Preliminary Noise Analysis Technical Report

Route 1 Widening Project Dumfries, VA

VDOT Project No. 0001-212-249, P101; UPC 90339
HMMH Report No. 306780.015
September 2018

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EXECUTIVE SUMMARY

This report describes the details of a noise impact assessment performed for the Route 1 Widening project in Dumfries, Virginia. The noise analysis was conducted in accordance with Federal Highway Administration (FHWA) and Virginia Department of Transportation (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 20, 2018.

The Route 1 Widening project involves improvements through Dumfries between the Route 234 intersection in the north and Bradys Hill Road in the south. For the majority of the corridor, between Possum Point Road and Bradys Hill Road, two northbound lanes of Route 1 are along Fraley Boulevard, and the southbound lanes of Route 1 are separated, following along Main Street to the west. The widening project includes adding four travel lanes to the existing two-lane Fraley Boulevard, so that corridor will consist of three travel lanes in each direction and carry all of the Route 1 traffic, as Jefferson Davis Highway does north and south of Dumfries. The project alleviates Main Street from carrying the southbound Route 1 traffic through Dumfries Center.

The study involved monitoring of existing noise conditions and modeling of existing (2017) and design year (2043) build noise conditions in the study area with the FHWA-approved computerized Traffic Noise Model. Modeling accounted for the existing terrain and buildings, and for existing and proposed roadways with projected loudest-hour traffic. Noise impact was assessed for both project alternatives at the noise-sensitive land uses within the study area. Land uses evaluated for noise impact included single- and multi-family residential areas, recreation areas associated with a school and a church, and the school and church interiors. Traffic noise projections are preliminary and will be reevaluated during the final design noise analysis.

The noise analysis did not predict any noise impact from the proposed Project at any of the noise-sensitive land uses in the study area. Therefore, no noise abatement measures were considered.

No undeveloped lands in the study corridor have active building permits for noise-sensitive land use, so none were assessed for noise impact. The undeveloped lands identified would be reviewed during the final design noise analysis, after the Date of Public Knowledge has been identified.

This report presents the results of a preliminary noise evaluation; a more detailed review will be completed during the final design of the Project. As such, noise impact may be predicted, and noise abatement with barriers may be found to be feasible and reasonable during the final design noise analysis. If a noise barrier is determined to be feasible and reasonable in final design, the affected public will be given an opportunity to decide whether they are in favor of construction of the noise barrier.

Construction activity may cause intermittent fluctuations in noise levels. During the construction phase of the project, all reasonable measures will be taken to minimize noise impact from these activities.

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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); VDOT's Highway Traffic Noise Impact Analysis Guidance Manual was updated most recently on February 20, 2018.

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 the list of preparers, Appendix B tabulates the traffic data used in the noise modeling, Appendix C presents predicted noise levels, Appendix D presents all noise measurement data, Appendix E provides a response from the VDOT project management on alternative noise abatement measures, and Appendix F presents VDOT's Warranted, Feasible and Reasonable barrier worksheets.

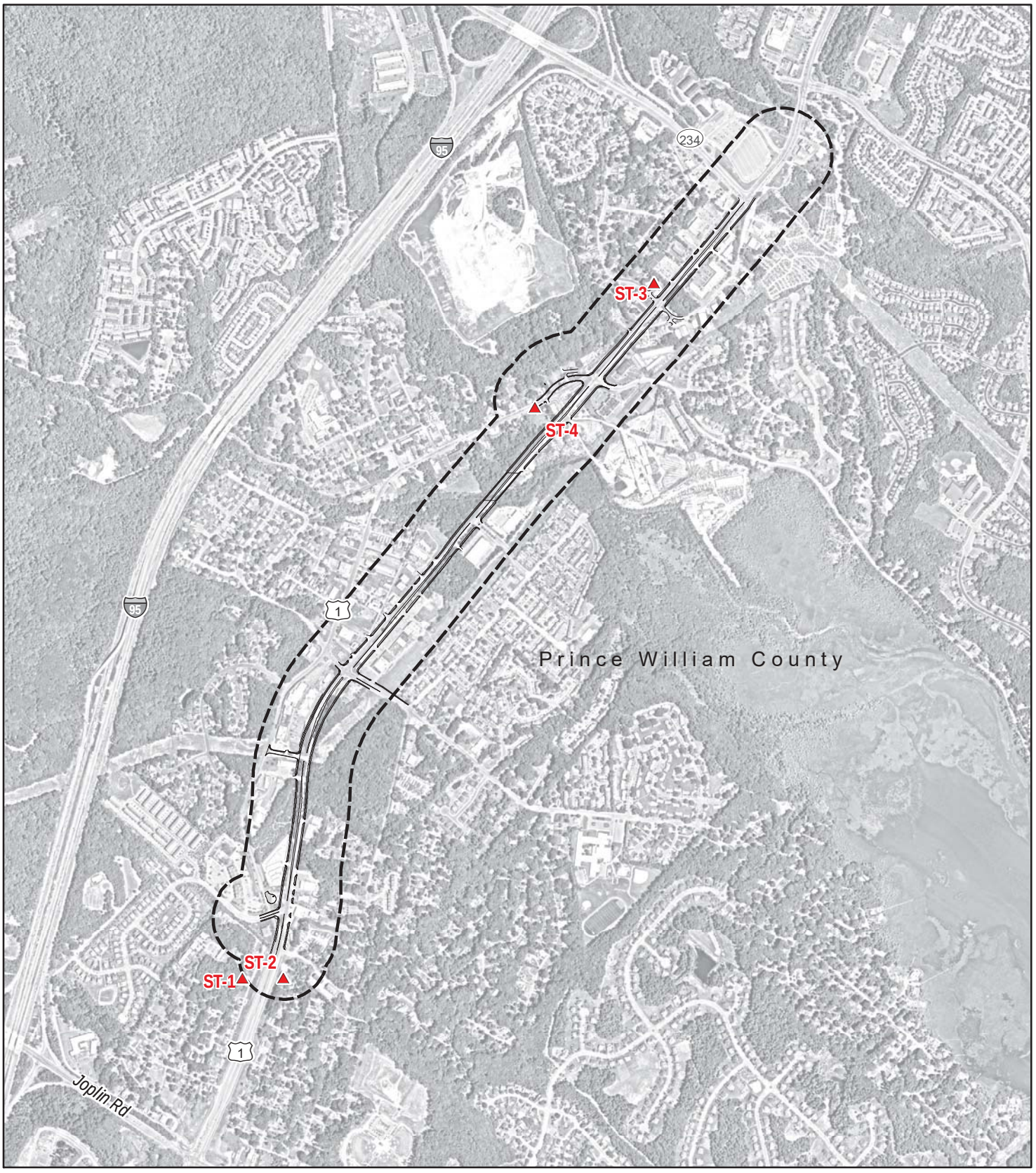
1.2 Project Description

The Route 1 Widening project involves improvements through Dumfries between the Route 234 intersection in the north and Bradys Hill Road in the south. For the majority of the corridor, between Possum Point Road and Bradys Hill Road, two northbound lanes of Route 1 are along Fraley Boulevard, and the southbound lanes of Route 1 are separated, following along Main Street to the west. The widening project includes adding four travel lanes to the existing two-lane Fraley Boulevard, so that corridor will consist of three travel lanes in each direction and carry all of the Route 1 traffic, as Jefferson Davis Highway does north and south of Dumfries. The project alleviates Main Street from carrying the southbound Route 1 traffic through Dumfries Center.

1.3 Study Area Description and Land Use

Figure 1 is an overview graphic of the study area showing the proposed roadway improvements, noise measurement sites, and noise study area. More detailed graphics showing the existing roadway and proposed improvements, Common Noise Environments, (CNEs), and receptor locations are provided in Section 4.

In this study, land uses evaluated for noise impact included single- and multi-family residential areas, recreation areas associated with a school and a church, and the school and church interiors. Section 4.4 in the report provides further description of the noise-sensitive land uses in the CNEs.



▲ ST-# Measurement Site

Noise Study Area

VDOT Virginia Department of Transportation

Figure 1 - Study Area Map

Route 1 Widening Project, Dumfries, VA

State Project (NFO) 0001-212-249, P101, UPC No.90339

0 1,500 3,000 Feet

hmmh

2 NOISE TERMINOLOGY AND CRITERIA

2.1 Regulations and Guidelines

The potential noise impact of the Route 1 Widening 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 that 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 20, 2018.

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). 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 (L_{eq}). The L_{eq} 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, L_{eq} is typically evaluated over a one-hour period, and may be denoted as $L_{eq}(h)$.

In this study, land uses evaluated for noise impact included single- and multi-family residential areas, FHWA Activity Category B; recreation areas associated with a school and a church, Activity Category C; and the school and church interiors, Activity Category D. For Categories B and C, noise impact would occur when predicted exterior noise levels due to the project, approach or exceed 67 dBA in terms of $L_{eq}(h)$ 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 $L_{eq}(h)$. VDOT defines the word "approach" in "approach or exceed" as within 1 decibel. Therefore, the threshold for noise impact is where exterior noise levels are within 1 decibel of 67 dBA $L_{eq}(h)$, or 66 dBA, and similarly, 51 dBA for interior areas of institutional uses.

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 for all noise-sensitive exterior activity categories. For example, if a receptor's existing noise level is 50 dBA, an impact due to a substantial increase would occur if the design year noise level is 60 dBA or higher as a result of the project. The design-year project noise level need not exceed the applicable NAC for an impact due to a substantial increase.

Table 1 FHWA Noise Abatement Criteria

Activity Category	$L_{eq}(h)$[1]	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[2]	67 (Exterior)	Residential
C[2]	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[2]	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)

[1] Hourly Equivalent A-weighted Sound Level (dBA)
[2] Includes undeveloped lands permitted for this activity category
Source: 23 CFR Part 772.

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 warranted and 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 predicted for Existing (2017) conditions and the design-year (2043) 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 4.

3 EXISTING NOISE CONDITIONS

This section of the report describes the noise monitoring program and the investigation of undeveloped lands and permitted developments.

3.1 Monitoring of Existing Noise Levels

A noise monitoring program was conducted within the Route 1 Widening project study area, consistent with FHWA and VDOT recommended procedures. The objectives of the monitoring program were to document existing ambient noise levels in noise-sensitive locations and to provide a means for validation of the traffic noise prediction model.

Noise monitoring was conducted at four short-term sites (30 minutes in duration) in the Route 1 Widening Study Area on May 25, 2018. Measurements were conducted with an HMMH-owned ANSI Type I Larson-Davis Model 824 sound level analyzer, which was field calibrated before each measurement with a Larson-Davis Model CAL250 calibrator. All instruments had current laboratory calibrations traceable to the National Institute of Standards and Technology.

Measurement sites were generally located in areas with the highest expected noise exposures, adjacent to first-row properties. Traffic classification counts on the roadways nearest each measurement site were conducted simultaneously with each noise measurement near an existing roadway. The short-term measurements characterized existing noise levels in the study area but were not necessarily conducted during the loudest hour of the day. They included contributions from sources other than traffic, such as aircraft and birds. Figure 1 shows the locations of the short-term noise measurement sites within the project study area, and are labeled with the prefix “ST-.” Appendix D provides details of the data acquired during the noise monitoring program, including noise monitor output, site sketches, photographs, noise level data with site summary results, and traffic counts.

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.

The data collection procedure involved continuous monitoring and logging of the one-second sound levels, and reporting individual one-minute L_{eq}s. Periods that included noise events unrelated to traffic noise (such as aircraft operations) were noted so that they could later be separated or excluded. The total measurement period L_{eq} was determined both with and without the periods that included these events. By comparing the two totals, the significance of non-traffic events to the overall noise level can be determined for the measurement period. Simultaneous traffic classification counts were performed during the noise monitoring, to provide a basis for the model validation effort.

The monitored noise levels appear in Table 2 as equivalent sound levels (L_{eq}). As described above, the L_{eq} is a sound-energy average of the fluctuating sound level (in A-weighted decibels, dBA) measured over a specified period of time. Table 2 provides the site address, as well as the date, start time, and duration of each measurement. The measured “Total” L_{eq}s ranged from a low of 55 dBA at 18412 Corby St (ST-1), to a high of 64 dBA at 17685 Main St (Site ST-4). All of the sites are

Table 2 Short-term Noise Monitoring Summary

Site No.	Address/Location	Date	Time Start (hh:mm)	Duration (minutes)	Monitored Total L_{eq} (dBA)	Monitored Traffic-Only L_{eq} (dBA)
ST-1	18412 Corby St	19-Jul-18	12:52	30	55	54
ST-2	18504 Triangle St	19-Jul-18	11:40	30	60	60
ST-3	17505 Tripoli Blvd	19-Jul-18	9:35	30	63	62
ST-4	17685 Main St	19-Jul-18	10:28	30	64	64

Source: HMMH, 2018

near roadways, therefore the values of the Traffic-only L_{eq}s are the same or nearly the same as the monitored Total L_{eq}. This result is an indication that roadway traffic was the dominant source of noise at those sites, in spite of the presence of other sporadic and occasional noise events in the community.

The locations of the measurement sites are shown on the overview map in Figure 1 and in Figure 2, presented in Section 4.

3.2 Predicted Existing Noise Levels

For calculation of loudest-hour noise levels throughout the study area, many additional receiver locations were added to the measurement sites in the TNM to provide a comprehensive basis of comparison for the analysis of noise impacts from the existing and future project conditions. Using the appropriate loudest-hour traffic data, existing and future traffic noise levels were predicted for the measurement sites and the additional receiver locations. The computation methods and predicted noise levels are presented in the next section of this report.

