



Technical Design Memo

Client: Ohio Department of Transportation, District 10

Project: **ATH-329-5.26 (Task Order 10-S)**
PID 114589

HDR Project No: 10292574

Rev: 0

Calculation No: 1

Page: 1 of 213

Title: Landslide Remediation Analyses and Design

Purpose: Prepare slope stability analyses and wall calculations for the design of a landslide repair along the southbound travel lane of State Route 329 (SR 329) in Athens County, Ohio.

Originator: DCM/PG

Date: 6/2/2021

Checked by: PG/DCM/AKB

Date: 6/4/2021

QC Review by: DMV

Date: 6/9/2021

Summary

1. A landslide has occurred on the slope below SR 329 near mile marker 5.26 in Athens County, Ohio. The project location is shown on the attached Site Vicinity and Topographic Map, near the base of the valley wall and along the floodplain of Federal Creek. The segments of SR 329 immediately adjacent to the project site, both up- and down-station, have had a history of landslide activities requiring design and construction of mitigation solutions. The mitigation measures consist of a structural solution south of the project site and an earthwork solution to the north. Based on observations gathered during the site reconnaissance performed on February 17, 2021, coupled with the findings from the geotechnical explorations performed between March 8 and 12, 2021, a combination of a soldier pile and lagging retaining wall within the southern portion of the site, where bedrock is relatively shallow, and an earthwork solution in the northern portion of the site is recommended to stabilize the landslide and repair SR 329. Presented herein are the discussion and evaluation of a soldier pile and lagging wall and an excavation and replacement scheme for landslide mitigation. These designs assume that the topography and slope geometry as presented in the surveyed cross sections are representative of the current field conditions.



2. The geotechnical exploration program consisted of a series of 7 test borings (designated as Borings B-001-0-21, B-002-0-21, B-003-0-21, B-004-0-21, B-005-0-21, B-005-1-21, and B-006-0-21) to characterize the subsurface profile in the vicinity of the existing landslide and develop the repairs. Six test borings were drilled within the southbound lane of SR 329 and 1 boring was drilled within the field below the project site at the locations shown on the attached Boring Location Plan. Typed boring logs are also included in the appendix. The soil profile, as encountered in the borings, generally consisted of an upper layer of medium stiff to stiff embankment fill, transitioning to stiff to very stiff cohesive overburden and hard cohesive residuum just before bedrock within Borings B-001-0-21 to B-004-0-21. At Borings B-005-0-21 to B-006-0-21, the roadway embankment is located upon the floodplain of Federal Creek, with the embankment fill underlain by layers of soft to stiff alluvial deposits before encountering stiff to hard cohesive, and very dense granular, residual soils. The overburden soils were underlain by severely weathered claystone and sandstone rock.

Generalized soil profiles developed for each of the recommended landslide mitigations are based on the segment geometries and encountered subsurface conditions. The design section for the soldier pile and lagging wall at Station 275+75 is primarily based on the findings from Boring B-002-0-21, and supplemented with information from B-005-1-21 to establish the soil profile along the slope below the roadway. The design section for the earthwork solution at Station 281+00 is primarily based on the findings from a combination of Borings B-005-0-21 and B-006-0-21 along SR 329, and B-005-1-21 on the slope below the roadway. These soil profiles are assumed to be depicted as shown graphically on the attached Slope/W output plots based on the generalized soil conditions as encountered in the explorations, as well as field observations gathered during the site reconnaissance.

3. Eastern Athens County is located within the Marietta Plateau region of the Allegheny (Kanawha) Plateaus section of the unglaciated and dissected Appalachian Plateaus province, described as dissected, high-relief terrain prone to landslide activity and mainly composed of fine-grained rocks, red shales and red residual soils. Soils in the Marietta Plateau region are identified as Pleistocene (Teays)-age Minford clays and/or red and brown colluvial silty-clay loam landslide deposits. The eastern portion of Athens County is drained by tributaries of the Hocking River, which in turn flows into the Ohio River at the southeastern corner of the county. The project site is drained directly by Federal Creek running along the toe of the slope below SR 329, which drains into the Hocking River approximately 1.3 miles south of the project site. Soils in the area are comprised primarily of residuum and colluvium derived from the underlying sedimentary bedrock on the hillside, and alluvial deposits within the floodplain. The bedrock at the project site is mapped within the Pennsylvanian-age Monongahela Group, though the Permian-Pennsylvanian-age Dunkard Group is present on the top of the hillside, above approximately elevation 860. The Monongahela Group consists of shale, siltstone, and mudstone, with minor amounts of limestone and coal. The Dunkard Group consists of mudstone, shale, and siltstone, with minor amounts of sandstone, limestone, and coal.
4. Coal seams of note within the Monongahela Group include the Pittsburgh No. 8, Pomeroy (Redstone) No. 8a, Meigs Creek (Sewickley) No. 9, Uniontown No. 10, and Waynesburg No. 11



coals. According to information from the Ohio Department of Natural Resources, two abandoned mines are mapped approximately 1 mile north of the project site, designated as AS-228 and AS-238. The Pittsburgh No. 8 coal is the commodity indicated in the ODNR records. A coal seam elevation of 600 is indicated for the AS-238 mine, and 3 abandoned mine openings are recorded on the slope below (east of) SR 329 between approximately elevation 600 and 620. A mine portal, designated as AS-OGS-047, indicating unknown extents is located approximately 0.7 miles north of the project site. The Pittsburgh No. 8 coal is the commodity indicated in ODNR records, with an approximate elevation of 593 recorded as the base of section elevation.

5. Free water was encountered in 6 of the test borings (Borings B-001-0-21, B-003-0-21, B-004-0-21, B-005-0-21, B-005-1-21, and B-006-0-21) at depths of 18.0 ft (El 600.7), 18.5 ft (El 606.8), 28.0 ft (El 595.3), 15.0 ft (El 606.4), 21.0 ft (El 588.6), and 18.5 (El 600.1) respectively, during drilling. However, delayed water level readings were not obtained as the borings were backfilled upon completion given their locations within, or in close proximity to, the roadway. Elevated moisture contents were also noted in the embankment fill material as well as the deeper alluvial layers.

The free water as encountered in the borings is anticipated to be groundwater rather than a perched water condition given the location of the project site near Federal Creek. Review of FEMA maps for the area indicate the area below SR 329 falls under Zone A with no base flood elevation provided, whereas the roadway and the hillside above classifies as Zone X, area of minimal flood hazard. The elevated moisture contents within the embankment fill is likely the result of run-off infiltration.

6. HDR is aware of two prior geotechnical explorations bounding the ATH-329-5.26 project site. Both explorations were performed for nearby landslide remediation projects. The exploration to the south, designated ATH-329-5.10, was performed in 2018 by HDR. The exploration to the north, designated ATH-329-5.44, was performed in 2016 by ODOT. A search of the available records on ODOT's Transportation Information Mapping System (TIMS) reveals the geographical locations of known landslide activity in the project area, but does not indicate any previous borings performed within the project limits. The nearest borings from prior studies on TIMS were performed in 1959 approximately 330 feet north of the ATH-329-5.26 project limits, at the north end of ODOT's 2016 ATH-329-5.44 project. Information from this 1959 exploration is not included in this memorandum.

HDR's 2018 exploration consisted of three borings performed near the top of the slope, outside the roadway, designated as B-001-0-18, B-002-0-18, and B-003-0-18. The soils encountered consisted of a layer of fill, underlain by colluvium and bedrock. The fill was comprised of predominantly medium stiff Clay (A-7-6), with a 1-foot thick layer of Stone Fragments with Sand, Silt, and Clay (A-2-6) encountered at the surface of Boring B-001-0-18. Fill depths ranged from about 4.5 to 8.5 feet below existing grades (El. 602.3 to 606.2). The colluvium consisted of medium stiff to hard Silty Clay (A-6b) and Clay (A-7-6) and was encountered to depths of about 8.6 to 23 feet below grade (El. 587.8 to 605.2). A possible 3-foot thick sandstone boulder was encountered in Boring B-002-0-18 between about 18.5 and 21.5 feet below grade (El. 589.3 to 592.3). Bedrock consisting of siltstone and sandstone was encountered below the colluvium.



RQD values for the siltstone ranged from 69% to 91%, and for the sandstone 78% to 100%. Groundwater was not recorded in any of the borings.

ODOT's 2016 exploration consisted of four borings performed within the roadway, designated as B-001-0-16, B-002-0-16, B-003-0-16, and B-004-0-16, and two borings in the floodplain below the slope, designated as B-002-1-16 and B-003-1-16. The soils encountered consisted of very soft to very stiff Sandy Silt (A-4a), Silt and Clay (A-6a), Silty Clay (A-6b), Clay (A-7-6), and very loose to medium dense Stone Fragments (A-1-A), Gravel and Stone Fragments with Sand (A-1-b), Gravel and Stone Fragments with Sand and Silt (A-2-4), Coarse and Fine Sand (A-3a), and Sandy Silt (A-4a). Only Borings B-002-1-16 and B-003-1-16 at the toe of the slope encountered sandstone bedrock in the SPT samples at depths of about 27 feet below grade (El. 577.0 to 577.7), which was not cored. Groundwater was recorded in Borings B-001-0-16, B-002-1-16, and B-003-1-16 at elevations ranging from 584.3 to 599.5.

Wall Design – Sta. 273+00 to Sta. 278+00

7. To determine the design section, a preliminary wall location was plotted with the centerline of the proposed drilled shafts a distance of 21 feet from the centerline of the roadway. A 4-foot bench was included in front of the wall, and the existing grade elevation was used as the proposed bench elevation. Elevations along this preliminary wall profile were reviewed to establish the tallest exposed wall height (considering the elevation at the centerline of SR 329 to the proposed bench elevation), which was about 8.5 feet at Station 275+60 (see attached). The section at Station 275+75 was selected for design, and the elevation of the bench was lowered to match the maximum exposed wall height (see attached).
8. In accordance with ODOT GB-7 recommendations, an initial set of soil strength parameters were selected based on laboratory tests and published correlations of soil strength with SPT N_{60} values. A statistical basis for selecting the initial soil parameters was performed utilizing the data collected at Borings B-001-0-21, B-002-0-21, B-003-0-21, B-004-0-21 and B-005-1-21, and is in the attached printed spreadsheets entitled "SOIL STRENGTH PARAMETER DETERMINATION". These values were then entered into the Slope/W slope stability modeling software to re-create the landslide observed in the field by simulating a series of optimized trial searches to determine the critical mode of failure based on a Morgenstern-Price stability model. In addition, the Slope/W optimization feature was utilized, which generates a hybrid circular and translational failure shape. Recognizing that a landslide had already occurred, strength parameters within the existing soil layers were adjusted in order to generate a reasonable slip surface ($FS < 1.0$) that is consistent with the field observations and engineering judgment.

Bedrock depths along the slope below SR 329 were estimated based on the slope of the existing terrain, exposed bedrock outcrops in the cuts north and south of the project site, limited data available on published bedrock topography maps, and overburden soil thicknesses encountered in the recent and historic soil borings. Once the soil parameters and failure surface were established, they were entered into the UA Slope Version 2.3 software program and a model was developed based on the current slope configuration (See attached UA Slope screen shot).

Based on the groundwater levels encountered in the borings and information available from published sources, groundwater for the wall design was modeled from the existing drainage ditch to the left of the existing roadway to the level of elevated moisture and encountered groundwater in B-002-0-21 (approximately El. 619.0) and extending to Federal Creek at approximate El 594.0.

9. After the soil profile and parameters between Slope/W and UA Slope were confirmed and finalized, a drilled shaft lagging wall was selected and analyzed at approximately 21 feet right of the SR 329 centerline. This allows for, at a minimum, a 10-foot travel lane, 2-foot shoulder, and a 5-foot clearance between the required guardrail to be installed and the back of the proposed 3-foot diameter drilled shaft. This recommended offset also allows for continuity with the existing features (existing wall, roadway section, shoulder width, guardrail offset, etc.) located to the south of the project site. Once the wall location was established, the “Manually Determined Load Transfer Factor” was selected in the UA Slope program and the load transfer factor (η) was set to zero in order to determine the horizontal forces acting on the wall. The computed unfactored force per shaft is $P_s = 69,336$ pounds based on 36-inch diameter drilled shafts spaced at approximate 6-foot centers. (See attached UA Slope computer screen shots of the post-construction condition of these calculations.) The numbering of soil layers for the UA Slope profile is listed as follows:
 - a. Layer 1 = Surcharge Load
 - b. Layer 2 = Item 203 Embankment Fill
 - c. Layer 3 = M. Stiff to Stiff Fill
 - d. Layer 4 = M. Stiff to Stiff Alluvium
 - e. Layer 5 = Stiff to V. Stiff Cohesive
 - f. Layer 6 = Hard Cohesive
 - g. Layer 7 = Bedrock

10. In accordance with ODOT design requirements, LPILE software was used to determine the pile response to the applied lateral loading from the failure wedge determined by the Slope/W and UA Slope analyses performed at the design section at Sta. 275+75. Relative to LPILE analyses, the following were considered for an 8.5-foot exposed wall height:

(a) Factored Distributed Load (per GB-7, pg. 30)

➤ Convert concentrated load from UA Slope to distributed load

○ $\frac{1}{2}(D_L)(H_T) = 69,336$ lbs.

D_L = distributed load

H_T = 16.8 feet (top/wall to slip surface, see attached)

○ $D_L = [(69,336 \text{ lbs})(2)] / [(16.8')(12''/\text{ft})] = \text{Resolution of Triangular Area}$
 $D_L = \mathbf{688 \text{ lbs/in}}$ (Service Load)

○ $(688 \text{ lbs/in})(\mathbf{g_{EH}}) = (688 \text{ lbs/in})(1.5) = \mathbf{1032 \text{ lbs/in}}$ (Strength Load for Moment/Shear Analysis).

Loading due to conventional earth pressures were performed for comparison purposes.



- Calculate conventional earth pressure wall loading.
 - Equivalent Fluid Weight (G_H) = $(\gamma_m) * (K) = \mathbf{47 \text{ pcf}}$
 γ_m = soil moist unit weight (see attached calculations)
 K_a = active earth pressure (see attached calculations)
 - Lateral Thrust (P) = $1/2 * G_H * H^2 = P = \mathbf{1,683 \text{ lbs/ft}}$
 H = Wall Height
 - Horizontal Force Per Shaft (P_{SH}) = $P * (S_{cc}) = \mathbf{10,096 \text{ lbs/shaft}}$
 S_{cc} = Center-to-Center Shaft Spacing = 6 ft
 - Resolve Horizontal Earth Pressure to Distributed Triangular Load
 $(2 * P_{SH} / H) / (12 \text{ in/ft})$
 $= \mathbf{198 \text{ lbs/in per shaft (Service Load)}}$
 $(198 \text{ lbs/in}) (\sigma_{EH}) = (198 \text{ lbs/in}) (1.5)$
 $= \mathbf{297 \text{ lbs/in per shaft (Strength Load)}}$

Based on a comparison of the two loading methods, landslide loading from UA Slope was applied to the proposed wall.

(b) Traffic Surcharge (per GB-7, pg. 30)

As loading traffic may be present within up to the front edge of the guardrail, located within 5 feet of the back of the drilled shafts, traffic surcharge loading was included in the distributed load acting on the shaft (see attached calculations).

(c) Modification of p-y curves

Since the center-to-center spacing is < 3.5 shaft diameters, a reduction in soil resistance (p) should be applied from the ground surface to the bottom of shaft or bedrock (whichever is shallower).

- $\beta_a = 0.64(S/D)^{0.34} = \beta_a = 0.64(6/3)^{0.34}$
- $\beta_a = \mathbf{0.81}$

The downslope stability exhibited a Factor of Safety greater than 1.3. (See the Slope/W output plot included in the attached calculations.) As such, the GB-7 recommendation of artificially lowering the ground surface in the LPILE analysis was not included.

(d) Pile Length (per GB-7, pg. 28)

- *Minimum 10 feet below slip plane
- *Slip Plane = 16.8 ft below top of wall
 $+10.0 \text{ ft}$
 26.8 ft minimum pile length

➤ **Bottom of Drilled Shaft = 42.0 ft > 26.8 ft** **OK**



ODOT GB-7 requires embedding a drilled shaft a minimum of 10 feet below the failure surface and into a solid stratum such that the calculated deflection at the top of the wall is constrained to the appropriate serviceability limits. (See Section 10e below.) The “Top Deflection Versus Length” plot produced by the LPILE software was reviewed to determine the recommended drilled shaft length. As the claystone bedrock encountered variable thicknesses and strengths, the claystone was modeled as hard clay to be present to the pile tip for conservatism. Based on the encountered profile and our experience with such local bedrock types, **a minimum drilled shaft length of 35 feet or 10 feet into sandstone bedrock**, whichever is encountered first, is recommended.

(e) Pile Head Deflection

As noted in ODOT GB-7 (pages 30 and 31), for the unfactored Service Limit State analysis, pile head deflection shall be limited 1% or less of the drilled shaft length above bedrock (or the total shaft length when bedrock is not encountered). If the drilled shafts are within 10 feet of the edge of pavement, the deflection must be limited to 2 inches. The centerline of the drilled shafts is anticipated to be located less than 10 feet from the edge of pavement. As such, a limited pile head deflection of 2 inches or less was adopted.

Computed Pile Head Deflection (W 24 x 146) = **1.84 inches** < 2.00 inches OK
(See attached calculations)

(f) Steel Reinforcement and Pile Cross Section Character

Use W 24 x 146 shaft reinforcement

A_s = Area of Steel = 43.0 in²

I_x = Moment of Inertia around strong axis = 4,580 in⁴

T_w = web thickness = 0.65 in

E = Modulus of Elasticity of Steel = 29,000,000 psi

F_y = yield strength of steel = 50,000 psi

B_f = Flange Width = 12.9 in

11. It is recommended that plug piles be utilized to prevent loss of material and undermining of the concrete lagging. Please refer to the attached “Soldier Pile and Lagging Wall Details” sheet for details on the plug piles as well as further details on the wall itself.

Earthwork Solution – Sta. 278+00 to Sta. 284+50

12. In accordance with ODOT GB-7 recommendations, an initial set of soil strength parameters were selected based on laboratory tests and published correlations of soil strength with SPT N_{60} values. A statistical basis for selecting the initial soil parameters was performed utilizing the data collected at Borings B-004-0-21, B-005-0-21, B-005-1-21, and B-006-0-21, and is in the attached printed spreadsheets entitled “SOIL STRENGTH PARAMETER DETERMINATION”. These values



were then entered into the Slope/W slope stability modeling software to re-create the landslide observed in the field by simulating a series of optimized trial searches to determine the critical mode of failure based on a Morgenstern-Price stability model. Recognizing that a landslide had already occurred, strength parameters within the existing soil layers were adjusted to generate a reasonable slip surface ($FS < 1.0$) that is consistent with the field observations and engineering judgment.

13. For the earthwork design, groundwater was modeled from the existing drainage ditch at the right of the existing roadway to the toe of the embankment material below the existing roadway elevation and continuing just beneath the ground surface to Federal Creek located at the toe of the slope.
14. As the apparent depth of the slide would prohibit excavation of the entire slide mass, analyses were performed assuming a partial excavation of the slide mass and reconstruction of the embankment and roadway. Design considerations for this repair include maintaining a least one 10-foot wide lane of traffic during construction (currently the northbound lane) and a minimum 2-foot shoulder along the construction barrier. The construction barrier was assumed for the development of the slope stability analyses to be approximately 2-feet wide, with another 2 feet of clearance needed between the barrier wall opposite of traffic and the crest of a temporary excavation slope.

Analyses were performed for a cross-section cut at Sta. 281+00. The dimensions of the dump rock shear key and the excavation benching are shown on the attached design cross-section. This excavation scheme removes portions of the failed material above the slip-surface. However, the benching geometry was restricted by the need to maintain one lane of traffic and by the apparent depth of the failure surface. As such, some of the slip surface will remain. Initial analyses were performed considering similar earthwork geometries as the construction north of the current project site, which used a temporary excavation (1.5H:1V slope) starting at 6 feet left of the centerline and extended to a working bench located at approximate El. 611. This bench was widened until intersecting the existing ground line, and then a 1H:1V temporary slope was excavated down to a 20-foot wide shear key at El. 597. The analyses considered Type C Dumped Rock Fill as defined by CMS Section 703.19.B.3 within the shear key (from El. 597 to El. 601 at design Sta. 281+00) and reestablishing the embankment above the shear key with Item 203 – Embankment Fill at a slope of 3H:1V. However, as shown in the attached Slope/W analyses, this slope geometry was undermined by a failure surface with a Factor of Safety less than the minimum target of 1.3 under long term (drained) conditions. As such, the geometry was modified to incorporate a 25-foot wide, mid-slope bench at El. 611 to increase the resisting forces acting along the slope. The slope stability analyses for this slope configuration indicate a Factor of Safety > 1.30 for both short term (undrained) and long term conditions, and above the target Factor of Safety of 1.10 for rapid drawdown given the proximity of the site to Federal Creek. These analyses have also been included in the attachments.

As the repair continues both up- and down-station from the design section at Sta. 281+00, transition zones are needed to tie the embankment into the retaining wall anticipated to end at



approximate Sta. 278+00 and into the slope geometry established by the ATH-329-5.41 project. Additional slope stability analyses were performed at Sta. 278+00 and Sta. 279+00 to establish the geometries within these zones. The output from these analyses are attached, with the configurations presented meeting or exceeding the target factors of safety for short term, long term, and rapid drawdown conditions.

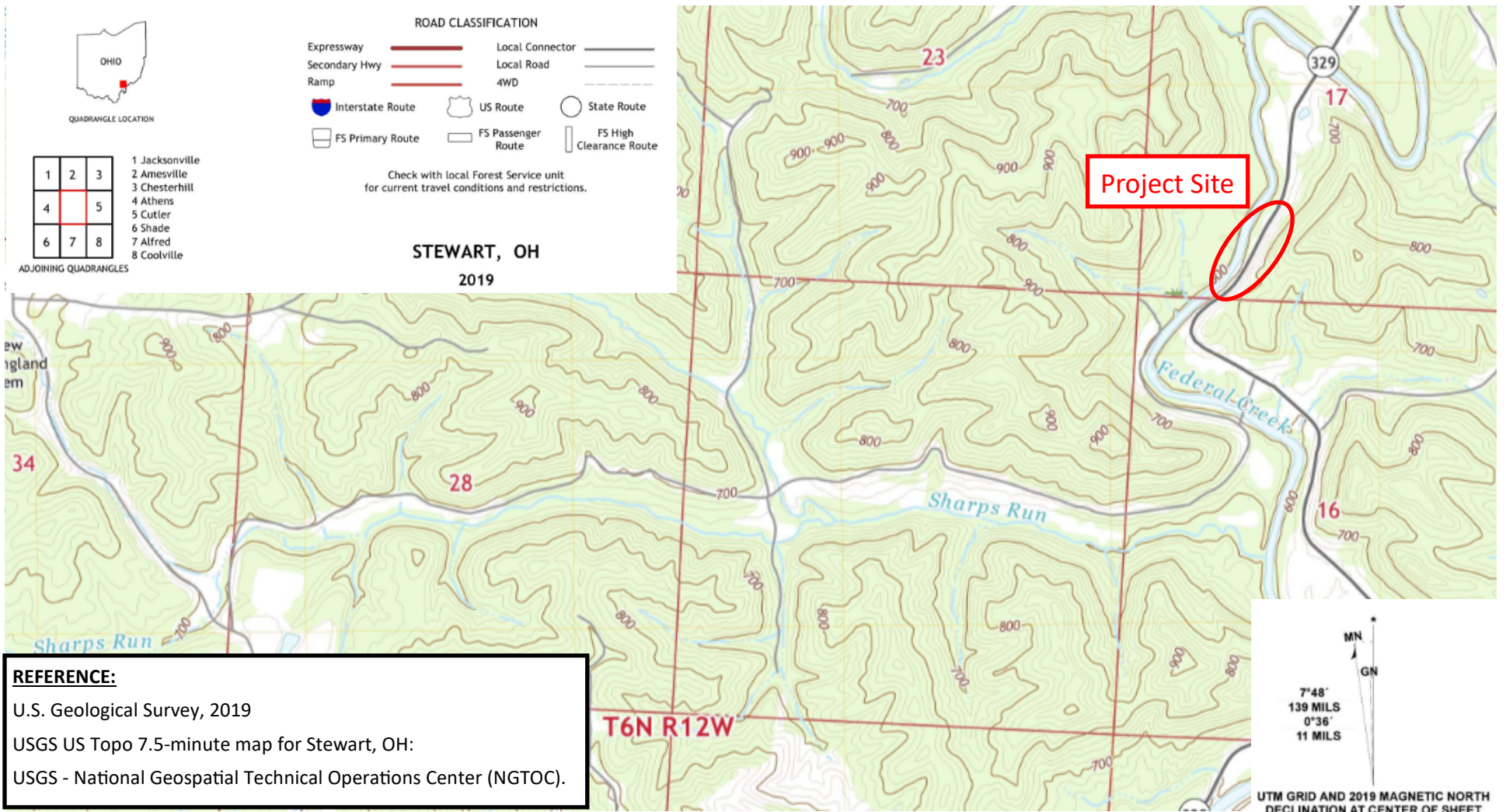
15. In addition to the analyzed cross-sections, a preliminary plan view has been provided to aid in transitioning to existing grade beyond the edges of the slip. Details of the shear key and excavation benching are shown on the attached design cross-sections.
16. Upon establishing the criteria remediating the slope, analyses were performed to evaluate the constructability of the shear key and temporary benching scheme in general accordance with ODOT Geotechnical Bulletin 2 (GB-2). The Factors of Safety were determined to be greater than 1.20 under short term conditions for the temporary slopes above and below the working bench, as well as for the global stability of the entire excavated slope. It is recommended that this temporary excavation not be left exposed any longer than necessary, with reconstruction of the slope to begin shortly after the excavation has been made. Drainage and run-off should also be diverted away from the excavation during construction.

Should a higher factor of safety be required during construction, other cut-slope stability measures/configurations or sheet piling may be needed to maintain the roadway embankment during construction of the shear key and sidehill benches. Determination of temporary shoring (if necessary) is to be determined by the contractor.



Site Vicinity and Topographic Map

Site Vicinity and Topographic Map

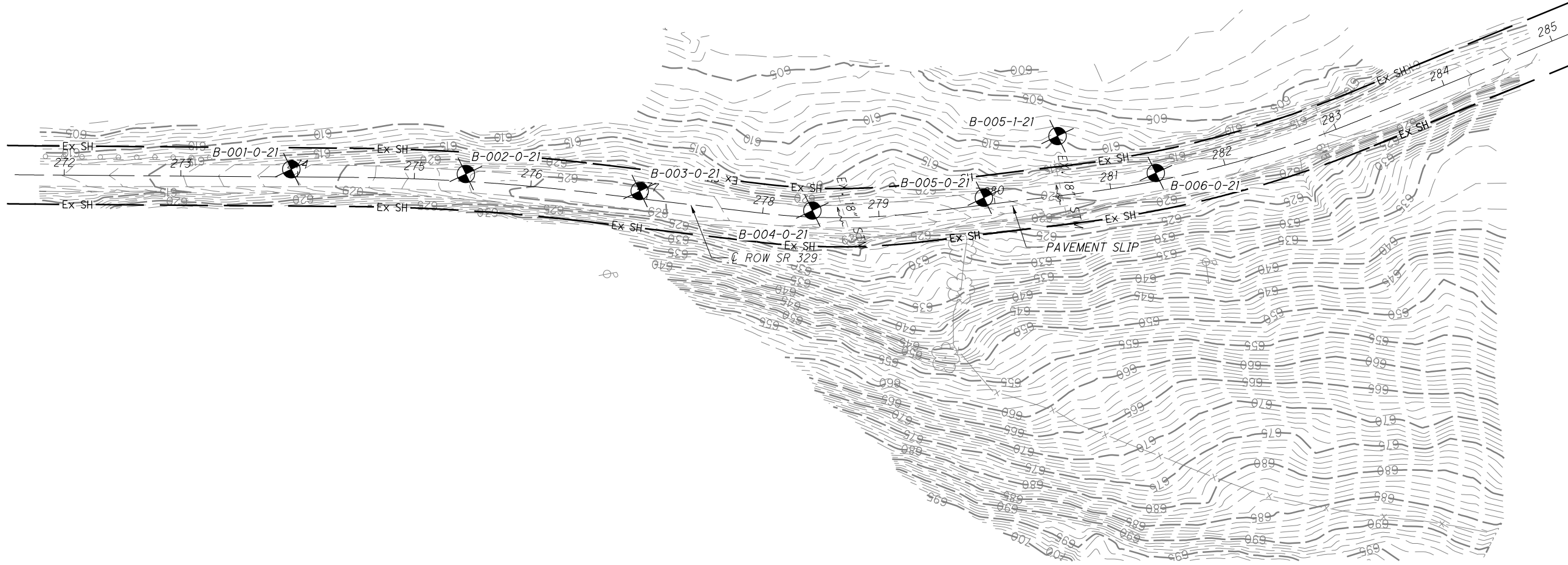


CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

U.S. National Grid
100,000 - m Square ID
MD
Grid Zone Designation
17S



Boring Location Plan



0 50 100
HORIZONTAL
SCALE IN FEET

DRAWN
CLW
CHECKED
DCM

BORING LOCATION PLAN

ATH-329-5.26



**Boring Logs
and
Rock Core Photos**

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:21 - C:\P\WORKING\AST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>273+95, 7' LT.</u>	EXPLORATION ID <u>B-001-0-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	PAGE 1 OF 2
PID: <u>114589</u> SFN: _____	DRILLING METHOD: <u>3.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>618.7 (MSL)</u> EOB: <u>49.5 ft.</u>	
START: <u>3/11/21</u> END: <u>3/11/21</u>	SAMPLING METHOD: <u>SPT / ST / NQ2</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.335836, -81.886972</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (14")	618.7																	
MEDIUM DENSE, DARK BROWN TO BLACK, GRAVEL WITH SAND, SILT, AND CLAY , TRACE ASPHALT, DAMP	617.5	1	6															
STIFF TO VERY STIFF, RED-BROWN TO BROWN, CLAY , SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	615.7	2	4	14	67	SS-1	-	28	20	18	19	15	29	17	12	10	A-2-6 (0)	
		3	3	10	78	SS-2	1.50	8	9	7	28	48	56	26	30	25	A-7-6 (19)	
		4	3	10	100	SS-3	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		5	4	10	100	SS-3	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		6	6	16	67	SS-4	4.00	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
		7	5	16	78	SS-5	4.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		8	6	16	78	SS-5	4.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		9	5	17	61	SS-6	3.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
		10	6	17	61	SS-6	3.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
		11	4	17	100	SS-7	4.00	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
VERY STIFF, RED-BROWN, SOME YELLOW-BROWN AND GRAY, CLAY , SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	608.2	12	4	20	100	SS-8	3.50	2	4	7	34	53	57	26	31	26	A-7-6 (19)	
		13	6	20	100	SS-8	3.50	2	4	7	34	53	57	26	31	26	A-7-6 (19)	
		14	8	25	39	SS-9	3.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
		15	8	25	39	SS-9	3.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
STIFF TO VERY STIFF, RED-BROWN, CLAY , "AND" SILT, TRACE SAND, TRACE GRAVEL, MOIST	603.7	16	3	13	78	SS-10	2.50	1	0	4	43	52	53	24	29	27	A-7-6 (18)	
		17	3	14	100	SS-11	2.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		18	5	14	100	SS-11	2.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
MEDIUM STIFF TO STIFF, RED-BROWN, SILTY CLAY , LITTLE SAND, MOIST @ 20.7' - 21.2' : Qu = 2,175 psf	600.7	18	2	10	100	SS-12	0.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
		19	3	10	100	SS-12	0.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
		20			100	ST-13	1.00	0	0	17	49	34	37	19	18	24	A-6b (11)	
		21			100	ST-13	1.00	0	0	17	49	34	37	19	18	24	A-6b (11)	
		22	2	6	100	SS-14	0.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
		23	2	7	100	SS-15	0.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
LOOSE, RED-BROWN, SANDY SILT , LITTLE CLAY, MOIST	594.2	24	0	7	100	SS-15	0.50	-	-	-	-	-	-	-	23	A-6b (V)		
		25	0	7	100	SS-16	-	0	0	51	31	18	25	19	6	22	A-4a (3)	
		26	1	7	100	SS-16	-	0	0	51	31	18	25	19	6	22	A-4a (3)	
CLAYSTONE , GRAY, SEVERELY WEATHERED, VERY WEAK.	591.2	27	1	33	100	SS-17	-	-	-	-	-	-	-	-	21	A-4a (V)		
		28	4	33	100	SS-17	-	-	-	-	-	-	-	-	21	A-4a (V)		
		29	33	-	100	SS-18	-	0	1	13	60	26	31	20	11	9	Rock (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:21 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 273+95, 7' LT.		START: 3/11/21		END: 3/11/21		PG 2 OF 2		B-001-0-21						
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
CLAYSTONE , GRAY, SEVERELY WEATHERED, VERY WEAK. <i>(continued)</i>			588.7	31	30	-	100	SS-19	-	-	-	-	-	-	-	-	-	-	7	Rock (V)
			585.2	32	50/4"	-	100	SS-20	-	0	26	47	20	7	NP	NP	NP	13	Rock (V)	
SANDSTONE , GRAY, SEVERELY WEATHERED, WEAK.			584.2	34	60/3"	-	100	SS-20	-	0	26	47	20	7	NP	NP	NP	13	Rock (V)	
SANDSTONE , GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, THICK TO VERY THICK BEDDED, JOINT AND BEDDING DISCONTINUITIES, INTACT TO UNFRACTURED, TIGHT APERTURE, VERY ROUGH TO SLIGHTLY ROUGH, INTACT OR MASSIVE STRUCTURE, GOOD TO VERY GOOD SURFACE; RQD 100%, REC 100%. @ 34.6' - 35.0' : Qu = 3,206 psi			569.2	35	100	100	NQ2-1												CORE	
				36																
				37																
				38																
				39																
				40																
				41																
				42																
				43																
				44																
				45																
				46																
				47																
				48																
				49																
NOTES: NONE																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER																				

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:21 - C:\P\WORKING\EA\ST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 275+44, 6' LT.		START: 3/11/21		END: 3/11/21		PG 2 OF 2		B-002-0-21						
MATERIAL DESCRIPTION AND NOTES			ELEV. 593.9	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
HARD, YELLOW-BROWN, CLAY , "AND" SILT, TRACE SAND, DAMP (continued)			592.1	TR	31	19	-	100	SS-13	-	-	-	-	-	-	-	-	-	12	A-7-6 (V)
CLAYSTONE , GRAY, SEVERELY WEATHERED, VERY WEAK.					32	37	-	100	SS-14	-	1	4	12	54	29	33	20	13	8	Rock (V)
			580.3		33															
					34	50	-	100	SS-15	-	-	-	-	-	-	-	-	-	6	Rock (V)
					35															
					36															
			564.3	EOB	37															
					38															
					39	50	-	100	SS-16	-	-	-	-	-	-	-	-	-	3	Rock (V)
					40															
					41															
					42															
					43	50	-	100	SS-16	-	-	-	-	-	-	-	-	-	3	Rock (V)
					44															
					45															
					46															
			47	100		100	NQ2-1												CORE	
			48																	
			49																	
			50																	
			51																	
			52																	
			53																	
			54	95		100	NQ2-2												CORE	
			55																	
			56																	
			57																	
			58																	
			59																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>276+93, 6' LT.</u>	EXPLORATION ID <u>B-003-0-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	
PID: <u>114589</u> SFN: _____	DRILLING METHOD: <u>3.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>625.3 (MSL)</u> EOB: <u>39.5 ft.</u>	PAGE <u>1 OF 2</u>
START: <u>3/10/21</u> END: <u>3/10/21</u>	SAMPLING METHOD: <u>SPT / NQ2</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.336550, -81.886449</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV. 625.3	DEPTH	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
								GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT (14") AGGREGATE BASE (3")	623.9	1																	
STIFF TO VERY STIFF, DARK BROWN, SOME GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP	620.3	2	4																
		3	5	14	33	SS-1	3.00	12	7	6	25	50	60	25	35	22	A-7-6 (20)		
		4	4	5	14	17	SS-2	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		5	3	5	14	17	SS-2	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
MEDIUM STIFF TO STIFF, RED-BROWN TO GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP	614.3	6	3	7	56	SS-3	2.00	16	11	7	24	42	51	23	28	20	A-7-6 (15)		
		7	3	4	12	39	SS-4	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		8	3	4	12	39	SS-4	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		9	3	3	9	67	SS-5	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		10	7	3	10	61	SS-6	3.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		11	3	4	10	61	SS-6	3.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
STIFF TO VERY STIFF, RED-BROWN, SOME YELLOW-BROWN AND GRAY, CLAY , SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST	609.8	12	3	9	100	SS-7	1.50	1	4	5	28	62	65	26	39	30	A-7-6 (20)		
		13	2	3	13	100	SS-8	2.00	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		14	3	6	13	100	SS-8	2.00	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
VERY DENSE, YELLOW-BROWN, SOME RED BROWN AND GRAY, SANDY SILT , SOME GRAVEL, LITTLE CLAY, DRY	606.8	15	3	4	14	67	SS-9	2.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		16	19	47	50/6"	-	100	SS-10	-	23	25	15	23	14	NP	NP	NP	6	A-4a (0)
		17	15	50/5"	-	100	SS-11	-	-	-	-	-	-	-	-	-	-	13	A-4a (V)
CLAYSTONE , RED-BROWN, SEVERELY WEATHERED, VERY WEAK.	606.8	18																	
	605.8	19	50/4"	-	100	SS-12	-	-	-	-	-	-	-	-	-	-	11	Rock (V)	
SANDSTONE , GRAY, SOME RED-BROWN, HIGHLY WEATHERED, WEAK TO SLIGHTLY STRONG, VERY FINE GRAINED TO FINE GRAINED, THIN BEDDED, FERRIFEROUS, ARGILLACEOUS, MICACEOUS, JOINT AND BEDDING DISCONTINUITIES, FRACTURED, NARROW TO OPEN APERTURE, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY STRUCTURE, POOR TO FAIR SURFACE; RQD 17%, REC 97%.	600.8	20																	
		21																	
		22	17		97		NQ2-1											CORE	
		23																	
		24																	
		25																	
CLAYSTONE , RED-BROWN, YELLOW-BROWN AND GRAY, HIGHLY WEATHERED, VERY WEAK, VERY THIN BEDDED, ARENACEOUS, FERRIFEROUS, JOINT DISCONTINUITIES, MODERATELY TO HIGHLY FRACTURED, OPEN APERTURE, SLIGHTLY ROUGH, DISINTEGRATED TO VERY BLOCK STRUCTURE, POOR TO FAIR SURFACE; RQD 33%, REC 82%.	600.8	26																	
		27	28		100		NQ2-2											CORE	
		28																	
		29																	

@ 29.1' - 29.5' : Qu = 49 psi

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EA\ST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN: _____		PROJECT: ATH-329-05.26		STATION / OFFSET: 278+43, 6' LT.		START: 3/9/21		END: 3/10/21		PG 3 OF 3		B-004-0-21										
MATERIAL DESCRIPTION AND NOTES				ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED			
											GR	CS	FS	SI	CL	LL	PL	PI						
				561.1																				
				560.6	EOB																			
<p>NOTES: NONE</p> <p>ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER</p>																								

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY AND RED-BROWN, SILTY CLAY , SOME SAND, TRACE GRAVEL, MOIST	591.4	31	11 10 12	32	33	SS-19	-	-	-	-	-	-	-	-	-	15	A-6b (V)	
		32	6 7 17	35	67	SS-20	-	10	14	14	28	34	37	19	18	20	A-6b (9)	
		33	16 11 11	32	61	SS-21	-	-	-	-	-	-	-	-	-	23	A-6b (V)	
		34	3 5 7	17	100	SS-22	-	-	-	-	-	-	-	-	-	23	A-6b (V)	
		35	4 8 13	30	100	SS-23	1.50	5	7	11	34	43	44	23	21	23	A-7-6 (13)	
STIFF TO VERY STIFF, GRAY, SOME RED-BROWN, CLAY , SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	585.4	36	4 7 10	25	100	SS-24	1.50	-	-	-	-	-	-	-	24	A-7-6 (V)		
		37	4 4 7	16	100	SS-25	1.00	-	-	-	-	-	-	-	26	A-6b (V)		
STIFF TO VERY STIFF, GRAY, SOME RED-BROWN, SILTY CLAY , SOME SAND, TRACE GRAVEL, MOIST	582.4	38	5 7 9	23	100	SS-26	0.50	3	7	20	32	38	36	17	19	20	A-6b (11)	
		39	3 4 5	13	100	SS-27	0.50	-	-	-	-	-	-	-	21	A-6b (V)		
		40	2 5 5	14	100	SS-28	0.50	-	-	-	-	-	-	-	23	A-6b (V)		
		41	3 3 3	9	100	SS-29	-	-	-	-	-	-	-	-	21	A-4a (V)		
		42	4 5 5	14	100	SS-30	-	-	-	-	-	-	-	-	21	A-4a (V)		
LOOSE TO MEDIUM DENSE, GRAY, SANDY SILT , LITTLE CLAY, WET	576.4	43	3 4 4	12	100	SS-31	-	0	1	48	31	20	NP	NP	NP	21	A-4a (3)	
		44	7 30 50/4"	-	100	SS-32	-	0	5	64	22	9	NP	NP	NP	16	A-3a (0)	
		45	50/3"	-	100	SS-33	-	-	-	-	-	-	-	-	17	A-3a (V)		
VERY DENSE, LIGHT GRAY, COARSE AND FINE SAND , WET (SEVERELY WEATHERED SANDSTONE)	567.9	54																
@ 56.5' : AUGER REFUSAL	564.9	56																

EOB

NOTES: NONE
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\AST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>280+60, 51' LT.</u>	EXPLORATION ID <u>B-005-1-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	
PID: <u>114589</u> SFN: _____	DRILLING METHOD: <u>2.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>609.6 (MSL)</u> EOB: <u>53.1 ft.</u>	PAGE 1 OF 2
START: <u>3/12/21</u> END: <u>3/12/21</u>	SAMPLING METHOD: <u>SPT / ST</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.337490, -81.886042</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
TOPSOIL (2")	609.6																	
MEDIUM STIFF TO STIFF, RED BROWN, CLAY , "AND" SILT, LITTLE SAND, TRACE GRAVEL, NOTED ORGANICS, MOIST	609.4	1	2															
		2	2	7	67	SS-1	1.50	1	6	7	36	50	50	24	26	28	A-7-6 (16)	
		3																
		4	2	6	0	SS-2	-	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
		5	2															
		6	2															
		7	2	7	78	SS-3	1.00	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
		8																
		9	2															
		10	3	12	67	SS-4	1.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
	598.6	11	3															
STIFF TO VERY STIFF, RED-BROWN, SOME YELLOW-BROWN AND GRAY, CLAY , SOME SILT, TRACE GRAVEL, LITTLE SAND, DAMP		12	5	16	56	SS-5	1.50	8	6	5	30	51	54	23	31	23	A-7-6 (19)	
		13																
		14	2															
		15	3	13	67	SS-6	1.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		16																
		17	3	14	78	SS-7	2.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		18																
		19	3	19	78	SS-8	3.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		20																
	588.6	21	6															
MEDIUM DENSE, GRAY, SOME YELLOW-BROWN, COARSE AND FINE SAND , LITTLE SILT, TRACE GRAVEL, TRACE CLAY, WET		22	7	20	67	SS-9	-	6	37	38	14	5	NP	NP	NP	22	A-3a (0)	
		23																
	586.1	24	2	9	67	SS-10	0.50	0	2	2	20	76	49	23	26	35	A-7-6 (16)	
MEDIUM STIFF TO STIFF, GRAY, CLAY , SOME SILT, TRACE SAND, MOIST		25	4															
	583.6	26	5															
STIFF TO VERY STIFF, GRAY, SOME YELLOW-BROWN, CLAY , "AND" SILT, TRACE GRAVEL, TRACE SAND, MOIST		27	7	27	78	SS-11	-	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
		28																
		29	4	19	100	SS-12	2.50	1	2	7	48	42	49	25	24	30	A-7-6 (15)	


STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 280+60, 51' LT.		START: 3/12/21		END: 3/12/21		PG 2 OF 2		B-005-1-21						
MATERIAL DESCRIPTION AND NOTES			ELEV. 579.6	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, GRAY, SOME YELLOW-BROWN, CLAY , "AND" SILT, TRACE GRAVEL, TRACE SAND, MOIST (continued)			576.1	31	2															
				32	3	7	14	100	SS-13	2.00	-	-	-	-	-	-	-	-	-	23
STIFF TO VERY STIFF, GRAY, SILT AND CLAY , SOME SAND, MOIST @ 34.5' - 35.0' : Qu = 2,054 psf			561.1	34																
				35				100	ST-14	2.00	0	1	22	44	33	31	18	13	21	A-6a (9)
HARD, GRAY, SILT AND CLAY , TRACE GRAVEL, TRACE SAND, DAMP			561.1	39	2															
				40	3	4	10	100	SS-15	1.50	-	-	-	-	-	-	-	-	-	23
HARD, GRAY, SILT AND CLAY , TRACE GRAVEL, TRACE SAND, DAMP			561.1	44	4															
				45	8	11	27	100	SS-16	1.50	-	-	-	-	-	-	-	-	-	19
HARD, GRAY, SILT AND CLAY , TRACE GRAVEL, TRACE SAND, DAMP			561.1	49	9															
				50	12	50/6"	-	100	SS-17	-	1	1	3	55	40	34	22	12	13	A-6a (9)
CLAYSTONE , GRAY, SEVERELY TO HIGHLY WEATHERED, VERY WEAK.			557.6	52																
				53																
CLAYSTONE, GRAY, SEVERELY TO HIGHLY WEATHERED, VERY WEAK.			556.5	52																
				53	50/2"				100	SS-18	-	-	-	-	-	-	-	-	-	12

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

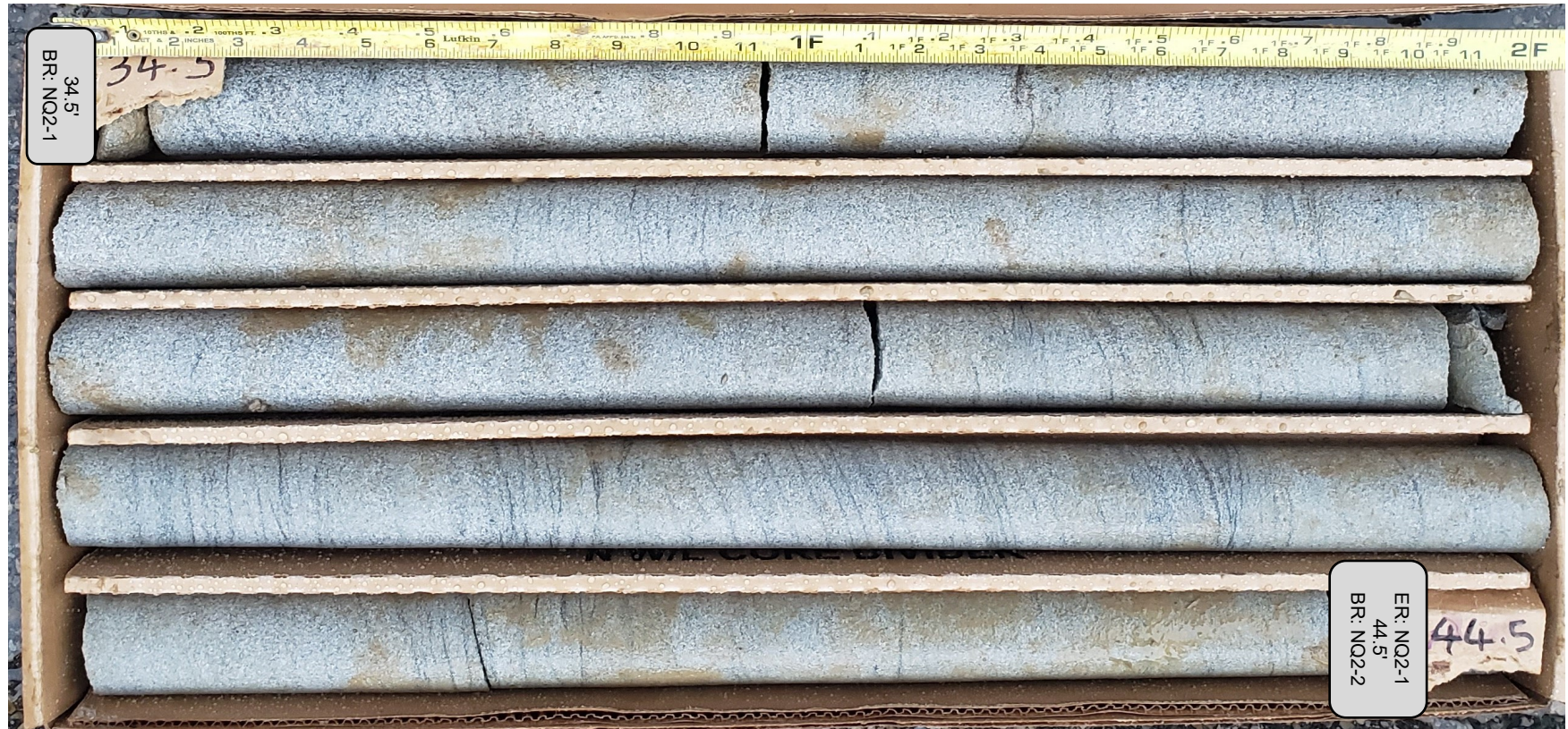
PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 281+41, 7' LT.		START: 3/8/21		END: 3/8/21		PG 3 OF 3		B-006-0-21								
MATERIAL DESCRIPTION AND NOTES				ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
											GR	CS	FS	SI	CL	LL	PL	PI				
CLAYSTONE, GRAY, SEVERELY WEATHERED, VERY WEAK. (continued)  @ 68.5': gray and red-brown				556.4																		
					63																	
					64	50/3"	-	100	SS-25	-	-	-	-	-	-	-	-	-	11	Rock (V)		
					65																	
					66																	
					67																	
					68																	
				549.8	EOB	50/4"	-	100	SS-26	-	-	-	-	-	-	-	-	11	Rock (V)			

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER



B-001-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-1	34.5	44.5	120 in./120 in.	100%	120 in./120 in.	100%

ATH-329-5.26 PID 114589



B-001-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-2	44.5	49.5	60 in./60 in.	100%	60 in./60 in.	100%

ATH-329-5.26 PID 114589



B-002-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-1	43.6	49.6	72 in./72 in.	100%	72 in./72 in.	100%
NQ2-2	49.6	59.6	120 in./120 in.	100%	114 in./120 in.	95%

ATH-329-5.26 PID 114589



B-002-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-2	49.6	59.6	120 in./120 in.	100%	114 in./120 in.	95%

ATH-329-5.26 PID 114589



B-003-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-1	19.5	24.5	58 in./60 in.	97%	10 in./60 in.	17%
NQ2-2	24.5	29.5	60 in./60 in.	100%	17 in./60 in.	28%

ATH-329-5.26 PID 114589



B-003-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-3	29.5	34.5	36 in./60 in.	60%	19 in./60 in.	32%
NQ2-4	34.5	39.5	60 in./60 in.	100%	50 in./60 in.	83%

ATH-329-5.26 PID 114589



B-004-0-21

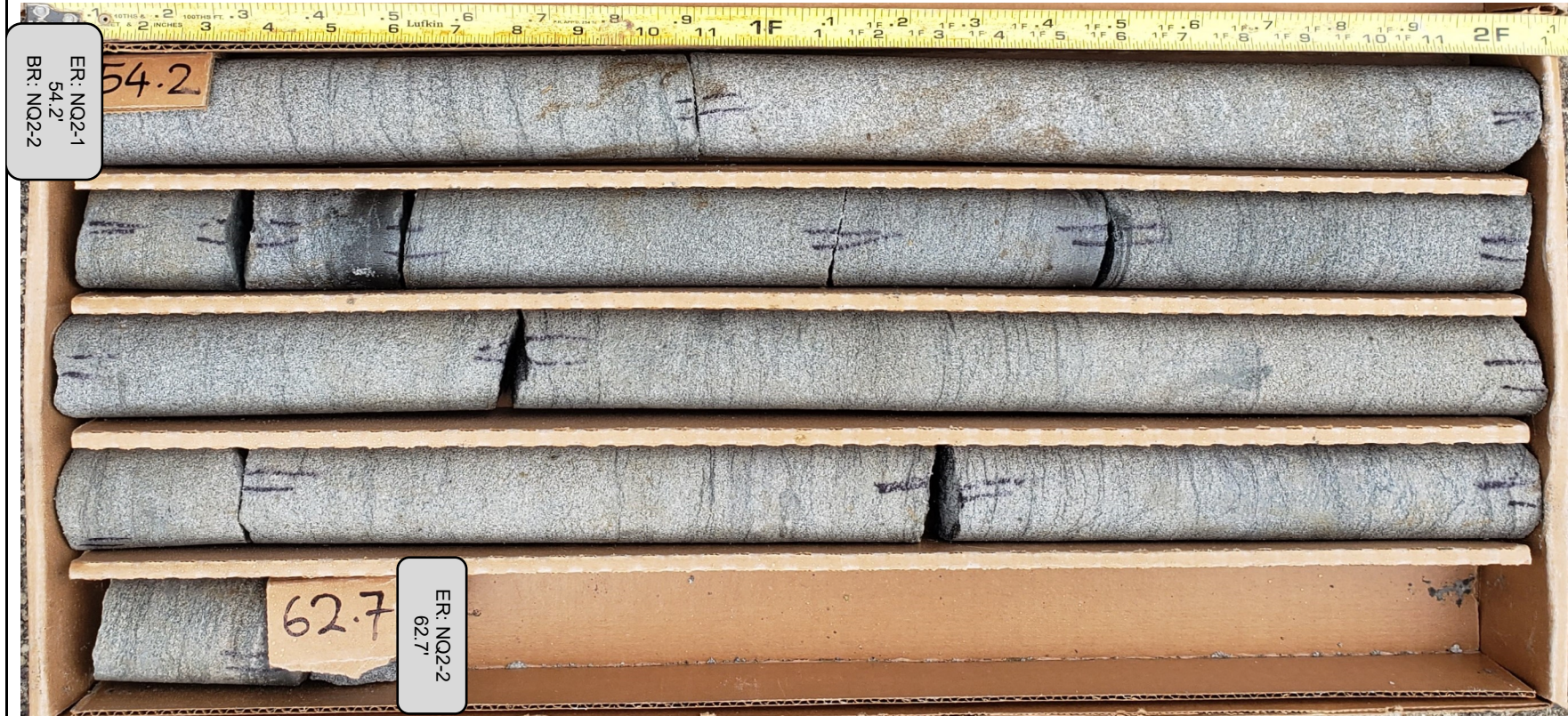


Run #	Depth (ft)		Recovery		RQD	
NQ2-1	44.2	54.2	120 in./120 in.	100%	120 in./120 in.	100%

ATH-329-5.26 PID 114589



B-004-0-21



Run #	Depth (ft)		Recovery		RQD	
NQ2-2	54.2	62.7	102 in./102 in.	100%	102 in./102 in.	100%

ATH-329-5.26 PID 114589



Bedrock Geology and Topography Maps

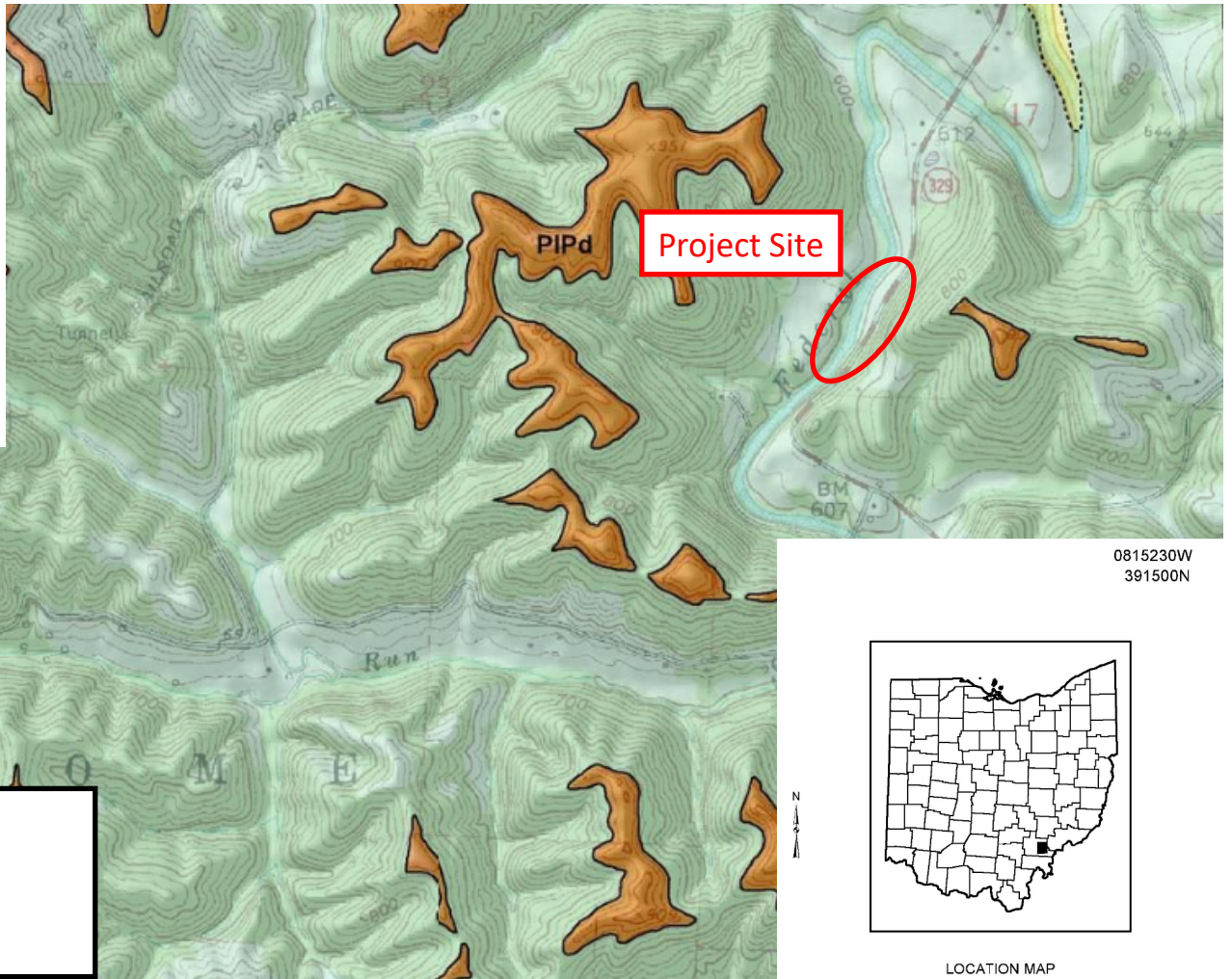
Bedrock Geology Map

Explanation

- Pd - Dunkard Group (Permian)
- PIPd - Dunkard Group (Permian-Pennsylvanian)
- IPm - Monongahela Group
- IPc - Conemaugh Group
- a - Ames limestone

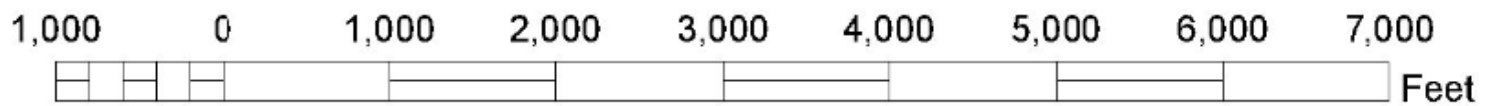
Contacts

- Exposed
- Concealed



REFERENCE:

OHIO DIVISION OF GEOLOGICAL SURVEY, 1997
Digital Map Series BG-2 of Stewart OH:
ODNR - Ohio Department of Natural Resources.



Bedrock Topography Map

0815230W
391500N

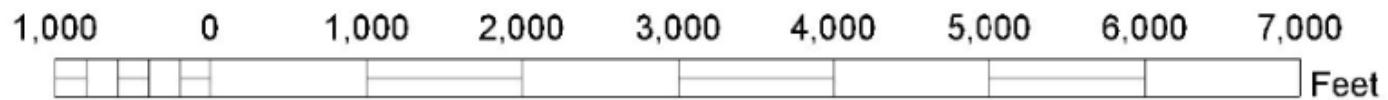


LOCATION MAP



REFERENCE:

OHIO DIVISION OF GEOLOGICAL SURVEY, 1996
Digital Map Series BT-3B of Stewart OH:
ODNR - Ohio Department of Natural Resources.





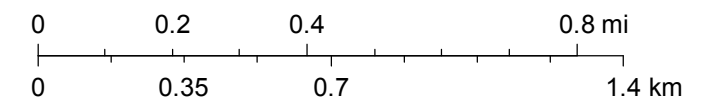
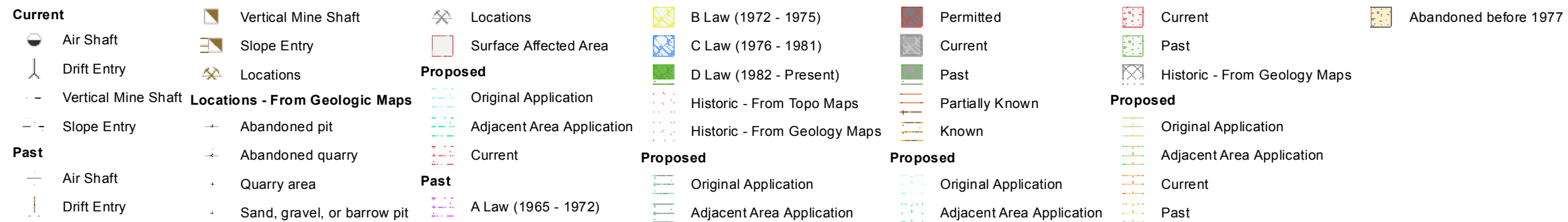
Mine Map

ATH-329-5.26_Mine Map



February 18, 2021

1:18,056



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



FEMA Flood Map

National Flood Hazard Layer FIRMMette



81°53'29"W 39°20'26"N



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>

OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
		Area of Undetermined Flood Hazard <i>Zone D</i>

GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall

OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature

MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.



