# TRAFFIC NOISE REPORT

Mid-Currituck Bridge Study

Currituck and Dare Counties

STIP Project No. R-2576
WBS Project No. 34470.1.TA1

Prepared for:

North Carolina Turnpike Authority
a division of the
North Carolina Department of Transportation

Submitted by:

WSP USA

June 2018

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Accepted by:

North Carolina Department of Transportation
Environmental Analysis Unit
Traffic Noise and Air Quality Group

Jacob Poling, INCE
Noise Modeler

6-25-18
Date

Patrick Romero, INCE, ENV SP
Quality Assurance

6-25-18
Date

## Executive Summary

The North Carolina Turnpike Authority, a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is evaluating proposed transportation improvements in the Currituck Sound area, including consideration of a Mid-Currituck Bridge. The project Preferred Alternative includes widening of existing roadways and construction of a new interchange, bridge, and roadway in Currituck and Dare Counties (refer to Figure 1). The Preferred Alternative is shown in Figures 2-1 thru 2-18.

The project's Final Environmental Impact Statement (FEIS) was approved in 2012 and an FEIS Reevaluation is currently being prepared. The purpose of the FEIS Reevaluation is to note the major changes in project settings, alternatives, and impacts since the FEIS was published.

Federal funds will be used for this project and the project is included in the NCDOT State Transportation Improvement Program (STIP) as Project R-2576. The Date of Public Knowledge will be the date the Record of Decision (ROD) is issued. After this date, federal and state governments are no longer responsible for providing noise abatement measures for new development within the noise impact area of the proposed project. NCDOT advocates the use of local government authority to regulate land development, planning, design and construction in such a way that noise impacts are minimized.

Per FHWA Procedures for Abatement of Highway Noise (23 CFR 772.5(2)) and the 2016 NCDOT Traffic Noise Policy (NCDOT Policy), the proposed project is a "Type I" project. This Traffic Noise Report (TNR) documents the methodologies, results, and recommendations in compliance with 23 CFR 772, NCDOT Policy, and the accompanying NCDOT Traffic Noise Manual.

Traffic noise impacts and temporary construction noise impacts can be a consequence of transportation projects. This Traffic Noise Report utilized computer models created with the Federal Highway Administration Traffic Noise Model® (FHWA TNM v.2.5) to predict future noise levels and define impacted receptors along the proposed project. Design Year 2040 build condition traffic noise is predicted to impact 59 noise-sensitive receptors. Noise impacts were identified along US 158 in Barco, Coinjock, and Southern Shores, and along NC 12 in Corolla. All predicted noise impacts were due to future Design Year 2040 build traffic noise levels approaching or exceeding the applicable Noise Abatement Criteria (NAC). No noise impacts due to a predicted substantial increase above existing noise levels were identified.

Consideration for noise abatement measures was given to all impacted receptors. Each Noise Study Area (NSA) along the project corridor where receptors were impacted by Design Year 2040 traffic noise was evaluated to determine if a noise barrier would be preliminarily found to be feasible and reasonable. One (1) NSA was identified along the project corridor that warranted evaluation of noise abatement measures.

A total of three (3) traffic noise barriers were assessed using validated FHWA TNM v.2.5 models and are described in the table below:

## PRELIMINARY NOISE WALL EVALUATION RESULTS

| Noise Barrier Location | Length / Height (feet) | Surface Area (square feet) | Number of Benefited Receptors | Square Feet per Benefited Receptor / Allowable Square Feet per Benefited Receptor | Preliminarily Recommended for Construction |
|---|---|---|---|---|---|
| NSA 1 / -NW1.1- | 396 / 17 | 6,732 | 2 | 3,366 / 1,500 | No |
| NSA 1 / -NW1.2- | 848 / 13 | 11,024 | 2 | 5,512 / 1,500 | No |
| NSA 1 / -NW1.3- | 602 / 9 | 5,418 | 2 | 2,709 / 1,500 | No |

NCDOT Policy requires the identification as to whether it is "likely" or "unlikely" that noise abatement measures will be installed for each NSA identified. "Likely" does not mean a firm commitment. The final decision on the installation of the abatement measures shall be made upon completion of the project design, the public involvement process, and concurrence with the NCDOT Policy.

The three evaluated noise barriers do not meet feasibility and reasonableness criteria and are considered to be "unlikely" for the Mid-Currituck Bridge project assessed in this TNR.

Construction noise impacts may occur due to the proximity of numerous noise-sensitive receptors to project construction activities. All reasonable efforts should be made to minimize exposure of noise-sensitive land uses to construction noise. Such efforts may include, but are not explicitly limited to, appropriate scheduling of construction activities, noise attenuating measures on construction equipment, and a consistent and open public involvement program.

None of the traffic noise abatement measures considered in this Traffic Noise Report meet the feasible and reasonable criteria detailed in the NCDOT Policy. Consequently, no traffic noise abatement measures are recommended for incorporation into the project plan. Additional traffic noise analysis will not be necessary during project final design unless modifications to the proposed roadway design occur, additional alignments are considered, or changes to Design Year 2040 traffic volumes are predicted.

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# Traffic Noise Report

# Mid-Currituck Bridge Study

## 1.0 PROJECT LOCATION, DESCRIPTION AND BACKGROUND

The North Carolina Turnpike Authority, a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is evaluating proposed transportation improvements in the Currituck Sound area, including consideration of a Mid-Currituck Bridge (TIP Project No. R-2576) within Currituck and Dare Counties. Figure 1 illustrates the project area, which spans 5.4 miles of US 158 in Currituck County, 6.7 miles of proposed new bridge and roadway between US 158 in Coinjock and NC 12 in Corolla, 0.7 miles of NC 12, and 0.3 miles of US 158 in Dare County.

The project purpose is to respond to three underlying needs in the project area:

- The need to substantially improve traffic flow on the project area's thoroughfares (US 158 and NC 12);
- The need to substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- The need to reduce substantially hurricane evacuation times from the Outer Banks for residents and visitors who use US 158 and NC 168 as an evacuation route.

The project's Preferred Alternative preliminary design proposes:

- Reversal of the US 158 center turn lane for hurricane evacuation between NC 168 and the US 158/Mid-Currituck Bridge interchange;
- Construction of a new interchange, bridge over Maple Swamp, and roadway between US 158 and the western shore of Currituck Sound in Aydlett;
- Construction of the new Mid-Currituck Bridge (MCB) across Currituck Sound between Aydlett and Corolla;
- Widening of NC 12 to 4-lanes in proximity to the new MCB – NC 12 roundabout;
- Addition of a left turn lane from Albacore Street to southbound NC 12; and
- Addition of a short hurricane evacuation lane near the NC 12 and US 158 intersection in Dare County.

The existing posted speed limit along US 158 varies from 45 to 55 miles per hour (mph) between NC 168 and Aydlett Road and is 50 mph within the US 158 section of the project area in Dare County. The existing posted speed limit along NC 12 is 45 mph.

The proposed Design Year 2040 design speeds along US 158 are 50 to 60 mph between NC 168 and Aydlett Road and 55 mph within the US 158 section of the project area in Dare County. The

proposed Design Year 2040 design speed is 30 mph along the 4-lane section of NC 12 and 60 mph for the Mid-Currituck Bridge.

## 1.1 Prior Traffic Noise Analyses

As part of the project Draft Environmental Impact Statement (DEIS) document, a previous traffic noise analysis was completed for the Mid-Currituck Bridge Project. The DEIS study evaluated the No-Build Alternative, the FEIS Preferred Alternative and ER2, as well as several variations on existing road improvements combined with a Mid-Currituck Bridge (Parsons Brinckerhoff, November 2009). The study was completed in accordance with Federal Highway Administration highway traffic noise standards (23 CFR, Part 772) and NCDOT Traffic Noise Abatement Policy (NCDOT, September 2004). It included field measurements throughout the project area, noise model validation, prediction of existing and future noise levels, identification of impacted sites, and noise barrier evaluations.

An addendum to the traffic noise analysis reflecting the revised Preferred Alternative roadway design was also completed for the Final Environmental Impact Statement (FEIS) (Parsons Brinckerhoff, November 2011) to comply with the NCDOT Traffic Noise Abatement Policy (NCDOT, July 2011).

A noise analysis update was later completed for the project's Reevaluation of Final Environmental Impact Statement report (WSP, February 2018) to account for revised traffic forecasts, revised roadway design alternatives, and new sensitive land uses. In addition, the study was updated to comply with the updated NCDOT Traffic Noise Policy and Traffic Noise Manual, both of which became effective on October 6, 2016.

## 1.2 Existing and Proposed Land Uses

In accordance with NCDOT Policy, the initial study area for the traffic noise assessment was established by extending 500-feet from the proposed project improvements in all directions. Existing and proposed noise-sensitive land uses within the study area were identified and categorized into the appropriate Activity Category, as described in Table 2 and further detailed in Section 7.2.

Noise-sensitive land uses within the project area include existing and permitted single-family residences (Category B); outdoor recreation areas, active sports areas, and pools (Category C); places of worship and medical facilities without exterior use (Category D); and restaurants with exterior use (Category E). Land uses that are not noise-sensitive within the project area include offices and restaurants without exterior use, retail, warehousing (Category F), and undeveloped lands without approved building permits (Category G.)

## 1.3 Noise Study Areas

To group noise-sensitive land uses that are geographically near one another and exposed to similar noise sources, the project study area was further segmented into six discrete Noise Study Areas

(NSAs). Figure 1 shows the NSAs identified within the project limits and a description of the location of each NSA is included below.

- **NSA 1** is located on the Currituck County mainland and extends along US 158 from NC 168 to the Intracoastal Waterway.

- **NSA 2** is located on the Currituck County mainland and extends along US 158 from the Intracoastal Waterway to 0.5 miles south of Aydlett Road.

- **NSA 3** is located on the Currituck County mainland and extends along the proposed future bridge and roadway alignment between US 158 and the western shore of Currituck Sound in Aydlett.

- **NSA 4** is located on the Currituck County Outer Banks and extends along NC 12 from 500 feet north of Herring Street to the Bonita Street/Monteray Drive intersection. NSA 4 also includes the area between the proposed Mid-Currituck Bridge terminus at the eastern shore of Currituck Sound and the roundabout at NC 12.

- **NSA 5** is located on the Currituck County Outer Banks and extends along Albacore Street from 500 feet west of NC 12 to 800 feet east of NC 12.

- **NSA 6** is located on the Dare County Outer Banks and extends along US 158 from 700 feet west of Birch Lane to 500 feet east of Cyprus Knee Trail.

## 2.0 PROCEDURE

This Traffic Noise Report represents the preliminary analysis of traffic noise impacts from the proposed Mid-Currituck Bridge project (R-2576).

The Federal Highway Administration Traffic Noise Model® version 2.5 (TNM) was used to predict Base Year 2015 existing, Design Year 2040 No-Build and Design Year 2040 Build condition hourly equivalent traffic noise levels, $L_{eq(h)}$, for the noise-sensitive receptors near the proposed project (refer to Figure 2).

The process for developing this Traffic Noise Report included:

- Measurement of existing noise levels that generally follow the guidelines contained in the FHWA's publication titled *Measurement of Highway Noise* (https://www.fhwa.dot.gov/environment/noise/measurement/). Land uses were identified, addresses obtained for all properties, weather data and unusual events recorded, field data logs and site sketches prepared and noise measurement locations were photographed at eight measurement locations on February 26th – February 28th, 2018 (refer to Appendix A).

- Developing a TNM traffic noise model to represent existing conditions. The model elements included receptors, roadways, terrain lines, ground zones, and fixed-height

barriers (to represent existing structures and jersey barriers). Traffic data collected during the time of the measurements was input into the TNM models as part of the validation process (refer to Appendix C).

- Incorporating the Build condition design elements, as defined in the NCDOT Traffic Noise Manual, into the validated existing-condition TNM models. Traffic noise impacts were assessed per the NCDOT Noise Abatement Criteria (NAC) and Substantial Increase criteria (the increase in predicted Design Year loudest-hour equivalent noise levels relative to Base Year baseline loudest-hour equivalent noise levels), as shown in Tables 2 and 4 and Appendix B. Design Year noise contours were created to assist land use planning efforts by local governments (see Section 8.0).

- Assessment of potential noise abatement measures as defined by the NCDOT Traffic Noise Policy for all traffic noise impacts resulting from the project. The noise barriers represent optimized designs that will preliminarily indicate feasibility and reasonableness of noise abatement for predicted traffic noise impacts (refer to Appendix E).

- Consideration of potential impacts from project-related construction noise. See Section 10.0 for a discussion of construction noise.

## 3.0 CHARACTERISTICS OF NOISE

Noise is commonly defined as unwanted sound and is emitted from many natural and man-made sources. Highway traffic noise is usually a combination of noise from vehicle engine exhaust, drive train, and tire-roadway interaction.

The magnitude, or loudness, of sound is determined by comparing the acoustic pressure (in Pascals) to a reference pressure of twenty micro-Pascals (20μPa). Because humans can perceive sounds over many orders of magnitude when expressed as a pressure, a base-10 logarithmic scale is used to compress the range of audible sound to a smaller scale, with the magnitude of sound then being expressed as a sound pressure level in units of decibels (dB). The commonly accepted range of human hearing is between the threshold of hearing at 0 decibels and the threshold of pain at 140 decibels.

All sound contains energy at multiple frequencies distributed across a frequency spectrum. The frequency, or pitch, of a sound is expressed in units of Hertz (Hz) and corresponds to the number of cycles per second of a sound wave. Traffic noise consists of low frequency components (engine "rumble") as well as middle and high frequency components (tire-roadway "whine"). The frequency spectrum can be grouped into ranges, or 'bands', which are typically defined as one 'octave' or '1/3 octave'. Overall sound pressure levels represent the combined acoustic energy present across a range of frequency bands.

The commonly accepted frequency range of human hearing is between 20 Hz and 20,000 Hz but human hearing is most sensitive to the frequencies between 1,000 Hz – 6,000 Hz. To account for how humans are not equally sensitive to sound across the audible frequency range, frequency

weightings are used to adjust the sound pressure level spectrum to better correspond with human perception. The "A-weighting" scale is applied to traffic noise levels and the resulting sound pressure levels are expressed a "A-weighted decibels", or dB(A).

Common indoor and outdoor noise levels are presented in Table 1. The degree of disturbance or annoyance from exposure to noise depends upon three factors:

1. The amount, nature, and duration of the intruding noise;

2. The relationship between the intruding noise and the existing (ambient) sound environment; and

3. The situation in which the disturbing noise is heard.

In considering the first of these factors, it is important to note that individuals have varying sensitivity to noise. Loud noises bother some people more than other people. The time patterns and durations of noise(s) also affect perception as to whether it is offensive. For example, noises that occur during nighttime (sleeping) hours are typically considered to be more offensive than the same noises in the daytime.

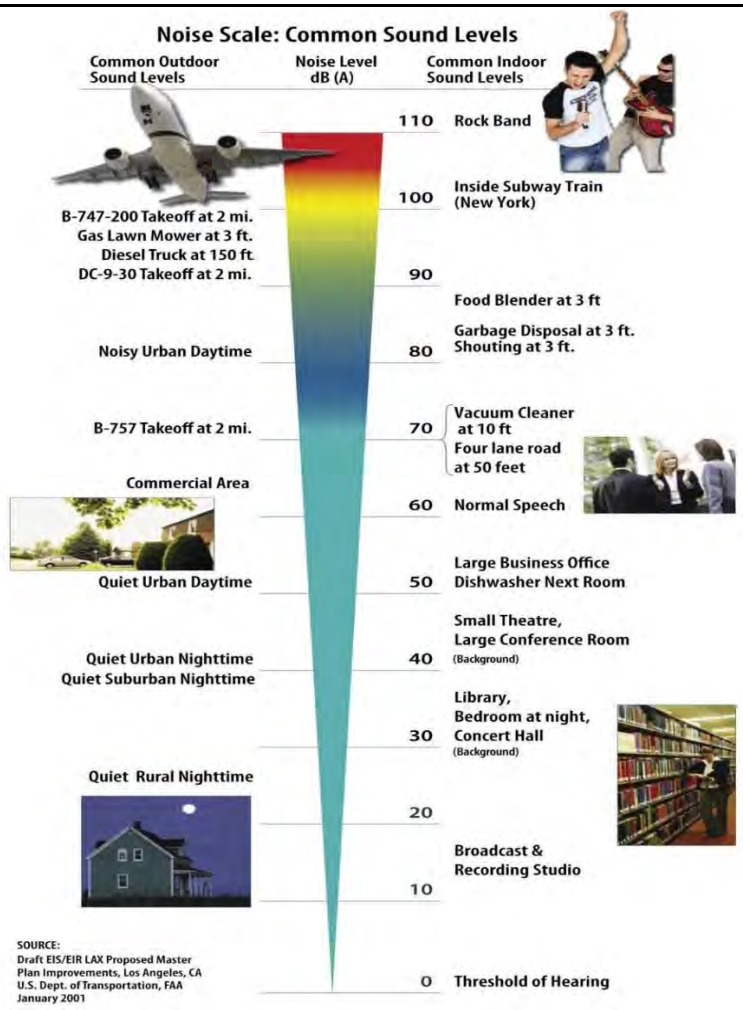
Regarding the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). A car horn blowing at night when background noise levels are low would generally be more objectionable than one blowing in the afternoon when background noise levels are typically higher. The response to noise stimulus is analogous to the response to turning on an interior light. During the daytime, an illuminated bulb simply adds to the ambient light, but when eyes are conditioned to the dark of night, a suddenly illuminated bulb can be temporarily blinding.

