

#### **DESIGN MEMORANDUM**

**Date:** April 25, 2025

To: Mr. Vince Amato, Burgess & Niple, Inc.

From: Brendan P. Andrews P.E., NEAS Inc.

RE: Geotechnical Design Memorandum Project HAM-75-1.05, PID 113361/122048 Noise Wall 5 City of Cincinnati, Hamilton County, Ohio

### INTRODUCTION

Per your request, this memorandum presents foundation design information for the proposed Noise Wall 5 (NW-5) as part of the overall Ohio Department of Transportation (ODOT) HAM-75-1.05 (PID 113361/122048) project located in the City of Cincinnati, Hamilton County, Ohio. A summary of: 1) the proposed structure; 2) the existing site conditions; 3) the surficial and subsurface conditions via project borings; and, 4) our recommendations for noise wall foundation design is presented below.

NEAS's analysis has been performed in accordance with Load and Resistance Factor Design (LRFD) method as set forth in AASHTO's Publication LRFD Bridge Design Specifications, 9th Edition (BDS) (AASHTO, 2020) and ODOT's 2021 LRFD Bridge Design Manual (BDM) (ODOT, 2025).

### **PROPOSED/EXISTING SITE CONDITIONS**

#### **Proposed Construction**

The eastern limits of Interstate Route 75 (IR-75) northbound (NB) from Linn Street to the Freeman Avenue (Ave) Bridge and IR-75 NB entrance ramp is planned to be realigned and improved as part of the referenced project. The improvements to IR-75 at this location will also include alterations to Winchell Ave and Ramp V as well as the addition of a 12-foot-wide shared use path planned along Winchell Ave. As part of these improvements, NW-5 is planned along the east side of the proposed Ramp V alignment. NW-5 begins at the Ramp V/Ezzard Charles Dr intersection and extends approximately 800 ft south along the newly proposed Ramp V alignment.

#### **Historical Records**

A historic record search was performed through ODOT's Transportation Information Mapping System (TIMS). However, no geotechnical data or information was available for review within the immediate vicinity of the proposed noise wall site. Therefore, historical borings are not referenced within this report nor pictured within the associated developed Structure Foundation Exploration Sheets.

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## Site Reconnaissance

A field reconnaissance visit for the proposed NW-5 was conducted on January 11, 2022, during which site conditions were noted and photographed. During our field reconnaissance, no geohazards were observed within the immediate vicinity of the proposed noise wall site. Land use of the area surrounding the proposed project site can be described as residential properties.

NW-5 is proposed to be located along the eastern side of the existing Winchell Ave immediately south of Ezzard Charles Ave. NW-5 is proposed within a grass and heavily vegetated strip of land between Winchell Ave and an adjacent apartment complex (Photograph 1). The proposed location is adjacent to an existing mature tree line and fence line that approximately parallels Winchell Ave to the east. In the area of the proposed wall, grades are relatively level with the surrounding property which descends gently from south to north along the southern half of the wall alignment and then gently rises from south to north along the northern half of the wall alignment up to the grade of Ezzard Charles Ave. The area of the proposed wall appeared to be stable with no signs of geotechnical instability nor signs of standing water observed during our visit. In general, the adjacent Winchell Ave pavement was observed to be fair to poor with signs of surface wear. High severity longitudinal and transverse cracking was observed along this section as well as wheel track cracking and crack sealing deficiencies.

Photograph 1: Overall Noise Wall 5 Site



# SUBSURFACE EXPLORATION

The exploration for NW-5 was conducted by NEAS between January 21, 2022 and March 17, 2022. The exploration for the referenced structure included 4 borings drilled to depths ranging from 25.0 to 26.5 ft below ground surface (bgs). Boring logs for the borings performed are attached. A summary of the exploration locations including latitude/longitude location information and elevations of the subject structure exploration are shown in Table 1 below. Additional information with respect to the subsurface exploration can be found in the Geotechnical Exploration Report for the overall project, HAM-75-1.05 (PID 113361).

Boring Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Depth (ft)							
B-113-0-21 39.107666 -84.530714 500.0 25.0											
B-114-0-21 39.108160 -84.530860 495.2 25.0											
B-115-0-21	39.108698	-84.530946	498.2	25.0							
B-116-0-21 39.109225 -84.530911 501.8 26.5											
Votes: 1. As-drilled boring location and corresponding ground surface elevation was surveyed in the field by NEAS Inc.											

 Table 1: Structure Boring Summary

## SUBSURFACE CONDITIONS

The subsurface profile at the referenced Noise Wall 5 site is generally consistent with the geological model for the project regarding the materials encountered. The subsurface profile along the proposed noise wall consists of existing fill soils overlying natural interlayered medium-fine to fine-grained materials.

