

## **Appendix B – Noise Analysis Technical Report**

# Preliminary Noise Analysis Technical Report

## Marina Way Extension

Prince William County Project No. 23C17011; UPC 120778

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## Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Background and Purpose .....	1
1.2	Project Description .....	1
1.3	Study Area Description and Land Use .....	1
<b>2</b>	<b>Noise Abatement Criteria .....</b>	<b>4</b>
2.1	Regulations and Guidelines .....	4
2.2	Noise Abatement Criteria .....	4
2.3	Monitoring of Existing Noise Levels .....	5
2.4	Predicted Existing Noise Levels .....	6
2.5	Undeveloped Lands and Permitted Developments .....	6
<b>3</b>	<b>Traffic Noise Prediction .....</b>	<b>8</b>
3.1	Noise Prediction Model .....	8
3.2	Noise Model Validation .....	8
3.3	Traffic Data for Noise Prediction .....	9
3.4	Predicted Noise Levels .....	10
<b>4</b>	<b>Noise Impact Assessment .....</b>	<b>12</b>
<b>5</b>	<b>Noise Abatement Measures .....</b>	<b>14</b>
<b>6</b>	<b>Information for Local Government Officials .....</b>	<b>15</b>
6.1	Noise-Compatible Land-Use Planning .....	15
6.2	VDOT's Noise Abatement Program .....	15
<b>7</b>	<b>References .....</b>	<b>16</b>
<b>Appendix A</b>	<b>Predicted Traffic Noise Levels .....</b>	<b>A-1</b>
<b>Appendix B</b>	<b>Traffic Data Used in Noise Analysis .....</b>	<b>B-1</b>
<b>Appendix C</b>	<b>Noise Measurement Details .....</b>	<b>C-1</b>
<b>Appendix D</b>	<b>List of Preparers .....</b>	<b>D-1</b>

## Figures

Figure 1. Overview of Project Study Area .....	3
Figure 2. Location Map for Common Noise Environments, Receptors, and Barriers .....	13
Figure 3. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2023 Existing Conditions .....	B-2
Figure 4. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2050 Build Conditions .....	B-2

Tables

Table 1. FHWA Noise Abatement Criteria (NAC) .....4

Table 2. Monitored Noise Levels .....6

Table 3. Computed vs. Measured Sound Levels at the Measurement Site .....9

Table 4. Ranges of Predicted Exterior and Interior Noise Levels for the Worst Hour .....11

Table 5. Predicted Traffic Noise Levels ..... A-2

# 1 Introduction

## 1.1 Background and Purpose

The Federal Highway Administration (FHWA) regulations for mitigation of highway traffic noise in the planning and design of federally aided highway projects are contained in Title 23 of the United States Code of Federal Regulations Part 772 (23 CFR 772). These regulations state that a “Type I” traffic noise impact analysis is required when there is the addition of through-traffic lanes or ramps in an interchange. The methods and procedures used in this preliminary noise impact evaluation are consistent with the latest noise assessment policies issued by FHWA and the Virginia Department of Transportation (VDOT).

This Preliminary Noise Analysis Technical Memorandum Report describes the details of a noise impact assessment and preliminary noise abatement evaluation performed for the Marina Way Extension Project in Prince William County, Virginia. The noise analysis was conducted in accordance with FHWA and VDOT noise assessment regulations and guidelines, both of which were revised and updated significantly in 2011. The FHWA regulations are set forth in 23 CFR Part 772. VDOT’s revised policy was updated most recently on February 15, 2022.

The study area analyzes all noise-sensitive land use within 500 feet of the proposed edge of pavement of the roadway improvements associated with the Marina Way Extension Project as seen in **Figure 1**.

This report presents a summary of the roadway improvements under study, description of noise terminology, the applicable standards and criteria, an evaluation of the existing noise conditions, a description of the computations of existing and future noise levels, a prediction of future noise impact, an evaluation of potential noise abatement measures, construction noise considerations, and information for local government officials. **Appendix A** presents predicted noise levels, **Appendix B** tabulates the traffic data used in the noise modeling, **Appendix C** presents details from the noise measurement program, and **Appendix D** provides the list of preparers.

## 1.2 Project Description

The Marina Way Extension Project includes a four-lane divided roadway extension of Marina Way from Annapolis Way to Gordon Boulevard (Route 123). The extension would function as a main street for the proposed North Woodbridge Town Center currently under development and would connect the existing Marina Way to Horner Road.

## 1.3 Study Area Description and Land Use

Noise sensitive land uses in the project study area include multi-family residences as well as one place of worship (Royalhouse Chapel International). Following VDOT and FHWA policies and procedures, the receptors used in the model to represent exterior activity areas at noise-sensitive land uses were grouped into Common Noise Environments (CNEs). Receptors in a CNE are exposed to similar noise sources and levels and are generally located between secondary noise sources, such as cross-streets. The modeled receptors for the Project were grouped into the CNEs listed below. **Figure 1** is an overview

graphic of the study area that shows the locations of the CNEs and the noise measurement site. The following paragraphs describe the land use located within each CNE.

**CNE A** is located in the north corner of the Marina Way and Annapolis Way intersection. It is comprised entirely of residences and associated areas of exterior use within the Viridium Apartments Woodbridge community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a rooftop common area and outdoor pool area are also part of the complex.

**CNE B** is located north of Annapolis Way and west of Marina Way. It is comprised entirely of residences and associated areas of exterior use within the Rivergate Apartments community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a common outdoor area with a pool is also part of the complex.

**CNE C** is located west of the Marina Way and Annapolis Way intersection. This CNE includes the Royalhouse Chapel International place of worship.





-  CNE Boundary
-  500' Noise Study Area
-  Measurement Site

**Figure 1**  
**Locations of Common Noise Environments**  
**and Noise Monitoring Site**  
 Marina Way Extension  
 Woodbridge, Prince William County, VA



0 200 400 800 Feet





## 2 Noise Abatement Criteria

### 2.1 Regulations and Guidelines

The potential noise impact of the Marina Way Extension Project was assessed in accordance with FHWA and VDOT noise assessment regulations and guidelines. The FHWA regulations are set forth in 23 CFR Part 772. On July 13, 2010, FHWA published revised noise regulations which became effective on July 13, 2011. FHWA has also published a guidance document to support the new regulations. VDOT prepared revisions to its noise policy in accordance with FHWA's requirements and revised policy. VDOT's revised policy has received approval from FHWA and was last updated on February 15, 2022.

### 2.2 Noise Abatement Criteria

To assess the degree of impact of highway traffic and noise on human activity, the FHWA established Noise Abatement Criteria (NAC) for different categories of land use activity (see **Table 1**).

