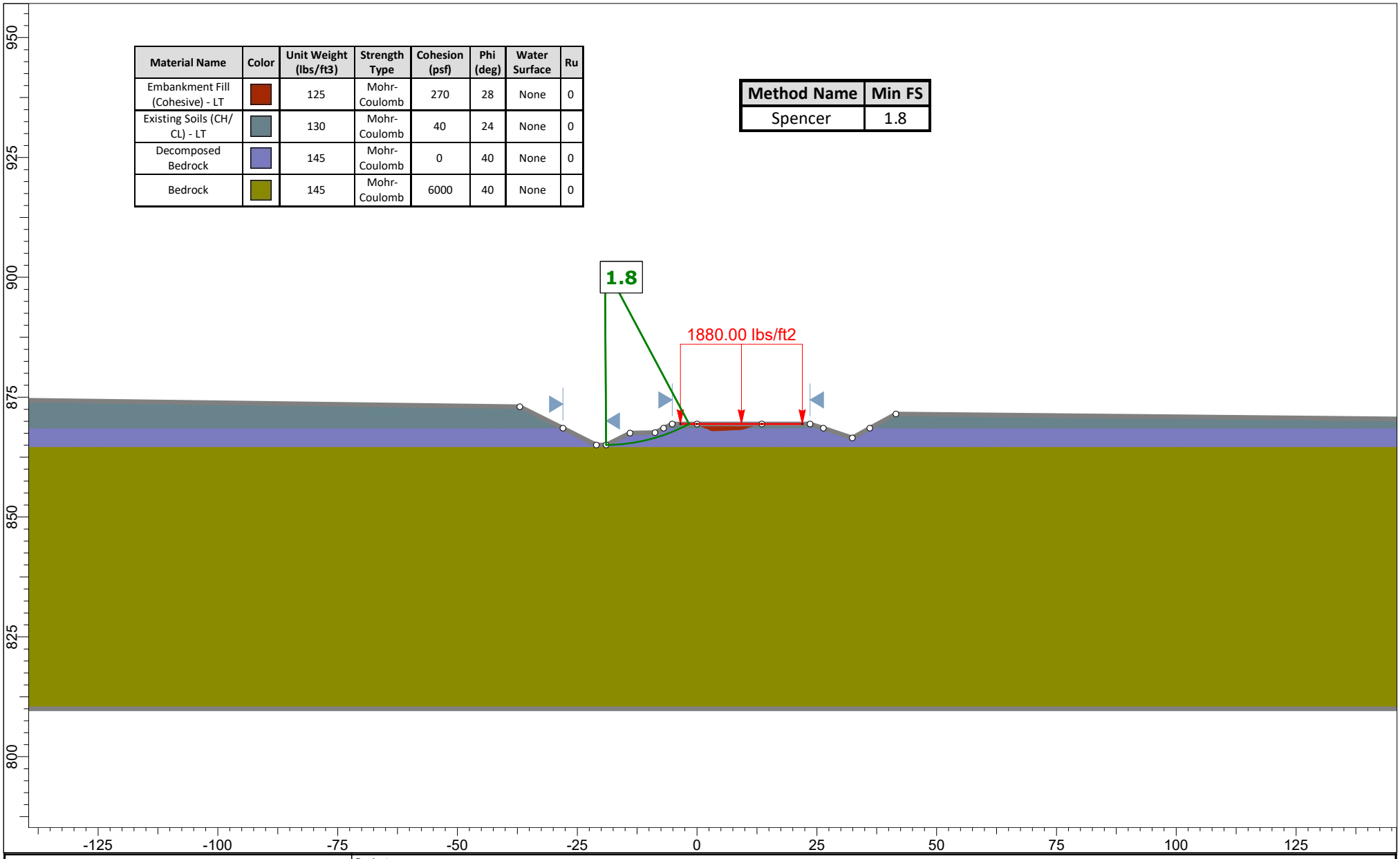
SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained)	Scenario	Granular Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1538+00 CSX Runaround.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment Fill (Cohesive) - LT		125	Mohr-Coulomb	270	28	None	0
Existing Soils (CH/CL) - LT		130	Mohr-Coulomb	40	24	None	0
Decomposed Bedrock		145	Mohr-Coulomb	0	40	None	0
Bedrock		145	Mohr-Coulomb	6000	40	None	0

Method Name	Min FS
Spencer	1.8



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SLIDEINTERPRET 9.010

Project	CSX Railroad Runaround (Item #5-434.00)		
Group	Long Term (Drained)	Scenario	Cohesive Fill
Drawn By	SEB	Company	DLZ
Date	1/27/2025, 1:53:17 PM	File Name	Sta. 1538+00 CSX Runaround.slmd

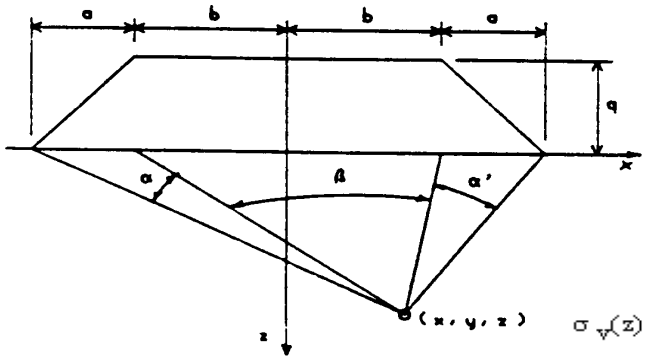
DLZ

SUBJECT	Client KYTC	JOB NUMBER	0631-0006.02		
	Project CSX Runaround (Item #5-434.00)	SHEET NO.	1	OF	2
	Item Settlement (STA. 1518+00)	COMP. BY	SEB	DATE	1/29/2025
	Based on Boring B-03	CHECKED BY	EWT	DATE	2/17/2025

Settlement 1 (Existing Embankment with Sidehill Fill)

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table:	D=	18.0	ft			
Embankment Height:	H =	8	ft			
Fill Unit Weight:	γ_{emb} =	125	pcf	q =	1,000	psf
Width of Slope:	a =	16.4				
Top half-width of Emb:	b =	12.5				
Distance from CL:	x =	21.4				
Output Range:	z =	0	to	30	ft	

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Granular Fill	115	2,000	288	458	745	25.0			
2	13.0	ft	CH/CL	130	2,000	1,095	464	1,559		0.023	0.23	0.63
3	18.0	ft	CH/CL	130	3,000	1,940	466	2,406		0.029	0.29	0.80
4	20.0	ft	Decomposed Rx	145	5,000	2,348	463	2,810	300.0			
5	30.0	ft	Bedrock	145	10,000	2,843	451	3,295	10000.0			
6				0	0							
7				0	0							
8				0	0							
9				0	0							
10				0	0							

No.	Settlement:		Total Se aqw	
1	0.083	ft	0.99	in
2	0.017	ft	0.21	in
3	0.008	ft	0.09	in
4	0.001	ft	0.01	in
5	0.000	ft	0.00	in
6				
7				
8				
9				
10				

0.108 ft

1.30 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

Cohesionless Soils ($\sigma'_0=\sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

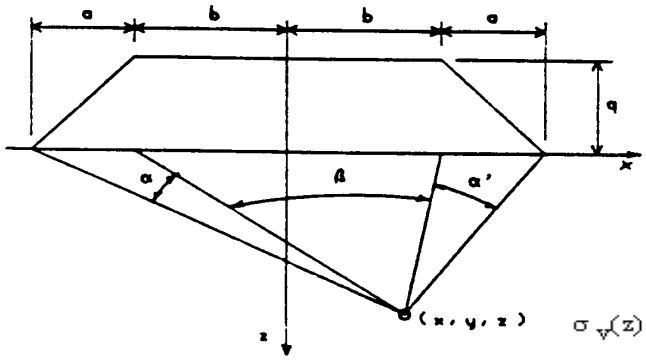
DLZ

SUBJECT	Client KYTC	JOB NUMBER	0631-0006.02		
	Project CSX Runaround (Item #5-434.00)	SHEET NO.	1	OF	2
	Item Settlement (STA. 1518+00)	COMP. BY	SEB	DATE	1/29/2025
	Based on Boring B-03 **(5-FT UNDERCUT)**	CHECKED BY	EWT	DATE	2/17/2025