The soil profile along the NW-5 alignment (borings B-113-0-21 to B-116-0-21) generally consisted of 3.0 to 9.5 ft of existing "man-made" fill soils atop 17.0 to 22.0 ft of natural interlayered medium-fine to fine grained material. The fill soils along the noise wall alignment consisted of both low plasticity, fine-grained soils and non-cohesive, coarse-grained material. The cohesive fills are classified on the boring logs as Silty Clay (A-6b), while the non-cohesive fill soils are classified on the logs as Gravel and/or Stone Fragments with Sand (A-1-b) and Gravel and Stone Fragments with Sand and Silt (A-2-4).

The natural soils consisted of both coarse- and fine-grained non-cohesive material interlayered with low to moderately plastic, fine-grained cohesive soils. The non-cohesive natural soils are classified on the boring logs as Gravel with Sand (A-1-b), Gravel with Sand, Silt, and Clay (A-2-7), Coarse and Fine Sand (A-3a), non-cohesive Sandy Silt (A-4a) and non-cohesive Silt (A-4b), while the cohesive natural soils are classified on the logs as cohesive Sandy Silt (A-4a), cohesive Silt (A-4b), Silt and Clay (A-6a) and Clay (A-7-6).

### Groundwater

Groundwater measurements were taken during the boring drilling procedures at each borehole location. Groundwater was not encountered during or following the completion of drilling in the referenced project borings performed at the proposed noise wall site. It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration. The specific groundwater observations are included on the attached boring logs.

# ANALYSES AND RECOMMENDATIONS

### Noise Wall Foundation Design

This memo provides information required to complete the design of 30-inch diameter drilled shaft noise wall supports. Geotechnical information has been developed in accordance with the ODOT GDM, Section 1600. ODOT design methodology requires that the  $N_{60}$  values of the granular soils be corrected using a factor to account for the depth of each test, and the material be broadly classified as either cohesive or granular soils. As several sampling intervals may have not aligned with those shown in the ODOT GDM,

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linear interpolation was used to acquire  $\rm N1_{60}$  correction factors for unlisted depths. These corrected  $\rm N_{60}$  values along with material classification are provided per boring within the  $\rm N1_{60}$  Values and Soil Type Tables attached.

Using the ODOT design methodology presented in Section 1600 of the GDM, NEAS has developed and attached tables (Design  $N1_{60}$  Values Based on Drilled Shaft Length Tables) indicating design  $N1_{60}$  values and soil types for various design shafts depth (i.e., 6 ft, 8 ft, 10 ft, etc.) per boring. For these tables the average of the  $N1_{60}$  values along the length of the drilled shaft (designated as the design  $N1_{60}$  herein) as well as the design soil type based on the majority soil type within the design length of the drilled shaft foundation is presented. Based on the design tables provided in the ODOT GDM, these design  $N1_{60}$  values and the design soil type should be used together with the proposed wall geometry (i.e., barrier height, post spacing, etc.) to determine the depth of shaft required for each boring location.

The conditions reflected at each boring in the attached tables were observed at those locations only and may not be indicative of conditions at intermediate points between borings. However, for purposes of design it is recommended that the supports be sized based on conditions at the nearest boring. In other terms, each boring may be considered representative of sub-surface conditions up to half the distance to the next nearest boring away for design purposes.

## **Drilled Shaft Depths**

Utilizing the design methodology presented in the above section of this memo and in accordance with Section 1600 "Noise Barrier Foundations" of the ODOT GDM, the drilled shaft design depths for the project noise walls are to be determined by Burgess & Niple, Inc. These drilled shaft depth calculations will be provided to ODOT as part of a separate submission.

# SOIL BORING LOGS

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ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELED SOIL CUTTINGS	ABANDONMENT METHODS, MATERIALS, QUANTITIES: SHOVELE	D SOIL C	UTTINGS																