This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **2/18/2021 at 4:18 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Historical Records

ATH-329-5.10

PROJECT: ATH-329-05.10	DRILLING FIRM / OPERATOR: NEAS / C. ASHBAUGH	DRILL RIG: CME 55 TRUCK RIG	STATION / OFFSET: 268+21, 12' LT.	EXPLORATION ID: B-001-0-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: HDR / S. REED	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: SR-329	
PID: 107803 SFN:	DRILLING METHOD: 3.25" HSA / NQ	CALIBRATION DATE: 11/21/17	ELEVATION: 613.8 (MSL) EOB: 19.25 ft.	PAGE: 1 OF 1
START: 3/8/18 END: 3/9/18	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 78.2	LAT / LONG: 39.334717, -81.887757	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI	WC				
LOOSE, DARK BROWN AND GRAY, STONE FRAGMENTS WITH SAND, SILT, AND CLAY MOIST (FILL)	613.8	1	3	7	22	SS-1	-	46	23	12	10	9	33	20	13	11	A-2-6 (0)			
MEDIUM STIFF, BROWN AND GRAY, CLAY , SOME SAND, TRACE STONE FRAGMENTS, MOIST (FILL)	612.3	2	2	8	44	SS-2	1.30	-	-	-	-	-	-	-	-	18	A-7-6 (V)			
		3	1	2	5	50	SS-3	0.50	8	13	10	23	46	49	22	27	26	A-7-6 (15)		
		4	2	2	5	56	SS-4	0.75	-	-	-	-	-	-	-	27	A-7-6 (V)			
		5	1	2	7	56	SS-5	0.88	-	-	-	-	-	-	-	25	A-7-6 (V)			
	605.8	6	2	3	75	SS-6A	4.50	-	-	-	-	-	-	-	-	-	A-7-6 (V)			
	605.2	7	2	6	50/4"	SS-6B	-	7	13	14	31	35	39	19	20	18	A-6b (10)			
HARD, REDDISH-BROWN, TAN AND GRAY, SILTY CLAY , SOME SAND, TRACE STONE FRAGMENTS, DAMP (COLLUVIUM)	604.5	8	50/3"	-	100	SS-7	-	-	-	-	-	-	-	-	-	11	Rock (V)			
SILTSTONE OLIVE-BROWN, HIGHLY WEATHERED, WEAK.		9																		
SANDSTONE GRAY, SLIGHTLY TO MODERATELY WEATHERED, MODERATELY STRONG, FINE TO MEDIUM GRAINED, THIN TO MEDIUM BEDDED, INTACT; RQD 78%, REC 99%. @ 13.1: Qu = 4787 psi		10	0		87	NQ-1													CORE	
		11																		
		12																		
		13																		
		14																		
		15	97		100	NQ-2														CORE
		16																		
		17																		
		18																		
	594.5	19																		

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT GDT - 3/23/18 16:00 - J:\ODOT-DISTRICT 5-10_GES\10-K ATH-329-5.10\GINT LOGS\20180321_ATH-329-5.10_TASK ORDER 10K_BORING LOGS.GPJ

NOTES: NONE
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED 20 LB. QUICK GROUT; 20 GAL. WATER

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI	WC		ODOT CLASS (GI)	
MEDIUM STIFF, DARK BROWN AND TAN, CLAY , SOME SILT, SOME SAND, LITTLE STONE FRAGMENTS, MOIST (FILL)	610.8	1	1	5	44	SS-1	0.50	16	19	11	21	33	57	27	30	28	A-7-6 (13)		
MEDIUM STIFF, DARK BROWN, TAN AND GRAY, CLAY , SOME SILT, SOME SAND, SOME STONE FRAGMENTS, MOIST (FILL)	609.3	2	3	8	44	SS-2	0.50	30	14	9	20	27	46	24	22	21	A-7-6 (7)		
		3	2	4															
		4	2	1	4	28	SS-3	0.50	-	-	-	-	-	-	-	28	A-7-6 (V)		
		5	1	2	7	22	SS-4	0.50	-	-	-	-	-	-	-	26	A-7-6 (V)		
	604.8	6	3																
MEDIUM STIFF, BROWN, TAN AND GRAY, CLAY , SOME SILT, SOME SAND, LITTLE STONE FRAGMENTS, MOIST (FILL)		7	1	1	4	72	SS-5	0.50	10	14	10	27	39	47	25	22	25	A-7-6 (12)	
		8	1	2	7	67	SS-6A	0.50	-	-	-	-	-	-	-	27	A-7-6 (V)		
	602.3	9	2	3			SS-6B	1.00	-	-	-	-	-	-	-	29	A-7-6 (V)		
MEDIUM STIFF, DARK BROWN, CLAY , "AND" TO SOME SILT, LITTLE SAND, TRACE GRAVEL, MOIST (COLLUVIUM)		10	2	2	8	89	SS-7	1.25	-	-	-	-	-	-	-	30	A-7-6 (V)		
		11	2	4	25	78	SS-8	1.00	2	4	5	37	52	54	25	29	30	A-7-6 (18)	
		12	4	15															
		13	3	4	12	28	SS-9	0.50	-	-	-	-	-	-	-	30	A-7-6 (V)		
		14	2	3	8	67	SS-10	1.50	-	-	-	-	-	-	-	27	A-7-6 (V)		
		15	3	3															
		16	1	3	9	67	SS-11	1.00	-	-	-	-	-	-	-	27	A-7-6 (V)		
@ 16.5': Qu = 1314 psf		17	3	4															
		18			62		ST-12	-	2	7	7	29	55	58	27	31	33	A-7-6 (20)	
	592.3	19	7	44		80	SS-13	-	-	-	-	-	-	-	-	18	Rock (V)		
SANDSTONE OLIVE-BROWN, HIGHLY TO MODERATELY WEATHERED, WEAK TO MODERATELY STRONG, FINE TO MEDIUM GRAINED, DISTURBED STRUCTURE, FRACTURED, POOR SURFACE CONDITION; RQD 0%, REC 22%. (POSSIBLE BOULDER)		20	44	50/3"															
	589.3	21	0		22		NQ-1											CORE	
STIFF, BROWN, CLAY , MOIST (CLAY SEAM)		22	0		95		NQ-2											CORE	
	587.8	23																	
SILTSTONE GRAY, SLIGHTLY WEATHERED, VERY WEAK, MEDIUM TO THICK BEDDED, FRIABLE, INTACT WITH OCCASIONAL SHALE PARTINGS, SLIGHTLY ROUGH SURFACE ROUGHNESS; RQD 91%, REC 91%. @ 24.5': Qu = 166 psi		24																	
		25	88		95		NQ-3											CORE	
	584.3	26																	
SANDSTONE GRAY, UNWEATHERED, SLIGHTLY TO MODERATELY STRONG, FINE TO MEDIUM GRAINED, THIN TO THICK BEDDED, INTACT; RQD 100%, REC 100%.		27																	
		28																	
		29	100		100		NQ-4											CORE	
		30																	
		31																	
		32																	
		33																	
		34	100		100		NQ-5											CORE	
		35																	
	574.3	36																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 20 LB. BENTONITE CHIPS; MIXED 65 LB. QUICK GROUT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH.DOT.GDT - 3/23/18 16:00 - J:\ODOT-DISTRICT 5-10_GES10-K ATH-329-5.10 TASK ORDER 10K BORING LOGS.GPJ

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI	WC		ODOT CLASS (GI)	
MEDIUM STIFF, DARK BROWN, CLAY , SOME STONE FRAGMENTS, SOME SAND, SOME SILT, DAMP (FILL)	610.7	1	1 2 6	10	28	SS-1	0.50	34	15	9	20	22	51	24	27	22	A-7-6 (6)		
		2																	
		3	2 1 3	5	17	SS-2	0.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)		
	606.2	4																	
MEDIUM STIFF TO STIFF, DARK BROWN, CLAY , SOME SILT, SOME SAND, LITTLE STONE FRAGMENTS, MOIST (COLLUVIUM)		5	1 2 3	7	61	SS-3	1.00	-	-	-	-	-	-	-	-	25	A-7-6 (V)		
		6																	
		7																	
		8	2 3 4	9	72	SS-4	0.63	-	-	-	-	-	-	-	-	25	A-7-6 (V)		
		9																	
@ 10.5': Qu = 1981 psf		10																	
		11			58	ST-5	1.25	15	12	11	23	39	50	25	25	22	A-7-6 (13)		
		12	3 5 7	16	72	SS-6	1.63	-	-	-	-	-	-	-	-	26	A-7-6 (V)		
	596.2	13																	
STIFF, MOTTLED DARK BROWN AND GRAY, CLAY , SOME SILT, LITTLE SAND, TRACE STONE FRAGMENTS, MOIST (COLLUVIUM)		14																	
		15	2 4 5	12	78	SS-7	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)		
		16																	
		17																	
		18	2 2 4	8	78	SS-8	0.88	3	8	7	26	56	55	23	32	30	A-7-6 (19)		
		19																	
		20	4 5 5	13	11	SS-9	-	-	-	-	-	-	-	-	-	28	A-7-6 (V)		
		21																	
	588.2	22																	
SILTSTONE GRAY, HIGHLY WEATHERED, VERY WEAK TO WEAK, OCCASIONAL SHALE PARTINGS.	587.4	23	44 50/3"	-	100	SS-10	-	-	-	-	-	-	-	-	-	5	Rock (V)		
SILTSTONE GRAY, HIGHLY TO MODERATELY WEATHERED, VERY WEAK TO WEAK, MEDIUM BEDDED, FRIABLE, INTACT WITH OCCASIONAL SHALE PARTINGS, FAIR SURFACE CONDITION; RQD 69%, REC 90%.	585.7	24	69		90	NQ-1											CORE		
SANDSTONE GRAY, UNWEATHERED, SLIGHTLY TO MODERATELY STRONG, MEDIUM GRAINED, THIN TO THICK BEDDED, INTACT, TRACE THIN SHALE PARTINGS, VERY GOOD SURFACE CONDITION; RQD 100%, REC 100%.		25																CORE	
		26																CORE	
		27																CORE	
		28	100		100	NQ-2												CORE	
		29																CORE	
		30																CORE	
		31																CORE	
		32																CORE	
		33	100		100	NQ-3												CORE	
		34																CORE	
	575.7	35																CORE	
		EOB																	

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT GDT - 3/23/18 16:00 - J:\ODOT-DISTRICT 5-10_GES\10-K ATH-329-5.10_GINT LOGS\20180321_ATH-329-5.10_TASK ORDER 10K_BORING LOGS.GPJ



Historical Records

ATH-329-5.44

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

ATH-329-5.44

ROME TOWNSHIP ATHENS COUNTY

PROJECT DESCRIPTION

THE PROJECT CONSIST OF A SOIL COUNTER BERM TO REPAIR A LANDSLIDE. PROJECT LENGTH 375 FT.

EARTH DISTURBED AREAS

PROJECT EARTH DISTURBED AREA: 0.69 ACRES
ESTIMATED CONTRACTOR EARTH DISTURBED AREA: 0.10 ACRES
NOTICE OF INTENT EARTH DISTURBED AREA: N/A ACRES

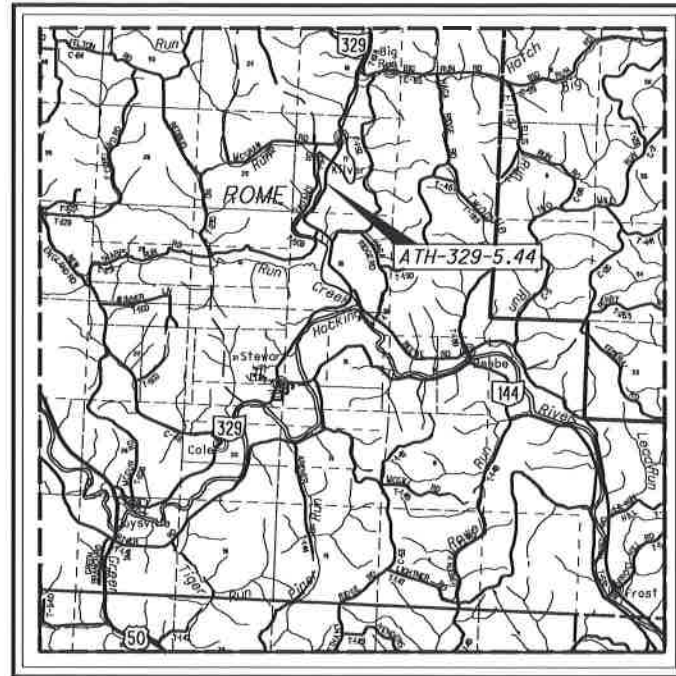
2016 SPECIFICATIONS

THE STANDARD SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, INCLUDING CHANGES AND SUPPLEMENTAL SPECIFICATIONS LISTED IN THE PROPOSAL SHALL GOVERN THIS IMPROVEMENT.

I HEREBY APPROVED THESE PLANS AND DECLARE THAT THE MAKING OF THIS IMPROVEMENT WILL NOT REQUIRE THE CLOSING TO TRAFFIC OF THE HIGHWAY AND THAT PROVISIONS FOR THE MAINTENANCE AND SAFETY OF TRAFFIC WILL BE AS SET FORTH ON THE PLANS AND ESTIMATES.

APPROVED _____
DATE 11/17/18 DISTRICT DEPUTY DIRECTOR

APPROVED _____
DATE _____ DIRECTOR, DEPARTMENT OF TRANSPORTATION



LOCATION MAP

LATITUDE: 39 °20'21" LONGITUDE: 81 °53'08"



PORTION TO BE IMPROVED	-----
INTERSTATE HIGHWAY	-----
FEDERAL ROUTES	-----
STATE ROUTES	-----
COUNTY & TOWNSHIP ROADS	-----
OTHER ROADS	-----

DESIGN DESIGNATION

CURRENT ADT (2018)	-----	470
DESIGN YEAR ADT (2038)	-----	650
DESIGN HOURLY VOLUME (2038)	-----	80
DIRECTIONAL DISTRIBUTION	-----	68%
TRUCKS (24 HOUR B&C)	-----	5%
DESIGN SPEED	-----	55
LEGAL SPEED	-----	55
DESIGN FUNCTIONAL CLASSIFICATION:		
RURAL COLLECTOR		
NHS PROJECT	-----	NO

DESIGN EXCEPTIONS

NONE REQUIRED

UNDERGROUND UTILITIES

CONTACT BOTH SERVICES TWO WORKING DAYS BEFORE YOU DIG.

Call Before You Dig
1-800-362-2764

(Non-members must be called directly)

OIL & GAS PRODUCERS
UNDERGROUND PROTECTION SERVICE
1-800-925-0988

PLAN PREPARED BY:
OHIO DEPARTMENT OF
TRANSPORTATION PLANNING
& ENGINEERING - DISTRICT 10

INDEX OF SHEETS:

TITLE SHEET	1
TYPICAL SECTION	2
GENERAL NOTES	3-6
MAINTENANCE OF TRAFFIC	7-8
GENERAL SUMMARY	9
CALCULATIONS	10
PLAN AND PROFILE	11
CROSS SECTIONS	12-17
CULVERT DETAIL	18
RIGHT OF WAY	19-22
LANDSLIDE EXPLORATION	

ENGINEERS SEAL	STANDARD CONSTRUCTION DRAWINGS				SUPPLEMENTAL SPECIFICATIONS	
<p>SIGNED: _____ DATE: <u>04-16-18</u></p>	BP-3.1	7/18/14	MT-101.90	7/17/15	800	4/20/18
	BP-4.1	7/19/13			832	1/17/14
			TC-65.10	1/17/14	902	12/31/12
	HW-2.1	7/21/17	TC-65.11	7/21/17		
	DM-1.1	7/21/17	RM-1.1	7/18/14		
	DM-4.4	1/15/16				
	MT-96.11	1/20/17				
	MT-96.20	7/15/16				
	MT-96.26	7/19/13				
	MT-97.10	7/18/14				
	MT-101.70	1/17/14				
	MT-101.75	7/15/16				

I:\project\ATH-329-5.44-PID-103391\roadway\sheet\103391GT001.dgn 16-APR-2018 8:03AM wiseman

FEDERAL PROJECT NO. **E160586**
PID NO. **103391**
CONSTRUCTION PROJECT NO. _____
ATH-329-5.44
1/22

BENCHING OF FOUNDATION SLOPES

ALTHOUGH CROSS-SECTIONS INDICATE SPECIFIC DIMENSIONS FOR PROPOSED BENCHING OF THE EMBANKMENT FOUNDATIONS IN CERTAIN AREAS, NO WAIVER OF THE SPECIFICATIONS IS INTENDED. BENCH ALL OTHER SLOPED EMBANKMENT AREAS AS SET FORTH IN CMS 203.05. NO ADDITIONAL PAYMENT WILL BE MADE FOR BENCHING REQUIRED UNDER THE PROVISIONS OF CMS 203.05.

FIELD VERIFICATION OF QUANTITIES

DUE TO THE NATURE OF THE PROJECT BEING A SLIDE REPAIR, THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFICATION OF QUANTITIES PRIOR TO BIDDING AND THEN PRIOR TO CONSTRUCTION. THE ACTUAL WORK LOCATIONS AND QUANTITIES PERFORMED SHALL BE INCORPORATED INTO THE FINAL CHANGE ORDER GOVERNING COMPLETION OF THIS PROJECT.

SPECIAL BENCHING SLOPE DRAINS

PLACE SPECIAL BENCHING SLOPE DRAINS AT THE LOCATIONS SHOWN ON THE PLAN AND PROFILE AND CROSS SECTION SHEETS. THESE DRAINS SHALL CONSIST OF ITEM 203, GRANULAR EMBANKMENT, AS PER PLAN (NO. 8 AGGREGATE), ITEM 690, GEOTEXTILE FABRIC, 712.09 TYPE A, AND ITEM 611, CONDUIT TYPE E, 707.31 (PERFORATED). THE TYPE E CONDUIT SHALL BE PERFORATED AS PER CONDUIT FOR ITEM 605, UNCLASSIFIED PIPE UNDERDRAINS. THE GRANULAR EMBANKMENT SHALL BE PLACED IN LIFTS AS THE SPECIAL BENCHING BACKFILL IS CONSTRUCTED. TRANSVERSE OUTLET DRAINS SHALL BE PROVIDED AT THE LOCATIONS SHOWN ON THE PLAN & PROFILE SHEET. THESE OUTLET DRAINS SHALL CONSIST OF ITEM 611 CONDUIT TYPE F, 707.33 WITH ITEM 604 PRECAST REINFORCED CONCRETE OUTLETS.

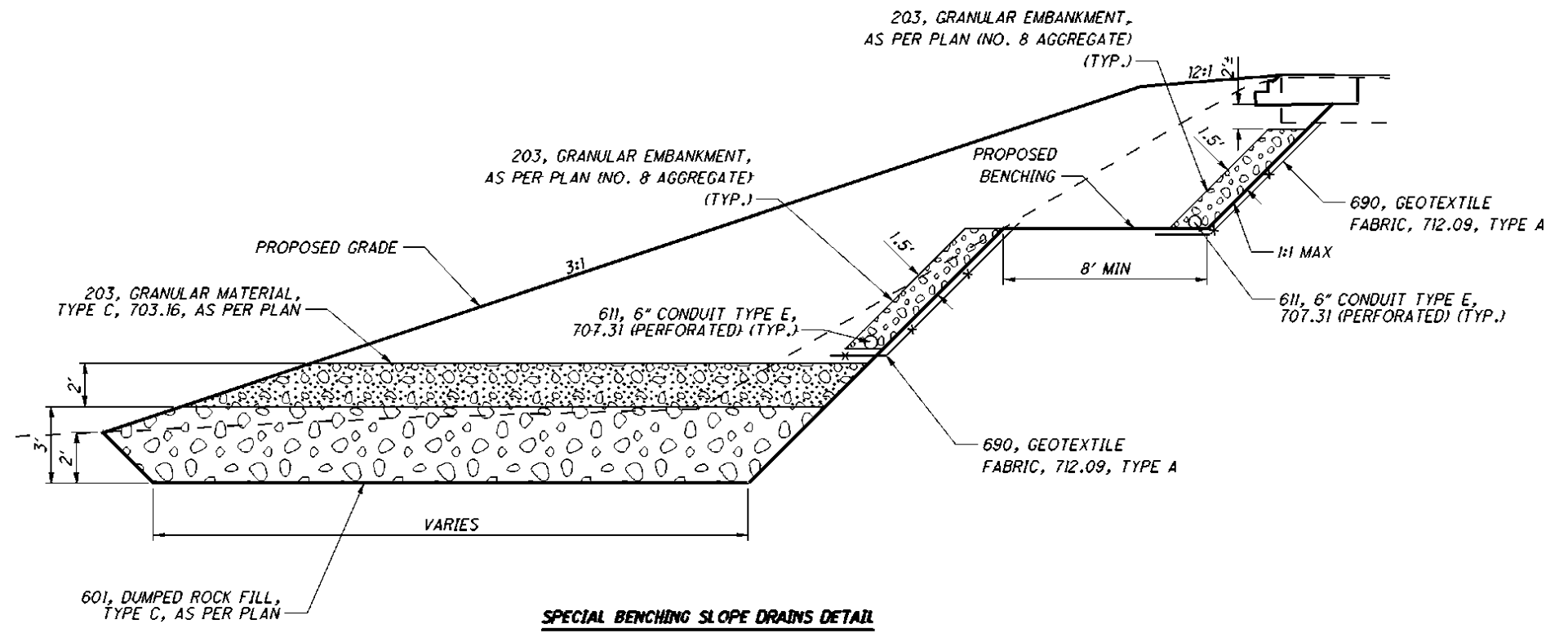
SEE SPECIAL BENCHING SLOPE DRAINS DETAIL ON THIS SHEET FOR ADDITIONAL INFORMATION.

ITEM 203 - GRANULAR EMBANKMENT, AS PER PLAN, (NO. 8 AGGREGATE)

FURNISH DURABLE, NATURAL AGGREGATE NO. 8 SIZE. PLACE THE AGGREGATE AT THE THICKNESS AND SLOPE AS SHOWN ON THE CROSS-SECTIONS AND THE SPECIAL BENCHING SLOPE DRAINS DETAIL.

ITEM 203 - GRANULAR MATERIAL, TYPE C, AS PER PLAN

TWENTY FOUR (24) INCHES OF 703.16 GRANULAR MATERIAL, TYPE C SHALL BE PLACED ON TOP OF ITEM 601, DUMPED ROCK FILL, TYPE C, AS PER PLAN. PAYMENT FOR PLACING 703.16 GRANULAR MATERIAL TYPE C SHALL BE INCLUDED IN ITEM 203 - GRANULAR MATERIAL, TYPE C, AS PER PLAN.



SPECIAL BENCHING SLOPE DRAINS DETAIL

NOT TO SCALE

ITEM 601 - DUMPED ROCK FILL, TYPE C, AS PER PLAN

IN THIS AREA BETWEEN STATIONS 1286+25 TO 1290+00, DUMPED ROCK FILL, TYPE C, AS PER PLAN, AS SHOWN ON THE CROSS-SECTIONS, MAY BE PLACED BY THE METHOD OF END DUMPING IF SURFACE WATER IS PRESENT AT THE TIME OF THE CONSTRUCTION. END DUMPING METHODS MAY BE USED UP TO AN ELEVATION 2 FEET ABOVE THE WATER LEVEL. ABOVE THIS ELEVATION, EMBANKMENT CONSTRUCTION METHODS WILL BE IN ACCORDANCE WITH 203.05 AND 203.07 INCLUSIVE. DURING NORMAL CLEARING AND GRUBBING, WHERE END DUMPING IS PERMITTED, THE REQUIREMENTS OF 201.04 FOR SCALPING SHALL BE WAIVED.

EXCAVATE THE TOE TO A MINIMUM OF 2 FEET INTO THE EXISTING GROUND AS SHOWN ON THE PLANS.

WHEN EXCAVATING THE TOE, NO MORE THAN 20 LINEAR FEET ALONG THE ROAD SHALL BE EXCAVATED FOR THE EMBANKMENT WITHOUT REPLACING WITH THE DUMPED ROCK FILL, TYPE C, AS PER PLAN. THE ENGINEER MAY VARY THE 20 LINEAR FT BASED ON SITE CONDITIONS (STABILITY). NO EXCAVATION SHALL BE LEFT OPEN OVERNIGHT. SCHEDULE WORK SO AS TO HAVE THE ROCK SHEAR KEY BACK FILLED AND STABILIZED PRIOR TO LEAVING THE SITE. FILL VOIDS AND CHOK OFF THE DUMPED ROCK FILL USING 703.16 GRANULAR TYPE C MATERIAL.

CALCULATED
JDW
CHECKED
ARM

GENERAL NOTES

ATH-329-5.44

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P.I. Sta. 1284+78.53
 $\Delta = 12^\circ 33' 14''$ (LT)
 $D_c = 7^\circ 09' 43''$
 $R = 800.00'$
 $T = 87.99'$
 $L = 175.28'$
 $E = 4.82'$
 $C = 174.93'$
 $C.B. = N 9^\circ 36' 24'' E$

ESTIMATED QUANTITIES

REF NO.	STATION		SIDE	611	611	611	690	202
	FROM	TO		6" CONDUIT TYPE E, 707.31 (PERFORATED)	6" CONDUIT, TYPE F, 707.33	PRECAST REINFORCED CONCRETE OUTLET	MAILBOX SUPPORT SYSTEM, SINGLE	PAVEMENT REMOVAL
	FT	FT		EACH	SY	SY	SY	SY
D-1	1286+25	1287+21	LT	96				
D-2	1286+25	1287+28	LT	103				
D-3	1287+35	1290+00	LT	266				
D-4	1287+43	1290+00	LT	258				
D-5	1287+10		LT		30	1		
D-6	1287+35		LT		33	1		
R-1	1287+00	1289+50	LT					83
MB-1	1290+21		RT				1	
TOTALS CARRIED TO GENERAL SUMMARY				723	63	2	1	83

* - RELOCATE MAILBOX TO THE OWNERS OTHER DRIVE DURING CONSTRUCTION
 SEE SHEET 18 OF 22 FOR CULVERT DETAILS.

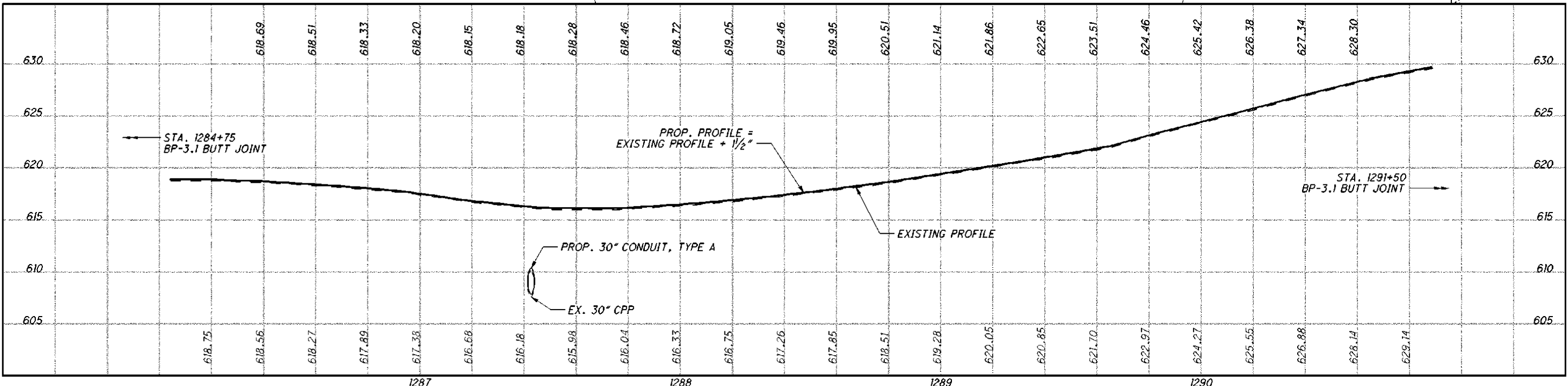
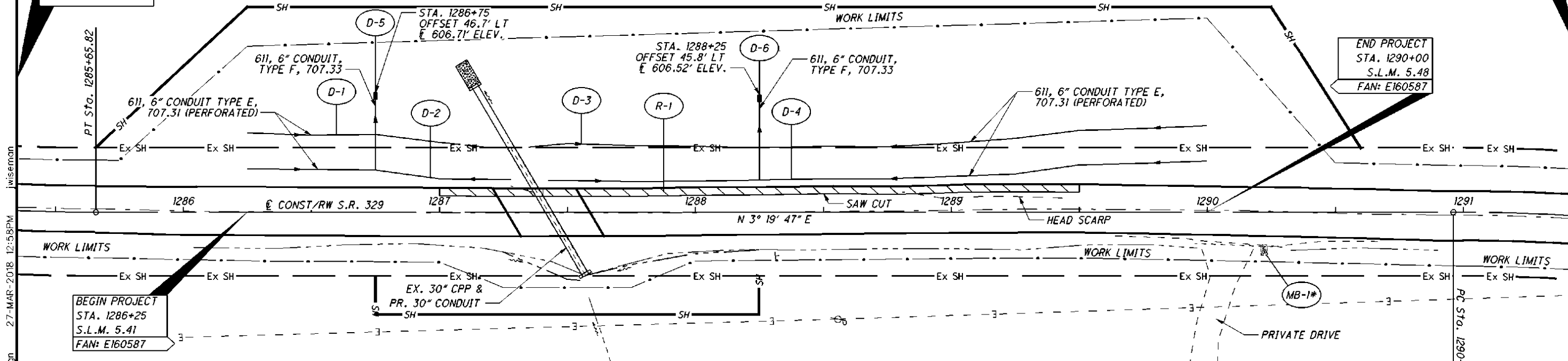
P.I. Sta. 1293+02.54
 $\Delta = 28^\circ 56' 34''$ (RT)
 $D_c = 7^\circ 09' 43''$
 $R = 800.00'$
 $T = 206.47'$
 $L = 404.12'$
 $E = 26.21'$
 $C = 399.84'$
 $C.B. = N 17^\circ 48' 04'' E$



BEGIN WORK
 ASPHALT OVERLAY
 STA. 1284+75

END WORK
 ASPHALT OVERLAY
 STA. 1291+50

END PROJECT
 STA. 1290+00
 S.L.M. 5.48
 FAN: E160587



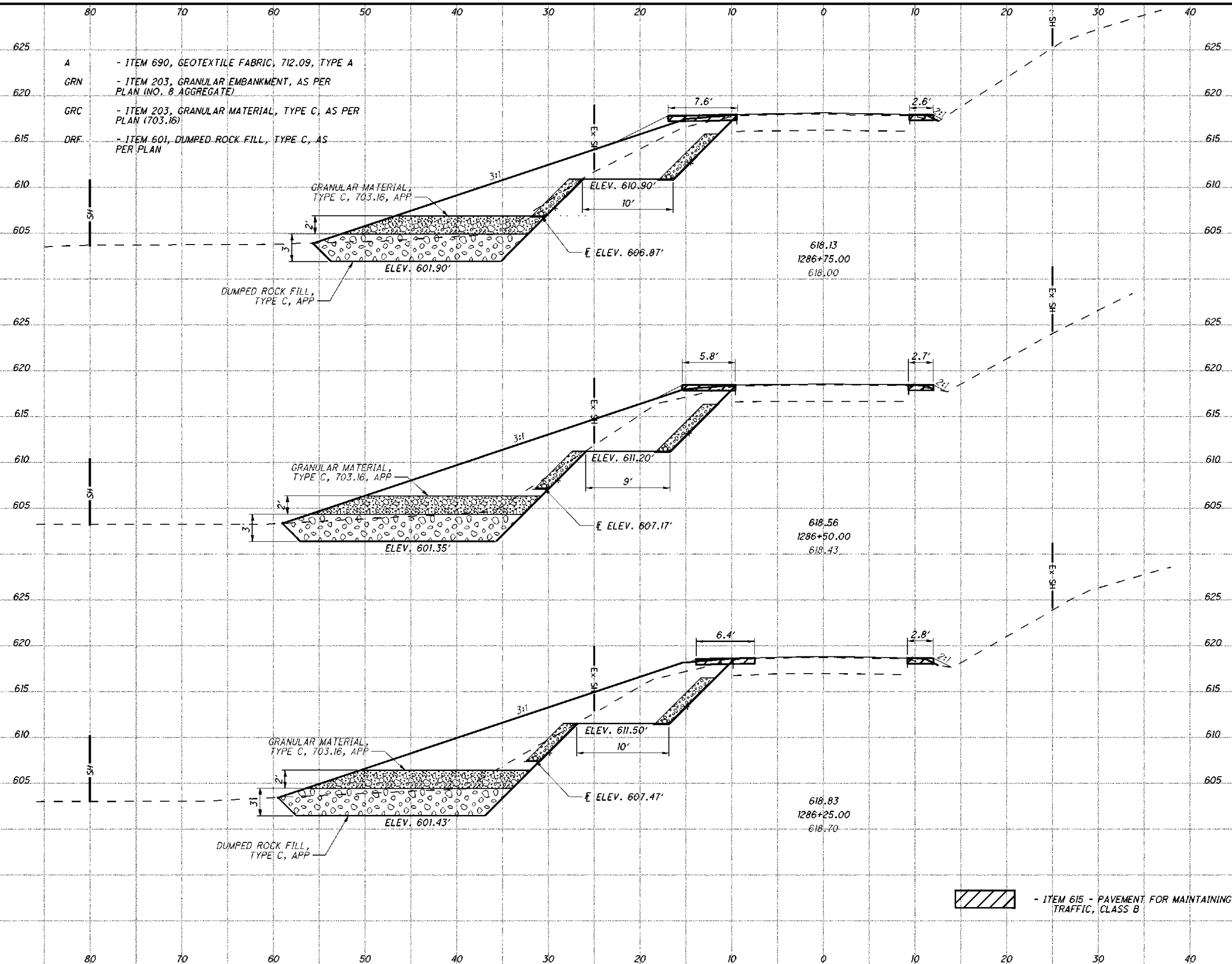
PLAN AND PROFILE
STA. 1285+50 TO STA. 1291+25

ATH-329-5.44

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SEEDING	
END WIDTH	SQ. YDS.
A	39
	196
16	A
73	
A	44
	206
16	A
75	
A	44
	212
16	A
77	
A	22
	107
0	A
0	
A	149
	721



END	AREA		VOLUME		CALCULATED	CHECKED	ARM
	CUT	FILL	CUT	FILL			
			GRC	34			
			GRN	11			
			DRF	57			
			GRC	37	46	108	
			GRN	14			
			DRF	62			
			48	115			
			GRC	37			
			GRN	13			
			DRF	62			
			47	118			
			GRC	43			
			GRN	14			
			DRF	71			
			53	139			
			GRC	39			
			GRN	13			
			DRF	65			
			50	127			
			GRC	42			
			GRN	14			
			DRF	69			
			56	135			
			GRC	19			
			GRN	7			
			DRF	32			
			26	63			
			GRC	0			
			GRN	0			
			DRF	0			
			0	0			
			GRC	129			
			GRN	44			
			DRF	216			
			169	416			

- ITEM 615 - PAVEMENT FOR MAINTAINING TRAFFIC, CLASS B

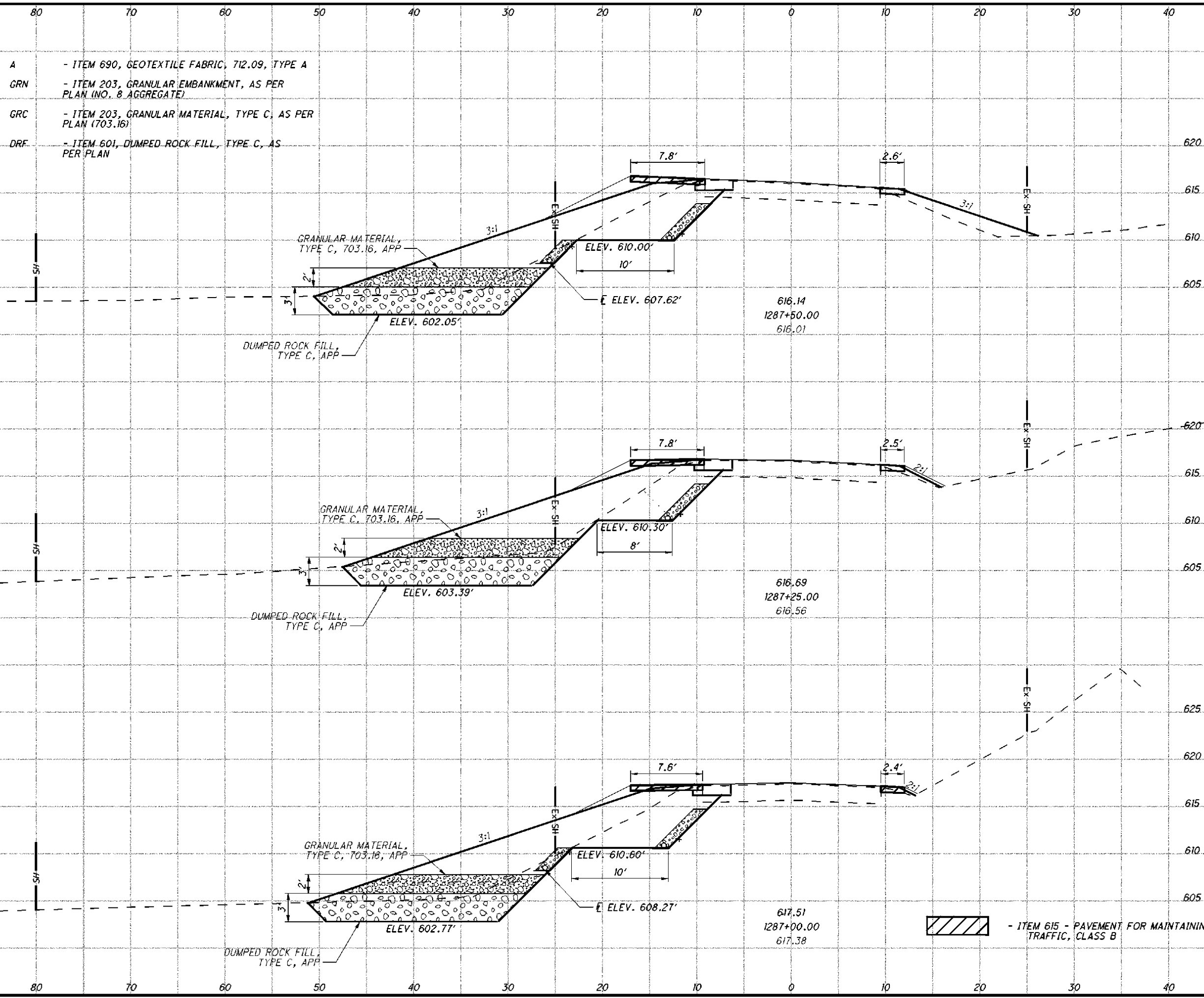
CROSS SECTIONS STA. 1286+25 TO STA. 1286+75

ATH-329-5.44

12
22

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SEEDING	
END WIDTH	SQ. YDS.
A	33
	223
12	A
82	
A	26
	209
7	A
68	
A	26
	189
12	A
68	
A	85
	621

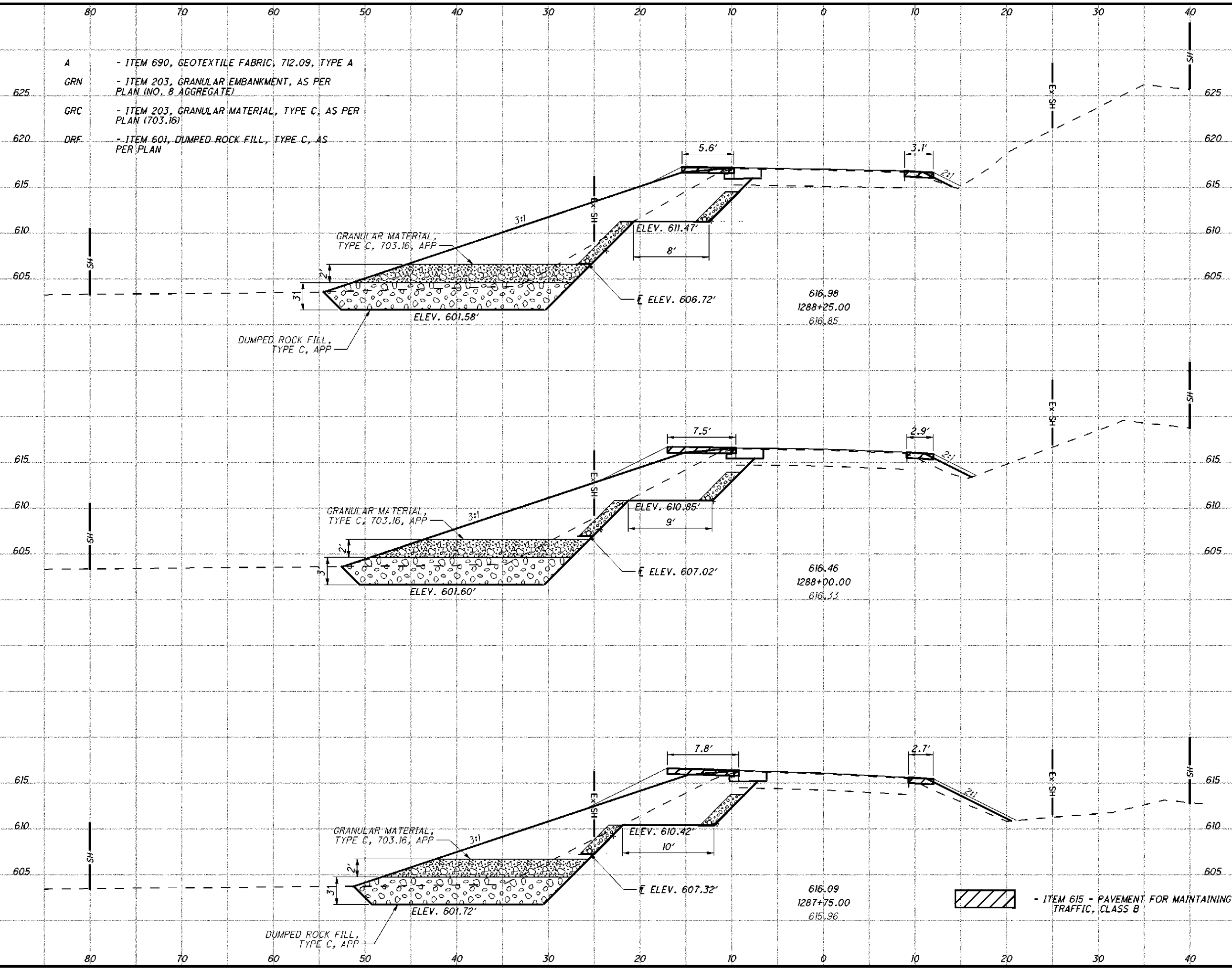


END AREA	VOLUME	CALCULATED	
		CUT	FILL
	GRC 34		
	GRN 9		
	DRF 58		
	46 105		
GRC 36			
GRN 10			
DRF 61			
51 114			
GRC 33			
GRN 7			
DRF 57			
43 102			
GRC 36			
GRN 6			
DRF 61			
41 106			
GRC 33			
GRN 7			
DRF 57			
43 104			
GRC 36			
GRN 10			
DRF 62			
51 118			
GRC 100			
GRN 23			
DRF 172			
132 311			

CROSS SECTIONS
STA. 1287+00 TO STA. 1287+50
ATH-329-5.44

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SEEDING	
END WIDTH	SO. YDS.
A	40
	210
14	A
75	
A	38
	209
13	A
75	
A	35
	213
12	A
78	
A	113
	632

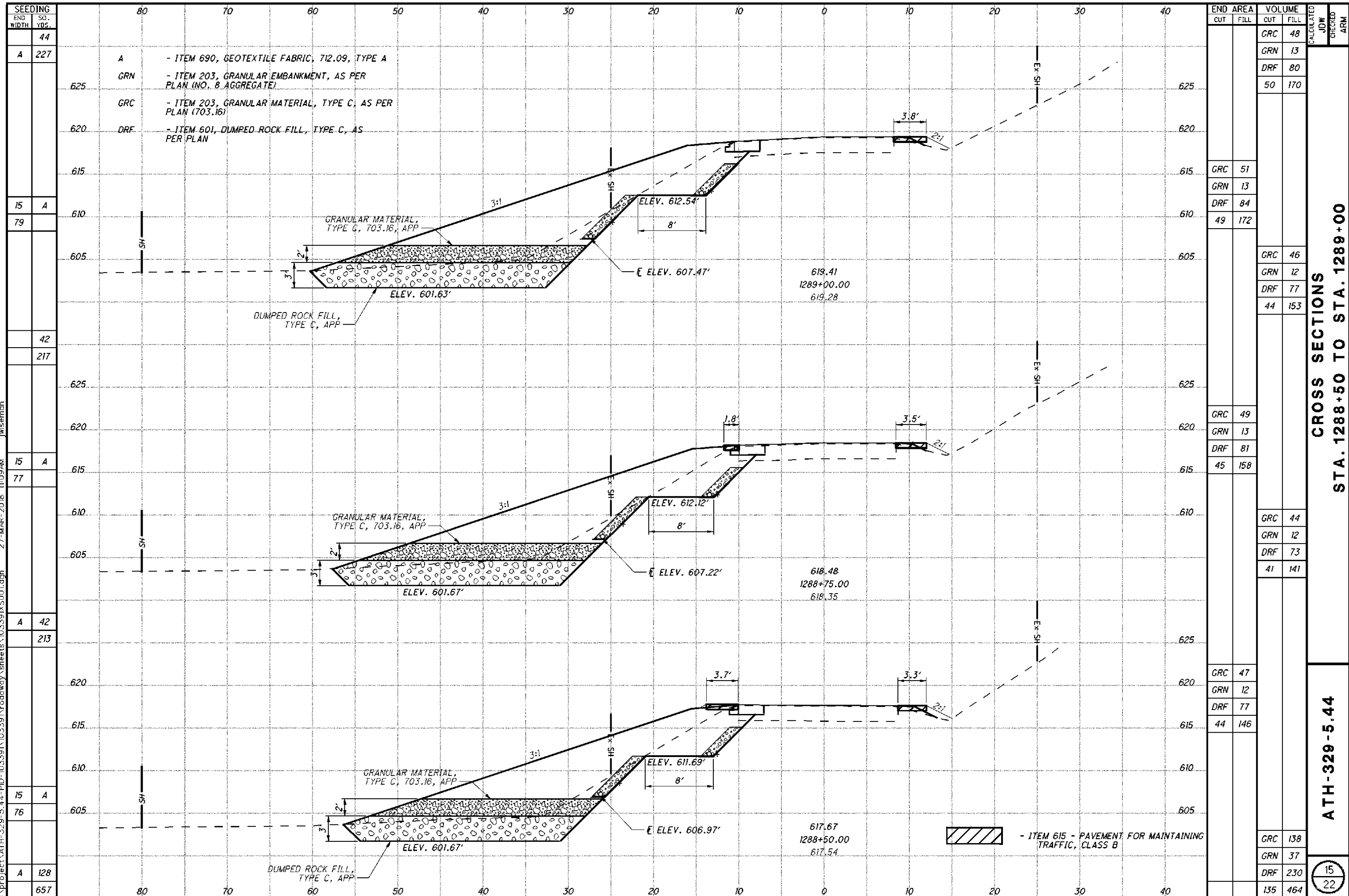


END AREA	VOLUME		CALCULATED	CHECKED	ARM
	CUT	FILL			
	GRC	42			
	GRN	11			
	DRF	70			
		40	130		
	GRC	44			
	GRN	12			
	DRF	74			
		43	134		
	GRC	39			
	GRN	10			
	DRF	65			
		41	117		
	GRC	40			
	GRN	10			
	DRF	67			
		46	118		
	GRC	36			
	GRN	9			
	DRF	60			
		44	107		
	GRC	37			
	GRN	10			
	DRF	63			
		48	113		
	GRC	117			
	GRN	30			
	DRF	195			
		125	354		

CROSS SECTIONS
STA. 1287+75 TO STA. 1288+25

ATH-329-5.44

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SEEDING	END WIDTH	SO. YDS.
		44
A		227

15	A
79	
42	
217	

15	A
77	
A	42
	213

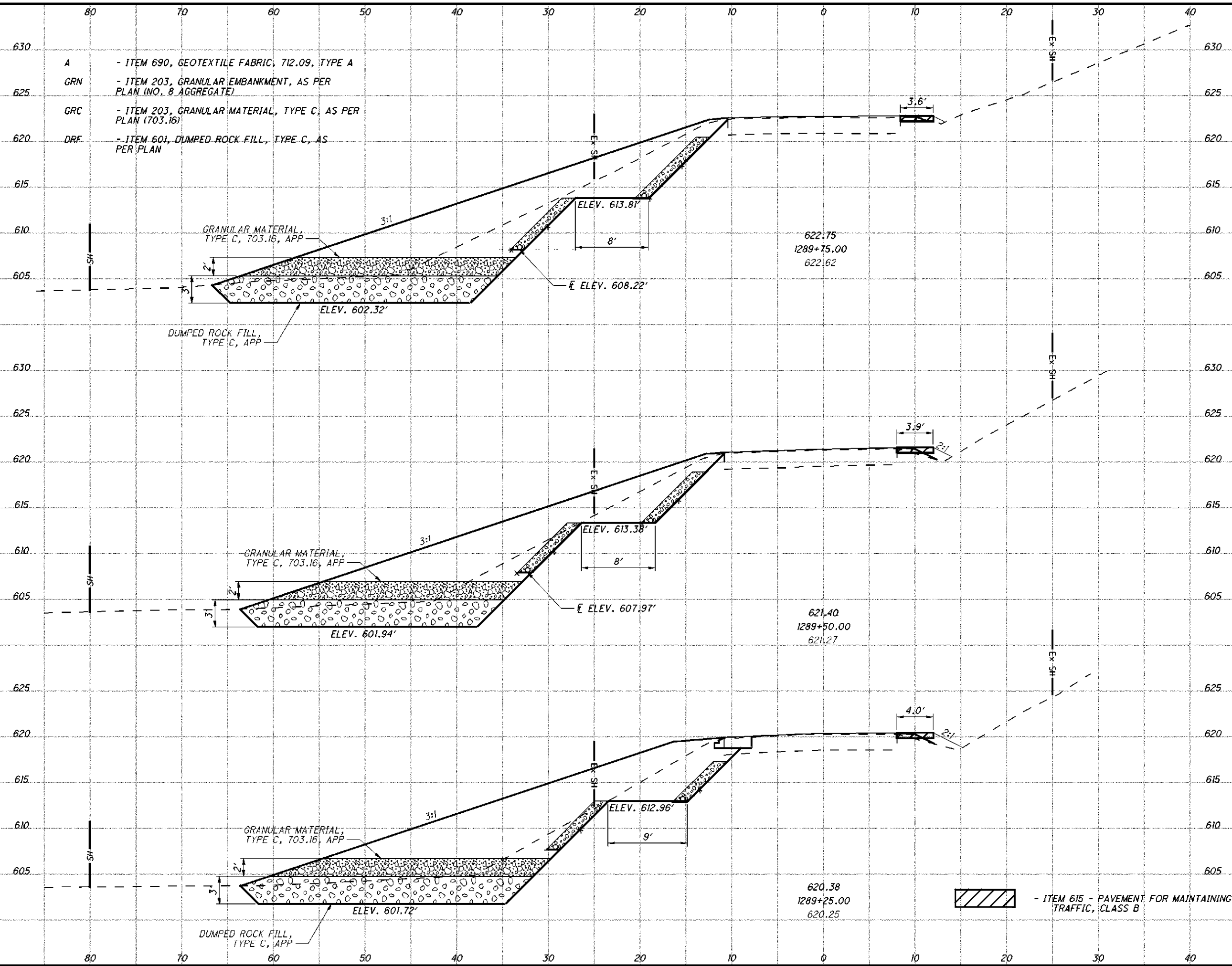
15	A
76	
A	128
	657

END AREA	VOLUME		CALCULATED	CHECKED	ARM
	CUT	FILL			
	GRC	48			
	GRN	13			
	DRF	80			
		50	170		
	GRC	51			
	GRN	13			
	DRF	84			
		49	172		
	GRC	46			
	GRN	12			
	DRF	77			
		44	153		
	GRC	49			
	GRN	13			
	DRF	81			
		45	158		
	GRC	44			
	GRN	12			
	DRF	73			
		41	141		
	GRC	47			
	GRN	12			
	DRF	77			
		44	146		
	GRC	138			
	GRN	37			
	DRF	230			
		135	464		

CROSS SECTIONS
STA. 1288+50 TO STA. 1289+00
ATH-329-5.44
15
22

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SEEDING	END WIDTH	SQ. YDS.	CROSS SECTION	
			CUT	FILL
A	60	241		
20	A	84		
A	54	231		
19	A	82		
A	50	231		
17	A	84		
A	164	703		



END AREA		VOLUME		CALCULATED	CHECKED	ARM
CUT	FILL	CUT	FILL			
		GRC	51			
		GRN	18			
		DRF	83			
			97			
		GRC	52			
		GRN	18			
		DRF	85			
			80			
		GRC	46			
		GRN	16			
		DRF	76			
			62			
		GRC	48			
		GRN	16			
		DRF	79			
			53			
		GRC	47			
		GRN	14			
		DRF	78			
			51			
		GRC	54			
		GRN	14			
		DRF	88			
			58			
		GRC	144			
		GRN	48			
		DRF	237			
			210			

**CROSS SECTIONS
STA. 1289+25 TO STA. 1289+75**

ATH-329-5.44

PROJECT DESCRIPTION

THE PROJECT CONSIST OF A SOIL COUNTER BERM TO REPAIR A LANDSLIDE PROJECT LENGTH 375 FT.

HISTORIC RECORDS

NO HISTORIC RECORDS WERE FOUND FOR THIS PROJECT.

GEOLOGY

THE PROJECT IS LOCATED IN THE NON-GLACIATED MARIETTA PLATEAU WHICH IS CHARACTERIZED AS A DISSECTED PLATEAU WITH HIGH RELIEF WITH MINOR TO MODERATE WIDE FLOOD PLAINS. MAPPING FOR THE AREA INDICATES THAT THE CONFLUENCE OF THE FEDERAL CREEK AND MARIETTA RUN STREAM VALLEYS ARE COMPRISED OF ALLUVIUM. UNDERLYING THE SOIL OVERBURDEN BEDROCK OF PENNSYLVANIAN AGE ARE ENCOUNTERED. WITHIN THE VALLEY BEDROCK FROM THE CONEMAUGH GROUP IS PRESENT WHEREAS THE HILLSIDES ARE COMPRISED OF BEDROCK FROM THE MONOGAHELA GROUP. THE RIDGELINES AND HILL TOPS ARE COMPRISED OF BEDROCK FROM THE DUNKARD GROUP. BEDROCK TYPES ENCOUNTERED ARE VERY DIVERSE CONSISTING OF SANDSTONE, SHALE, SILTSTONE, MUDSTONE, COAL AND MINOR LIMESTONE. THE AREA IS NOTED FOR MINING ALONG THE VALLEYS AND THE COMMON OCCURRENCE OF RED SHALE AND MUDSTONE BEDS IN WHICH LANDSLIDES ARE COMMONLY NOTED.

RECONNAISSANCE

A FIELD RECONNAISSANCE WAS COMPLETED ON JUNE 24, 2016 BY ODOT DISTRICT PERSONNEL. SLOPE INSTABILITY WAS NOTED WITHIN THE SOUTHBOUND LANE AND WITHIN THE SLOPE BELOW THE ROADWAY. A HEAD SCARP AND DISPLACED PAVEMENT WERE PRESENT AND HUMMOCKY TERRAIN WITH LEANING TREES WERE PRESENT WITHIN THE SLOPE. AT THE BASE OF THE SLOPE IS AGRICULTURAL LAND WITHIN THE FLOODPLAIN OF FEDERAL CREEK. ABOVE THE ROADWAY IS A WELL VEGETATED CUT SLOPE LEADING TO MIXED WOODED AND RURAL RESIDENTIAL LAND.

SUBSURFACE EXPLORATION

SIX (6) BORINGS, B-001-0-16 THROUGH B-004-0-16, B-002-1-16 AND B-003-1-16, WERE COMPLETED AS PART OF THE SUBSURFACE EXPLORATION. B-001-0-16 THROUGH B-004-0-16 WERE COMPLETED BETWEEN AUGUST 4 AND 10, 2016 UTILIZING A TRUCK MOUNTED ROTARY DRILL RIG, AND B-002-1-16 AND B-003-1-16 WERE COMPLETED ON AUGUST 23 AND 24, 2016 UTILIZING A TRACK MOUNTED ROTARY DRILL RIG. ALL BORINGS UTILIZED 3-1/4 INCH I.D. HOLLOW STEM AUGERS TO ADVANCE THE BORINGS THROUGH THE SOIL. DISTURBED SAMPLES WERE COLLECTED IN ACCORDANCE WITH THE STANDARD PENETRATION TEST (AASHTO T206) AT CONTINUOUS OR 2.5-FOOT INTERVALS FOR THE FULL DEPTH OF THE BORINGS. THE HAMMER SYSTEMS USED WERE CALIBRATED ON JUNE 27, 2015, AND THE AVERAGE DRILL ROD ENERGY RATIO (ER) WERE 85% FOR THE TRUCK DRILL AND 87% FOR THE TRACK DRILL. UNDISTURBED SOIL SAMPLES WERE COLLECTED AT THE LOCATIONS INDICATED ON THE LOGS, IN ACCORDANCE WITH AASHTO T-207.

EXPLORATION FINDINGS

B-001-0 THROUGH B-004-0 WERE COMPLETED WITHIN THE EXISTING PAVEMENT AND ENCOUNTERED BETWEEN 8 AND 24 INCHES OF ASPHALT WITH B-004-0 ENCOUNTERING BASE MATERIAL TO ELEVATION 620.1 FEET. BENEATH THE PAVEMENT THE BORINGS ENCOUNTERED PREDOMINATELY COHESIVE SOILS RANGING FROM SANDY SILT (A-4a) TO CLAY (A-7-6). THE SOILS RANGED FROM MEDIUM STIFF TO VERY STIFF IN CONSISTENCY AND DAMP TO WET IN CONDITION. B-001-0 ENCOUNTERED A MEDIUM DENSE COARSE AND FINE SAND (A-3a) BETWEEN ELEVATION 596.5 AND 591.4 FEET AND BETWEEN 584.8 AND 581.7 FEET. B-002-0 ENCOUNTERED COARSE AND FINE SAND (A-3a) IN LOOSE COMPACTNESS BETWEEN ELEVATION 601.6 AND 599.8 FEET AND IN MEDIUM DENSE BETWEEN 594.8 AND 587.3 FEET. MEDIUM DENSE GRAVEL AND STONE FRAGMENTS WITH SAND (A-1-b) WAS ENCOUNTERED BETWEEN ELEVATION 584.8 AND 582.3 FEET. B-003-0 ENCOUNTERED MEDIUM DENSE COARSE AND FINE SAND (A-3a) AND GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT (A-2-4) BETWEEN ELEVATION 595.6 AND 588.7 FEET. B-004-0 ENCOUNTERED MEDIUM DENSE COARSE AND FINE SAND (A-3a) BETWEEN ELEVATION 592.6 AND 590.1 FEET.

B-002-1 AND B-003-1 WERE COMPLETED OFF THE ROADWAY AND ENCOUNTERED 12 INCHES OF TOPSOIL UNDERLAIN BY PREDOMINATELY COHESIVE SOILS. COHESIVE SOILS CONSISTING OF SANDY SILT (A-4a), SILT AND CLAY (A-6a), SILTY CLAY (A-6b) AND CLAY (A-7-6) WHICH RANGED BETWEEN VERY SOFT AND STIFF IN COMPACTNESS AND MOIST TO WET IN CONDITION. BOTH B-002-1 AND B-003 ENCOUNTERED NON-COHESIVE SOILS BELOW ELEVATION 587.5 AND 589.7 FEET, RESPECTIVELY. THE NON-COHESIVE SOILS ENCOUNTERED CONSISTED OF GRAVEL WITH SAND (A-1-b), COARSE AND FINE SAND (A-3a), AND SANDY SILT (A-4a) WHICH RANGED FROM VERY LOOSE TO LOOSE IN COMPACTNESS AND WERE TYPICALLY WET IN CONDITION. BOTH BORINGS ENCOUNTERED SANDSTONE, WHICH WAS SPLIT SPOON SAMPLED, AT ELEVATION 577.0 AND 577.7 FEET, RESPECTIVELY.

UNCONFINED COMPRESSIVE STRENGTH TESTING WAS COMPLETED IN FROM UNDISTURBED SAMPLES COLLECTED FROM OFFSET BORINGS WITH RESULTS RANGING FROM 1,504 TO 1,907 PSF.

STATIC WATER LEVELS WERE RECORDED AT COMPLETION OF THE DRILLING ACTIVATES IN B-001-0, B-002-1, AND B-003-1 AT ELEVATION 584.3, 596.0, AND 560.2 FEET, RESPECTIVELY.

LEGEND

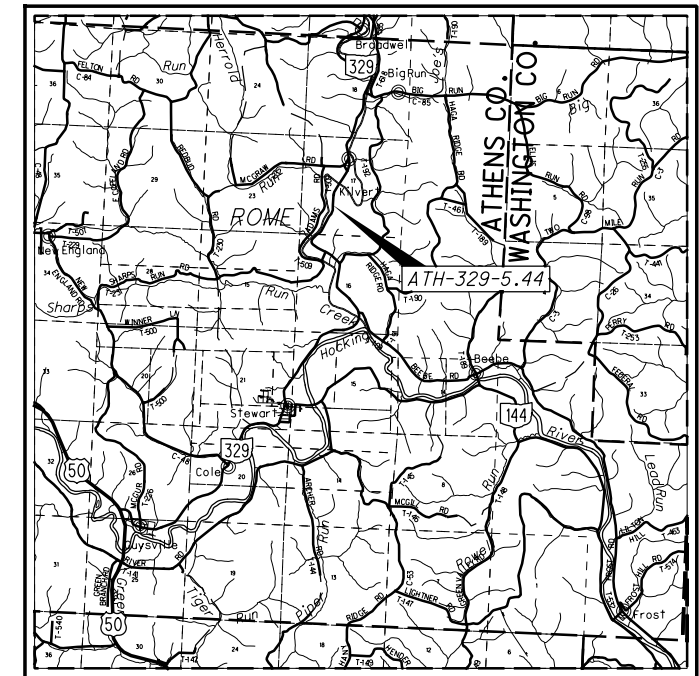
DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL
GRAVEL AND STONE FRAGMENTS	A-1-a	- 1
GRAVEL AND STONE FRAGMENTS WITH SAND	A-1-b	3 -
COARSE AND FINE SAND	A-3a	10 8
GRAVEL AND STONE FRAGS. WITH SAND & SILT	A-2-4	1 2
SANDY SILT	A-4a	9 6
SILT AND CLAY	A-6a	6 7
SILTY CLAY	A-6b	14 17
CLAY	A-7-6	9 15
	TOTAL	52 56
SANDSTONE	VISUAL	
PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL	
SOD AND TOPSOIL = X = APPROXIMATE THICKNESS	VISUAL	
BORING LOCATION - PLAN VIEW.		
DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.		
WC	INDICATES WATER CONTENT IN PERCENT.	
N ₆₀	INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.	
X/Y/D"	NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT): X= NUMBER OF BLOWS FOR 6 INCHES (UNCORRECTED). Y/D"= NUMBER OF BLOWS (UNCORRECTED) FOR D" OF PENETRATION AT REFUSAL.	
INDICATES STATIC WATER ELEVATION.		
INDICATES FREE WATER ELEVATION.		
INDICATES A PLASTIC MATERIAL WITH A MOISTURE CONTENT EQUAL TO OR GREATER THAN THE LIQUID LIMIT MINUS 3.		
INDICATES A NON-PLASTIC MATERIAL WITH A MOISTURE CONTENT GREATER THAN 25 % OR GREATER THAN 19 % WITH A WET APPEARANCE.		
SS	INDICATES A SPLIT SPOON SAMPLE.	
ST	INDICATES A SHELBY TUBE SAMPLE.	
LOI	INDICATES ORGANIC CONTENT BY LOSS ON IGNITION (AASHTO T267).	
QU	INDICATES SOIL COMPRESSION TEST, AASHTO T-208, RESULTS	
NP	INDICATES A NON-PLASTIC SAMPLE.	

SPECIFICATIONS

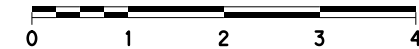
THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JUNE 1, 2016.

AVAILABLE INFORMATION

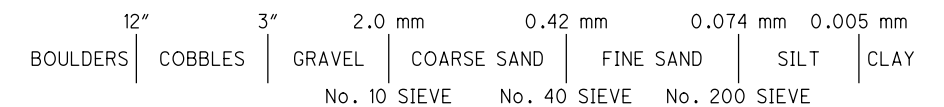
ALL AVAILABLE SOIL AND BEDROCK INFORMATION THAT CAN BE CONVENIENTLY SHOWN ON THE GEOTECHNICAL EXPLORATION SHEETS HAS BEEN SO REPORTED. ADDITIONAL EXPLORATIONS MAY HAVE BEEN MADE TO STUDY SOME SPECIAL ASPECT OF THE PROJECT. COPIES OF THIS DATA, IF ANY, MAY BE INSPECTED IN THE DISTRICT DEPUTY DIRECTOR'S OFFICE OR THE OFFICE OF GEOTECHNICAL ENGINEERING AT 1980 WEST BROAD STREET.



