FINAL Report of Roadway Exploration – HAN-US 68/SR 15 Interchange

Findlay, Hancock County, Ohio

November 2, 2023

Prepared for:

Ohio Department of Transportation, District 1

Prepared by:

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Table of Contents

LIST OF APPENDICES

Executive Summary

Stantec Consulting Services Inc. (Stantec) is performing the engineering design for proposed roadway improvements to the US-68/SR 15 Interchange in Hancock County, south of the city of Findlay. These improvements are to reroute traffic as needed due to permanent road closures associated with the proposed flood mitigation project along Eagle Creek, near the project site. The existing exit ramp from SR 15 SB to US 68 will be relocated, and a roundabout is proposed at the ramp intersection with US 68. The existing SR 15 exit ramp is to be converted into a connector road to Liberty Township Road (TR) 80.

Nine borings were drilled as part of this exploration; four along the dedicated exit ramp, four around the new roundabout, and one near the dedicated TR 80 connection to US 68. Two of the nine borings (B-001-0-22 and B-005-0-22) were completed in the pavement of the existing roadway and were drilled to a depth of 8.0 and 7.5 feet below ground surface respectively. The remainder of the borings were drilled adjacent to the existing roadway to a depth of 11.5 feet. Encountered overburden soils included sandy clays, gravelly clays, lean clays, and gravel and stone fragments with sand. These soils classified as A-1-b, A-3a, A-4a, A-6a, A-6b, and A-7-6 according to the Ohio DOT Classification System. Boring B-004 encountered a layer of Elastic Clay (A-7-5) at the ground surface. Bedrock was not encountered in any of these nine borings.

Based upon the results of the exploration, and the use of ODOT's Subgrade Analysis Spreadsheet, a design CBR of 7 is recommended for the project. Due to high sulfate contents and low N_{60} values, all areas of new pavement subgrade are recommended to be excavated and replace to a maximum depth of 15 inches. A geotextile reinforcement is recommended to be used in conjunction with the placement of suitable subgrade material.

New embankments are expected to be a maximum of 10 feet in height, and are expected to be stable with the proposed side slopes of 3:1 or 2.5:1. Side hill fills are recommended to be benched following the ODOT CMS guidance for standard benching (Section 203.05). Special benching design may be necessary if sidehill fills are expected to be less than 3 feet in width.

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) is performing the engineering design for proposed roadway improvements to the US-68/SR 15 Interchange in Hancock County, south of the city of Findlay. These improvements are to reroute traffic as needed due to permanent road closures associated with the proposed flood mitigation project along Eagle Creek, near the project site. The existing exit ramp from SR 15 SB to US 68 will be relocated, and a roundabout is proposed at the ramp intersection with US 68. The existing SR 15 exit ramp is to be converted into a connector road to Liberty Township Road (TR) 80.

This roadway exploration report was prepared to summarize the exploration and laboratory testing program and the subsurface findings during the exploration. Recommendations related to the design and construction of the roadway improvements are provided based upon the findings during the exploration. The geotechnical exploration was performed in accordance with the ODOT Specifications for Geotechnical Explorations (SGE) dated July, 2022.

2.0 GEOLOGY

2.1 GENERAL

As shown on the Physiographic Regions of Ohio Map (Ohio Department of Natural Resources (ODNR), 1998), the project site is located in Findlay Embayment. This region of the Huron-Erie Lake Plains consists of broadly rolling lacustrine plains having thin drift and very low relief (10 feet). The project also resides in an outwash region with a drift thickness of 0 to 50 feet, according to the Glacial Map of Ohio (Ohio Department of Natural Resources (ODNR), 2005) and Shaded Drift Thickness Map of Ohio (ODNR, 2004).

2.2 SOIL GEOLOGY

Published soils information from the United States Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS) website (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) shows primarily Udorthents (UcA) in the project area. This soil contains 0 to 2 percent slopes and is frequently flooded, while being somewhat poorly drained with a moderately high to high hydraulic conductivity.

From the Physiographic Regions of Ohio Map (ODNR, 1998), the project site consists of silty to gravelly Wisconsinan-age lacustrine deposits and is near an unmodified Defiance Moraine according to the Glacial Map of Ohio (ODNR, 2005).

2.3 BEDROCK GEOLOGY

The Physiographic Regions of Ohio Map (ODNR, 1998) and Bedrock Geologic Map of Ohio (ODNR, 2006) shows bedrock of the Silurian age consisting of dolomite and shales with some limestone. The bedrock has low relief from its marine origin.

The project site is not located within the limits of any known inactive underground mines according to the Mines of Ohio Map (ODNR 2018) and the Abandoned Underground Mines of Ohio Map (ODNR, 2012).

The Ohio Karst Areas Map (ODNR, 2006) shows no known karst areas are in the project vicinity. However it is located in a region with Silurian- and Devonian-age carbonate bedrock overlain by less than 20 feet of glacial drift and/or alluvium which contains some possibility of similar features.

From the Oil and Gas Fields Map of Ohio (ODNR, 1996), oil and gas fields of the Ordovician fractured shale, Trenton Limestone, Black River Group, and Wells Creek Formation are present in the project area.

2.4 HYDROLOGY AND HYDROGEOLOGY

The project site is located near Eagle Creek, which is a tributary to the Blanchard River. The Primary Lithology of the Unconsolidated Deposits of Ohio (ODNR, 2000) reveals the project site to be in an area of containing an alluvial / buried valley unconsolidated aquifer. Yields of upper bedrock stratas in the area result in 0 to 5 gallons per minute (gpm) as shown in the Yields of the Uppermost Bedrock Aquifers of Ohio map (ODNR, 2000).

Published data from (USDA) – (NRCS) website (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) indicates a shallow depth to water table of over 80 inches (>6.5 feet) with a hydrologic soil group class B/D. The project is located in a known frequently flooded location of flat to shallow sloped land. The saturated silt loam soil has a hydraulic conductivity of 0.60 to 2.00 inches per hour (4.2×10^{-4} to 1.4×10^{-3} centimeters per second).

3.0 EXPLORATION

This exploration consisted of nine borings (B-001-0-22 through B-009-0-22); four along the proposed exit ramp, four around the new roundabout, and one near the proposed TR 80 connection to US 68. The locations of the borings are provided in the Plan of Exploration in Appendix A. ODOT's Specification for Geotechnical Explorations (SGE) Section 303 was followed to determine the depth and sample interval of the borings. Two of the borings, B-001 and B-005, were Pavement Subgrade Type A borings, sampled continuously below the existing pavement for four samples. The remainder of the borings were Roadway Type B or embankment Type B1 borings, sampled at 2.5-foot intervals to a minimum depth of 10 feet.

