CTL Engineering, Inc.
2860 Fisher Road, P.O. Box 44548, Columbus, Ohio 43204-3538
Phone: 614/276-8123; Fax: 614/276-6377
Email: ctl@ctleng.com

AN EMPLOYEE OWNED COMPANY

Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

Established 1927

November 6, 2023

EMH&T
5500 New Albany Road
Columbus, Ohio 43054

Attention: Mr. Mark Rahall, P.E
Associate, Project Manager

Reference: Roadway Subsurface Exploration- Final Report
Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
Franklin County, Ohio
CTL Project No. 20050033COL

Dear Mr. Rahall:

CTL Engineering, Inc. has completed the Roadway Exploration for this project. Enclosed is the digital (pdf) copy of the Final Report.

Thank you for the opportunity to work with you on this project. If you have any questions or need further information, please feel free to contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.

Joe Grani, P.E
Project Engineer

ROADWAY SUBSURFACE EXPLORATION-FINAL REPORT

BROAD STREET AND HAMILTON ROAD INTERSECTION IMPROVEMENTS
FRA-16-6.87, PID NO. 105768
FRANKLIN COUNTY, OHIO
CTL PROJECT NO. 20050033COL

PREPARED FOR:

EMH&T, INC.
5500 NEW ALBANY ROAD
COLUMBUS, OHIO 43054

PREPARED BY:

CTL ENGINEERING, INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204
Phone 614-276-8123
Fax 614-276-6377

November 6, 2023

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The project involves performing improvements to the intersection of State Route (SR) 16 (East Broad Street) and SR 317 (Hamilton Road) in Franklin County, Ohio.

Twelve (12) soil test borings, identified as B-001-0-19 through B-012-0-19, were drilled to depths ranging from 5.5 to 8.0 feet below grade. Auger refusal was encountered on concrete in boring B-008-0-19 at a depth of 5.5 feet below grade. Twelve (12) pavement cores were also performed at the boring locations. Two (2) additional pavement cores, designated as B-008-1-19 and B-008-2-19, were performed offset from the location of a failed joint at the composite pavement section of SR 317.

Below the surface cover, the borings encountered fine-grained cohesive and coarse-grained granular soils extending down to the test boring termination depths or auger refusal depth in boring B-008-0-19. The cohesive soils were classified as sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), or clay (A-7-6). Granular soils were described as gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and/or stone fragments with sand, silt and clay (A-2-6), fine sand (A-3) or coarse and fine sand (A-3a).

According to requirements outlined in ODOT's Geotechnical Bulletin 1 (GB1), some of the subgrade soils will require stabilization. Please refer to the *Analyses and Recommendation* section of this report for additional details.

Unsuitable soils (A-7-5) were encountered along SR 317 in boring B-007-0-19, near Station 269+5.7, between approximate depths of 1.0 and 2.5 feet below the proposed subgrade level. These A-7-5 soils are not suitable to be left in place in the upper 36 inches of proposed subgrade. No roadway widening is proposed near boring B-007-0-19. However, if full depth replacement of the existing pavement is required in this area, and the pavement subgrade is exposed, then the unsuitable A-7-5 soils will need to be removed to a depth of 36 inches below the top of the proposed pavement subgrade.

Based on the subsurface conditions encountered in the borings, and the results of GB1 analyses, the pavement for this project may be designed using a CBR value of 6.0.

II. INTRODUCTION

The project involves performing improvements to the intersection of State Route (SR) 16 (East Broad Street) and SR 317 (Hamilton Road) in Franklin County, Ohio. The improvements will involve pavement widening for SR 16 and SR 317.

The project limits and approximate cut/fill depths were taken from the plans provided by EMH&T personnel, and are shown in Table 1 below:

Table 1. Project/Work Limits and Cut/Fill Depths

Roadway	Approximate Begin Project Station	Approximate End Project Station	Maximum Cut (feet)	Maximum Fill (feet)
SR 16	360+72.24	377+27.30	NA	NA
SR 317	269+10.11	288+60.17	NA	NA

This report is a Final Roadway Exploration report.

III. GEOLOGY AND OBSERVATIONS OF THE PROJECT

According to the Ohio Department of Natural Resources (ODNR), *Physiographic Regions of Ohio*, the site lies in the Columbus Low Land region of the Central Low Land Till Plains section of Ohio.

According to Bedrock Geologic Map of Ohio, the bedrock below the site consists of Devonian age shale of the Ohio Shale Formation.

According to web based mapping from United States Department of Agriculture, Natural Resources Conservation Service, the project area contains primarily Bennington-Urban land complex, 0 to 2 percent slopes (BfA) and Bennington-Urban land complex, 0 to 6 percent slopes (BfB). According to the *Soil Survey of Franklin County, Ohio*, these soils are considered somewhat poorly drained and exhibit moderately low to moderately high permeability.

According to the ODNR's Mines of Ohio website, no mines were located within the project area. According to information obtained from ODNR's Karst Area Map, the project lies in the area that is not known to contain karst features.

The most recent site visit by CTL personnel was performed on August 19, 2020. Some longitudinal and transverse cracks were noted on the pavement of SR 16 and SR 317. Alligator cracking was noted on SR 317, between approximate Stations 271+00 and 272+00. Several underground and overhead utility lines were present within the project limits.

Historic geotechnical records were searched for on the ODOT TIMS website. Historic auger probe sampling records were found within the project area. However, no historic test boring records were found within the project area.

IV. EXPLORATION

Twelve (12) soil test borings, identified as B-001-0-19 through B-012-0-19, were drilled to depths ranging from 5.5 to 8.0 feet below grade. Auger refusal was encountered on concrete in boring B-008-0-19 at a depth of 5.5 feet below grade. Twelve (12) pavement cores were also performed at the boring locations. Two (2) additional pavement cores, designated as B-008-1-19 and B-008-2-19, were performed offset from the location of a failed joint at the composite pavement section of SR 317. The borings were drilled at the approximate locations indicated on the Soil Profile sheets provided in Appendix A. Survey data at the test boring locations were provided by personnel from EMH&T.

The borings were performed with a track-mounted drill rig utilizing hollow stem augers (HSA), between August 18 and August 20, 2020. Standard penetration tests were conducted using a 140-pound automatic hammer falling 30 inches to drive 2-inch O.D. split barrel samplers. The energy transfer ratio associated with the automatic SPT hammer was 89.3 percent. The hammer was calibrated on August 5, 2020.

Soil samples obtained from drilling operation, were preserved in glass jars, visually classified in the field and laboratory, and tested for natural moisture content. Representative soil samples were subjected to laboratory testing including grain size distribution, Atterberg limits and hand penetrometer.

V. FINDINGS

A summary of the pavement thickness encountered in the test borings and the pavement cores is provided in Table 2 below. Please refer to Appendix C Pavement Core Report for details on pavement cores.

Table 2: Existing Pavement Thickness

Roadway	Boring No.	Pavement Material Thickness (inches)		
		Asphalt	Concrete	Granular Base
SR 16	B-001-0-19	15	---	3
	B-002-0-19	12	---	---
	B-003-0-19	10	---	4
	B-004-0-19	11	---	9
	B-005-0-19	9	---	3
	B-006-0-19	11	---	---
SR 317	B-007-0-19	2	10.5	---
	B-008-0-19	6	6.75	---
	B-008-1-19	5	6	---
	B-008-2-19	5	7	---
	B-009-0-19	4	13	---
	B-010-0-19	14	---	---
	B-011-0-19	13	---	---
	B-012-0-19	5	11	---

Below the surface cover, borings B-003-0-19 through B-006-0-19, B-008-0-19, and B-012-0-19 encountered fill materials to depths ranging from 2.5 to 5.5 feet below grade. The fill materials were described as gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and/or stone fragments with sand, silt and clay (A-2-6), coarse and fine sand (A-3a), or silt and clay (A-6a). These soils exhibited standard penetration (N_{60}) values ranging from 10 to 73 blows per foot (bpf), with natural moisture content values ranging from 5 to 22 percent.

Below the fill materials or surface cover, the test borings, except for boring B-008-0-19, encountered both fine-grained cohesive and coarse-grained granular soils extending down to the test boring termination depths. The soils were classified as fine sand (A-3), sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), or clay (A-7-6). These soils exhibited N_{60} values ranging from 7 to 55 bpf, with natural moisture content values ranging from 10 to 32 percent. Auger refusal in concrete was encountered in boring B-008-0-19 at 5.5 feet below grade.

No groundwater was encountered in the test borings at any time during the field exploration. After removing the augers, no soil cave-in was observed in the test borings.

VI. ANALYSES AND RECOMMENDATIONS

Based on the soil and rock data obtained from the field and laboratory testing, the following recommendations are provided.

A. Subgrade Considerations

A subgrade analysis was performed utilizing the subsurface information from the drilled borings along with ODOT Geotechnical Bulletin 1 (GB1) guidelines. A copy of the GB1 spreadsheet is provided in Appendix D. For estimating cut/fill per GB1, the proposed pavement thickness was taken as 1.5 feet.

The natural moisture content values of the near surface soil samples ranged from 5 to 32 percent, averaging 18 percent. The estimated optimum moisture content (OMC) values ranged from 0 to 25 percent, averaging 15 percent. On average, the natural moisture content values were 3 percent higher than the optimum moisture content values.

Based on the requirements outlined in GB1, it is estimated that subgrade stabilization will be required in some areas within the project limits. The subgrade stabilization may consist of excavate and replace per Item 204. The approximate areas and depths are summarized in Table 3. The approximate depth of excavate and replace is measured from the top of the proposed pavement subgrade level. The locations and values are only an estimate. The actual depths and horizontal limits of excavate and replace will be determined by the Project Engineer in the field based upon proofrolling.

Table 3: Estimated Excavate and Replace

Location	Approximate Limits	Approximate Depth of Excavate and Replace (inches)
SR 16	From Sta. 367+50 to Sta. 371+50	12
SR 317	From Sta. 271+00 to Sta. 279+25	12
	From Sta. 284+25 to Sta. 288+60.17	12

If the soils at the excavated depth exhibit unstable conditions, a bridge lift should be placed as outlined in Item 203.05 of the ODOT Construction and Material Specifications.

It is CTL's opinion that any subgrade stabilization in the proposed widening areas will most likely consist of excavate and replace at isolated locations. Therefore, no global stabilization information is included. It should be noted that chemical stabilization in the proposed widening areas may not be feasible due to space limitations.

Group Index values were calculated for each of the samples tested. The Group Index values for soils ranged from 0 to 20, averaging 10. This average Group

Index value corresponds to an estimated California Bearing Ratio (CBR) value of 6.0. The pavement for this project may be designed using a CBR value of 6.0.

It is CTL's opinion that mill and overlay will generally be acceptable for the pavement resurfacing areas. However, alligator cracking was noted in an area between approximate Stations 271+00 and 272+00. Additionally, the concrete base in cores B-008-1-19 and B-008-2-19 (approx. Station 271+70) was broken/not intact. In this area, the pavement repair will likely need to consist of full depth replacement.

Unsuitable soils (A-7-5) were encountered along SR 317 in boring B-007-0-19, near Station 269+05.7 SR 317, between approximate depths of 1.0 and 2.5 feet below the proposed subgrade level. These A-7-5 soils are not suitable to be left in-place in the upper 36 inches of proposed subgrade. No roadway widening is proposed near boring B-007-0-19. However, if full depth replacement of the existing pavement is required in this area, and the pavement subgrade is exposed, then the unsuitable A-7-5 soils will need to be removed to a depth of 36 inches below the top of the proposed pavement subgrade.