The noise measurements provided valuable information on current noise conditions and the effects of terrain and shielding on sound propagation from the roadway to the nearby residential land uses. However, because existing noise levels are not always measured during the loudest hour of the day, estimates of the loudest-hour existing noise levels were computed with an FHWA-approved noise prediction model using the appropriate traffic data as input. These predicted estimates of existing noise levels for the loudest hour of the day 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 4.

3.3 Undeveloped Lands and Permitted Developments

Highway traffic noise analyses are (and will be) performed for developed lands as well as undeveloped lands if they are considered “permitted.” Undeveloped lands are deemed to be permitted when there is a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of at least one building permit.

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 Protection Act (NEPA) approval is made. VDOT has no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed after this date. The undeveloped lands identified would be reviewed during the final design noise analysis, after the Date of Public Knowledge has been identified.

HMMH received future planning information from Kellie Remick of the Prince William County planning office on August 14, 2018, which covers the southern portion of the study area in the town of Triangle. It was confirmed that no new noise-sensitive residential developments are being planned or permitted in the corridor. New townhomes are under construction along the south side of Bradys Hill Rd; those properties (Receptors F-013-018 in CNE F, shown in Figure 2) were included in the noise study modeling.

HMMH discussed future plans and potential permitted properties in the Town of Dumfries with Mr. Jatinder Khokhar, the Town's Community Development Director and Building Official on August 20, 2018. Mr. Khokhar provided preliminary plans dated March 2018 for the Townsquare mixed-use development, which has proposed multi-family residential buildings adjacent to Fraley Boulevard. There are no building permits issued for this development yet, as it is still in the planning stages. The development is proposed for a wooded site of 28.6 acres bounded by Fraley Blvd in the west, Graham Park Road in the north, Old Triangle Rd in the east, and Orange St in the south. The proposed multi-family building that would be closest to Fraley Boulevard is proposed to be 60 feet from the edge of the roadway. Future Build case noise levels in this area are predicted to be approximately 63 dBA, L_{eq} during the loudest hour in the design year of 2043. Therefore, noise impact would not be predicted at the development as currently proposed if it had an active building permit.

Mr. Khokhar also stated that Community Housing Partners seeks an updated Zoning Certification regarding a proposed new multifamily project, Parkside at Dumfries 2. The project would be located at 17870 Fraley Blvd, which is currently a wooded lot opposite Williamstown Drive, west of CNE D (Figure 2, Sheet 3) . It would be one building with 48 residential units and 1st floor commercial space. Building permits have not been issued.

Demolition for construction of the Dumfries First Town Center project along Main Street next to the Town Hall has begun this year. The project would be a few mixed-use buildings, with residential on the upper levels. However, the proposed locations of the buildings are along Main Street and are outside of the Route 1 Widening project corridor.

4 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.

4.1 Noise Prediction Model

HMMH used the latest version of the FHWA's Traffic Noise Model (TNM Version 2.5) to compute existing and future Build case loudest-hour noise levels and develop the preliminary heights, lengths and locations for all potential noise barriers along the project corridor. 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.

Available project engineering plans, aerial photography, topographic contours and building information are used to create a three-dimensional model in the TNM of the geometry of the existing and future design roadway configurations and the surrounding terrain and buildings. The noise modeling also accounts 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, 95 noise prediction receivers (also called "receptors" and "sites") were added to the measurement sites in the modeling. TNM runs are available upon request.

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 field verification.

4.2 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:

- 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;
- 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 of outcomes. 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 site-by-site comparison of measured noise levels and the corresponding TNM-computed noise levels. At all four sites, the differences between measured and predicted noise levels fall within three decibels, which is the accepted level of accuracy in the noise model. The project-wide average difference between calculated noise levels and monitored noise levels is 0.7 decibels, averaged over all sites. This shows good agreement between monitored and modeled sound levels, suggesting confidence in the modeling assumptions.

Table 3 Computed vs. Measured Sound Levels at Measurement Sites

Site No.	CNE	Address / Location	Monitored L_{eq} (dBA)*	TNM-Computed L_{eq} (dBA)	Difference (dB) (computed *minus* monitored)
ST-1	G	18412 Corby St	54.3	55.7	1.4
ST-2	F	18504 Triangle St	59.8	58.7	-1.1
ST-3	B	17505 Tripoli Blvd	62.0	59.6	-2.4
ST-4	C	17685 Main St	63.7	63.1	-0.6
Average difference:					-0.7
Standard deviation of difference:					1.6

* Monitored traffic-only sound level
Source: HMMH, 2018

Appendix D provides the normalized traffic count data that were collected simultaneously with the noise monitoring data and subsequently used as input to the TNM for model validation.

4.3 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 for the Route 1 mainline roadways were supplied by VDOT in the form of Environmental Traffic Data (ENTRADA) spreadsheets, both for the 2017 Existing case and the 2043 Design Year.

HMMH conducted a determination of the loudest hour of the day consistent with VDOT's current methodology. First, the two loudest hours of the day for each project alternative was determined by using TNM to compute the overall traffic noise level at a reference distance on each side of Route 1, for each project segment between interchanges, for each hour of the day. Then, in the full TNM implementations for the Existing and Build alternatives, the traffic for the two loudest hours was input and TNM was run with representative receivers throughout the study corridor.

The TNM runs indicated in the Existing case, the 16:00 hour was louder at a clear majority of the receivers where a difference was predicted. And, the differences where the 16:00 hour was louder were greater than those where the 17:00 was louder. Therefore, the 16:00 hour was chosen as the loudest for all sections of the Existing alternative.

In the Build alternative, the 17:00 hour was slightly louder than the 16:00 hour in the north end of the study area. In the south, the 16:00 hour was slightly louder. The two ends of the study area are widely separated with the town center of Dumfries between them, and Route 1 has notably different traffic volumes in the two sections, with less in the south. Therefore, for the Build alternative, the 17:00 hour was used in the north and the 16:00 hour was used in the south. A memo was prepared detailing the loudest-hour development for VDOT review. The memo is included in Appendix B of this report.

4.4 Presentation of Results

The study area primarily consists of residential (Category B) land use and as well as two churches and a school (Category D), and playgrounds adjacent to the school and one church (Category C).

As mentioned previously, 95 additional noise prediction receptors were incorporated in the model to fully characterize existing and future noise levels at all noise-sensitive land uses in the study area. The receptors in the study area are divided into Common Noise Environments (CNEs) with similar noise sources and land uses.

The proposed Project is not related to the interstate system, nor is there potential for a "constructive use" determination of a Section 4(f) property, since no historic sites or recreation areas are currently impacted or near the Project's 2043 noise impact zones. Consequently, this preliminary noise study does not include an analysis of traffic noise levels for the design year No-build alternative, consistent with VDOT's noise policy.

All noise levels predicted were the A-weighted equivalent sound level, or L_{eq}, in dBA. Loudest-hour noise levels were predicted for the Existing 2017 and the design-year 2043 Build alternatives. As described above, the loudest hour in the Build case was found to be the hour starting at 16:00 (4 PM) in the Existing case, and for the Build case at 1600 in the southern part of the study area, and at 17:00 (5 PM) in the northern part.

Table 4 presents ranges of the predicted sound levels at the receptors in each CNE for each alternative. The table also provides descriptions of the land use within and location of each CNE along with the applicable FHWA Activity Categories. Exterior sound levels are shown for all activity categories. Interior sound levels are evaluated for noise impact at noise-sensitive Activity Category D institutional facilities. All such facilities identified in the study area (schools and churches) appear to have air conditioning and masonry construction. Therefore, per FHWA

Table 4 Ranges of Predicted Exterior Noise Levels

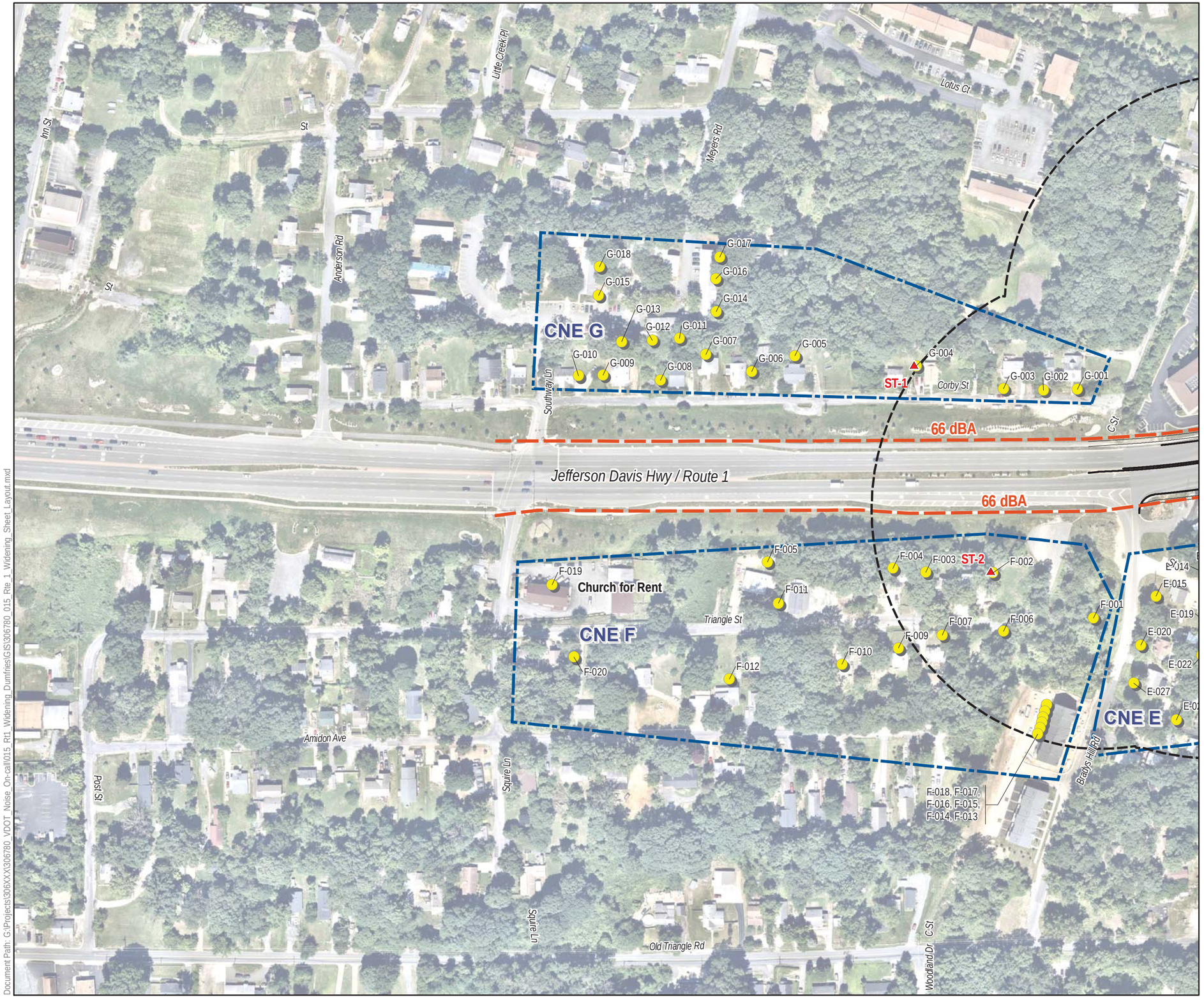
CNE	Land Use – Description		Ranges of Predicted Exterior L_{eq} Noise Levels for the Worst Hour (dBA)	
		Activity Category	2017 Existing	2043 Build
A	Residential on Wilson Street west of Route 1 and south of Dumfries Road set back behind a row of businesses	B	48 – 58	47 – 58
B	Residences on Tripoli Avenue west of Route 1	B	48 – 59	50 – 62
C	Residences west of Route 1 adjacent to both sides of Main Street	B	48 – 61	48 – 58
D	Grace Church and playground located east of Route 1/Fraley Boulevard and north of and off Williamstown Drive	C, D	47 – 48	53 – 54
E	Residences and a school with playground set back east of Route 1/Fraley Boulevard, west of Old Triangle Road and north of Bradys Hill Road	B, C, D	39 – 55	42 – 56
F	Residences and church east of Route 1 south of Bradys Hill Road, residents adjacent to Triangle Street and north of Squire Lane.	B, D	39 – 59	41– 59
G	Southhampton Apartments multi-family, residential neighborhood west of Route 1 and Corby Street and north of Southway Lane	B	50 – 58	51 – 60

Source: HMMH, 2018

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 C provides a table that lists the predicted sound levels at all of the receptors for each alternative. Each receptor is given an identifier with the CNE ID followed by a number.

Figure 2 provides a location map for the CNEs, noise-sensitive receptors, and the 66 dBA L_{eq} "contour" for the 2043 Build alternative, which shows the noise impact zone for Activity Categories B and C in undeveloped areas. Each receptor is shown in Figure 2 with its ID. All of the sites are shown with yellow dots since no sites in the study area are predicted to be impacted by the Project.

Table 4 shows that the computed exterior noise levels ranged from 39 to 61 dBA L_{eq} in the Existing case and from 41 to 62 dBA L_{eq} in the 2043 Build case. In the north and south sections of the study area, where both directions of Route 1 are currently in the same corridor (CNEs A, B, F and G), the predicted sound level are expected to increase by an average of 1 to 2 decibels from 2017 Existing to 2043 Build conditions primarily due to traffic growth. However, along Fraley Boulevard where it currently carries only Route 1 northbound traffic and would carry both directions in the future, the predicted future increases in sound levels are higher, averaging 3 decibels in CNEs D and E. Only limited noise-sensitive land use exists along this section of Fraley Boulevard, and that is set well back from the roadway, such that future Build sound levels are not predicted to exceed 56 dBA, L_{eq} in those CNEs.