The third factor, situational noise, is related to the interference of noise with activities of individuals. In an environment with an ambient noise level of 60 dB(A), such as is commonly found in a large business office, normal conversation would be possible, while sleep might be difficult. Loud noises may easily interrupt activities that require a quiet setting for greater mental concentration or rest; however, the same loud noises may not interrupt activities requiring less mental focus or tranquility.

Over time, individuals tend to become accustomed to the noises that intrude into their lives on a regular basis. However, exposure to prolonged and/or extremely loud noise(s) can prevent the full use of exterior and interior spaces, and could potentially pose health risks.

Appropriately, regulations exist to control noise from many particularly offensive sources, including airplanes, factories, railroads, and highways. For all federal, state, or federal-aid highway projects in the State of North Carolina that meet the definition of "Type I", analysis of noise from traffic and roadway construction is required as dictated by NCDOT Policy.

**Table 1: Common Indoor and Outdoor Noise Levels**




## 4.0 NOISE ABATEMENT CRITERIA

### 4.1 Title 23 Code of Federal Regulations, Part 772 (23 CFR 772)

The Federal Highway Administration has developed Noise Abatement Criteria (NAC) and procedures to be used when analyzing traffic noise in the planning and design of highways. The noise abatement criteria and procedures are set forth in Title 23 CFR Part 772. The purpose of 23 CFR 772 is "to provide procedures for noise studies and noise abatement measures to help protect the public's health, welfare and livability, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to title 23 U.S.C." The regulation also states that, "in abating traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs".

A summary of the NAC for various land uses is presented in Table 2. The $L_{eq(h)}$, or equivalent hourly sound level, is the equivalent steady-state sound level that contains the same acoustic energy as a time-varying sound level over one hour. Traffic noise levels are expressed as $L_{eq(h)}$ noise levels, in units of dB(A), to account for the fluctuating nature of traffic noise over time.

### 4.2 North Carolina Department of Transportation Traffic Noise Policy

The North Carolina Department of Transportation Traffic Noise Policy (October 6, 2016) establishes the state's official policy on highway noise and abatement. This policy describes the NCDOT process that is used in determining traffic noise impacts, construction noise impacts and abatement measures, and the equitable and cost-effective expenditure of public funds for traffic noise abatement. Where the FHWA has given highway agencies flexibility in implementing the 23 CFR 772 standards, this policy describes the NCDOT's approach to implementation. This policy is included as Appendix F of this report.

### 4.3 Noise Abatement Criteria

The two categories of traffic noise impacts are defined as (1) traffic noise levels that "approach" or exceed the FHWA Noise Abatement Criteria (NAC), as shown in Table 2, and (2) traffic noise levels that represent a "substantial increase" over existing noise levels as defined by NCDOT. NCDOT defines "approach" as noise levels within 1 dB(A) of the NAC (e.g. 66 dB(A) for Activity Category B). An impact that represents a "substantial increase" is based on a comparison of the Base Year noise level ($L_{eq(h)}$) with respect to a predicted increase in noise levels in the Design Year of 10 dB(A) or greater.

| **Table 2: Noise Abatement Criteria** | | | |
|---|---|---|---|
| Hourly Equivalent A-Weighted Sound Level (dB(A)) | | | |
| **Activity Category** | **Activity Criteria[1] $L_{eq(h)}$[2]** | **Evaluation Location** | **Activity Description** |
| 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 [3] | 67 | Exterior | Residential |
| C [3] | 67 | Exterior | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section4(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 [3] | 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 |

1 The $L_{eq(h)}$ Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
2 The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with $L_{eq(h)}$ being the hourly value of $L_{eq}$.
3 Includes undeveloped lands permitted for this activity category.

## 5.0 AMBIENT NOISE LEVELS

Ambient noise is ever-present noise caused by natural and manmade sources and events. It includes the wind, rain, thunder, birds chirping, insects, household appliances, HVAC equipment, commercial operations, lawn mowers, airplanes, automobiles, etc. It is the summation of all noise sources that are present in an area.

The ambient noise environment varies depending on the location within the Mid-Currituck Bridge project area. Along US 158 within NSAs 1, 2, and 6, traffic noise from US 158 was the dominant noise source observed during ambient noise monitoring. Along NC 12 within NSAs 4 and 5, traffic noise from NC 12 was the dominant noise source during ambient noise monitoring at most locations. Along the proposed project alignment in Aydlett (NSA 3), where there are no existing major roadway noise sources, audible existing noise sources included birds, aircraft overpasses, local traffic, wind in trees, and the surf from Currituck Sound.

Ambient noise monitoring was completed at eight locations from February 26 – 28, 2018. At each location, 20-minute long noise measurements were completed to establish existing sound levels and to collect data to be used for validation of the traffic noise model. The ambient noise monitoring locations are shown in Figures 2-1 thru 2-18 labeled with the prefix "V". The measured ambient noise levels ranged from 40 to 69 dB(A) $L_{eq}$.

To establish noise levels in areas where the existing environment is not dominated by roadway traffic noise sources, long-term noise monitoring was completed at:

- Site LT-1: 115 Lighthouse View, Aydlett (NSA 3)
- Site LT-2: 358 Narrow Shore Road, Aydlett (NSA 3)
- Site LT-3: 983 Ocean Forest Court, Corolla (NSA 4)

These locations were selected to represent other nearby residences exposed to similar existing noise sources and are shown in Figures 2-14 and 2-15. At all three sites, the distance and/or shielding from major roadway noise sources resulted in traffic noise not being the dominant existing noise source. Noise levels were measured for 24 to 48-hours at each location between February 26 and March 1, 2018. After reviewing the measurement results, site LT-1 was selected to represent all receptors in Aydlett (NSA 3) because the measured noise levels were lower than site LT-2, resulting in a more conservative assessment of existing loudest-hour noise levels. Based on the long-term measurements, the existing loudest-hour noise level was determined to be 47 dB(A) $L_{eq(h)}$ at both LT-1 and LT-3.

Noise monitoring was completed using equipment complying with ANSI S1.4 Type I or Type II precision. Sound level meters that were used for short-term measurements were a Bruel & Kjaer 2250, Bruel & Kjaer 2238, and Larson Davis LxT. Three (3) Larson Davis model 720 noise monitors were used for the long-term measurements. A hand-held Bruel & Kjaer 4231 calibrator was used to check equipment calibration in the field. All sound level meters were equipped with a 3-inch foam windscreen during measurements and calibrated by a certified laboratory within 2 years of use.

The noise monitoring results, concurrent traffic counts, estimated vehicle speeds, weather information for the monitoring sites, and photographs of each location are included in Appendix A.

## 6.0 NOISE MODEL VALIDATION

To validate the noise models developed for the project, measured traffic noise levels were compared to TNM-predicted noise levels at the field measurement locations. For each monitoring location, traffic volumes counted during the 20-minute ambient noise monitoring periods were used to calculate 1-hour traffic volumes. These hourly traffic volumes were then assigned to the corresponding project area roadways to simulate vehicle traffic that was observed during the actual measurement period. Modeled and measured sound levels were then compared to one another to validate the accuracy of the model, the results of which are included in Appendix C.

## 7.0 PROCEDURE FOR PREDICTING EXISTING AND FUTURE NOISE LEVELS

In accordance with industry standards and accepted best-practices, detailed TNM models were developed to predict existing and future traffic noise levels. Appendix B includes a comprehensive list of noise-sensitive receptors along with their Base Year 2015 and predicted Design Year 2040 traffic noise levels.

The TNM noise prediction algorithms account for the distance between the roadway noise source and receptor location, the number and type of vehicles on the planned roadway, vehicle speeds, the physical characteristics of the road (curves, hills, depressions, elevations, etc..), and intervening objects (buildings, barriers, hills, etc..) between the roadway and receptor.

Traffic noise consists of three primary components: tire/pavement noise, engine noise, and exhaust noise. Of these sources, tire/pavement noise is typically the most offensive at unimpeded travel speeds. Sporadic noises such as horns, squealing brakes, screeching tires, etc. are considered anomalous and are not included within the predictive model algorithm.

Because traffic noise emissions are different for various types of vehicles, the TNM model's algorithms distinguish between the source emissions from the following vehicle types depicted in Table 3: Automobiles (FHWA vehicle classifications 2 and 3), Medium Trucks (FHWA vehicle classification 5), Heavy Trucks (FHWA vehicle classifications 6 – 13), Buses (FHWA vehicle classification 4), and Motorcycles (vehicle classification 1). All two-axle, four wheel vehicles – including pickup trucks – are categorized as Automobiles. Two-axle, six wheel vehicles (e.g. delivery trucks and small box trucks) are categorized as Medium Trucks. All other trucks are categorized as Heavy Trucks. The Bus category encompasses all types of buses (e.g. school, inter-city, and intra-city buses).

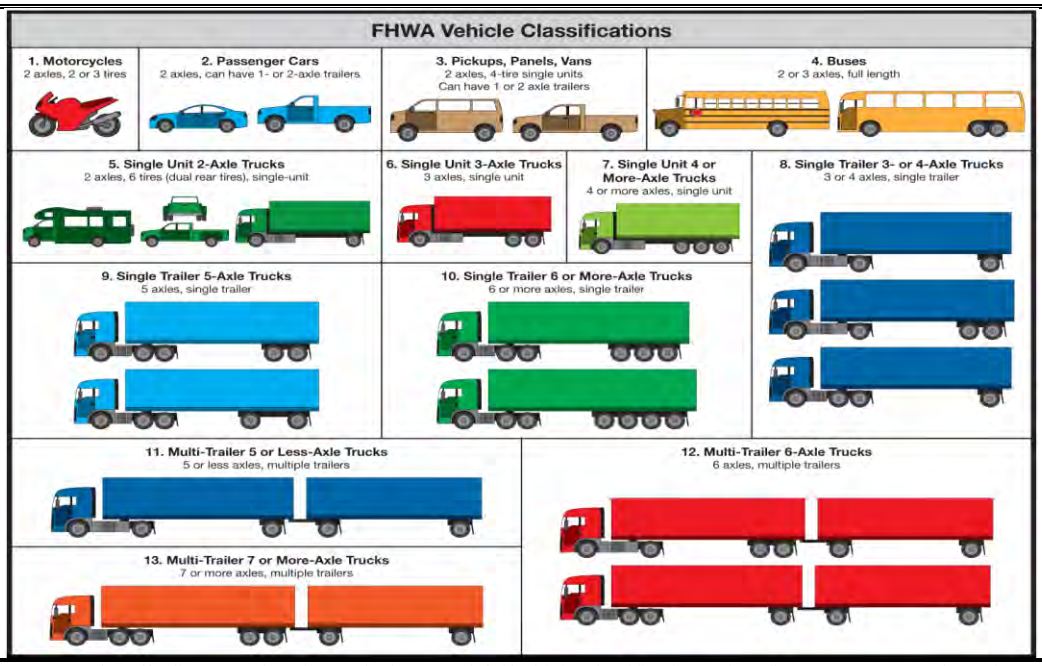
### 7.1 Traffic Forecasts

Per FHWA guidelines, the predictions documented in this report are based upon the traffic conditions resulting in the loudest predicted hourly-equivalent traffic noise levels for each receptor. Traffic forecast volumes were based on the Project Level Traffic Forecast Report (WSP-Parsons Brinckerhoff, June 2016). In accordance with NCDOT Policy, design hour volume (DHV) traffic forecasts were compared to level of service (LOS) C roadway capacity volumes for US 158 and NC 12. DHV forecasts corresponding to the summer weekend condition of the Base Year 2015

and Design year 2040 were utilized because it resulted in the worst-case (highest) traffic volumes. If the DHV forecast exceeded the LOS C volume for a roadway, then LOS C volumes were used for the noise analysis, otherwise DHV forecasts were used.

Modeled vehicle types include automobiles, medium trucks, and heavy trucks. Recreational vehicles that were included in the DHV forecasts along NC 12 were modeled as medium trucks in TNM. The predicted traffic volumes used for TNM model input are included in Appendix D.

**Table 3: Traffic Noise Model (TNM) Vehicle Classification Types**




Source: http://onlinemanuals.txdot.gov/txdotmanuals/tri/vehicle_classification_using_fhwa_13category_scheme.htm

## 7.2 Existing Noise Levels

Base Year 2015 noise levels were predicted at all noise-sensitive receptor locations within the Mid-Currituck Bridge project area using the validated TNM models and loudest-hour traffic volumes and speeds. The existing and proposed noise-sensitive land uses identified within each NSA (as defined in Section 1.3) are discussed below.

- **NSA 1**: Existing land uses within NSA 1 includes single family residences (Category B); tennis courts and a soccer field at the Currituck County Middle and High School, a library with an exterior use area (Category C); a medical facility and a place or worship without exterior use areas (Category D); a restaurant with exterior seating (Category E); offices without exterior use areas, retail, and warehousing (Category F); and undeveloped lands (Category G.) The noise-sensitive receptor locations within NSA 1 are located along US 158 (Caratoke Highway) and adjacent cross streets in Barco and Coinjock.

- **NSA 2**: Existing land uses within NSA 2 includes single family residences (Category B); retail and warehousing (Category F); and undeveloped lands (Category G.) The noise-sensitive receptor locations within NSA 2 are located along US 158 (Caratoke Highway) or adjacent cross streets in Coinjock.

- **NSA 3**: Existing land uses within NSA 3 include single family residences (Category B) and undeveloped lands (Category G.) The noise-sensitive receptor locations within NSA 3 are located along Lighthouse View and Narrow Shore Road in Aydlett.

- **NSA 4**: Existing land uses within NSA 4 include single family residences (Category B); pool and tennis courts (Category C); and undeveloped lands (Category G.) The noise-sensitive receptor locations within NSA 4 are located along Cane Garden Bay Circle, Corolla Drive, Pelican Court, Harbor View, Ocean Forest Court, Misty Pond Court, Sunset Crescent, Sea View Court, and Soundside Court in Corolla.

- **NSA 5**: Existing land uses within NSA 5 include single family residences (Category B); a pool, tennis courts, basketball courts, an outdoor mini golf course (Category C); restaurants with outdoor seating (Category E); and retail (Category F.) The noise-sensitive receptor locations within NSA 5 are located along Ocean Trail, Broad Street, W Meeting Street, and Orions Way in Corolla.

- **NSA 6**: Existing land uses within NSA 6 include single family residences (Category B); the Duck Woods County Club golf course (Category C); offices without exterior use areas and retail (Category F); and undeveloped lands (Category G.) The noise-sensitive receptor locations within NSA 6 are located along Birch Lane, Windsor Place, and Dogwood Trail in Kitty Hawk and Southern Shores.

Undeveloped land that is permitted for development is considered noise-sensitive and included in traffic noise assessments if a building permit for an individual lot or site is approved prior to the Date of Public Knowledge for the project. A land use review was completed as part of the FEIS Reevaluation in May 2017 and updated in March 2018 by reviewing building permit records supplied by Currituck and Dare Counties and investigating sites under construction during field review. Within the study area, the sites below were identified as having an approved building permit and included in the noise assessment.

- 112 Simpson Road, Barco (R-2 in NSA 1) – single-family residence
- 972 Ocean Forest Court, Corolla (R-183 in NSA 4) – single-family residence
- 969 Ocean Forest Court, Corolla (R-188 in NSA 4) – single-family residence
- 931 Soundside Court, Corolla (R-256 in NSA 4) – single-family residence

For this Traffic Noise Report, loudest-hour existing noise levels were identified as either the TNM-predicted noise levels based on existing loudest-hour traffic estimates, or the ambient noise levels

obtained by measurements at representative locations in the field.[1] Measured ambient noise levels were used for the traffic noise assessment at receptors represented by the long-term measurement locations discussed in Section 5.0 because the measured loudest-hour noise levels were higher than the TNM-predicted noise levels. Measured ambient noise levels were utilized for receptors R-93 – R-103 in Aydlett (NSA 3) and receptors R-178 and R-179 along Ocean Forest Court in Corolla (NSA 4). At all other receptor locations, the TNM-predicted loudest-hour existing noise levels were used in the assessment.

TNM-predicted 2015 Existing condition noise levels ranged from 37 to 76 dB(A) $L_{eq(h)}$. Existing noise levels are highest at first-row receptors within NSA 1 and NSA 2 due to the high existing traffic volumes and vehicle travel speeds along US 158. Existing noise levels are lowest at second- and third-row receptor locations in NSA 4 because the sites are well shielded from existing NC 12 traffic noise by building structures.

### 7.3 Future Noise Levels

Future Year 2040 No-Build noise levels were predicted by modifying the Existing condition TNM model to include traffic input data to correspond to future No-Build loudest-hour traffic conditions.

