I-375 Traffic Noise Analysis
Technical Memorandum

August 26, 2020

Michigan Department of Transportation

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1. Executive Summary

This report evaluates the potential noise impacts of the proposed improvements along Interstate 375 (I-375) from I-75 to Jefferson Avenue in Downtown Detroit, in conformance with corresponding Federal regulations and guidance, and the National Environmental Policy Act (NEPA).

The project is located within the city of Detroit, in Wayne County, Michigan (see Figure 1). The project area is defined as:

- I-375 from I-75 to south of Jefferson Avenue to Atwater Street.
- I-75 south of Mack Avenue to east of John R.
- I-75/I-375 Interchange, including all ramps, and the Gratiot Avenue Connector.
- Gratiot Avenue from south of Beaubien Street to the Dequindre Cut Greenway.
- Jefferson Avenue from Woodward Avenue to Rivard Street.

The project is being studied as a Type I project because it includes substantial horizontal and vertical alterations.

This report evaluates the potential noise impacts of the proposed improvements of the project in conformance with corresponding Federal regulations and guidance, and NEPA. The noise analysis presents the existing and future acoustical environment at receptors located in the I-375 Preferred Alternative noise study area.

The determination of noise abatement measures and locations complies with the Federal Highway Administration's (FHWA's) *Procedures for Abatement of Highway Traffic Noise and Construction Noise* as presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 722), July 2010, and the Michigan Department of Transportation (MDOT): *Highway Noise Analysis and Abatement Handbook*, dated July 2011 (Handbook). The Handbook complies with the State Transportation Commission Policy 10136 Noise Abatement, dated October 17, 2019.

Figure 1. Project Location

Existing noise level measurements were conducted on Oct. 26, 2017, at 13 representative sites in the project vicinity. Fifteen-minute measurements were taken at each site. Measurement locations are shown in Appendix A. Traffic was counted and classified concurrently during each noise measurement by vehicle type: cars, medium trucks, heavy trucks, and buses. FHWA's Traffic Noise Model Version 2.5 (TNM) was used to validate the predicted noise levels through comparison with the measured and predicted noise levels.

TNM was used to model existing (2017) and Build (2040) design hour traffic noise levels within the study area for the Preferred Alternative. This analysis modeled 221 receivers representing 203 receptors (or units). The analysis provides existing and future noise levels, as well as identifies receptors that are impacted, that is, they approach or exceed the FHWA Noise Abatement Criteria (NAC). The analysis results indicate 13 units are impacted by the Preferred Alternative.

Two noise barriers (NB) have been evaluated for this noise study (NB1 and NB2). NB1 is located on the west side of I-75 between Wilkins Street and Mack Avenue, and was designed to mitigate the noise impact from the Preferred Alternative for residences in Brewster Homes along the I-75 Frontage Road. This barrier is not acoustically feasible, as it did not achieve a 5 dB(A) reduction at 75 percent of the impacted receptors.

NB2 is located on the north side of I-75 between approximately 250 feet west of Woodward Avenue to John R Street and was designed to mitigate noise impact for second-floor residential balconies along the I-75 Frontage Road. This barrier is acoustically feasible but not reasonable, as the estimated cost per benefited receptor ($84,706) would exceed the allowable cost per benefited receptor ($47,489 in 2019 dollars[1]).

The locations of the project's modeled receptors and noise barriers (Figures 4-2 and 4-3) are shown in the exhibits in Appendix A. Table 1 includes the barrier analysis results.

MDOT's policy is to install feasible and reasonable noise barriers associated with transportation improvements. Based on this noise analysis completed, mitigation of noise impacts for the proposed I-375 Improvement Project would not be feasible and reasonable for the analyzed noise barrier location.

[1] Email with Mr. Thomas Hanf (MDOT), dated August 21, 2019.

Table 1. Noise Barrier Summary

Barrier ID	# of Total Impacted	Number of Attenuated Locations						Cost ($45 per sq. ft)	Cost/Benefit	Feasible[a]	Reasonable[b]
		≥ 5 dB(A)			≥ 7 dB(A)		≥ 10 dB(A)			(Y/N)	(Y/N)
		# of Impacted	% of Total Impacted	# of Total Benefitting	#	% of Benefited					
NB 1	8	0	0%	0	0	0%	0	$757,440	NA	N[d]	N
NB 2	5	4	80%	15	6	40%	1	$1,270,590[c]	$84,706	Y	N

Source: HNTB analysis, 2020

[a]) MDOT requires that noise barriers achieve a 5 dB(A) reduction at 75 percent of the impacted receptors. If a barrier cannot achieve this, abatement is considered to not be acoustically feasible. Noise barrier abatement also might not be feasible due to constructability or safety constraints.

[b]) The design year attenuation requirement for Michigan is to provide a noise reduction of 10 dB(A) for at least one benefited receptor and at least a 7 dB(A) reduction for 50 percent or more of the benefited receptor sites.

[c]) Includes an estimated additional cost of $132,450 for potential retaining wall updates.

[d]) Noise barrier is not feasible because a 5 dB reduction was not achieved at 75 percent of the impacted receptors.

2. Purpose of this Report

This report evaluates the potential noise impacts of the proposed improvements along Interstate Highway 375 (I-375) from Interstate Highway 75 (I-75) to Jefferson Avenue in Downtown Detroit, in conformance with corresponding Federal regulations and guidance, and the National Environmental Policy Act (NEPA).

2.1. Project Description

After more than 50 years of use, the I-375 infrastructure is nearing the end of its useful service life, including the I-75/I-375 Interchange and the freeway bridges, and it requires modernization. The current condition is one of the primary drivers of the study's Purpose and Need, along with the opportunity to help the city of Detroit meet certain economic development and land use planning goals for the vicinity. The I-375 Environmental Assessment was initiated, following the completion of a Planning and Environmental Linkages Study (PEL) in 2014, to identify and evaluate alternatives for the corridor, and several adjacent facilities, which would address the need for near- and long-term rehabilitation, meet the transportation needs of all users in a cost-effective manner, and improve the connectivity, vibrancy, and economic development potential of the corridor. The I-375 freeway was constructed as a limited access, depressed, urban freeway approximately one mile in length. The project area is contained within the city of Detroit, in Wayne County.

The project area is defined as:

- I-375 from I-75 to south of Jefferson Avenue to Atwater Street.
- I-75 south of Mack Avenue to east of John R.
- I-75/I-375 Interchange, including all ramps, and the Gratiot Avenue Connector.
- Gratiot Avenue from south of Beaubien Street to the Dequindre Cut Greenway.
- Jefferson Avenue from Woodward Avenue to Rivard Street.

I-375 is a median-divided below grade urban freeway with two lanes each northbound and southbound between Jefferson Avenue and Larned Street. Between Larned Street and Lafayette Avenue, the freeway is three lanes in each direction. The freeway then transitions to four lanes wide in each direction from Lafayette Avenue to the I-75 interchange. Along the I-375 freeway, there are seven bridges connecting surface streets over I-375.

I-375 is at the east edge of the city of Detroit's central business district (CBD) and provides freeway access directly to the riverfront, the Renaissance Center, Hart Plaza and the financial district. Land uses in this area include businesses, residential, and urban open spaces.

2.2. Preferred Alternative

The Preferred Alternative includes a new I-75/I-375 interchange and a six-lane boulevard with direct left-turns to local streets south of Gratiot Avenue. The I-375 below-grade freeway would become an at-grade boulevard at Gratiot Avenue, creating a new intersection and improved access to Gratiot Avenue. Continuing south of Gratiot Avenue, the boulevard will have signalized intersections with direct left-turns to and from the side streets. The I-375/I-75 interchange will be an urban-type interchange with right-sided ramps to Gratiot Avenue and Eastern Market, and will allow for through traffic for I-75 along the left-side.

Roadway refinements were made to the local street design in the Eastern Market area. This includes an extension of Montcalm Street to Jay Street, east of Gratiot Avenue, providing connectivity between neighborhoods north and south of Gratiot Avenue. A New Local Connector roadway will connect Gratiot Avenue to the west to Brush Park to the east and will provide additional local connectivity east and west.

The Preferred Alternative includes a 10-foot wide two-way cycle track along the east side of the boulevard and extends from Montcalm Street in the north to Atwater Street in the south. A cycle track along the north side of Montcalm Street extends from Brush Street in the west to the Dequindre Cut Greenway in the east.

The full Preferred Alternative is described in the I-375 Improvement Project Environmental Assessment. Plan view exhibits are shown in Figure 4 in Appendix A.

3. Traffic Noise Concepts, Policy and Guidelines

3.1. Basic Noise Information

Noise is defined as unwanted sound. Sound is what we hear when there are variations in air pressure. The ear is sensitive to this pressure variation and perceives it as sound. The intensity of these pressure variations causes the ear to discern different levels of loudness. These pressure differences are most commonly measured in decibels.

The decibel (dB) is the unit of measurement for sound. The decibel scale audible to humans spans approximately 140 dB. A level of zero decibels corresponds to the lower limit of audibility, while 140 dB produces a sensation more akin to pain than sound. The decibel scale is a logarithmic representation of the actual sound pressure variations. Therefore, a 26 percent change in the energy level only changes the sound level 1-dB. The human ear would not detect this change except in an acoustical laboratory. A doubling of the energy level would result in a 3-dB increase, which would be barely perceptible in the natural environment. A tripling in energy sound level would result in a clearly noticeable change of 5-dB in the sound level. A change of 10 times the energy level would result in a 10-dB change in the sound level. This would be perceived as a doubling (or halving) of the apparent loudness. Table 2 provides a comparison of sound level changes with relative loudness.

The human ear has a non-linear sensitivity to noise. To account for this in noise measurements, electronic weighting scales are used to define the relative loudness of different frequencies. The "A" weighting scale is widely used in environmental work because it closely resembles the non-linearity of human hearing. Therefore, the unit of measurement for an A-weighted noise level is dB(A).

Table 2. Logarithmic Nature of Sound

Change in Leq (1h) Sound Level Relative Loudness in the Natural Environment	Change in Leq (1h) Sound Level Relative Loudness in the Natural Environment
+/- 3 dB(A)	Barely Perceptible Change
+/- 5 dB(A)	Readily Perceptible Change
+/- 10 dB(A)	Considered Twice or Half as Loud

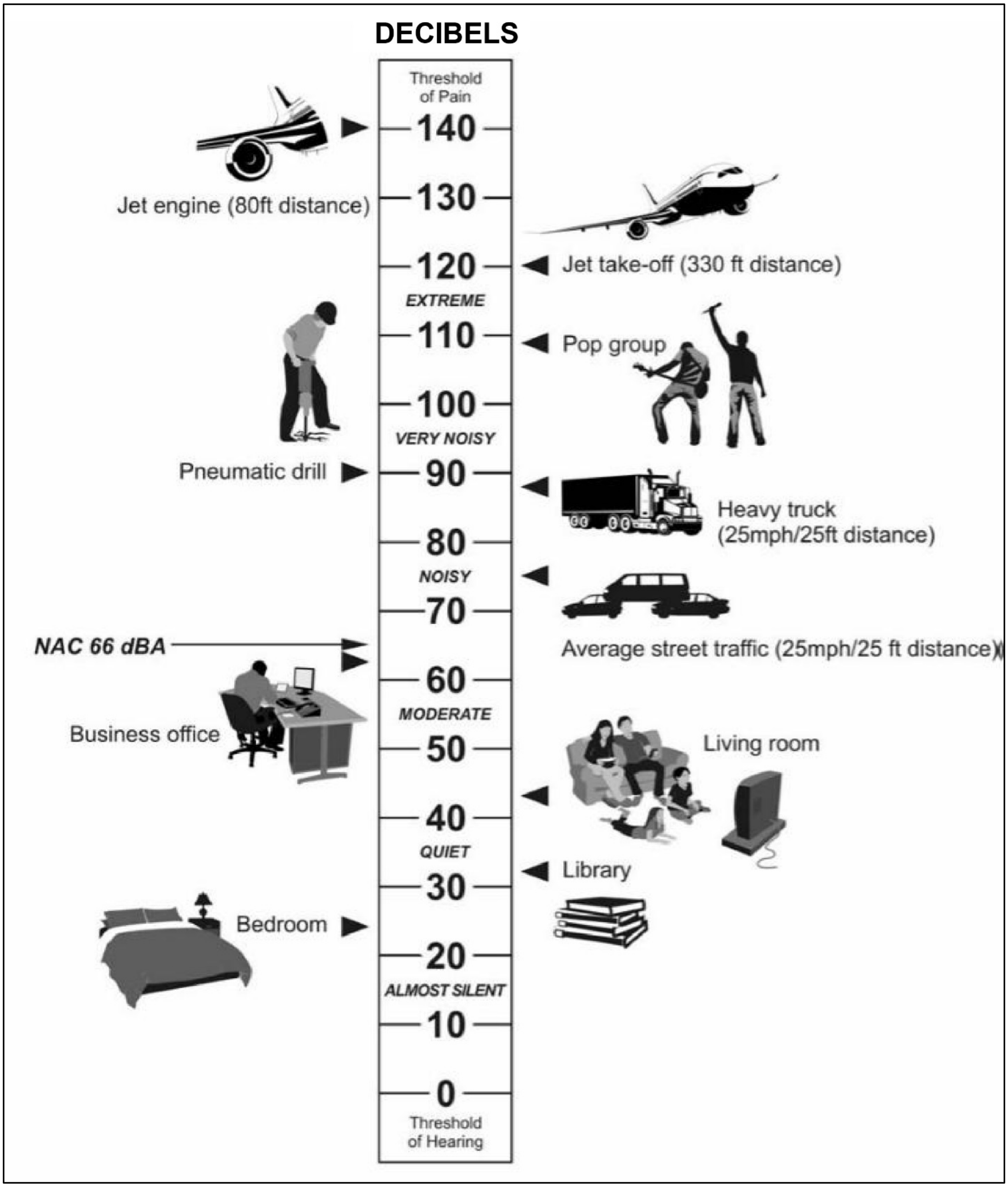
Traffic noise is not constant. It varies as each vehicle passes through a certain location. The time-varying characteristics of environmental noise are analyzed statistically to determine the duration and intensity of noise exposure. In an urban environment, noise is made up of two distinct components. One is ambient or background noise. Wind noise and distant traffic noise make up the ambient acoustical environment surrounding the project. These sounds are not readily recognized but combine to produce a non-irritating ambient sound level. This background sound level varies throughout the day, being lowest at night and highest during the day. The other component of urban noise is intermittent and louder than the background noise.

Transportation noise and local industrial noise are examples of this type of noise. It is for these reasons that environmental noise is analyzed statistically.

It is necessary to use a method of measure that will account for the time-varying nature of sound when studying environmental noise. The equivalent sound pressure level (L_{eq}) is defined as the continuous steady sound level that would have the same total A-weighted sound energy as the real fluctuating sound measured over a given period of time. As a result, the three characteristics of noise combine to form a single descriptor (L_{eq} in dB(A)) that is used to evaluate human response to noise and has been chosen for use in this study. The time-period used to determine traffic noise levels is one hour and uses the descriptor L_{eq}(1h).

Traffic noise at a receiver is influenced by the following major factors: distance from the traffic to the receiver, volume of traffic, speed of traffic, vehicle mix, and acoustical shielding. Tire sound levels increase with vehicle speed but also depend upon road surface, vehicle weight, tread design and wear. Change in any of these can vary noise levels. At lower speeds, especially in trucks and buses, the dominant noise source is the engine and related accessories. Figure 2 provides sound levels of typical noise sources.

Figure 2. Sound Levels of Typical Noise Sources



Source: Adopted from "Environmental Criteria for Road Traffic Noise", Environmental Protection Authority, South Sydney, NSW, May 1999, Page 38.

3.2. Federal Regulations and Guidance

The FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise* are presented in the Code of Federal Regulations, Title 23 Part 772 (23 CFR 772), July 2010. This regulation, plus other guidance documents written to explain the regulation, sets forth the process for performing a traffic noise analysis. The process includes the following:

1. Identification of highway traffic noise impacts;
2. Examination of potential abatement measures;
3. Gathering of public input approval for reasonable and feasible abatement measure;
4. Incorporation of reasonable and feasible highway traffic noise abatement measures into the highway project;
5. Coordination with local officials to provide helpful information on compatible land use planning and control; and
6. Identification and incorporation of necessary measures to abate construction noise.

The highway traffic noise impact identification process involves a review of the existing land use activity categories that parallel the highway corridor and determining existing and future noise levels within those areas. Existing land use of developed lands is identified by inspecting aerial photography and performing site reconnaissance. Highway traffic noise analyses are also performed for undeveloped lands that have received a building permit.

After the existing and proposed land uses are established, ambient noise levels are measured along the corridor with simultaneous traffic counts. The measured noise levels are then compared to modeled noise levels based on the traffic counts. The model is validated if measured highway traffic noise levels and predicted highway traffic noise levels for the existing conditions are within +/- 3 dB(A).[2] This modeling, as required by the FHWA, is performed with TNM version 2.5. Once the model is validated, TNM is used to model the existing and the future build loudest hour for traffic noise analysis.

The FHWA Noise Abatement Criteria (NAC), which are presented in 23 CFR 772, establish the NAC for various land uses, and are presented in Table 3. A traffic noise impact is defined as a future noise level that approaches or exceeds the NAC; or a future noise level that creates a substantial noise increase over existing noise levels. An approaching noise level is defined as being at least one dB(A) less than the noise level value listed in the NAC for Activity Category A through G. For Activity Category C/D land uses, NAC C is applied if an exterior use is present, and NAC D is applied if there is no exterior use or if abatement (e.g., a noise barrier) for NAC C is not feasible and reasonable. The FHWA allows states to define a substantial noise increase as an increase of anywhere between 5 and 15 dB(A).

After traffic noise impacts are identified, potential abatement alternatives are examined. The following abatement alternatives, which are listed in 23 CFR 772.15(c) are permitted and can be evaluated where applicable:

[2] *Highway Noise Analysis and Abatement Handbook, Michigan Department of Transportation, 2011, page 16.*

1. Construction of noise barriers including acquisition of property rights, either within or outside the highway right-of-way;
2. Traffic management measures;
3. Alteration of horizontal and vertical alignments;
4. Acquisition of real property or interests therein to serve as a buffer zone to preempt development; and
5. Noise insulation of Activity Category D land use activities listed in Table 3.

At a minimum, state highway agencies are required to consider noise abatement in the form of noise barriers.

FHWA defines feasible highway traffic noise abatement as objective engineering considerations (e.g., can a barrier be built given the topography of the location; can a substantial noise reduction be achieved given certain access, drainage, safety, or maintenance requirements; are other noise sources present in the area, etc.). An abatement measure must achieve a noise reduction of at least five dB(A) to be considered feasible, according to 23 CFR 772.13 (d)(1)(i). MDOT's feasibility criteria are provided in Section 5.1 of this document.

The FHWA lists three required reasonableness factors when considering noise barriers: cost effectiveness, viewpoints of benefiting receptors, and achievement of noise reduction design goals. For reasonableness, 23 CFR 772.13 (d)(2)(iii) requires state Departments of Transportation to define design year reduction goals somewhere between 7 and 10 dB(A). FHWA lists **optional reasonableness factors** that can be added to but not overrule the required reasonableness factors.

Table 3. Noise Abatement Criteria (NAC)

Activity Category	Activity Criteria[a,b] Leq(h)[c]	Activity Criteria[a,b] L10(h)[d]	Evaluation Locator	Activity Description
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	70	Exterior	Residential
C	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[e]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	N/A	N/A	N/A	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	N/A	N/A	N/A	Undeveloped lands that are not permitted.

Source: Highway Noise Analysis and Abatement Handbook, *Michigan Department of Transportation, 2011.*

[a] *MDOT defines a noise impact as a 10 dB(A) increase between the existing noise level to the design year predicted noise level, OR a predicted design year noise level that is 1 dB(A) less than the levels Table 3 shows.*

[b] *Either L_{eq}(h) or L10(h) (but not both) may be used on a project. MDOT uses L_{eq}(h). The L_{eq}(h) and L10(h) Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.*

[c] *L_{eq} is the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with L_{eq}(h) being the hourly value of L_{eq}.*

[d] *L10 is the sound level that is exceeded 10 percent of the time (90th percentile) for the period under consideration, with L10 being the hourly value of L10.*

[e] *Includes undeveloped lands permitted for this activity category*

3.3. State Rules and Procedures

The Handbook is the State's tool for implementing 23 CFR 772. The Handbook expands on 23 CFR 772 by refining definitions and establishing milestones within the design phase for the completion of noise impact analysis and mitigation development.

The Handbook includes the following definitions:

Noise Impact: A substantial noise increase or a predicted design year noise level that is one dB(A) less, equal to, or greater than the NAC level.

Common Noise Environment (CNE): A group of receptors within the same Activity Category that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections, and cross-roads.

Substantial Noise Increase: A 10 dB(A) or greater increase between the existing noise level and the design year predicted noise level.

Feasible Noise Barrier: A barrier that has no construction impediments, meets safety requirements for the traveling public, and provides at least 5 dB(A) noise reduction at 75 percent of the impacted receptors.

Reasonable Noise Barrier: A barrier that is cost effective, favorable to the majority of benefited receptors, and achieves noise reduction design goals by meeting or exceeding the reasonableness factor.

Cost Effective Noise Barrier: A noise barrier analyzed for environmental clearance with a preliminary construction cost that is not more than three percent above the allowable cost per benefited receptor unit (CPBU) of $47,489 (year 2019), assuming a $45.00 per square foot noise barrier construction cost.

Benefited Receptor: A receptor that receives a 5 dB(A) or greater traffic noise reduction as a result of a proposed noise barrier.

Design Year Reduction Goal: Design year reduction goal by 10 dB(A) for at least one benefited receptor and provide at least a 7 dB(A) reduction for 50 percent or more of the benefited receptor sites.

Permitted Development: Any presently undeveloped lands that have received a building permit from the local township or city.

3.4. Highway Traffic Induced Vibration

Automobiles, trucks and buses do not typically generate enough vibration to be a concern, except under specific situations, such as pavement irregularities adjacent to sensitive locations. Studies to assess the impact of operational traffic induced vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. Normal living activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic. There are no Federal requirements directed specifically to highway traffic induced vibration.