LOCATION MAP
SCALE IN MILES



PARTICLE SIZE DEFINITIONS

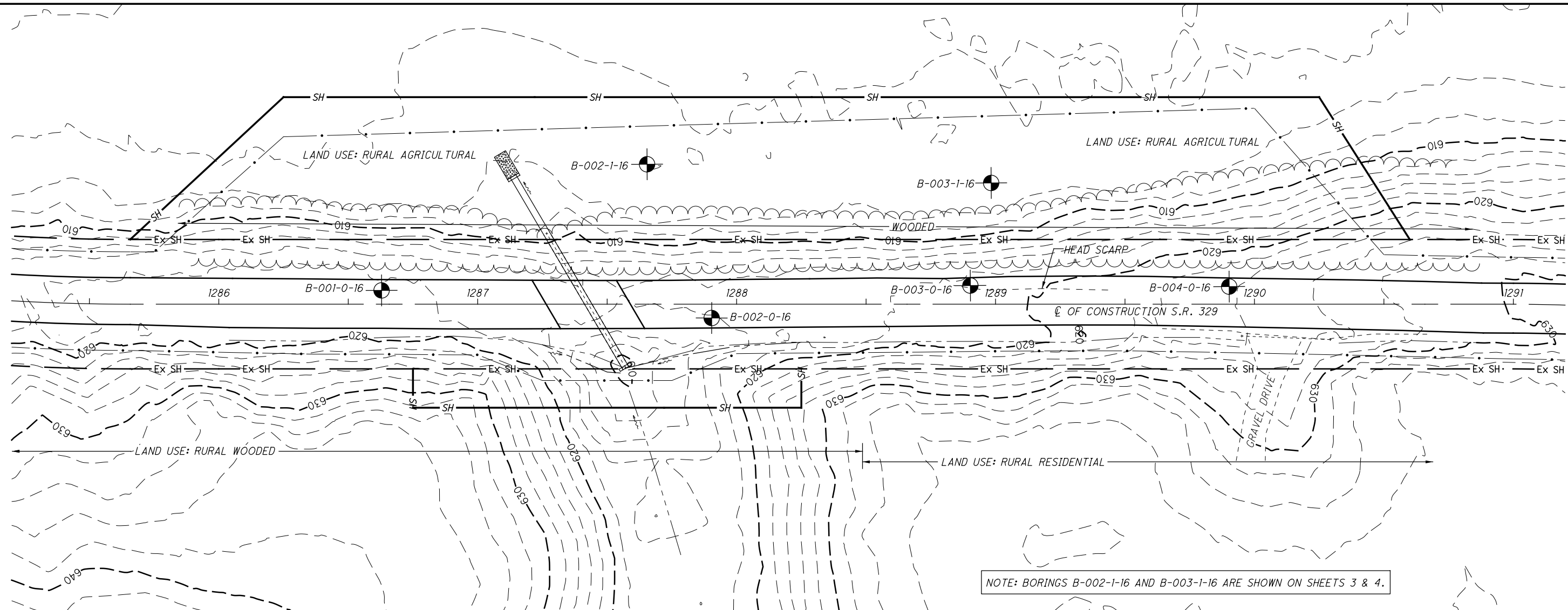


RECON.	- JW	06/24/16
DRILLING	- KAM	08/04-08/10/16 & 08/23-08/24/16
DRAWN	- GLM	03/2018
REVIEWED	- SAT	03/2018

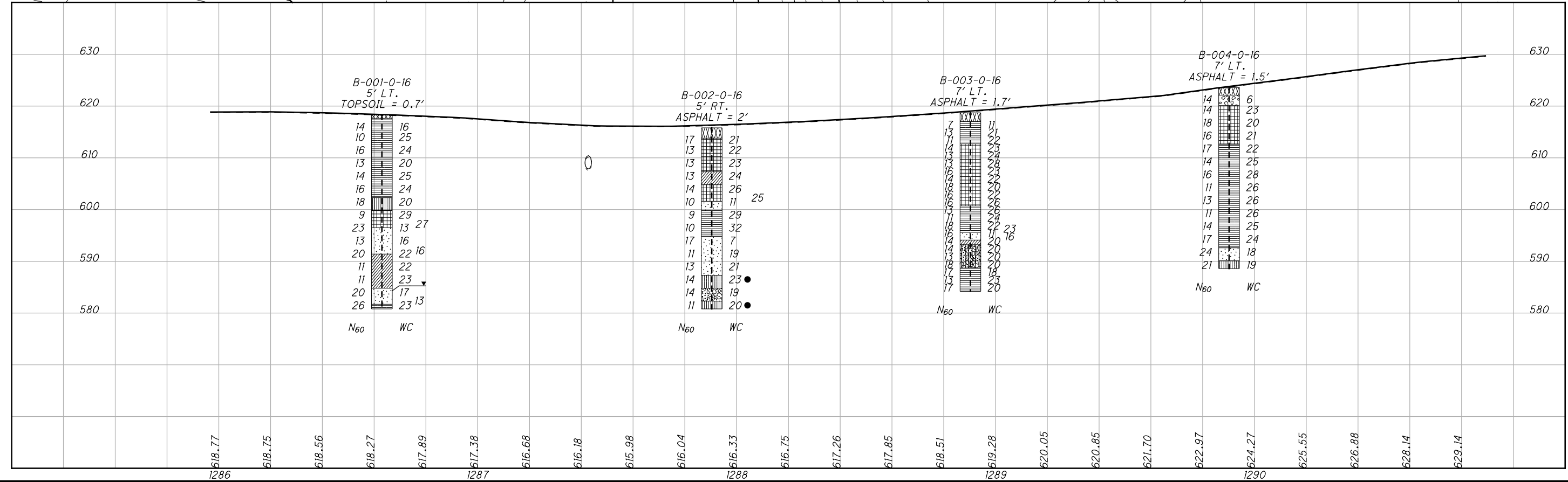
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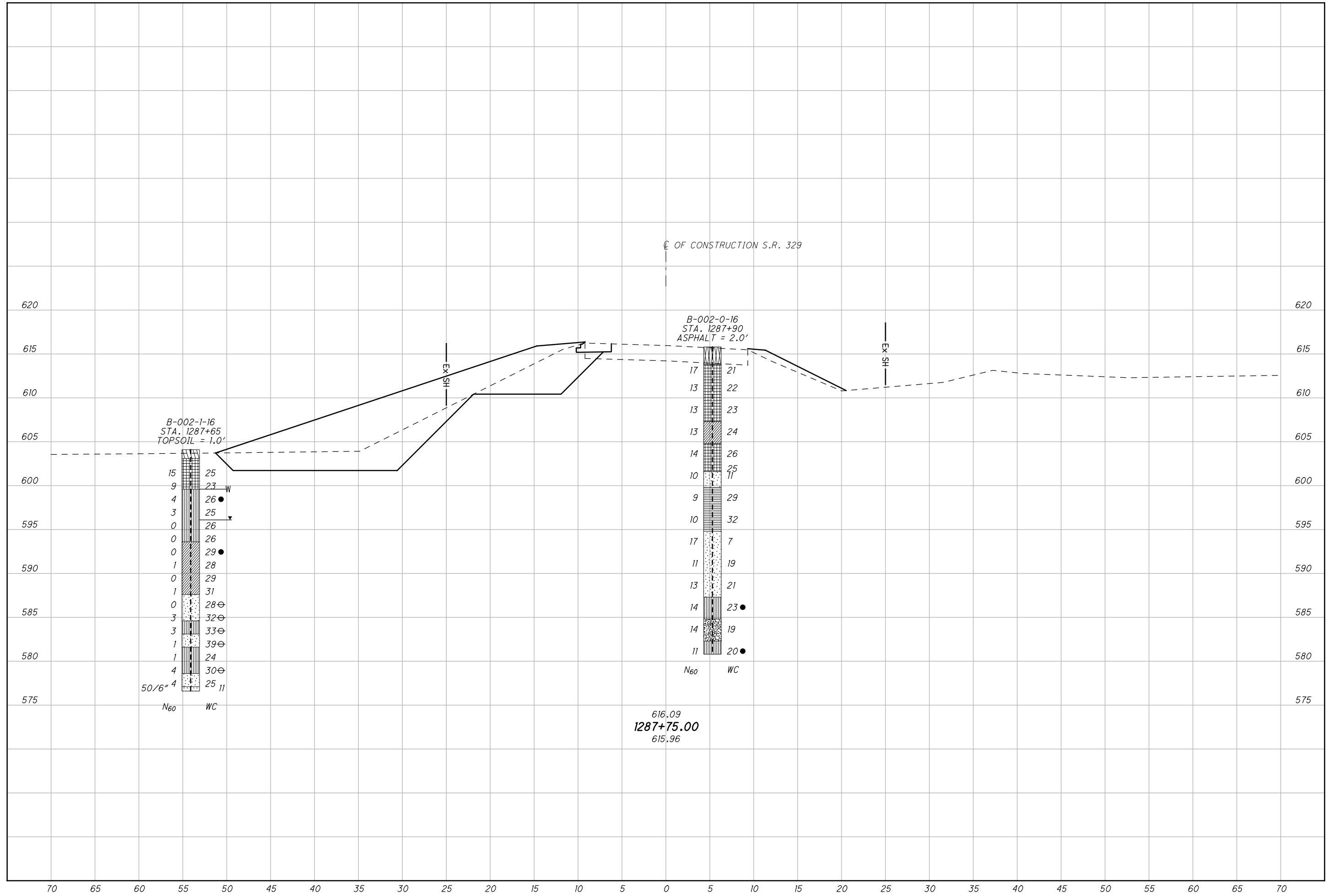
NOTE: BORINGS B-002-1-16 AND B-003-1-16 ARE SHOWN ON SHEETS 3 & 4.



LANDSLIDE EXPLORATION
STA. 1285+50 TO STA. 1291+00

ATH-329-5.44

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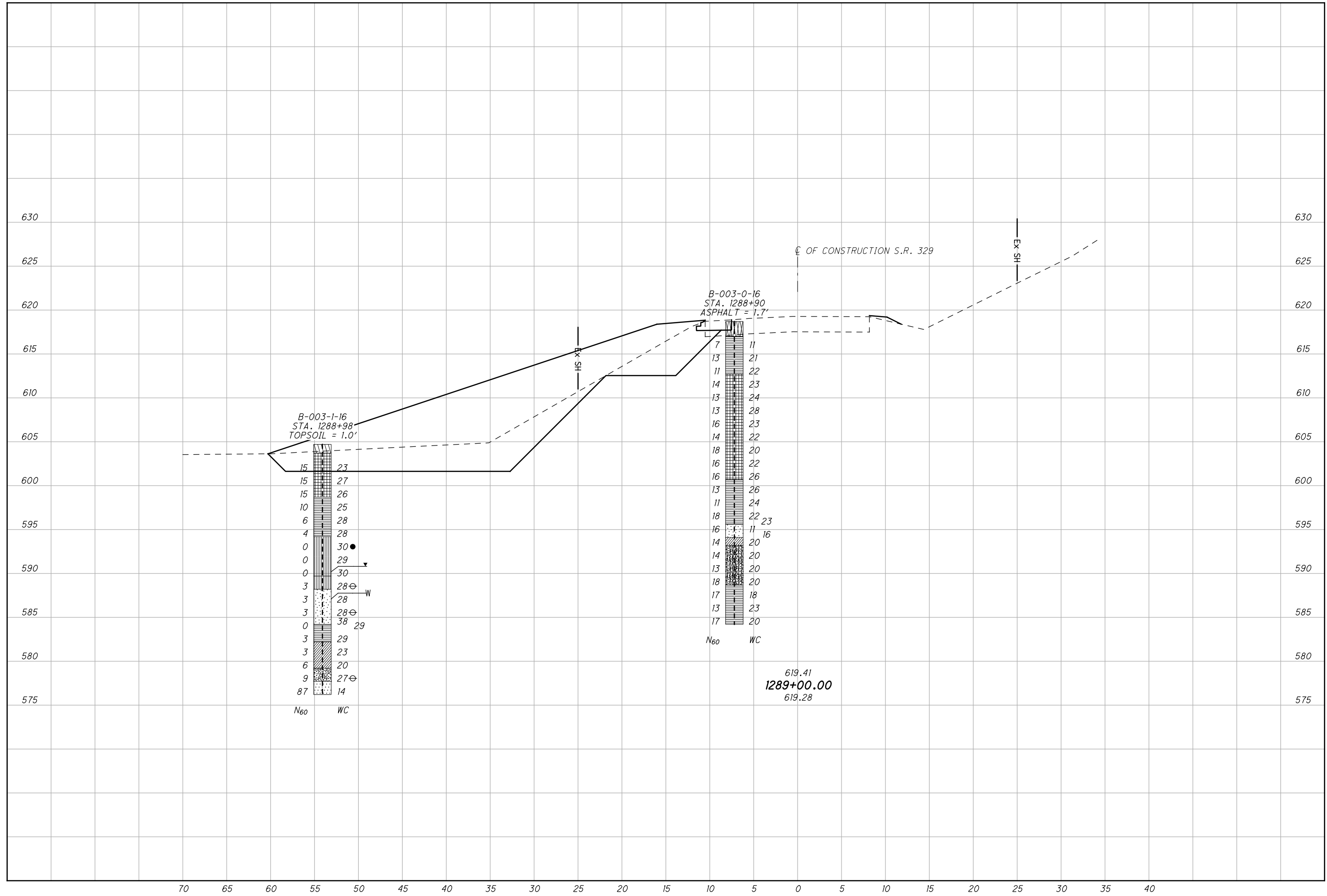
0 5 10
 2.5
 HORIZONTAL
 SCALE IN FEET

DRAWN
GLM
 CHECKED
SAT

**LANDSLIDE EXPLORATION
 CROSS SECTION STA. 1287+75.00**

ATH-329-5.44

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DRAWN
GLM
CHECKED
SAT

0 5 10
2.5
HORIZONTAL
SCALE IN FEET

**LANDSLIDE EXPLORATION
CROSS SECTION STA. 1289+00.00**

ATH-329-5.44

PROJECT: ATH-329-05.44
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/4/16 END: 8/4/16

DRILLING FIRM / OPERATOR: ODOT / FAST
 SAMPLING FIRM / LOGGER: ODOT / MCLEISH
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 55 TRUCK
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 85

STATION / OFFSET: 1286+63.5' LT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 618.3 (MSL) EOB: 37.5 ft.
 LAT / LONG: 39.338391, -81.885682

EXPLORATION ID: B-001-0-16
 PAGE: 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)								ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI		
ASPHALT (8") STIFF TO VERY STIFF, BROWN, SILTY CLAY, TRACE SAND, TRACE GRAVEL, DAMP	618.3 617.6	1-3															
@3.5'; GRAYISH BROWN, MOIST		4-8															
@8.5'; BROWN, NO GRAVEL		9-13															
@11.5' - 12.0'; SAND SEAM, MOIST TO WET		14-16															
VERY STIFF, BROWN AND YELLOWISH BROWN, SANDY SILT, SOME CLAY, TRACE GRAVEL, MOIST	602.3	17-20															
STIFF, GRAYISH RED, CLAY, "AND" SILT, TRACE SAND, MOIST	599.8	21-23															
MEDIUM DENSE, REDDISH BROWN, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, LITTLE GRAVEL, DAMP TO MOIST	596.5	24-26															
MEDIUM STIFF, REDDISH BROWN, SILT AND CLAY, "AND" SAND, MOIST	591.4	27-31															
@28.5'; STIFF		32-37															
MEDIUM DENSE, REDDISH BROWN AND DARK YELLOWISH BROWN, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, TRACE GRAVEL, MOIST	584.8	34-35															
STIFF, GRAYISH BROWN, SILTY CLAY, LITTLE SAND, MOIST	581.7 580.8	36-37															

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT.GDT - 3/23/18 08:36 - X:\GINT\PROJECTS\2017 COMPLETE\60253 2.GPJ

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: TREMIED 50 LB. BENTONITE GROUT, 32 GAL. WATER



ATH - 329 - 5.44

LANDSLIDE EXPLORATION
 BORING LOG B-001-0-16

DRAWN: GLM
 CHECKED: SAT

PROJECT: ATH-329-05.44
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/10/16 END: 8/10/16

DRILLING FIRM / OPERATOR: ODOT / FAST
 SAMPLING FIRM / LOGGER: ODOT / MCLEISH
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 55 TRUCK
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 85

STATION / OFFSET: 1287+90, 5' RT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 615.8 (MSL) EOB: 35.0 ft.
 LAT / LONG: 39.338739, -81.885615

EXPLORATION ID: B-002-0-16
 PAGE: 1 OF 1

DEPTH	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)						WC	ODOT CLASS (GI)	BACK FILL
						GR	CS	FS	SI	CL	LL			
1														
2	8	17	100	SS-1A	-									
3	7	5		SS-1B	3.00	6	1	3	32	58	42	20	22	21
4	3	4	78	SS-2A	2.00	-	-	-	-	-	-	-	-	22
5	4	5												
6	3	4	100	SS-3A	1.00	-	-	-	-	-	-	-	-	23
7	4	5												
8	3	4	100	SS-4A	1.50	0	1	21	37	41	30	18	12	24
9	4	5												
10	3	4	100	SS-5A	1.50	3	0	4	38	55	42	18	24	26
11	4	5												
12	4	5												
13	2	3	100	SS-6A	1.50	-	-	-	-	-	-	-	-	25
14	3	4	100	SS-6B	-	0	9	61	15	15	NP	NP	NP	11
15	4	5												
16	2	3	100	SS-7A	0.50	0	2	5	35	58	39	20	19	29
17	3	3												
18	2	3	100	SS-8A	0.50	-	-	-	-	-	-	-	-	32
19	3	4												
20	3	5	100	SS-9A	-	3	27	46	13	11	NP	NP	NP	7
21	4	7												
22	3	4	100	SS-10A	-	14	32	28	15	11	NP	NP	NP	19
23	4	4												
24	3	4	100	SS-11A	-	-	-	-	-	-	-	-	-	21
25	4	5												
26	3	4	100	SS-12A	1.00	4	11	28	32	25	25	15	10	23
27	4	6												
28	3	4	78	SS-13A	-	13	37	27	14	9	NP	NP	NP	19
29	4	6												
30	3	4	100	SS-14A	1.50	0	3	50	22	25	23	15	8	20
31	4	4												
32	3	4	100											
33	4	4												
34	3	4	100											
35	4	4												

ASPHALT (24")

VERY STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, TRACE SAND, MOIST

@3.5'; STIFF, REDDISH BROWN

STIFF, REDDISH BROWN, SILT AND CLAY, SOME SAND, MOIST

STIFF, REDDISH BROWN, CLAY, "AND" SILT, TRACE SAND, TRACE GRAVEL, MOIST

LOOSE, REDDISH BROWN, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, DAMP

MEDIUM STIFF, REDDISH BROWN, SILTY CLAY, TRACE SAND, MOIST

@18.5'; REDDISH BROWN TO GRAYISH BROWN

MEDIUM DENSE, BROWN, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, TRACE GRAVEL, DAMP

@23.5'; LITTLE GRAVEL, WET

STIFF, REDDISH GRAY, SANDY SILT, SOME CLAY, TRACE GRAVEL, MOIST

MEDIUM DENSE, BROWN AND GRAY, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, WET

STIFF, BROWN AND GRAY MOTTLED, SANDY SILT, SOME CLAY, MOIST

EOB

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS. HOLE DRY UPON COMPLETION.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 100 LB. BENTONITE CHIPS

ATH - 329 - 5.44

LANDSLIDE EXPLORATION BORING LOG B-002-0-16

DRAWN: GLM
 CHECKED: SAT

PROJECT: ATH-329-05.44
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/23/16 END: 8/24/16

DRILLING FIRM / OPERATOR: ODOT / LEWIS
 SAMPLING FIRM / LOGGER: ODOT / LEWIS
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 850R TRACKED
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 87

STATION / OFFSET: 1287+65.54' LT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 604.0 (MSL) EOB: 27.5 ft.
 LAT / LONG: 39.338681, -81.885830

EXPLORATION ID: B-002-1-16
 PAGE: 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)								ODOT CLASS (GI)	BACK FILL	
								GR	CS	FS	SI	CL	LL	PL	PI			WC
TOPSOIL (12")	604.0	1																
STIFF, BROWN, CLAY, "AND" SILT, TRACE SAND, MOIST	603.0	2	2	15	78	SS-1A	2.00	0	1	4	46	49	23	23	25	A-7-6 (14)		
@3.0' WITH SAND SEAMS @4.0'; QU = 1,504 PSF @ 6.15% STRAIN; $\gamma_d = 103.74$ PCF	599.5	3	2	9	78	SS-2A	1.00	-	-	-	-	-	-	-	23	A-7-6 (V)		
		4	3	3														
VERY SOFT TO SOFT, BROWN, SANDY SILT, SOME CLAY, WET	596.0	5	1	4	67	SS-3A	0.50	0	0	43	28	29	16	9	26	A-4a (4)		
VERY SOFT, BROWN, SILT AND CLAY, SOME SAND, MOIST TO WET	593.5	6	0	1	3	SS-4A	0.25	-	-	-	-	-	-	-	25	A-4a (V)		
		7	1															
VERY LOOSE, GRAY, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, WET	587.5	8	0	0	78	SS-5A	0.25	-	-	-	-	-	-	-	26	A-4a (V)		
		9	0															
VERY LOOSE, GRAY AND BROWN MOTTLED, SANDY SILT, LITTLE CLAY, SLIGHTLY ORGANIC (LOI = 3.9%), WET	584.5	10	0	0	89	SS-6A	0.25	-	-	-	-	-	-	-	26	A-4a (V)		
		11	0															
VERY LOOSE, GRAY AND BROWN, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, WET	583.0	12	0	0	89	SS-7A	0.25	0	0	26	42	32	17	13	29	A-6a (9)		
		13	0	1	89	SS-8A	0.25	-	-	-	-	-	-	-	-	28	A-6a (V)	
VERY LOOSE, GRAY, SANDY SILT, SOME CLAY, MOIST TO WET	581.5	14	0	0	89	SS-9A	0.25	-	-	-	-	-	-	-	29	A-6a (V)		
		15	0															
VERY LOOSE, GRAY WITH BROWN, GRAVEL WITH SAND, TRACE CLAY, TRACE SILT, WET	578.5	16	0	1	89	SS-10A	0.25	-	-	-	-	-	-	-	31	A-6a (V)		
		17	0															
SANDSTONE, GRAY, MODERATELY WEATHERED, VERY WEAK, FINE TO MEDIUM GRAINED.	577.0	18	0	0	78	SS-11A	-	0	1	71	16	12	NP	NP	28	A-3a (0)		
		19	1	3	78	SS-12A	-	-	-	-	-	-	-	-	-	32	A-3a (V)	
SANDSTONE, GRAY, MODERATELY WEATHERED, VERY WEAK, FINE TO MEDIUM GRAINED.	576.5	20	1	3	89	SS-13A	0.25	0	0	55	25	20	NP	NP	33	A-4a (2)		
		21	0	1	89	SS-14A	-	0	5	63	17	15	NP	NP	NP	39	A-3a (0)	
SANDSTONE, GRAY, MODERATELY WEATHERED, VERY WEAK, FINE TO MEDIUM GRAINED.	576.5	22	0	1	89	SS-15A	0.25	0	1	49	26	24	NP	NP	24	A-4a (3)		
		23	0	1	89	SS-16A	0.00	-	-	-	-	-	-	-	-	30	A-4a (V)	
SANDSTONE, GRAY, MODERATELY WEATHERED, VERY WEAK, FINE TO MEDIUM GRAINED.	576.5	24	0	1	89	SS-17A	-	10	40	41	3	6	NP	NP	25	A-1-b (0)		
		25	1	2	67	SS-18A	-	-	-	-	-	-	-	-	-	11	Rock (V)	
		26	0	1	4	78	SS-17A	-	10	40	41	3	6	NP	NP	25	A-1-b (0)	
		27	50	-	67	SS-18A	-	-	-	-	-	-	-	-	11	Rock (V)		

NOTE: SHELBY TUBE TAKEN IN AN OFFSET BORING

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS



ATH - 329 - 5.44

LANDSLIDE EXPLORATION
 BORING LOG B-002-1-16

DRAWN
GLM
CHECKED
SAT

PROJECT: ATH-329-05.44
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/8/16 END: 8/9/16

DRILLING FIRM / OPERATOR: ODOT / FAST
 SAMPLING FIRM / LOGGER: ODOT / MCLEISH
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 55 TRUCK
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 85

STATION / OFFSET: 1288+90.7' LT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 618.7 (MSL) EOB: 34.5 ft.
 LAT / LONG: 39.339015, -81.885636

EXPLORATION ID: B-003-0-16
 PAGE: 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)								ODOT CLASS (GI)	HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI			WC	
ASPHALT (20")	618.7	1																	
STIFF, GRAY AND BLACK, SILTY CLAY, SOME GRAVEL, SOME SAND, DAMP @3.0'; BROWN, TRACE SAND, TRACE GRAVEL, MOIST	617.0	2	2	7	44	SS-1A	-	33	11	12	18	26	39	20	19	11	A-6b (4)		
		3	2	3	13	67	SS-2A	2.00	5	2	4	36	53	40	19	21	21	A-6b (12)	
		4	3	6															
		5	1	3	11	78	SS-3A	2.00	-	-	-	-	-	-	-	-	22	A-6b (V)	
		6	2	5	14	100	SS-4A	2.50	1	3	35	60	42	21	21	23	23	A-7-6 (13)	
		7	2	5															
VERY STIFF, BROWN AND GRAY MOTTLED, CLAY, SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST @12.0'; YELLOWISH BROWN	612.7	8	2	4	100	SS-5A	2.50	-	-	-	-	-	-	-	-	24	A-7-6 (V)		
		9	2	4	13	100	SS-6A	2.50	-	-	-	-	-	-	-	28	A-7-6 (V)		
		10	2	4	13	100	SS-6A	2.50	-	-	-	-	-	-	-	23	A-7-6 (V)		
		11	3	4	16	100	SS-7A	3.00	-	-	-	-	-	-	-	23	A-7-6 (V)		
		12	3	4	14	100	SS-8A	3.00	7	1	2	35	55	41	20	21	22	A-7-6 (13)	
		13	3	4	18	100	SS-9A	2.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
@16.5'; REDDISH BROWN STIFF, REDDISH BROWN, SILTY CLAY, TRACE SAND, TRACE GRAVEL, MOIST	600.7	14	3	5	100	SS-10A	3.00	-	-	-	-	-	-	-	-	22	A-7-6 (V)		
		15	3	4	16	100	SS-10A	3.00	-	-	-	-	-	-	-	22	A-7-6 (V)		
		16	3	4	16	100	SS-10A	3.00	-	-	-	-	-	-	-	26	A-7-6 (V)		
		17	3	5	16	100	SS-11A	2.50	-	-	-	-	-	-	-	26	A-7-6 (V)		
		18	3	4	13	100	SS-12A	1.50	1	0	4	44	51	39	19	20	26	A-6b (12)	
		19	3	4	11	100	SS-13A	1.50	-	-	-	-	-	-	-	-	24	A-6b (V)	
MEDIUM DENSE, REDDISH BROWN, COARSE AND FINE SAND, LITTLE CLAY, LITTLE SILT, TRACE GRAVEL, MOIST STIFF, REDDISH BROWN, SILT AND CLAY, "AND" SAND, TRACE GRAVEL, MOIST MEDIUM DENSE, REDDISH BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, MOIST	595.6	20	3	5	100	SS-14A	1.50	-	-	-	-	-	-	-	-	22	A-6b (V)		
		21	5	6	18	100	SS-14A	1.50	-	-	-	-	-	-	-	22	A-6b (V)		
		22	4	6	16	100	SS-15A	1.00	-	-	-	-	-	-	-	23	A-6b (V)		
		23	4	5	16	100	SS-15B	-	1	21	48	14	16	NP	NP	11	A-3a (0)		
		24	2	5	14	100	SS-16A	-	-	-	-	-	-	-	-	16	A-3a (V)		
		25	5	5	14	100	SS-16B	0.50	4	7	32	23	34	27	16	11	20	A-6a (5)	
STIFF, BROWN, SILTY CLAY, LITTLE SAND, LITTLE STONE FRAGMENTS, MOIST @33.0'; MEDIUM STIFF	588.7	26	4	5	100	SS-17A	-	12	29	25	16	18	25	18	7	20	A-2-4 (0)		
		27	2	5	13	100	SS-18A	-	-	-	-	-	-	-	-	20	A-2-4 (V)		
		28	6	8	18	100	SS-19A	-	-	-	-	-	-	-	-	20	A-2-4 (V)		
		29	5	6	17	78	SS-20A	1.50	10	4	10	25	51	35	18	17	18	A-6b (11)	
		30	2	4	13	100	SS-21A	1.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
		31	2	4	17	78	SS-22A	0.50	-	-	-	-	-	-	-	-	20	A-6b (V)	
		32	4	8															
		33	2	4															
		34	2	4															

EOB

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS. HOLE DRY UPON COMPLETION.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: TREMIED 50 LB. BENTONITE GROUT. 30 GAL. WATER

ATH-329-5.44	LANDSLIDE EXPLORATION	
	BORING LOG B-003-0-16	
8/11	DRAWN GLM	CHECKED SAT

PROJECT: ATH-329-05.44 LANDSLIDE
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/23/16 END: 8/23/16
 DRILLING FIRM / OPERATOR: ODOT / LEWIS
 SAMPLING FIRM / LOGGER: ODOT / LEWIS
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 850R TRACKED
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 87

STATION / OFFSET: 1288+98.47 LT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 604.7 (MSL) EOB: 28.5 ft.
 LAT / LONG: 39.339044, -81.885774

EXPLORATION ID: B-003-1-16
 PAGE: 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)								ODOT CLASS (GI)	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI		
TOPSOIL (12")	604.7	1															
VERY STIFF, BROWN, CLAY, "AND" SILT, TRACE SAND, DAMP	603.7	2	3	15	67	SS-1A	2.50	0	1	3	41	55	46	24	22	23	A-7-6 (14)
@3.0'; MOIST		3	2	15	67	SS-2A	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)
@4.5'; STIFF		4	4	15	78	SS-3A	1.50	-	-	-	-	-	-	-	-	26	A-7-6 (V)
STIFF, BROWN, SILTY CLAY, LITTLE SAND, MOIST	596.7	5	4	10	67	SS-4A	1.00	0	1	10	52	37	37	21	16	25	A-6b (10)
@7.5'; MEDIUM STIFF		6	2	6	78	SS-5A	0.50	-	-	-	-	-	-	-	-	28	A-6b (V)
@8.0'; QU = 1,907 PSF @ 14.9% STRAIN; $\gamma_d = 96.87$ PCF		7	1	4	89	SS-6A	0.50	-	-	-	-	-	-	-	-	28	A-6b (V)
@9.0'; SOFT		8	0	0	89	SS-7A	0.00	0	1	39	34	26	27	19	8	30	A-4a (5)
VERY SOFT, BROWN, SANDY SILT, SOME CLAY, WET	594.2	9	0	0	89	SS-8A	0.25	-	-	-	-	-	-	-	-	29	A-4a (V)
		10	0	0	89	SS-9A	0.25	-	-	-	-	-	-	-	-	30	A-4a (V)
		11	0	0	89	SS-10A	-	0	1	59	23	17	NP	NP	NP	28	A-4a (1)
VERY LOOSE, GRAY AND BROWN MOTTLED, SANDY SILT, LITTLE CLAY, SLIGHTLY ORGANIC (LOI = 3.1%), WET	588.2	12	1	3	89	SS-11A	-	0	2	75	12	11	NP	NP	NP	28	A-3a (0)
VERY LOOSE, GRAY, COARSE AND FINE SAND, LITTLE SILT, LITTLE CLAY, WET		13	1	3	89	SS-12A	-	-	-	-	-	-	-	-	-	28	A-3a (V)
		14	1	3	89	SS-13A	-	-	-	-	-	-	-	-	-	38	A-3a (V)
		15	0	0	89	SS-13B	0.50	1	0	8	40	51	38	20	18	29	A-6b (11)
SOFT, BROWN, SILTY CLAY, TRACE SAND, TRACE GRAVEL, MOIST	584.2	16	0	0	89	SS-14A	0.50	-	-	-	-	-	-	-	-	29	A-6a (V)
SOFT, BROWN AND GRAY MOTTLED, SILT AND CLAY, SOME SAND, MOIST	583.7	17	0	1	78	SS-15A	0.50	0	1	21	37	41	30	16	14	23	A-6a (10)
@24.0'; MEDIUM STIFF		18	1	6	78	SS-16A	1.00	-	-	-	-	-	-	-	-	20	A-6a (V)
LOOSE, BROWN, GRAVEL WITH SAND, TRACE SILT, TRACE CLAY, WET	579.2	19	1	9	67	SS-17A	-	1	49	35	9	6	NP	NP	NP	27	A-1-b (0)
SANDSTONE, GRAY, HIGHLY WEATHERED, VERY WEAK, FINE TO MEDIUM GRAINED.	577.7	20	2	4	67	SS-18A	-	-	-	-	-	-	-	-	-	14	Rock (V)
		21	4	10	87			-	-	-	-	-	-	-	-		
		22	50														

NOTE: SHELBY TUBE TAKEN IN AN OFFSET BORING

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS



ATH-329-5.44

LANDSLIDE EXPLORATION
 BORING LOG B-003-1-16

DRAWN: GLM
 CHECKED: SAT

PROJECT: ATH-329-05.44
 TYPE: LANDSLIDE
 PID: 103391 SFN: N/A
 START: 8/9/16 END: 8/9/16

DRILLING FIRM / OPERATOR: ODOT / FAST
 SAMPLING FIRM / LOGGER: ODOT / MCLEISH
 DRILLING METHOD: 3.25HS
 SAMPLING METHOD: SPT

DRILL RIG: CME 55 TRUCK
 HAMMER: CME AUTOMATIC
 CALIBRATION DATE: 5/27/15
 ENERGY RATIO (%): 85

STATION / OFFSET: 1289+90.7' LT.
 ALIGNMENT: C.L. S.R. 329
 ELEVATION: 623.6 (MSL) EOB: 35.0 ft.
 LAT / LONG: 39.339289, -81.885612

EXPLORATION ID: B-004-0-16
 PAGE: 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)							WC	ODOT CLASS (GI)	BACK FILL
							GR	CS	FS	SI	CL	LL	PL			
ASPHALT (18")	623.6															
MEDIUM DENSE, BROWN AND BLACK, STONE FRAGMENTS , TRACE SAND, TRACE SILT, TRACE CLAY, (NOT ENOUGH MATERIAL TO TEST), DRY	622.1	4 5 5	14	11	SS-1A	-	-	-	-	-	-	-	-	6	A-1-A (V)	
VERY STIFF, DARK YELLOWISH BROWN, CLAY, SOME SILT, TRACE GRAVEL, TRACE SAND, DAMP TO MOIST	620.1	3 4 6	14	78	SS-2A	2.50	1	1	27	68	44	21	23	23	A-7-6 (14)	
@6.0'; REDDISH BROWN		4 6 7	18	100	SS-3A	2.50	-	-	-	-	-	-	-	20	A-7-6 (V)	
		2 4 7	16	100	SS-4A	3.00	-	-	-	-	-	-	-	21	A-7-6 (V)	
VERY STIFF, REDDISH BROWN, SILTY CLAY , TRACE SAND, MOIST	612.6	3 6 6	17	100	SS-5A	2.00	0	1	5	44	50	34	16	18	A-6b (11)	
		2 4 6	14	100	SS-6A	2.50	-	-	-	-	-	-	-	25	A-6b (V)	
@18.5'; STIFF		3 5 6	16	100	SS-7A	2.50	-	-	-	-	-	-	-	28	A-6b (V)	
		2 3 5	11	100	SS-8A	2.00	-	-	-	-	-	-	-	26	A-6b (V)	
		2 4 5	13	100	SS-9A	1.00	0	0	6	50	44	34	18	16	A-6b (10)	
		2 3 5	11	100	SS-10A	1.00	-	-	-	-	-	-	-	26	A-6b (V)	
		2 5 5	14	100	SS-11A	1.50	-	-	-	-	-	-	-	25	A-6b (V)	
		3 6 6	17	78	SS-12A	1.50	-	-	-	-	-	-	-	24	A-6b (V)	
MEDIUM DENSE, BROWN, COARSE AND FINE SAND , LITTLE SILT, LITTLE CLAY, TRACE GRAVEL, MOIST	592.6	5 8 9	24	89	SS-13A	-	5	27	38	15	15	NP	NP	18	A-3a (0)	
STIFF, BROWN AND REDDISH BROWN, SANDY SILT , SOME CLAY, TRACE GRVEL, MOIST	590.1	5 7 8	21	100	SS-14A	1.00	6	18	33	17	26	23	14	9	A-4a (2)	
	588.6															

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT.GDT - 3/23/18 08:36 - X:\GINT\PROJECTS\2017 COMPLETE\60253 2.GPJ

NOTES: LAT/LONG/ELEV FROM DISTRICT SURVEY GRADE INSTRUMENTS. HOLE DRY UPON COMPLETION.
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH 100 LB. BENTONITE CHIPS



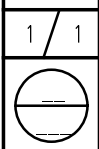
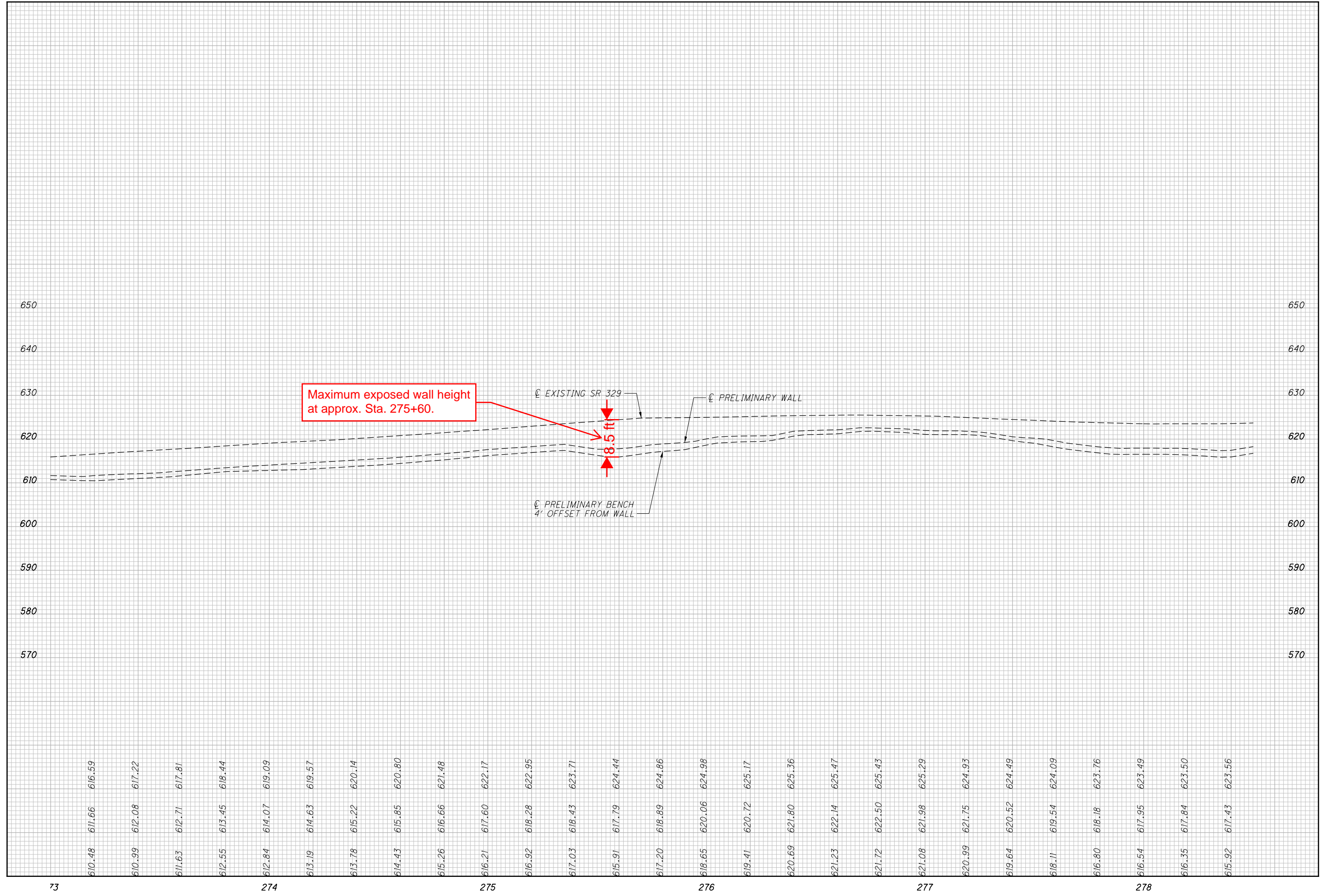
ATH - 329 - 5.44

LANDSLIDE EXPLORATION
 BORING LOG B-004-0-16

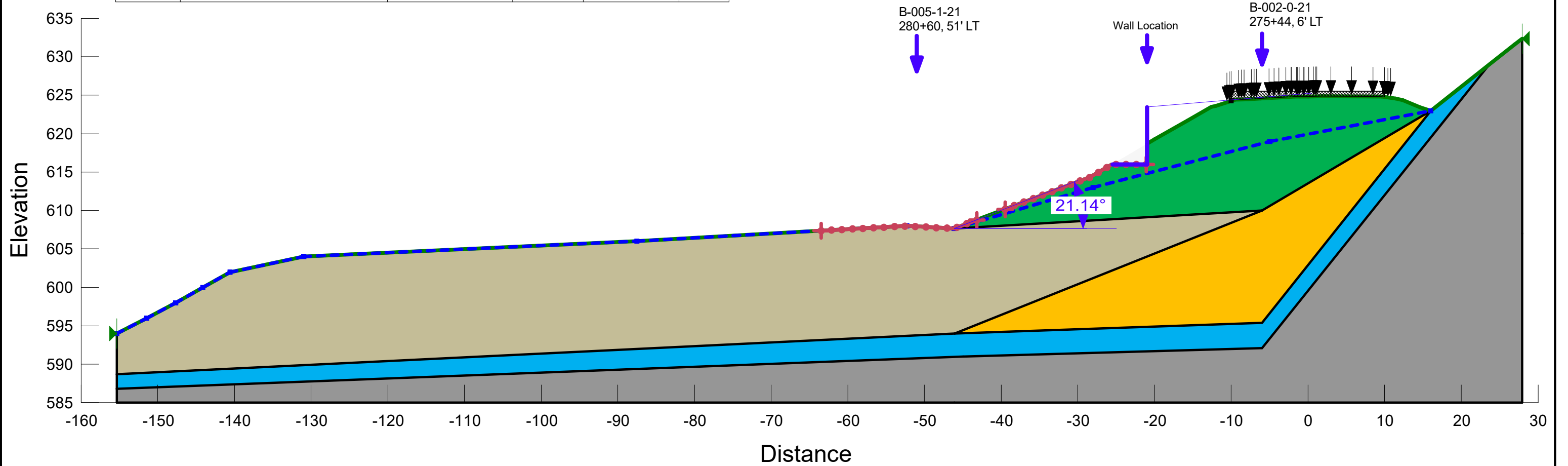
DRAWN: GLM
 CHECKED: SAT



Wall Profile and Cross-Section at 275+75



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1. M. Stiff to Stiff Fill	Mohr-Coulomb	120	120	20
Yellow	2. Stiff to V. Stiff Cohesive	Mohr-Coulomb	125	125	23
Blue	4. Hard Cohesive	Mohr-Coulomb	140	200	28
Tan	5. M. Stiff to Stiff Alluvium	Mohr-Coulomb	110	80	20
Grey	6. Bedrock	Bedrock (Impenetrable)			



SLOPE/W Analysis - Wall	
20210526_ATH-329-5.26_SlopeW_Sta. 275+75 1.gsz	
06/02/2021	1:152



**Soil Strength Parameter Determination
(Structural Solution)
Sta. 273+00 to Sta. 278+00**

SOIL STRENGTH PARAMETER DETERMINATION

Layer	Undrained Shear Strength (Su) (psf)				Dry Unit Weight (pcf)		Moist Unit Wt. (pcf)		Adopted Short Term Parameters	Long-Term Strength Values				Adopted Long Term Strength Parameters (Back-Calculated from SlopeW)	
	PPR	N-values		Tested Values	Correlation	Tested	Correlation	Tested		N ₆₀ Value	ODOT GB-7 Correlations		Cohesion (psf)		phi (deg)
		Sowers	T and P								Cohesion (psf)	phi (deg)			
Layer 1 MEDIUM STIFF TO STIFF FILL	Max	4000	4000	2261	110		125		$S_u = 1100$ psf $\phi = 0$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 120$ pcf	Max	17	157	24	$c' = 120$ psf $\phi' = 20$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 120$ pcf	
	Min	1500	1750	931	95		120			Min	7	88	22		
	Average	2542	3021	1618	104		123			Average	12	128	23		
	Std Dev	1076	849	467	6		3			Std Dev	4	25	1		
	Avg + Std	3617	3870	2085	110		125			Avg + Std	16	153	24		
	Avg - Std	1466	2172	1151	98		120			Avg - Std	9	103	22		
Layer 2 STIFF TO VERY STIFF COHESIVE	Max	4000	4000	3458	1088	120	103	135	127	$S_u = 1300$ psf $\phi = 0$ deg $Y_{dry} = 110$ pcf $Y_{moist} = 125$ pcf	Max	26	187	25	$c' = 125$ psf $\phi' = 23$ deg $Y_{dry} = 110$ pcf $Y_{moist} = 125$ pcf
	Min	500	1050	798	1088	95	103	120	127		Min	6	75	21	
	Average	2200	2881	1848	1088	109	103	127	127		Average	14	134	23	
	Std Dev	1014	966	756		7		4			Std Dev	6	32	1	
	Avg + Std	3214	3847	2604		117		131			Avg + Std	20	166	25	
	Avg - Std	1186	1915	1092		102		122			Avg - Std	8	102	22	
Layer 3 GRANULAR SOIL	Max	N/A	N/A	N/A		120		140		$S_u = 0$ psf $\phi = 25$ deg $Y_{dry} = 115$ pcf $Y_{moist} = 135$ pcf	Max	33	N/A	35	$c' = 0$ psf $\phi' = 25$ deg $Y_{dry} = 115$ pcf $Y_{moist} = 135$ pcf
	Min	N/A	N/A	N/A		110		130			Min	7	N/A	29	
	Average	N/A	N/A	N/A		115		135			Average	20	N/A	33	
	Std Dev	N/A	N/A	N/A		7		7			Std Dev	18	N/A	3	
	Avg + Std	N/A	N/A	N/A		122		142			Avg + Std	38	N/A	36	
	Avg - Std	N/A	N/A	N/A		108		128			Avg - Std	2	N/A	30	
Layer 4 HARD COHESIVE	Max	N/A	4000	4000		130		140		$S_u = 4000$ psf $\phi = 0$ deg $Y_{dry} = 130$ pcf $Y_{moist} = 140$ pcf	Max	42	250	28	$c' = 200$ psf $\phi' = 28$ deg $Y_{dry} = 130$ pcf $Y_{moist} = 140$ pcf
	Min	N/A	4000	4000		130		140			Min	39	200	28	
	Average	N/A	4000	4000		130		140			Average	41	240	28	
	Std Dev	N/A	0	0		0		0			Std Dev	2	22	0	
	Avg + Std	N/A	4000	4000		130		140			Avg + Std	43	262	28	
	Avg - Std	N/A	4000	4000		130		140			Avg - Std	38	218	28	
Layer 5 MEDIUM STIFF TO STIFF ALLUVIUM	Max	1500	3000	1596		105		125		$S_u = 1100$ psf $\phi = 0$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 110$ pcf	Max	12	129	23	$c' = 80$ psf $\phi' = 20$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 110$ pcf
	Min	1000	1500	798		95		110			Min	6	75	21	
	Average	1333	2000	1064		98		116			Average	8	95	22	
	Std Dev	289	677	360		5		8			Std Dev	3	23	1	
	Avg + Std	1622	2677	1424		103		124			Avg + Std	11	118	23	
	Avg - Std	1045	1323	704		93		109			Avg - Std	5	72	21	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 1	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
													N-values												
													PPR	Sowers	T & P										
Max	17	100	4.0	12	11	7	30	48	56	26	31	31	Max	4000	4000	2261	157	24	12.0	618.3	110	125	0.414	2.65	0.741
Min	7	33	1.5	8	8	6	26	44	52	24	28	22	Min	1500	1750	931	88	22	4.0	608.7	95	120	0.378	2.65	0.503
Average	12	64	2.5	10	9	7	28	46	54	25	30	26	Average	2542	3021	1618	128	23	7.9	613.6	104	123	0.399	2.65	0.592
Std Dev	4	18	1.1	2	2	1	2	2	2	1	2	3	Std Dev	1076	849	467	25	1	2.6	2.8	6	3	0.019	0.00	0.093
Avg + Std	16	82	3.6	12	11	7	30	48	56	26	31	29	Avg + Std	3617	3870	2085	153	24	10.5	616.4	110	125	0.418	2.65	0.686
Avg - Std	9	46	1.5	8	8	6	26	44	52	24	28	23	Avg - Std	1466	2172	1151	103	22	5.3	610.8	98	120	0.380	2.65	0.499

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)
																					N-values											
																					PPR	Sowers	T & P									
SR 329	618.7	B-001-0-21	3	-	4.5	10	78	1.5	8	9	7	28	48	56	26	30	25	A-7-6	Cohesive	1	1500	2500	1330	114	23	4.0	614.7	100	120	0.414	2.65	0.654
SR 329	618.7	B-001-0-21	4.5	-	6	10	100	2	-	-	-	-	-	-	-	-	29	A-7-6	Cohesive	1	2000	2500	1330	114	23	5.0	613.7	100	120	2.65	0.654	
SR 329	618.7	B-001-0-21	6	-	7.5	16	67	4	-	-	-	-	-	-	-	-	24	A-7-6	Cohesive	1	4000	4000	2128	153	24	7.0	611.7	110	125	2.65	0.503	
SR 329	618.7	B-001-0-21	7.5	-	9	16	78	4	-	-	-	-	-	-	-	-	27	A-7-6	Cohesive	1	4000	4000	2128	153	24	8.0	610.7	110	125	2.65	0.503	
SR 329	618.7	B-001-0-21	9	-	10.5	17	61	3.5	-	-	-	-	-	-	-	-	25	A-7-6	Cohesive	1	3500	4000	2261	157	24	10.0	608.7	110	125	2.65	0.503	
SR 329	623.9	B-002-0-21	6	-	7.5	7	61	2.5	9	8	6	30	47	55	24	31	24	A-7-6	Cohesive	1	2500	1750	931	88	22	7.0	616.9	95	120	0.405	2.65	0.741
SR 329	623.9	B-002-0-21	8.5	-	10	14	56	3.5	-	-	-	-	-	-	-	-	23	A-7-6	Cohesive	1	3500	3500	1862	143	24	9.0	614.9	105	125	2.65	0.575	
SR 329	623.9	B-002-0-21	11	-	12.5	17	78	3.5	-	-	-	-	-	-	-	-	23	A-7-6	Cohesive	1	3500	3500	1862	143	24	12.0	611.9	110	125	2.65	0.503	
SR 329	623.3	B-004-0-21	4	-	5.5	14	39	1.5	12	11	7	26	44	52	24	28	22	A-7-6	Cohesive	1	1500	3500	1862	143	24	5.0	618.3	100	120	0.378	2.65	0.654
SR 329	623.3	B-004-0-21	6	-	7.5	12	56	1.5	-	-	-	-	-	-	-	-	28	A-7-6	Cohesive	1	1500	3000	1596	129	23	7.0	616.3	105	125	2.65	0.575	
SR 329	623.3	B-004-0-21	8.5	-	10	7	61	1.5	-	-	-	-	-	-	-	-	28	A-7-6	Cohesive	1	1500	1750	931	88	22	9.0	614.3	95	120	2.65	0.741	
SR 329	623.3	B-004-0-21	11	-	12.5	9	33	1.5	-	-	-	-	-	-	-	-	31	A-7-6	Cohesive	1	1500	2250	1197	107	22	12.0	611.3	110	125	2.65	0.503	

Granular samples (encountered base material) were removed from parameter calculation to provide more representative results.

Values for Soil Strength Correlation Reference		Value
HI PI (Sowers)		0.25
MD PI (Sowers)		0.175
LO PI (Sowers)		0.075
T&P		0.133

Layer 2														Short-Term Cohesion (psf)			Correlated		Midpoint	Midpoint	Correlated	Correlated		Strength Testing			
N ₆₀	Rec	HP	Gr	CS	FS	Silt	Clay	LL	PL	PI	WC	N-values			LT Cohesion (psf) per GB-7	phi (deg)	Sample Depth (ft.)	Sample Elevation (ft.)	Dry Unit Wt. (pcf) per GB-7	Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	
												PPR	Sowers	T & P													
Max	26	100	4.0	16	13	17	49	62	65	26	39	30	4000	4000	3458	187	25	27.0	622.3	120	135	0.495	2.70	0.741	103	127	1088
Min	6	17	0.5	0	0	4	24	34	37	19	17	17	500	1050	798	75	21	3.0	594.7	95	120	0.243	2.65	0.404	103	127	1088
Average	14	82	2.2	4	5	9	35	47	50	24	27	23	2200	2881	1848	134	21	16.1	606.6	109	127	0.362	2.67	0.526	103	127	1088
Std Dev	6	25	1.0	5	4	5	9	9	9	2	7	4	1014	966	756	32	1	6.6	7.9	7	4	0.085	0.02	0.103	N/A	N/A	N/A
Avg + Std	20	106	3.2	10	9	13	44	56	60	26	34	27	3214	3847	2604	166	25	22.6	614.5	117	131	0.447	2.69	0.629	N/A	N/A	N/A
Avg - Std	8	57	1.2	-1	1	4	26	38	41	21	19	20	1186	1915	1092	102	22	9.5	598.7	102	122	0.277	2.64	0.423	N/A	N/A	N/A

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	Rec	HP	Gr	CS	FS	Silt	Clay	LL	PL	PI	WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Strength Testing		
																					PPR	N-values Sowers	T & P	LT Cohesion (psf) per GB-7									Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)
SR 329	618.7	B-001-0-21	10.5	-	12	17	100	4	-	-	-	-	-	-	-	-	17	A-7-6	Cohesive	2	4000	4000	2261	157	24	11.0	607.7	115	130	0.423	2.65	0.438			
SR 329	618.7	B-001-0-21	12	-	13.5	20	100	3.5	2	4	7	34	53	57	26	31	26	A-7-6	Cohesive	2	3500	4000	2660	167	25	13.0	605.7	115	130	0.423	2.65	0.438			
SR 329	618.7	B-001-0-21	13.5	-	15	25	39	3.5	-	-	-	-	-	-	-	23	23	A-7-6	Cohesive	2	3500	4000	3325	183	25	14.0	604.7	115	130	0.423	2.65	0.438			
SR 329	618.7	B-001-0-21	15	-	16.5	13	78	2.5	1	0	4	43	52	53	24	29	27	A-7-6	Cohesive	2	2500	3250	1729	136	23	16.0	602.7	110	125	0.387	2.65	0.503			
SR 329	618.7	B-001-0-21	16.5	-	18	14	100	2.5	-	-	-	-	-	-	-	22	22	A-7-6	Cohesive	2	2500	3500	1862	143	24	17.0	601.7	110	125	0.387	2.65	0.503			
SR 329	618.7	B-001-0-21	18	-	19.5	10	100	0.5	-	-	-	-	-	-	-	23	23	A-6b	Cohesive	2	500	1750	1330	114	23	19.0	599.7	110	125	0.387	2.70	0.532			
SR 329	618.7	B-001-0-21	19.5	-	21.5	10	100	1	0	0	17	49	34	37	19	18	24	A-6b	Cohesive	2	1000	N/A	N/A	114	23	21.0	597.7	110	125	0.243	2.70	0.532	102.6	127.3	1087.5
SR 329	618.7	B-001-0-21	21.5	-	23	6	100	0.5	-	-	-	-	-	-	-	23	23	A-6b	Cohesive	2	500	1050	798	75	21	22.0	596.7	105	125	0.243	2.70	0.605			
SR 329	618.7	B-001-0-21	23	-	24.5	7	100	0.5	-	-	-	-	-	-	-	23	23	A-6b	Cohesive	2	500	1225	931	88	22	24.0	594.7	105	125	0.243	2.70	0.605			
SR 329	623.9	B-002-0-21	13.5	-	15	22	100	3.5	-	-	-	-	-	-	-	22	22	A-7-6	Cohesive	2	3500	4000	2926	173	25	14.0	609.9	115	130	0.378	2.65	0.438			
SR 329	623.9	B-002-0-21	16	-	17.5	20	100	3	3	6	6	36	49	52	25	27	23	A-7-6	Cohesive	2	3000	4000	2660	167	25	17.0	606.9	115	130	0.378	2.65	0.438			
SR 329	623.9	B-002-0-21	18.5	-	20	26	100	3.5	-	-	-	-	-	-	-	21	21	A-7-6	Cohesive	2	3500	4000	3458	187	25	19.0	604.9	115	130	0.378	2.65	0.438			
SR 329	623.9	B-002-0-21	21	-	22.5	22	100	3	-	-	-	-	-	-	-	24	24	A-6b	Cohesive	2	3000	3850	2926	173	25	22.0	601.9	120	135	0.378	2.70	0.404			
SR 329	623.9	B-002-0-21	23.5	-	25	10	100	1.5	0	3	17	46	34	38	21	17	24	A-6b	Cohesive	2	1500	1750	1330	114	23	24.0	599.9	115	130	0.252	2.70	0.465			
SR 329	623.9	B-002-0-21	26	-	27.5	10	100	0.5	-	-	-	-	-	-	-	22	22	A-6b	Cohesive	2	500	1750	1330	114	23	27.0	596.9	115	130	0.252	2.70	0.465			
SR 329	625.3	B-003-0-21	2	-	3.5	14	33	3	12	7	6	25	50	60	25	35	22	A-7-6	Cohesive	2	3000	3500	1862	143	24	3.0	622.3	100	120	0.45	2.65	0.654			
SR 329	625.3	B-003-0-21	3.5	-	5	14	17	2	-	-	-	-	-	-	-	27	27	A-7-6	Cohesive	2	2000	3500	1862	143	24	4.0	621.3	100	120	0.45	2.65	0.654			
SR 329	625.3	B-003-0-21	5	-	6.5	7	56	2	16	11	7	24	42	51	23	28	20	A-7-6	Cohesive	2	2000	1750	931	88	22	6.0	619.3	95	120	0.369	2.65	0.741			
SR 329	625.3	B-003-0-21	6.5	-	8	12	39	2	-	-	-	-	-	-	-	29	29	A-7-6	Cohesive	2	2000	3000	1596	129	23	7.0	618.3	105	125	0.369	2.65	0.575			
SR 329	625.3	B-003-0-21	8	-	9.5	9	67	2	-	-	-	-	-	-	-	27	27	A-7-6	Cohesive	2	2000	2250	1197	107	22	9.0	616.3	105	125	0.369	2.65	0.575			
SR 329	625.3	B-003-0-21	9.5	-	11	10	61	3	-	-	-	-	-	-	-	19	19	A-7-6	Cohesive	2	3000	2500	1330	114	23	10.0	615.3	105	125	0.369	2.65	0.575			
SR 329	625.3	B-003-0-21	11	-	12.5	9	100	1.5	1	4	5	28	62	65	26	39	30	A-7-6	Cohesive	2	1500	2250	1197	107	22	12.0	613.3	110	125	0.495	2.65	0.503			
SR 329	625.3	B-003-0-21	12.5	-	14	13	100	2	-	-	-	-	-	-	-	17	17	A-7-6	Cohesive	2	2000	3250	1729	136	23	13.0	612.3	110	125	0.495	2.65	0.503			
SR 329	625.3	B-003-0-21	14	-	15.5	14	67	2.5	-	-	-	-	-	-	-	21	21	A-7-6	Cohesive	2	2500	3500	1862	143	24	15.0	610.3	110	125	0.495	2.65	0.503			
SR 329	623.3	B-004-0-21	13.5	-	15	7	67	1	2	4	6	35	53	49	25	24	28	A-7-6	Cohesive	2	1000	1750	931	88	22	14.0	609.3	95	120	0.351	2.65	0.741			
SR 329	623.3	B-004-0-21	16	-	17.5	7	78	1.5	-	-	-	-	-	-	-	29	29	A-7-6	Cohesive	2	1500	1750	931	88	22	17.0	606.3	95	120	0.351	2.65	0.741			
SR 329	623.3	B-004-0-21	18.5	-	20	14	100	2.5	-	-	-	-	-	-	-	20	20	A-7-6	Cohesive	2	2500	3500	1862	143	24	19.0	604.3	110	125	0.351	2.65	0.503			
SR 329	623.3	B-004-0-21	21	-	22.5	19	100	3	6	13	11	31	39	40	21	19	18	A-6b	Cohesive	2	3000	3325	2527	163	25	22.0	601.3	120	135	0.27	2.70	0.404			
SR 329	623.3	B-004-0-21	23.5	-	25	13	78	2	-	-	-	-	-	-	-	21	21	A-6b	Cohesive	2	2000	2275	1729	136	23	24.0	599.3	115	130	0.27	2.70	0.465			
SR 329	623.3	B-004-0-21	26	-	27.5	19	67	2.5	-	-	-	-	-	-	-	20	20	A-6b	Cohesive	2	2500	3325	2527	163	25	27.0	596.3	120	135	0.27	2.70	0.404			

Layer 3														Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)
N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	PPR	N-values Sowers	T & P											
Max	33	100	N/A	23	25	51	31	18	25	19	6	22	N/A	N/A	N/A	N/A	35	27.0	609.3	120	140	0.135	2.72	0.543	
Min	7	100	N/A	0	0	15	23	14	25	19	6	6	N/A	N/A	N/A	N/A	29	16.0	591.7	110	130	0.135	2.72	0.414	
Average	20	100	N/A	12	13	33	27	16	25	19	6	16	N/A	N/A	N/A	N/A	33	21.3	600.8	115	135	0.135	2.72	0.479	
Std Dev	18	0	N/A	16	18	25	6	3	N/A	N/A	N/A	8	N/A	N/A	N/A	N/A	3	5.6	9.3	7	7	N/A	0.00	0.091	
Avg + Std	38	100	N/A	28	30	58	33	19	N/A	N/A	N/A	23	N/A	N/A	N/A	N/A	36	26.8	610.1	122	142	N/A	2.72	0.570	
Avg - Std	2	100	N/A	-5	-5	8	21	13	N/A	N/A	N/A	8	N/A	N/A	N/A	N/A	30	15.7	591.4	108	128	N/A	2.72	0.388	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)
																					PPR	N-values Sowers	T & P									
SR 329	618.7	B-001-0-21	24.5	-	26	SS-16	7	100	-	0	0	51	31	18	25	19	6	22	A-4a	Granular	3	N/A	N/A	N/A	29	25.0	593.7	110	130	0.135	2.72	0.543
SR 329	618.7	B-001-0-21	26	-	27.5	SS-17	33	100	-	-	-	-	-	-	-	-	21	A-4a	Granular	3	N/A	N/A	N/A	34	27.0	591.7	120	140		2.72	0.414	
SR 329	625.3	B-003-0-21	15.5	-	17	SS-10	Refusal	100	-	23	25	15	23	14	NP	NP	6	A-4a	NP SILT	3	N/A	N/A	N/A	35	16.0	609.3			N/A	2.72		
SR 329	625.3	B-003-0-21	17	-	17.92	SS-11	Refusal	100	-	-	-	-	-	-	-	-	13	A-4a	NP SILT	3	N/A	N/A	N/A	35	17.0	608.3				2.72		

Layer 4

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)
													N-values											
													PPR	Sowers	T & P									
Max	42	100	N/A	0	9	12	58	38	42	27	15	18	N/A	4000	4000	250	28	34.0	594.9	130	140	0.288	2.72	0.306
Min	39	67	N/A	0	1	3	41	38	37	22	15	12	N/A	4000	4000	200	28	29.0	589.3	130	140	0.243	2.65	0.272
Average	41	89	N/A	0	5	8	50	38	40	25	15	16	N/A	4000	4000	240	28	31.0	592.5	130	140	0.266	2.69	0.289
Std Dev	2	16	N/A	0	6	6	12	0	4	4	0	3	N/A	0	0	22	0	2.1	2.3	0	0	0.032	0.04	0.024
Avg + Std	43	105	N/A	0	11	14	62	38	43	28	15	19	N/A	4000	4000	262	28	33.1	594.8	130	140	0.297	2.73	0.313
Avg - Std	38	73	N/A	0	-1	1	37	38	36	21	15	13	N/A	4000	4000	218	28	28.9	590.2	130	140	0.234	2.65	0.265

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
																					N-values												
																					PPR	Sowers	T & P										
SR 329	623.9	B-002-0-21	28.5	-	30	SS-12	42	78	-	0	1	3	58	38	42	27	15	18	A-7-6	Cohesive	4	N/A	4000	4000	250	28	29.0	594.9	130	140	0.288	2.65	0.272
SR 329	623.9	B-002-0-21	31	-	31.83	SS-13	Refusal	100	-	-	-	-	-	-	-	-	-	12	A-7-6	Cohesive	4	N/A	N/A	N/A	250	28	31.0	592.9			2.65		
SR 329	623.3	B-004-0-21	28.5	-	30	SS-12	39	67	-	-	-	-	-	-	-	-	-	18	A-6a	Cohesive	4	N/A	4000	4000	200	28	29.0	594.3	130	140	2.72	2.65	0.306
SR 329	623.3	B-004-0-21	31	-	32.42	SS-13	Refusal	100	-	0	9	12	41	38	37	22	15	17	A-6a	Cohesive	4	N/A	N/A	N/A	250	28	32.0	591.3			2.72	2.65	
SR 329	623.3	B-004-0-21	33.5	-	34.33	SS-14	Refusal	100	-	-	-	-	-	-	-	-	-	15	A-6a	Cohesive	4	N/A	N/A	N/A	250	28	34.0	589.3			2.72	2.65	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 5	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
													N-values												
													PPR	Sowers	T & P										
Max	12	78	1.5	1	6	7	36	50	50	24	26	28	Max	1500	3000	1596	129	23	9.0	607.6	105	125	0.360	2.65	0.741
Min	6	0	1.0	1	6	7	36	50	50	24	26	20	Min	1000	1500	798	75	21	2.0	600.6	95	110	0.360	2.65	0.575
Average	8	53	1.3	1	6	7	36	50	50	24	26	24	Average	1333	2000	1064	95	22	5.5	604.1	98	116	0.360	2.65	0.699
Std Dev	3	36	0.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	Std Dev	289	677	360	23	1	3.1	3.1	5	8	N/A	0.00	0.083
Avg + Std	11	89	1.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	28	Avg + Std	1622	2677	1424	118	23	8.6	607.2	103	124	N/A	2.65	0.782
Avg - Std	5	17	1.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	Avg - Std	1045	1323	704	72	21	2.4	600.9	93	109	N/A	2.65	0.616

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
																					N-values												
																					PPR	Sowers	T & P										
SR 329	609.6	B-005-1-21	1	-	2.5	SS-1	7	67	1.5	1	6	7	36	50	50	24	26	28	A-7-6	Cohesive	5	1500	1750	931	88	22	2.0	607.6	95	110	0.36	2.65	0.741
SR 329	609.6	B-005-1-21	3.5	-	5	SS-2	6	0	-	-	-	-	-	-	-	-	-	-	A-7-6	Cohesive	5	N/A	1500	798	75	21	4.0	605.6	95	110	2.65	0.741	
SR 329	609.6	B-005-1-21	6	-	7.5	SS-3	7	78	1	-	-	-	-	-	-	-	24	A-7-6	Cohesive	5	1000	1750	931	88	22	7.0	602.6	95	120	2.65	0.741		
SR 329	609.6	B-005-1-21	8.5	-	10	SS-4	12	67	1.5	-	-	-	-	-	-	-	20	A-7-6	Cohesive	5	1500	3000	1596	129	23	9.0	600.6	105	125	2.65	0.575		

Projected soil layers below 10 feet were omitted from Wall Design Profile based on bedrock projections of borings along proposed wall alignment.

