Technical Memorandum

To:	Ken Fertal, PS, PE (HDR) Brandon Chavel, PhD, PE (HDR) Phil Fry, PE (HDR)		
Project:	**FRA-70-22.61**		
Project No:	10027695	Rev:	Rev #
Calculation No:	1	Page:	1 of 2
Title:	On-Site Borrow Materials		
Purpose:	Provide a description of encountered subsurface conditions at proposed on-site borrow areas		
Originator:	DCM	Date:	12/28/2018
Checked by:	SPR	Date:	1/2/2019
QC Review by:	DMV	Date:	1/11/2019

Introduction

The following technical memorandum provides a description of the encountered subsurface conditions at the proposed borrow locations for the FRA-70-22.61 IR-70/IR-270 interchange reconstruction project (FRA-70) in Franklin County, Columbus, Ohio. The FRA-70 project includes partially reconfiguring the system-to-system interchange of IR-70 and IR-270 and the system-to-service interchange of IR-70 and Brice Road by removing major weaving movements. The reconfiguration will separate the through and local traffic from IR-270 and IR-70 headed eastbound and to Brice Road. Through traffic will utilize a new directional fly-over ramp from south bound IR-270 to eastbound IR-70. Exits for Brice Road will occur on IR-270 north and southbound and on IR-70 eastbound; funneling local traffic onto a collector-distributor exit ramp.

As much of the interchange improvements will require the placement of embankment fill for the construction of new ramps with limited cuts planned elsewhere across the project, two potential on-site borrow sites were proposed to minimize importing fill to the project site, the locations of which are illustrated on the attached Grading Plan and Potential Fill Area (excerpt from Stage 1 plans dated December 11, 2018). One potential borrow site (West Borrow Site) is located west of IR-270 in the area bordered by Ramp A1, IR-70 and the ramp from IR-70 West to IR-270 South. Another potential borrow site (East Borrow Site) is located east of IR-270, within the infield of the clover-leaf exit ramp from IR-270 north to IR-70 east. Based on the above-referenced Stage 1 plan excerpts, the West Borrow Site is roughly triangular shaped measuring some 500 feet in an east-west direction and about 225 feet in a north-south direction with proposed cuts to El. 770. The East Borrow Site is roughly circular in shape measuring approximately 250 feet in diameter with proposed cuts varying between El. 780 and El. 785.

Subsurface Exploration

The field exploration program for this project consists of three (3) different phases spanning four (4) years. The first phase consists of eighty-one (81) borings drilled in 2014 to assist in the project planning and development of the roadway alignments followed by an additional sixty-four (64) borings in 2016 for the development of the Stage 2 plans once alignments had been finalized. Two years later in response to the design changes that came out of a 2017 VE study, forty-five (45) borings were drilled in 2018 primarily for two noise walls along the northwest and southeast quadrants of the interchange as well as the widening of IR-70 between Brice Road and the county line.

Two (2) of the Phase 2 borings, identified as Borings B-089-0-16 and B-026-1-17, were drilled in the near vicinity of the proposed borrow areas as shown on the attached Grading Plans. Both borings were drilled by Barr Engineering, Inc. (now NEAS, Inc.). Boring B-026-1-16 was drilled between July 18, 2016 and July 19, 2016 using a CME 55 track-mounted drill rig whereas Boring B-089-0-16 was drilled within the West Borrow Site on September 15, 2016 using a CME 55X track-mounted drill rig. Both borings were drilled in general accordance with the Specifications for Geotechnical Explorations (ODOT revised January 2016) utilizing 3.25 inch-internal diameter hollow stem augers to advance the borings to their explored depths with the sampling of the soils accomplished in accordance with the "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils", ASTM D 1586. In the split-barrel sampling procedure, a standard 2-inch outside diameter split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a typical 18-inch penetration is recorded as the standard penetration test (SPT) resistance or N-values. A sample of augerable shale as encountered in Boring B-089-0-16 was also obtained by the split-barrel sampling procedure. Sampling of the bedrock encountered in Boring B-026-1-16 was obtained in accordance with the "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation", ASTM D 2113, using an NQ2-size double tube-swivel barrel with a diamond bit. One undisturbed soil sample was also collected in Boring B-026-1-16 in accordance with the "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes", ASTM D 1587. The depth of the undisturbed sample was determined in the field by HDR's geotechnical staff after review of the encountered subsurface conditions above the undisturbed sample depth.