4. Noise Analysis

4.1. FHWA Traffic Noise Model (TNM)

TNM version 2.5 is FHWA's computer model for highway traffic noise prediction and analysis. The following parameters are used in this model to calculate an hourly L_{eq}(1h) at a specific receiver location:

- Distance between roadway and receiver
- Relative elevations of roadway and receiver
- Hourly traffic volume in light-duty (two axles, four tires), medium-duty (two axles, six tires), and heavy-duty (three or more axles) vehicles
- Vehicle speed
- Ground absorption
- Topographic features, including retaining walls and berms

Highway noise sources have been divided into five types of vehicles; automobiles, medium trucks, heavy trucks, Buses and Motorcycles. Each vehicle type is defined as follows[3]:

- Automobiles – all vehicles with two axles and four tires, includes passenger vehicles and light trucks, less than 10,000 pounds
- Medium trucks – all vehicles having two axles and six tires, vehicle weight between 10,000 and 26,000 pounds
- Heavy trucks – all vehicles having three or more axles, vehicle weight greater than 26,000 pounds
- Buses – all vehicles designed to carry more than nine passengers
- Motorcycles – all vehicles with two or three tires and an open-air driver/passenger compartment

Noise levels produced by highway vehicles can be attributed to three major categories:

- Running gear and accessories (tires, drive train, fan and other auxiliary equipment)
- Engine (intake and exhaust noise, radiation from engine casing)
- Aerodynamic and body noise

[3] *G.S. Anderson, C.S.Y. Lee, G.G. Fleming and C. Menge, "FHWA Traffic Noise Model®, Version 1.0 User's Guide", Federal Highway Administration, January 1998, p.60.*

4.2. Analysis

4.2.1. Land Use and Field Measurement Levels

The I-375 noise analysis study area includes residential, places of worship, school, hotel, retail, commercial, industrial and recreational areas. The criteria stated in Table 3 helps to determine if the proposed project will produce noise levels that approach or exceed the NAC throughout the corridor.

The project corridor was divided into common noise environments (CNE) to facilitate the analysis of highway noise of areas of like land uses. The CNE listed boundaries are identified in Table 4 and illustrated in Appendix A.

Table 4. Study Area Common Noise Environments

CNE	Site Description
A	Residential, place of worship, hotel and office uses bounded approximately by W Fisher Service Drive, Woodward Avenue, Adelaide Street and Brush Street.
B	Vacant land located adjacent to the southbound I-75 off-ramp to westbound I-75. A vacant building is the only structure remaining in CNE B.
C	Brewster Homes (including two playgrounds) bounded approximately by the S I-75 Service Drive, Alfred Street, St. Antione Street and Mack Avenue.
D	Restaurant, residential, place of worship, nonprofit institutional structure, picnic table and industrial uses bounded by Chrysler Service Drive, Rivard Street and Mack Avenue.
E	Industrial and restaurant uses on Russell Street between E Fisher Service Drive and Adelaide Street.
F	Retail facilities, vacant building, place of worship and residential uses bounded by Dequindre Cut Greenway, Gratiot Avenue, Orleans Street and Antietam Avenue.
G	Place of worship, residential and retail facility uses east of Gratiot Avenue between Riopelle Street and Rivard Street.
H	Retail facility, offices, a place of worship and picnic table uses bounded by Gratiot Avenue and the I-375 Service Drive.
I	Industrial, office, vacant building, recreational and residential uses bounded by Antietam Avenue, Rivard Street, I-375 Service Drive, and Larned Street.
J	Office, place of worship and residential uses bounded by Larned Street, Rivard Street, I-375 Service drive and Franklin Street.
K	School, place of worship, restaurant, and office uses bounded by S. I-375 Service Drive, Congress Street, Beaubien Street and Jefferson Avenue.
L	Office, public institutional structure, place of worship active sport area, residential and park uses bounded by Gratiot Avenue, S. I-75 Service Chrysler Service Drive, Congress Street, and St. Antoine Street.
M	Place of worship use bounded by Church bounded by N. I-75 Service Drive, Brush Street, Columbia Street and Woodward Avenue.

Existing noise level measurements were conducted on Oct. 26, 2017, at 13 representative sites in the project corridor. A 15-minute measurement was taken at each site. The measurements were made in accordance with MDOT guidelines using an integrating sound level analyzer meeting ANSI and IEC Type 1 specifications. Sound level analyzer calibration certification documentation is provided in Appendix B. Traffic classification counts were taken concurrently with the noise measurements. The locations of the field measurement sites are presented in Appendix A. The data collected at the 13 sites are presented in Table 5.

Table 5. Measured Existing Noise Levels

Field Site #	Site Description	Date	Start Time	Duration	Traffic[1] Direction	Auto	Med Truck	Heavy Truck	Buses	MC	Speed mph	Noise Level, dB(A) Leq(h)
1	Garden Lofts at Woodward Place (residential). 14 feet se of mid-point of building, on edge of sidewalk along north side of E. Fisher Service Dr.	10/26/17	8:53 am	15 min	E. Fisher Service Dr. (southbound)	17	0	0	0	0	35	71.8
					I-75 Fisher Fwy NB @ John R	662	23	85	1	0	50	
					I-75 Fisher Fwy SB @ John R	558	18	49	9	0	60	
2	Vacant land. 233 feet southeast of the west side of St. Antoine St. On back edge of sidewalk on north side of Chrysler Service Dr. East of Winder St.	10/26/17	9:50 am	15 min	Chrysler Service Dr. (southbound)	8	0	1	0	0	35	61.3
					I-75 Fisher Fwy NB @ John R	582	19	67	5	1	60	
					I-75 Fisher Fwy SB @ John R	377	22	41	4	0	60	
3	Brewster Homes (residential). 520 feet southeast of Mack Ave. and I-75 Frontage Rd. corner. On back of sidewalk (west side) where sidewalk expands from 10 feet to 16 feet.	10/26/17	10:40 am	15 min	I-75 Frontage Rd. (southbound)	33	4	2	0	0	45	67.4
					I-75 Chrysler Fwy NB @ Mack	536	34	58	1	0	60	
					I-75 Chrysler Fwy NB @ Mack	557	10	35	2	0	60	
4	Sacred Heart Church (place of worship). Back of sidewalk on east side of Chrysler Service Dr., in line with southeastern edge of Sacred Heart parking lot.	10/26/17	11:02 am	15 min	Chrysler Service Dr. (northbound)	14	3	2	0	0	35	72.2
					I-75 Chrysler Fwy NB @ Mack	585	20	70	2	1	60	
					I-75 Chrysler Fwy NB @ Mack	562	7	42	1	0	60	
5	Supino Pizzeria (retail). On metal tree grate in front of Suprino Pizzeria. 4 feet west of Russell St. and 30 feet north of E. Fisher Service Dr.	10/26/17	11:41 am	15 min	Russell St. NB	66	1	0	1	0	15	62.6
					Russell St. SB	41	0	0	0	0	15	
					I-75 Fisher Fwy NB @ Russell	206	3	11	1	0	50	
					I-75 Fisher Fwy SB @ Russell	162	4	4	1	0	50	
6	St. Joseph Oratory (place of worship). At the northwest corner of the St. Joseph surface parking lot on the corner of Jay St. and Orleans St. Back of sidewalk on west side of Orleans St. 33 feet southeast of Gratiot Ave.	10/26/17	12:08 pm	15 min	Gratiot Ave. NB	75	10	0	2	0	35	68.8
					Gratiot Ave. SB	60	2	1	0	0	35	
					I-75 Fisher Fwy NB @ Ped Bridge	180	7	12	0	0	45	
					I-75 Fisher Fwy SB @ Ped Bridge	183	3	8	0	0	50	
7	St. John St. Luke United Church (place of worship). Back of sidewalk on southeast corner of Russell St. and Gratiot Ave. At base of traffic signal pole.	10/26/17	12:42 pm	15 min	Russell St. west of Gratiot Ave.	60	0	2	0	0	20	66.2
					Russell St. east of Gratiot Ave.	9	1	0	0	0	20	
					Gratiot Ave. NB	81	0	2	1	0	35	
					Gratiot Ave. SB	85	4	1	3	0	35	

Table 5. Measured Existing Noise Levels Continued

Field Site #	Site Description	Date	Start Time	Duration	Traffic[1]							Noise Level, dB(A) Leq(h)
					Direction	Auto	Med Truck	Heavy Truck	Buses	MC	Speed mph	
8	Historic Trinity Lutheran Church (place of worship). Back of curb in line with southwest side of church.	10/26/17	12:54 pm	15 min	Gratiot Ave. NB	91	0	1	1	0	35	67.3
					Gratiot Ave. SB	112	0	1	1	0	35	
9	Jean Rivard Apartments (residential). Back of curb on east side of Chrysler Dr. NB., at southern end of parking lot entrance (~299 feet southeast of Lafayette Ave.).	10/26/17	2:11 pm	15 min	Chrysler Dr. (northbound)	7	0	0	0	0	30	62.3
					I-375 NB @ Lafayette	326	8	2	3	0	60	
					I-375 SB @ Lafayette	198	2	3	1	0	60	
10	Christ Church (place of worship). Edge of sidewalk (south side of E. Jefferson Ave.) on western edge of parking lot. 2 feet north of Christ Church digital sign.	10/26/17	3:03 pm	15 min	E. Jefferson (eastbound)	271	3	3	4	0	25	69.8
					I-375 NB @ Larned	752	4	12	0	0	50	
					I-375 SB @ Larned	60	1	2	0	0	50	
11	St. Peter & Paul Jesuit Church (place of worship). In line with front of church. 15 feet west of southwest corner.	10/26/17	3:23 pm	15 min	E. Jefferson (westbound)	248	6	2	3	0	40	67.8
					I-375 NB @ Larned	161	0	1	1	0	50	
					I-375 SB @ Larned	256	0	4	8	0	50	
12	Holy Family Church (place of worship). 35 feet north of north corner of church. Back of sidewalk (west side) and north point of service drive to church.	10/26/17	2:31 pm	15 min	Chrysler Service Dr. (southbound)	24	0	0	0	0	30	62.3
					I-375 NB @ Lafayette	121	1	1	1	0	60	
					I-375 SB @ Lafayette	213	3	1	3	0	60	
13	St. John's Church (place of worship). 52 feet northeast of the northeast corner of the church. On back of sidewalk at the corner of E. Fisher Service Dr. and Witherell St.	10/26/17	9:22 am	15 min	E. Fisher Service Dr. (northbound)	30	1	0	0	0	30	72.3
					I-75 Fisher Fwy NB @ John R	641	19	115	8	1	60	
					I-75 Fisher Fwy SB @ John R	439	13	44	3	0	60	

Source: HNTB Corporation, October 26, 2017

Notes: 1) Autos defined as 2-axle, 4-tire; medium trucks as 2-axle, 6-tire; heavy trucks as 3 or more axles; buses as vehicles designed to carry more than 9 passengers; and motorcycles as vehicles with two or three axles. 2) Duration of measurement was 15 minutes. However, half of the data was removed due to lawn mower interference during portions of the measurement.

4.2.2. Field Measurements versus Modeled Noise Levels

TNM was used to validate the predicted noise levels through comparison with the measured and predicted noise levels. Traffic was counted and classified concurrently during the noise measurement by vehicle type: cars, medium trucks, heavy trucks, and buses. Comparing the modeled noise levels to the measured noise levels validates the noise model for use on the specific project. Traffic counts were taken concurrently with the noise measurements at all the sites and used in the model. All the modeled data compared within three dB(A) of the measured levels, which satisfies the MDOT requirement for validating noise measurements. The site by site comparison is presented in Table 6.

Table 6. Comparison of Measured and Modeled Noise Levels

Field Site	Appendix A Map Page#	Measured Noise Level (dB(A) L_{eq}(1h))	Modeled Noise Level (dB(A) L_{eq}(1h))	Difference (dB(A) L_{eq}(1h))
FS-1	2, 3	71.8	69.5	-2.3
FS-2	2, 3, 6, 7	61.3	63.9	2.6
FS-3	4, 5	67.4	70.3	2.9
FS-4	4, 5	72.2	71.8	-0.4
FS-5	8, 9	62.6	62.3	-0.3
FS-6	8, 9	68.8	71.2	2.4
FS-7	8, 9	66.2	65.1	-1.1
FS-8	8, 9	67.3	64.7	-2.6
FS-9	10, 11, 12	62.3	62.0	-0.3
FS-10	13, 14, 15	69.8	69.3	-0.5
FS-11	13, 14, 15	67.8	68.5	0.7
FS-12	10, 11, 12	62.3	63.6	1.3
FS-13	2, 3	72.3	69.3	-3.0

Source: HNTB Corporation, December 2017

4.2.3. Traffic Noise Levels and Noise Impact Analysis

FHWA's TNM Version 2.5, was used to model existing (2017) and design year (2040) worst hourly traffic noise levels within the I-375 noise analysis study area.

Modeled receptors were placed in accordance with FHWA requirements in areas with evidence of frequent human use. This area is typically located between the highway and any structure, such as a residence. MDOT considers this area within 35 feet from the back of a residence as the backyard area. Balconies in apartment buildings are included when the balcony faces the highway and there are no ground-level areas of frequent human use between the highway and the building. Second floor balconies are included in noise impact and abatement analyses.

Balconies on floors higher than the second floor may be included depending on their relationship to the level of the roadway.

FHWA's Recommended Best Practices for the Use of the FHWA Traffic Noise Model (TNM) states, 'The loudest hour of the day is dependent upon traffic conditions – vehicle volume, operating speed, and number of trucks – that combine to produce the highest hourly noise levels adjacent to the highway corridor. According to FHWA guidance, the "worst hourly traffic noise impact" usually occurs at a time when truck volumes and vehicle speeds are the greatest, typically when traffic is free flowing and at or near LOS C conditions. Based on this guidance, the use of traffic data that are based on LOS was the preferred approach.'

Five hours of existing traffic data and speeds, with spot data on vehicle mix, were used to determine the loudest hour in this analysis. All five hours of traffic data were modeled at various locations in the study area. The loudest hour was not uniform throughout the entire corridor. Therefore, the range in noise levels across the five hours and the number of receptors above the NAC were used to determine that the 4pm to 5pm timeframe was the loudest hour.

Future alignments and changes in speed limit for the I-375 boulevard corridor Preferred Alternative were used for the design year analysis.

A total 221 noise receivers were modeled; these noise receivers represented 203 receptors. Each receiver represents a single point in the noise model and are representative of the noise receptors being analyzed. One receiver can represent multiple receptors in the noise analysis. These receivers were selected to model noise impacts as shown in Appendix A. The existing and design year noise levels at the modeled sites are presented in Table 7.

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h)