The borings were advanced using a track mounted drill rig using 3.25-inch hollow stem augers. Standard Penetration Test (SPT) samples were conducted using a calibrated automatic hammer with an 87.6% energy ratio. One undisturbed Shelby Tube sample was collected from Boring B-004 for further strength and consolidation characteristic testing. A bulk sample of the auger cutting from the top 3 to 5 feet of each boring was collected for sulfate content testing. Field observations of encountered water and material descriptions were logged during drilling by a Stantec representative.

All samples obtained were transported to Stantec's materials testing laboratory where a visual classification was performed, and water content (WC) measured on all retained soil samples. Engineering classification, consisting of Atterberg Limits (ASTM D 4318 Method A) and Particle Size Analysis (ASTM D 421-422) testing was performed on select soil samples within each boring reflecting the primary soil horizons.

Upon completion of drilling activities, the boreholes were backfilled in accordance with ODOT SGE requirements using bentonite chips and soil cuttings. Asphalt cold patch was also used in borings drilled through existing pavement.

The boring locations are shown in the Plan of Exploration provided in Appendix A. The boring logs are provided in Appendix B.

4.0 FINDINGS

Detailed descriptions of the encountered subsurface conditions, including the results of the laboratory testing are included in the boring logs presented in Appendix B. Undisturbed sample testing results, consisting of unconfined compressive strength and one-dimensional consolidation testing, are provided in Appendix C.

Two of the borings, B-001 and B-005 were advanced through existing pavement. The pavement thickness was measured as 1.0 feet in both of the borings. Below the pavement, a 1.0- to 1.5-foot-thick layer of gravel was encountered. Boring B-009 was located on the shoulder of the existing exit ramp, and a 6-inch layer of gravel was encountered at the top of the boring.

Granular soil was encountered in several of the other borings at the ground surface, consisting of Gravel with Sand (A-1-b). The granular material was generally one to two feet thick where encountered. Below this layer, or beginning at the ground surface for the remainder of the borings, fine-grained cohesive soil was encountered. This soil layer classified as Silt and Clay (A-6a), Silty Clay (A-6b), Clay (A-7-6), and in B-008, Sandy Silt (A-4a). The fine-grained soils were generally described as medium stiff to very stiff, with some hand penetrometer values falling within the soft and also hard ranges. Hand penetrometer values ranged from 0.5 to 4.5 tons per square foot (tsf). An Unconfined Compressive strength test was performed on a sample collected from B-004, and resulted in an unconfined compressive strength of 1.28 tsf at a depth of 2.7 feet. The samples recovered were generally described as damp to moist, however, the soft zones encountered were described as moist to wet. No static groundwater encountered in the borings.

One boring (B-004) encountered a layer of Elastic Clay (A-7-5) at the ground surface. This layer was measured to be approximately 1.5 feet thick. This soil was described as medium stiff, brown and moist.

Four of the borings (B-002, B-004, B-008 and B-009) encountered a granular layer near the bottom of the drilled depths. This granular layer was first encountered between Elevation 781 and 784 feet. This layer was described as very loose to medium dense Coarse and Fine Sand (A-3a) or non-cohesive Sandy Silt (A-4a), and moist to wet.

Sulfate content was measured from grab samples of the auger cutting from the top 3-5 feet in each boring. The results of the sulfate testing showed a varying amount, from 166 to more than 8,000 parts-per-million (ppm) in the borings. The results of the tests are included on the boring logs in Appendix B, and also the lab data sheet from the testing is included in Appendix C.

Bedrock was not encountered in any of the borings.

5.0 ANALYSIS AND RECOMMENDATIONS

These conclusions and recommendations are based on data and subsurface conditions from the borings advanced during this exploration using the degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions between borings.

5.1 PAVEMENT SUBGRADE

A Subgrade Analysis Spreadsheet (ODOT, 2022) was completed for the project using the data collected during the exploration. The spreadsheet is included as Appendix D. Based upon the results of the spreadsheet, a design CBR value of 7 is recommended for use in pavement design.

Boring B-001-0-22 had a sulfate content test result of greater than 8,000 ppm, and B-005 through B-007 had sulfate content results above 1,000 ppm, with two of them near 3,000 ppm. Boring B-003 also exhibited low N_{60} values within three feet of proposed grade. Based upon these results, it is recommended that Item 204 – Excavate and Replace be performed at any location of new pavement between Stations 612+50 and 615+50. This is generally along the west side of the proposed roundabout. It is recommended that a maximum of 15 inches of subgrade material be removed, and replaced with suitable soil, along with a geotextile reinforcement layer.

While measured moisture contents were generally within acceptable ranges for the soils identified, any wet or saturated soils encountered during subgrade preparation should either be removed or dried in place prior to final subgrade preparation.

5.2 EMBANKMENTS

The proposed new Ramp A will consist of areas of embankment fill to meet the existing grade of US 68. In addition, around the proposed roundabout, new fill will be required. Based upon the proposed finished grade, it is estimated that the new embankments will not exceed 10 feet in height. Side slopes are planned to be 3H:1V or 2.5H:1V.

Based upon the soils encountered during the geotechnical exploration, the geometry of the proposed embankments, and the general recommendations in the ODOT Geotechnical Design Manual, Section 500, new embankments up to a height of 10 feet of new fill are expected to be stable. Areas of sidehill fill are recommended to be benched per the Standard Benching method (ODOT Construction and Materials Specifications Item 203.05). Special benching may be required if the sidehill fill material is less than three feet in width, and recommendations for design will be provided during Stage 2 of the design.

Consolidation settlement due to new embankment loading is expected to be less than three inches due to the limited new fill proposed. If areas of fill are expected to exceed 10 feet in height, an embankment settlement analysis is recommended, utilizing the results of the one-dimensional consolidation testing performed.