		HAM-75-	1.05	DRILLING FIRM / O	PERA		EAS / J. HODGES	DRIL	L RIG:		CME 55	5X		STAT	ION /	OFF	SET:					EXPLOR B-115	ATION ID
	IYPE: PID: 11336'	<u>NOISE WAL</u> 1 SEN <sup>.</sup>	<u>_L</u>	DRILLING METHOD	.OGGI	=R: <u>Nt</u> 3	<u>-AS / J. HODGES</u> 25" HSA		MER: BRATI		ATE· 1	/IATIC 2/5/19	_	ALIGI FI FV	NMEI ATIO	NI: _ N'	0.0 (	MSL	) F	-OB.		i o ft	PAGE
2	START: <u>3/1</u>	17/22 END:	3/17/22	SAMPLING METHO	D:	0.	SPT		RGY R	ATIO	(%):	81.9		COO	RD:	····	0.0 (	N	ot Re	corde	d		1 OF 1
9.00		MATERI	AL DESCRIPT	ION		ELEV.	DEPTHS	SPT/	N	REC	SAMPLE	HP		GRAD	ATIO	N (%	)	ATT	ERBE	ERG		ODOT	BACK
			ND NOTES			0.0		RQD	• 60	(%)	ID	(tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	CLASS (GI)	FILL
	SAND, TRAC	E TO LITTLE GR	AVEL, CONTA	AY, LITTLE JINS BRICK			- 1 -	-															7676
	FRAGMENTS	s, damp					- 2 -	5	15	100	SS-1	4.50	-	-	-	-	-	-	-	-	19	A-6b (V)	TLV TL
Ī							- 2	5															
							- 3 -	2															1>11
							- 4 -	4	11	100	SS-2	3.00	16	10	9	33	32	37	21	16	19	A-6b (8)	7 1 7 1
							_ 5 -	4															7 LV 7 L
						-6.5	- 6 -	4			SS-3A	2.50	-	-	-	-	-	-	-	-	19	A-6b (V)	1 > 1 · 1 >
	VERY LOOSE		ENSE, BROWI	N, GRAVEL WITH			- 7 -	6 9	20	100	SS-3B	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
D Y L	SAND, TRAC	E TO LITTLE SIL	I, IRACE CLA		60		- 8 -																12412
N L							- 9 -	2		400													JLV JL
⊐ >					60		- 10 -	2	4	100	55-4	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	1 21 1 2 X
ב אר	VERY STIFE	BROWN GRAV			01	-10.5		_															1>1-1>
	CLAY, WET				<u>ک</u>		- 11 -	1	7	33	SS-5	2 50	20	31	15	7	27	57	22	35	22	$A_{-}2_{-}7(A)$	1 L 1 L 1 > L 1 >
E C C						12.0	- 12 -	<u></u> 3	, '	- 55	33-3	2.30	20	51	13	'	21	51	~~~	- 35	22	A-2-7 (4)	TLV TL
ц Ц	VERY LOOSE	E TO LOOSE, BR	ROWN, COARS			-13.0	13 -																
2	SAND, SOME	E SILT, LITTLE C	LAY, TRACE C	GRAVEL, WET			- 14 -	2	5	44	SS-6	_	-	_	-	-	-	-	_	-	21	A-3a (V)	<l 1<l<="" td=""></l>
4.×							- 15 -	2															7676
80.1							- 16 -	-															JLV JL
1.77							- 17 -	<sup>2</sup> 1	4	33	SS-7	-	-	-	-	-	-	-	-	-	22	A-3a (V)	1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
0/14						-18.0	- 10 -	2															1>11
<u>-</u>	VERY STIFF,	BROWN, SILT,	SOME CLAY,	TRACE SAND,	+++++++++++++++++++++++++++++++++++++++		- 10 -	1															7676
2	READINGS, V	WET	TAINS NO INT	ACT SOIL FOR HE	+++++++++++++++++++++++++++++++++++++++		- 19 - -	2	7	28	SS-8	3.50	-	-	-	-	-	-	-	-	24	A-4b (V)	JLV JL
					++++		- 20 -	3															1 > 1 · 1 >
-					+ + + + + + + + + + + + + + + + + + +		21 -	2															4 7 4 7
× c					+ + + + + + + + + + + + + + + + + + +		- 22 -	23	7	39	SS-9	2.50	0	0	9	68	23	27	17	10	25	A-4b (8)	1 L 1 L
<u>م</u>					+++++++++++++++++++++++++++++++++++++++		- 23 -																JLV JL
ר פ					+++++++++++++++++++++++++++++++++++++++		- 24 -	3	7	00	00.40										00		1 > 1 · 1 >
					+++++++++++++++++++++++++++++++++++++++	-25.0	FOB25	<sup>2</sup> 3	1	39	55-10	-	-	-	-	-	-	-	-	-	33	A-40 (V)	<1 ×1 ×1
JIL B							200 20																
201																							
ARU																							
ANL																							
°	NOTES: CP								S STAI														
F	ABANDONME	ENT METHODS.	MATERIALS, (	QUANTITIES: SHOV	ELED	SOIL C	UTTINGS																