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
CNE A								
A1.2	**RESIDENTIAL**	B	67	1	68.2	69.1	0.9	**Yes**
A2.2	RESIDENTIAL	B	67	1	60.9	61.7	0.8	No
A3.2	RESIDENTIAL	B	67	1	59.4	60.0	0.6	No
A4.2	RESIDENTIAL	B	67	1	56.8	56.7	-0.1	No
A5.2	RESIDENTIAL	B	67	1	56.1	55.9	-0.2	No
A6.2	RESIDENTIAL	B	67	1	53.5	53.3	-0.2	No
A7.2	**RESIDENTIAL**	B	67	1	68.3	69.0	0.7	**Yes**
A8.2	**RESIDENTIAL**	B	67	1	71.0	71.8	0.8	**Yes**
A9.2	**RESIDENTIAL**	B	67	1	70.9	71.9	1.0	**Yes**
A10.2	**RESIDENTIAL**	B	67	1	67.7	69.0	1.3	**Yes**
A11.2	RESIDENTIAL	B	67	1	56.5	56.1	-0.4	No
A12.2	RESIDENTIAL	B	67	2	55.7	55.8	0.1	No
A13.2	RESIDENTIAL	B	67	1	55.0	55.0	0.0	No
A15.2	RESIDENTIAL	B	67	1	55.4	55.5	0.1	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
A16.2	RESIDENTIAL	B	67	2	56.6	57.0	0.4	No
A17.2	RESIDENTIAL	B	67	1	59.5	59.8	0.3	No
A18.2	RESIDENTIAL	B	67	1	49.8	48.8	-1.0	No
A19.2	RESIDENTIAL	B	67	1	46.3	43.9	-2.4	No
A20.2	RESIDENTIAL	B	67	1	46.1	43.6	-2.5	No
A21.2	RESIDENTIAL	B	67	1	46.6	44.7	-1.9	No
A22.2	RESIDENTIAL	B	67	1	47.9	47.2	-0.7	No
A23.2	RESIDENTIAL	B	67	1	53.3	53.4	0.1	No
A24	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	42.0	42.8	0.8	No
A25	RESIDENTIAL	B	67	1	62.2	63.1	0.9	No
A26	HOTEL	E	72	1	63.3	64.1	0.8	No
A27.2	RESIDENTIAL	B	67	1	56.1	55.8	-0.3	No
A28.2	RESIDENTIAL	B	67	1	49.3	49.0	-0.3	No
A29.2	RESIDENTIAL	B	67	1	49.1	48.8	-0.3	No
A30.2	RESIDENTIAL	B	67	1	48.6	48.3	-0.3	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
A31.2	RESIDENTIAL	B	67	1	48.4	48.1	-0.3	No
A32.2	RESIDENTIAL	B	67	1	47.8	47.6	-0.2	No
A33.2	RESIDENTIAL	B	67	1	42.2	41.6	-0.6	No
A34.2	RESIDENTIAL	B	67	1	42.2	41.7	-0.5	No
A35.2	RESIDENTIAL	B	67	1	42.3	41.8	-0.5	No
A36.2	RESIDENTIAL	B	67	1	42.6	41.7	-0.9	No
A37.2	RESIDENTIAL	B	67	1	42.5	41.4	-1.1	No
A38.2	RESIDENTIAL	B	67	1	44.3	44.2	-0.1	No
A39.2	RESIDENTIAL	B	67	1	49.4	48.9	-0.5	No
A40.2	RESIDENTIAL	B	67	1	43.1	42.6	-0.5	No
A41.2	RESIDENTIAL	B	67	1	42.3	41.7	-0.6	No
A42.2	RESIDENTIAL	B	67	1	43.2	42.7	-0.5	No
A43.2	RESIDENTIAL	B	67	1	47.0	46.7	-0.3	No
A44.2	RESIDENTIAL	B	67	1	49.1	49.0	-0.1	No
A45	HOTEL	E	72	1	42.3	42.3	0.0	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
A46.2	RESIDENTIAL	B	67	1	43.5	42.4	-1.1	No
A47.2	RESIDENTIAL	B	67	1	43.1	42.7	-0.4	No
A48.2	RESIDENTIAL	B	67	1	45.8	46.0	0.2	No
A49.2	RESIDENTIAL	B	67	1	46.4	46.2	-0.2	No
A50.2	RESIDENTIAL	B	67	1	47.2	47.0	-0.2	No
A51.2	RESIDENTIAL	B	67	1	48.1	48.3	0.2	No
A52.2	RESIDENTIAL	B	67	1	55.4	55.7	0.3	No
A53.2	RESIDENTIAL	B	67	1	51.8	52.3	0.5	No
A54.2	RESIDENTIAL	B	67	1	51.5	51.9	0.4	No
A55.2	RESIDENTIAL	B	67	1	50.5	51.0	0.5	No
A56.2	RESIDENTIAL	B	67	1	50.0	50.5	0.5	No
A57.2	RESIDENTIAL	B	67	1	48.7	49.2	0.5	No
A58	RESIDENTIAL	B	67	1	42.6	41.9	-0.7	No
A59	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
CNE B								
B1	VACANT BUILDING	G	-	-	-	-	-	-
CNE C								
C1	RESIDENTIAL	B	67	1	64.3	62.3	-2.0	No
C2	RESIDENTIAL	B	67	1	64.0	62.0	-2.0	No
C3	RESIDENTIAL	B	67	1	63.9	61.9	-2.0	No
C4	RESIDENTIAL	B	67	1	63.9	61.8	-2.1	No
C5	RESIDENTIAL	B	67	1	64.9	61.4	-3.5	No
C6	RESIDENTIAL	B	67	1	65.2	61.6	-3.6	No
C7	RESIDENTIAL	B	67	1	65.2	61.7	-3.5	No
C8	RESIDENTIAL	B	67	1	65.2	61.8	-3.4	No
C9	RESIDENTIAL	B	67	1	64.9	63.3	-1.6	No
C10	RESIDENTIAL	B	67	1	65.1	63.8	-1.3	No
C11	RESIDENTIAL	B	67	1	65.1	64.1	-1.0	No
C12	RESIDENTIAL	B	67	1	64.9	64.2	-0.7	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C13	**RESIDENTIAL**	B	67	1	68.5	66.2	-2.3	**Yes**
C14	**RESIDENTIAL**	B	67	1	68.9	66.5	-2.4	**Yes**
C15	**RESIDENTIAL**	B	67	1	68.6	66.7	-1.9	**Yes**
C16	**RESIDENTIAL**	B	67	1	68.3	66.7	-1.6	**Yes**
C17	**RESIDENTIAL**	B	67	1	69.1	67.3	-1.8	**Yes**
C18	**RESIDENTIAL**	B	67	1	68.7	67.7	-1.0	**Yes**
C19	**RESIDENTIAL**	B	67	1	68.2	67.8	-0.4	**Yes**
C20	**RESIDENTIAL**	B	67	1	68.1	67.8	-0.3	**Yes**
C21	RESIDENTIAL	B	67	1	63.2	59.9	-3.3	No
C22	RESIDENTIAL	B	67	1	62.5	59.0	-3.5	No
C23	RESIDENTIAL	B	67	1	62.2	58.6	-3.6	No
C24	RESIDENTIAL	B	67	1	61.9	58.4	-3.5	No
C25	RESIDENTIAL	B	67	1	59.8	56.0	-3.8	No
C26	RESIDENTIAL	B	67	1	59.6	55.6	-4.0	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C27	RESIDENTIAL	B	67	1	59.4	55.4	-4.0	No
C28	RESIDENTIAL	B	67	1	59.2	55.1	-4.1	No
C29	RESIDENTIAL	B	67	1	59.2	56.2	-3.0	No
C30	RESIDENTIAL	B	67	1	56.7	53.5	-3.2	No
C31	RESIDENTIAL	B	67	1	53.3	50.3	-3.0	No
C32	RESIDENTIAL	B	67	1	43.7	49.0	5.3	No
C33	RESIDENTIAL	B	67	1	59.4	56.7	-2.7	No
C34	RESIDENTIAL	B	67	1	56.0	53.1	-2.9	No
C35	RESIDENTIAL	B	67	1	53.2	50.0	-3.2	No
C36	RESIDENTIAL	B	67	1	52.0	49.1	-2.9	No
C37	RESIDENTIAL	B	67	1	51.8	50.3	-1.5	No
C38	RESIDENTIAL	B	67	1	50.4	48.5	-1.9	No
C39	RESIDENTIAL	B	67	1	47.2	45.7	-1.5	No
C40	RESIDENTIAL	B	67	1	46.0	45.1	-0.9	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C41	RESIDENTIAL	B	67	1	52.2	50.4	-1.8	No
C42	RESIDENTIAL	B	67	1	48.4	46.9	-1.5	No
C43	RESIDENTIAL	B	67	1	47.3	45.8	-1.5	No
C44	RESIDENTIAL	B	67	1	47.2	45.6	-1.6	No
C45	RESIDENTIAL	B	67	1	47.4	46.0	-1.4	No
C46	RESIDENTIAL	B	67	1	46.3	44.9	-1.4	No
C47	PLAYGROUND	C	67	1	50.7	49.0	-1.7	No
C48	RESIDENTIAL	B	67	1	61.9	59.4	-2.5	No
C49	RESIDENTIAL	B	67	1	59.0	56.5	-2.5	No
C50	RESIDENTIAL	B	67	1	55.7	52.5	-3.2	No
C51	RESIDENTIAL	B	67	1	54.3	51.0	-3.3	No
C52	RESIDENTIAL	B	67	1	52.3	50.7	-1.6	No
C53	RESIDENTIAL	B	67	1	49.9	48.6	-1.3	No
C54	RESIDENTIAL	B	67	1	48.4	46.6	-1.8	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C55	RESIDENTIAL	B	67	1	48.0	46.3	-1.7	No
C56	RESIDENTIAL	B	67	1	47.3	45.9	-1.4	No
C57	RESIDENTIAL	B	67	1	47.0	45.7	-1.3	No
C58	RESIDENTIAL	B	67	1	62.1	59.4	-2.7	No
C59	RESIDENTIAL	B	67	1	59.0	55.0	-4.0	No
C60	RESIDENTIAL	B	67	1	55.3	52.1	-3.2	No
C61	RESIDENTIAL	B	67	1	53.8	51.0	-2.8	No
C62	RESIDENTIAL	B	67	1	51.6	50.3	-1.3	No
C63	RESIDENTIAL	B	67	1	50.1	48.5	-1.6	No
C64	RESIDENTIAL	B	67	1	49.3	47.4	-1.9	No
C65	RESIDENTIAL	B	67	1	49.0	47.1	-1.9	No
C66	RESIDENTIAL	B	67	1	48.0	46.5	-1.5	No
C67	RESIDENTIAL	B	67	1	47.6	46.3	-1.3	No
C68	RESIDENTIAL	B	67	1	46.1	44.9	-1.2	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C69	RESIDENTIAL	B	67	1	44.3	41.8	-2.5	No
C70	RESIDENTIAL	B	67	1	44.0	41.9	-2.1	No
C71	RESIDENTIAL	B	67	1	45.8	44.4	-1.4	No
C72	PLAYGROUND	C	67	1	50.1	49.2	-0.9	No
C73	RESIDENTIAL	B	67	1	52.3	51.7	-0.6	No
C74	RESIDENTIAL	B	67	1	48.5	48.7	0.2	No
C75	RESIDENTIAL	B	67	1	47.3	47.8	0.5	No
C76	RESIDENTIAL	B	67	1	47.1	47.9	0.8	No
C77	RESIDENTIAL	B	67	1	46.8	47.7	0.9	No
C78	RESIDENTIAL	B	67	1	47.0	47.6	0.6	No
C79	RESIDENTIAL	B	67	1	61.2	62.1	0.9	No
C80	RESIDENTIAL	B	67	1	58.0	59.9	1.9	No
C81	RESIDENTIAL	B	67	1	54.4	56.6	2.2	No
C82	RESIDENTIAL	B	67	1	53.3	55.2	1.9	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C83	RESIDENTIAL	B	67	1	52.6	52.7	0.1	No
C84	RESIDENTIAL	B	67	1	51.6	51.7	0.1	No
C85	RESIDENTIAL	B	67	1	50.4	50.7	0.3	No
C86	RESIDENTIAL	B	67	1	49.6	49.7	0.1	No
C87	RESIDENTIAL	B	67	1	61.8	62.5	0.7	No
C88	RESIDENTIAL	B	67	1	59.1	59.4	0.3	No
C89	RESIDENTIAL	B	67	1	55.1	56.6	1.5	No
C90	RESIDENTIAL	B	67	1	53.5	55.5	2.0	No
C91	RESIDENTIAL	B	67	1	63.1	62.1	-1.0	No
C92	RESIDENTIAL	B	67	1	62.6	61.6	-1.0	No
C93	RESIDENTIAL	B	67	1	62.4	61.4	-1.0	No
C94	RESIDENTIAL	B	67	1	61.9	60.9	-1.0	No
C95	RESIDENTIAL	B	67	1	59.2	58.6	-0.6	No
C96	RESIDENTIAL	B	67	1	59.1	58.3	-0.8	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
C97	RESIDENTIAL	B	67	1	58.9	58.1	-0.8	No
C98	RESIDENTIAL	B	67	1	58.9	58.0	-0.9	No
CNE D								
D1	RESTAURANT (NO EXTERIOR USE)	E	72	-	-	-	-	-
D2	RESIDENTIAL	B	67	1	66.0	64.0	-2.0	No
D3	PLACE OF WORSHIP (EXTERIOR USE)	C	67	1	59.2	58.8	-0.4	No
D4	NONPROFIT INSTITUTIONAL STRUCTURE (NO EXTERIOR USE)	D[2]	52	1	48.7	44.3	-4.4	No
D5	INDUSTRIAL	F	–	-	-	-	-	-
D6	INDUSTRIAL	F	–	-	-	-	-	-
D7	INDUSTRIAL	F	–	-	-	-	-	-
CNE E								
E1	INDUSTRIAL	F	–	-	-	-	-	-
E2	RESTAURANT (EXTERIOR USE)	E	72	1	60.1	61.9	1.8	No
E3	RESTAURANT (EXTERIOR USE)	E	72	1	56.4	56.9	0.5	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
CNE F								
F1	RETAIL FACILITY	F	–	-	-	-	-	-
F2	VACANT BUILDING	G	-	-	-	-	-	-
F3	PLACE OF WORSHIP	C	67	1	59.4	58.8	-0.6	No
F4	RESIDENTIAL	B	67	1	59.5	58.6	-0.9	No
CNE G								
G1	PLACE OF WORSHIP	C	67	1	61.6	61.6	0.0	No
G2	RESIDENTIAL	B	67	1	56.3	56.3	0.0	No
G3	RETAIL FACILITY	F	-	-	-	-	-	-
G4	RETAIL FACILITY	F	-	-	-	-	-	-
G5	RESIDENTIAL	B	67	1	56.2	55.7	-0.5	No
CNE H								
H1	RETAIL FACILITY	F	-	-	-	-	-	-
H2	RETAIL FACILITY	F	-	-	-	-	-	-
H3	OFFICE (EXTERIOR USE)	E	72	1	61.1	61.4	0.3	No
H4	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	41.1	41.6	0.5	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
H5	OFFICE (EXTERIOR USE)	E	72	1	56.4	56.2	-0.2	No
H6	OFFICE (EXTERIOR USE)	C	67	1	61.8	62.1	0.3	No
CNE I								
I1	INDUSTRIAL	F	-	-		65.6	-	-
I2	OFFICE (EXTERIOR USE)	E	72	1	62.2	62.0	-0.2	No
I3	VACANT BUILDING	G	-	-	-	-	-	-
I4	VACANT SCHOOL	G	-	-	-	-	-	-
I5	RESIDENTIAL	B	67	1	66.2	61.3	-4.9	No
I6	RESIDENTIAL	B	67	1	66.2	61.2	-5.0	No
I7	RESIDENTIAL	B	67	1	66.3	61.2	-5.1	No
I8	RESIDENTIAL	B	67	1	64.7	59.7	-5.0	No
I9	RESIDENTIAL	B	67	1	67.3	61.1	-6.2	No
I10	RECREATION AREA	C	67	1	50.3	50.9	0.6	No
I11.4	RESIDENTIAL	B	67	1	58.2	56.0	-2.2	No
I12	RECREATION AREA	C	67	1	50.8	46.8	-4.0	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
I13.4	RESIDENTIAL	B	67	1	61.3	57.2	-4.1	No
I14	RECREATION AREA	C	67	1	56.9	57.2	0.3	No
I15.4	RESIDENTIAL	B	67	1	47.7	46.7	-1.0	No
I16.4	RESIDENTIAL	B	67	1	57.4	56.0	-1.4	No
I17.4	RESIDENTIAL	B	67	1	52.6	53.1	0.5	No
I18.4	RESIDENTIAL	B	67	1	53.1	53.3	0.2	No
I19.4	RESIDENTIAL	B	67	1	55.1	54.9	-0.2	No
CNE J								
J1	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
J2	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
J3	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
J4	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	41.7	42.7	1.0	No
J5	RESIDENTIAL	B	67	1	52.8	54.0	1.2	No
CNE K								
K1	SCHOOL (NO EXTERIOR USE)	D[2]	52	1	46.0	43.3	-2.7	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
K2	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	46.0	42.9	-3.1	No
K3	RESTAURANT (NO EXTERIOR USE)	E	72	-	-	-	-	-
K4	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
K5	RESTAURANT (EXTERIOR USE)	E	72	1	69.8	66.0	-3.8	No
CNE L								
L1	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
L2	PUBLIC INSTITUTIONAL STRUCTURE (NO EXTERIOR USE)	D[2]	52	1	40.5	43.6	3.1	No
L3	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	36.1	39.8	3.7	No
L4	OFFICE (NO EXTERIOR USE)	E	72	-	-	-	-	-
L5	PLACE OF WORSHIP (EXTERIOR USE)	C	67	1	63.2	64.9	1.7	No
L6	ACTIVE SPORT AREA	C	67	1	56.7	54.6	-2.1	No
L7	RESIDENTIAL	B	67	1	52.9	56.5	3.6	No
L8	PLACE OF WORSHIP	C	67	1	49.8	51.4	1.6	No
L9	PARK	C	67	1	54.7	52.5	-2.2	No

Table 7. Impact Analysis Results, dB(A) L_{eq}(1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)			
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative		
						NL	Change from Existing	Impact (Y/N)
CNE M								
M1	PLACE OF WORSHIP (NO EXTERIOR USE)	D[2]	52	1	42.8	41.8	-1.0	No
Boldface	indicates noise levels that approach, equal or exceed the NAC and create an impact.							
Receiver IDs with a decimal point followed by the number two (.2) indicate second-floor balconies. For example, A1.2, indicates a second-floor receiver. If there is not a decimal point, it is a first-floor receiver.								

Source: HNTB Corporation, April 2020

4.3. Impact Assessment

A traffic noise impact is defined as a future noise level that approaches[4] or exceeds the NAC; or a future noise level that creates a substantial noise increase over existing noise levels[5]. MDOT identifies a noise impact as a 10 dB(A) increase between the existing noise level to the design year predicted traffic noise level, or a design year build condition noise level that approaches, (equal to one dB(A) less than the NAC), or exceeds the NAC level for the future build condition.

For NAC D uses, FHWA guidance uses *Table 6: Building Noise Reduction Factors* to identify interior noise levels.[6] Nine noise receivers were modeled as NAC D (interior) land use because no observable exterior area of frequent human use was identified.

Predicted future design year (2040) noise levels adjacent to the proposed Preferred Alternative would approach or exceed the NAC at 13 receiver locations representing 13 residential receptors. The noise levels at these 13 impacted receptors would range from 66.0 to 72.0 dB(A) L_{eq}(h) in the future design year. The noise levels at these 13 impacted receptors already approach or exceed NAC in the existing year (2017) as well.

Changes in L_{eq} noise levels under the future Build condition for the Preferred Alternative will range from -6.2 to 5.3 dB(A) compared to existing conditions. Therefore, none of the predicted future noise levels would substantially exceed existing noise levels.

[4] *A noise level 'approaches' when the noise level is one dB(A) less than the NAC standard.*

[5] *Substantial Noise Increase: A 10 dB(A) or greater increase between the existing noise level and the design year predicted noise level.*

[6] *FHWA Noise Analysis and Abatement Guidelines, https://www.fhwa.dot.gov/Environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/polguide02.cfm*

5. Noise Abatement Measures

5.1. Federal and State Abatement Guidance

The Handbook has established the criteria for determining where noise abatement must be provided.[7]

The policy is summarized as follows:

- Where adverse noise impacts are expected to occur, noise abatement will be considered and will be implemented if found feasible and reasonable for existing developments, and future developments that were approved before the date of public knowledge of the project. Approved means that a building permit has been received. After the date of public knowledge, MDOT is not responsible for providing noise abatement for new developments. The date of public knowledge is the date on which the project's environmental documentation (e.g., the date of the ROD for an EIS) is approved. The provision of noise abatement for new developments becomes the responsibility of local governments and private developers.
- All sites will be considered; however, it is generally known that NAC E sites prefer that there be no interference with the view to their establishments. Only residential land use that is converted or zoned commercial before the Date of Public Knowledge will be given the option on abatement.
- Feasible – This refers to engineering considerations such as: constructability of a noise barrier on the existing topography; achievement of substantial noise reductions; the presence of other noise sources in the area; and the ability to maintain access, drainage, safety, utilities in the area. While every reasonable effort should be made to obtain a substantial noise reduction, a noise abatement measure is not feasible if it cannot achieve at least a 5 dB(A) noise reduction for 75 percent of impacted receivers during design year traffic noise.
- Reasonable – Noise mitigation will be considered reasonable if:
    - During the environmental clearance phase, the preliminary cost per benefiting unit is less than three percent above allowable per benefiting unit level ($47,489 in 2019 dollars);
    - The public viewpoint reasonableness factor for the environmental clearance phase receives generally positive comments from the benefiting units; and
    - The noise barrier provides a design year traffic noise reduction of 10 dB(A) for at least one benefited unit and at least a seven dB(A) for 50 percent or more of the benefited units.

23 CFR 772.15(c) lists abatement alternatives. The following list summarizes abatement alternatives examined for this project:

1) Construction of noise barriers including acquisition of property rights, either within or outside the highway right-of-way;

[7] *The Handbook and other MDOT resources can be found at https://www.michigan.gov/mdot/0,4616,7-151-9621_11041_25846---,00.html.*

2) Traffic management measures;
3) Alteration of horizontal and vertical alignments;
4) Acquisition of real property or interests therein to serve as a buffer zone to preempt development;
5) Noise insulation of Activity Category D land use facilities listed in Table 3.

Upon review of the listed abatement alternatives, it has been determined that:

- Reductions of speed limits, although acoustically beneficial, are seldom practical unless the design speed of the proposed roadway is also reduced;
- Restriction or prohibition of trucks is extremely undesirable;
- Design criteria, project limits, and the existing alignment and land use preclude substantial horizontal and vertical alignment shifts that could potentially produce noticeable changes in the projected acoustical environment;
- Cost restrictions typically prohibit the acquisition of property
- The construction of noise berms is neither feasible nor reasonable because of the amount of space that would be required; and
- Noise impact is not predicted at Activity Category D land uses.

Therefore, the construction of noise barriers within the existing right-of-way was the only mitigation measure that received in-depth evaluation.

5.2. Abatement Analysis

Abatement analysis was completed for two noise barriers. At a minimum, the Handbook requires that noise barriers be analyzed as a noise abatement measure. To satisfy this requirement, noise barriers have been evaluated for CNE areas with impacted noise receptors as a part of this noise study. Noise barrier locations are shown in Appendix A.

Based on the future design year noise levels, two noise barrier adjacent to residential land use were modeled:

- Noise Barrier 1 (NB1) – On the west side of I-75 between Wilkins Street and Mack Avenue, designed to mitigate the noise impact from the Preferred Alternative for residences in Brewster Homes along the I-75 Frontage Road. NB1 is located on Figure 4.3 in Appendix A.
- Noise Barrier 2 (NB2) – On the north side of I-75 between approximately 250 feet west of Woodward Avenue to John R Street, designed to mitigate noise impact for second-floor residential balconies along the I-75 Frontage Road. NB2 is located on Figure 4.2 in Appendix A.

The results of the evaluated noise barriers for CNEs A and C, including future L_{eq}(1h) noise levels without and with a barrier, barrier length and height, and the noise reduction provided by the barrier, are presented in Table 8. Whether the barrier meets the design goal, total estimated cost (based on $45.00 per square foot), the number of benefited receptors (i.e., residential, commercial, or equivalent), the cost per benefited receptor, feasibility determination, and reasonableness determination for the barrier is presented in Table 9. The design year noise levels with and without the incorporation of a noise barrier for the modeled sites are presented in Table 10.

NB1 is not acoustically feasible, as none of the impacted receptors achieve a five dB(A) reduction. NB1 is not feasible due to the traffic noise from the frontage road and on ramp adjacent to the impacted receptors that would not be shielded by the barrier. There is not sufficient room or MDOT right-of-way between the proposed sidewalk and the residential property to place the noise barrier in an alternate location.

NB2 is acoustically feasible but not reasonable, as the estimated cost per benefited receptor ($84,706) would exceed the allowable cost per benefited receptor ($47,489 in 2019 dollars[8]). The total cost of this noise barrier includes an estimated additional cost of $132,450 for potential retaining wall updates (using an estimated $150 per linear foot). The retaining walls along I-75 from west of Woodward Avenue to Brush Street were constructed over 50 years ago and are not proposed to be moved or reconstructed as part of the project; therefore, noise barriers constructed immediately adjacent or attached to these retaining walls would likely require additional costs to update the retaining walls to withstand the dead load or wind loads from a noise barrer.

[8] Email with Mr. Thomas Hanf (MDOT), dated August 21, 2019.

Table 8. Evaluated Noise Barriers

Noise Barrier ID	Receiver IDs	Existing Noise Levels dB(A)	Future Noise Levels dB(A) W/O Barrier	Future Noise Levels dB(A) W/ Barrier	Noise Reduction dB(A)	Barrier Length (ft)	Barrier Height (ft)
NB1	C9-C20; C68-C98	44.0-69.1	41.8-67.8	41.4-66.1	0-2.2	561	30
NB2	A1.2-A58	42.0-71.0	41.4-72.0	39.7-65.7	0.2-10.9	883	27-30

Table 9. Noise Barrier Designs Analyzed

<table>
<tr><th rowspan="3">Barrier ID</th><th rowspan="3"># of Total Impacted</th><th colspan="6">Number of Attenuated Locations</th><th rowspan="3">Cost ($45 per sq. ft)</th><th rowspan="3">Cost/Benefit</th><th>Feasible[a]</th><th>Reasonable[b]</th></tr>
<tr><th colspan="3">≥ 5 dB(A)</th><th colspan="2">≥ 7 dB(A)</th><th rowspan="2">≥ 10 dB(A)</th><th rowspan="2">(Y/N)</th><th rowspan="2">(Y/N)</th></tr>
<tr><th># of Impacted</th><th>% of Total Impacted</th><th># of Total Benefitting</th><th>#</th><th>% of Benefited</th></tr>
<tr><td>NB 1</td><td>8</td><td>0</td><td>0%</td><td>0</td><td>0</td><td>0%</td><td>0</td><td>$757,440</td><td>NA</td><td>N[d]</td><td>N</td></tr>
<tr><td>NB 2</td><td>5</td><td>4</td><td>80%</td><td>15</td><td>6</td><td>40%</td><td>1</td><td>$1,270,590[c]</td><td>$84,706</td><td>Y</td><td>N</td></tr>
</table>

Source: HNTB analysis, 2020

[a]) MDOT requires that noise barriers achieve a 5 dB(A) reduction at 75 percent of the impacted receptors. If a barrier cannot achieve this, abatement is considered to not be acoustically feasible. Noise barrier abatement also might not be feasible due to constructability or safety constraints.

[b]) The design year attenuation requirement for Michigan is to provide a noise reduction of 10 dB(A) for at least one benefited receptor and at least a 7 dB(A) reduction for 50 percent or more of the benefited receptor sites.

[c]) Includes an estimated additional cost of $132,450 for potential retaining wall updates.

[d]) Noise barrier is not feasible because a 5 dB reduction was not achieved at 75 percent of the impacted receptors.