Unsuitable soil (Elastic Clay, A-7-5) was encountered in Boring B-004, along the Ramp A alignment. The Elastic Clay was observed in the top 18 inches of the boring. This soil layer was not encountered in the borings on either side of B-004 (B-003 and B-006). The A-7-5 material is unsuitable due to its potential for volume change under changing moisture

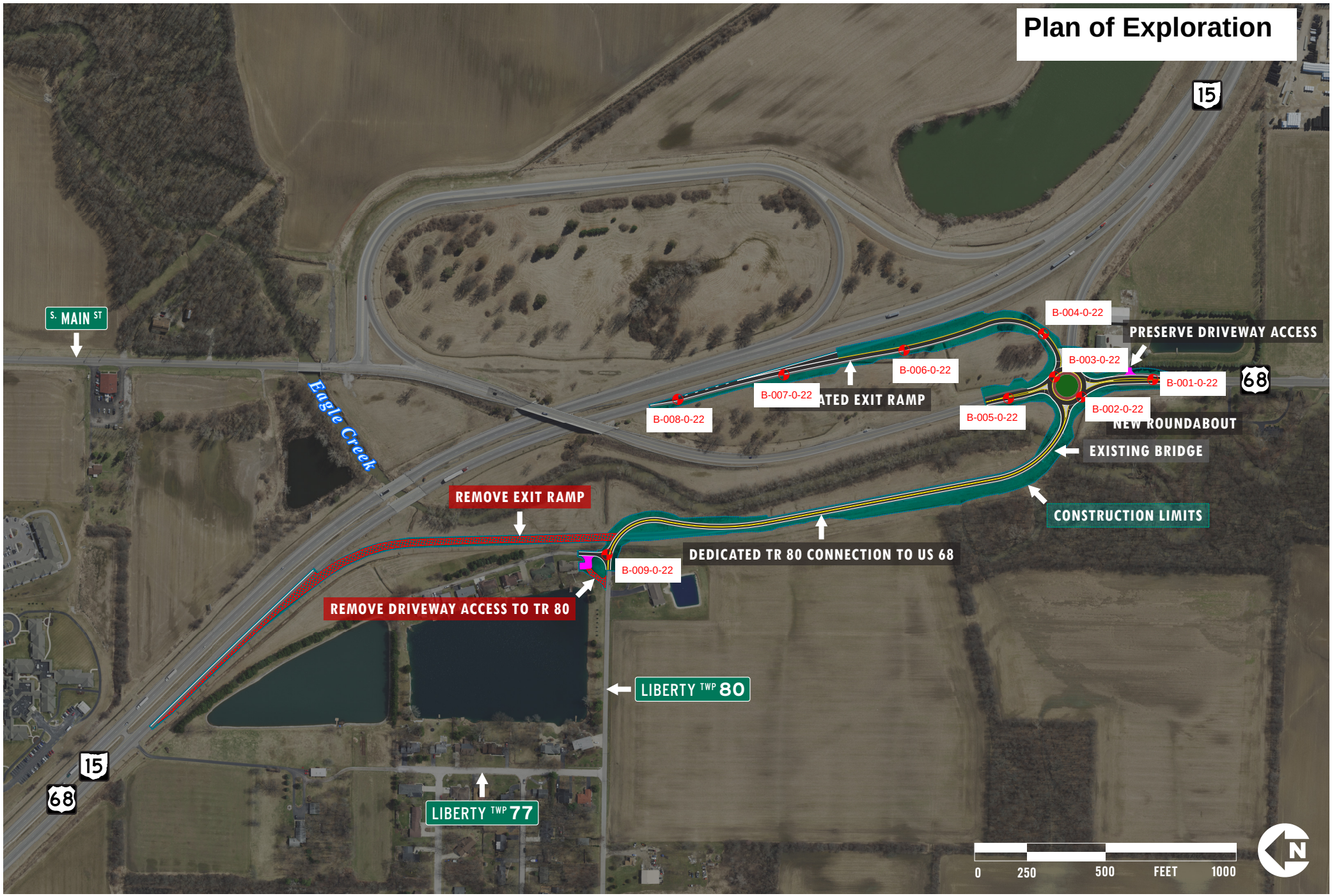
conditions. It is recommended that this soil layer be removed prior to construction of the proposed Ramp A embankment to the maximum extents of Station 613+50 to 619+00 (Ramp A Centerline). These extents may be reduced based upon observations during construction.

APPENDICES

Appendix A PLAN OF EXPLORATION

Alternative 1

HAN-US 68/SR 15 Interchange • PID 112280



Appendix B BORING LOGS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 611+22, 21' LT.
ALIGNMENT: SR68
ELEVATION: 796.0 (MSL) EOB: 8.0 ft.
COORD: 305450.5932 N, 163862.9718 E

EXPLORATION ID: B-001-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ASPHALT	796.0																		
AGGREGATE BASE	795.0																		
DENSE, TAN AND GRAY, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	794.0	1	17 17 17	50	93	SPT-1	-	37	28	13	15	7	17	15	2	8	A-1-b (0)	8000	
MEDIUM DENSE, GRAYISH BROWN AND DARK GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP	792.5	2																	
	791.8	3	14 7 6	19	40	SPT-2	-	-	-	-	-	-	-	-	-	6	A-2-6 (V)	-	
MEDIUM STIFF TO STIFF, DARK BROWN WITH DARK GRAY, **SILT AND CLAY**, TRACE GRAVEL, SOME SAND, MOIST	789.2	4	2 3 5	12	100	SPT-3	1.75	10	10	24	27	29	31	18	13	24	A-6a (5)	-	
STIFF, ORANGISH BROWN, **SILT AND CLAY**, TRACE COARSE GRAVEL, MOIST	788.0	5	3 5 6	16	100	SPT-4A	-	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		6				SPT-4B	3.00	-	-	-	-	-	-	-	-	-	A-6a (V)	-	
		7																	
		EOB 8																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE | DRILLING FIRM / OPERATOR: STANTEC / GREG W. | DRILL RIG: CME 45 TRACK /03 (#815) | STATION / OFFSET: 613+75, 59' LT. | EXPLORATION ID: B-002-0-22

TYPE: ROADWAY | SAMPLING FIRM / LOGGER: STANTEC / L. BROWN | HAMMER: CME AUTOMATIC | ALIGNMENT: SR68

PID: 112280 SFN: | DRILLING METHOD: 3.25" HSA | CALIBRATION DATE: 4/15/21 | ELEVATION: 795.2 (MSL) EOB: 11.5 ft. | PAGE 1 OF 1

START: 5/2/23 END: 5/2/23 | SAMPLING METHOD: SPT / BULK | ENERGY RATIO (%): 87.6 | COORD: 305695.3361 N, 163802.2318 E

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM DENSE, LIGHT GRAY, **GRAVEL AND/OR STONE FRAGMENTS**, DAMP	795.2																		
	793.7	1	4 7 4	16	73	SPT-1	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	1800	
STIFF, BROWN AND GRAY, **CLAY**, LITTLE GRAVEL, SOME SAND AND SILT, DAMP		2																	
		3	5 7 5	18	100	SPT-2	3.00	14	11	24	21	30	41	22	19	17	A-7-6 (7)	-	
	790.2	4																	
STIFF, DARK GRAY, **CLAY**, TRACE GRAVEL, LITTLE SAND, SOME SILT, DAMP		5	5 6 7	19	100	SPT-3	4.50	18	6	15	28	33	44	25	19	22	A-7-6 (9)	-	
		6																	
		7																	
		8	2 3 3	9	33	SPT-4	4.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	-	
		9																	
	784.5	10	2 2 3	7	73	SPT-5A	1.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	
LOOSE, TAN, **COARSE AND FINE SAND**, WET	783.7	EOB 11				SPT-5B	-	-	-	-	-	-	-	-	-	13	A-3a (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 614+22, 30' RT.
ALIGNMENT: SR68
ELEVATION: 797.2 (MSL) EOB: 11.5 ft.
COORD: 305754.6912 N, 163883.5083 E