Settlement 1 (Existing Embankment with Sidehill Fill)

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table: D= 18.0 ft

Embankment Height: H = 8 ft

Fill Unit Weight: γ_{emb} = 125 pcf q = 1,000 psf

Width of Slope: a = 16.4

Top half-width of Emb: b = 12.5

Distance from CL: x = 21.4

Output Range: z = 0 to 30 ft

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Granular Fill	125	2,000	313	458	770	250.0			
2	13.0	ft	CH/CL	130	2,000	1,145	464	1,609		0.023	0.23	0.63
3	18.0	ft	CH/CL	130	3,000	1,990	466	2,456		0.029	0.29	0.80
4	20.0	ft	Decomposed Rx	145	5,000	2,398	463	2,860	300.0			
5	30.0	ft	Bedrock	145	10,000	2,893	451	3,345	10000.0			
6				0	0							
7				0	0							
8				0	0							
9				0	0							
10				0	0							

No.	Settlement:		Total Se aqw	
1	0.008	ft	0.09	in
2	0.017	ft	0.20	in
3	0.007	ft	0.09	in
4	0.001	ft	0.01	in
5	0.000	ft	0.00	in
6				
7				
8				
9				
10				

0.032 ft

0.39 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

Cohesionless Soils ($\sigma'_0=\sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

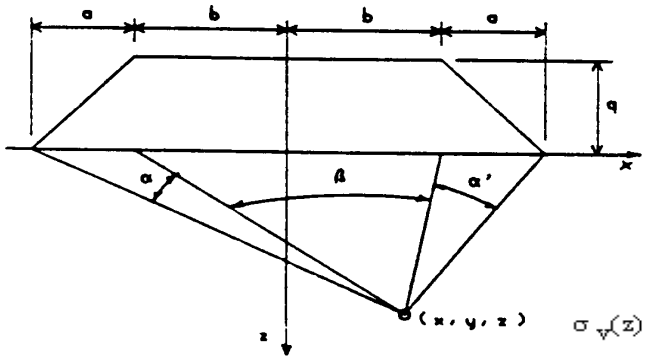
DLZ

SUBJECT	Client KYTC	JOB NUMBER	0631-0006.02		
	Project CSX Runaround (Item #5-434.00)	SHEET NO.	1	OF	2
	Item Settlement (STA. 1518+00)	COMP. BY	SEB	DATE	1/29/2025
	Based on Boring B-03	CHECKED BY	EWT	DATE	2/17/2025

Settlement 2 (Existing Embankment Only)

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table:	D=	18.0	ft			
Embankment Height:	H =	8	ft			
Fill Unit Weight:	γ_{emb} =	125	pcf	q =	1,000	psf
Width of Slope:	a =	25.2				
Top half-width of Emb:	b =	4.4				
Distance from CL:	x =	29.6				
Output Range:	z =	0	to	30	ft	

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Granular Fill	115	2,000	288	30	318	25.0			
2	13.0	ft	CH/CL	130	2,000	1,095	108	1,203		0.023	0.23	0.63
3	18.0	ft	CH/CL	130	3,000	1,940	166	2,106		0.029	0.29	0.80
4	20.0	ft	Decomposed Rx	145	5,000	2,348	192	2,539	300.0			
5	30.0	ft	Bedrock	145	10,000	2,843	222	3,065	10000.0			
6				0	0							
7				0	0							
8				0	0							
9				0	0							
10				0	0							

No.	Settlement:		Total Se aqw	
1	0.009	ft	0.10	in
2	0.005	ft	0.06	in
3	0.003	ft	0.03	in
4	0.000	ft	0.00	in
5	0.000	ft	0.00	in
6				
7				
8				
9				
10				

0.016 ft

0.20 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

Cohesionless Soils ($\sigma'_0=\sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

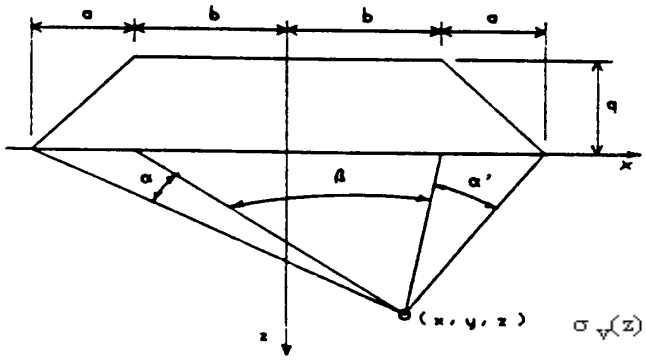
DLZ SUBJECT

Client KYTC	JOB NUMBER	0631-0006.02			
Project CSX Runaround (Item #5-434.00)	SHEET NO.	1	OF	2	
Item Settlement (STA. 1518+00)	COMP. BY	SEB	DATE	1/29/2025	
Based on Boring B-03 **(5-FT UNDERCUT)**	CHECKED BY	EWT	DATE	2/17/2025	

Settlement 2 (Existing Embankment Only)

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table:	D=	18.0	ft			
Embankment Height:	H =	8	ft			
Fill Unit Weight:	γ_{emb} =	125	pcf	q =	1,000	psf
Width of Slope:	a =	25.2				
Top half-width of Emb:	b =	4.4				
Distance from CL:	x =	29.6				
Output Range:	z =	0	to	30	ft	

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Granular Fill	125	2,000	313	30	343	250.0			
2	13.0	ft	CH/CL	130	2,000	1,145	108	1,253		0.023	0.23	0.63
3	18.0	ft	CH/CL	130	3,000	1,990	166	2,156		0.029	0.29	0.80
4	20.0	ft	Decomposed Rx	145	5,000	2,398	192	2,589	300.0			
5	30.0	ft	Bedrock	145	10,000	2,893	222	3,115	10000.0			
6				0	0							
7				0	0							
8				0	0							
9				0	0							
10				0	0							

No.	Settlement:		Total Se aqw	
1	0.001	ft	0.01	in
2	0.004	ft	0.05	in
3	0.003	ft	0.03	in
4	0.000	ft	0.00	in
5	0.000	ft	0.00	in
6				
7				
8				
9				
10				

0.008 ft

0.10 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

Cohesionless Soils ($\sigma'_0=\sigma'_c$)

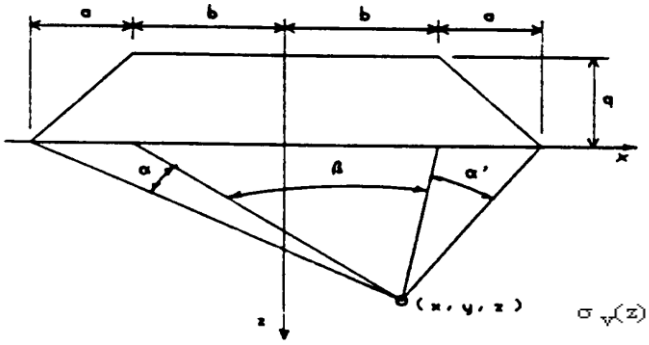
$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

DLZ

SUBJECT	Client KYTC		JOB NUMBER	0631-0006.02		
	Project CSX Runaround (Item #5-434.00)		SHEET NO.	1	OF	2
	Item Settlement (STA. 1528+00)		COMP. BY	SEB	DATE	1/30/2025
	Based on Boring B-07		CHECKED BY		DATE	