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h)

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
NB1											
C9	RESIDENTIAL	B	67	1	64.9	63.3	-1.6	No	62.0	1.3	No
C10	RESIDENTIAL	B	67	1	65.1	63.8	-1.3	No	62.5	1.3	No
C11	RESIDENTIAL	B	67	1	65.1	64.1	-1.0	No	62.7	1.4	No
C12	RESIDENTIAL	B	67	1	64.9	64.2	-0.7	No	62.7	1.5	No
C13	**RESIDENTIAL**	B	67	1	68.5	66.2	-2.3	**Yes**	**64.8**	1.4	No
C14	**RESIDENTIAL**	B	67	1	68.9	66.5	-2.4	**Yes**	**65.1**	1.4	No
C15	**RESIDENTIAL**	B	67	1	68.6	66.7	-1.9	**Yes**	**65.2**	1.5	No
C16	**RESIDENTIAL**	B	67	1	68.3	66.7	-1.6	**Yes**	**65.2**	1.5	No
C17	**RESIDENTIAL**	B	67	1	69.1	67.3	-1.8	**Yes**	**65.3**	2.0	No
C18	**RESIDENTIAL**	B	67	1	68.7	67.7	-1.0	**Yes**	**65.8**	1.9	No
C19	**RESIDENTIAL**	B	67	1	68.2	67.8	-0.4	**Yes**	**66.0**	1.8	No
C20	**RESIDENTIAL**	B	67	1	68.1	67.8	-0.3	**Yes**	**66.1**	1.7	No
C68	RESIDENTIAL	B	67	1	46.1	44.9	-1.2	No	44.4	0.5	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
C69	RESIDENTIAL	B	67	1	44.3	41.8	-2.5	No	41.4	0.4	No
C70	RESIDENTIAL	B	67	1	44.0	41.9	-2.1	No	41.4	0.5	No
C71	RESIDENTIAL	B	67	1	45.8	44.4	-1.4	No	43.4	1.0	No
C72	PLAYGROUND	C	67	1	50.1	49.2	-0.9	No	48.4	0.8	No
C73	RESIDENTIAL	B	67	1	52.3	51.7	-0.6	No	50.6	1.1	No
C74	RESIDENTIAL	B	67	1	48.5	48.7	0.2	No	47.3	1.4	No
C75	RESIDENTIAL	B	67	1	47.3	47.8	0.5	No	46.1	1.7	No
C76	RESIDENTIAL	B	67	1	47.1	47.9	0.8	No	46.1	1.8	No
C77	RESIDENTIAL	B	67	1	46.8	47.7	0.9	No	45.9	1.8	No
C78	RESIDENTIAL	B	67	1	47.0	47.6	0.6	No	45.9	1.7	No
C79	RESIDENTIAL	B	67	1	61.2	62.1	0.9	No	60.1	2.0	No
C80	RESIDENTIAL	B	67	1	58.0	59.9	1.9	No	57.7	2.2	No
C81	RESIDENTIAL	B	67	1	54.4	56.6	2.2	No	54.6	2.0	No
C82	RESIDENTIAL	B	67	1	53.3	55.2	1.9	No	53.3	1.9	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
C83	RESIDENTIAL	B	67	1	52.6	52.7	0.1	No	51.4	1.3	No
C84	RESIDENTIAL	B	67	1	51.6	51.7	0.1	No	50.4	1.3	No
C85	RESIDENTIAL	B	67	1	50.4	50.7	0.3	No	49.4	1.3	No
C86	RESIDENTIAL	B	67	1	49.6	49.7	0.1	No	48.4	1.3	No
C87	RESIDENTIAL	B	67	1	61.8	62.5	0.7	No	60.4	2.1	No
C88	RESIDENTIAL	B	67	1	59.1	59.4	0.3	No	57.6	1.8	No
C89	RESIDENTIAL	B	67	1	55.1	56.6	1.5	No	54.7	1.9	No
C90	RESIDENTIAL	B	67	1	53.5	55.5	2.0	No	53.3	2.2	No
C91	RESIDENTIAL	B	67	1	63.1	62.1	-1.0	No	61.9	0.2	No
C92	RESIDENTIAL	B	67	1	62.6	61.6	-1.0	No	61.4	0.2	No
C93	RESIDENTIAL	B	67	1	62.4	61.4	-1.0	No	61.3	0.1	No
C94	RESIDENTIAL	B	67	1	61.9	60.9	-1.0	No	60.8	0.1	No
C95	RESIDENTIAL	B	67	1	59.2	58.6	-0.6	No	58.6	0.0	No
C96	RESIDENTIAL	B	67	1	59.1	58.3	-0.8	No	58.2	0.1	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)							
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative						
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
C97	RESIDENTIAL	B	67	1	58.9	58.1	-0.8	No	58.0	0.1	No
C98	RESIDENTIAL	B	67	1	58.9	58.0	-0.9	No	57.9	0.1	No
NB2											
A1.2	**RESIDENTIAL**	**B**	**67**	**1**	**68.2**	**69.1**	**0.9**	**Yes**	**58.2**	**10.9**	**Yes**
A2.2	RESIDENTIAL	B	67	1	60.9	61.7	0.8	No	53.8	7.9	Yes
A3.2	RESIDENTIAL	B	67	1	59.4	60.0	0.6	No	52.7	7.3	Yes
A4.2	RESIDENTIAL	B	67	1	56.8	56.7	-0.1	No	50.3	6.4	Yes
A5.2	RESIDENTIAL	B	67	1	56.1	55.9	-0.2	No	49.8	6.1	Yes
A6.2	RESIDENTIAL	B	67	1	53.5	53.3	-0.2	No	48.4	4.9	No
A7.2	**RESIDENTIAL**	**B**	**67**	**1**	**68.3**	**69.0**	**0.7**	**Yes**	**61.1**	**7.9**	**Yes**
A8.2	**RESIDENTIAL**	**B**	**67**	**1**	**71.0**	**71.9**	**0.9**	**Yes**	**62.8**	**9.1**	**Yes**
A9.2	**RESIDENTIAL**	**B**	**67**	**1**	**70.9**	**72.0**	**1.1**	**Yes**	**63.0**	**9.0**	**Yes**
A10.2	**RESIDENTIAL**	**B**	**67**	**1**	**67.7**	**69.1**	**1.4**	**Yes**	**65.7**	**3.4**	**No**
A11.2	RESIDENTIAL	B	67	1	56.5	56.1	-0.4	No	50.1	6.0	Yes

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
A12.2	RESIDENTIAL	B	67	2	55.7	55.8	0.1	No	50.2	5.6	Yes
A13.2	RESIDENTIAL	B	67	1	55	55.0	0.0	No	50.4	4.6	No
A15.2	RESIDENTIAL	B	67	1	55.4	55.5	0.1	No	50.5	5.0	Yes
A16.2	RESIDENTIAL	B	67	2	56.6	57.0	0.4	No	50.9	6.1	Yes
A17.2	RESIDENTIAL	B	67	1	59.5	59.7	0.2	No	57.3	2.4	No
A19.2	RESIDENTIAL	B	67	1	46.3	43.9	-2.4	No	43.0	0.9	No
A18.2	RESIDENTIAL	B	67	1	49.8	48.8	-1.0	No	45.5	3.3	No
A20.2	RESIDENTIAL	B	67	1	46.1	43.6	-2.5	No	42.9	0.7	No
A21.2	RESIDENTIAL	B	67	1	46.6	44.8	-1.8	No	44.4	0.4	No
A22.2	RESIDENTIAL	B	67	1	47.9	47.2	-0.7	No	46.9	0.3	No
A23.2	RESIDENTIAL	B	67	1	53.3	53.4	0.1	No	52.6	0.8	No
A24	Place of Worship	D	52	1	42	42.8	0.8	Yes	41.9	0.9	No
A25	RESIDENTIAL	B	67	1	62.2	63.1	0.9	No	62.9	0.2	No
A26	Hotel	E	72	1	63.3	64.1	0.8	No	63.9	0.2	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
A27.2	RESIDENTIAL	B	67	1	56.1	55.8	-0.3	No	53.3	2.5	No
A28.2	RESIDENTIAL	B	67	1	49.3	49.0	-0.3	No	45.2	3.8	No
A29.2	RESIDENTIAL	B	67	1	49.1	48.8	-0.3	No	45.0	3.8	No
A30.2	RESIDENTIAL	B	67	1	48.6	48.3	-0.3	No	44.6	3.7	No
A31.2	RESIDENTIAL	B	67	1	48.4	48.1	-0.3	No	44.7	3.4	No
A32.2	RESIDENTIAL	B	67	1	47.8	47.6	-0.2	No	44.3	3.3	No
A33.2	RESIDENTIAL	B	67	1	42.2	41.5	-0.7	No	40.7	0.8	No
A34.2	RESIDENTIAL	B	67	1	42.2	41.7	-0.5	No	41.0	0.7	No
A35.2	RESIDENTIAL	B	67	1	42.3	41.8	-0.5	No	41.1	0.7	No
A36.2	RESIDENTIAL	B	67	1	42.6	41.7	-0.9	No	41.0	0.7	No
A37.2	RESIDENTIAL	B	67	1	42.5	41.4	-1.1	No	40.7	0.7	No
A38.2	RESIDENTIAL	B	67	1	44.3	44.2	-0.1	No	43.9	0.3	No
A39.2	RESIDENTIAL	B	67	1	49.4	48.9	-0.5	No	43.8	5.1	Yes
A40.2	RESIDENTIAL	B	67	1	43.1	42.6	-0.5	No	40.8	1.8	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)						
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative					
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
A41.2	RESIDENTIAL	B	67	1	42.3	41.7	-0.6	No	39.7	2.0	No
A42.2	RESIDENTIAL	B	67	1	43.2	42.7	-0.5	No	41.3	1.4	No
A43.2	RESIDENTIAL	B	67	1	47	46.7	-0.3	No	44.9	1.8	No
A44.2	RESIDENTIAL	B	67	1	49.1	49.0	-0.1	No	45.9	3.1	No
A45	Hotel	E	72	1	42.3	42.4	0.1	No	42.1	0.3	No
A46.2	RESIDENTIAL	B	67	1	43.5	42.4	-1.1	No	41.5	0.9	No
A47.2	RESIDENTIAL	B	67	1	43.1	42.7	-0.4	No	41.7	1.0	No
A48.2	RESIDENTIAL	B	67	1	45.8	46.0	0.2	No	45.7	0.3	No
A49.2	RESIDENTIAL	B	67	1	46.4	46.2	-0.2	No	45.0	1.2	No
A50.2	RESIDENTIAL	B	67	1	47.2	47.0	-0.2	No	46.6	0.4	No
A51.2	RESIDENTIAL	B	67	1	48.1	48.3	0.2	No	48.0	0.3	No
A52.2	RESIDENTIAL	B	67	1	55.4	55.7	0.3	No	54.1	1.6	No
A53.2	RESIDENTIAL	B	67	1	51.8	52.3	0.5	No	48.6	3.7	No
A54.2	RESIDENTIAL	B	67	1	51.5	51.9	0.4	No	48.2	3.7	No

Table 10. Abatement Analysis Results per Receiver, dB(A) L_{eq} (1h) Continued

Receiver ID	Noise Abatement Criteria (NAC)			Receptors	Noise Level – dB(A) L_{eq}(1h)							
	Description	Category	Criteria, L_{eq}(h)		Existing	Future Preferred Alternative						
						NL	Change from Existing	Impact (Y/N)	NL with Barrier	Noise Barrier Reduction	Benefited Receptor
A55.2	RESIDENTIAL	B	67	1	50.5	51.0	0.5	No	47.1	3.9	No
A56.2	RESIDENTIAL	B	67	1	50	50.5	0.5	No	46.6	3.9	No
A57.2	RESIDENTIAL	B	67	1	48.7	49.2	0.5	No	45.5	3.7	No
A58	RESIDENTIAL	B	67	1	42.6	41.9	-0.7	No	41.5	0.4	No
Boldface	indicates noise levels that approach, equal or exceed the NAC and create an impact.										

Source: HNTB Corporation, April 2020

6. Undeveloped Lands

The distances to 66 dB(A) L_{eq}(1h), which vary along the project corridor, were developed to assist local planning authorities in developing land use control over the remaining undeveloped lands along the project to prevent further development of incompatible land uses. There is potential for redevelopment in CNE L, and undeveloped areas exist in CNEs A, B and I.

Appendix A provides setback distances for CNE A, B, L and I for 66 dB(A). The 71 dB(A) setback does not extend beyond the project right-of-way in these areas.

It is recommended that any future development proposed in the project be modeled with accurate survey data to avoid creating incompatible land uses adjacent to the project.

7. Conclusions and Recommendations

NB1 and NB2 did not meet MDOT’s preliminary feasible and reasonableness criteria.

7.1. Statement of Likelihood

Based on the studies thus far accomplished, MDOT does not intend to install highway traffic noise abatement as discussed in this document. The preliminary assessment is based on preliminary design for barrier cost(s) and noise abatement as discussed in this document. If it subsequently develops during final design that these conditions have substantially changed, abatement measures will be reanalyzed.

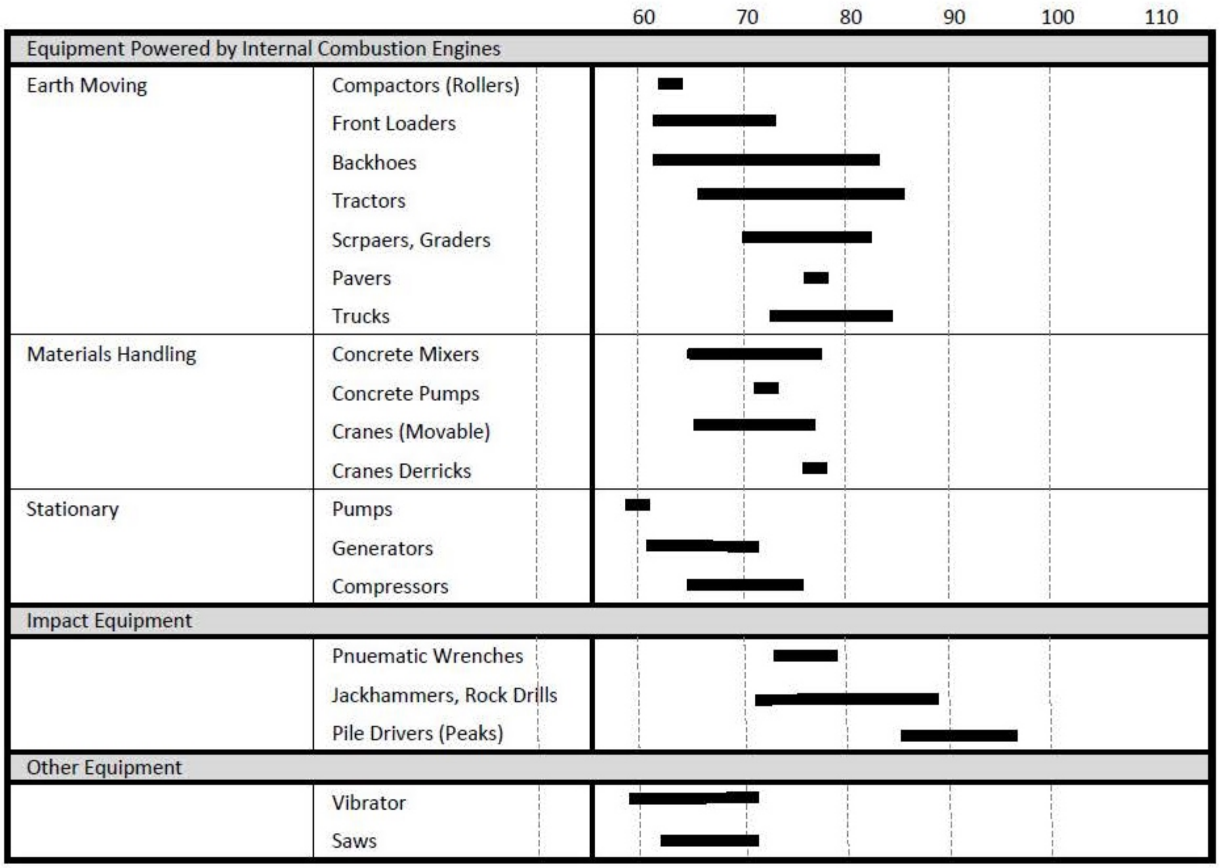
7.2. Construction Noise

In addition to noise from traffic, construction activities themselves can produce increased noise of a temporary nature. MDOT will be sensitive to local needs and may adjust work practices to reduce inconvenience to the public.

The major construction elements of this project are expected to be demolition, hauling, grading, paving, and bridge construction. Construction of the proposed improvements will result in a temporary increase in the ambient noise level along I-375. General construction noise impacts for passerby and those individuals living or working near the project can be expected particularly from demolition, earth moving, pile driving, and paving operations. Equipment associated with construction generally includes backhoes, graders, pavers, concrete trucks, compressors, and other miscellaneous heavy equipment. Figure 3 illustrates typical peak operating noise levels at 50 feet, grouping construction equipment according to mobility and operating characteristics. Considering the relatively short-term nature of construction noise, impacts are not expected to be substantial. The transmission loss characteristics of nearby structures are believed to be sufficient to moderate the effects of intrusive construction noise.

Figure 3. Construction Noise Sound Levels

Sound levels[dB(A)] at 50 feet



Source: U.S. Report to the President and the Congress on Noise, February 1972

7.3. Construction Vibration

Temporary vibration impacts could occur in residential areas and at other vibration-sensitive land uses from activities associated with construction of the project, such as excavation, demolition, and vibratory compaction, as well as pile-driving at bridges, noise walls, and retaining walls. The potential for vibration impact would be greatest at locations near pile-driving for bridges and other structures, pavement breaking, and at locations close to vibratory compactor operations.

The equipment with the highest vibration level for roadway construction is the vibratory roller, and the highest potential vibration level for pile driving is with the impact pile driver. For buildings near pile driving activities, short-term construction vibration impact can extend to approximately 100 feet from the construction site. For buildings near roadway construction activities, short-term construction vibration impact can extend to approximately 30 feet from the construction site.

Human annoyance from pile driving could extend to approximately 400 feet from the construction site while roadway construction annoyance could extend to approximately 100 feet from the construction site.

The primary means of mitigating short-term vibration impacts resulting from construction activities is to require the contractors to prepare a vibration control plan. Key elements of a plan include:

- Identify vibration sensitive buildings
- Conduct a pre-construction of inspection of residences, historical and other vibration sensitive structures in the project corridor
- Prohibit certain activities that create higher vibration levels during nighttime hours
- Implement vibration control measures where appropriate
- Develop a method for responding to community complaints

8. References

Anderson, G. S., C.S.Y. Lee, G.G. Fleming and C. Menge, "FHWA Traffic Noise Model®, Version 1.0 User's Guide", Federal Highway Administration, January 1998, p. 60.

FHWA, Noise Policy FAQs – Frequently Asked Questions

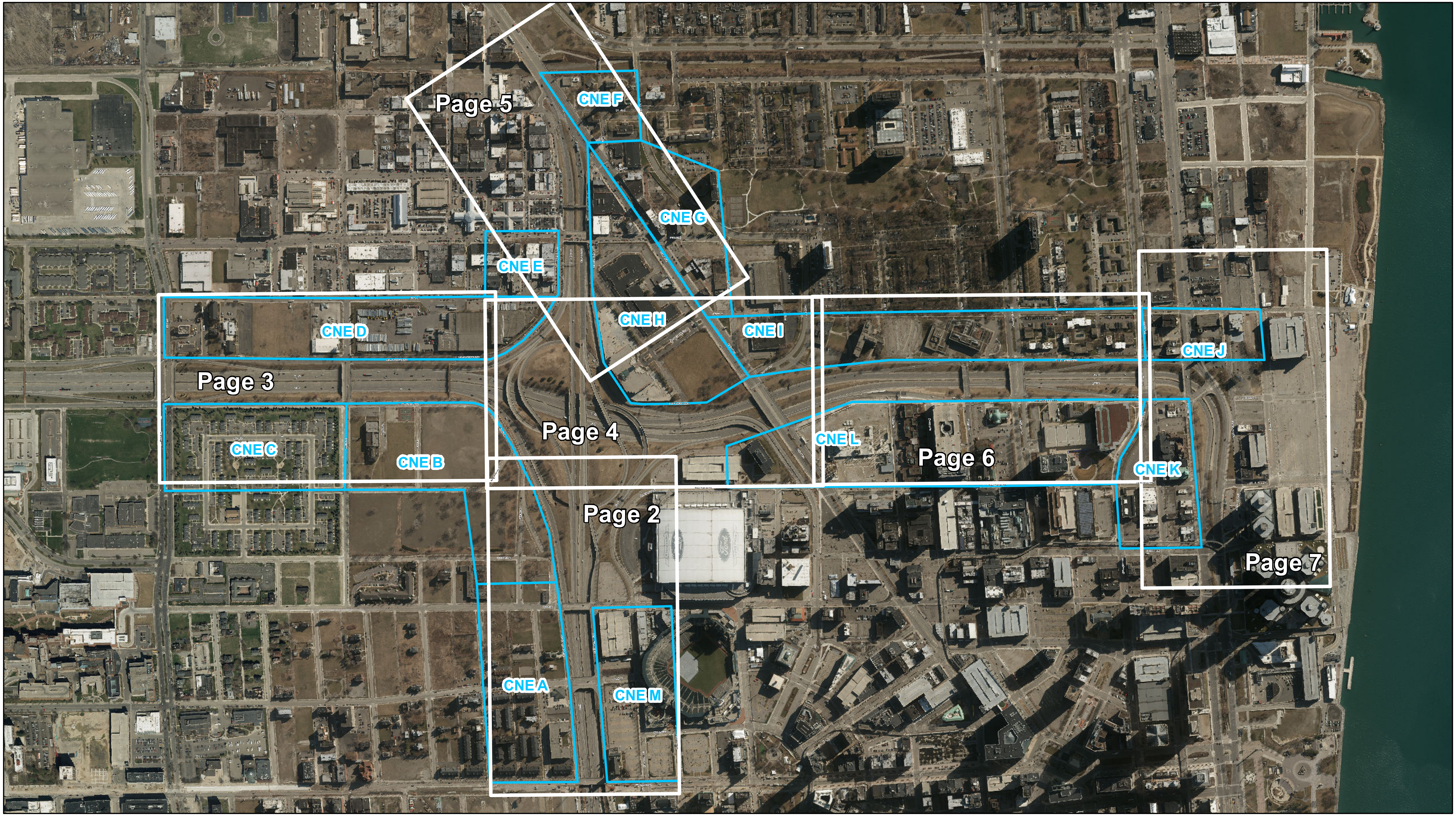
https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm#D4e

FHWA, *Procedures for Abatement of Highway Traffic Noise and Construction Noise,* Code of Federal Regulations, Title 23 Part 772 (23 CFR 722), July 13, 2010.

Hanf, Thomas. Email regarding "Re: Noise and Air Quality Guidance – I-375". MDOT Air Quality & Noise Abatement, April 17, 2018.

Michigan Department of Transportation. Highway Noise Analysis and Abatement Handbook, July 2011.

