APPENDIX G

TRAFFIC NOISE TECHNICAL REPORT

Traffic Noise Technical Report, Beck Road Corridor Improvement Project, Cities of Novi and Wixom, MI

Project number: 60719086

March 4 2025

Delivering a better world

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List of Acronyms and Abbreviations

ANSI	American National Standards Institute
CNE	common noise environment
CPBU	cost per benefited receptor unit
dB	decibel (measure of sound pressure level on a logarithmic scale)
dBA	A-weighted decibel (sound pressure level)
DU	dwelling unit
DUE	dwelling unit equivalent
FHWA	Federal Highway Administration
Leq	equivalent sound level (energy averaged sound level)
Leq(1h)	A-weighted, energy average sound level during a 1-hour period
LOS	level of service
MDOT	Michigan Department of Transportation
mph	miles per hour
NAC	noise abatement criteria
NR	noise reduction
ROW	right of way
ST	short-term
LT	long-term
TNM	Traffic Noise Model

Executive Summary

This noise analysis was conducted to assess the noise impacts associated with the Beck Road Corridor Improvement Project in Novi, MI. The purpose of the proposed project improvements is to alleviate traffic congestion, improve traffic flow, enhance safety for all roadway users (including pedestrians and bicyclists) and improve infrastructure aesthetics along the corridor. The project includes widening Beck Road from one through lane in each direction (North, and South-Bound) to two lanes in each direction plus a center turn lane between West Pontiac Trail on the north to Grand River Ave on the south, and additional boulevard improvements to 580 feet south of 9 Mile Road. In addition to the lane additions, the project includes the addition of a roundabout at the intersection of 11 Mile Road and Beck Road as well as, intersection and signal improvements, pavement repairs, and sidewalk work. The study area originally extended south to 8 Mile Rd. but has since been shortened with the southern limits just south of 9 Mile Rd. However, the City of Novi requested to report all data and analysis from the originally studied limits as a matter of full disclosure. As a result the analysis of study areas south of 9 Mile Road (designated as CNE-7 and CNE-8) are retained in the report although they are technically no longer part of the proposed project.

FHWA defines Type I projects as Federal highway projects that result in a highway in a new location, a physical alteration of an existing highway that significantly changes either horizontal or vertical alignment, or an increase to the number of through lanes. This noise study is required for this project because the increase of the number of lanes along Beck Road, satisfying the definition of a Type I project. Thus, the entire project area needs to be studied as a Type I project and assessed for potential noise impacts and mitigation options.

This noise study included on-site noise measurements in the project vicinity. Measurements were conducted in August 2022 to validate noise models. A total of one long-term (LT) and six short-term (ST) noise measurements were conducted at representative locations across the project area.

A predictive noise model was developed in the FHWA Traffic Noise Model (TNM) version 2.5 and validated against these field measurements. Noise-sensitive receptors were then identified and classified with existing and future traffic noise levels calculated in TNM 2.5. Predicted noise levels were then checked against FHWA and MDOT standards to determine traffic noise impacts in the study area. Noise abatement for these impacts were analyzed using TNM and assessed per MDOT feasibility and reasonableness criteria.

The analysis identified a total of eight defined Common Noise Environments (CNEs). Of these eight established CNEs, all except CNE-8 were identified to contain impacted receptors. Abatement in the form of noise walls were considered in each impacted CNE but none were determined to be reasonable and feasible in accordance with MDOT policy. A summary of these findings is presented in Table ES-1 and discussed in more detail in the body of the report.

Table ES-1 Summary of Project Impacts and Proposed Noise Abatement

CNE	Description/Location	Existing Impacts	Future Impacts	Noise Abatement Recommendation
CNE-1	Multi-Family Homes South of West Pontiac Trail, West of Beck Road	0	12	Not Recommended
CNE-2A	Multi-Family Homes South of Grand River Ave, East of Beck Road	0	1	Not Recommended
CNE-2B	Day Care Facilities. South of I-96, North of Grand River Ave, West of Beck Road	0	0	Not Recommended
CNE-2C	Day Care Facilities. South of Heritage Drive, North of 11 Mile Road, West of Beck Road	0	0	Not Recommended
CNE-3	Single-Family Homes, Recreational South of 11 Mile Road, West of Beck Road	2	6	Not Recommended
CNE-4	Single-Family Homes, Commercial South of 11 Mile Road, East of Beck Road	7	23	Not Recommended
CNE-5	Single-Family Homes South of 10 Mile Road, West of Beck Road	1	2	Not Recommended
CNE-6	Single-Family Homes South of 10 Mile Road, East of Beck Road	0	10	Not Recommended
CNE-7*	Single-Family Homes South of 9 Mile Road, West of Beck Road	0	1	Not Recommended

CNE-8*	Single-Family Homes South of 9 Mile Road, East of Beck Road	0	0	Not Recommended
* CNE-7 and CNE-8 are included for information purposes, but are no longer part of the project study area.				

1. Introduction and Project Description

Project Description

This project is located on Beck Road from West Pontiac Trail on the north to 580 feet south of 9 Mile Road on the south, a distance of approximately 5.25 miles. The project area and limits are shown in Figure 1-1. The primary objective of the project is to increase the lanes along Beck Road to two lanes in each direction plus a center left turn lane between West Pontiac Trail and Grand River Ave. Additional work associated with the larger project area includes intersection and signal improvements, pavement repairs, and sidewalk work. The proposed Beck Road modifications qualify the project as Type I and thus require a full noise analysis. FHWA and MDOT policy requires the noise analysis to assess the entire project area for noise impacts and potential noise abatement. All noise-sensitive properties with a defined outdoor use area within approximately 500 feet of the project roadways were evaluated for noise impacts and potential noise abatement in accordance with Michigan Department of Transportation, Highway Noise Analysis and Abatement Handbook. July 13, 2011 (MDOT policy).

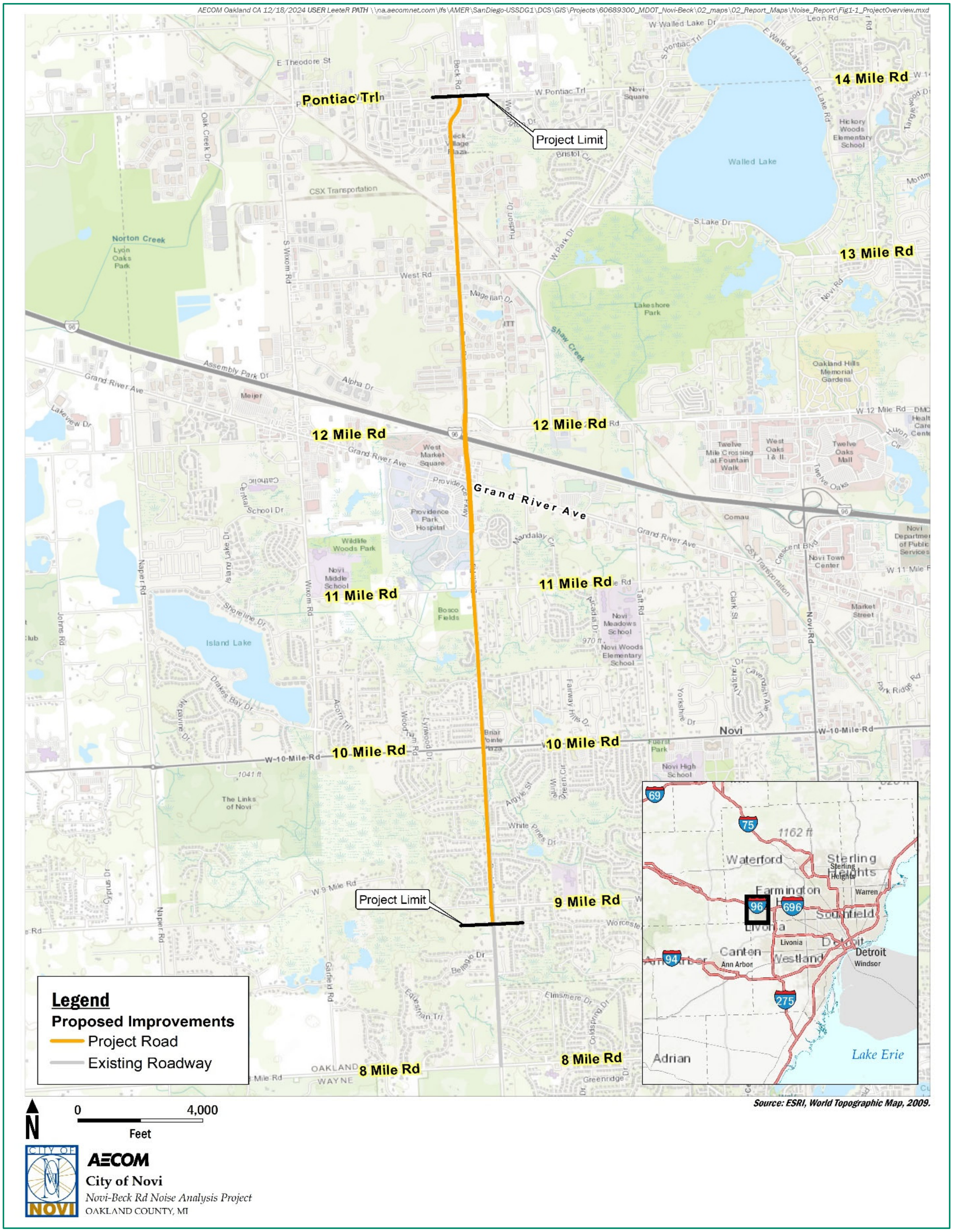
The areas along either side of Beck Road within the project area include several single and multi-family residential properties, and several commercial properties. Within the project limits there is also a church located at 23892 Beck Road, and two active sport areas within the Central Park Estates located at 47305 Central Park Blvd., and Bosco Fields sports fields and playground southwest of the intersection of Beck Road and 11 Mile Road.

Description of Alternatives

This project includes one future build alternative to be evaluated:

- Future build (includes all proposed improvements and projected traffic volumes for Year 2045)

Figure 1-1 Project Overview



2. Traffic Noise Concepts

The following glossary of acoustical terms is intended to help frame the discussion of project-generated noises and their potential effects on neighboring communities in the project area.

Acoustical Terms

Noise: Whether something is perceived as a noise event is influenced by the type of sound, the perceived importance of the sound, and its appropriateness in the setting, the time of day, and the type of activity during which the noise occurs, and the sensitivity of the listener. Local jurisdictions may have legal definitions of what constitutes "noise" and such environmental parameters to consider.

Sound: For this analysis, sound is a physical phenomenon generated by vibrations that result in waves that travel through a medium, such as air, and result in auditory perception by the human brain.

Frequency: Sound frequency or "pitch" is measured in hertz (Hz), which is a measure of how many times each second the crest of a sound pressure wave passes a fixed point. For example, when a drummer beats a drum, the skin of the drum vibrates at a number of times per second. When the drum skin vibrates 100 times per second, it generates a sound pressure wave that is oscillating at 100 Hz, and this pressure oscillation is perceived by the brain as a tonal pitch of 100 Hz. Sound frequencies between 20 and 20,000 Hz are within the range of sensitivity of the best human ear.

Amplitude or Level: Sound levels are measured in decibels (dB) using a logarithmic scale. A sound level of zero dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above approximately 110 dB begin to be felt inside the human ear as discomfort and eventually as pain at 120 dB and higher levels. The minimum change in the sound level of individual events that the average human ear can detect is about 1 to 2 dB. A 3 to 5 dB change is readily perceived. A change in sound level of about 10 dB usually is perceived by the average person as a doubling (or if decreasing by 10 dB, halving) of the sound's loudness. Table 2-1 shows typical indoor and outdoor sounds and their corresponding dB levels, arranged on what often is referenced as an "acoustic thermometer" to show relative loudness.

Sound pressure: Sound level usually is expressed by reference to a known standard. This report refers to sound pressure level, which is expressed on a logarithmic scale with respect to a reference value of 20 micropascals. Sound pressure level depends not only on the power of the source, but also on the distance from the source and the acoustical characteristics of the space surrounding the source.

A-weighting: Sound from a tuning fork contains a single frequency (a pure tone), but most sounds heard in the environment do not consist of a single frequency; instead, they are composed of a broad band of frequencies, differing in sound levels. The method commonly used to quantify environmental sounds consists of evaluating all frequencies of a sound according to a weighting system that reflects the typical frequency-dependent sensitivity of average healthy human hearing. This is called "A-weighting," and the measured decibel level is referred to as A-weighted decibels (dBA).

Equivalent sound level: Environmental noise levels vary continuously and include a mixture of noise from near and distant sources. A single descriptor, energy-average sound level during a measured time interval (L_{eq}), may be used to describe such sound that is changing in level from one moment to another. L_{eq} is the energy-average sound level during a measured time interval. This is the "equivalent" constant sound level that would have to be produced by a single, steady source to equal the acoustic energy contained in the fluctuating sound level measured.

Insertion loss (IL): The IL is the reduction in noise level at a location from noise abatement means, placed in the sound path between that location and a sound source.

Fundamentals of Traffic Noise Assessment and Control

Sound Propagation

Atmospheric conditions (e.g., wind, temperature gradients, humidity) can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound traveling over an acoustically absorptive surface (e.g., grass) attenuates at a greater rate than sound traveling over a hard surface (e.g., pavement, expanses of open water). When located near either the sound source or the listener position, physical barriers (e.g., naturally occurring ridgelines or buildings, and other topography that block the line-of-sight between a source and receiver) also increase the attenuation of sound over distance.

Multiple Sound Sources

Because sound pressure levels in decibels are based on a logarithmic scale, they cannot be added or subtracted in an arithmetic fashion. Therefore, sound pressure level dB are logarithmically added on an energy summation basis. In other words, adding a new noise source to an existing noise source, both producing noise at the same level, does not double the noise level. Instead, if the difference between two noise sources is 10 dBA or more, the louder noise source dominates, and the resultant noise level is equal to the noise level of the louder source. In general, if the difference between two noise sources is 0 to 1 dBA, the resultant noise level is 3 dBA higher than the louder noise source, or both sources if they are equal. If the difference between two noise sources is 2 to 3 dBA, the resultant noise level is 2 dBA above the louder noise source. If the difference between two noise sources is 4 to 10 dBA, the resultant noise level is 1 dBA higher than the louder noise source.

How Noise is Measured

Sound can vary over an extremely large range of amplitudes. The decibel (dB) is a logarithmic unit that is the accepted standard unit for measuring the amplitude of sound because it accounts for these large variations in amplitude and reflects the way people perceive changes in sound amplitude. Different sounds may have different frequency content. Frequency content of a sound refers to its tonal quality or pitch. When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute (ANSI). The A-weighted noise level has been found to correlate well with peoples' judgments of the noisiness of different sounds and has been used for many years as a measure of community noise. Table 2-1 illustrates sound pressure levels in dBA of various sound sources between 0 dBA (threshold of hearing) and 120 dBA (threshold of pain). An increase of 3 dBA in noise level can barely be perceived, while an increase of 5 dBA is readily noticeable and considered a significant noise increase. A 10 dBA increase corresponds to a subjective doubling of loudness. A relationship between changes in noise level and loudness is indicated in Table 2-2. Since noise fluctuates from moment to moment, it is common practice to condense the noise level over a specified period of time into a single number called the Equivalent Noise Level (Leq). Many surveys have shown that the Leq properly predicts annoyance, and thus this metric is commonly used for noise measurements, prediction, and impact assessment.

Table 2-1 Common Indoor and Outdoor Noise Levels

Common Outdoor Noise Sources	Noise Level (A-weighted decibels)	Common Indoor Noise Sources
-	110	Rock Band
Jet Flyover at 1000 feet	100	Inside Subway Train (NY)
Gas Lawn Mower at 3 feet	-	-
Diesel Truck at 50 feet	90	Food Blender at 3 feet
Noisy Urban Daytime	80	Garbage Disposal at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Commercial Area	-	Normal Speech at 3 feet
-	60	-
-	-	Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theater
Quiet Suburban Nighttime	-	Library
-	30	-
Quiet Rural Nighttime	-	Bedroom at Night
-	20	-
-	-	Broadcast & Recording Studio
-	10	-
-	0	Threshold of Hearing

Source: Adapted from Caltrans Technical Noise Supplement, 2013

Table 2-2 Relationship between Changes in Noise Level and Perceived Loudness

Increase (or Decrease) in Noise Level	Loudness Multiplied (or Divided) by
3 decibels	1.2
6 decibels	1.5
10 decibels	2
20 decibels	4

Source: Adapted from Caltrans Technical Noise Supplement, 2013

How Highway Noise is Generated

Highway noise is generated from three primary sources: tire/pavement noise, engine noise, and exhaust noise. Tire/pavement noise is the noise generated by the rubber tires rolling over the pavement surface and may vary in intensity and character depending on the type and condition of both the tires and the pavement. For automobiles and light trucks traveling at typical highway speeds (over about 50 miles per hour [mph]), tire/pavement noise is generally the dominant noise source. For medium and heavy trucks (like large commercial delivery vehicles and long-haul tractor-trailers) engine and exhaust noise also contribute to the noise that they produce. At typical highway speeds, one large truck can produce as much noise energy as ten automobiles. How highway noise is experienced at nearby homes is controlled by a number of factors, including: the total number of vehicles on the highway, the percentage of large trucks, the average speed of the vehicles, the distance to the highway, obstructions blocking the view of the highway, and meteorological conditions. Generally speaking, the more vehicles, the higher percentage of large trucks or the closer one is to the highway, the greater the noise will be. Intervening obstructions, either manmade (buildings, walls, berms) or natural (such as intervening terrain) will reduce noise levels. Foliage and vegetation can reduce noise levels, but it must be dense (completely obscuring the view of the highway) and thick (on the order of 50 to 100 feet) to make a noticeable difference.

