



ECS Midwest, LLC | Solar Testing Laboratories, Inc.

Final Geotechnical Engineering Report

CUY-422-16.20 (Harper Road Interchange)

PID 113889

Solon, Cuyahoga County, Ohio

ECS Project No. 67:1371

May 3, 2022



April 15, 2022

Mr. Mark Grossman, P.E.
Director of Transportation – Roadway
GPD Group
520 South Main Street, Suite 2531
Akron, OH 44311

ECS Project No. 67:1371

Reference: Final Geotechnical Engineering Report
CUY-422-16.20 (Harper Road Interchange)
PID 113889
Solon, Cuyahoga County, Ohio

Dear Mr. Grossman:

ECS Midwest, LLC/Solar Testing Laboratories, Inc. (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This final report addresses comments received from ODOT following their Stage 1 review of our original report dated August 20, 2021, ODOT Stage 2 report comments dated March 31, 2022, and project plans by GPD Group.

It has been our pleasure to be of service to GPD Group during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Midwest, LLC/Solar Testing Laboratories, Inc.

Michael S. Russo, P.E.
Senior Geotechnical Engineer
MRusso@ecslimited.com



Mark R. Recktenwald, P.E.
Geotechnical Department Manager
MRecktenwald@ecslimited.com

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Certification of Geotechnical Plan Review – Stage 2

February 10, 2022

Mr. Mark Grossman, P.E.
Director of Transportation – Roadway
GPD Group
520 South Main Street, Suite 2531
Akron, OH 44311

Re: CUY-422-16.20 (Harper Road Interchange)
PID : 113889

Dear Mr. Grossman:

As the Geotechnical Engineer of Record for the subject project, I certify that I have reviewed the Stage 2 plans (or equivalent) for the subject project.

Respectfully,

A handwritten signature in blue ink that reads 'Michael S. Russo'.

Michael S. Russo, P.E.
Senior Geotechnical Engineer

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- ODOT Classification of Soils
- Geotechnical Bulletin GB1 Analysis

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- Field Photographs
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- Core Photographs

EXECUTIVE SUMMARY

The following summarizes the main findings of the roadway exploration, particularly those that may have a cost impact on the project. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire report.

- The existing pavement section varied throughout the project limits and consisted of asphalt or concrete, with asphalt over concrete at some locations. The total pavement section measured between 7.25 and 14.5 inches. The underlying subbase also varied in composition with both crushed limestone and slag encountered, which measured between approximately 3 and 14 inches. Borings drilled off existing pavement encountered 2 to 6 inches of topsoil.
- Between 4.5 and 8.5 feet of fill material was noted beneath the surface materials at 12 of the 14 boring locations, with the other two locations designated as possible fill material. The fill material varied in composition and generally consisted of brown and gray sandy silt or brown and gray silt and clay. Pieces of slag and asphalt were noted within the fill at 5 boring locations.
- Groundwater was measured between 4.5 and 8.5 feet below existing grades at borings B-001-0-20, B-006-0-20, B-007-0-20, and B-009-0-20. The other borings were dry at the time of drilling operations.
- Based on subsurface conditions and the results of our field and laboratory testing, we do anticipate that there will be areas of subgrade instability that will need remediation. In general, the soil borings drilled off existing pavement encountered subgrade that may be unstable. This corresponds to the following stationing within proposed ramps. These limits should be used for estimating purposes only.

Proposed Ramp	Estimated Limits of Subgrade Instability	
	Starting Station	Ending Station
1A	344+27	345+58
1B	444+82	446+42
2B	548+87	550+13
3A	645+00	646+50
3B	544+05	545+65
4A	350+20	352+15
4B	450+13	451+46

- Unstable subgrade may be undercut and replaced with ODOT Item 204 Granular Material Type B that drains to an underdrain or catch basin. Geo-grid, in accordance with ODOT Item 204.07.B, may also be included in order to limit undercut depth to a maximum of 12 inches. GPD Group does not believe deeper undercuts are feasible because they would not be able to be drained to storm sewers. Chemical stabilization is also not feasible due to the number of existing underground utilities.
- A presumptive California Bearing Ratio (CBR) value of 7 for flexible pavement or a presumptive Modulus of Subgrade Reaction (k) value of 165 pounds per cubic inch (pci) for rigid pavement could be used as anticipated subgrade reaction values.

1.0 INTRODUCTION

This report presents the results of a roadway exploration conducted for the Harper Road Interchange project located in Solon, Cuyahoga County, Ohio (ODOT PID 113889). This exploration was performed under the ODOT Specifications to Geotechnical Exploration (SGE) dated January 2020 to determine the subsurface conditions and their suitability for support of the proposed roadway reconstruction.

Our services were provided in accordance with our Proposal No. 67:1007-GP(R1), dated March 6, 2020, as authorized by Mr. Jeffrey Evans on August 31, 2020, which includes our Terms and Conditions of Service.

This is an ODOT-Let Local Public Agency (LPA) project that involves reconfiguring the US-422 westbound interchange at Harper Road. Aspects of the project include improving the interchange to a diverging diamond interchange (DDI), eliminating the existing northbound to westbound loop ramp, and lengthening the existing turn lanes on the US-422 westbound exit ramp. Please see Figures 1.1 and 1.2 for more details (approximate project limits denoted by red lines in Figure 1.1). Significant changes to the pavement profile are not anticipated.

During Stage 1 review, ODOT determined that a proposed concrete barrier wall needs to be designed as a retaining wall. At the request of GPD, ECS reviewed their design calculations and performed global stability on a cross-section of the retaining wall. Please see our report dated December 3, 2021 for more details. As the project design progressed, GPD was able to eliminate this retaining wall by redesigning the adjacent dual-use path.

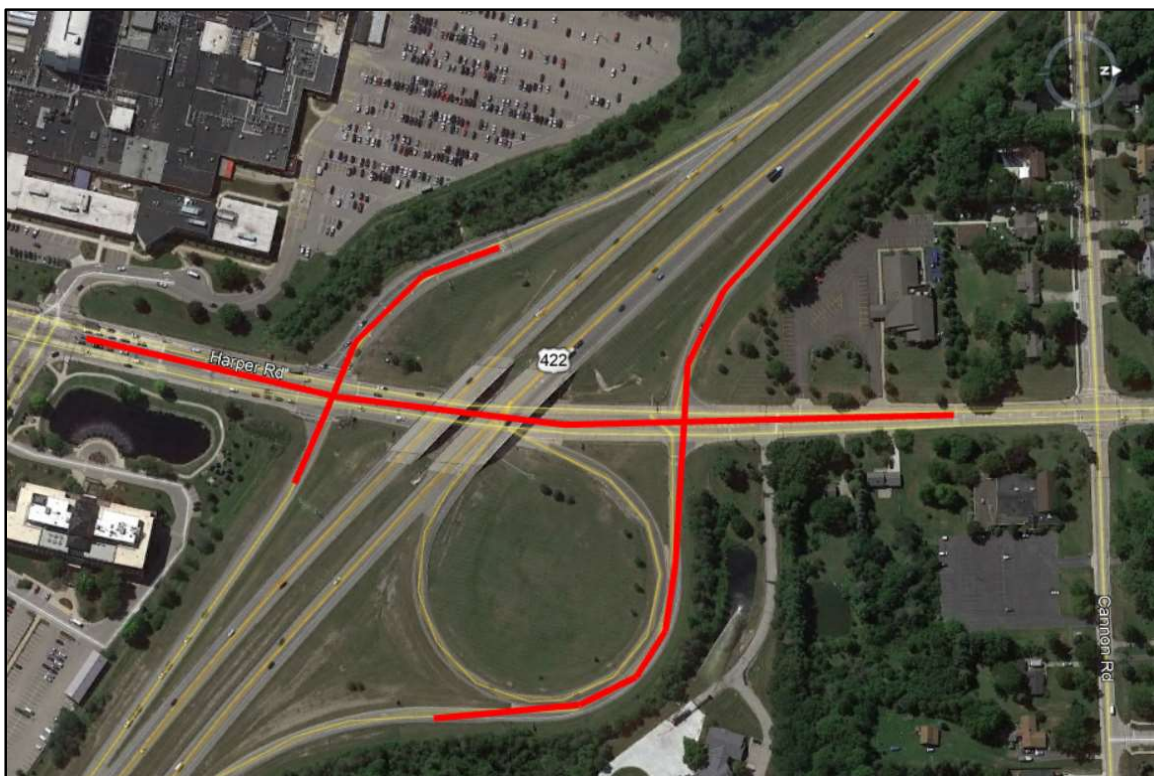


Figure 1.1 – Site Location/Approximate Project Limits

Over the project limits, Harper Road generally consists of four traffic lanes, two in each direction, with one or two center turning lanes south of the US-422 overpass. The pavement surface is mainly concrete along Harper Road with asphalt pavement near the south end. The highway entrance and exit ramps consist of asphalt pavement. The surface elevation falls approximately 14 feet from north to south along Harper Road. The entrance and exit ramps vary in elevation accordingly to allow traffic to access US-422 which passes over Harper Road.

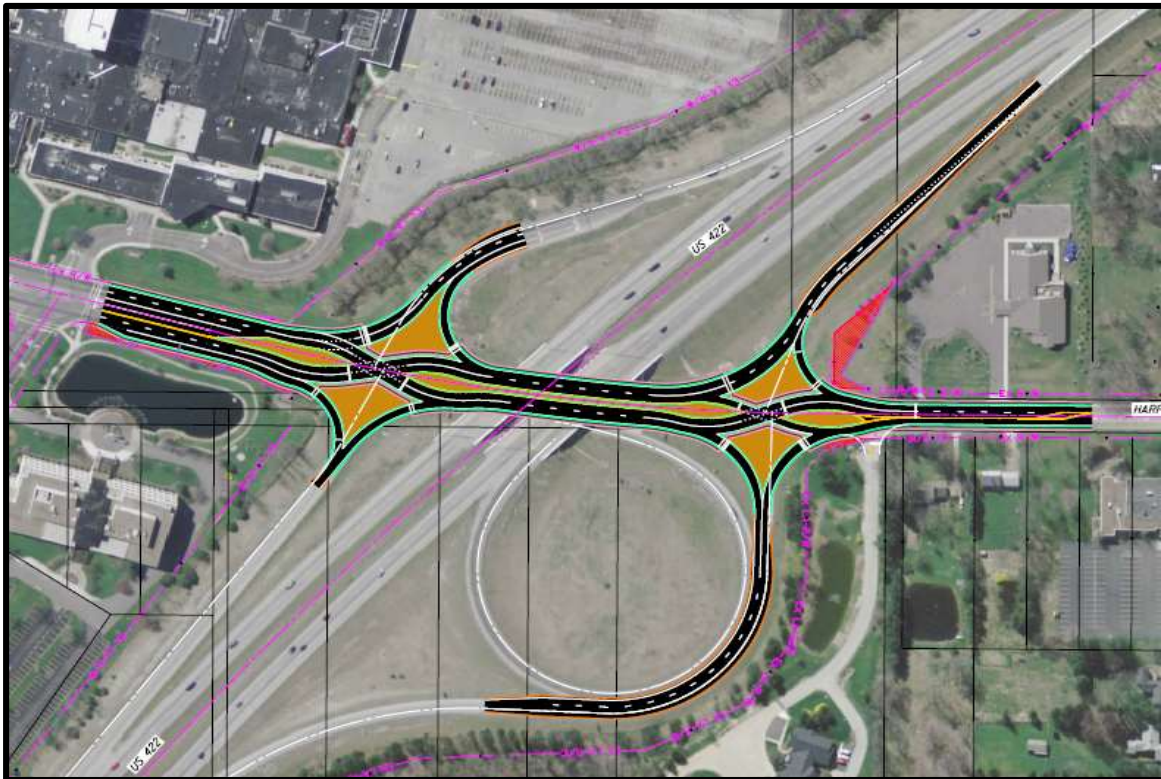


Figure 1.2 – Proposed Reconstruction

This report contains the procedures and findings of our subsurface exploration and laboratory testing programs, review of existing site geology, engineering analyses, and recommendations for the design and construction of the project. The findings and recommendations presented in this report are based upon:

- Visual site reconnaissance.
- Pavement core, soil boring, ground water, and penetration resistance data gathered during the site sampling operations.
- Laboratory examinations, classifications, and evaluations of the soil samples.
- General project information provided by GPD Group.
- Experience with similar project and site conditions.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

This site is located in the Akron Canton Interlobate Plateau of the Glaciated Allegheny Plateaus section of the Appalachian Plateau Physiographic Province. The topography of this area is flat to rolling.

The soils in this area are glacial in origin. The soils are Lavery Till, which is a ground moraine, consisting of silt and clay with some sand. They are Wisconsin in age.

Bedrock in this area is approximately 75 feet below the surface. The bedrock is Mississippian in age and consists of shale and sandstone.

3.0 EXPLORATION

A review of TIMS showed historical borings drilled for construction of US 422 over Harper Road, including soil borings for the bridge overpass (CUY-422-13.73). The historical borings were dated from 1965 and were difficult to determine their locations relative to Harper Road. Therefore, the only historical borings included for reference to this current project are the two soil borings for the bridge overpass.

A total of fourteen (14) soil borings with sampling, designated as B-001-0-20 through B-014-0-20, were drilled at the project site on November 19 and 20, 2020 to determine the subsurface conditions. Seven (7) borings were located within existing pavement and seven (7) borings were located within proposed pavement.

The existing pavement section was cored for material identification and thickness verification, and to provide access to the subgrade for soil borings. ECS Midwest LLC/Solar Testing Laboratories, Inc. (ECS) selected and field located the boring locations in general accordance with the ODOT Specifications for Geotechnical Engineering (SGE) while giving consideration to subsurface utilities. ECS cored the existing pavement section and the soil borings were drilled by Ridgeway Drilling, Inc.

The boring and sampling operations were performed in accordance with the SGE. However, even though no significant grade changes are anticipated for this project, the borings were drilled up to 10 feet as requested by GPD Group. The soil borings were drilled using either a heavy, truck-mounted or ATV-mounted, hollow-stem, continuous rotary drill. Soil sampling was conducted as outlined below, in accordance with ASTM D1586:

- Continuous sampling was performed in the upper 6 feet of subgrade. The split-barrel sampler was driven 18 inches into the soil by the use of a 140-pound hammer falling 30 inches. The number of blows of the hammer was recorded for every 6 inches of penetration (SPT data). Where the number of blows exceeded 50 per interval, the actual depth of penetration was recorded.
- All samples were visually classified and logged by the drillers immediately upon removal from the split-barrel. Hand penetrometer readings of cohesive samples were then taken. The samples were secured in glass jars and delivered to our soil mechanics laboratory in accordance with ASTM D4220.
- Ground water level was measured and recorded upon encounter and at completion of each soil boring.

Laboratory soil testing was performed in accordance with ODOT Geotechnical Bulletin 1 guidelines. Selected samples were tested for Moisture Content, Particle Size Analysis, Atterberg Limits, and Sulfates Content, performed in accordance with applicable ASTM Standards. The results of the laboratory testing are shown on the boring logs. The soil samples were classified in accordance with the Unified Soil Classification System (USCS).

4.0 FINDINGS

The existing pavement section along Harper Road consisted of 5 inches of asphalt over 9.5 inches of reinforced concrete at boring B-010-0-20, and between 9 and 9.75 inches of reinforced concrete only at borings B-001-0-20 and B-006-0-20. The underlying subbase along Harper Road varied between 2.75 and 10 inches of crushed limestone or 6 inches of slag. The existing pavement section along the US 422 W entrance ramp consisted of 5 to 5.25 inches of asphalt over 8.5 to 9 inches of reinforced concrete. The underlying subbase was 12 inches of crushed limestone. The existing pavement section along the US 422 W exit ramp consisted of 7.25 to 7.5 inches of asphalt only. The underlying subbase consisted of 14 inches of slag at boring B-013-0-20 whereas almost 4 feet of crushed limestone was encountered beneath the asphalt at boring B-014-0-20. Borings drilled off pavement encountered 2 to 6 inches of topsoil at the surface.

Between 4.5 and 8.5 feet of fill material was noted beneath the surface materials at 12 of the 14 boring locations, with the other two locations designated as possible fill material. The fill material varied in composition and generally consisted of brown and gray sandy silt or brown and gray silt and clay. Thicker layers of brown gravel were noted at borings B-001-0-20, B-010-0-20, and B-014-0-20. The fill material generally appeared to be clean with asphalt and/or slag pieces noted at 5 of the boring locations. Please note that the composition of fill material can widely vary even across short distances and the contractor should be prepared for such variations within the on-site fill material.

The natural subsurface generally consisted of medium stiff to very stiff brown and gray silty clay with varying amounts of sand and gravel and very stiff gray sandy silt with varying amounts of clay and gravel. Medium dense gray silty sand was encountered at 8.5 feet in boring B-003-0-20.

The subgrade was determined visually or through laboratory testing to have ODOT classifications of A-1-a, A-1-b, A-2-4, A-4a, A-6a, and A-7-6 with moisture contents ranging between 5 and 33 percent. The tested moisture contents were often greater than 2 percentage points over optimum for a given ODOT classification. Sulfate contents varied between <100 and 2600 parts per million (ppm). For more detailed information regarding subsurface soil conditions, please refer to the enclosed Boring Logs.

Groundwater was measured between 4.5 and 8.5 feet below existing grades at borings B-001-0-20, B-006-0-20, B-007-0-20, and B-009-0-20. The other borings were dry at the time of drilling operations. It is possible, however, that trapped pockets of ground water exist throughout the near-surface fill material and that the contractor may encounter ground water seepage during earthwork operations especially if the work occurs during or immediately after wetter parts of the year. It also should be noted that ground water depths are subject to seasonal fluctuations; therefore, we cannot predict the actual ground water level at the time of construction.

5.0 ANALYSES AND RECOMMENDATIONS

5.1 PAVEMENT SUPPORT

Based on subsurface conditions and the results of our field and laboratory testing, we do anticipate that there will be areas of subgrade instability that will need remediation. In general, the soil borings drilled off existing pavement encountered subgrade that may be unstable based on hand penetrometer readings and SPT-N blow counts. The near-surface fill material had varying amounts of sand and gravel mixed in which could have resulted in low hand penetrometer values as the soil crumbled somewhat under pressure from the penetrometer.

Elevated moisture contents could also be a cause of instability. The contractor should mitigate the effects of precipitation on exposed subgrade during construction by establishing and maintaining drainage as soon as possible throughout the project. We recommend the installation of underdrains at the edge of pavement and the installation of weep holes or finger drains at all catch basins.

Based on subsurface conditions and the results of our field and laboratory testing, we do anticipate that there will be areas of subgrade instability that will need remediation. In general, the soil borings drilled off existing pavement encountered subgrade that may be unstable. This corresponds to the following stationing within proposed ramps. These limits should be used for estimating purposes only.

Proposed Ramp	Estimated Limits of Subgrade Instability	
	Starting Station	Ending Station
1A	344+27	345+58
1B	444+82	446+42
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3A	645+00	646+50
3B	544+05	545+65
4A	350+20	352+15
4B	450+13	451+46

Chemical stabilization is not feasible due to the number of existing underground utilities. We recommend the subgrade be stabilized by undercutting and replacing with ODOT Item 204 Granular Material Type B that drains to an underdrain or catch basin. GPD Group believes that undercuts greater than 12 inches would not be feasible to drain because the existing storm sewers are shallow that will not allow for deeper underdrains. Therefore, Geo-grid may be placed in accordance with ODOT Item 204.07.B to provide additional stability. If Harper Road and the highway ramps are replaced via part-width construction, Geo-grid should overlap with itself in accordance with Item 204.07.B.

We do not anticipate widespread subgrade instability under existing pavement. However, isolated areas of unstable subgrade may be identified based on proof rolling.

Either a flexible or rigid pavement could be used provided that the subgrade is properly prepared and well-drained, and that the pavement has a sufficient structural section determined on the basis of subgrade reaction, traffic number, and traffic loads. A presumptive California Bearing Ratio (CBR) value of 7 for flexible pavement or a presumptive Modulus of Subgrade Reaction (k) value of 165 pounds per cubic inch (pci) for rigid pavement could be used as anticipated subgrade reaction values. However, if poor drainage or other deleterious conditions are allowed to develop, these estimated values become invalid.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by GPD Group. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

Field observations, and quality assurance testing during earthwork and pavement operations are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Diagrams & Reports