EXPLORATION ID: B-003-0-22
PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM STIFF, BROWN, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, MOIST	797.2	1	2 2 3	7	80	SPT-1	2.00	31	11	17	20	21	30	19	11	15	A-6a (1)	170	
		2																	
		3	3 6 7	19	73	SPT-2	2.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	792.1	4																	
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST		5	13 7 5	18	93	SPT-3	3.00	47	8	12	14	19	37	23	14	19	A-2-6 (1)	-	
	789.5	6																	
MEDIUM STIFF, GRAY AND DARK GRAY, **SILTY CLAY**, MOIST		7																	
		8	2 2 4	9	80	SPT-4	2.00	-	-	-	-	-	-	-	-	33	A-6b (V)	-	
	787.2	9																	
SOFT, TAN AND GRAY, **SILTY CLAY**, WET		10																	
	785.7	11 EOB	1 2 2	6	73	SPT-5	0.50	-	-	-	-	-	-	-	-	20	A-6b (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 614+94, 15' RT.
ALIGNMENT: RAMPA
ELEVATION: 791.8 (MSL) EOB: 11.5 ft.
COORD: 305806.7368 N, 164044.9707 E

EXPLORATION ID: B-004-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM STIFF, BROWN, **ELASTIC CLAY**, TRACE GRAVEL, SOME SAND, MOIST	791.8	1	2 3 4	10	60	SPT-1	1.75	6	6	20	32	36	49	30	19	22	A-7-5 (12)	700	
MEDIUM STIFF, BROWN, **SILTY CLAY**, TRACE SAND, DAMP @2.7'- UC=1.28 tsf	790.3	2 3 4			65	ST-2	-	0	1	2	58	39	38	17	21	25	A-6b (12)	-	
SOFT, DARK GRAY, **SILT AND CLAY**, WITH SAND, SOME GRAVEL, MOIST TO WET	786.5	5	2			SPT-3A	1.50	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
		6	2 2	6	53	SPT-3B	-	-	-	-	-	-	-	-	-	34	A-6a (V)	-	
MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, MOIST	784.3	8	2 2 5	10	100	SPT-4	1.50	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, TRACE GRAVEL, SILT, AND CLAY, WET	781.8	10	6 8 6	20	73	SPT-5	-	1	22	64	8	5	NP	NP	NP	22	A-3a (0)	-	
	780.3 EOB	11																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 616+96, 27' RT.
ALIGNMENT: SR68
ELEVATION: 795.4 (MSL) EOB: 7.5 ft.
COORD: 306022.8057 N, 163816.5396 E

EXPLORATION ID: B-005-0-22
PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ASPHALT	795.4																		
	794.4																		
MEDIUM DENSE, LIGHT BROWN AND GRAY, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	793.0	1	10 4 4	12	73	SPT-1A	-	39	35	9	14	3	16	15	1	10	A-1-b (0)	1100	
						SPT-1B	-	-	-	-	-	-	-	-	-	-	A-6a (V)	-	
STIFF TO VERY STIFF, DARK BROWN, **SILT AND CLAY**, WITH SAND, DAMP		2 3 4	9 4 5	13	33	SPT-2	2.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		5	8 10 9	28	27	SPT-3	2.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	789.4	6																	
VERY STIFF, BROWNISH GRAY, **SILT AND CLAY**, LITTLE GRAVEL AND SAND, MOIST	787.9	7 EOB	4 8 9	25	100	SPT-4	4.00	11	5	14	30	40	34	20	14	18	A-6a (9)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 619+47, 60' RT.
ALIGNMENT: RAMPA
ELEVATION: 797.3 (MSL) EOB: 11.5 ft.
COORD: 306260.7058 N, 164068.0206 E

EXPLORATION ID: B-006-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	797.3	1	7 6 6	18	80	SPT-1	-	55	20	8	13	4	NP	NP	NP	5	A-1-b (0)	2700	
	795.8																		
STIFF, DARK BROWN AND GRAY, **SILT AND CLAY**, LITTLE GRAVEL, SOME SAND, DAMP		2																	
		3	10 6 6	18	33	SPT-2	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		4																	
		5	6 6 5	16	20	SPT-3	-	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
		6																	
		7																	
		8	3 4 6	15	93	SPT-4	3.75	17	8	21	24	30	35	21	14	15	A-6a (5)	-	
		9																	
	787.3	10																	
SOFT, GRAY, **SILT AND CLAY**, SOME SAND, MOIST		11	1 2 1	4	100	SPT-5	0.50	-	-	-	-	-	-	-	-	25	A-6a (V)	-	
	785.8	EOB																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 621+97, 38' RT.
ALIGNMENT: RAMPA
ELEVATION: 795.6 (MSL) EOB: 11.5 ft.
COORD: 306491.6892 N, 163994.7181 E

EXPLORATION ID: B-007-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV. 795.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
MEDIUM DENSE, BROWN AND GRAY, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP	794.1	1	3 5 4	13	80	SPT-1	-	56	18	9	12	5	NP	NP	NP	9	A-1-b (0)	1600	
STIFF TO VERY STIFF, DARK BROWN, **SILT AND CLAY**, TRACE GRAVEL, SOME SAND, DAMP		2 3 4	2 5 7	18	100	SPT-2	-	7	8	18	29	38	33	19	14	15	A-6a (8)	-	
		5 6 7	4 5 6	16	100	SPT-3	-	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
		8 9	4 5 5	15	100	SPT-4	-	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
	784.1 EOB	10 11	6 9 10	28	100	SPT-5	-	-	-	-	-	-	-	-	-	15	A-6a (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 624+79, 6' LT.
ALIGNMENT: RAMPA
ELEVATION: 794.3 (MSL) EOB: 11.5 ft.
COORD: 306761.6024 N, 163239.2379 E