Predicted 2040 No-Build condition noise levels ranged from 38 to 77 dB(A) $L_{eq(h)}$. The predicted increase at individual receptor locations in 2040 No-Build condition noise levels above Existing condition noise levels ranged from 0 to 2 dB(A) $L_{eq(h)}$. The No-Build condition involves no improvements to existing roadways in NSAs 1 – 5, so increases in predicted No-Build condition noise levels at individual receptor locations relative to the Existing condition are solely due to increases in future loudest-hour traffic volumes in these areas. In NSA 6, along US 158 east of the Wright Memorial Bridge, the No-Build condition assumes US 158 would be a four-lane superstreet constructed by STIP Project R-3419. Thus, the predicted No-Build condition noise levels in this area also reflect the greater future traffic volumes that a four-lane superstreet roadway would facilitate.

Future Year 2040 Build noise levels were predicted by modifying the Existing condition TNM model roadways and terrain features, and adding new roadways and bridge structures based on the proposed preliminary roadway plans. The model was also updated to include traffic input data corresponding to future Build loudest-hour traffic conditions.

Predicted 2040 Build condition noise levels ranged from 38 to 77 dB(A) $L_{eq(h)}$. The predicted increase at individual receptor locations in 2040 Build condition noise levels above Existing condition noise levels ranged from 0 to 9 dB(A) $L_{eq(h)}$. The increases in predicted future Build condition noise levels relative to the Existing condition are due to several factors, including:

- Increased future loudest-hour traffic volumes throughout the project area;

[1] Per 23 CFR 772.5, existing noise levels are defined as "the worst noise hour resulting from the combination of natural and mechanical sources and human activity usually present in a particular area." If the TNM-predicted existing loudest-hour *traffic* noise levels are lower than the hourly-equivalent noise levels obtained in the field, then existing noise levels are assessed as the latter.

- Proposed widening of existing US 158 and NC 12 roadways in NSAs 2 and 4; and
- Proposed addition of the new interchange, roadway, bridges, and roundabout between US 158 and NC 12 in NSAs 2, 3 and 4.

2040 Build condition noise levels are also predicted to be up to 4 dB(A) $L_{eq(h)}$ lower than Existing condition noise levels at some receptors in NSA 4. This is due to the decrease in vehicle travel speeds for the proposed 4-lane section of NC 12 near the roundabout compared to the existing 2-lane roadway. The existing posted speed limit in this area is 45 mph and the proposed posted speed limit is 30 mph.

## 8.0 TRAFFIC NOISE IMPACTS AND NOISE CONTOURS

Traffic noise impacts occur when the predicted traffic noise levels either: (1) approach or exceed the FHWA noise abatement criteria (with "approach" meaning within 1 dB(A) of the NAC values listed in Table 2), or (2) substantially exceed the existing noise levels in the design year by 10 dB(A) or greater. FHWA and NCDOT require that feasible and reasonable measures be considered to abate traffic noise at all predicted traffic noise impact locations. Measures considered include highway alignment selection, traffic systems management, buffer zones, noise walls, and earthen berms.

As shown in Table 4, traffic noise levels are predicted to cause 59 impacts in the 2040 Build condition. 55 impacts are predicted at Category B (residential) receptor locations and 4 impacts are predicted at Category C (recreational and library) receptor locations. All impacts are due to future noise levels exceeding the NAC and no receptors are predicted to experience an impact due to a substantial increase in noise levels.

Impacted receptors are identified in the noise level results table in Appendix B as cells highlighted red and shown on Figures 2-1 thru 2-18 with either a red or blue circle, depending on whether the receptor is also benefited by a potential noise barrier.

**Table 4: Traffic Noise Impact Summary for the 2040 Build Condition**

| REASON FOR NOISE IMPACT | SUMMARY OF IMPACTED RECEPTORS[7] 2040 BUILD CONDITION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | BY ACTIVITY CATEGORY | | | | | | | |
| | A | B | C | D | E | F[5] | G[6] | ALL ACTIVITY CATEGORIES |
| Based on NAC Criteria Only[1] | 0 | 55 | 4 | 0 | 0 | 0 | 0 | 59 |
| Based on Substantial Increase Criteria Only[2] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Based on Both Criteria[3] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL IMPACTS[4] | 0 | 55 | 4 | 0 | 0 | 0 | 0 | 59 |

Note 1: Predicted traffic noise level impacts due to design year worst hour build-condition noise levels approaching or exceeding the NCDOT Noise Abatement Criteria (NAC)

Note 2: Predicted design year worst hour noise levels exceeding existing worst hour noise levels by 10 dB(A) or greater. (NCDOT Substantial Increase Criteria).

Note 3: Predicted traffic noise level impacts due to both 1 and 2 above.

Note 4: Only one of the Note 1 and Note 2 conditions must be met for an impact to exist.

Note 5: There are no impact criteria for land use facilities in this activity category and no analysis of noise impacts is required.

Note 6: There are no impact criteria for undeveloped lands but some noise levels may need to be provided to local officials to aid them in future land use planning efforts.

Note 7: Values noted for Activity Category C, D, and E represent Equivalent Receptor values for these non-residential land uses.

Predicted 2040 Build condition traffic noise level contours are not a definitive means by which to assess traffic noise level impacts; however, they can aid in future land use planning efforts in presently undeveloped areas. Due to the variety of future traffic conditions and roadway sections for this project, noise level contours vary throughout the project area. Correlating to the traffic noise impact thresholds for FHWA NAC "B" and "E" land uses, respectively, the 66 and 71 dB(A) noise level contour distances for the Mid-Currituck Bridge project are shown in Table 5.

**Table 5: Design Year 2040 Noise Contours**

| Location | Distance to Noise Level Contour (feet) [1] | |
|---|---|---|
| | 66 dB(A) | 71 dB(A) |
| NSA 1, east of US 158 | 200 | 75 |
| NSA 2, east of US 158 and north of interchange | 225 | 125 |
| NSA 2, east of US 158 NB on-ramp | 175 | 75 |
| NSA 2, east of US 158 NB off-ramp | 200 | 100 |
| NSA 2, west of US 158 and south of interchange | 100 | 25 |
| NSA 3, south of proposed roadway in Aydlett | 75 | 25 |
| NSA 4, west of NC 12 and north of roundabout | 75 | 25 |
| NSA 4, north of roadway between MCB and roundabout | 25 | 10 |

| Location | Distance to Noise Level Contour (feet) [1] | |
|---|---|---|
| | 66 dB(A) | 71 dB(A) |
| NSA 4, east of NC 12 and south of roundabout | 25 | 10 |
| NSA 6, south of US 158 | 150 | 75 |

1 The contour distance is from the proposed edge of the nearest travel lane.

Per 23 CFR 772.9(c) and NCDOT Policy, noise contour lines shall not be used for determining highway traffic noise impacts. However, the 71 dB(A) and 66 dB(A) noise level contour information could assist local authorities in exercising control over the remaining undeveloped lands in order to avoid creating incompatible situations involving new developments adjacent to the roadways.

## 9.0 POTENTIAL TRAFFIC NOISE ABATEMENT MEASURES

FHWA and NCDOT require that feasible and reasonable noise abatement measures be considered and evaluated for the benefit of all predicted Build condition traffic noise impacts. Feasibility and reasonableness are distinct, well defined, and separate considerations. Feasibility is the consideration of whether noise abatement measures *can* be implemented. Reasonableness is the consideration of whether noise abatement measures *should* be implemented. Per NCDOT Policy, the following traffic noise abatement measures may be considered: highway alignment selection, traffic systems management, buffer zones, noise barriers (earthen berms and noise walls), and noise insulation of Activity Category D land use facilities.

### 9.1 Highway Alignment Selection

Highway alignment selection for traffic noise abatement purposes involves modifying the horizontal and vertical geometry of the proposed roadway(s) to minimize traffic noise affecting noise-sensitive receptors. The selection of alternative alignments for noise abatement purposes must consider the balance between noise impacts and other engineering and environmental factors. This abatement option was not considered practicable because several portions of the project are widening existing roadways in developed areas with limited space available to shift the roadway alignment. Additionally, bridge alignment alternatives have been studied as part of prior environmental documents (DEIS and FEIS) and the current alignment has been selected to minimize overall environmental impacts.

### 9.2 Traffic System Management Measures

Traffic management measures such as prohibition of heavy truck traffic, lowering speed limits, limiting of traffic volumes, and/or limiting time of operation were considered as possible traffic noise impact abatement measures. However, part of the purpose of the Mid-Currituck Bridge project is to improve traffic flow and reduce travel times along between the Currituck County mainland and the Currituck County Outer Banks. The prohibition of certain vehicle types, reduction of the existing or future speed limit, or limiting of overall traffic volumes on US 158 or NC 12 would not support the purpose of the project, and are thus not considered practicable.

## 9.3 Buffer Zones

Buffer zones are typically not practical and/or cost effective for noise abatement due to the substantial amount of right-of-way required, and would not be a feasible noise abatement measure for this project due to the proximity of existing development to the right of way. Furthermore, if the acquisition of a suitable buffer zone had been feasible, the associated costs would exceed the NCDOT reasonable abatement cost threshold per benefited receptor.

## 9.4 Noise Barriers

Physical barriers, walls and berms can be an effective means of noise abatement because they reduce the amount of sound energy that reaches a receptor by extending the source-to-receptor sound transmission path and prevent people from seeing the noise source in question.

Highway noise barriers are primarily constructed as earthen berms or solid-mass walls adjacent to limited-access freeways that are near noise-sensitive land use(s). To be effective, a noise barrier must long enough and tall enough to shield the impacted receptor(s). Generally, the noise barrier length must extend in each direction by at least four-times the distance from the barrier to the receptor. For example, if a receptor is 200 feet from the roadway, an effective barrier would be approximately 1,600 feet long – with the receptor in the horizontal center. Assuming a suitable barrier length can be achieved, then the most important factor determining the noise reduction effectiveness of a barrier will be its height.

A noise barrier should be tall enough to block the line-of-sight between the noise source(s) and the receptor(s), keeping in mind that heavy truck exhaust stacks can extend to a height of 12 feet above pavement. Blocking the line-of-sight will result in a noise reduction of approximately 5 decibels. Increasing the height of a barrier will improve its noise reduction performance at a rate of approximately 2 decibels for every 3 feet of additional height.

In the case of highways with direct access for driveways, noise barriers are typically not feasible because the openings render the barrier ineffective in impeding the transmission of traffic noise. Moreover, the barriers could pose a risk from the driver's visibility perspective. Due to the requisite lengths for effectiveness, noise barriers are typically determined to not be economically justified in cases involving isolated or sporadically developed areas. This is often due to not having enough receptors that could potentially be benefited by the barrier to adequately distribute the barrier cost.

Consideration for noise abatement measures was given to all impacted receptors. The project corridor was analyzed for areas where there were traffic noise impacts from the proposed project and where sufficient area to locate a barrier, if deemed feasible and reasonable, exists. The noise barrier analyses for each NSA are discussed below and additional details can be found in Table 6 and Appendix E.

- NSA 1 – Fifty-two (52) residences, a sports field, and a library without outdoor use were identified as impacted and noise barriers were evaluated at three locations in NSA 1.

  There is frequent direct-access to US 158 in NSA 1 from residential driveways, side streets, or parking lots as can be seen in Figures 2-1 to 2-5. Noise barriers for impacted receptors R-4, R-7 – R-12, R-14 – R-21, R-23 – R-25, R-27 – R-34, R-36 – R-45, R-47, R-49 – R-55, and R-58 – R-62 were determined not to be feasible because a barrier would adversely impact property access. In addition, many of the impacted receptors are isolated and a single noise barrier would not be able to benefit two impacted receptors. Therefore, these sites are not eligible for noise abatement and noise abatement is Unlikely.

  -NW1.1- was evaluated to provide noise abatement for two impacted residential receptors (R-3 and R-5) west of US 158 to the north of Swains Lane, as shown in Figure 2-1. A 17-foot tall and 396-foot long wall would benefit both impacts with an average of 3,366 square-feet per benefitted receptor. -NW1.1- was found to meet NCDOT feasibility criteria but did not meet NCDOT criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Thus, this site is not eligible for noise abatement and noise abatement is Unlikely.

  -NW1.2- was evaluated to provide noise abatement for the impacted Currituck County High School tennis courts and soccer field (R-35 receptor array) to the east of US 158, as shown in Figure 2-3. Equivalent Receptors (ERs) are used to represent non-residential land uses such as sports fields. The calculation of Equivalent Receptors for this site can be found in Appendix B. The ER calculations show that this site has an ER value of 2. A 13-foot tall and 848-foot long wall would benefit 2 ERs with an average of 5,512 square-feet per benefitted receptor. -NW1.2- was found meet NCDOT feasibility criteria but did not meet criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Therefore, this site is not eligible for noise abatement and noise abatement is Unlikely.

  -NW1.3- was evaluated to provide noise abatement for two impacted residences (R-63 and R-65) along Worth Guard Road directly east of US 158, as shown in Figure 2-5. A 9-foot tall and 602-foot long wall would benefit both impacts with an average of 2,709 square-feet per benefitted receptor. -NW1.3- was found to meet NCDOT feasibility criteria but did not meet criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Thus, this site is not eligible for noise abatement and noise abatement is Unlikely.

- NSA 2 – Two residences (R-84 and R-91) were identified as impacted in NSA 2. Both residences, shown in Figures 2-9 and 2-10, are isolated from other impacted receptor locations. A noise barrier at either site would not be able to benefit at least two impacted receptors, so noise barriers were determined not to be feasible per NCDOT policy.

Therefore, these sites are not eligible for noise abatement and noise abatement is Unlikely.

- NSA 3 – No sites were identified as impacted in NSA 3, so this area is not eligible for noise abatement.

- NSA 4 – One (1) residence and a community pool were identified as impacted in NSA 4. The impacted residence (R-173), shown in Figure 2-15, is isolated from other impacted locations. A noise barrier at this site would not be able to benefit at least two impacted receptors, so a noise barrier was determined not to be feasible per NCDOT policy. Therefore, this site is not eligible for noise abatement and noise abatement is Unlikely.

  The impacted pool (R-225), shown in Figure 2-16, is located west of NC 12 north of Bonita Street/Monteray Drive. The receptor is 300-feet south of the NC 12 project improvement limits. There are no differences between the NC 12 roadway design or traffic forecasts for the Existing, No Build, and Build conditions in this area. Further, no increase in Build condition noise level relative to the Existing condition is predicted at this receptor. Therefore, the noise impact at this site has been determined not to be caused by the project, so this site is not eligible for noise abatement and noise abatement is Unlikely.

- NSA 5 – No sites were identified as impacted in NSA 5, so this area is not eligible for noise abatement.

- NSA 6 – A section of the Duck Woods Country Club golf course (R-282 receptor array) was identified as impacted in NSA 6. This site can be seen in Figure 2-18. Equivalent Receptors (ERs) are used to represent non-residential land uses such as golf courses. The calculation of Equivalent Receptors for this site can be found in Appendix B. The ER calculations show that this site has an ER value of 1. A noise barrier at this site would not be able to benefit at least two receptors, so a noise barrier was determined not to be feasible per NCDOT policy. Therefore, this site is not eligible for noise abatement and noise abatement is Unlikely.

**Table 6: Preliminary Noise Wall Evaluation Results**

| Noise Barrier Location | Length / Height (feet) | Surface Area (sq-ft) | Number of Benefited Receptors | Square Feet per Benefited Receptor / Allowable Square Feet per Benefited Receptor | Preliminarily Recommended for Construction |
|---|---|---|---|---|---|
| NSA 1 / -NW1.1- | 396 / 17 | 6,732 | 2 | 3,366 / 1,500 | No |
| NSA 1 / -NW1.2- | 848 / 13 | 11,024 | 2 | 5,512 / 1,500 | No |
| NSA 1 / -NW1.3- | 602 / 9 | 5,418 | 2 | 2,709 / 1,500 | No |

None of the noise abatement measures evaluated in this Traffic Noise Report meet the feasible and reasonable criteria detailed in the NCDOT Policy. Consequently, no traffic noise abatement measures are recommended for incorporation into the project plan.

## 9.5 Noise Insulation

Two interior noise-sensitive land uses (activity category D) are located along the project corridor within NSA 1. The NAC D land uses described below were evaluated for interior noise levels because outdoor use areas were not identified in the field:

- Albtuck Family Medical and Care, a medical facility located at 4039 Caratoke Highway, is predicted to be exposed to a Build noise level of 68 dB(A) $L_{eq(h)}$ at the exterior of the building. There is no outdoor use area associated with the facility. When Building Noise Reduction Factors are applied assuming a masonry structure and single glazed windows, as shown in Table 7, the interior sound level of 43 dB(A) is not an impact based on NAC activity category D.

- New Life of Currituck Church, located at 4143 Caratoke Highway, is predicted to be exposed to a Build noise level of 72 dB(A) $L_{eq(h}$ at the exterior of the church. There is no outdoor recreation area associated with the church. When Building Noise Reduction Factors are applied assuming a masonry structure and single glazed windows, as shown in Table 7, the interior sound level of 47 dB(A) is not an impact based on NAC activity category D.