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:21 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 273+95, 7' LT.		START: 3/11/21		END: 3/11/21		PG 2 OF 2		B-001-0-21						
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
CLAYSTONE , GRAY, SEVERELY WEATHERED, VERY WEAK. <i>(continued)</i>			588.7	31	30	-	100	SS-19	-	-	-	-	-	-	-	-	-	-	7	Rock (V)
			585.2	32	50/4"	-	100	SS-20	-	0	26	47	20	7	NP	NP	NP	13	Rock (V)	
SANDSTONE , GRAY, SEVERELY WEATHERED, WEAK.			584.2	34	60/3"	-	100	SS-20	-	0	26	47	20	7	NP	NP	NP	13	Rock (V)	
SANDSTONE , GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, THICK TO VERY THICK BEDDED, JOINT AND BEDDING DISCONTINUITIES, INTACT TO UNFRACTURED, TIGHT APERTURE, VERY ROUGH TO SLIGHTLY ROUGH, INTACT OR MASSIVE STRUCTURE, GOOD TO VERY GOOD SURFACE; RQD 100%, REC 100%. @ 34.6' - 35.0' : Qu = 3,206 psi			569.2	35	100	100	NQ2-1												CORE	
				36																
				37																
				38																
				39																
				40																
				41																
				42																
				43																
				44																
				45																
				46																
				47																
				48																
				49																
NOTES: NONE																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER																				

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:21 - C:\P\WORKING\EA\ST01D2010876\20210323 10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 275+44, 6' LT.		START: 3/11/21		END: 3/11/21		PG 2 OF 2		B-002-0-21						
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTH	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
HARD, YELLOW-BROWN, CLAY, "AND" SILT, TRACE SAND, DAMP (continued)			593.9																	
4. Hard Cohesive			592.1	TR	19	-	100	SS-13	-	-	-	-	-	-	-	-	-	12	A-7-6 (V)	
CLAYSTONE, GRAY, SEVERELY WEATHERED, VERY WEAK.					37	-	100	SS-14	-	1	4	12	54	29	33	20	13	8	Rock (V)	
					50	-	100	SS-15	-	-	-	-	-	-	-	-	-	6	Rock (V)	
			580.3		50	-	100	SS-16	-	-	-	-	-	-	-	-	-	3	Rock (V)	
SANDSTONE, GRAY, SLIGHTLY WEATHERED, STRONG, FINE TO MEDIUM GRAINED, THICK TO VERY THICK BEDDED, ARGILLACEOUS, JOINT AND BEDDING DISCONTINUITIES, INTACT, TIGHT TO NARROW APERTURE, VERY ROUGH TO SLIGHTLY ROUGH, INTACT OR MASSIVE STRUCTURE, GOOD TO VERY GOOD SURFACE; RQD 97%, REC 100%.					100		100	NQ2-1											CORE	
@ 53.7' - 54.1' : Qu = 9,357 psi					95		100	NQ2-2											CORE	
			564.3	EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EA\ST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>276+93, 6' LT.</u>	EXPLORATION ID <u>B-003-0-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	PAGE 1 OF 2
PID: <u>114589</u> SFN: _____	DRILLING METHOD: <u>3.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>625.3 (MSL)</u> EOB: <u>39.5 ft.</u>	
START: <u>3/10/21</u> END: <u>3/10/21</u>	SAMPLING METHOD: <u>SPT / NQ2</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.336550, -81.886449</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV. 625.3	DEPTH	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI					
ASPHALT (14") AGGREGATE BASE (3")	623.9	1																		
STIFF TO VERY STIFF, DARK BROWN, SOME GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP <div style="border: 1px solid red; padding: 2px; display: inline-block; color: red; font-weight: bold;">1. M. Stiff to Stiff Fill</div>	620.3	2	4																	
		3	5	14	33	SS-1	3.00	12	7	6	25	50	60	25	35	22	A-7-6 (20)			
		4	4	5	14	17	SS-2	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)		
		5	5	5	14	17	SS-2	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)		
MEDIUM STIFF TO STIFF, RED-BROWN TO GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP <div style="border: 1px solid red; padding: 2px; display: inline-block; color: red; font-weight: bold;">2. Stiff to V. Stiff to Cohesive</div>	614.3	6	3	7	56	SS-3	2.00	16	11	7	24	42	51	23	28	20	A-7-6 (15)			
		7	3	4	12	39	SS-4	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)		
		8	3	4	12	39	SS-4	2.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)		
		9	3	3	9	67	SS-5	2.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)		
		10	7	3	10	61	SS-6	3.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)		
		11	3	4	10	61	SS-6	3.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)		
STIFF TO VERY STIFF, RED-BROWN, SOME YELLOW-BROWN AND GRAY, CLAY , SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST	609.8	12	3	9	100	SS-7	1.50	1	4	5	28	62	65	26	39	30	A-7-6 (20)			
		13	2	3	13	100	SS-8	2.00	-	-	-	-	-	-	-	-	17	A-7-6 (V)		
		14	3	6	13	100	SS-8	2.00	-	-	-	-	-	-	-	-	17	A-7-6 (V)		
		15	3	4	14	67	SS-9	2.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)		
VERY DENSE, YELLOW-BROWN, SOME RED BROWN AND GRAY, SANDY SILT , SOME GRAVEL, LITTLE CLAY, DRY <div style="border: 1px solid red; padding: 2px; display: inline-block; color: red; font-weight: bold;">3. Granular Soil</div>	606.8	16	19	47	-	100	SS-10	-	23	25	15	23	14	NP	NP	NP	6	A-4a (0)		
		17	15	50/6"	-	100	SS-11	-	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
CLAYSTONE , RED-BROWN, SEVERELY WEATHERED, VERY WEAK.	606.8	18	15	50/5"	-	100	SS-11	-	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
	605.8	19	15	50/4"	-	100	SS-12	-	-	-	-	-	-	-	-	-	-	11	Rock (V)	
SANDSTONE , GRAY, SOME RED-BROWN, HIGHLY WEATHERED, WEAK TO SLIGHTLY STRONG, VERY FINE GRAINED TO FINE GRAINED, THIN BEDDED, FERRIFEROUS, ARGILLACEOUS, MICACEOUS, JOINT AND BEDDING DISCONTINUITIES, FRACTURED, NARROW TO OPEN APERTURE, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY STRUCTURE, POOR TO FAIR SURFACE; RQD 17%, REC 97%.	600.8	20																		
		21																		
		22	17		97		NQ2-1													CORE
		23																		
CLAYSTONE , RED-BROWN, YELLOW-BROWN AND GRAY, HIGHLY WEATHERED, VERY WEAK, VERY THIN BEDDED, ARENACEOUS, FERRIFEROUS, JOINT DISCONTINUITIES, MODERATELY TO HIGHLY FRACTURED, OPEN APERTURE, SLIGHTLY ROUGH, DISINTEGRATED TO VERY BLOCK STRUCTURE, POOR TO FAIR SURFACE; RQD 33%, REC 82%.	600.8	24																		
		25																		
		26																		
		27	28		100		NQ2-2													CORE
		28																		
		29																		

@ 29.1' - 29.5' : Qu = 49 psi

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EA\ST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>278+43, 6' LT.</u>	EXPLORATION ID: <u>B-004-0-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	
PID: <u>114589</u> SFN: <u></u>	DRILLING METHOD: <u>3.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>623.3 (MSL)</u> EOB: <u>62.7 ft.</u>	PAGE: <u>1 OF 3</u>
START: <u>3/9/21</u> END: <u>3/10/21</u>	SAMPLING METHOD: <u>SPT / NQ2</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.336894, -81.886166</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (25") GRANULAR BASE (3")	623.3	1																
MEDIUM DENSE, GRAY TO BLACK, COARSE AND FINE SAND , SOME SILT, LITTLE GRAVEL, LITTLE CLAY, TRACE ASPHALT FRAGMENTS, DAMP	620.9	2																
MEDIUM STIFF TO STIFF, DARK BROWN, SOME GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP	619.3	3	5			SS-1	-	16	27	25	20	12	NP	NP	NP	7	A-3a (0)	
		4	3	5	13													
		5	3	7	14	SS-2	1.50	12	11	7	26	44	52	24	28	22	A-7-6 (16)	
		6	3															
		7	4	4	12	SS-3	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		8																
		9	2	2	7	SS-4	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		10		3														
		11	2															
		12	3	3	9	SS-5	1.50	-	-	-	-	-	-	-	-	31	A-7-6 (V)	
MEDIUM STIFF TO STIFF, RED-BROWN, CLAY , "AND" SILT, TRACE SAND, TRACE GRAVEL, MOIST	610.8	13																
		14	2	1	7	SS-6	1.00	2	4	6	35	53	49	25	24	28	A-7-6 (15)	
		15		4														
		16	2															
		17	2	2	7	SS-7	1.50	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		18		3														
		19	2															
		20	4	4	14	SS-8	2.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
STIFF TO VERY STIFF, RED-BROWN, MOTTLED YELLOW BROWN AND GRAY, SILTY CLAY , LITTLE SAND, TRACE GRAVEL, DAMP	603.3	21																
		22	4	7	19	SS-9	3.00	6	13	11	31	39	40	21	19	18	A-6b (11)	
		23		6														
		24	3	4	13	SS-10	2.00	-	-	-	-	-	-	-	-	21	A-6b (V)	
		25		5														
		26	5															
		27	5	5	19	SS-11	2.50	-	-	-	-	-	-	-	-	20	A-6b (V)	
		28		8														
HARD, YELLOW BROWN TO RED BROWN, SILT AND CLAY , SOME SAND, DAMP	595.8	29																
		30	4	10	39	SS-12	-	-	-	-	-	-	-	-	-	18	A-6a (V)	

1. M. Stiff to Stiff Fill

2. Stiff to V. Stiff to Cohesive

W 595.3

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 278+43, 6' LT.		START: 3/9/21		END: 3/10/21		PG 3 OF 3		B-004-0-21									
MATERIAL DESCRIPTION AND NOTES				ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED		
											GR	CS	FS	SI	CL	LL	PL	PI					
				561.1																			
				560.6	EOB																		
<p>NOTES: NONE</p> <p>ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER</p>																							

PROJECT: ATH-329-05.26	DRILLING FIRM / OPERATOR: CENTRAL STAR / TS	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 280+60, 51' LT.	EXPLORATION ID B-005-1-21
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: HDR / PG	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: SR 329	
PID: 114589 SFN:	DRILLING METHOD: 2.25" HSA / NQ2	CALIBRATION DATE: 11/26/19	ELEVATION: 609.6 (MSL) EOB: 53.1 ft.	PAGE 1 OF 2
START: 3/12/21 END: 3/12/21	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 86.8	LAT / LONG: 39.337490, -81.886042	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI	WC		
TOPSOIL (2")	609.6																	
MEDIUM STIFF TO STIFF, RED BROWN, CLAY , "AND" SILT, LITTLE SAND, TRACE GRAVEL, NOTED ORGANICS, MOIST	609.4	1	2															
		2	2	7	67	SS-1	1.50	1	6	7	36	50	50	24	26	28	A-7-6 (16)	
		3																
		4	2	6	0	SS-2	-	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
		5	2															
		6	2															
		7	2	7	78	SS-3	1.00	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
		8																
		9	2															
		10	3	12	67	SS-4	1.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		11	5															
STIFF TO VERY STIFF, RED-BROWN, SOME YELLOW-BROWN AND GRAY, CLAY , SOME SILT, TRACE GRAVEL, LITTLE SAND, DAMP	598.6	11	3	16	56	SS-5	1.50	8	6	5	30	51	54	23	31	23	A-7-6 (19)	
		12	5															
		13																
		14	2	13	67	SS-6	1.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		15	3															
		16	3	14	78	SS-7	2.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		17	4															
		18	6															
		19	3	19	78	SS-8	3.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		20	5	8														
		21	8															
MEDIUM DENSE, GRAY, SOME YELLOW-BROWN, COARSE AND FINE SAND , LITTLE SILT, TRACE GRAVEL, TRACE CLAY, WET	588.6	21	6	20	67	SS-9	-	6	37	38	14	5	NP	NP	NP	22	A-3a (0)	
		22	7															
		23																
MEDIUM STIFF TO STIFF, GRAY, CLAY , SOME SILT, TRACE SAND, MOIST	586.1	24	2	9	67	SS-10	0.50	0	2	2	20	76	49	23	26	35	A-7-6 (16)	
		25	4															
		26	2															
STIFF TO VERY STIFF, GRAY, SOME YELLOW-BROWN, CLAY , "AND" SILT, TRACE GRAVEL, TRACE SAND, MOIST	583.6	26	5	27	78	SS-11	-	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
		27	7															
		28	12															
		29	4	19	100	SS-12	2.50	1	2	7	48	42	49	25	24	30	A-7-6 (15)	
			5	8														

5. Medium Stiff to Stiff Cohesive

Projected soil layers below 10 feet were omitted from Wall Design Profile based on bedrock projections of borings along proposed wall alignment.

3. Granular Soil

2. Stiff to Very Stiff Cohesive

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\AST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: ATH-329-5.26, Boring Location: B-001-0-21, ST-13, Depth: 20.7 - 21.2ft)

Tested Date: 3/22/2021

Specimen Properties

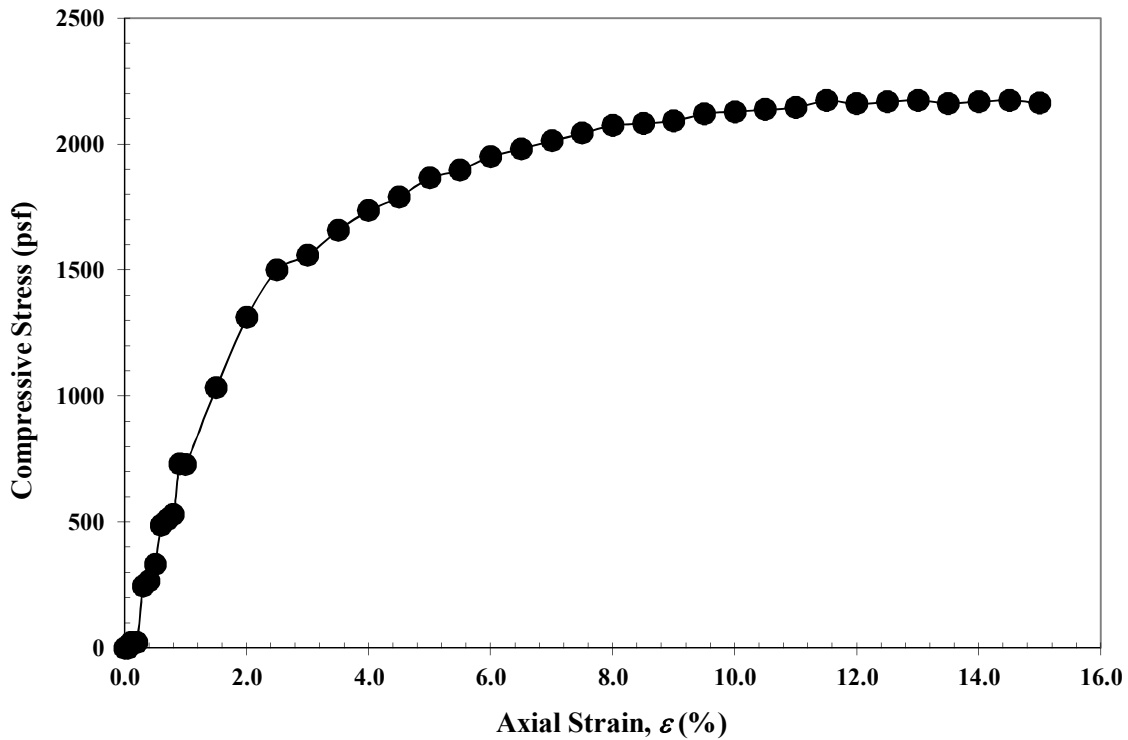
Average Dia., D_{avg} (in):	2.87
Average Height, H_{avg} (in):	5.74
Area, A (in ²):	6.45
Volume, V (in ³):	37.04
Wet Mass of Specimen (lb):	2.7
Moisture Content (%):	24.0
Dry Mass of Specimen (lb):	2.2
Wet Unit Weight, γ (lb/ft ³):	127.3
Dry Unit Weight, γ_d (lb/ft ³):	102.6

Final Specimen Figure



Results

Unconfined Compressive Strength (psf):	2175
Strain (%):	13.0



Notes: Stiff, brown, SILTY CLAY, little sand, trace gravel, moist.



Rock Strength Parameter Determination and Laboratory Testing

BEDROCK TESTING

Project	Exploration ID	Sample Depth (ft)	Sample ID	Rock Type	Color	Moist Unit Weight (pcf)	Compressive Strength		Er Modulus		GSI Range	GSI USE	Em (Hoek & Brown) Modulus		Lesser of Er vs Em		Em (Yang) Modulus	
							(psi)	(MPa)	(psi)	(MPa)			(GPa)	(psi)	(psi)	(MPa)	(psi)	
ATH-329-5.26	B-001-0-21	34.6	R-1	Sandstone	Gray	141.1	3206	22.1	410,256	2829	50-60	55	6.3	909332	410256	356.6	51723	
ATH-329-5.26	B-002-0-21	53.7	R-2	Sandstone	Gray	160.9	9357	64.5	2,611,111	18003	60-70	65	19.0	2762542	2611111	3598.3	521882	
ATH-329-5.26	B-004-0-21	53.8	R-1	Sandstone	Gray	143.3	3697	25.5	500,000	3447	50-60	55	6.7	976484	500000	434.6	63038	
				Sandstone	Maximum		160.9	9357			Sandstone	Maximum		2611111				
					Minimum		141.1	3206				Minimum		410256				
					Average		148	5420				Average		1173789				
					Std Dev		11	3418				Std Dev		1245566				
					Adopted Value		145	5000				Adopted Value		500000				

Project	Exploration ID	Sample Depth (ft)	Sample ID	Rock Type	Color	Moist Unit Weight (pcf)	Compressive Strength		Er Modulus		GSI Range	GSI USE	Em (Hoek & Brown) Modulus		Lesser of Er vs Em		Em (Yang) Modulus	
							(psi)	(MPa)	(psi)	(MPa)			(GPa)	(psi)	(psi)	(MPa)	(psi)	
ATH-329-5.26	B-003-0-21	29.1	R-2	Claystone	Gray	139.4	49	0.3	3,684	25	25-35	20	0.1	14991	3684	0.6	93	
				Claystone	Maximum		139.4	49			Claystone	Maximum		3684				
					Minimum		139.4	49				Minimum		3684				
					Average		139	49				Average		3684				
					Std Dev		N/A	N/A				Std Dev		N/A				
					Adopted Value		140	50				Adopted Value		3500				

Table 10.4.6.5-1—Estimation of E_m Based on GSI

Expression	Notes/Remarks	Reference
$E_m (GPa) = \sqrt{\frac{q_u}{100}} \cdot 10^{\frac{GSI-10}{40}}$ <p>for $q_u \leq 100$ MPa</p>	Accounts for rocks with $q_u < 100$ MPa; notes q_u in MPa	Hoek and Brown (1997); Hoek et al. (2002)
$E_m (GPa) = 10^{\frac{GSI-10}{40}}$ <p>for $q_u \leq 100$ MPa</p>		
$E_m = \frac{E_R}{100} e^{\frac{GSI}{21.7}}$	Reduction factor on intact modulus, based on GSI	Yang (2006)

Notes: E_r = modulus of intact rock, E_m = equivalent rock mass modulus, GSI = geological strength index, q_u = uniaxial compressive strength, and 1 MPa = 2.09 ksf.

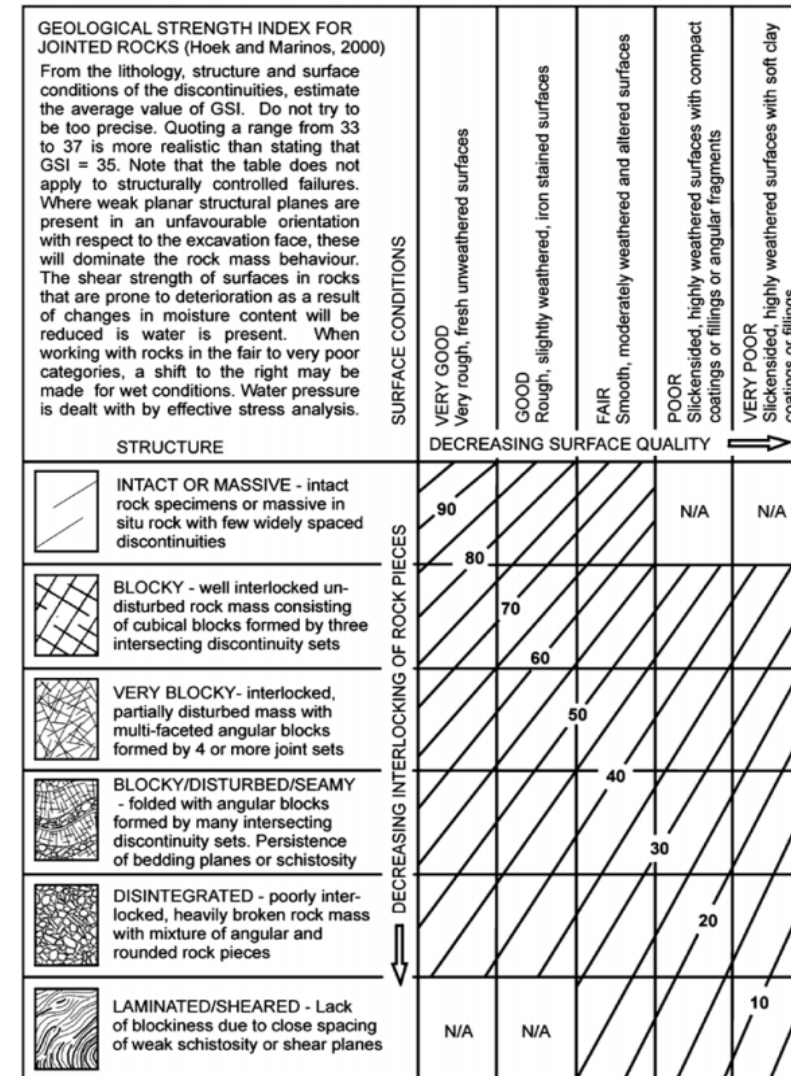
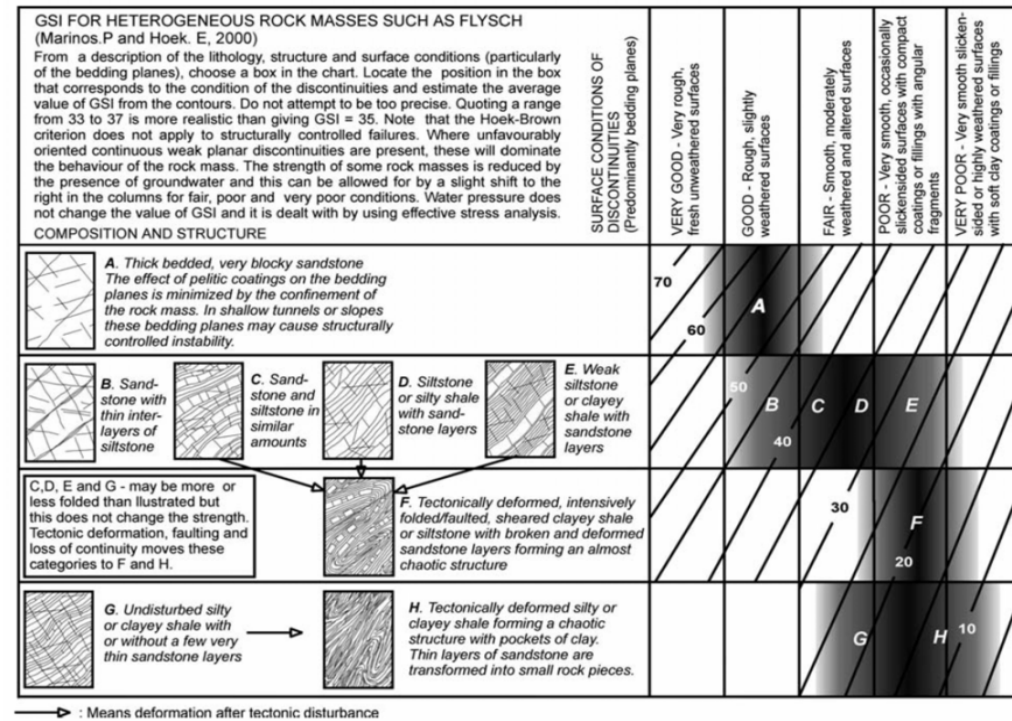


Figure 10.4.6.4.1—Determination of GSI for Jointed Rock Mass (Hoek and Marinos, 2000)

BEDROCK QUALITY

Project	Exploration ID	Rock Type	Depth Range (ft.)		Thickness (ft)	Layer RQD (%)	Weighted RQD* (Length / Total Length)	
			From	To				
ATH-329-5.26	B-001-0-21	Sandstone	34.5	49.5	15	100	22.8	
ATH-329-5.26	B-002-0-21	Sandstone	43.6	59.6	16	97	23.6	
ATH-329-5.26	B-003-0-21	Sandstone	19.5	24.5	5	17	1.3	
ATH-329-5.26	B-003-0-21	Sandstone	24.5	35.9	11.4	94	16.3	
ATH-329-5.26	B-004-0-21	Sandstone	44.2	62.7	18.5	100	28.1	
					Sandstone	65.9	RQD SUM	92
					Maximum	18.5	100	
					Minimum	5	17	
					Average	13.2	81.6	
					Adopted Value			80

Project	Exploration ID	Rock Type	Depth Range (ft.)		Thickness (ft)	Layer RQD (%)	Weighted RQD* (Length / Total Length)	
			From	To				
ATH-329-5.26	B-003-0-21	Claystone	24.5	35.9	11.4	33	33.0	
					Claystone	11.4	RQD SUM	33
					Maximum	11.4	33	
					Minimum	11.4	33	
					Average	11.4	33.0	
					Adopted Value			30.0

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: ATH-329-5.26, Boring Location: B-001-0-21, NQ2-1, Depth: 34.6 - 35.0ft)

Tested Date: 3/29/2021

Specimen Properties

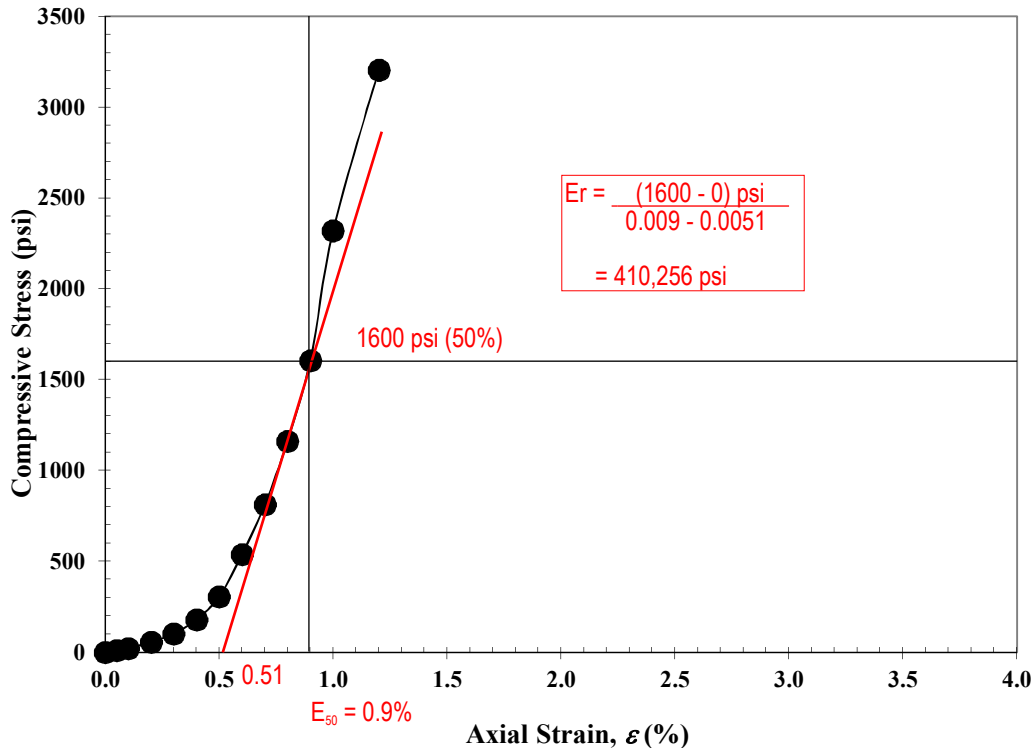
Average Dia., D_{avg} (in):	1.99
Average Height H_{avg} (in):	4.28
Length to Diameter Ratio:	2.15
Area, A (in ²):	3.10
Volume, V (in ³):	13.25
Wet Mass of Specimen (lb):	1.1
Moisture Content (%):	3.5
Dry Mass of Specimen (lb):	1.0
Wet Unit Weight, γ (lb/ft ³):	141.1
Dry Unit Weight, γ_d (lb/ft ³):	136.3

Final Specimen Figure



Results

Unconfined Compressive Strength (psi):	3206	22	(MPa)
Strain (%):	1.2		



Notes: Sandstone, gray, slightly weathered, slightly strong, fine to coarse grained.

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: ATH-329-5.26, Boring Location: B-002-0-21, NQ2-2, Depth: 53.7 - 54.1ft)

Tested Date: 3/29/2021

Specimen Properties

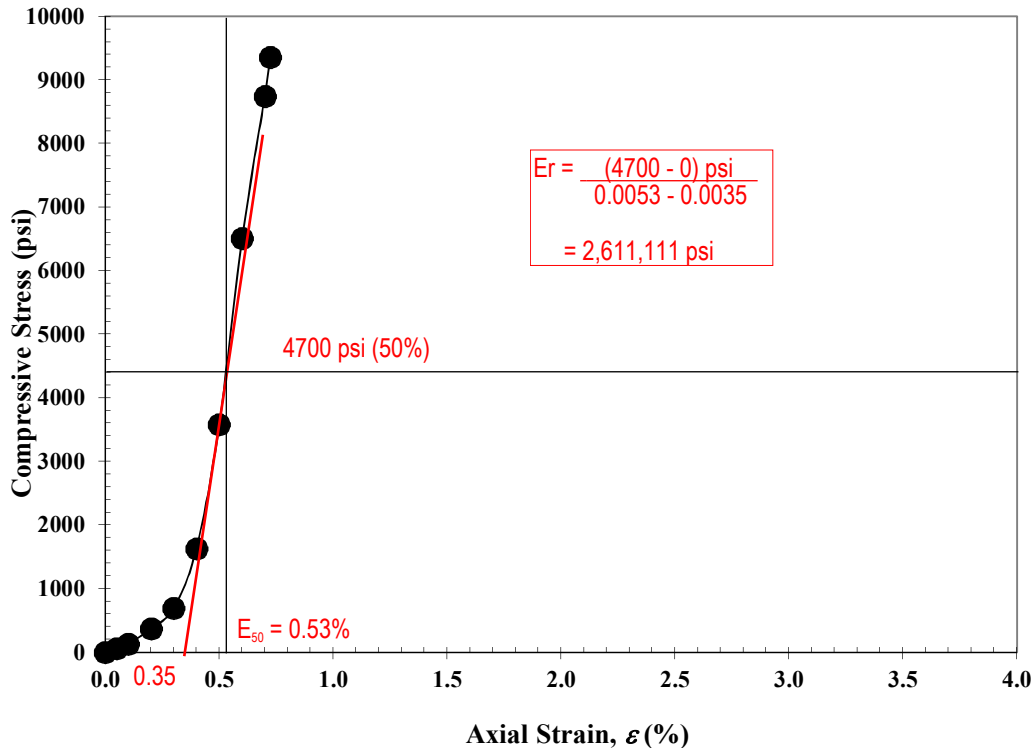
Average Dia., D_{avg} (in):	1.99
Average Height H_{avg} (in):	4.28
Length to Diameter Ratio:	2.15
Area, A (in ²):	3.11
Volume, V (in ³):	13.33
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	0.7
Dry Mass of Specimen (lb):	1.2
Wet Unit Weight, γ (lb/ft ³):	160.9
Dry Unit Weight, γ_d (lb/ft ³):	159.7

Final Specimen Figure



Results

Unconfined Compressive Strength (psi):	9357	65	(MPa)
Strain (%):	0.7		



Notes: Sandstone, gray, slightly weathered, strong, fine to coarse grained, calcareous matrix, crystalline.

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: ATH-329-5.26, Boring Location: B-003-0-21, NQ2-2, Depth: 29.1 - 29.5ft)

Tested Date: 3/29/2021

Specimen Properties

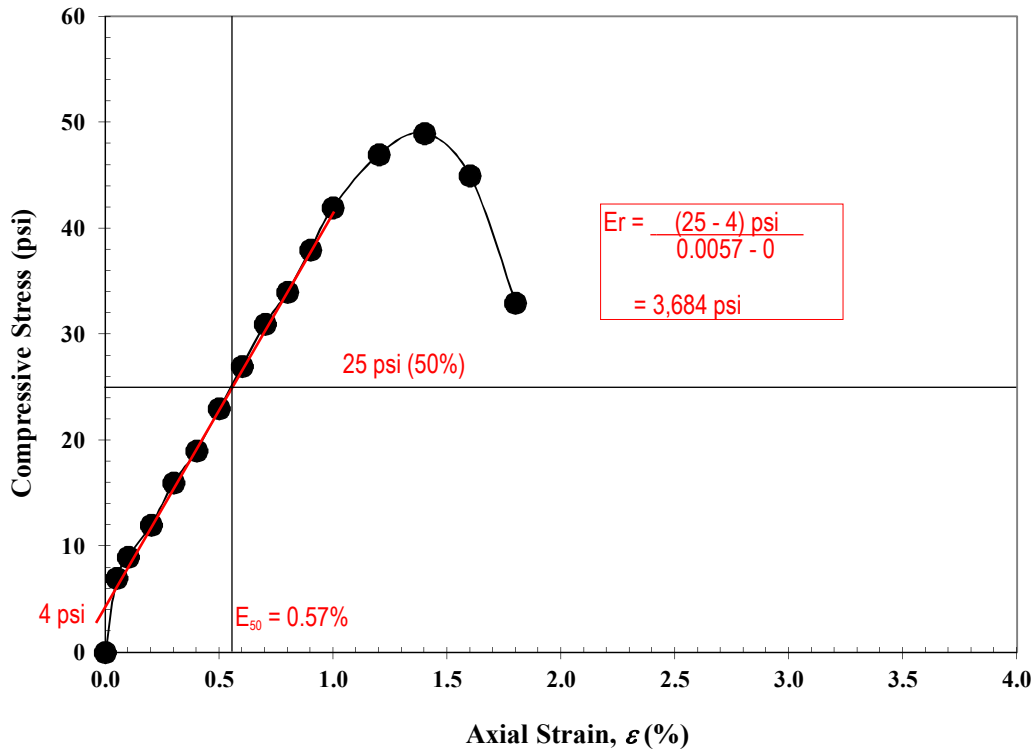
Average Dia., D_{avg} (in):	2.02
Average Height H_{avg} (in):	4.65
Length to Diameter Ratio:	2.30
Area, A (in ²):	3.21
Volume, V (in ³):	14.91
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	12.3
Dry Mass of Specimen (lb):	1.1
Wet Unit Weight, γ (lb/ft ³):	139.4
Dry Unit Weight, γ_d (lb/ft ³):	124.1

Final Specimen Figure



Results

Unconfined Compressive Strength (psi):	49	0.3	(MPa)
Strain (%):	1.4		



Notes: Claystone, gray, severely weathered, extremely weak, heavily slickensided (after testing).

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: ATH-329-5.26, Boring Location: B-004-0-21, NQ2-1, Depth: 53.8 - 54.1ft)

Tested Date: 3/29/2021

Specimen Properties

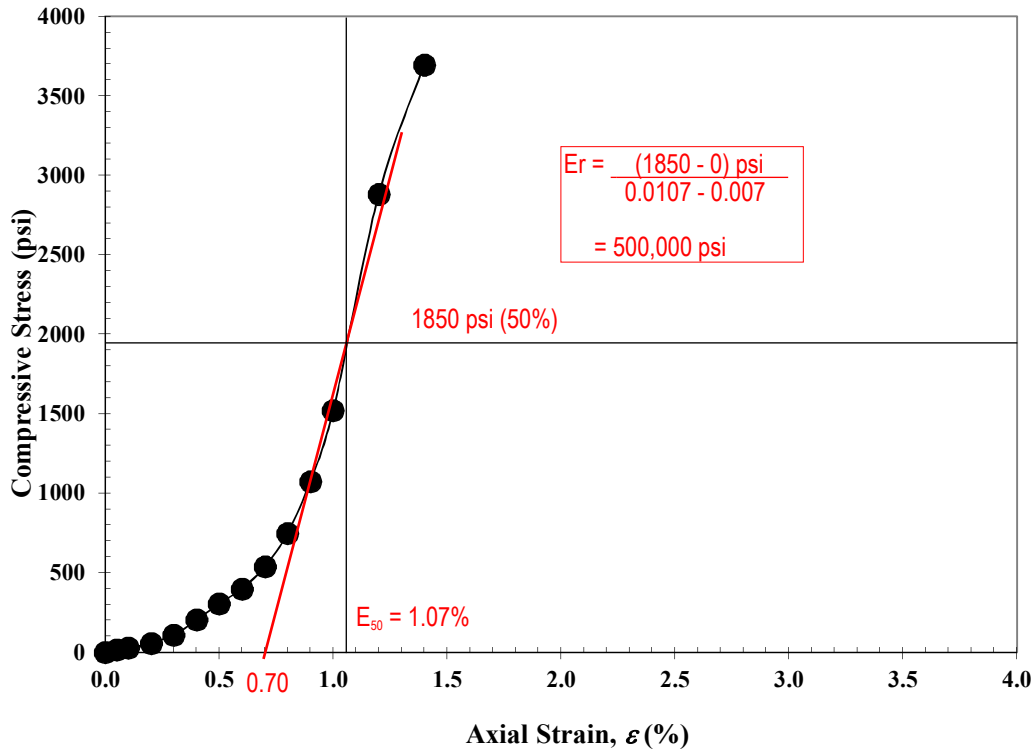
Average Dia., D_{avg} (in):	1.99
Average Height H_{avg} (in):	4.14
Length to Diameter Ratio:	2.08
Area, A (in ²):	3.11
Volume, V (in ³):	12.89
Wet Mass of Specimen (lb):	1.1
Moisture Content (%):	3.0
Dry Mass of Specimen (lb):	1.0
Wet Unit Weight, γ (lb/ft ³):	143.3
Dry Unit Weight, γ_d (lb/ft ³):	139.1

Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **3697** (MPa) **25**
Strain (%): **1.4**



Notes: Sandstone, gray, slightly weathered, moderately strong, fine to medium grained.

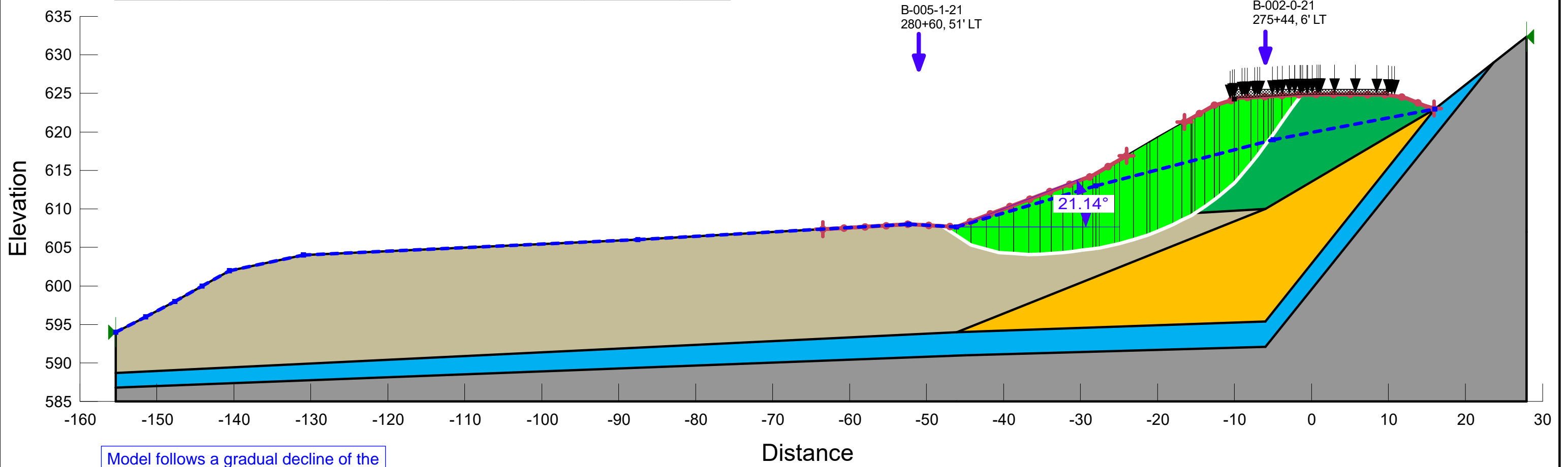


Slope Stability Analyses



Station 275+75
Existing Conditions

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1. M. Stiff to Stiff Fill	Mohr-Coulomb	120	120	20
Yellow	2. Stiff to V. Stiff Cohesive	Mohr-Coulomb	125	125	23
Blue	4. Hard Cohesive	Mohr-Coulomb	140	200	28
Tan	5. M. Stiff to Stiff Alluvium	Mohr-Coulomb	110	80	20
Grey	6. Bedrock	Bedrock (Impenetrable)			

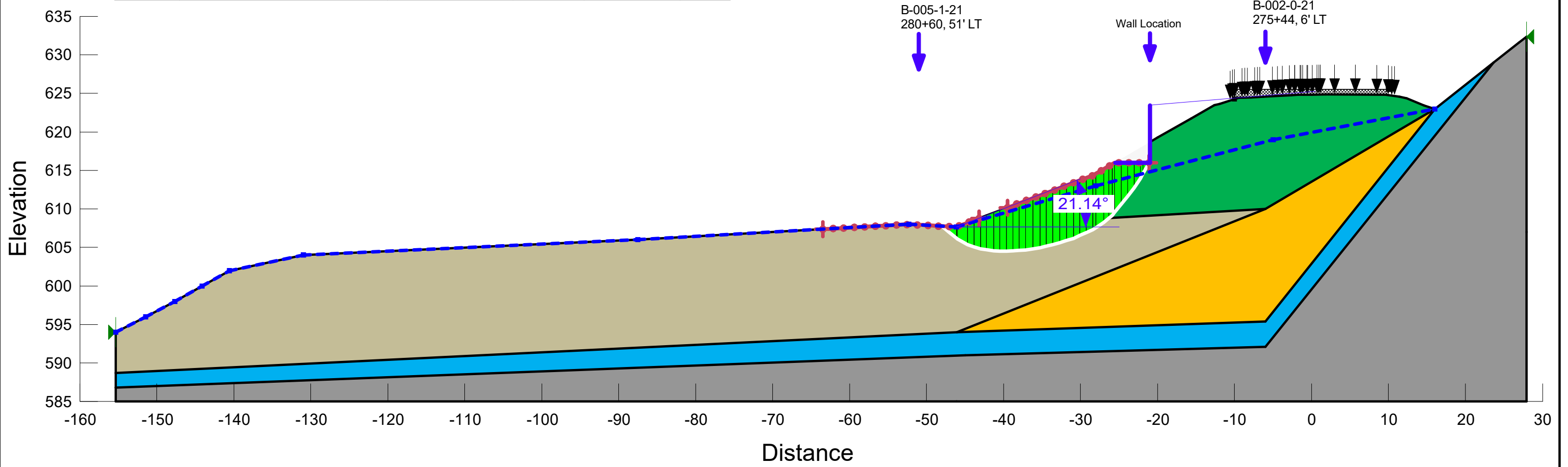


Model follows a gradual decline of the Hard Cohesive and Bedrock layers and is not reflective of B-005-1-21 which was only used to interpolate the Medium Stiff to Stiff Alluvium layer.



Station 275+75
Downslope Stability

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1. M. Stiff to Stiff Fill	Mohr-Coulomb	120	120	20
Yellow	2. Stiff to V. Stiff Cohesive	Mohr-Coulomb	125	125	23
Blue	4. Hard Cohesive	Mohr-Coulomb	140	200	28
Tan	5. M. Stiff to Stiff Alluvium	Mohr-Coulomb	110	80	20
Grey	6. Bedrock	Bedrock (Impenetrable)			



SLOPE/W Analysis - Wall
 20210526_ATH-329-5.26_SlopeW_Sta. 275+75 1.gsz
 06/02/2021 1:152



UA SLOPE Analyses



Station 275+75
Existing Conditions

File Run Options Help

Calculated Results

Factor of Safety:

Force per Shaft: lb

Acting Point X: ft Y: ft

Analysis Unit System

English Metric

Number of Vertical Sections and Soil Layers

Vertical Section Num: Soil Layer Num:

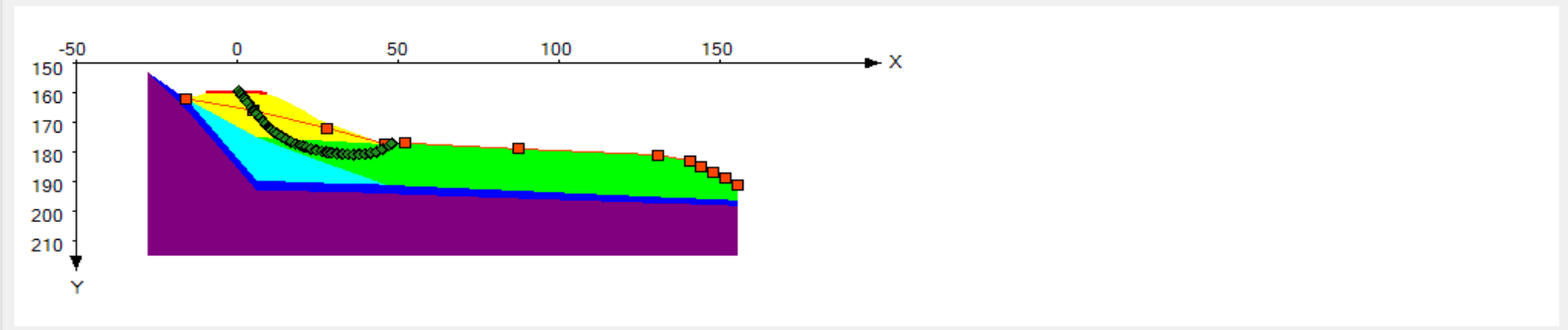
Analysis Method

Total Stress Effective Stress

Soil Properties

	Cohesion (psf)	Friction Angle	Total Unit Weight (pcf)
Layer1	0.1	0.0	250.0
Layer2	200.0	28.0	120.0
Layer3	120.0	20.0	120.0
Layer4	80.0	22.0	110.0
Layer5	125.0	23.0	125.0
▶ Layer6	200.0	28.0	140.0
Layer7	4000.0	45.0	140.0

Chart (Double-Click for More Options)



Slope Profile Vertical Sections

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9	Section 10	Section 11	Section 12	Section 13	Section 14
▶ X (ft)	-27.90	-16.00	-9.70	-9.70	6.00	9.50	9.50	12.60	21.00	21.00	25.00	46.10	52.30	130.90
Y1 (ft)	153.00	162.00	160.20	159.20	159.40	159.60	160.60	161.50	166.20	166.20	169.00	177.40	177.00	181.00
Y2 (ft)	153.00	162.00	160.20	160.20	160.40	160.60	160.60	161.50	166.20	166.20	169.00	177.40	177.00	181.00
Y3 (ft)	153.00	162.00	160.20	160.20	160.40	160.60	160.60	161.50	166.20	166.20	169.00	177.40	177.00	181.00
Y4 (ft)	153.00	162.00	165.70	165.70	175.00	175.20	175.20	175.40	176.00	176.00	176.10	177.40	177.00	181.00
Y5 (ft)	153.00	162.00	165.70	165.70	175.00	176.50	176.50	177.80	181.20	181.20	182.80	191.00	191.40	195.20
Y6 (ft)	153.00	162.00	169.90	169.90	189.60	189.70	189.70	189.90	190.20	190.20	190.40	191.00	191.40	195.20
Y7 (ft)	153.00	165.50	173.30	173.30	192.90	193.00	193.00	193.10	193.30	193.30	193.40	194.00	194.40	197.30
Y8 (ft)	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00

Coordinates of Crest X: ft Y: ft

Coordinates of Toe X: ft Y: ft

Drilled Shaft Information

Calculate without Drilled Shaft

Automatic Load Transfer Factor

Manually Defined Load Transfer Factor

Anchor (On/Off)

Anchor force: lb

Anchor angle:

Anchor spacing: ft

Auto On Off (ft)

Xmin: Diameter: ft

Xmax: CTC Spacing: ft

XDelta: X Coordinate: ft

Auto Save Data

Pore Water Pressure

Pore Pressure Options: No Pore Pressure Constant Ratio Specified phreatic surface

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
▶ X (ft)	-15.99	5.00	28.00	46.15	52.33	87.53	130.93	140.58	144.11	147.64	151.47	155.35
Y (ft)	162.03	166.00	172.00	177.35	177.00	179.00	181.00	183.00	185.00	187.00	189.00	191.00

Slip Surface

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17	Point 18
▶ X (ft)	0.50	1.02	1.40	2.12	2.56	3.22	4.41	5.09	5.41	5.92	7.06	8.02	8.80	9.74	10.04	10.45	11.40	12.20
Y (ft)	159.40	160.24	160.79	161.81	162.44	163.35	164.98	165.92	166.36	167.03	168.48	169.71	170.64	171.73	172.08	172.42	173.14	173.14



Station 275+75
Post-Construction Conditions

File Run Options Help

Calculated Results

Factor of Safety:
 Force per Shaft: lb
 Acting Point X: ft Y: ft

Analysis Unit System

English Metric

Number of Vertical Sections and Soil Layers

Vertical Section Num: Soil Layer Num:

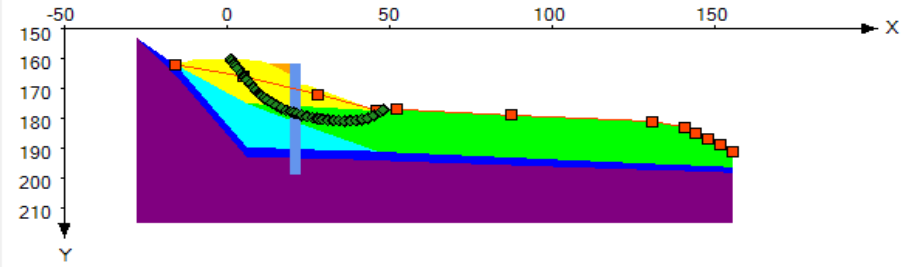
Analysis Method

Total Stress Effective Stress

Soil Properties

	Cohesion (psf)	Friction Angle	Total Unit Weight (pcf)
Layer1	0.1	0.0	250.0
Layer2	200.0	28.0	120.0
Layer3	120.0	20.0	120.0
Layer4	80.0	22.0	110.0
Layer5	125.0	23.0	125.0
▶ Layer6	200.0	28.0	140.0
Layer7	4000.0	45.0	140.0

Chart (Double-Click for More Options)



Slope Profile Vertical Sections

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9	Section 10	Section 11	Section 12	Section 13	Section 14
▶ X (ft)	-27.90	-16.00	-9.70	-9.70	6.00	9.50	9.50	12.60	21.00	21.00	25.00	46.10	52.30	130.90
Y1 (ft)	153.00	162.00	160.20	160.20	160.40	160.60	160.60	161.50	161.50	169.00	169.00	177.40	177.00	181.00
Y2 (ft)	153.00	162.00	160.20	160.20	160.40	160.60	160.60	161.50	161.50	169.00	169.00	177.40	177.00	181.00
Y3 (ft)	153.00	162.00	160.20	160.20	160.40	160.60	160.60	161.50	166.20	169.00	169.00	177.40	177.00	181.00
Y4 (ft)	153.00	162.00	165.70	165.70	175.00	175.20	175.20	175.40	176.00	176.00	176.10	177.40	177.00	181.00
Y5 (ft)	153.00	162.00	165.70	165.70	175.00	176.50	176.50	177.80	181.20	181.20	182.80	191.00	191.40	195.20
Y6 (ft)	153.00	162.00	169.90	169.90	189.60	189.70	189.70	189.90	190.20	190.20	190.40	191.00	191.40	195.20
Y7 (ft)	153.00	165.50	173.30	173.30	192.90	193.00	193.00	193.10	193.30	193.30	193.40	194.00	194.40	197.30
Y8 (ft)	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00	215.00

Coordinates of Crest X: ft Y: ft Coordinates of Toe X: ft Y: ft

Drilled Shaft Information

- Calculate without Drilled Shaft
- Automatic Load Transfer Factor
- Manually Defined Load Transfer Factor
- Anchor (On/Off)

Anchor force: lb

Anchor angle:

Anchor spacing: ft

Auto On Off (ft)

Xmin Diameter: ft

Xmax CTC Spacing: ft

XDelta X Coordinate: ft

Auto Save Data

Pore Water Pressure

Pore Pressure Options: No Pore Pressure Constant Ratio Specified phreatic surface

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
▶ X (ft)	-15.99	5.00	28.00	46.15	52.33	87.53	130.93	140.58	144.11	147.64	151.47	155.35
Y (ft)	162.03	166.00	172.00	177.35	177.00	179.00	181.00	183.00	185.00	187.00	189.00	191.00

Slip Surface

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17	Point 18
▶ X (ft)	1.00	1.02	1.40	2.12	2.56	3.22	4.41	5.09	5.41	5.92	7.06	8.02	8.80	9.74	10.04	10.45	11.40	12.20
Y (ft)	160.23	160.24	160.79	161.81	162.44	163.35	164.98	165.92	166.36	167.03	168.48	169.71	170.64	171.73	172.08	172.42	173.14	173.14



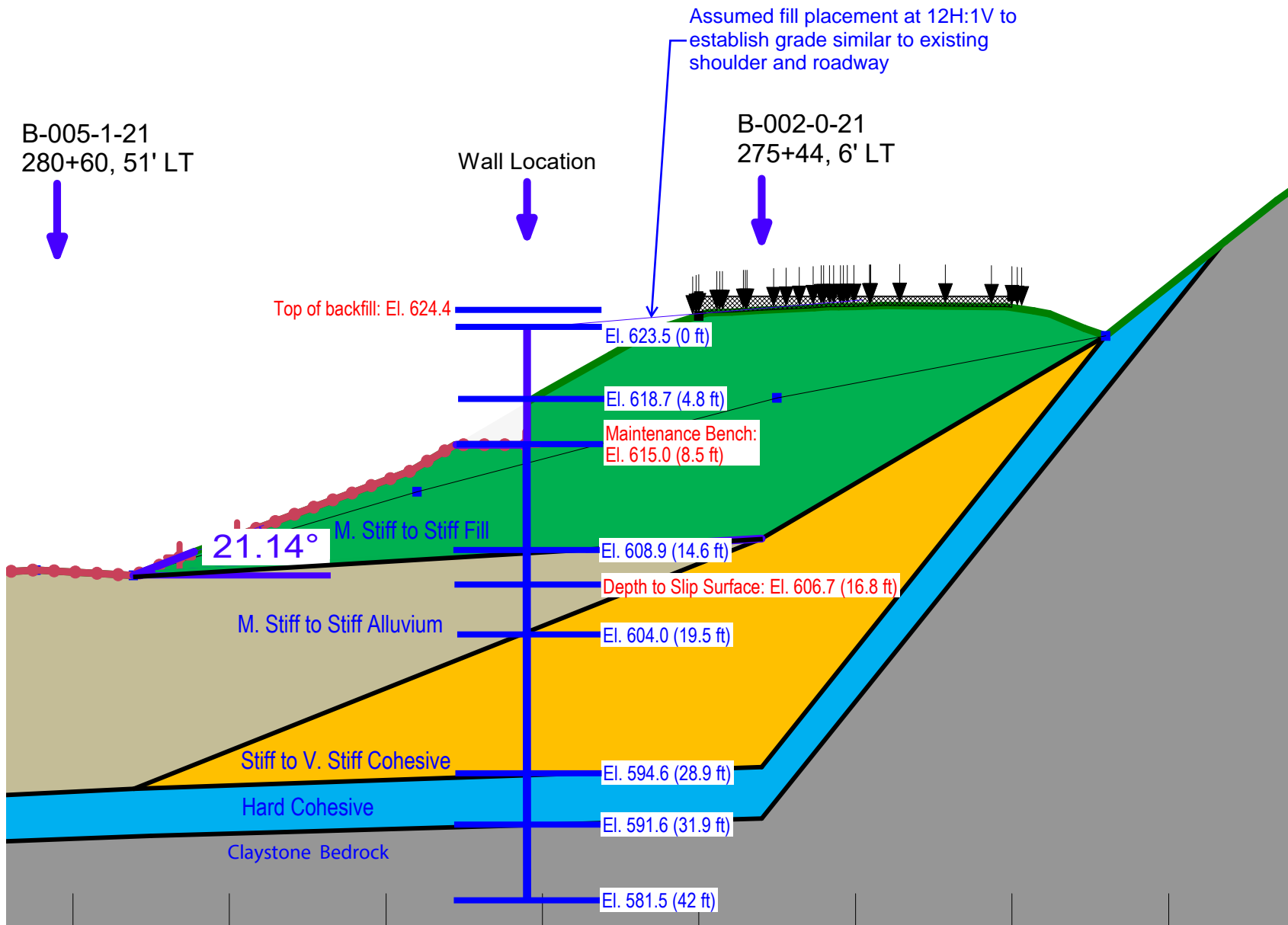
Wall Calculations



LPILE Analyses (W 24 x 146)



LPILE Design Profile



Note: Top of Sandstone Bedrock varies from El 579.1 to El 589.4. Given the variability, claystone was assumed to El 579.1 (below the tip of the drilled shaft) and modeled as a hard clay soil.