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table: D= 11.0 ft

Embankment Height: H = 8.6 ft

Fill Unit Weight: γ_{emb} = 125 pcf q = 1,075 psf

Width of Slope: a = 18

Top half-width of Emb: b = 10

Distance from CL: x = 0

Output Range: z = 0 to 50 ft

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi\, a}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Fat Clay (CH)	130	2,000	325	1,073	1,398		0.022	0.22	0.611
2	13.5	ft	Fat Clay (CH)	130	3,000	1,203	1,215	2,418		0.025	0.25	0.690
3	18.5	ft	Granular Soils	120	2,000	1,743	1,126	2,869	40.0			
4	22.6	ft	Decomposed Rx	145	5,000	2,056	1,054	3,110	300.0			
5	30.0	ft	Bedrock	145	10,000	2,531	963	3,494	10000.0			
6	40.0	ft	Bedrock	145	10,000	3,250	834	4,084	10000.0			
7	50.0	ft	Bedrock	145	10,000	4,076	710	4,786	10000.0			
8												
9												
10												

No.	Settlement:		Total Se aqw	
1	0.044	ft	0.52	in
2	0.038	ft	0.46	in
3	0.027	ft	0.32	in
4	0.002	ft	0.03	in
5	0.000	ft		
6	0.000	ft		
7	0.000	ft		
8				
9				
10				

0.112 ft

1.34 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

Cohesionless Soils ($\sigma'_0=\sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

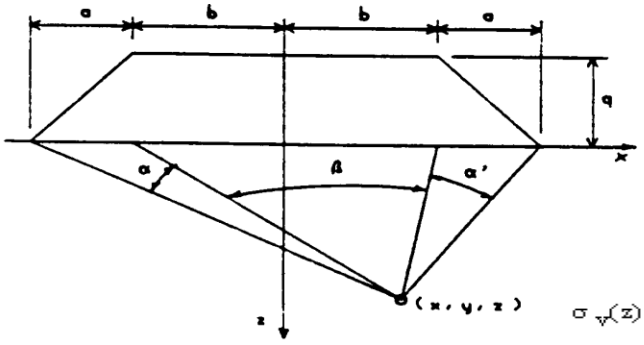
DLZ

SUBJECT	Client KYTC	JOB NUMBER	0631-0006.02			
	Project CSX Runaround (Item #5-434.00)	SHEET NO.	1	OF	2	
	Item Settlement (STA. 1528+00)	COMP. BY	SEB	DATE	1/30/2025	
	Based on Boring B-07	CHECKED BY		DATE		

5 Foot Undercut and Replace

SETTLEMENT ANALYSIS - EMBANKMENT

Embankment Informaiton:



Groundwater Table:	D=	11.0	ft		
Embankment Height:	H =	8.6	ft		
Fill Unit Weight:	γ_{emb} =	125	pcf	q =	1,075 psf
Width of Slope:	a =	18			
Top half-width of Emb:	b =	10			
Distance from CL:	x =	0			
Output Range:	z =	0	to	50	ft

**See Data output Attached*

$$\sigma_v(z) := \left(\frac{q}{\pi\, a}\right)\left(a\cdot(\alpha(z)+\beta(z)+\alpha'(z)) + b\cdot(\alpha(z)+\alpha'(z)) + x\cdot(\alpha(z)-\alpha'(z))\right)$$

$$\beta(z) := \operatorname{atan}\left[\frac{(b-x)}{z}\right] + \operatorname{atan}\left[\frac{(b+x)}{z}\right] \qquad \alpha'(z) := \operatorname{atan}\left[\frac{(a+b-x)}{z}\right] - \operatorname{atan}\left[\frac{(b-x)}{z}\right] \qquad \alpha(z) := \operatorname{atan}\left[\frac{(a+b+x)}{z}\right] - \operatorname{atan}\left[\frac{(b+x)}{z}\right]$$

Reference: US Army Corps of Engineers EM 1110-1-1904 "Settlement Analysis", Table C-1

Soil Properites: *Settlement is calculated at mid-point of layer*

No.	Bot. of Laye		Soil Type	γ_{soil} (pcf)	σ'_c (psf)	σ'_o (psf)	$\Delta\sigma z$ (psf)	σ'_f (psf)	Cohesionless Soils C'	Cohesive Soils C_r	C_c	e_o
1	5.0	ft	Fat Clay (CH)	130	2,000	325	1,073	1,398	250.0			
2	13.5	ft	Fat Clay (CH)	130	3,000	1,203	1,215	2,418		0.025	0.25	0.690
3	18.5	ft	Granular Soils	120	2,000	1,743	1,126	2,869	40.0			
4	22.6	ft	Decomposed Rx	145	5,000	2,056	1,054	3,110	300.0			
5	30.0	ft	Bedrock	145	10,000	2,531	963	3,494	10000.0			
6	40.0	ft	Bedrock	145	10,000	3,250	834	4,084	10000.0			
7	50.0	ft	Bedrock	145	10,000	4,076	710	4,786	10000.0			
8												
9												
10												

No.	**Settlement:**		**Total Se** aqw	
1	0.013	ft	0.15	in
2	0.038	ft	0.46	in
3	0.027	ft	0.32	in
4	0.002	ft	0.03	in
5	0.000	ft		
6	0.000	ft		
7	0.000	ft		
8				
9				
10				

0.081 ft

0.97 in

Reference: Geotechnical Engineering Principles and Practices; Coduto, 1999

Overconsolidated Soils - Case I ($\sigma'_0<\sigma'_c$) Eqn:11.24

$$(\delta_c)_{ult} = \sum \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Overconsolidated Soils - Case II ($\sigma'_0<\sigma'_c<\sigma_f$) Eqn:11.25

$$(\delta_c)_{ult} = \sum\left[\frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_c}{\sigma'_0}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_c}\right)\right]$$

Normally Consolidated Soils ($\sigma'_0=\sigma'_c$) Eqn: 11.23

$$(\delta_c)_{ult} = \sum \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

Reference: FHWA NHI-00-045

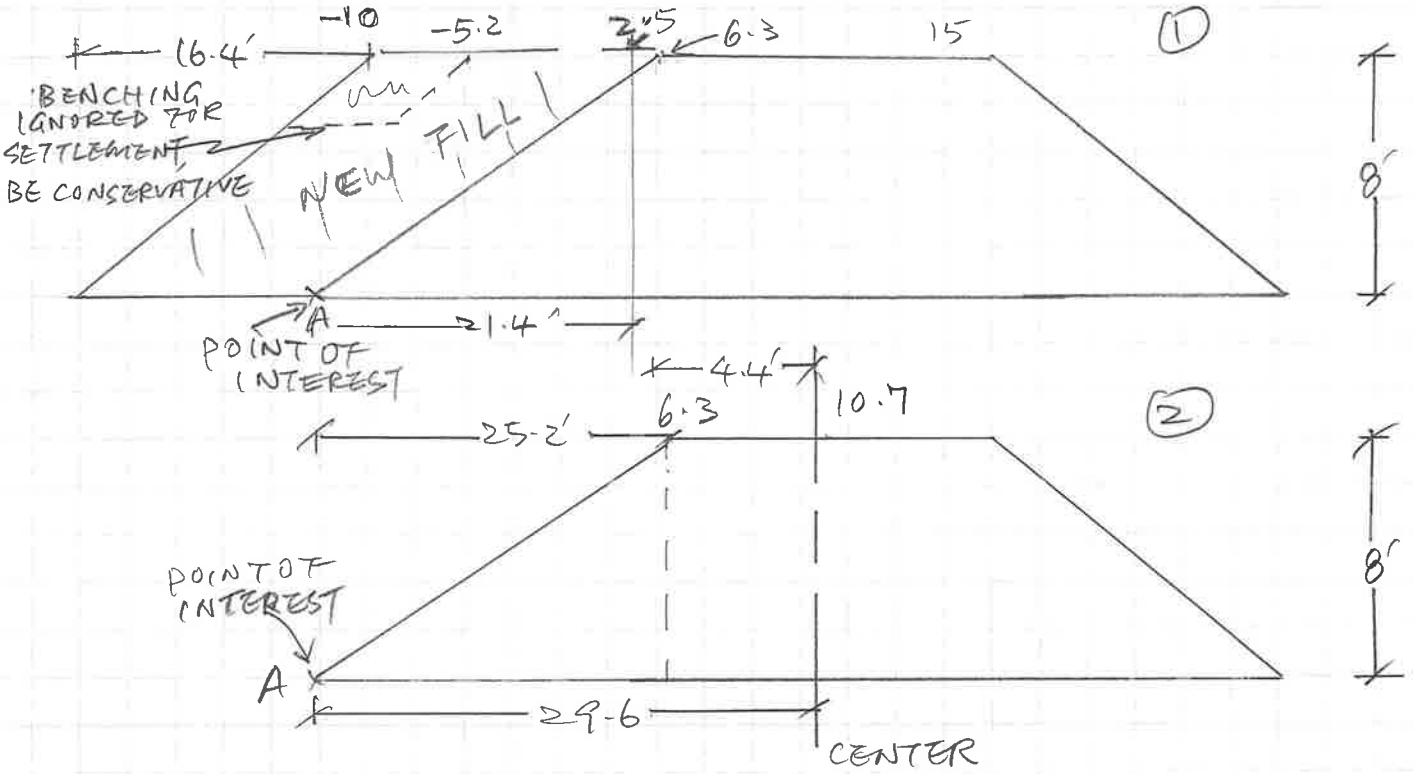
Cohesionless Soils ($\sigma'_0=\sigma'_c$)