B. General Construction and Earthwork

1. Site preparation and earthwork should be performed in accordance with the ODOT Construction and Material Specifications, and applicable Geotechnical Bulletins.

2. Temporary excavations in excess of 4 feet in depth should be sloped or shored according to OSHA requirements.

VII. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can modified, if required

VIII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

IX. CLOSING

The report was prepared by CTL Engineering, Inc. (Consultant) solely for the use of the Client in accordance with an executed contract. The Client's use of or reliance on this report is limited by the terms and conditions of the contract and by the qualifications and limitations stated in the report. It is also acknowledged that the Client's use of and reliance of this report is limited for reasons which include: actual site conditions that may change with time; hidden conditions, not discoverable within the scope of the assessment, may exist at the site; and the scope of the investigation may have been limited by time, budget and other constraints imposed by the Client.

Neither the report, nor its contents conclusions or recommendations, are intended for the use of any party other than the Client. Consultant and the Client assume no liability for any reliance placed on this report by such party. The rights of the Client under contract may not be assigned to any person or entity, without the consent of the Consultant which consent shall not be unreasonably withheld.

This geotechnical report does not address the environmental conditions of the site. The Consultant is not responsible for consequences or conditions arising from facts that were concealed, withheld, or not fully disclosed at the time the assessment was conducted.

To the fullest extent permitted by law, the Consultant and Client agree to indemnify and hold each other, and their officers and employees harmless from and against claims, damages, losses and expenses arising out of unknown or concealed conditions. Furthermore, neither the Consultant nor its employees shall be liable to the Owner in an amount in excess of the available professional liability insurance coverage of the Consultant. In addition, Client and Consultant agree neither shall be liable for any special, indirect or consequential damages of any kind or nature.

The Consultant's services have been provided consistent with its professional standard of care. No other warranties are made, either expressed or implied.

Respectfully Submitted,

CTL ENGINEERING, INC.

Joe Grani, P.E
Project Engineer

Shahedur Rahman
Geotechnical Engineer

APPENDIX A
ROADWAY EXPLORATION SHEETS

PROJECT DESCRIPTION

THE PROJECT INVOLVES PERFORMING IMPROVEMENTS TO THE INTERSECTION OF STATE ROUTE (SR) 16 (EAST BROAD STREET) AND SR 317 (HAMILTON ROAD) IN FRANKLIN COUNTY, OHIO.

HISTORIC RECORDS

HISTORIC GEOTECHNICAL RECORDS WERE SEARCHED FOR ON THE ODOT TIMS WEBSITE. HISTORIC GEOTECHNICAL RECORDS OF AUGER PROBE SAMPLING WERE FOUND WITHIN THE PROJECT AREA. HOWEVER, NO HISTORIC TEST BORING RECORDS WERE FOUND FOR THIS PROJECT.

GEOLOGY

ACCORDING TO THE OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), PHYSIOGRAPHIC REGIONS OF OHIO, THE SITE LIES IN THE COLUMBUS LOW LAND REGION OF THE CENTRAL LOW LAND TILL PLAINS SECTION OF OHIO.

ACCORDING TO BEDROCK GEOLOGIC MAP OF OHIO (2006), THE BEDROCK BELOW THE SITE CONSISTS OF DEVONIAN AGE SHALE OF OHIO SHALE FORMATION.

RECONNAISSANCE

THE MOST RECENT SITE VISIT WAS PERFORMED BY CTL PERSONNEL ON AUGUST 19, 2020 SOME LONGITUDINAL AND TRANSVERSE CRACKS WERE NOTED ON THE PAVEMENT OF SR 16 AND SR 317. ALLIGATOR CRACKING WAS NOTED ON SR 317, BETWEEN APPROXIMATE STATIONS 271+00 AND 272+00. SEVERAL UNDERGROUND AND OVERHEAD UTILITY LINES WERE PRESENT WITHIN THE PROJECT LIMITS.

SUBSURFACE EXPLORATION

TWELVE (12) TYPE A SOIL BORINGS, IDENTIFIED AS B-001-0-19 THROUGH B-012-0-19, WERE DRILLED TO DEPTHS RANGING FROM 5.5 TO 8.0 FEET BELOW GRADE. AUGER REFUSAL WAS ENCOUNTERED ON CONCRETE IN BORING B-008-0-19 AT A DEPTH OF 5.5 FEET BELOW GRADE. TWELVE (12) PAVEMENT CORES WERE ALSO PERFORMED AT THE BORING LOCATIONS. TWO (2) ADDITIONAL PAVEMENT CORES, DESIGNATED AS B-008-1-19 AND B-008-2-19, WERE PERFORMED OFFSET FROM THE LOCATION OF A FAILED JOINT AT THE COMPOSITE PAVEMENT SECTION OF SR 317. THE BORINGS WERE PERFORMED WITH A TRACK-MOUNTED DRILL RIG UTILIZING HOLLOW STEM AUGERS (HSA), BETWEEN AUGUST 18 AND AUGUST 20, 2020. STANDARD PENETRATION TESTS WERE CONDUCTED USING A 140-POUND AUTOMATIC HAMMER FALLING 30 INCHES TO DRIVE 2-INCH O.D. SPLIT BARREL SAMPLERS. THE ENERGY TRANSFER RATIO ASSOCIATED WITH THE AUTOMATIC SPT HAMMER WAS 89.3 PERCENT. THE HAMMER WAS CALIBRATED ON AUGUST 5, 2020.

EXPLORATION FINIDNGS

BELOW THE SURFACE COVER, BORINGS B-003-0-19 THROUGH B-006-0-19, B-008-0-19, AND B-012-0-19 ENCOUNTERED FILL MATERIALS TO DEPTHS RANGING FROM 2.5 TO 5.5 FEET BELOW GRADE. THE FILL MATERIALS WERE DESCRIBED AS GRAVEL AND/OR STONE FRAGMENTS WITH SAND (A-1-b), GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT (A-2-4), GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), COARSE AND FINE SAND (A-3a) OR SILT AND CLAY (A-6a). UNDERNEATH THE FILL MATERIALS OR SURFACE COVER, THE TEST BORINGS, EXCEPT FOR BORING B-008-0-19, ENCOUNTERED BOTH FINE-GRAINED COHESIVE AND COARSE-GRAINED GRANULAR SOILS EXTENDING DOWN TO THE TEST BORING TERMINATION DEPTHS. THE SOILS WERE CLASSIFIED AS FINE SAND (A-3), SANDY SILT (A-4a), SILT AND CLAY (A-6a), SILTY CLAY (A-6b), ELASTIC CLAY (A-7-5) OR CLAY (A-7-6). AUGER REFUSAL IN CONCRETE WAS ENCOUNTERED IN BORING B-008-0-19 AT 5.5 FEET BELOW GRADE.

NO GROUNDWATER WAS ENCOUNTERED IN THE TEST BORINGS AT ANY TIME DURING THE FIELD EXPLORATION. AFTER REMOVING THE AUGERS, NO SOIL CAVE-IN WAS OBSERVED IN THE TEST BORINGS.

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 JULY 2020.

AVAILABLE INFORMATION

ALL AVAILABLE SOIL INFORMATION THAT CAN BE CONVINIENTLY SHOWN ON THE GEOTECHNICAL EXPLORATION SHEETS HAS BEEN REPORTED. ADDITIONAL SUBSURFACE 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, THE OFFICE OF GEOTECHNICAL ENGINEERING AT 1980 WEST BROAD STREET.

LEGEND

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
GRAVEL AND/OR STONE FRAGMENTS WITH SAND	*A-1-b*	*1*	*1*
FINE SAND	A-3	0	1
COARSE AND FINE SAND	A-3a	1	0
GRAVEL AND/OR STONE FRAGMENTS W/SAND AND SILT	*A-2-4*	*3*	*0*
GRAVEL AND/OR STONE FRAGMENTS W/SAND, SILT & CLAY	*A-2-6*	*0*	*2*
SANDY SILT	*A-4a*	*2*	*1*
SILT AND CLAY	*A-6a*	*8*	*4*
SILTY CLAY	*A-6b*	*1*	*9*
ELASTIC CLAY	*A-7-5*	*1*	*0*
CLAY	*A-7-6*	*6*	*6*
	TOTAL	*23*	*24*

PAVEMENT OR BASE = X = APPROXIMATE THICKNESS — *VISUAL*

EXPLORATION LOCATION - PLAN VIEW

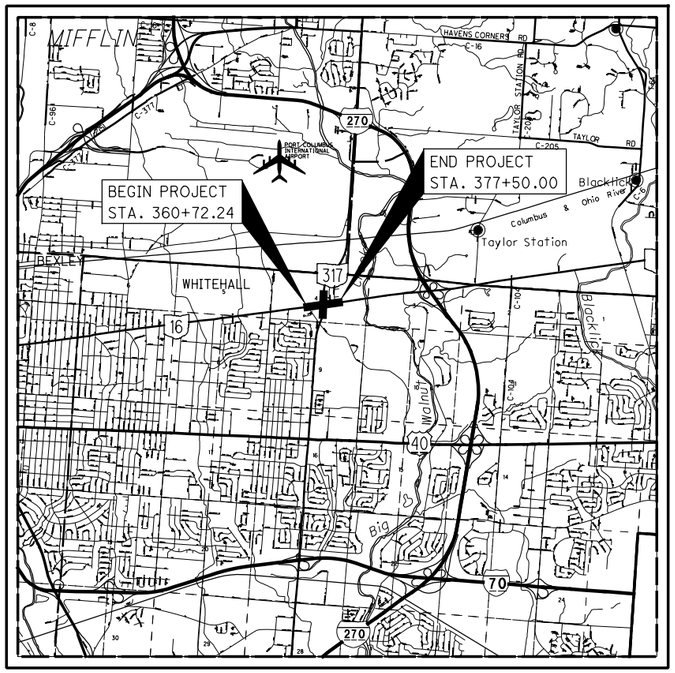
DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.

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.

SS INDICATES A SPLIT SPOON SAMPLE.