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VDOT
Virginia Department of Transportation

Figure 2
Location Map for Common Noise Environments, Receptors, and Build Contours

Route 1 Widening Project
Noise Analysis

Dumfries, VA
State Project (NFO) 0001-212-249, P101, UPC No.90339

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted

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

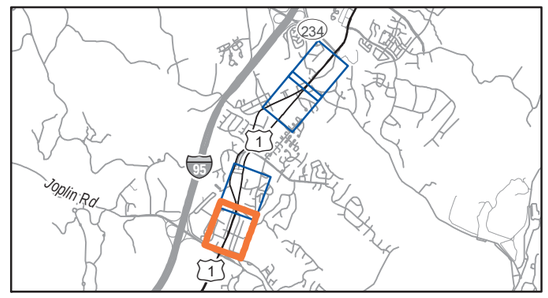
ST-# Measurement Site

- CNE Boundary
- 66 dBA Noise Contour
- 500' Noise Study Area

Service Layer Credits:

0 200 400 Feet

Sheet 1 of 4



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U.S. Department of Transportation
Federal Highway Administration

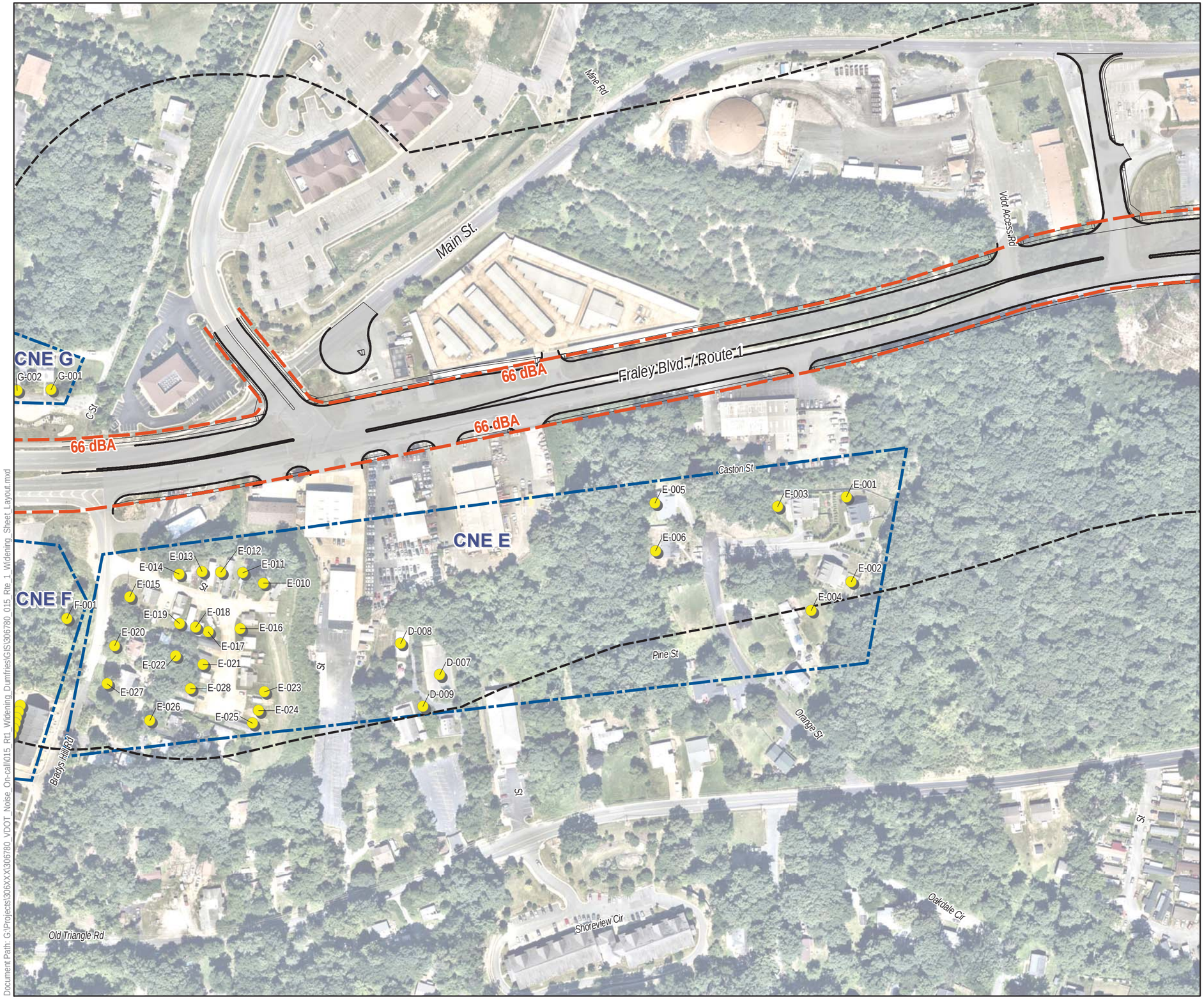

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Figure 2
Location Map for Common Noise Environments, Receptors, and Build Contours

Route 1 Widening Project
Noise Analysis

Dumfries, VA
State Project (NFO) 0001-212-249, P101, UPC No.90339

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted

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

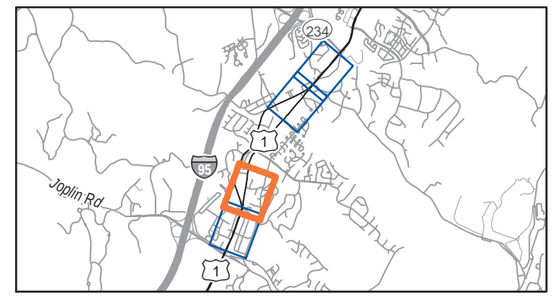
▲ ST-# Measurement Site

CNE Boundary
66 dBA Noise Contour
500' Noise Study Area

Service Layer Credits:

0 200 400 Feet

Sheet 2 of 4



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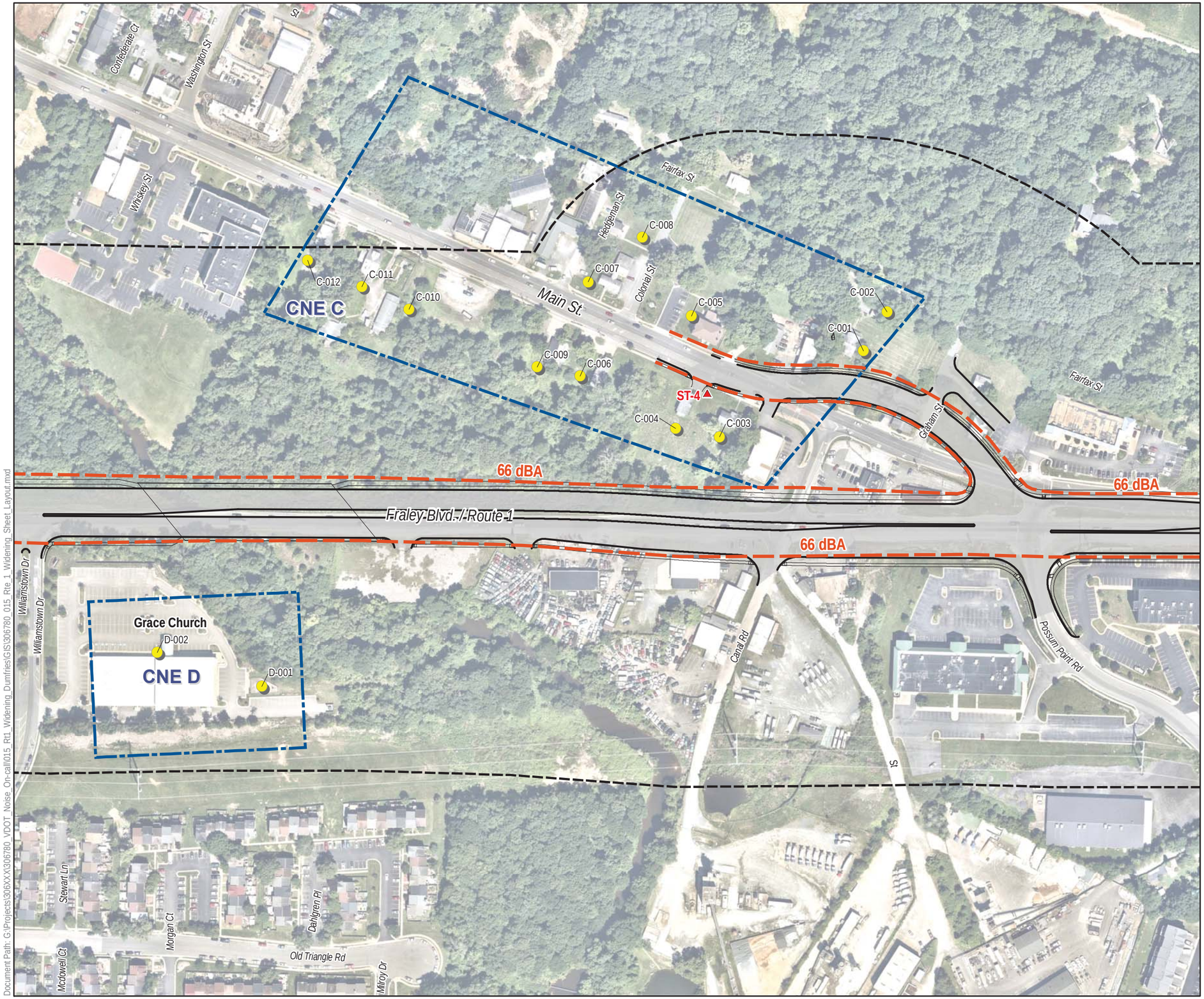
Federal Highway Administration



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VDOT
Virginia Department of Transportation

Figure 2
Location Map for Common Noise Environments, Receptors, and Build Contours

Route 1 Widening Project
Noise Analysis

Dumfries, VA
State Project (NFO) 0001-212-249, P101, UPC No.90339

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted

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

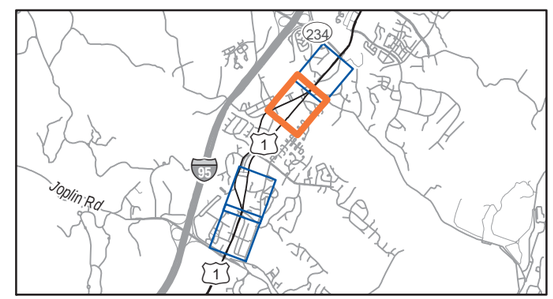
ST-# Measurement Site

CNE Boundary
66 dBA Noise Contour
500' Noise Study Area

Service Layer Credits:

0 200 400 Feet

Sheet 3 of 4



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U.S. Department of Transportation
Federal Highway Administration

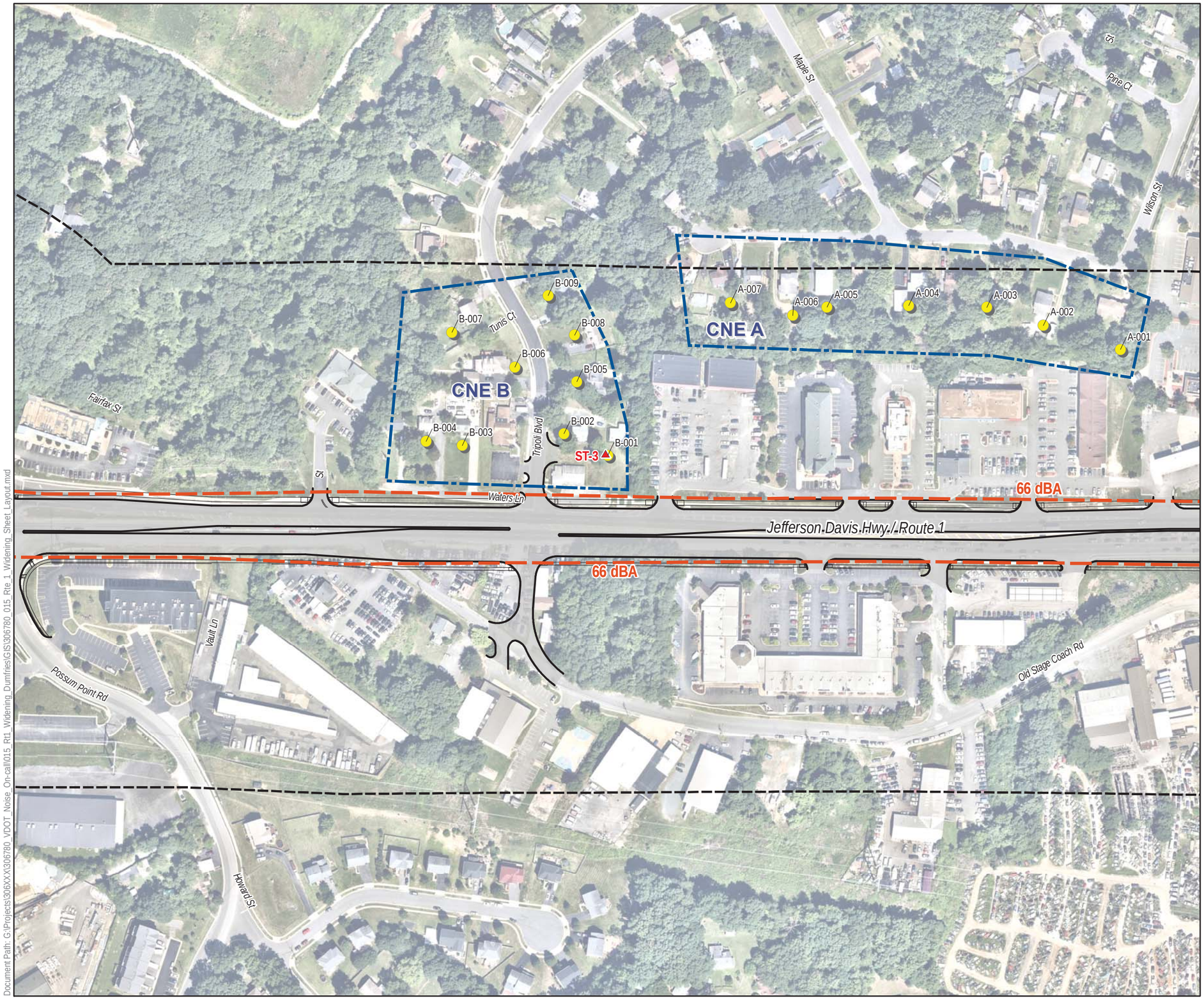

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Figure 2
Location Map for Common Noise Environments, Receptors, and Build Contours

Route 1 Widening Project
Noise Analysis

Dumfries, VA
State Project (NFO) 0001-212-249, P101, UPC No.90339

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
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Note: Grouped Receiver Labels are in order of Leader Occurrence.