How Highway Noise Can Be Reduced

Highway noise can be reduced in several ways. Here are some of the most recognized:

Traffic Controls

The faster vehicles travel, and the higher percentage of large trucks, the louder the noise. Reduced speed limits, or more rigorously enforced existing speed limits, and heavy truck restrictions will reduce noise levels. However, the implementation of such measures is often politically difficult for the sake of lower noise levels alone.

Land Use Controls:

Perhaps the most common sense and fiscally responsible solution to highway noise, and one favored by most highway agencies is to restrict the development of lands near highways. Restricting development of land near new highway corridors to non-noise sensitive land uses, such as commercial or industrial activities can eliminate most noise problems. However, this approach is not suitable for circumstances when land near existing or future highways has already been developed for residential land use.

Quieter Vehicle Noise Sources

Quieter vehicles mean less highway noise. For automobiles, this means quieter tires (since tire/pavement noise is the dominant noise source). For large trucks, the EPA has established standards for maximum noise levels for new and in-use trucks. The maximum noise levels for new trucks are lower than those for some older trucks, so as old trucks are phased out and replaced with newer ones the noise produced by the average truck may go down.

Noise Barrier Walls and Berms

Noise barriers, both structural walls and earthen berms, are often constructed specifically for the purpose of reducing highway noise levels. Noise barriers can be very effective for reducing noise levels at nearby homes, often reducing noise levels by as much as 10 decibels at the closest homes (a perceived halving of loudness). Noise barrier walls may not be feasible on some arterial roadways due to required gaps in walls to allow property access. Noise barriers can be expensive to build, on the order of $2 million per mile. Because of their cost, the construction of noise barriers is often restricted to large highway improvement or construction projects. Some jurisdictions however, are quite active in constructing “retrofit” noise barriers on existing highways.

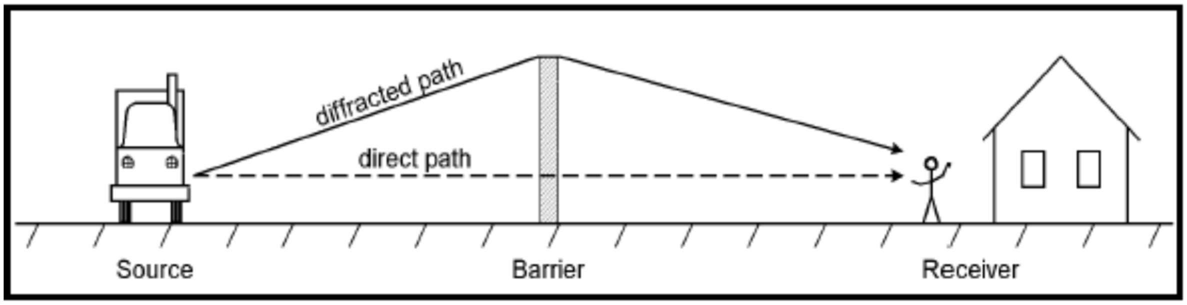
Quieter Pavements

It has long been recognized that some pavement types tend to be quieter than others. White concrete pavement, for example, is typically louder than asphalt blacktop. White concrete with tining (grooves cut into the pavement surface) is louder still. However, white concrete pavement (also known as Portland Cement Concrete, or PCC) is thought to be more durable, and perhaps safer than blacktop pavements (due to better skid resistance and drainage). There is also considerable concern that the low noise advantages of some blacktop pavements may diminish over time. As the tiny “nooks and crannies” in the blacktop pavement that give it acoustical absorption may fill up with silt and sand or become compressed over time, the acoustical benefits are reduced. As a result, the Federal government does not currently provide funding for quieter pavements as a noise reduction option except for approved research purposes.

How Noise Barriers Work

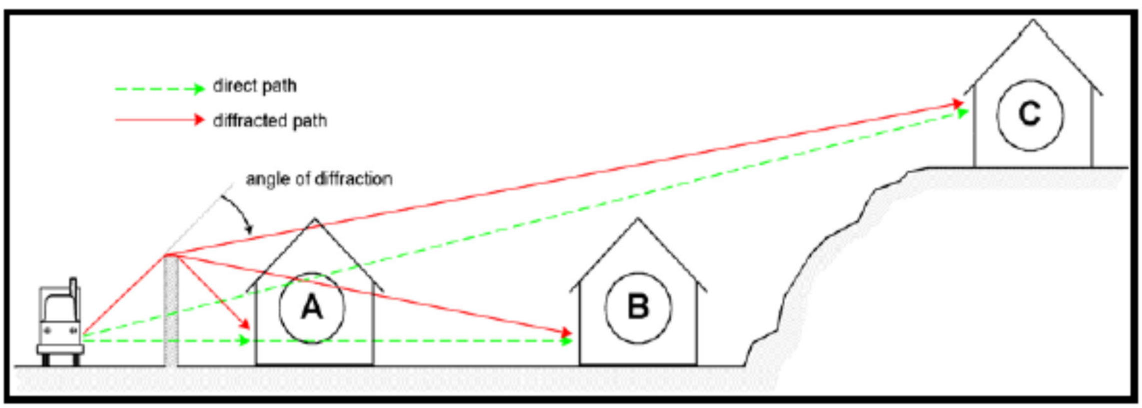
Noise barriers reduce noise levels by interrupting or lengthening the path that the noise takes between the source and the receiver. To be effective at reducing noise, noise barriers must be able to block the “line of sight” between the object producing the noise (like vehicles on the highway) and the person subjected to the noise (like residents living near the highway). The amount that the noise will be reduced is related to the path length difference between the “direct path” that the uninterrupted sound would take between the source and receiver (with no barrier) and the “diffracted path” that the sound must take going over or around the barrier, as illustrated in Figure 2-1.

Figure 2-1 Simple Noise Barrier Geometry



Noise barriers may work better for some homes than for others. In Figure 2-2, below, home “A” is relatively close to the highway where the noise barrier can provide a large path length difference between the direct and diffracted paths, resulting in a substantial noise reduction (perhaps as much as 10 to 15 decibels). Home “B” is further from the barrier and the path length difference is not as great, resulting in less noise reduction (perhaps 7 to 10 decibels). Home “C” is even further from the highway and also elevated above the highway grade, providing an even smaller path length difference (resulting in a noise reduction of perhaps 3 to 5 decibels). In general, for a given barrier height and location, the further the receiver is from the barrier or the higher the receiver is elevated, the smaller the path length difference (or angle of diffraction) and the smaller the resulting noise reduction.

Figure 2-2 Path Length Difference for Varying Receiver Geometry



Regulatory Overview

Federal Regulations

The FHWA noise policy is contained within The Code of Federal Regulations, Title 23, Part 772 (23 CFR 772) which provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. The code was most recently updated in July of 2010. Under the current version of 23 CFR 772.5, projects are categorized as Type I, Type II, or Type III projects. The FHWA defines a Type I project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes. The proposed project is a Type I project as defined by the FHWA.

Type I projects include those that create a completely new noise source, as well as those that increase the volume or speed of traffic or move the traffic closer to a receptor. Type I projects include the addition of an interchange, ramp, auxiliary lane, or truck-climbing lane to an existing highway, or the widening of an existing ramp by a full lane width for its entire length. Projects unrelated to increased noise levels, such as lighting, signing, and landscaping, are not normally considered Type I projects.

Under 23 CFR 772.13, noise abatement must be considered for Type I projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR 772 requires that the project sponsor "consider" noise abatement before adoption of the final NEPA document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the design year condition noise levels approach or exceed the noise abatement criteria (NAC) specified in 23 CFR 772, or design year condition noise levels create a substantial noise increase over existing noise levels. 23 CFR 772 does not specifically define the terms "substantial increase" or "approach"; these criteria are defined in the MDOT Noise Analysis and Abatement Handbook (July 13, 2011), as described in the following section.

Table 2-3 summarizes the FHWA NAC corresponding to various defined land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in each area.

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. Interior noise impacts will only be addressed for land uses listed with Activity Category D.

Table 2-3 FHWA Noise Abatement Criteria

Activity Category	Activity Criteria		Evaluation Location	Activity description
	Leq(h)	L10(h)		
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, day care 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, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio stations recording studios, schools, and television studios.
E	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	--	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	--	--	--	Undeveloped lands that are not permitted.

1 Either Leq(h) or L10(h) (but not both) may be used on a project.

2 The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise

3 Includes undeveloped lands permitted for this activity

State Regulations and Policies

MDOT has published the noise policy which provides guidelines in the analysis of highway traffic noise and the evaluation of noise abatement measures. Effective July 13, 2011, the MDOT Highway Noise Analysis and Abatement Handbook (hereafter referred to as "the MDOT noise handbook") also includes current policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The MDOT noise handbook defines that a noise impact occurs when the sound level approaches or exceeds the assigned NAC level for a specific category, which is defined as an Leq(h) sound level 1 dBA less than the NAC identified in 23 CFR 772. This means that for an Activity Category B land use (residential), a peak hour noise level of 66 dBA is considered to approach the NAC of 67 dBA and is identified as an impact. The MDOT noise handbook defines a noise increase as substantial when the predicted traffic noise levels with project implementation exceed existing noise levels by 10 dBA. The MDOT noise handbook provides detailed technical guidance for the evaluation of highway traffic noise. This includes field measurement methods, noise modeling methods, and report preparation guidelines. In addition to the NAC criteria above, the MDOT noise handbook also specifies the following definitions and policies:

- **Benefited Receptor** is the recipient of an abatement measure that receives a noise reduction at or above the minimum threshold of 5 dBA.
- **Feasible Noise Abatement Measure** is an abatement measure that is acoustically feasible and meets engineering requirements for constructability. A noise abatement measure is considered feasible when it can provide at least a 5 dBA reduction to at least 75% of impacted noise receptors and meets constructability, safety, access, utility, and drainage requirements.
- **Reasonable Noise Abatement Measure** is an abatement measure that has been determined to be cost-effective if it costs at or below the allowable cost per benefited receptor unit (CPBU) of $56,428 (2024 dollars) and is considered acceptable to the majority of residents and property owners who benefit from the noise abatement. The MDOT design year attenuation requirement requires that a minimum of one benefited receptor achieve at least a 10 dBA noise reduction and that at least 50% of benefited receptors achieve a 7 dBA reduction.

3. Methods of Noise Analysis

Defining Area or Potential Impact

The extent of the noise study analysis area should include all receptors potentially impacted by the project. The FHWA does not establish a fixed distance to define the noise impact analysis area. Historically, absolute noise impacts (those areas with noise levels approaching or exceeding the NAC – 66 dBA for residential land uses) rarely exist beyond about 500 feet from the roadway. The MDOT noise handbook defines the study zone to be a minimum of 500 feet, including all noise-sensitive receptors on all sides of the highway. If an impact is identified at 500 feet, the next closest receptor would need to be analyzed until a distance where impacts are no longer identified is reached. If no receptors are located within the 500-foot zone, then the closest receptor(s) should be analyzed.

Field Measurement Procedures

Several field noise measurements were conducted for this project. The noise measurement procedures in the field follow applicable standard procedures, including those outlined in the FHWA's Measurement of Highway Related Noise, May 1996, and the MDOT noise handbook. Specifically, the following practices and procedures were used.

The short-term (ST) noise measurements (typically 15-25 minutes) were conducted at actual or representative receptor locations and were used primarily to validate the noise prediction model (at locations where traffic noise was dominant). Short-term noise measurements were generally conducted at exterior areas of frequent human use and were only conducted during periods of free-flowing traffic, dry roadways, and low to moderate wind speeds (less than 12 mph to avoid extraneous wind noise).

One long-term (LT) measurement (24-hour period) was conducted at an actual or representative receptor location and was used to show a typical noise pattern throughout the day.

ANSI Class I sound level meters were used for both ST and LT measurements. The meters were subjected to a field calibration checks before and after the measurement session.

Concurrent traffic counts (classified in auto, medium and heavy trucks, buses, and motorcycles) for the acoustically dominant road were conducted for each short-term measurement. Traffic was videotaped during the measurements to be subsequently counted. The traffic counts can be found in Table 3-3.

All field data were recorded on field data sheets, which included the time, name and location of the measurement, instrument information, observed meteorological data, field calibration results, a measurement site diagram, GPS coordinates, and notes regarding the dominant noise sources and any other observed acoustically relevant events (such as aircraft over-flights, emergency vehicle pass-bys, etc.). Field sheets and photographs of measurement sites can be found in Appendix A.

Analysis Objectives

The purpose of this noise analysis report is to identify, and document potential noise impacts associated with the proposed future project and to identify feasible and reasonable abatement. The general analysis procedure for the project noise study includes the following steps:

1. **Review Project Description:** Review the project description and project data to be analyzed and collect additional required data (including roadway design files, existing and future traffic data, land use data, etc.). Consider all alternatives, design options, and construction phasing scenarios. This information is presented in Section 1 of this report.

2. **Identify Regulatory Framework:** Investigate and establish the regulatory framework to be followed for the noise analysis, including federal, state, and local regulations and ordinances applicable to the Project. This information is presented in Section 2 of this report.

3. **Noise Analysis Methodology and Establish Existing Land Use and Noise Environment:** Investigate and document the existing noise environment for the project area, including existing noise-sensitive land uses and existing noise levels in the project area. These were accomplished with a careful review of local zoning information, review of aerial photography, and a site visit to the project area. This information is presented in Section 3 of this report.

4. **Predict Future Noise Levels and Assess Noise Impacts:** Future noise levels at noise-sensitive land uses for the future build alternative are predicted using the FHWA TNM Version 2.5. For each alternative, future noise levels (as well as increases in future noise levels over existing noise levels) are assessed for compliance with the identified noise impact criteria and quantify resulting noise impacts. This information is presented in Section 4 of this report.

5. **Evaluate Noise Abatement:** Where noise impacts are identified, evaluate potential noise abatement measures. Abatement measures are evaluated for feasibility and reasonableness according to FHWA and MDOT standards. This information is presented in Section 5 of this report.

6. **Construction Noise Considerations:** Analyze potential construction noise impacts and discuss available abatement options. This information is presented in Section 6 of this report.

7. **Information for Public Officials:** Provide or identify appropriate information for local public officials to help avoid future noise impacts. This information is presented in Section 7 of this report.

A more detailed accounting of the specific procedures involved in each of the above analysis steps is provided in the indicated report section.

Selection of Noise-Sensitive Receptors

In general, modeled noise-sensitive receptors are identified to represent potentially impacted land uses within the project area. A common noise environment, or CNE, is generally defined as a group of receptors within the same Activity Category in Table 2-3 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/or cross-roads. The delineated CNEs for this project are described in Section 3 of this report. Within each CNE, representative noise measurements and noise prediction locations are identified. Typically, each CNE would have one short-term measurement location and multiple noise prediction locations. The number and locations of the receptors (measurement and modeling locations) within each CNE are selected to adequately represent all of the noise-sensitive property units (dwellings) within that CNE, and these properties may include Activity Categories A through E and G in Table 2-3 (including residential, noise-sensitive commercial, parks, schools, hotels, and undeveloped lands.). Activity Category F (agriculture, retail, industrial, transportation, and utilities), may still be located within a CNE, but would be considered a noise-compatible land use and would not require noise analysis. For residential properties, more-isolated residences would generally be modeled as individual receptors, while residences in multi-family buildings and dense neighborhoods may be modeled with one modeled receptor location representing multiple dwelling units or homes (receptors).

All noise prediction locations are placed to represent an exterior area of frequent human use of the receptor. For residential properties, this would normally be an exterior activity area between the structure and the proposed project roadway, such as a pool, patio, or play area.

Loudest Hour Noise Conditions

When determining noise impacts, traffic noise predictions must be made for the loudest noise hour (generally during level of service [LOS] C or D with high heavy truck volumes and speeds close to the posted speed limit or design speed). The loudest hour noise is typically either the peak vehicular truck hour or the peak vehicular volume hour (with LOS A through D conditions).

Noise Abatement Requirements

According to FHWA policy and the MDOT noise handbook, once a noise impact has been identified, feasible and reasonable noise abatement measures must be considered. For noise abatement, primary consideration is given to exterior areas of frequent human use.

When traffic noise impacts are identified, noise barrier walls, at a minimum, are required to be considered. In addition to noise walls, other abatement elements may also be considered, if appropriate and applicable, including the following:

- Traffic management measures.
- Alteration of horizontal and vertical alignments.
- Acquisition of property to serve as a buffer to preempt development that would be adversely impacted by traffic noise; and
- Noise insulation (NAC D Only).

When noise barriers are considered, a noise barrier design analysis must show that the barrier is feasible. This typically requires that the barrier provides a minimum required level of noise reduction. According to the MDOT noise handbook, feasible noise barriers must provide at least 5 dBA of noise reduction to at least 75% of impacted receptors. In addition to meeting minimum noise reduction requirements, noise barriers must also meet engineering and constructability feasibility requirements in terms of safety, property and emergency access, drainage control, overhead and underground utility clearance, and other issues.

Noise barrier reasonableness is generally related to cost-effectiveness and benefited receptors. The MDOT noise handbook expresses barrier cost-effectiveness by a quotient formula called the Cost Per Benefited Receptor Unit (CPBU), which divides the total square-foot-cost of the barrier (at a rate of $45.00/ft^2) by the number of benefitted dwelling units. To maintain reasonableness, the total CPBU cannot exceed $56,428, (the total allowable cost established by MDOT for FY 2024). Barriers must also achieve the MDOT noise reduction design goal of 10 dBA reduction for at least one benefited receptor, and 7dBA reduction for at least 50% of benefitted receptors.