Since no activity category D traffic noise impacts are predicted to occur for the Mid-Currituck Bridge project, interior noise insulation was not considered as a potential traffic noise abatement measure.

**Table 7: Building Reduction Factors**

| Building Type | Window Condition | Noise Reduction Due to Exterior of the Structure |
|---|---|---|
| All | Open | 10 dB(A) |
| Light Frame | Ordinary Sash (closed) | 20 dB(A) |
| | Storm Windows | 25 dB(A) |
| Masonry | Single Glazed | 25 dB(A) |
| | Double Glazed | 35 dB(A) |

Source: FHWA-PD-96-046, Measurement of Highway Related Noise, Final Report, May 1996.

## 10.0 CONSTRUCTION NOISE

Construction activities associated with this project are expected to include earth removal, hauling, grading, paving, and pile driving. Typical construction noise emission levels for these activities are presented in Table 8.

Temporary and localized construction noise impacts may occur because of earth removal, hauling, grading and paving activities. During daytime hours, the potential effects of these impacts would be temporary speech interference for passers-by and those individuals living or working near the project.

For this project, earth removal, grading, hauling, and paving is expected to occur in the near vicinity of several residential areas:

- Residences along US 158 near Young Road and Aydlett Road in Coinjock (NSA 2), in proximity to the proposed US 158 interchange construction.
- Residences along Lighthouse View and Narrow Shore Road in Aydlett (NSA 3), to the north and south of the proposed roadway construction between the bridges over Maple Swamp and Currituck Sound.
- Residences to the east and west of NC 12 in Corolla (NSA 4), between Harbor View and Herring Street near the proposed widening of NC 12 and roundabout construction.

Extremely loud construction noise activities such as usage of pile-drivers to install structural piles and impact-hammers (jack hammer, hoe-ram) could cause temporary, sporadic and acute construction noise impacts at nearby noise-sensitive locations.

Pile driving as part of construction of the Maple Swamp Bridge and the Mid-Currituck Bridge is expected to occur in the near vicinity of several residential areas:

- Residences along Lighthouse View and Narrow Shore Road in Aydlett (NSA 3), to the north and south of the proposed Maple Swamp Bridge and Mid-Currituck Bridge alignments.
- Residences along Ocean Forest Court and Cruz Bay Lane in Corolla (NSA 4), near the proposed Mid-Currituck Bridge terminus at the eastern shore of Currituck Sound.

Because existing noise levels are relatively low in the residential areas near the proposed pile driving activities, there is a likelihood that pile driving will result in construction noise levels that are significantly higher than existing ambient noise levels in these areas.

Generally, low-cost and easily implemented construction noise control measures should be incorporated into the project plans and specifications (e.g. work-hour limits, equipment exhaust muffler requirements, haul-road locations, elimination of “tail gate banging”, ambient-sensitive backup alarms, construction noise complaint mechanisms, and consistent and transparent community communication and rapport).

Although construction noise impact abatement should not place an undue burden upon the financial cost of the project or the project construction schedule, pursuant to the requirements of 23 CFR 772.19, it is the recommendation of this Traffic Noise Report that:

- Earth removal, grading, hauling, paving, and pile driving activities near the residential areas noted above should be limited to weekday daytime hours.
- If meeting the project schedule requires that earth removal, grading, hauling, paving and/or pile driving must occur during evening, nighttime and/or weekend hours near the residential areas noted above, the Contractor shall notify NCDOT as soon as possible. In such instance(s), all reasonable attempts shall be made to notify and to make appropriate arrangements for the abatement of the predicted construction noise impacts upon the affected property owners and / or residents.
- If construction activities must occur during context-sensitive hours near noise-sensitive areas, discrete construction noise abatement measures including, but not limited to portable noise barriers, equipment-quieting devices such as noise attenuating enclosures or resilient pile caps (to mitigate pile-driving noise), or the use of alternative (quieter) equipment or construction techniques, shall be considered.

For additional information on construction noise, please refer to the FHWA Construction Noise Handbook (FHWA-HEP-06-015) and the Roadway Construction Noise Model (RCNM), available online at: http://www.fhwa.dot.gov/environment/noise/cnstr_ns.htm.

**Table 8: Construction Equipment Typical Noise Level Emissions[1]**

| Equipment | Noise Level Emissions (dB(A)) at 50 Feet From Equipment[2] (70, 80, 90, 100) |
|---|---|
| Pile Driver[3] | |
| Jack Hammer | |
| Tractor | |
| Road Grader | |
| Backhoe | |
| Truck | |
| Paver | |
| Pneumatic Wrench | |
| Crane | |
| Concrete Mixer | |
| Compressor | |
| Front-End Loader | |
| Generator | |
| Saws | |
| Roller (Compactor) | |

1. Adapted from *Noise Construction Equipment and Operations, Building Equipment, and Home Appliances*. U.S. Environmental Protection Agency. Washington D.C. 1971.
2. Cited noise level ranges are typical for the respective equipment. For "point sources" such as the construction equipment listed above, noise levels generally dissipate at a rate of -6 dB(A) for every doubling of distance. For example, if the noise level from a pile driver at a distance of 50 feet = 100 dB(A), then at 400 feet, it might be 82 dB(A) or less.
3. Due to project safety and potential construction noise concerns, pile driving activities are typically limited to daytime hours.

## 11.0 NOISE-COMPATIBLE LAND USE

One of the most effective means to prevent future traffic noise impacts is noise-sensitive land use development. The compatibility of highways and neighboring local areas is essential for continued growth, and can be achieved if local governments and developers require and practice noise-sensitive land use planning. Although regulation of land use is not within the purview of FHWA

or NCDOT, some widely accepted techniques for noise-sensitive land use planning near existing and proposed highway facilities include:

- Locating retail, industrial, manufacturing, and other noise-compatible land uses adjacent to highways
- Incorporating effective traffic noise mitigating features, such as earth berms and solid-mass noise walls, as part of residential developments
- Utilization of noise-sensitive architectural design and site planning, such as the orientation of quiet spaces away from roadways
- Required use of sound insulating building materials and construction methods

As indicated in the NCDOT Traffic Noise Policy (October 6, 2016), local jurisdictions with zoning control should use the information contained in this report to develop policies and/or ordinances to limit the growth of noise-sensitive land uses located adjacent to roadways. Furthermore, NCDOT encourages the dissemination of this information to all people who may be affected by, or who might influence others affected by, traffic noise.

## 12.0 CONCLUSION

Traffic noise and temporary construction noise can be a consequence of transportation projects, especially in areas near high-volume and high-speed roadways. This Traffic Noise Report utilized computer models created with the FHWA Traffic Noise Model software (TNM 2.5), validated to field-collected traffic noise monitoring data, to predict future noise levels and define impacted receptors along the proposed new highway project.

For Design Year 2040 traffic volumes the Build condition is predicted to create 59 traffic noise impacts. Furthermore, construction noise impacts – some of them potentially substantial – may occur due to the proximity of numerous noise-sensitive receptors to project construction activities. It is the recommendation of this Traffic Noise Report that all reasonable efforts should be made to minimize exposure of noise-sensitive areas to construction noise impacts.

Consideration for noise abatement measures was given to all impacted receptors. However, none of the traffic noise abatement measures considered in this Traffic Noise Report meet the feasible and reasonable criteria detailed in the NCDOT Policy. Consequently, no traffic noise abatement measures are recommended for incorporation into the project plan. Additional traffic noise analysis will not be necessary during project final design unless modifications to the proposed roadway design occur, additional alignments are considered, or changes to Design Year 2040 traffic volumes are predicted.

## 13.0 REFERENCES

Federal Highway Administration. *Analysis of Highway Construction Noise*. 1984.

Federal Highway Administration. CFR 23 Part 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise. [75 FR 39820-39838, July 13, 2010].

Federal Highway Administration. *Highway Traffic Noise Analysis and Abatement Policy and Guidance*. December 2011.

Federal Highway Administration. *FHWA Traffic Noise Model User's Guide*. April 2004.

Federal Highway Administration. *Recommended Best practices for the Use of the FHWA Traffic Noise Model (TNM)*. December 8, 2015.

Lee, Cynthia S.Y. and Fleming, Gregg G. *Measurement of Highway-Related Noise*. U.S. Department of Transportation Research and Special Programs Administration John A. Volpe National Transportation Systems Center Acoustics Facility, DTS-75. Cambridge, MA. May 1996.

North Carolina Department of Transportation. *Traffic Noise Policy*. *October 6, 2016.*

North Carolina Department of Transportation. *Traffic Noise Manual*. *October 6, 2016.*

Parsons Brinckerhoff. *Mid-Currituck Bridge Study, Traffic Noise Technical Report.* November 2009.

Parsons Brinckerhoff. *Mid-Currituck Bridge Study, Traffic Noise Technical Report Addendum.* November 2011.

Transportation Research Board NCHRP Report 791. *Supplemental Guidance on the Application of FHWA's Traffic Noise Model (TNM)*. August 2014.

U.S. Environmental Protection Agency. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. Washington, D.C. 1971.

WSP. *Mid-Currituck Bridge Study, Reevaluation of Final Environmental Impact Statement (Draft Report).* May 2018.

WSP-Parsons Brinckerhoff. *Mid-Currituck Bridge Study, Project Level Traffic Forecast Report*. June 2016.

# FIGURES

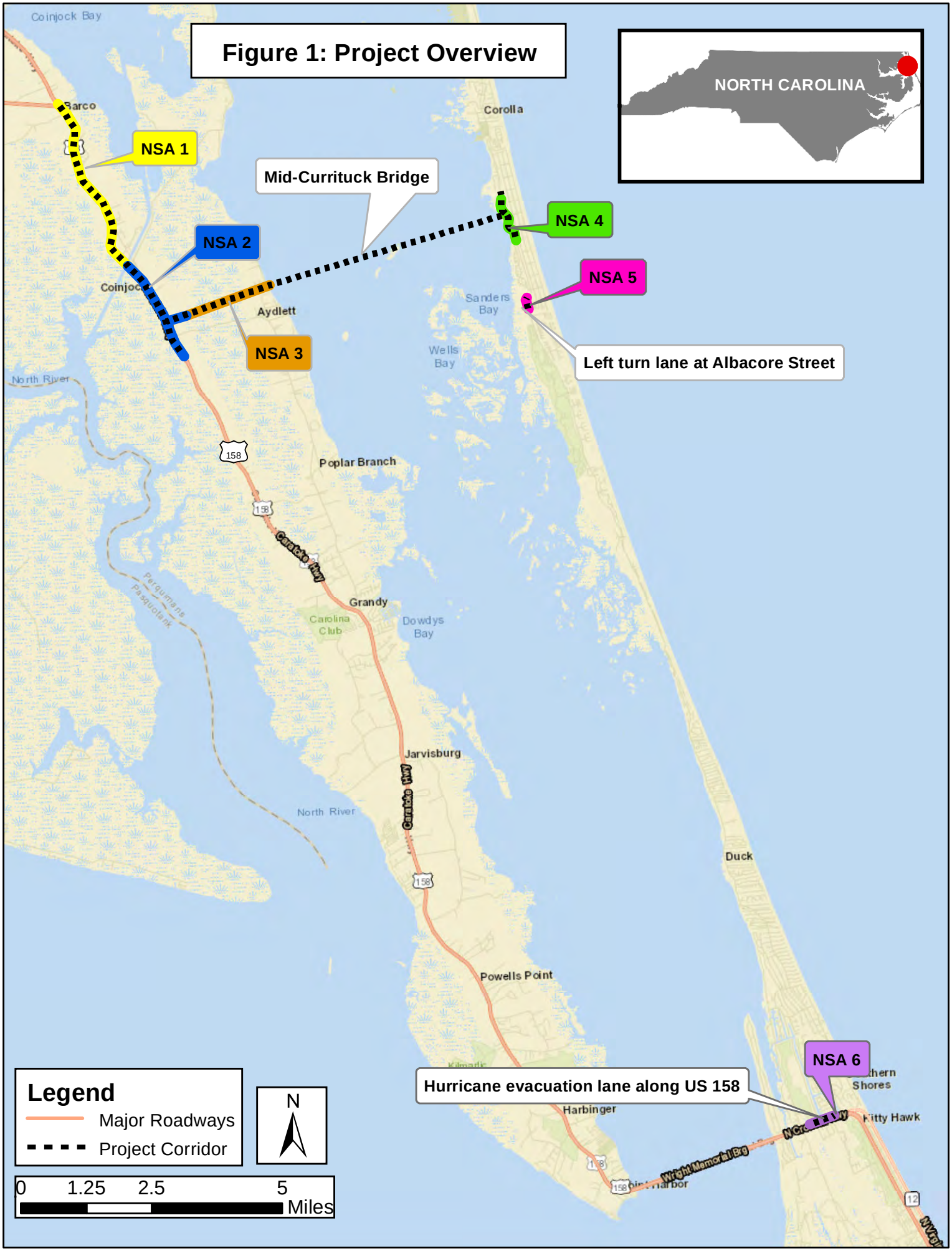


Figure 1: Project Overview
NORTH CAROLINA
NSA 1
NSA 2
NSA 3
NSA 4
NSA 5
NSA 6
Mid-Currituck Bridge
Left turn lane at Albacore Street
Hurricane evacuation lane along US 158
Coinjock Bay
Sarco
Corolla
Coinjock
Aydlett
Sanders Bay
Wells Bay
North River
Poplar Branch
Grandy
Carolina Club
Dowdys Bay
Jarvisburg
Duck
Powells Point
Harbinger
Kitty Hawk
Legend
Major Roadways
Project Corridor
N
0 1.25 2.5 5 Miles

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-1**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-2**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-3**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-4**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-5**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-6**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-7**
**Noise Study Area 1**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-8**
**Noise Study Area 2**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Right-of-Way Acquisition
Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**

Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

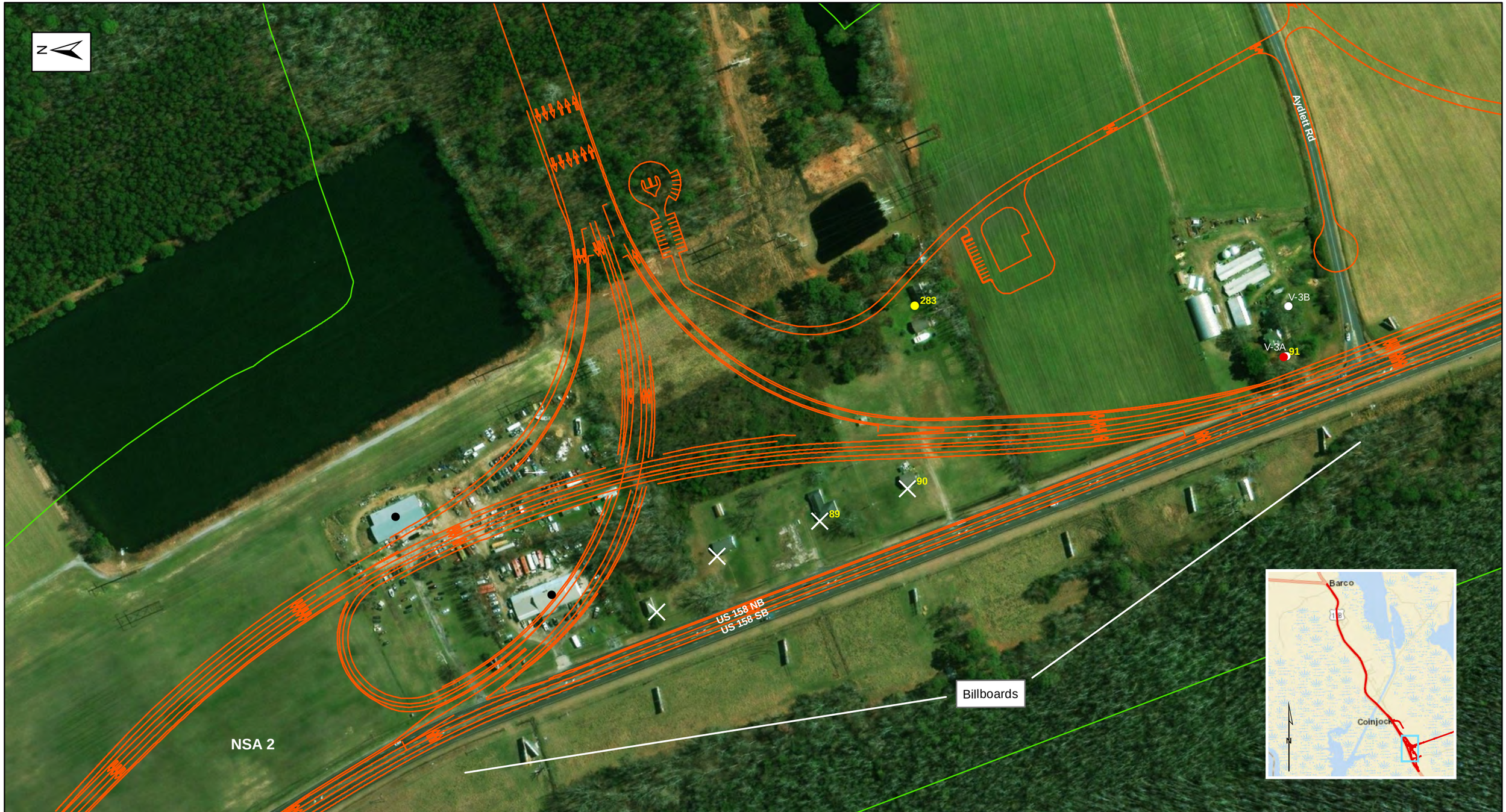
**Preliminary Evaluated Noise Barriers**

Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-9**
**Noise Study Area 2**
**Noise Receptors, Measurement Locations, and Build Alternative Results**




**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Right-of-Way Acquisition
Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-10**
**Noise Study Area 2**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-11**
**Noise Study Area 2**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-12**
**Noise Study Area 3**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-13**
**Noise Study Area 3**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-14**
**Noise Study Area 3**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

- Project Improvements
- Study Area Limits
- Noise Measurement Location
- Non Noise Sensitive Properties

**Noise Receptors**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**

- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-15**
**Noise Study Area 4**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

**LEGEND**

- Project Improvements
- Study Area Limits
- Noise Measurement Location
- Non Noise Sensitive Properties

**Noise Receptors**

- Impacted & Benefited
- Impacted & Not Benefited
- Not Impacted & Benefited
- Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**

- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-16**
**Noise Study Area 4**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-17**
**Noise Study Area 5**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

**Mid-Currituck Bridge**
**TIP Project R-2576**
**Currituck and Dare Counties**

**North Carolina Department of Transportation**

Project Improvements
Study Area Limits
Noise Measurement Location
Non Noise Sensitive Properties

**Noise Receptors**
Impacted & Benefited
Impacted & Not Benefited
Not Impacted & Benefited
Not Impacted & Not Benefited

**Preliminary Evaluated Noise Barriers**
Feasible and Reasonable
Feasible and Not Reasonable
Not Feasible

0 100 200 400 Feet

**Mid-Currituck Bridge**
**Traffic Noise Report**

**Figure 2-18**
**Noise Study Area 6**
**Noise Receptors, Measurement Locations, and Build Alternative Results**

# Appendix A

# AMBIENT NOISE LEVEL MEASUREMENTS

**Table A-1: Mid-Currituck Bridge Study**
**Measured Ambient Equivalent Noise Levels, $L_{eq}$ in dB(A)**

| Setup | Receptor | Land Use/ Activity Category | Roadway Noise Source(s)[1] | Start / Stop Time | Measured $L_{eq}$ (dB(A)) |
|---|---|---|---|---|---|
| V-1 | V-1A | Residential/B | US 158 | 1:40 PM - 2:00 PM | 69.2 |
| | V-1B | Residential/B | | | 61.4 |
| | V-1C | Residential/B | | | 57.9 |
| V-2 | V-2A | Residential/B | US 158 | 2:48 PM - 3:08 PM | 64.8 |
| | V-2B | Residential/B | | | 59.2 |
| | V-2C | Residential/B | | | 59.0 |
| V-3 | V-3A | Residential/B | US 158, Aydlett Rd | 9:52 AM - 10:12 AM | 62.3 |
| | V-3B | Residential/B | | | 55.6 |
| V-4 | V-4A | Residential/B | US 158 | 10:35 AM - 10:55 AM | 58.2 |
| | V-4B | Residential/B | | | 52.3 |
| | V-4C | Residential/B | | | 48.3 |
| V-5 | V-5A | Residential/B | US 158, Duck Woods Drive | 3:55 PM - 4:15 PM | 68.2 |
| | V-5B | Residential/B | | | 59.3 |
| V-7 | V-7A | Residential/B | NC 12, N Harbor View | 11:18 AM - 11:38 AM | 57.2 |
| | V-7B | Residential/B | | | 45.4 |
| | V-7C | Residential/B | | | 43.0 |
| V-8 | V-8A | Residential/B | NC 12, Albacore Street | 12:35 AM - 12:55 AM | 51.1 |
| | V-8B | Residential/B | | | 47.7 |
| V-9 | V-9A | Residential/B | NC 12 | 4:04 PM - 4:24 PM | 55.6 |
| | V-9B | Residential/B | | | 43.8 |
| | V-9C | Residential/B | | | 39.8 |

1. For each Setup, noise meters were located at logical locations for the assessment of existing highway traffic noise.
2. Noise measurement at Setup V-6 (Currituck County Middle/High School soccer field) is not included because the measurement was stopped after 16-minutes due to instrument power failure and it was determined there is sufficient coverage of the study area from other measurement sites.

**Table A-2: Mid-Currituck Bridge Study Noise Monitoring Sessions Weather Data[1]**

| Setup | Temp. (ºF) | Wind Speed (mph) | Relative Humidity | Precip. (in) |
|---|---|---|---|---|
| V-1 | 60 | 0 - 5 | 51% | N/A |
| V-2 | 63 | 1 – 5 | 46% | N/A |
| V-3 | 54 | 2 – 7 | 40% | N/A |
| V-4 | 54 | 6 – 9 | 49% | N/A |
| V-5 | 56 | 0 – 2 | 52% | N/A |
| V-7 | 59 | 0 – 5 | 47% | N/A |
| V-8 | 60 | 0 – 5 | 46% | N/A |
| V-9 | 61 | 0 – 5 | 61% | N/A |

1. Source: Field measurements using hand-held anemometer (Kestrel 3000).

**Figure A.1: Ambient Noise Monitoring Setup 1, Receptor V-1A**

**Figure A.2: Ambient Noise Monitoring Setup 1, Receptor V-1B**

**Figure A.3: Ambient Noise Monitoring Setup 1, Receptor V-1C**

**Figure A.4: Ambient Noise Monitoring Setup 2, Receptor V-2A**

**Figure A.5: Ambient Noise Monitoring Setup 2, Receptor V-2B**

**Figure A.6: Ambient Noise Monitoring Setup 2, Receptor V-2C**

**Figure A.7: Ambient Noise Monitoring Setup 3, Receptor V-3A**

**Figure A.8: Ambient Noise Monitoring Setup 3, Receptor V-3B**

**Figure A.9: Ambient Noise Monitoring Setup 4, Receptor V-4A**

**Figure A.10: Ambient Noise Monitoring Setup 4, Receptor V-4B**

**Figure A.11: Ambient Noise Monitoring Setup 4, Receptor V-4C**

**Figure A.12: Ambient Noise Monitoring Setup 5, Receptor V-5A**

**Figure A.13: Ambient Noise Monitoring Setup 5, Receptor V-5B**

**Figure A.14: Ambient Noise Monitoring Setup 7, Receptor V-7A**

**Figure A.15: Ambient Noise Monitoring Setup 7, Receptor V-7B**

**Figure A.16: Ambient Noise Monitoring Setup 7, Receptor V-7C**

**Figure A.17: Ambient Noise Monitoring Setup 8, Receptor V-8A**

**Figure A.18: Ambient Noise Monitoring Setup 8, Receptor V-8B**

**Figure A.19: Ambient Noise Monitoring Setup 9, Receptor V-9A**

**Figure A.20: Ambient Noise Monitoring Setup 9, Receptor V-9B**

**Figure A.21: Ambient Noise Monitoring Setup 9, Receptor V-9C**

**Figure A.22: Long-Term Ambient Noise Monitoring Site LT-1, 115 Lighthouse View, Aydlett**

**Figure A.23: Long-Term Ambient Noise Monitoring Site LT-2, 358 Narrow Shore Road, Aydlett**

**Figure A.24: Long-Term Ambient Noise Monitoring Site LT-3, 983 Ocean Forest Court, Corolla**

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-1~~A~~ : Sam Wilkins Ln

**DATE:** 2/20/18 **STAFF:** Poling/Green

| MEAS NO | V-1A | V-1B | V-1C |
|---|---|---|---|
| START TIME | 1:40 PM | | |
| END TIME | 2:00 PM | | |
| INSTRUMENT | BK 2250 | LD LXT | BK 2238 |
| BATTERY | | | |
| LEQ | 69.2 | 61.4 | 57.9 |
| CAL CHECK | 94.0 / 93.9 | 94.0 / 94.0 | 94.0 / 93.9 |

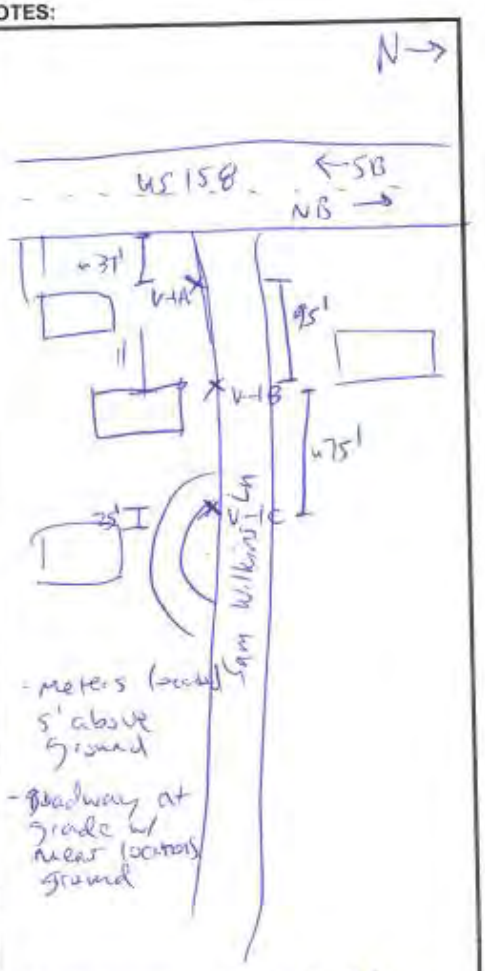
**TRAFFIC**

| | | | |
|---|---|---|---|
| ROADWAY | US 158 NB – near | | |
| VEH SPEED | 45 mph – 50 mph | | |
| AUTO | 152 | | |
| MT | 7 | | |
| HT | 7 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | US 158 SB – far | | |
| VEH SPEED | 45 mph – 50 mph | | |
| AUTO | 116 | | |
| MT | 7 | | |
| HT | 4 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | | | |
| VEH SPEED | | | |
| AUTO | 152 | | |
| MT | 7 | | |
| HT | 7 | | |
| BUS | 0 | | |
| MOTO | 0 | | |

**WEATHER**

| | |
|---|---|
| GENERAL | overcast |
| TEMP | 60°F |
| % RH | 51% |
| WIND | 0-5 mph |
| ROAD COND. | dry |

**NOTES:**




- meters (each) 5' above ground
- Roadway at grade w/ near location ground

Noise Sources: US 158 traffic, birds,

Traffic is free flowing at speed limit of 45 mph, possibly 50 mph.

**INSTRUMENTS:**

BK 2250 – Project 002
LD LXT – Lxt Data.005
BK 2238 – 004-026

– no events to note during measurements

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-2 : Simmons Rd

**DATE:** 2/26/18 **STAFF:** Poling / Green

| MEAS NO | V-2A | V-2B | V-2C |
|---|---|---|---|
| START TIME | 2:48 PM | | |
| END TIME | 3:08 PM | | |
| INSTRUMENT | BK 2250 | LD LxT | BK 2238 |
| BATTERY | | | |
| LEQ | 64.8 | 59.2 | 59.0 |
| CAL CHECK | 93.9 / 93.9 | 94.0 / 94.0 | 93.9 / 93.9 |

**TRAFFIC**

| | | | |
|---|---|---|---|
| ROADWAY | US 158 NB - far | | |
| VEH SPEED | 45-50 mph | | |
| AUTO | 159 | | |
| MT | 7 | | |
| HT | 5 | | |
| BUS | 1 | | |
| MOTO | 6 | | |
| ROADWAY | US 158 SB - near | | |
| VEH SPEED | 45-50 mph | | |
| AUTO | 119 | | |
| MT | 6 | | |
| HT | 7 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | | | |
| VEH SPEED | | | |
| AUTO | | | |
| MT | | | |
| HT | | | |
| BUS | | | |
| MOTO | | | |

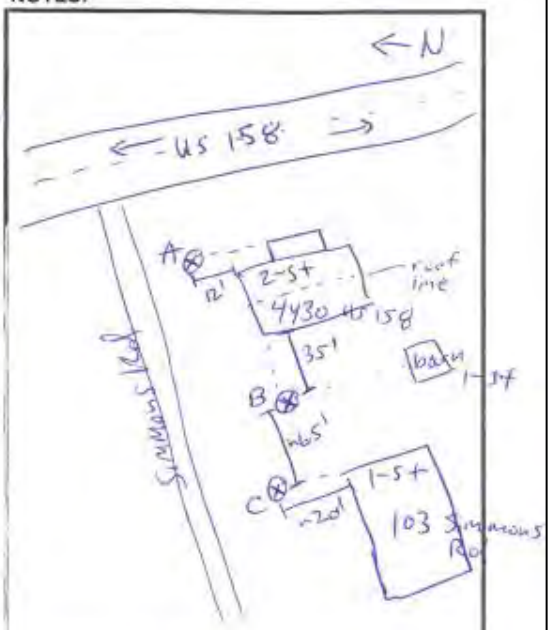
**WEATHER**

| | |
|---|---|
| GENERAL | overcast |
| TEMP | 63°F |
| % RH | 46% |
| WIND | 1-5 mph |
| ROAD COND. | dry |

**INSTRUMENTS:**

BK 2250 : Project 003
LD LxT : LxT_Data.006
BK 2238 : 027 - 048

**NOTES:**




- meters 5-ft above ground
- road at grade w/ meas locations

Noise sources: US 158 traffic, birds, wind in trees, distant backup alarm (vehicle)

traffic is free flowing, 45 mph speed limit

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-3: 5067 US 158

**DATE:** 2/27/18 **STAFF:** Poling / Green

| MEAS NO | V-3A | V-3B | |
|---|---|---|---|
| START TIME | 9:52 AM | | |
| END TIME | 10:12 AM | | |
| INSTRUMENT | BK 2250 | LD LxT | |
| BATTERY | | | |
| LEQ | 62.3 | 55.6 | |
| CAL CHECK | 93.9 / 93.9 | 94.0 / 94.0 | / |

**TRAFFIC**

| ROADWAY | US 158 - near (NB) | | |
|---|---|---|---|
| VEH SPEED | 50-60 mph | | |
| AUTO | 114 | | |
| MT | 4 | | |
| HT | 11 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | US 158 - far (SB) | | |
| VEH SPEED | 50-60 mph | | |
| AUTO | 87 | | |
| MT | 8 | | |
| HT | 7 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | Aydlett Rd - both directions | | |
| VEH SPEED | 30 mph | | |
| AUTO | 14 | | |
| MT | 0 | | |
| HT | 0 | | |
| BUS | 0 | | |
| MOTO | 0 | | |

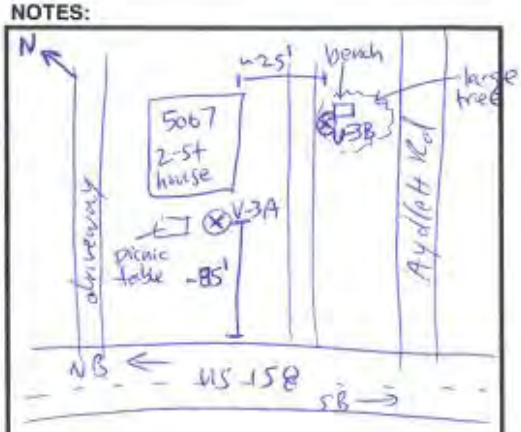
**WEATHER**

| GENERAL | clear sky |
|---|---|
| TEMP | 54°F |
| % RH | 40% |
| WIND | 2-7 mph |
| ROAD COND. | dry |

**INSTRUMENTS:**

BK 2250: Project 004
LD LxT: LxT_Data.008

**NOTES:**




traffic is free flowing, speed limit is 55 mph on US 158

SLM located 5' above ground, at grade w/ roadway

noise sources: US 158 traffic, birds, wind in trees, rustling leaves, occasional traffic on Aydlett Rd.