**Table 1. FHWA Noise Abatement Criteria (NAC)**

Activity Category	Leq(h) <sup>1</sup>	Description of Activity Category
A	57 (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 <sup>2</sup>	67 (Exterior)	Residential
C <sup>2</sup>	67 (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 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E <sup>2</sup>	72 (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 (without building permits)

Notes:

1. Hourly equivalent A-weighted sound level (dBA)
2. Includes undeveloped lands permitted for this activity category

Source: 23 CFR Part 772.

The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The A-weighted sound level is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response to noise because the sensitivity of human hearing varies with frequency. The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise. Most environmental noise (and the A-weighted sound



level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (Leq). The Leq is the value or level of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over the same time period. For traffic noise assessment, Leq is typically evaluated over a one-hour period and may be denoted as Leq(h).

In this study, residential areas (Activity Category B) and institutional interior spaces (Activity Category D) were evaluated for noise impact. For Category B, noise impact would occur when predicted exterior noise levels, due to the project, approach or exceed 67 dBA in terms of Leq(h) during the loudest hour of the day. For Category D, noise impact would occur where predicted interior sound levels due to the project approach or exceed 52 dBA Leq(h). VDOT defines the word “approach” in “approach or exceed” as within 1 decibel. For example, the threshold for noise impact for Activity Category B and C is where exterior noise levels are within 1 decibel of 67 dBA Leq(h), or 66 dBA. Noise impact also would occur wherever project noise causes a substantial increase over existing noise levels. VDOT defines a substantial increase as an increase of 10 decibels or more above existing noise levels.

When the predicted design-year Build case noise levels approach or exceed the NAC during the loudest hour of the day or cause a substantial increase in existing noise, consideration of traffic noise reduction measures is necessary. If it is found that such mitigation measures will cause adverse social, economic or environmental effects that outweigh the benefits received, they may be dismissed from consideration. For this study, noise levels throughout the study area were determined for Existing (2023) conditions and the design-year (2050) Build alternative.

All noise-sensitive land uses potentially affected by the project are near roads for which traffic data was developed as part of the environmental study. Therefore, all noise levels were computed from the appropriate loudest-hour traffic data. The prediction methods and predicted noise levels appear in **Section 3**.

This section of the report describes the methodology and establishes existing noise levels and the investigation of undeveloped lands and permitted developments.

## 2.3 Monitoring of Existing Noise Levels

Noise monitoring was conducted at one short-term site on November 28, 2023. The noise measurement was located adjacent to residential properties with the highest noise exposures nearest the proposed project. Traffic classification counts on the roadways nearest the measurement site were conducted simultaneously during the measurement as well as before and after the measurement. The short-term measurement characterized existing noise levels in the study area but was not necessarily conducted during the loudest hour of the day. It included contributions from sources other than traffic, such as train passbys and intermittent noise from the adjacent concrete plant. The short-term noise monitoring location is shown in **Figure 2** in **Section 4** and numbered with the prefix “M.” It is also shown on the monitoring site log field data sheet in **Appendix C**.

Short-term noise monitoring is not a process to determine design-year noise impacts or barrier locations. Short-term noise monitoring provides a level of consistency between what is present in real-world situations and how that is represented in the computer noise model. Short-term monitoring does not need to occur within every CNE to validate the computer noise model.

Noise monitoring was conducted using a Brüel & Kjær Model 2245 sound level meter with current calibration traceable to the U.S. National Institute of Standards and Technology (NIST) and conforming

to American National Standards Institute (ANSI) Standard S1.4 and International Electrotechnical Commission (IEC) Standard 61672 for Type 1 (precision) spectrum analyzers. Additional field calibrations were carried out at the beginning and end of each measurement using a NIST-certified Brüel & Kjær Model 4231 acoustic calibrator. The instruments were programmed to log noise levels continuously during each measurement period and recorded broadband A-weighted Leq sound levels in 1-second intervals. The short-term data collection procedure involved a measurement over a period of 30 minutes. Continuous logging of events was conducted during the monitoring, so that intervals with events not representative of the ambient noise environment or not traffic-related could be excluded later. For the 30-minute period, a “Total Leq” (includes non-contaminated sound level contributions from every 1-second interval) and a “Traffic-only Leq” (excludes those intervals that contained noise events unrelated to roadway noise) were determined. By comparing the two totals, the significance of non-traffic events (such as aircraft operations) to the overall noise level can be determined for the measurement period.

**Table 2** presents the results of the noise monitoring program. The measured “Total” Leq sound level at site M1 was 59 dBA. **Table 2** shows the site number, address/location, date, start time, measurement duration and monitored noise level at the monitoring site. Note that the “Total” Leq value at site M1 was higher than the “Traffic-Only” Leq value indicating that there were non-traffic related noises occurring during the measurement duration that needed to be excluded during the post processing task.

**Table 2. Monitored Noise Levels**

Site No.	Address/ Location	Date	Time Start (hh:mm)	Duration (minutes)	Measured Total Leq (dBA)	Measured Traffic-only Leq (dBA)
M1	North corner of Marina Way and Annapolis Way	11/28/2023	15:06	30	59.0	58.2

Source: HMMH, 2023.

The noise measurement field notes, traffic counts, site photographs and calibration output are provided in **Appendix C**. The sound level meter calibration certificate is also included in **Appendix C**.

## 2.4 Predicted Existing Noise Levels

For calculation of loudest-hour noise levels throughout the study area for the existing (2023) conditions, receiver locations representing noise-sensitive sites adjacent to the project, along with the appropriate traffic data were added as input in the FHWA-approved noise prediction model to provide predicted existing noise levels. These predicted estimates of existing noise levels are then used as the baseline against which probable future noise levels are compared and potential noise impacts assessed. Additional information on the computation methods and computed levels used in this study are provided in **Section 3**.

## 2.5 Undeveloped Lands and Permitted Developments

In accordance with the VDOT Traffic Noise Policy, an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. VDOT considers the “Date of Public Knowledge” as the date that the final National Environmental Policy Act (NEPA) approval is made. VDOT or Prince William

County has no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed after this date.

As mentioned within, the extension of Marina Way will provide a main street for the future development of the North Woodbridge Town Center. The town center is planned to be comprised of mixed-use development and includes future residential use. The location of the town center would be located on the east and west side of the Marina Way extension and within 500 feet of the proposed roadway improvements, therefore requiring further investigation into the status of the development. It was determined that no building permits have been issued for the North Woodbridge Town Center. Therefore, this future development was not incorporated into the noise analysis. No other undeveloped lots were identified within 500 feet of the Marina Way Extension project.