$$(\delta_c)_{ult} = \sum \frac{1}{C'} H \log\left(\frac{\sigma'_f}{\sigma'_0}\right)$$

DLZ
ARCHITECTURE • ENGINEERING • PLANNING
SURVEYING • CONSTRUCTION SERVICES

CLIENT KYTC
PROJECT OLDHAM COUNTY CSX RUNAROUND
SUBJECT SETTLEMENT
SIDEHILL FILL AT STA 1518+00

PROJECT NO. 0631-0006.02
SHEET NO. 1 OF 1
COMP. BY SEB DATE 2-5-25
CHECKED BY SWT DATE 2-7-25



SETTLEMENT (1) − SETTLEMENT (2) = TOTAL SETTLEMENT FROM PROPOSED SIDEHILL FILL

ASSUMING IN-SITU SOIL CONDITIONS:

TOTAL SETTLEMENT
= SETTLEMENT (1) − SETTLEMENT (2) = 1.30 − 0.39
= 0.91 Inches

ASSUMING 5-FT UNDERCUT INTO EXISTING FOUNDATION SOILS (5-FT UNDERCUT NEEDED FOR STABILITY), AND REPLACE WITH GRANULAR STRUCTURAL FILL:

TOTAL SETTLEMENT = SETTLEMENT (1) − SETTLEMENT (2)
= 0.20 − 0.10 = 0.1 inches

CLIENT	KYTC	JOB NUMBER	0631-0006.02		
PROJECT	CSX Railroad Runaround	SHEET NO.	1	OF	1
SUBJECT	Lateral Squeeze, STA. 1528+00	COMP. BY	SEB	DATE	1/30/2025
	Embankment - No Ground Improvement	CHECKED BY		DATE	

Embankment - No Improvement

Lateral Squeeze

$$FS_{Squeeze} = \frac{2}{\gamma_{slope}} \frac{s_u}{D_s \tan\theta_{slope}} + \frac{4.14}{H_{slope}} \frac{s_u}{\gamma_{slope}}$$

FHWA-NHI-06-088 VOL. I
Eq. 7-12

$$FS_{Squeeze} = \frac{2}{130\text{ pcf}} \frac{1000\text{ psf}}{12.0\text{ ft}\ \tan(26.6°)} + \frac{4.14}{8.6\text{ ft}} \frac{1000\text{ psf}}{130\text{ pcf}}$$

D_s considers average slope from toe to approach slab

$$FS_{Squeeze} = \frac{2000.0}{781.2} + \frac{4140.0}{1118.0}$$

$$FS_{Squeeze} = 6.3 \qquad FS_{Squeeze} \geq 2.0$$

FHWA-NHI-06-088 VOL. I
Pg. 7-42

$$H_{slope}\ \gamma_{slope} < 3.0\ s_u$$

FHWA-NHI-06-088 VOL. I
Eq. 7-11

$$8.6\text{ ft}\ \ 130\text{ pcf} \quad 3.0\ \ 1000\text{ psf}$$

$$1118\text{ psf} < 3000\text{ psf}$$

CLIENT	KYTC			JOB NUMBER	0631-0006.02		
PROJECT	Oldham County CSX Runaround			SHEET NO.	1	OF	1
SUBJECT	Bearing Resistance Calculation - STA. 1518+00			COMP. BY	SEB	DATE	02/25/25
	Granular Embankment - Railroad Footing Adjacent to Slope			CHECKED BY		DATE	

Bearing Depth = 857.1 ft Foot. Width (B') = 20.0 ft

Foot. Width (B) = 20.0 ft Embankment Height = 8.0 ft

Embankment Soil Type = Granular

Distance from footing to edge of slope (b) = 5.0 ft

Calculate factored bearing resistance (q_R) *Reference: AASHTO LRFD Bridge Design Specifications*

$q_{ns} = q_n * RB_{BC}$

$q_n = cN_c + 0.5\gamma BN_\gamma$

$q_R = \varphi_b q_{ns}$

Total Stress	Effective Stress
c = 0 psf	c' = 0 psf
φ_f = 34°	φ'_f = 34°
N_c= 42.2	N_c= 42.2
N_q= 29.4	N_q= 29.4
N_γ= 41.1	N_γ= 41.1

N_c, N_q, N_γ values from Tables 10.6.3.1.2a-1

Groundwater 834.0 ft → (857.1' - 834') = 23.1' Water is within 1.5B of bearing depth

Total and Effective Stress

q_n = 0 + (0.5) (125.0 pcf) (20.0 ft) (41.1)

q_n = 51375 psf

q_n = 51375 psf

RC_{BC} = 0.51 Table 10.6.3.1.2c-2 For RC_{BC}, Emb Slope = 27° c' = 0 B/H= 2.5 b/B = 0.25

Resistance Factor (φ_b) = 0.45 strength limit state Ns = γ∗Hs/c 10.6.3.1.2c-2

$q_R = q_n$ *φb*RC_{BC} = (11790.6 psf) = 11.79 ksf > 3.76 ksf (Railroad Surcharge Load)

CLIENT	KYTC	JOB NUMBER	0631-0006.02		
PROJECT	Oldham County CSX Runaround	SHEET NO.	1	OF	1
SUBJECT	Bearing Resistance Calculation - STA. 1528+00	COMP. BY	SEB	DATE	02/25/25
	Cohesive Embankment - Railroad Footing Adjacent to Slope	CHECKED BY		DATE	

Bearing Depth = 862.7 ft Foot. Width (B') = 8.5 ft

Foot. Width (B) = 8.5 ft Embankment Height = 8.6 ft

Embankment Soil Type = Cohesive

Distance from footing to edge of slope (b) = 10.0 ft

Calculate factored bearing resistance (q_R) *Reference: AASHTO LRFD Bridge Design Specifications*

$qns = q_n * RB_{BC}$

$q_n = cN_{c+} 0.5\gamma BN_\gamma$

$q_R = \varphi_b q_n$

Total Stress		Effective Stress	
c =	1500 psf	c' =	0 psf
φ_f =	0°	φ'_f =	28°
N_c=	5.14	N_c=	25.8
N_q=	1	N_q=	14.7
N_γ=	0	N_γ=	16.7

N_c, N_q, N_γ values from Tables 10.6.3.1.2a-1

Groundwater 838.0 ft → (862.7' - 838') = 24.7' Water is below 1.5B from the bearing depth

Total Stress

q_n = (1500 psf) (5.14) = 7710 psf

Effective Stress

q_n = 0 + (0.5) (125.0 pcf) (8.5 ft) (16.7)

q_n = 8872 psf

q_n = 7710 psf Total Stress < Effective Stress

RC_{BC} = 0.92 Table 10.6.3.1.2c-2 For RC_{BC}, Emb Slope = 27° Ns = 0.72 B/H= 1 b/B = 1.18