EXPLORATION ID: B-008-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
STIFF TO VERY STIFF, DARK BROWN, **SANDY SILT**, LITTLE GRAVEL, SOME CLAY, DAMP	794.3	1	1 3 5	12	93	SPT-1	4.50	12	7	15	33	33	29	19	10	2	A-4a (6)	2600	
		2																	
sand seam @ 3.5 ft		3	6 9 8	25	93	SPT-2	4.25	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
	789.0	4																	
SOFT TO MEDIUM STIFF, LIGHT BROWN AND ORANGE, **SILT AND CLAY**, LITTLE GRAVEL, SOME SAND, MOIST		5	1 1 2	4	67	SPT-3	0.50	16	12	23	26	23	29	18	11	20	A-6a (3)	-	
	786.0	6																	
SOFT TO MEDIUM STIFF, LIGHT BROWN, **SILT AND CLAY**, MOIST		7																	
		8	1 4 3	10	100	SPT-4A	1.00	-	-	-	-	-	-	-	-	23	A-6a (V)	-	
						SPT-4B	0.25	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
	783.2	9																	
VERY LOOSE, GRAY, **COARSE AND FINE SAND**, WITH GRAVEL, WET	782.8	10	1 1 1	3	100	SPT-5A	-	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	EOB	11				SPT-5B	-	-	-	-	-	-	-	-	-	29	A-3a (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 11/2/23 23:43 - U:\1743162O4\TRANSPORTATION\112280\400-ENGINEERING\GEOTECHNICAL\DRILLING\HAN - US 68 - SR 15 INTI

PROJECT: HAN-US 68/SR 15 INTERCHANGE
TYPE: ROADWAY
PID: 112280 SFN:
START: 5/2/23 END: 5/2/23

DRILLING FIRM / OPERATOR: STANTEC / GREG W.
SAMPLING FIRM / LOGGER: STANTEC / L. BROWN
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT / BULK

DRILL RIG: CME 45 TRACK /03 (#815)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/15/21
ENERGY RATIO (%): 87.6

STATION / OFFSET: 11+80, 15' LT.
ALIGNMENT: TR80
ELEVATION: 794.9 (MSL) EOB: 11.5 ft.
COORD: 307482.1534 N, 163239.2379 E

EXPLORATION ID: B-009-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
GRANULAR BASE	794.9																		
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, SOME GRAVEL, LITTLE SAND, DAMP	794.4	1	4 4 6	15	73	SPT-1A	-	-	-	-	-	-	-	-	-	-	A-1-b (V)	-	
						SPT-1B	4.50	24	6	12	22	36	34	19	15	13	A-6a (7)	890	
		2																	
		3	4 5 7	18	100	SPT-2	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		4																	
	789.9	5																	
STIFF TO VERY STIFF, TAN AND GRAY, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP		6	6 6 8	20	93	SPT-3	4.50	11	6	13	28	42	37	21	16	17	A-6b (9)	-	
		7																	
		8	4 7 9	23	100	SPT-4	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
		9																	
	783.9	10																	
		11	6 8 14	32	100	SPT-5A	4.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
MEDIUM DENSE, TAN AND GRAY, **SANDY SILT**, MOIST	783.4	EOB				SPT-5B	-	-	-	-	-	-	-	-	-	23	A-4a (V)	-	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH AUGER CUTTINGS; BENTONITE CHIPS

Appendix C LABORATORY TEST DATA

Unconfined Compressive Strength of Cohesive Soil

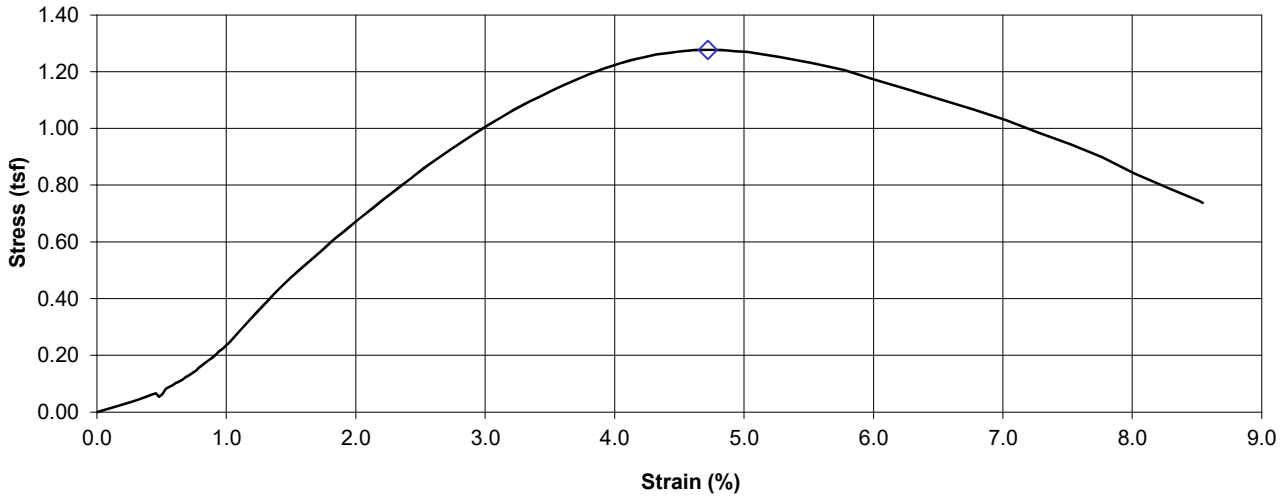
ASTM D 2166

Project Name	HAN - US68/SR15 Interchange	Project Number	174316204
Source	B-004-0-22, 2.5'-4.5'	Lab ID	267
Visual Description	Lean Clay (CL), gray, moist, firm		
		Recovered	1'
		Test Interval	2.7' - 3.2'

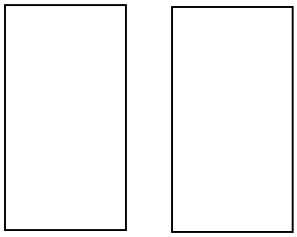
Specimen Type:	Undisturbed	LL	38	PL	17
				PI	21

Date Extruded	05/16/2023		
Date Tested	05/24/2023		
Initial Wet Density (pcf)	123.6		
Initial Moisture Content (%)	25.2	Initial MC Taken	Before Test, From Trimmings
Initial Dry Density (pcf)	98.7		
At Test Moisture Content (%)	N/A	At Test MC Taken	N/A
At Test Dry Density (pcf)	N/A		
Specific Gravity	N/A		
Degree of Saturation (%)	N/A	Unconfined Compressive Strength (tsf)	1.28
Average Height (in)	5.924	Undrained Shear Strength (tsf)	0.64
Average Diameter (in)	2.888	Strain at Maximum Stress (%)	4.7
Height to Diameter Ratio	2.1	Strain Rate to Failure (% / min.)	0.99