## 3 Traffic Noise Prediction

This section discusses the noise prediction model, the model validation process, traffic data used as input to the noise prediction model, and then presents a summary of the predicted noise levels.

### 3.1 Noise Prediction Model

HMMH used the FHWA's Traffic Noise Model (TNM Version 2.5) to compute existing and future Build case loudest-hour noise levels for all receptors located within the Project Noise Study Area. TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs and show excellent agreement in most cases for sites with and without noise barriers.

The traffic data and engineering plans, along with topographic contours and other supplemental information, were used to create a three-dimensional model of the existing and future design roadway configurations and the surrounding terrain within the FHWA TNM. The noise modeling accounted for such factors as propagation over different types of ground (acoustically soft and hard ground), elevated roadway sections, significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, over 260 noise prediction receivers (also called "receptors" and "sites") were added to the modeling.

Information on noise-sensitive residential land use in the study area (Activity Category B) includes the number of dwelling units identified from existing mapping and publicly available parcel data from Prince William County, Virginia.

Traffic-noise levels were predicted for the 2023 Existing conditions and 2050 Build alternative. No-Build noise levels are not typically required for a categorical exclusion (CE) or environmental assessment (EA) unless the project is related to the interstate system or there is a 4(f) resource within the corridor. The Marina Way Extension project is not located along an interstate system and there is no 4(f) resources within the corridor. Therefore, no traffic-noise prediction was completed for the 2050 No-Build condition.

### 3.2 Noise Model Validation

According to FHWA and VDOT policies, the accuracy of the noise prediction model must be verified on a project-by-project basis. The noise model validation process compares existing noise levels monitored in the field with predicted noise levels from the FHWA TNM using the traffic conditions during the monitoring period as input to the model. The purpose of the noise model validation is to evaluate the success of the model in representing the important acoustical characteristics of the study area. This is determined by examining the overall trend of the differences between measured and predicted noise levels at each measurement site. Individual site-to-site differences may vary significantly, depending on factors that may affect either the measured noise level or the predicted noise level at a given site. Examples of factors that affect noise levels are provided below:

- Factors affecting measured noise levels include atmospheric conditions (upwind, neutral or downwind conditions), shielding by structures that are difficult to model, and/or the presence of “loud” vehicle pass-bys during the measurement.
- Factors affecting predicted noise levels include the level of detail in modeling terrain features and locating receptors, as well as the degree to which ground zones, tree zones, and sparse rows of buildings are incorporated into the model.
- FHWA and VDOT consider the noise model to be validated when measured noise levels are within +/- 3 dBA of predicted noise levels for existing conditions.

FHWA discourages the “calibration” of a noise model through the use of adjustment factors within the noise model to match measured and predicted levels. FHWA recognizes that many factors are present both in the measurement of noise and in the development of a model that can lead to variability. Differences between measured and predicted levels that are outside the accepted accuracy of the model are likely due to unusual circumstances during the measurements, or to insufficient detail or inaccurate assumptions in the model. Only after a thorough examination of the measurement conditions and the modeling assumptions has been completed, should the highway noise analyst consider the use of adjustment factors in the model. FHWA recognizes that in some cases, it may not be possible to identify a specific reason for not validating a specific measurement site. Any such cases are to be documented in the noise study report.

**Table 3** presents a comparison of the measured noise level and the corresponding TNM-computed noise level. The comparison for site M1 shows a difference of less than 3 dBA, and so the model has been appropriately validated for this project.

**Table 3. Computed vs. Measured Sound Levels at the Measurement Site**

Site No.	Address/ Location	Land Use	Measured Traffic-only Leq (dBA)	Computed Leq (dBA)	Difference (dBA)
M1	North corner of Marina Way and Annapolis Way	Residential	58.2	55.3	-2.9

Source: HMMH, 2023.

### 3.3 Traffic Data for Noise Prediction

The traffic data used in the noise analysis must produce sound levels representative of the loudest hour of the day in the future design year, per FHWA and VDOT policy. Traffic data provided by the project team and found within the *Marina Way and Annapolis Way Alternative Intersection Report* was used for input into the traffic noise model. The report includes traffic volumes along Marina Way and Annapolis Way for 2023 Existing Conditions and the Design Year of 2050. During the noise model validation exercise, it was determined that traffic from Richmond Highway (Route 1) contributes to the overall noise environment. Therefore, traffic counts conducted during the noise measurement for Richmond Highway (Route 1) were used to represent this additional traffic noise at receptors.

Traffic data were supplied as peak hourly volumes for one AM hour (7:15 AM – 8:15 AM) and one PM hour (6:15 PM – 7:15 PM). Truck percentages for Marina Way and Annapolis Way were provided by project traffic engineers. Based on observations from the noise measurements, it was assumed that all truck traffic would be related to medium trucks. Truck percentages along Richmond Highway (Route 1) were estimated using traffic counts collected during the noise measurement program. For existing



conditions, average speeds collected during the noise measurement program were used in the noise model. Per Section 6.4.3 of the VDOT Noise Policy, the operating speed must be used if it has been determined to be consistently higher than the posted speed limit, and vice versa. However, since the future operating speeds were not readily available for Marina Way, the proposed speed limit of 30 miles-per-hour was used. For speeds along Annapolis Way and Richmond Highway (Route 1), it was assumed that future speeds would remain the same as existing.

The TNM model for existing conditions and the future design year Build Alternative were run for the entire set of receptors for all peak hour volumes. The loudest hour was determined to be PM peak traffic hour (6:15 PM – 7:15 PM) for most of the receptors located within the project study area and was therefore chosen for the noise analysis. **Appendix B** provides the loudest-hour traffic data for the roadways used in the TNM for this project.

### 3.4 Predicted Noise Levels

The study area includes exterior residential (FHWA Activity Category B) and interior institutional and religious (Category D) land uses.

**Table 4** summarizes the range of predicted noise levels by CNE. The table includes a description of each CNE and its land use, the FHWA Activity Category, and the loudest-hour traffic noise levels, which are presented in terms of the A-weighted equivalent sound level, or Leq, in dBA. Loudest-hour noise levels were computed for 2023 Existing conditions, as well as the design-year (2050) Build alternative. Exterior sound levels are shown for Activity Category B and predicted interior sound levels are shown for Category D (interior institutional) land use. The noise-sensitive place of worship identified in the study area (Royalhouse Chapel International) appear to have air conditioning and masonry construction. Therefore, per FHWA guidance, an outside-to-inside noise reduction value of 25 decibels is used to determine the interior sound levels from the exterior sound levels predicted by TNM. **Appendix A** provides a table that lists the computed sound levels at all the modeled receptors included in the noise assessment.