Water levels were measured when encountered during drilling. However, water was introduced into the borehole of Boring B-026-1 to facilitate rock coring activities, and as such the water level is not indicative of static groundwater conditions. Furthermore, the borings were either backfilled or grouted/sealed upon completion and 24-hour water level readings were not obtained. A summary of those recorded water level readings pertinent to the proposed borrow sites are provided in Table 1 below.

Table 1: Summary of Encountered Groundwater Conditions

Boring	Ground Surface (El.)	During Drilling (El.)	Upon Completion (El.)	24-Hour (El.)
B-026-1-16	791.0	768.5	Not Recorded	Not Recorded
B-089-0-16	790.7	Not Encountered	Not Encountered	Not Encountered

Laboratory Testing

The soil and rock samples collected from both borings were visually examined by HDR's geotechnical staff. Representative soil samples were selected for laboratory testing to confirm the field classification and to assess the various engineering properties of the soils. Soil index testing from all three phases was performed by NEAS and included a project total of 1257 natural moisture content tests (per ASTM D 2216), 737 Atterberg limit determinations (per ASTM D 4318), and 740 particle size analyses (per ASTM D422). From the two borings drilled in the near vicinity of the proposed borrow sites , 27 natural moisture content tests (per ASTM D 2216), 7 Atterberg limit determinations (per ASTM D 4318), and 7 particle size analyses (per ASTM D422) were conducted. In addition

to these classification tests, 1 Unconfined Compression Test was conducted on an undisturbed soil sample (per ASTM D 2166) and 1 Unconfined Compression test was conducted on an intact rock core sample (per ASTM D 7012). The results of the soil index tests and soil and rock strength tests are presented on the final boring logs, attached to this technical memo.

Encountered Subsurface Conditions

West Borrow Pit

Existing fill material was encountered in Boring B-089-0-16 to a depth of 23.5 feet below the existing ground surface (El 767.2), though the materials transitioned at a depth of 17 feet from a soil-like fill described as Stone fragments with Sand, Silt and Clay (A-2-6) to an uncontrolled fill (UCF) with asphalt and reinforced concrete debris. The corrected N_{60} values ranged from 4 blows per foot (bpf) to 26 bpf in the upper soil fill indicating a very loose to medium dense material while the corrected N_{60} values in the uncontrolled fill and asphalt/concrete debris ranged from 25 bpf to split spoon refusal (>50 blows per 6 inch interval).

Reinforced Portland Cement Concrete (RCPP) and Asphalt, while suitable for some borrow material applications, also have specific requirements prior to placement, as described in the ODOT CMS. As such, the depth of readily available borrow material may be limited in depth to approximately El. 774. Furthermore, the extents of this uncontrolled fill is not known beyond the specific borehole location of B-089-0-16 and readily available borrow material may be further limited.

Glacial till was encountered in Boring B-089-0-16 from a depth of 23.5 feet (El. 767.2) to 27.0 feet (El. 763.7) below existing grade and consisted of fine-grained Silty Clay (A-6b) with corrected SPT N_{60}-values ranging from 16 bpf to 21 bpf indicating a generally very stiff consistency. Based on the findings from Boring B-089-0-16, this layer is below the lowest elevation of proposed cut (El. 770). While variations can occur between borings and across the plan dimensions of the borrow site, this layer should not be expected to be encountered within the limits of the West Borrow Site.