Appendix A: Traffic Noise Analysis Exhibits



MDOT
Michigan Department of Transportation

HNTB

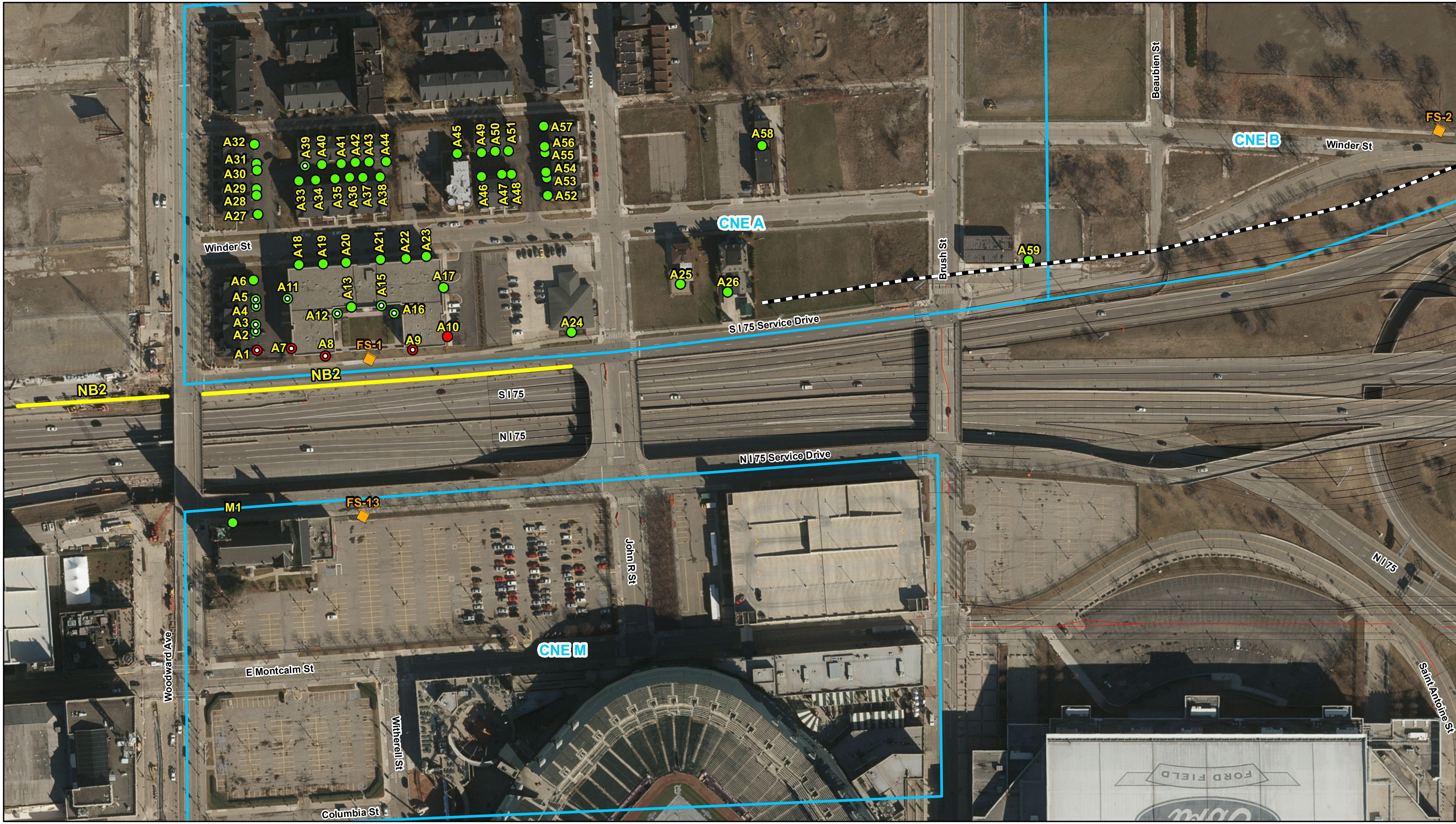
Legend

Common Noise Environment

0 500 1,000
Feet

Traffic Noise Study Overview
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-1



MDOT Michigan Department of Transportation

HNTB

Legend

- Benefitted Receiver
- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- Modeled Noise Barrier
- 66 dB Setback
- Common Noise Environment

N

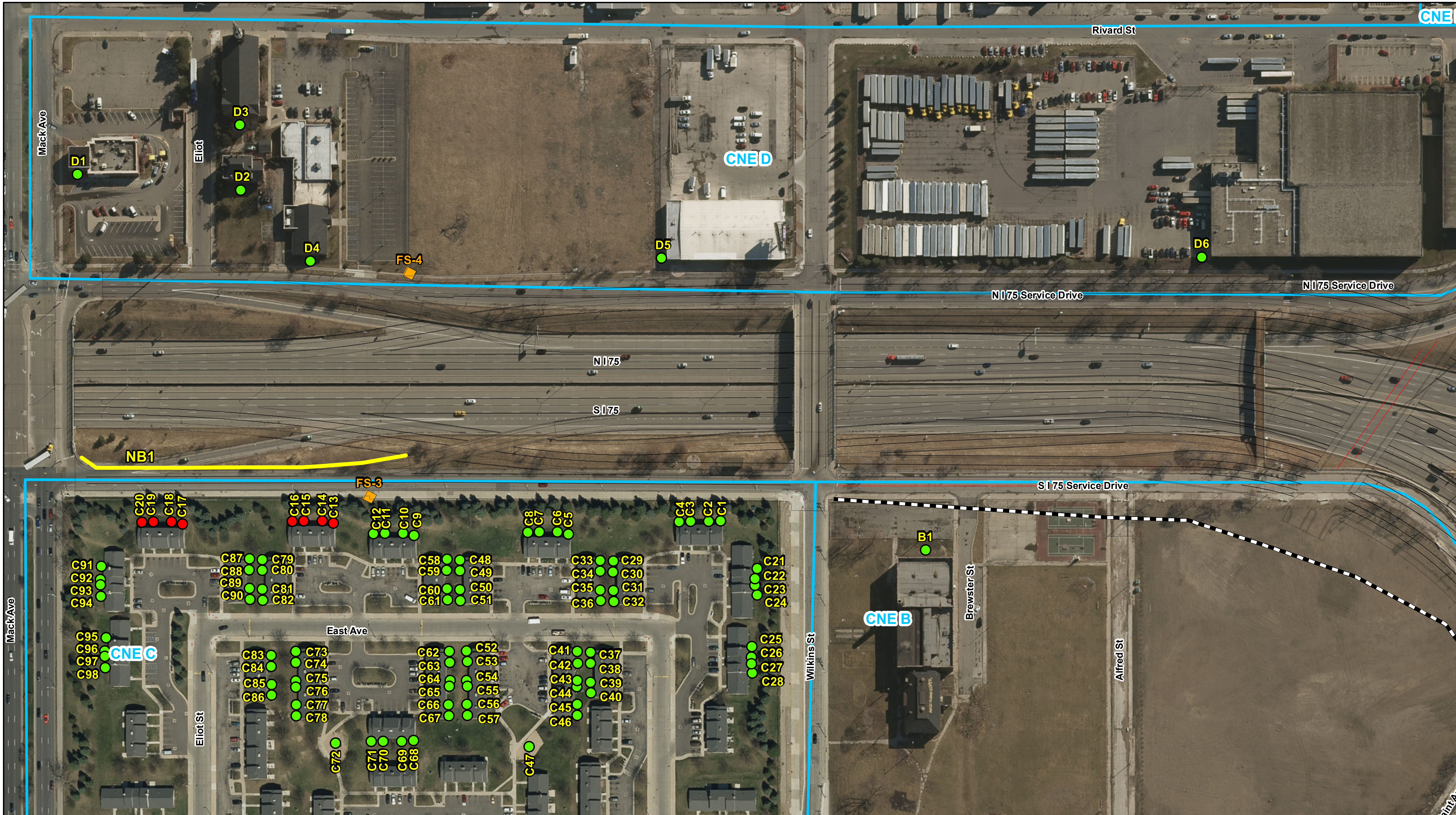
150 75 0 150

Feet

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-2



Legend

- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- Modeled Noise Barrier
- 66 dB Setback
- Common Noise Environment

150 75 0 150

Feet

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-3

MDOT Michigan Department of Transportation

HNTB

Legend

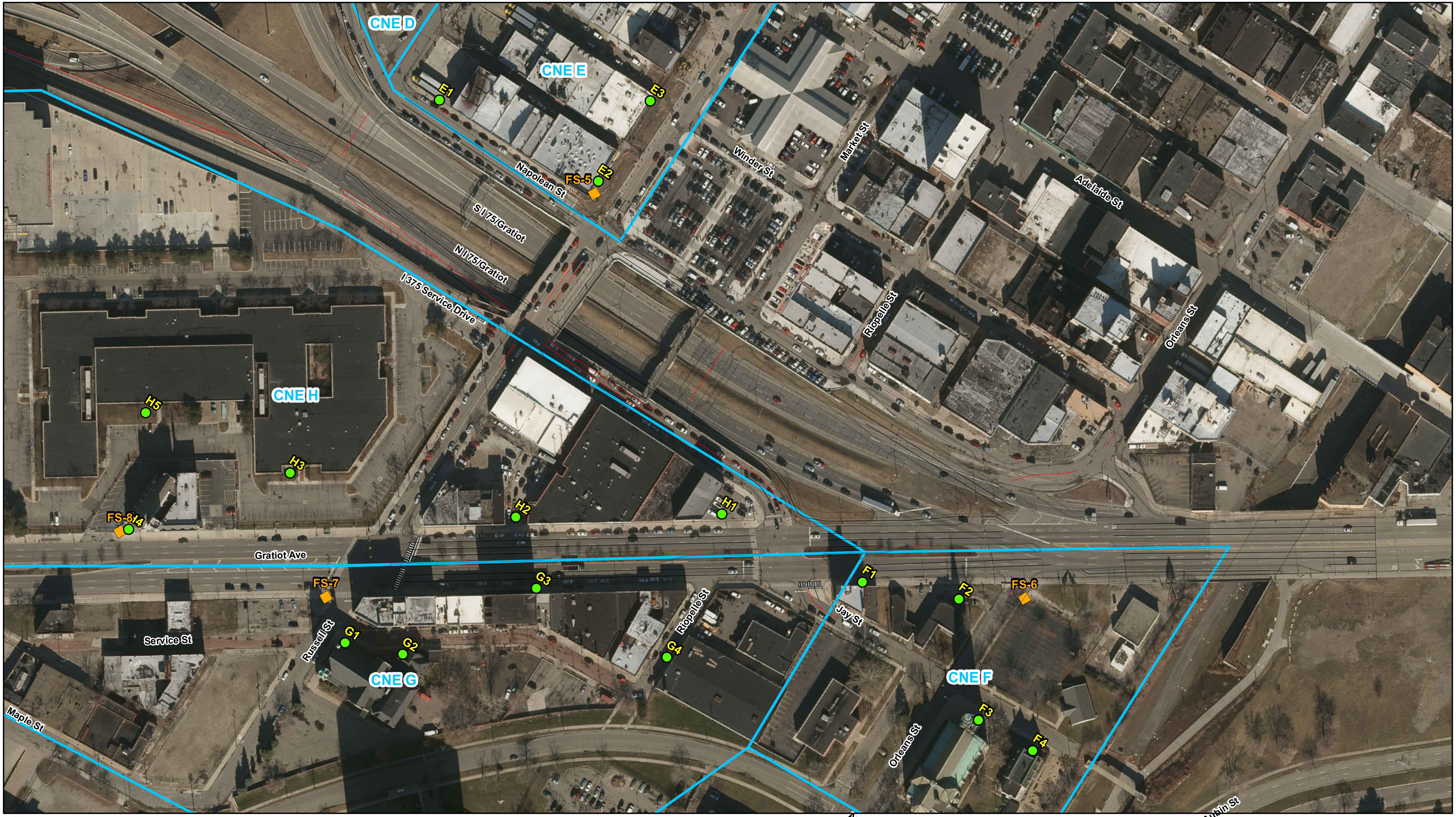
- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- 66 dB Setback
- Common Noise Environment

150 75 0 150
Feet

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-4



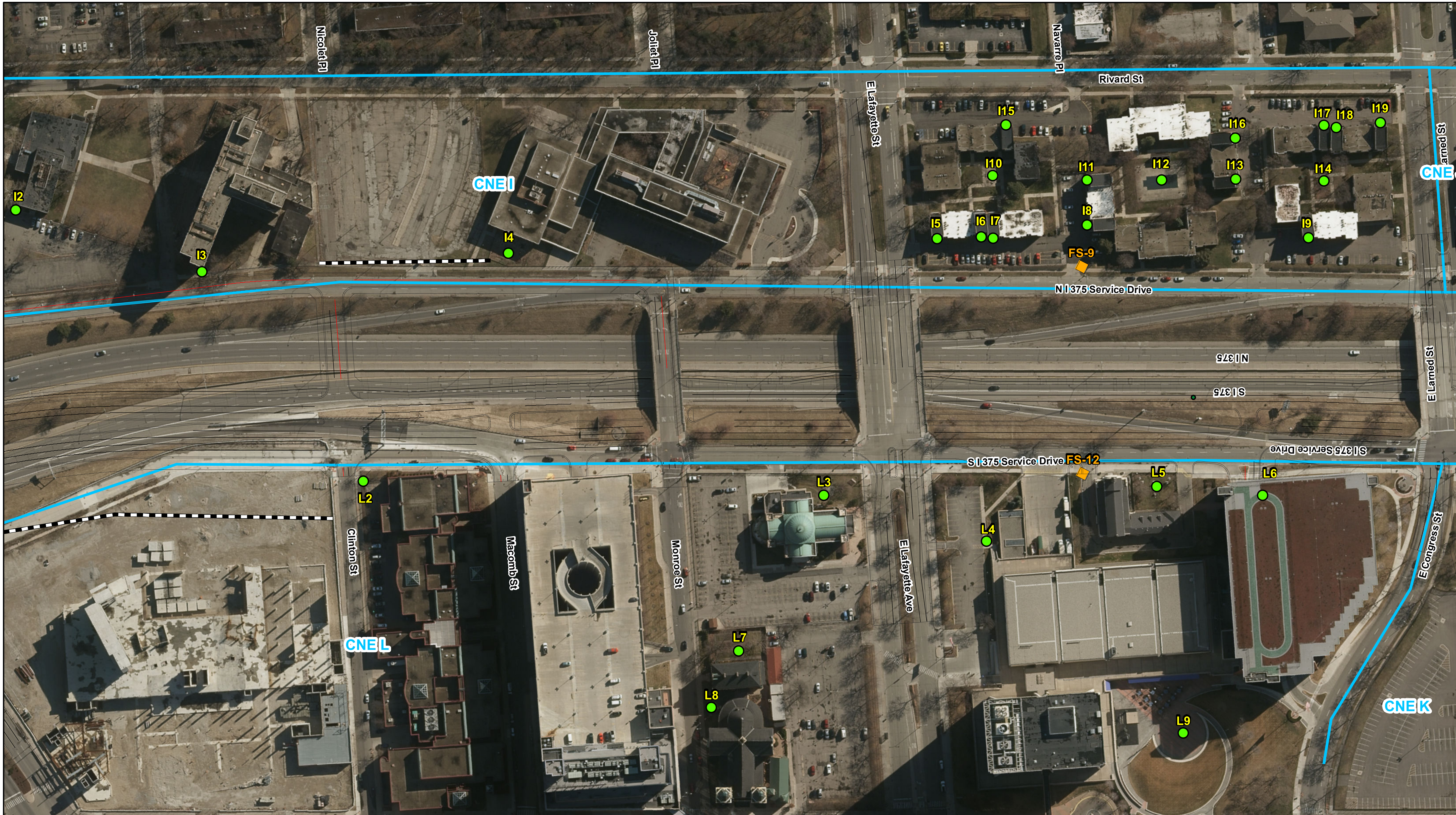
Legend

- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- 66 dB Setback
- Common Noise Environment

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-5



Legend

- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- 66 dB Setback
- Common Noise Environment

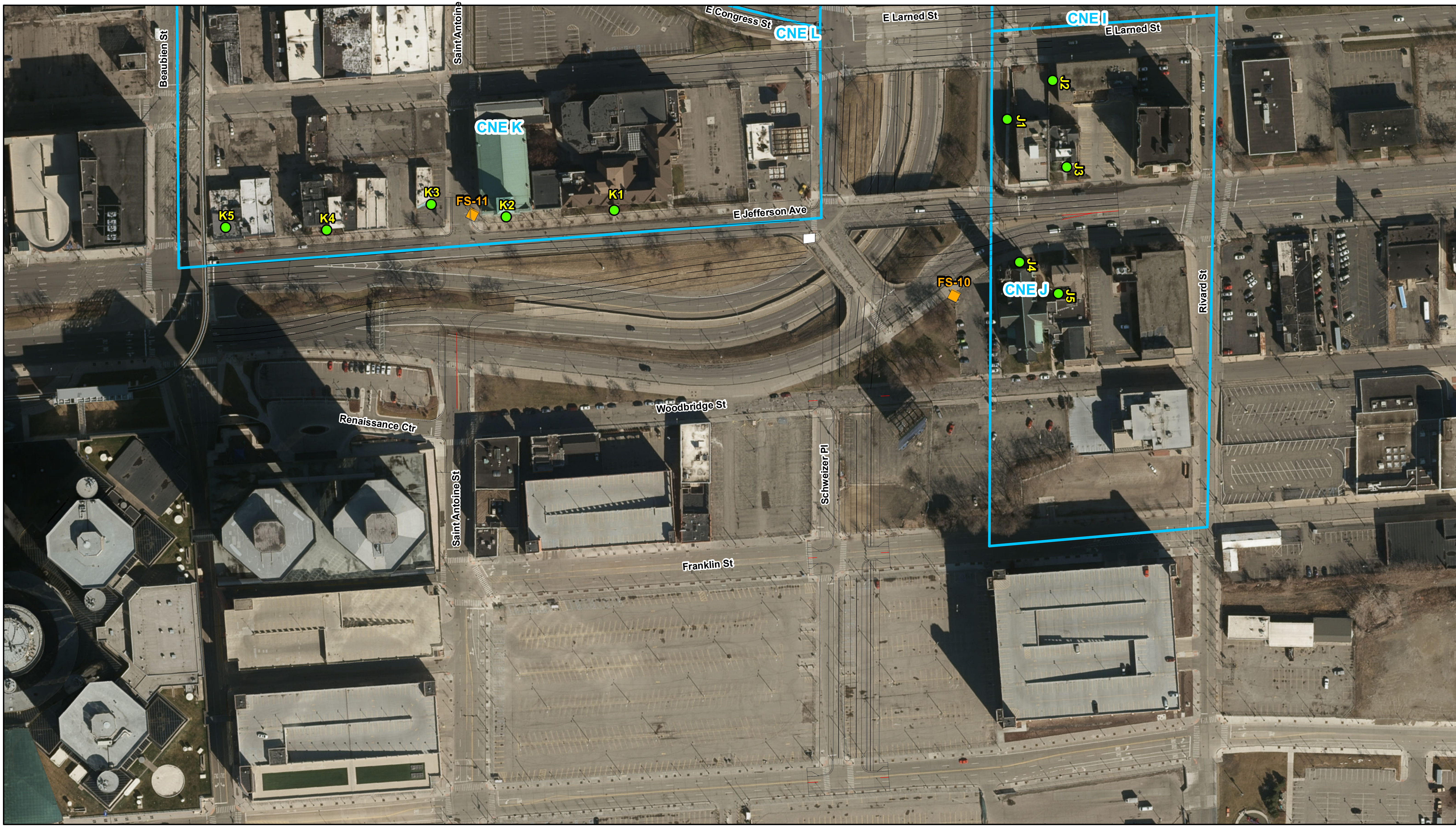
150 75 0 150

Feet

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-6



MDOT Michigan Department of Transportation

HNTB

Legend

- Impacted Receiver
- Not Impacted Receiver
- Field Sites
- 66 dB Setback
- Common Noise Environment

N

150 75 0 150

Feet

Note: Each TNM receiver can represent multiple receptor units. Table 7 provides details of the number of receptors per receiver shown on this exhibit.

Traffic Noise Study
Preferred Alternative
I-375 Improvement Project
Detroit, Michigan

Figure 4-7

Appendix B: Calibration Certification and Field Data Sheets

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38003

Instrument: **Acoustical Calibrator**
Model: **1251**
Manufacturer: **Norsonic**
Serial number: **30825**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **3/7/2017** *Cal Due:* **3/7/2018**

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __**Yes** _X_ **No**

Customer: **HNTB Corporation**
Tel/Fax: **414-359-2300 / 414-359-2314**
Address: **11414 West Park Place, Suite 300**
Milwaukee, WI 53224

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 6, 2016	Scantek, Inc./ NVLAP	Jul 6, 2017
DS-360-SRS	Function Generator	61646	Aug 12, 2015	ACR Env./ A2LA	Aug 12, 2017
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Aug 16, 2016	ACR Env. / A2LA	Aug 16, 2017
DPI 141-Druck	Pressure Indicator	790/00-04	Dec 22, 2016	ACR Env./ A2LA	Dec 22, 2018
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Oct 1, 2015	ACR Env./ A2LA	Apr 1, 2017
8903A-HP	Audio Analyzer	2514A05691	Dec 19, 2016	ACR Env./ A2LA	Dec 19, 2019
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	950698	Nov 10, 2016	Scantek, Inc. / NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	14059	Feb 13, 2017	Scantek, Inc./ NVLAP	Feb 13, 2018

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	3/7/17	Date	3/8/2017

Document stored as: Z:\Calibration Lab\Cal 2017\NOR1251_30825_M1.doc

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES:	MET[2]	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	-	-	
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 The tests marked with (*) are not covered by the current NVLAP accreditation.