LOCATION MAP
SCALE IN MILES
0 1 2 3 4

PARTICLE SIZE DEFINITIONS

12"	3"	2.0 mm	0.42 mm	0.074 mm	0.005 mm
BOULDERS	COBBLES	GRAVEL	COARSE SAND	FINE SAND	SILT	CLAY
		No. 10 SIEVE	No. 40 SIEVE	No. 200 SIEVE	

RECON. - SM 8/19/2020
DRILLING - CTL ENGINEERING INC 08/18/2020-08/20/2020
DRAWN - NKS 04/30/21
REVIEWED - JG 04/30/21

INDEX OF SHEETS

LOCATION FROM STA.	TO STA.	PLAN VIEW SHEET	PROFILE SHEET	CROSS-SECTION SHEET	CUT MAX.	FILL EMB. MAX.
SR 16						
356+00	368+50	3	3	-	<1.0 FT	<1.0 FT
368+50	380+00	4	4	-	<1.0 FT	<1.0 FT
SR 317						
267+00	280+00	5	5	-	<1.0 FT	<1.0 FT
280+00	291+00	6	6	-	<1.0 FT	<1.0 FT

CTL ENGINEERING, INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE:(614)276-8123 FAX:(614)276-6377

PID NO. 105768

SOIL PROFILE

FRA-16-6.87

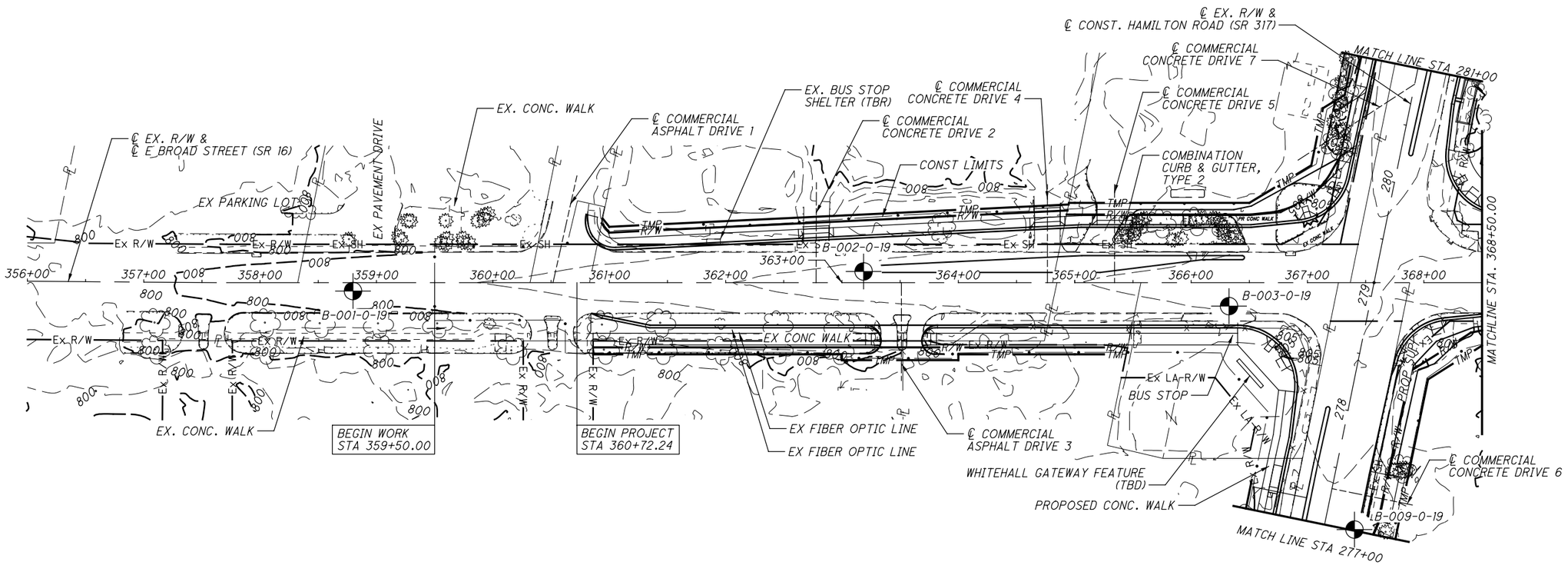
SUMMARY OF SOIL TEST DATA

E BROAD STREET (SR 16)

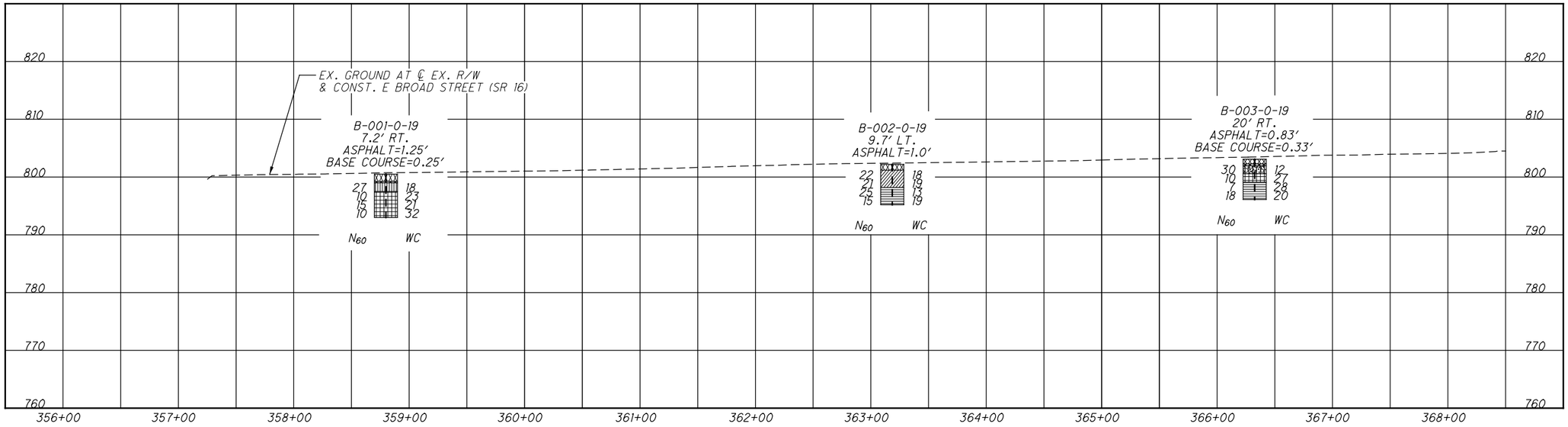
EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	N60	% REC	HP tsf	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO4
B-001-0-19 LATITUDE = 39.97586 LONGITUDE = -82.87713	01.50-03.00	SS-1	27	100	4	7	13	17	37	26	31	21	10	18	A-4a (6)	-
	03.00-04.50	SS-2	10	89	2.75	1	2	9	36	52	54	25	29	23	A-7-6 (18)	-
	04.50-06.00	SS-3	15	100	2.75				SAME AS SS-2					21	A-7-6 (VISUAL)	-
	06.00-07.50	SS-4	10	56	0.5				SAME AS SS-2					32	A-7-6 (VISUAL)	-
B-002-0-19 LATITUDE = 39.976075 LONGITUDE = -82.875601	01.00-02.50	SS-1	22	67	-	28	9	9	30	24	32	20	12	18	A-6a (5)	-
	02.50-04.00	SS-2	21	100	4.5	3	8	12	38	39	38	23	15	19	A-6a (10)	-
	04.00-05.50	SS-3	25	100	4.5				BROWN, SILTY CLAY, SOME SAND, LITTLE GRAVEL					13	A-6b (VISUAL)	-
	05.50-07.00	SS-4	15	100	3				SAME AS SS-3					19	A-6b (VISUAL)	-
B-003-0-19 LATITUDE = 39.97608 LONGITUDE = -82.874353	01.00-02.50	SS-1	30	56	-	35	21	12	21	11	22	18	4	12	A-2-4 (0)	-
	02.50-04.00	SS-2	10	89	2	1	2	8	41	48	48	28	20	27	A-7-6 (14)	-
	04.00-05.50	SS-3	7	89	1.5				BROWN, SILTY CLAY, SOME SAND, TRACE GRAVEL					28	A-6b (VISUAL)	-
	05.50-07.00	SS-4	18	100	3.5				SAME AS SS-3					19	A-6b (VISUAL)	-
B-004-0-19 LATITUDE = 39.976307 LONGITUDE = -82.873364	02.00-03.50	SS-1	10	89	3.75	2	6	11	47	34	37	22	15	22	A-6A (10)	-
	03.50-05.00	SS-2	16	28	-				BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY, FILL					17	A-2-6 (VISUAL)	-
	05.00-06.50	SS-3	25	100	4.5	3	4	10	41	42	44	21	23	23	A-7-6 (14)	-
	06.50-08.00	SS-4	42	67	3.5				GRAY, FINE SAND, TRACE GRAVEL, TRACE SILT					17	A-3 (VISUAL)	-
B-005-0-19 LATITUDE = 39.976451 LONGITUDE = -82.871843	01.00-02.50	SS-1	57	100	-	38	19	11	21	11	21	17	4	12	A-2-4 (0)	-
	02.50-04.00	SS-2	37	100	4.5	6	9	13	40	32	33	19	14	15	A-6a (9)	-
	04.00-05.50	SS-3	27	100	4.5				SAME AS SS-2					14	A-6a (VISUAL)	-
	05.50-07.00	SS-4	28	100	4.5				SAME AS SS-2					14	A-6a (VISUAL)	-
B-006-0-19 LATITUDE = 39.976579 LONGITUDE = -82.870332	01.00-02.50	SS-1	73	100	-	41	20	9	19	11	23	17	6	8	A-2-4 (0)	-
	02.50-04.00	SS-2	39	100	4.5	10	12	17	36	25	24	16	8	11	A-4a (5)	-
	04.00-05.50	SS-3	25	100	4.5				SAME AS SS-2					10	A-4a (VISUAL)	-
	05.50-07.00	SS-4	24	100	4.5				GRAY, SILTY CLAY, SOME SAND, LITTLE GRAVEL, TILL					11	A-6b (VISUAL)	-

HAMILTON ROAD (SR 317)

B-007-0-19 LATITUDE = 39.973408 LONGITUDE = -82.874625	01.00-02.50	SS-1	9	89	-	25	23	12	21	19	32	20	12	12	A-6a (2)	-
	02.50-04.00	SS-2	18	100	4.5	0	1	3	48	48	45	30	15	16	A-7-5 (11)	-
	04.00-05.50	SS-3	16	100	-				BROWN, SILTY CLAY, TRACE SAND					28	A-6b (VISUAL)	-
	05.50-07.00	SS-4	55	100	4.5				SAME AS SS-3					18	A-6b (VISUAL)	-
B-008-0-19 LATITUDE = 39.974504 LONGITUDE = -82.874235	01.00-02.50	SS-1	21	78	-	10	41	21	17	11	19	15	4	9	A-3a (0)	-
	02.50-04.00	SS-2	15	89	-	13	42	22	16	7	NP	NP	NP	7	A-1-b (0)	-
	04.00-05.08	SS-3	3/4/50/1"	100	-				SAME AS SS-2					10	A-1-b (VISUAL)	-
B-009-0-19 LATITUDE = 39.975644 LONGITUDE = -82.87389	01.50-03.00	SS-1	10	67	1.25	1	4	9	47	39	35	21	14	22	A-6a (10)	-
	03.00-04.50	SS-2	9	100	1.25	0	2	6	38	53	60	27	33	25	A-7-6 (20)	-
	04.50-06.00	SS-3	18	100	1.5				SAME AS SS-2					29	A-7-6 (VISUAL)	-
	06.00-07.50	SS-4	15	100	1				SAME AS SS-2					29	A-7-6 (VISUAL)	-
B-010-0-19 LATITUDE = 39.977115 LONGITUDE = -82.873813	01.50-03.00	SS-1	18	100	1.75	8	4	9	42	37	39	24	15	21	A-6a (10)	-
	03.00-04.50	SS-2	12	100	2.5	2	2	7	38	51	56	26	30	26	A-7-6 (19)	-
	04.50-06.00	SS-3	15	100	4.5				SAME AS SS-2					22	A-7-6 (VISUAL)	-
	06.00-07.50	SS-4	21	100	2.5				SAME AS SS-2					20	A-7-6 (VISUAL)	-
B-011-0-19 LATITUDE = 39.978129 LONGITUDE = -82.873879	01.50-03.00	SS-1	10	100	2.25	1	6	9	47	37	37	18	19	23	A-6b (12)	-
	03.00-04.50	SS-2	12	100	1.75	0	1	4	53	42	51	26	25	27	A-7-6 (16)	-
	04.50-06.00	SS-3	13	100	3.25				BROWN, SILTY CLAY, LITTLE SAND, TRACE GRAVEL					25	A-6b (VISUAL)	-
	06.00-07.50	SS-4	21	100	1.5				SAME AS SS-3					20	A-6b (VISUAL)	-
B-012-0-19 LATITUDE = 39.9792 LONGITUDE = -82.873559	01.50-03.00	SS-1	13	28	-				GRAY, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY, CONTAINS ASPHALT, FILL					5	A-2-6 (VISUAL)	-
	03.00-04.50	SS-2	36	100	4.5	5	10	15	37	33	30	19	11	13	A-6a (7)	-
	04.50-06.00	SS-3	27	100	4.5				SAME AS SS-2					18	A-6a (VISUAL)	-
	06.00-07.50	SS-4	43	100	4.5				SAME AS SS-2					13	A-6a (VISUAL)	-