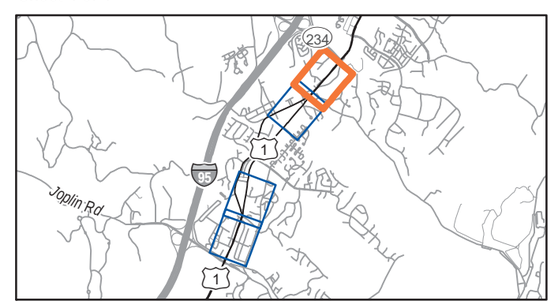
ST-# Measurement Site

CNE Boundary
66 dBA Noise Contour
500' Noise Study Area

Service Layer Credits:

0 200 400 Feet

Sheet 4 of 4



U.S. Department of Transportation
Federal Highway Administration

5 NOISE IMPACT ASSESSMENT

The potential noise impact of the Route 1 Widening Project was assessed according to FHWA and VDOT noise assessment guidelines. As described in Section 2, noise impact would occur wherever Project noise levels are predicted to approach or exceed the NAC at noise-sensitive land uses during the loudest hour of the day.

As shown in Table 4, noise levels are not predicted to approach or exceed the FHWA NAC for any of the Activity Categories under the design-year Build alternative. Further, no impacts due to substantial increases in existing noise levels were identified for this project.

6 NOISE ABATEMENT MEASURES

Noise abatement is considered to be warranted for all receptors where future Build case noise impact has been predicted. However, no noise impact is predicted at sensitive receptors in the design year 2043 Build alternative. Therefore, no noise abatement measures have been considered or evaluated.

7 CONSTRUCTION NOISE CONSIDERATION

Construction noise provisions are contained in Section 107.16(b)3 Noise of the 2016 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 his 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.

8 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.

8.1 Noise-Compatible Land-Use Planning

Section 9.0 of VDOT's 2011 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. Figure 2 includes a noise contour that depicts the zone where noise impact would occur adjacent to the highway under the 2040 Build Alternative for exterior first-floor residential and recreational land uses.

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

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

8.2 Noise Impact Zones in Undeveloped Land along the Study Corridor

Also required under the revised 2011 FHWA and VDOT noise policies is information on the noise impact zones adjacent to project roadways in undeveloped lands. To determine these zones, noise levels are computed at various distances from the edge of the project roadways in the undeveloped areas of the project study area. Then, the distances from the edge of the roadway to the noise abatement criteria sound levels are determined through interpolation. Distances may vary in the project corridor due to changes in traffic volumes, or terrain features. Any noise sensitive sites within these zones should be considered noise impacted if no barrier is present to reduce sound levels.

Noise level contours are lines of equal noise exposure that typically parallel roadway alignments and are often useful to local officials in undeveloped corridors. Highway traffic noise is considered a linear noise source and sound levels can drop considerably over distance. The degree that sound levels decrease can vary based on a number of different factors including objects that shield the roadway noise, terrain features and ground cover type (e.g. grass, pavement or water). Through conscious planning efforts and noise contour information, municipal officials may restrict future development inside the noise impact zone (i.e., the area within the 66 dBA noise contour). Figure 2 shows the approximate 66 dBA, L_{eq} noise level contours for the study area when incorporating the proposed improvements and the Design Year traffic volumes, speeds and composition during the loudest hour of the day. This 66 dBA noise contour can be used to approximate the distance away from project roadways within which the NAC would be exceeded for Activity Category B or C receptors (residential and recreational). Any noise-sensitive property within this 66 dBA contour should be considered to be noise-impacted in the Design Year.

8.3 VDOT's Noise Abatement Program

Information on VDOT's noise program is provided in "Highway Traffic Noise Impact Analysis Guidance Manual (Version 8)," updated February 20, 2018. This document is available on VDOT's web page (http://www.virginiadot.org/projects/pr-noise-walls-about.asp) and from VDOT's Noise Abatement Section, Virginia Department of Transportation, 1401 E. Broad St., Richmond, VA 23219.

9 REFERENCES

Federal Highway Administration, US Department of Transportation. July 13, 2010. *23 CFR Part 772, as amended 75 FR 39820, Procedures for Abatement of Highway Traffic Noise and Construction Noise*. Washington, DC: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/

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Virginia Department of Transportation. February 20, 2018. Highway Traffic Noise Impact Analysis Guidance Manual (Version 8). Richmond, VA. http://www.virginiadot.org/projects/pr-noise-walls-about.asp

APPENDIX A LIST OF PREPARERS

This appendix lists the preparers of this report.

Preparers with HMMH are as follows:

- Christopher Menge – noise analysis, documentation, Project Manager.
- Dillon Tannler – noise modeling, impact assessment, abatement analysis, documentation.
- Hayden Jubera – noise measurements, noise analysis.
- Julia Nagy – noise measurements.
- Michael Hamilton – GIS support, report graphics.
- Christopher Bajdek – quality assurance.

Reviewers with VDOT are as follows:

- LJ Muchenje
- T. Ross Hudnall

TNM Certification of HMMH's Project Manager, Christopher Menge, is on file in VDOT's offices.

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 2017 Existing conditions in Table 5 and for the 2043 Build alternative in Table 6. After the traffic data tables, a memorandum detailing the selection of the loudest-hour traffic for the noise analysis is provided.

Table 5 Traffic Data Used in 2017 Existing Case Noise Analysis – Loudest Hour Starting 16:00 (4 PM)

Roadway Name (From ENTRADA Data)	Direction	Vehicle Volume in Loudest Hour (vph)			Speed (mph)
		Autos	Medium Trucks	Heavy Trucks	
US_Route_1_-_Fraley_BlvdFrom_Wayside_Drive_To_Route_234	NB	1351	19	38	29
US_Route_1_-_Fraley_BlvdFrom_Wayside_Drive_To_Route_234	SB	1778	19	49	24
US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Road	NB	1019	14	28	29
US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Road	SB	1257	14	35	26
Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	NB	930	3	6	26
Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	SB	0	3	0	26
Route_1,_Fraley_BlvdFrom_SCL_Dumfries_To_Main_St-Bradys_Hill_Road	NB	644	2	4	32
Route_1,_Fraley_BlvdFrom_SCL_Dumfries_To_Main_St-Bradys_Hill_Road	SB	0	2	0	26
US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_Street	NB	572	7	13	37
US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_Street	SB	686	7	16	36
Main_Street From_Possum_Point_Road_To_Bradys_Hill_Road	NB	84	0	1	30
Main_Street From_Possum_Point_Road_To_Bradys_Hill_Road	SB	1227	0	8	26
Route_234_-_Dumfries_RoadFrom_I-95_To_US_Route_1	EB	1504	32	64	37
Route_234_-_Dumfries_RoadFrom_I-95_To_US_Route_1	WB	1119	32	48	40

Table 6 Traffic Data Used in 2043 Build Alternative Noise Analysis

Loudest Hour Starting	Roadway Name (From ENTRADA Data)	Direction	Vehicle Volume in Loudest Hour (vph)			Speed (mph)
			Autos	Medium Trucks	Heavy Trucks	
1700	US_Route_1_-_Fraley_BlvdFrom_Wayside_Drive_To_Route_234	NB	2043	28	57	31
1700	US_Route_1_-_Fraley_BlvdFrom_Wayside_Drive_To_Route_234	SB	2688	28	74	26
1700	US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Road	NB	1511	21	42	31
1700	US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Road	SB	1864	21	52	28
1600	Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	NB	1377	5	9	29
1600	Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	SB	1695	5	11	25
1600	Route_1,_Fraley_BlvdFrom_SCL_Dumfries_To_Main_St-Bradys_Hill_Road	NB	1085	4	7	33
1600	Route_1,_Fraley_BlvdFrom_SCL_Dumfries_To_Main_St-Bradys_Hill_Road	SB	1339	4	9	30
1600	US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_Street	NB	952	11	22	36
1600	US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_Street	SB	1018	11	23	36
1600	Main_Street From_Possum_Point_Road_To_Bradys_Hill_Road	NB	168	1	1	30
1600	Main_Street From_Possum_Point_Road_To_Bradys_Hill_Road	SB	168	1	1	30
1700	Route_234_-_Dumfries_RoadFrom_I-95_To_US_Route_1	EB	2276	48	97	29
1700	Route_234_-_Dumfries_RoadFrom_I-95_To_US_Route_1	WB	1694	48	73	35

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TECHNICAL MEMORANDUM

To:	LJ Muchenje, Ross Hudnall, Jim Ponticello, VDOT
From:	Christopher Menge
Date:	August 20, 2018
Subject:	Noise Monitoring Plan in Support of the Preliminary Noise Study for the Route 1 Widening Project, Dumfries, VA
Reference:	VDOT UPC 90339, Project No. 0001-212-249, P101; HMMH Project No. 306780.015

This memorandum describes the approach taken by HMMH to determine the loudest hour for noise modeling of the Existing and Build Alternatives for the preliminary noise study for the Route 1 Widening Study in Dumfries. It is submitted to VDOT for approval.

Traffic data were extracted from ENTRADA sheets provided by VDOT and processed to determine the hourly breakdown of vehicles for Route 1/Fraley Boulevard Northbound and Southbound. Reference Leqs for each vehicle type were calculated with TNM models using a simple roadway and with the ENTRADA interrupted speeds for each hour. The Leqs for all hours of the day between 6 AM and 10 PM were then calculated with HMMH's updated loudest-hour spreadsheet using the reference Leqs and the hourly vehicle volumes and speeds for the all sections of Route 1. There are two regions of the study area with the majority of adjacent noise-sensitive land use. One is at the north end of the project, the other is at the south end of the project, just south of Bradys Hill Rd, where the roadway improvements end. Therefore, results for those two sections drove the loudest-hour determination decision and are reported here. The two most important roadway links are where both directions of Route 1 are together in the same corridor. Those are between Rt. 234 and Possum Point Road (segment 2) and between Fuller Road and Bradys Hill Road (segment 5).

The loudest-hour spreadsheet analysis results were then used to determine the two loudest hours for the Existing and Build cases. As shown in both the Existing and Build cases in Tables 1 and 2 below, the hours starting at 16:00 and 17:00 are the loudest and second-loudest hours for the combined NB and SB lanes for road segments 2 and 5. The computed L_{eq} values for the two hours are very close or the same. Therefore, those two hours were chosen for analysis in TNM.

The traffic for the two hours described above were entered into the TNM implementations of the Existing and Build alternatives. All project receptors were modeled. In the Existing case, the 16:00 hour was louder at a clear majority of the receivers where a difference was predicted, and the differences where the 16:00 hour was louder were greater than those where the 17:00 was louder. Therefore, the 16:00 hour was chosen as the loudest for all sections of the Existing alternative. Notably, no noise impact is predicted at any of the receptors.

In the Build alternative, the 17:00 hour was very slightly louder than the 16:00 hour (averaging 0.1 dB) in the north end of the study area. In the south, the 16:00 hour was slightly louder (also by an average of 0.1 dB). The two ends of the study area are widely separated with the town center of Dumfries between them, and Route 1 has notably different traffic volumes in the two sections, with less in the south. Therefore, even though the differences are small, we thought it reasonable to use the traffic for the two different loudest hours for the two different sections of the project. For the Build alternative, we recommend the 17:00 hour be used in the north and the 16:00 hour be used in the south. Notably, as with the Existing case, no noise impact was predicted at any of the receptors in the Build alternative.