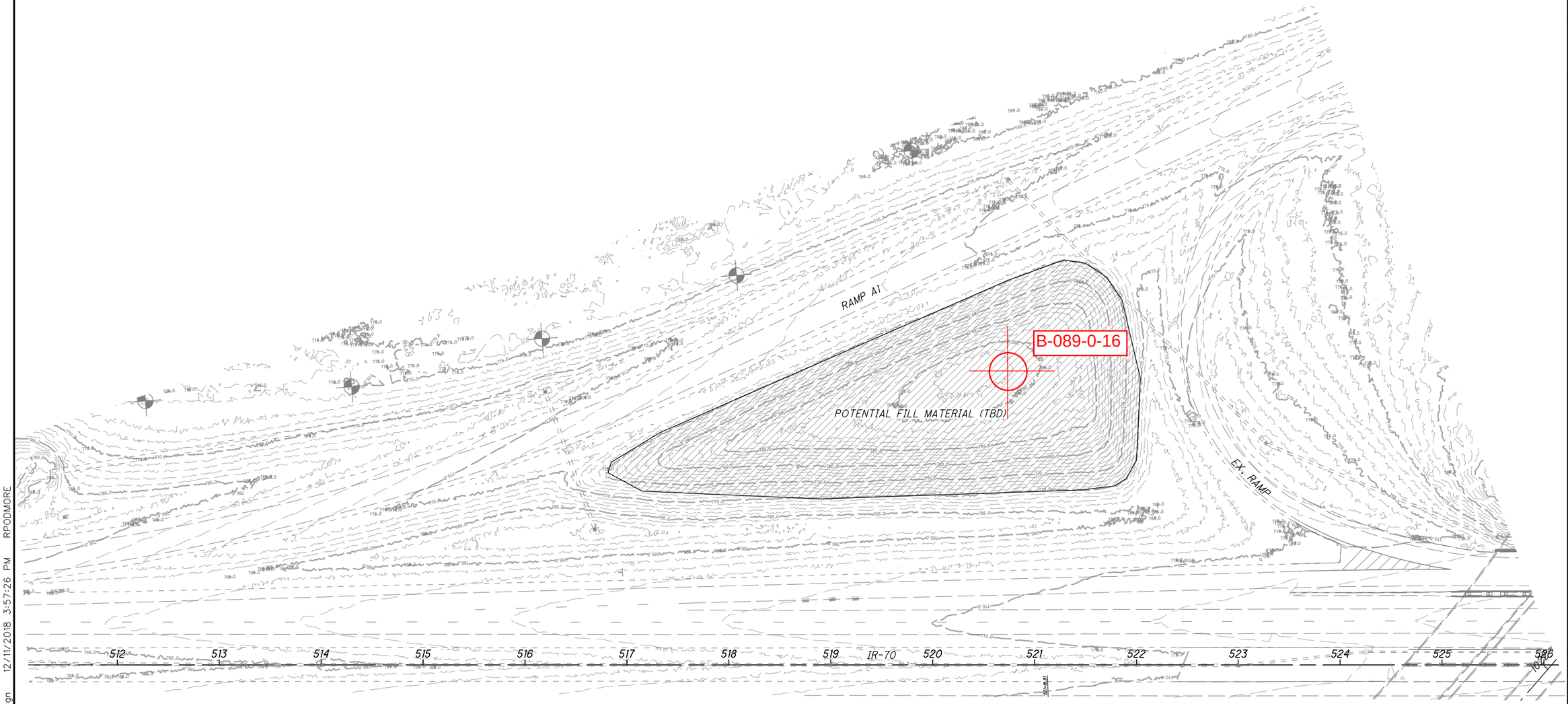
East Borrow Pit

Existing fill material was encountered beneath a 6-inch thick layer of topsoil in Boring B-026-1-16 and extended to a depth of 12 feet below existing grade (El. 779). The encountered fill material consisted of Gravel and Stone Fragments with Sand and Silt (A-2-4) with corrected N_{60}-values ranging from 11 bpf to 19 bpf indicating a medium dense relative density. As the bottom of the proposed borrow cut is planned to extend from roughly El. 780 to El. 785, cohesionless A-2-4 fill materials should be anticipated based on the findings from Boring B-026-1-16.