Geometry

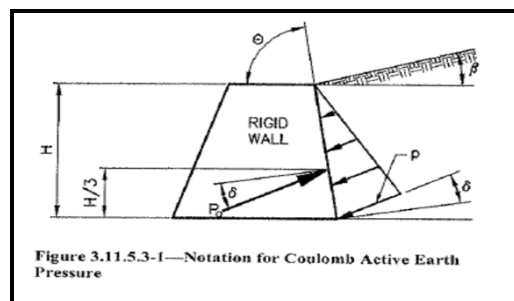
Elevation (ft)		Horiz. Distance from C/L (ft)	
Top of Backfill =	624.4	at Outside Edge of Shoulder	Start of Wall Backfill = 9.5
Top of Wall =	623.5	at C/L of Wall	Wall = 21.0
Existing Ground Surface =	618.7	at C/L of Wall	Backfill Slope Angle = 12.0
Maintenance Bench =	615.0	at C/L of Wall	H:1V
Slip Plane =	606.7	at C/L of Wall	

Wall Loading Profile

	Top Elev.	Thickness (ft)	Cohesion (psf)	Phi (deg)	Unit Wt (pcf)
Item 203	623.5	4.8	200	28	120
Medium Stiff to Stiff Fill	618.7	3.7	120	20	120
Bottom of Wall/Maintenance Bench	615.0				
Weighted Value		8.5	165	25	120

Earth Pressure Coefficients

	Deg	
Shear Resistance, Φ =	28	
Wall Friction, δ^A =	0.0	
Wall Slope, θ =	90	
Backfill Slope, β =	4.76	
Revised Backfill Slope, β =	4.76	
Backfill Condition	INFINITE	
Horz. Backslope Dist.	11.5	feet (C/L of Wall - Edge of Shoulder)
Wall Height (H)	8.5	feet (Top of Wall - Maintenance Bench)
Slope Height (h)	0.9	feet (Top of Backfill - Top of Wall)
I =	3.03	degrees



Active Earth Coefficient

$$K_a = \frac{\sin^2(\theta + \Phi)}{(\sin^2(\theta) * \sin(\theta - \delta) * [1 + \nu(\sin(\Phi + \delta) * \sin(\Phi - \beta)) / (\sin(\theta - \delta) * \sin(\theta + \beta))])^2}$$

$$K_a = 0.388$$

At-Rest Earth Coefficient

$$K_o = (1 - \sin(\Phi)) * (1 + \sin(\beta))$$

$$K_o = 0.583$$

Notes:

- Wall friction neglected
- Figure and Equation for Active Earth Pressure from AASHTO 3.11.5.3 (LRFD Design Manual).
- The wall backfill will consist of proposed fill and cohesive overburden. Using the soil layer thicknesses and respective soil parameters as determined by backcalculation in SlopeW, a weighted average was determined and assumed for the entire backfill ($c' = 165$ psf and $\phi' = 25^\circ$, per backcalculated UA Slope Values). The parameters were converted to equivalent soil strength parameters $c' = 0$ psf and $\phi' = 28^\circ$ for computing earth pressures based on a 1 degree increase in friction angle for every 50 psf decrease in cohesion up to 150 psf (Ref: Hall's Thesis).

Soil Lateral Design Profile

	Top Elev	Depth (ft)	Cohesion (psf)	Phi (deg)	Unit Wt (pcf)	ϵ_{50}
Medium Stiff to Stiff Fill	615.0	8.5	1100	0	57.6	0.007
Medium Stiff to Stiff Alluvium	608.9	14.6	1100	0	47.6	0.007
Stiff to V. Stiff Cohesive	604	19.5	1300	0	62.6	0.007
Hard Cohesive	594.6	28.9	4000	0	77.6	0.005
Bedrock	591.6	31.9	N/A	N/A	N/A	N/A

Depths referenced below the top of wall, starting at the lowered ground surface. ϵ_{50} values per LPile Technical Manual.

Wall Loading Computations

Earth Pressure Model = **CONVENTIONAL** (Conventional or UA SLOPE)

UA SLOPE

1) Soil Unit Weight = **120** pcf Weighted Average Along Cantilevered Wall Height

2) Determine Coefficient of Earth Pressure (K)

Restraint Condition = **ACTIVE** (Active or At-Rest)

Ka = **0.388**

3) Determine Equivalent Fluid Weight (G_H)

G_H = (γ_m) * (K_a)

G_H = **47** For application to CONVENTIONAL Earth Pressure Model

4) Artificially Lowered Ground Surface (ODOT GB-7, pgs. 27 and 28) for FS_{dh} < 1.30

Lowered Ground Surface (ft) = **0.0** = dt (tan(β_{dh}))

β_{dh} = **21.14** = steepness of the slope downhill of the drilled shaft

FS_{dh} = **1.45** = Factor of Safety down slope of the proposed wall

d_t = **8.3** = depth below bench to the shear surface at the location of the drilled shaft

5) Modification of p-y curves (ODOT GB-7, pg. 27)

β_a = 0.64*(S/D)^{0.34} (Ref: Reese, Isenhower, & Wang - 2006)

D = **3** feet (shaft diameter or pile flange width)

Assumed Shaft Spacing = **6** feet (center-to-center pile spacing)

β_s = **0.81**

6) Determine Lateral Thrust

Conventional Earth Pressure Theory

UA SLOPE

Exposed Wall Height (H) = **8.5** feet

Depth from T/Wall to Slip Plane = **16.8** feet

Wall Height (H) + GS_{AL} = **8.5**

P = 1/2 * G_H * H²

P = **1683** lbs/foot

P_{SH} = P*(Shaft Spacing) (earth loading)

P_{SH} = **10096** lbs/shaft

Force Per Shaft = **69336** lbs/shaft

7) Resolve horizontal earth force to distributed triangular load (for LPILE)

w = 2*P_{SH}/H

w = **2376** lbs/foot per shaft (Earth - Service Limit)

8254 lbs/foot per shaft

w = **198** lbs/inch per shaft (Earth - Service Limit)

688 lbs/inch per shaft

γ_E = **1.5** Earth Load Factor

w = (2*P_{SH}/H)*γ_E

w = **297** lbs/inch per shaft (Earth - Strength Limit)

1032 lbs/inch per shaft

8) Determine live-load traffic surcharge force (P_s)

Surcharge Pressure (q_s) = **250** psf

Include traffic surcharge? **YES**

P_s = Ka * q_s * H

P_s = **825** lbs/foot

(surcharge resolved to distributed load)

1630 lbs/foot

P_s = **4949** lbs/shaft

9782 lbs/shaft

9) Resolve surcharge to distributed rectangular load (for LPILE)

w = P_s/H

w = **582** lbs/foot per shaft (surcharge - unfactored)

582 lbs/foot per shaft

w = **49** lbs/inch per shaft (surcharge - unfactored)

49 lbs/inch per shaft

γ_s = **1.75** Surcharge Load Factor - Strength I

w = (P_s/L)*γ_s

w = **85** lbs/inch per shaft (Surcharge - Strength I)

85 lbs/inch per shaft

Distributed Lateral Loads for LPILE

CONVENTIONAL		
Depth (ft.)	Service (psi)	Strength-I (psi)
0	49	85
8.5	246	382

Distributed Lateral Loads for LPILE

UA SLOPE		
Depth (ft.)	Service (psi)	Strength-I (psi)
0	49	85
16.8	736	1117

Steel Beam and Cross-Section Properties

Assumed Pile Shape **W 24x146**

Pile Availability	
AISC Member Producers	3
Non-Member Producers	1
Shaft Geometry	
Shaft Diameter	36 in
Longest Beam Dimension	27.86575 in
Clear Distance	4.0671252 in
Steel Beam Geometry	
Beam Depth (D)	24.7 in
Web Thickness (t_w)	0.65 in
Flange Width (B_f)	12.9 in
Flange Thickness (t_f)	1.09 in
Area of Steel (A_s)	43 in ²
Steel Properties	
Yield Strength of Steel	50 ksi
Moment of Inertia (I_{xx}) of Steel	4580 in ⁴
Modulus of Elasticity of Steel (E)	29000 ksi
Modulus of Elasticity of Steel (E)	29000000 psi
EI (Steel Only)	1.328E+11 lb*in ²
Section Modulus (S_x)	371 in ³
Section Modulus (Z_x)	418 in ³
Shear-Buckling Coefficient (k)	5
Ratio of Shear-Buckling Resistance (C)	1
D/ t_w	38
1.12VEk/ F_{yw}	60.313846
1.40VEk/ F_{yw}	75.392307

Determined by AASHTO LRFD Bridge Specifications Eqn's 6.10.9.3.2-4, 6.10.9.3.2-5, and 6.10.9.3.2-6

Shear Capacity Calculation

$$V_u \leq \phi V_{cr}$$

$$\phi_v = \boxed{1} \text{ AASHTO LRFD Bridge Design Spec's 6.5.4.2}$$

$$V_u = \text{shear in web due to factored permanent and construction loads applied to noncompact section (kips)}$$

$$V_{cr} = \text{shear buckling resistance determined from Equation 6.10.9.3.3-1 (AASHTO LRFD Bridge Design Spec's)}$$

$$V_n = V_{cr} = C V_p$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_p = \text{plastic shear force (kips)}$$

$$C = \text{ratio of shear-buckling resistance to shear yield strength determined by AASHTO Eqn's 6.10.9.3.2-4, 6.10.9.3.2-5, 6.10.9.3.2-5, or 6.10.9.3.2-6}$$

$$V_p = 0.58 * 50 * 24.7 * 0.65$$

$$V_p = \boxed{465.6} \text{ kips}$$

$$\phi V_{cr} = \phi * C * V_p$$

$$\phi V_{cr} = 1 * 1 * 465.6$$

$$\phi V_{cr} = \boxed{465.6} \text{ kips}$$

$$V_u = \boxed{89.221} \text{ kips (from LPILE)}$$

$$V_u = \boxed{} \text{ kips (from PYWALL)}$$

$$V_u < \phi V_{cr} \quad \text{OK}$$

Flexure Capacity Calculation

$$M_u \leq \phi M_n$$

$$\phi_b = \boxed{1} \text{ AASHTO LRFD Bridge Design Spec's 6.5.4.2}$$

$$M_u = \text{Moment due to the factored loads}$$

$$M_n = \text{Nominal flexural resistance of a section}$$

$$S_x = \text{Elastic section modulus about the x-axis}$$

$$\phi M_n = \phi * F_y * S_x$$

$$\phi M_n = 1 * 50 * 371$$

$$\phi M_n = \boxed{18550} \text{ in*kips}$$

$$M_u = \boxed{9113.2} \text{ in*kips (from LPILE)}$$

$$M_u = \boxed{} \text{ in*kips (from PYWALL)}$$

$$M_u < \phi M_n \quad \text{OK}$$

Minimum Pile Length

$$\text{Top of Wall to Slip Plane} = \boxed{16.8} \text{ ft}$$

$$\text{Minimum Pile Length Below Slip Plane} = \boxed{10} \text{ ft} \quad \text{ODOT Minimum Required Length}$$

$$\text{Minimum Required Pile Length} = \boxed{26.8} \text{ ft}$$

Deflection Criteria

Pile Length Above Rock = 42 ft	Exposed Wall Height = 8.5 ft
Pile Length Above Rock = 504 in	Exposed Wall Height = 102 in

- Per ODOT GB-7, pile-head deflection in the service limit state limited to 1% or less of the shaft length above bedrock, or 1% of total drilled shaft length if not embedded in bedrock.
- Following industry acceptance criteria, limit wall deflection to 1% of exposed wall height where ODOT landslide criteria does not govern. Alternatively, limit wall deflection to 1.5% of the exposed wall height in accordance with NCDOT guidelines. Use 1.5% wall deflection for PYWALL software.

ODOT Landslide Criteria Governs	YES	
1% Wall Height OR 2 inches- LPILE	2 in	$\delta = \boxed{1.84}$ in (from LPILE)
1.5% Wall Height - PYWALL		$\delta = \boxed{}$ in (from PYWALL)

Drilled Shafts Located Within 10 feet of Edge of Pavement **YES**



Service Limit Analyses

=====
LPile for Windows, Version 2019-11.002

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\pwworking\east01\d2010892\

Name of input data file:
LPile ATH-329-5.26 - Service.lp11

Name of output report file:
LPile ATH-329-5.26 - Service.lp11

Name of plot output file:
LPile ATH-329-5.26 - Service.lp11

Name of runtime message file:
LPile ATH-329-5.26 - Service.lp11

Date and Time of Analysis

Date: June 4, 2021

Time: 17:36:06

Problem Title

Project Name: ATH-329-5.26 - 10S

Job Number: PID 114589

Client: ODOT

Engineer: Praveen Gopallawa

Description: Landslide - Service

Program Options and Settings

Computational Options:

- Conventional Analysis

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- Analysis includes loading by one distributed lateral load acting on pile
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected

- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

 Pile Structural Properties and Geometry

Number of pile sections defined = 1
 Total length of pile = 42.000 ft
 Depth of ground surface below top of pile = 8.5000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	42.000	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
 Cross-sectional Shape = Circular Pile
 Length of section = 42.000000 ft
 Width of top of section = 36.000000 in
 Width of bottom of section = 36.000000 in

Top Area	=	43.000000 sq. in
Bottom Area	=	43.000000 sq. in
Moment of Inertia at Top	=	4580. in^4
Moment of Inertia at Bottom	=	4580. in^4
Elastic Modulus	=	29000000. psi

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	8.500000 ft
Distance from top of pile to bottom of layer	=	14.600000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1100. psf
Undrained cohesion at bottom of layer	=	1100. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	14.600000 ft
Distance from top of pile to bottom of layer	=	19.500000 ft
Effective unit weight at top of layer	=	47.600000 pcf
Effective unit weight at bottom of layer	=	47.600000 pcf
Undrained cohesion at top of layer	=	1100. psf
Undrained cohesion at bottom of layer	=	1100. psf
Epsilon-50 at top of layer	=	0.007000

Epsilon-50 at bottom of layer = 0.007000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 19.500000 ft
Distance from top of pile to bottom of layer = 28.900000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 1300. psf
Undrained cohesion at bottom of layer = 1300. psf
Epsilon-50 at top of layer = 0.007000
Epsilon-50 at bottom of layer = 0.007000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer = 28.900000 ft
Distance from top of pile to bottom of layer = 31.900000 ft
Effective unit weight at top of layer = 77.600000 pcf
Effective unit weight at bottom of layer = 77.600000 pcf
Undrained cohesion at top of layer = 4000. psf
Undrained cohesion at bottom of layer = 4000. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer = 31.900000 ft
Distance from top of pile to bottom of layer = 44.400000 ft
Effective unit weight at top of layer = 77.600000 pcf
Effective unit weight at bottom of layer = 77.600000 pcf
Undrained cohesion at top of layer = 4000. psf
Undrained cohesion at bottom of layer = 4000. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

(Depth of the lowest soil layer extends 2.400 ft below the pile tip)

Summary of Input Soil Properties

Layer Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	E50 or krm
1	Stiff Clay	8.5000	57.6000	1100.	0.00700
	w/o Free Water	14.6000	57.6000	1100.	0.00700
2	Stiff Clay	14.6000	47.6000	1100.	0.00700
	w/o Free Water	19.5000	47.6000	1100.	0.00700
3	Stiff Clay	19.5000	62.6000	1300.	0.00700
	w/o Free Water	28.9000	62.6000	1300.	0.00700
4	Stiff Clay	28.9000	77.6000	4000.	0.00500
	w/o Free Water	31.9000	77.6000	4000.	0.00500
5	Stiff Clay	31.9000	77.6000	4000.	0.00500
	w/o Free Water	44.4000	77.6000	4000.	0.00500

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	8.500	0.8100	1.0000
2	45.000	0.8100	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading Used For All Load Cases

Distributed lateral load intensity defined using 2 points

Point No.	Depth X in	Dist. Load lb/in
--------------	---------------	---------------------

1	0.000	49.000
2	201.600	736.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	8.5000	0.00	N.A.	No	0.00	73838.
2	14.6000	6.1000	Yes	No	73838.	78455.
3	19.5000	9.7369	Yes	No	152293.	221728.
4	28.9000	8.3072	Yes	No	374021.	171866.
5	31.9000	11.2982	Yes	No	545887.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

 Computed Values of Pile Loading and Deflection
 for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
 Applied moment at pile head = 0.0 in-lbs
 Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.8397	-2.67E-05	0.00	-0.00724	1.05E-07	1.33E+11	0.00	0.00	53.2938
0.4200	1.8033	676.8732	301.0613	-0.00724	2.6602	1.33E+11	0.00	0.00	66.1750
0.8400	1.7668	3035.	677.8642	-0.00724	11.9268	1.33E+11	0.00	0.00	83.3500
1.2600	1.7303	7510.	1141.	-0.00724	29.5143	1.33E+11	0.00	0.00	100.5250
1.6800	1.6938	14538.	1691.	-0.00724	57.1374	1.33E+11	0.00	0.00	117.7000
2.1000	1.6573	24557.	2328.	-0.00724	96.5107	1.33E+11	0.00	0.00	134.8750
2.5200	1.6208	38001.	3051.	-0.00724	149.3487	1.33E+11	0.00	0.00	152.0500
2.9400	1.5843	55308.	3860.	-0.00724	217.3662	1.33E+11	0.00	0.00	169.2250
3.3600	1.5479	76913.	4756.	-0.00723	302.2777	1.33E+11	0.00	0.00	186.4000
3.7800	1.5114	103253.	5739.	-0.00723	405.7977	1.33E+11	0.00	0.00	203.5750
4.2000	1.4750	134764.	6809.	-0.00723	529.6410	1.33E+11	0.00	0.00	220.7500

4.6200	1.4386	171883.	7964.	-0.00722	675.5222	1.33E+11	0.00	0.00	237.9250
5.0400	1.4022	215045.	9207.	-0.00721	845.1557	1.33E+11	0.00	0.00	255.1000
5.4600	1.3659	264687.	10536.	-0.00720	1040.	1.33E+11	0.00	0.00	272.2750
5.8800	1.3296	321246.	11951.	-0.00719	1263.	1.33E+11	0.00	0.00	289.4500
6.3000	1.2934	385157.	13453.	-0.00718	1514.	1.33E+11	0.00	0.00	306.6250
6.7200	1.2573	456857.	15042.	-0.00716	1796.	1.33E+11	0.00	0.00	323.8000
7.1400	1.2212	536781.	16717.	-0.00714	2110.	1.33E+11	0.00	0.00	340.9750
7.5600	1.1853	625368.	18479.	-0.00712	2458.	1.33E+11	0.00	0.00	358.1500
7.9800	1.1494	723051.	20328.	-0.00710	2842.	1.33E+11	0.00	0.00	375.3250
8.4000	1.1137	830269.	22262.	-0.00707	3263.	1.33E+11	0.00	0.00	392.5000
8.8200	1.0782	947456.	23298.	-0.00703	3724.	1.33E+11	-391.0921	1828.	409.6750
9.2400	1.0428	1065116.	23414.	-0.00699	4186.	1.33E+11	-399.4673	1931.	426.8500
9.6600	1.0077	1183471.	23575.	-0.00695	4651.	1.33E+11	-407.5798	2039.	444.0250
10.0800	0.9728	1302752.	23782.	-0.00690	5120.	1.33E+11	-415.4225	2152.	461.2000
10.5000	0.9381	1423196.	24037.	-0.00685	5593.	1.33E+11	-422.9878	2273.	478.3750
10.9200	0.9037	1545047.	24341.	-0.00680	6072.	1.33E+11	-430.2677	2400.	495.5500
11.3400	0.8696	1668556.	24696.	-0.00674	6558.	1.33E+11	-437.2543	2534.	512.7250
11.7600	0.8358	1793982.	25103.	-0.00667	7051.	1.33E+11	-443.9392	2677.	529.9000
12.1800	0.8023	1921592.	25563.	-0.00660	7552.	1.33E+11	-450.3138	2829.	547.0750
12.6000	0.7693	2051659.	26079.	-0.00652	8063.	1.33E+11	-456.3691	2990.	564.2500
13.0200	0.7366	2184467.	26651.	-0.00644	8585.	1.33E+11	-462.0959	3162.	581.4250
13.4400	0.7043	2320306.	27283.	-0.00636	9119.	1.33E+11	-467.4848	3345.	598.6000
13.8600	0.6725	2459476.	27974.	-0.00627	9666.	1.33E+11	-472.5261	3541.	615.7750
14.2800	0.6411	2602284.	28727.	-0.00617	10227.	1.33E+11	-477.2098	3751.	632.9500
14.7000	0.6103	2749049.	29545.	-0.00607	10804.	1.33E+11	-481.4252	3976.	650.1250
15.1200	0.5799	2900098.	30430.	-0.00596	11398.	1.33E+11	-484.9477	4215.	667.3000
15.5400	0.5502	3055780.	31384.	-0.00585	12010.	1.33E+11	-488.0925	4471.	684.4750
15.9600	0.5210	3216450.	32410.	-0.00573	12641.	1.33E+11	-490.8496	4749.	701.6500
16.3800	0.4924	3382475.	33510.	-0.00561	13294.	1.33E+11	-493.2090	5048.	718.8250
16.8000	0.4645	3554231.	33753.	-0.00547	13969.	1.33E+11	-495.1607	5373.	735.8531
17.2200	0.4372	3722702.	32175.	-0.00534	14631.	1.33E+11	-496.6956	5726.	0.00
17.6400	0.4107	3878556.	29669.	-0.00519	15243.	1.33E+11	-497.8044	6109.	0.00
18.0600	0.3849	4021765.	27158.	-0.00504	15806.	1.33E+11	-498.4778	6528.	0.00
18.4800	0.3598	4152313.	24645.	-0.00489	16319.	1.33E+11	-498.7059	6985.	0.00
18.9000	0.3356	4270192.	22133.	-0.00473	16782.	1.33E+11	-498.4788	7486.	0.00
19.3200	0.3122	4375409.	19622.	-0.00456	17196.	1.33E+11	-497.7859	8036.	0.00
19.7400	0.2896	4467981.	16982.	-0.00440	17560.	1.33E+11	-549.7427	9567.	0.00
20.1600	0.2679	4546589.	14214.	-0.00422	17869.	1.33E+11	-548.6851	10323.	0.00
20.5800	0.2470	4611260.	11453.	-0.00405	18123.	1.33E+11	-547.0453	11161.	0.00
21.0000	0.2271	4662035.	8701.	-0.00387	18322.	1.33E+11	-544.8082	12093.	0.00
21.4200	0.2080	4698971.	5963.	-0.00370	18468.	1.33E+11	-541.9576	13134.	0.00
21.8400	0.1898	4722140.	3240.	-0.00352	18559.	1.33E+11	-538.4763	14300.	0.00
22.2600	0.1725	4731631.	536.6025	-0.00334	18596.	1.33E+11	-534.3456	15612.	0.00
22.6800	0.1561	4727549.	-2144.	-0.00316	18580.	1.33E+11	-529.5457	17094.	0.00
23.1000	0.1407	4710016.	-4799.	-0.00298	18511.	1.33E+11	-524.0545	18777.	0.00
23.5200	0.1261	4679170.	-7425.	-0.00280	18390.	1.33E+11	-517.8480	20699.	0.00
23.9400	0.1124	4635171.	-10018.	-0.00263	18217.	1.33E+11	-510.8992	22906.	0.00

24.3600	0.09962	4578194.	-12573.	-0.00245	17993.	1.33E+11	-503.1781	25456.	0.00
24.7800	0.08771	4508435.	-15088.	-0.00228	17719.	1.33E+11	-494.6499	28424.	0.00
25.2000	0.07666	4426112.	-17557.	-0.00211	17395.	1.33E+11	-485.2750	31905.	0.00
25.6200	0.06645	4331461.	-19977.	-0.00194	17023.	1.33E+11	-475.0065	36026.	0.00
26.0400	0.05708	4224745.	-22343.	-0.00178	16604.	1.33E+11	-463.7884	40954.	0.00
26.4600	0.04851	4106248.	-24649.	-0.00162	16138.	1.33E+11	-451.5527	46917.	0.00
26.8800	0.04072	3976281.	-26891.	-0.00147	15627.	1.33E+11	-438.2143	54233.	0.00
27.3000	0.03370	3835182.	-29063.	-0.00132	15073.	1.33E+11	-423.6642	63359.	0.00
27.7200	0.02741	3683321.	-31159.	-0.00118	14476.	1.33E+11	-407.7586	74973.	0.00
28.1400	0.02183	3521103.	-33170.	-0.00104	13838.	1.33E+11	-390.2997	90126.	0.00
28.5600	0.01691	3348971.	-35088.	-9.11E-04	13162.	1.33E+11	-371.0030	110548.	0.00
28.9800	0.01264	3167414.	-37911.	-7.87E-04	12448.	1.33E+11	-749.2650	298682.	0.00
29.4000	0.00898	2966826.	-41562.	-6.71E-04	11660.	1.33E+11	-699.5169	392703.	0.00
29.8200	0.00588	2748468.	-44937.	-5.63E-04	10802.	1.33E+11	-639.8309	548464.	0.00
30.2400	0.00331	2513857.	-47969.	-4.63E-04	9880.	1.33E+11	-563.2572	858392.	0.00
30.6600	0.00122	2264939.	-50512.	-3.72E-04	8902.	1.33E+11	-445.7317	1848290.	0.00
31.0800	-4.43E-04	2004698.	-51019.	-2.91E-04	7879.	1.33E+11	244.4357	2780405.	0.00
31.5000	-0.00172	1750667.	-49140.	-2.20E-04	6880.	1.33E+11	501.3889	1470712.	0.00
31.9200	-0.00266	1509372.	-46445.	-1.58E-04	5932.	1.33E+11	567.7092	1076252.	0.00
32.3400	-0.00331	1282497.	-43480.	-1.05E-04	5040.	1.33E+11	608.8627	927037.	0.00
32.7600	-0.00372	1071088.	-40343.	-6.03E-05	4210.	1.33E+11	636.1841	862723.	0.00
33.1800	-0.00392	875840.	-37091.	-2.34E-05	3442.	1.33E+11	654.2031	841526.	0.00
33.6000	-0.00395	697209.	-33766.	6.48E-06	2740.	1.33E+11	665.2068	848312.	0.00
34.0200	-0.00385	535476.	-30400.	2.99E-05	2104.	1.33E+11	670.5176	877125.	0.00
34.4400	-0.00365	390775.	-27020.	4.74E-05	1536.	1.33E+11	670.9686	926207.	0.00
34.8600	-0.00337	263117.	-23648.	5.98E-05	1034.	1.33E+11	667.1146	996326.	0.00
35.2800	-0.00305	152406.	-20305.	6.77E-05	598.9746	1.33E+11	659.3385	1090286.	0.00
35.7000	-0.00269	58442.	-17011.	7.17E-05	229.6861	1.33E+11	647.9070	1213037.	0.00
36.1200	-0.00232	-19063.	-13783.	7.25E-05	74.9208	1.33E+11	633.0010	1372262.	0.00
36.5400	-0.00196	-80489.	-10639.	7.06E-05	316.3342	1.33E+11	614.7260	1579583.	0.00
36.9600	-0.00161	-126301.	-7595.	6.67E-05	496.3785	1.33E+11	593.1068	1852819.	0.00
37.3800	-0.00129	-157046.	-4669.	6.13E-05	617.2120	1.33E+11	568.0564	2220323.	0.00
37.8000	-9.96E-04	-173362.	-1878.	5.50E-05	681.3355	1.33E+11	539.2992	2730119.	0.00
38.2200	-7.35E-04	-175979.	756.3967	4.84E-05	691.6199	1.33E+11	506.1923	3471634.	0.00
38.6400	-5.08E-04	-165738.	2938.	4.19E-05	651.3703	1.33E+11	359.6260	3569242.	0.00
39.0600	-3.12E-04	-146361.	4409.	3.60E-05	575.2187	1.33E+11	224.0022	3613231.	0.00
39.4800	-1.45E-04	-121295.	5239.	3.09E-05	476.7045	1.33E+11	105.2801	3657229.	0.00
39.9000	-9.14E-07	-93554.	5506.	2.68E-05	367.6801	1.33E+11	0.6712	3701235.	0.00
40.3200	1.25E-04	-65796.	5273.	2.38E-05	258.5887	1.33E+11	-93.1598	3745249.	0.00
40.7400	2.39E-04	-40405.	4585.	2.18E-05	158.7975	1.33E+11	-179.7360	3789271.	0.00
41.1600	3.45E-04	-19579.	3471.	2.07E-05	76.9497	1.33E+11	-262.4217	3833301.	0.00
41.5800	4.47E-04	-5420.	1942.	2.02E-05	21.2999	1.33E+11	-344.0787	3877337.	0.00
42.0000	5.48E-04	0.00	0.00	2.01E-05	0.00	1.33E+11	-426.7164	1960690.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 1.83974875 inches
 Computed slope at pile head = -0.00724025 radians
 Maximum bending moment = 4731631. inch-lbs
 Maximum shear force = -51019. lbs
 Depth of maximum bending moment = 22.26000000 feet below pile head
 Depth of maximum shear force = 31.08000000 feet below pile head
 Number of iterations = 31
 Number of zero deflection points = 2

 Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
 Moment = 0. in-lbs
 Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
42.00000	1.83974875	4731631.	-51019.
39.90000	1.83175671	4711198.	-50100.
37.80000	1.81454551	4675644.	-49525.
35.70000	1.84023373	4533626.	-52937.
33.60000	2.20986309	4287718.	-53742.
31.50000	2.74495884	3762881.	-50244.
29.40000	4.81556237	3074468.	-43759.
27.30000	9.29281947	2550350.	-41592.
25.20000	14.89309120	2007760.	-37550.
23.10000	34.68202458	1711076.	-35932.

 Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

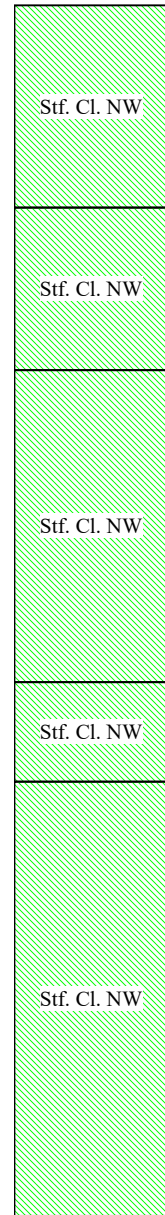
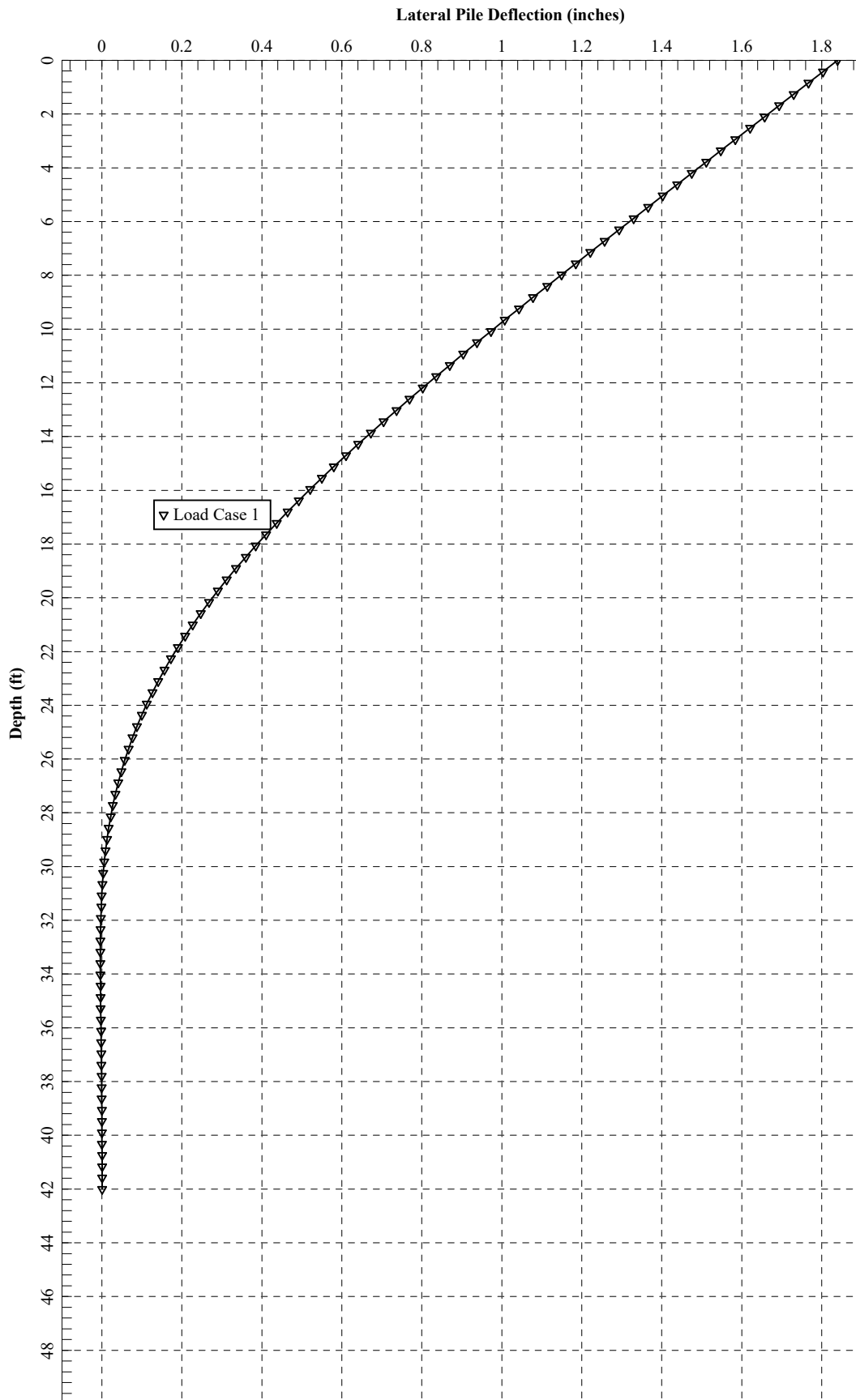
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
 Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians

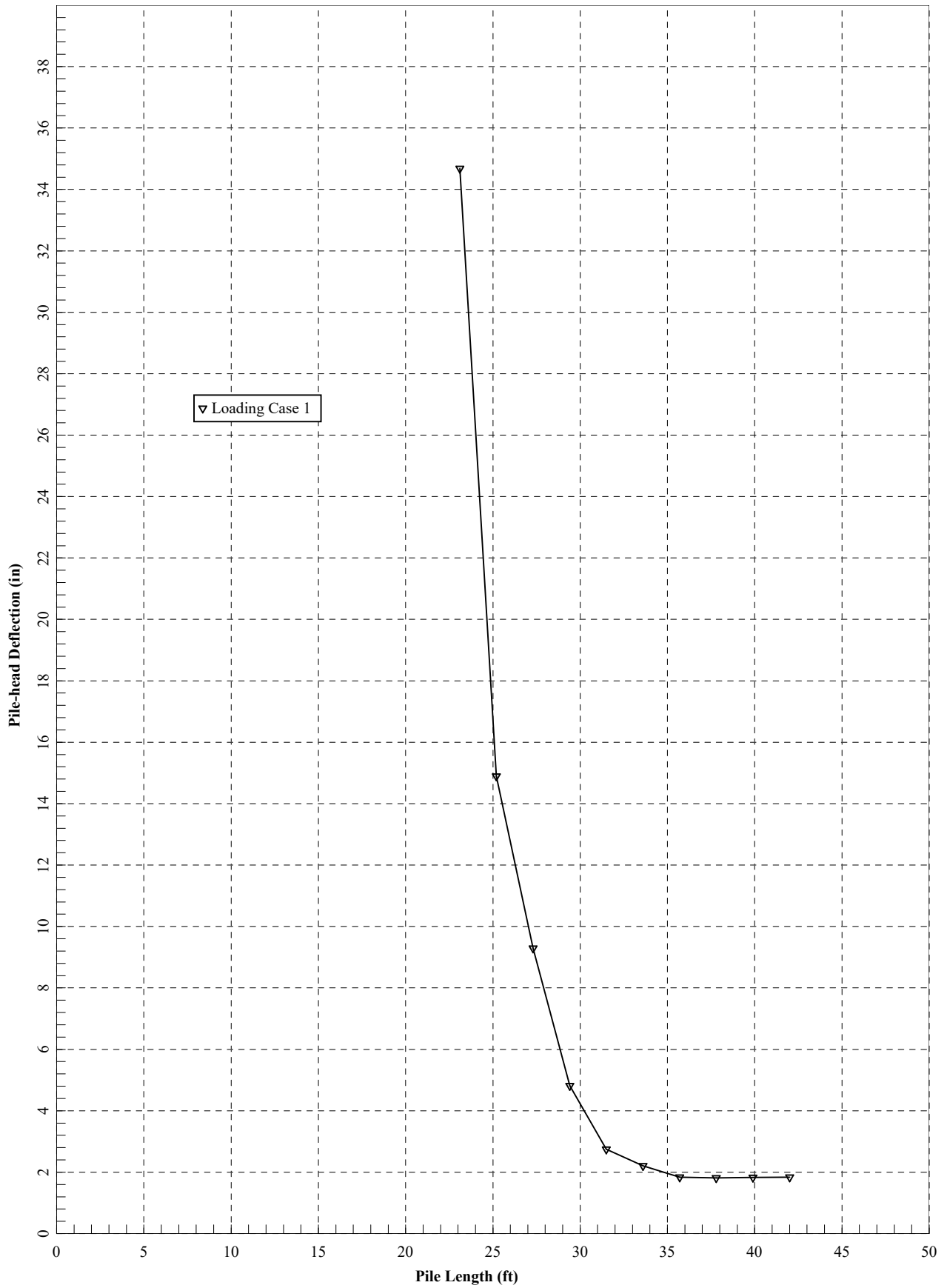
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
 Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
 Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.8397	-0.00724	-51019.	4731631.

Maximum pile-head deflection = 1.8397487506 inches
 Maximum pile-head rotation = -0.0072402457 radians = -0.414836 deg.

The analysis ended normally.





42 feet pile length - 8.5 feet cantilever = 33.5 feet
Use minimum drilled shaft length of 35.0 feet.



Strength Limit Analyses

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LPile for Windows, Version 2019-11.002

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\pwworking\east01\d2010892\

Name of input data file:
LPile ATH-329-5.26 - Strength.lp11

Name of output report file:
LPile ATH-329-5.26 - Strength.lp11

Name of plot output file:
LPile ATH-329-5.26 - Strength.lp11

Name of runtime message file:
LPile ATH-329-5.26 - Strength.lp11

Date and Time of Analysis

Date: June 4, 2021

Time: 17:35:57

Problem Title

Project Name: ATH-329-5.26 - 10S

Job Number: PID 114589

Client: ODOT

Engineer: Praveen Gopallawa

Description: Landslide - Strength

Program Options and Settings

Computational Options:

- Conventional Analysis

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- Analysis includes loading by one distributed lateral load acting on pile
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected

- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

 Pile Structural Properties and Geometry

Number of pile sections defined = 1
 Total length of pile = 42.000 ft
 Depth of ground surface below top of pile = 8.5000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	42.000	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
 Cross-sectional Shape = Circular Pile
 Length of section = 42.000000 ft
 Width of top of section = 36.000000 in
 Width of bottom of section = 36.000000 in

Top Area	=	43.000000 sq. in
Bottom Area	=	43.000000 sq. in
Moment of Inertia at Top	=	4580. in^4
Moment of Inertia at Bottom	=	4580. in^4
Elastic Modulus	=	29000000. psi

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer	=	8.500000 ft
Distance from top of pile to bottom of layer	=	14.600000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	1100. psf
Undrained cohesion at bottom of layer	=	1100. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	14.600000 ft
Distance from top of pile to bottom of layer	=	19.500000 ft
Effective unit weight at top of layer	=	47.600000 pcf
Effective unit weight at bottom of layer	=	47.600000 pcf
Undrained cohesion at top of layer	=	1100. psf
Undrained cohesion at bottom of layer	=	1100. psf
Epsilon-50 at top of layer	=	0.007000

Epsilon-50 at bottom of layer = 0.007000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 19.500000 ft
Distance from top of pile to bottom of layer = 28.900000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 1300. psf
Undrained cohesion at bottom of layer = 1300. psf
Epsilon-50 at top of layer = 0.007000
Epsilon-50 at bottom of layer = 0.007000

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer = 28.900000 ft
Distance from top of pile to bottom of layer = 31.900000 ft
Effective unit weight at top of layer = 77.600000 pcf
Effective unit weight at bottom of layer = 77.600000 pcf
Undrained cohesion at top of layer = 4000. psf
Undrained cohesion at bottom of layer = 4000. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer = 31.900000 ft
Distance from top of pile to bottom of layer = 44.400000 ft
Effective unit weight at top of layer = 77.600000 pcf
Effective unit weight at bottom of layer = 77.600000 pcf
Undrained cohesion at top of layer = 4000. psf
Undrained cohesion at bottom of layer = 4000. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

(Depth of the lowest soil layer extends 2.400 ft below the pile tip)

Summary of Input Soil Properties

Layer Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	E50 or krm
1	Stiff Clay	8.5000	57.6000	1100.	0.00700
	w/o Free Water	14.6000	57.6000	1100.	0.00700
2	Stiff Clay	14.6000	47.6000	1100.	0.00700
	w/o Free Water	19.5000	47.6000	1100.	0.00700
3	Stiff Clay	19.5000	62.6000	1300.	0.00700
	w/o Free Water	28.9000	62.6000	1300.	0.00700
4	Stiff Clay	28.9000	77.6000	4000.	0.00500
	w/o Free Water	31.9000	77.6000	4000.	0.00500
5	Stiff Clay	31.9000	77.6000	4000.	0.00500
	w/o Free Water	44.4000	77.6000	4000.	0.00500

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	8.500	0.8100	1.0000
2	45.000	0.8100	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading Used For All Load Cases

Distributed lateral load intensity defined using 2 points

Point No.	Depth X in	Dist. Load lb/in
--------------	---------------	---------------------

1	0.000	85.000
2	201.600	1117.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	8.5000	0.00	N.A.	No	0.00	73838.
2	14.6000	6.1000	Yes	No	73838.	78455.
3	19.5000	9.7369	Yes	No	152293.	221728.
4	28.9000	8.3072	Yes	No	374021.	171866.
5	31.9000	11.2982	Yes	No	545887.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

 Computed Values of Pile Loading and Deflection
 for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
 Applied moment at pile head = 0.0 in-lbs
 Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	4.3106	-9.29E-06	0.00	-0.01554	3.65E-08	1.33E+11	0.00	0.00	91.4500
0.4200	4.2322	1161.	509.6700	-0.01554	4.5648	1.33E+11	0.00	0.00	110.8000
0.8400	4.1539	5137.	1133.	-0.01554	20.1909	1.33E+11	0.00	0.00	136.6000
1.2600	4.0756	12583.	1887.	-0.01554	49.4541	1.33E+11	0.00	0.00	162.4000
1.6800	3.9972	24154.	2770.	-0.01554	94.9299	1.33E+11	0.00	0.00	188.2000
2.1000	3.9189	40506.	3784.	-0.01554	159.1940	1.33E+11	0.00	0.00	214.0000
2.5200	3.8406	62294.	4927.	-0.01554	244.8221	1.33E+11	0.00	0.00	239.8000
2.9400	3.7623	90173.	6201.	-0.01554	354.3898	1.33E+11	0.00	0.00	265.6000
3.3600	3.6840	124798.	7604.	-0.01553	490.4727	1.33E+11	0.00	0.00	291.4000
3.7800	3.6057	166826.	9138.	-0.01553	655.6466	1.33E+11	0.00	0.00	317.2000
4.2000	3.5275	216911.	10802.	-0.01552	852.4871	1.33E+11	0.00	0.00	343.0000

4.6200	3.4493	275708.	12596.	-0.01551	1084.	1.33E+11	0.00	0.00	368.8000
5.0400	3.3712	343874.	14519.	-0.01550	1351.	1.33E+11	0.00	0.00	394.6000
5.4600	3.2931	422063.	16573.	-0.01548	1659.	1.33E+11	0.00	0.00	420.4000
5.8800	3.2151	510932.	18757.	-0.01547	2008.	1.33E+11	0.00	0.00	446.2000
6.3000	3.1372	611134.	21071.	-0.01544	2402.	1.33E+11	0.00	0.00	472.0000
6.7200	3.0594	723326.	23515.	-0.01542	2843.	1.33E+11	0.00	0.00	497.8000
7.1400	2.9818	848163.	26089.	-0.01539	3333.	1.33E+11	0.00	0.00	523.6000
7.5600	2.9043	986300.	28793.	-0.01535	3876.	1.33E+11	0.00	0.00	549.4000
7.9800	2.8270	1138392.	31627.	-0.01531	4474.	1.33E+11	0.00	0.00	575.2000
8.4000	2.7500	1305096.	34591.	-0.01527	5129.	1.33E+11	0.00	0.00	601.0000
8.8200	2.6731	1487066.	36448.	-0.01521	5844.	1.33E+11	-490.7489	925.2732	626.8000
9.2400	2.5966	1672492.	37171.	-0.01515	6573.	1.33E+11	-501.7963	973.9897	652.6000
9.6600	2.5204	1861749.	37969.	-0.01509	7317.	1.33E+11	-512.5629	1025.	678.4000
10.0800	2.4445	2055218.	38843.	-0.01501	8077.	1.33E+11	-523.0415	1078.	704.2000
10.5000	2.3690	2253289.	39796.	-0.01493	8856.	1.33E+11	-533.2246	1134.	730.0000
10.9200	2.2940	2456358.	40828.	-0.01484	9654.	1.33E+11	-543.1043	1193.	755.8000
11.3400	2.2194	2664830.	41940.	-0.01474	10473.	1.33E+11	-552.6728	1255.	781.6000
11.7600	2.1454	2879118.	43136.	-0.01464	11315.	1.33E+11	-561.9218	1320.	807.4000
12.1800	2.0719	3099640.	44416.	-0.01453	12182.	1.33E+11	-570.8428	1389.	833.2000
12.6000	1.9990	3326827.	45781.	-0.01440	13075.	1.33E+11	-579.4271	1461.	859.0000
13.0200	1.9267	3561116.	47235.	-0.01427	13996.	1.33E+11	-587.6659	1537.	884.8000
13.4400	1.8551	3802952.	48777.	-0.01413	14946.	1.33E+11	-595.5500	1618.	910.6000
13.8600	1.7842	4052791.	50411.	-0.01398	15928.	1.33E+11	-603.0700	1704.	936.4000
14.2800	1.7141	4311098.	52138.	-0.01383	16943.	1.33E+11	-610.2164	1794.	962.2000
14.7000	1.6448	4578345.	53961.	-0.01366	17993.	1.33E+11	-616.8508	1890.	988.0000
15.1200	1.5764	4855020.	55881.	-0.01348	19081.	1.33E+11	-622.6874	1991.	1014.
15.5400	1.5090	5141630.	57904.	-0.01329	20207.	1.33E+11	-628.1326	2098.	1040.
15.9600	1.4425	5438691.	60030.	-0.01309	21375.	1.33E+11	-633.1769	2212.	1065.
16.3800	1.3771	5746732.	62262.	-0.01288	22585.	1.33E+11	-637.8108	2334.	1091.
16.8000	1.3127	6066290.	63186.	-0.01265	23841.	1.33E+11	-642.0249	2465.	555.2750
17.2200	1.2495	6383644.	61340.	-0.01242	25089.	1.33E+11	-645.8102	2605.	0.00
17.6400	1.1876	6684594.	58076.	-0.01217	26271.	1.33E+11	-649.1576	2755.	0.00
18.0600	1.1269	6969054.	54797.	-0.01191	27389.	1.33E+11	-652.0579	2916.	0.00
18.4800	1.0675	7236950.	51505.	-0.01164	28442.	1.33E+11	-654.5016	3090.	0.00
18.9000	1.0096	7488222.	48201.	-0.01136	29430.	1.33E+11	-656.4790	3277.	0.00
19.3200	0.9530	7722817.	44889.	-0.01107	30352.	1.33E+11	-657.9799	3480.	0.00
19.7400	0.8980	7940699.	41392.	-0.01077	31208.	1.33E+11	-729.4907	4094.	0.00
20.1600	0.8444	8140051.	37712.	-0.01047	31991.	1.33E+11	-731.0975	4364.	0.00
20.5800	0.7924	8320831.	34024.	-0.01016	32702.	1.33E+11	-732.1113	4656.	0.00
21.0000	0.7421	8483015.	30333.	-0.00984	33339.	1.33E+11	-732.5177	4975.	0.00
21.4200	0.6933	8626592.	26642.	-0.00951	33904.	1.33E+11	-732.3016	5324.	0.00
21.8400	0.6462	8751567.	22953.	-0.00918	34395.	1.33E+11	-731.4471	5705.	0.00
22.2600	0.6007	8857962.	19271.	-0.00885	34813.	1.33E+11	-729.9377	6124.	0.00
22.6800	0.5570	8945815.	15597.	-0.00851	35158.	1.33E+11	-727.7556	6586.	0.00
23.1000	0.5149	9015182.	11937.	-0.00817	35431.	1.33E+11	-724.8820	7095.	0.00
23.5200	0.4746	9066137.	8292.	-0.00783	35631.	1.33E+11	-721.2968	7660.	0.00
23.9400	0.4360	9098769.	4668.	-0.00748	35759.	1.33E+11	-716.9783	8288.	0.00

24.3600	0.3992	9113188.	1067.	-0.00714	35816.	1.33E+11	-711.9029	8988.	0.00
24.7800	0.3641	9109525.	-2506.	-0.00679	35802.	1.33E+11	-706.0452	9774.	0.00
25.2000	0.3307	9087926.	-6048.	-0.00645	35717.	1.33E+11	-699.3771	10658.	0.00
25.6200	0.2991	9048562.	-9554.	-0.00610	35562.	1.33E+11	-691.8674	11658.	0.00
26.0400	0.2692	8991624.	-13020.	-0.00576	35338.	1.33E+11	-683.4818	12796.	0.00
26.4600	0.2410	8917324.	-16441.	-0.00542	35046.	1.33E+11	-674.1814	14097.	0.00
26.8800	0.2146	8825899.	-19813.	-0.00508	34687.	1.33E+11	-663.9223	15594.	0.00
27.3000	0.1898	8717609.	-23131.	-0.00475	34261.	1.33E+11	-652.6540	17330.	0.00
27.7200	0.1667	8592741.	-26389.	-0.00442	33771.	1.33E+11	-640.3181	19360.	0.00
28.1400	0.1452	8451608.	-29582.	-0.00410	33216.	1.33E+11	-626.8461	21754.	0.00
28.5600	0.1254	8294551.	-32705.	-0.00378	32599.	1.33E+11	-612.1564	24608.	0.00
28.9800	0.1071	8121945.	-37468.	-0.00347	31920.	1.33E+11	-1278.	60145.	0.00
29.4000	0.09041	7916869.	-43830.	-0.00317	31114.	1.33E+11	-1246.	69467.	0.00
29.8200	0.07521	7680140.	-50019.	-0.00287	30184.	1.33E+11	-1210.	81084.	0.00
30.2400	0.06148	7412676.	-56016.	-0.00258	29133.	1.33E+11	-1170.	95868.	0.00
30.6600	0.04917	7115504.	-61795.	-0.00231	27965.	1.33E+11	-1124.	115195.	0.00
31.0800	0.03823	6789782.	-67329.	-0.00204	26685.	1.33E+11	-1072.	141368.	0.00
31.5000	0.02858	6436825.	-72583.	-0.00179	25298.	1.33E+11	-1013.	178608.	0.00
31.9200	0.02016	6058143.	-77510.	-0.00156	23809.	1.33E+11	-942.1749	235571.	0.00
32.3400	0.01290	5655528.	-82040.	-0.00133	22227.	1.33E+11	-855.5467	334325.	0.00
32.7600	0.00672	5231181.	-86055.	-0.00113	20559.	1.33E+11	-737.8431	553468.	0.00
33.1800	0.00154	4788092.	-89221.	-9.37E-04	18818.	1.33E+11	-518.4609	1695825.	0.00
33.6000	-0.00272	4331833.	-89001.	-7.64E-04	17025.	1.33E+11	605.7432	1121784.	0.00
34.0200	-0.00616	3890961.	-85575.	-6.08E-04	15292.	1.33E+11	753.7295	617146.	0.00
34.4400	-0.00885	3469235.	-81567.	-4.68E-04	13635.	1.33E+11	837.0127	476930.	0.00
34.8600	-0.01087	3068770.	-77205.	-3.44E-04	12061.	1.33E+11	893.6851	414310.	0.00
35.2800	-0.01231	2691007.	-72598.	-2.35E-04	10576.	1.33E+11	934.6644	382645.	0.00
35.7000	-0.01324	2336985.	-67811.	-1.39E-04	9185.	1.33E+11	964.7376	367362.	0.00
36.1200	-0.01371	2007469.	-62894.	-5.67E-05	7890.	1.33E+11	986.4407	362539.	0.00
36.5400	-0.01381	1703011.	-57885.	1.37E-05	6693.	1.33E+11	1001.	365483.	0.00
36.9600	-0.01358	1423986.	-52817.	7.30E-05	5596.	1.33E+11	1010.	375011.	0.00
37.3800	-0.01307	1170619.	-47717.	1.22E-04	4601.	1.33E+11	1014.	390806.	0.00
37.8000	-0.01234	942999.	-42613.	1.62E-04	3706.	1.33E+11	1012.	413188.	0.00
38.2200	-0.01143	741083.	-37529.	1.94E-04	2913.	1.33E+11	1005.	443096.	0.00
38.6400	-0.01038	564704.	-32492.	2.19E-04	2219.	1.33E+11	993.6375	482235.	0.00
39.0600	-0.00923	413565.	-27527.	2.38E-04	1625.	1.33E+11	976.5853	533449.	0.00
39.4800	-0.00799	287232.	-22663.	2.51E-04	1129.	1.33E+11	953.5322	601512.	0.00
39.9000	-0.00670	185121.	-17933.	2.60E-04	727.5502	1.33E+11	923.3716	694866.	0.00
40.3200	-0.00537	106465.	-13378.	2.65E-04	418.4217	1.33E+11	884.1486	829838.	0.00
40.7400	-0.00402	50268.	-9053.	2.68E-04	197.5592	1.33E+11	832.1846	1042829.	0.00
41.1600	-0.00266	15209.	-5042.	2.70E-04	59.7751	1.33E+11	759.5050	1436664.	0.00
41.5800	-0.00130	-556.3404	-1509.	2.70E-04	2.1865	1.33E+11	642.5624	2483490.	0.00
42.0000	5.63E-05	0.00	0.00	2.70E-04	0.00	1.33E+11	-43.8036	1960690.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 4.31057853 inches
Computed slope at pile head = -0.01554261 radians
Maximum bending moment = 9113188. inch-lbs
Maximum shear force = -89221. lbs
Depth of maximum bending moment = 24.36000000 feet below pile head
Depth of maximum shear force = 33.18000000 feet below pile head
Number of iterations = 36
Number of zero deflection points = 2

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
42.00000	4.31057853	9113188.	-89221.
39.90000	4.39897491	8972983.	-93883.
37.80000	4.91701817	8464330.	-98842.
35.70000	6.12364749	7660462.	-96607.
33.60000	9.03950743	6890947.	-88435.
31.50000	12.82806445	5932901.	-79781.
29.40000	35.01495945	5149643.	-73683.

Summary of Pile-head Responses for Conventional Analyses

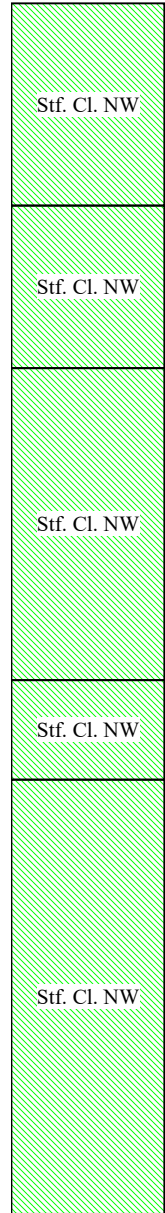
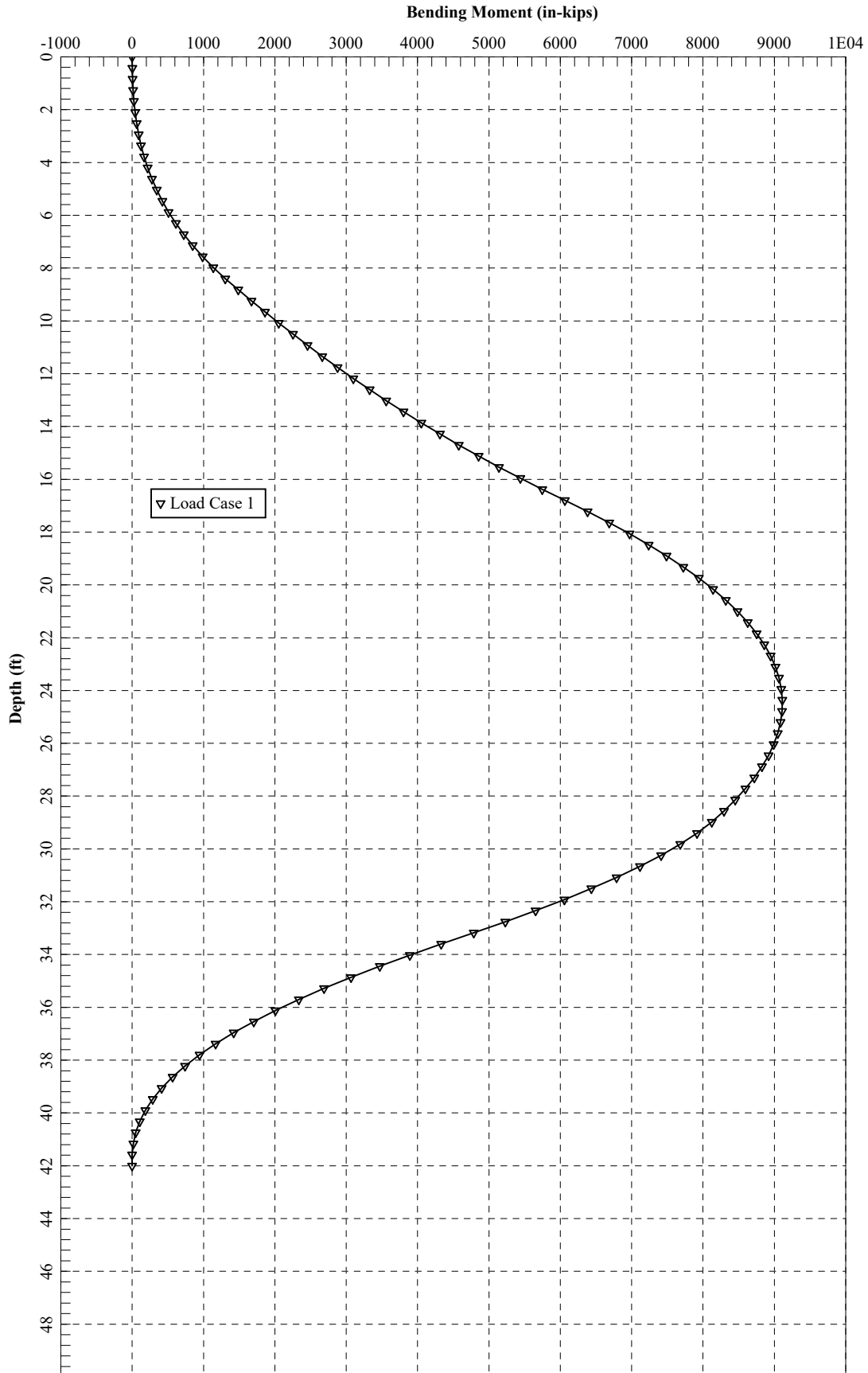
Definitions of Pile-head Loading Conditions:

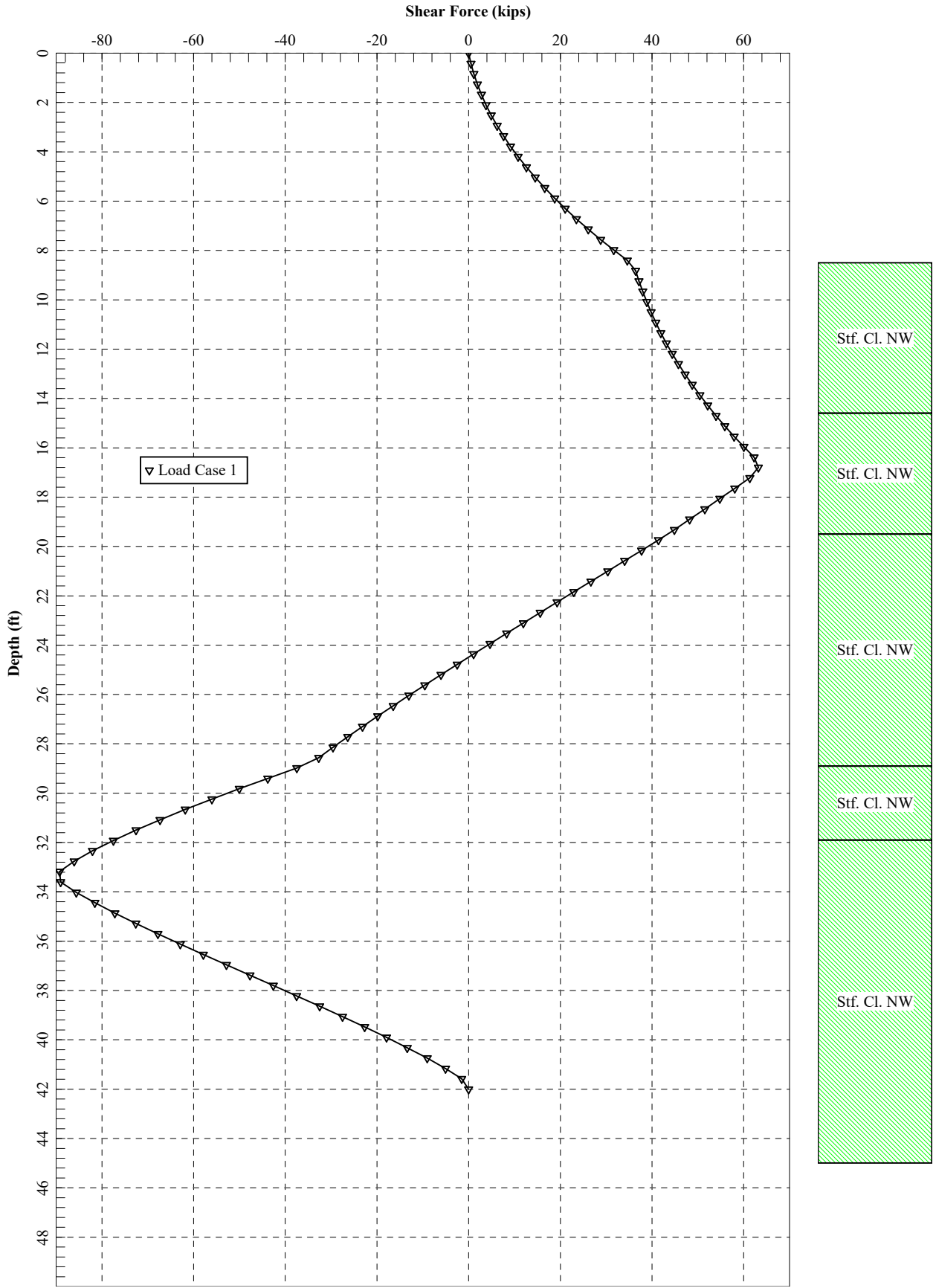
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

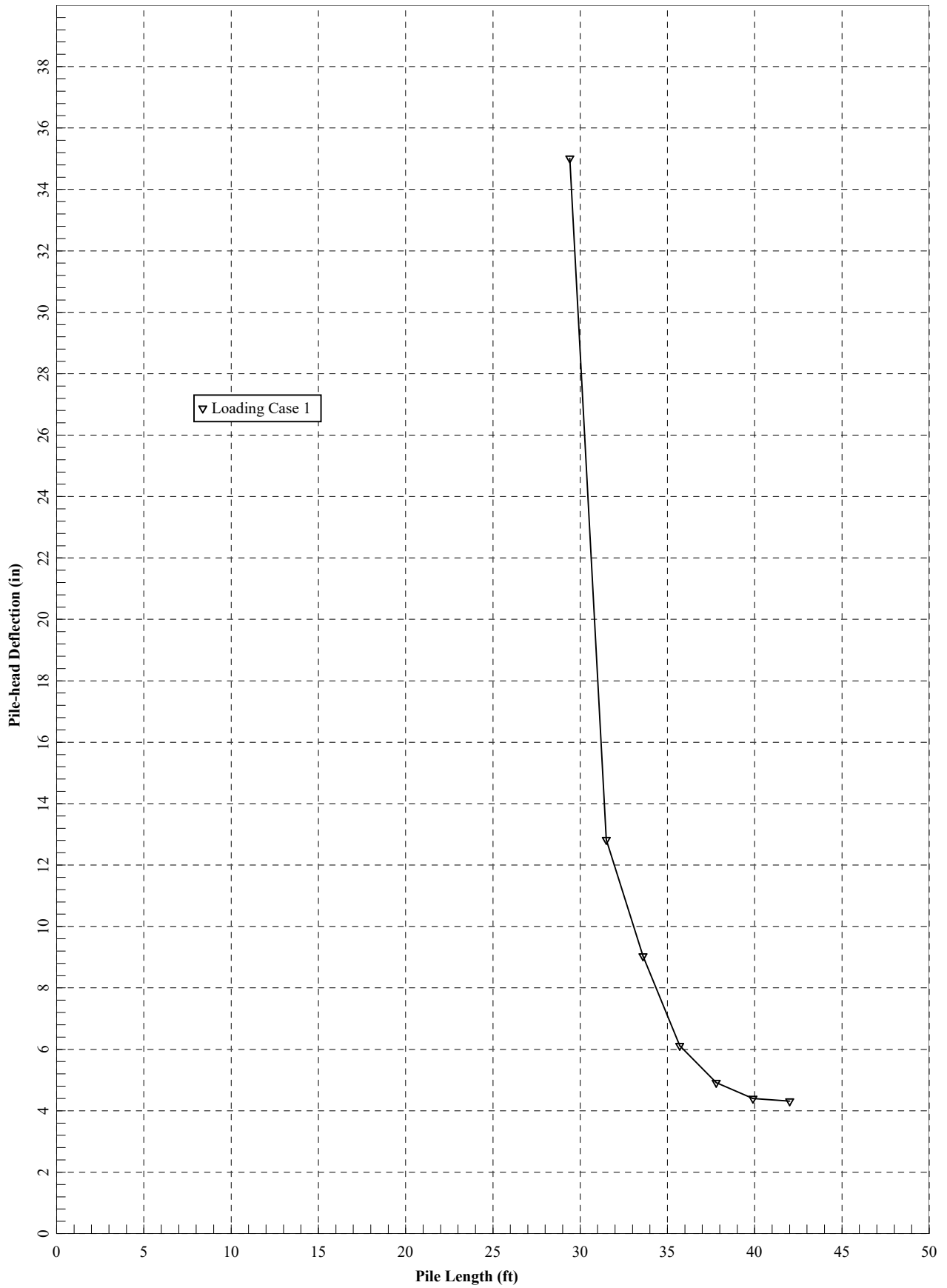
Load Case No.	Load Type 1	Load Type 2	Pile-head Load 1	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	M, in-lb	0.00	0.00	0.00	4.3106	-0.01554	-89221.	9113188.