Table 1. Route 1 Widening Existing Loudest Hour Spreadsheet Results Summary

			Loudest Hour									2nd Loudest Hour									3rd Loudest Hour								
			NB			SB			Combined			NB			SB			Combined			NB			SB			Combined		
Hide/Unhide Unused Rows																													
No.	Road Name	Project Importance (Should the	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq
2	US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Road	YES	17:00	29	63.5	16:00	26	63.5	17:00	29, 26	66.5	16:00	29	63.5	17:00	26	63.5	16:00	29, 26	66.5	6:00	29	63.3	18:00	27	63.3	15:00	30, 29	66.2
3	Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	YES	15:00	29	60.5	6:00	0	0.0	15:00	29, 0	60.5	6:00	26	60.4	6:00	0	0.0	6:00	26, 0	60.4	7:00	26	60.2	6:00	0	0.0	7:00	26, 0	60.2
5	US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_Stre	YES	8:00		63.3	16:00	47	63.5	16:00	37, 37	66.4	16:00	37	63.3	17:00	36	63.5	17:00	37, 36	66.2	7:00	37	63.0	15:00	37	63.2	7:00	37, 37	66.1

Table 2. Route 1 Widening Build Loudest Hour Spreadsheet Results Summary

			Loudest Hour									2nd Loudest Hour									3rd Loudest Hour								
			NB			SB			Combined			NB			SB			Combined			NB			SB			Combined		
Hide/Unhide Unused Rows																													
No.	Road Name	Project Importance (Should the	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq	Hour	Speed	Leq	Hour	Speed	Leq	Hour	Speed (NB, SB)	Leq
2	US_Route_1_-_Fraley_BlvdFrom_Route_234_To_Possum_Point_Roa	YES	6:00	32	65.8	18:00	30	65.8	17:00	31, 28	68.8	7:00	32	65.8	15:00	32	65.8	16:00	31, 28	68.8	17:00	31	65.7	16:00	28	65.8	15:00	33, 32	68.8
3	Route_1,_Fraley_BlvdFrom_Possum_Point_Road_To_SCL_Dumfries	YES	18:00	31	63.1	14:00	31	63.0	8:00	30, 33	65.9	8:00	30	63.0	7:00	32	62.8	14:00	32, 31	65.9	17:00	29	63.0	13:00	33	62.8	18:00	31, 27	65.8
5	US_Route_1_-_Fraley_BlvdFrom_Fuller_Road_To_US-1_Par_Main_St	YES	8:00	36	65.0	17:00	36	65.3	17:00	37, 36	68.1	7:00	37	65.0	16:00	36	65.2	16:00	36, 36	68.0	16:00	36	64.9	18:00	37	64.8	7:00	37, 36	67.9

APPENDIX C PREDICTED TRAFFIC NOISE LEVELS

This appendix provides the predicted noise levels at all of the receiver (receptor) locations shown in the study graphics for the 2017 Existing and design-year 2043 Build alternative. The receptor sites are organized by CNE. Also provided are the name and location of each receptor site, the number of dwelling units or recreational units assigned to each receptor, a description of the land use, the applicable Noise Abatement Criteria, and the predicted loudest-hour L_{eq} sound levels.

Table 7 Predicted Existing (2017) and Build Design Year (2043) Noise Levels for Route 1 Widening Project

CNE-Site No.	Address	Recp. Unit	Activ. Cat.*	Land Use*	NAC Impact Criteria	Loudest-Hour Leq (dBA)**	
						Existing	Build
A-001	17383 DUMFRIES RD, Row 1	1	B	Res.	67	58	58
A-002	17391 WILSON ST, Row 1	1	B	Res.	67	55	55
A-003	17397 WILSON ST, Row 1	1	B	Res.	67	53	53
A-004	17423 WILSON ST, Row 1	1	B	Res.	67	51	51
A-005	17435 WILSON ST, Row 1	1	B	Res.	67	51	50
A-006	17445 WILSON ST, Row 1	1	B	Res.	67	50	49
A-007	17465 WILSON ST, Row 1	1	B	Res.	67	48	47
B-001	17505 TRIPOLI BLVD, Row 1	1	B	Res.	67	59	62
B-002	17521 TRIPOLI BLVD, Row 1	1	B	Res.	67	57	61
B-003	17530 WATERS LN, Row 1	1	B	Res.	67	56	62
B-004	17540 WATERS LN, Row 1	1	B	Res.	67	55	61
B-005	17499 TRIPOLI BLVD, Row 2	1	B	Res.	67	53	55
B-006	17530 TRIPOLI BLVD, Row 2	1	B	Res.	67	52	53
B-007	17520 TRIPOLI BLVD, Row 2	1	B	Res.	67	48	50
B-008	17495 TRIPOLI BLVD, Row 2	1	B	Res.	67	51	52
B-009	17489 TRIPOLI BLVD, Row 2	1	B	Res.	67	49	51
C-001	17650 GRAHAM ST, Row 1	1	B	Res.	67	53	58
C-002	17650 GRAHAM ST, Row 1	1	B	Res.	67	50	54
C-003	17679 MAIN ST, Row 1	1	B	Res.	67	49	53
C-004	17685 MAIN ST, Row 1	1	B	Res.	67	50	54
C-005	17674 MAIN ST, Row 1	1	B	Res.	67	57	53
C-006	17701 MAIN ST, Row 1	1	B	Res.	67	53	52
C-007	17682 MAIN ST, Row 1	1	B	Res.	67	61	57
C-008	3734 HEDGEMAN ST, Row 1	1	B	Res.	67	50	48
C-009	17703 MAIN ST, Row 1	1	B	Res.	67	48	52
C-010	17719 MAIN ST, Row 1	1	B	Res.	67	54	52
C-011	17725 MAIN ST, Row 1	1	B	Res.	67	51	49
C-012	17733 MAIN ST, Row 1	1	B	Res.	67	52	50
D-001	Grace Church Playground, 1006 WILLIAMSTOWN DR, Row 1	1	C	Rec.	67	47	53
D-002	Grace Church, 1006 WILLIAMSTOWN DR, Row 1	1	D	Int.	52	23 (48 exterior)	29 (54 exterior)
E-001	3980 ORANGE ST, Row 1	1	B	Res.	67	45	51
E-002	3970 ORANGE ST, Row 2	1	B	Res.	67	42	47
E-003	3988 ORANGE ST, Row 1	1	B	Res.	67	44	49
E-004	3958 ORANGE ST, Row 2	1	B	Res.	67	41	46
E-005	3993 ORANGE ST, Row 1	1	B	Res.	67	44	47
E-006	3983 ORANGE ST, Row 1	1	B	Res.	67	41	45
E-007	School Playground, 18302 OLD TRIANGLE RD, Row 1	1	C	Rec.	67	39	43
E-008	School Playground, 18302 OLD TRIANGLE RD, Row 1	1	C	Rec.	67	39	42

Table 7 Predicted Existing (2017) and Build Design Year (2043) Noise Levels for Route 1 Widening Project

CNE-Site No.	Address	Recp. Unit	Activ. Cat.*	Land Use*	NAC Impact Criteria	Loudest-Hour Leq (dBA)**	
						Existing	Build
E-009	School on Triangle Road, 18302 Old Triangle Rd, Row 1	1	D	Int.	52	15 (40 exterior)	18 (43 exterior)
E-010	Brady's Hill Mobile Home Park, 4036 BRADYS HILL RD, Row 1	1	B	Res.	67	53	56
E-011	Brady's Hill Mobile Home Park, 4036 BRADYS HILL RD, Row 1	1	B	Res.	67	54	56
E-012	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 1	1	B	Res.	67	54	56
E-013	Brady's Hill Mobile Home Park, 4024 BRADYS HILL RD, Row 1	1	B	Res.	67	55	56
E-014	Brady's Hill Mobile Home Park, 4024 BRADYS HILL RD, Row 1	1	B	Res.	67	55	56
E-015	Brady's Hill Mobile Home Park, 4022 BRADYS HILL RD, Row 1	1	B	Res.	67	53	54
E-016	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 2	1	B	Res.	67	50	53
E-017	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 2	1	B	Res.	67	51	53
E-018	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 2	1	B	Res.	67	51	53
E-019	Brady's Hill Mobile Home Park, 4022 BRADYS HILL RD, Row 2	1	B	Res.	67	51	53
E-020	Brady's Hill Mobile Home Park, 4018 BRADYS HILL RD, Row 3	1	B	Res.	67	49	50
E-021	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 3	1	B	Res.	67	49	51
E-022	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 3	1	B	Res.	67	49	51
E-023	Brady's Hill Mobile Home Park, 4034 BRADYS HILL RD, Row 3	1	B	Res.	67	47	50
E-024	Brady's Hill Mobile Home Park, 4016 BRADYS HILL RD, Row 4	1	B	Res.	67	46	49
E-025	Brady's Hill Mobile Home Park, 4012 BRADYS HILL RD, Row 4	1	B	Res.	67	46	48
E-026	Brady's Hill Mobile Home Park, 4012 BRADYS HILL RD, Row 4	1	B	Res.	67	46	48
E-027	Brady's Hill Mobile Home Park, 4012 BRADYS HILL RD, Row 1	1	B	Res.	67	46	48
E-028	4016 BRADYS HILL RD, Row 1	1	B	Res.	67	48	50
F-001	4015 BRADYS HILL RD, Row 1	1	B	Res.	67	46	48
F-002	18502 TRIANGLE ST, Row 1	1	B	Res.	67	57	58
F-003	18508 TRIANGLE ST, Row 1	1	B	Res.	67	58	59
F-004	18510 TRIANGLE ST, Row 1	1	B	Res.	67	59	59
F-005	18518 TRIANGLE ST, Row 1	1	B	Res.	67	59	59
F-006	18501 TRIANGLE ST, Row 2	1	B	Res.	67	44	46
F-007	18505 TRIANGLE ST, Row 2	1	B	Res.	67	52	54
F-009	18509 TRIANGLE ST, Row 2	1	B	Res.	67	54	55
F-010	18513 TRIANGLE ST, Row 2	1	B	Res.	67	49	49
F-011	18518 TRIANGLE ST, Row 1	1	B	Res.	67	57	56
F-012	18516 AMIDON AVE, Row 1	1	B	Res.	67	51	50
F-013	4009 BRADYS HILL RD, Row 1	1	B	Res.	67	39	41
F-014	4007 BRADYS HILL RD, Row 1	1	B	Res.	67	39	41
F-015	4007 BRADYS HILL RD, Row 1	1	B	Res.	67	39	41
F-016	4005 BRADYS HILL RD, Row 1	1	B	Res.	67	39	41
F-017	4003 BRADYS HILL RD, Row 1	1	B	Res.	67	40	41
F-018	4003 BRADYS HILL RD, Row 1	1	B	Res.	67	39	41

Table 7 Predicted Existing (2017) and Build Design Year (2043) Noise Levels for Route 1 Widening Project

CNE-Site No.	Address	Recp. Unit	Activ. Cat.*	Land Use*	NAC Impact Criteria	Loudest-Hour Leq (dBA)**	
						Existing	Build
F-019	Church for rent, 4074 SQUIRE LN, Row 1	1	D	Int.	52	32 (57 exterior)	30 (55 exterior)
F-020	18531 TRIANGLE ST, Row 1	1	B	Res.	67	53	50
G-001	18402 CORBY ST, Row 1	1	B	Res.	67	58	60
G-002	18404 CORBY ST, Row 1	1	B	Res.	67	58	60
G-003	18406 CORBY ST, Row 1	1	B	Res.	67	58	60
G-004	18412 CORBY ST, Row 1	1	B	Res.	67	54	55
G-005	18500 CORBY ST, Row 1	1	B	Res.	67	55	56
G-006	18504 CORBY ST, Row 1	1	B	Res.	67	56	57
G-007	18506 CORBY ST, Row 1	1	B	Res.	67	55	57
G-008	18510 CORBY ST, Row 1	1	B	Res.	67	57	59
G-009	18514 CORBY ST, Row 1	1	B	Res.	67	57	58
G-010	18516 CORBY ST, Row 1	1	B	Res.	67	57	58
G-011	Southampton Apartments, 4101 SOUTHWAY LN, Row 1	2	B	Res.	67	54	56
G-012	Southampton Apartments, 4101 SOUTHWAY LN, Row 1	4	B	Res.	67	54	56
G-013	Southampton Apartments, 4101 SOUTHWAY LN, Row 1	2	B	Res.	67	54	56
G-014	Southampton Apartments, 4112 SOUTHWAY LN, Row 1	4	B	Res.	67	53	54
G-015	Southampton Apartments, 4101 SOUTHWAY LN, Row 1	4	B	Res.	67	51	53
G-016	Southampton Apartments, 4106 SOUTHWAY LN, Row 1	2	B	Res.	67	50	51
G-017	Southampton Apartments, 4102 SOUTHWAY LN, Row 1	2	B	Res.	67	51	53
G-018	Southampton Apartments, 4147 SOUTHWAY LN, Row 1	4	B	Res.	67	50	52

* Activ. Cat. Refers to FHWA Activity Category. Res.= Residential, Rec.= Recreational, Mon.= Noise Monitoring Site, Com.= Commercial, Int.=Interior Institutional
** Numbers in parentheses are exterior levels predicted at Category D sites; interior levels are shown first for comparison with the NAC. Red numbers indicate noise impact due to NAC or Substantial Increase in existing noise levels.
Source: HMMH, 2018

APPENDIX D NOISE MEASUREMENT DATA

This appendix includes data acquired during the site visit and noise measurement program, including noise monitor calibration data, site sketches, photographs, field noise and traffic data sheets. Also included are noise measurement results spreadsheets, which include site summary results, noise monitor acoustic data with L_{eq} calculations, and simultaneous traffic count data.