Main measured parameters [3]:

Measured[4]/Acceptable[5] Tone frequency (Hz):	Measured[4]/Acceptable[5] Total Harmonic Distortion (%):	Measured [4]/Acceptable Level[5] (dB):
1000.20 ± 1.0/1000.0 ± 10.0	0.44 ± 0.10/ < 3	114.06 ± 0.12/114.0 ± 0.4

3 The stated level is valid at reference conditions.

4 The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

5 Acceptable parameters values are from the current standards

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.9 ± 1.0	100.86 ± 0.002	42.4 ± 2.2

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type: Norsonic Type 1443
Other:

Adjustments: Unit was not adjusted.
Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Measured Data: in Acoustical Calibrator Test Report # 38003 of one page.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.34247

Instrument: **Acoustical Calibrator**
Model: **1251**
Manufacturer: **Norsonic**
Serial number: **30825**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **7/9/2015** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	**X**	**X**
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ **Yes** _X_ **No**

Customer: **HNTB Corporation**
Tel/Fax: **414-359-2300 / -2314**

Address: **11414 West Park Place, Suite 300**
Milwaukee, WI 53224

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 1/16/2015

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jul 2, 2015	Scantek, Inc./ NVLAP	Jul 2, 2016
DS-360-SRS	Function Generator	61646	Nov 11, 2014	ACR Env./ A2LA	Nov11, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Nov 11, 2014	ACR Env. / A2LA	Nov 11, 2015
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 18, 2014	ACR Env./ A2LA	Nov 18, 2016
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	Mar 17, 2014	ACR Env./ A2LA	Sep 17, 2015
8903A-HP	Audio Analyzer	2514A05691	Dec 12, 2013	ACR Env./ A2LA	Dec 12, 2016
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	906763	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015
1203-Norsonic	Preamplifier	14059	Jan 5, 2015	Scantek, Inc./ NVLAP	Jan 5, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Valentin Buzduga	**Authorized signatory:**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	7/09/2015	Date	7/9/2015

Document stored as: Z:\Calibration Lab\Cal 2015\NOR1251_30825_M1.doc

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES:	MET[2]	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	-	-	
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 The tests marked with (*) are not covered by the current NVLAP accreditation.

Main measured parameters [3]:

Measured[4]/Acceptable[5] Tone frequency (Hz):	Measured[4]/Acceptable[5] Total Harmonic Distortion (%):	Measured [4]/Acceptable Level[5] (dB):
1000.61 ± 1.0/1000.0 ± 10.0	0.23 ± 0.10/ < 3	114.13 ± 0.12/114.0 ± 0.4

3 The stated level is valid at reference conditions.

4 The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

5 Acceptable parameters values are from the current standards

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3 ± 1.0	100.13 ± 0.003	41.6 ± 2.2

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type:	1443
Other:	

Adjustments: Unit was not adjusted.
Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Measured Data: in Acoustical Calibrator Test Report # 34247 of one page.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.35788

Instrument:	**Sound Level Meter**	*Date Calibrated:* **3/14/2016**	*Cal Due:*	
Model:	**118**	*Status:*	**Received**	**Sent**
Manufacturer:	**Norsonic**	*In tolerance:*	**X**	**X**
Serial number:	**31483**	*Out of tolerance:*		
Tested with:	**Microphone 1225 s/n 52318** **Preamplifier 1206 s/n 30522**	*See comments:*		

Contains non-accredited tests: __Yes _X_ No
Calibration service: __ Basic _X_ Standard

Type (class): **1**
Customer: **HNTB Corporation**
Tel/Fax: **414-359-2300 / 414-359-2314**
Address: **11414 West Park Place, Suite 300, Milwaukee, WI 53224**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 23, 2015	Scantek, Inc./ NVLAP	Oct 23, 2016
DS-360-SRS	Function Generator	33584	Oct 20, 2015	ACR Env./ A2LA	Oct 20, 2017
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 6, 2015	ACR Env. / A2LA	Oct 6, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016

Jul 24, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
24.1	99.86	39.2

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Valentin Buzduga
Signature	Lydon Dawkins	Signature	[signature]
Date	3/14/2016	Date	3/14/2016

Document stored Z:\Calibration Lab\SLM 2016\NOR118_31483_M1.doc

Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	RESULT[2,3]	EXPANDED UNCERTAINTY (coverage factor 2) [dB]
INDICATION AT THE CALIBRATION CHECK FREQUENCY - IEC61672-3 ED.2 CLAUSE 10	Passed	0.15
SELF-GENERATED NOISE - IEC 61672-3 ED.2 CLAUSE 11	Passed	0.30
FREQUENCY WEIGHTINGS: A NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY WEIGHTINGS: C NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY WEIGHTINGS: Z NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY AND TIME WEIGHTINGS AT 1 KHZ IEC 61672-3 ED.2.0 CLAUSE 14	Passed	0.20
LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE - IEC 61672-3 ED.2 CLAUSE 16	Passed	0.25
TONEBURST RESPONSE - IEC 61672-3 ED.2.0 CLAUSE 18	Passed	0.30
PEAK C SOUND LEVEL - IEC 61672-3 ED.2.0 CLAUSE 19	Passed	0.35
OVERLOAD INDICATION - IEC 61672-3 ED.2.0 CLAUSE 20	Passed	0.25
HIGH LEVEL STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 21	Passed	0.10
LONG TERM STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 15	Passed	0.10
FILTER TEST 1/1OCTAVE: RELATIVE ATTENUATION - IEC 61260, CLAUSE 4.4 & #5.3	Passed	0.25
FILTER TEST 1/3OCTAVE: RELATIVE ATTENUATION - IEC 61260, CLAUSE 4.4 & #5.3	Passed	0.25
COMBINED ELECTRICAL AND ACOUSTICAL TEST - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	See test report

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 Parameters are certified at actual environmental conditions.

3 The tests marked with (*) are not covered by the current NVLAP accreditation.

Comments: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2, to demonstrate that the model of sound level meter fully conforms to the requirements in the IEC 61672-2, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the instrument:

Microphone:	Norsonic 1225 s/n 52318 for acoustical test
Preamplifier:	Norsonic 1206 s/n 30522 for all tests
Other: line adaptor ADP005 (18pF) for electrical tests	
Accompanying acoustical calibrator:	none
Windscreen:	Norsonic Nor1451 (ø 60mm)

Measured Data: in Test Report # 35788 of 9 + 1 pages.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.35789

Instrument:	**Microphone**	*Date Calibrated:* **3/14/2016**	*Cal Due:*		
Model:	**1225**	*Status:*	**Received**	**Sent**	
Manufacturer:	**Norsonic**	*In tolerance:*	X	X	
Serial number:	**52318**	*Out of tolerance:*			
Composed of:		*See comments:*			
		Contains non-accredited tests: __Yes _X_ No			
Customer:	**HNTB Corporation**	*Address:*	**11414 West Park Place, Suite 300, Milwaukee, WI 53224**		
Tel/Fax:	**414-359-2300/414-359-2314**				

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 23, 2015	Scantek, Inc./ NVLAP	Oct 23, 2016
DS-360-SRS	Function Generator	33584	Oct 20, 2015	ACR Env./ A2LA	Oct 20, 2017
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 6, 2015	ACR Env. / A2LA	Oct 6, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	14052	Aug 24, 2015	Scantek, Inc./ NVLAP	Aug 24, 2016
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Lydon Dawkins	**Authorized signatory:**	Valentin Buzduga
Signature	Lydon Dawkins	Signature	[signature]
Date	3/14/2016	Date	3/14/2016

Document stored as: Z:\Calibration Lab\Mic 2016\NOR1225_52318_M1.doc

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES / METHODS[1] FROM PROCEDURES		MET[2,3]	NOT MET	NOT TESTED	MEASUREMENT EXPANDED UNCERTAINTY (coverage factor 2)
Open circuit sensitivity (insert voltage method, 250 Hz)		X			See below
Frequency response	Actuator response	X			63 – 200Hz: 0.3 dB 200 – 8000 Hz: 0.2 dB 8 – 10 kHz: 0.5 dB 10 – 20 kHz: 0.7 dB 20 – 50 kHz: 0.9 dB 50 – 100 kHz: 1.2 dB
	FF/Diffuse field responses	X			63 – 200Hz: 0.3 dB 200 – 4000 Hz: 0.2 dB 4 – 10 kHz: 0.6 dB 10 – 20 kHz: 0.9 dB 20 – 50 kHz: 2.2 dB 50 – 100 kHz: 4.4 dB
	Scantek, Inc. acoustical method			X	31.5 – 125 Hz: 0.16 dB 250, 1000 Hz: 0.12 dB 2 – 8 kHz: 0.8 dB 12.5 – 16 kHz: 2.4 dB

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 Results are normalized to the reference conditions.

3 The tests marked with (*) are not covered by the current NVLAP accreditation.

Note: The free field/diffuse field characteristics were calculated based on the measured actuator response and adjustment coefficients as provided by the manufacturer. The uncertainties reported for these characteristics may include assumed uncertainty components for the adjustment coefficients.

Comments: The instrument was tested and met all specifications found in the referenced procedures.

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.9 ± 1.1	99.88 ± 0.025	37.8 ± 2.1

Main measured parameters:

Tone frequency (Hz)	Measured[4] /Nominal Open circuit sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)
250	-26.24 ± 0.12/ -26.0	48.73

4 The reported expanded uncertainty is calculated with a coverage factor k=2.00

Tests made with following attachments to instrument and auxiliary devices:

Protection grid mounted for sensitivity measurements
Actuator type: G.R.A.S. RA0014

Measured Data: Found on Microphone Test Report # 35789 of one page.

Place of Calibration: Scantek, Inc.

6430 Dobbin Road, Suite C
Columbia, MD 21045 USA

Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-1 DATE: 10-26-2017 TIME: 8:53

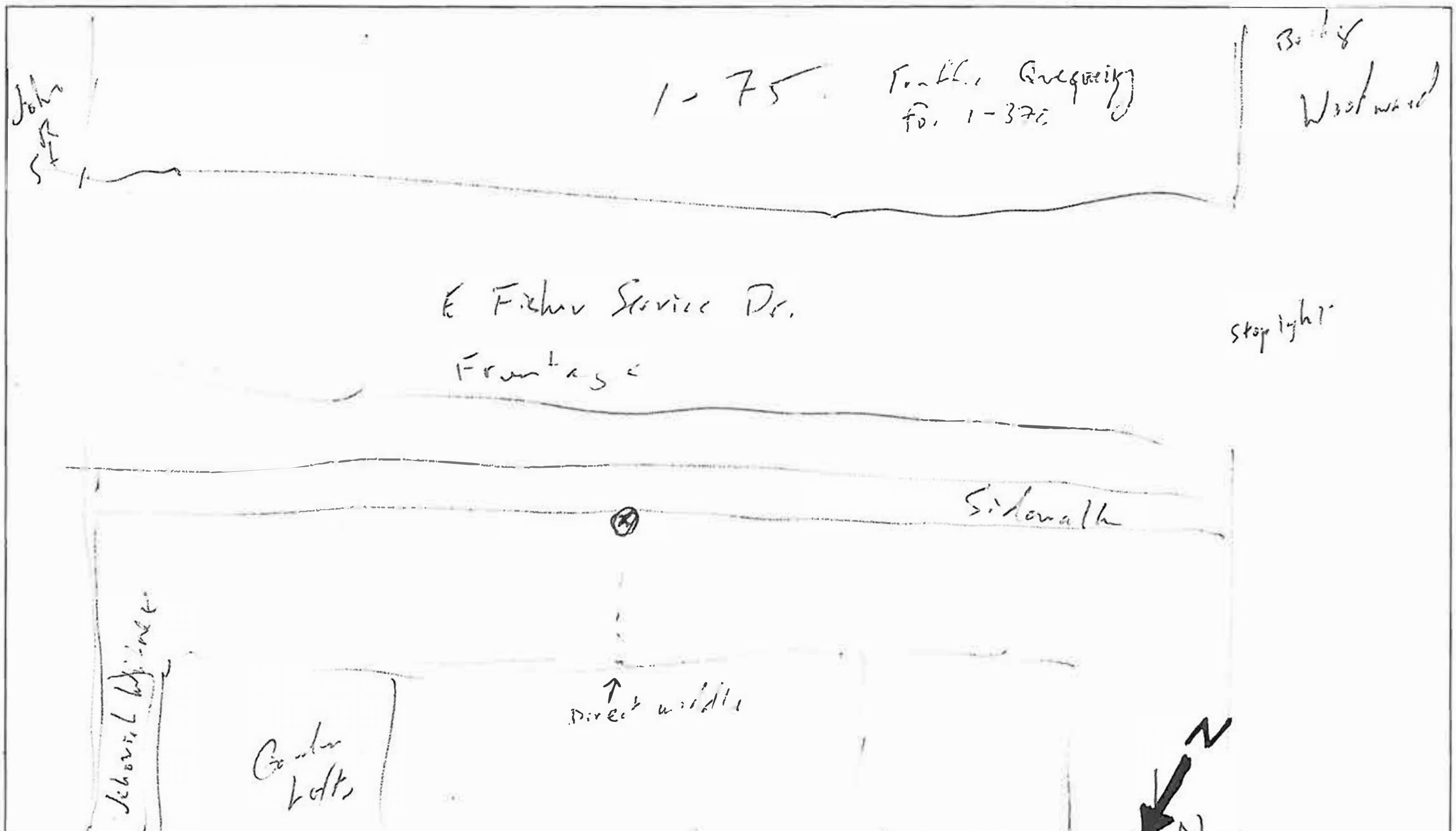
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	L.T (Frontage)	
AUTOS	~~HH~~ ~~HH~~ ~~HH~~ II	
MED TRKS		
HVY TRKS		
BUS		
MOTORCYCLE		
SPEED	30-35 mph	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration/5 min	Leq 71.8	

WEATHER DATA WIND SPEED (MPH) 1-2 DIR. S TEMP 58 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE F

MAJOR SOURCES I-75, Frontage Rd.

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detr oit,MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-2 DATE: 10-26 2017 TIME: 9:50

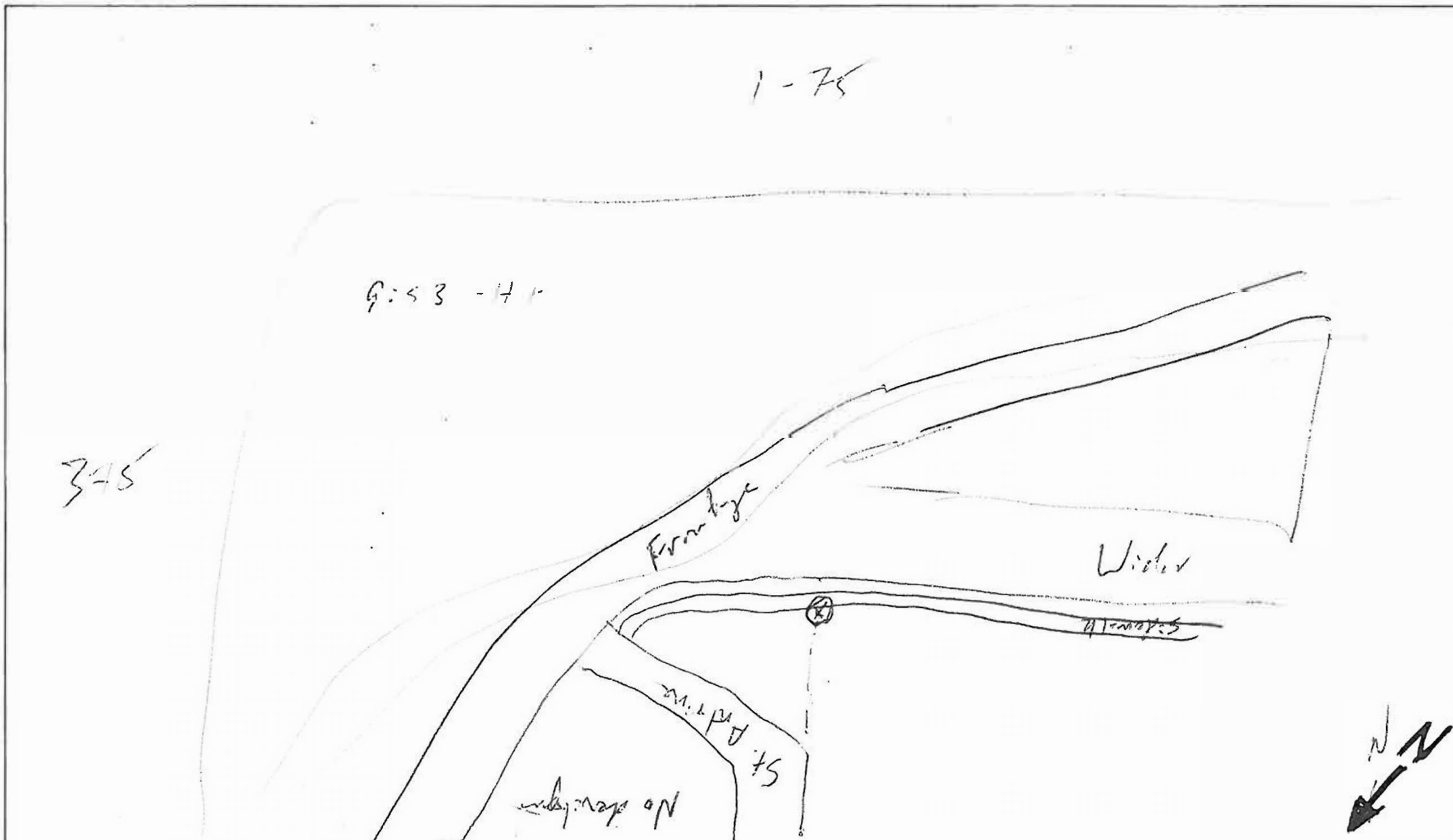
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	LT (Frontage)	
AUTOS	~~||||~~ |||	
MED TRKS		
HVY TRKS	/	
BUS		
MOTORCYCLE		
SPEED	35	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min	Leq 61.3	

WEATHER DATA WIND SPEED (MPH) 1-2 DIR. N TEMP. 52.6 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES I-75/375, LT

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-3 DATE: 10-26-2017 TIME: 10:40

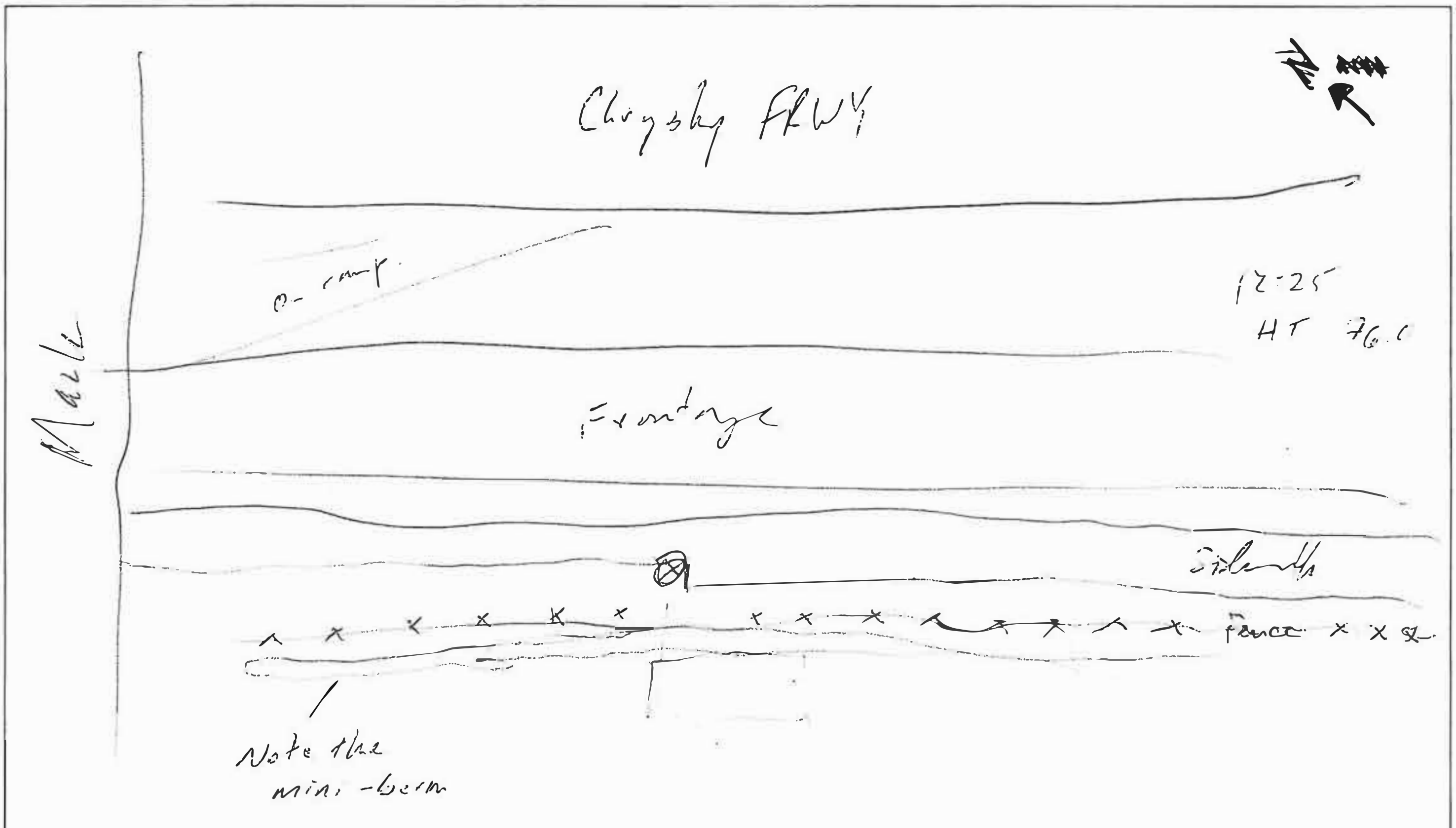
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	(Frontage) LT	
AUTOS	IIII IIII IIIIIIII IIII IIII III	
MED TRKS	IIII	
HVY TRKS	II	
BUS		
MOTORCYCLE		
SPEED	40-45 mph	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min	Leq 67.4	

WEATHER DATA WIND SPEED (MPH) – DIR. – TEMP. 61.6 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES I-75, Frontage

UNUSUAL EVENTS

OTHER NOTES Make sure mini-berm is modeled.