NOTE: PLEASE SEE SHEET 5 OF 6 FOR B-009-0-19 SOIL PROFILE



SOIL PROFILE - E BROAD STREET (SR 16)
STA. 356+00.00 TO STA. 368+50.00

FRA-16-6.87

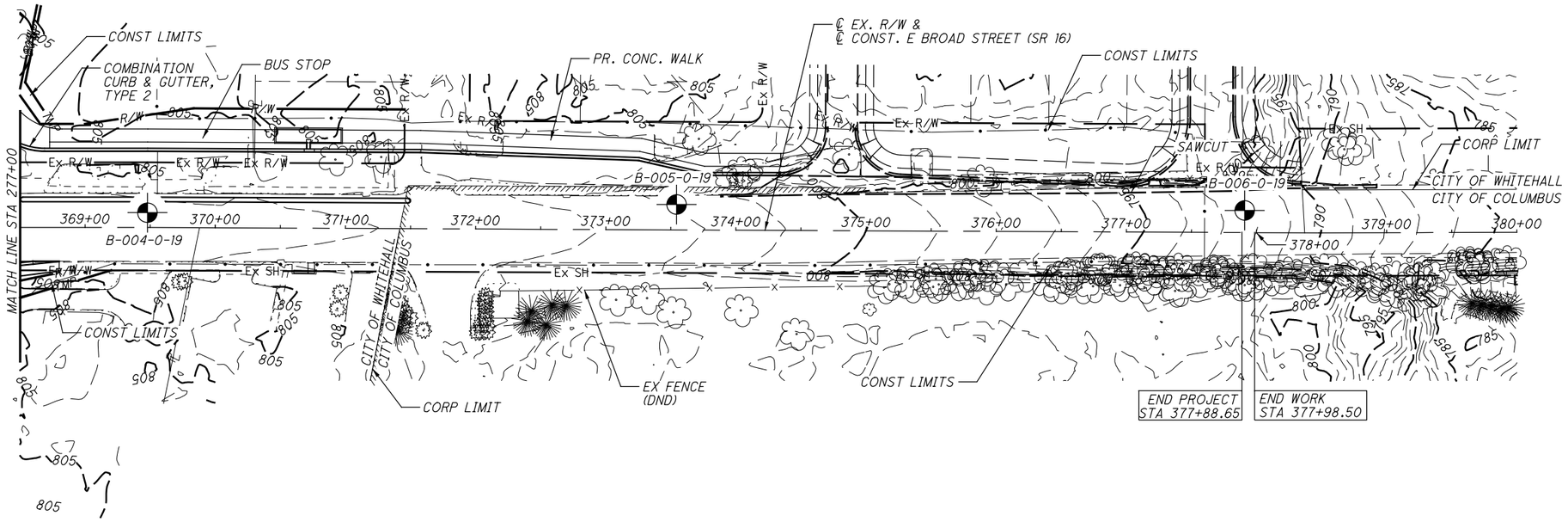
DRAWN N.K.S
CHECKED SM

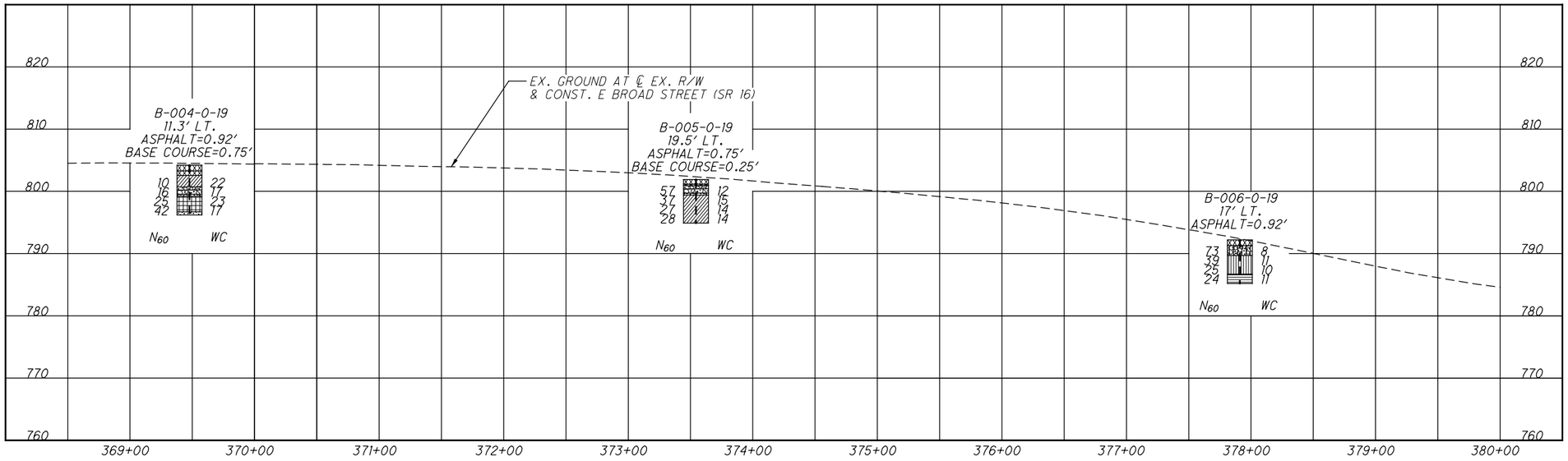
HORIZONTAL SCALE IN FEET
0 25 50 100

3 / 6

203
206

D:\Drop Box\CTL 2023\October\Dept 05\COL\Shared\20050033COL_ODOT\Mod_31.10.23\105768GP001.dgn Sheet 31-10-2023 14:00:36 hp





SOIL PROFILE - E BROAD STREET (SR 16)
STA. 368+50.00 TO STA. 380+00.00

HORIZONTAL SCALE IN FEET
0 25 50 100

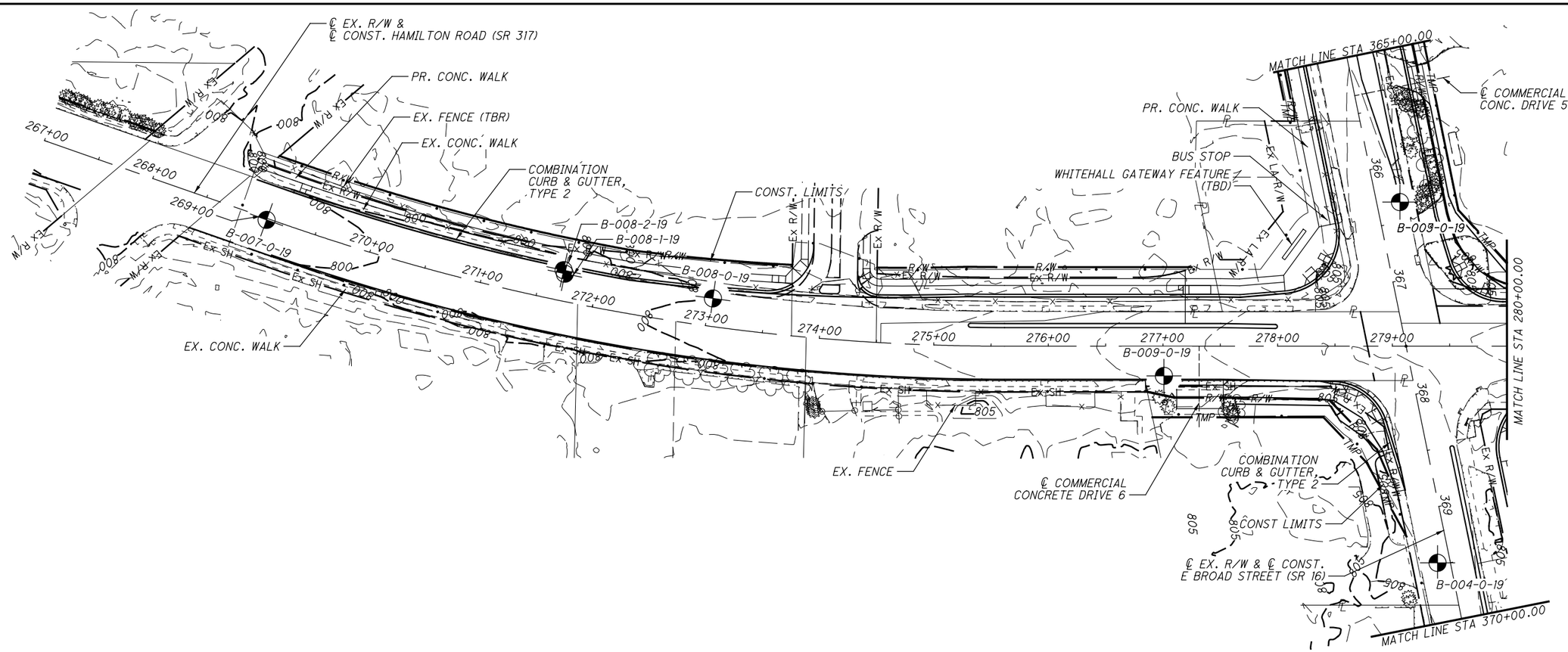
DRAWN N.K.S
CHECKED SM

FRA-16-6.87

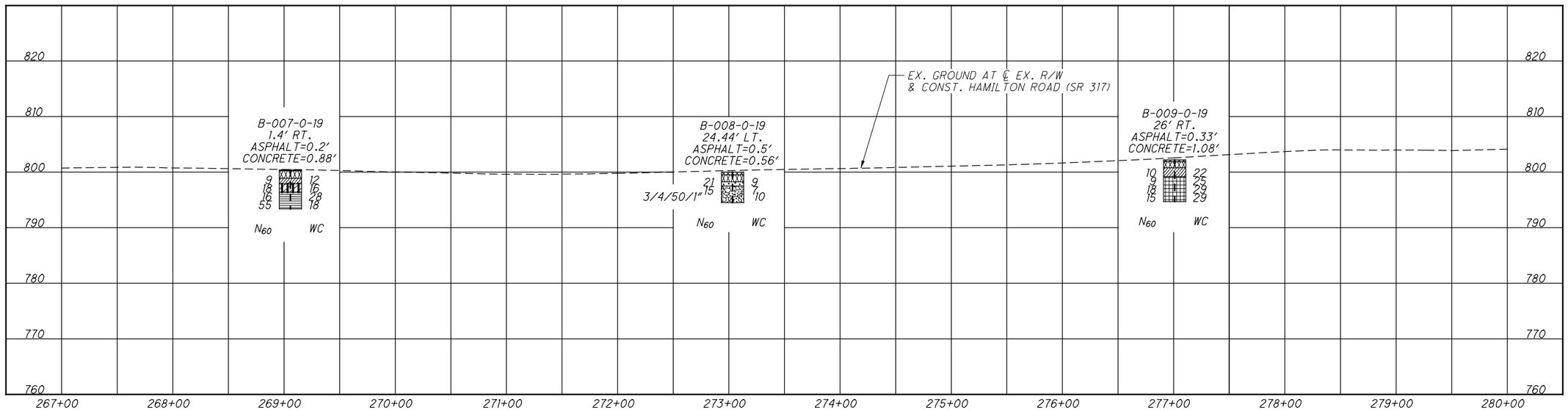
4 / 6

204
206

D:\Drop Box\CTL 2023\October\Dept 05\COL\Shared\20050033COL_ODOT\Mod_31.10.23\105768GP002.dgn Sheet 31-10-2023 14:01:46 hp