	PROJECT:	HAM-75-1.05	DRILLING FIRM / OPERA	TOR: N	EAS / ASHBAUGH	DRIL	L RIG:		CME 5	5T		STAT	ION /	/ OFF	SET:					EXPLOR	ATION ID
	TYPE:	NOISE WALL	SAMPLING FIRM / LOGG	ER: NE	EAS / ASHBAUGH	HAM	MER:	CN	NE AUTON	MATIC		ALIG	NME	NT: _						B-116	5-0-21
	PID: <u>113361</u>	_ SFN:	DRILLING METHOD:	3	.25" HSA	CALI	BRATI	ON DA	ATE: <u>1</u>	2/5/19		ELEV	ATIC	)N: _{	502.6	(MS	L) E	OB:	26	<u>6.5 ft.</u>	PAGE
GPJ	START: <u>1/21</u>	<u>22</u> END: <u>1/21/22</u>	SAMPLING METHOD:				RGY R		(%):	68.4	<u> </u>	LAI /	LON	G:	、 I	39.10	J9255	o, -84	.53092		
1.05		MATERIAL DESCRIPT	IION	ELEV.	DEPTHS	SP1/ ROD	N <sub>60</sub>	(%)		(tsf)	GR		FS	SI (%	) CI		PI	PI	wc	ODOT CLASS (GI)	BACK
1-75-	MEDIUM DENS	E, BROWN AND GRAY, GR	AVEL AND	502.0				(70)						0.							$\frac{1}{2}L^{\vee}_{2}L^{\vee}$
<b>NHAN</b>	STONE FRAG	IENTS WITH SAND AND SIL	T, TRACE CLAY,		- 1																12112
LES	(FILL)	CK FRAGMENTS, MOIST			- 2 -																7676
ヨケ	()				- 2 -	5															JLV JL
5/GII						6 4	11	67	SS-1	-	-	-	-	-	-	-	-	-	16	A-2-4 (V)	< V < V <
-1.0				1																	72.72
M-75			Pat b		_ 5 _	4															7 LV 7 L
S/H/S					- 6 -	6 10	18	56	SS-2	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	1>1, 1>
ECT				495.6	- 7 -																1>112
RO,		E, GRAY, <b>GRAVEL AND ST</b> VITH SAND. TRACE SILT. T	RACE CLAY.		- 8 -	7													-		7676
ЭĽЕ	DAMP	- , - ,	o D			9 13	25	33	SS-3	-	-	-	-	-	-	-	-	-	3	A-1-b (V)	JLV JL
/E S(				493.1																	< L 1 < L
CT	STONE FRAG	IENTS, DAMP				8															12.17
TS/A					- 11 -	10 13	26	56	SS-4	3.00	21	13	12	29	25	30	21	9	17	A-4a (4)	JLV JL
JEC				490.6	- 12 -																1   
PRC	ORANGISH BR	OWN, <b>SILT AND CLAY</b> , TR	ACE SAND, TRACE		- 13 -	8													10		12472
ΓIVE	GRAVEL, DAM					11 13	27	/2	55-5	4.00	-	-	-	-	-	-	-	-	19	A-6a (V)	7676
AC					- 14 -																7 LV 7 L
8 - X					- 15 -	5	40				_		•								4>14
11:0					- 16 -	6 5	13	61	SS-6	2.50	7	3	6	42	42	34	21	13	21	A-6a (9)	7672
4/22				485.6	- 17																JLV JL
- 6/1	GRAVEL, MOIS	TTO DAMP	E CLAY, TRACE		- 18 -	6	10	70		0.75									40		< / / < /
GDT					- 10 -	<u>б</u>	13	12	55-7	2.75	-	-	-	-	-	-	-	-	18	A-4a (V)	12472
OT.					- 19 -																7 6 7 6
OHI					- 20 -	5	14	70	00.0	0.50			00	00	07	05	10	~	40	A 4 - (0)	7 LV 7 L
11) -					- 21 -	6	14	12	55-8	3.50	4	11	20	38	27	25	16	9	16	A-4a (6)	1>11
5 X				480.6	- 22																1 L 1 L 1>1 1>
G (8	CLAY, TRACE	GRAVEL, MOIST	1110, LITTLE  ++++  ++++  ++++		- 23 -	7	16	70	<u> </u>										10		ÍLV ÍL
015			+++++++++++++++++++++++++++++++++++++++		- 24 -	8	10	/0	- 55-9	-	-	-	-	-	-	-	-	-	19	A-40 (V)	1>1/1>
RING			+ + + + + + + + + + + + + + + + + + + +																		12112
LBC			+ + + +  + + + +  + + + +		- 25 -	7 。	21	<u>80</u>	SS 10		1		20	56	11				17	A 16 (6)	7676
SOL			++++ ++++	476.1	EOB - 26 -	10	21	09	33-10	-		4	20	50	11	INP	INP	١٩٣	17	A-40 (0)	
RD C																					
NDA																					
STA																					
	NOTES: GRO	UNDWATER NOT ENCOUN	TERED DURING DRILLING.	HOLE D	ID NOT CAVE. DRIL	ED A	S STA	KED.													
	ABANDONMEN	IT METHODS, MATERIALS,	QUANTITIES: SHOVELED	SOIL C	UTTINGS																