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: _____ MEASUREMENT SITE NO.: ST-1

ADDRESS: 18412 Corby St, Dumfries, VA

OWNER: _____

DESCRIPTION: single family home on slight hill

NOISE SOURCES: route 1, N/S bound traffic; cicadas

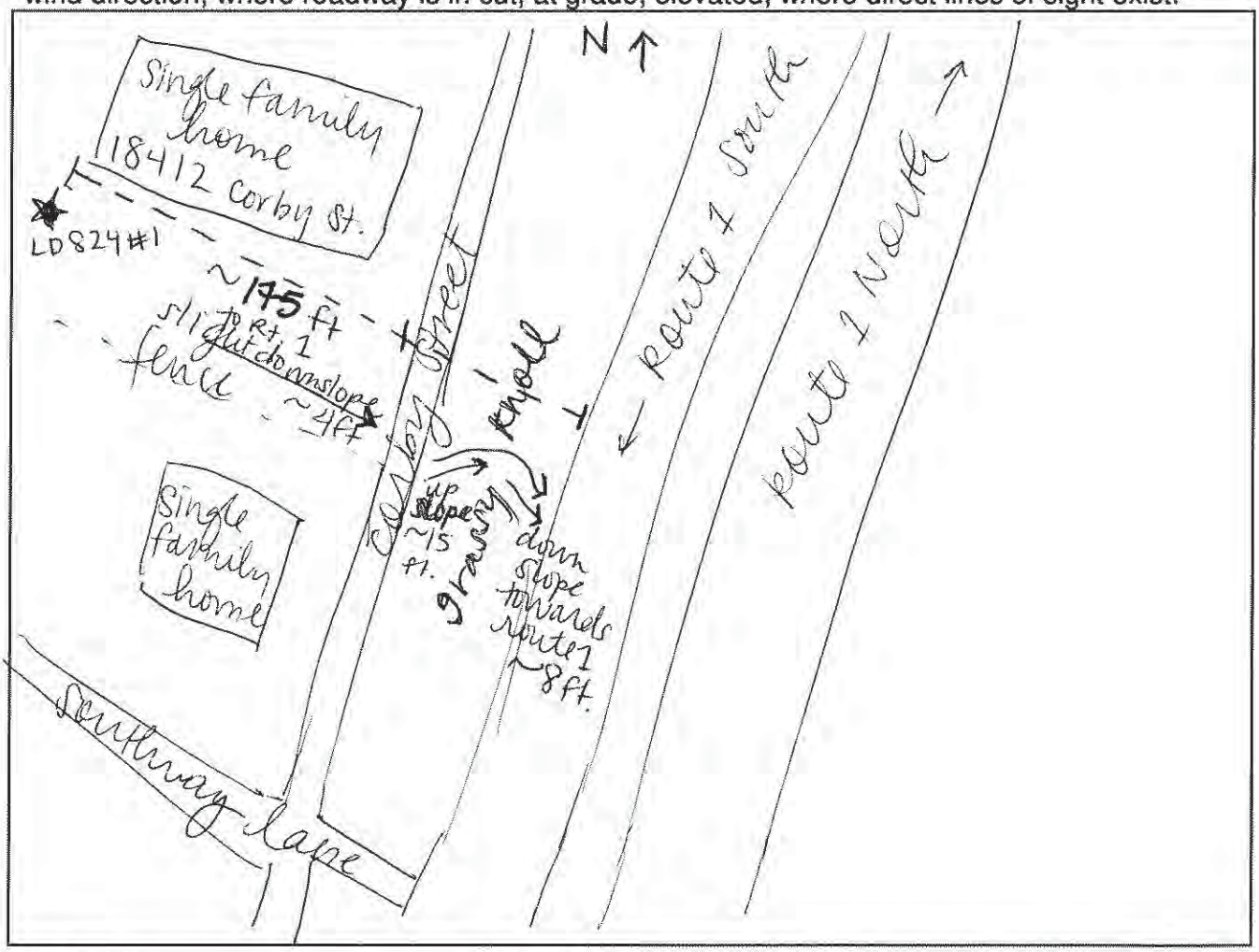
NOISE MONITOR: LD 824 #1 S/N: _____

MICROPHONE: _____ S/N: _____

CALIBRATOR: _____ S/N: _____

TEMP. RANGE (°F): 84.6-86.2, 53% humidity WEATHER CONDITIONS: sunny, light wind, some clouds

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: _____ GPS COORDINATES: _____

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

MEASUREMENT SITE NO.: ST-1 PERSONNEL: HTJ/JMN

ADDRESS/DESCRIPTION: 18412 Corby Street DATE: 7/19/18

#	30 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	12:52	51.2						Cal Check: -0.3
2	53	51						
3	54	51						
4	55	53.1						
5	56	52.4						
6	57	52.3						
7	58	54.5						
8	59	50.3						
9	1:01	57.1						
10	02	51.6						
11	03	53.6						
12	04	51.4						
13	05	52.5						
14	06	62.3						
15	07	50.7						
16	08	52.6						
17	09	52.4						
18	10	56.4						
19	11	53.5						
20	12	50.2						
21	13	59.3	X					cement truck
22	14	55.2						
23	15	51.8						
24	16	52.5						
25	17	53.4						
26	18	52.9						
27	19	53.8						
28	20	52.2	√					car horn at site
29	21	54.6	X					ups truck at site
30	22	55.6						

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

PROJECT: Route 1 Widening Noise Study
JOB NO.: 306780.015

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA:
MEASUREMENT SITE NO.: ST-1
ADDRESS/DESCRIPTION: 18412 Corby St, Dumfries, VA

START TIME: 12:52 PM
END TIME: 01:22 PM
DATE: 7/19/18
PERSONNEL: HTJ/ JMN

ROADWAY: Route 1

	DIRECTION 1: NB	DIRECTION 2: SB
First Sample: 5 minutes **Start Time: 12:52 PM**		
Automobiles	55	
Medium Trucks (6 Tires)	4	
Heavy Trucks (>6 Tires)	1	
Average speed (mph)	29, 33, 36, 40, 39, 32, 30	
Second Sample: 5 minutes **Start Time: 12:58**		
Automobiles		55
Medium Trucks (6 Tires)		1
Heavy Trucks (>6 Tires)		6
Average speed (mph)		40, 43, 43, 45, 47, 40, 36
Third Sample: 5 minutes **Start Time: 1:03**		
Automobiles	26	
Medium Trucks (6 Tires)	1	
Heavy Trucks (>6 Tires)	4	
Average speed (mph)	36, 35, 34, 32, 36	
motorcycle	III	
Fourth Sample: 5 minutes **Start Time: 1:09**		
Automobiles		63
Medium Trucks (6 Tires)		1
Heavy Trucks (>6 Tires)		3
Average speed (mph)		37, 38, 38, 36, 33, 40

Motorcycle! 1

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: _____ MEASUREMENT SITE NO.: ST-2

ADDRESS: 18504 Triangle St, Triangle, VA

OWNER: _____

DESCRIPTION: SF Home, East of Rte 1, up a hill ~ 20' above road

NOISE SOURCES: Route 1 Traffic, Road Construction (Faint), Cicadas, Dogs

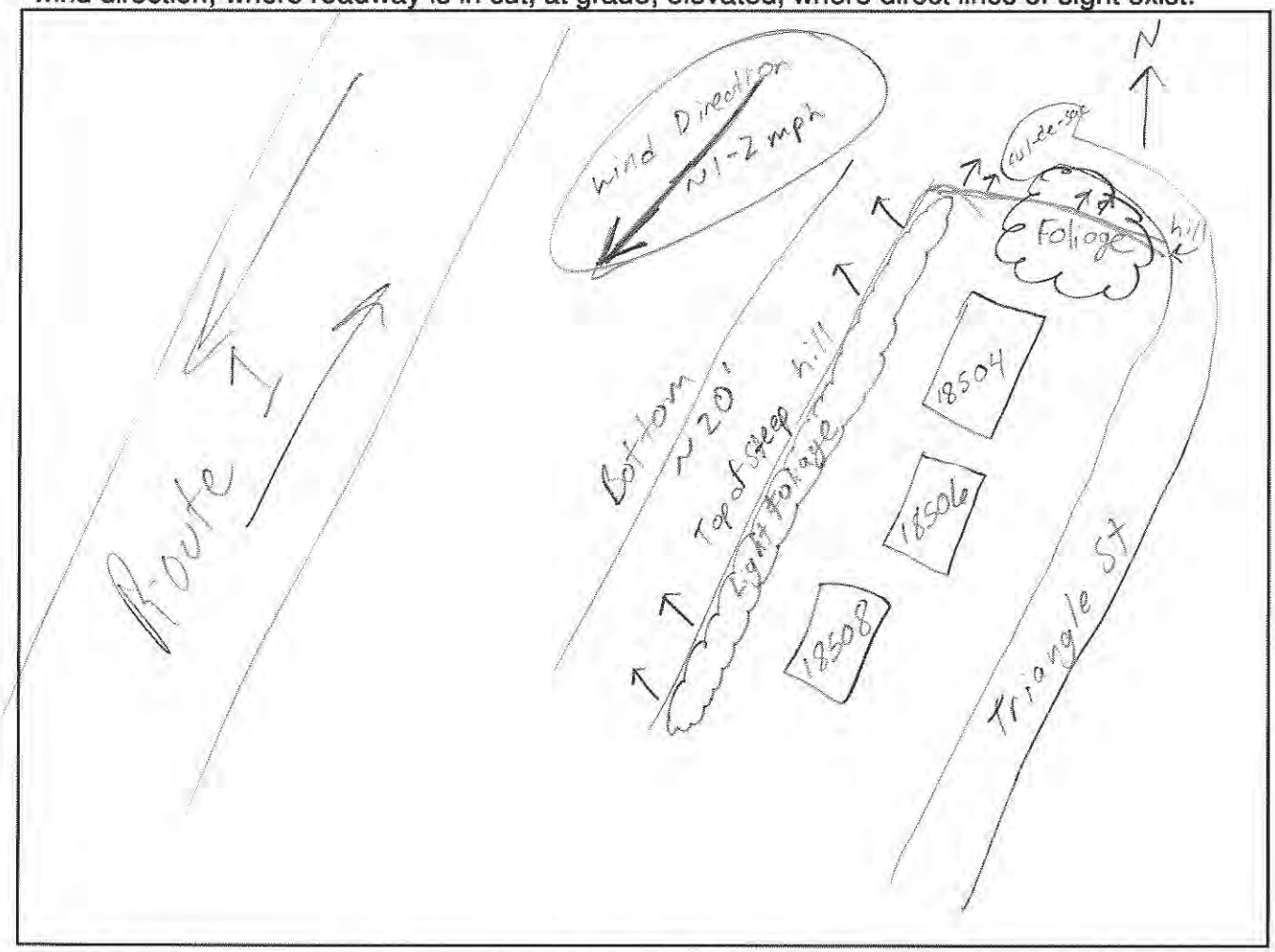
NOISE MONITOR: LD 824 #1 S/N: _____

MICROPHONE: _____ S/N: _____

CALIBRATOR: _____ S/N: _____

TEMP. RANGE (°F): 83°F, 50% humidity WEATHER CONDITIONS: Sunny

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: _____ GPS COORDINATES: _____

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

MEASUREMENT SITE NO.: ST-2 PERSONNEL: HTJ/JMN

ADDRESS/DESCRIPTION: 18504 Triangle St DATE: 7/19/18

#	30 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	11:40	61.5						cal check: -0.2
2	41	61.2						
3	42	60.3	✓					Drilling from Auto Shop
4	43	59.1						
5	44	58.3						
6	45	55.0						
7	46	61.9						
8	47	61.9						
9	48	61.0	✓					Dog Barking
10	49	58.3	✓					Drilling Again
11	50	55.4						
12	51	59.5	✓					Dog Barking
13	52	58.0						↓
14	53	61.5	✓					Motorcycle
15	54	61.9						
16	55	55.2	✓					Dog Barking
17	56	59.5						
18	57	59.1	✓					Dog Barking
19	58	58.9						
20	59	59.6						
21	12:00	60.4						
22	01	54.5						
23	02	58.4						
24	03	60.4	X					Temper Tantrum
25	04	61.2						
26	05	62.3						
27	06	58.6						
28	07	57.7						
29	08	61.4						
30	09	60.9						

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

PROJECT: Route 1 Widening Noise Study
JOB NO.: 306780.015

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA:
MEASUREMENT SITE NO.: ST-2
ADDRESS/DESCRIPTION: 18504 Triangle St, Triangle, VA

START TIME: 11:40
END TIME: 12:03
DATE: 7/19/18
PERSONNEL: HTJ/ JMN

ROADWAY: Route 1

	DIRECTION 1: North	DIRECTION 2: South
First Sample: 5 minutes **Start Time: 11:40 - 11:45**		
Automobiles	55	
Medium Trucks (6 Tires)	0	
Heavy Trucks (>6 Tires)	1	
Average speed (mph)	10, 28, 42, 36, 40, 33	
small road	1	
Second Sample: 5 minutes **Start Time: 11:45 - 11:50**		
Automobiles	39	
Medium Trucks (6 Tires)	2	
Heavy Trucks (>6 Tires)	3	
Average speed (mph)	36, 32, 28, 27, 39, 40	
1 motorcycle		
Third Sample: 5 minutes **Start Time: 11:51 - 11:56**		
Automobiles	33 →	
Medium Trucks (6 Tires)	0 →	
Heavy Trucks (>6 Tires)	3 →	
Average speed (mph)	N/A (too fast)	40, 43, 45, 40, 36
Fourth Sample: 5 minutes **Start Time: 11:57 - 12:03**		
Automobiles	47 →	
Medium Trucks (6 Tires)	2 →	
Heavy Trucks (>6 Tires)	0 →	
Average speed (mph)	N/A (too fast)	37, 38, 40, 36, 33

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: _____ MEASUREMENT SITE NO.: ST-3