Upon completion of the noise measurement program and noise modeling, it was determined that other sources of noise, other than roadway noise, contribute to the overall background noise level in the study area. To prevent under-predicting existing and future noise levels, an ambient noise level was incorporated into the traffic-noise modeling results. Based on noise measurement data and proximity of receptors to project roadways, it was determined that a background noise level of 50 decibels was an appropriate value to represent the ambient noise environment.

**Figure 2**, presented in **Section 4**, provides a location map for the CNEs and noise sensitive receptors. Each receptor is shown in **Figure 2** with a color-coded dot that indicates the status of each receptor according to its 2050 Build noise level.

**Table 4. Ranges of Predicted Exterior and Interior Noise Levels for the Worst Hour**

CNE	Land Use – Description	Activity Categories	Range of Predicted Exterior & Interior Noise Levels for the Worst Hour (dBA)	
			2023 Existing	2050 Build
A	Residential – West of Marina Way, between Annapolis Way and Rivergate Place. Comprised entirely of residences within the Viridium Woodbridge Apartments community.	B	50 - 58	50 - 61
B	Residential – West of Marina Way, north of Rivergate Place. Comprised entirely of residences within the Rivergate Apartments community.	B	50 - 54	50 - 56
C	Institutional – West of Marina Way, south of Annapolis Way. Includes the Royalhouse Chapel International.	D	26 - 26	31 - 31

Source: HMMH, 2023.

## 4 Noise Impact Assessment

The potential noise impact of the Marina Way Extension Project was evaluated according to FHWA and VDOT noise assessment guidelines, described in detail in **Section 2**. In summary, noise impact would occur wherever project noise levels are expected to approach within one decibel or exceed 67 dBA Leq at noise-sensitive land uses in Activity Categories B (exterior residential) or approach within one decibel or exceed 52 dBA Leq at noise-sensitive land uses in Activity Category D (interior institutional) during the loudest hour of the day. Noise impact also would occur wherever project noise levels cause a substantial increase over existing noise levels—an increase of 10 dB or more is considered substantial by VDOT.

In the 2023 Existing condition, noise-sensitive receptors are not predicted to be exposed to traffic-noise levels that approach or exceed the applicable NAC impact threshold for all locations. Likewise, in the 2050 Build alternative, traffic-noise levels at noise-sensitive receptors are predicted to be below the applicable NAC threshold for all locations. Additionally, increases in traffic-noise levels are predicted to range between one and seven decibels. Therefore, no impacts due to substantial increases are predicted. Since no noise impact is predicted to occur as a result of the project, no further analysis is required and noise mitigation would not be warranted.

**Figure 2** shows the locations of individual receptors analyzed in the 2050 Build alternative. Receptors representing residences within the apartment communities have a designation of A, B, C, D, or E at the end of the receptor name, which represents Floor 1, 2, 3, 4, and 5, respectively.





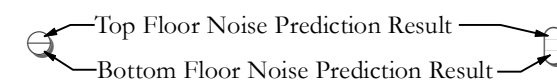
**Figure 2**  
**Location Map for Common Noise**  
**Environments and Receptors**

**Marina Way Extension**

Prince William County Project No. 23C17011; UPC 120778

Receiver Site and Number

- Impacted
- Not Impacted



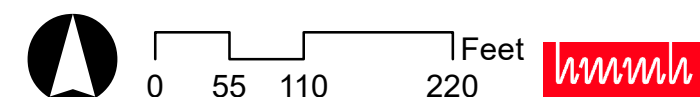
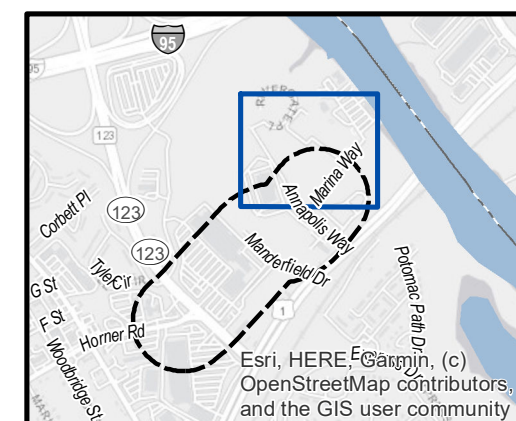
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

--- 500 ft Noise Study Area

--- CNE Boundary

--- Property Parcel





## 5 Noise Abatement Measures

FHWA and VDOT policies require that noise abatement be considered for all receptors that are predicted to be impacted by traffic noise from the proposed project. FHWA has identified certain noise abatement measures that may be incorporated in projects to reduce traffic noise impact. In general, mitigation measures can include alternative measures (traffic management, the alteration of horizontal and vertical alignment, and low-noise pavement), in addition to the construction of noise barriers.

As discussed in **Section 4**, no impacts are predicted at any receptors within the noise study area. Therefore, no further analysis is required since noise abatement is not warranted. Construction Noise Consideration

Construction noise provisions are contained in Section 107.16(b)3 Noise of the 2020 VDOT Road and Bridge Specifications. The specifications have been reproduced below:

- The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise-sensitive activity is occurring. A noise-sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.
- The Department may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.
- The Department may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 P.M. and 6 A.M. If other hours are established by local ordinance, the local ordinance shall govern.
- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.
- When feasible, the Contractor shall establish haul routes that direct vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.
- These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.



## 6 Information for Local Government Officials

FHWA and VDOT policies require that VDOT provides certain information to local officials within whose jurisdiction the highway project is located, to minimize future traffic noise impacts of Type I projects on currently undeveloped lands. (Type I projects involve highway improvements with noise analysis.) This information must include information on noise-compatible land-use planning, noise impact zones in undeveloped land in the highway project corridor and federal participation in Type II projects (noise abatement only). This section of the report provides that information, as well as information about VDOT's noise abatement program.

### 6.1 Noise-Compatible Land-Use Planning

Section 9.0 of VDOT's noise policy outlines VDOT's approach to communication with local officials and provides information and resources on highway noise and noise-compatible land-use planning. VDOT's intention is to assist local officials in planning the uses of undeveloped land adjacent to highways to minimize the potential impacts of highway traffic noise.