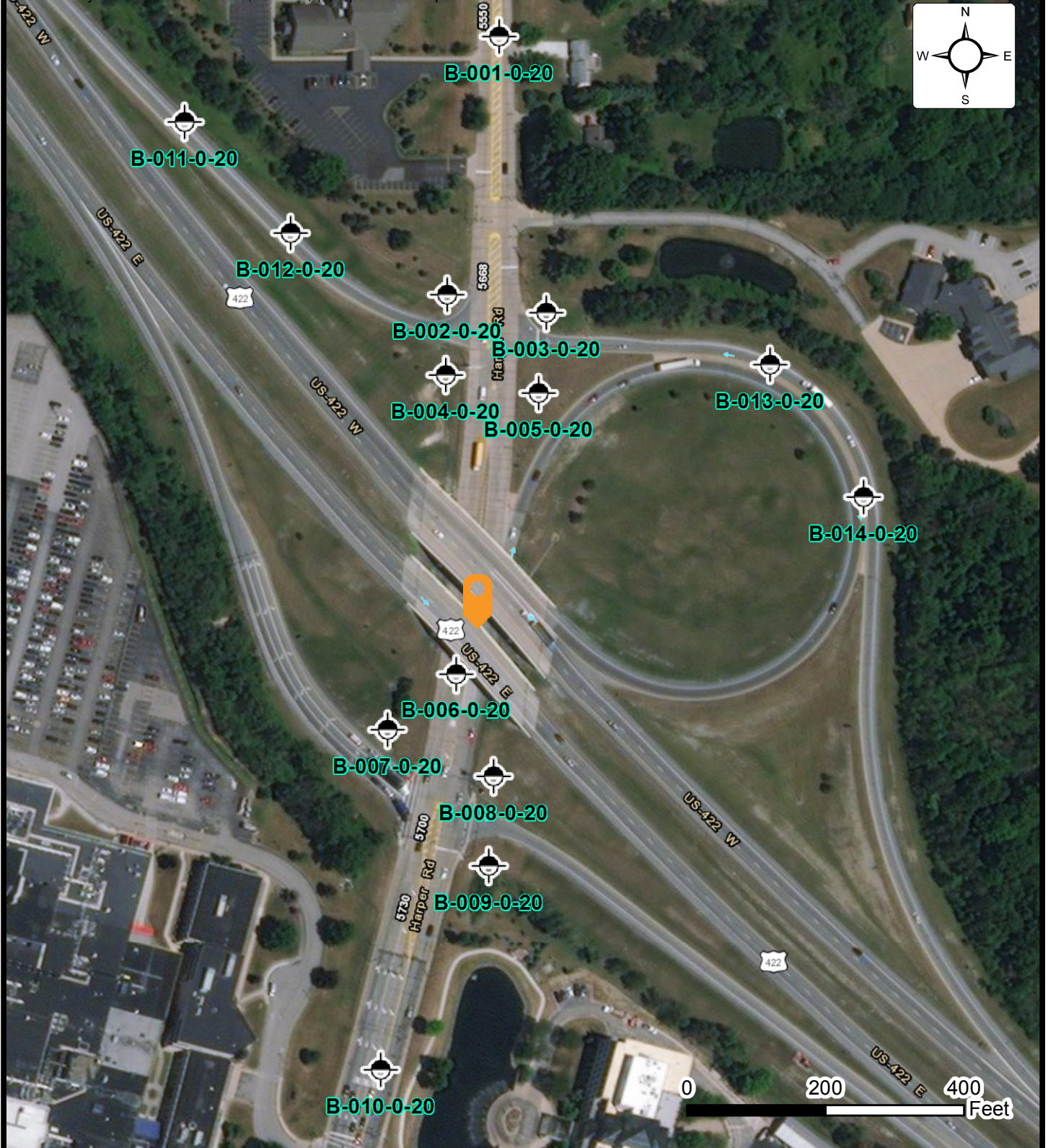
Boring Location Diagram

Plan and Profile Sheets

Boring Logs B-001-0-20 through B-014-0-20

ODOT Classification of Soils

Geotechnical Bulletin GB1 Analysis



BORING LOCATION DIAGRAM CUY-422-16.20 (HARPER ROAD)

OLON, CUYAHOGA COUNTY, OHIO

GPD GROUP

ENGINEER
MR6

SCALE
AS NOTED

PROJECT NO.
67:1371

SHEET
1 OF 1

DATE
1/31/2022

PROJECT DESCRIPTION

THIS PROJECT, CUY-HARPER RD, IS THE RECONFIGURATION OF THE US-422 WESTBOUND INTERCHANGE AT HARPER ROAD IN THE CITY OF SOLON, CUYAHOGA COUNTY, OHIO. ASPECTS OF THE PROJECT INCLUDE IMPROVING THE INTERCHANGE TO A DIVERGING DIAMOND INTERCHANGE (DDI), ELIMINATING THE EXISTING NORTHBOUND TO WESTBOUND LOOP RAMP, AND LENGTHENING THE EXISTING TURN LANES ON THE US-422 WESTBOUND EXIT RAMP.

HISTORIC RECORDS

TWO HISTORIC BORINGS DRILLED FOR PROJECT CUY-422-13.73 (US 422 BRIDGE OVER HARPER ROAD) ARE PRESENTED ON THIS SOIL PROFILE. DUE TO THEM BEING STRUCTURE BORINGS AND THIS IS A ROADWAY PROJECT, ONLY A PORTION OF THE TOTAL DEPTH OF THE HISTORIC BORINGS IS SHOWN FOR PURPOSES OF CLARITY.

GEOLOGY

THIS SITE IS LOCATED IN THE AKRON CANTON INTERLOBATE PLATEAU OF THE GLACIATED ALLEGHENY PLATEAUS SECTION OF THE APPALACHIAN PLATEAU PHYSIOGRAPHIC PROVINCE. THE TOPOGRAPHY OF THIS AREA IS FLAT TO ROLLING.

THE SOILS IN THIS AREA ARE GLACIAL IN ORIGIN. THE SOILS ARE LAVERY TILL, WHICH IS A GROUND MORANE, CONSISTING OF SILT AND CLAY WITH SOME SAND. THE ARE WISCONSIN IN AGE.

BEDROCK IN THIS AREA IS APPROXIMATELY 75 FEET BELOW THE SURFACE. THE BEDROCK IS MISSISSIPPIAN IN AGE AND CONSISTS OF SHALE AND SANDSTONE.

RECONNAISSANCE

A SITE VISIT WAS CONDUCTED ON NOVEMBER 10, 2020. THE LAND USAGE AROUND THE PROJECT IS DOMINATED BY THE HIGHWAY INTERCHANGE WITH A CHURCH AND FIRE STATION NEAR THE NORTH END OF THE PROJECT LIMITS AND COMMERCIAL PROPERTIES NEAR THE SOUTH END OF THE PROJECT LIMITS. THE PAVEMENT SURFACE SHOWS DISTRESS SUCH AS LONGITUDINAL AND TRANSVERSE CRACKING WITH SPALLING, JOINT SEAL DAMAGE, AND REFLECTIVE AND ALLIGATOR CRACKING. SPALLED CRACKS ARE SOMETIMES FILLED WITH ASPHALT PATCH. THE GRADE OF HARPER RD FALLS 17 FEET FROM NORTH TO SOUTH. US 422 ENTRANCE RAMPS RISE TO MEET THE HIGHWAY WHILE US 422 EXIT RAMPS FALL TO MEET HARPER ROAD.

SUBSURFACE EXPLORATION

FOURTEEN (14) TEST BORINGS WERE COMPLETED AS PART OF THIS SUBSURFACE EXPLORATION ON NOVEMBER 19 AND 20, 2020. THE BORINGS WERE DRILLED WITH A TRUCK OR ATV MOUNTED ROTARY DRILL RIG, USING 2¼-INCH I.D. HOLLOW STEM AUGERS TO ADVANCE THE HOLES THROUGH SOIL. DISTURBED SOIL SAMPLES WERE OBTAINED IN ACCORDANCE WITH THE STANDARD PENETRATION TEST (ASTM D 1586) AT CONTINUOUS 1.5-FOOT SAMPLES IN THE UPPER 6 FEET OF SUBGRADE. TWO DRILL RIGS USED WITH HAMMERS CALIBRATED ON JULY 29, 2019 AND HAVING DRILL ROD ENERGIES OF 81.9 % AND 83.7%. NO UNDISTURBED SAMPLES, AUGER SAMPLES, OR ROCK CORING WAS PERFORMED AS PART OF THIS SUBSURFACE EXPLORATION.

EXPLORATION FINDINGS

BETWEEN 4.5 AND 8.5 FEET OF FILL SOIL WAS ENCOUNTERED AT THE SUBGRADE SURFACE AT 12 OF THE 14 BORING LOCATIONS. WITH THE OTHER TWO LOCATIONS DESIGNATED AS POSSIBLE FILL MATERIAL. THE FILL MATERIAL VARIED IN COMPOSITION WITH BOTH GRANULAR AND COHESIVE SOILS ENCOUNTERED. CLASSIFIED AS ODOT A-1-A, A-1-B, A-2-4, A-4-A, A-6-A, AND A-7-6. THICKER LAYERS OF CRUSHED LIMESTONE OR GRAVEL WERE ENCOUNTERED AT BORINGS B-001-0-20, B-010-0-20, AND B-014-0-20.

BELOW THE FILL SOIL, MAINLY COHESIVE SOIL WAS ENCOUNTERED, GENERALLY CLASSIFIED AS ODOT A-4-A AND A-6-A. GROUNDWATER WAS MEASURED BETWEEN 4.5 AND 8.5 FEET BELOW EXISTING GRADES AT BORINGS B-001-0-20, B-006-0-20, B-007-0-20 AND B-009-0-20. THE OTHER BORING LOCATIONS WERE DRY AT THE TIME OF DRILLING OPERATIONS.

SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATION, DATED JULY 2020.

AVAILABLE INFORMATION

THE SOIL, BEDROCK, AND GROUNDWATER INFORMATION COLLECTED FOR THIS SUBSURFACE EXPLORATION THAT CAN BE CONVENIENTLY DISPLAYED ON THE SOIL PROFILE SHEETS HAS BEEN PRESENTED. GEOTECHNICAL REPORTS, IF PREPARED, ARE AVAILABLE FOR REVIEW ON THE OFFICE OF CONTRACT SALES WEBSITE.

LEGEND

DESCRIPTION

ODOT CLASSIFIED
CLASS

MECH. VISUAL



GRAVEL AND/OR STONE FRAGMENTS

A-1-a - 3



GRAVEL AND/OR STONE FRAGMENTS WITH SAND

A-1-b 2 2



GRAVEL AND/OR ST. FRAGS. WITH SAND AND SILT

A-2-4 1 1



SANDY SILT

A-4a 15 14



SILT AND CLAY

A-6a 9 15



CLAY

A-7-6 1 2

TOTAL 28 37

PAVEMENT OR BASE = X = APPROXIMATE THICKNESS

VISUAL

TOPSOIL = X = APPROXIMATE THICKNESS

VISUAL

EXPLOURATION LOCATION - PLAN VIEW



HISTORIC BORING LOCATION - PLAN VIEW - CUY-422-13.73, 1965

WC INDICATES WATER CONTENT IN PERCENT.

N₆₀ INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60 % DRILL ROD ENERGY RATIO.

N INDICATES STANDARD PENETRATION RESISTANCE.

SS INDICATES A SPLIT-SPOON SAMPLE.

NP INDICATES A NON-PLASTIC SAMPLE.

X/D" NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT):
X/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D' OF PENETRATION AT REFUSAL.