If noise barriers are determined to be reasonable and feasible as defined above, then the viewpoints of property owners and residences should be taken into consideration. Approval by a simple majority (greater than 50%) of all responding benefited owners and residences is needed to implement noise abatement. Public votes should occur during final design and could happen during the Context Sensitive Design aesthetic public input phase.

Noise Modeling Methodology

Future build noise levels, along with existing noise levels, were predicted using FHWA TNM Version 2.5, the most recent authorized version at the time of the analysis. All conventional modeling techniques and recommendations for TNM by both FHWA and MDOT were implemented. These included the following modeling procedures and conventions:

- TNM roadways were generally modeled as bundled roadways with no more than three lanes represented by a single modeled roadway.
- All roadway pavement types were modeled as “Average”.
- Traffic speeds and volumes for peak traffic hour as provided in the traffic data were modeled to predict worst-case noise levels. Traffic speeds and volumes used in this analysis were based on the predicted traffic data included in Table 3-1.
- Existing terrain lines (topography) and buildings were modeled where appropriate.
- All TNM inputs and model runs were reviewed for accuracy by an independent noise analyst.
- Sample TNM input/output files for this project are provided in Appendix B.
- All TNM model run files are available upon request.

Project Traffic Data

Predicted traffic data for the existing and Future Build were taken from a previous Beck Road Scoping Study. Existing traffic data from 2023, the most recent available, and Future Build data for year 2045 were used in the study. AM and PM peak values were evaluated; however, it was determined that combined AM peak values were greater and therefore were used in the loudest hour noise analysis. A summary of the traffic data used for this analysis can be found in Table 3-1.

Table 3-1 Existing and Future Peak Hour Traffic Volumes

	Existing Traffic (2023 Worst Hour)															
	Beck Road															
	8 Mile Road		9 Mile Road		10 Mile Road		Cider Mill Drive		11 Mile Road		Grand River		12 Mile Road		Pontiac Trail	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Speed (mph)	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Total	751	944	678	814	788	633	872	622	911	641	982	1366	1780	1207	300	845
Autos, Light Trucks	721	897	651	773	764	589	846	572	865	603	972	1311	1744	1159	279	828
Heavy Trucks	30	47	27	41	24	44	26	50	46	38	10	55	36	48	21	17
	Future Traffic (2045 Worst Hour)															
	Beck Road															
	8 Mile Road		9 Mile Road		10 Mile Road		Cider Mill Drive		11 Mile Road		Grand River		12 Mile Road		Pontiac Trail	
	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
Speed (mph)	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Total	1071	814	968	1163	857	903	1245	888	1300	915	1400	1950	2539	1721	403	1206
Autos, Light Trucks	1028	773	929	1105	831	840	1208	817	1235	860	1386	1872	2488	1652	375	1182
Heavy Trucks	43	41	39	58	26	63	37	71	65	55	14	78	51	69	28	24
Notes: Posted speeds for Autos/Heavy Trucks Source: Beck Road Scoping Study, 2023																

Existing Condition and Common Noise Environments

Existing Land Use and Zoning

Land uses within the project study area are a mix of residential (single- and multi-family), commercial, industrial, a place of worship, recreational/athletic fields, and undeveloped land. Undeveloped areas are assumed to be available for future residential or commercial development.

Common Noise Environments

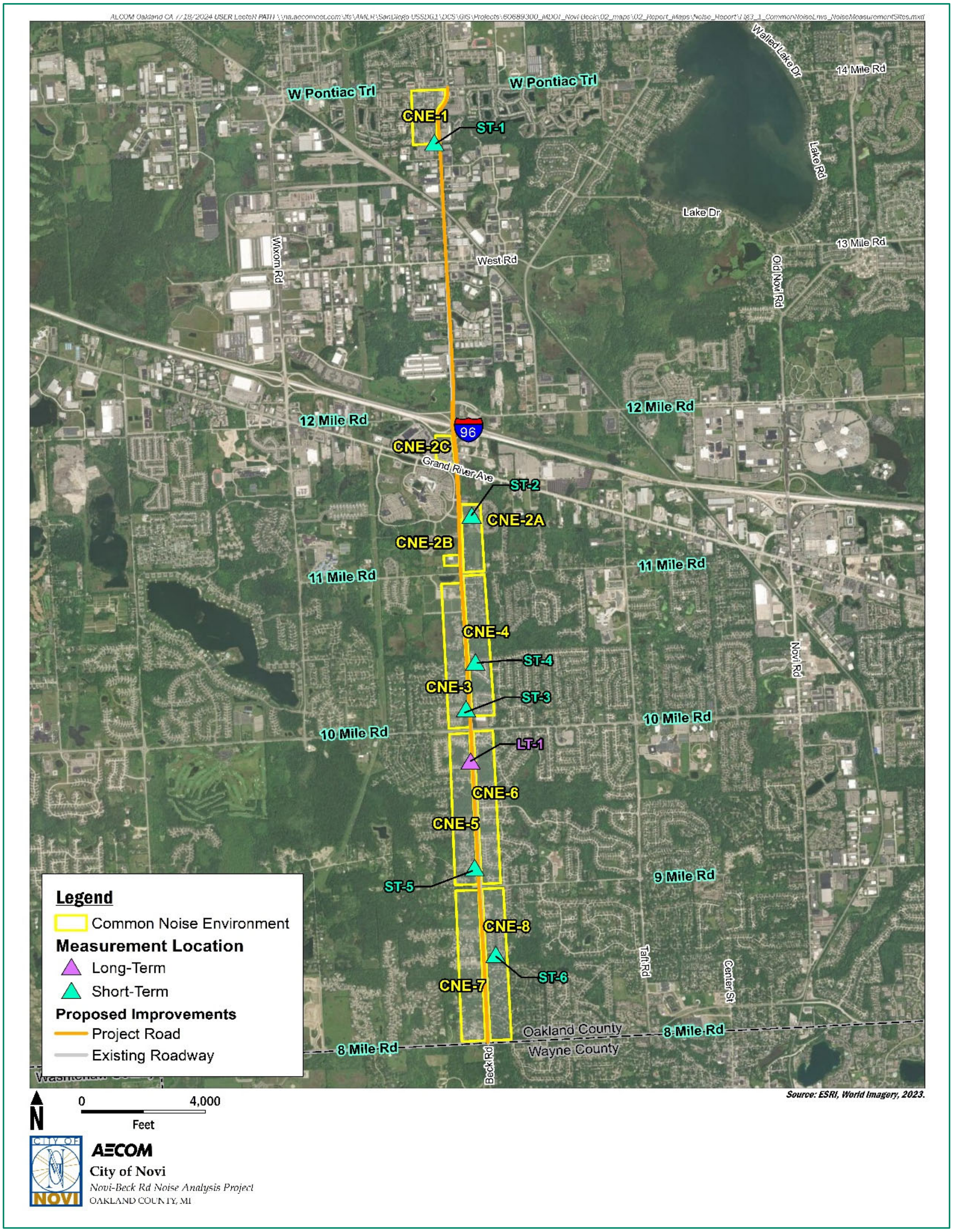
To better categorize the potential noise impacts and evaluate noise abatement for the proposed future build alternative, all of the potentially impacted noise-sensitive receptors have been organized into CNEs. A CNE is defined as an area containing land uses that share a common highway traffic noise influence. Descriptions of delineated CNEs, including location, primary land use, and type of noise-sensitive receptors are listed in Table 3-2. Figure 3-2 shows an overview of the project area illustrating the defined CNEs. It should be noted that a receptor was added to CNE-2 outside of its boundaries. This receptor, receptor 2-22, was added later in the process to represent a home that seems to be vacant but not uninhabitable. The study area originally extended to 8 Mile Rd. It has since been shortened with the southern limits just south of 9 Mile Rd. All data from the originally studied limits (including CNEs 7 and 8) remain in this report for informational purposes.

Table 3-2 Common Noise Environments

CNE	Location	Land Use	Measurement ID
CNE-1	South of West Pontiac Trail, West of Beck Road	Multi-Family Homes	ST-1
CNE-2A	South of Grand River Ave, East of Beck Road	Multi-Family Homes	ST-2
CNE-2B	South of Heritage Drive, West of Beck Road	Day Care Center, Recreational	None
CNE-2C	North of Grand River, West of Beck Road	Day Care Center	None
CNE-3	South of 11 Mile Road, West of Beck Road	Single-Family Homes	ST-3
CNE-4	South of 11 Mile Road, East of Beck Road	Single Family Homes, Commercial	ST-4
CNE-5	South of 10 Mile Road, West of Beck Road	Single-Family Homes, Religious Buildings	LT-1, ST-5
CNE-6	South of 10 Mile Road, East of Beck Road	Single-Family Homes	None
CNE-7*	South of 9 Mile Road, West of Beck Road	Single-Family Homes	None
CNE-8*	South of 9 Mile Road, East of Beck Road	Single-Family Homes	ST-6

*** CNE-7 and CNE-8 are** included for informational purposes**, but are no longer part of the project study area**

Figure 3-1. Common Noise Environments and Noise Measurement Sites



Note: CNE-7 and CNE-8 are shown for informational purposes, but are no longer part of the project study area

Existing Noise Environment

Field Noise Measurements

Noise measurements were conducted for this project between August 16 and August 17, 2022. Noise measurements were conducted to provide information for noise model validation (short-term measurements with accompanying classified traffic counts). Noise measurements were conducted as described in Section 3.2. Appendix A includes measurement-related materials.

A total of six ST noise measurements were conducted as summarized in Table 3-3. Figure 3-1 contains an aerial figure of the project area showing each measurement location.

Noise Model Validation and Results

The FHWA TNM Version 2.5 was used to predict noise levels for both the existing condition and future build alternative at receptor locations where noise levels are dominated by traffic noise on project roadways. To demonstrate that the noise model is predicting traffic noise levels within a reasonable margin of error, the noise model runs were validated by comparing predicted noise levels to measured noise levels for similar traffic conditions. However, since the TNM only predicts noise levels associated with traffic noise, the model runs can only be validated at measurement locations where noise levels were dominated by project roadways. For this project, noise model validation was possible for all six ST noise measurement locations. Noise models are considered to be validated if the difference between measured and modeled noise levels for comparable conditions is 3 dBA or less. The successful results of the noise validation effort are presented in Table 3-3.

Table 3-3 TNM Validation Summary

Measurement Location	Observed Traffic Count			Measured Leq, dBA	Modeled Leq, dBA	Difference
	Type	Beck Road NB	Beck Road SB			
ST-1	Autos	364	312	60.7	58.3	-2.4
	Medium Trucks	20	16			
	Heavy Trucks	20	20			
	Busses	0	0			
	Motorcycle	0	0			
ST-2	Autos	364	312	55.7	57.8	+2.1
	Medium Trucks	20	16			
	Heavy Trucks	20	20			
	Busses	0	0			
	Motorcycle	0	0			
ST-3	Autos	644	540	61.8	62.6	+0.8
	Medium Trucks	32	16			
	Heavy Trucks	12	20			
	Busses	0	0			
	Motorcycle	0	0			
ST-4	Autos	644	540	58.6	57.8	-0.8
	Medium Trucks	32	16			
	Heavy Trucks	12	20			
	Busses	0	0			
	Motorcycle	0	0			
ST-5	Autos	620	520	64.3	63.1	-1.2
	Medium Trucks	48	20			
	Heavy Trucks	8	4			
	Busses	0	0			
	Motorcycle	0	2			
ST-6	Autos	620	520	59.5	61.8	+2.3
	Medium Trucks	48	20			
	Heavy Trucks	8	4			
	Busses	0	0			
	Motorcycle	0	2			

As shown in Table 3-3, all calculated differences between modeled and measured noise levels are less than 3.0 dBA, therefore, the noise model predictions are considered to be valid.

4. Noise Impact Analysis

Future Noise Levels and Impacts

This section presents predicted noise levels and noise impacts (or noise impact distances for identified CNE areas and general undeveloped areas).

Predicted Noise Levels and Noise Impacts

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the design year condition noise levels approach or exceed the noise abatement criteria (NAC) specified in 23 CFR 772, or design year condition noise levels create a substantial noise increase over existing noise levels. 23 CFR 772 does not specifically define the terms “substantial increase” or “approach”; these criteria are defined in the MDOT Noise Analysis and Abatement Guidelines (July 13, 2011), as described in the following section. Table 2-3 summarizes the FHWA NAC corresponding to various defined land use activity categories.

The MDOT noise handbook defines that a noise impact occurs when the sound level approaches or exceeds the NAC level, which is defined as an Leq(h) sound level 1 dBA less than the NAC identified in 23 CFR 772. This means that a loudest-hour noise level of 66 dBA is considered to approach the NAC for Category B of 67 dBA and is identified as an impact. The MDOT noise handbook defines a noise increase as substantial when the predicted traffic noise levels with project implementation exceed existing noise levels by 10 dBA. All conventional modeling techniques and recommendations for TNM by both FHWA and MDOT were implemented, as described in Section 3.

Table 4-1 below contains a summary of the predicted noise levels and noise impacts at all modeled CNE locations in the project. Figures 5-1**,** 5-2, 5-3, 5-4, 5-5 contain detailed aerial imagery of the project area showing all modeled receptor locations and predicted future build impacts. Due to the large number of modeled receptors and CNEs within the project area, prediction information for individual receptors is presented in detail in Appendix C.

Table 4-1 Summary of Predicted Noise Levels by CNE

CNE	**No. of Modeled Receptors**	**Total Dwelling Units**	**Predicted Noise Level (Range), Leq (1h)**		**Total Number of Future Noise Impacted Units**		
			Existing	Future Build	Approach or Exceed NAC	Significant Increase	Total Impacted Dwelling Units
CNE-1	86	172	35-64	38-71	12	0	24
CNE-2A	26	26	48-63	53-66	1	0	1
CNE-2B	3	3	50-58	51-60	0	0	0
CNE-2C	2	2	46-53	49-56	0	0	0
CNE-3	62	62	43-67	46-69	6	0	6
CNE-4	115	115	42-66	44-69	23	0	23
CNE-5	51	51	48-67	50-69	2	0	2
CNE-6	81	81	42-65	46-68	10	0	10
CNE-7*	28	28	33-64	34-66	1	0	1
CNE-8*	87	87	37-64	39-65	0	0	0
*** CNE-7 and CNE-8 are included for informational purposes, but are no longer part of the project study area**							

Figures showing all receiver locations along with evaluated noise abatement elements are included in Section 5.

5. Noise Abatement Evaluation

Noise Abatement Measures

According to FHWA and MDOT policies, when noise impacts are identified, noise barriers (at a minimum) must be considered as noise abatement. Other potential noise abatement measures might include heavy truck or speed restrictions, alignment changes, and depressed roadways. Of these alternatives, the project alignment was evaluated and compared for noise impacts (as presented in Section 4), but truck restrictions and speed restrictions below proposed speed limits would significantly reduce the value of the roadway. Noise barriers were evaluated for each CNE with noise impacts for feasibility and reasonableness. The following section describes the results of the barrier assessments for each evaluated CNE.

Feasible and Reasonable Criteria and Requirements

For abatement to be recommended, the barrier must meet certain feasibility and reasonableness requirements established by MDOT in the Noise Analysis and Abatement Guidelines.

When noise barriers are considered, a preliminary noise barrier design analysis must show that the barrier is feasible. According to the MDOT noise handbook, feasible noise barriers must provide at least 5 dBA of noise reduction to 75% of the impacted receptors. In addition to meeting minimum noise reduction requirements, noise barriers must also meet engineering and constructability feasibility requirements in terms of safety, property and emergency access, drainage control, overhead and underground utility clearance, and other issues.

Noise barrier reasonableness is generally related to cost-effectiveness and benefited receptors, where a benefited receptor receives at least 5 dBA of noise reduction (NR), and cost-effectiveness is driven by a Cost per Benefited Receptor Unit (CPBU) value. The handbook identifies a CPBU of $56,428, which is a final quotient resulting from dividing the total cost of abatement (at a rate of $45.00 ft^2) by the total number of benefited receptors. Additionally, The MDOT design year attenuation requirement requires that a minimum of one benefited receptor achieve at least a 10 dBA noise reduction and that at least 50% of benefited receptors achieve a 7dBA reduction for noise abatement to be reasonable.

To summarize, for a barrier to be considered feasible and reasonable, it must have:

- A noise reduction of at least 5 dBA must be achieved at 75% of impacted receptors.
- A noise reduction of 10 dBA must be achieved for at least one receptor.
- A noise reduction of 7 dBA must be achieved at 50% of benefitted receptors.
- An estimated cost must not exceed $56,428 per benefited unit.

For a noise barrier to be considered reasonable in addition to the requirements listed above, the viewpoints of benefited property owners and residents must be taken into consideration. Greater than 50% in favor of all responding benefited owners and residents is needed to construct noise abatement. Public viewpoints and votes of benefited receptors are not part of this noise analysis but are collected during the Preliminary Engineering Phase and are recorded in the environmental documentation.

Findings and Recommendations for Noise Abatement

Noise abatement was considered for each CNE with identified noise impacts. Initially, noise abatement was checked for feasibility (5 dBA reduction for at least 75% of impacted receptors and access restrictions). If abatement was determined to be feasible, the abatement was analyzed for cost-effectiveness and other reasonableness factors. For all impacted receptors meeting feasibility requirements, preliminary barrier designs were evaluated using TNM. If the abatement was found to be both reasonable and feasible, it would be recommended for inclusion in the project pending a polling of viewpoints from benefited receptors. A summary of the barrier locations and resulting sound levels are provided in Table 5-1. The details of the barrier analysis including determinations of feasibility and reasonableness are included in Table 5-2. The narrative results of abatement evaluations for each impacted CNE are summarized in subsequent sub-sections.

Table D-1 in Appendix D lists the predicted existing, future build, and future build with barrier noise levels per modeled receptor location. The table also includes the information regarding benefited receptors and barrier design goal achievement.