Entering the Quiet Zone is a brochure that provides general information and examples to elected officials, planners, developers, and the general public about the problem of traffic noise and effective responses to it. A link to this brochure on FHWA's website is provided:

[http://www.fhwa.dot.gov/environment/noise/noise\\_compatible\\_planning/federal\\_approach/land\\_use/qz00.cfm](http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/qz00.cfm)

A wide variety of administrative strategies may be used to minimize or eliminate potential highway noise impacts, thereby preventing the need or desire for costly noise abatement structures such as noise barriers in future years. There are five broad categories of such strategies:

- Zoning,
- Other legal restrictions (subdivision control, building codes, health codes),
- Municipal ownership or control of the land,
- Financial incentives for compatible development, and
- Educational and advisory services.

The Audible Landscape: A Manual for Highway and Land Use is a very well-written and comprehensive guide addressing these noise-compatible land use planning strategies, with significant detailed information. This document is available through FHWA's Website, at

[http://www.fhwa.dot.gov/environment/noise/noise\\_compatible\\_planning/federal\\_approach/audible\\_landscape/al00.cfm](http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/audible_landscape/al00.cfm)

### 6.2 VDOT's Noise Abatement Program

Information on VDOT's noise program is provided in "Highway Traffic Noise Guidance Manual (Version 9)," updated February 15, 2022. This document is available from VDOT's Noise Abatement Section, Virginia Department of Transportation, 1401 E. Broad St., Richmond, VA 23219.

## 7 References

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- Federal Highway Administration, US Department of Transportation. January 1998. *FHWA Traffic Noise Model, Version 1.0 User's Guide. FHWA-PD-96-009*. Cambridge, MA: U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center, Acoustics Facility.  
[http://www.fhwa.dot.gov/environment/noise/traffic\\_noise\\_model/old\\_versions/tnm\\_version\\_10/users\\_guide/index.cfm](http://www.fhwa.dot.gov/environment/noise/traffic_noise_model/old_versions/tnm_version_10/users_guide/index.cfm)
- Federal Highway Administration, US Department of Transportation. February 1998. *FHWA Traffic Noise Model, Version 1.0: Technical Manual, Report No. FHWA-PD-96-010 and DOT-VNTSC-FHWA-98-2*. Cambridge, MA: U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center, Acoustics Facility.  
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- Johnson, Mirmiran & Thompson. November 22, 2023. *Marina Way and Annapolis Way Alternative Intersection Report DRAFT*.
- US Department of Transportation, John A. Volpe National Transportation Systems Center. July 2004. *TNM Version 2.5 Addendum to Validation of FHWA's TNM® (TNM) Phase 1 report*. Cambridge, MA. [http://www.fhwa.dot.gov/environment/noise/traffic\\_noise\\_model/model\\_validation/](http://www.fhwa.dot.gov/environment/noise/traffic_noise_model/model_validation/)
- Virginia Department of Transportation. February 15, 2022. Highway Traffic Noise Guidance Manual (Version 9). Richmond, VA. <http://www.virginiadot.org/projects/pr-noise-walls-about.asp>

## Appendix A Predicted Traffic Noise Levels

This appendix provides the predicted noise levels at all the receiver (receptor) locations shown in the study graphics for the 2023 Existing and design-year 2050 Build alternative. The receptor sites are organized by CNE. Also provided are the name and location of each receiver site, the number of dwelling units or recreational units assigned, a description of the land use, the applicable Noise Abatement Criteria, and the predicted loudest-hour Leq sound levels.

**Table 5. Predicted Traffic Noise Levels**

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-001A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	53	58	No Impact
A-001B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-001C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-001D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-001E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-002A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	53	59	No Impact
A-002B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-002C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-002D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-002E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-003A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	58	No Impact
A-003B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	60	No Impact
A-003C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	60	No Impact
A-003D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	60	No Impact
A-003E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	60	No Impact
A-004A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	57	No Impact
A-004B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	59	No Impact
A-004C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-004D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-004E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-005	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	55	No Impact
A-006A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-006B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-006C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-006D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	53	No Impact
A-007A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-007B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-007C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-007D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	54	No Impact
A-008A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-009	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-010A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-011A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-012A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-013A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-014A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact



CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-014C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-015A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-015E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-016A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
A-016E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
A-017A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-017B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-017C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	60	No Impact
A-017D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-017E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-018A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
A-018B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	52	No Impact
A-019A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-019B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-019C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-019D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-019E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-020A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-020B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
A-020C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
A-020D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
A-020E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
A-021A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-021B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	60	No Impact
A-021C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-021D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-021E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-022A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-022E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-023A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-024A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-025A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-026A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-027	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-001A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-001B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-001C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-001D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
B-001E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
B-002A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-002B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
B-002C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
B-002D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	52	No Impact
B-002E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-003A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-003B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-003C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-003D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-003E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	52	No Impact
B-004A	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-004B	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004C	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004D	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004E	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	52	No Impact
B-005A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-005B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-005C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-005D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-005E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-006A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-006E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-007A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-007E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-008A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-008E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-009A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-011A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-011C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-012A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-013A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-014A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-015A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-016A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-016B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-017A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact



CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-017B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-018A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-019A	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019B	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019C	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019D	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019E	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-020A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-020B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-021B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-022D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-022E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-023A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-023B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-023C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-023D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-023E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-024A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-024B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-025A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	54	56	No Impact
B-026A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-026B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-026C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-026D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-026E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-027A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-027E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-028	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
B-029A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-029B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-029C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour Leq (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-029D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	54	No Impact
B-029E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
B-030A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	52	No Impact
B-030B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
C-001	991 Annapolis Way, Woodbridge, VA 22191	1	D	Int.	52	26	31	No Impact
* "Cat." = FHWA Activity Category. HMMH, 2023.								