Resistance Factor (φ_b) = 0.50 strength limit state Ns = γ∗Hs/c 10.6.3.1.2c-2

$qR = \varphi_b * qn$ $*RC_{BC}$ = (3546.6 psf) = 3.55 ksf > 1.88 ksf (Railroad Surcharge Load)

CLIENT	KYTC	JOB NUMBER	0631-0006.02		
PROJECT	Oldham County CSX Runaround	SHEET NO.	1	OF	1
SUBJECT	Bearing Resistance Calculation - STA. 1528+00	COMP. BY	SEB	DATE	02/25/25
	Granular Embankment - Railroad Footing Adjacent to Slope	CHECKED BY		DATE	

Bearing Depth = 862.7 ft Foot. Width (B') = 8.5 ft

Foot. Width (B) = 8.5 ft Embankment Height = 8.6 ft

Embankment Soil Type = Granular

Distance from footing to edge of slope (b) = 10.0 ft

Calculate factored bearing resistance (q_R) *Reference: AASHTO LRFD Bridge Design Specifications*

$q_{ns} = q_n * RB_{BC}$

$q_n = cN_c + 0.5\gamma BN_\gamma$

$q_R = \varphi_b q_{ns}$

Total Stress	Effective Stress
c = 0 psf	c' = 0 psf
φ_f = 34°	φ'_f = 34°
N_c= 42.2	N_c= 42.2
N_q= 29.4	N_q= 29.4
N_γ= 41.1	N_γ= 41.1

N_c, N_q, N_γ values from Tables 10.6.3.1.2a-1

Groundwater 838.0 ft → (862.7' - 838') = 24.7' Water is below 1.5B from the bearing depth

Total and Effective Stress

q_n = 0 + (0.5) (125.0 pcf) (8.5 ft) (41.1)

q_n = 21834 psf

q_n = 21834 psf

RC_{BC} = 0.58 Table 10.6.3.1.2c-2 For RC_{BC}, Emb Slope = 27° c' = 0 B/H= 1 b/B = 1.18

Resistance Factor (φ_b) = 0.45 strength limit state Ns = γ*Hs/c 10.6.3.1.2c-2

$q_R = q_n$ *φb*RC_{BC} = (5698.8 psf) = 5.70 ksf > 1.88 ksf (Railroad Surcharge Load)

CLIENT	KYTC	JOB NUMBER	0631-0006.02		
PROJECT	Oldham County CSX Runaround	SHEET NO.	1	OF	1
SUBJECT	Bearing Resistance Calculation - STA. 1538+00	COMP. BY	SEB	DATE	02/25/25
	Cohesive Embankment - Railroad Footing Adjacent to Slope	CHECKED BY		DATE	

Bearing Depth = 869.4 ft | Foot. Width (B') = 8.5 ft | Embankment Height = 4.3 ft

Foot. Width (B) = 8.5 ft | Embankment Soil Type = Cohesive

Distance from footing to edge of slope (b) = 10.0 ft

Calculate factored bearing resistance (q_R) *Reference: AASHTO LRFD Bridge Design Specifications*

$qns = q_n * RB_{BC}$

$q_n = cN_{c+} 0.5\gamma BN_\gamma$

$q_R = \varphi_b qns$

Total Stress		Effective Stress	
c =	1500 psf	c' =	0 psf
φ_f =	0°	φ'_f =	28°
N_c=	5.14	N_c=	25.8
N_q=	1	N_q=	14.7
N_γ=	0	N_γ=	16.7

N_c, N_q, N_γ values from Tables 10.6.3.1.2a-1

Groundwater none → No water - -

Total Stress

q_n = (1500 psf) (5.14) = 7710 psf

Effective Stress

q_n = 0 + (0.5) (125.0 pcf) (8.5 ft) (16.7)

q_n = 8872 psf

q_n = 7710 psf Total Stress < Effective Stress

RC_{BC} = 0.98 Table 10.6.3.1.2c-2 For RC_{BC}, Emb Slope = 27° Ns = 0.36 B/H= 2 b/B = 1.18

Resistance Factor (φ_b) = 0.50 strength limit state Ns = γ∗Hs/c 10.6.3.1.2c-2

$qR = \varphi_b * qn$ $*RC_{BC}$ = (3777.9 psf) = 3.78 ksf > 1.88 ksf (Railroad Surcharge Load)

CLIENT	KYTC	JOB NUMBER	0631-0006.02		
PROJECT	Oldham County CSX Runaround	SHEET NO.	1	OF	1
SUBJECT	Bearing Resistance Calculation - STA. 1538+00	COMP. BY	SEB	DATE	02/25/25
	Granular Embankment - Railroad Footing Adjacent to Slope	CHECKED BY		DATE	

Bearing Depth = 869.4 ft Foot. Width (B') = 8.5 ft

Foot. Width (B) = 8.5 ft Embankment Height = 4.3 ft

Embankment Soil Type = Cohesive

Distance from footing to edge of slope (b) = 10.0 ft

Calculate factored bearing resistance (q_R) *Reference: AASHTO LRFD Bridge Design Specifications*

$qns = q_n * RB_{BC}$

$q_n = cN_{c+} 0.5\gamma BN_\gamma$

$q_R = \varphi_b qns$

Total Stress		Effective Stress	
c =	0 psf	c' =	0 psf
φ_f =	34°	φ'_f =	34°
N_c=	42.2	N_c=	42.2
N_q=	29.4	N_q=	29.4
N_γ=	41.1	N_γ=	41.1

N_c, N_q, N_γ values from Tables 10.6.3.1.2a-1

Groundwater 838.0 ft → (869.4' - 838') = 31.4' Water is below 1.5B from the bearing depth

Effective Stress

q_n = 0 + (0.5) (125.0 pcf) (8.5 ft) (41.1)

q_n = 21834 psf

RC_{BC} = 0.70 Table 10.6.3.1.2c-2 For RC_{BC}, Emb Slope = 27° c'=0 B/H= 2 b/B = 1.18

Resistance Factor (φ_b) = 0.50 strength limit state Ns = γ∗Hs/c 10.6.3.1.2c-2

qR = φ_b*qn *RC_{BC} = (7642.0 psf) = 7.64 ksf > 1.88 ksf (Railroad Surcharge Load)

Appendix IV

Soil Profile Sheets

MicroStation v10.17.02.61 | E-SHEET NAME: RO2500PF | USER: sbollinger DATE PLOTTED: June 14, 2024 | FILE NAME: \\DLZCORP.COM\PAN-FILES$\FILES\PROJECTS\2006\0631\000602 OLDHAM COUNTY KY\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\MISCELLANEOUS

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	001

DATUM

STA. 1515+24.98
BEGIN CONST.

TOP OF RAIL
MAINLINE EXISTING

Top Of Rail Temp
Runaround Proposed

EXISTING GROUND

B-03
1518+02.60
15.8 ft. Lt.
850.5

w%	LI	
32	8.18	N=1, A-4(0), SM, S+C=47(39+8)
28		
23	0.29	N=11, A-6(18), CL, S+C=92(59+33)
29	0.15	N=11, A-7-6(55), CH, S+C=99(35+64)
27		N=R/0.20'

R(832.0')

B-04
1520+00.20
38.9 ft. Lt.
848.8

w%	LI	
13	-0.57	N=15, A-6(12), CL, S+C=94(72+22)
19	0	N=17
7	0	N=R/0.10'

R(835.3')

880	875	870	865	860	855	850	845	840	835	830	825

1512+50	1513+00	1513+50	1514+00	1514+50	1515+00	1515+50	1516+00	1516+50	1517+00	1517+50	1518+00	1518+50	1519+00	1519+50	1520+00	1520+50	1521+00
854.8	855.0	855.1	855.3	856.2	855.6 / 856.44	855.8 / 856.57	855.9 / 856.70	856.0 / 856.84	855.3 / 856.97	854.5 / 857.10	853.5 / 857.24	852.5 / 857.37	851.8 / 857.52	850.7 / 857.69	849.5 / 857.89	849.3 / 858.11	

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

SOIL PROFILE CSX RAILROAD RUNAROUND
STA. 1514+50.00 TO STA. 1521+00.00

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	002

DATUM

B-08

856.4-841.4 Overburden

841.4-836.4 Dolomite: Brown and gray, moderately strong, fine to medium grained, moderately to highly weathered, fossiliferous, vuggy, thinly bedded, highly fractured to broken, contain zones of dissolution and openings.