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-4: Young Rd

**DATE:** 2/27/18 **STAFF:** Poling / Green

| MEAS NO | V-4A | V-4B | V-4C |
|---|---|---|---|
| START TIME | 10:35 AM | | |
| END TIME | 10:55 AM | | |
| INSTRUMENT | BK 2250 | LD LxT | BK 2238 |
| BATTERY | | | |
| LEQ | 58.2 | 52.3 | 48.3 |
| CAL CHECK | 93.9 / 93.9 | 94.0 / 94.1 | 93.9 / 93.9 |

**TRAFFIC**

| | | | |
|---|---|---|---|
| ROADWAY | US 158 NB - near | | |
| VEH SPEED | 55-60 mph | | |
| AUTO | 119 | | |
| MT | 8 | | |
| HT | 6 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | US 158 SB - far | | |
| VEH SPEED | 55-60 mph | | |
| AUTO | 110 | | |
| MT | 11 | | |
| HT | 6 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | | | |
| VEH SPEED | | | |
| AUTO | | | |
| MT | | | |
| HT | | | |
| BUS | | | |
| MOTO | | | |

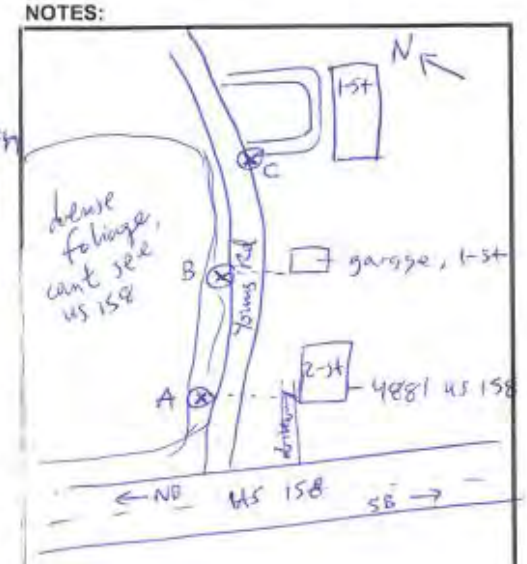
**WEATHER**

| | |
|---|---|
| GENERAL | clear sky |
| TEMP | 54°F |
| % RH | 49% |
| WIND | 6-9 mph |
| ROAD COND. | dry |

**INSTRUMENTS:**

BK 2250 : Project 005
LD LxT : LxT-Auto.010
BK 2238 : 049-071

**NOTES:**




traffic free flowing, 55 mph speed limit

Meters 5-ft above ground, ground at grade w/ roadway

Audible noise sources: US 158 traffic, birds, wind in trees, distant chickens, aircraft overpass, distant dog barking

Events
10:52 truck passby w/ flapping

**PROJECT:** ~~US~~ Mid-Currituck Bridge

**MEAS SITE:** V-5 : Duck Woods Drive

**DATE:** 2/27/18 **STAFF:** Poling / Green

| MEAS NO | V-5A | V-5B | |
|---|---|---|---|
| START TIME | 3:55 PM | | |
| END TIME | 4:15 PM | | |
| INSTRUMENT | BK 2250 | LD LXT | |
| BATTERY | | | |
| LEQ | 68.2 | 59.3 | |
| CAL CHECK | 93.9 / 93.9 | 94.1 / 94.0 | / |

**TRAFFIC**

| | | | |
|---|---|---|---|
| ROADWAY | US 158 WB - near | | |
| VEH SPEED | 50-55 mph | | |
| AUTO | 335 | | |
| MT | 28 | | |
| HT | 0 | | |
| BUS | 1 | | |
| MOTO | 1 | | |
| ROADWAY | US 158 EB - far | | |
| VEH SPEED | 50-55 mph | | |
| AUTO | 283 | | |
| MT | 9 | | |
| HT | 2 | | |
| BUS | 1 | | |
| MOTO | 0 | | |
| ROADWAY | Duck Woods Dr | | |
| VEH SPEED | 25-30 mph — speed limit 25 | | |
| AUTO | 17 NB | 10 SB | |
| MT | 0 | 0 | |
| HT | 0 | 0 | |
| BUS | 1 | 1 | |
| MOTO | 0 | 0 | |

**WEATHER**

| | | | |
|---|---|---|---|
| GENERAL | clear skies | | |
| TEMP | 56°F | | |
| % RH | 52% | | |
| WIND | 0-2 mph | | |
| ROAD COND. | dry | | |

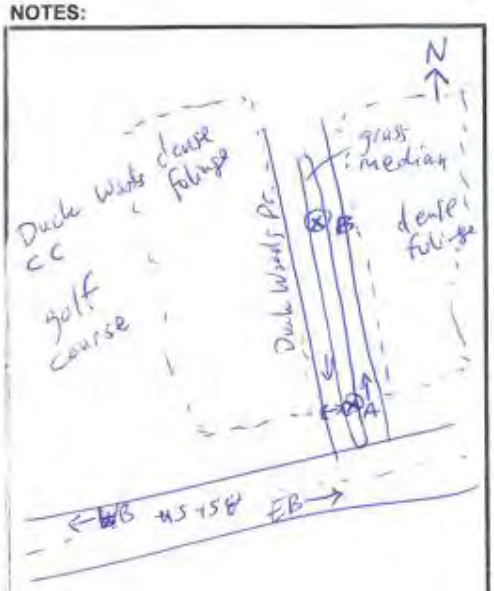
**INSTRUMENTS:**

BK 2250 : Project 006

LD LXT : LXT_Data.012

V-5B coordinates:

**NOTES:**




Traffic free flowing, US 158 speed limit of 50 mph

Meters 5' above ground, ground is at grade w/ US 158 roadway

Noise sources : US 158 traffic, birds wind in trees, traffic along Duck Woods Dr., prop plane overpass

| Duck Woods | NB | SB |
|---|---|---|
| Auto | | |
| MT | | |
| HT | | |
| Bus | 1 | 1 |

4:09 bus Duck Woods NB,

4:08 car revving engine

4:09 bus DW SB

4:12 dog bark

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-7: N Harbor View

**DATE:** 2/28/18 **STAFF:** Poling/Green

| MEAS NO | V-7A | V-7B | V-7C |
|---|---|---|---|
| START TIME | 11:18 AM | | |
| END TIME | 11:38 AM | | |
| INSTRUMENT | BK 2250 | LD LxT | BK 2238 |
| BATTERY | | | |
| LEQ | 57.2 | 45.4 | 43.0 |
| CAL CHECK | 93.9 / 93.9 | 94.0 / 94.0 | 93.9 / 93.9 |

**TRAFFIC**

| | | | |
|---|---|---|---|
| ROADWAY | NC 12 SB - far | | |
| VEH SPEED | 40 - 50 mph | | |
| AUTO | 27 | | |
| MT | 2 | | |
| HT | 0 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | NC 12 NB - near | | |
| VEH SPEED | 40 - 50 mph | | |
| AUTO | 28 | | |
| MT | 1 | | |
| HT | 1 | ← recycling truck | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | N Harbor View (2-way) | | |
| VEH SPEED | 25 mph | | |
| AUTO | 0 | | |
| MT | 0 | | |
| HT | 2 | ← recycling truck | |
| BUS | 0 | | |
| MOTO | 0 | | |

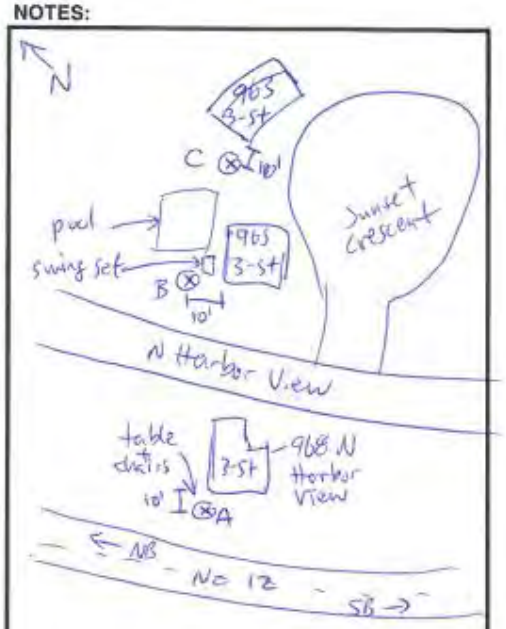
**WEATHER**

| | |
|---|---|
| GENERAL | overcast |
| TEMP | 59° F |
| % RH | 47% |
| WIND | calm |
| ROAD COND. | dry |

**INSTRUMENTS:**

BK 2250: Project 008
LD LxT: LxT_Data.017
BK 2238: 092-116

**NOTES:**




Meters 5-ft above ground, ground is at grade w/ NC 12

Noise Sources:

A: NC 12 traffic, intermittent distant construction across NC 12 (mainly hand tools)

B: NC 12 traffic, birds, distant hand tools

C: NC 12 traffic, birds, distant hand tools

All: aircraft overpass

N Harbor View traffic

Autos:

Heavy: 11 ← recycling truck

Events

11:22 ~~garbage~~ recycling truck stop, pass on NHV
11:24
11:28 recycling truck stop, pass on NHV
11:32 dump truck leave Ocean Forest Ct across

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-8 Albacore Street

**DATE:** 2/28/18 **STAFF:** Poling / Green

| MEAS NO | V-8A | V-8B | |
|---|---|---|---|
| START TIME | 12:35 PM | | |
| END TIME | 12:55 PM | | |
| INSTRUMENT | BK 2250 | LD LxT | |
| BATTERY | | | |
| LEQ | 51.1 | 47.7 | |
| CAL CHECK | 93.9 / 93.9 | 94.0 / 94.1 | / |

**TRAFFIC**

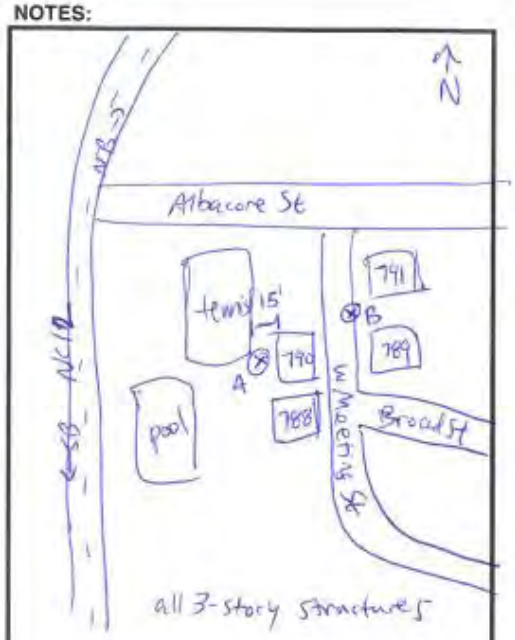
| ROADWAY | NC 12 NB - near | | |
|---|---|---|---|
| VEH SPEED | 40-50 mph | | |
| AUTO | 41 | | |
| MT | 3 | | |
| HT | 0 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | NC 12 SB - far | | |
| VEH SPEED | 40-50 mph | | |
| AUTO | 54 | | |
| MT | 8 | | |
| HT | 2 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | Albacore St. | | |
| VEH SPEED | WB | EB | 20-30 mph |
| AUTO | 12 | 8 | |
| MT | 1 | 0 | |
| HT | 0 | 0 | |
| BUS | 0 | 0 | |
| MOTO | 0 | 0 | |

**WEATHER**

| GENERAL | cloudy |
|---|---|
| TEMP | 60°F |
| % RH | 46% |
| WIND | calm |
| ROAD COND. | dry |

**INSTRUMENTS:**
BK 2250: Project 009
LD LxT: LxT_Data.019
BK 2238: 117-137

**NOTES:**




noise meters placed 5' above ground, ground n at grade w/ roadways

traffic is free flowing
Speed limits: Albacore: 25 mph
NC 12: 45 mph

Noise sources: NC 12 traffic, Albacore St traffic, birds, aircraft overpass, distant dog barking

12:45 truck idling across Albacore
↓ near B
12:46

**PROJECT:** Mid-Currituck Bridge

**MEAS SITE:** V-9: Villas at Corolla Bay

**DATE:** 2/28/18 **STAFF:** Poling/Green

| MEAS NO | V-9A | V-9B | V-9C |
|---|---|---|---|
| START TIME | ~~3:58 PM~~ | 4:04 PM | |
| END TIME | 4:24 PM | | |
| INSTRUMENT | BK 2250 | LD LXT | BK 2238 |
| BATTERY | | | |
| LEQ | 55.6 | 43.8 | 39.8 |
| CAL CHECK | 93.9 / 93.9 | 94.1 / 94.1 | 93.9 / 93.9 |

**TRAFFIC**

| ROADWAY | NC 12 NB - near | | |
|---|---|---|---|
| VEH SPEED | 45-50 mph | | |
| AUTO | 11 | | |
| MT | 0 | | |
| HT | 1 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | NC 12 SB - far | | |
| VEH SPEED | 45-50 mph | | |
| AUTO | 30 | | |
| MT | 1 | | |
| HT | 0 | | |
| BUS | 0 | | |
| MOTO | 0 | | |
| ROADWAY | | | |
| VEH SPEED | | | |
| AUTO | | | |
| MT | | | |
| HT | | | |
| BUS | | | |
| MOTO | | | |

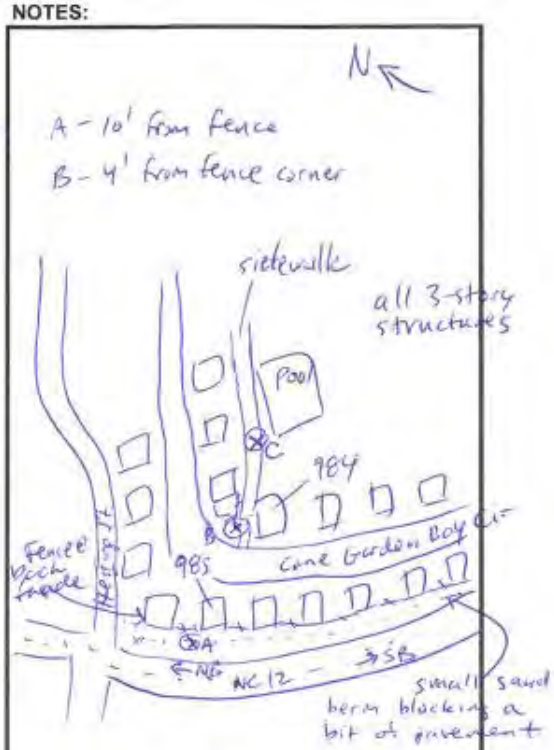
**WEATHER**

| GENERAL | partly cloudy |
|---|---|
| TEMP | 61°F |
| % RH | 51% |
| WIND | calm |
| ROAD COND. | dry |

**INSTRUMENTS:**

BK 2250: Project 010
LD LXT: LXT_Data.021
BK 2238: 138-164

**NOTES:**




Noise Sources: NC 12 traffic, birds, aircraft overpass

C: intermittent outdoor HVAC unit in distance
B: "
meters 4 at grade w/ road, road slightly above (A) grade.

meters 5' above ground

traffic is free flowing, 45-50 mph, 45 mph speed limit

## West Caldwell Calibration Laboratories Inc.

# Certificate of Calibration

for

HAND-HELD ANALYZER

| | |
|---|---|
| Manufactured by: | BRUEL & KJAER |
| Model No: | 2250 |
| Serial No: | 3002633 |
| Calibration Recall No: | 28141 |

Submitted By:

| | |
|---|---|
| Customer: | JACOB POLING |
| Company: | WSP USA |
| Address: | 520 NICOLLET MALL<br>MINNEAPOLIS MN 55402 |

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. 2250 BRUE

Upon receipt for Calibration, the instrument was found to be:

Within ( X )

tolerance of the indicated specification. See attached Report of Calibration.
The information supplied relates to the calibrated item listed above.
West Caldwell Calibration Laboratories' calibration control system meets the requirements of MIL-STD-45662A

Note: With this Certificate, Report of Calibration is included.

Approved by: FC

Felix Christopher (QA Mgr.)

Calibration Date: 30-Oct-17

Certificate No: 28141 - 1

QA Doc. #1051 Rev. 2.0 10/1/01

Certificate Page 1 of 1

ISO/IEC 17025:2005

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor, NY 14564, U.S.A.