With the exception of a few relatively thin (2.5 feet), interbedded, medium dense to very dense, cohesionless silt (A-4a) and sand/gravel (A-1-b) seams, the existing fill was primarily underlain by cohesive glacial till to an approximate depth of 46 feet. The glacial till consisted of fine grained soils including Sandy Silt (A-4a) and Silt and Clay (A-6a) with corrected SPT N_{60}-values ranging from 12 bpf to 53 bpf, with an average value of 33 bpf, indicating a generally very stiff to hard consistency. As the native cohesive glacial till and interbedded cohesionless soils exist below the lowest elevation of the proposed cut (fill/native contact at El. 779 versus cut at El. 780 to El. 785), this layer should not be expected to be encountered.

Boring Plan

WEST BORROW SITE



As-Drilled Boring Location

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED | CHECKED

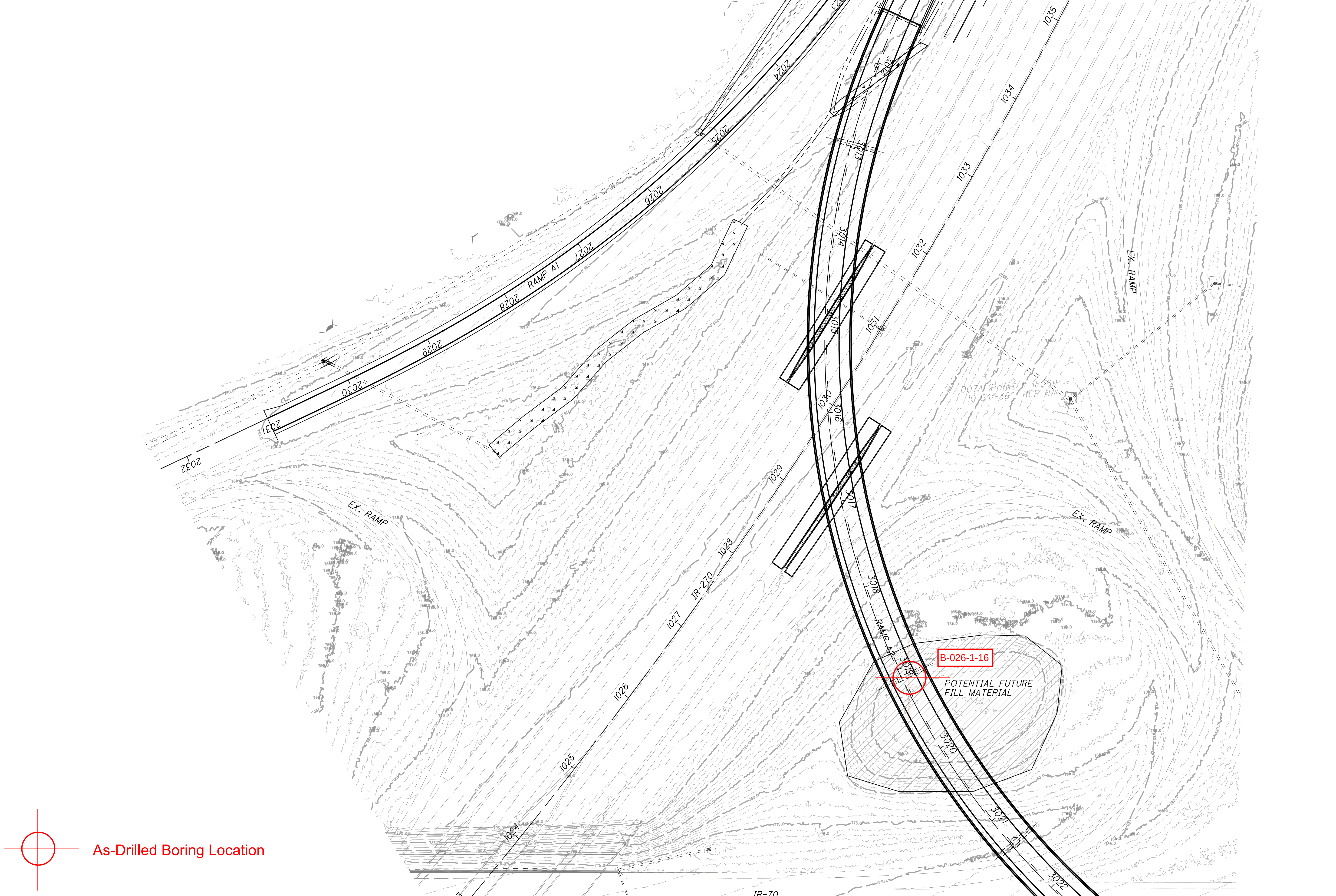
GRADING PLAN AND POTENTIAL FILL AREA
IR-70, RAMP A1 AND EXISTING RAMP

FRA-70-22.61

503
570

c:\pwworking\pitt\d1607352\95639_XG1103.dgn 12/11/2018 3:57:26 PM RPODMORE

EAST BORROW SITE



GRADING PLAN AND POTENTIAL FILL AREA
IR-270, IR-70, RAMP A2 AND EXISTING RAMP

CALCULATED
CHECKED

FRA-70-22.61

504
570

c:\pwworking\pitt\d1607352\95639_XG1202.dgn 12/11/2018 3:57:34 PM RPODMORE

Boring Logs

PROJECT: FRA-70-22.61	DRILLING FIRM / OPERATOR: BEI / J. HODGES	DRILL RIG: CME 55X	STATION / OFFSET: 520+80, 290' LT.	EXPLORATION ID B-089-0-16
TYPE: UNCONTROLLED FILL	SAMPLING FIRM / LOGGER: HDR / J.BUDNER	HAMMER: CME AUTOMATIC	ALIGNMENT: I70	