Table 5-1 Evaluated Barrier Descriptions

Barrier ID	Location	Existing Leq (dBA)	Future Leq Range (dBA)		Barrier Noise Reduction (dBA)	Barrier Geometries (feet)	
			No Barrier	With Barrier		Length	Avg. Height
Wall-1	CNE 1, Residential	35-64	38-71	38-65	3-10	723	13
Wall-3a	CNE 3, Residential	43-67	46-69	46-62	0-7	300	14
Wall-3b	CNE 3, Residential	43-67	46-69	46-61	3-5	320	14
Wall-4	CNE 4, Residential	42-66	55-69	55-65	3-10	417	12
Wall-6	CNE 6, Residential	42-65	46-68	46-63	3-11	816	13.4

Table 5-2 Barrier Analysis Results

Barrier ID	Number of Attenuated Locations[1]					Cost[2]	Cost Per Benefitted Unit	Feasible?	Reasonable?	Recommended?
	≥ 10 dBA	≥ 7 dBA		≥ 5 dBA (Benefitted Receptors)						
		#	% of Benefit	#	% of Impacts					
Wall-1	1	2	33%	6	33%	$422,955	$70,493	No	No	No
Wall 3a	0	2	67%	3	52%	$189,000	$63,000	No	No	No
Wall 3b	0	0	0%	3	48%	$201,600	$67,200	No	No	No
Wall 4	1	3	100%	3	50%	$225,180	$75,060	No	No	No
Wall 6	1	6	100%	6	75%	$492,048	$82,008	Yes	No	No

Note:
1) MDOT policy requires that reasonable and feasible noise walls must be constructable, provide at least 10 dBA noise reduction at one impacted receptor, at least 7 dBA noise reduction for at-least 50% of benefited receptors, at least 5 dBA noise reduction for at least 75% of impacted receptors, and be constructed at an estimated cost of no more than $56,428 per benefited receptor.
2) Wall costs reported here are based on wall area in square feet as calculated by TNM times MDOT unit cost of $45.00/square foot.

CNE-1 Noise Abatement Analysis

CNE-1, East of Beck Road, south of W. Pontiac Trail, contains 86 modeled receiver locations each representing a total of 172 individual multi-family homes with each home representing two dwelling units. 12 receptors, representing 24 dwelling units, were determined to be impacted under the future build condition. One wall system, consisting of two barriers, was analyzed. These walls were analyzed together to have a better chance to achieve reasonableness and feasibility criteria. This system is located partially to the north of Tamarack Street and partially south of Tamarack Street along the ROW of Beck Road. Wall 1 would cost at least $70,493 per benefitted receptor, exceeding the allowable CPBU. Thus, no abatement was recommended in this location. CNE-1 is shown in Figure 5-1.

CNE-2A Noise Abatement Analysis

CNE-2A contains 26 modeled receiver locations representing a total of 26 individual dwelling units, 1 of which was impacted. This dwelling unit is directly accessed from Beck Road; therefore, a barrier would not be feasible due to private driveway access.   As it would not be feasible, no abatement was analyzed. CNE-2A is shown in Figure 5-2.

CNE-2B Noise Abatement Analysis

CNE-2B contains 3 modeled receiver locations representing a total of 3 individual dwelling units, none of which were impacted. Therefore, no abatement was analyzed. CNE-2B is shown in Figure 5-2.

CNE-2C Noise Abatement Analysis

CNE-2C contains 2 modeled receiver locations representing a total of 2 individual dwelling units, none of which were impacted. Therefore, no abatement was analyzed. CNE-2C is shown in Figure 5-2.

CNE-3 Noise Abatement Analysis

CNE-3 contains 62 modeled receiver locations representing a total of 62 individual dwelling units, 6 of which were impacted. Two walls were analyzed. Wall 3a is located north of Kirkway Boulevard along the ROW of Beck Road. Wall 3b is located south of Kirkway Boulevard along the ROW of Beck Road. Due to Kirkway Boulevard access, the cost per benefited unit for Wall 3a and Wall 3b is $63,000 and $67,200, respectively, both exceeding the allowable CPBU. As it would not meet the criteria, abatement is not recommended for this CNE. CNE-3 is shown in Figure 5-3

CNE-4 Noise Abatement Analysis

CNE-4 contains 115 modeled receiver locations representing a total of 115 individual single-family homes with each home representing one dwelling unit. 23 receptors were determined to be impacted under the future build condition. Most of the impacted homes in this CNE could not be protected by a noise barrier due to direct driveway access to the main road. However, one noise wall was analyzed, Wall 4 along Beck Road ROW South of Cider Mill Drive, where six impacted homes had driveway access via Edgewood Drive. This wall was found to not satisfy MDOT reasonableness criterion with a cost per benefited unit of $75,060 per benefitted receptor, exceeding the allowable CPBU. Thus, abatement is not recommended for this CNE. CNE-4 is shown in Figure 5-3.

CNE-5 Noise Abatement Analysis

CNE-5 contains 49 modeled receiver locations representing a total of 49 individual dwelling units, 2 of which were impacted. All of these dwelling units are directly accessed from Beck Road; therefore, a barrier would not be feasible due to required private driveway access. As it would not be feasible, no abatement was analyzed. CNE-5 is shown in Figure 5-4.

CNE-6 Noise Abatement Analysis

CNE-6 contains 81 modeled receiver locations representing a total of 81 individual single-family homes with each home representing one dwelling unit. 10 receptors were determined to be impacted under the future build condition. For this CNE in particular, it appeared that several receivers were at similar distance from the road, but some were indicated as impacted and others were not. This was because many of the receivers at similar distances from the project roadway were very close to the 66 dBA impact threshold, with some but barely above the impact threshold (66 dBA) and some just barely below (65 dBA). One noise wall was analyzed for this CNE where several impacted homes did not require direct driveway access to Beck Road, Wall 6 along Beck Road ROW North of White Pines Drive. This wall was found to meet MDOT reasonableness standards. Wall 6 would cost at least $82,008 per benefitted receptor, exceeding the allowable CPBU. Thus, abatement is not recommended for this CNE. These walls are shown in Figure 5-4.

CNE-7 Noise Abatement Analysis

CNE-7 contains 28 modeled receiver locations representing a total of 28 individual dwelling units, 1 of which were impacted. Following a basic assumption that a barrier would need to extend at least 4 times the distance from the barrier to the receiver in each direction and be tall enough to block the line of sight to the highway vehicles, a barrier of at least 420 feet in length and at least 12 feet in height would be needed to provide a minimum of 5 dBA reduction at the receptor. Due to roadway access not allowing a barrier of that length, a barrier would not be feasible in this location. As it would not be feasible, no abatement was analyzed. CNE-7 is shown in Figure 5-5. Please note, CNE-7 is included for informational purposes, but is no longer part of the project study area

CNE-8 Noise Abatement Analysis

CNE-8 contains 87 modeled receiver locations representing a total of 87 individual single-family homes with each home representing one dwelling unit. No impacts were determined; therefore, no abatement was analyzed. CNE-8 is shown in Figure 5-5. Please note, CNE-8 is included for informational purposes, but are no longer part of the project study area

Figure 5-1. Acoustical Analysis for CNE-1

Figure 5-2. Acoustical Analysis for CNE-2

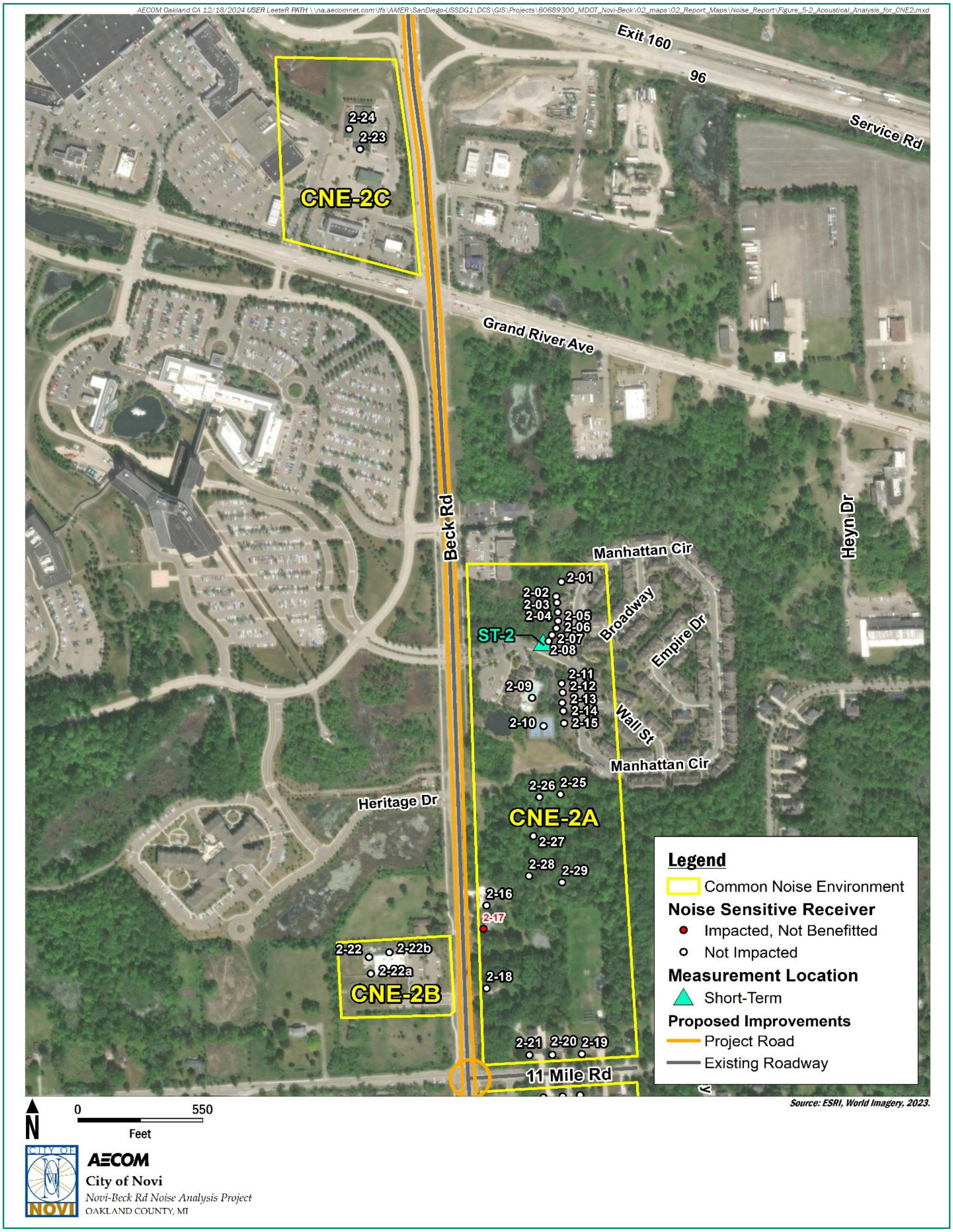


Figure 5-3. Acoustical Analysis for CNE-3, CNE-4

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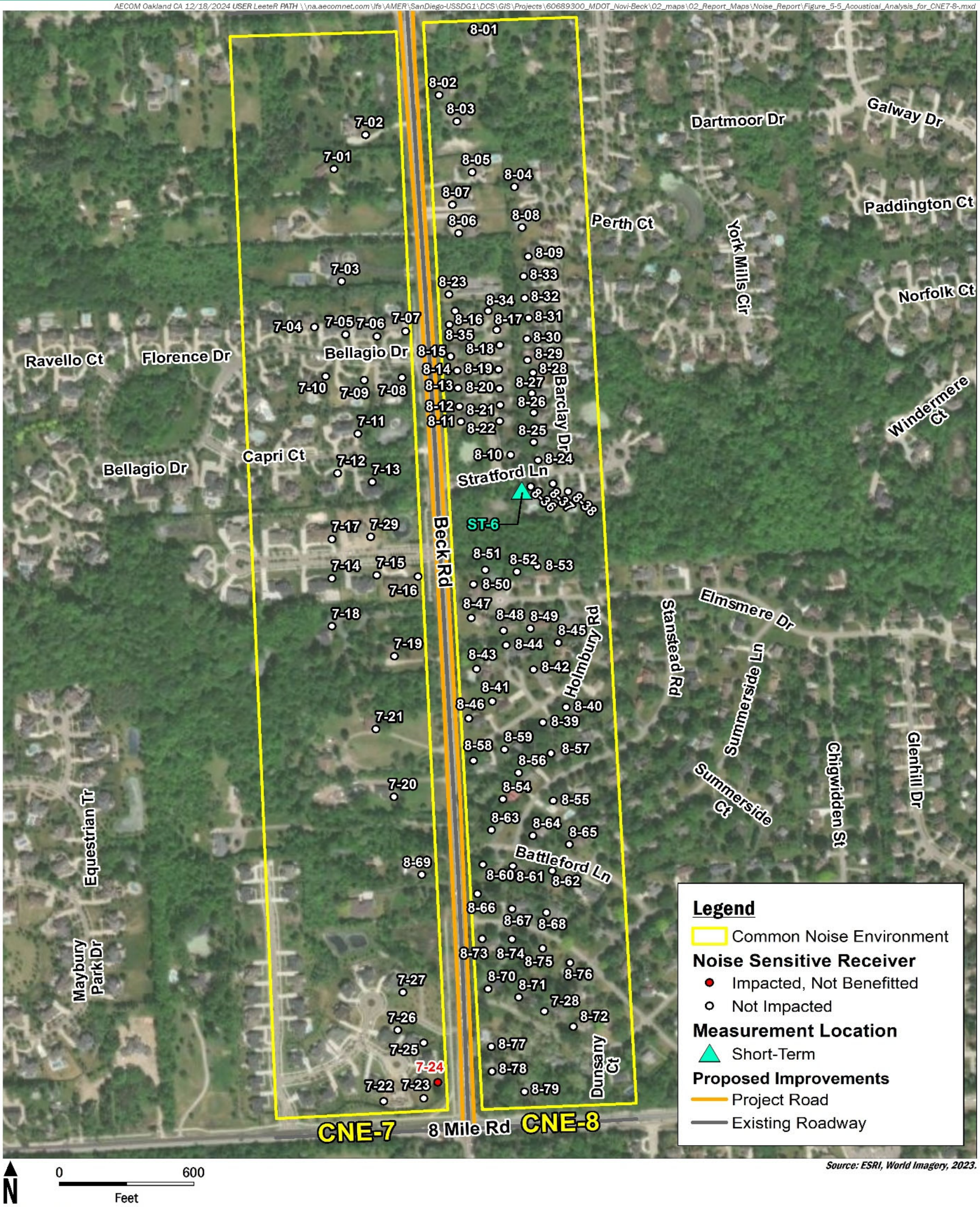
OAKLAND COUNTY, MI

Figure 5-4. Acoustical Analysis for CNE 5, CNE-6

Figure 5-5. Acoustical Analysis for CNE 7, CNE-8



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OAKLAND COUNTY, MI

6. Construction Noise Analysis

FHWA policy requires that construction noise be considered in a Type 1 highway noise analysis. This analysis would generally include the following:

1. Identification of land uses that may be affected by construction noise,
2. Determination of the measures needed in the plans and specifications to minimize or eliminate construction noise impacts; and,
3. Incorporate needed abatement into the plans and specifications.

Neither FHWA nor MDOT identify specific construction noise impact criteria. In addition, the detailed information necessary to predict actual construction noise levels (construction schedules, phasing, equipment lists, laydown areas, etc.) has not yet been determined. However, for this project, it is anticipated that pile driving and some nighttime construction work will be required.

It is recognized that areas adjacent to the highway right of way and other construction areas (such as staging areas and laydown sites) can temporarily be exposed to high levels of noise during peak construction periods. It is reasonable to assume that the same CNEs identified for potential traffic noise impacts could also be exposed to construction noise. The effect of the noise on the local area can be reduced if the hours and days of construction activity are limited to less sensitive time periods. The project construction standard noise specifications help minimize the effects of construction noise.

The following special provisions may be incorporated into the construction contract:

- Inform the local public in advance of construction activities that may generate particularly high noise levels (such as pile drivers) or periods of nighttime construction activity.
- Noise barriers approved for incorporation into the project should be constructed as close to the beginning of the project's construction timeline as practical.
- Noise created by truck movement shall not exceed 88 dBA at a distance of 50 feet.
- When working between 7:00 P.M. and 10:00 P.M., use “smart alarms” instead of standard reverse signal alarms or use spotters. When working between 10:00 P.M. and 7:00 A.M. use spotters instead of auditory alarms.
- Have portable noise meters on the job at all times for noise level spot checks on specific operations. Employ an individual trained in the use of noise meters, with working knowledge of sound measurements and their meaning and use as applied to these abatement/abatement measures.

Typical Construction Noise Levels

Table 7-1 contains a list of commonly used construction equipment and noise levels associated with using that equipment.