GRAVEL AND/OR ST. FRAGS. W/SAND & SILT

A-2-4 - 4

TOTAL - 4

ODOT CLASSIFIED

MECH. VISUAL

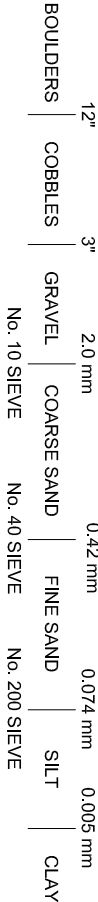
HISTORIC BORING DESCRIPTIONS



LOCATION MAP
SCALE IN MILES



PARTICLE SIZE DEFINITIONS



INDEX OF SHEETS					
LOCATION FROM STA. TO STA.	PLAN VIEW SHEET	PROFILE SHEET	CROSS-SECTION SHEET	CUT MAX.	FILL MAX.
HARPER RD. BEGIN 66+50	4	4	-	<1 FT	<1 FT
HARPER RD. 66+50 END	5	5	-	<1 FT	<1 FT
RAMP 1B 446+40	6	6	-	<1 FT	<1 FT
RAMP 3A 654+00	7	7	-	<1 FT	<1 FT



DESIGN AGENCY

DESIGNER

MSR

REVIEWER

MRR 04-15-22

PROJECT ID

113889

REVIEWED - MRR 08/19/21, 02/09/22, 04/15/22

DRAWN - MSR 08/16/21 - 04/15/22

DRILLING - PS 11/19/20 AND 11/20/20

RECON. - MSR 11/10/20

1 / 7

SHEET TOTAL

P-0 0

SOIL PROFILE

SUMMARY OF SOIL TEST DATA
HARPER ROAD

EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	N ₆₀	% REC	HP tsf	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO ₄		
B-001-0-20 STA. 58+38, 5' RT. LATITUDE = 41.408437 LONGITUDE = -81.466720	01.00 - 02.50 02.50 - 04.00 04.00 - 05.50 05.50 - 07.00	SS-1 SS-2 SS-3 SS-4	24 6 15 18	78 89 67 44	- 0.50 2.50 3.00	MED. DENSE, BROWN, GRAVEL AND/OR STONE FRAGS									5 15 15 16	A-1-a A-4a A-6a A-6a	(VISUAL) (3) (10) (VISUAL)	240
B-002-0-20 STA. 62+11, 76' RT. LATITUDE = 41.407419 LONGITUDE = -81.467007	00.00 - 00.50 00.50 - 01.50 01.50 - 03.00 03.00 - 04.50 04.50 - 06.00 08.50 - 10.00	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	11 18 12 11 15	100 100 100 100 100	- 1.50 1.75 1.50 1.50 2.00	TOPSOIL 1 4 37 58 25 16 9 SAME AS SS-1B 6 4 27 42 21 NP NP NP SAME AS SS-3 STIFF, GRAY, SILTY CLAY, MOIST									- 22 16 13 14 17	- A-4a A-4a A-4a A-4a A-6a	(5) (VISUAL) (6) (VISUAL) (VISUAL)	<100
B-003-0-20 STA. 62+35, 67' LT. LATITUDE = 41.407343 LONGITUDE = -81.466489	00.00 - 00.50 00.50 - 01.50 01.50 - 03.00 03.00 - 04.50 04.50 - 06.00 08.50 - 10.00	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	10 10 10 7 7 15	100 100 100 100 100	- 0.50 1.50 1.50 1.25 -	TOPSOIL 40 9 13 21 17 31 21 10 0 2 16 39 43 41 19 22 SAME AS SS-2 SAME AS SS-2 MEDIUM DENSE, GRAY, SILTY SAND, WET									- 17 13 18 21 20	- A-4a A-7-6 A-7-6 A-7-6 A-2-4	(1) (13) (VISUAL) (VISUAL) (VISUAL)	300
B-004-0-20 STA. 63+29, 75' RT. LATITUDE = 41.407101 LONGITUDE = -81.467020	00.00 - 00.50 00.50 - 01.50 01.50 - 03.00 03.00 - 04.50 04.50 - 06.00 08.50 - 10.00	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	12 19 22 25 19	100 100 100 100 100	- 2.00 2.00 2.50 2.50 2.50	TOPSOIL SAME AS SS-3 SAME AS SS-3 22 11 15 31 21 23 17 6 7 5 8 41 39 28 18 10 SAME AS SS-4									- 14 15 14 12 12	- A-4a A-4a A-4a A-4a A-4a	(VISUAL) (VISUAL) (3) (8) (VISUAL)	400
B-005-0-20 STA. 63+49, 60' LT. LATITUDE = 41.407026 LONGITUDE = -81.466533	00.00 - 00.50 00.50 - 01.50 01.50 - 02.08 03.00 - 04.50 04.50 - 06.00 08.50 - 10.00	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	18 50/1" 8 14 20	100 86 100 100 100	- 1.50 - 1.50 1.50 2.50	TOPSOIL 14 8 34 24 20 20 15 5 5 6 13 42 34 24 19 5 SAME AS SS-3 VERY STIFF, BROWN, SILTY CLAY, MOIST									- 15 10 19 17 13	- A-4a A-4a A-4a A-4a A-6a	(2) (VISUAL) (8) (VISUAL) (VISUAL)	120
B-006-0-20 STA. 67+62, 17' RT. LATITUDE = 41.405919 LONGITUDE = -81.466986	01.50 - 03.00 03.00 - 04.50 04.50 - 05.50 05.50 - 06.00 06.00 - 07.50 07.50 - 09.00	SS-1 SS-2 SS-3A SS-3B SS-4 SS-5	11 24 10 7 28	100 100 100 100 33 67	1.50 2.25 1.50 1.50 1.50 3.00	6 5 14 40 35 34 22 12 8 9 19 32 32 28 17 11 SAME AS SS-2 STIFF TO VERY STIFF, GRAY, SANDY SILT SAME AS SS-4									18 31 23 22 13	A-6a A-6a A-6a A-4a A-4a	(9) (6) (VISUAL) (VISUAL) (VISUAL)	760
B-007-0-20 STA. 68+60, 101' RT. LATITUDE = 41.405699 LONGITUDE = -81.467348	00.00 - 01.50 01.50 - 03.00 03.00 - 04.50 04.50 - 06.00 08.50 - 10.00	SS-1 SS-2 SS-3 SS-4 SS-5	16 16 11 18 30	78 44 78 100 100	2.00 1.75 1.75 2.00 3.00	15 7 14 31 33 22 15 7 11 9 18 33 29 21 14 7 SAME AS SS-2 SAME AS SS-2 VERY STIFF, GRAY, SILTY CLAY "AND" GRAVEL									13 14 33 14 9	A-4a A-4a A-4a A-4a A-6a	(6) (5) (VISUAL) (VISUAL) (VISUAL)	1480
B-008-0-20 STA 68+97, 61' LT. LATITUDE = 41.405511 LONGITUDE = -81.466795	00.00 - 00.50 00.50 - 01.50 01.50 - 02.25 03.00 - 03.42 04.50 - 06.00 08.50 - 08.92	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	11 50/3" 50/5" 46 50/4"	100 100 100 100 50	- 1.50 - - 3.00 -	TOPSOIL 7 6 12 32 43 28 18 10 6 6 13 33 42 31 18 13 SAME AS SS-2 HARD, BROWN, SILT AND CLAY, MOIST SAME AS SS-4									- 14 13 6 10 1	- A-4a A-6a A-6a A-6a A-6a	(8) (9) (VISUAL) (VISUAL) (VISUAL)	<100
B-009-0-20 STA. 70+23, 82' LT. LATITUDE = 41.405156 LONGITUDE = -81.466824	00.00 - 00.50 00.50 - 01.50 01.50 - 03.00 03.00 - 03.75 04.50 - 06.00 08.50 - 10.00	SS-1A SS-1B SS-2 SS-3 SS-4 SS-5	10 33 50/3" 10 16	100 100 89 67 78	- 1.50 2.75 - 2.00 2.75	TOPSOIL 17 4 9 34 36 32 20 12 8 7 18 35 32 32 20 12 SAME AS SS-1B SAME AS SS-3 VERY STIFF, GRAY, SILT AND CLAY, MOIST									- 13 11 10 9 10	- A-6a A-6a A-6a A-6a A-6a	(8) (VISUAL) (7) (VISUAL) (VISUAL)	380
B-010-0-20 STA. 73+46, 4' LT. LATITUDE = 41.404351 LONGITUDE = -81.467408	02.00 - 03.50 03.50 - 05.00 05.00 - 06.50 06.50 - 08.00	SS-1 SS-2 SS-3 SS-4	15 17 21 15	78 100 100 100	- - - -	SAME AS SS-2 25 33 31 4 7 NP NP NP 23 31 33 7 6 NP NP NP SAME AS SS-3									15 10 17 18	A-1-b A-1-b A-1-b A-1-b	(VISUAL) (0) (0) (VISUAL)	<100

SUMMARY OF SOIL TEST DATA
RAMP 1B

EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	No	% REC	HP tsf	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO4
B-011-0-20 STA. 440+45, 15' RT. LATITUDE = 41.408115 LONGITUDE = -81.468381	02.50 - 04.00	SS-1	20	44	2.50	18	13	18	29	22	26	17	9	11	A-4a (3)	<100
	04.00 - 05.50	SS-2	27	100	2.50			SAME AS SS-1						9	A-4a (VISUAL)	
	05.50 - 07.00	SS-3	18	86	2.00			SAME AS SS-1						12	A-4a (VISUAL)	
	07.00 - 08.50	SS-4	24	100	2.50	14	6	12	45	23	23	15	8	14	A-4a (3)	
B-012-0-20 STA. 442+67, 3' RT. LATITUDE = 41.407671 LONGITUDE = -81.467828	02.50 - 04.00	SS-1	29	89	3.25	24	6	15	26	29	30	18	12	22	A-6a (5)	2600
	04.00 - 05.50	SS-2	35	89	3.50			SAME AS SS-1						12	A-6a (VISUAL)	
	05.50 - 07.00	SS-3	35	100	3.50	4	5	14	42	35	40	26	14	10	A-6a (10)	
	07.00 - 08.50	SS-4	24	100	3.50			SAME AS SS-3						13	A-6a (VISUAL)	