Maximum pile-head deflection = 4.3105785322 inches
Maximum pile-head rotation = -0.0155426081 radians = -0.890526 deg.

The analysis ended normally.



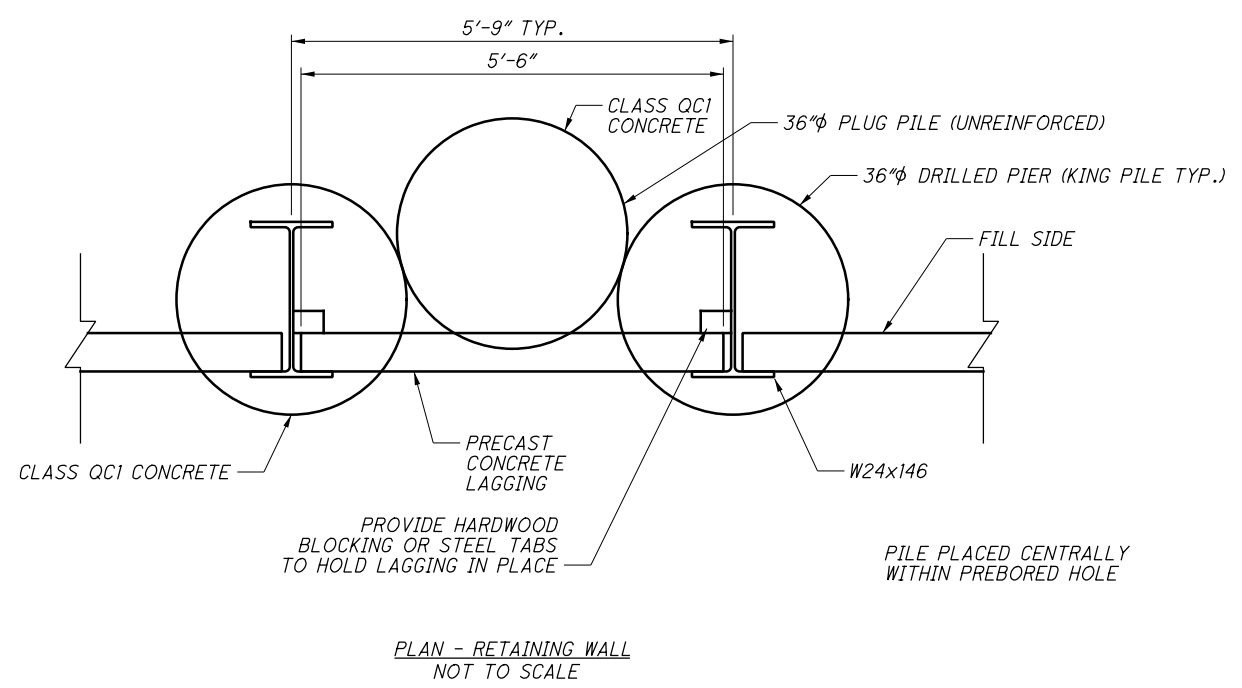
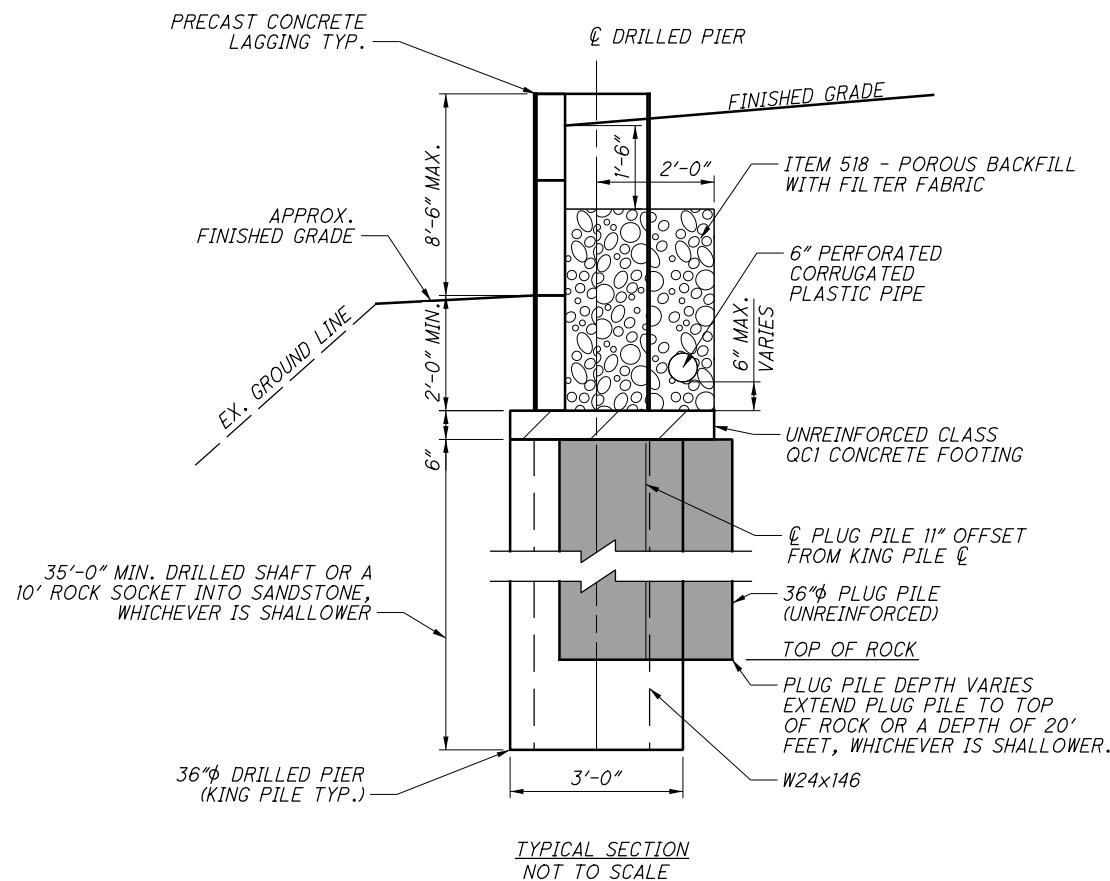




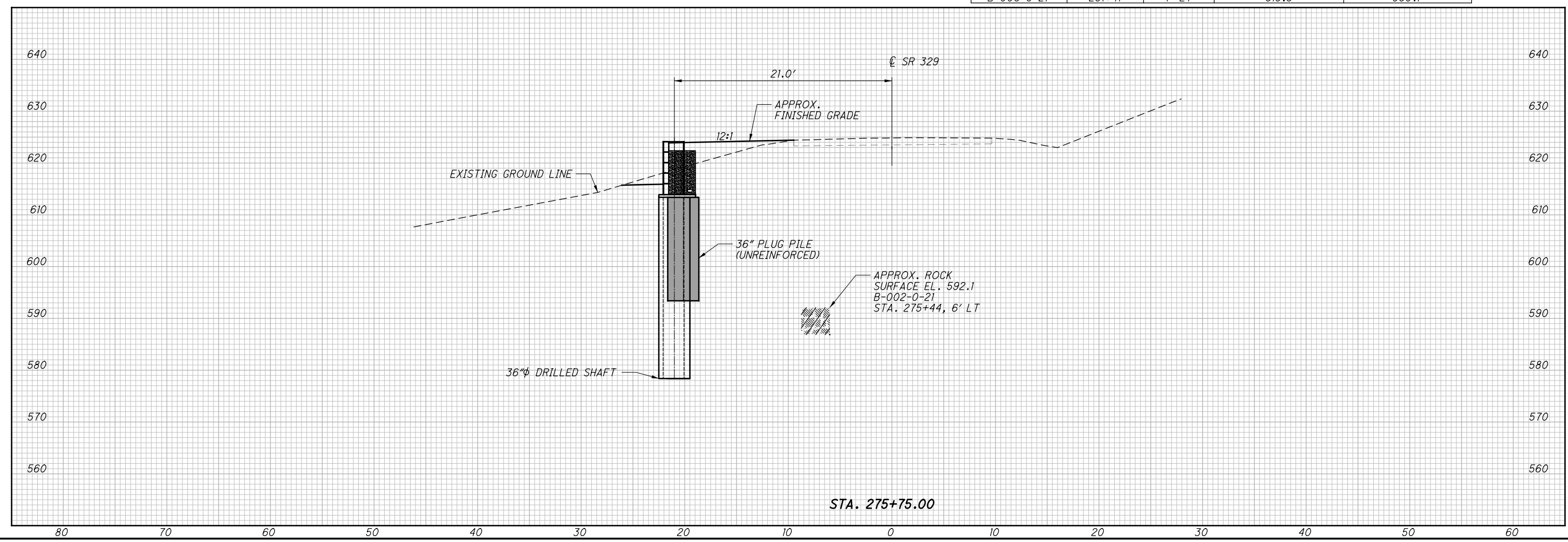
42 feet pile length - 8.5 feet cantilever = 33.5 feet
Use minimum drilled shaft length of 35.0 feet.



Soldier Pile Lagging Wall Detail



GEOTECHNICAL EXPLORATION	STATION	OFFSET	APPROXIMATE SURFACE ELEVATION	APPROXIMATE ROCK SURFACE ELEVATION
B-001-0-21	273+95	7' LT	618.7	591.2
B-002-0-21	275+44	6' LT	623.9	592.1
B-003-0-21	276+93	6' LT	625.3	606.8
B-004-0-21	278+43	6' LT	623.3	587.3
B-005-0-21	279+91	6' LT	621.4	564.9
B-005-1-21	280+60	5' LT	609.6	557.6
B-006-0-21	281+41	7' LT	618.6	560.1

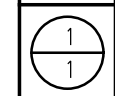


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**SOLDIER PILE AND LAGGING WALL DETAILS
CRITICAL SECTION STA. 275+75**

ATH-329-5.26





**Soil Strength Parameter Determination
(Earthwork Solution)**

Sta. 278+00 to Sta. 284+50

SOIL STRENGTH PARAMETER DETERMINATION
(Earth Solution)

Layer	Undrained Shear Strength (Su) (psf)					Dry Unit Weight (pcf)		Moist Unit Wt. (pcf)		Adopted Short Term Parameters	Long-Term Strength Values				Adopted Long Term Strength Parameters (Back-Calculated from SlopeW)
	PPR	N-values		Tested Values	Correlation	Tested	Correlation	Tested	N ₆₀ Value		ODOT GB-7 Correlations		Cohesion (psf)	phi (deg)	
		Sowers	T and P								Cohesion (psf)	phi (deg)			
Layer 1 MED STIFF TO STIFF EMBANKMENT	Max	2500	3500	1862		110		125		$S_u = 800$ psf $\Phi = 0$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 120$ pcf	Max	14	143	31	$c' = 75$ psf $\Phi' = 19$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 120$ pcf
	Min	1500	1050	798		95		110			Min	6	75	21	
	Average	1750	2159	1214		101		120			Average	10	106	24	
	Std Dev	378	828	359		5		6			Std Dev	3	22	4	
	Avg + Std	2128	2987	1572		105		125			Avg + Std	13	128	27	
	Avg - Std	1372	1331	855		96		114			Avg - Std	7	83	20	
Layer 2 STIFF TO VERY STIFF COHESIVE	Max	3500	4000	4000	1027	130	106	140	129	$S_u = 1000$ psf $\Phi = 0$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 130$ pcf	Max	35	200	27	$c' = 80$ psf $\Phi' = 21$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 130$ pcf
	Min	500	1750	931	1027	95	106	120	129		Min	7	88	22	
	Average	1533	3256	2315	1027	118	106	133	129		Average	18	153	24	
	Std Dev	754	758	872		8		6			Std Dev	7	28	1	
	Avg + Std	2287	4014	3187		125		138			Avg + Std	25	181	25	
	Avg - Std	780	2497	1443		110		127			Avg - Std	11	125	23	
Layer 2b SOFT TO MEDIUM STIFF COHESIVE	Max	1000	3250	1729	305	120	107	135	131	$S_u = 500$ psf $\Phi = 0$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 130$ pcf	Max	13	136	23	$c' = 40$ psf $\Phi' = 16$ deg $Y_{dry} = 105$ pcf $Y_{moist} = 130$ pcf
	Min	250	525	399	305	95	107	115	131		Min	3	38	19	
	Average	550	1258	839	305	103	107	122	131		Average	6	74	21	
	Std Dev	258	680	465		8		6			Std Dev	3	34	1	
	Avg + Std	808	1938	1304		111		128			Avg + Std	10	108	22	
	Avg - Std	292	577	374		94		116			Avg - Std	3	40	19	
Layer 3 GRANULAR SOIL	Max	N/A	N/A	N/A		115		140		$S_u = 0$ psf $\Phi = 25$ deg $Y_{dry} = 115$ pcf $Y_{moist} = 135$ pcf	Max	23	N/A	40	$c' = 0$ psf $\Phi' = 25$ deg $Y_{dry} = 115$ pcf $Y_{moist} = 135$ pcf
	Min	N/A	N/A	N/A		110		130			Min	9	N/A	25	
	Average	N/A	N/A	N/A		114		136			Average	15	N/A	31	
	Std Dev	N/A	N/A	N/A		2		3			Std Dev	4	N/A	5	
	Avg + Std	N/A	N/A	N/A		116		139			Avg + Std	20	N/A	36	
	Avg - Std	N/A	N/A	N/A		113		133			Avg - Std	11	N/A	26	
Layer 4 HARD COHESIVE	Max	N/A	4000	4000		130		140		$S_u = 4000$ psf $\Phi = 0$ deg $Y_{dry} = 130$ pcf $Y_{moist} = 140$ pcf	Max	82	250	28	$c' = 230$ psf $\Phi' = 28$ deg $Y_{dry} = 130$ pcf $Y_{moist} = 140$ pcf
	Min	N/A	4000	4000		130		140			Min	32	200	26	
	Average	N/A	4000	4000		130		140			Average	51	233	28	
	Std Dev	N/A	0	0		0		0			Std Dev	27	26	1	
	Avg + Std	N/A	4000	4000		130		140			Avg + Std	78	259	28	
	Avg - Std	N/A	4000	4000		130		140			Avg - Std	24	208	27	
Layer 5 MEDIUM STIFF TO STIFF COHESIVE	Max	2500	3500	1862	796	110	101	125	127	$S_u = 800$ psf $\Phi = 0$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 120$ pcf	Max	14	143	24	$c' = 60$ psf $\Phi' = 18$ deg $Y_{dry} = 100$ pcf $Y_{moist} = 120$ pcf
	Min	1000	1500	798	796	95	101	110	127		Min	6	75	21	
	Average	1500	2194	1167	796	99	101	119	127		Average	9	102	22	
	Std Dev	500	748	398		7		6			Std Dev	3	25	1	
	Avg + Std	2000	2942	1565		106		125			Avg + Std	12	126	23	
	Avg - Std	1000	1447	770		93		114			Avg - Std	6	77	21	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 1	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
													N-values												
													PPR	Sowers	T & P										
Max	14	67	2.5	46	27	25	33	50	57	27	30	31	Max	2500	3500	1862	143	31	12.0	620.3	110	125	0.423	2.72	0.787
Min	6	17	1.5	2	8	7	15	10	29	17	12	7	Min	1500	1050	798	75	21	3.0	611.3	95	110	0.171	2.65	0.503
Average	10	47	1.8	18	17	14	24	27	43	22	22	22	Average	1750	2159	1214	106	24	5.7	616.1	101	120	0.299	2.67	0.661
Std Dev	3	17	0.4	17	8	8	7	19	13	5	9	9	Std Dev	378	828	359	22	4	2.9	2.5	5	6	0.120	0.03	0.092
Avg + Std	13	65	2.1	35	25	23	30	46	57	26	30	30	Avg + Std	2128	2987	1572	128	27	8.6	618.6	105	125	0.420	2.70	0.752
Avg - Std	7	30	1.4	1	9	6	17	9	30	17	13	13	Avg - Std	1372	1331	855	83	20	2.8	613.5	96	114	0.179	2.64	0.569

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	% HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
																					N-values												
																					PPR	Sowers	T & P										
SR 329	623.3	B-004-0-21	2.5	-	4	SS-1	13	17	-	16	27	25	20	12	NP	NP	NP	7	A-3a	Granular	1	N/A		31	3.0	620.3	100	120	N/A	2.65	0.654		
SR 329	623.3	B-004-0-21	4	-	5.5	SS-2	14	39	1.5	12	11	7	26	44	52	24	22	A-7-6	Cohesive	1	1500	3500	1862	143	24	5.0	618.3	100	120	0.378	2.65	0.654	
SR 329	623.3	B-004-0-21	6	-	7.5	SS-3	12	56	1.5	-	-	-	-	-	-	-	28	A-7-6	Cohesive	1	1500	3000	1596	129	23	7.0	616.3	105	125		2.65	0.575	
SR 329	623.3	B-004-0-21	8.5	-	10	SS-4	7	61	1.5	-	-	-	-	-	-	-	28	A-7-6	Cohesive	1	1500	1750	931	88	22	9.0	614.3	95	120		2.65	0.741	
SR 329	623.3	B-004-0-21	11	-	12.5	SS-5	9	33	1.5	-	-	-	-	-	-	-	31	A-7-6	Cohesive	1	1500	2250	1197	107	22	12.0	611.3	110	125		2.65	0.503	
SR 329	621.4	B-005-0-21	2.5	-	4	SS-1	12	67	-	46	18	11	15	10	35	19	16	8	A-2-6	Granular	1	N/A		30	3.0	618.4	100	120	0.225	2.71	0.691		
SR 329	621.4	B-005-0-21	4	-	5.5	SS-2	9	33	2	2	8	7	33	50	57	27	30	28	A-7-6	Cohesive	1	2000	2250	1197	107	22	5.0	616.4	100	120	0.423	2.65	0.654
SR 329	621.4	B-005-0-21	5.5	-	7	SS-3	9	39	2.5	-	-	-	-	-	-	-	25	A-7-6	Cohesive	1	2500	2250	1197	107	22	6.0	615.4	105	125		2.65	0.575	
SR 329	618.6	B-006-0-21	2	-	3.5	SS-1	6	67	1.5	14	21	21	24	20	29	17	12	16	A-6a	Cohesive	1	1500	1050	798	75	21	3.0	615.6	95	110	0.171	2.72	0.787
SR 329	618.6	B-006-0-21	3.5	-	5	SS-2	7	61	2	-	-	-	-	-	-	-	25	A-6b	Cohesive	1	2000	1225	931	88	22	4.0	614.6	95	110		2.70	0.773	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 2													Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Strength Testing					
N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	PPR	N-values Sowers	T & P	per GB-7	(deg)	(ft.)	(ft.)	per GB-7	per GB-7	C _c	G _s	(e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)
Max	35	100	3.5	10	14	28	48	76	60	28	36	3500	4000	4000	200	27	54.0	611.6	130	140	0.450	2.72	0.741	106	129	1027	N/A	N/A	N/A	N/A
Min	7	0	0.5	0	1	2	20	31	30	17	14	500	1750	931	88	22	7.0	564.6	95	120	0.180	2.65	0.296	106	129	1027	N/A	N/A	N/A	N/A
Average	18	83	1.5	3	6	12	34	45	43	21	22	1533	3256	2315	153	24	29.8	587.2	118	133	0.294	2.68	0.426	106	129	1027	N/A	N/A	N/A	N/A
Std Dev	7	24	0.8	3	4	8	7	12	9	3	5	754	758	872	28	1	12.4	12.4	8	6	0.078	0.03	0.091	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + Std	25	108	2.3	7	10	19	41	58	51	25	27	2287	4014	3187	181	25	42.1	599.6	125	138	0.371	2.71	0.517	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - Std	11	59	0.8	0	1	4	27	33	34	18	18	780	2497	1443	125	23	17.4	574.9	110	127	0.216	2.65	0.335	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	Layer 2													Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Strength Testing					
						N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	PPR	N-values Sowers	T & P	per GB-7	(deg)	(ft.)	(ft.)	per GB-7	per GB-7	C _c	G _s	(e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)
SR 329	623.3	B-004-0-21	21	22.5	SS-9	19	100	3	6	13	11	31	39	40	21	19	18	A-6b	Cohesive	2	3000	3325	2527	163	25	22.0	601.3	120	135	0.270	2.70	0.404				
SR 329	623.3	B-004-0-21	23.5	25	SS-10	13	78	2	-	-	-	-	-	-	-	21	A-6b	Cohesive	2	2000	2275	1729	136	23	24.0	599.3	115	130		2.70	0.465					
SR 329	623.3	B-004-0-21	26	27.5	SS-11	19	67	2.5	-	-	-	-	-	-	-	20	A-6b	Cohesive	2	2500	3325	2527	163	25	27.0	596.3	120	135		2.70	0.404					
SR 329	621.4	B-005-0-21	30	31.5	SS-19	32	33	-	-	-	-	-	-	-	-	15	A-6b	Cohesive	2	N/A	4000	4000	200	26	31.0	590.4	130	140		2.70	0.296					
SR 329	621.4	B-005-0-21	31.5	33	SS-20	35	67	-	10	14	14	28	34	37	19	18	20	A-6b	Cohesive	2	N/A	4000	4000	200	27	32.0	589.4	130	140	0.243	2.70	0.296				
SR 329	621.4	B-005-0-21	33	34.5	SS-21	32	61	-	-	-	-	-	-	-	-	23	A-6b	Cohesive	2	N/A	4000	4000	200	26	34.0	587.4	130	140		2.70	0.296					
SR 329	621.4	B-005-0-21	34.5	36	SS-22	17	100	-	-	-	-	-	-	-	-	23	A-6b	Cohesive	2	N/A	2975	2261	157	24	35.0	586.4	120	135		2.70	0.404					
SR 329	621.4	B-005-0-21	36	37.5	SS-23	30	100	1.5	5	7	11	34	43	44	23	21	23	A-7-6	Cohesive	2	1500	4000	3990	200	26	37.0	584.4	120	135	0.306	2.65	0.378				
SR 329	621.4	B-005-0-21	37.5	39	SS-24	25	100	1.5	-	-	-	-	-	-	-	24	A-7-6	Cohesive	2	1500	4000	3325	183	25	38.0	583.4	120	135		2.65	0.378					
SR 329	621.4	B-005-0-21	39	40.5	SS-25	16	100	1	-	-	-	-	-	-	-	26	A-6b	Cohesive	2	1000	2800	2128	153	24	40.0	581.4	120	135		2.70	0.404					
SR 329	621.4	B-005-0-21	40.5	42	SS-26	23	100	0.5	3	7	20	32	38	36	17	19	20	A-6b	Cohesive	2	500	4000	3059	177	25	41.0	580.4	125	140	0.234	2.70	0.348				
SR 329	621.4	B-005-0-21	42	43.5	SS-27	13	100	0.5	-	-	-	-	-	-	-	21	A-6b	Cohesive	2	500	2275	1729	136	23	43.0	578.4	120	135		2.70	0.404					
SR 329	621.4	B-005-0-21	43.5	45	SS-28	14	100	0.5	-	-	-	-	-	-	-	23	A-6b	Cohesive	2	500	2450	1862	143	24	44.0	577.4	120	135		2.70	0.404					
SR 329	609.6	B-005-1-21	11	12.5	SS-5	16	56	1.5	8	6	5	30	51	54	23	31	23	A-7-6	Cohesive	2	1500	4000	2128	153	24	12.0	597.6	115	130	0.396	2.65	0.438				
SR 329	609.6	B-005-1-21	13.5	15	SS-6	13	67	1.5	-	-	-	-	-	-	-	21	A-7-6	Cohesive	2	1500	3250	1729	136	23	14.0	595.6	110	125		2.65	0.503					
SR 329	609.6	B-005-1-21	16	17.5	SS-7	14	78	2	-	-	-	-	-	-	-	19	A-7-6	Cohesive	2	2000	3500	1862	143	24	17.0	592.6	110	125		2.65	0.503					
SR 329	609.6	B-005-1-21	18.5	20	SS-8	19	78	3.5	-	-	-	-	-	-	-	17	A-7-6	Cohesive	2	3500	4000	2527	163	25	19.0	590.6	115	130		2.65	0.438					
SR 329	609.6	B-005-1-21	23.5	25	SS-10	9	67	0.5	0	2	2	20	76	49	23	26	35	A-7-6	Cohesive	2	500	2250	1197	107	22	24.0	585.6	115	130	0.351	2.65	0.438				
SR 329	609.6	B-005-1-21	26	27.5	SS-11	27	78	-	-	-	-	-	-	-	-	14	A-7-6	Cohesive	2	N/A	4000	3591	190	26	27.0	582.6	120	135		2.65	0.378					
SR 329	609.6	B-005-1-21	28.5	30	SS-12	19	100	2.5	1	2	7	48	42	49	25	24	30	A-7-6	Cohesive	2	2500	4000	2527	163	25	29.0	580.6	120	135	0.351	2.65	0.378				
SR 329	609.6	B-005-1-21	31	32.5	SS-13	14	100	2	-	-	-	-	-	-	-	23	A-7-6	Cohesive	2	2000	3500	1862	143	24	32.0	577.6	115	130		2.65	0.438					
SR 329	609.6	B-005-1-21	33.5	35.5	ST-14	ST	100	2	0	1	22	44	33	31	18	13	21	A-6a	Cohesive	2	2000	N/A	N/A	143	24	35.0	574.6	115	130	0.189	2.72	0.438	106.1	129.1	1027	
SR 329	609.6	B-005-1-21	38.5	40	SS-15	10	100	1.5	-	-	-	-	-	-	-	23	A-6a	Cohesive	2	1500	1750	1330	114	23	39.0	570.6	115	130		2.72	0.476					
SR 329	609.6	B-005-1-21	43.5	45	SS-16	27	100	1.5	-	-	-	-	-	-	-	19	A-6a	Cohesive	2	1500	4000	3591	190	26	44.0	565.6	125	140		2.72	0.358					
SR 329	618.6	B-006-0-21	6	7.5	SS-3	10	78	1	1	4	4	31	60	60	28	32	30	A-7-6	Cohesive	2	1000	2500	1330	114	23	7.0	611.6	105	125	0.450	2.65	0.575				
SR 329	618.6	B-006-0-21	8.5	10	SS-4	13	100	1.5	-	-	-	-	-	-	-	21	A-7-6	Cohesive	2	1500	3250	1729	136	23	9.0	609.6	105	125		2.65	0.575					
SR 329	618.6	B-006-0-21	11	12.5	SS-5	13	100	2	-	-	-	-	-	-	-	20	A-7-6	Cohesive	2	2000	3250	1729	136	23	12.0	606.6	110	125		2.65	0.503					
SR 329	618.6	B-006-0-21	13.5	15	SS-6	14	56	2	-	-	-	-	-	-	-	19	A-7-6	Cohesive	2	2000	3500	1862	143	24	14.0	604.6	110	125		2.65	0.503					
SR 329	618.6	B-006-0-21	16	17.5	SS-7	10	39	2	7	9	8	34	42	42	21	21	20	A-7-6	Cohesive	2	2000	2500	1330	114	23	17.0	601.6	110	125	0.288	2.65	0.503				
SR 329	618.6	B-006-0-21	18.5	20	SS-8	7	0	-	-	-	-	-	-	-	-	23	A-7-6	Cohesive	2	N/A	1750	931	88	22	19.0	599.6	95	120		2.65	0.7					

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 2b														Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Strength Testing					
N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	N-values			per GB-7	(deg)		per GB-7	per GB-7	C _c	G _s	Ratio (e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)		
												PPR	Sowers	T & P																	
Max	13	100	1.0	9	15	37	37	70	49	24	25	36	1000	3250	1729	136	23	49.0	608.4	120	135	0.351	2.72	0.773	107	131	305	N/A	N/A	N/A	N/A
Min	3	33	0.3	0	0	1	22	24	26	16	10	19	250	525	399	38	19	13.0	569.6	95	115	0.144	2.65	0.414	107	131	305	N/A	N/A	N/A	N/A
Average	6	90	0.6	2	6	21	28	43	38	20	18	29	550	1258	839	74	21	24.9	596.1	103	122	0.252	2.68	0.633	107	131	305	N/A	N/A	N/A	N/A
Std Dev	3	21	0.3	4	8	18	7	21	11	4	7	6	258	680	465	34	1	11.1	12.1	8	6	0.095	0.03	0.122	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + Std	10	111	0.8	6	14	39	35	64	49	24	25	35	808	1938	1304	108	22	36.1	608.2	111	128	0.347	2.71	0.755	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - Std	3	69	0.3	-2	-2	3	22	21	27	16	11	23	292	577	374	40	19	13.8	584.0	94	116	0.157	2.64	0.511	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)
																					PPR	Sowers	T & P	per GB-7	(deg)		per GB-7	per GB-7	per GB-7	G _s	Ratio (e)								
SR 329	621.4	B-005-0-21	12	-	SS-7	10	100	-	1	15	30	22	32	38	20	18	24	A-6b	Cohesive	2b	N/A	1750	1330	114	23	13.0	608.4	110	125	0.252	2.70	0.532							
SR 329	621.4	B-005-0-21	13.5	-	SS-8	6	100	-	-	-	-	-	-	-	-	-	29	A-6b	Cohesive	2b	N/A	1050	798	75	21	14.0	607.4	95	120		2.70	0.773							
SR 329	621.4	B-005-0-21	15	-	SS-9	3	100	-	-	-	-	-	-	-	-	-	29	A-6b	Cohesive	2b	N/A	525	399	38	19	16.0	605.4	95	115		2.70	0.773							
SR 329	621.4	B-005-0-21	16.5	-	SS-10	3	100	0.5	-	-	-	-	-	-	-	-	34	A-7-6	Cohesive	2b	500	750	399	38	19	17.0	604.4	95	115		2.65	0.741							
SR 329	621.4	B-005-0-21	18	-	SS-11	4	33	0.5	-	-	-	-	-	-	-	-	36	A-7-6	Cohesive	2b	500	1000	532	50	20	19.0	602.4	95	115		2.65	0.741							
SR 329	621.4	B-005-0-21	19.5	-	SS-12	4	100	0.5	0	0	2	37	61	49	24	25	35	A-7-6	Cohesive	2b	500	1000	532	50	20	20.0	601.4	95	115	0.351	2.65	0.741							
SR 329	621.4	B-005-0-21	21	-	SS-13	6	100	0.5	-	-	-	-	-	-	-	-	32	A-7-6	Cohesive	2b	500	1500	798	75	21	22.0	599.4	105	125		2.65	0.575							
SR 329	621.4	B-005-0-21	22.5	-	SS-14	6	100	-	0	15	37	22	26	29	16	13	25	A-6a	Cohesive	2b	N/A	1050	798	75	21	23.0	598.4	105	125	0.171	2.72	0.616							
SR 329	621.4	B-005-0-21	24	-	SS-15	4	100	0.5	-	-	-	-	-	-	-	-	29	A-7-6	Cohesive	2b	500	1000	532	50	20	25.0	596.4	100	120		2.65	0.654							
SR 329	621.4	B-005-0-21	25.5	-	SS-16	6	100	0.25	0	0	1	29	70	48	24	35	35	A-7-6	Cohesive	2b	250	1500	798	75	21	26.0	595.4	105	125	0.342	2.65	0.575							
SR 329	621.4	B-005-0-21	27	-	SS-17	4	67	0.25	-	-	-	-	-	-	-	-	33	A-7-6	Cohesive	2b	250	1000	532	50	20	28.0	593.4	100	120		2.65	0.654							
SR 329	621.4	B-005-0-21	28.5	-	SS-18	13	61	0.5	-	-	-	-	-	-	-	-	26	A-7-6	Cohesive	2b	500	3250	1729	136	23	29.0	592.4	115	130		2.65	0.438							
SR 329	618.6	B-006-0-21	46.5	-	ST-19	ST	100	1	9	1	34	32	24	26	16	10	19	A-4a	Cohesive	2b	1000	N/A	N/A	N/A	48.0	570.6			0.144	2.72		107.1	131.2	304.5					
SR 329	618.6	B-006-0-21	48.5	-	SS-20	13	100	1	-	-	-	-	-	-	-	-	20	A-4a	Cohesive	2b	1000	975	1729	136	23	49.0	569.6	120	135		2.72	0.414							

Layer 3

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
													N-values												
													PPR	Sowers	T & P										
Max	23	100	N/A	16	37	64	31	20	N/A	N/A	N/A	24	Max	N/A	N/A	N/A	N/A	40	57.0	596.6	115	140	N/A	2.72	0.543
Min	9	67	N/A	0	1	30	14	5	N/A	N/A	N/A	12	Min	N/A	N/A	N/A	N/A	25	22.0	561.6	110	130	N/A	2.65	0.438
Average	15	97	N/A	5	21	42	21	12	N/A	N/A	N/A	19	Average	N/A	N/A	N/A	N/A	31	40.4	578.7	114	136	N/A	2.67	0.458
Std Dev	4	10	N/A	6	15	13	6	5	N/A	N/A	N/A	4	Std Dev	N/A	N/A	N/A	N/A	5	14.5	12.5	2	3	N/A	0.03	0.036
Avg + Std	20	107	N/A	11	36	55	27	17	N/A	N/A	N/A	23	Avg + Std	N/A	N/A	N/A	N/A	36	54.9	591.2	116	139	N/A	2.70	0.494
Avg - Std	11	87	N/A	-2	6	29	15	7	N/A	N/A	N/A	15	Avg - Std	N/A	N/A	N/A	N/A	26	25.9	566.1	113	133	N/A	2.64	0.422

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)
																					N-values											
																					PPR	Sowers	T & P									
SR 329	621.4	B-005-0-21	46	-	SS-29	9	100	-	-	-	-	-	-	-	-	NP	21	A-4a	NP SILT	3	N/A	25	47.0	574.4	110	130		2.72	0.543			
SR 329	621.4	B-005-0-21	48.5	-	SS-30	14	100	-	-	-	-	-	-	-	NP	21	A-4a	NP SILT	3	N/A	26	49.0	572.4	115	140		2.72	0.476				
SR 329	621.4	B-005-0-21	51	-	SS-31	12	100	-	0	1	48	31	20	NP	NP	NP	21	A-4a	NP SILT	3	N/A	25	52.0	569.4	115	140	N/A	2.72	0.476			
SR 329	621.4	B-005-0-21	53.5	-	SS-32	Refusal	100	-	0	5	64	22	9	NP	NP	NP	16	A-3a	Granular	3	N/A	40	54.0	567.4			N/A	2.65				
SR 329	621.4	B-005-0-21	56	-	SS-33	Refusal	100	-	-	-	-	-	-	-	NP	17	A-3a	Granular	3	N/A	40	56.0	565.4			N/A	2.65					
SR 329	609.6	B-005-1-21	21	-	SS-9	20	67	-	6	37	38	14	5	NP	NP	NP	22	A-3a	Granular	3	N/A	32	22.0	587.6	115	135	N/A	2.65	0.438			
SR 329	618.6	B-006-0-21	21	-	SS-9	19	100	-	2	29	40	16	13	NP	NP	NP	12	A-3a	Granular	3	N/A	32	22.0	596.6	115	135	N/A	2.65	0.438			
SR 329	618.6	B-006-0-21	23.5	-	SS-10	13	100	-	-	-	-	-	-	-	-	24	A-3a	Granular	3	N/A	31	24.0	594.6	115	135	N/A	2.65	0.438				
SR 329	618.6	B-006-0-21	28.5	-	SS-12	14	100	-	-	-	-	-	-	-	-	23	A-3a	Granular	3	N/A	31	29.0	589.6	115	135		2.65	0.438				
SR 329	618.6	B-006-0-21	31	-	SS-13	13	100	-	3	33	30	22	12	NP	NP	NP	21	A-3a	Granular	3	N/A	31	32.0	586.6	115	135	N/A	2.65	0.438			
SR 329	618.6	B-006-0-21	56	-	SS-23	23	100	-	16	19	30	22	13	NP	NP	NP	14	A-3a	Granular	3	N/A	33	57.0	561.6	115	140	N/A	2.65	0.438			

Layer 4													Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	PPR	N-values Sowers	T & P											
Max	82	100	N/A	15	9	12	55	40	37	22	15	19	Max	N/A	4000	4000	250	28	49.0	594.3	130	140	0.243	2.72	0.306
Min	32	67	N/A	0	1	3	32	37	34	19	12	13	Min	N/A	4000	4000	200	26	29.0	560.6	130	140	0.216	2.72	0.306
Average	51	95	N/A	5	6	8	43	38	35	21	14	16	Average	N/A	4000	4000	233	28	36.7	582.7	130	140	0.225	2.72	0.306
Std Dev	27	13	N/A	8	4	5	12	2	2	2	2	2	Std Dev	N/A	0	0	26	1	7.0	12.3	0	0	0.016	0.00	0.000
Avg + Std	78	108	N/A	14	10	13	54	40	37	23	16	18	Avg + Std	N/A	4000	4000	259	28	43.7	595.0	130	140	0.241	2.72	0.306
Avg - Std	24	81	N/A	-3	2	3	31	37	33	19	12	14	Avg - Std	N/A	4000	4000	208	27	29.7	570.5	130	140	0.209	2.72	0.306

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf) per GB-7	phi (deg)	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf) per GB-7	Correlated Moist Unit Wt. (pcf) per GB-7	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	
																					PPR	N-values Sowers	T & P										
SR 329	623.3	B-004-0-21	28.5	-	30	SS-12	39	67	-	-	-	-	-	-	-	-	18	A-6a	Cohesive	4	N/A	4000	4000	200	28	29.0	594.3	130	140	0.243	2.72	0.306	
SR 329	623.3	B-004-0-21	31	-	32.42	SS-13	Refusal	100	-	0	9	12	41	38	37	22	15	17	A-6a	Cohesive	4	N/A	N/A	N/A	250	28	32.0	591.3			0.216	2.72	
SR 329	623.3	B-004-0-21	33.5	-	34.33	SS-14	Refusal	100	-	-	-	-	-	-	-	-	15	A-6a	Cohesive	4	N/A	N/A	N/A	250	28	34.0	589.3			0.216	2.72		
SR 329	609.6	B-005-1-21	48.5	-	50	SS-17	Refusal	100	-	1	1	3	55	40	34	22	12	13	A-6a	Cohesive	4	N/A	N/A	N/A	250	28	49.0	560.6			0.216	2.72	
SR 329	618.6	B-006-0-21	36	-	37.5	SS-15	82	100	-	15	7	9	32	37	34	19	15	16	A-6a	Cohesive	4	N/A	4000	4000	250	28	37.0	581.6	130	140	0.216	2.72	0.306
SR 329	618.6	B-006-0-21	38.5	-	40	SS-16	32	100	-	-	-	-	-	-	-	-	19	A-6a	Cohesive	4	N/A	4000	4000	200	26	39.0	579.6	130	140	0.216	2.72	0.306	

Values for Soil Strength Correlation	
Reference	Value
HI PI (Sowers)	0.25
MD PI (Sowers)	0.175
LO PI (Sowers)	0.075
T&P	0.133

Layer 5														Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Strength Testing					
N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	N-values			per GB-7	(deg)		per GB-7	per GB-7	C _c	G _s	Ratio (e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)		
												PPR	Sowers	T & P																	
Max	14	100	2.5	2	6	7	36	60	58	26	29	Max	2500	3500	1862	143	24	19.0	613.4	110	125	0.432	2.65	0.741	101	127	796	N/A	N/A	N/A	N/A
Min	6	0	1.0	1	4	5	28	50	49	24	20	Min	1000	1500	798	75	21	2.0	600.6	95	110	0.351	2.65	0.503	101	127	796	N/A	N/A	N/A	N/A
Average	9	71	1.5	1	5	6	33	54	52	25	27	Average	1500	2194	1167	102	22	10.1	607.1	99	119	0.381	2.65	0.669	101	127	796	N/A	N/A	N/A	N/A
Std Dev	3	28	0.5	1	1	1	4	5	5	1	4	Std Dev	500	748	398	25	1	5.4	4.1	7	6	0.044	0.00	0.109	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg + Std	12	99	2.0	2	6	7	37	59	57	26	31	Avg + Std	2000	2942	1565	126	23	15.5	611.2	106	125	0.425	2.65	0.778	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg - Std	6	43	1.0	1	4	5	29	49	47	24	23	Avg - Std	1000	1447	770	77	21	4.7	603.0	93	114	0.337	2.65	0.561	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Alignment	Surface Elevation	Exploration ID	From	To	Sample ID	N ₆₀	% Rec	HP	% Gr	% CS	% FS	% Silt	% Clay	LL	PL	PI	% WC	ODOT Class.	Soil Type	Layer	Short-Term Cohesion (psf)			Correlated LT Cohesion (psf)	phi	Midpoint Sample Depth (ft.)	Midpoint Sample Elevation (ft.)	Correlated Dry Unit Wt. (pcf)	Correlated Moist Unit Wt. (pcf)	Correlated C _c	Assumed Specific Gravity (G _s)	Computed Void Ratio (e)	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)	Qu/UU Su (psf)	CU Eff. c (psf)	CU Eff. phi (deg)	CU Total c (psf)	CU Total phi (deg)
																					PPR	Sowers	T & P	per GB-7	(deg)		per GB-7	per GB-7	per GB-7	per GB-7	C _c	G _s	Ratio (e)						
SR 329	623.3	B-004-0-21	13.5	-	15	SS-6	7	67	1	2	4	6	35	53	49	25	24	28	A-7-6	Cohesive	5	1000	1750	931	88	22	14.0	609.3	95	120	0.351	2.65	0.741						
SR 329	623.3	B-004-0-21	16	-	17.5	SS-7	7	78	1.5	-	-	-	-	-	-	-	29	A-7-6	Cohesive	5	1500	1750	931	88	22	17.0	606.3	95	120		2.65	0.741							
SR 329	623.3	B-004-0-21	18.5	-	20	SS-8	14	100	2.5	-	-	-	-	-	-	-	20	A-7-6	Cohesive	5	2500	3500	1862	143	24	19.0	604.3	110	125		2.65	0.503							
SR 329	621.4	B-005-0-21	7	-	9	ST-4	ST	75	1.5	1	6	5	28	60	58	26	32	26	A-7-6	Cohesive	5	1500	N/A	N/A			8.0	613.4		0.432	2.65		101.1	126.8	795.5				
SR 329	621.4	B-005-0-21	9	-	10.5	SS-5	7	78	1	-	-	-	-	-	-	-	25	A-7-6	Cohesive	5	1000	1750	931	88	22	10.0	611.4	95	120		2.65	0.741							
SR 329	621.4	B-005-0-21	10.5	-	12	SS-6	12	100	2	-	-	-	-	-	-	-	25	A-7-6	Cohesive	5	2000	3000	1596	129	23	11.0	610.4	110	125		2.65	0.503							
SR 329	609.6	B-005-1-21	1	-	2.5	SS-1	7	67	1.5	1	6	7	36	50	50	24	26	28	A-7-6	Cohesive	5	1500	1750	931	88	22	2.0	607.6	95	110	0.360	2.65	0.741						
SR 329	609.6	B-005-1-21	3.5	-	5	SS-2	6	0	-	-	-	-	-	-	-	-	-	-	A-7-6	Cohesive	5	N/A	1500	798	75	21	4.0	605.6	95	110		2.65	0.741						
SR 329	609.6	B-005-1-21	6	-	7.5	SS-3	7	78	1	-	-	-	-	-	-	-	24	A-7-6	Cohesive	5	1000	1750	931	88	22	7.0	602.6	95	120		2.65	0.741							
SR 329	609.6	B-005-1-21	8.5	-	10	SS-4	12	67	1.5	-	-	-	-	-	-	-	20	A-7-6	Cohesive	5	1500	3000	1596	129	23	9.0	600.6	105	125		2.65	0.575							

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EA\ST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: ATH-329-05.26	DRILLING FIRM / OPERATOR: CENTRAL STAR / TS	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 278+43, 6' LT.	EXPLORATION ID: B-004-0-21
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: HDR / PG	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: SR 329	
PID: 114589 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/26/19	ELEVATION: 623.3 (MSL) EOB: 62.7 ft.	PAGE: 1 OF 3
START: 3/9/21 END: 3/10/21	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 86.8	LAT / LONG: 39.336894, -81.886166	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (25") GRANULAR BASE (3")	623.3	1																
MEDIUM DENSE, GRAY TO BLACK, COARSE AND FINE SAND , SOME SILT, LITTLE GRAVEL, LITTLE CLAY, TRACE ASPHALT FRAGMENTS, DAMP	620.9	2																
MEDIUM STIFF TO STIFF, DARK BROWN, SOME GRAY, CLAY , SOME SILT, LITTLE SAND, LITTLE GRAVEL, DAMP	619.3	3	5															
		4	4	13	17	SS-1	-	16	27	25	20	12	NP	NP	NP	7	A-3a (0)	
		5	3	14	39	SS-2	1.50	12	11	7	26	44	52	24	28	22	A-7-6 (16)	
		6	3															
		7	4	12	56	SS-3	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		8																
		9	2	7	61	SS-4	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
		10																
		11	2															
		12	3	9	33	SS-5	1.50	-	-	-	-	-	-	-	-	31	A-7-6 (V)	
MEDIUM STIFF TO STIFF, RED-BROWN, CLAY , "AND" SILT, TRACE SAND, TRACE GRAVEL, MOIST	610.8	13																
		14	2	7	67	SS-6	1.00	2	4	6	35	53	49	25	24	28	A-7-6 (15)	
		15																
		16	2															
		17	2	7	78	SS-7	1.50	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		18																
		19	2															
		20	4	14	100	SS-8	2.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
STIFF TO VERY STIFF, RED-BROWN, MOTTLED YELLOW BROWN AND GRAY, SILTY CLAY , LITTLE SAND, TRACE GRAVEL, DAMP	603.3	21																
		22	4	19	100	SS-9	3.00	6	13	11	31	39	40	21	19	18	A-6b (11)	
		23																
		24	3	13	78	SS-10	2.00	-	-	-	-	-	-	-	-	21	A-6b (V)	
		25	4															
		26	5															
		27	5	19	67	SS-11	2.50	-	-	-	-	-	-	-	-	20	A-6b (V)	
		28																
HARD, YELLOW BROWN TO RED BROWN, SILT AND CLAY , SOME SAND, DAMP	595.8	29																
		30	4	39	67	SS-12	-	-	-	-	-	-	-	-	-	18	A-6a (V)	

1. M. Stiff to Stiff Fill

2. Stiff to V. Stiff to Cohesive

W 595.3

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN: _____		PROJECT: ATH-329-05.26		STATION / OFFSET: 278+43, 6' LT.		START: 3/9/21		END: 3/10/21		PG 3 OF 3		B-004-0-21									
MATERIAL DESCRIPTION AND NOTES				ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED		
											GR	CS	FS	SI	CL	LL	PL	PI					
				561.1																			
				560.6	EOB																		
<p>NOTES: NONE</p> <p>ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER</p>																							

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: ATH-329-05.26	DRILLING FIRM / OPERATOR: CENTRAL STAR / TS	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 279+91, 6' LT.	EXPLORATION ID: B-005-0-21
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: HDR / PG	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: SR 329	
PID: 114589 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/26/19	ELEVATION: 621.4 (MSL) EOB: 56.5 ft.	PAGE: 1 OF 2
START: 3/9/21 END: 3/9/21	SAMPLING METHOD: SPT / ST / NQ2	ENERGY RATIO (%): 86.8	LAT / LONG: 39.337270, -81.885972	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED		
								GR	CS	FS	SI	CL	LL	PL	PI					
ASPHALT (27")	621.4	1																		
MEDIUM DENSE, GRAY TO BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, SILT, AND CLAY, DAMP	619.2	2																		
STIFF TO VERY STIFF, DARK BROWN TO BROWN, CLAY, SOME SILT, LITTLE SAND, TRACE GRAVEL, MOIST 1. M. Stiff to Stiff Fill	617.4	3	6	4	12	67	SS-1	-	46	18	11	15	10	35	19	16	8	A-2-6 (1)		
		4	3	2	9	33	SS-2	2.00	2	8	7	33	50	57	27	30	28	A-7-6 (19)		
		5	2	4																
		6	2	3	9	39	SS-3	2.50	-	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
MEDIUM STIFF TO STIFF, RED-BROWN, CLAY, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP @ 7.7' - 8.2' : Qu = 1,591 psf 5. Medium Stiff to Stiff Cohesive	614.4	7	3																	
		8				75	ST-4	1.50	1	6	5	28	60	58	26	32	26	A-7-6 (20)		
		9	2																	
		10	3	2	7	78	SS-5	1.00	-	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
		11	2	3	12	100	SS-6	2.00	-	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
STIFF, BROWN TO YELLOW-BROWN, SILTY CLAY, "AND" SAND, TRACE GRAVEL, MOIST	609.9	12	2																	
		13	3	4	10	100	SS-7	-	1	15	30	22	32	38	20	18	24	A-6b (7)		
SOFT TO MEDIUM STIFF, BROWN TO YELLOW-BROWN, SILTY CLAY, "AND" SAND, TRACE GRAVEL, MOIST	606.4	14	2	2	6	100	SS-8	-	-	-	-	-	-	-	-	-	-	29	A-6b (V)	
		15	1	2																
SOFT TO MEDIUM STIFF, GRAY, CLAY, "AND" SILT, TRACE SAND, MOIST 2b. Soft to Medium Stiff Cohesive	600.9	16	1	1	3	100	SS-9	-	-	-	-	-	-	-	-	-	-	29	A-6b (V)	
		17	2	1	3	100	SS-10	0.50	-	-	-	-	-	-	-	-	-	34	A-7-6 (V)	
		18	2	1																
		19	2	2	4	33	SS-11	0.50	-	-	-	-	-	-	-	-	-	36	A-7-6 (V)	
		20	0	1	4	100	SS-12	0.50	0	0	2	37	61	49	24	25	35	A-7-6 (16)		
MEDIUM STIFF, GRAY, SILT AND CLAY, "AND" SAND, MOIST	598.9	21	1	1	6	100	SS-13	0.50	-	-	-	-	-	-	-	-	-	32	A-7-6 (V)	
		22	2	2																
SOFT TO MEDIUM STIFF, GRAY, CLAY, SOME SILT, TRACE SAND, MOIST	597.4	23	1	2	6	100	SS-14	-	0	15	37	22	26	29	16	13	25	A-6a (4)		
		24	2	2																
STIFF, GRAY, CLAY, SOME SILT, TRACE SAND, MOIST	592.9	25	2	1	4	100	SS-15	0.50	-	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		26	1	2	6	100	SS-16	0.25	0	0	1	29	70	48	24	24	35	A-7-6 (15)		
		27	2	2																
STIFF, GRAY, CLAY, SOME SILT, TRACE SAND, MOIST	591.4	28	1	1	4	67	SS-17	0.25	-	-	-	-	-	-	-	-	-	33	A-7-6 (V)	
		29	1	2	13	61	SS-18	0.50	-	-	-	-	-	-	-	-	-	26	A-7-6 (V)	

Combine as
2b. Soft to Medium Stiff Cohesive
In Slope W

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

MATERIAL DESCRIPTION AND NOTES	ELEV. 591.4	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
HARD, GRAY AND RED-BROWN, SILTY CLAY , SOME SAND, TRACE GRAVEL, MOIST	585.4	31	11 10 12	32	33	SS-19	-	-	-	-	-	-	-	-	-	15	A-6b (V)	
		32	6 7 17	35	67	SS-20	-	10	14	14	28	34	37	19	18	20	A-6b (9)	
		33	16 11 11	32	61	SS-21	-	-	-	-	-	-	-	-	-	23	A-6b (V)	
		34	3 5 7	17	100	SS-22	-	-	-	-	-	-	-	-	-	23	A-6b (V)	
		35	4 8 13	30	100	SS-23	1.50	5	7	11	34	43	44	23	21	23	A-7-6 (13)	
STIFF TO VERY STIFF, GRAY, SOME RED-BROWN, CLAY , SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	582.4	36	4 7 10	25	100	SS-24	1.50	-	-	-	-	-	-	-	24	A-7-6 (V)		
		37	4 4 7	16	100	SS-25	1.00	-	-	-	-	-	-	-	26	A-6b (V)		
STIFF TO VERY STIFF, GRAY, SOME RED-BROWN, SILTY CLAY , SOME SAND, TRACE GRAVEL, MOIST	576.4	38	5 7 9	23	100	SS-26	0.50	3	7	20	32	38	36	17	19	20	A-6b (11)	
		39	3 4 5	13	100	SS-27	0.50	-	-	-	-	-	-	-	-	21	A-6b (V)	
		40	2 5 5	14	100	SS-28	0.50	-	-	-	-	-	-	-	-	23	A-6b (V)	
		41	3 3 3	9	100	SS-29	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		42	4 5 5	14	100	SS-30	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
LOOSE TO MEDIUM DENSE, GRAY, SANDY SILT , LITTLE CLAY, WET	567.9	43	3 4 4	12	100	SS-31	-	0	1	48	31	20	NP	NP	NP	21	A-4a (3)	
		44	7 30 50/4"	-	100	SS-32	-	0	5	64	22	9	NP	NP	NP	16	A-3a (0)	
		45	50/3"	-	100	SS-33	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
VERY DENSE, LIGHT GRAY, COARSE AND FINE SAND , WET (SEVERELY WEATHERED SANDSTONE)	564.9	56																

2. Stiff to V. Stiff to Cohesive

3. Granular Soil

@ 56.5' : AUGER REFUSAL

EOB

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

MATERIAL DESCRIPTION AND NOTES	ELEV. 579.6	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
STIFF TO VERY STIFF, GRAY, SOME YELLOW-BROWN, CLAY , "AND" SILT, TRACE GRAVEL, TRACE SAND, MOIST (continued)	576.1	31	2															
		32	3	7	14	100	SS-13	2.00	-	-	-	-	-	-	-	-	23	A-7-6 (V)
STIFF TO VERY STIFF, GRAY, SILT AND CLAY , SOME SAND, MOIST @ 34.5' - 35.0' : Qu = 2,054 psf	576.1	34																
		35				100	ST-14	2.00	0	1	22	44	33	31	18	13	21	A-6a (9)
2. Stiff to Very Stiff Cohesive	561.1	39	2															
		40	3	4	10	100	SS-15	1.50	-	-	-	-	-	-	-	-	23	A-6a (V)
4. Hard Cohesive	561.1	44	4															
		45	8	11	27	100	SS-16	1.50	-	-	-	-	-	-	-	-	19	A-6a (V)
HARD, GRAY, SILT AND CLAY , TRACE GRAVEL, TRACE SAND, DAMP	561.1	49	9															
4. Hard Cohesive		50	12															
		51	50/6"		-	100	SS-17	-	1	1	3	55	40	34	22	12	13	A-6a (9)
CLAYSTONE , GRAY, SEVERELY TO HIGHLY WEATHERED, VERY WEAK.	557.6	52																
	557.6	52																
	556.5	53																
Claystone Bedrock		53	50/2"		-	100	SS-18	-	-	-	-	-	-	-	-	-	12	Rock (V)

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PROJECT: <u>ATH-329-05.26</u>	DRILLING FIRM / OPERATOR: <u>CENTRAL STAR / TS</u>	DRILL RIG: <u>DIEDRICH D-50</u>	STATION / OFFSET: <u>281+41, 7' LT.</u>	EXPLORATION ID: <u>B-006-0-21</u>
TYPE: <u>LANDSLIDE</u>	SAMPLING FIRM / LOGGER: <u>HDR / PG</u>	HAMMER: <u>DIEDRICH AUTOMATIC</u>	ALIGNMENT: <u>SR 329</u>	
PID: <u>114589</u> SFN: <u></u>	DRILLING METHOD: <u>3.25" HSA / NQ2</u>	CALIBRATION DATE: <u>11/26/19</u>	ELEVATION: <u>618.6 (MSL)</u> EOB: <u>68.8 ft.</u>	PAGE: <u>1 OF 3</u>
START: <u>3/8/21</u> END: <u>3/8/21</u>	SAMPLING METHOD: <u>SPT / ST</u>	ENERGY RATIO (%): <u>86.8</u>	LAT / LONG: <u>39.337659, -81.885811</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (21") AGGREGATE BASE (3")	618.6	1																
MEDIUM STIFF TO STIFF, DARK BROWN, SILT AND CLAY, "AND" SAND, LITTLE GRAVEL, DAMP 1. M. Stiff to Stiff Fill	616.6	2	3															
		3	2	6	67	SS-1	1.50	14	21	21	24	20	29	17	12	16	A-6a (2)	
		4	2	7	61	SS-2	2.00	-	-	-	-	-	-	-	-	25	A-6a (V)	
		5	3															
STIFF, BROWN TO RED-BROWN, CLAY, SOME SILT, LITTLE GRAVEL, TRACE SAND, MOIST 5. Medium Stiff to Stiff Cohesive	612.6	6	2															
		7	3	10	78	SS-3	1.00	1	4	4	31	60	60	28	32	30	A-7-6 (20)	
		8																
		9	3	13	100	SS-4	1.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		10	4	5														
		11	3	13	100	SS-5	2.00	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		12	4	5														
		13																
		14	4	14	56	SS-6	2.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		15	4	6														
MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, LITTLE SAND, DAMP w 600.1	602.6	16	2															
		17	3	10	39	SS-7	2.00	7	9	8	34	42	42	21	21	20	A-7-6 (13)	
		18	4															
		19	2	7	0	SS-8	-	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
		20	3	2														
MEDIUM DENSE, YELLOW-BROWN, COARSE AND FINE SAND, TRACE GRAVEL, LITTLE SILT, LITTLE CLAY, WET 3. Granular Soil	597.6	21	7	19	100	SS-9	-	2	29	40	16	13	NP	NP	NP	12	A-3a (0)	
		22	6	7														
		23																
		24	4	13	100	SS-10	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
		25	5	4														
STIFF TO VERY STIFF, GRAY AND BROWN, CLAY, LITTLE SAND, SOME SILT, MOIST 3. Granular Soil	592.6	26	3	17	100	SS-11	1.00	0	2	11	34	53	41	22	19	28	A-7-6 (12)	
		27	4	8														
		28																
MEDIUM DENSE, BROWN TO YELLOW-BROWN AND GRAY, COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE GRAVEL, WET 3. Granular Soil	590.6	29	4	14	100	SS-12	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
		30	5	5														


↑
3. Granular Soil
In Slope W
↓

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01D2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN:		PROJECT: ATH-329-05.26		STATION / OFFSET: 281+41, 7' LT.		START: 3/8/21		END: 3/8/21		PG 2 OF 3		B-006-0-21						
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
										GR	CS	FS	SI	CL	LL	PL	PI			
MEDIUM DENSE, BROWN TO YELLOW-BROWN AND GRAY, COARSE AND FINE SAND , SOME SILT, LITTLE CLAY, TRACE GRAVEL, WET (continued)			588.6	31	4															
MEDIUM STIFF TO STIFF, LIGHT GRAY AND RED-BROWN, SILT AND CLAY , LITTLE SAND, LITTLE GRAVEL, WET 2. Stiff to Very Stiff Cohesive			586.1	32	4	13	100	SS-13	-	3	33	30	22	12	NP	NP	NP	21	A-3a (0)	
HARD, LIGHT GRAY AND RED-BROWN, SILT AND CLAY , LITTLE SAND, LITTLE GRAVEL, DAMP 4. Hard Cohesive			582.6	33	4	14	100	SS-14	0.50	-	-	-	-	-	-	-	-	36	A-6a (V)	
STIFF TO VERY STIFF, GRAY, CLAY , "AND" SILT, LITTLE SAND, TRACE GRAVEL, MOIST 2. Stiff to Very Stiff Cohesive			578.6	34	6	14	100	SS-14	0.50	-	-	-	-	-	-	-	-	36	A-6a (V)	
SOFT TO MEDIUM STIFF, GRAY, SANDY SILT , SOME CLAY, TRACE GRAVEL, MOIST @ 46.9' - 47.4' : Qu = 609 psf 2b. Soft to Medium Stiff Cohesive			572.6	35	4	14	100	SS-14	0.50	-	-	-	-	-	-	-	-	36	A-6a (V)	
STIFF TO VERY STIFF, GRAY, SILT AND CLAY , SOME SAND, TRACE GRAVEL, MOIST 2. Stiff to Very Stiff Cohesive			567.6	36	9	82	100	SS-15	-	15	7	9	32	37	34	19	15	16	A-6a (9)	
MEDIUM DENSE, GRAY, SOME BROWN, COARSE AND FINE SAND , SOME SILT, LITTLE GRAVEL, LITTLE CLAY, WET 3. Granular Soil			563.6	37	6	32	100	SS-16	-	-	-	-	-	-	-	-	-	19	A-6a (V)	
CLAYSTONE, GRAY, SEVERELY WEATHERED, VERY WEAK. Claystone Bedrock			560.1	38	4	19	100	SS-17	1.00	1	2	12	40	45	41	20	21	25	A-7-6 (13)	
				39	6	16	100	SS-18	1.00	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
				40	3	13	100	SS-20	1.00	-	-	-	-	-	-	-	-	20	A-4a (V)	
				41	4	13	100	SS-20	1.00	-	-	-	-	-	-	-	-	20	A-4a (V)	
				42	3	12	100	SS-21	1.00	1	3	28	37	31	30	17	13	21	A-6a (8)	
				43	3	17	100	SS-22	1.50	-	-	-	-	-	-	-	-	20	A-6a (V)	
				44	3	17	100	SS-22	1.50	-	-	-	-	-	-	-	-	20	A-6a (V)	
				45	9	23	100	SS-23	-	16	19	30	22	13	NP	NP	NP	14	A-3a (0)	
				46	9	23	100	SS-23	-	16	19	30	22	13	NP	NP	NP	14	A-3a (0)	
				47	50/4"	-	100	SS-24	-	12	11	14	32	31	35	21	14	12	Rock (V)	

Combine as
2. Stiff to Very Stiff Cohesive
In Slope W

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/4/21 16:22 - C:\P\WORKING\EAST01\2010876\20210323_10-S_ATH-329-5.26_BORING LOGS.GPJ

PID: 114589		SFN: _____		PROJECT: ATH-329-05.26		STATION / OFFSET: 281+41, 7' LT.		START: 3/8/21		END: 3/8/21		PG 3 OF 3		B-006-0-21							
MATERIAL DESCRIPTION AND NOTES				ELEV. 556.4	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
											GR	CS	FS	SI	CL	LL	PL	PI			
CLAYSTONE, GRAY, SEVERELY WEATHERED, VERY WEAK. (continued)  @ 68.5': gray and red-brown				549.8	63 64 65 66 67 68	50/3"	-	100	SS-25	-	-	-	-	-	-	-	-	-	11	Rock (V)	
						EOB	50/4"	-	100	SS-26	-	-	-	-	-	-	-	-	-	-	
NOTES: NONE ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED 94 LB. BENTONITE POWDER; 25 LB. CEMENT; 50 GAL. WATER																					

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: ATH-329-5.26, Boring Location: B-005-0-21, ST-4, Depth: 7.7 - 8.2ft)

Tested Date: 3/22/2021

Specimen Properties

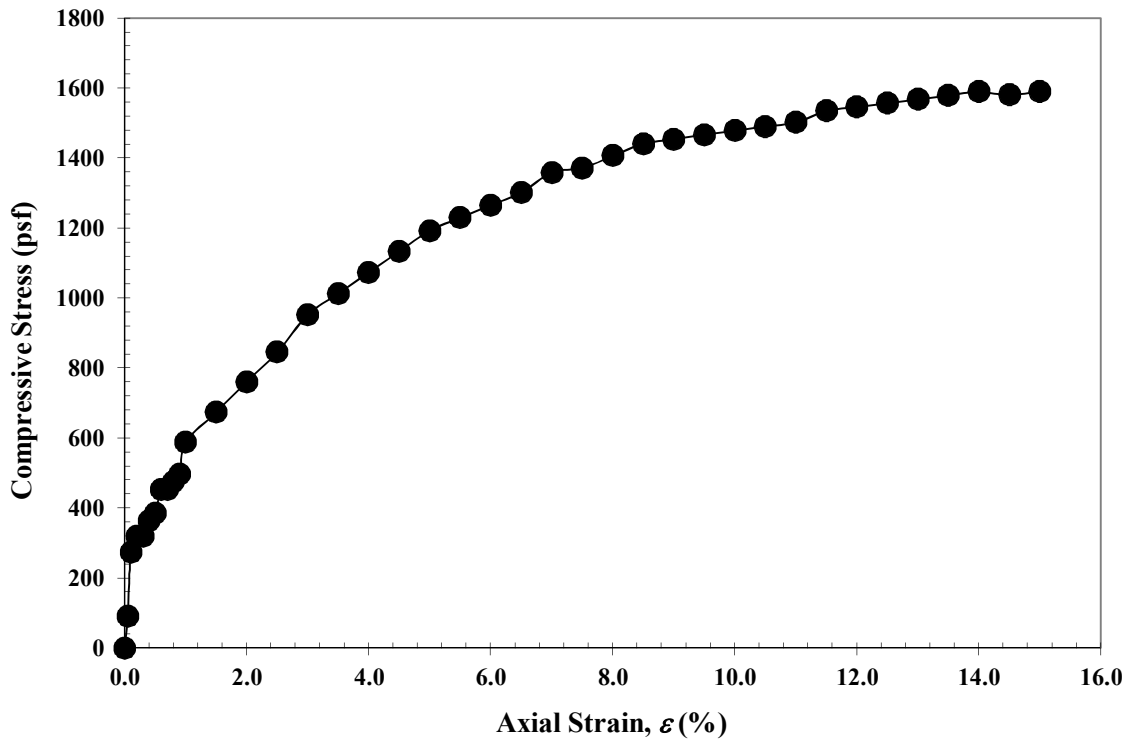
Average Dia., D_{avg} (in):	2.83
Average Height, H_{avg} (in):	5.74
Area, A (in ²):	6.31
Volume, V (in ³):	36.22
Wet Mass of Specimen (lb):	2.7
Moisture Content (%):	25.5
Dry Mass of Specimen (lb):	2.1
Wet Unit Weight, γ (lb/ft ³):	126.8
Dry Unit Weight, γ_d (lb/ft ³):	101.1

Final Specimen Figure



Results

Unconfined Compressive Strength (psf):	1591
Strain (%):	15.0



Notes: Specimen exceeded equipment strain limitations of 15.0%. Medium stiff, brown, CLAY, some silt, little sand, trace gravel, damp.