Table 6-1 Typical Construction Equipment Noise Levels

Equivalent Type	Lmax Ref dBA (50 feet)	Acoustic Use Factor %
Auger Drill	84	20
Backhoe	78	40
Boring Jack Power Unit	83	50
Chain Saw	84	20
Compactor (ground)	83	20
Compressor (air)	78	40
Concrete Mixer Truck	79	40
Concrete Pump Truck	81	20
Concrete Saw	90	20
Crane	81	16
Dozer	82	40
Drill Rig Truck	79	20
Drum Mixer	80	50
Dump Truck	76	40
Excavator	81	40
Flat Bed Truck	74	40
Front End Loader	79	40
Generator (>25KVA)	81	50
Generator (<25KVA)	73	50
Gradall	83	40
Grader	85	40
Horizontal Boring Jack	82	25
Hoe Ram	90	20
Jackhammer	89	20
Man Lift	75	20
Pavement Scarafier	90	20
Paver	77	50
Pickup Truck	75	40
Pneumatic Tools	85	50
Pumps	81	50
Roller	80	20
Scraper	84	40
Shears (on backhoe)	96	40
Tractor	84	40
Vacuum Excavator	85	40
Vacuum Street Sweeper	82	10
Ventilating Fan	79	100
Vibrating Hopper	87	50
Vibratory Concrete Mixer	80	20
Warning Horn	83	5
Welder/Torch	74	40

Source: RCNM User Guide, Table 1 (actual measured Lmax)

Construction Noise Abatement Measures

Although MDOT does not identify any specific abatement measures related to construction noise, the following list could be considered best practices for the avoidance of any potential problems related to construction noise impacts:

- No construction shall be performed within 1,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 10 p.m. and 6 a.m. on other days without the approval of the City of Novi or City of Wixom Engineer.
- All equipment used shall have sound-control devices no less effective than those provided on the original equipment. No equipment shall have unmuffled exhaust.
- All equipment shall comply with pertinent equipment noise standards of the U.S. Environmental Protection Agency.
- No pile driving or blasting operations shall be performed within 3,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 8 p.m. and 8 a.m. on other days without the approval of the City of Novi, or City of Wixom Engineer.
- The noise from rock crushing or screening operations performed within 3,000 feet of any occupied dwelling shall be mitigated by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the City of Novi or City of Wixom Engineer.

If a specific noise impact complaint is received during construction of the project, the contractor may be required to implement one or more of the following noise abatement measures at the contractor’s expense, as directed by the construction project manager:

- Locate stationary construction equipment as far from nearby noise-sensitive properties as feasible.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residents whenever extremely noisy work will be occurring.
- Install temporary or portable acoustic barriers around stationary construction noise sources.
- Operate electrically powered equipment using line voltage power or solar power.

7. Information for Local Government Officials

FHWA and MDOT policy specify that local officials should be provided appropriate information to assist with future compatible land use planning, especially regarding the planning and development of undeveloped lands near the proposed project right-of-way. Table 9-1 below provides potential noise impact distances from the roadway pavement for future developments on undeveloped lands.

Table 7-1 Noise Impact Distances for Undeveloped Lands

Project Roadway	Distance from the Edge of Pavement (Feet)	
	71 dBA	**66 dBA**
Beck Road	78	136

8. Conclusions and Recommendations

The noise analysis for the proposed project included a total of 6 short-term measurement locations and 233 predicted representative noise levels for 232 dwelling units in the project area. The project was split into six separate CNEs for noise impact analysis within the study area.

Six of the eight CNEs contained receptors with predicted future noise levels approaching or exceeding the NAC. Noise abatement was not found to be feasible and reasonable as defined by MDOT policy. Therefore, no noise abatement is recommended for this project.

9. Statement of Likelihood

Based on the studies thus far accomplished, the Cities of Novi and Wixom do not intend to install highway traffic noise abatement for this project. The preliminary noise abatement measures were based on preliminary roadway design, and design and costs for noise abatement as presented in Table 5-2 in this document. If roadway designs have substantially changed during the final design process, noise abatement measures may be re-evaluated.

10.References

Federal Highway Administration, 23 CFR 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise, July 2010. https://www.fhwa.dot.gov/legsregs/directives/fapg/cfr0772.htm

Federal Highway Administration (FHWA). 2011. Highway Traffic Noise: Analysis and Abatement Guidance. U.S. Department of Transportation, Federal Highway Administration, Washington, DC. . https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/revguidance.pdf

Michigan Department of Transportation, Highway Noise Analysis and Abatement Handbook. July 13, 2011. https://www.michigan.gov/documents/mdot/MDOT_HighwayNoiseAnalysis_and_AbatementHandbook_358156_7.pdf

California Department of Transportation (Caltrans) Technical Noise Supplement, September 2013. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf

FHWA Roadway Construction Noise Model User Guide, FHWA-HEP-06-015, August 2006. https://www.fhwa.dot.gov/Environment/noise/construction_noise/rcnm/rcnm00.cfm

Appendix A Noise Measurement Data and Documentation

Appendix A contains the following noise measurement data and documentation:

- Short-term Noise Measurement Summary Table
- Noise Measurement Photo Log
- Noise Measurement Field Data Sheets
- Noise Measurement Equipment Calibration Certificates

A.1 Short Term Measurement Summary

ID	*Location*	*Average Leq (dBA)*	*Leq Range (dBA)*	*Start (hh:mm)*	*Stop (hh:mm)*	*Duration (hh:mm)*
ST-1	30739 Tamarack St	59.7	54.5-75.8	15:45	16:00	00:15
ST-2	47167 Manhattan Cir	58.2	50.2-77.5	15:45	16:00	00:15
ST-3	47430 Valencia Cir	61.4	49.0-70.5	15:05	15:20	00:15
ST-4	47365 Cider Mill Dr	61.5	47.9-82.0	15:05	15:20	00:15
ST-5	47455 Beckenham Blvd	63.3	47.4-72.7	14:30	14:45	00:15
ST-6	47281 Stratford Ln	55.9	46.1-68.9	14:30	14:45	00:15

A.2 Noise Measurement Photo Log

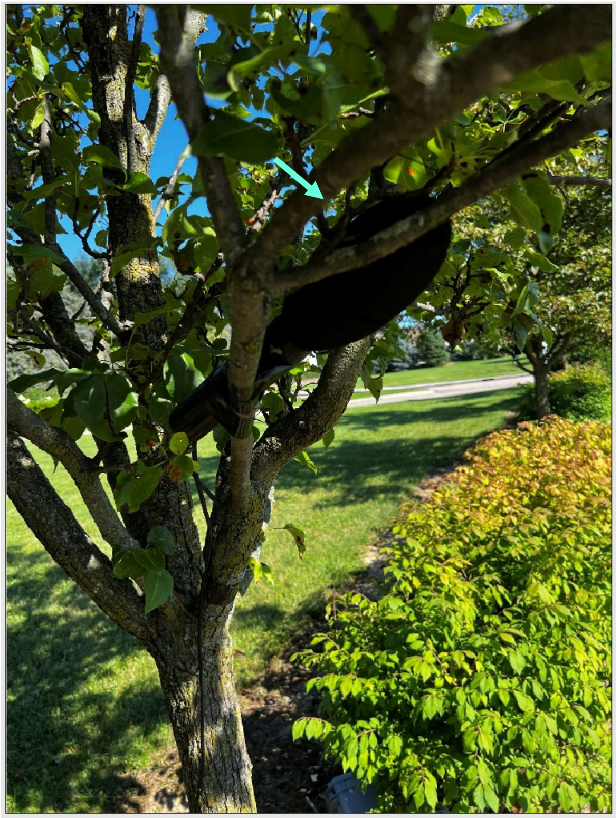
	**Photo 1** **Monitoring Site:** LT-1 **Date Taken:** August 16, 2022 **Camera Facing:** Northwest **Description:** View of the noise monitor set up.
	**Photo 2** **Monitoring Site:** LT-1 **Date Taken:** August 16, 2022 **Camera Facing:** West **Description:** View of the noise monitor set up towards the closest receptor.

	**Photo 3** **Monitoring Site:** ST-1 **Date Taken:** August 16, 2022 **Camera Facing:** East **Description:** View toward project area.
	**Photo 4** **Monitoring Site:** ST-1 **Date Taken:** August 16, 2022 **Camera Facing:** North **Description:** View toward nearest noise-sensitive receptor.

	**Photo 5** **Monitoring Site:** ST-2 **Date Taken:** August 16, 2022 **Camera Facing:** West **Description:** View toward project area.
	**Photo 6** **Monitoring Site:** ST-2 **Date Taken:** August 16, 2022 **Camera Facing:** East **Description:** View toward nearest noise-sensitive receptor.

Photo 7

Monitoring Site:
ST-3

Date Taken:
August 16, 2022

Camera Facing:
East

Description:
View toward project area.

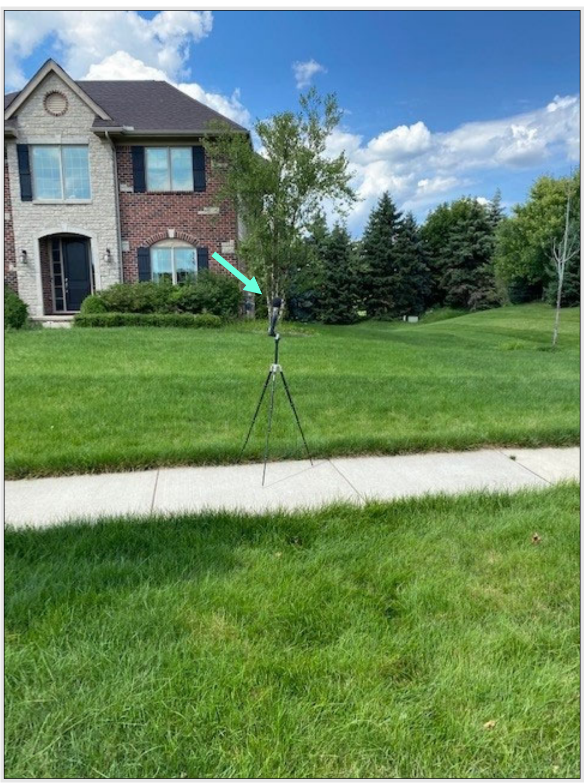


Photo 8

Monitoring Site:
ST-3

Date Taken:
August 16, 2022

Camera Facing:
South

Description:
View toward nearest noise-sensitive receptor.

	**Photo 9** **Monitoring Site:** ST-4 **Date Taken:** August 16, 2022 **Camera Facing:** Northeast **Description:** View toward project area.
	**Photo 10** **Monitoring Site:** ST-4 **Date Taken:** August 16, 2022 **Camera Facing:** West **Description:** View toward nearest noise-sensitive receptor.

 	**Photo 11** **Monitoring Site:** ST-5 **Date Taken:** August 16, 2022 **Camera Facing:** Northeast **Description:** View toward project area.
	**Photo 12** **Monitoring Site:** ST-5 **Date Taken:** August 16, 2022 **Camera Facing:** Southwest **Description:** View toward nearest noise-sensitive receptor.

Photo 11

Monitoring Site:
ST-6

Date Taken:
August 16, 2022

Camera Facing:
Northeast

Description:
View toward project area.

Photo 12

Monitoring Site:
ST-6

Date Taken:
August 16, 2022

Camera Facing:
Southwest

Description:
View toward nearest noise-sensitive receptor.

A.3 Field Sheets

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening Project #: 60689300 Date: 8-16-2022 Page 1 of

Measurement Location: ST-1 Beck and Blvd. Analyst: B. VASQUEZ

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD LxT.	Model #: LD CAL 200	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test: 113.5 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test: 114.0 dBA	Avg Wind Speed/Direction: 0 m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location): N: 42° 27' 10" W: 83° 30' 50"	Temp (°F): 75.2 RH (%): 74%
Terrain: Hard / Soft / Mixed / Agg / Snow		Bar Psr (Hg): 29.74 Cloud Cover (%): 50%

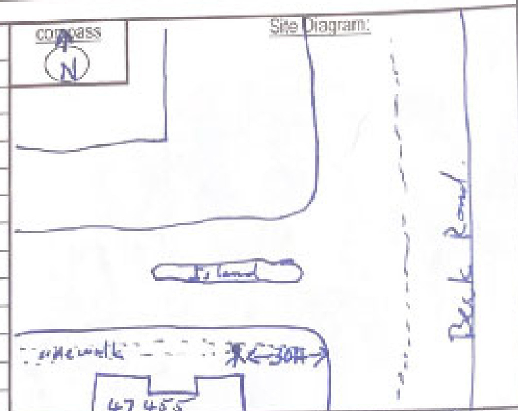
Time Obs/Meas: 3:30

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
[illegible]	02:30	02:45	main noise source vehicle traffic on Beck Rd
.003	file		quiet neighborhood birds chirping

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	2	
Automobiles	130	
Medium Trucks	5	
Heavy Trucks	1	
Buses	0	
Count duration	15 min	

* - Speed estimated by Radar / Driving / Observation

Compass / Site Diagram:



Photos Taken? Yes / No 4

Additional Notes/Comments: meter 30ft. to Beck Rd.

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 60689200 Date: 8-16 Page 2 of 3

Measurement Location: ST-2 Analyst: JM

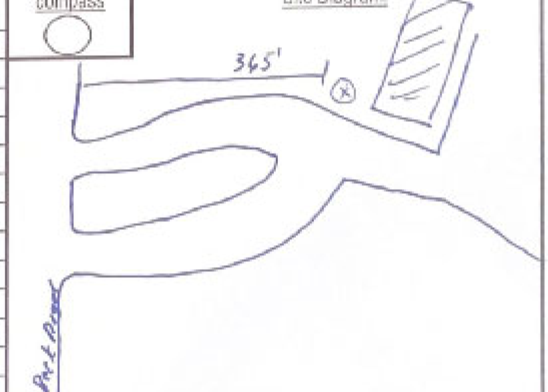
Sound Level Meter	Field Calibration	Meteorological Data
Model #:	Model #:	Model #: ; Time Obs/Meas:
Serial #:	Serial #:	Serial #:
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test ___ dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test ___ dBA	Avg Wind Speed/Direction: ___ m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): ; RH (%):
Terrain: Hard / Soft / Mixed / Agg / Snow	293394.7 mE, 4706729.5 mN	Bar Psr (Hg): ; Cloud Cover (%):

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
ST-2	15:45	16:00	

Roadway Name/Dir.	Beck NB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	—	
Automobiles	171	
Medium Trucks	10	
Heavy Trucks	1	
Buses	0	
Count duration	15 min	

compass

Site Diagram:



Photos Taken? Yes / No

* - Speed estimated by Radar / Driving / Observation

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening Project #: 60689300 Date: 8-16-2022 Page 1 of

Measurement Location: Valencia Circle N 47430 Analyst: B. Vasquez

Sound Level Meter

Model #: LD LxT
Serial #: 4486
Weighting: A / C / Flat
Response: Slow / Fast / Impl
Windscreen: Yes / No (explain)

Field Calibration

Model #: LD CAL200
Serial #: 3764
Calibration Level (dB): 94 / 114
Pre-Test 113.5 dBA
Post-Test 114.0 dBA

Meteorological Data

Model #: Kestrel
Serial #: 2679384
Time Obs/Meas:
Precipitation: Yes (explain) / No
Wind: Steady / Gusty / Calm
Avg Wind Speed/Direction: 6 m/s / MPH
Temp (°F): 63
RH (%): 95%
Bar Psr (Hg): 30.
Cloud Cover (%):

Topo: Flat / Hilly
Terrain: Hard / Soft / Mixed / Agg / Snow

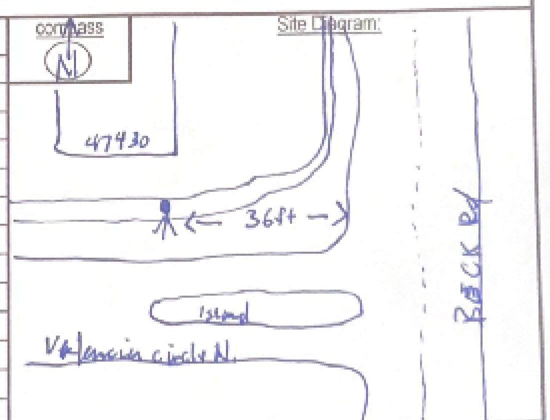
GPS Coordinates (at SLM location): N:42°28'3" W:83°30'53"

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	03:05	3:20	main noise source vehicle traffic
			on Beck Rd
.004	file		big open neighborhood
			some people on a walk.

Roadway Name/Dir.	Beck S B	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	0	
Automobiles	135	
Medium Trucks	4	
Heavy Trucks	5	
Buses	0	
Count duration	15 min	

compass

Site Diagram:



* - Speed estimated by Radar / Driving / Observation

Additional Notes/Comments: meter 36ft. to Beck Rd.