SUMMARY OF SOIL TEST DATA
RAMP 3A

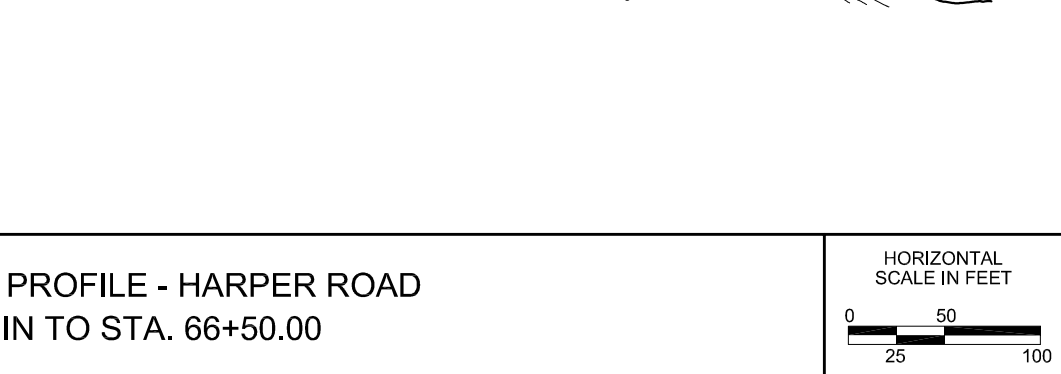
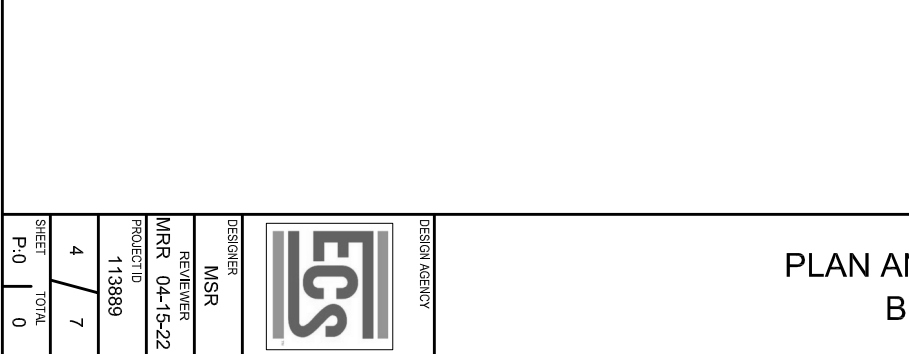
EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	No	% REC	HP tsf	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	ppm SO4
B-013-0-20	02.50 - 04.00	SS-1	25	100	2.50	30	8	23	19	20	27	15	12	12	A-6a (1)	240
STA. 647+58, 1' RT.	04.00 - 05.50	SS-2	18	100	2.50	28	12	16	25	19	27	19	8	4	A-4a (2)	
LATITUDE = 41.407128	05.50 - 07.00	SS-3	13	100	2.00	SAME AS SS-2								16	A-4a (VISUAL)	
LONGITUDE = -81.465314	07.00 - 08.50	SS-4	7	78	1.75	MEDIUM STIFF TO STIFF, GRAY, SILTY CLAY, MOIST								18	A-6a (VISUAL)	
	08.50 - 10.00	SS-5	13	78	1.75	SAME AS SS-4								17	A-6a (VISUAL)	
B-014-0-20	01.50 - 03.00	SS-1	13	67	-	MED. DENSE, BROWN, GRAVEL AND/OR STONE FRAGS								6	A-1-a (VISUAL)	
STA. 650+11, 22' RT.	03.00 - 04.50	SS-2	10	67	-	SAME AS SS-1								6	A-1-a (VISUAL)	
LATITUDE = 41.406599	04.50 - 06.00	SS-3	24	67	2.25	21	10	18	28	23	26	19	7	14	A-4a (3)	360
LONGITUDE = -81.464831	06.00 - 07.50	SS-4	25	100	-	43	14	14	17	12	28	21	7	17	A-2-4 (0)	

SUMMARY OF SOIL TEST DATA
HARPER ROAD HISTORIC BORINGS

EXPLORATION NO., STATION & OFFSET	FROM TO	SAMPLE ID	N	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS
B-005-1-65 BL CONST. HARPER ROAD, STA 65+88, 25' RT. (BL EX. HARPER ROAD, STA. 848+05, 57' LT.)	04.00 - 06.00	SS-1	18	59	7	13	15	6	NP	NP	NP	9	A-2-4
	06.00 - 08.00	SS-2	23	56	14	11	12	7	NP	NP	NP	12	A-2-4
B-012-1-65 BL CONST. HARPER ROAD, STA. 67+92, 154' LT. (BL EX. HARPER ROAD, STA. 850+39, 60' RT.)	04.00 - 06.00	SS-1	22	31	15	21	23	10	NP	NP	NP	25	A-2-4
	06.00 - 08.00	SS-2	28	50	21	11	- 18 -	-	NP	NP	NP	13	A-2-4

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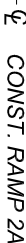


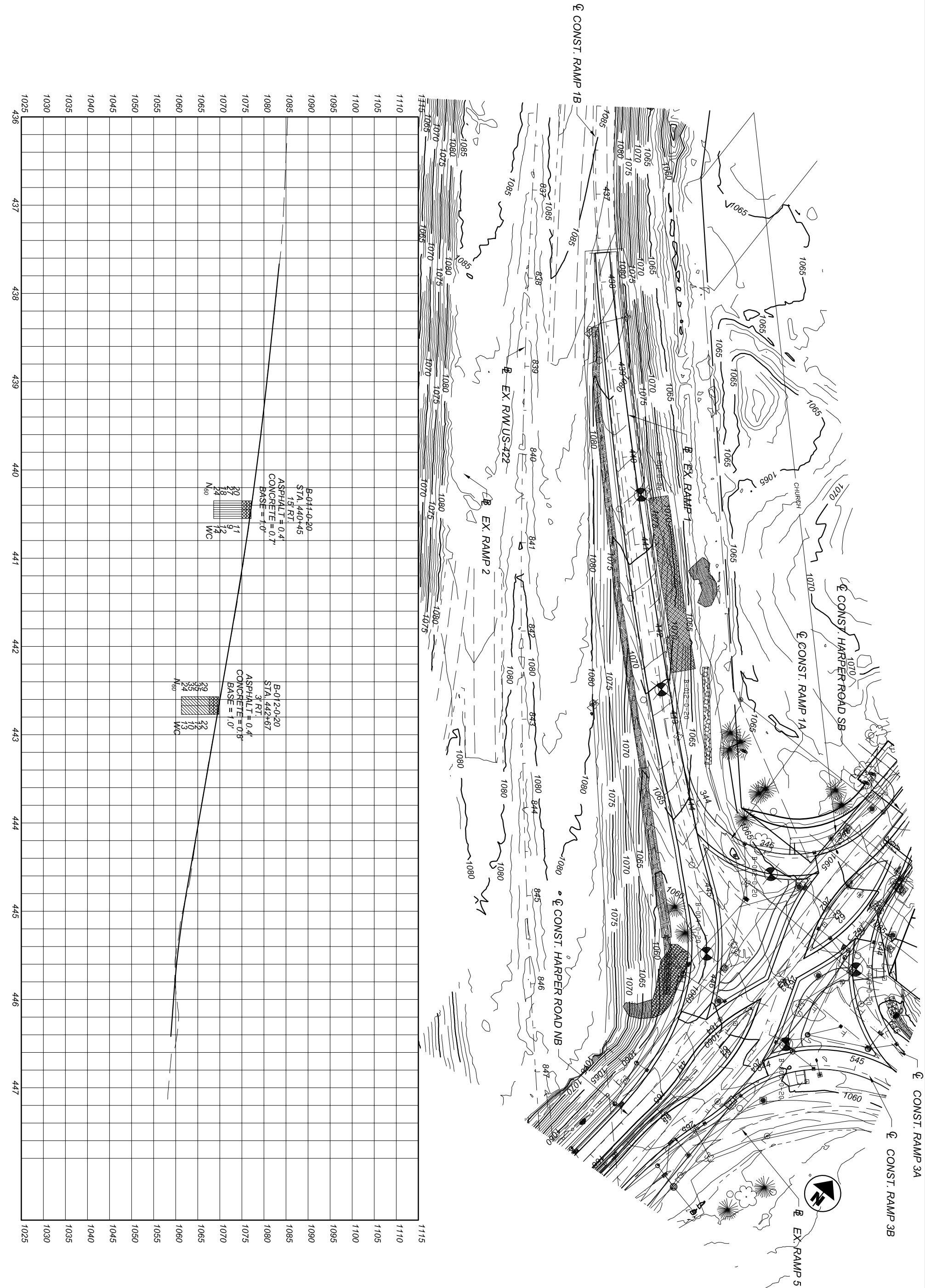
HORIZONTAL
SCALE IN FEET

A horizontal scale bar labeled "HORIZONTAL SCALE IN FEET". The scale ranges from 0 to 100 feet, with major markings at 0, 25, 50, and 100. The bar is divided into four equal segments of 25 feet each. The segments alternate in color: the first segment (0-25) is black, the second (25-50) is white, the third (50-75) is black, and the fourth (75-100) is white.

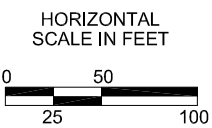
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PLAN AND PROFILE
RAMP 1B