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: ATH-329-5.26, Boring Location: B-005-1-21, ST-14, Depth: 34.5 - 35.0ft)

Tested Date: 3/22/2021

Specimen Properties

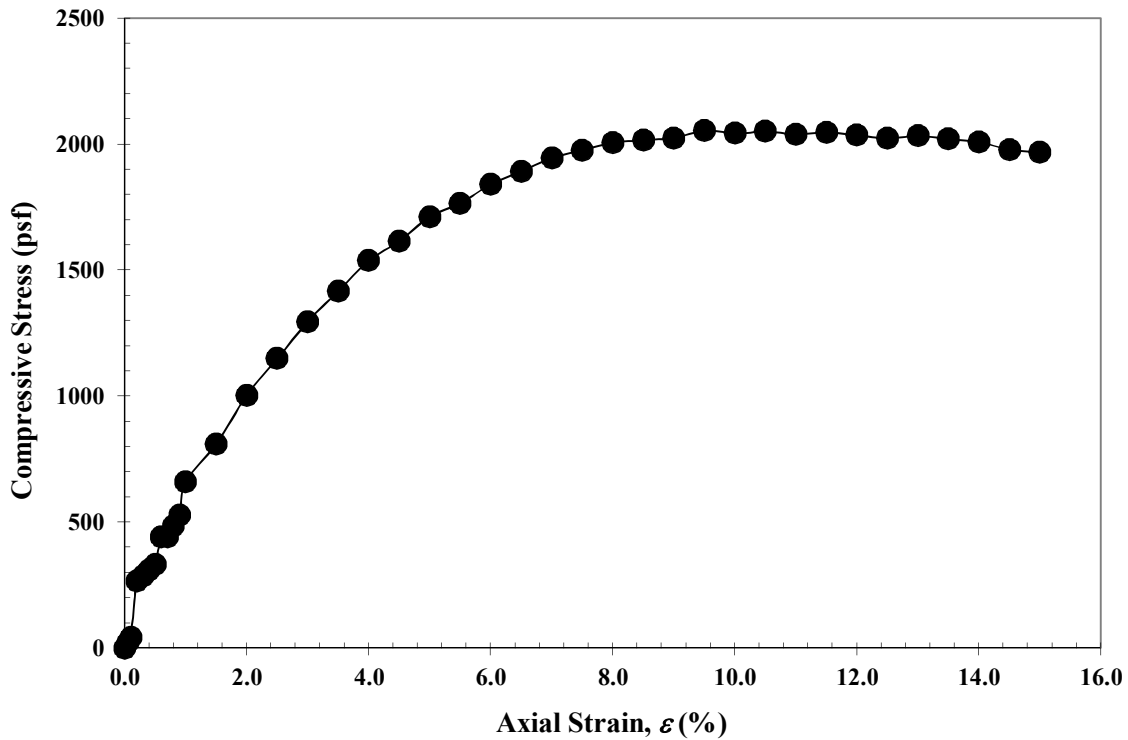
Average Dia., D_{avg} (in):	2.87
Average Height, H_{avg} (in):	5.73
Area, A (in ²):	6.47
Volume, V (in ³):	37.10
Wet Mass of Specimen (lb):	2.8
Moisture Content (%):	21.6
Dry Mass of Specimen (lb):	2.3
Wet Unit Weight, γ (lb/ft ³):	129.1
Dry Unit Weight, γ_d (lb/ft ³):	106.1

Final Specimen Figure



Results

Unconfined Compressive Strength (psf):	2054
Strain (%):	9.5



Notes: Stiff, gray, SILT AND CLAY, some sand, trace gravel, moist.

Unconfined Compressive Strength of Cohesive Soil (ASTM D2166)

(Project: ATH-329-5.26, Boring Location: B-006-0-21, ST-19, Depth: 46.9 - 47.4ft)

Tested Date: 3/22/2021

Specimen Properties

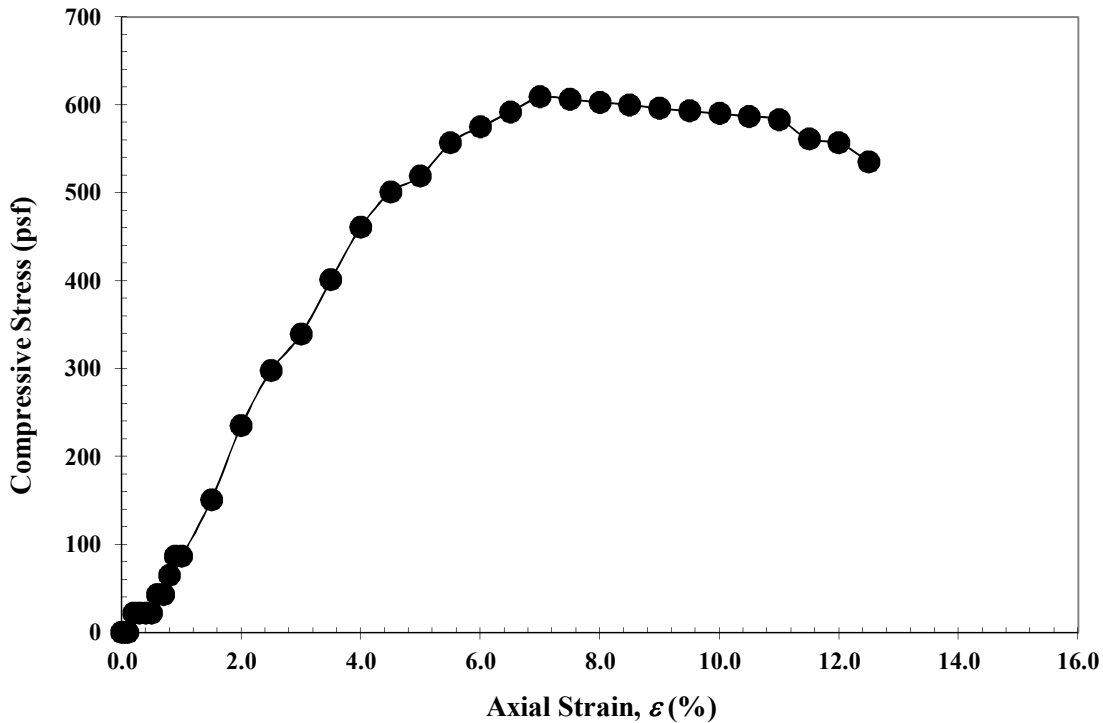
Average Dia., D_{avg} (in):	2.90
Average Height, H_{avg} (in):	5.63
Area, A (in ²):	6.59
Volume, V (in ³):	37.12
Wet Mass of Specimen (lb):	2.8
Moisture Content (%):	22.5
Dry Mass of Specimen (lb):	2.3
Wet Unit Weight, γ (lb/ft ³):	131.2
Dry Unit Weight, γ_d (lb/ft ³):	107.1

Final Specimen Figure



Results

Unconfined Compressive Strength (psf):	609
Strain (%):	7.0



Notes: Upon trimming the specimen, a 1.0" x 1.0" void was encountered and patched with material from a similar depth. After compression, a large stone fragment (approx. 2"x2"x0.75") was observed in a horizontal orientation approximately 1.5" below top of the specimen. The results reported may differ from a specimen that meets the maximum particle size and patching allowances of D2166. Soft, brownish gray, SANDY SILT, some clay, trace gravel, moist.



Slope Stability Analyses

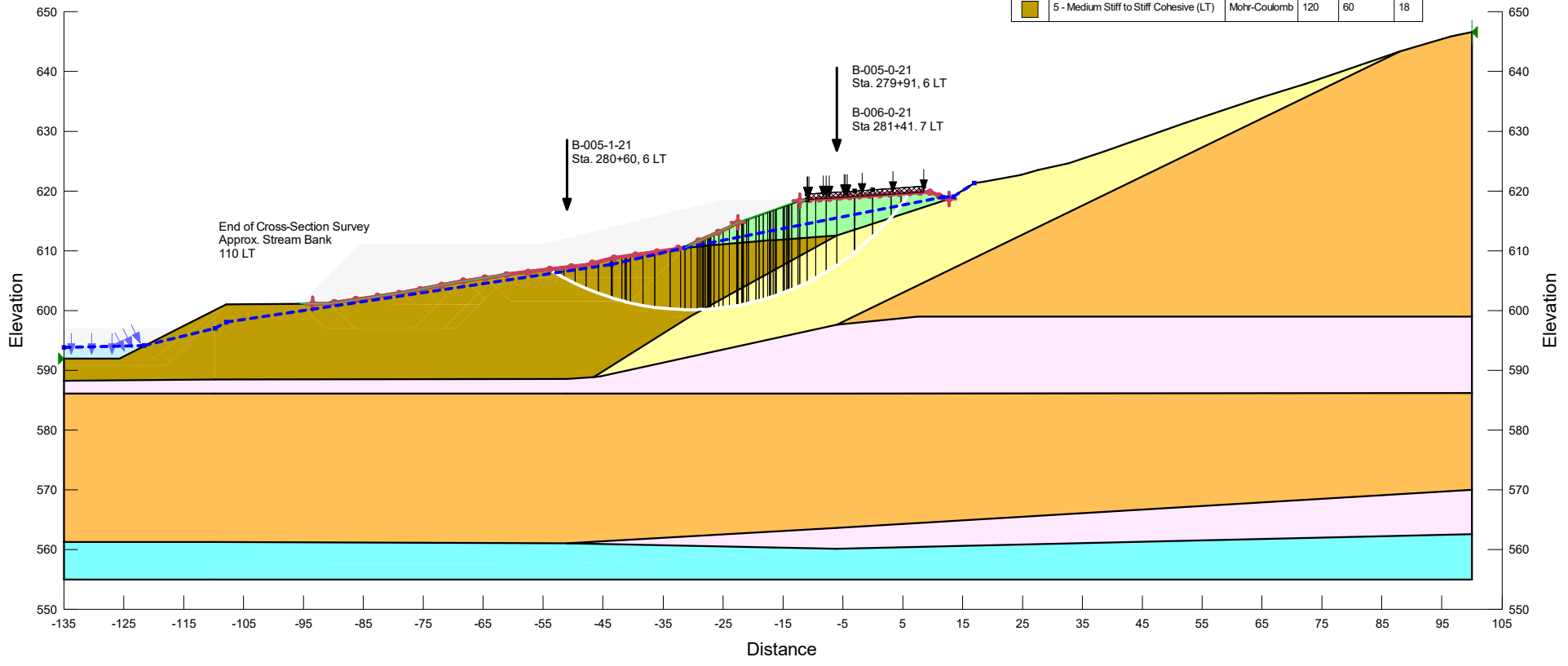


Station 281+00
Existing Conditions

Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability
 Description: Existing Conditions
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.02

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Olive Green	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18





Post-Construction

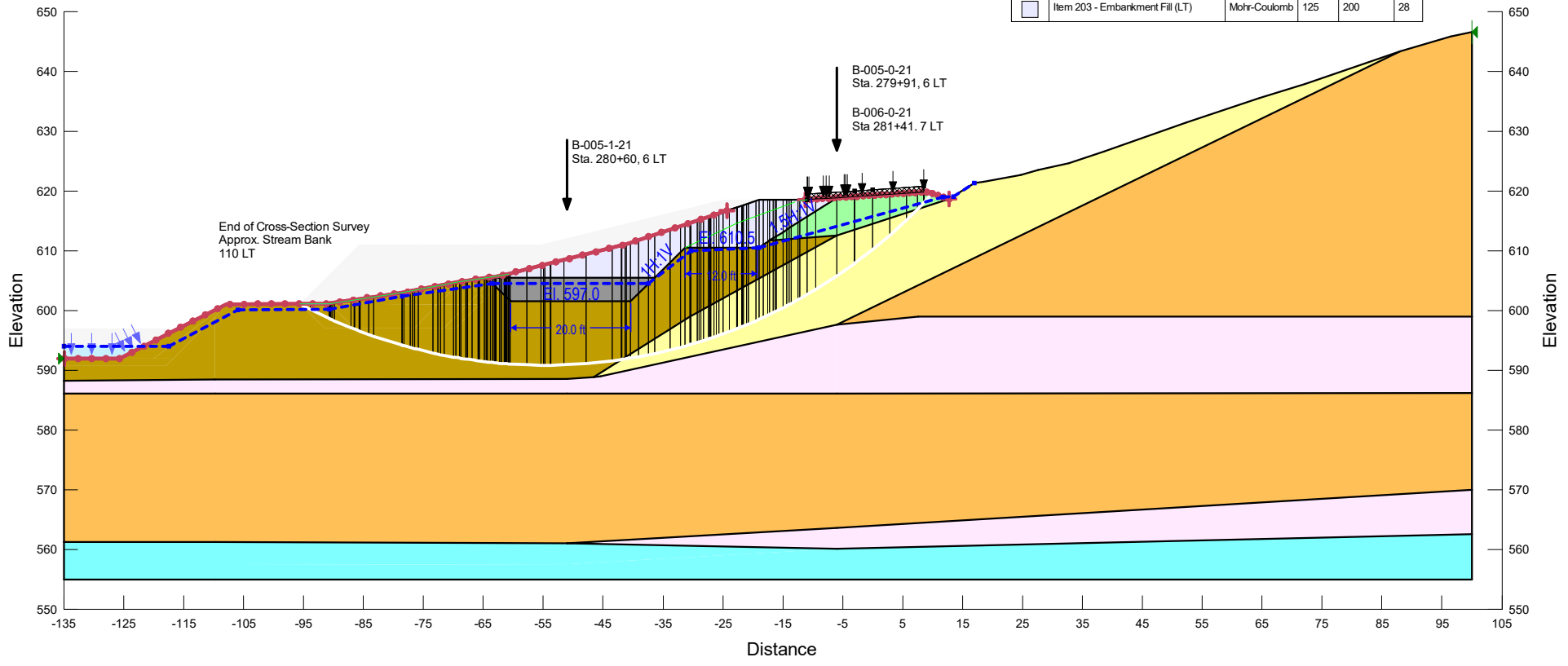
Based on ODOT Geometries provided
in ATH-329-5.44 (ODOT, 2016)

Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (5b)
 Description: Post-Construction (Long Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

ODOT geometry, as provided in the 2016 historic plans, will need to be revised for sections of ATH-329-5.26 project

1.19

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28

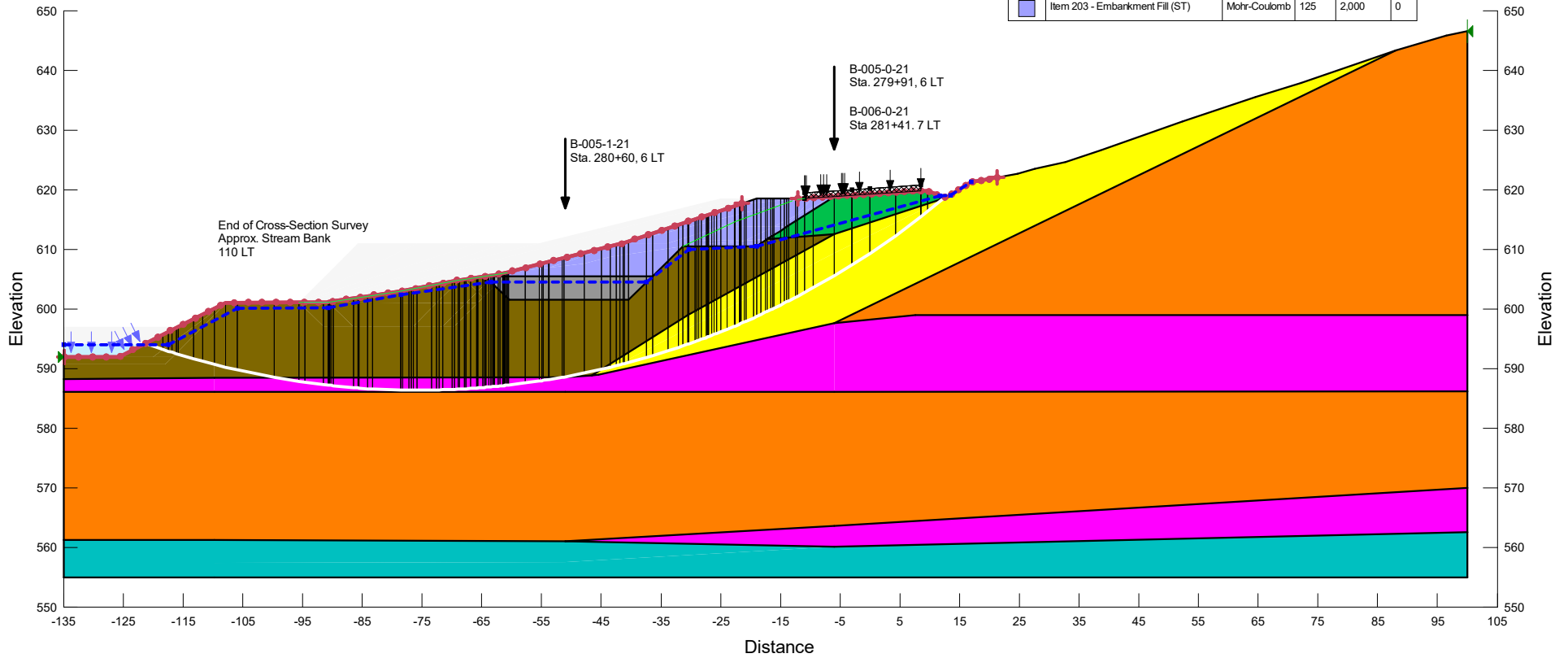


Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (5a)
 Description: Post Construction (Short Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

ODOT geometry, as provided in the 2016 historic plans, will need to be revised for sections of ATH-329-5.26 project

1.78

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Blue	Item 203 - Embankment Fill (ST)	Mohr-Coulomb	125	2,000	0



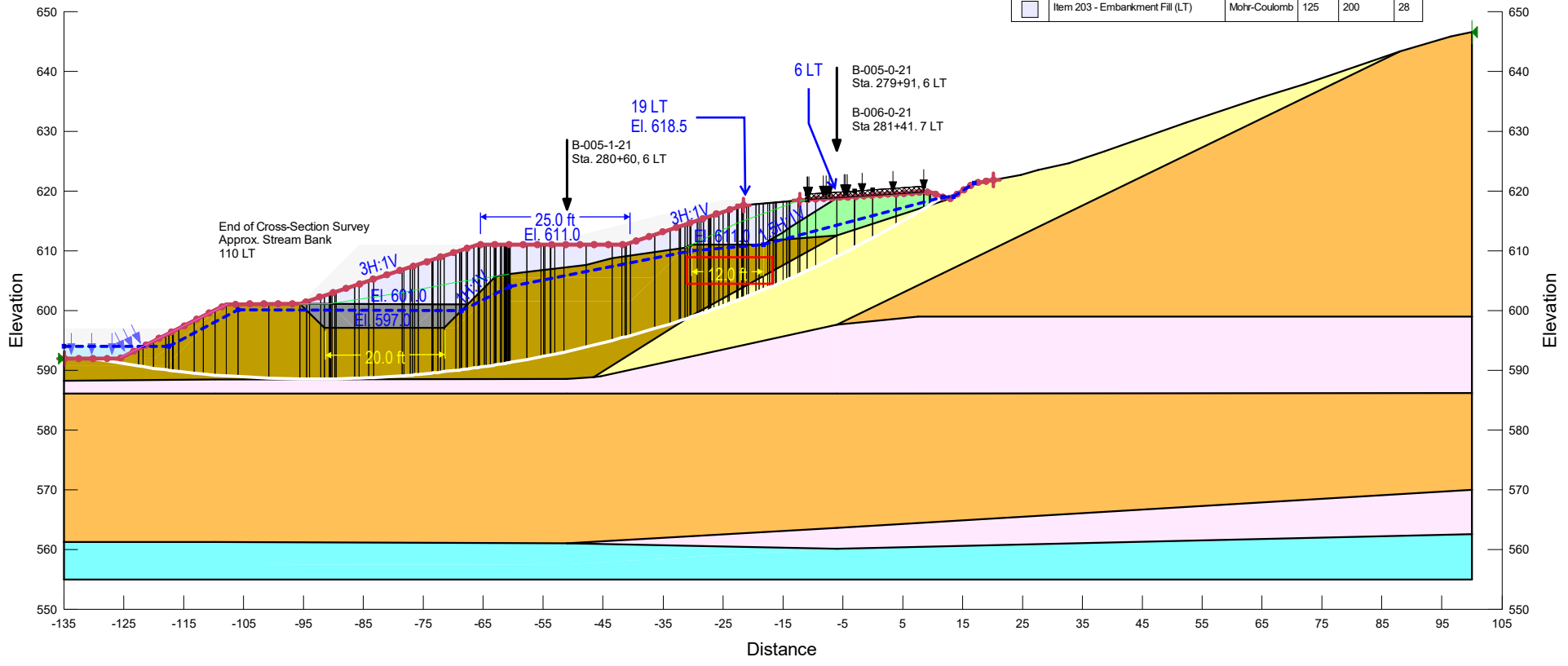


Station 281+00
Post-Construction

Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (4b)
 Description: Post-Construction (Long Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.30

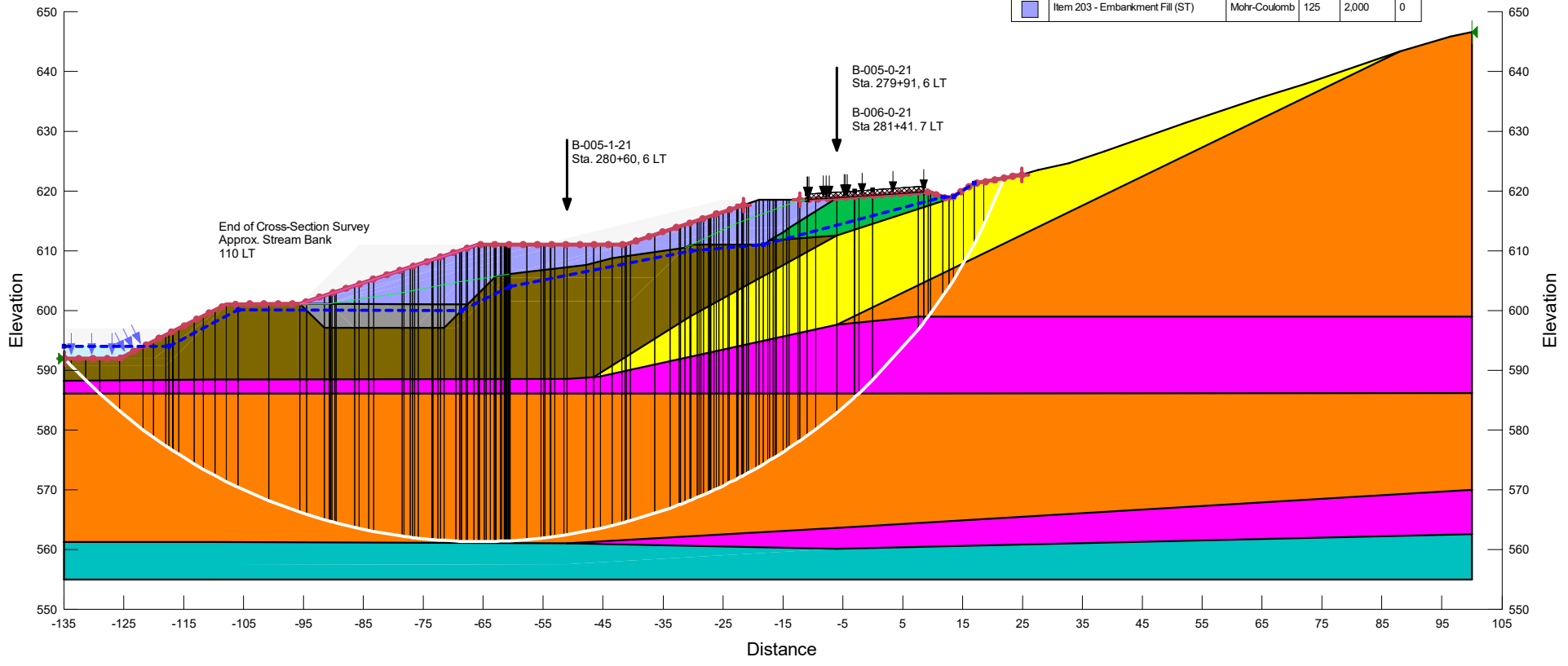
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28



Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (4a)
 Description: Post Construction (Short Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.85

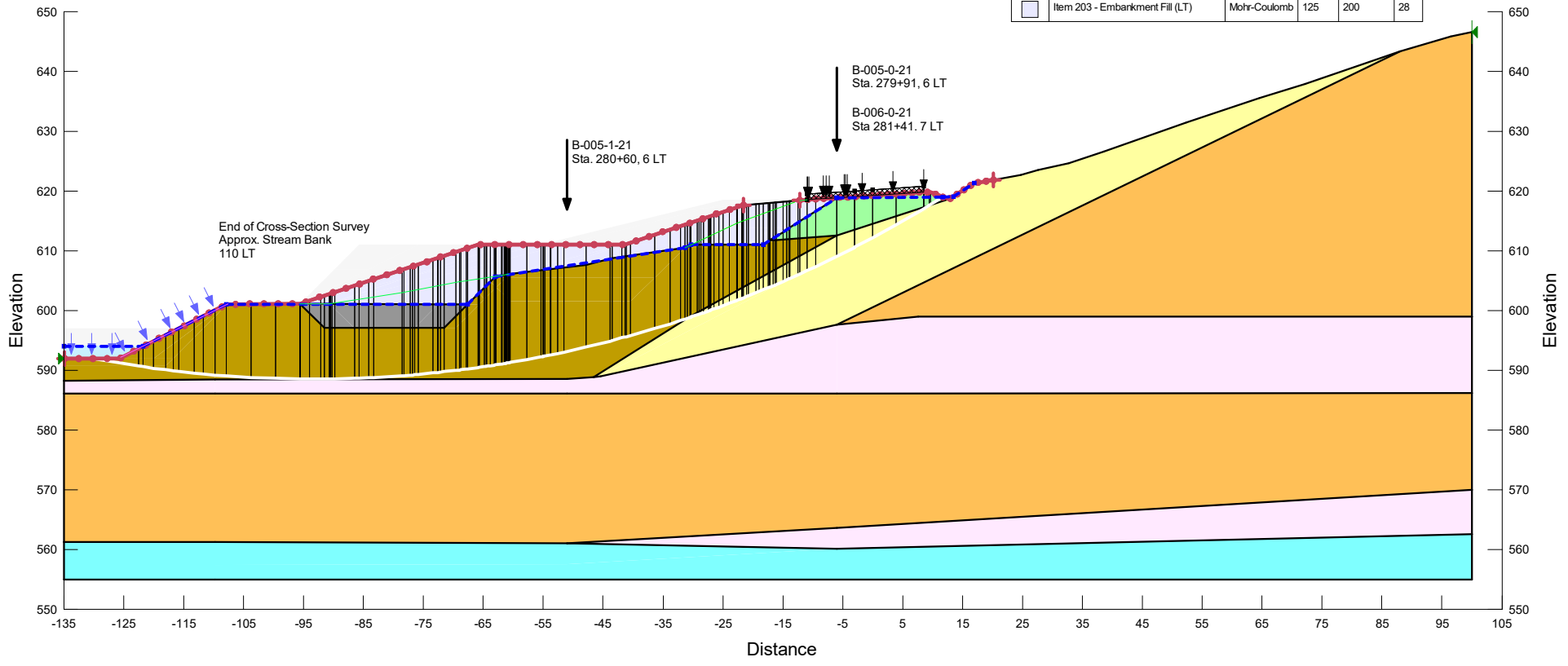
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Blue	Item 203 - Embankment Fill (ST)	Mohr-Coulomb	125	2,000	0



Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (4c)
 Description: Post-Construction (Long Term - Rapid Drawdown)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.20

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28

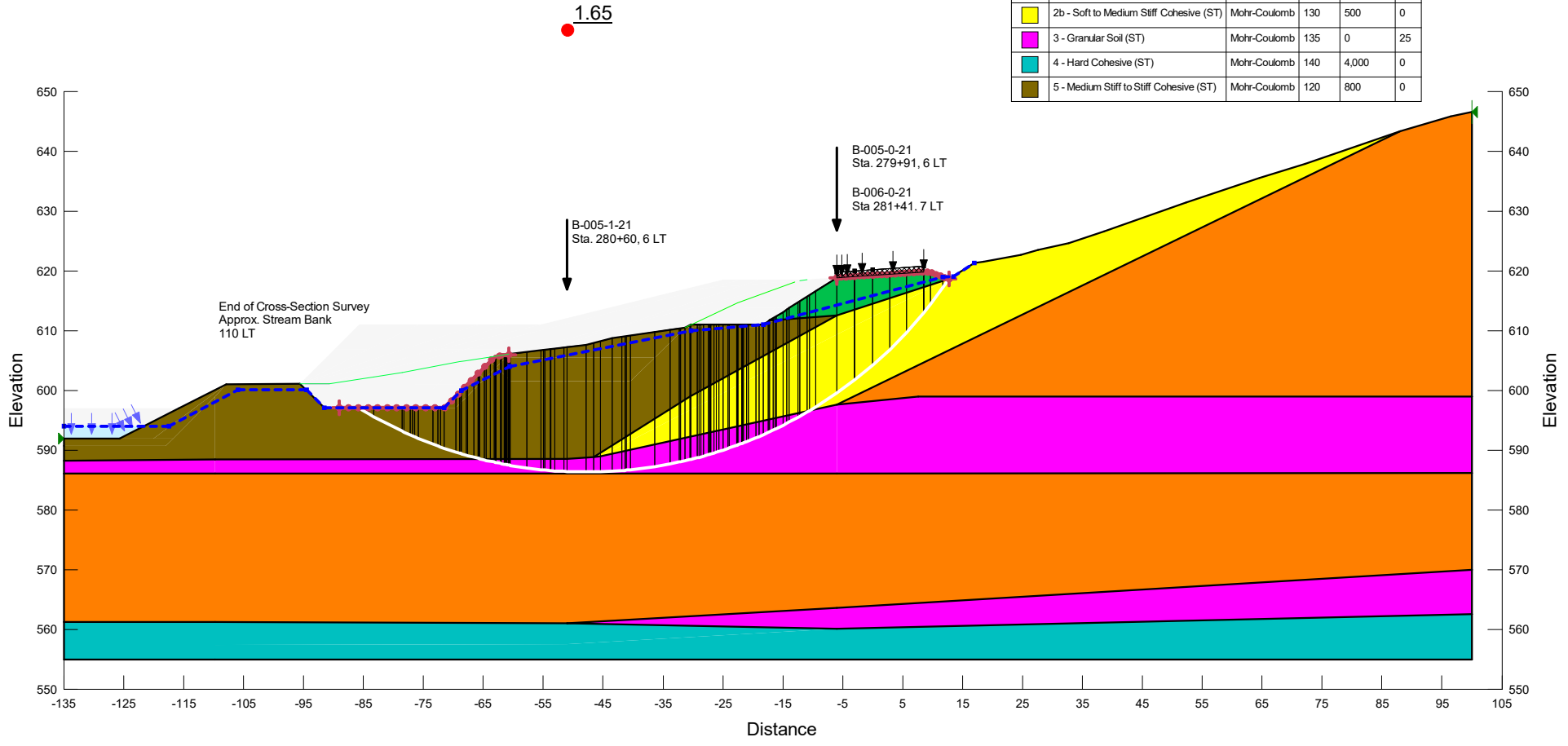




Station 281+00
Constructability

Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (2a)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

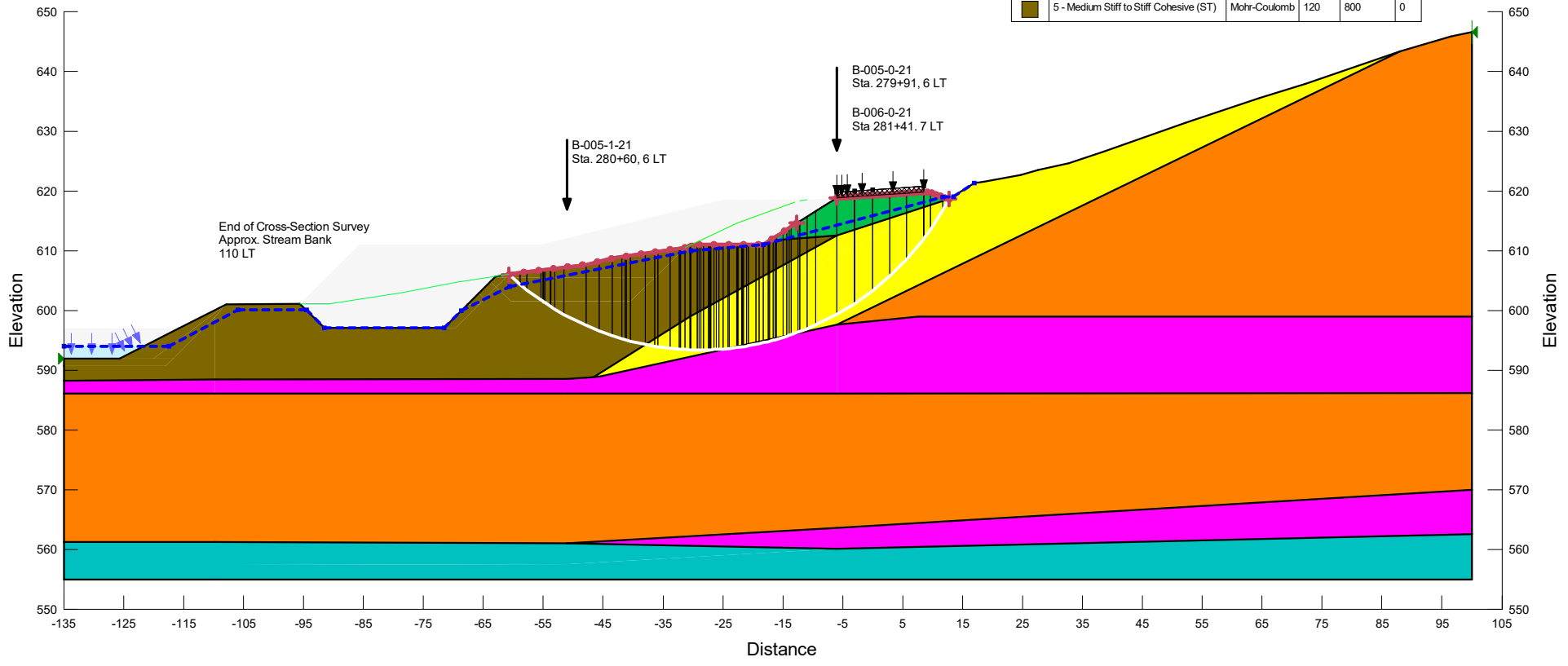
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0



Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (2b)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0

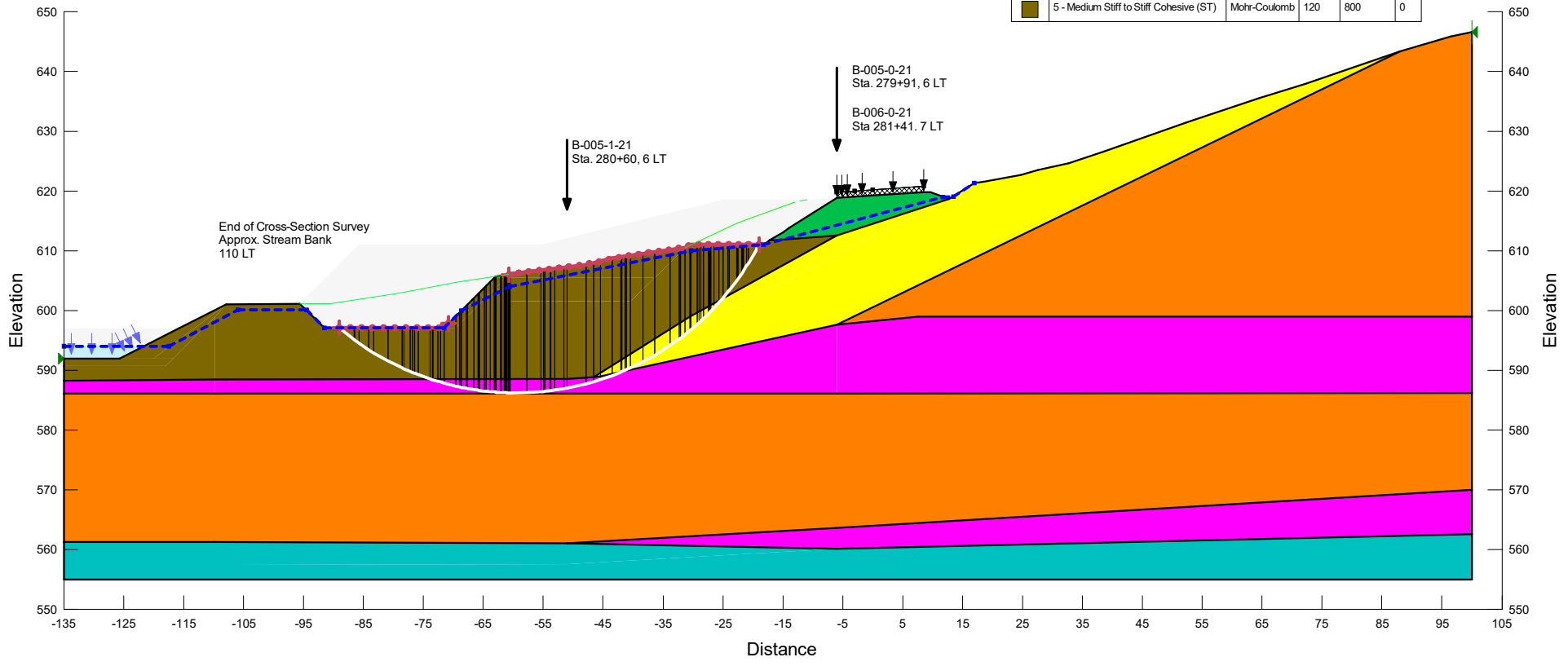
2.21



Title: ATH-329-5.26
 Name: Sta.281+00_Slope Stability (2c)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

2.38

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0



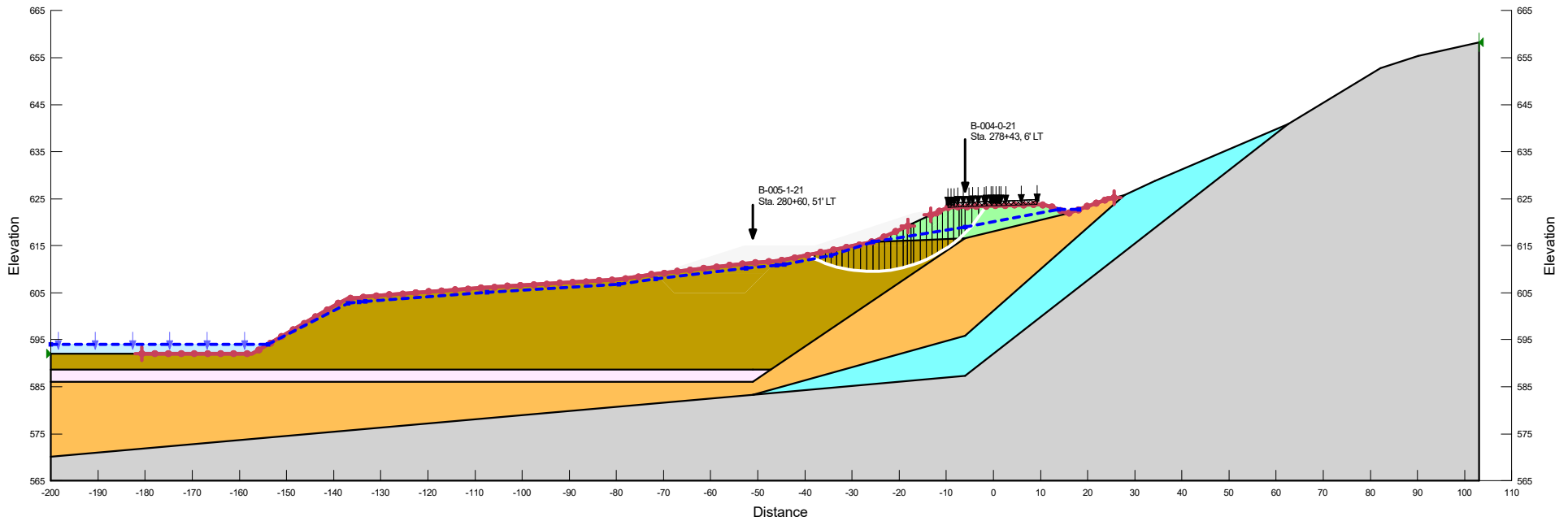


Station 278+00
Existing Conditions

Title: ATH-329-5.26
 Name: Sta. 278+00_Existing Condition
 Description: Existing Conditions
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Olive Green	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			

1.09



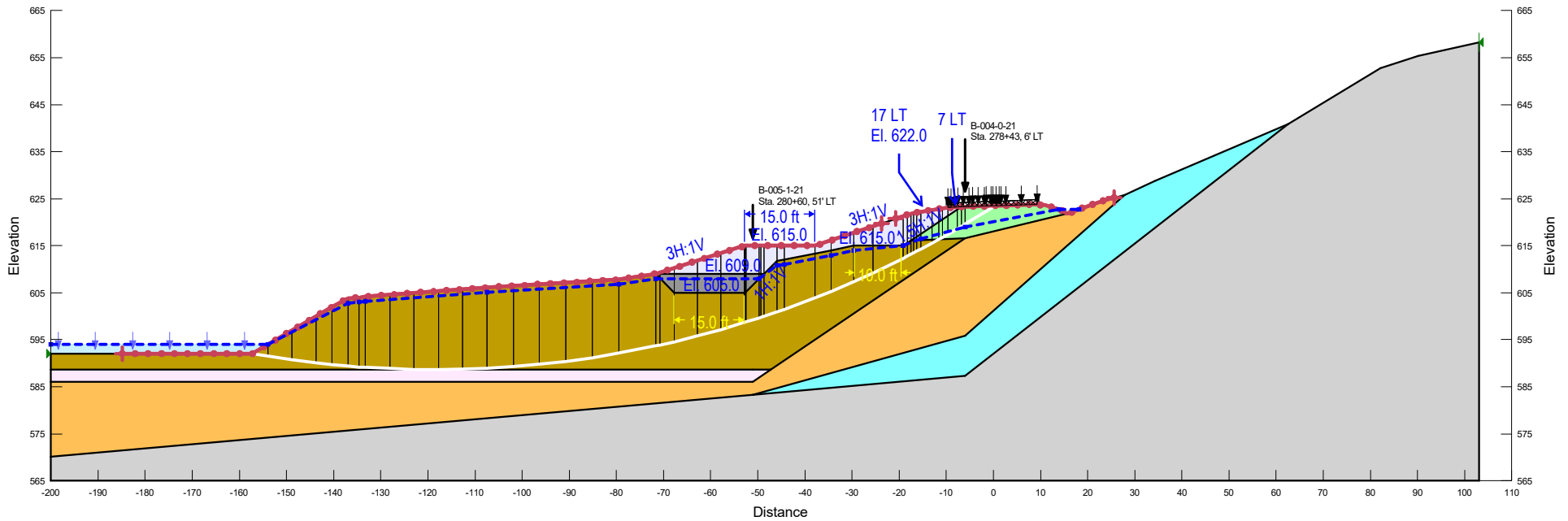


Station 278+00
Post-Construction

Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (LT)
 Description: Post-Construction (Long Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Olive Green	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28

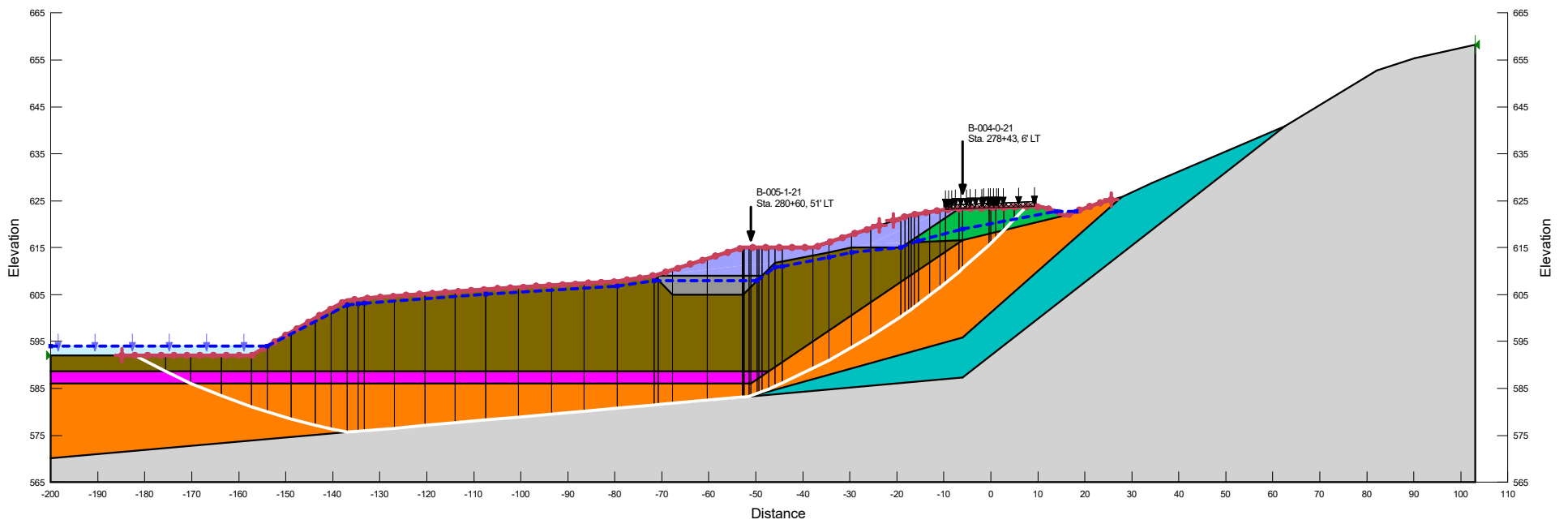
1.39



Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (ST)
 Description: Post Construction (Short Term)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Pink	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Blue	Item 203 - Embankment Fill (ST)	Mohr-Coulomb	125	2,000	0

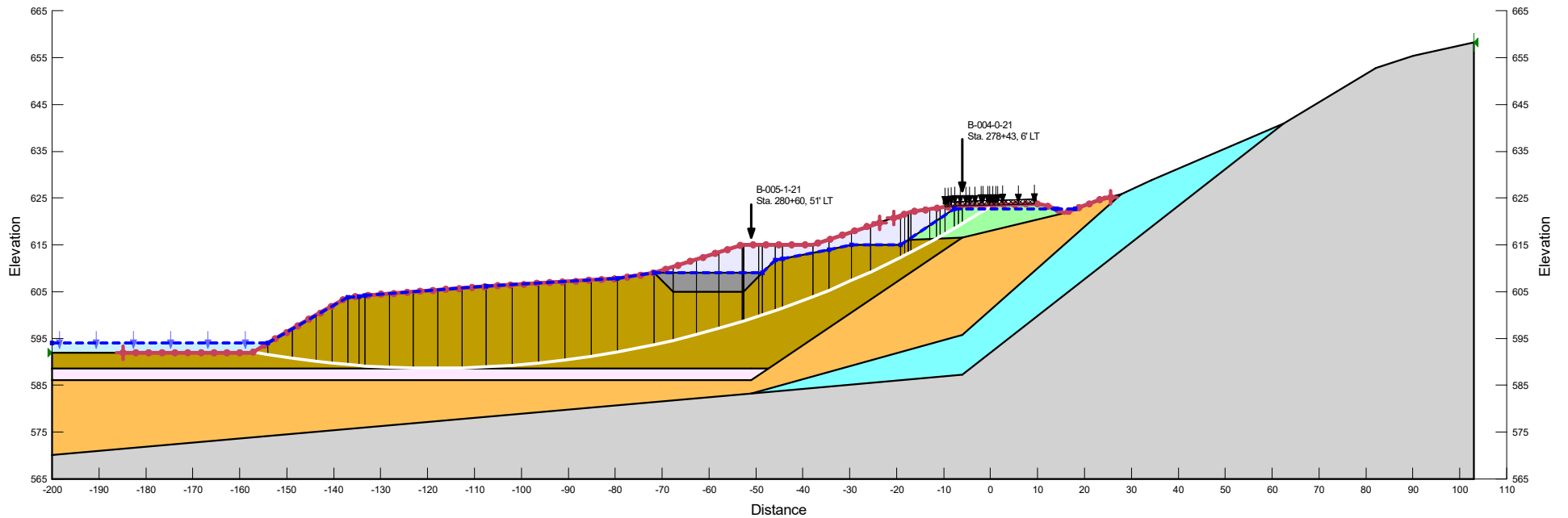
2.44



Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (RDD)
 Description: Post-Construction (Long Term - Rapid Drawdown)
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (LT)	Mohr-Coulomb	140	230	28
Olive Green	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28

1.31

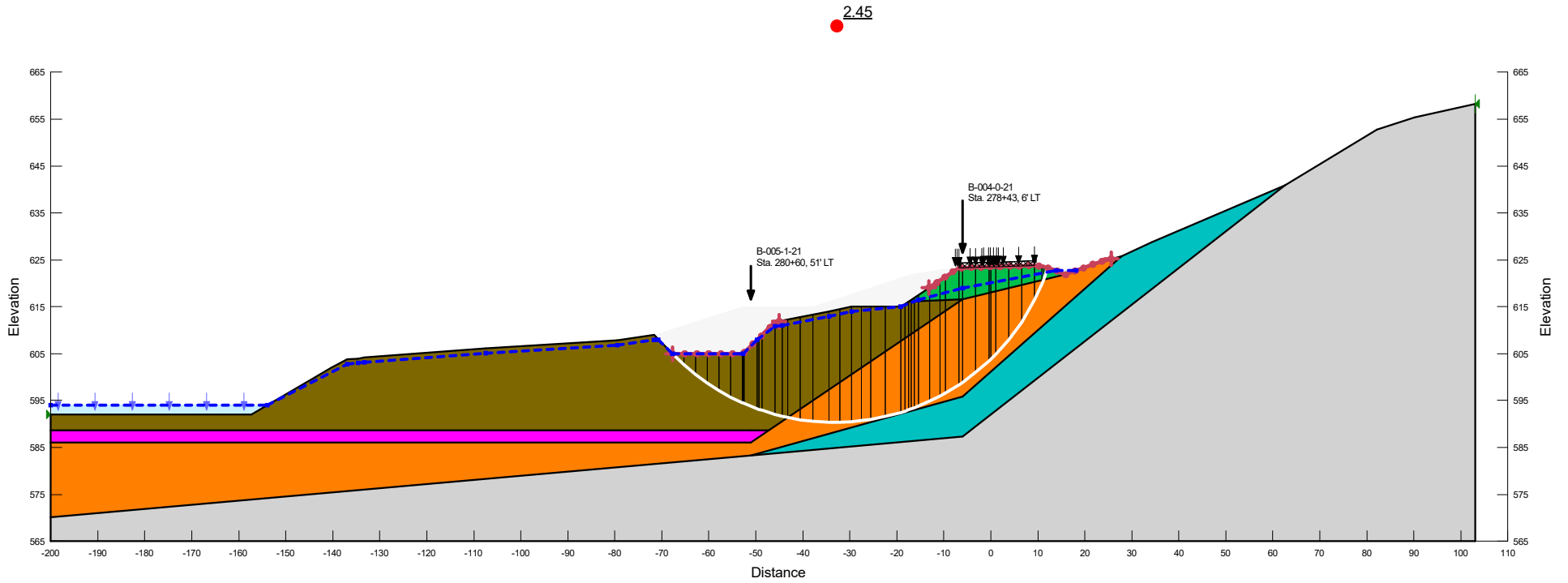




Station 278+00
Constructability

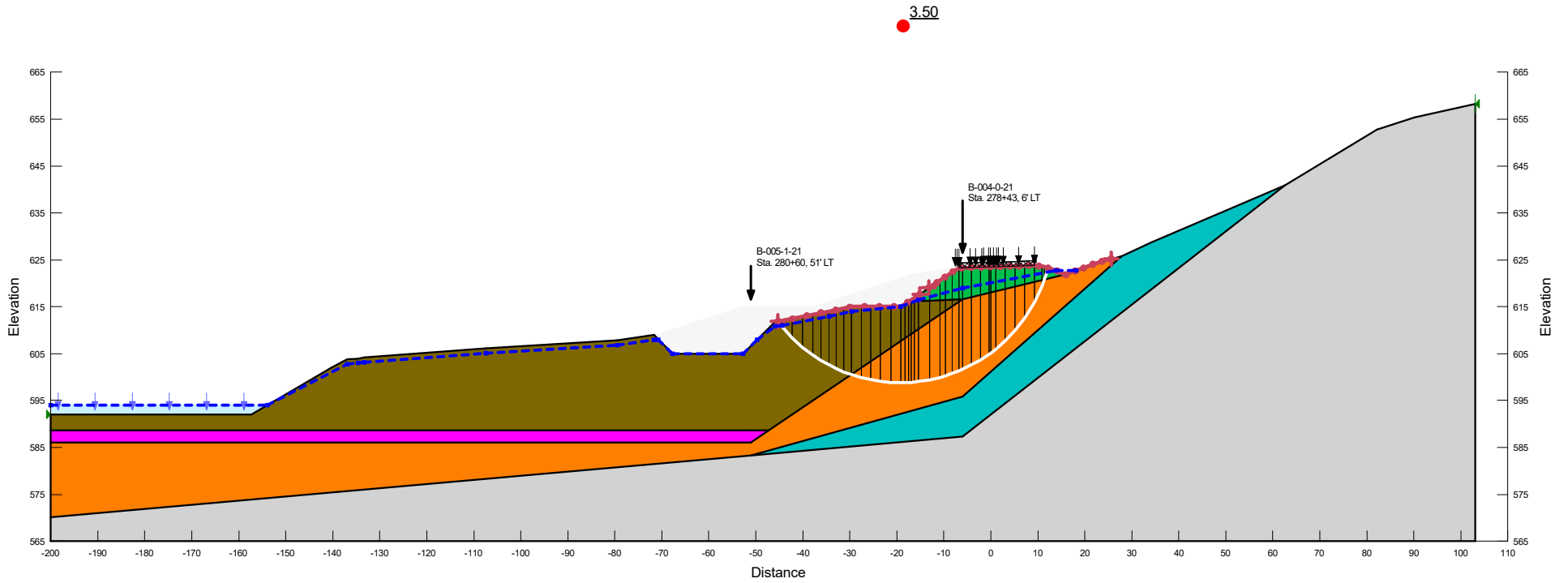
Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (Const.)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Pink	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			



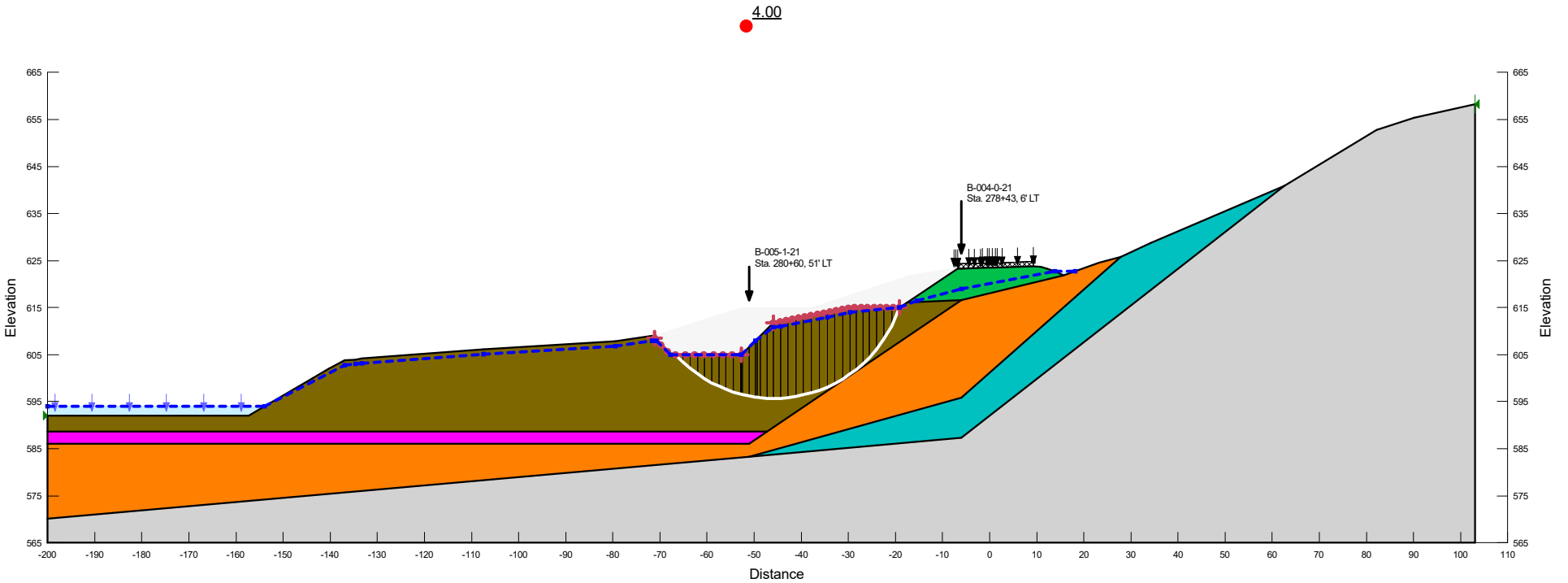
Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (Const.) (2)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Pink	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			



Title: ATH-329-5.26
 Name: Sta. 278+00_Proposed (Const.) (3)
 Description: Constructability
 Kind: SLOPE/W
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Green	1 - Medium Stiff to Stiff Fill (ST)	Mohr-Coulomb	120	800	0
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Olive Green	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			



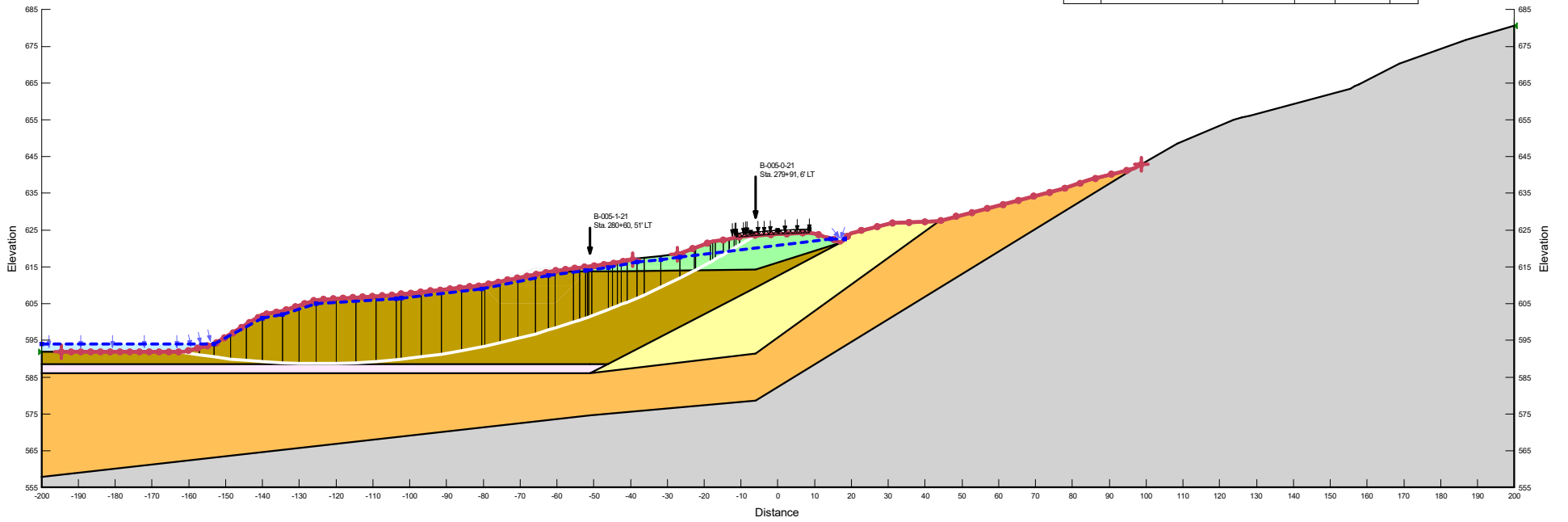


Station 279+00
Existing Conditions

Title: ATH-329-526
 Name: Sta. 279+00_Existing Condition
 Description: Existing Conditions
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.25