Photos Taken? Yes / No 4

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 6068930 Date: 8-16 Page 2 of 3

Measurement Location: ST-4 Analyst: JM

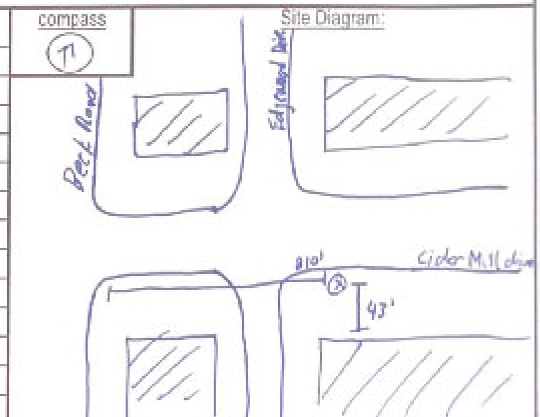
Sound Level Meter	Field Calibration	Meteorological Data
Model #:	Model #:	Model #: Time Obs/Meas:
Serial #:	Serial #:	Serial #:
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test dBA	Avg Wind Speed/Direction: m/s / MPH
Topo: (Flat) Hilly	GPS Coordinates (at SLM location)	Temp (°F): RH (%):
Terrain: Hard / Soft / (Mixed) / Agg / Snow	293769.4 mE, 4705828.5 N	Bar Psr (Hg): Cloud Cover (%):

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
ST-4	15:05	15:20	
			- Slight foot traffic
			- Some animals barking

Roadway Name/Dir.	Beck Rd NB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	—	
Automobiles	163	
Medium Trucks	8	
Heavy Trucks	3	
Buses	0	
Count duration	15 min.	

compass

Site Diagram:



* - Speed estimated by Radar / Driving / Observation

Photos Taken? (Yes) / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • (roadway traffic) • rail ops • landscaping • (rustling leaves) • children playing • (dogs barking/birds) • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 60689300 Date: 8-16 Page 1 of 3

Measurement Location: ST-6 Analyst: JM

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD Lxt	Model #: Cal200	Model #: Kestrel Time Obs/Meas: 14:06
Serial #: 6208	Serial #: 3704	Serial #: 2679384
Weighting: (A) C / Flat	Calibration Level (dB): 94 / (114)	Precipitation: Yes (explain) / (No)
Response: (Slow) Fast / Impl	Pre-Test -.52 dBA	Wind: Steady / Gusty / (Calm)
Windscreen: (Yes) / No (explain)	Post-Test .13 dBA	Avg Wind Speed/Direction: Ø m/s / MPH
Topo: (Flat) / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 62° RH (%): 98%
Terrain: Hard / Soft / (Mixed) / Agg / Snow	293480.4 mE, 4702209.7 mN	Bar Psr (Hg): 30.12 Cloud Cover (%): 70

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
ST-6	14:30	14:45	14:37 Flyover
			14:39 Flyover

Roadway Name/Dir.	Beck NB	
Speed (post/obs*)	42	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	0	
Automobiles	155	
Medium Trucks	12	
Heavy Trucks	2	
Buses	0	
Count duration	15	

compass

Site Diagram:

* Speed estimated by Radar / Driving / Observation

Photos Taken? (Yes) / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • (roadway traffic) • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd. Widening   Project #: 60689300   Date: 8-16-2022   Page 1 of

Measurement Location: The Village Apt Bldg 39 30727   Analyst: B. Vasquez

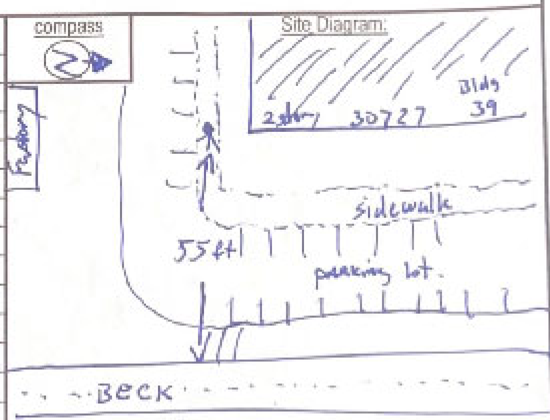
Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD LxT	Model #: LD CAL200	Model #: Kestrel; Time Obs/Meas: 3:45
Serial #: 4486	Serial #: 3764	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test 113.9 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test 114.0 dBA	Avg Wind Speed/Direction: S/W 6 m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 79; RH (%): 42%
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42° 31' 12" W: 83° 31' 4"	Bar Psr (Hg): 30.03; Cloud Cover (%): 40%

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	3:45	4:00	main noise source vehicle traffic.
005	Ale		some steady main noise source also coming from factory to the south
			car with loud muffler/engine started up last 45 seconds of measurment in parking lot
			wind picking up.

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	0	
Automobiles	78	
Medium Trucks	4	
Heavy Trucks	5	
Buses	0	
Count duration		

compass

Site Diagram:



* - Speed estimated by Radar / Driving / Observation

Additional Notes/Comments: meter 55+ft. to Beck Rd.

Photos Taken? Yes / No 4

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening   Project #: 60689300   Date: 8/16 22   Page ___ of ___

Measurement Location: Analyst: JM/ BV

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD 831	Model #: CAL 200	Model #: Kestrel
Serial #: 10613	Serial #: 3704	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test: -.98 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test: -.09 dBA	Avg Wind Speed/Direction: 2 m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 75.2 RH (%): 74%
Terrain: Hard / Soft / Mixed / Agg / Snow	293201.24 mE 4704187.82 mN	Bar Psr (Hg): 29.74 Cloud Cover (%): 50%

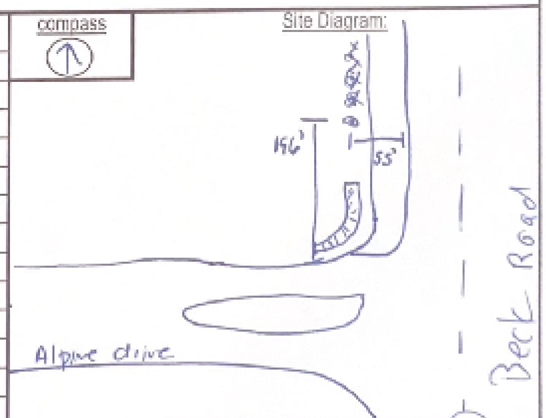
Time Obs/Meas:

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
LT-1	6:00		
			10:00 start
			5:AM stop
			Meter switched at 9:00 8-17

Roadway Name/Dir.		
Speed (post/obs*)		
Number of Lanes		
Width (pave/row)		
1- or 2- way		
Grade		
Bus Stops		
Stoplights		
Motorcycles		
Automobiles		
Medium Trucks		
Heavy Trucks		
Buses		
Count duration		

compass

Site Diagram:



Photos Taken? Yes / No

* - Speed estimated by Radar / Driving / Observation

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening Project #: 60689300 Date: 8-17-2022 Page 2 of

Measurement Location: Apt The Village Analyst: B. Vasquez

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD Lxt	Model #: LD CAL	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679984
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test 113.9 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test 114.0 dBA	Avg Wind Speed/Direction: m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 64° RH (%): 90%
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42° 31' 12" W: 83° 31' 4"	Bar Psr (Hg): 30. Cloud Cover (%):

Time Obs/Meas:

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	09:40	9:55	main noise source vehicle traffic and steady noise from factory
			maintenance work being done at apartment steady not to loud.
008	EL		
			sirens passing EMT

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	0	
Automobiles	147	
Medium Trucks	5	
Heavy Trucks	3	
Buses	0	
Count duration	15 min	

compass

Site Diagram: Please see page 1 for diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road widening   Project #: 60689800   Date: 8-17   Page 2 of 3

Measurement Location: ST-2   Analyst: JM

Sound Level Meter	Field Calibration	Meteorological Data
Model #:	Model #:	Model #: / Time Obs/Meas:
Serial #:	Serial #:	Serial #:
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test dBA	Avg Wind Speed/Direction: m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): RH (%):
Terrain: Hard / Soft / Mixed / Agg / Snow		Bar Psr (Hg): Cloud Cover (%):

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	9:40	9:55	
			fast traffic & dogs walking

Roadway Name/Dir.	Beck Rd NB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	—	
Automobiles	137	
Medium Trucks	6	
Heavy Trucks	2	
Buses	0	
Count duration	15 min	

compass

Site Diagram:

See day 1 diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking • birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening Project #: 60689300 Date: 8.17.2022 Page 2 of

Measurement Location: Valencia Circle N. 47430 Analyst: B. Vasquez

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD Lxt	Model #: LD CAL 200	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679[illegible]384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test 113.9 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test 114.0 dBA	Avg Wind Speed/Direction: m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 79° RH (%): 95 %
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42°28'3" W: 83°30'55"	Bar Psr (Hg): 30.11 Cloud Cover (%):

Time Obs/Meas:

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	9:10	9:25	main noise source vehicle traffic on Beck Rd.
			landscaping ie. mowing, leaf blower.
007	file		Jets overhead.

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	0	
Automobiles	95	
Medium Trucks	8	
Heavy Trucks	2	
Buses	0	
Count duration	15 min	

compass

Site Diagram:

please see page 1 for Diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 60689200 Date: 8.17.22 Page 2 of 3

Measurement Location: ST-4 Analyst: JM

Sound Level Meter	Field Calibration	Meteorological Data	
Model #:	Model #:	Model #:	Time Obs/Meas:
Serial #:	Serial #:	Serial #:	
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No	
Response: Slow / Fast / Impl	Pre-Test dBA	Wind: Steady / Gusty / Calm	
Windscreen: Yes / No (explain)	Post-Test dBA	Avg Wind Speed/Direction:	m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F):	RH (%):
Terrain: Hard / Soft / Mixed / Agg / Snow		Bar Psr (Hg):	Cloud Cover (%):

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
ST-4	9:10	9:25	
			Some landscaping trucks / garage trucks

Roadway Name/Dir.	Beck NB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	–	
Bus Stops	–	
Stoplights		
Motorcycles	–	
Automobiles	101	
Medium Trucks	6	
Heavy Trucks	0	
Buses	0	
Count duration	15 min	

compass

Site Diagram:

Please see day 1 diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening   Project #: 60689300   Date: 8-17-2022   Page 2 of

Measurement Location: 47455 Beckham Blvd   Analyst: B. Vargas

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD LxT	Model #: LD CAL 200	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test 113.9 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test dBA	Avg Wind Speed/Direction: 0 m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 62° RH (%): 58%
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42°27'10" W: 83°30'50"	Bar Psr (Hg): 30.12 Cloud Cover (%): 20%

Time Obs/Meas:

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	8:45	9:00	
			main noise source vehicle traffic
			on Beck Rd
006	5.6		birds chirping
			some landscaping be conducted
			in the neighborhood
			No 1st

Roadway Name/Dir.	BECK SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	—	
Bus Stops	—	
Stoplights	—	
Motorcycles	2	
Automobiles	143	
Medium Trucks	8	
Heavy Trucks	2	
Buses	0	
Count duration	15 min	

compass

Site Diagram: please see page 1 for diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking • birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road [illegible] Project #: [illegible] Date: 8.17.2022 Page 1 of 3

Measurement Location: ST-6 Analyst: JM

Sound Level Meter

Model #: LDLxT
Serial #: 6200
Weighting: (A) / C / Flat
Response: (Slow) / Fast / Impl
Windscreen: (Yes) / No (explain)
Topo: (Flat) / Hilly
Terrain: Hard / Soft / (Mixed) / Agg / Snow

Field Calibration

Model #: LD Cal 200
Serial #: 3764
Calibration Level (dB): 94 / (114)
Pre-Test: .02 dBA
Post-Test: -.09 dBA
GPS Coordinates (at SLM location):

Meteorological Data

Model #: Kestrel
Serial #: 267984
Precipitation: Yes (explain) / (No)
Wind: Steady / Gusty / (Calm)
Avg Wind Speed/Direction: 0 m/s / MPH
Temp (°F): 62°
RH (%):
Bar Psr (Hg):
Cloud Cover (%):
Time Obs/Meas:

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
ST-4	8:45	9:00	Insect noise + birds chirping

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	–	
Bus Stops	–	
Stoplights	–	
Motorcycles	–	
Automobiles	152	
Medium Trucks	6	
Heavy Trucks	2	
Buses	0	
Count duration	15 min	

compass

Site Diagram:

Please see page 1 for diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • (roadway traffic) • rail ops • landscaping • rustling leaves • children playing • dogs barking/(birds) • vocalizing insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening
Project #: 60669300
Date: 8-17-2022
Page 3 of
Measurement Location: 47430 [illegible]
Analyst: B. Vasquez

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD LxT	Model #: LD CAL200	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test 113.8 dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test 114.1 dBA	Avg Wind Speed/Direction: 9 m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 79° RH (%): 46
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42' 28 3" W: 83' 30' 55"	Bar Psr (Hg): 30.4 Cloud Cover (%): 60-70

Time Obs/Meas: 2:55

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	2:55	3:10	main noise source vehicle traffic.
			Jets overhead
			skid steer for land scaping nearby on but 2 homes down in neighborhood
010	file		
			siren at 5:57 mark noticed

Roadway Name/Dir.	Beck SB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	~	
Bus Stops	–	
Stoplights	–	
Motorcycles	0	
Automobiles	185	
Medium Trucks	6	
Heavy Trucks	2	
Buses	0	
Count duration	15 min.	

compass

Site Diagram: Refer to page 1 of sheets.

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Rd Widening Project #: 60609300 Date: 8-17-2022 Page 3 of

Measurement Location: 47430 Valencia Analyst: B. Vasquez

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD LxT	Model #: LD CAL200	Model #: Kestrel
Serial #: 4486	Serial #: 3764	Serial #: 2679384
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Time Obs/Meas: 2:55
Response: Slow / Fast / Impl	Pre-Test 113.8 dBA	Precipitation: Yes (explain) / No
Windscreen: Yes / No (explain)	Post-Test 114.1 dBA	Wind: Steady / Gusty / Calm
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Avg Wind Speed/Direction: 9 m/s / MPH
Terrain: Hard / Soft / Mixed / Agg / Snow	N: 42' 28 3" W: 83' 30' 55"	Temp (°F): 79° RH (%): 46
		Bar Psr (Hg): 30.4 Cloud Cover (%): 60 20

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	2:55	3:10	main noise source vehicle traffic.
			Jets overhead
			skid steer for landscaping nearby on but 2 homes down in neighborhood
.010	file		
			siren at 5:57 mark noticed

Roadway Name/Dir.	Beck SB		
Speed (post/obs*)	45		
Number of Lanes	2		
Width (pave/row)			
1- or 2- way	2		
Grade	~		
Bus Stops	–		
Stoplights	–		
Motorcycles	0		
Automobiles	185		
Medium Trucks	6		
Heavy Trucks	2		
Buses	0		
Count duration	15 min.		

compass

Site Diagram: Refer to page 1 of sheets.

* - Speed estimated by Radar / Driving / Observation

Photos Taken? Yes / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 60681 Date: 8-17-22 Page 2 of 2

Measurement Location: ST-4 Analyst: JM

Sound Level Meter	Field Calibration	Meteorological Data
Model #:	Model #:	Model #: Time Obs/Meas:
Serial #:	Serial #:	Serial #:
Weighting: A / C / Flat	Calibration Level (dB): 94 / 114	Precipitation: Yes (explain) / No
Response: Slow / Fast / Impl	Pre-Test dBA	Wind: Steady / Gusty / Calm
Windscreen: Yes / No (explain)	Post-Test dBA	Avg Wind Speed/Direction: m/s / MPH
Topo: Flat / Hilly	GPS Coordinates (at SLM location)	Temp (°F): RH (%):
Terrain: Hard / Soft / Mixed / Agg / Snow		Bar Psr (Hg): Cloud Cover (%):

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	2:55	3:10	
			Some landscaping

Roadway Name/Dir.	Beck NB	
Speed (post/obs*)	45	
Number of Lanes	2	
Width (pave/row)		
1- or 2- way	2	
Grade	–	
Bus Stops	–	
Stoplights	–	
Motorcycles	–	
Automobiles	183	
Medium Trucks	6	
Heavy Trucks	2	
Buses	0	
Count duration	15 MIN	

compass

Site Diagram:

Please day 1 diagram

Photos Taken? Yes / No

* - Speed estimated by Radar / Driving / Observation

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.6 2021

GENERAL

AECOM Acoustics and Noise Control Practice

FIELD NOISE MEASUREMENT DATA FORM

Project Name: Beck Road Widening Project #: 606[illegible] Date: 8-17-22 Page 1 of 3

Measurement Location: Beck ST-6 Analyst:

Sound Level Meter	Field Calibration	Meteorological Data
Model #: LD 831	Model #: CAL 200	Model #: Kestrel Time Obs/Meas: 2:50
Serial #: 6200	Serial #: 3740	Serial #: 2679384
Weighting: (A) / C / Flat	Calibration Level (dB): 94 / (114)	Precipitation: Yes (explain) / (No)
Response: (Slow) / Fast / Impl	Pre-Test + .14 dBA	Wind: Steady / Gusty / (Calm)
Windscreen: (Yes) / No (explain)	Post-Test - .11 dBA	Avg Wind Speed/Direction: 0-2 m/s / (MPH)
Topo: (Flat) / Hilly	GPS Coordinates (at SLM location)	Temp (°F): 79° RH (%): 46%
Terrain: Hard / Soft / (Mixed) / Agg / Snow		Bar Psr (Hg): 30.06 Cloud Cover (%): 40%

Loc. ID	Start Time (hh:mm)	Stop Time (hh:mm)	Notes/Events
	2:25	2:40	
			Main noise source Beck Road

Roadway Name/Dir.	Beck NB		
Speed (post/obs*)	45		
Number of Lanes	2		
Width (pave/row)			
1- or 2- way	2		
Grade	—		
Bus Stops	—		
Stoplights	—		
Motorcycles	—		
Automobiles	181		
Medium Trucks	7		
Heavy Trucks	6		
Buses	0		
Count duration	15 min		

compass

Site Diagram:

See day 1 for diagram

* - Speed estimated by Radar / Driving / Observation

Photos Taken? (Yes) / No

Additional Notes/Comments:

Noise Sources (circle all that apply): distant aircraft • roadway traffic • rail ops • landscaping • rustling leaves • children playing • dogs barking/birds • vocalizing/insects/mechanical

Additional Notes and Sketches on Reverse or Indicated Separate Sheet(s)

AECOM ANCP, Field Noise Measurement Form, Vers. 1.5 2021

A.4 Equipment Calibration Certificates

CERTIFICATE OF CALIBRATION
27187-1
FOR LARSON DAVIS PRECISION INTEGRATING SOUND LEVEL METER

Model **LxT1** — Serial No. **0004486**
ID No. **4486**

With Microphone **377B02** — Serial No. **315398**
With Preamplifier **PRMLxT1L** — Serial No. **055767**

Customer: **AECOM**
San Diego, CA 92101 — P.O. No. **Credit Card**

was tested and met Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 61672-2002 Class1; 60651-2001 Type 1

on **15 JUN 2022** BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **15 JUN 2023**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1051	1777523	28 SEP 2021	28 SEP 2022
B&K	2636	1423390	03 JAN 2022	03 JAN 2023
B&K	4226	3274134	30 NOV 2021	30 NOV 2022
B&K	4231	1770857	09 SEP 2021	09 SEP 2022
HP	34401A	MY45023668	25 JAN 2022	25 JAN 2023
HP	3458A	2823A07179	21 AUG 2021	21 AUG 2022

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" conditions.