Stress vs. Strain



Failure Sketch



Pocket Penetrometer Reading (tsf) N/A

Torvane Reading (kg/cm^2) N/A

Comments

2.5'-2.7' - NMC

2.7'-3.2' - UW

3.2'-3.5' - con

Classification :

LL= 38, PL = 17, PI = 21

%GR = 0.7, %CS = 0.7, %FS = 2.1, %SI = 66.5, %CL = 30.0

Reviewed By RHB

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name	HAN - US68/SR15 Interchange	Project No.	174316204
Source	B-004-0-22, 3.2'-3.5'	Lab ID	267
Description	Lean Clay (CL), brown, wet, soft	Date Received	05/12/2023
Specimen Type	Undisturbed		

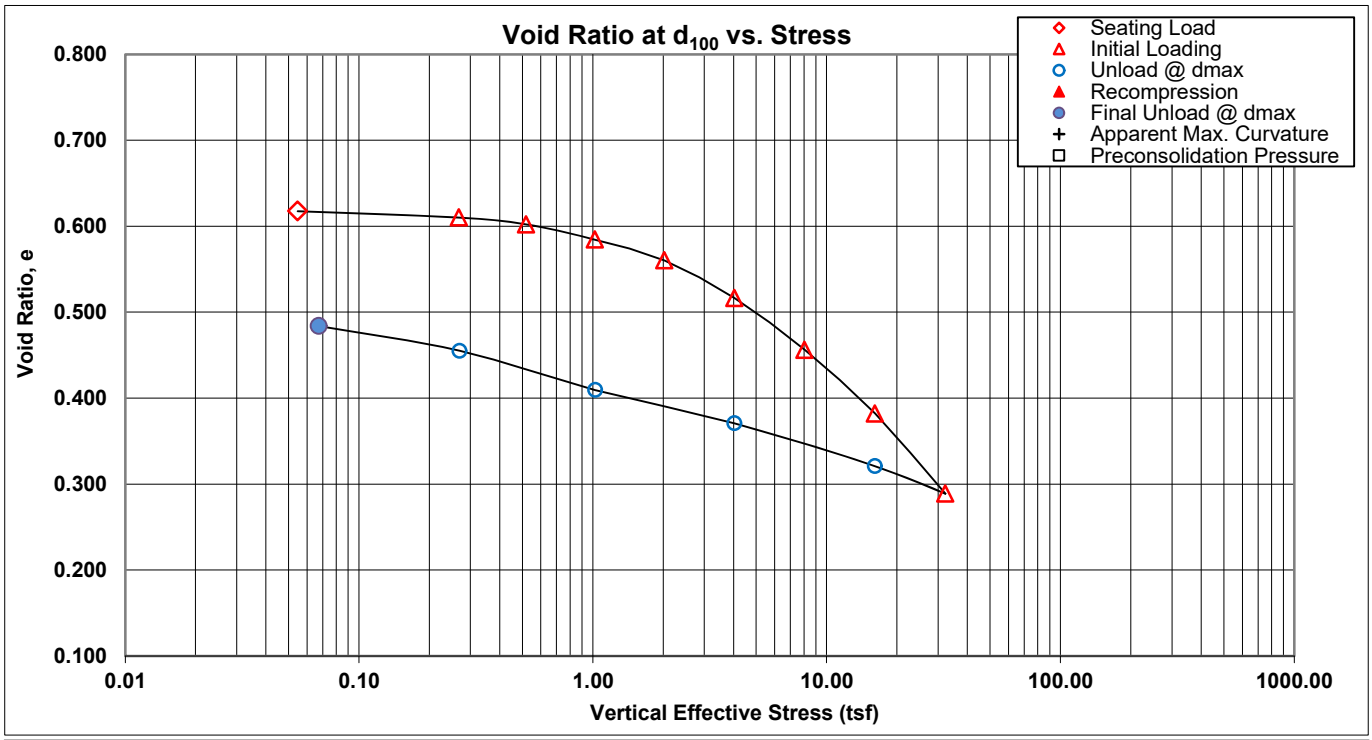
LL	38	Specific Gravity	2.68 ASTM D 854, Dry	Prepared	Using Cutting Ring
PL	17			Test Method	B - for 120 min.
PI	21			Test Condition	Inundated at 0.05 tsf

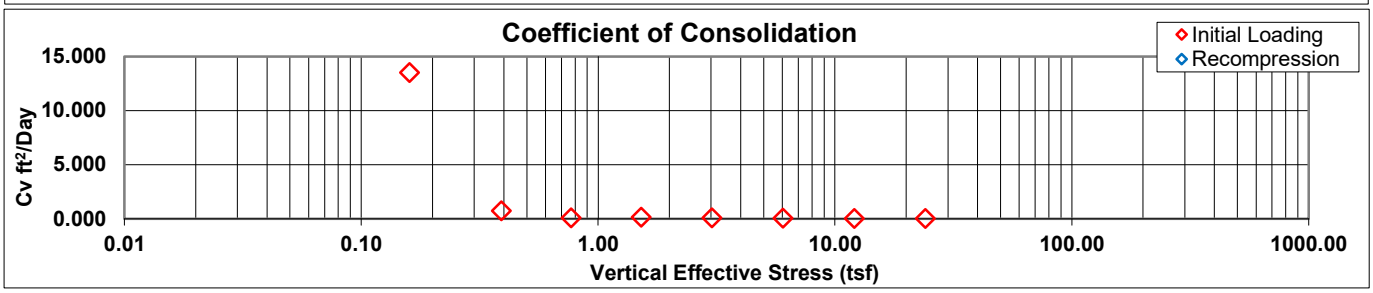
Initial Specimen Conditions

Moisture Content (%)	23.1
Dry Unit Weight (pcf)	103.2
Void Ratio	0.618
Degree of Saturation (%)	100.3
Initial Specimen Height (in)	0.9980
Equivalent Height of Solids (in)	0.617

Final Specimen Conditions

Moisture Content (%)	20.2
Dry Unit Weight (pcf)	112.5
Void Ratio	0.484
Degree of Saturation (%)	111.7
Final Specimen Height (in)	0.9156
Preconsolidation Pressure* (tsf)	
Void Ratio @ Preconsolidation Pressure	





Comments Classification :