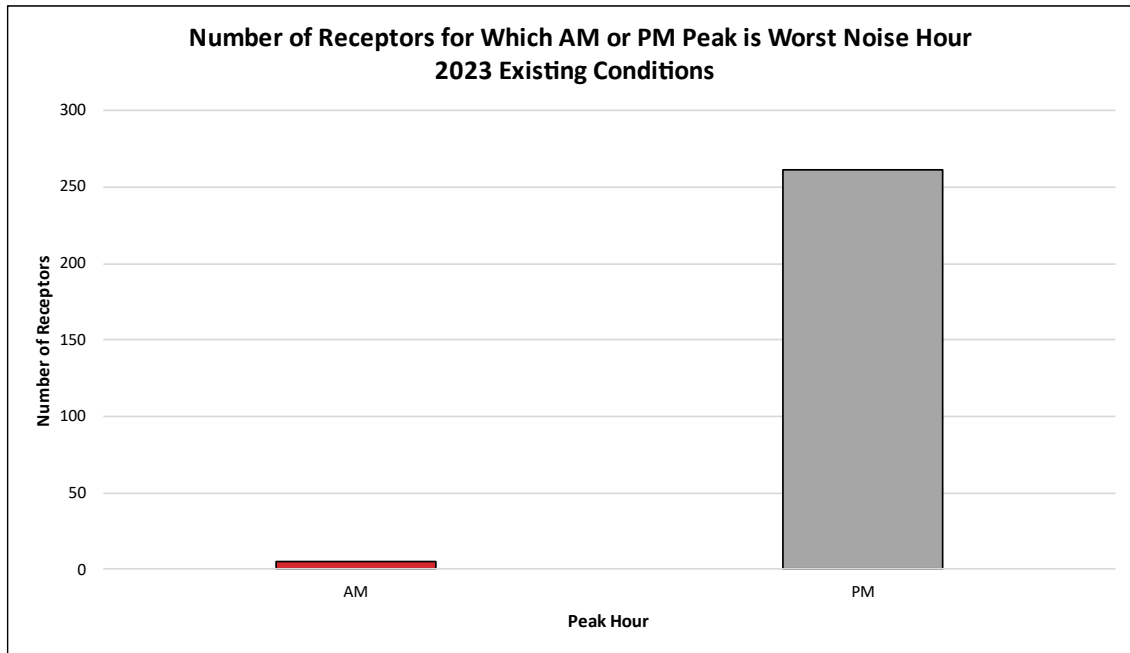


## Appendix B Traffic Data Used in Noise Analysis

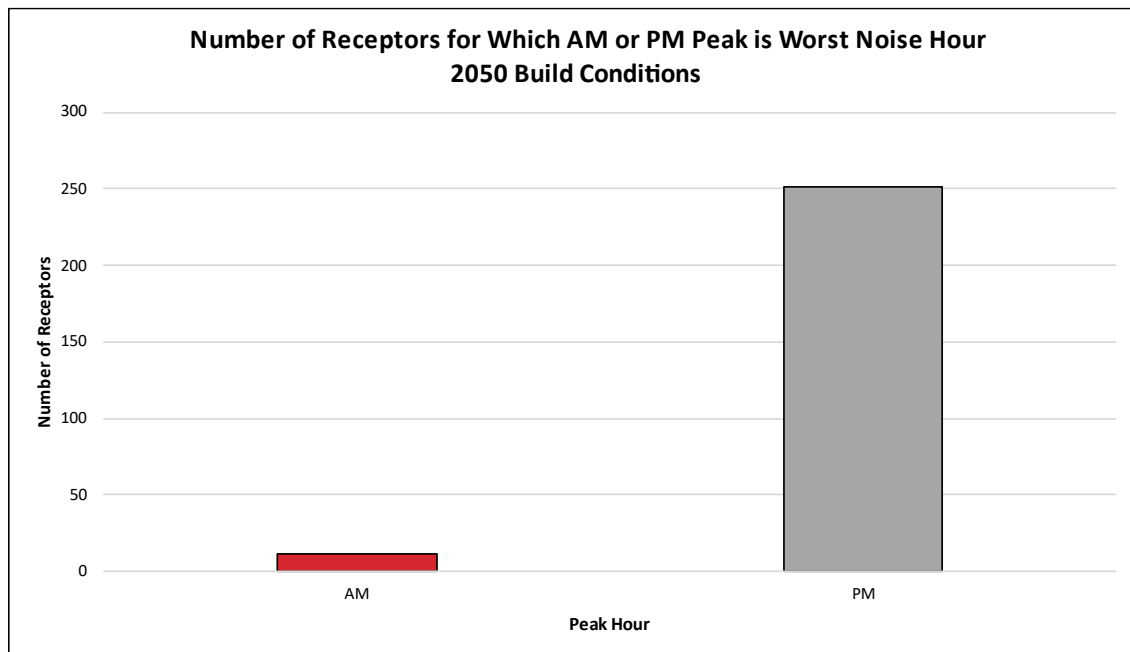
This appendix provides the loudest-hour roadway traffic volumes and speeds used in the noise modeling for the 2023 Existing conditions, as well as the 2050 Build alternative.

**Figure 3** shows the number of receptors for which the AM Peak Hour or the PM Peak Hour represents the worst noise hour for existing conditions by CNE. **Figure 4** shows the equivalent information for the Build Alternative.

**Figure 3. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2023 Existing Conditions**



**Figure 4. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2050 Build Conditions**





**Marina Way Extension**  
**Noise Measurement Traffic Data**

**Sample Counts**

**Sample #1**

Time 14:00-14:15

Duration (min) 15

**Sample #2**

Time 15:46-16:02

Duration (min) 15

**Route 1 NB**

Veh.Type	# of Veh.
A	190
MT	2
HT	10
Speed	35

**Route 1 NB**

Veh.Type	# of Veh.
A	191
MT	4
HT	3
Speed	34

**Route 1 SB**

Veh.Type	# of Veh.
A	295
MT	5
HT	14
Speed	36

**Route 1 SB**

Veh.Type	# of Veh.
A	600
MT	5
HT	6
Speed	34

Time 15:06-15:36

Duration (min) 30

**Marina Way NB/SB**

Veh.Type	# of Veh.
A	54
MT	4
HT	0
Speed	15

**Annapolis EB (West of Marina)**

Veh.Type	# of Veh.
A	21
MT	4
HT	0
Speed	23

**Annapolis EB (East of Marina)**

Veh.Type	# of Veh.
A	40
MT	8
HT	0
Speed	23

**Annapolis WB (West of Marina)**

Veh.Type	# of Veh.
A	23
MT	2
HT	0
Speed	35

**Annapolis WB (East of Marina)**

Veh.Type	# of Veh.
A	44
MT	2
HT	0
Speed	35

**TNM Input**

**Route 1 NB (Sample #2)**

Veh.Type	# of Veh.	Speed
A	764	35
MT	16	35
HT	12	35

**Route 1 SB (Sample #2)**

Veh.Type	# of Veh.	Speed
A	2400	36
MT	20	36
HT	24	36

**Marina Way NB/SB**

Veh.Type	# of Veh.	Speed
A	108	15
MT	8	15
HT	0	0

**Annapolis EB (West of Marina)**

Veh.Type	# of Veh.	Speed
A	42	23
MT	8	23
HT	0	0

**Annapolis EB (East of Marina)**

Veh.Type	# of Veh.	Speed
A	80	23
MT	16	23
HT	0	0

**Annapolis WB (West of Marina)**

Veh.Type	# of Veh.	Speed
A	46	35
MT	4	35
HT	0	0

**Annapolis WB (East of Marina)**

Veh.Type	# of Veh.	Speed
A	88	35
MT	4	35
HT	0	0

Note:

1) Speeds use in validation exercise are based on average speeds collected during field measurements.