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			



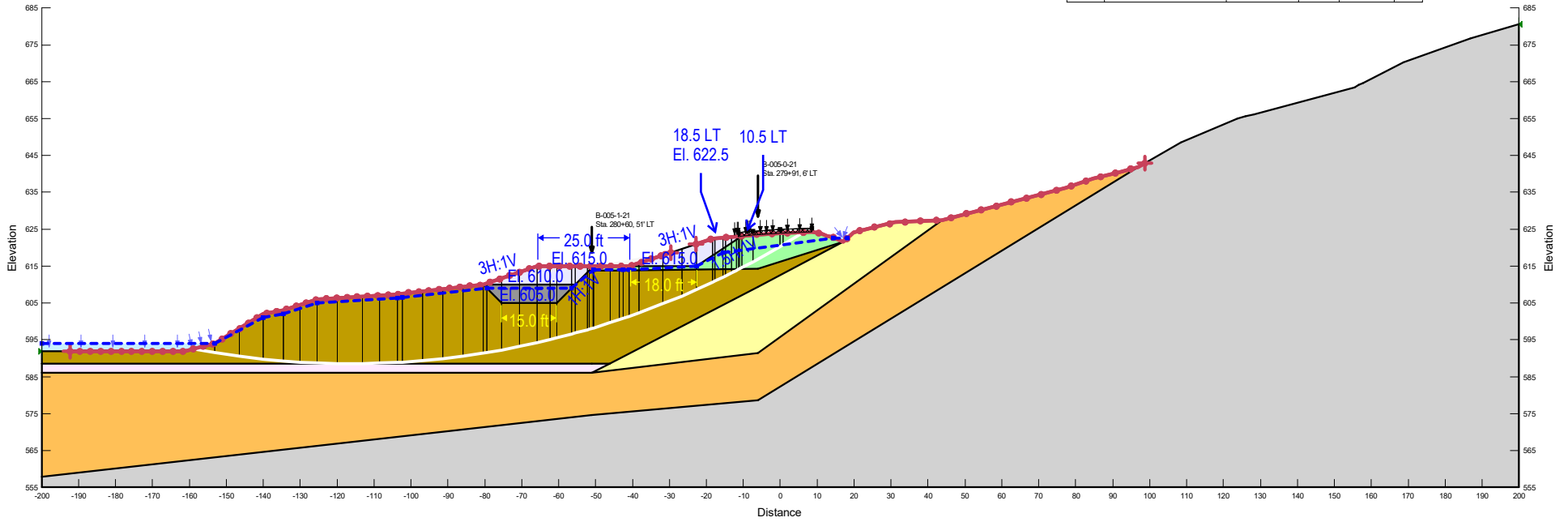


Station 279+00
Post-Construction

Title: ATH-329-526
 Name: Sta. 279+00_Proposed (LT)
 Description: Post-Construction (Long Term)
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.31

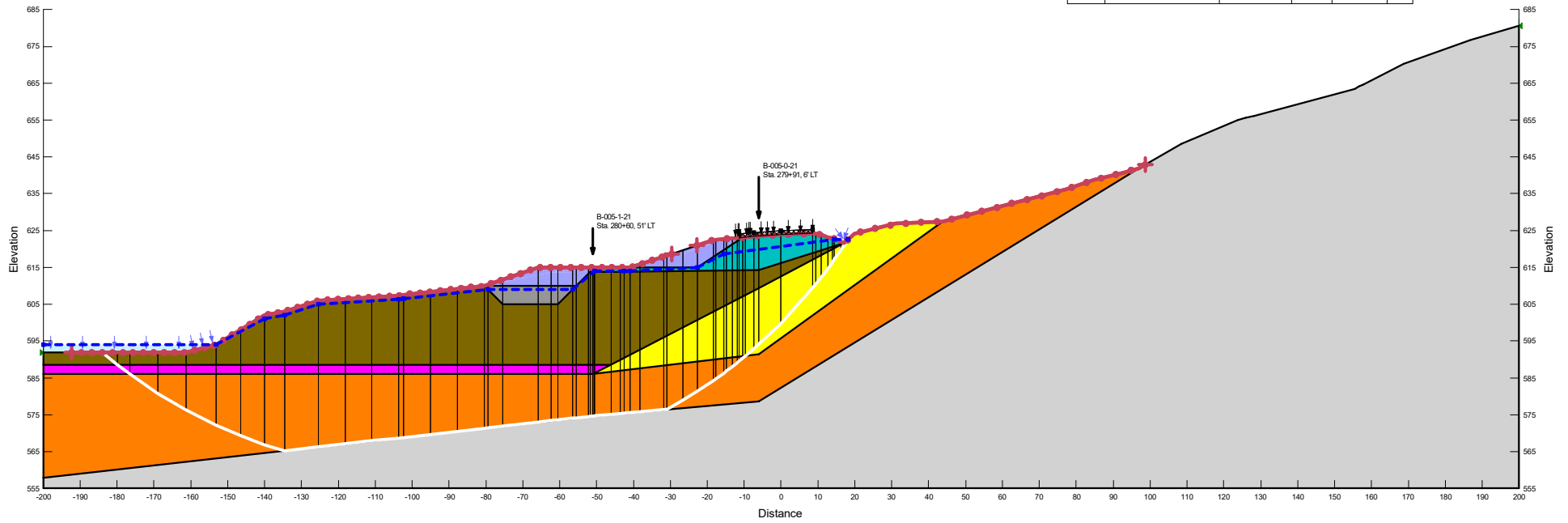
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28



Title: ATH-329-526
 Name: Sta. 279+00_Proposed (ST)
 Description: Post Construction (Short Term)
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.71

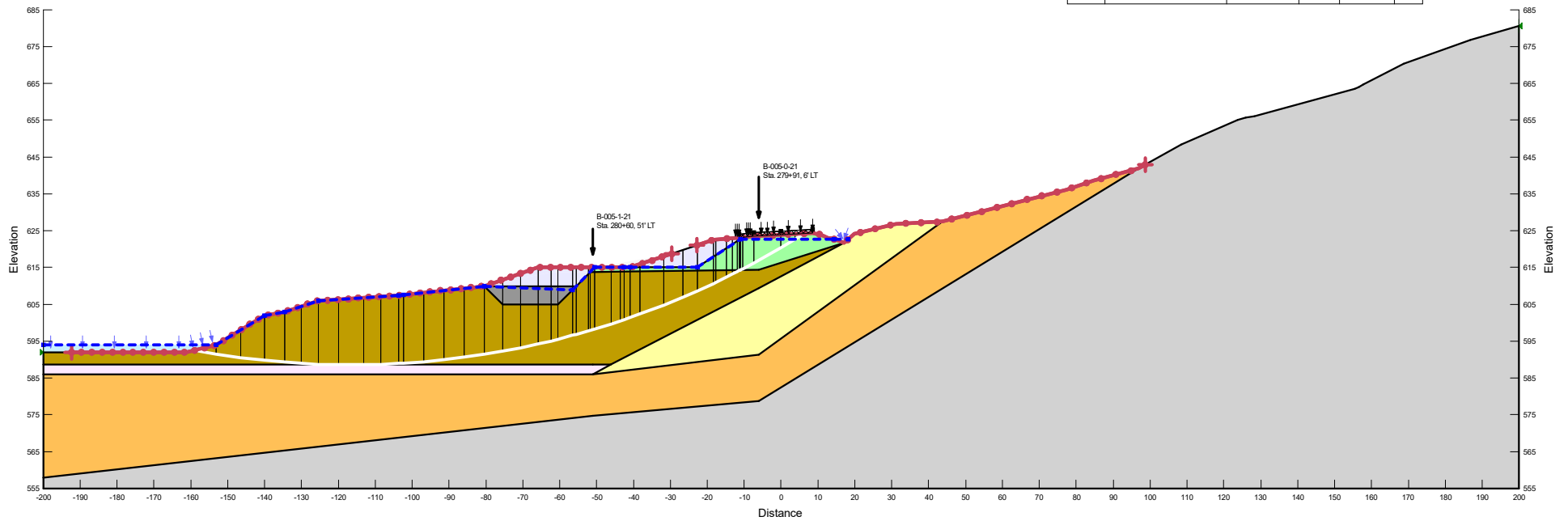
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Pink	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Blue	Item 203 - Embankment Fill (ST)	Mohr-Coulomb	125	2,000	0



Title: ATH-329-526
 Name: Sta. 279+00_Proposed (RDD)
 Description: Post-Construction (Long Term - Rapid Drawdown)
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

1.24

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Light Green	1 - Medium Stiff to Stiff Fill (LT)	Mohr-Coulomb	120	75	19
Orange	2 - Stiff to Very Stiff Cohesive (LT)	Mohr-Coulomb	130	80	21
Yellow	2b - Soft to Medium Stiff Cohesive (LT)	Mohr-Coulomb	130	40	16
Pink	3 - Granular Soil (LT)	Mohr-Coulomb	135	0	25
Brown	5 - Medium Stiff to Stiff Cohesive (LT)	Mohr-Coulomb	120	60	18
Grey	Bedrock	Bedrock (Impenetrable)			
Dark Grey	Dump Rock Fill	Mohr-Coulomb	145	0	36
Light Blue	Item 203 - Embankment Fill (LT)	Mohr-Coulomb	125	200	28



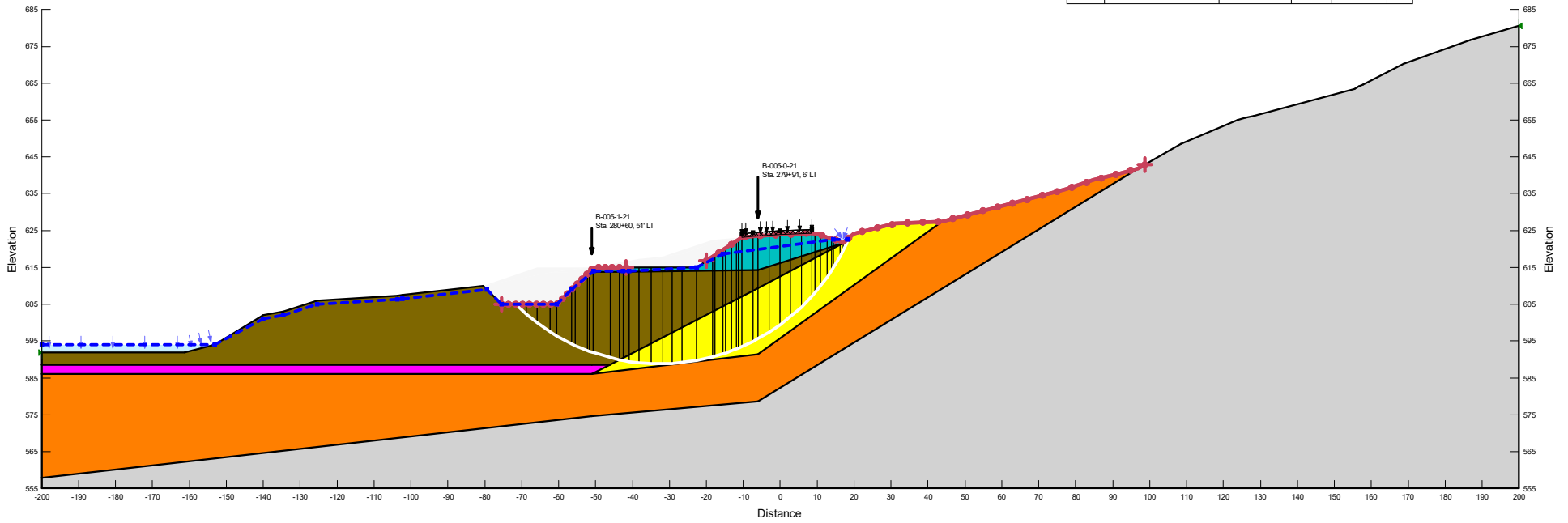


Station 279+00
Constructability

Title: ATH-329-526
 Name: Sta. 279+00_Proposed (Const.)
 Description: Constructability
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

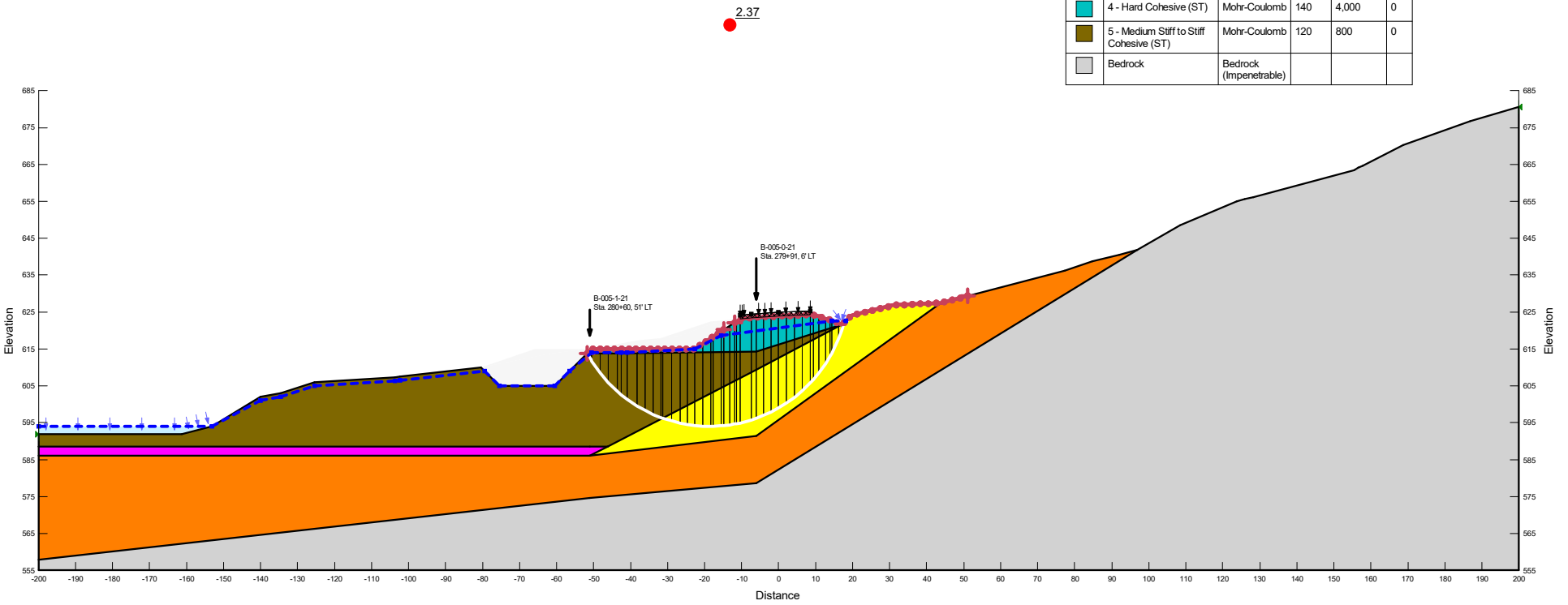
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Olive Green	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			

1.52



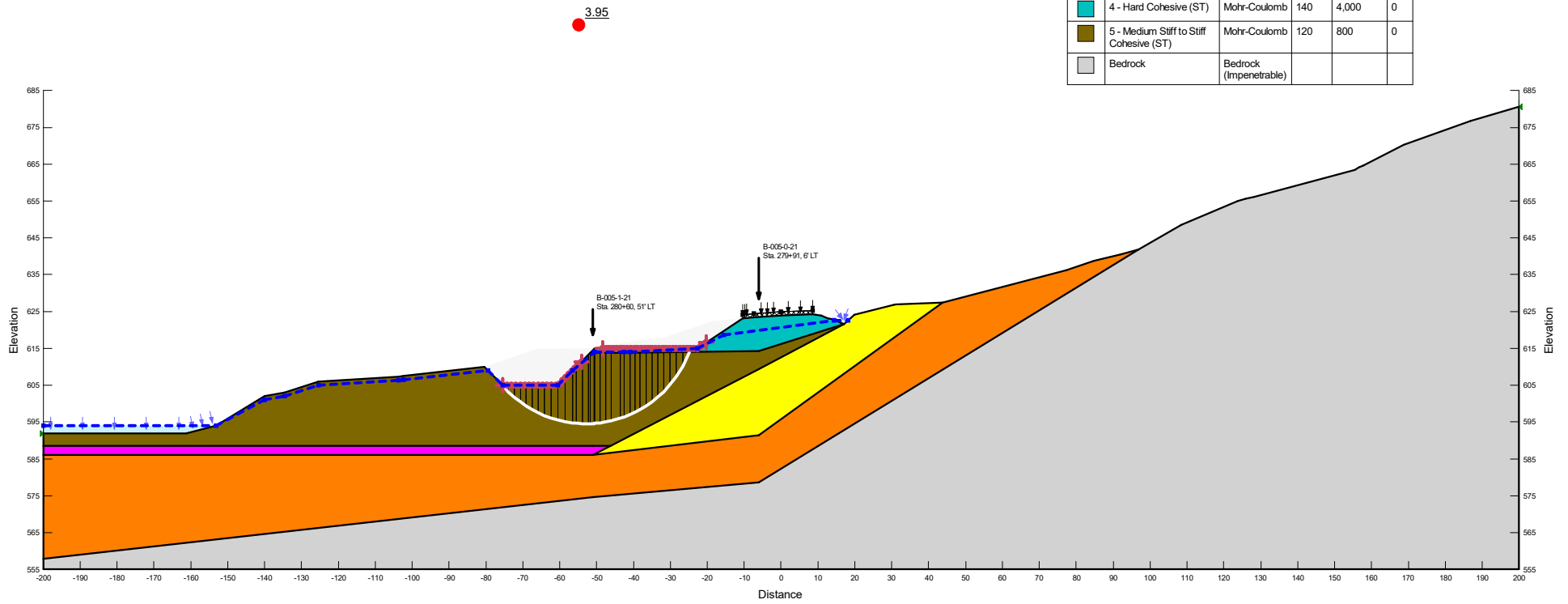
Title: ATH-329-526
 Name: Sta. 279+00_Proposed (Const.) (2)
 Description: Constructability
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			



Title: ATH-329-526
 Name: Sta. 279+00_Proposed (Const.) (3)
 Description: Constructability
 Kind: SLOPEW
 Method: Morgenstern-Price
 Optimize Critical Slip Surface Location: No
 Surcharge (Unit Weight): 250 pcf

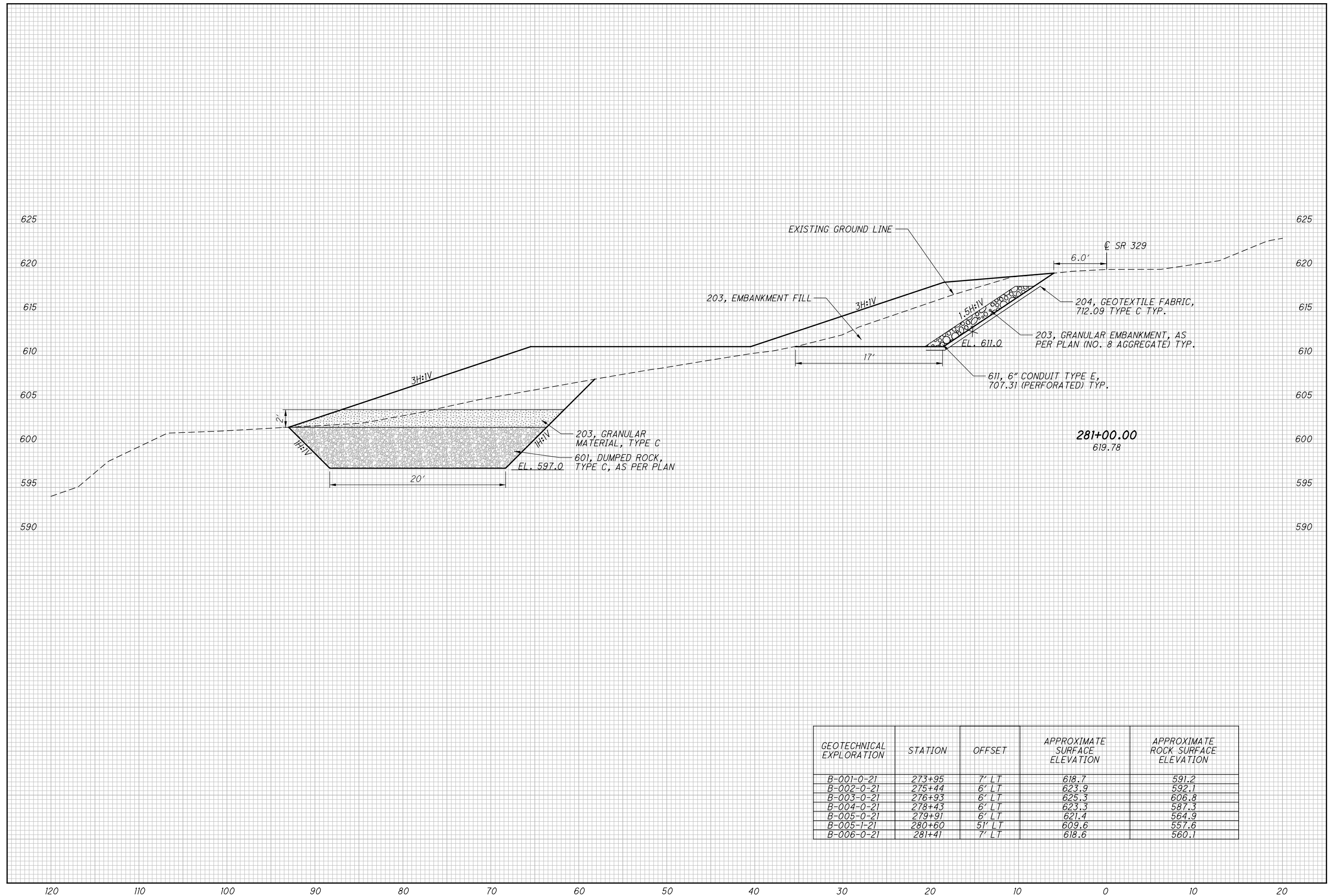
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Orange	2 - Stiff to Very Stiff Cohesive (ST)	Mohr-Coulomb	130	1,000	0
Yellow	2b - Soft to Medium Stiff Cohesive (ST)	Mohr-Coulomb	130	500	0
Magenta	3 - Granular Soil (ST)	Mohr-Coulomb	135	0	25
Cyan	4 - Hard Cohesive (ST)	Mohr-Coulomb	140	4,000	0
Brown	5 - Medium Stiff to Stiff Cohesive (ST)	Mohr-Coulomb	120	800	0
Grey	Bedrock	Bedrock (Impenetrable)			





Slope Excavation and Replacement Details

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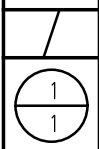


0 5 10
2.5
HORIZONTAL
SCALE IN FEET

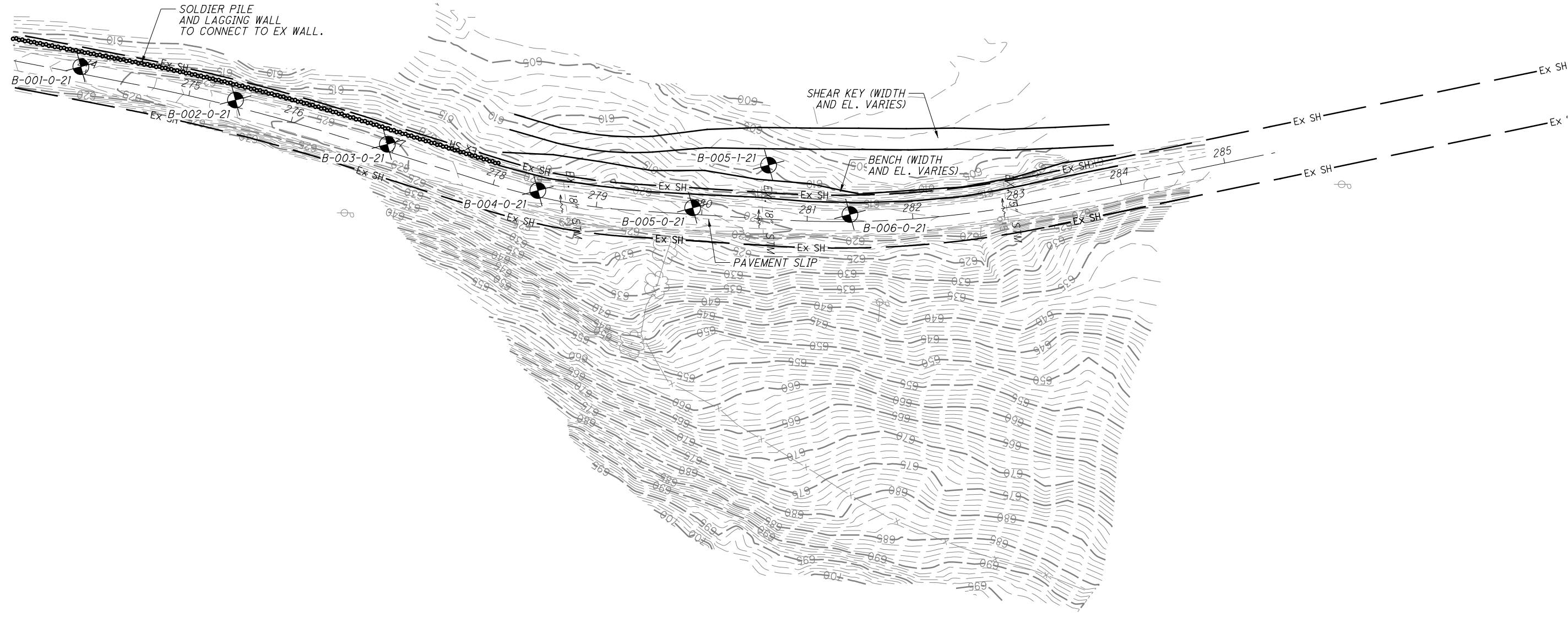
DRAWN
CLW
CHECKED
DMV

DESIGN CROSS SECTION
STA. 281+00.00

ATH-329-5.26



GEOTECHNICAL EXPLORATION	STATION	OFFSET	APPROXIMATE SURFACE ELEVATION	APPROXIMATE ROCK SURFACE ELEVATION
B-001-0-21	273+95	7' LT	618.7	591.2
B-002-0-21	275+44	6' LT	623.9	592.1
B-003-0-21	276+93	6' LT	625.3	606.8
B-004-0-21	278+43	6' LT	623.3	587.3
B-005-0-21	279+91	6' LT	621.4	564.9
B-005-1-21	280+60	5' LT	609.6	557.6
B-006-0-21	281+41	7' LT	618.6	560.1



BENCHING OF FOUNDATION SLOPES

ALTHOUGH CROSS-SECTIONS INDICATE SPECIFIC DIMENSIONS FOR PROPOSED BENCHING OF THE EMBANKMENT FOUNDATIONS IN CERTAIN AREAS, NO WAIVER OF THE SPECIFICATIONS IS INTENDED. BENCH ALL OTHER SLOPED EMBANKMENT AREAS AS SET FORTH IN 203.05. NO ADDITIONAL PAYMENT WILL BE MADE FOR BENCHING REQUIRED UNDER THE PROVISIONS OF 203.05.

FIELD VERIFICATION OF QUANTITIES

DUE TO THE NATURE OF THE PROJECT BEING A SLIDE REPAIR, THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFICATION OF QUANTITIES PRIOR TO BIDDING AND THEN PRIOR TO CONSTRUCTION. THE ACTUAL WORK LOCATIONS AND QUANTITIES PERFORMED SHALL BE INCORPORATED INTO THE FINAL CHANGE ORDER GOVERNING COMPLETION OF THIS PROJECT.

ITEM 601 - DUMPED ROCK FILL, TYPE C, AS PER PLAN

DUMPED ROCK FILL, TYPE C, AS PER PLAN MAY BE PLACED BY THE METHOD OF END DUMPING IF SURFACE WATER IS PRESENT AT THE TIME OF CONSTRUCTION. END DUMPING METHODS MAY BE USED UP TO AN ELEVATION OF 2 FEET ABOVE THE WATER LEVEL. ABOVE THIS LEVEL, CONSTRUCTION METHODS WILL BE IN ACCORDANCE WITH 203.05, 203.06, AND 203.07 INCLUSIVE

WHEN EXCAVATING FOR THE SHEAR KEY, NO MORE THAN 50 LINEAR FEET ALONG THE BACK OF THE KEY SHALL BE EXCAVATED FOR THE KEY WITHOUT REPLACING WITH DUMPED ROCK FILL, TYPE C, AS PER PLAN. THE ENGINEER MAY VARY THE 50 LINEAR FT BASED ON SITE CONDITIONS (STABILITY). NO EXCAVATION SHALL BE LEFT OPEN OVERNIGHT. SCHEDULE WORK SO AS TO HAVE THE SHEAR KEY BACKFILLED AND STABILIZED PRIOR TO LEAVING THE SITE.

ITEM 203 - EMBANKMENT, AS PER PLAN

IN ADDITION TO THE REQUIREMENTS OF CMS ITEM 203, THIS ITEM SHALL INCLUDE ITEM 203, EXCAVATION REQUIRED TO BLEND THE EXISTING SLOPES TO THE NEWLY CONSTRUCTED SLOPE AT EACH END OF THE SITE. THIS SHALL BE INCIDENTAL TO ITEM 203, EMBANKMENT, AS PER PLAN.

ITEM 204 - GEOTEXTILE FABRIC, AS PER PLAN

IN ADDITION TO THE REQUIREMENTS OF CMS ITEM 204, THIS ITEM SHALL BE 712.09 TYPE D FABRIC.

PAYMENT FOR THE ABOVE WORK SHALL BE MADE AT THE UNIT PRICE BID FOR ITEM 204, GEOTEXTILE FABRIC, AS PER PLAN AND SHALL INCLUDE ALL LABOR, TOOLS, EQUIPMENT AND MATERIALS NECESSARY TO INSTALL THE FABRIC.

SPECIAL BENCHING SLOPE DRAINS

PLACE SPECIAL BENCHING SLOPE DRAINS AT THE LOCATIONS SHOWN ON THE PLAN AND PROFILE AND CROSS SECTION SHEETS. THESE DRAINS SHALL CONSIST OF ITEM 690, GEOTEXTILE FABRIC, 712.09 TYPE A, AND ITEM 611, CONDUIT TYPE E, 707.31 (PERFORATED). THE TYPE E CONDUIT SHALL BE PERFORATEED AS PER CONDUIT FOR ITEM 605, UNCLASSIFIED PIPE UNDERDRAINS. TRANSVERSE OUTLET DRAINS SHALL BE PROVIDED AT THE LOCATIONS SHOWN ON THE PLAN & PROFILE AND CROSS SECTION SHEETS. THESE OUTLET DRAINS SHALL CONSIST OF ITEM 611 CONDUIT TYPE F, 707.33 WITH ITEM 604 PRECAST REINFORCED CONCRETE OUTLETS.

SEE SPECIAL BENCHING SLOPE DRAINS DETAIL ON THIS SHEET FOR ADDITIONAL INFORMATION.

DESIGNER NOTE

AN APPROPRIATELY SIZED PIPE OR CULVERT COULD BE UTILIZED RATHER THAN THE TRADITIONAL DRAINAGE GALLERY SHOWN GIVEN THE DEPTH OF THE SHEAR KEY AND THE NEED TO LIMIT ANY RIGHT OF WAY TAKES.

SHEAR KEY

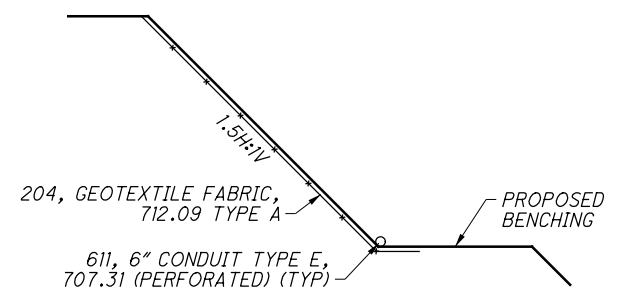
CONSTRUCT THE SHEAR KEY TO THE LIMITS SHOWN ON THE DRAWINGS AND AS DIRECTED IN THE CONSTRUCTION DETAIL ENTITLED "SHEAR KEY".

SPRING DRAINS

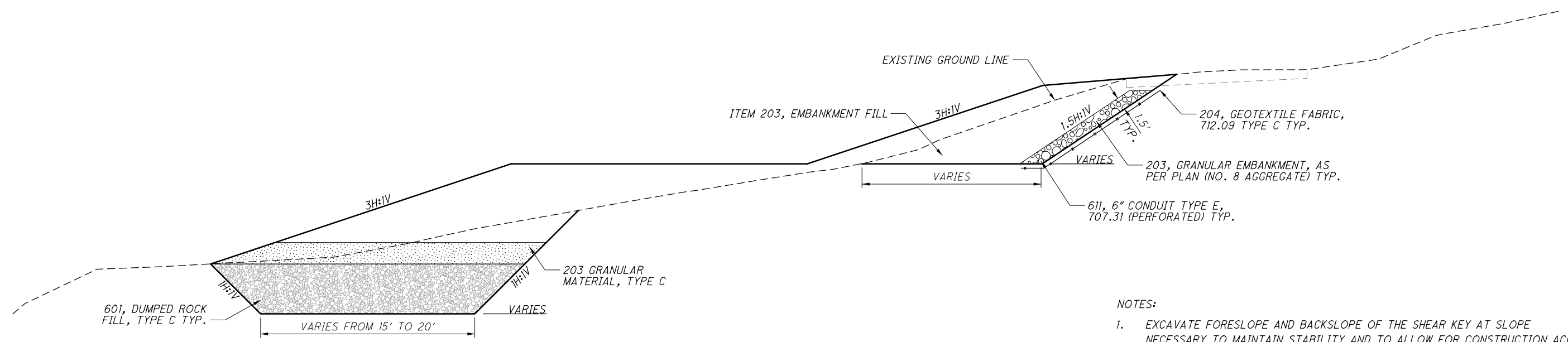
THE FOLLOWING ESTIMATED QUANTITIES HAVE BEEN CARRIED TO THE GENERAL SUMMARY FOR USE AS DIRECTED BY THE ENGINEER FOR DRAINING ANY SPRINGS SHOWN IN THE PLAN OR ENCOUNTERED DURING CONSTRUCTION. THE FOLLOWING TYPES OF PIPES MAY BE USED: 707.33, 707.41, 707.42 or 707.45 PERFORATED PER 707.31.

SPRING DRAINS SHALL BE CONSTRUCTED AS SHOWN ON STANDARD CONSTRUCTION DRAWING DM-1.1 AND PAID FOR AT THE CONTRACT PRICE FOR:

- 605, 6" UNCLASSIFIED PIPE UNDERDRAINS FOR SPRINGS ----- FT.
- 605, AGGREGATE DRAINS FOR SPRINGS ----- FT.
- 611, PRECAST REINFORCED CONCRETE OUTLET ----- EACH



SPECIAL BENCHING SLOPE DRAINS DETAIL
NOT TO SCALE



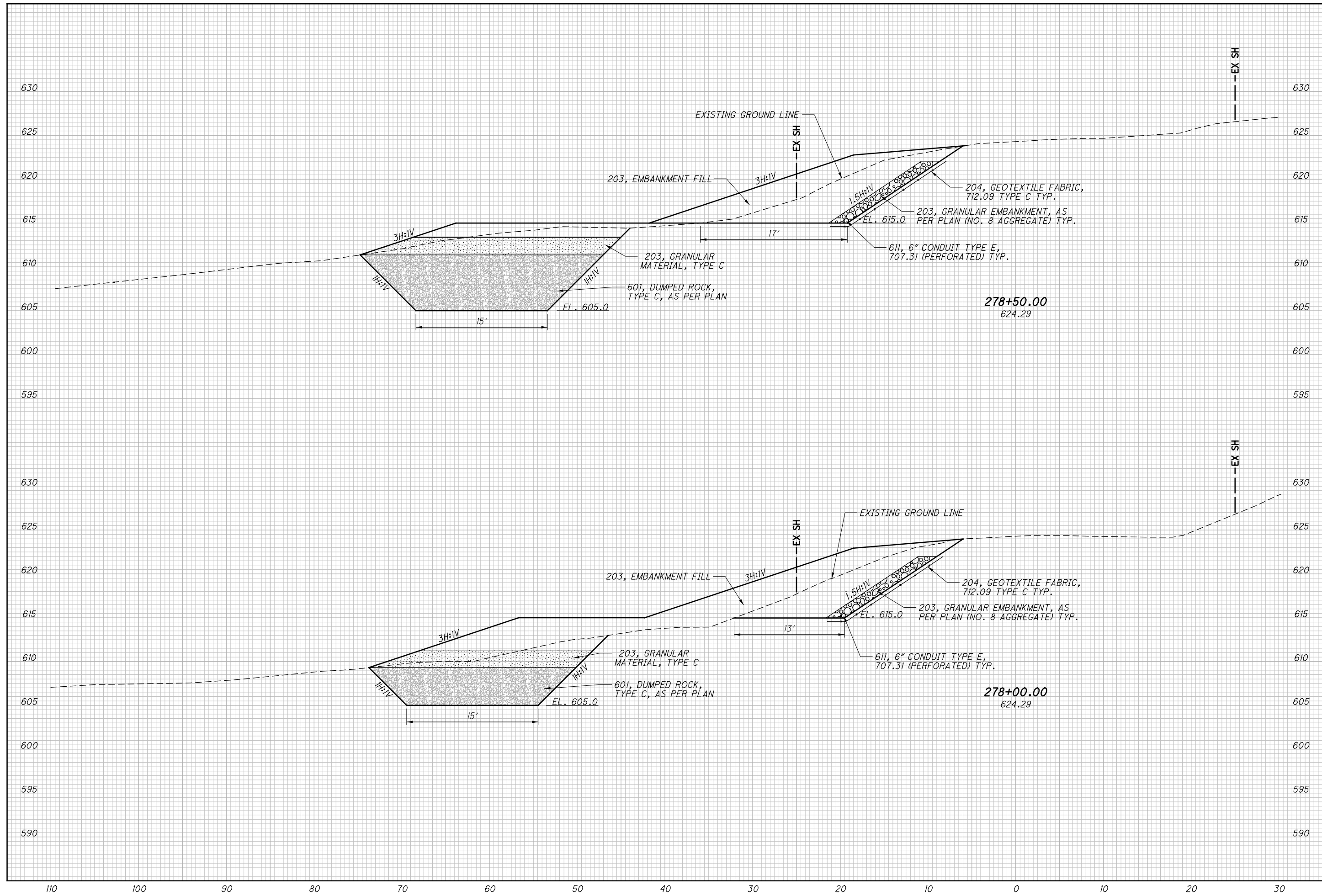
SHEAR KEY
NOT TO SCALE

NOTES:

1. EXCAVATE FORESLOPE AND BACKSLOPE OF THE SHEAR KEY AT SLOPE NECESSARY TO MAINTAIN STABILITY AND TO ALLOW FOR CONSTRUCTION ACCESS.

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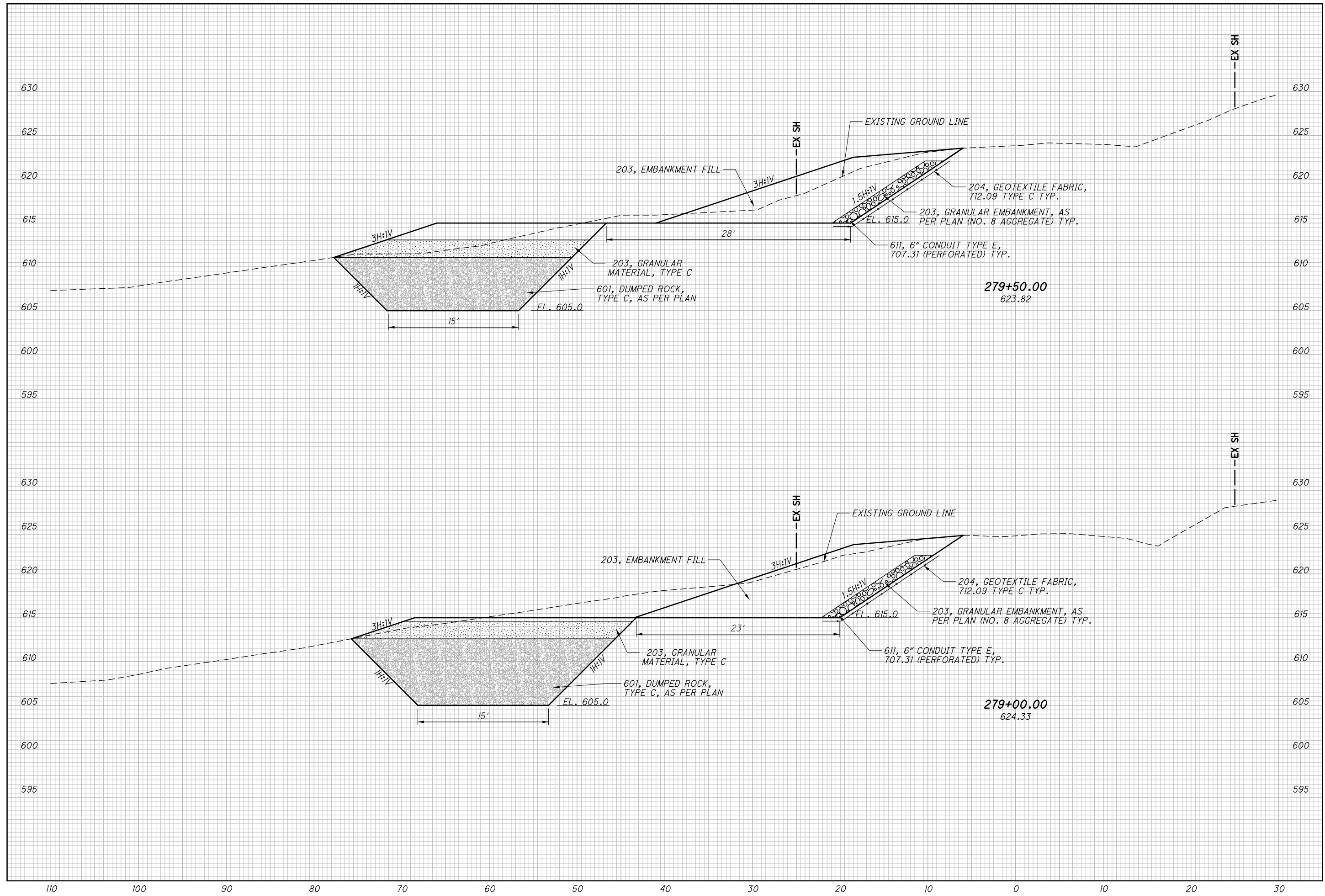


DRAWN	CLW
CHECKED	DMV

CROSS SECTIONS
STA. 278+50.00 TO STA. 278+00.00

ATH-329-5.26

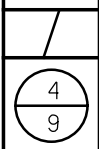
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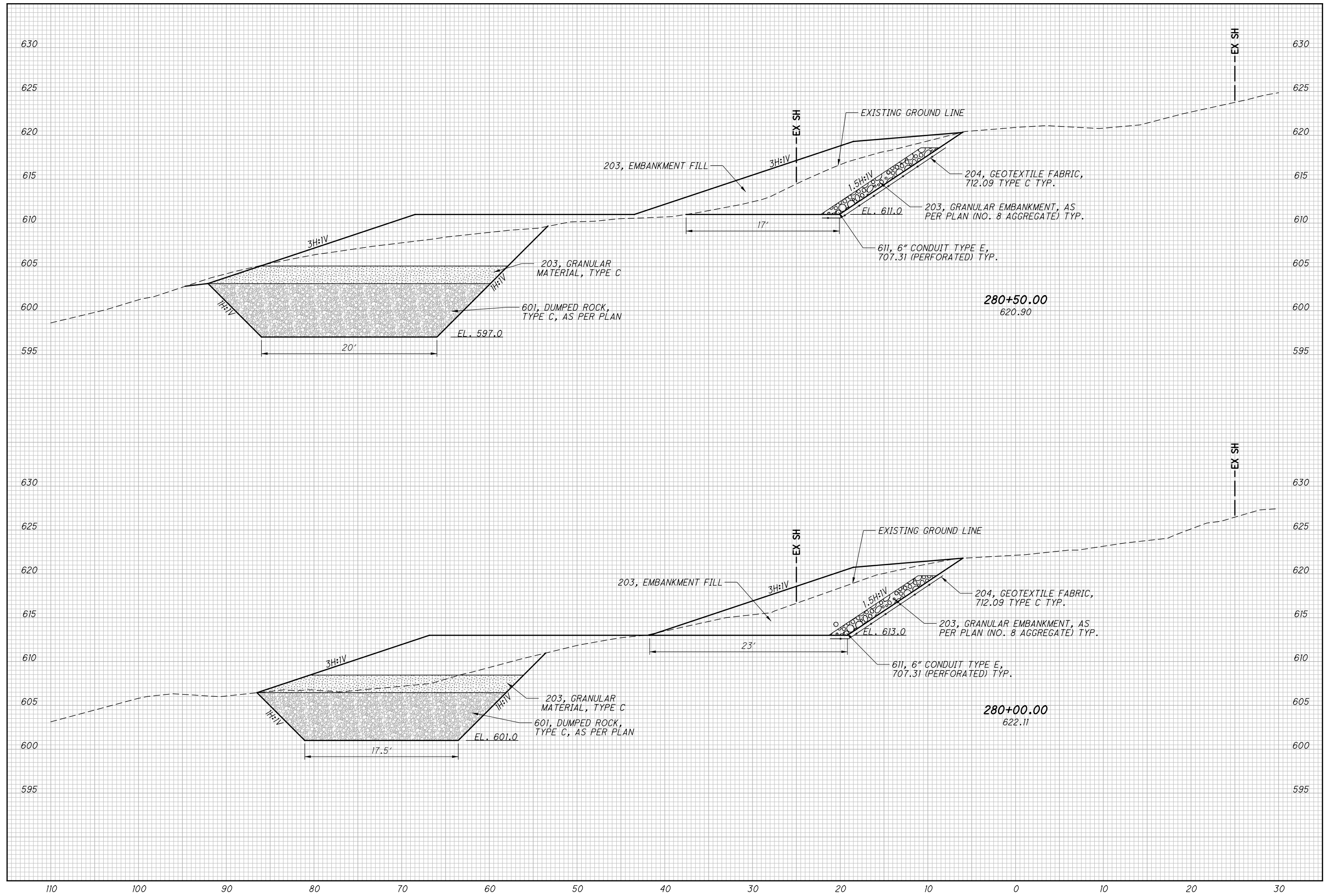
DRAWN	CLW
CHECKED	DMV

CROSS SECTIONS
STA. 279+50.00 TO STA. 279+00.00

ATH-329-5.26



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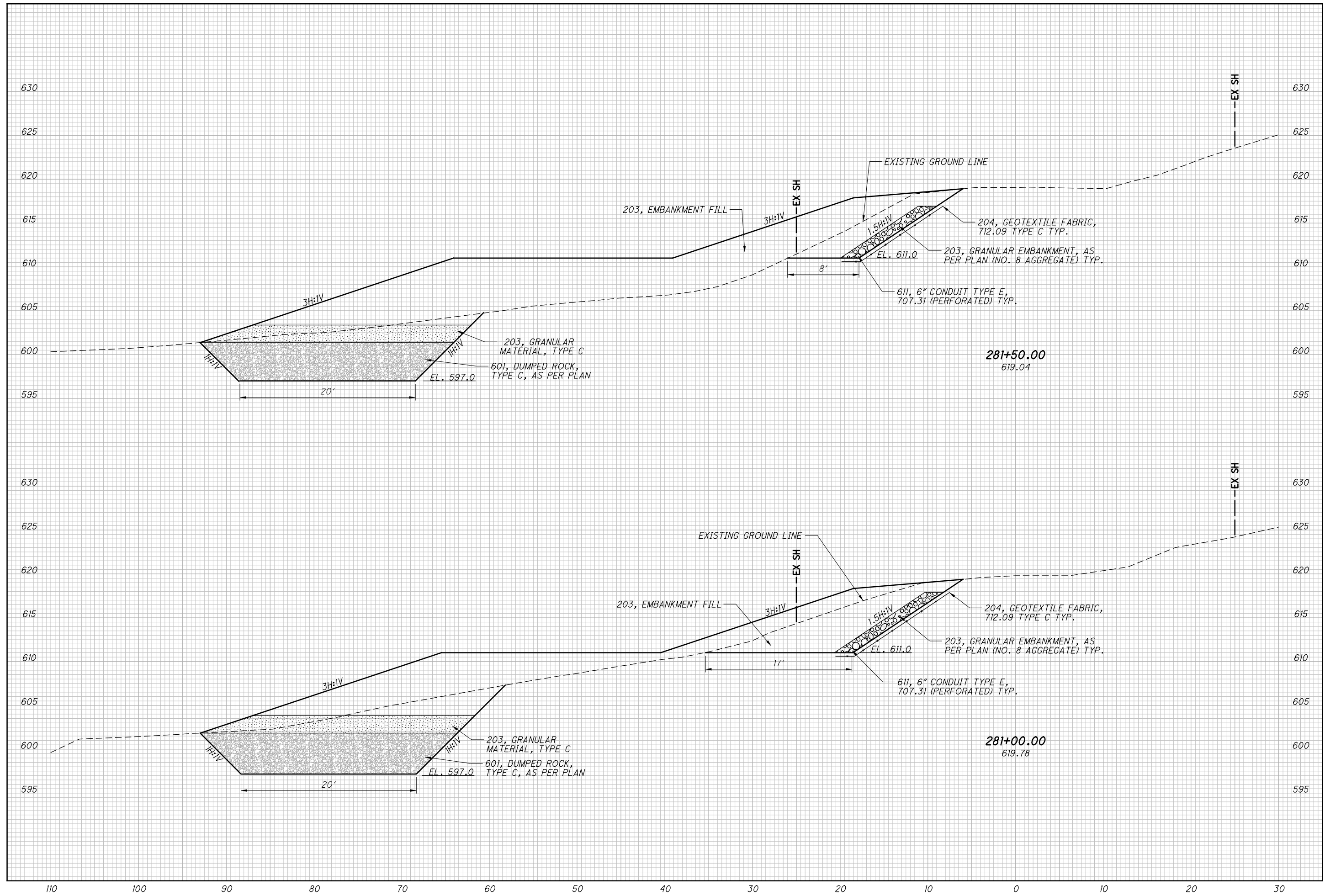
0	5	10
2.5		
HORIZONTAL SCALE IN FEET		
DRAWN	CLW	CHECKED
		DMV

CROSS SECTIONS
STA. 280+50.00 TO STA. 280+00.00

ATH-329-5.26

5
9

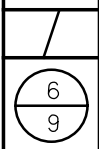
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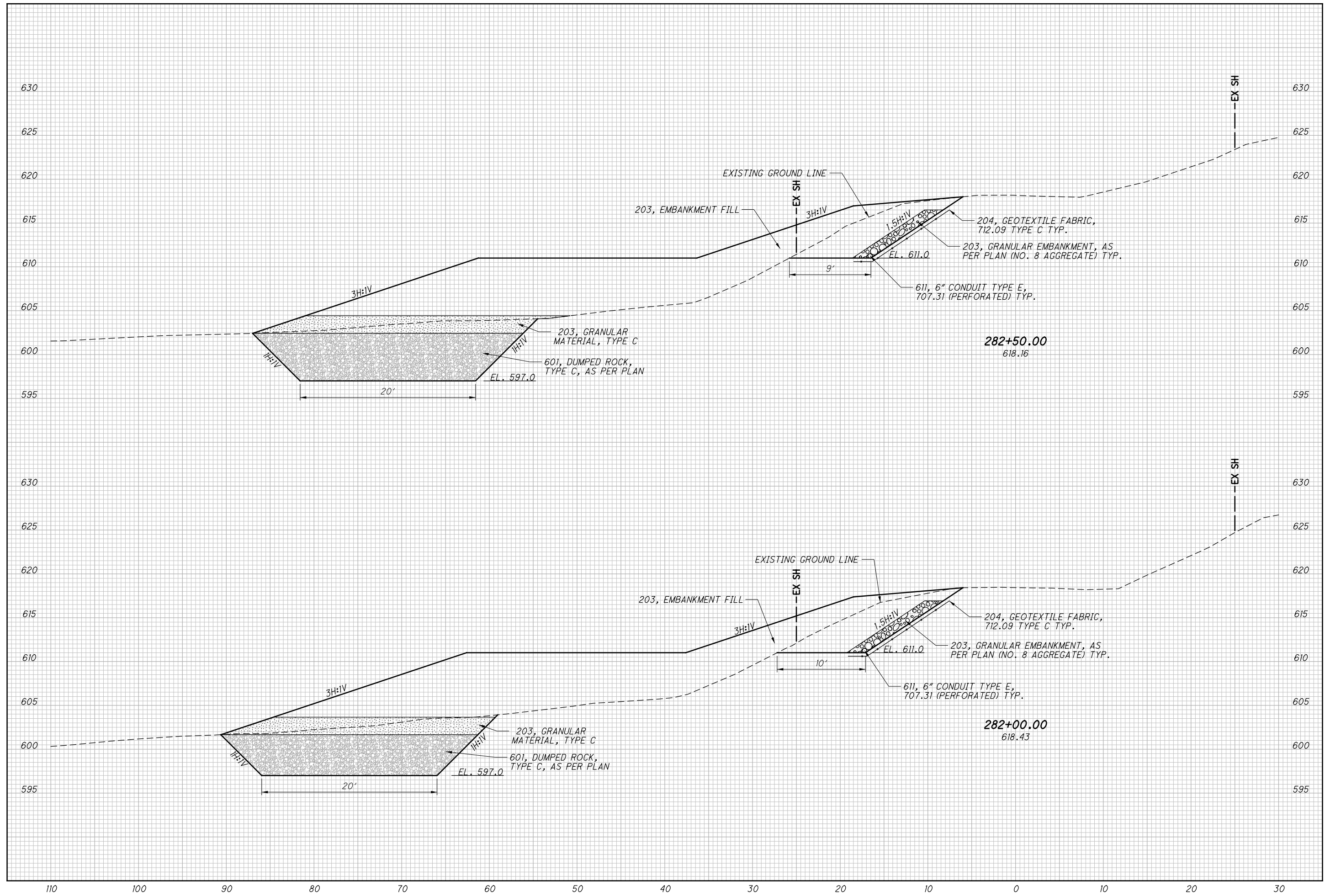
DRAWN
CLW
CHECKED
DMV

CROSS SECTIONS
STA. 281+50.00 TO STA. 281+00.00

ATH-329-5.26



c:\pwworking\east01\42036425\114589_WX101.dgn 6/9/2021 5:05:19 PM CWAHLBRI

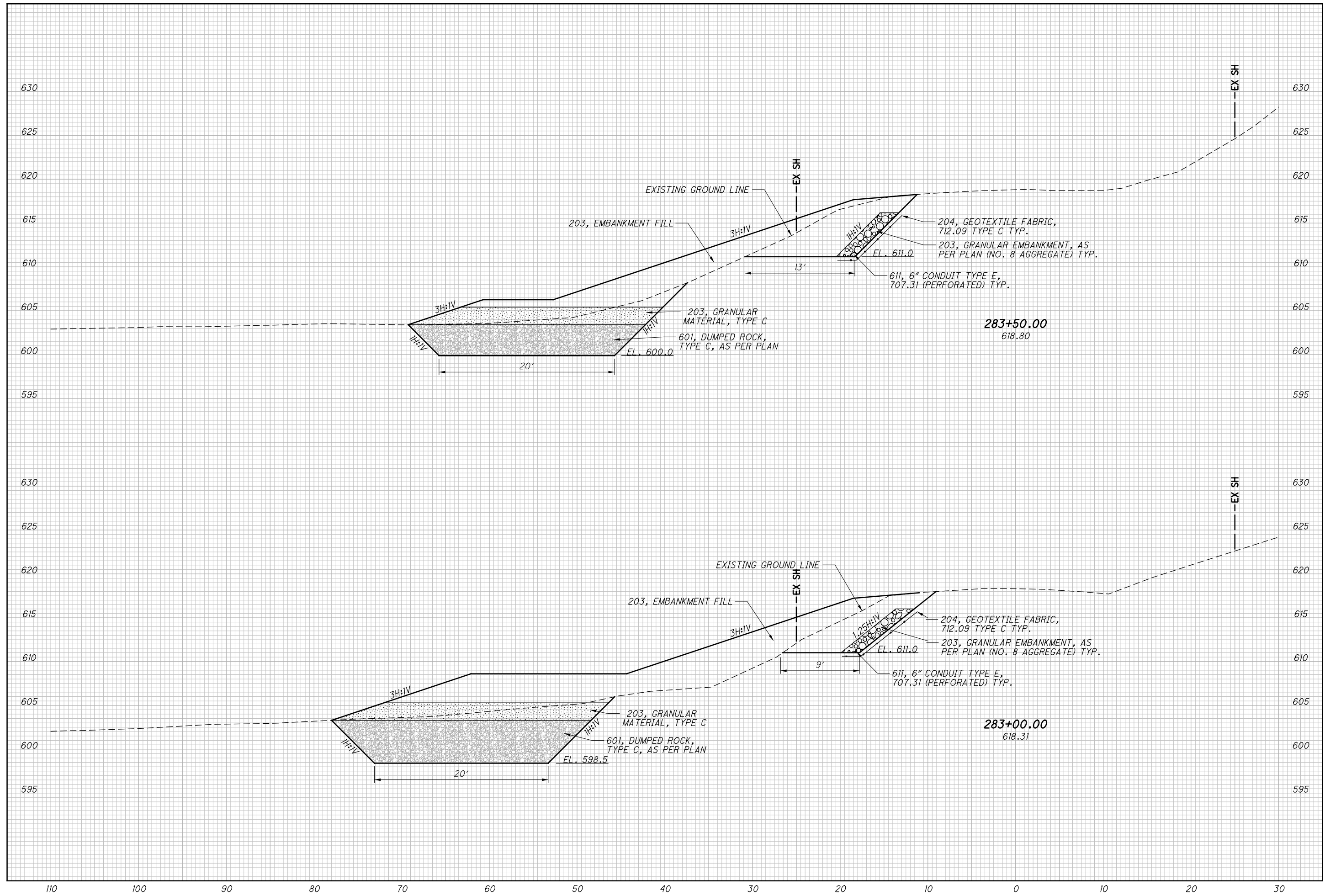


DRAWN	CLW
CHECKED	DMV

CROSS SECTIONS
STA. 282+50.00 TO STA. 282+00.00

ATH-329-5.26

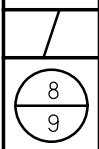
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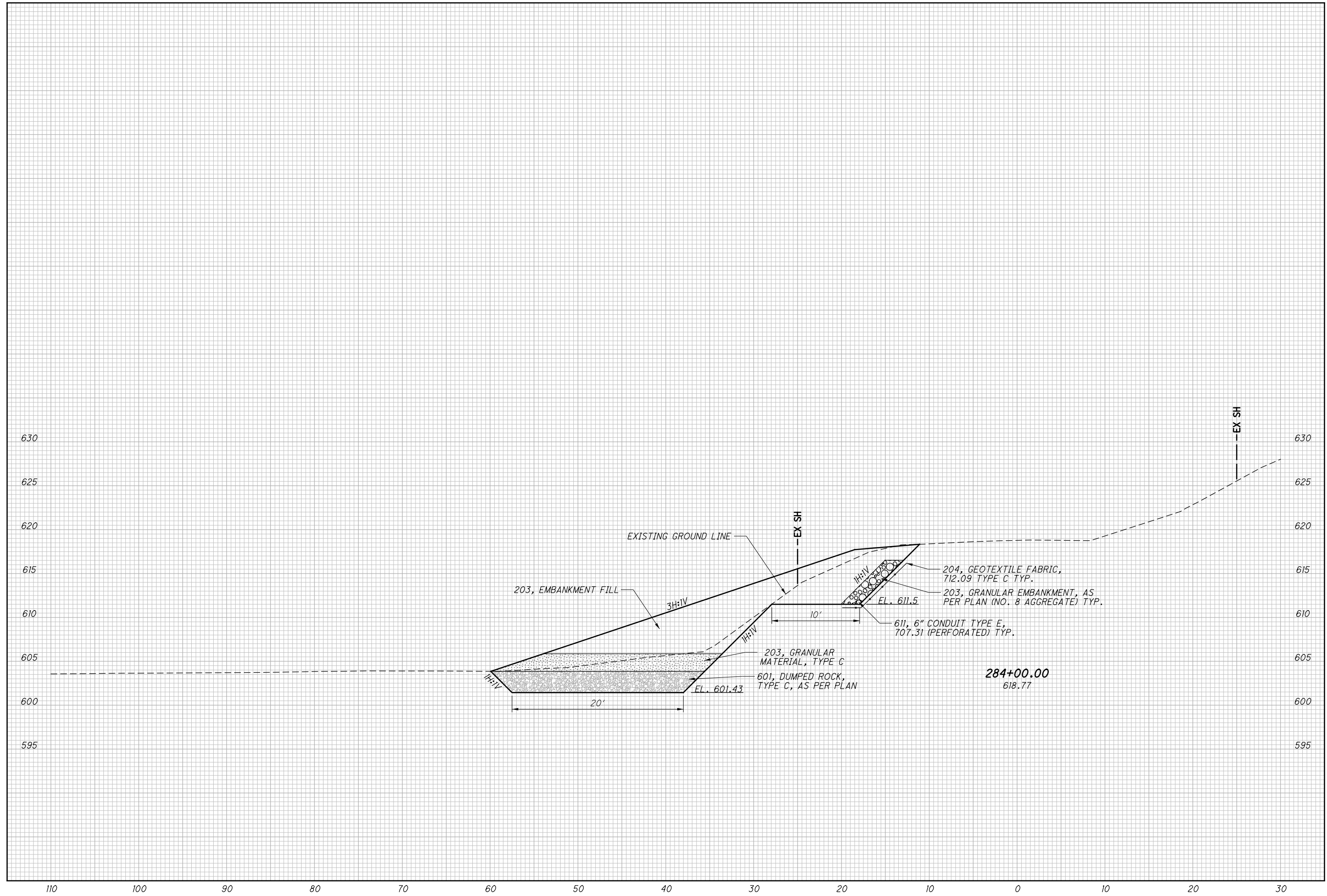
DRAWN	CLW
CHECKED	DMV

CROSS SECTIONS
STA. 283+50.00 TO STA. 283+00.00

ATH-329-5.26



c:\pwworking\east01\42036425\114589_WX101.dgn 6/9/2021 5:05:20 PM CWAHLBRI



0	5	10
2.5		
HORIZONTAL SCALE IN FEET		
DRAWN	CLW	
CHECKED	DMV	

CROSS SECTIONS
STA. 284+00.00

ATH-329-5.26