PID: 95639 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 12/3/15	ELEVATION: 790.7 (MSL) EOB: 28.4 ft.	PAGE 1 OF 1
START: 9/15/16 END: 9/15/16	SAMPLING METHOD: SPT	ENERGY RATIO (%): 88.1	LAT / LONG: 39.935009, -82.853907	

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
STIFF TO VERY STIFF, BROWN AND GRAY, **STONE FRAGMENTS WITH SAND, SILT, AND CLAY**, DAMP TO MOIST (FILL)	790.7		4 4 5	13	67	SS-1	-	-	-	-	-	-	-	-	-	10	A-2-6 (V)	
			3 5 7	18	87	SS-2	-	33	21	11	20	15	32	19	13	11	A-2-6 (1)	
			7 1 2	4	100	SS-3	1.50	-	-	-	-	-	-	-	-	13	A-2-6 (V)	
			3 5 13	26	100	SS-4	2.25	-	-	-	-	-	-	-	-	9	A-2-6 (V)	
			3 2 3	7	100	SS-5	-	-	-	-	-	-	-	-	-	13	A-2-6 (V)	
			2 3 3	9	100	SS-6	2.00	-	-	-	-	-	-	-	-	14	A-2-6 (V)	
@ 15.0' - 16.5' : trace asphalt fragments			2 4 13	25	100	SS-7	2.00	-	-	-	-	-	-	-	-	14	A-2-6 (V)	
ASPHALT AND REINFORCED CONCRETE DEBRIS (FILL)	773.7		17 9 8	25	100	SS-8	-	-	-	-	-	-	-	-	-	2	UCF (V)	
Bottom of Cut - West Borrow Site (El. 770)	769.7		50/4"	-	33	SS-9	-	-	-	-	-	-	-	-	-	-	UCF (V)	
REINFORCED CONCRETE DEBRIS (FILL)	767.2		50/0"	-			-	-	-	-	-	-	-	-	-	-		
VERY STIFF, GRAY-BROWN, **SILTY CLAY**, SOME SAND, TRACE STONE FRAGMENTS, DAMP TO MOIST (GLACIAL TILL)			5 4 7	16	100	SS-11	2.50	9	12	15	34	30	35	19	16	16	A-6b (8)	
@ 23.5' - 25.0' : trace roots			3 5 9	21	100	SS-12	-	-	-	-	-	-	-	-	-	12	A-6b (V)	
@ 26.5' : shale fragments in end of sampler	763.7	TR																
SHALE, GRAY, HIGHLY WEATHERED, VERY WEAK.	762.3	EOB	32 50/5"	-	100	SS-13	-	-	-	-	-	-	-	-	-	7	Rock (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/17/20 13:47 - C:\PWWORKING\PITT\D1616576\20160802_FRA-70-22.61_MASTER_PHASE-2-3.GPJ