## Marina Way Extension

### Existing 2023

#### Peak AM (7:15 AM - 8:15 AM)

##### Marina Way NB/SB

Total Vehicles 152			
Veh.Type	# of Veh.	Speed	Truck %
A	149	25	
MT	3	25	2%
HT	0	25	

##### Annapolis EB (West of Marina)

Total Vehicles 32			
Veh.Type	# of Veh.	Speed	Truck %
A	31	30	
MT	1	30	2%
HT	0	0	

##### Annapolis EB (East of Marina)

Total Vehicles 141			
Veh.Type	# of Veh.	Speed	Truck %
A	138	30	
MT	3	30	2%
HT	0	0	

##### Annapolis WB (East of Marina)

Total Vehicles 57			
Veh.Type	# of Veh.	Speed	Truck %
A	56	30	
MT	1	30	2%
HT	0	30	

##### Annapolis WB (West of Marina)

Total Vehicles 12			
Veh.Type	# of Veh.	Speed	Truck %
A	12	30	
MT	0	0	2%
HT	0	0	

##### Route 1 NB

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	764	35	
MT	16	35	2%
HT	12	35	2%

##### Route 1 SB

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	2400	36	
MT	20	36	1%
HT	24	36	1%

#### Peak PM (6:15 PM - 7:15 PM)

##### Marina Way NB/SB

Total Vehicles 189			
Veh.Type	# of Veh.	Speed	Truck %
A	185	25	
MT	4	25	2%
HT	0	25	

##### Annapolis EB (West of Marina)

Total Vehicles 19			
Veh.Type	# of Veh.	Speed	Truck %
A	6	30	
MT	0	0	2%
HT	0	0	

##### Annapolis EB (East of Marina)

Total Vehicles 112			
Veh.Type	# of Veh.	Speed	Truck %
A	55	30	
MT	1	30	2%
HT	0	0	

##### Annapolis WB (East of Marina)

Total Vehicles 145			
Veh.Type	# of Veh.	Speed	Truck %
A	48	30	
MT	1	30	2%
HT	0	0	

##### Annapolis WB (West of Marina)

Total Vehicles 26			
Veh.Type	# of Veh.	Speed	Truck %
A	13	30	
MT	0	30	2%
HT	0	0	

##### Route 1 NB

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	764	35	
MT	16	35	2%
HT	12	35	2%

##### Route 1 SB

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	2400	36	
MT	20	36	1%
HT	24	36	1%

#### Notes:

1) Per the draft "Marina Way and Annapolis Way Alternative Intersection Report" (November 2023), since Marina Way does not extend west beyond the Annapolis way intersection under existing conditions, the existing conditions operational analysis was not needed for this study as the proposed conditions alter the 991 Annapolis Way entrance to a four-lane divided throughoutway. Therefore, no traffic data beyond the existing Marina Way and Annapolis Way intersection is available.

2) Volumes for Route 1 reflect traffic counts conducted during the noise measurement program. Although this roadway is not included in the project's roadway network, traffic-noise from Route 1 contributes to the overall noise environment, as determined during the validation exercise.

**Marina Way Extension**

**Build 2050**

**Peak AM (7:15 AM - 8:15 AM)**

**Marina Way NB/SB (North of intersection)**

Total Vehicles 515			
Veh.Type	# of Veh.	Speed	Truck %
A	505	30	
MT	10	30	2%
HT	0	0	

**Marina Way NB (South of intersection)**

Total Vehicles 525			
Veh.Type	# of Veh.	Speed	Truck %
A	260	30	
MT	5	30	2%
HT	0	0	

**Marina Way SB (South of intersection)**

Total Vehicles 420			
Veh.Type	# of Veh.	Speed	Truck %
A	208	30	
MT	4	30	2%
HT	0	0	

**Annapolis EB (West of Marina)**

Total Vehicles 230			
Veh.Type	# of Veh.	Speed	Truck %
A	76	30	
MT	2	30	2%
HT	0	0	

**Annapolis EB (East of Marina)**

Total Vehicles 445			
Veh.Type	# of Veh.	Speed	Truck %
A	147	30	
MT	3	30	2%
HT	0	0	

**Annapolis WB (East of Marina)**

Total Vehicles 310			
Veh.Type	# of Veh.	Speed	Truck %
A	103	30	
MT	2	30	2%
HT	0	0	

**Annapolis WB (West of Marina)**

Total Vehicles 370			
Veh.Type	# of Veh.	Speed	Truck %
A	183	30	
MT	4	30	2%
HT	0	0	

**Route 1 NB**

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	382	35	
MT	8	35	2%
HT	6	35	2%

**Route 1 SB**

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	600	36	
MT	5	36	1%
HT	6	36	1%

**Peak PM (6:15 PM - 7:15 PM)**

**Marina Way NB/SB (North of intersection)**

Total Vehicles 530			
Veh.Type	# of Veh.	Speed	Truck %
A	519	30	
MT	11	30	2%
HT	0	0	

**Marina Way NB (South of intersection)**

Total Vehicles 390			
Veh.Type	# of Veh.	Speed	Truck %
A	193	30	
MT	4	30	2%
HT	0	0	

**Marina Way SB (South of intersection)**

Total Vehicles 814			
Veh.Type	# of Veh.	Speed	Truck %
A	403	30	
MT	8	30	2%
HT	0	0	

**Annapolis EB (West of Marina)**

Total Vehicles 405			
Veh.Type	# of Veh.	Speed	Truck %
A	134	30	
MT	3	30	2%
HT	0	0	

**Annapolis EB (East of Marina)**

Total Vehicles 370			
Veh.Type	# of Veh.	Speed	Truck %
A	123	30	
MT	2	30	2%
HT	0	0	

**Annapolis WB (East of Marina)**

Total Vehicles 710			
Veh.Type	# of Veh.	Speed	Truck %
A	235	30	
MT	5	30	2%
HT	0	0	

**Annapolis WB (West of Marina)**

Total Vehicles 395			
Veh.Type	# of Veh.	Speed	Truck %
A	196	30	
MT	4	30	2%
HT	0	0	

**Route 1 NB**

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	382	35	
MT	8	35	2%
HT	6	35	2%

**Route 1 SB**

Total Vehicles			
Veh.Type	# of Veh.	Speed	Truck %
A	600	36	
MT	5	36	1%
HT	6	36	1%

**Notes:**

1) Per the draft "Marina Way and Annapolis Way Alternative Intersection Report" (November 2023), since Marina Way does not extend west beyond the Annapolis way intersection under existing conditions, the existing conditions operational analysis was not needed for this study as the proposed conditions alter the 991 Annapolas Way entrance to a four-lane divided throughoutway. Therefore, traffic data along Gordon Boulevard was not utilized in the Build condition.