B-10

864.7-854.7 Overburden

854.7-851.2 Dolomite: Brown, strong, very fine grained, moderately weathered, slightly vuggy, thinly bedded, highly fractured.

851.2-846.2 Dolomite: Gray, strong, fine to very fine grained, moderately weathered, very vuggy and pitted, thinly bedded, highly fractured, contains karstic openings and calcite deposits, dissolutioned beds.

B-05

848.8-831.8 Overburden

831.8-828.8 Dolomite: Gray and brown, moderately strong, fine grained, highly weathered, fossiliferous, vuggy and pitted, thinly bedded, highly fractured to broken.

828.8-826.8 Dolomite: Bluish gray, strong, fine grained, slightly weathered, pitted, pyritic, medium bedded, moderately fractured.

Top Of Rail Temp Runaround Proposed

TOP OF RAIL MAINLINE EXISTING

EXISTING GROUND

B-10
1534+00.30
2.3 ft. Lt.
864.7

B-09
1531+94.40
2.8 ft. Rt.
860.8

B-08
1530+02.60
13.4 ft. Rt.
856.4

B-07
1525+94.50
24.8 ft. Lt.
851.4

B-06 | 1524+10.30
20.7' Lt. | 849.1

B-05
1522+27.9
25.4 ft. Lt.
848.8

w% LI

27	0.38	N=6, A-7-6(18), CL, S+C=70(37+33)	
27	0.38	N=8, A-6(8), CL, S+C=79(65+14)	
		N=50/0.30'	
21	0.08	N=10, A-7-6(13), CL, S+C=67(43+24)	
32	0.29	N=8, A-7-6(41), CH, S+C=96(43+53)	
43	0.43	N=9, A-7-6(50), CH, S+C=96(32+64)	
		N=50/0.20'	R(847.3')
14		N=15	
25	0.02	N=10, A-7-6(42), CH, S+C=70(38+32)	
20	0	N=9, A-2-4(0), SM, S+C=19(16+3)	
15	0	N=73, A-2-4(0), SM, S+C=24(21+3)	
4		N=R/0.10'	R(832.9')
1		N=R/0.10'	
11		N=R/0.20'	R(835.6')
15	-0.16	N=19, A-6(17), CL, S+C=89(60+29)	
17			
22	0.09	N=18, A-7-6(36), CH, S+C=94(44+50)	
14	0	N=17, A-2-4(0), SM, S+C=21(19+2)	
15	-0.26	N=16, A-6(10), CL, S+C=86(66+20)	
22	0.06	N=11, A-6(15), CL, S+C=95(66+29)	

KY ROD REC

23	34	
62	90	RDZ = 12.90'
14	96	RDZ = 16.00'
54	92	RDZ = 20.00'

Top of Rock elev. = 856.2
Base of weathered rock elev. = 851.8

Top of Rock elev. = 842.9
Base of weathered rock elev. = 840.4

Top of Rock elev. = 831.8
Base of weathered rock elev. = 828.8

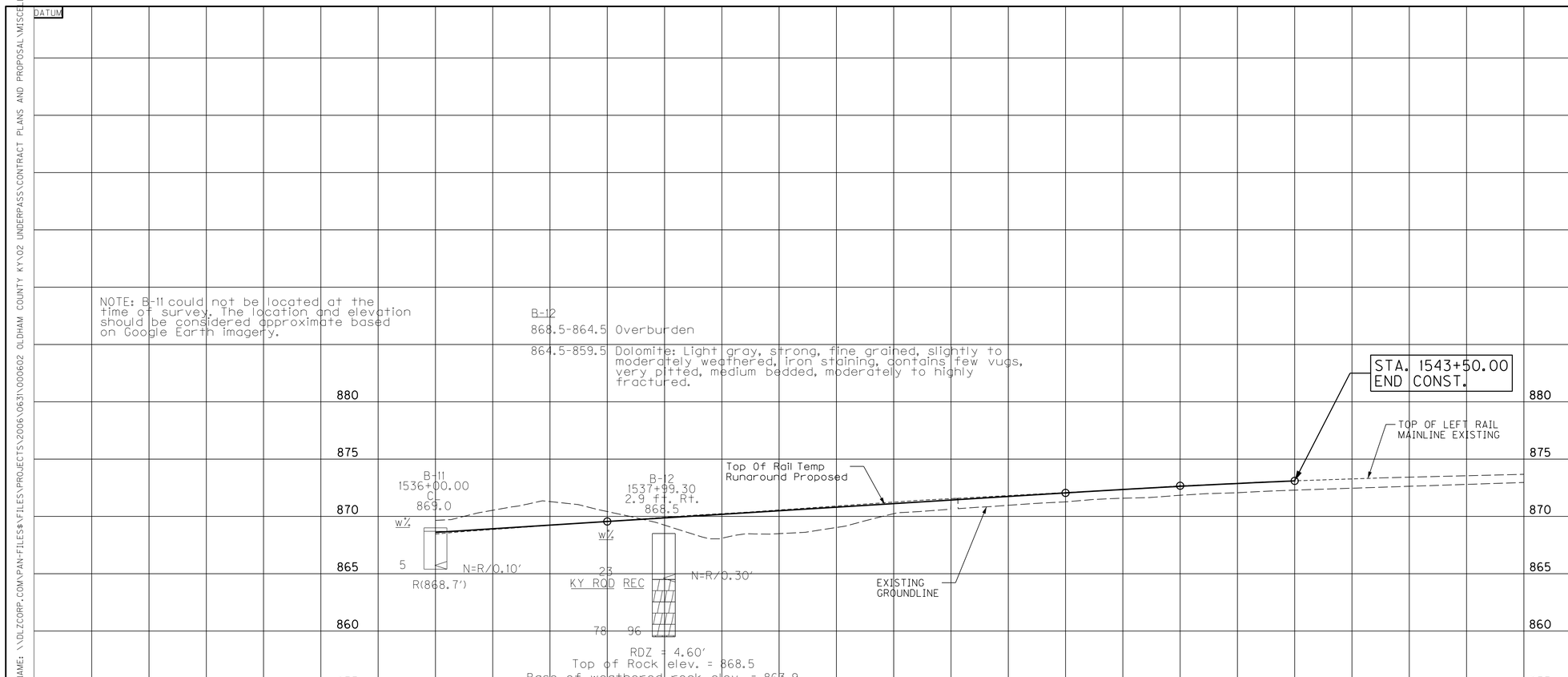
SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

| | | |

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	003

NOTE: B-11 could not be located at the time of survey. The location and elevation should be considered approximate based on Google Earth imagery.

B-12
868.5-864.5 Overburden
864.5-859.5 Dolomite: Light gray, strong, fine grained, slightly to moderately weathered, iron staining, contains few vugs, very pitted, medium bedded, moderately to highly fractured.



SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

SOIL PROFILE CSX RAILROAD RUNAROUND
STA. 1536+00.00 TO STA. 1543+50.00

FILE NAME: \\DLZCORP.COM\PAN-FILES$\FILES\PROJECTS\2006\0631\000602 OLDHAM COUNTY KY\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\MISCELLANEOUS\
USER: sbollinger
DATE PLOTTED: June 14, 2024
E-SHEET NAME: R0270BPF
MicroStation v10.17.02.61

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	004

B-32C

856.9-836.9 Overburden

836.9-833.6 Limestone: Light brown, strong, fine to coarse grained, highly weathered, fossilferous, thin bedded, highly fractured to broken.