LL= 38, PL = 17, PI = 21

%GR = 0.7, %CS = 0.7, %FS = 2.1, %SI = 66.5, %CL = 30.0

Reviewed By KG

Stantec

Sulfate Content in Soils
Colorimetric Method
ODOT Supplement 1122

Project Name HAN-US68/SR15 Interchange

Project Number 173409690

Lab ID	Source	Depth	Prep. Date	Test Date	Tech.	Reading 1 (mg/l)	Reading 2 (mg/l)	Reading 3 (mg/l)	Reading Average (mg/l)	Dilution Factor	Sulfate Concentration (ppm)
1039A	B-001-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	>100	>100	>100	>100	40	>8000
1039B	B-001-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	>100	>100	>100	>100	40	>8000
1039C	B-001-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	>100	>100	>100	>100	40	>8000
1044A	B-002-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	52	55	56	54	20	1087
1044B	B-002-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	62	62	62	62	40	2480
1044C	B-002-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	93	95	97	95	20	1900
1051A	B-003-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	<5	<5	<5	<5	20	<100
1051B	B-003-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	10	10	10	10	20	200
1051C	B-003-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	10	10	10	10	20	200
1057A	B-004-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	47	48	49	48	20	960
1057B	B-004-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	51	52	53	52	20	1040
1057C	B-004-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	<5	<5	<5	<5	20	<100
1063A	B-005-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	47	47	48	47	20	947
1063B	B-005-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	63	63	63	63	20	1260
1063C	B-005-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	47	48	48	48	20	953
1068A	B-006-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	74	74	74	74	40	2960
1068B	B-006-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	66	67	67	67	40	2667
1068C	B-006-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	61	61	61	61	40	2440
1074A	B-007-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	79	80	80	80	20	1593
1074B	B-007-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	80	81	81	81	20	1613
1074C	B-007-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	80	80	80	80	20	1600
1080A	B-008-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	74	74	74	74	40	2960
1080B	B-008-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	57	58	58	58	40	2307
1080C	B-008-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	62	62	62	62	40	2480
1088A	B-009-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	44	44	45	44	20	887
1088B	B-009-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	40	40	41	40	20	807
1088C	B-009-0-22	0.0'-5.0'	05/31/2023	06/02/2023	JP	49	49	50	49	20	987

Comments

Reviewed By RHB

Appendix D SUBGRADE ANALYSIS SPREADSHEET

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

Instructions: Enter data in the shaded cells only.
(Enter state route number, project description,county, consultant's name, prepared by name, and date prepared. This information will be transferred to all other sheets. The date prepared must be entered in the appropriate cell on this sheet to remove these instructions prior to printing.)

HAN-US 68/SR 15 Interchange
112280

Relocation of existing SR 15 SB exit ramp to US 68, inlcuding a roundabout at the new intersection.

Stantec Consulting Services Inc.

Prepared By: Jared Musselman
Date prepared: Monday, June 19, 2023

Jared Musselman
1500 Lake Shore Dr.
Suite 100
Columbus, OH 43204
614-545-3398
jared.musselman@stantec.com

NO. OF BORINGS: 9

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-22	US 68	611+22	21	Lt	CME 45 Track 815	88	796.0	797.8	1.8 F
2	B-002-0-22	US 68	613+75	59	Lt	CME 45 Track 815	88	795.2	797.2	2.0 F
3	B-003-0-22	US 68	614+22	30	Rt	CME 45 Track 815	88	797.2	797.0	0.2 C
4	B-004-0-22	Ramp A	614+94	15	Rt	CME 45 Track 815	88	791.8	798.6	6.8 F
5	B-005-0-22	US 68	616+96	27	Rt	CME 45 Track 815	88	795.4	795.4	0.0
6	B-006-0-22	Ramp A	619+47	60	Rt	CME 45 Track 815	88	797.3	795.6	1.7 C
7	B-007-0-22	Ramp A	621+97	38	Rt	CME 45 Track 815	88	795.6	795.4	0.2 C
8	B-008-0-22	Ramp A	624+79	6	Lt	CME 45 Track 815	88	794.3	794.9	0.6 F
9	B-009-0-22	TR 80	11+80	15	Lt	CME 45 Track 815	88	794.9	795.4	0.5 F

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS_1	2.0	3.5	3.8	5.3	50			17	15	2	15	7	22	8	6	A-1-b	0	8000					
	001-0	SS_2	3.5	5.0	5.3	6.8	19									6	10	A-2-6								
	22	SS_3	5.0	6.5	6.8	8.3	12		1.75	31	18	13	27	29	56	24	14	A-6a								
		SS_4	6.5	8.0	8.3	9.8	16	19	3							16	14	A-6a								
2	B	SS_1	0.0	1.5	2.0	3.5	16									7	6	A-1-b	0	1822						
	002-0	SS_2	2.5	4.0	4.5	6.0	18		3	41	22	19	21	30	51	17	19	A-7-6	7							
	22	SS_3	5.0	6.5	7.0	8.5	19		4.5	44	25	19	28	33	61	22	22	A-7-6								
		SS_4	7.5	9.0	9.5	11.0	9	16	4.5							22	18	A-7-6								
3	B	SS_1	0.0	1.5	-0.2	1.3	7		2	30	19	11	20	21	41	15	14	A-6a	1	166		N_{60}		15"	15"
	003-0	SS_2	2.5	4.0	2.3	3.8	19		2							14	14	A-6a	10							204 Geotextile
	22	SS_3	5.0	6.5	4.8	6.3	18		3	37	23	14	14	19	33	19	10	A-2-6	1							
		SS_4	7.5	9.0	7.3	8.8	9	7	2							33	16	A-6b								
5	B	SS_1	1.5	3.0	1.5	3.0	12			16	15	1	14	3	17	10	6	A-1-b	0	1053						
	005-0	SS_2	3.0	4.5	3.0	4.5	13		2							16	14	A-6a	10							
	22	SS_3	4.5	6.0	4.5	6.0	28		2							14	14	A-6a	10							
		SS_4	6.0	7.5	6.0	7.5	25	12	4	34	20	14	30	40	70	18	15	A-6a								
6	B	SS_1	0.0	1.5	-1.7	-0.2	18			0	0	NP	13	4	17	5	6	A-1-b	0	2689						
	006-0	SS_2	2.5	4.0	0.8	2.3	18		4.5							13	14	A-6a	10							
	22	SS_3	5.0	6.5	3.3	4.8	16									11	14	A-6a	10							
		SS_4	7.5	9.0	5.8	7.3	15	15	3.75	35	21	14	24	30	54	15	16	A-6a								
7	B	SS_1	0.0	1.5	-0.2	1.3	13			0	0	NP	12	5	17	9	6	A-1-b	0	1602						
	007-0	SS_2	2.5	4.0	2.3	3.8	18			33	19	14	29	38	67	15	14	A-6a	8							
	22	SS_3	5.0	6.5	4.8	6.3	16									19	14	A-6a	10							
		SS_4	7.5	9.0	7.3	8.8	15	13								20	14	A-6a								
8	B	SS_1	0.0	1.5	0.6	2.1	12		4.5	29	19	10	33	33	66	2	14	A-4a	6	2582						
	008-0	SS_2	2.5	4.0	3.1	4.6	25		4.25							15	10	A-4a	8							
	22	SS_3	5.0	6.5	5.6	7.1	4		0.5	29	18	11	26	23	49	20	14	A-6a								
		SS_4	7.5	9.0	8.1	9.6	10	4	0.75							23	14	A-6a								
9	B	SS_1	0.0	1.5	0.5	2.0	15		4.5	34	19	15	22	36	58	13	14	A-6a	7	894						
	009-0	SS_2	2.5	4.0	3.0	4.5	18		4.5							16	14	A-6a	10							
	22	SS_3	5.0	6.5	5.5	7.0	20		4.5	37	21	16	28	42	70	17	16	A-6b								
		SS_4	7.5	9.0	8.0	9.5	23	15	4.5							15	16	A-6b								