ADDRESS: 17505 Tripoli Blvd, Dumfries, VA

OWNER: _____

DESCRIPTION: SF home, up a hill, west side of Route 1

NOISE SOURCES: Rte 1, Cicades, Birds

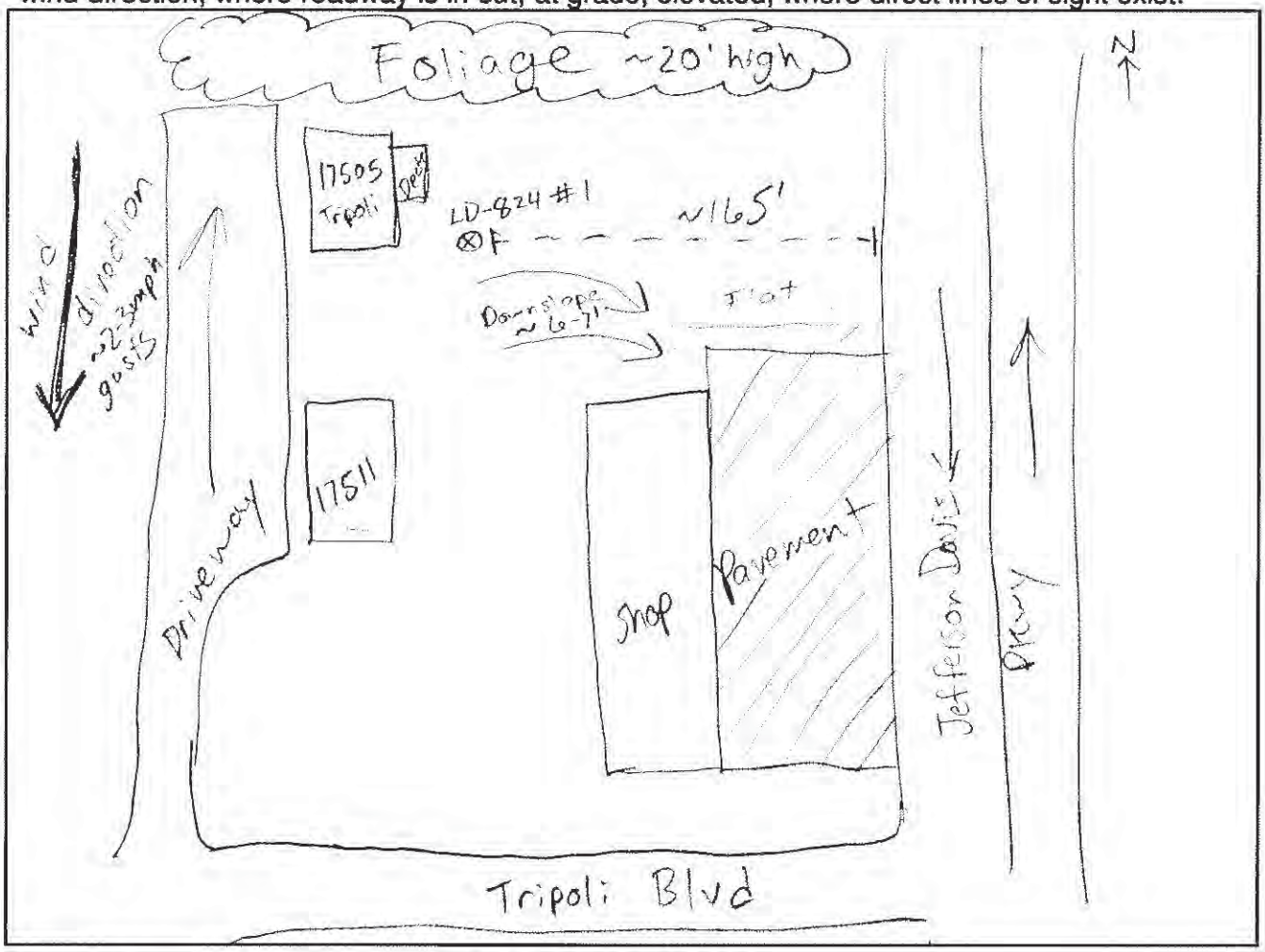
NOISE MONITOR: LD 824 #1 S/N: _____

MICROPHONE: _____ S/N: _____

CALIBRATOR: _____ S/N: _____

TEMP. RANGE (°F): 81-83°F, 70% humidity WEATHER CONDITIONS: Sunny, Breezy,

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: _____ GPS COORDINATES: _____

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

MEASUREMENT SITE NO.: ST-3 PERSONNEL: HTJ/JMN

ADDRESS/DESCRIPTION: 17505 Tripoli Blvd DATE: 7/19/18

#	30 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	09:35	63.8						cal - 114.00 ±0
2	36	62.0						
3	37	64.9						
4	38	65.5				1		
5	39	63.5				1		
6	40	63.3						
7	41	63.9						
8	42	66.6						
9	43	65.1	X			1		Sirens, only few seconds
10	44	63.6						
11	45	64.9						
12	46	63.4						
13	47	65.4	✓			1		9:47:57, Truck Horn
14	48	63.6						
15	49	64.4						
16	50	65.5						
17	51	63.6						
18	52	65.5						
19	53	61.3						
20	54	64.3						
21	55	63.4						
22	56	60.9						
23	57	64.7						
24	58	62.9						
25	59	62.6						
26	10:06	64.5						
27	01	63.5						
28	02	62.5						
29	03	62.1						
30	04	64.8						Cicada's chirping throughout msmt

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

PROJECT: Route 1 Widening Noise Study
JOB NO.: 306780.015

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA: _____
MEASUREMENT SITE NO.: ST-3
ADDRESS/DESCRIPTION: 17505 Tripoli Blvd Dumfries, VA

START TIME: 9:35
END TIME: 9:58
DATE: 7/19/18
PERSONNEL: HTJ/ JMN

ROADWAY: Route 1

	DIRECTION 1: North	DIRECTION 2: South
First Sample: 5 minutes, **Start Time:** 9:35 - 9:40		
Automobiles	91	
Medium Trucks (6 Tires)	1	
Heavy Trucks (>6 Tires)	1	
Average speed (mph)	25, 32	
Second Sample: 5 minutes, **Start Time:** 9:42 - 9:47	1 motorcycle	
Automobiles	63	
Medium Trucks (6 Tires)	0	
Heavy Trucks (>6 Tires)	2	
Average speed (mph)	41, 38, 29, 34	
Third Sample: 5 minutes, **Start Time:** 9:48 - 9:53		
Automobiles		73
Medium Trucks (6 Tires)		2
Heavy Trucks (>6 Tires)		0
Average speed (mph)	14, 35, 39, 32	→ 42, 35, 25
Fourth Sample: 5 minutes, **Start Time:** 9:53 - 9:58		
Automobiles		54
Medium Trucks (6 Tires)		1
Heavy Trucks (>6 Tires)		1
Average speed (mph)		34, 32, 43, 39

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

SHORT-TERM NOISE MEASUREMENT SITE LOG

ASSESSMENT AREA: _____ MEASUREMENT SITE NO.: ST-4

ADDRESS: 17685 Main St, Dumfries, VA

OWNER: Condemned

DESCRIPTION: SF home, condemned, in between Main St & Rte 1/Farley

NOISE SOURCES: Main St Traffic, Route 1 Traffic, Cicadas

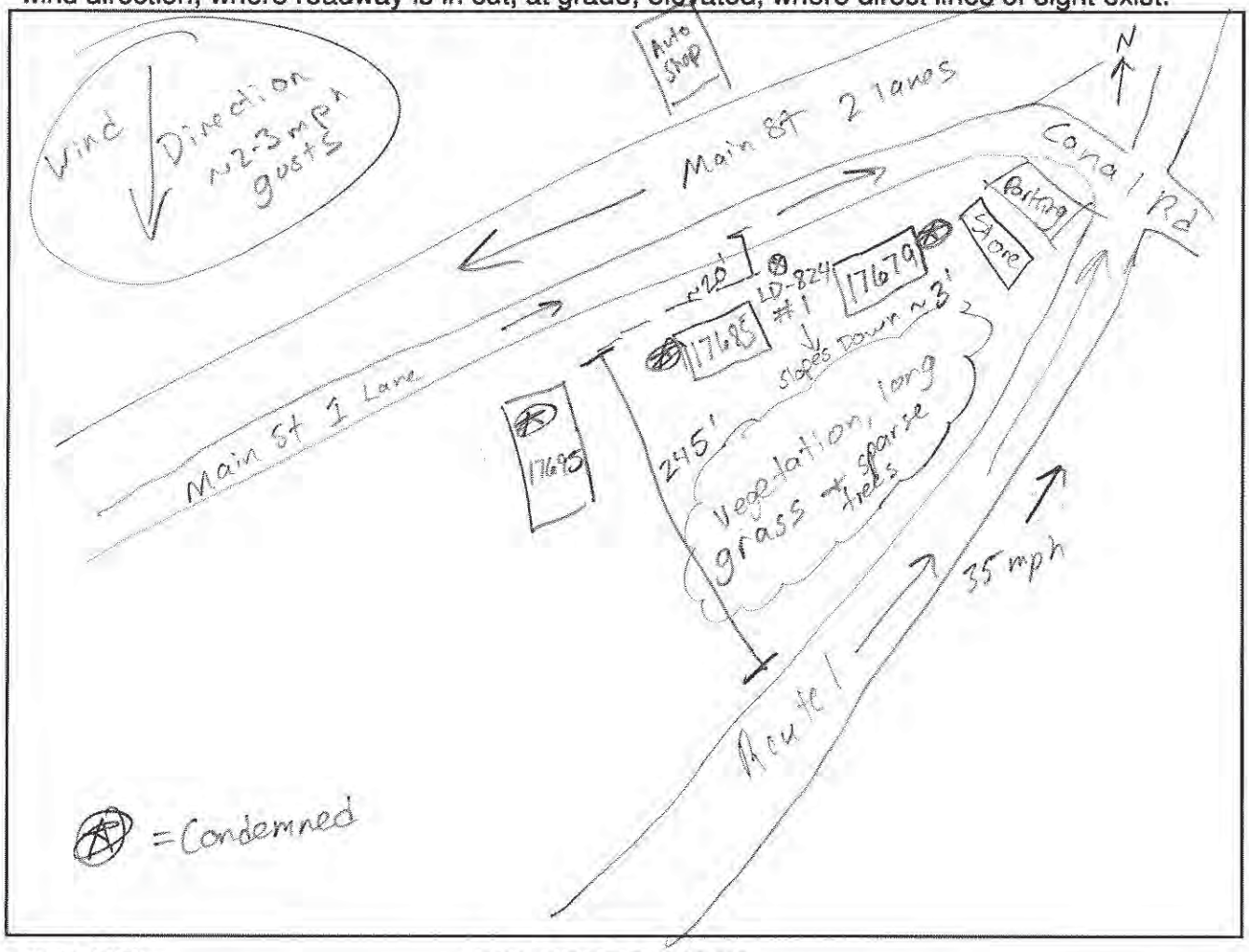
NOISE MONITOR: LD 824 #1 (↓ main St Dominates) S/N: _____

MICROPHONE: _____ S/N: _____

CALIBRATOR: _____ S/N: _____

TEMP. RANGE (°F): 85-86 °F, 50% humidity WEATHER CONDITIONS: Sunny, Breezy

SITE SKETCH: Show roadway, homes, local roads, reference distances, arrows for North & wind direction, where roadway is in cut, at grade, elevated, where direct lines of sight exist.



PHOTOS: _____ GPS COORDINATES: _____

SHORT-TERM NOISE MEASUREMENT DATA SHEET

PROJECT: Route 1 Widening Noise Study

JOB NO.: 306780.015

MEASUREMENT SITE NO.: ST-4 PERSONNEL: HTJ/JMN

ADDRESS/DESCRIPTION: 17685 Main St DATE: 7/19/18

#	30 Minute Period Starting	Meas'd Leq (dBA)	√ or X	Autos	Medium Trucks	Heavy Trucks	Other Noise Sources	COMMENTS (Include Calibration Data)
1	10:28	63.8				1		
2	29	63.8						
3	30	63.3						
4	31	60.0						
5	32	63.7						
6	33	61.8	X				10:	33:20 ~ 10:34:40 = Sirens
7	34	60.1						
8	35	66.4						
9	36	65.7						
10	37	61.6						
11	38	63.1						
12	39	64.0						
13	40	64.0						
14	41	62.9						
15	42	60.7						
16	43	66.5				1		
17	44	64.1	√					Prop Plane ↓ ↓
18	45	62.2			1			
19	46	65.0						
20	47	59.0						
21	48	64.2						
22	49	66.2			1			
23	50	58.4						
24	51	66.9						
25	52	67.0						
26	53	62.7						
27	54	63.1						
28	55	59.4						
29	56	62.4	√					Truck Backup Alarm
30	57	63.7						

TOTAL Leq = SUBSET Leq =

√ = Other sources contributed to Leq X = Exclude period - contaminated by non-characteristic sources

>> ADD SKETCH AND WEATHER CONDITIONS TO REVERSE OR OTHER SHEET <<

PROJECT: Route 1 Widening Noise Study
JOB NO.: 306780.015

TRAFFIC VOLUME COUNT DATA SHEET

ASSESSMENT AREA: _____
MEASUREMENT SITE NO.: ST-4
ADDRESS/DESCRIPTION: 17685 Main St, Dumfries, VA

START TIME: 10:28
END TIME: 10:52
DATE: 7/19/18
PERSONNEL: HTJ/ JMN

ROADWAY: Main Street

	DIRECTION 1: South	DIRECTION 2: North (1 lane)
First Sample: 5 minutes **Start Time: 10:28 – 10:33**		
Automobiles	51	𝍸 𝍸 =10
Medium Trucks (6 Tires)	1	0
Heavy Trucks (>6 Tires)	0	0
Average speed (mph)	29, 24, 29	28, 30, 32, 29
Second Sample: 5 minutes **Start Time: 10:34 – 10:39**		
Automobiles	48	𝍸 𝍸 | =11
Medium Trucks (6 Tires)	3	0
Heavy Trucks (>6 Tires)	3	0
Average speed (mph)	29, 17, 30	30, 26, 28, 29, 31
Third Sample: 5 minutes **Start Time: 10:41 – 10:46**	Route 1/Farley	North
Automobiles		62
Medium Trucks (6 Tires)		2
Heavy Trucks (>6 Tires)		2
Average speed (mph)		31, 33, 41
Fourth Sample: 5 minutes **Start Time: 10:47 – 10:52**	1 moto	
Automobiles		66
Medium Trucks (6 Tires)		0
Heavy Trucks (>6 Tires)		2
Average speed (mph)		32, 36, 30