NOTE: PLEASE SEE SHEET 3 OF 6 FOR B-003-0-19 SOIL PROFILE
PLEASE SEE SHEET 4 OF 6 FOR B-004-0-19 SOIL PROFILE



HORIZONTAL SCALE IN FEET
0 25 50 100

DRAWN N.K.S
CHECKED SM

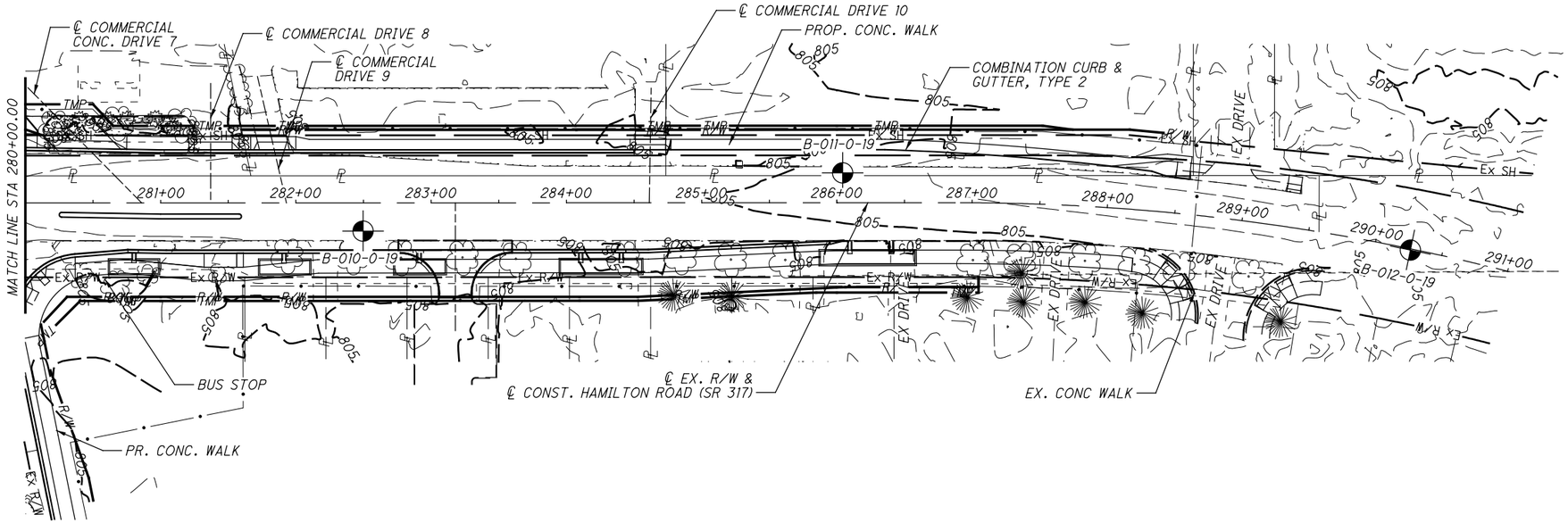
SOIL PROFILE - HAMILTON ROAD (SR 317) STA. 267+00.00 TO STA. 280+00.00

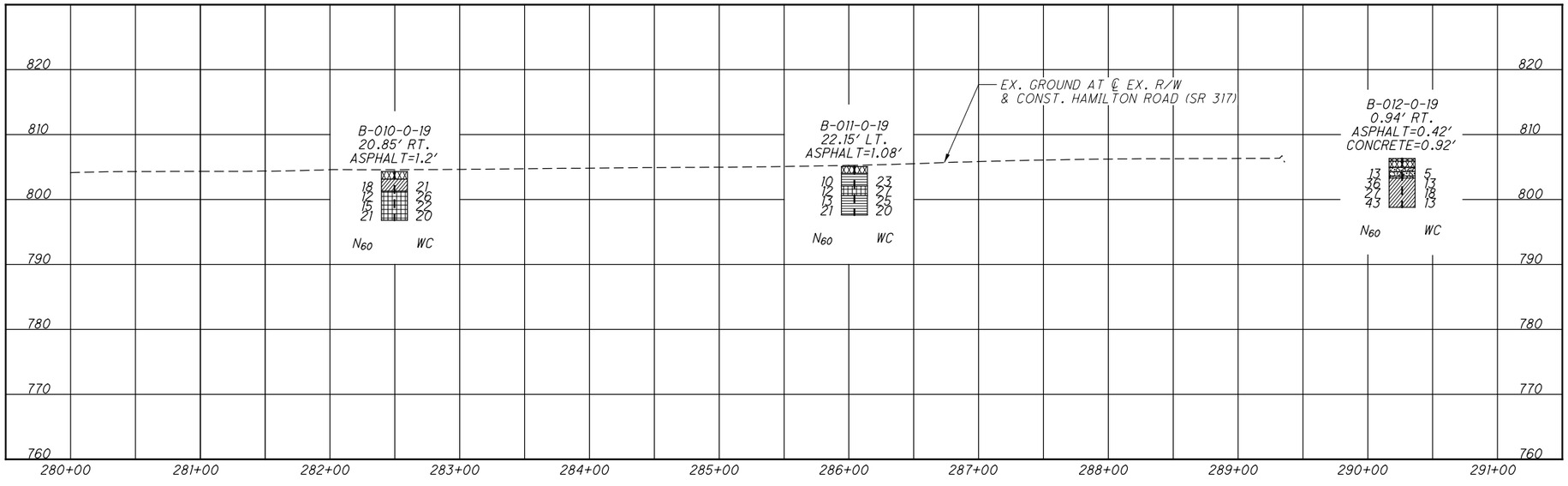
FRA-16-6.87

5 / 6

205
206

D:\Drop Box\CTL 2023\October\Dept 05\COL\Shared\20050033COL_ODOT\Mod_31.10.23\105768GP003.dgn Sheet 31-10-2023 14:02:58 hp





SOIL PROFILE - HAMILTON ROAD (SR 317)
STA. 280+00.00 TO STA. 291+00.00

DRAWN N.K.S
CHECKED SM

HORIZONTAL SCALE IN FEET
0 25 50 100

FRA-16-6.87

6 / 6

206
206

APPENDIX B
TEST BORING RECORDS

SOIL DESCRIPTION

Descriptors for soil consistency used in this report are based upon the Standard Penetration Test (SPT), ASTM D 1587, with the penetration (N) values corrected to N_{60} , based upon the efficiency of the SPT Hammer used for the soil sampling.

Descriptors for both non-cohesive and cohesive soils are presented below, with the corresponding range of corrected penetration values.

NON-COHESIVE SOIL DESCRIPTION	CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11- 30
Dense	31 – 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)
Very Soft	0 – 1
Soft	2 – 4
Medium Stiff	5 – 8
Stiff	9 – 15
Very Stiff	16 –30
Hard	Over 30

Moisture term descriptors for both non-cohesive and cohesive soils are presented below.

NON-COHESIVE SOIL DESCRIPTION	MOISTURE TERMS	COHESIVE SOIL DESCRIPTION
Powdery	Dry	Powdery
Some Moisture	Damp	Below Plastic Limit
Damp to the Touch	Moist	Above Plastic, Below Liquid Limit
Free Water	Wet	Above Liquid Limit

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 358+80, 7' RT.	EXPLORATION ID B-001-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:	
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 800.5 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/19/20 END: 8/19/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.975860, -82.877130	

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Asphalt (15")	799.3	1																
Base course (3")	799.0																	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	797.5	2	13 8 10	27	100	SS-1	4.00	7	13	17	37	26	31	21	10	18	A-4a (6)	
VERY STIFF, BROWN, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, DAMP		3	3 3 4	10	89	SS-2	2.75	1	2	9	36	52	54	25	29	23	A-7-6 (18)	
		4	4 5 5	15	100	SS-3	2.75	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
@6.0'; MEDIUM STIFF, BROWN AND GRAY, SOME SAND, LITTLE SILT, LITTLE GRAVEL, MOIST	793.0	5	5 4 3	10	56	SS-4	0.50	-	-	-	-	-	-	-	-	32	A-7-6 (V)	
EOB		6																
		7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 363+19, 10' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 802.2 (MSL) EOB: 7.0 ft.
START: 8/20/20 END: 8/20/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.976075, -82.875601

EXPLORATION ID B-002-0-19

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 802.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Asphalt (12")	801.2																	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME GRAVEL, LITTLE SAND, CONTAINS COBBLES, DAMP		1	15 7 8	22	67	SS-1	-	28	9	9	30	24	32	20	12	18	A-6a (5)	
@2.5'; HARD, TRACE GRAVEL	798.2	2 3	5 6 8	21	100	SS-2	4.50	3	8	12	38	39	38	23	15	19	A-6a (10)	
HARD, BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP		4	7 7 10	25	100	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	
@5.5'; VERY STIFF	795.2	5 6	7 5 5	15	100	SS-4	3.00	-	-	-	-	-	-	-	-	19	A-6b (V)	
		EOB 7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/15/20 09:23 - J:\DEPT5\20 PROJECTS\20050033COL-EMH-T-FRA-16-6.87\REPORTS\LOGS\20050033COL.GPJ

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 366+33, 20' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 803.1 (MSL) EOB: 7.0 ft.
START: 8/19/20 END: 8/19/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.976080, -82.874353

EXPLORATION ID B-003-0-19

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)	BACK FILL
	803.1																	
Asphalt (10")	802.3																	
Base course (4")	802.0																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, CONTAINS COBBLE, FILL, DAMP	800.6	1	15 11 9	30	56	SS-1	-	35	21	12	21	11	22	18	4	12	A-2-4 (0)	
STIFF, BROWN, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, DAMP	799.1	2	3 3 4	10	89	SS-2	2.00	1	2	8	41	48	48	28	20	27	A-7-6 (14)	
STIFF, BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP @5.5'; VERY STIFF	796.1	3	2 2 3	7	89	SS-3	1.50	-	-	-	-	-	-	-	-	28	A-6b (V)	
		4	4 5 7	18	100	SS-4	3.50	-	-	-	-	-	-	-	-	20	A-6b (V)	
		EOB 5																
		6																
		7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 369+48, 11' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 804.2 (MSL) EOB: 8.0 ft.
START: 8/18/20 END: 8/18/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.976307, -82.873364

EXPLORATION ID B-004-0-19

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)	BACK FILL
	804.2																	
Asphalt (11")	803.3																	
Base course (9")	802.6																	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, FILL, DAMP	800.7	1	6 4 3	10	89	SS-1	3.75	2	6	11	47	34	37	22	15	22	A-6a (10)	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, FILL, WET	799.2	2	3 4 7	16	28	SS-2	-	-	-	-	-	-	-	-	-	17	A-2-6 (V)	
HARD, BROWN, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, MOIST		3	5 7 10	25	100	SS-3	4.50	3	4	10	41	42	44	21	23	23	A-7-6 (14)	
@6.5'; VERY STIFF, DAMP	796.7	4	4 6 22	42	67	SS-4	3.50	-	-	-	-	-	-	-	-	17	A-3 (V)	
DENSE, GRAY, **FINE SAND**, TRACE, GRAVEL, TRACE SILT, DAMP	796.2	EOB 8																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 373+54, 20' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 801.9 (MSL) EOB: 7.0 ft.
START: 8/18/20 END: 8/18/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.976451, -82.871843