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 112280

County-Route-Section: HAN-US 68/SR 15 Interchange
No. of Borings: 9

Geotechnical Consultant: Stantec Consulting Services Inc.
Prepared By: Jared Musselman
Date prepared: 6/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	4%	HP ≤ 0.5	4%
$N_{60} < 12$	9%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	17%	1 < HP ≤ 2	17%
$N_{60} \geq 20$	22%	HP > 2	43%
M+	0%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	2"
Maximum	15"
Minimum	0"

% Proposed Subgrade Surface	
Unstable & Unsuitable	10%
Unstable	10%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	13	3.18	30	18	12	23	26	49	16	13	6
Maximum	50	19	4.50	44	25	19	33	42	70	33	22	10
Minimum	4	4	0.50	0	0	1	12	3	17	2	6	0

Classification Counts by Sample

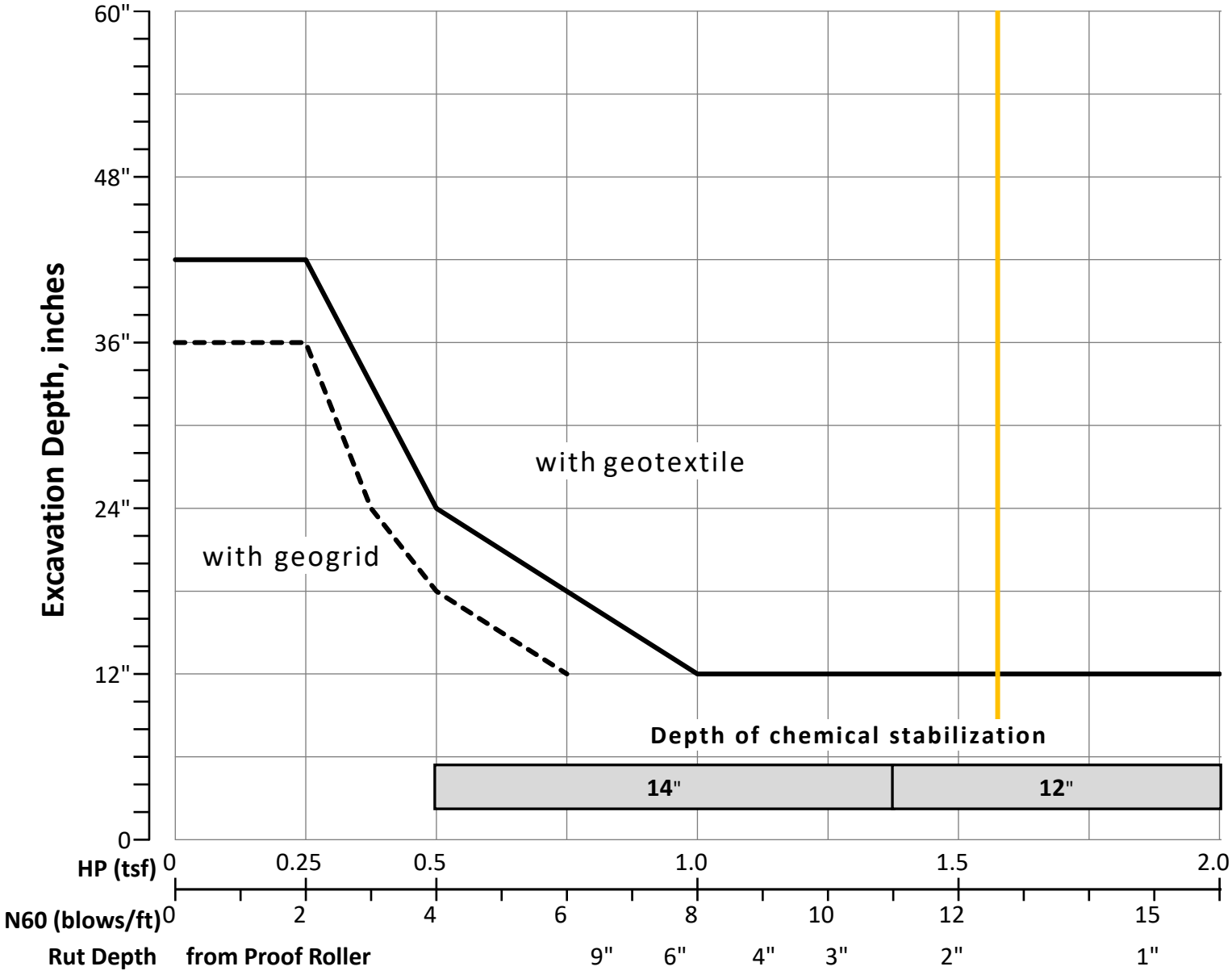
ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	4	0	0	2	0	0	0	2	0	0	17	3	0	3	0	0	31
Percent	0%	0%	13%	0%	0%	6%	0%	0%	0%	6%	0%	0%	55%	10%	0%	10%	0%	0%	100%
% Rock|Granular|Cohesive	0%	26%									74%								100%
Surface Class Count	0	0	4	0	0	0	0	0	0	1	0	0	5	0	0	0	0	0	10
Surface Class Percent	0%	0%	40%	0%	0%	0%	0%	0%	0%	10%	0%	0%	50%	0%	0%	0%	0%	0%	100%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.18	0.50	☐ HP
12.63	6.00	☐ N60L

Average HP

Average N_{60L}