Job#:	306780.015
Name:	Route 1 Widening
Location:	Dumfries, VA
Date:	7/7/2018

NOISE MEASUREMENT SUMMARY

		Measurement data				
Site	Address	Date	Time Start	Duration	Total Leq, dBA	Traffic Only Leq, dBA
M1	18412 Corby St	19-Jul-18	12:52:29	30	54.5	54.3
M2	18504 Triangle St	19-Jul-18	11:40:05	30	59.9	59.8
M3	17505 Tripoli Blvd	19-Jul-18	9:35:04	30	62.7	62.0
M4	17685 Main St	19-Jul-18	10:28:05	30	63.8	63.7

Site Number	M1
Location:	18412 Corby St
Date:	7/19/2018
Start Time:	12:52
Duration (min):	30

VALIDATION SOUND LEVEL

Time	Overall Leq	Traffic-only Leq	Seconds Excluded	Comment
12:52	51.3	51.3		
12:53	50.9	50.9		
12:54	51.1	51.1		
12:55	53.2	53.2		
12:56	52.2	52.2		
12:57	52.7	52.7		
12:58	54.2	54.2		
12:59	50.3	50.3		
13:00	57.1	57.1		
13:01	51.7	51.7		
13:02	53.5	53.5		
13:03	51.4	51.4		
13:04	52.7	52.7		
13:05	62.3	62.3		
13:06	50.7	50.7		
13:07	52.6	52.6		
13:08	52.3	52.3		
13:09	56.4	56.4		
13:10	53.5	53.5		
13:11	50.4	50.4		
13:12	59.3	57.6	7	0
13:13	54.9	54.9		
13:14	51.9	51.9		
13:15	52.4	52.4		
13:16	53.4	53.4		
13:17	52.9	52.9		
13:18	53.9	53.9		
13:19	52.0	52.0		
13:20	54.7	54.7		
13:21	55.6	54.2	17	0
30 Minute Leq	**54.5**	**54.3**	**24**	
		Percentage Excluded	**1.3%**	

TRAFFIC INPUT

Data Entry Table

Roadway	Direction	VehicleType	Total_Looku	VehType_Lookup	Start_Time	Duration	Count	Speed
Route_1	NB	A	Route_1_NB	Route_1_NB_A	12:52	5	55	34
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	12:52	5	4	34
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	12:52	5	1	34
Route_1	SB	A	Route_1_SB	Route_1_SB_A	12:58	5	55	42
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	12:58	5	1	42
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	12:58	5	6	42
Route_1	NB	A	Route_1_NB	Route_1_NB_A	1:03	5	26	35
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	1:03	5	1	35
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	1:03	5	4	35
Route_1	SB	A	Route_1_SB	Route_1_SB_A	1:09	5	63	37
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	1:09	5	1	37
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	1:09	5	3	37

Site Number	M2
Location:	18504 Triangle St
Date:	7/19/2018
Start Time:	11:40
Duration (min):	30

VALIDATION SOUND LEVEL

Time	Overall Leq	Traffic-only Leq	Seconds Excluded	Comment
11:40	61.4	61.4		
11:41	61.2	61.2		
11:42	60.3	60.3		
11:43	59.1	59.1		
11:44	58.4	58.4		
11:45	54.7	54.7		
11:46	61.9	61.9		
11:47	61.9	61.9		
11:48	61.1	61.1		
11:49	58.1	58.1		
11:50	55.7	55.7		
11:51	59.4	59.4		
11:52	57.9	57.9		
11:53	61.5	61.5		
11:54	61.8	61.8		
11:55	55.3	55.3		
11:56	59.4	59.4		
11:57	59.1	59.1		
11:58	58.8	58.8		
11:59	59.7	59.7		
12:00	60.3	60.3		
12:01	54.5	54.5		
12:02	58.6	58.6		
12:03	60.6	60.1	2	
12:04	60.9	60.0	3	
12:05	62.4	62.4		
12:06	58.5	58.5		
12:07	57.8	57.8		
12:08	61.4	61.4		
12:09	60.7	60.7		
30 Minute Leq	**59.9**	**59.8**	**5**	
	Percentage Excluded		**0.3%**	

TRAFFIC INPUT

Data Entry Table

Roadway	Direction	VehicleType	Total_Looku	VehType_Lookup	Start_Time	Duration	Count	Speed
Route_1	NB	A	Route_1_NB	Route_1_NB_A	11:40	5	55	38
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	11:40	5	0	38
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	11:40	5	1	38
Route_1	SB	A	Route_1_SB	Route_1_SB_A	11:45	5	39	34
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	11:45	5	2	34
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	11:45	5	3	34
Route_1	NB	A	Route_1_NB	Route_1_NB_A	11:51	5	33	41
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	11:51	5	0	41
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	11:51	5	3	41
Route_1	SB	A	Route_1_SB	Route_1_SB_A	11:57	5	47	37
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	11:57	5	2	37
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	11:57	5	0	37

Site Number	M3
Location:	17505 Tripoli Blvd
Date:	7/19/2018
Start Time:	9:35
Duration (min):	30

VALIDATION SOUND LEVEL

Time	Overall Leq	Traffic-only Leq	Seconds Excluded	Comment
9:35	63.7	63.7		
9:36	62.1	62.1		
9:37	64.7	64.7		
9:38	65.7	65.7		
9:39	63.2	63.2		
9:40	63.3	63.3		
9:41	64.2	64.2		
9:42	67.4	65.7	6	0
9:43	63.8	63.8		
9:44	63.5	63.5		
9:45	64.9	64.9		
9:46	63.0	63.0		
9:47	65.5	65.5		
9:48	63.4	63.4		
9:49	64.7	64.7		
9:50	65.6	65.6		
9:51	63.3	63.3		
9:52	65.4	65.4		
9:53	61.8	61.8		
9:54	64.4	64.4		
9:55	63.3	63.3		
9:56	60.8	60.8		
9:57	64.8	64.8		
9:58	62.8	62.8		
9:59	62.3	62.3		
10:00	64.7	64.7		
10:01	63.7	63.7		
10:02	61.8	61.8		
10:03	63.2	63.2		
10:04	64.7	64.7		
30 Minute Leq	**62.7**	**62.0**	**6**	
		Percentage Excluded	**0.3%**	

TRAFFIC INPUT
Data Entry Table
TRAFFIC INPUT
Data Entry Table

Roadway	Direction	VehicleType	Total_Looku	VehType_Lookup	Start_Time	Duration	Count	Speed
Route_1	NB	A	Route_1_NB	Route_1_NB_A	9:35	5	91	34
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	9:35	5	1	34
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	9:35	5	1	34
Route_1	NB	A	Route_1_NB	Route_1_NB_A	9:42	5	63	36
Route_1	NB	MT	Route_1_NB	Route_1_NB_MT	9:42	5	0	36
Route_1	NB	HT	Route_1_NB	Route_1_NB_HT	9:42	5	2	36
Route_1	SB	A	Route_1_SB	Route_1_SB_A	9:48	5	73	35
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	9:48	5	2	35
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	9:48	5	0	35
Route_1	SB	A	Route_1_SB	Route_1_SB_A	9:53	5	54	37
Route_1	SB	MT	Route_1_SB	Route_1_SB_MT	9:53	5	1	37
Route_1	SB	HT	Route_1_SB	Route_1_SB_HT	9:53	5	1	37

Site Number	M4
Location:	17685 Main St
Date:	7/19/2018
Start Time:	10:28
Duration (min):	30

VALIDATION SOUND LEVEL

Time	Overall Leq	Traffic-only Leq	Seconds Excluded	Comment
10:28	63.7	63.7		
10:29	63.8	63.8		
10:30	63.2	63.2		
10:31	59.9	59.9		
10:32	63.8	57.0	22	0
10:33	61.6	59.9	9	0
10:34	60.2	60.2		
10:35	66.5	66.5		
10:36	65.7	65.7		
10:37	61.5	61.5		
10:38	63.3	63.3		
10:39	63.8	63.8		
10:40	64.0	64.0		
10:41	62.9	62.9		
10:42	60.6	60.6		
10:43	66.5	66.5		
10:44	64.0	64.0		
10:45	62.2	62.2		
10:46	65.2	65.2		
10:47	58.1	58.1		
10:48	64.3	64.3		
10:49	66.1	66.1		
10:50	58.4	58.4		
10:51	66.8	66.8		
10:52	67.0	67.0		
10:53	62.7	62.7		
10:54	63.1	63.1		
10:55	59.3	59.3		
10:56	62.5	62.5		
10:57	63.6	63.6		
30 Minute Leq	**63.8**	**63.7**	**31**	
		Percentage Excluded	**1.7%**	

TRAFFIC INPUT

Data Entry Table

Roadway	Direction	VehicleType	Total_Looku	VehType_Lookup	Start_Time	Duration	Count	Speed
Main_St	SB	A	Main_St_SB	Main_St_SB_A	10:28	5	51	27
Main_St	SB	MT	Main_St_SB	Main_St_SB_MT	10:28	5	1	27
Main_St	SB	HT	Main_St_SB	Main_St_SB_HT	10:28	5	0	27
Main_St	NB	A	Main_St_NB	Main_St_NB_A	10:28	5	10	30
Main_St	NB	MT	Main_St_NB	Main_St_NB_MT	10:28	5	0	30
Main_St	NB	HT	Main_St_NB	Main_St_NB_HT	10:28	5	0	30
Main_St	SB	A	Main_St_SB	Main_St_SB_A	10:34	5	48	25
Main_St	SB	MT	Main_St_SB	Main_St_SB_MT	10:34	5	3	25
Main_St	SB	HT	Main_St_SB	Main_St_SB_HT	10:34	5	3	25
Main_St	NB	A	Main_St_NB	Main_St_NB_A	10:34	5	11	29
Main_St	NB	MT	Main_St_NB	Main_St_NB_MT	10:34	5	0	29
Main_St	NB	HT	Main_St_NB	Main_St_NB_HT	10:34	5	0	29
Route_1/Farley	NB	A	Route_1/Far	Route_1/Farley_NB_A	10:41	5	62	35
Route_1/Farley	NB	MT	Route_1/Far	Route_1/Farley_NB_MT	10:41	5	2	35
Route_1/Farley	NB	HT	Route_1/Far	Route_1/Farley_NB_HT	10:41	5	2	35
Route_1/Farley	NB	A	Route_1/Far	Route_1/Farley_NB_A	10:47	5	66	33
Route_1/Farley	NB	MT	Route_1/Far	Route_1/Farley_NB_MT	10:47	5	0	33
Route_1/Farley	NB	HT	Route_1/Far	Route_1/Farley_NB_HT	10:47	5	2	33

Scantek, Inc.
CALIBRATION LABORATORY

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

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40297

Instrument:	**Sound Level Meter**
Model:	**824**
Manufacturer:	**Larson Davis**
Serial number:	**A0795**
Tested with:	**Microphone 40AQ s/n 19907** **Preamplifier PRM902 s/n 1208**
Type (class):	**1**
Customer:	**Harris Miller Miller & Hanson Inc.**
Tel/Fax:	**781-229-0707 x3119 / 781-229-7939**

Date Calibrated: **3/14/2018** *Cal Due:*

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

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **77 South Bedford Street**
Burlington, MA 01803

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

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

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018

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

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.5	99.25	37.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature		Signature	
Date	3/14/18	Date	3/15/2018

Scantek, Inc.
CALIBRATION LABORATORY

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

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40298

Instrument: **Microphone**
Model: **40AQ**
Manufacturer: **GRAS**
Serial number: **19907**
Composed of:

Date Calibrated: **3/13/2018** *Cal Due:*

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

Contains non-accredited tests: ___Yes _X_ No

Customer: **Harris Miller Miller & Hanson Inc.**
Tel/Fax: **781-229-0707 x3119/781-229-7939**
Address: **77 South Bedford Street**
Burlington, MA 01803

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

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

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018
4180-Brüel&Kjær	Microphone	2246115	Oct 24, 2017	DANAK / DPLA	Oct 24, 2019

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

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Steven E Marshall
Signature		Signature	
Date	3/13/18	Date	3/15/2018

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

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40299

Instrument:	**Microphone Unit**	*Date Calibrated:*	**3/13/2018** *Cal Due:*
Model:	**40AE-PRM902**	*Status:*	**Received** / **Sent**
Manufacturer:	**GRAS**	*In tolerance:*	X / X
Serial number:	**8310-3185**	*Out of tolerance:*	
Composed of:	**Microphone 40AE s/n: 8310**	*See comments:*	
	Preamplifier PRM902 s/n: 3185	*Contains non-accredited tests:*	__Yes _X_ No
Customer:	**Harris Miller Miller & Hanson Inc.**	*Address:*	**77 South Bedford Street**
Tel/Fax:	**781-229-0707 x3119/781-229-7939**		**Burlington, MA 01803**

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

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

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018
4180-Brüel&Kjær	Microphone	2246115	Oct 24, 2017	DANAK / DPLA	Oct 24, 2019

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

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Steven E Marshall
Signature		Signature	
Date	3/13/18	Date	3/15/2018

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

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40300

Instrument:	**Acoustical Calibrator**	*Date Calibrated:* **3/12/2018** *Cal Due:*	
Model:	**CAL250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Larson Davis**	*In tolerance:*	X / X
Serial number:	**4182**	*Out of tolerance:*	
Class (IEC 60942):	**1L**	*See comments:*	
Barometer type:		*Contains non-accredited tests:*	**__Yes _X_ No**
Barometer s/n:			
Customer:	**Harris Miller Miller & Hanson Inc.**	*Address:*	**77 South Bedford Street**
Tel/Fax:	**781-229-0707 x3119 / 781-229-7939**		**Burlington, MA 01803**

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

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

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
140-Norsonic	Real Time Analyzer	1403978	Mar 22, 2017	Scantek, Inc. / NVLAP	Mar 22, 2018
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4192-Brüel&Kjær	Microphone	2854675	Nov 11, 2017	Scantek, Inc. / NVLAP	Nov 11, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018

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

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature		Signature	
Date	3/12/18	Date	3/15/2018