EXPLORATION ID B-005-0-19

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)	BACK FILL
Asphalt (9")	801.1																	
Base Course (3")	800.9																	
VERY DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, FILL, DAMP	799.4	1	12 16 22	57	100	SS-1	-	38	19	11	21	11	21	17	4	12	A-2-4 (0)	
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP @4.0'; BROWN		2																
		3	6 8 17	37	100	SS-2	4.50	6	9	13	40	32	33	19	14	15	A-6a (9)	
		4																
		5	6 8 10	27	100	SS-3	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
		6																
	794.9	EOB 7	6 7 12	28	100	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 377+91, 17' LT.	EXPLORATION ID B-006-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:	
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 792.2 (MSL) EOB: 7.0 ft.	PAGE 1 OF 1
START: 8/18/20 END: 8/18/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.976579, -82.870332	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Asphalt (11")	792.2																	
	791.3																	
VERY DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, FILL, DAMP	789.7	1	12 22 27	73	100	SS-1	-	41	20	9	19	11	23	17	6	8	A-2-4 (0)	
HARD, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP		2																
		3	11 12 14	39	100	SS-2	4.50	10	12	17	36	25	24	16	8	11	A-4a (5)	
	786.7	4																
		5	10 8 9	25	100	SS-3	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	
HARD, GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, TILL, DAMP	785.2	6	5 8 8	24	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6b (V)	
		EOB 7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 269+06, 1' RT.	EXPLORATION ID B-007-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:	
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 800.4 (MSL) EOB: 7.0 ft.	PAGE 1 OF 1
START: 8/19/20 END: 8/19/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.973408, -82.874625	

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Asphalt (2")	800.2																	
Concrete (10.5")	798.9	1	3 3 3	9	89	SS-1	-	25	23	12	21	19	32	20	12	12	A-6a (2)	
STIFF, BROWN, **SILT AND CLAY**, SOME SAND, SOME GRAVEL, DAMP	797.9	2																
HARD, BROWN, **ELASTIC CLAY**, "AND" SILT, TRACE SAND, DAMP	796.4	3	5 5 7	18	100	SS-2	4.50	0	1	3	48	48	45	30	15	16	A-7-5 (11)	
VERY STIFF, BROWN, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		4	4 5 6	16	100	SS-3	-	-	-	-	-	-	-	-	-	28	A-6b (V)	
@5.5'; HARD, GRAY, CONTAINS SHALE FRAGMENTS, DAMP	793.4	5																
EOB		6	6 7 30	55	100	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	
		7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/15/20 09:23 - J:\DEPT5\20 PROJECTS\20050033COL-EMH-T-FRA-16-6.87\REPORTS\LOGS\20050033COL.GPJ

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 273+03, 24' LT.	EXPLORATION ID B-008-0-19
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:	
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 800.0 (MSL) EOB: 5.5 ft.	PAGE 1 OF 1
START: 8/19/20 END: 8/19/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.974504, -82.874235	

MATERIAL DESCRIPTION AND NOTES	ELEV. 800.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Asphalt (6")	799.5																	
Concrete (6.75")	798.3	1	7 6 8	21	78	SS-1	-	10	41	21	17	11	19	15	4	9	A-3a (0)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE CLAY, TRACE SILT, TRACE GRAVEL, FILL, DAMP	797.5	2																
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, FILL, DAMP		3	8 5 5	15	89	SS-2	-	13	42	22	16	7	NP	NP	NP	7	A-1-b (0)	
		4	3 4 50/1"	-	100	SS-3	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	794.5 EOB	5																

NOTES: SPOON REFUSAL ON CONCRETE AT 5.5 FEET

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 277+01, 26' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 802.2 (MSL) EOB: 7.5 ft.
START: 8/20/20 END: 8/20/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.975644, -82.873890

EXPLORATION ID B-009-0-19

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)	BACK FILL
	802.2																	
Asphalt (4")	801.9																	
Concrete (13")	800.8	1																
STIFF, BROWN AND GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST	799.2	2	3 3 4	10	67	SS-1	1.25	1	4	9	47	39	35	21	14	22	A-6a (10)	
STIFF, BROWN, **CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP		3	2 3 3	9	100	SS-2	1.25	1	2	6	38	53	60	27	33	25	A-7-6 (20)	
@4.5'; BROWN AND GRAY, LITTLE SAND, MOIST		4	3 4 8	18	100	SS-3	1.50	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
@6.0'; LITTLE GRAVEL	794.7	5	3 4 6	15	100	SS-4	1.00	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		6																
		7 EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 282+50, 21' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 804.3 (MSL) EOB: 7.5 ft.
START: 8/20/20 END: 8/20/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.977115, -82.873813

EXPLORATION ID B-010-0-19

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)	BACK FILL
Asphalt (14")	804.3																	
	803.2	1																
STIFF, BROWN AND GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		2	4 5 7	18	100	SS-1	1.75	8	4	9	42	37	39	24	15	21	A-6a (10)	
	801.3	3																
VERY STIFF, BROWN AND GRAY, **CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP		4	3 4 4	12	100	SS-2	2.50	2	2	7	38	51	56	26	30	26	A-7-6 (19)	
@4.5'; HARD, BROWN		5	3 4 6	15	100	SS-3	4.50	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
@6.0'; VERY STIFF		6	4 6 8	21	100	SS-4	2.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
	796.8 EOB	7																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 286+04, 22' LT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 805.3 (MSL) EOB: 7.5 ft.
START: 8/20/20 END: 8/20/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.978129, -82.873879

EXPLORATION ID B-011-0-19

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)	BACK FILL
Asphalt (13")	805.3																	
	804.2																	
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST		1	3 3 4	10	100	SS-1	2.25	1	6	9	47	37	37	18	19	23	A-6b (12)	
	802.3	2																
STIFF, BROWN, **CLAY**, "AND" SILT, TRACE SAND, MOIST		3	3 4 4	12	100	SS-2	1.75	0	1	4	53	42	51	26	25	27	A-7-6 (16)	
	800.8	4																
VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST		5	3 4 5	13	100	SS-3	3.25	-	-	-	-	-	-	-	-	25	A-6b (V)	
@6.0'; STIFF		6	5 6 8	21	100	SS-4	1.50	-	-	-	-	-	-	-	-	20	A-6b (V)	
	797.8	7																
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

PROJECT: FRA-16-6.87	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45-TRACK 509	STATION / OFFSET: 290+26, 1' RT.
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: 105768 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 806.3 (MSL) EOB: 7.5 ft.
START: 8/20/20 END: 8/20/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 39.979200, -82.873559

EXPLORATION ID B-012-0-19

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)	BACK FILL
	806.3																	
Asphalt (5")	805.9																	
Concrete (11")	805.0																	
MEDIUM DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, CONTAINS ASPHALT, FILL, DAMP	803.3	1	17 4 5	13	28	SS-1	-	-	-	-	-	-	-	-	-	5	A-2-6 (V)	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		2																
		3	7 10 14	36	100	SS-2	4.50	5	10	15	37	33	30	19	11	13	A-6a (7)	
		4																
		5	5 6 12	27	100	SS-3	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
		6																
	798.8	7	11 13 16	43	100	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/15/20 09:23 - J:\DEPT5\20 PROJECTS\20050033COL-EMH-T-FRA-16-6.87\REPORTS\LOGS\20050033COL.GPJ

APPENDIX C
PAVEMENT CORE REPORT

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-001-0-19	08/19/2020	6.0”	719860.6130	1862826.1010	800.543

Depth (inches)	Pavement Type	Notes
0 – 6.0	Asphalt Concrete	Surface Course
6.0 – 15.0	Asphalt Concrete	Intermediate Course

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
15.0	15.0	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-002-0-19	08/19/2020	6.0”	719937.2300	1863258.5390	802.236

Depth (inches)	Pavement Type	Notes
0 – 6.0	Asphalt Concrete	Surface Course
6.0 – 12.0	Asphalt Concrete	Intermediate Course

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
12.0	12.0	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-003-0-19	08/19/2020	6.0”	719950.6350	1863573.5860	803.144

Depth (inches)	Pavement Type	Notes
0 – 7.0	Asphalt Concrete	Surface Course
7.0 – 10.0	Asphalt Concrete	Intermediate Course

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
10.0	10.0	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-004-0-19	08/19/2020	6.0”	720024.8290	1863881.6160	804.244

Depth (inches)	Pavement Type	Notes
0 – 11.0	Asphalt Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
7.0*	11.0	63.6
* Portion of core crumbled during recovery		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-005-0-19	08/19/2020	6.0”	720086.6100	1864283.5500	801.853

Depth (inches)	Pavement Type	Notes
0 – 9.0	Asphalt Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
8.0*	9.0	88.9*
* Portion of core crumbled during recovery		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-006-0-19	08/19/2020	6.0”	720141.7380	1864716.6070	792.207

Depth (inches)	Pavement Type	Notes
0 – 11.0	Asphalt Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
11.0	11.0	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-007-0-19	08/19/2020	6.0”	719002.8020	1863519.9800	800.395

Depth (inches)	Pavement Type	Notes
0 – 2.0	Asphalt Concrete	Surface Course
2.0 – 12.5	Cement Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
10.5*	12.5	84*
* Portion of core crumbled and not recovered		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-008-0-19	08/19/2020	6.0”	719386.9440	1863613.6140	800.023

Depth (inches)	Pavement Type	Notes
0 – 5.5	Asphalt Concrete	Surface Course
5.5 – 12.75	Cement Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
12.75	12.75	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-008-1-19	08/19/2020	6.0”	719259.4230	1863583.7760	799.450

Depth (inches)	Pavement Type	Notes
0 – 5.0	Asphalt Concrete	Surface Course
5.0 – 11.0	Cement Concrete	Crumbled

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
5.0*	11.0	45.45*
* Portion of core crumbled		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-008-2-19	08/19/2020	6.0”	719258.5290	1863580.5380	799.356

Depth (inches)	Pavement Type	Notes
0 – 5.0	Asphalt Concrete	Surface Course
5.0 – 12.0	Cement Concrete	Crumbled

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
5.0*	12.0	41.67*
* Portion of core crumbled		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-009-0-19	08/19/2020	6.0”	719775.1940	1863706.5900	802.247

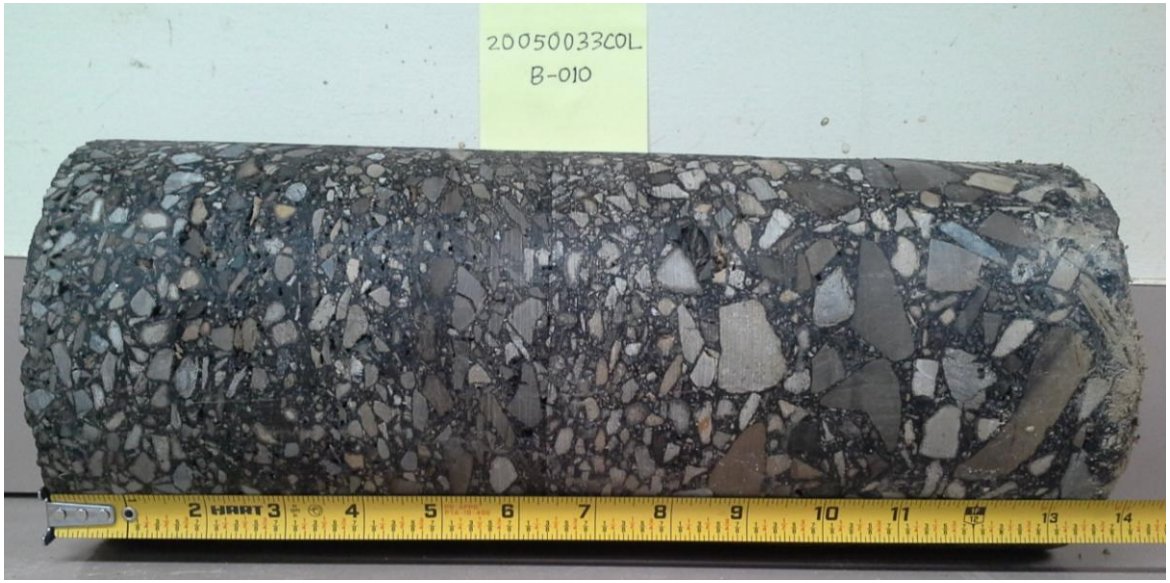
Depth (inches)	Pavement Type	Notes
0 – 4.0	Asphalt Concrete	Surface Course
4.0 – 8.5	Cement Concrete	
8.5 – 17.0	Cement Concrete	Crumbled (Not Included in the Picture)