ACCREDITED
Calibration Lab. Cert. # 1533.01

# CERTIFICATE OF CALIBRATION
# # 23706-1
# FOR LARSON DAVIS PRECISION INTEGRATING SOUND LEVEL METER

Model **LxT1** Serial No. **0003980**
ID No. **N/A**

With Microphone **377B02** Serial No. **146338**
With Preamplifier **PRMLxT1L** Serial No. **035954**

Customer: **WSP USA**
**New York, NY 10119** P.O. No. **Verbal-Brian Isoldi**

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

on **20 DEC 2017** **BY HAROLD LYNCH**
**Service Manager**

As received and as left condition: Within Specification.
Re-calibration due on: **20 DEC 2018**

Certified References*

| Mfg. | Type | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|
| B&K | 1049 | 1314996 | 09 JUN 2017 | 09 JUN 2018 |
| B&K | 2636 | 1423390 | 03 JAN 2017 | 03 JAN 2018 |
| B&K | 4226 | 2141942 | 01 DEC 2017 | 01 DEC 2018 |
| B&K | 4231 | 1770857 | 14 SEP 2017 | 14 SEP 2018 |
| HP | 34401A | MY45023668 | 10 FEB 2017 | 10 FEB 2018 |
| HP | 3458A | 2823A07179 | 23 JUL 2017 | 23 JUL 2018 |

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2008 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

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

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

| Temperature | Relative Humidity | Barometric Pressure |
|---|---|---|
| **23°C** | **26 %** | **994.21** hPa |

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

## ODIN METROLOGY, INC.

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

Doc. Rev. 01 Mar 2017 Page 1 of 15

# CERTIFICATE OF CALIBRATION
# # 23706-7
# FOR BRÜEL & KJÆR
# SOUND LEVEL METER

Model **2238** Serial No. **2394977**
ID No. **N/A**
With Microphone Model **4188** Serial No. **2157363**

Customer: **WSP USA**
**New York, NY 10119** P.O. No. **Verbal-Brian Isoldi**

was tested and met factory specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 651-1979 Type 1; IEC-61672-3:2006 Class 1

on **20 DEC 2017** **BY** **HAROLD LYNCH**
**Service Manager**

As received and as left condition: Within Specification.
Re-calibration due on: **20 DEC 2018**

Certified References*

| Mfg. | Type | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|
| B&K | 1049 | 1314996 | 09 JUN 2017 | 09 JUN 2018 |
| B&K | 2636 | 1423390 | 03 JAN 2017 | 03 JAN 2018 |
| B&K | 4226 | 2141942 | 01 DEC 2017 | 01 DEC 2018 |
| B&K | 4231 | 1770857 | 14 SEP 2017 | 14 SEP 2018 |
| HP | 34401A | MY45023668 | 10 FEB 2017 | 10 FEB 2018 |
| HP | 3458A | 2823A07179 | 23 JUL 2017 | 23 JUL 2018 |

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2008 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

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

Reference Test Procedure: **ACCT Procedure 2238 Version 2.1.0.** (Rev. Aug 2013)
Brüel & Kjær Factory Service Instructions: **2238**

| Temperature | Relative Humidity | Barometric Pressure |
|---|---|---|
| **23**°C | **26** % | **994.21** hPa |

*Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.*
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# CERTIFICATE OF CALIBRATION
# # 22492-5
# FOR LARSON DAVIS
# INTEGRATING SOUND LEVEL METER

Model **720**

With 3/8" electret microphone

Serial No. **0297**
ID No. **N/A**
Serial No. **N/A**

Customer: **Parsons Brinckerhoff**
**Boston, MA 02116**

P.O. No. **ETBE6-20-16**

was tested to Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 2; IEC 651-1979 Type 2

on **06 JUL 2016** BY **HAROLD LYNCH**
**Service Manager**

As received condition: Within Specifications.
Re-calibration due on: **06 JUL 2017**

Certified References*

| Mfg. | Type | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|
| HP | 34401A | 3146A48348 | 27 AUG 2015 | 27 AUG 2016 |
| B&K | 4226 | 2141942 | 02 DEC 2015 | 02 DEC 2016 |
| B&K | 4134 | 1315901 | 08 DEC 2015 | 08 DEC 2017 |

Calibration System operates in conformance to ANSI/ NCSL Z540-1, 1994 and ISO 17025, ISO 9001:2008 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

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

Reference Test Procedure: **Odin Metrology Procedure for Larson Davis 720.**
*Uncertainty of Reference 4226 in Pressure:*
*31.5 Hz-4k Hz: ± .20 dB 4k Hz-8k Hz: ± .25 dB*
*Uncertainty of ANSI Type 1 S.L.M.: 31.5 Hz-2k Hz: ± 2 dB*
*2k Hz-4k Hz: ± 2.5 dB 4k Hz-5k Hz: ± 3.0 dB 5k Hz-6.3k Hz: ± 3.5 dB 6.3k Hz-8k Hz: ± 4.5 dB*
*Uncertainty Ratio: > 4:1*

| Temperature | Relative Humidity | Barometric Pressure |
|---|---|---|
| **23°C** | **43 %** | **989.51** hPa |

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Doc. Rev 06 Jun 2016 Page 1 of 4

# CERTIFICATE OF CALIBRATION
# # 22492-2
# FOR LARSON DAVIS
# INTEGRATING SOUND LEVEL METER

Model **720**

Serial No. **0108**
ID No. **N/A**
Serial No. **B5895**

With 3/8" electret microphone

Customer: **Parsons Brinckerhoff**
**Boston, MA 02116**

P.O. No. **ETBE6-20-16**

was tested to Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 2; IEC 651-1979 Type 2

on **06 JUL 2016** **BY** **HAROLD LYNCH**
**Service Manager**

As received condition: Within Specifications.
Re-calibration due on: **06 JUL 2017**

Certified References*

| Mfg. | Type | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|
| HP | 34401A | 3146A48348 | 27 AUG 2015 | 27 AUG 2016 |
| B&K | 4226 | 2141942 | 02 DEC 2015 | 02 DEC 2016 |
| B&K | 4134 | 1315901 | 08 DEC 2015 | 08 DEC 2017 |

Calibration System operates in conformance to ANSI/ NCSL Z540-1, 1994 and ISO 17025, ISO 9001:2008 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

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

Reference Test Procedure: **Odin Metrology Procedure for Larson Davis 720.**
*Uncertainty of Reference 4226 in Pressure:*
*31.5 Hz-4k Hz: ± .20 dB 4k Hz-8k Hz: ± .25 dB*
*Uncertainty of ANSI Type 1 S.L.M.: 31.5 Hz-2k Hz: ± 2 dB*
*2k Hz-4k Hz: ± 2.5 dB 4k Hz-5k Hz: ± 3.0 dB 5k Hz-6.3k Hz: ± 3.5 dB 6.3k Hz-8k Hz: ± 4.5 dB*
*Uncertainty Ratio: > 4:1*

| Temperature | Relative Humidity | Barometric Pressure |
|---|---|---|
| **23°C** | **43 %** | **989.51** hPa |

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# CERTIFICATE OF CALIBRATION
# # 22492-1
# FOR LARSON DAVIS
# INTEGRATING SOUND LEVEL METER

Model **720** Serial No. **0465**
ID No. **N/A**
With 3/8" electret microphone Serial No. **B2056**

Customer: **Parsons Brinckerhoff**
**Boston, MA 02116** P.O. No. **ETBE6-20-16**

was tested to Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 2; IEC 651-1979 Type 2

on **06 JUL 2016** **BY** **HAROLD LYNCH**
**Service Manager**

As received condition: Within Specifications.
Re-calibration due on: **06 JUL 2017**

Certified References*

| Mfg. | Type | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|
| HP | 34401A | 3146A48348 | 27 AUG 2015 | 27 AUG 2016 |
| B&K | 4226 | 2141942 | 02 DEC 2015 | 02 DEC 2016 |
| B&K | 4134 | 1315901 | 08 DEC 2015 | 08 DEC 2017 |

Calibration System operates in conformance to ANSI/ NCSL Z540-1, 1994 and ISO 17025, ISO 9001:2008 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

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

Reference Test Procedure: **Odin Metrology Procedure for Larson Davis 720.**
*Uncertainty of Reference 4226 in Pressure:*
*31.5 Hz-4k Hz: ± .20 dB 4k Hz-8k Hz: ± .25 dB*
*Uncertainty of ANSI Type 1 S.L.M.: 31.5 Hz-2k Hz: ± 2 dB*
*2k Hz-4k Hz: ± 2.5 dB 4k Hz-5k Hz: ± 3.0 dB 5k Hz-6.3k Hz: ± 3.5 dB 6.3k Hz-8k Hz: ± 4.5 dB*
*Uncertainty Ratio: > 4:1*

| Temperature | Relative Humidity | Barometric Pressure |
|---|---|---|
| **23°C** | **43 %** | **989.51** hPa |

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PHONE: (805) 375-0830 FAX: (805) 375-0405