DESIGN AGENCY

DESIGNER
MSR

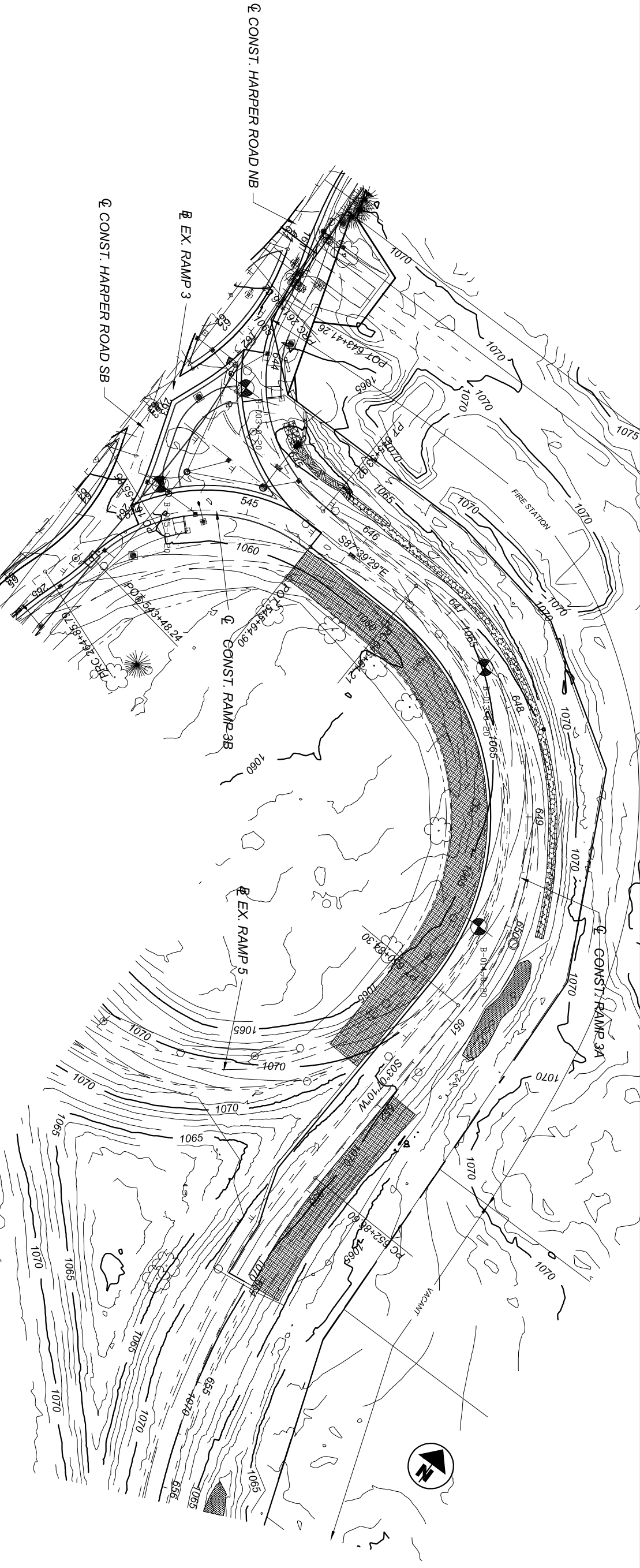
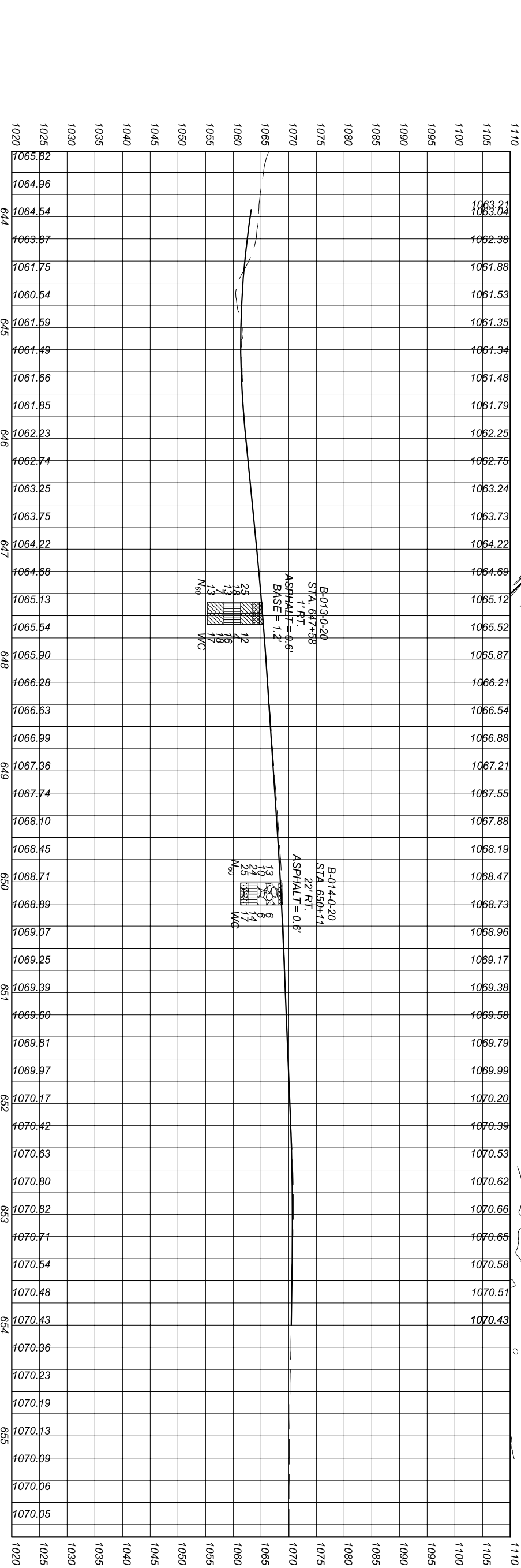
REVIEWER
MRR 04-15-22

PROJECT ID
113889

SHEET
P-0

TOTAL
0

CUY-HARPER RD



DESIGN AGENCY

DESIGNER

MSR

REVIEWER

MRR 04-15-22

PROJECT ID

113889

SHEET

7

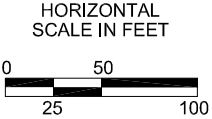
TOTAL

7

P-0

0

PLAN AND PROFILE
RAMP 3A



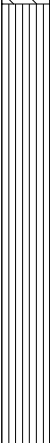
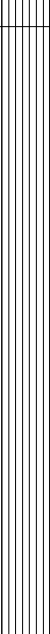
MATERIAL DESCRIPTION AND NOTES	ELEV. 1072.6	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI				
9.75" REINFORCED CONCRETE	1071.8																		
2.75" LIMESTONE BASE	1071.6																		
MEDIUM DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS, FILL, DAMP	1070.1	1	12 11 6	24	78	SS-1	-	-	-	-	-	-	-	-	5	A-1-a (V)	-		
LOOSE, BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, FILL, WET	1068.6	3	2 2 2	6	89	SS-2	0.50	21	10	20	30	19	27	20	7	15	A-4a (3)	240	
STIFF TO VERY STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE STONE FRAGMENTS, FILL, WET	1068.1	4	4 5 6	15	67	SS-3	2.50	6	4	13	35	42	31	17	14	15	A-6a (10)	-	
@5'-7"; WATER CHASING DOWN SPLIT-SPOON	1065.6	6	3 4 9	18	44	SS-4	3.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		7																	

NOTES: BORE HOLE CAVED AT 4 FEET.

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

PROJECT: CUY-422-16.20		DRILLING FIRM / OPERATOR: RIDGEWAY / PS		DRILL RIG: CME 550 ATV		STATION / OFFSET: 62+11, 76' RT.		EXPLORATION ID	
TYPE: ROADWAY		SAMPLING FIRM / LOGGER: RIDGEWAY / PS		HAMMER: AUTOMATIC HAMMER		ALIGNMENT: CLX RW_C018		B-002-0-20	
PID: 113889 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/29/19		ELEVATION: 1064.5 (MSL) EOB: 10.0 ft.		PAGE	
START: 11/20/20 END: 11/20/20		SAMPLING METHOD: SPT		ENERGY RATIO (%): 81.9		LAT / LONG: 41.407419, -81.467007		1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL	
								GR	CS	FS	SI	CL	LL	PL	PI					
5" TOPSOIL	1064.5																			
STIFF, BROWN AND GRAY, SANDY SILT , SOME CLAY, TRACE STONE FRAGMENTS, FILL , MOIST @1'; SLAG PIECES	1064.1		1	3	11	100	SS-1A	-	-	-	-	-	-	-	-	-	-			
		1	3	5			SS-1B	1.50	1	4	37	-	58	-	25	16	9	22	A-4a (5)	<100
		2	4	6	7	18	100	SS-2	1.75	-	-	-	-	-	-	-	-	16	A-4a (V)	-
		3																		
		4	3	4	5	12	100	SS-3	1.50	6	4	27	42	21	NP	NP	NP	13	A-4a (6)	-
		5	3	3	5	11	100	SS-4	1.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-
		6																		
		7																		
		8																		
	1056.0																			
STIFF, GRAY, SILTY CLAY , LITTLE SAND, MOIST		9	3	4	7	15	100	SS-5	2.00	-	-	-	-	-	-	-	-	17	A-6a (V)	-
	1054.5	10																		
EOB																				
NOTES: BORE HOLE CAVED AT 7 FEET.																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH BENTONITE CHIPS																				

MATERIAL DESCRIPTION AND NOTES		ELEV. 1060.0	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL	
										GR	CS	FS	SI	CL	LL	PL	PI					
6" TOPSOIL		1059.5						SS-1A	-	-	-	-	-	-	-	-	-	-	-	-		
STIFF TO VERY STIFF, BROWN AND GRAY, SANDY SILT, SOME CLAY, GRAVEL, FILL, MOIST		1055.5	1		2 3 6	12	100	SS-1B	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-		
			2		4 7 7	19	100	SS-2	2.00	-	-	-	-	-	-	-	15	A-4a (V)	-			
			3																			
			4		3 6 10	22	100	SS-3	2.50	22	11	15	31	21	23	17	6	14	A-4a (3)	400		
VERY STIFF, GRAY, SANDY SILT, "AND" CLAY, TRACE GRAVEL, MOIST		1050.0	5		5 8 10	25	100	SS-4	2.50	7	5	8	41	39	28	18	10	12	A-4a (8)	-		
			6																			
			7																			
			8																			
			9		5 6 8	19	100	SS-5	2.50	-	-	-	-	-	-	-	-	12	A-4a (V)	-		
		1050.0	10																			

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

NOTES: BORE HOLE CAVED AT 7 FEET.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH BENTONITE CHIPS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 8/8/21 00:34 - C:\USERS\MRUSSOIDROPBOX (SOLAR TESTING LABS)\RUSSO MIKE\PROJECT REPORTS\IDONE\67-1371_USA2

PROJECT: CUY-422-16.20		DRILLING FIRM / OPERATOR: RIDGEWAY / PS		DRILL RIG: CME 550 ATV		STATION / OFFSET: 68+60, 101' RT.		EXPLORATION ID												
TYPE: ROADWAY		SAMPLING FIRM / LOGGER: RIDGEWAY / PS		HAMMER: AUTOMATIC HAMMER		ALIGNMENT: CLX RW_C018		B-007-0-20												
PID: 113889 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/29/19		ELEVATION: 1057.4 (MSL) EOB: 10.0 ft.		PAGE												
START: 11/20/20 END: 11/20/20		SAMPLING METHOD: SPT		ENERGY RATIO (%): 81.9		LAT / LONG: 41.405699, -81.467348		1 OF 1												
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	SO4 ppm	BACK FILL
		1057.4							GR	CS	FS	SI	CL	LL	PL	PI	WC			
2" TOPSOIL		1057.2																		
VERY STIFF, BROWN AND GRAY, SANDY SILT, SOME CLAY, LITTLE STONE FRAGMENTS, TRACE ORGANICS, FILL, MOIST				3	16	78	SS-1	2.00	15	7	14	31	33	22	15	7	13	A-4a (6)	1480	
			1	5	7															
			2	4	16	44	SS-2	1.75	11	9	18	33	29	21	14	7	14	A-4a (5)	-	
			3																	
@2.5'; DROVE ROCK			4	2	11	78	SS-3	1.75	-	-	-	-	-	-	-	-	33	A-4a (V)	-	
			5	4	18	100	SS-4	2.00	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
			6	7	6															
			7																	
			8																	
		1048.9	▽ 1048.9																	
VERY STIFF, GRAY, SILTY CLAY, "AND" GRAVEL, MOIST TO WET			9	4	30	100	SS-5	3.00	-	-	-	-	-	-	-	-	9	A-6a (V)	-	
			10	10	12															
		1047.4	EOB																	
NOTES: BORE HOLE CAVED AT 7.5 FEET.																				
ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH BENTONITE CHIPS																				