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: 75-4 DATE: 10-26-2017 TIME: 11:02

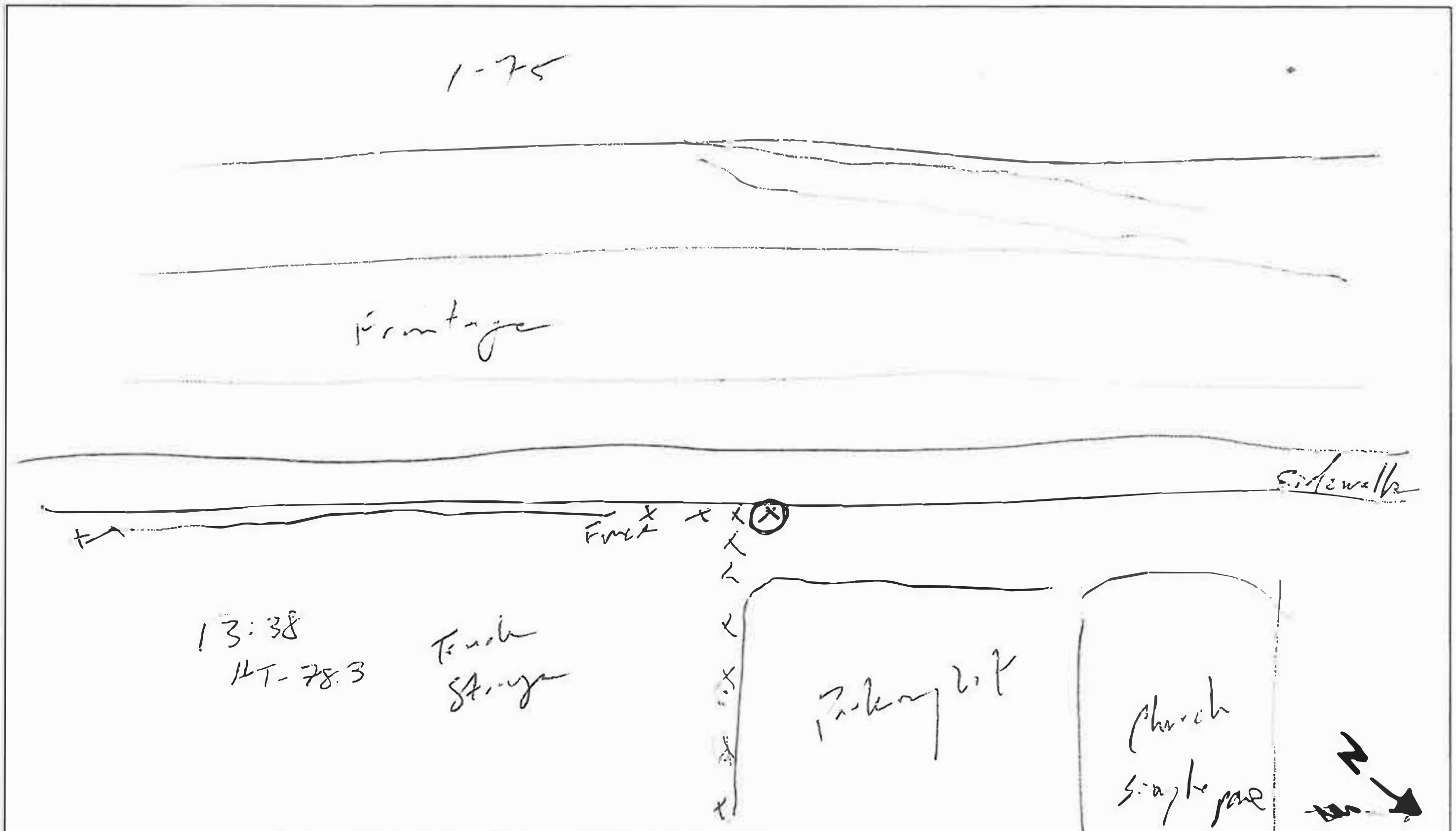
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	Frontage Rd	
AUTOS	~~||||~~ ~~||||~~ ||||	
MED TRKS	|||	
HVY TRKS	||	
BUS		
MOTORCYCLE		
SPEED	35	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min	Leq 72.2	

WEATHER DATA WIND SPEED (MPH) 4-5 DIR. S TEMP. 52.2 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES I-75, Frontage

UNUSUAL EVENTS

OTHER NOTES Take land here.

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-5 DATE: 10-26-2017 TIME: 11:41

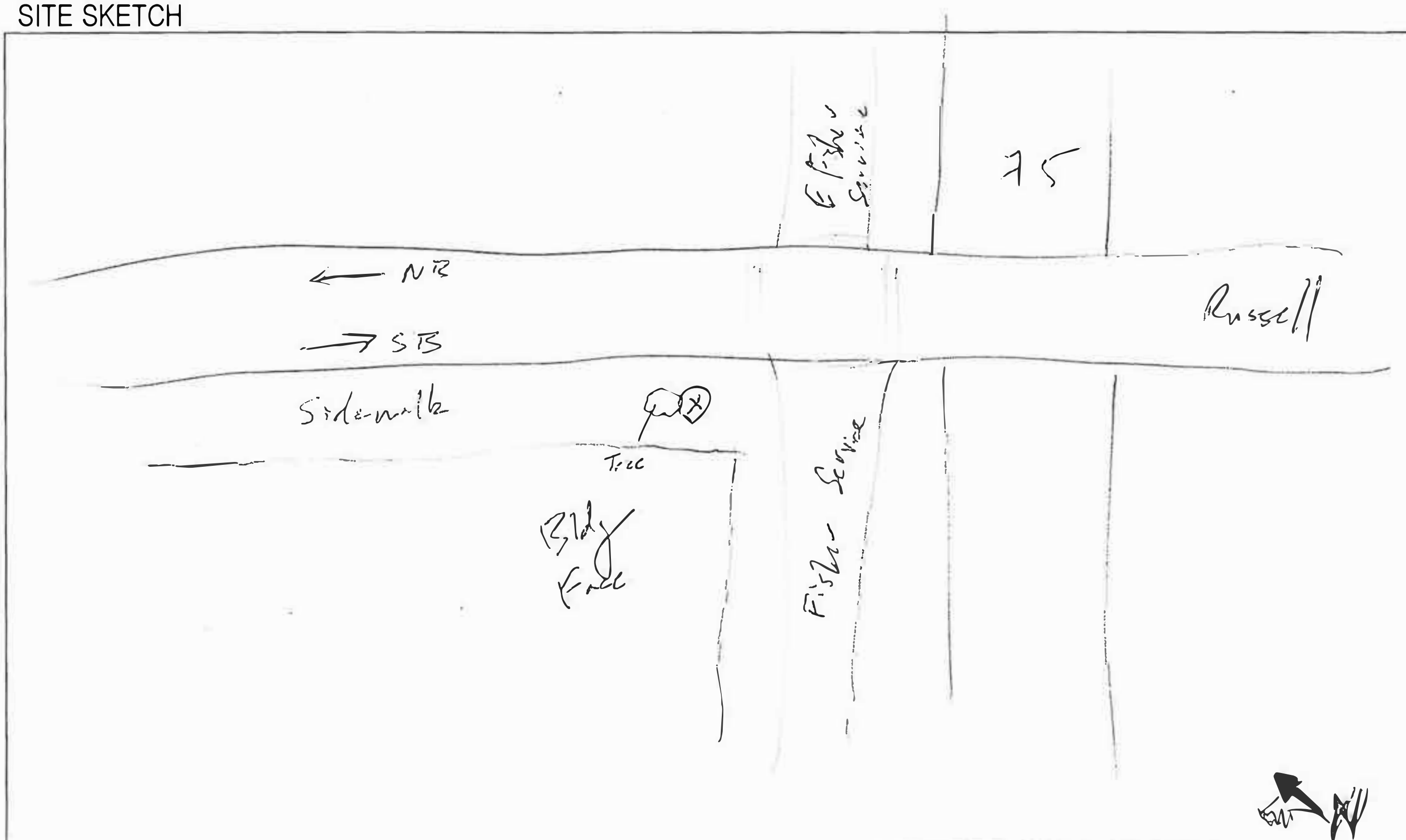
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	Russell SB	Russell NB
AUTOS	[illegible]	[illegible]
MED TRKS	[illegible]	[illegible]
HVY TRKS	[illegible]	[illegible]
BUS		[illegible]
MOTORCYCLE		[illegible]
SPEED	10-20	10-20

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 MIN	Leq 62.6	

WEATHER DATA WIND SPEED (MPH) 1-2 DIR. S TEMP. HUMIDITY CLOUD COVER Clr

BACKGROUND NOISE Foot traffic, Seagulls

MAJOR SOURCES Highway, LT (Russell)

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: TS-6 DATE: 10-2 6- 2017 TIME: 12:02

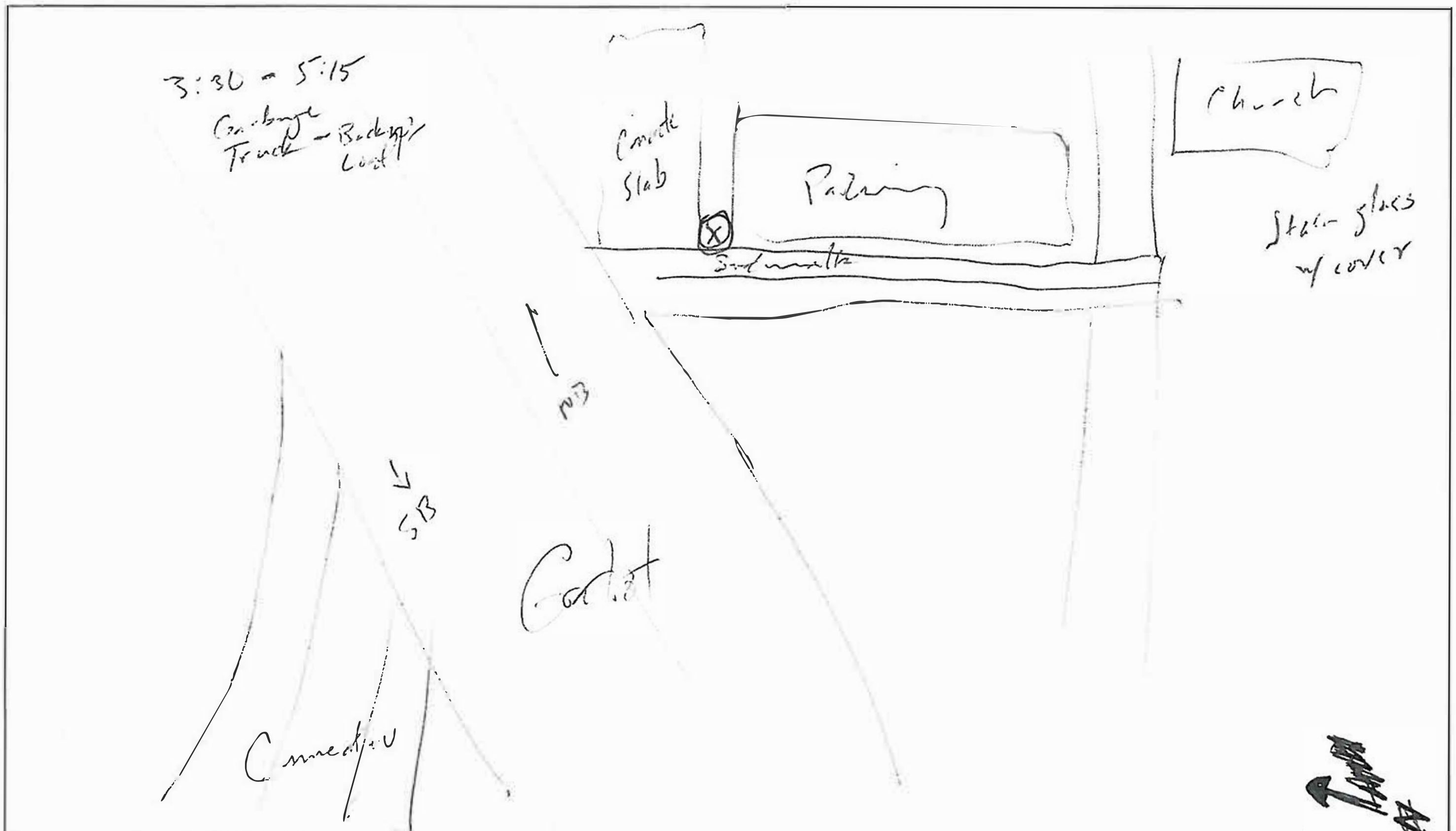
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / [✓ SLOW] WEIGHTING: [✓ A] / C / LIN.

TRAFFIC DATA Gratiot		
ROAD (Name/Dir)	NB	SB
AUTOS	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	𝍸 𝍸 𝍸 𝍸 𝍸
MED TRKS	𝍸 ~~𝍸~~ 𝍸 𝍸	‖ 𝍸 𝍸
HVY TRKS	𝍸 𝍸 𝍸	| 𝍸 𝍸
BUS	‖ 𝍸 𝍸	𝍸 𝍸
MOTORCYCLE	𝍸 𝍸	𝍸
SPEED	30 - 40	30 - 40

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 Min	Leq 68.8	

WEATHER DATA WIND SPEED (MPH) 5-6 DIR. S TEMP. 52.9 HUMIDITY CLOUD COVER

BACKGROUND NOISE Garbage truck

MAJOR SOURCES Gratiot, highway

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-#7 DATE: 10-26-2017 TIME: 12:42

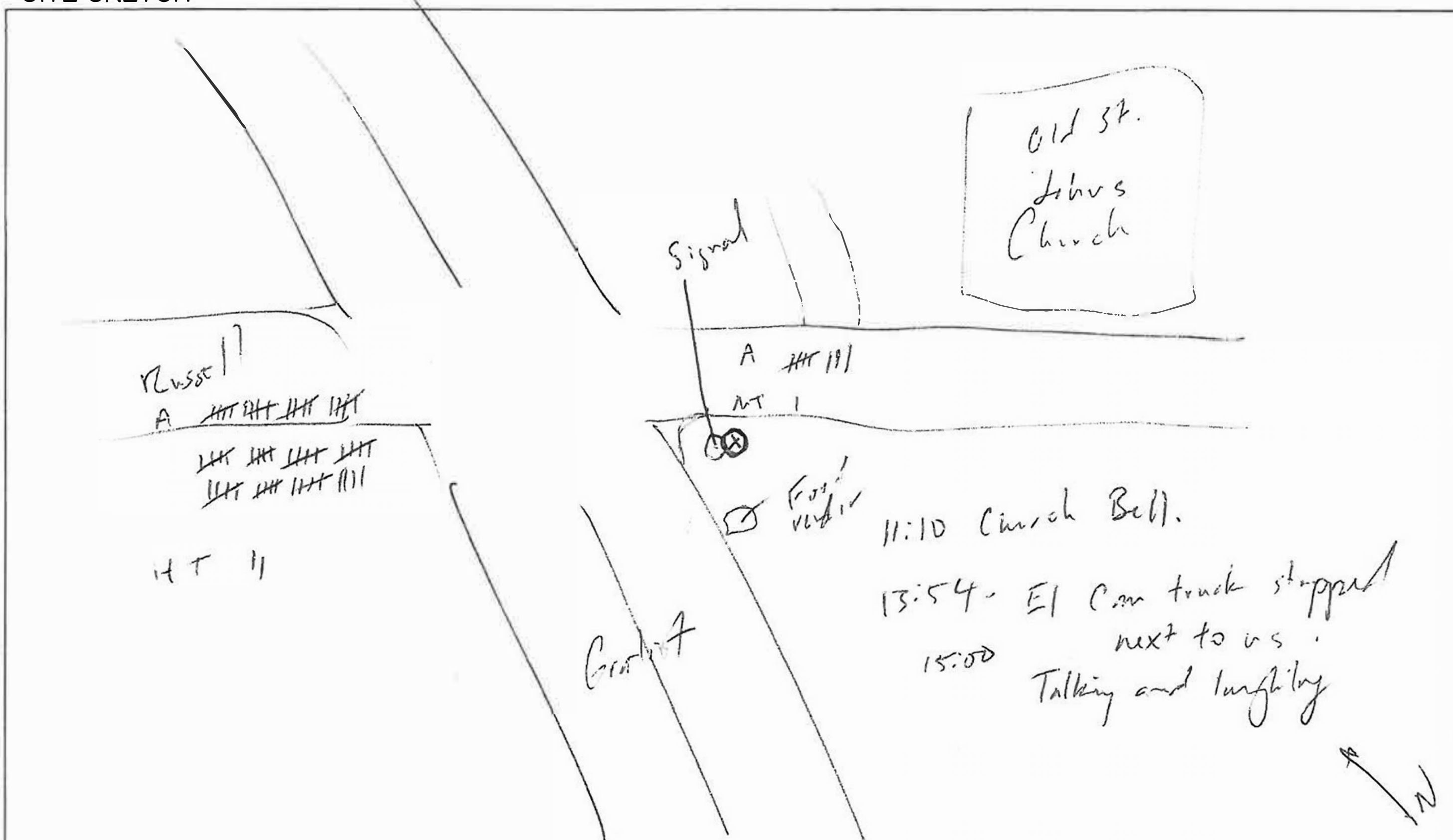
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)		
AUTOS		
MED TRKS		
HVY TRKS		
BUS		
MOTORCYCLE		
SPEED		

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 MIN	Leq 66.2	

WEATHER DATA WIND SPEED (MPH) 3-5 DIR. S TEMP. 58.6 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE Road Traffic

MAJOR SOURCES Gratiot

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-8 DATE: 10-26 2017 TIME: 12:54

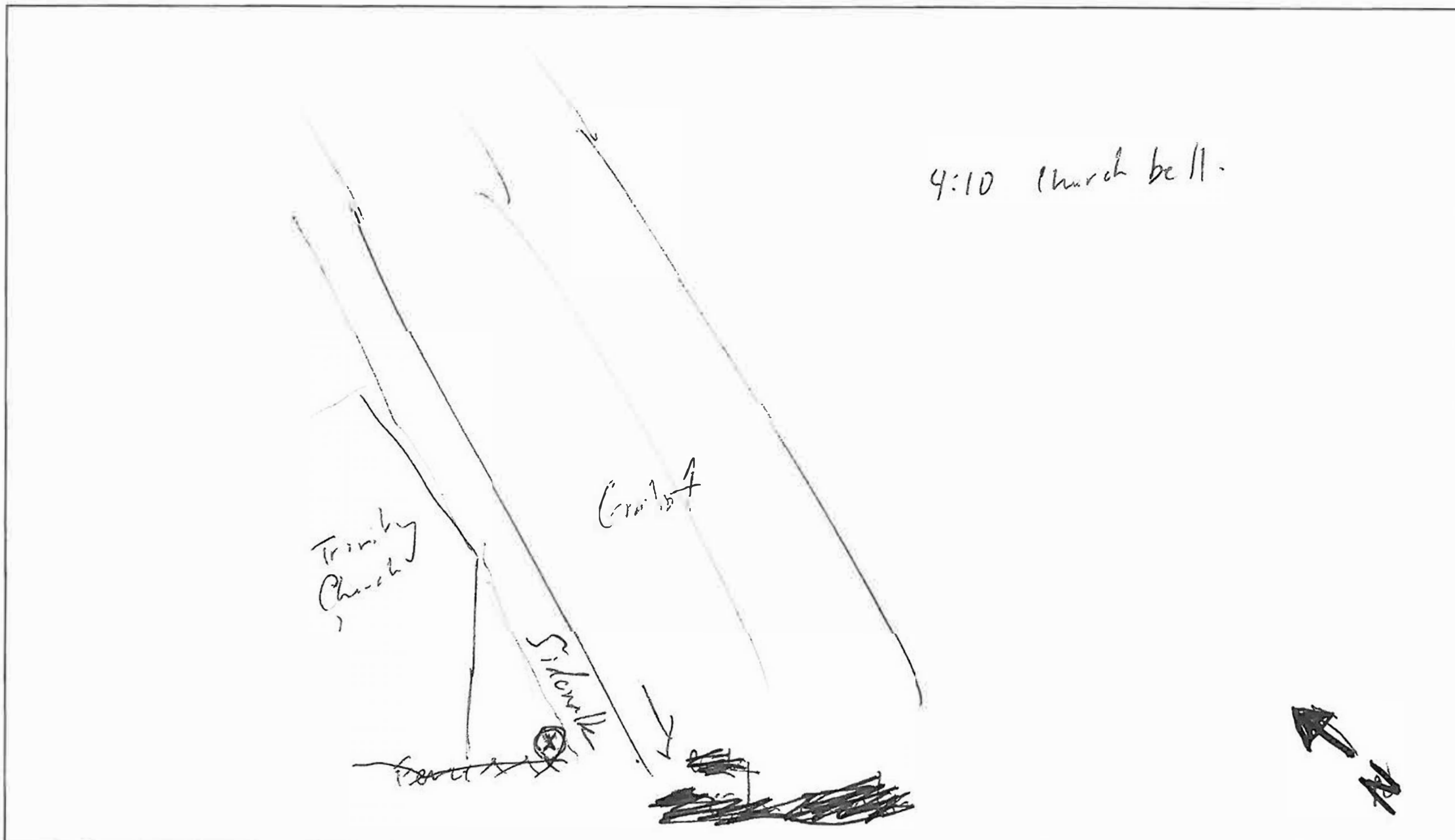
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir.)		
AUTOS		
MED TRKS		
HVY TRKS		
BUS		
MOTORCYCLE		
SPEED		

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration, 5 min.	Leq 67.3	

WEATHER DATA WIND SPEED (MPH) 4-5 DIR. SE TEMP. 62.8 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES Gratiot Ave

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-9 DATE: 10-26-2017 TIME: 14 11