N1<sub>60</sub> VALUES AND SOIL TYPE



Depth of	Correction	B-113	8-0-21	Cohesive or	Dept	of Corr	ection	B-114	-0-21	Cohesive or	Dept	h of	Correction	B-115	5-0-21	Cohesive or
SPT (ft)	Factor	N <sub>60</sub>	N1 <sub>60</sub>	Granular	SPT (	ft) Fa	actor	N <sub>60</sub>	N1 <sub>60</sub>	Granular	SPT	(ft)	Factor	N <sub>60</sub>	N1 <sub>60</sub>	Granular
2.5	1.64	14	23	Granular	2.5	1	64	29	48	Granular	2.	5	1.64	15	-	Cohesive
5	1.4	5	7	Granular	5	-	1.4	4	6	Granular	5		1.4	11	-	Cohesive
7.5	1.27	5	-	Cohesive	7.5	1	.27	7	1	Cohesive	7.	5	1.27	20	25	Granular
10	1.17	4	-	Cohesive	10	1	.17	5	1	Cohesive	10	)	1.17	4	5	Granular
12.5	1.1	8	-	Cohesive	12.	5 1	1.1	3	3	Granular	12	5	1.1	7	8	Granular
15	1.04	10	-	Cohesive	15	1	.04	3	3	Granular	1	5	1.04	5	5	Granular
17.5	0.98	10	-	Cohesive	17.	5 0	).98	8	8	Granular	17	5	0.98	4	4	Granular
20	0.94	7	-	Cohesive	20	0	).94	7	7	Granular	20	)	0.94	7	-	Cohesive
22.5	0.9	8	-	Cohesive	22.	5 (	0.9	7	6	Granular	22	5	0.9	7	-	Cohesive
25	0.86	5	-	Cohesive	25	0	).86	8	7	Granular	2	5	0.86	7	-	Cohesive

r

Depth of	Correction	B-116	-0-21	Cohesive or
SPT (ft)	Factor	N <sub>60</sub>	N1 <sub>60</sub>	Granular
4	1.496	11	16	Granular
6.5	1.322	18	24	Granular
9	1.21	25	30	Granular
11.5	1.128	26	-	Cohesive
14	1.064	27	-	Cohesive
16.5	1.004	13	-	Cohesive
19	0.956	13	-	Cohesive
21.5	0.916	14	-	Cohesive
24	0.876	16	-	Cohesive
26.5	0.86	21	18	Granular

# DESIGN N160 VALUES BASED ON DRILLED SHAFT LENGTH



#### Noise Wall 5 HAM-75-1.05 (PID: 113361/122048) Design N1<sub>60</sub> Values Based on Drilled Shaft Length

	B-113	B-113-0-21							
Depth of Shaft (ft)	Design N160	Cohesive or Granular							
6	15	Granular							
8	12	Cohesive							
10	10	Cohesive							
12	9	Cohesive							
14	9	Cohesive							
16	10	Cohesive							
18	9	Cohesive							
20	9	Cohesive							
22	9	Cohesive							
24	9	Cohesive							

	B-114	-0-21
Depth of Shaft (ft)	Design N1 <sub>60</sub>	Cohesive or Granulai
6	27	Granular
8	20	Cohesive
10	16	Cohesive
12	14	Granular
14	12	Granular
16	12	Granular
18	11	Granular
20	11	Granular
22	10	Granular
24	10	Granular

	B-115	5-0-21
Depth of Shaft (ft)	Design N1 <sub>60</sub>	Cohesive or Granular
6	13	Cohesive
8	17	Cohesive
10	14	Cohesive
12	13	Granular
14	11	Granular
16	10	Granular
18	10	Granular
20	10	Granular
22	9	Cohesive
24	9	Cohesive

	B-116	5-0-21
Depth of Shaft (ft)	Design N1 <sub>60</sub>	Cohesive or Granular
6	20	Granular
8	24	Granular
10	24	Granular
12	25	Granular
14	23	Cohesive
16	23	Cohesive
18	21	Cohesive
20	20	Cohesive
22	20	Cohesive
24	20	Granular