PROJECT: CUY-422-16.20		DRILLING FIRM / OPERATOR: RIDGEWAY / PS		DRILL RIG: CME 550 ATV		STATION / OFFSET: 70+23, 82' LT.		EXPLORATION ID	
TYPE: ROADWAY		SAMPLING FIRM / LOGGER: RIDGEWAY / PS		HAMMER: AUTOMATIC HAMMER		ALIGNMENT: CLX RW_C018		B-009-0-20	
PID: 113889 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/29/19		ELEVATION: 1057.6 (MSL) EOB: 10.0 ft.		PAGE	
START: 11/20/20 END: 11/20/20		SAMPLING METHOD: SPT		ENERGY RATIO (%): 81.9		LAT / LONG: 41.405156, -81.466824		1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI				
6" TOPSOIL	1057.6					SS-1A	-	-	-	-	-	-	-	-	-	-	-	-	
STIFF, BROWN, SILT AND CLAY , LITTLE TO SOME SAND, TRACE STONE FRAGMENTS, FILL , MOIST	1057.1	1	2 3 4	10	100	SS-1B	1.50	17	4	9	34	36	32	20	12	13	A-6a (8)	380	
		2	3 10 14	33	100	SS-2	2.75	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
		3	18 50/3"	-	89	SS-3	-	8	7	18	35	32	32	20	12	10	A-6a (7)	-	
		4																	
		5	12 4 3	10	67	SS-4	2.00	-	-	-	-	-	-	-	-	9	A-6a (V)	-	
@3.5'; SLAG PIECES		6																	
		7																	
		8																	
	1049.1	9	4 5 7	16	78	SS-5	2.75	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
VERY STIFF, GRAY, SILT AND CLAY , TRACE GRAVEL, MOIST	1047.6	10																	
		EOB																	

NOTES: BORE HOLE CAVED AT 7 FEET.

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

PROJECT: CUY-422-16.20		DRILLING FIRM / OPERATOR: RIDGEWAY / PS		DRILL RIG: DIEDRICH D-50 TRUCK		STATION / OFFSET: 73+46, 4' LT.		EXPLORATION ID	
TYPE: ROADWAY		SAMPLING FIRM / LOGGER: RIDGEWAY / PS		HAMMER: AUTOMATIC HAMMER		ALIGNMENT: CLX RW_C018		B-010-0-20	
PID: 113889 SFN: N/A		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/29/19		ELEVATION: 1058.9 (MSL) EOB: 8.0 ft.		PAGE	
START: 11/19/20 END: 11/19/20		SAMPLING METHOD: SPT		ENERGY RATIO (%): 83.7		LAT / LONG: 41.404351, -81.467408		1 OF 1	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
								GR	CS	FS	SI	CL	LL	PL	PI				
5" ASPHALT	1058.9																		
9.5" REINFORCED CONCRETE	1058.5																		
10" LIMESTONE BASE	1057.7	1																	
MEDIUM DENSE, BROWN AND GRAY, GRAVEL WITH SAND, TRACE SILT, CLAY, POSSIBLE FILL, DAMP	1056.9	2																	
		3	6 5 6	15	78	SS-1	-	-	-	-	-	-	-	-	15	A-1-b (V)	-		
		4	4 5 7	17	100	SS-2	-	25	33	31	4	7	NP	NP	NP	10	A-1-b (0)	<100	
		5																	
		6	5 7 8	21	100	SS-3	-	23	31	33	7	6	NP	NP	NP	17	A-1-b (0)	-	
		7	4 5 6	15	100	SS-4	-	-	-	-	-	-	-	-	18	A-1-b (V)	-		
	1050.9	8																	

EOB

NOTES: BORE HOLE CAVED AT 5.5 FEET.

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

NOTES: BORE HOLE CAVED AT 7 FEET. ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; AUGER CUTTINGS MIXED WITH BENTONITE CHIPS
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CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart.
The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classification		LL _O /LL × 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
		AASHTO	OHIO							
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	75 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	75 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		75 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	75 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	75 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		75 Min.		36 Min.	41 Min.	≤ LL-30	20	
	Clay	A-7-6		75 Min.		36 Min.	41 Min.	> LL-30	20	
	Organic Silt	A-8	A-8a	74 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	74 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6
MATERIAL CLASSIFIED BY VISUAL INSPECTION Sod and Topsoil Pavement or Base Uncontrolled Fill (Describe) Bouldery Zone Peat										

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

Figure 600-1. ODOT Soil Classification Chart



OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

CUY-422-16.20
PID 113889

HARPER ROAD INTERCHANGE

ECS Midwest, LLC

Prepared By: Michael S. Russo, P.E.
Date prepared: Wednesday, August 4, 2021

1125 Valley Belt Road
Brooklyn Heights, OH 44131

(216) 741-7007
MRusso@ecslimited.com

NO. OF BORINGS: **14**



#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-20	CLX_RW_C018	58+38	5	RT	Diedrich D-50 Truck	84	1072.6	1070.9	1.7 C
2	B-002-0-20	CLX_RW_C018	62+11	76	RT	CME 550 ATV	82	1064.5	1061.6	2.9 C
3	B-003-0-20	CLX_RW_C018	62+35	67	LT	CME 550 ATV	82	1063.4	1061.2	2.2 C
4	B-004-0-20	CLX_RW_C018	63+29	75	RT	CME 550 ATV	82	1060.0	1058.6	1.4 C
5	B-005-0-20	CLX_RW_C018	63+49	60	LT	Diedrich D-50 Truck	84	1060.8	1058.8	2.0 C
6	B-006-0-20	CLX_RW_C018	67+62	17	RT	CME 550 ATV	82	1057.9	1056.3	1.6 C
7	B-007-0-20	CLX_RW_C018	68+60	101	RT	CME 550 ATV	82	1057.4	1056.1	1.3 C
8	B-008-0-20	CLX_RW_C018	68+97	61	LT	CME 550 ATV	82	1059.6	1057.0	2.6 C
9	B-009-0-20	CLX_RW_C018	70+23	82	LT	CME 550 ATV	82	1057.6	1058.0	0.4 F
10	B-0010-0-20	CLX_RW_C018	73+46	4	LT	Diedrich D-50 Truck	84	1058.9	1057.5	1.4 C
11	B-0011-0-20	BLP_R0181B	440+45	15	RT	Diedrich D-50 Truck	84	1076.8	1075.3	1.5 C
12	B-0012-0-20	BLP_R0181B	442+67	3	RT	Diedrich D-50 Truck	84	1069.8	1068.4	1.4 C
13	B-0013-0-20	BLP_R0183A	647+58	1	RT	Diedrich D-50 Truck	84	1065.2	1063.8	1.4 C
14	B-0014-0-20	BLP_R0183A	650+11	22	RT	Diedrich D-50 Truck	84	1067.5	1066.1	1.4 C

#	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 001-0 20	SS-1	1.0	2.5	-0.7	0.8	24	6								5	6	A-1-b	0							
		SS-2	2.5	4.0	0.8	2.3	6		0.5	27	20	7	30	19	49	15	15	A-4a	3	240		HP			24"	
		SS-3	4.0	5.5	2.3	3.8	15		2.5	31	17	14	35	42	77	15	14	A-6a	10							
		SS-4	5.5	7.0	3.8	5.3	18		3							16	14	A-6a	10							
2	B 002-0 20	SS-1	0.0	1.5	-2.9	-1.4	11	11	1.5	25	16	9	33	25	58	22	11	A-4a	5	0					12" 861 Geogrid	
		SS-2	1.5	3.0	-1.4	0.1	18		1.75							16	10	A-4a	8			HP & Mc		12"		
		SS-3	3.0	4.5	0.1	1.6	12		1.5	0	0	NP	42	21	63	13	11	A-4a	6			HP		12"		
		SS-4	4.5	6.0	1.6	3.1	11		1.5							14	10	A-4a	8			HP & Mc				
3	B 003-0 20	SS-1	0.0	1.5	-2.2	-0.7	10	7	0.5	31	21	10	21	17	38	17	16	A-4a	1	300					12" 861 Geogrid	
		SS-2	1.5	3.0	-0.7	0.8	10		1.5	41	19	22	39	43	82	13	18	A-7-6	13			HP		12"		
		SS-3	3.0	4.5	0.8	2.3	7		1.5							18	18	A-7-6	16			HP		15"		
		SS-4	4.5	6.0	2.3	3.8	7		1.25							21	18	A-7-6	16							
4	B 004-0 20	SS-1	0.0	1.5	-1.4	0.1	12	12	2							14	10	A-4a	8			N ₆₀ & Mc		12"	12" 861 Geogrid	
		SS-2	1.5	3.0	0.1	1.6	19		2							15	10	A-4a	8			Mc				
		SS-3	3.0	4.5	1.6	3.1	22		2.5	23	17	6	31	21	52	14	12	A-4a	3	400						
		SS-4	4.5	6.0	3.1	4.6	25		2.5	28	18	10	41	39	80	12	13	A-4a	8							
5	B 005-0 20	SS-1	0.0	1.5	-2.0	-0.5	18	8	1.5	20	15	5	25	19	44	15	10	A-4a	2	120					12" 861 Geogrid	
		SS-2	1.5	3.0	-0.5	1.0	50									10	10	A-4a	8							
		SS-3	3.0	4.5	1.0	2.5	8		1.5	24	19	5	42	34	76	19	14	A-4a	8			HP & Mc		12"		
		SS-4	4.5	6.0	2.5	4.0	14		1.5							17	10	A-4a	8							
6	B 006-0 20	SS-1	1.5	3.0	-0.1	1.4	11	7	1.5	34	22	12	40	35	75	18	17	A-6a	9	760			HP		12"	
		SS-2	3.0	4.5	1.4	2.9	24		2.25	28	17	11	32	32	64	31	14	A-6a	6			Mc				
		SS-3	4.5	6.0	2.9	4.4	10		1.5							23	10	A-4a	8							
		SS-4	6.0	7.5	4.4	5.9	7		1.5							22	10	A-4a	8							
7	B 007-0 20	SS-1	0.0	1.5	-1.3	0.2	16	11	2	22	15	7	31	33	64	13	10	A-4a	6	1480			Mc			12" 861 Geogrid
		SS-2	1.5	3.0	0.2	1.7	16		1.75	21	14	7	33	29	62	14	10	A-4a	5			HP & Mc		12"		
		SS-3	3.0	4.5	1.7	3.2	11		1.75							33	10	A-4a	8			HP & Mc				
		SS-4	4.5	6.0	3.2	4.7	18		2							14	10	A-4a	8							
8	B 008-0 20	SS-1	0.0	1.5	-2.6	-1.1	11	30	1.5	28	18	10	32	43	75	14	13	A-4a	8	80					12" 861 Geogrid	
		SS-2	1.5	3.0	-1.1	0.4	50			31	18	13	33	42	75	13	14	A-6a	9							
		SS-3	3.0	4.5	0.4	1.9	50									6	14	A-6a	10							
		SS-4	4.5	6.0	1.9	3.4	46		3							10	14	A-6a	10							
9	B 009-0 20	SS-1	0.0	1.5	0.4	1.9	10		1.5	32	20	12	34	36	70	13	15	A-6a	8	380			HP		12"	12" 861 Geogrid
		SS-2	1.5	3.0	1.9	3.4	33		2.75							11	14	A-6a	10							
		SS-3	3.0	4.5	3.4	4.9	50			32	20	12	35	32	67	10	15	A-6a	7							