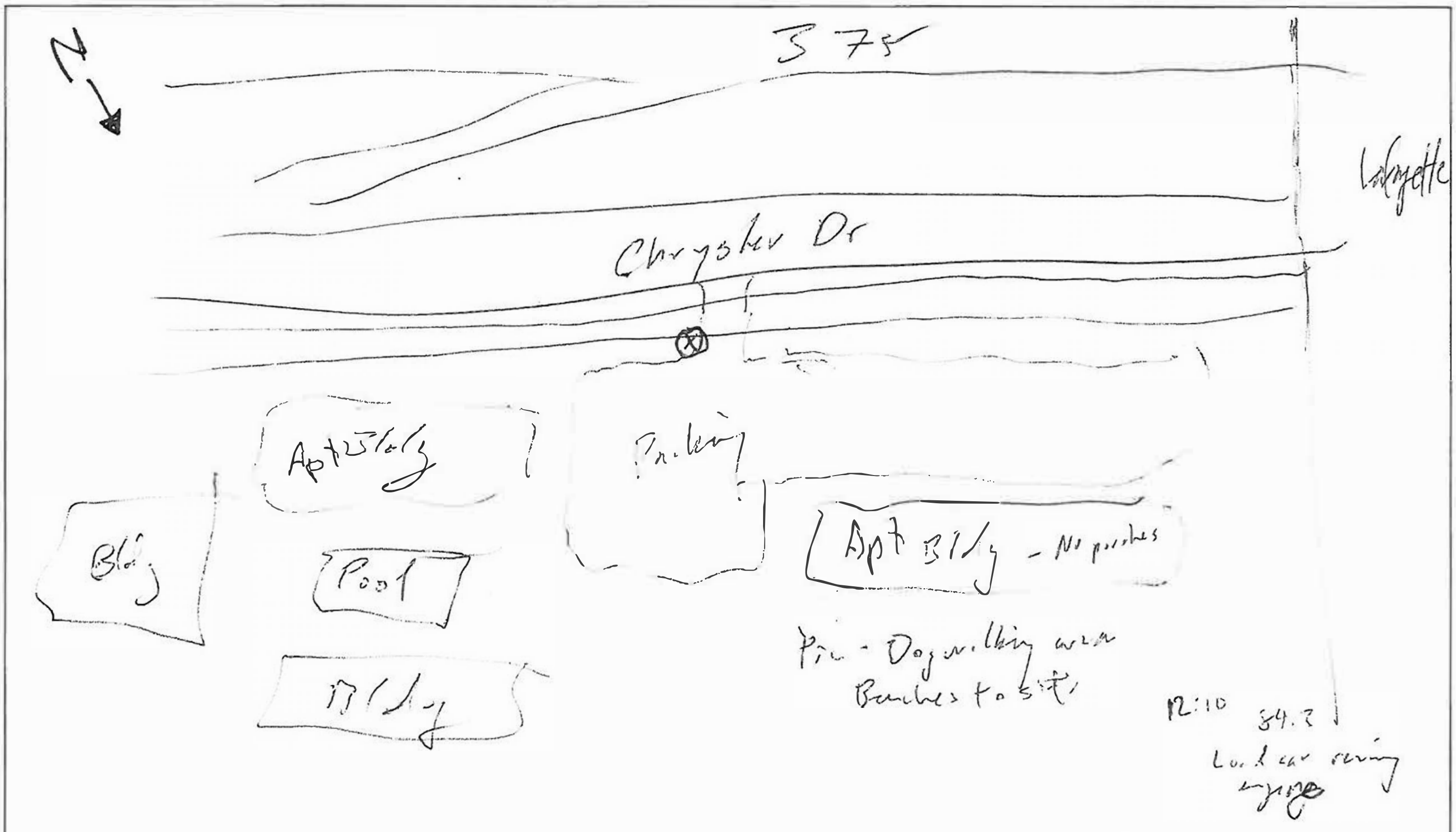
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	Chrysler	
AUTOS	HH 11	
MED TRKS		
HVY TRKS		
BUS		
MOTORCYCLE		
SPEED	30	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 Mins	Leq 62.3	

WEATHER DATA WIND SPEED (MPH) 2-6 DIR. S TEMP 67.9 HUMIDITY CLOUD COVER Clr

BACKGROUND NOISE Lafayette

MAJOR SOURCES 375; Frontage Rd, On ramp

UNUSUAL EVENTS

OTHER NOTES

NOISE MEASUREMENT DATA SHEET

HNTB

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-10 DATE: 10-26-2017 TIME: 15:03

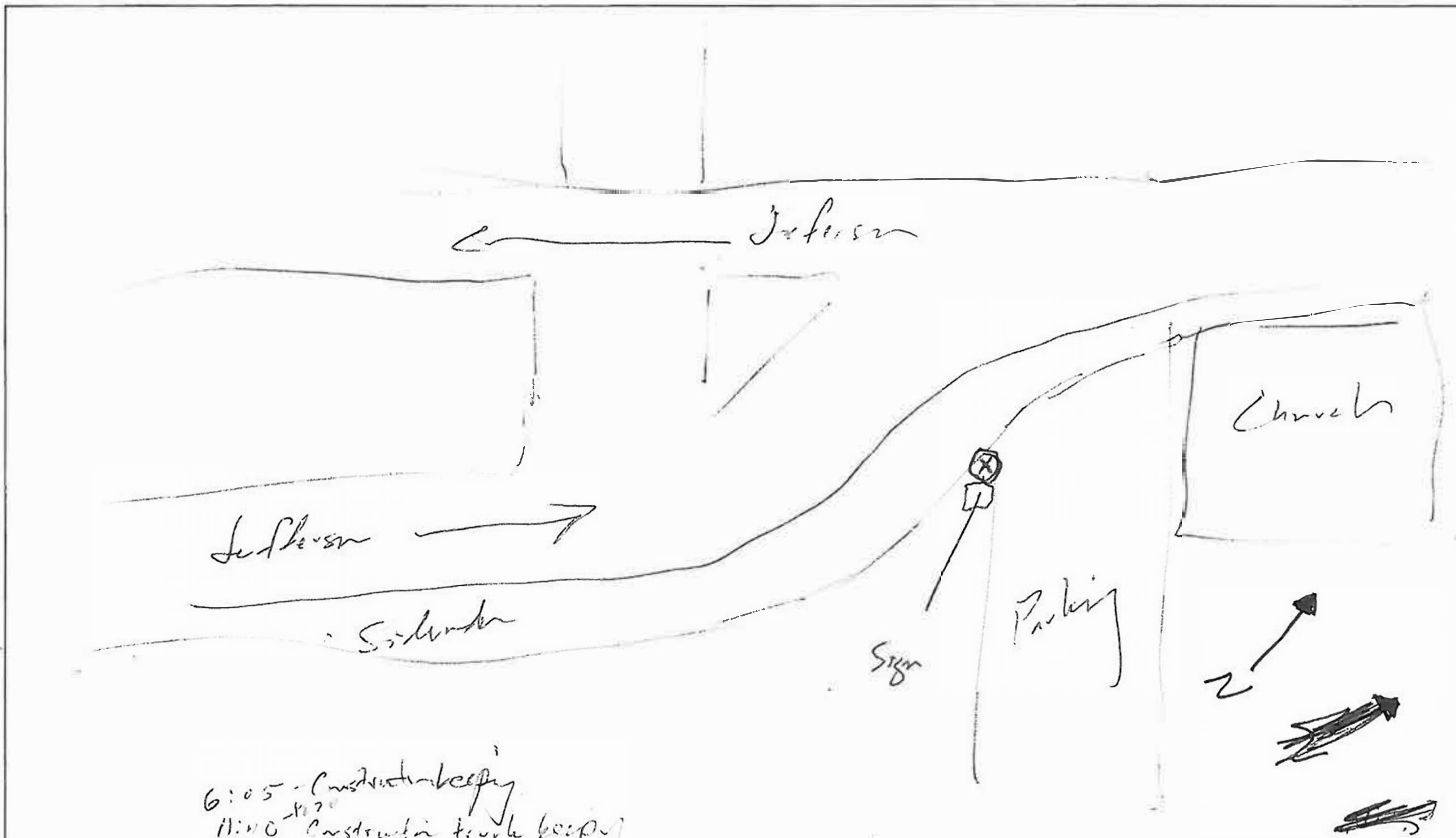
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	Jefferson NB	
AUTOS	[illegible]	[illegible]
MED TRKS	||| [illegible]	[illegible]
HVY TRKS	||| [illegible]	[illegible]
BUS	|||| [illegible]	[illegible]
MOTORCYCLE	[illegible]	[illegible]
SPEED	25-35	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min.	Leq 69.8	

WEATHER DATA WIND SPEED (MPH) 5-7 DIR. S TEMP. 57.2 HUMIDITY CLOUD COVER CLR.

BACKGROUND NOISE

MAJOR SOURCES 375, NB Jefferson.

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-11 DATE: 10-26-2017 TIME: 15:23

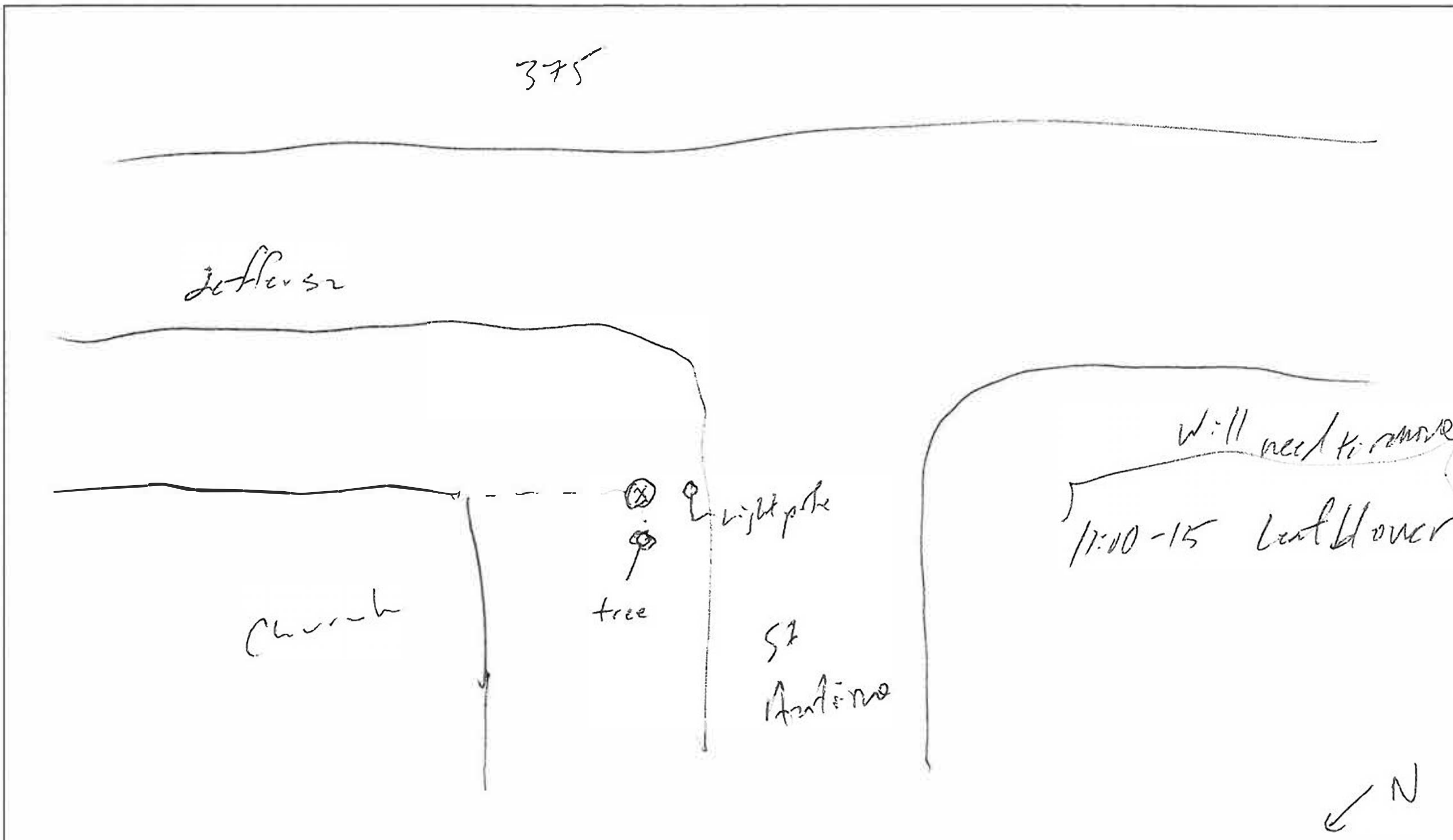
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	East Jefferson Ave	(WB)
AUTOS	[illegible]	[illegible]
MED TRKS	[illegible]	[illegible]
HVY TRKS	[illegible]	[illegible]
BUS	[illegible]	[illegible]
MOTORCYCLE		[illegible]
SPEED	35-40	[illegible]

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min	Leq 67.8	

WEATHER DATA WIND SPEED (MPH) 4-6 DIR. S TEMP. HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE leaf blower

MAJOR SOURCES 375, Jefferson

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-12 DATE: 1 0-26- 2017 TIME: 14:31

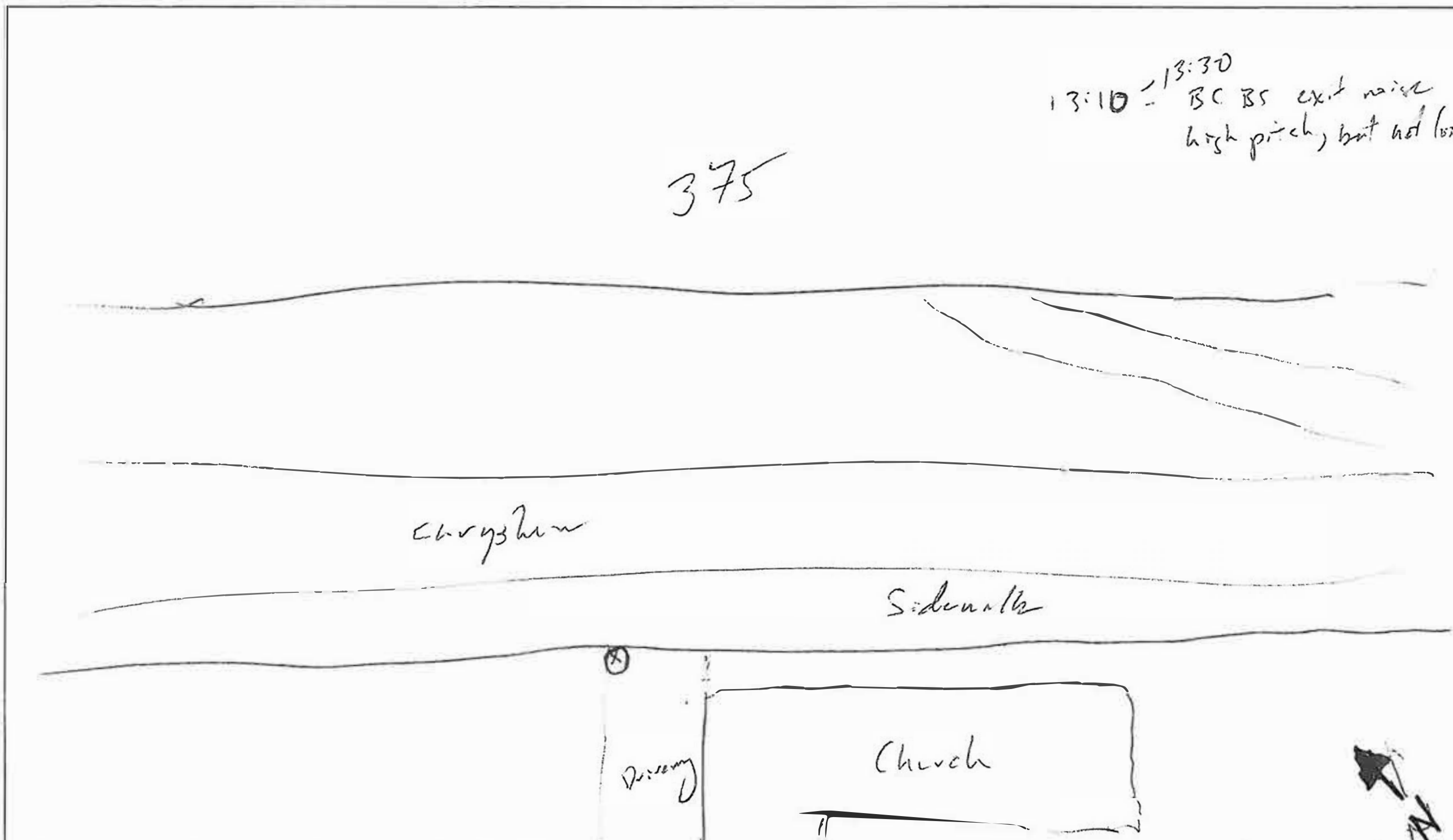
CALIBRATION: 113.8 at 1k Hz dB.

RESPONSE: FAST / SLOW WEIGHTING: A / C / LIN.

TRAFFIC DATA		
ROAD (Name/Dir)	LT Chrysler	
AUTOS	𝍸 𝍸 𝍸 𝍸	||||
MED TRKS		
HVY TRKS		
BUS	|	
MOTORCYCLE		
SPEED	35-45	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min.	Leq 62.3	

WEATHER DATA WIND SPEED (MPH) DIR. 1-3 TEMP. 5 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES 375, Frontage

UNUSUAL EVENTS

OTHER NOTES

HNTB

NOISE MEASUREMENT DATA SHEET

PROJECT: I-375 (Detroit, MI) JOB #: 60798-DS-001-004 BY: MFZ

SITE: FS-13 DATE: 10-26-2017 TIME: 9:22 AM

CALIBRATION: 113.8 at 1k Hz dB.

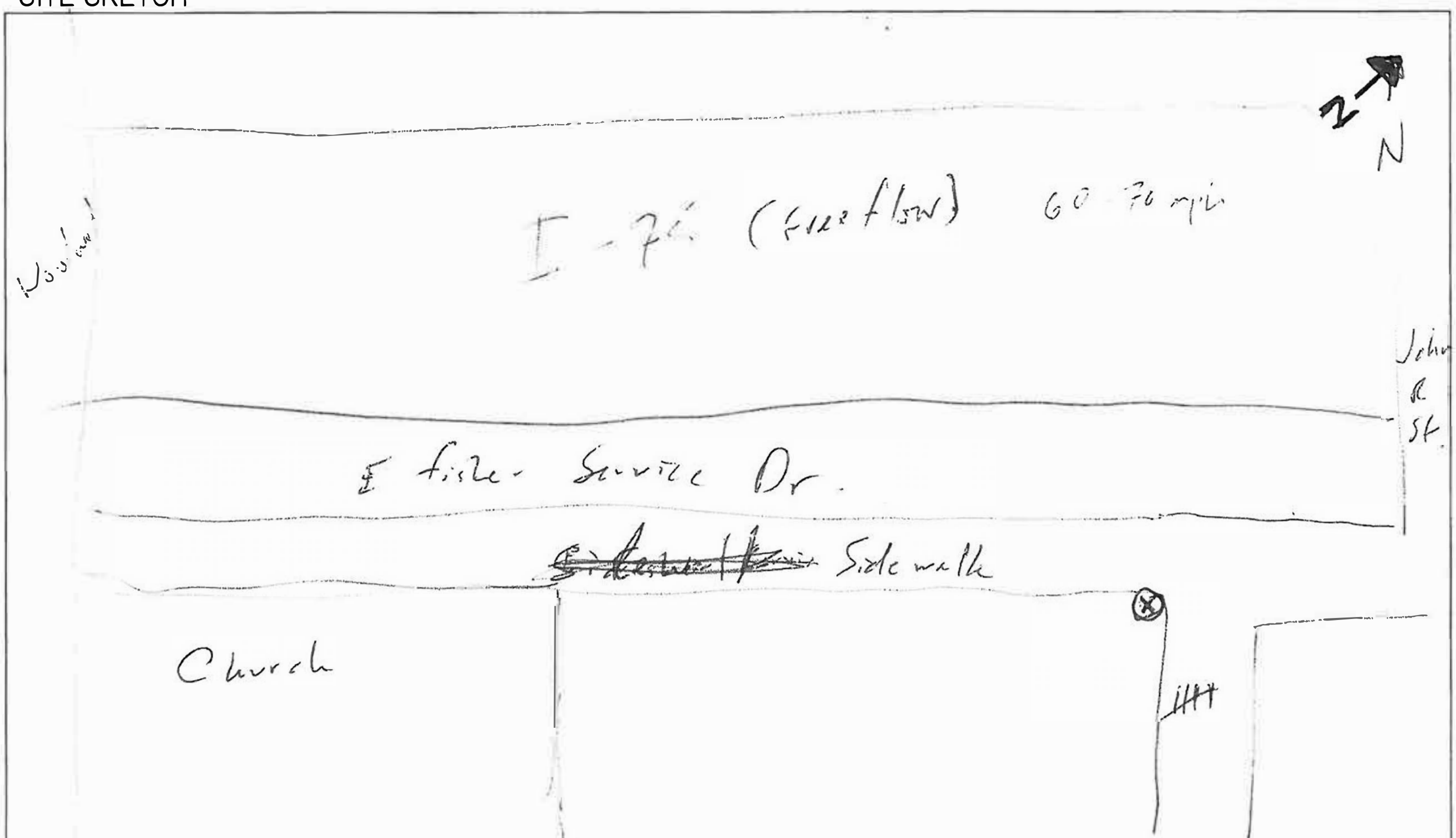
RESPONSE: FAST / SLOW (SLOW marked)

WEIGHTING: A / C / LIN. (A marked)

TRAFFIC DATA		
ROAD (Name/Dir)	LT (Frontage)	
AUTOS	卌 卌 卌 卌 卌 卌	
MED TRKS	/	
HVY TRKS		
BUS		
MOTORCYCLE		
SPEED	30-35	

EQUIPMENT	
INSTRUMENT	
SLM MANUFACTURER	Norsonic
SLM MODEL	Type 118
SLM	S / N 31483
PREAMPLIFIER – Type 1206	S / N 30522
MICROPHONE – Type 1225	S / N 52318
CALIBRATOR – Type 1251	S / N 30825

SITE SKETCH



MEASUREMENT DATA	Duration 15 min.	Leq 72.3	

WEATHER DATA WIND SPEED (MPH) 1-2 DIR. S TEMP. 43.7 HUMIDITY CLOUD COVER CLR

BACKGROUND NOISE

MAJOR SOURCES I-75, E Fisher Service Dr

UNUSUAL EVENTS

OTHER NOTES