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
8.5*	17.0	50*
* Portion of core crumbled		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-010-0-19	08/19/2020	6.0”	720323.1410	1863736.9400	804.328



Depth (inches)	Pavement Type	Notes
0 – 8.0	Asphalt Concrete	Surface Course
8.0 – 14.5	Asphalt Concrete	Intermediate Course

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
14.0*	14.5	96.5*
* Portion of core crumbled and not recovered		

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-011-0-19	08/19/2020	6.0”	720679.7470	1863716.9080	805.303

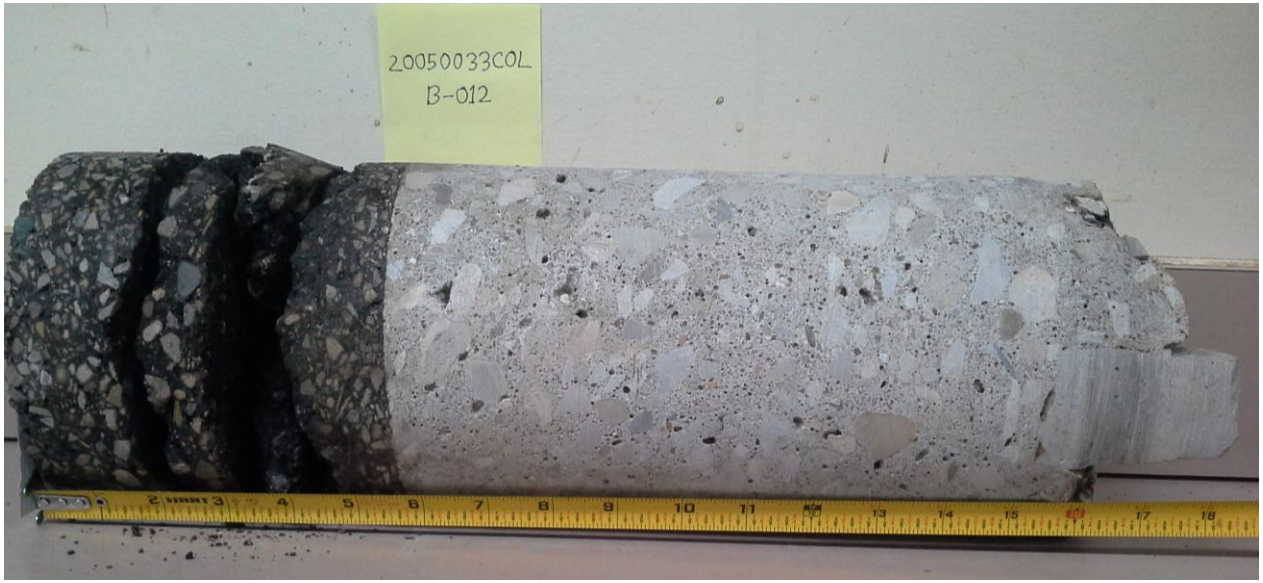
Depth (inches)	Pavement Type	Notes
0 – 8.0	Asphalt Concrete	Surface Course
8.0 – 13.0	Asphalt Concrete	Intermediate Course

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
13.0	13.0	100

PAVEMENT CORE REPORT

Broad Street and Hamilton Road Intersection Improvements
FRA-16-6.87, PID No. 105768
CTL Project No.: 20050033COL

Core No.	Date Cored	Core Diameter	Northing (feet)	Easting (feet)	Elevation (feet)
B-012-0-19	08/19/2020	6.0”	721094.9430	1863801.1250	806.329



Depth (inches)	Pavement Type	Notes
0 – 5.5	Asphalt Concrete	Surface Course
5.5 – 18.0	Cement Concrete	

Recovered Core Length (inches)	In-hole Depth (inches)	Recovery (%)
16.5	16.5	100

APPENDIX D
GB1 ANALYSIS

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FRA-16-6.87
105768

Broad Street and Hamilton Road Intersection Improvements

CTL Engineering, Inc.

Prepared By: SR
Date prepared: Monday, October 12, 2020

Shahedur Rahman, E.I.
2860 Fisher Rd
Columbus
Ohio 43204
(614) 276-8123
srahman@ctleng.com

NO. OF BORINGS: 12

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-19	SR 16 (East Broad St)	58+79.7	7	Right	CME 45C Track	89	800.5	799.0	1.5 C
2	B-002-0-19	SR 16 (East Broad St)	63+18.6	10	Left	CME 45C Track	89	802.2	800.7	1.5 C
3	B-003-0-19	SR 16 (East Broad St)	66+32.54	20	Right	CME 45C Track	89	803.1	801.6	1.5 C
4	B-004-0-19	SR 16 (East Broad St)	69+47.82	11	Left	CME 45C Track	89	804.2	802.7	1.5 C
5	B-005-0-19	SR 16 (East Broad St)	73+54.34	20	Left	CME 45C Track	89	801.9	800.4	1.5 C
6	B-006-0-19	SR 16 (East Broad St)	77+90.88	17	Left	CME 45C Track	89	792.2	790.7	1.5 C
7	B-007-0-19	SR 317 (Hamilton Rd)	69+5.66	1	Right	CME 45C Track	89	800.4	798.9	1.5 C
8	B-008-0-19	SR 317 (Hamilton Rd)	73+3.33	24	Left	CME 45C Track	89	800.0	798.5	1.5 C
9	B-009-0-19	SR 317 (Hamilton Rd)	77+0.87	26	Right	CME 45C Track	89	802.2	800.7	1.5 C
10	B-010-0-19	SR 317 (Hamilton Rd)	82+49.63	21	Right	CME 45C Track	89	804.3	802.8	1.5 C
11	B-011-0-19	SR 317 (Hamilton Rd)	286+4.2	22	Left	CME 45C Track	89	805.3	803.8	1.5 C
12	B-012-0-19	SR 317 (Hamilton Rd)	90+26.49	1	Right	CME 45C Track	89	806.3	804.8	1.5 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	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	1.5	3.0	0.0	1.5	27		4	31	21	10	37	26	63	18	16	A-4a	6						
	001-0	SS-2	3.0	4.5	1.5	3.0	10		2.75	54	25	29	36	52	88	23	22	A-7-6	18			N_{60}			
	19	SS-3	4.5	6.0	3.0	4.5	15		2.75							21	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	10	10	0.5							32	18	A-7-6	16						
2	B	SS-1	1.0	2.5	-0.5	1.0	22			32	20	12	30	24	54	18	15	A-6a	5			Mc			
	002-0	SS-2	2.5	4.0	1.0	2.5	21		4.5	38	23	15	38	39	77	19	18	A-6a	10						
	19	SS-3	4.0	5.5	2.5	4.0	25		4.5							13	16	A-6b	16						
		SS-4	5.5	7.0	4.0	5.5	15	15	3							19	16	A-6b	16						
3	B	SS-1	1.0	2.5	-0.5	1.0	30			22	18	4	21	11	32	12	10	A-2-4	0						
	003-0	SS-2	2.5	4.0	1.0	2.5	10		2	48	28	20	41	48	89	27	25	A-7-6	14			N_{60}		12"	
	19	SS-3	4.0	5.5	2.5	4.0	7		1.5							28	16	A-6b	16						
		SS-4	5.5	7.0	4.0	5.5	18	7	3.5							20	16	A-6b	16						
4	B	SS-1	2.0	3.5	0.5	2.0	10		3.75	37	22	15	47	34	81	22	17	A-6a	10			N_{60} & Mc		12"	
	004-0	SS-2	3.5	5.0	2.0	3.5	16									17	10	A-2-6	4			Mc			
	19	SS-3	5.0	6.5	3.5	5.0	25		4.5	44	21	23	41	42	83	23	18	A-7-6	14						
		SS-4	6.5	8.0	5.0	6.5	42	10	3.5							17	8	A-3	0						
5	B	SS-1	1.0	2.5	-0.5	1.1	57			21	17	4	21	11	32	12	10	A-2-4	0						
	005-0	SS-2	2.5	4.0	1.1	2.6	37		4.5	33	19	14	40	32	72	15	14	A-6a	9						
	19	SS-3	4.0	5.5	2.6	4.1	27		4.5							14	14	A-6a	10						
		SS-4	5.5	7.0	4.1	5.6	28	27	4.5							14	14	A-6a	10						
6	B	SS-1	1.0	2.5	-0.5	1.0	73			23	17	6	19	11	30	8	10	A-2-4	0						
	006-0	SS-2	2.5	4.0	1.0	2.5	39		4.5	24	16	8	36	25	61	11	11	A-4a	5						
	19	SS-3	4.0	5.5	2.5	4.0	25		4.5							10	10	A-4a	8						
		SS-4	5.5	7.0	4.0	5.5	24	24	4.5							11	16	A-6b	16						
7	B	SS-1	1.0	2.5	-0.5	1.0	9			32	20	12	21	19	40	12	15	A-6a	2			N_{60}		12"	
	007-0	SS-2	2.5	4.0	1.0	2.5	18		4.5	45	30	15	48	48	96	16		A-7-5	11		A-7-5		30"		
	19	SS-3	4.0	5.5	2.5	4.0	16									28	16	A-6b	16						
		SS-4	5.5	7.0	4.0	5.5	55	9	4.5							18	0	Rock	0						
8	B	SS-1	1.0	2.5	-0.5	1.0	21			19	15	4	17	11	28	9	8	A-3a	0						
	008-0	SS-2	2.5	4.0	1.0	2.5	15			NP	NP	NP	16	7	23	7	6	A-1-b	0						
	19	SS-3	4.0	5.1	2.5	3.6										10	6	A-1-b	0						
		SS-4						15																	
9	B	SS-1	1.5	3.0	0.0	1.5	10		1.25	35	21	14	47	39	86	22	16	A-6a	10			HP & Mc		12"	
	009-0	SS-2	3.0	4.5	1.5	3.0	9		1.25	60	27	33	38	53	91	25	24	A-7-6	20			HP			
	19	SS-3	4.5	6.0	3.0	4.5	18		1.5							29	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	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	
		SS-4	6.0	7.5	4.5	6.0	15	9	1							29	18	A-7-6	16						
10	B	SS-1	1.5	3.0	0.0	1.5	18		1.75	39	24	15	42	37	79	21	19	A-6a	10						
	010-0	SS-2	3.0	4.5	1.5	3.0	12		2.5	56	26	30	38	51	89	26	23	A-7-6	19			N_{60} & Mc			
	19	SS-3	4.5	6.0	3.0	4.5	15		4.5							22	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	21	12	2.5							20	18	A-7-6	16						
11	B	SS-1	1.5	3.0	0.0	1.5	10		2.25	37	18	19	47	37	84	23	16	A-6b	12			N_{60} & Mc		**12"**	
	011-0	SS-2	3.0	4.5	1.5	3.0	12		1.75	51	26	25	53	42	95	27	23	A-7-6	16			HP & Mc			
	19	SS-3	4.5	6.0	3.0	4.5	13		3.25							25	16	A-6b	16						
		SS-4	6.0	7.5	4.5	6.0	21	10	1.5							20	16	A-6b	16						
12	B	SS-1	1.5	3.0	0.0	1.5	13									5	10	A-2-6	4						
	012-0	SS-2	3.0	4.5	1.5	3.0	36		4.5	30	19	11	37	33	70	13	14	A-6a	7						
	19	SS-3	4.5	6.0	3.0	4.5	27		4.5							18	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	43	13	4.5							13	14	A-6a	10						

PID: 105768

County-Route-Section: FRA-16-6.87

No. of Borings: 12

Geotechnical Consultant: CTL Engineering, Inc.