#	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	4.5	6.0	4.9	6.4	10	10	2							9	14	A-6a	10						
10	B 0010- -2	SS-1	2.0	3.5	0.6	2.1	15	15								15	6	A-1-b	0						
		SS-2	3.5	5.0	2.1	3.6	17			0	0	NP	4	7	11	10	6	A-1-b	0	0					
		SS-3	5.0	6.5	3.6	5.1	21			0	0	NP	7	6	13	17	6	A-1-b	0						
		SS-4	6.5	8.0	5.1	6.6	15									18	6	A-1-b							
11	B 0011- -2	SS-1	2.5	4.0	1.0	2.5	20	18	2.5	26	17	9	29	22	51	11	12	A-4a	3	20					
		SS-2	4.0	5.5	2.5	4.0	27		2.5							9	10	A-4a	8						
		SS-3	5.5	7.0	4.0	5.5	18		2							12	10	A-4a	8						
		SS-4	7.0	8.5	5.5	7.0	24		2.5	23	15	8	45	23	68	14	10	A-4a							
12	B 0012- -2	SS-1	2.5	4.0	1.1	2.6	29	24	3.25	30	18	12	26	29	55	22	14	A-6a	5	2600		Mc			
		SS-2	4.0	5.5	2.6	4.1	35		3.5							12	14	A-6a	10						
		SS-3	5.5	7.0	4.1	5.6	35		3.5	40	26	14	42	35	77	10	21	A-6a	10						
		SS-4	7.0	8.5	5.6	7.1	24		3.5							13	14	A-6a							
13	B 0013- -2	SS-1	2.5	4.0	1.1	2.6	25	7	2.5	27	15	12	19	20	39	12	14	A-6a	1	240					
		SS-2	4.0	5.5	2.6	4.1	18		2.5	27	19	8	25	19	44	4	14	A-4a	2						
		SS-3	5.5	7.0	4.1	5.6	13		2							16	10	A-4a	8						
		SS-4	7.0	8.5	5.6	7.1	7		1.75							18	14	A-6a							
14	B 0014- -2	SS-1	1.5	3.0	0.1	1.6	13	10								6	6	A-1-b	0						
		SS-2	3.0	4.5	1.6	3.1	10									6	6	A-1-b	0						
		SS-3	4.5	6.0	3.1	4.6	24		2.25	26	19	7	29	22	51	14	14	A-4a	3	360					
		SS-4	6.0	7.5	4.6	6.1	25			28	21	7	17	12	29	17	10	A-2-4	0						

PID: PID 113889

County-Route-Section: CUY-422-16.20

No. of Borings: 14

Geotechnical Consultant: ECS Midwest, LLC

Prepared By: Michael S. Russo, P.E.

Date prepared: 8/4/2021

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 ≤ 5	0%	HP ≤ 0.5	2%
N ₆₀ < 12	27%	0.5 < HP ≤ 1	0%
12 ≤ N ₆₀ < 15	10%	1 < HP ≤ 2	42%
N ₆₀ ≥ 20	40%	HP > 2	33%
M+	19%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	6"
Maximum	12"
Minimum	0"

% Proposed Subgrade Surface	
Unstable & Unsuitable	41%
Unstable	41%
Unsuitable	0%

	N ₆₀	N _{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M _C	M _{OPT}	GI
Average	20	13	2.12	25	16	10	31	27	58	14	12	7
Maximum	50	30	3.50	41	26	22	45	43	82	33	21	16
Minimum	6	6	0.50	0	0	5	4	6	11	4	6	0

Classification Counts by Sample																			Totals
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	
Count	0	0	7	1	0	0	0	0	0	24	0	0	17	0	0	3	0	0	52
Percent	0%	0%	13%	2%	0%	0%	0%	0%	0%	46%	0%	0%	33%	0%	0%	6%	0%	0%	100%
% Rock Granular Cohesive	0%	62%										38%							100%
Surface Class Count	0	0	5	0	0	0	0	0	0	20	0	0	11	0	0	3	0	0	39
Surface Class Percent	0%	0%	13%	0%	0%	0%	0%	0%	0%	51%	0%	0%	28%	0%	0%	8%	0%	0%	100%

APPENDIX B – Field Operations

Field Photographs

Coring Report

Core Photographs



**ECS MIDWEST LLC/
SOLAR TESTING LABORATORIES, INC.**
1125 Valley Belt Road Brooklyn Heights, OH 44131
Phone (216) 741-7007 Fax (216) 741-7011

FIELD PHOTOGRAPHS

PROJECT: CUY-422-16.20 (HARPER ROAD INTERCHANGE)
CLIENT: GPD GROUP

FILE NO.: 67:1371
DATE: 11/19/20 & 11/20/20



Boring No. B-001-0-20 Elevation: 1072.6
Location: Harper Rd center striped zone
STA 58+38 5' RT



Boring No. B-006-0-20 Elevation: 1057.9
Location: Harper Rd southbound curb lane
STA 67+62 17' RT



Boring No. B-010-0-20 Elevation: 1058.9
Location: Harper Rd southbound left turn lanes
STA 73+46 4' LT



Boring No. B-011-0-20 Elevation: 1076.8
Location: U.S. 422 W entrance ramp
STA 440+45 15' RT



**ECS MIDWEST LLC/
SOLAR TESTING LABORATORIES, INC.**
1125 Valley Belt Road Brooklyn Heights, OH 44131
Phone (216) 741-7007 Fax (216) 741-7011

FIELD PHOTOGRAPHS

PROJECT: CUY-422-16.20 (HARPER ROAD INTERCHANGE)
CLIENT: GPD GROUP

FILE NO.: 67:1371
DATE: 11/19/20 & 11/20/20



Boring No. B-012-0-20 Elevation: 1069.8
Location: U.S. 422 W entrance ramp
STA 442+67 3' RT



Boring No. B-013-0-20 Elevation: 1065.2
Location: U.S. 422 W exit ramp
STA 647+58 1' RT



Boring No. B-014-0-20 Elevation: 1067.5
Location: U.S. 422 W exit ramp
STA 650+11 22' RT



**ECS MIDWEST LLC/
SOLAR TESTING LABORATORIES, INC.**
1125 Valley Belt Road Brooklyn Heights, OH 44131
Phone (216) 741-7007 Fax (216) 741-7011

CORING REPORT

PROJECT: CUY-422-16.20 (HARPER ROAD INTERCHANGE)
CLIENT: GPD GROUP

FILE NO.: 67:1371
DATE: 11/19/20 & 11/20/20

On November 19 and 20, 2020 ECS Midwest LLC/Solar Testing Laboratories, Inc. (ECS) procured seven (7), 8-inch-diameter pavement cores on Harper Road and the U.S. 422 West entrance and exit ramps for material identification and thickness verification, and to provide access to the subgrade for soil borings. The information follows:

Boring No.	Elevation (feet)	Location	Total Length (in)	Length (in)	Description
B-001-0-20	1072.6	Harper Rd Center striped zone STA 58+38 5' RT	9.750	9.750	Reinforced concrete
				2.750	Limestone SUBBASE
				18.000	Crushed limestone
				---	Sandy silt SUBGRADE (A-4a)
B-006-0-20	1057.9	Harper Rd Southbound curb lane STA 67+62 17' RT	9.000	9.000	Reinforced concrete
				6.000	Slag SUBBASE
				---	Silt and clay SUBGRADE (A-6a)
B-010-0-20	1058.9	Harper Rd Southbound left turn lanes STA 73+46 4' LT	14.500	2.500	Limestone surface course
				2.500	Limestone intermediate course
				9.500	Reinforced concrete
				10.000	Limestone SUBBASE
				---	Gravel SUBGRADE (A-1-b)
B-011-0-20	1076.8	U.S. 422 W entrance ramp STA 440+45 15' RT	13.750	1.500	Limestone surface course
				1.750	Limestone intermediate course
				2.000	Limestone base course
				8.500	Reinforced concrete
				12.000	Limestone SUBBASE
				---	Sandy silt SUBGRADE (A-4a)
B-012-0-20	1069.8	U.S. 422 W entrance ramp STA 442+67 3' RT	14.000	1.500	Limestone surface course
				1.500	Limestone intermediate course
				2.000	Limestone base course
				9.000	Reinforced concrete
				12.000	Limestone SUBBASE
				---	Silt and clay SUBGRADE (A-6a)
B-013-0-20	1065.2	U.S. 422 W exit ramp STA 647+58 1' RT	7.250	1.500	Limestone surface course
				1.500	Limestone surface course
				1.250	Limestone intermediate course
				3.000	Slag base course
				14.000	Slag SUBBASE
				---	Silt and clay SUBGRADE (A-6a)
B-014-0-20	1067.5	U.S. 422 W exit ramp STA 650+11 22' RT	7.500	1.750	Limestone surface course
				1.750	Limestone intermediate course
				4.000	Limestone base course
				46.500	Crushed limestone
				---	Sandy silt SUBGRADE (A-4a)



**ECS MIDWEST LLC/
SOLAR TESTING LABORATORIES, INC.**
1125 Valley Belt Road Brooklyn Heights, OH 44131
Phone (216) 741-7007 Fax (216) 741-7011

CORE PHOTOGRAPHS

PROJECT: CUY-422-16.20 (HARPER ROAD INTERCHANGE)
CLIENT: GPD GROUP

FILE NO.: 67:1371
DATE: 11/19/20 & 11/20/20



Coring No. B-001-0-20 Total Length: 9.750"
Location: Harper Rd center striped zone
STA 58+38 5' RT



Coring No. B-006-0-20 Total Length: 9.000"
Location: Harper Rd southbound curb lane
STA 67+62 17' RT



Coring No. B-010-0-20 Total Length: 14.500"
Location: Harper Rd southbound left turn lanes
STA 73+46 4' LT



Coring No. B-011-0-20 Total Length: 13.750"
Location: U.S. 422 W entrance ramp
STA 440+45 15' RT



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Coring No. B-012-0-20 Total Length: 14.000"
Location: U.S. 422 W entrance ramp
STA 442+67 3' RT



Coring No. B-013-0-20 Total Length: 7.250"
Location: U.S. 422 W exit ramp
STA 647+58 1' RT



Coring No. B-014-0-20 Total Length: 7.500"
Location: U.S. 422 W exit ramp
STA 650+11 22' RT