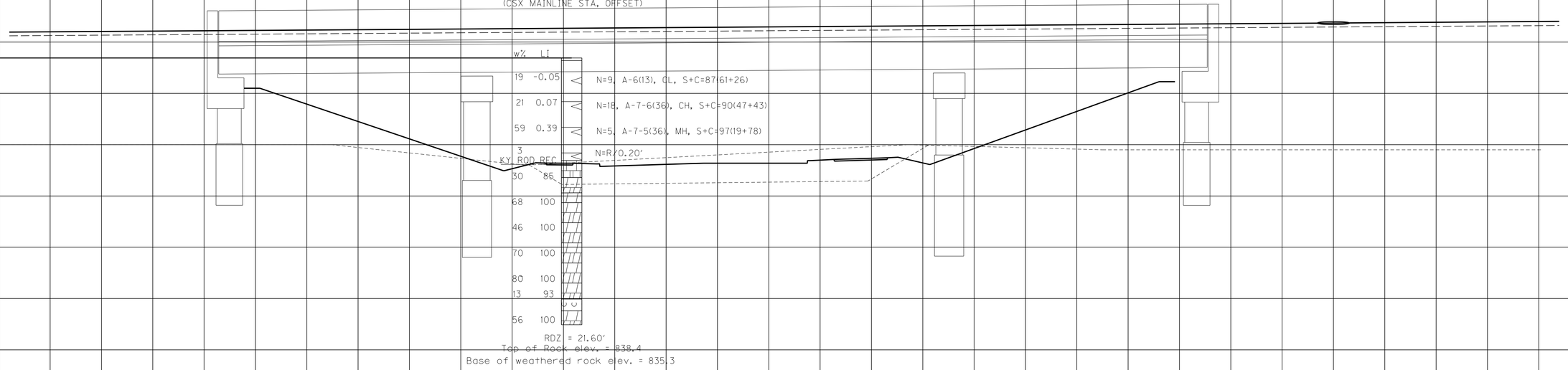
833.6-830.6 Dolomite: Gray, strong, fine grained, moderately weathered, pitted, medium bedded, highly fractured.

830.6-828.7 Dolomite: Gray, moderately strong, (60%) interbedded with SILTSTONE (40%); fine grained, slightly weathered, thinly bedded, highly fractured to broken.

828.7-809.9 Dolomite: Gray to greenish gray, strong, fine grained, slightly weathered, argillaceous, medium bedded, moderately fractured.

809.9-807.6 Shale (claystone): Gray, moderately strong, fine grained, highly weathered, thickly bedded, highly fractured to broken.

807.6-804.9 Dolomite: Gray to greenish gray, strong, fine grained, slightly weathered, medium bedded, highly fractured.



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

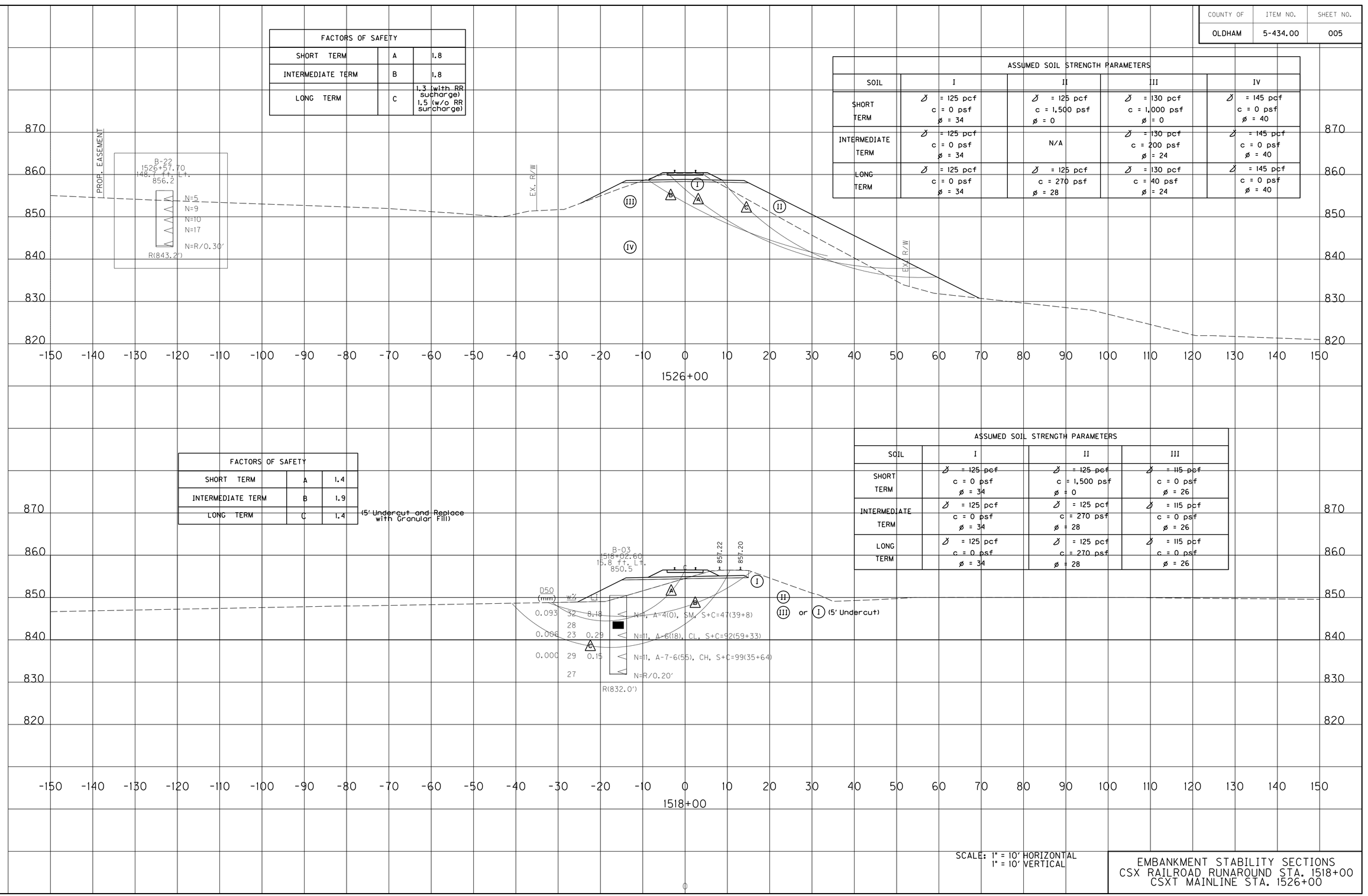
SOIL PROFILE - CSXT MAINLINE
STA. 1528+61.60

MicroStation v10.17.02.61
E-SHEET NAME: X00100XS
USER: sbollinger
DATE PLOTTED: June 14, 2024
FILE NAME: \\DLZCORP.COM\PAN-FILES$\FILES\PROJECTS\2006\0631\000602 OLDHAM COUNTY KY\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\MISCELLANEOUS\

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	005

FACTORS OF SAFETY		
SHORT TERM	A	1.8
INTERMEDIATE TERM	B	1.8
LONG TERM	C	1.3 (with RR surcharge) 1.5 (w/o RR surcharge)

ASSUMED SOIL STRENGTH PARAMETERS				
SOIL	I	II	III	IV
SHORT TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 1,500 psf ø = 0	γ = 130 pcf c = 1,000 psf ø = 0	γ = 145 pcf c = 0 psf ø = 40
INTERMEDIATE TERM	γ = 125 pcf c = 0 psf ø = 34	N/A	γ = 130 pcf c = 200 psf ø = 24	γ = 145 pcf c = 0 psf ø = 40
LONG TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 270 psf ø = 28	γ = 130 pcf c = 40 psf ø = 24	γ = 145 pcf c = 0 psf ø = 40



FACTORS OF SAFETY		
SHORT TERM	A	1.4
INTERMEDIATE TERM	B	1.9
LONG TERM	C	1.4

(5' Undercut and Replace with Granular Fill)