Prepared By: SR

Date prepared: 10/12/2020

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

Excavate and Replace Stabilization Options	
Global Geotextile Override(N60L):	18''
Override(HP):	24''
Global Geogrid Override(N60L):	12''
Override(HP):	18''

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	2%
$N_{60} < 12$	19%	0.5 < HP ≤ 1	2%
$12 \leq N_{60} < 15$	9%	1 < HP ≤ 2	17%
$N_{60} \geq 20$	47%	HP > 2	55%
M+	15%		
Rock	0%		
Unsuitable	4%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

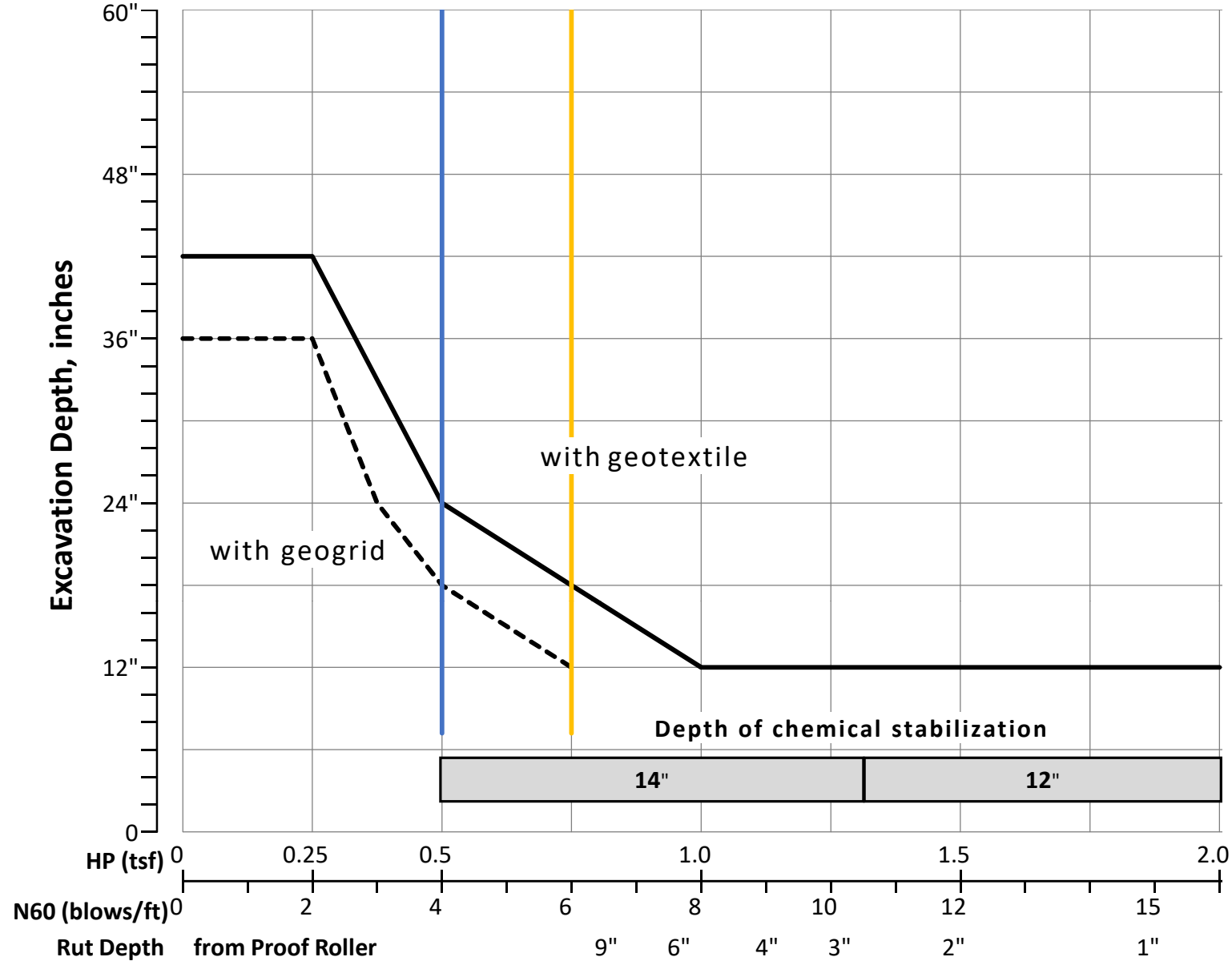
% Proposed Subgrade Surface	
Unstable & Unsuitable	40%
Unstable	37%
Unsuitable	3%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	23	13	3.20	37	22	15	35	32	67	18	15	10
Maximum	73	27	4.50	60	30	33	53	53	96	32	25	20
Minimum	7	7	0.50	19	15	4	16	7	23	5	0	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	1	0	2	3	0	2	0	1	1	3	0	0	12	9	1	12	0	0	47
Percent	2%	0%	4%	6%	0%	4%	0%	2%	2%	6%	0%	0%	26%	19%	2%	26%	0%	0%	100%
% Rock|Granular|Cohesive	2%	26%									72%								100%
Surface Class Count	0	0	2	3	0	2	0	0	1	3	0	0	9	4	1	5	0	0	30
Surface Class Percent	0%	0%	7%	10%	0%	7%	0%	0%	3%	10%	0%	0%	30%	13%	3%	17%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.20	0.50	☑ HP
13.42	6.00	☑ N60L

Average HP
Average N_{60L}

The subgrade analysis workbook consists of five worksheets. Each worksheet functions independently. In all of the worksheets the fields are color coded as follows:

- Every yellow highlighted field indicates a field to be entered by the user.
- Every salmon field is to indicate a problem/issue.
- Every gray or green field is a heading/informational field.

IMPORTANT: The sequence of filling out the data needs to be followed as outlined below:

1. Cover Sheet: this worksheet is designed for the purpose of entering the project information. Enter all the following fields:

County-Route-Section	This includes the county, route, section number assigned to the project.
PID	the Project Identification Number
Project Description	See Cover Sheet for list of example details
Geotechnical Consultant	The Geotechnical Consultant performing the analysis.
Prepared By	The preparer of the subgrade analysis
Date prepared	The date the analysis is performed.
Contact Information	Name, address, telephone #, and email address
No. of Borings	Enter the total number of borings within the alignment that is being analyzed.

2. Boring Logs Entry Worksheet: this worksheet has a programming code that will run in the background every time the sheet is activated and will make the sheet unresponsive for less than a minute. The code is designed to read the total number of borings from the cover sheet and generate the needed number of fields.
   a. All yellow highlighted fields are user's entry.
   b. ODOT has developed a text table export from gINT *(GB 1 Borings Log Entry Tab)* that will allow for copy and paste of all highlighted fields with the exception of proposed subgrade elevation. The designer must provide a proposed subgrade elevation in order for the spreadsheet to function properly.
   c. The Cut/Fill field is a calculated field that, based on the difference between the boring elevation and the proposed subgrade elevation, will highlight the cell either gray and adds the letter "C" to the end in a cut situation or highlights the cell in light purple and adds the letter "F" to the end in a fill situation.
   d. Every duplicate boring ID will be highlighted in salmon background and red text.
   e. **IMPORTANT**: After entering all the borings' information, the user must click "Add Subgrade Analysis Entry Fields" button. This will generate all the required fields in the "Subgrade Analysis" Worksheet.

3. Subgrade Analysis Worksheet:
   a. The boring number and boring ID is read from the "Boring Logs Entry Worksheet" excluding every boring that has six feet or more of fill.
   b. All yellow highlighted fields are to be entered by the user and salmon highlighted fields indicates a problem or issue.
   c. Every sample that has a Sulfate Content greater than or equal to 3000 will be highlighted in light salmon background. Every sample that has a Sulfate Content greater than or equal to 8000 will be highlighted in darker salmon background. Note the revised sulfate criteria in GB1 issued July 20, 2018.

d. Unsuitable/Unstable:

i. Unsuitable samples that are within 3 feet of the top of subgrade will be highlighted with salmon background and the class will be showing in this field.

ii. Unstable Samples that are within 3 feet of top of subgrade will be highlighted with salmon background and text to indicate the problem as follows:

Criterion	Stabilization Need Check	Text displayed in the field
A-1-a, A-1-b, A-3, or A-3a Soil Class	No Stabilization is needed	
HP ≥ 1.875	No Stabilization is needed	
N_{60} ≥ 15	No Stabilization is needed	
1.875 ≥ HP ≥ 1.5 and M_c≥ Opt. M_c+3	Unstable Subgrade	HP & Mc
15 ≥ N_{60} ≥ 12 and M_c≥ Opt. M_c+3	Unstable Subgrade	N_{60} & Mc
HP ≤ 1.5	Unstable Subgrade	HP
N_{60} ≤ 12	Unstable Subgrade	N_{60}

iii. The field is formulated to check for HP first and check for N_{60} second.

e. Excavate and Replace (Item 204) is going to be calculated based on the subgrade depth for each sample indicating an unsuitable or unstable problem.

f. Recommendation:

i. Geotextile Option is calculated and rounded to a multiple of 3 inches based on the subgrade depth for every sample indicating an unsuitable or unstable problem.

ii. GEOGRID Option is only offered in case of unstable subgrade problem and if the geotextile option indicates the need to excavate greater than 12 inches.

PLEASE NOTE: The Problem, Excavate & Replace, and Recommendation Fields are the responsibility of the Designer. These fields are being enhanced to attempt to capture the ODOT philosophy regarding the GB1 stabilization chart, but are considered still under development. If there are discrepancies between the spreadsheet output and the GB1 chart - the chart governs in conjunction with engineering judgement. Please contact Steve Taliaferro at stephen.taliaferro@dot.ohio.gov if you have any questions.

PLEASE NOTE: It is the Designer's responsibility to identify the most representative data when samples have been separated into multiple specimen (say 1.5 to 2.3 feet and 2.3 to 3.0 feet). The spreadsheet is not capable at this time of addressing this issue within a direct data export from gINT.

4. Results Summary:
All fields in this sheet are password protected and are either calculated or read from the other worksheets.

5. Graph Worksheet:
This worksheet is designed to read the average N_{60L} and the average HP from the Cover Sheet and plot a blue line for Average HP and orange line for Average N_{60L} on GB1 Figure B – Subgrade Stabilization. The Override Table can be used to enter HP and/or N_{60L} values that are different than the calculated averages. The Override values will change the global undercut recommendation in the Results Summary.