2) Volumes for Route 1 reflect traffic counts conducted during the noise measurement program. Although this roadway is not included in the project's roadway network, traffic-noise from Route 1 contributes to the overall noise environment, as determined during the validation exercise.

## Appendix C Noise Measurement Details

This appendix includes data acquired during the noise measurement program including the site sketch, photographs, field noise and traffic count data sheets, and the calibration certificate.

**Site M1. Facing East on Annapolis Way.**



**Site M1. Facing West on Annapolis Way.**



The Hottinger Brüel & Kjær Calibration Laboratory  
3079 Premiere Parkway Suite 120  
Duluth, GA 30097  
Telephone: 770/209-6907  
Fax: 770/447-4033  
Web site address: <http://www.hbkworld.com>

**CERTIFICATE OF CALIBRATION**

Certificate No: CAS-616753-T0X2P4-801

Page 1 of 10

**CALIBRATION OF:**

Sound Level Meter:	Brüel & Kjær	2245	Serial No: 2245-100484
Microphone:	Brüel & Kjær	4966	Serial No: 3236856
Supplied Calibrator:	Brüel & Kjær	4231	Serial No: 3025167
Software version:	1.1.2.386		

**CLIENT:** Harris Miller Miller & Hanson Inc.  
700 District Avenue Suite 800  
Burlington, MA 01803

**CALIBRATION CONDITIONS:**

Preconditioning: 4 hours at  $23 \pm 3$  °C  
Environment conditions See actual values in Environmental Condition sections

**SPECIFICATIONS:**

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor  $k = 2$  providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (\*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

**PROCEDURE:**

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.6 - DB: 8.60 Test Collection 2245-E, 4966 (BZ-7301).

**RESULTS:**

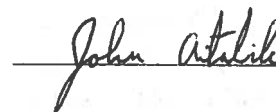
As Received Condition	As Received Data	Final Data
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<input type="checkbox"/> Damaged - See attached report	<input type="checkbox"/> Outside acceptance criteria	<input type="checkbox"/> Limited test - See attached details
	<input type="checkbox"/> Inoperative	
	<input type="checkbox"/> Data not taken	

Date of Calibration: Jan. 09. 2023

Certificate issued: Jan. 10. 2023

Grant Kennedy

Calibration Technician



John Avitabile  
Quality Representative





HOTTINGER  
BRÜEL & KJÆR

The Hottinger Brüel & Kjær Inc. Calibration Laboratory  
3079 Premiere Parkway Suite 120  
Duluth, GA 30097  
Telephone: 770-209-6907  
Fax: 770-447-4033  
Web site address: <http://www.hbkworld.com>



Calibration  
Certificate  
# 1568.01

## CERTIFICATE OF CALIBRATION

No.: CAS-616753-T0X2P4-402

Page 1 of 4

### CALIBRATION OF:

Microphone: Brüel & Kjær Type 4966 Serial No. 3236856

### CUSTOMER:

Harris Miller Miller & Hanson, Inc  
700 District Ave, Ste 800  
Burlington, MA 01803

### CALIBRATION CONDITIONS:

Environment conditions:	Air temperature:	23.1 °C
	Air pressure:	98.027 kPa
	Relative Humidity:	30 %RH
Applied polarization voltage:	0 Vdc	

### SPECIFICATIONS:

This document certifies that the instrument as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (\*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

### PROCEDURE:

The measurements have been performed with the assistance of the Hottinger Brüel & Kjær Inc. Microphone Calibration System B&K 9721 with application software WT9649 and WT9650 version 5.3.0.10 using calibration procedure: 4966 S251-FR01

### RESULTS:

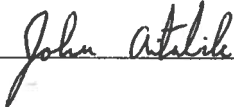
<input checked="" type="checkbox"/> "As Received" Data: Within Acceptance Criteria	<input type="checkbox"/> "As Received" Data: Outside Acceptance Criteria
<input checked="" type="checkbox"/> "Final" Data : Within Acceptance Criteria	<input type="checkbox"/> "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from standards, calibration method, effect of environmental conditions and any short term contribution from the device under calibration.

Date of Calibration: January 11, 2023

Certificate issued: January 11, 2023

Meshaun Hobbs  
Calibration Technician

  
John Avitabile  
Quality Representative



HOTTINGER  
BRÜEL & KJÆR

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Telephone: 770-209-6907  
Fax: 770-447-4033  
Web site address: <http://www.hbkworld.com>



Calibration  
Certificate  
# 1568.01

## CERTIFICATE OF CALIBRATION

No.: CAS-616753-T0X2P4-401

Page 1 of 2

### CALIBRATION OF:

Calibrator: Brüel & Kjær      Type 4231      Serial No.: 3025167  
IEC Class: 1

### CUSTOMER:

Harris Miller Miller & Hanson, Inc  
700 District Ave, Ste 800  
Burlington, MA 01803

### CALIBRATION CONDITIONS:

Environment conditions:      Air temperature: 23.4 °C  
Air pressure: 97.81 kPa  
Relative Humidity: 31.8 %RH

### SPECIFICATIONS:

This document certifies that the acoustic calibrator as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (\*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Hottinger Brüel & Kjær Inc. Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants. The acoustic calibrator has been calibrated in accordance with the requirements as specified in IEC60942.

### PROCEDURE:

The measurements have been performed with the assistance of Hottinger Brüel & Kjær Inc. acoustic calibrator calibration application  
Software version 2.3.4 Type 7794 using calibration procedure 4231 Complete

### RESULTS:

☒ "As Received" Data: Within Acceptance Criteria      ☐ "As Received" Data: Outside Acceptance Criteria  
☒ "Final" Data : Within Acceptance Criteria      ☐ "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the calibrator under calibration.

Date of Calibration: January 11, 2023

Certificate issued: January 11, 2023

Meshaun Hobbs

Calibration Technician

Grant Kennedy  
Quality Representative

## Appendix D List of Preparers

This appendix lists the preparers of this report.

Preparers with HMMH are as follows:

- Tara Cruz - Project Manager and Lead Analyst
- Christopher Menge - Senior Technical Advisor and Principal-in-Charge
- Bob Finck - Document development support and QC
- Logan Katsoufis – Noise Measurements