Reference Test Procedure: **ACCT Procedure LxT-831 Version 0.5.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	38 %	984.51 hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed:

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

Doc. Rev 16 Feb 2018 — Page 1 of 15

CERTIFICATE OF CALIBRATION
27187-3
FOR LARSON DAVIS PRECISION INTEGRATING SOUND LEVEL METER

Model **LxT1** Serial No. **0006202**
ID No. **6202**

With Microphone **377B02** Serial No. **322055**
With Preamplifier **PRMLxT1L** Serial No. **069963**

Customer: **AECOM**
San Diego, CA 92101 P.O. No. **Credit Card**

was tested and met Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 61672-2002 Class1; 60651-2001 Type 1

on **16 JUN 2022** BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **16 JUN 2023**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1051	1777523	28 SEP 2021	28 SEP 2022
B&K	2636	1423390	03 JAN 2022	03 JAN 2023
B&K	4226	3274134	30 NOV 2021	30 NOV 2022
B&K	4231	1770857	09 SEP 2021	09 SEP 2022
HP	34401A	MY45023668	25 JAN 2022	25 JAN 2023
HP	3458A	2823A07179	21 AUG 2021	21 AUG 2022

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" conditions.

Reference Test Procedure: **ACCT Procedure LxT-831 Version 0.5.1.**

Temperature	Relative Humidity	Barometric Pressure
23°C	38 %	983.29 hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed: [signature]

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

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Appendix B Sample TNM Input/Output Files

Sample TNM output tables are provided for CNE 1 Abatement analysis. Additional input and output files are available upon request.

CNE 1 TNM Sound Level Prediction Output Table

Sound Levels : Beck 1:2

AECOM
JM

9 December 2022
TNM 2.5
Calculated with TNM 2.5

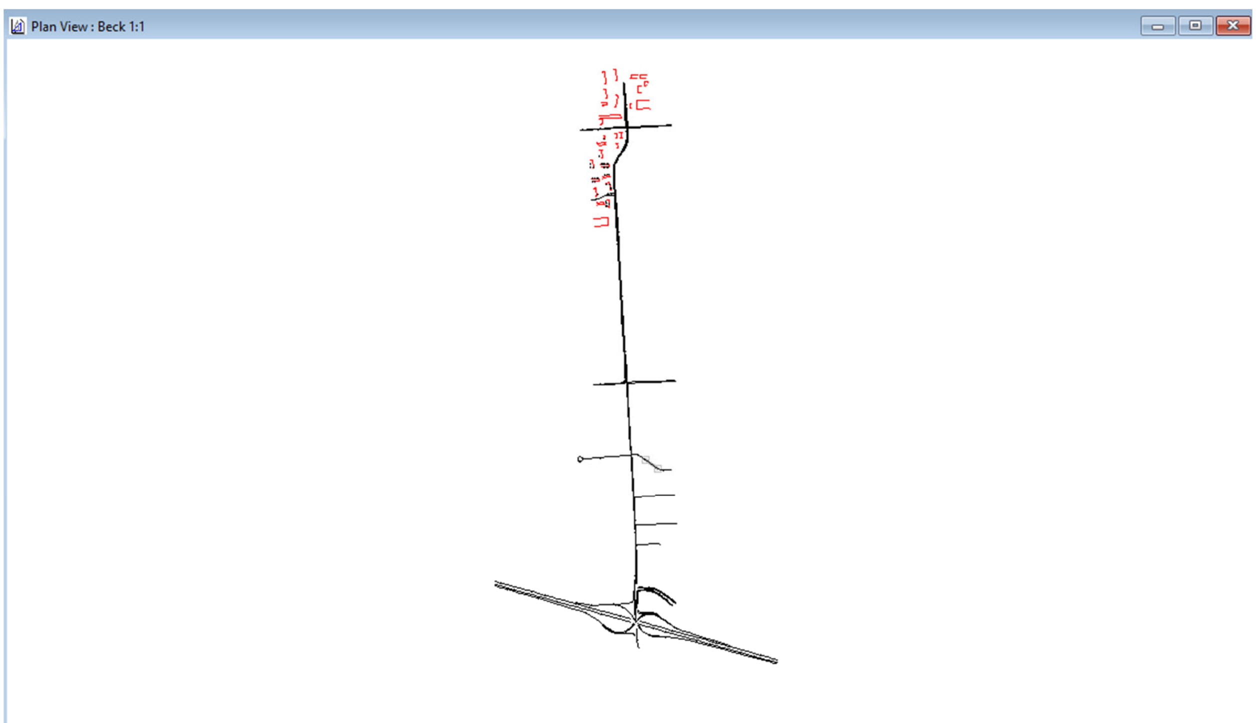
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Beck Road
RUN: VAL
BARRIER DESIGN: INPUT HEIGHTS

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

ATMOSPHERICS: 68 deg F, 50% RH

Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	Impact	LAeq1h	Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST-1	7	1	0.0	60.3	66	60.3	10	—	60.3	0.0	8	-8.0
1-01	9	1	0.0	45.1	66	45.1	10	—	45.1	0.0	8	-8.0
1-02	10	1	0.0	51.9	66	51.9	10	—	51.9	0.0	8	-8.0
1-03	11	1	0.0	43.4	66	43.4	10	—	43.4	0.0	8	-8.0
1-04	12	1	0.0	50.2	66	50.2	10	—	50.2	0.0	8	-8.0
1-05	13	1	0.0	53.5	66	53.5	10	—	53.5	0.0	8	-8.0
1-06	14	1	0.0	51.9	66	51.9	10	—	51.9	0.0	8	-8.0
1-07	15	1	0.0	50.3	66	50.3	10	—	50.3	0.0	8	-8.0
1-08	16	1	0.0	53.2	66	53.2	10	—	53.2	0.0	8	-8.0
1-09	17	1	0.0	53.1	66	53.1	10	—	53.1	0.0	8	-8.0
1-10	18	1	0.0	52.7	66	52.7	10	—	52.7	0.0	8	-8.0

Plan View



Appendix C Predicted Noise Levels and Impacts

Table C-1 Loudest Hour Noise Levels, Leq(1h), dBA

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
CNE 1							
01-01	Residential	B	2	66	48	54	6
01-02	Residential	B	2	66	50	55	6
01-03	Residential	B	2	66	46	52	6
01-04	Residential	B	2	66	50	53	3
01-05	Residential	B	2	66	51	58	7
01-06	Residential	B	2	66	50	56	7
01-07	Residential	B	2	66	48	53	5
01-08	Residential	B	2	66	53	59	6
01-09	Residential	B	2	66	53	59	6
01-10	Residential	B	2	66	53	58	5
01-11	Residential	B	2	66	44	49	5
01-12	Residential	B	2	66	44	49	5
01-13	Residential	B	2	66	44	49	5
01-14	Residential	B	2	66	58	59	1
01-15	Residential	B	2	66	58	60	2
01-16	Residential	B	2	66	59	62	3
01-17	Residential	B	2	66	56	60	4
01-18	Residential	B	2	66	58	65	7
01-19	Residential	B	2	66	60	65	5
01-20	Residential	B	2	66	51	58	7
01-21	Residential	B	2	66	52	59	7
01-22	Residential	B	2	66	53	60	7
01-23	Residential	B	2	66	54	61	7
01-24	Residential	B	2	66	56	62	6
01-25	Residential	B	2	66	59	64	5
01-26	Residential	B	2	66	35	40	5
01-27	Residential	B	2	66	35	40	5
01-28	Residential	B	2	66	36	41	5
01-29	Residential	B	2	66	50	55	5
01-30	Residential	B	2	66	47	50	3
01-31	Residential	B	2	66	48	51	3
01-32	Residential	B	2	66	48	53	5
01-33	Residential	B	2	66	49	52	3
01-34	Residential	B	2	66	49	54	5
01-35	Residential	B	2	66	49	56	7
01-36	Residential	B	2	66	49	55	6
01-37	Residential	B	2	66	49	55	6
01-38	Residential	B	2	66	49	55	6
01-39	Residential	B	2	66	63	65	2
01-40	Residential	B	2	66	60	65	5
01-41	Residential	B	2	66	57	63	6
01-42	Residential	B	2	66	55	61	6
01-43	Residential	B	2	66	53	60	7
01-44	Residential	B	2	66	52	59	7
01-45	Residential	B	2	66	62	65	3
01-46	Residential	B	2	66	59	65	6
01-47	Residential	B	2	66	57	63	6
01-48	Residential	B	2	66	56	63	7
01-49	Residential	B	2	66	54	58	4
01-50	Residential	B	2	66	53	58	5

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
01-51	Residential	B	2	66	36	38	2
01-52	Residential	B	2	66	50	55	5
01-53	Residential	B	2	66	36	38	2
01-54	Residential	B	2	66	48	54	6
01-55	Residential	B	2	66	36	38	2
01-56	Residential	B	2	66	47	53	6
01-57	Residential	B	2	66	53	58	5
01-58	Residential	B	2	66	52	59	7
01-59	Residential	B	2	66	52	58	6
01-60	Residential	B	2	66	51	57	6
01-61	Residential	B	2	66	51	56	5
01-62	Residential	B	2	66	51	55	4
01-63	Residential	B	2	66	64	**71**	7
01-64	Residential	B	2	66	64	**70**	7
01-65	Residential	B	2	66	62	**69**	7
01-66	Residential	B	2	66	62	**69**	7
01-67	Residential	B	2	66	62	**69**	7
01-68	Residential	B	2	66	62	**69**	7
01-69	Residential	B	2	66	50	56	6
01-70	Residential	B	2	66	51	56	5
01-71	Residential	B	2	66	51	58	7
01-72	Residential	B	2	66	51	57	6
01-73	Residential	B	2	66	51	59	8
01-74	Residential	B	2	66	51	58	7
01-75	Residential	B	2	66	51	57	6
01-76	Residential	B	2	66	52	56	4
01-77	Residential	B	2	66	42	47	5
01-78	Residential	B	2	66	42	45	3
01-79	Residential	B	2	66	42	46	4
01-80	Residential	B	2	66	50	56	6
01-81	Residential	B	2	66	61	**68**	6
01-82	Residential	B	2	66	61	**68**	6
01-83	Residential	B	2	66	61	**68**	6
01-84	Residential	B	2	66	61	**68**	6
01-85	Residential	B	2	66	61	**67**	6
01-86	Residential	B	2	66	61	**68**	6
CNE 2A							
02-01	Residential	B	2	66	48	53	5
02-02	Residential	B	2	66	49	54	5
02-03	Residential	B	2	66	49	54	5
02-04	Residential	B	2	66	49	54	5
02-05	Residential	B	2	66	49	54	5
02-06	Residential	B	2	66	49	54	5
02-07	Residential	B	2	66	50	55	5
02-08	Residential	B	2	66	50	55	5
02-09	Active Sport Area	C	0	66	48	52	4
02-10	Active Sport Area	C	0	66	51	56	5
02-11	Residential	B	2	66	48	54	6
02-12	Residential	B	2	66	48	54	6
02-13	Residential	B	2	66	48	54	6
02-14	Residential	B	2	66	48	54	6
02-15	Residential	B	2	66	49	55	6
02-16	Residential	B	1	66	62	65	2
02-17	Residential	B	1	66	63	**66**	2
02-18	Residential	B	1	66	62	65	3
02-19	Residential	B	1	66	62	64	2
02-20	Residential	B	1	66	62	64	2
02-21	Residential	B	1	66	62	65	3
2-25	Residential	B	1	66	50	53	3
2-26	Residential	B	1	66	52	58	5

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
2-27	Residential	B	1	66	54	58	5
2-28	Residential	B	1	66	55	59	4
2-29	Residential	B	1	66	52	55	3
CNE 2B							
02-22	Day Care/ Recreation	C	1	66	58	60	2
2-22a	Day Care/ Recreation	C	1	66	52	54	2
2-22b	Day Care/ Recreation	C	1	66	50	51	1
CNE 2C							
2-23	Day Care/ Recreation	C	1	66	53	56	3
2-24	Day Care/ Recreation	C	1	66	46	49	4
CNE 3							
03-01	Residential	B	1	66	64	**67**	3
03-02	Residential	B	1	66	60	63	3
03-03	Residential	B	1	66	54	56	3
03-04	Residential	B	1	66	50	54	4
03-05	Residential	B	1	66	65	**69**	3
03-06	Residential	B	1	66	63	**66**	3
03-07	Residential	B	1	66	60	64	4
03-08	Residential	B	1	66	57	61	4
03-09	Residential	B	1	66	49	52	3
03-10	Residential	B	1	66	49	51	2
03-11	Residential	B	1	66	47	50	3
03-12	Residential	B	1	66	50	52	2
03-13	Residential	B	1	66	52	55	3
03-14	Residential	B	1	66	55	59	4
03-15	Residential	B	1	66	55	58	3
03-16	Residential	B	1	66	52	56	3
03-17	Residential	B	1	66	51	54	3
03-18	Residential	B	1	66	44	49	5
03-19	Residential	B	1	66	43	46	3
03-20	Residential	B	1	66	59	61	2
03-21	Residential	B	1	66	54	56	3
03-22	Residential	B	1	66	49	53	4
03-23	Residential	B	1	66	47	51	5
03-24	Residential	B	1	66	63	**66**	3
03-25	Residential	B	1	66	62	64	3
03-26	Residential	B	1	66	60	63	2
03-27	Residential	B	1	66	60	62	2
03-28	Residential	B	1	66	**66**	**67**	1
03-29	Residential	B	1	66	**67**	**69**	2
03-30	Residential	B	1	66	47	51	3
03-31	Residential	B	1	66	57	59	2
03-32	Residential	B	1	66	59	61	2
03-33	Residential	B	1	66	47	50	3
03-34	Residential	B	1	66	50	52	2
03-35	Residential	B	1	66	49	51	2
03-36	Residential	B	1	66	60	62	3
03-37	Residential	B	1	66	48	50	2
03-38	Residential	B	1	66	59	61	3
03-39	Residential	B	1	66	48	50	2
03-40	Residential	B	1	66	59	62	3
03-41	Residential	B	1	66	48	50	2
03-42	Residential	B	1	66	47	50	3
03-43	Residential	B	1	66	58	61	3
03-44	Residential	B	1	66	58	61	3

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
03-45	Residential	B	1	66	48	51	3
03-46	Residential	B	1	66	58	62	4
03-47	Residential	B	1	66	48	52	4
03-48	Residential	B	1	66	61	64	4
03-49	Residential	B	1	66	61	65	3
03-50	Residential	B	1	66	50	55	5
03-51	Residential	B	1	66	44	48	4
03-52	Residential	B	1	66	49	52	3
03-53	Residential	B	1	66	52	55	3
03-54	Residential	B	1	66	55	57	2
03-55	Residential	B	1	66	62	64	2
03-56	Residential	B	1	66	52	55	3
03-57	Residential	B	1	66	48	51	3
03-58	Residential	B	1	66	49	52	3
03-59	Residential	B	1	66	53	56	3
03-60	Residential	B	1	66	57	59	2
03-61	Residential	B	1	66	51	53	2
03-62	Residential	B	1	66	47	50	2
03-63	Active Sport Area	C	0	66	62	65	3
03-64	Active Sport Area	C	0	66	60	64	4
03-65	Active Sport Area	C	0	66	62	64	3
CNE 4							
04-01	Residential	B	1	66	45	48	2
04-02	Residential	B	1	66	48	50	2
04-03	Residential	B	1	66	52	55	3
04-04	Residential	B	1	66	44	48	4
04-05	Residential	B	1	66	48	52	4
04-06	Residential	B	1	66	55	58	3
04-07	Residential	B	1	66	65	**67**	2
04-08	Residential	B	1	66	54	58	4
04-09	Residential	B	1	66	65	**67**	2
04-10	Residential	B	1	66	46	51	4
04-11	Residential	B	1	66	45	49	3
04-12	Residential	B	1	66	44	48	5
04-13	Residential	B	1	66	53	57	4
04-14	Residential	B	1	66	65	**68**	3
04-15	Residential	B	1	66	64	**67**	3
04-16	Residential	B	1	66	48	53	5
04-17	Residential	B	1	66	64	**67**	4
04-18	Residential	B	1	66	45	47	2
04-19	Residential	B	1	66	48	53	5
04-20	Residential	B	1	66	64	**67**	3
04-21	Residential	B	1	66	42	45	3
04-22	Residential	B	1	66	54	56	2
04-23	Residential	B	1	66	64	**67**	3
04-24	Residential	B	1	66	55	58	3
04-25	Residential	B	1	66	45	51	6
04-26	Residential	B	1	66	46	48	2
04-27	Residential	B	1	66	46	48	2
04-28	Residential	B	1	66	52	58	6
04-29	Residential	B	1	66	52	56	4
04-30	Residential	B	1	66	53	57	4
04-31	Residential	B	1	66	54	58	3
04-32	Residential	B	1	66	64	**68**	4
04-33	Residential	B	1	66	64	**67**	4
04-34	Residential	B	1	66	65	**68**	3
04-35	Residential	B	1	66	65	**69**	3
04-36	Residential	B	1	66	42	47	5
04-37	Residential	B	1	66	45	48	4
04-38	Residential	B	1	66	42	45	4