PROJECT: FRA-70-22.61	DRILLING FIRM / OPERATOR: BEI / ASHBAUGH	DRILL RIG: CME 55	STATION / OFFSET: 3019+06, 8' LT.	EXPLORATION ID B-026-1-16
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: HDR / J.BUDNER	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP A2	
PID: 95639 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 12/3/15	ELEVATION: 791.0 (MSL) EOB: 55.8 ft.	PAGE 1 OF 2
START: 7/18/16 END: 7/19/16	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 81.8	LAT / LONG: 39.934920, -82.850031	

MATERIAL DESCRIPTION AND NOTES	ELEV. 791.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Topsoil (6 inches)	790.5																	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, DAMP (FILL)			2 6 5	15	28	SS-1	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
			4 5 5	14	67	SS-2	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
Bottom of Cut - East Borrow Site (El. 785)			2 7 4	15	67	SS-3	-	41	19	10	17	13	26	16	10	9	A-2-4 (0)	
			4 2 6	11	72	SS-4	1.75	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
			2 7 7	19	100	SS-5	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
	779.0																	
MEDIUM DENSE, DARK GRAY, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, MOIST (ALLUVIUM)			3 5 5	14	100	SS-6	-	14	9	27	36	14	NP	NP	NP	13	A-4a (3)	
	776.5																	
STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST			3 4 5	12	100	SS-7	1.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
@ 17.7' - Qu = 3168 psf					90	ST-8	1.75	10	12	17	38	23	23	14	9	12	A-4a (5)	
			3 7 14	29	100	SS-9	2.00	-	-	-	-	-	-	-	-	11	A-4a (V)	
			9 15 24	53	100	SS-10	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
	769.0																	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE CLAY, DAMP (ALLUVIUM)		W 768.5	7 23 29	71	100	SS-11	-	43	32	8	10	7	NP	NP	NP	11	A-1-b (0)	
	766.5																	
VERY STIFF TO HARD, DARK GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL AND STONE FRAGMENTS, DAMP (GLACIAL TILL)			9 11 13	33	89	SS-12	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	

PID: 95639	SFN:	PROJECT: FRA-70-22.61	STATION / OFFSET: 3019+06, 8' LT.	START: 7/18/16	END: 7/19/16	PG 2 OF 2	B-026-1-16

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)	HOLE SEALED
VERY STIFF TO HARD, DARK GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL AND STONE FRAGMENTS, DAMP (GLACIAL TILL) *(continued)*	761.0	31	6 10 13	31	100	SS-13	4.50	9	8	17	34	32	28	15	13	13	A-6a (7)	
		32																
		33																
		34																
		35																
		36	8 10 15	34	100	SS-14	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	
		37																
		38																
		39																
		40																
@ 40 - 41.5 : Shale Fragments		41	7 11 18	40	100	SS-15	4.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
		42																
		43																
		44																
		45																
	745.2	TR	48 50/4"	-	100	SS-16	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
SHALE, DARK GRAY, MODERATELY TO SLIGHTLY WEATHERED, VERY WEAK TO WEAK, VERY FINE GRAINED, LAMINATED, FISSILE, ARGILACEOUS, JOINTS AND BEDDING DISCONTINUOUS, MODERATELY FRACTURED, SLICKENSIDED AND SLIGHTLY ROUGH; RQD 41%, REC 98%. @ 46.9' - 47.2' : Qu = 185 psi (light gray seam)		46																
		47	37		93	NQ2-1											CORE	
		48																
		49																
		50																
		51	48		100	NQ2-2											CORE	
		52																
		53																
		54																
		55	25		100	NQ2-3											CORE	
	735.2	EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 50 LB. BENTONITE GROUT; 40 LB. WATER