ASSUMED SOIL STRENGTH PARAMETERS			
SOIL	I	II	III
SHORT TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 1,500 psf ø = 0	γ = 115 pcf c = 0 psf ø = 26
INTERMEDIATE TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 270 psf ø = 28	γ = 115 pcf c = 0 psf ø = 26
LONG TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 270 psf ø = 28	γ = 115 pcf c = 0 psf ø = 26

SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

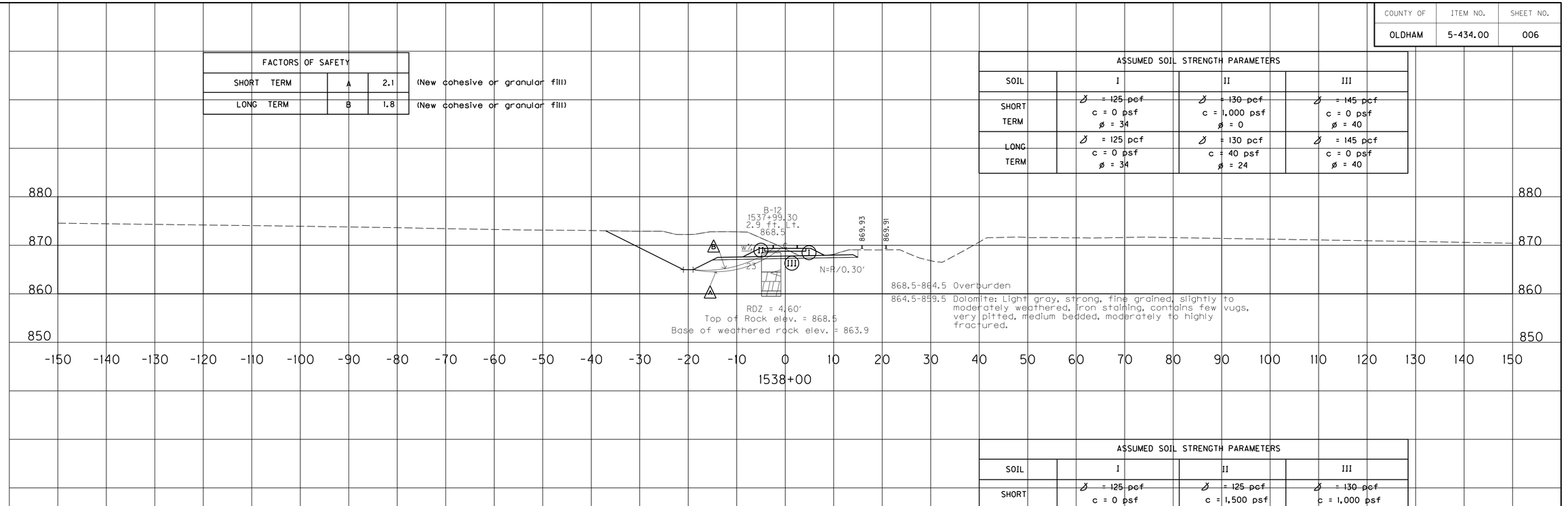
EMBANKMENT STABILITY SECTIONS
CSX RAILROAD RUNAROUND STA. 1518+00
CSXT MAINLINE STA. 1526+00

FILE NAME: \\DLZCORP.COM\PAN-FILES\PROJECTS\2006\0631\000602 OLDHAM COUNTY KY\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\MISCELLANEOUS\
USER: sbollinger
DATE PLOTTED: June 14, 2024
E-SHEET NAME: X00100XS
MicroStation v10.17.02.61

COUNTY OF	ITEM NO.	SHEET NO.
OLDHAM	5-434.00	006

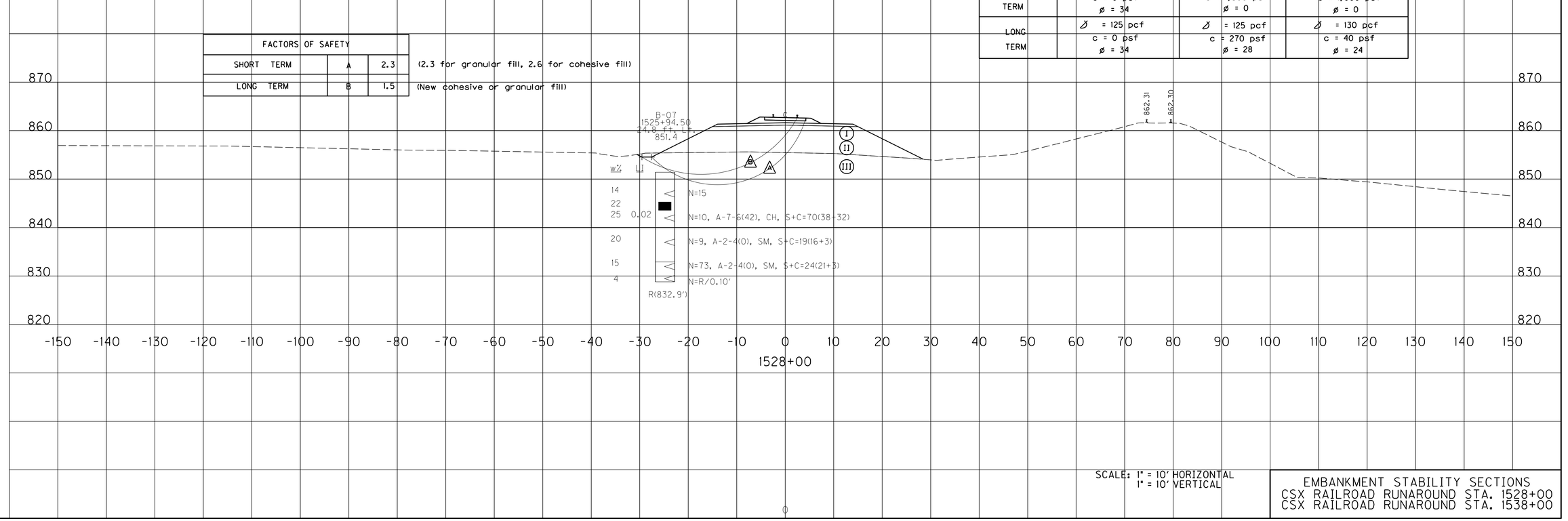
FACTORS OF SAFETY			
SHORT TERM	A	2.1	(New cohesive or granular fill)
LONG TERM	B	1.8	(New cohesive or granular fill)

ASSUMED SOIL STRENGTH PARAMETERS			
SOIL	I	II	III
SHORT TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 130 pcf c = 1,000 psf ø = 0	γ = 145 pcf c = 0 psf ø = 40
LONG TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 130 pcf c = 40 psf ø = 24	γ = 145 pcf c = 0 psf ø = 40



ASSUMED SOIL STRENGTH PARAMETERS			
SOIL	I	II	III
SHORT TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 1,500 psf ø = 0	γ = 130 pcf c = 1,000 psf ø = 0
LONG TERM	γ = 125 pcf c = 0 psf ø = 34	γ = 125 pcf c = 270 psf ø = 28	γ = 130 pcf c = 40 psf ø = 24

FACTORS OF SAFETY			
SHORT TERM	A	2.3	(2.3 for granular fill, 2.6 for cohesive fill)
LONG TERM	B	1.5	(New cohesive or granular fill)



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

EMBANKMENT STABILITY SECTIONS
CSX RAILROAD RUNAROUND STA. 1528+00
CSX RAILROAD RUNAROUND STA. 1538+00

MicroStation v10.17.02.61 | E-SHEET NAME: X0010OXS | USER: sbollinger DATE PLOTTED: June 14, 2024 | FILE NAME: \\DLZCORP.COM\PAN-FILES$\FILES\PROJECTS\2006\0631\000602 OLDHAM COUNTY KY\02 UNDERPASS\CONTRACT PLANS AND PROPOSAL\MISCELLANEOUS\