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
04-39	Residential	B	1	66	47	51	5
04-40	Residential	B	1	66	52	57	5
04-41	Residential	B	1	66	65	**68**	3
04-42	Residential	B	1	66	54	58	4
04-43	Residential	B	1	66	55	58	3
04-44	Residential	B	1	66	65	**68**	3
04-45	Residential	B	1	66	45	50	6
04-46	Residential	B	1	66	53	57	4
04-47	Residential	B	1	66	65	**69**	4
04-48	Residential	B	1	66	65	**69**	4
04-49	Residential	B	1	66	51	55	4
04-50	Residential	B	1	66	56	59	3
04-51	Residential	B	1	66	63	65	2
04-52	Residential	B	1	66	**66**	**66**	1
04-53	Residential	B	1	66	65	**66**	1
04-54	Residential	B	1	66	44	46	3
04-55	Residential	B	1	66	45	48	3
04-56	Residential	B	1	66	47	50	3
04-57	Residential	B	1	66	51	53	2
04-58	Residential	B	1	66	54	55	1
04-59	Residential	B	1	66	45	48	3
04-60	Residential	B	1	66	48	50	3
04-61	Residential	B	1	66	52	54	2
04-62	Residential	B	1	66	46	49	4
04-63	Residential	B	1	66	48	53	5
04-64	Residential	B	1	66	48	55	7
04-65	Residential	B	1	66	48	55	7
04-66	Residential	B	1	66	47	54	6
04-67	Residential	B	1	66	48	55	6
04-68	Residential	B	1	66	49	56	6
04-69	Residential	B	1	66	51	56	6
04-70	Residential	B	1	66	52	58	6
04-71	Residential	B	1	66	54	59	5
04-72	Residential	B	1	66	57	62	4
04-73	Residential	B	1	66	61	64	3
04-74	Residential	B	1	66	**66**	**68**	1
04-75	Residential	B	1	66	**66**	**68**	2
04-76	Residential	B	1	66	**66**	**68**	2
04-77	Residential	B	1	66	**66**	**68**	2
04-78	Residential	B	1	66	**66**	**68**	2
04-79	Residential	B	1	66	**66**	**67**	1
04-80	Residential	B	1	66	46	52	6
04-81	Residential	B	1	66	47	53	6
04-82	Residential	B	1	66	49	55	6
04-83	Residential	B	1	66	52	57	5
04-84	Residential	B	1	66	55	60	5
04-85	Residential	B	1	66	59	63	4
04-86	Residential	B	1	66	62	65	3
04-87	Residential	B	1	66	43	47	5
04-88	Residential	B	1	66	44	49	5
04-89	Residential	B	1	66	45	50	5
04-90	Residential	B	1	66	52	56	5
04-91	Residential	B	1	66	43	47	4
04-92	Residential	B	1	66	43	49	5
04-93	Residential	B	1	66	47	51	5
04-94	Residential	B	1	66	54	58	5
04-95	Residential	B	1	66	53	57	4
04-96	Residential	B	1	66	42	47	5
04-97	Residential	B	1	66	43	48	5
04-98	Residential	B	1	66	47	51	5

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
04-99	Residential	B	1	66	45	48	3
04-100	Residential	B	1	66	46	49	3
04-101	Residential	B	1	66	47	51	4
04-102	Residential	B	1	66	51	54	3
04-103	Residential	B	1	66	52	56	4
04-104	Residential	B	1	66	52	56	3
04-105	Residential	B	1	66	61	64	3
04-106	Residential	B	1	66	62	65	3
04-107	Residential	B	1	66	62	65	3
04-108	Residential	B	1	66	64	65	1
04-109	Residential	B	1	66	62	64	2
04-110	Residential	B	1	66	60	62	3
04-111	Residential	B	1	66	56	58	2
04-112	Residential	B	1	66	42	44	2
04-113	Residential	B	1	66	44	46	2
04-114	Residential	B	1	66	48	50	2
04-115	Residential	B	1	66	54	56	2
CNE 5							
05-01	Residential	B	1	66	59	60	0
05-02	Residential	B	1	66	60	61	1
05-03	Residential	B	1	66	55	56	1
05-04	Residential	B	1	66	53	53	1
05-05	Residential	B	1	66	54	54	1
05-06	Residential	B	1	66	60	61	1
05-07	Residential	B	1	66	53	55	2
05-08	Residential	B	1	66	54	56	2
05-09	Residential	B	1	66	60	61	2
05-10	Residential	B	1	66	64	65	1
05-11	Residential	B	1	66	57	58	1
05-12	Church	C	1	66	59	60	1
05-13	Residential	B	1	66	58	58	1
05-14	Residential	B	1	66	65	**67**	2
05-15	Residential	B	1	66	**67**	**69**	3
05-16	Residential	B	1	66	53	54	2
05-17	Residential	B	1	66	55	57	1
05-18	Residential	B	1	66	53	54	1
05-19	Residential	B	1	66	50	52	2
05-20	Residential	B	1	66	53	55	2
05-21	Residential	B	1	66	61	63	2
05-22	Residential	B	1	66	49	50	1
05-23	Residential	B	1	66	53	55	1
05-24	Residential	B	1	66	62	64	2
05-25	Residential	B	1	66	63	65	2
05-26	Residential	B	1	66	63	65	2
05-27	Residential	B	1	66	63	65	2
05-28	Residential	B	1	66	62	65	3
05-29	Residential	B	1	66	64	65	2
05-30	Residential	B	1	66	54	56	2
05-31	Residential	B	1	66	55	55	0
05-32	Residential	B	1	66	51	50	0
05-33	Residential	B	1	66	51	51	0
05-34	Residential	B	1	66	53	54	1
05-35	Residential	B	1	66	53	55	2
05-36	Residential	B	1	66	60	63	3
05-37	Residential	B	1	66	62	65	3
05-38	Residential	B	1	66	48	50	2
05-39	Residential	B	1	66	52	54	2
05-40	Residential	B	1	66	61	64	3
05-41	Residential	B	1	66	61	65	3
05-42	Residential	B	1	66	50	54	3

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
05-43	Residential	B	1	66	62	65	3
05-44	Residential	B	1	66	52	56	4
05-45	Residential	B	1	66	50	52	2
05-46	Residential	B	1	66	49	51	2
05-47	Residential	B	1	66	51	53	2
05-48	Residential	B	1	66	56	58	2
05-49	Residential	B	1	66	61	64	3
05-50	Residential	B	1	66	56	57	1
05-51	Residential	B	1	66	63	63	0
CNE 6							
06-01	Residential	B	1	66	50	52	2
06-02	Residential	B	1	66	50	54	4
06-03	Residential	B	1	66	57	60	3
06-04	Residential	B	1	66	65	**68**	3
06-05	Residential	B	1	66	64	**66**	3
06-06	Residential	B	1	66	64	**66**	2
06-07	Residential	B	1	66	65	**66**	1
06-08	Residential	B	1	66	63	**66**	2
06-09	Residential	B	1	66	63	65	2
06-10	Residential	B	1	66	65	65	0
06-11	Residential	B	1	66	65	65	0
06-12	Residential	B	1	66	58	60	2
06-13	Residential	B	1	66	56	60	4
06-14	Residential	B	1	66	56	60	4
06-15	Residential	B	1	66	65	**68**	3
06-16	Residential	B	1	66	50	52	2
06-17	Residential	B	1	66	43	47	3
06-18	Residential	B	1	66	43	46	3
06-19	Residential	B	1	66	52	53	2
06-20	Residential	B	1	66	56	58	2
06-21	Residential	B	1	66	54	55	1
06-22	Residential	B	1	66	54	55	1
06-23	Residential	B	1	66	53	54	1
06-24	Residential	B	1	66	53	54	1
06-25	Residential	B	1	66	54	56	2
06-26	Residential	B	1	66	54	56	2
06-27	Residential	B	1	66	58	63	5
06-28	Residential	B	1	66	65	**67**	2
06-29	Residential	B	1	66	62	65	3
06-30	Residential	B	1	66	63	65	3
06-31	Residential	B	1	66	63	**66**	3
06-32	Residential	B	1	66	63	**66**	2
06-33	Residential	B	1	66	63	65	3
06-34	Residential	B	1	66	63	**66**	2
06-35	Residential	B	1	66	50	52	2
06-36	Residential	B	1	66	51	53	2
06-37	Residential	B	1	66	56	58	2
06-38	Residential	B	1	66	53	55	2
06-39	Residential	B	1	66	57	58	1
06-40	Residential	B	1	66	65	65	1
06-41	Residential	B	1	66	44	47	2
06-42	Residential	B	1	66	44	46	2
06-43	Residential	B	1	66	55	54	0
06-44	Residential	B	1	66	61	61	0
06-45	Residential	B	1	66	48	50	1
06-46	Residential	B	1	66	49	50	1
06-47	Residential	B	1	66	49	51	2
06-48	Residential	B	1	66	55	57	2
06-49	Residential	B	1	66	62	65	2
06-50	Residential	B	1	66	49	51	2

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
06-51	Residential	B	1	66	52	53	1
06-52	Residential	B	1	66	52	53	1
06-53	Residential	B	1	66	52	53	1
06-54	Residential	B	1	66	52	53	1
06-55	Residential	B	1	66	52	54	1
06-56	Residential	B	1	66	53	54	1
06-57	Residential	B	1	66	50	52	2
06-58	Residential	B	1	66	59	61	2
06-59	Residential	B	1	66	60	63	3
06-60	Residential	B	1	66	61	63	2
06-61	Residential	B	1	66	61	63	2
06-62	Residential	B	1	66	61	63	2
06-63	Residential	B	1	66	62	64	2
06-64	Residential	B	1	66	49	50	1
06-65	Residential	B	1	66	48	49	1
06-66	Residential	B	1	66	49	51	2
06-67	Residential	B	1	66	53	55	2
06-68	Residential	B	1	66	54	55	1
06-69	Residential	B	1	66	64	65	2
06-70	Residential	B	1	66	63	65	2
06-71	Residential	B	1	66	61	63	2
06-72	Residential	B	1	66	58	59	2
06-73	Residential	B	1	66	55	57	3
06-74	Residential	B	1	66	49	52	3
06-75	Residential	B	1	66	47	49	3
06-76	Residential	B	1	66	57	59	2
06-77	Residential	B	1	66	42	46	5
06-78	Residential	B	1	66	50	52	3
06-79	Residential	B	1	66	55	57	2
06-80	Residential	B	1	66	63	64	0
CNE 7							
07-01	Residential	B	1	66	50	51	1
07-02	Residential	B	1	66	56	57	1
07-03	Residential	B	1	66	51	51	1
07-04	Residential	B	1	66	33	34	1
07-05	Residential	B	1	66	49	51	2
07-06	Residential	B	1	66	54	55	0
07-07	Residential	B	1	66	64	65	1
07-08	Residential	B	1	66	62	62	0
07-09	Residential	B	1	66	53	53	0
07-10	Residential	B	1	66	48	48	1
07-11	Residential	B	1	66	53	54	1
07-12	Residential	B	1	66	50	51	1
07-13	Residential	B	1	66	53	53	0
07-14	Residential	B	1	66	48	51	4
07-15	Residential	B	1	66	53	56	2
07-16	Residential	B	1	66	64	65	2
07-17	Residential	B	1	66	46	49	3
07-18	Residential	B	1	66	47	51	4
07-19	Residential	B	1	66	56	59	4
07-20	Residential	B	1	66	54	56	2
07-21	Residential	B	1	66	53	56	3
07-22	Residential	B	1	66	59	59	0
07-23	Residential	B	1	66	62	63	1
07-24	Residential	B	1	66	63	**66**	3
07-25	Residential	B	1	66	56	58	2
07-26	Residential	B	1	66	49	50	1
07-27	Residential	B	1	66	56	58	2
07-27	Residential	B	1	66	54	55	2
CNE 8							

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
08-01	Residential	B	1	66	63	64	1
08-02	Residential	B	1	66	63	65	3
08-03	Residential	B	1	66	57	62	5
08-04	Residential	B	1	66	46	51	6
08-05	Residential	B	1	66	54	59	5
08-06	Residential	B	1	66	58	63	5
08-07	Residential	B	1	66	60	64	4
08-08	Residential	B	1	66	46	52	6
08-09	Residential	B	1	66	46	52	6
08-10	Residential	B	1	66	55	57	2
08-11	Residential	B	1	66	62	65	3
08-12	Residential	B	1	66	63	65	3
08-13	Residential	B	1	66	63	65	3
08-14	Residential	B	1	66	62	65	3
08-15	Residential	B	1	66	64	65	1
08-16	Residential	B	1	66	61	64	4
08-17	Residential	B	1	66	50	53	3
08-18	Residential	B	1	66	51	54	3
08-19	Residential	B	1	66	52	54	2
08-20	Residential	B	1	66	52	55	2
08-21	Residential	B	1	66	54	56	2
08-22	Residential	B	1	66	55	57	2
08-23	Residential	B	1	66	63	64	1
08-24	Residential	B	1	66	51	52	2
08-25	Residential	B	1	66	49	52	3
08-26	Residential	B	1	66	49	52	2
08-27	Residential	B	1	66	48	51	2
08-28	Residential	B	1	66	47	50	3
08-29	Residential	B	1	66	47	49	3
08-30	Residential	B	1	66	46	49	4
08-31	Residential	B	1	66	45	48	4
08-32	Residential	B	1	66	46	51	5
08-33	Residential	B	1	66	47	52	6
08-34	Residential	B	1	66	37	39	2
08-35	Residential	B	1	66	64	65	1
08-36	Residential	B	1	66	51	54	2
08-37	Residential	B	1	66	47	51	4
08-38	Residential	B	1	66	39	41	2
08-39	Residential	B	1	66	47	52	4
08-40	Residential	B	1	66	45	48	3
08-41	Residential	B	1	66	56	59	3
08-42	Residential	B	1	66	48	51	3
08-43	Residential	B	1	66	61	62	1
08-44	Residential	B	1	66	53	53	1
08-45	Residential	B	1	66	43	47	4
08-46	Residential	B	1	66	61	62	1
08-47	Residential	B	1	66	62	62	0
08-48	Residential	B	1	66	53	54	1
08-49	Residential	B	1	66	61	62	1
08-50	Residential	B	1	66	61	63	2
08-51	Residential	B	1	66	59	60	2
08-52	Residential	B	1	66	52	53	1
08-53	Residential	B	1	66	50	51	1
08-54	Residential	B	1	66	55	60	5
08-55	Residential	B	1	66	46	51	5
08-56	Residential	B	1	66	51	56	5
08-57	Residential	B	1	66	45	48	3
08-58	Residential	B	1	66	57	59	2
08-59	Residential	B	1	66	53	57	4
08-60	Residential	B	1	66	62	65	3

Receptor Number	Land Use	Activity Category	Dwelling Units	FHWA/MDOT NAC	Existing	Build	Change
08-61	Residential	B	1	66	62	65	3
08-62	Residential	B	1	66	62	65	3
08-63	Residential	B	1	66	59	63	5
08-64	Residential	B	1	66	49	55	5
08-65	Residential	B	1	66	45	50	5
08-66	Residential	B	1	66	59	65	6
08-67	Residential	B	1	66	53	58	5
08-68	Residential	B	1	66	48	52	4
08-69	Residential	B	1	66	59	59	0
08-70	Residential	B	1	66	63	63	1
08-71	Residential	B	1	66	55	58	2
08-72	Residential	B	1	66	54	55	1
08-73	Residential	B	1	66	62	65	3
08-74	Residential	B	1	66	53	57	4
08-75	Residential	B	1	66	49	53	5
08-76	Residential	B	1	66	45	50	4
08-77	Residential	B	1	66	62	63	1
08-78	Residential	B	1	66	63	63	1
08-79	Residential	B	1	66	60	60	0

Appendix D Noise Barrier Analysis Detail

Table D-1 Noise Barrier Analysis, Receiver Level Detail

Receptor Number	Land Use	Category	Units	FHWA/MDOT NAC	Build	Noise Level w/Barr	Noise Reduction	Benefit?
Wall 1								
1-63	Residential	B	2	66	71	61	10	Y
1-64	Residential	B	2	66	70	63	7	Y
1-65	Residential	B	2	66	69	64	5	Y
1-66	Residential	B	2	66	69	64	5	Y
1-67	Residential	B	2	66	69	64	5	Y
1-68	Residential	B	2	66	69	64	5	Y
1-81	Residential	B	2	66	68	65	3	N
1-82	Residential	B	2	66	68	64	4	N
1-83	Residential	B	2	66	68	64	4	N
1-84	Residential	B	2	66	68	64	4	N
1-85	Residential	B	2	66	67	64	3	N
1-86	Residential	B	2	66	68	64	4	N
Wall 3a								
3-01	Residential	B	1	66	67	60	7	Y
3-02	Residential	B	1	66	63	62	1	N
3-03	Residential	B	1	66	56	56	0	N
3-04	Residential	B	1	66	54	54	0	N
3-05	Residential	B	1	66	69	62	7	Y
3-06	Residential	B	1	66	66	61	5	Y
Wall 3b								
3-24	Residential	B	1	66	66	61	5	Y
3-25	Residential	B	1	66	64	60	5	Y
3-26	Residential	B	1	66	63	60	3	N
3-27	Residential	B	1	66	62	60	2	N
3-20	Residential	B	1	66	61	59	2	N
Wall 4								
4-74	Residential	B	1	66	68	65	3	N
4-75	Residential	B	1	66	68	64	4	N
4-76	Residential	B	1	66	68	60	8	Y
4-77	Residential	B	1	66	68	61	7	Y
4-78	Residential	B	1	66	68	58	10	Y
4-79	Residential	B	1	66	67	64	3	N
Wall 6								
6-28	Residential	B	1	66	67	56	11	Y
6-29	Residential	B	1	66	65	57	8	Y
6-30	Residential	B	1	66	65	59	6	Y
6-31	Residential	B	1	66	66	59	7	Y
6-32	Residential	B	1	66	66	58	8	Y
6-33	Residential	B	1	66	65	58	7	Y
6-34	Residential	B	1	66	66	63	3	N

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