Doc. Rev 06 Jun 2016 Page 1 of 4

# Appendix B

# HOURLY EQUIVALENT TRAFFIC NOISE LEVEL TABLES AND EQUIVALENT RECEPTOR WORKSHEETS

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-1 | Restaurant | E | 2-1 | 1 | 3997 CARATOKE HWY | 69 | 70 | 70 | 1 |
| R-2 | Residential | B | 2-1 | 1 | 112 SIMPSON RD | 58 | 59 | 59 | 1 |
| R-3 | Residential | B | 2-1 | 1 | 4016 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-4 | Residential | B | 2-1 | 1 | 4023 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-5 | Residential | B | 2-1 | 1 | 106 SWAINS LN | 68 | 69 | 69 | 1 |
| R-6 | Medical facility | D | 2-1 | 1 | 4039 CARATOKE HWY | 43 | 45 | 45 | 2 |
| R-7 | Residential | B | 2-1 | 1 | 4042 CARATOKE HWY | 75 | 76 | 76 | 1 |
| R-8 | Residential | B | 2-1 | 1 | 4049 CARATOKE HWY | 67 | 69 | 69 | 2 |
| R-9 | Residential | B | 2-1 | 1 | 4054 CARATOKE HWY | 67 | 68 | 68 | 1 |
| R-10 | Residential | B | 2-1 | 1 | 4062 CARATOKE HWY | 66 | 67 | 67 | 1 |
| R-11 | Residential | B | 2-1 | 1 | 4068 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-12 | Residential | B | 2-1 | 1 | 4092 CARATOKE HWY | 68 | 69 | 69 | 1 |
| R-13 | Residential | B | 2-2 | 1 | 4097 CARATOKE HWY | 63 | 64 | 64 | 1 |
| R-14 | Residential | B | 2-2 | 1 | 4096 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-15 | Residential | B | 2-2 | 1 | 4108 CARATOKE HWY | 74 | 76 | 76 | 2 |
| R-16 | Residential | B | 2-2 | 1 | 4109 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-17 | Residential | B | 2-2 | 1 | 4113 CARATOKE HWY | 71 | 72 | 72 | 1 |
| R-18 | Residential | B | 2-2 | 1 | 4117 CARATOKE HWY | 68 | 69 | 69 | 1 |
| R-19 | Residential | B | 2-2 | 1 | 4131 CARATOKE HWY | 73 | 74 | 74 | 1 |
| R-20 | Residential | B | 2-2 | 1 | 4135 CARATOKE HWY | 65 | 66 | 66 | 1 |
| R-21 | Residential | B | 2-2 | 1 | 4135 CARATOKE HWY | 70 | 71 | 71 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-22 | Place of worship | D | 2-2 | 1 | 4134 CARATOKE HWY | 47 | 48 | 48 | 1 |
| R-23 | Residential | B | 2-2 | 1 | 4141 CARATOKE HWY | 74 | 75 | 75 | 1 |
| R-24 | Residential | B | 2-2 | 1 | 4150 CARATOKE HWY | 73 | 75 | 75 | 2 |
| R-25 | Residential | B | 2-2 | 1 | 4157 CARATOKE HWY | 71 | 73 | 73 | 2 |
| R-26 | Residential | B | 2-2 | 1 | 111 SAM WILKINS LN | 60 | 62 | 62 | 2 |
| R-27 | Residential | B | 2-2 | 1 | 4166 CARATOKE HWY | 68 | 69 | 69 | 1 |
| R-28 | Residential | B | 2-2 | 1 | 4167 CARATOKE HWY | 64 | 66 | 66 | 2 |
| R-29 | Residential | B | 2-2 | 1 | 4171 CARATOKE HWY | 74 | 75 | 75 | 1 |
| R-30 | Residential | B | 2-2 | 1 | 4174 CARATOKE HWY | 71 | 72 | 72 | 1 |
| R-31 | Residential | B | 2-2 | 1 | 4179 CARATOKE HWY | 66 | 67 | 67 | 1 |
| R-32 | Residential | B | 2-2 | 1 | 4198 CARATOKE HWY | 71 | 73 | 73 | 2 |
| R-33 | Residential | B | 2-2 | 1 | 4206 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-34 | Residential | B | 2-3 | 1 | 4216 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-35A | Tennis court | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-35B | Tennis court | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 67 | 68 | 68 | 1 |
| R-35C | Tennis court | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 64 | 65 | 65 | 1 |
| R-35D | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 73 | 74 | 74 | 1 |
| R-35E | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 67 | 68 | 68 | 1 |
| R-35F | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 63 | 65 | 65 | 2 |
| R-35G | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 60 | 62 | 62 | 2 |
| R-35H | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 71 | 72 | 72 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-35I | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 66 | 67 | 67 | 1 |
| R-35J | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 62 | 64 | 64 | 2 |
| R-35K | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 59 | 61 | 61 | 2 |
| R-35L | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 69 | 71 | 71 | 2 |
| R-35M | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 65 | 66 | 66 | 1 |
| R-35N | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 62 | 63 | 63 | 1 |
| R-35O | Soccer field | C | 2-3 | 0.13 | 4263 CARATOKE HWY | 59 | 60 | 60 | 1 |
| R-36 | Library | C | 2-3 | 1 | 4261 CARATOKE HWY | 65 | 66 | 66 | 1 |
| R-37 | Residential | B | 2-3 | 1 | 4271 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-38 | Residential | B | 2-3 | 1 | 4285 CARATOKE HWY | 68 | 69 | 69 | 1 |
| R-39 | Residential | B | 2-3 | 1 | 4297 CARATOKE HWY | 66 | 67 | 67 | 1 |
| R-40 | Residential | B | 2-3 | 1 | 4296 CARATOKE HWY | 73 | 75 | 75 | 2 |
| R-41 | Residential | B | 2-3 | 1 | 4306 CARATOKE HWY | 73 | 74 | 74 | 1 |
| R-42 | Residential | B | 2-3 | 1 | 4313 CARATOKE HWY | 74 | 75 | 75 | 1 |
| R-43 | Residential | B | 2-3 | 1 | 4322 CARATOKE HWY | 71 | 72 | 72 | 1 |
| R-44 | Residential | B | 2-3 | 1 | 4358 CARATOKE HWY | 75 | 76 | 76 | 1 |
| R-45 | Residential | B | 2-3 | 1 | 4364 CARATOKE HWY | 73 | 74 | 74 | 1 |
| R-46 | Residential | B | 2-4 | 1 | 4379 CARATOKE HWY | 64 | 65 | 65 | 1 |
| R-47 | Residential | B | 2-4 | 1 | 4422 CARATOKE HWY | 72 | 73 | 73 | 1 |
| R-48 | Residential | B | 2-4 | 1 | 103 SIMMONS RD | 62 | 63 | 63 | 1 |
| R-49 | Residential | B | 2-4 | 1 | 4430 CARATOKE HWY | 69 | 70 | 70 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-50 | Residential | B | 2-4 | 1 | 4429 CARATOKE HWY | 67 | 68 | 68 | 1 |
| R-51 | Residential | B | 2-4 | 1 | 4451 CARATOKE HWY | 71 | 72 | 72 | 1 |
| R-52 | Residential | B | 2-4 | 1 | 4460 CARATOKE HWY | 71 | 73 | 73 | 2 |
| R-53 | Residential | B | 2-4 | 1 | 4464 CARATOKE HWY | 71 | 72 | 72 | 1 |
| R-54 | Residential | B | 2-4 | 1 | 4472 CARATOKE HWY | 69 | 70 | 70 | 1 |
| R-55 | Residential | B | 2-4 | 1 | 4474 CARATOKE HWY | 76 | 77 | 77 | 1 |
| R-56 | Residential | B | 2-4 | 1 | 102 COINJOCK VILLAGE DR | 61 | 62 | 62 | 1 |
| R-57 | Residential | B | 2-4 | 1 | 104 COINJOCK VILLAGE DR | 58 | 59 | 59 | 1 |
| R-58 | Residential | B | 2-4 | 1 | 4478 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-59 | Residential | B | 2-4 | 1 | 4484 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-60 | Residential | B | 2-4 | 1 | 4488 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-61 | Residential | B | 2-4 | 1 | 4494 CARATOKE HWY | 70 | 71 | 71 | 1 |
| R-62 | Residential | B | 2-4 | 1 | 4498 CARATOKE HWY | 70 | 72 | 72 | 2 |
| R-63 | Residential | B | 2-5 | 1 | 106 WORTH GUARD RD | 71 | 72 | 72 | 1 |
| R-64 | Residential | B | 2-5 | 1 | 117 WORTH GUARD RD | 59 | 61 | 61 | 2 |
| R-65 | Residential | B | 2-5 | 1 | 112 WORTH GUARD RD | 67 | 68 | 68 | 1 |
| R-66 | Residential | B | 2-5 | 1 | 118 WORTH GUARD RD | 63 | 65 | 65 | 2 |
| R-67 | Residential | B | 2-7 | 1 | 216 WORTH GUARD RD | 58 | 59 | 59 | 1 |
| R-68 | Residential | B | 2-7 | 1 | 216 WORTH GUARD RD | 57 | 58 | 58 | 1 |
| R-69 | Residential | B | 2-7 | 1 | 120 HAMPTON RD | 57 | 58 | 58 | 1 |
| R-70 | Residential | B | 2-7 | 1 | 120 HAMPTON RD | 57 | 58 | 58 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-71 | Residential | B | 2-7 | 1 | 150 HAMPTON RD | 59 | 59 | 59 | 0 |
| R-72 | Residential | B | 2-7 | 1 | 124 HAMPTON RD | 56 | 57 | 57 | 1 |
| R-73 | Residential | B | 2-7 | 1 | 142 HAMPTON RD | 58 | 59 | 59 | 1 |
| R-74 | Residential | B | 2-7 | 1 | 150 HAMPTON RD | 58 | 59 | 59 | 1 |
| R-75 | Residential | B | 2-7 | 1 | 150 HAMPTON RD | 58 | 59 | 59 | 1 |
| R-76 | Residential | B | 2-8 | 1 | 150 WATERLILY RD | 60 | 61 | 62 | 2 |
| R-77 | Residential | B | 2-8 | 1 | 146 WATERLILY RD | 59 | 60 | 61 | 2 |
| R-78 | Residential | B | 2-8 | 1 | 142 WATERLILY RD | 60 | 61 | 62 | 2 |
| R-79 | Residential | B | 2-8 | 1 | 138 WATERLILY RD | 59 | 61 | 62 | 3 |
| R-80 | Residential | B | 2-8 | 1 | 130 WATERLILY RD | 60 | 61 | 62 | 2 |
| R-81 | Residential | B | 2-9 | 1 | 122 WATERLILY RD | 60 | 62 | 63 | 3 |
| R-82 | Residential | B | 2-9 | 1 | 129 YOUNG RD | 53 | 54 | 55 | 2 |
| R-83 | Residential | B | 2-9 | 1 | 149 YOUNG RD | 52 | 53 | 53 | 1 |
| R-84 | Residential | B | 2-9 | 1 | 4881 CARATOKE HWY | 69 | 71 | 73 | 4 |
| R-85 | Residential | B | 2-9 | 1 | 120 YOUNG RD | 60 | 61 | 63 | 3 |
| R-86 | Residential | B | 2-9 | 1 | 4929 CARATOKE HWY | 68 | 69 | #N/A | N/A |
| R-87 | Residential | B | 2-10 | 1 | 5005 CARATOKE HWY | 75 | 76 | #N/A | N/A |
| R-88 | Residential | B | 2-10 | 1 | 5013 CARATOKE HWY | 70 | 71 | #N/A | N/A |
| R-89 | Residential | B | 2-10 | 1 | 5023 CARATOKE HWY | 71 | 72 | #N/A | N/A |
| R-90 | Residential | B | 2-10 | 1 | 5031 CARATOKE HWY | 71 | 72 | #N/A | N/A |
| R-91 | Residential | B | 2-10 | 1 | 5067 CARATOKE HWY | 72 | 73 | 76 | 4 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-92 | Residential | B | 2-11 | 1 | 5067 CARATOKE HWY | 52 | 54 | 54 | 2 |
| R-283 | Residential | B | 2-11 | 1 | 5031 CARATOKE HWY | 58 | 59 | 62 | 4 |
| R-93 | Residential | B | 2-14 | 1 | 125 LIGHTHOUSE VW | 47[1] | 47[1] | 52 | 5 |
| R-94 | Residential | B | 2-14 | 1 | 123 LIGHTHOUSE VW | 47[1] | 47[1] | 52 | 5 |
| R-95 | Residential | B | 2-14 | 1 | 121 LIGHTHOUSE VW | 47[1] | 47[1] | 51 | 4 |
| R-96 | Residential | B | 2-14 | 1 | 119 LIGHTHOUSE VW | 47[1] | 47[1] | 50 | 3 |
| R-97 | Residential | B | 2-14 | 1 | 115 LIGHTHOUSE VW | 47[1] | 47[1] | 51 | 4 |
| R-98 | Residential | B | 2-14 | 1 | 109 LIGHTHOUSE VW | 47[1] | 47[1] | 50 | 3 |
| R-99 | Residential | B | 2-14 | 1 | 105 LIGHTHOUSE VW | 47[1] | 47[1] | 50 | 3 |
| R-100 | Residential | B | 2-14 | 1 | 358 NARROW SHORE RD | 47[1] | 47[1] | 56 | 9 |
| R-101 | Residential | B | 2-14 | 1 | 103 LIGHTHOUSE VW | 47[1] | 47[1] | 50 | 3 |
| R-102 | Residential | B | 2-14 | 1 | 318 NARROW SHORE RD | 47[1] | 47[1] | 50 | 3 |
| R-103 | Residential | B | 2-14 | 1 | 330 NARROW SHORE RD | 47[1] | 47[1] | 54 | 7 |
| R-104 | Residential | B | 2-15 | 1 | 1002 CRUZ BAY LN | 51 | 51 | 52 | 1 |
| R-105 | Residential | B | 2-15 | 1 | 998 CRUZ BAY CT | 52 | 52 | 52 | 0 |
| R-106 | Residential | B | 2-15 | 1 | 992 CRUZ BAY CT | 53 | 53 | 53 | 0 |
| R-107 | Residential | B | 2-15 | 1 | 1001 CANE GARDEN BAY CIR | 52 | 53 | 53 | 1 |
| R-108 | Residential | B | 2-15 | 1 | 999 CANE GARDEN BAY CIR | 53 | 54 | 54 | 1 |
| R-109 | Residential | B | 2-15 | 1 | 997 CANE GARDEN BAY CIR | 55 | 56 | 55 | 0 |
| R-110 | Residential | B | 2-15 | 1 | 995 CANE GARDEN BAY CIR | 57 | 57 | 56 | -1 |
| R-111 | Residential | B | 2-15 | 1 | 993 CANE GARDEN BAY CIR | 58 | 58 | 57 | -1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-112 | Residential | B | 2-15 | 1 | 991 CANE GARDEN BAY CIR | 59 | 59 | 58 | -1 |
| R-113 | Residential | B | 2-15 | 1 | 989 CANE GARDEN BAY CIR | 60 | 60 | 59 | -1 |
| R-114 | Residential | B | 2-15 | 1 | 987 CANE GARDEN BAY CIR | 65 | 65 | 63 | -2 |
| R-115 | Residential | B | 2-15 | 1 | 985 CANE GARDEN BAY CIR | 67 | 67 | 64 | -3 |
| R-116 | Residential | B | 2-15 | 1 | 983 CANE GARDEN BAY CIR | 66 | 66 | 63 | -3 |
| R-117 | Residential | B | 2-15 | 1 | 981 CANE GARDEN BAY CIR | 66 | 66 | 64 | -2 |
| R-118 | Residential | B | 2-15 | 1 | 979 CANE GARDEN BAY CIR | 63 | 63 | 64 | 1 |
| R-119 | Residential | B | 2-15 | 1 | 977 CANE GARDEN BAY CIR | 64 | 64 | 64 | 0 |
| R-120 | Residential | B | 2-15 | 1 | 975 CANE GARDEN BAY CIR | 62 | 62 | 64 | 2 |
| R-121 | Residential | B | 2-15 | 1 | 973 CANE GARDEN BAY CIR | 62 | 62 | 63 | 1 |
| R-122 | Residential | B | 2-15 | 1 | 971 CANE GARDEN BAY CIR | 64 | 64 | 64 | 0 |
| R-123 | Residential | B | 2-15 | 1 | 969 CANE GARDEN BAY CIR | 66 | 66 | 64 | -2 |
| R-124 | Residential | B | 2-15 | 1 | 967 CANE GARDEN BAY CIR | 67 | 67 | 65 | -2 |
| R-125 | Residential | B | 2-15 | 1 | 965 CANE GARDEN BAY CIR | 63 | 63 | 62 | -1 |
| R-126 | Residential | B | 2-15 | 1 | 963 CANE GARDEN BAY CIR | 56 | 56 | 56 | 0 |
| R-127 | Residential | B | 2-15 | 1 | 961 CANE GARDEN BAY CIR | 54 | 54 | 54 | 0 |
| R-128 | Residential | B | 2-15 | 1 | 959 CANE GARDEN BAY CIR | 51 | 51 | 51 | 0 |
| R-129 | Residential | B | 2-15 | 1 | 957 CANE GARDEN BAY CIR | 47 | 47 | 49 | 2 |
| R-130 | Residential | B | 2-15 | 1 | 955 CANE GARDEN BAY CIR | 47 | 47 | 48 | 1 |
| R-131 | Residential | B | 2-15 | 1 | 953 CANE GARDEN BAY CIR | 46 | 46 | 48 | 2 |
| R-132 | Residential | B | 2-15 | 1 | 951 CANE GARDEN BAY CIR | 42 | 43 | 46 | 4 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-133 | Residential | B | 2-15 | 1 | 949 CANE GARDEN BAY CIR | 45 | 45 | 48 | 3 |
| R-134 | Residential | B | 2-15 | 1 | 947 CANE GARDEN BAY CIR | 44 | 44 | 47 | 3 |
| R-135 | Residential | B | 2-15 | 1 | 945 CANE GARDEN BAY CIR | 41 | 41 | 43 | 2 |
| R-136 | Residential | B | 2-15 | 1 | 943 CANE GARDEN BAY CIR | 38 | 38 | 39 | 1 |
| R-137 | Residential | B | 2-15 | 1 | 954 CANE GARDEN BAY CIR | 39 | 39 | 40 | 1 |
| R-138 | Residential | B | 2-15 | 1 | 956 CANE GARDEN BAY CIR | 38 | 38 | 39 | 1 |
| R-139 | Residential | B | 2-15 | 1 | 958 CANE GARDEN BAY CIR | 37 | 38 | 38 | 1 |
| R-140 | Residential | B | 2-15 | 1 | 962 CANE GARDEN BAY CIR | 41 | 41 | 44 | 3 |
| R-141 | Residential | B | 2-15 | 1 | 964 CANE GARDEN BAY CIR | 42 | 42 | 45 | 3 |
| R-142 | Residential | B | 2-15 | 1 | 966 CANE GARDEN BAY CIR | 40 | 40 | 41 | 1 |
| R-143 | Residential | B | 2-15 | 1 | 968 CANE GARDEN BAY CIR | 40 | 40 | 40 | 0 |
| R-144 | Residential | B | 2-15 | 1 | 970 CANE GARDEN BAY CIR | 41 | 41 | 42 | 1 |
| R-145 | Residential | B | 2-15 | 1 | 972 CANE GARDEN BAY CIR | 40 | 40 | 42 | 2 |
| R-146 | Residential | B | 2-15 | 1 | 974 CANE GARDEN BAY CIR | 45 | 45 | 47 | 2 |
| R-147 | Residential | B | 2-15 | 1 | 976 CANE GARDEN BAY CIR | 48 | 48 | 50 | 2 |
| R-148 | Residential | B | 2-15 | 1 | 980 CANE GARDEN BAY CIR | 47 | 47 | 48 | 1 |
| R-149 | Residential | B | 2-15 | 1 | 982 CANE GARDEN BAY CIR | 48 | 48 | 50 | 2 |
| R-150 | Residential | B | 2-15 | 1 | 984 CANE GARDEN BAY CIR | 50 | 50 | 49 | -1 |
| R-151 | Residential | B | 2-15 | 1 | 988 CANE GARDEN BAY CIR | 54 | 54 | 52 | -2 |
| R-152 | Residential | B | 2-15 | 1 | 990 CANE GARDEN BAY CIR | 46 | 46 | 45 | -1 |
| R-153 | Residential | B | 2-15 | 1 | 992 CANE GARDEN BAY CIR | 43 | 43 | 43 | 0 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-154 | Residential | B | 2-15 | 1 | 994 CANE GARDEN BAY CIR | 41 | 41 | 41 | 0 |
| R-155 | Residential | B | 2-15 | 1 | 998 CANE GARDEN BAY CIR | 44 | 44 | 45 | 1 |
| R-156 | Residential | B | 2-15 | 1 | 1000 CANE GARDEN BAY CIR | 41 | 41 | 41 | 0 |
| R-157 | Pool | C | 2-15 | 1 | CANE GARDEN BAY CIR - POOL | 43 | 43 | 42 | -1 |
| R-158 | Residential | B | 2-15 | 1 | 986 COROLLA DR | 42 | 42 | 44 | 2 |
| R-159 | Residential | B | 2-15 | 1 | 982 PELICAN CT | 45 | 46 | 49 | 4 |
| R-160 | Residential | B | 2-15 | 1 | 980 PELICAN CT | 48 | 49 | 52 | 4 |
| R-161 | Residential | B | 2-15 | 1 | 984 COROLLA DR | 42 | 42 | 45 | 3 |
| R-162 | Residential | B | 2-15 | 1 | 980 COROLLA DR | 43 | 44 | 47 | 4 |
| R-163 | Residential | B | 2-15 | 1 | 978 COROLLA DR | 45 | 45 | 49 | 4 |
| R-164 | Residential | B | 2-15 | 1 | 976 COROLLA DR | 47 | 47 | 51 | 4 |
| R-165 | Residential | B | 2-15 | 1 | 974 COROLLA DR | 45 | 46 | 50 | 5 |
| R-166 | Residential | B | 2-15 | 1 | 972 COROLLA DR | 41 | 41 | 44 | 3 |
| R-167 | Residential | B | 2-15 | 1 | 975 COROLLA DR | 41 | 41 | 42 | 1 |
| R-168 | Residential | B | 2-15 | 1 | 973 COROLLA DR | 41 | 41 | 41 | 0 |
| R-169 | Residential | B | 2-15 | 1 | 971 COROLLA DR | 39 | 39 | 43 | 4 |
| R-170 | Residential | B | 2-15 | 1 | 981 N HARBOR VW | 54 | 54 | 57 | 3 |
| R-171 | Residential | B | 2-15 | 1 | 968 COROLLA DR | 45 | 45 | 49 | 4 |
| R-172 | Residential | B | 2-15 | 1 | 969 COROLLA DR | 40 | 40 | 44 | 4 |
| R-173 | Residential | B | 2-15 | 1 | 980 N HARBOR VW | 67 | 67 | 67 | 0 |
| R-174 | Residential | B | 2-15 | 1 | 977 N HARBOR VW | 55 | 55 | 56 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-175 | Residential | B | 2-15 | 1 | 966 COROLLA DR | 47 | 47 | 49 | 2 |
| R-176 | Residential | B | 2-16 | 1 | 967 COROLLA DR | 40 | 40 | 41 | 1 |
| R-177 | Residential | B | 2-15 | 1 | 964 COROLLA DR | 48 | 48 | 50 | 2 |
| R-178 | Residential | B | 2-15 | 1 | 983 OCEAN FOREST CT | 47[2] | 47[2] | 53 | 6 |
| R-179 | Residential | B | 2-15 | 1 | 986 OCEAN FOREST CT | 47[2] | 47[2] | 51 | 4 |
| R-180 | Residential | B | 2-15 | 1 | 984 OCEAN FOREST CT | 48 | 49 | 52 | 4 |
| R-181 | Residential | B | 2-15 | 1 | 982 OCEAN FOREST CT | 48 | 49 | 52 | 4 |
| R-182 | Residential | B | 2-15 | 1 | 980 OCEAN FOREST CT | 48 | 48 | 52 | 4 |
| R-183 | Residential | B | 2-15 | 1 | 972 OCEAN FOREST CT | 53 | 53 | 53 | 0 |
| R-184 | Residential | B | 2-15 | 1 | 978 OCEAN FOREST CT | 50 | 50 | 52 | 2 |
| R-185 | Residential | B | 2-15 | 1 | 972 MISTY POND CT | 51 | 51 | 51 | 0 |
| R-186 | Residential | B | 2-15 | 1 | 970 MISTY POND CT | 56 | 56 | 53 | -3 |
| R-187 | Residential | B | 2-15 | 1 | 968 MISTY POND CT | 66 | 66 | 63 | -3 |
| R-188 | Residential | B | 2-15 | 1 | 969 OCEAN FOREST CT | 61 | 61 | 60 | -1 |
| R-189 | Residential | B | 2-15 | 1 | 971 MISTY POND CT | 66 | 66 | 63 | -3 |
| R-190 | Residential | B | 2-15 | 1 | 976 OCEAN FOREST CT | 63 | 63 | 62 | -1 |
| R-191 | Residential | B | 2-15 | 1 | 974 N HARBOR VW | 67 | 67 | 65 | -2 |
| R-192 | Residential | B | 2-15 | 1 | 973 N HARBOR VW | 55 | 55 | 56 | 1 |
| R-193 | Residential | B | 2-15 | 1 | 979 OCEAN FOREST CT | 55 | 55 | 57 | 2 |
| R-194 | Residential | B | 2-15 | 1 | 962 COROLLA DR | 46 | 46 | 48 | 2 |
| R-195 | Residential | B | 2-15 | 1 | 971 N HARBOR VW | 55 | 55 | 56 | 1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-196 | Residential | B | 2-15 | 1 | 958 COROLLA DR | 45 | 45 | 46 | 1 |
| R-197 | Residential | B | 2-15 | 1 | 954 SUN BURST CT | 57 | 57 | 54 | -3 |
| R-198 | Residential | B | 2-15 | 1 | 953 SUN BURST CT | 64 | 64 | 60 | -4 |
| R-199 | Residential | B | 2-15 | 1 | 950 SUN BURST CT | 52 | 52 | 51 | -1 |
| R-200 | Residential | B | 2-16 | 1 | 948 SUN BURST CT | 54 | 54 | 53 | -1 |
| R-201 | Residential | B | 2-16 | 1 | 944 SUN BURST CT | 52 | 52 | 52 | 0 |
| R-202 | Residential | B | 2-16 | 1 | 942 S HARBOR VW | 49 | 50 | 51 | 2 |
| R-203 | Residential | B | 2-16 | 1 | 940 S HARBOR VW | 49 | 50 | 51 | 2 |
| R-204 | Residential | B | 2-16 | 1 | 938 S HARBOR VW | 49 | 50 | 51 | 2 |
| R-205 | Residential | B | 2-16 | 1 | 936 S HARBOR VW | 50 | 51 | 52 | 2 |
| R-206 | Residential | B | 2-16 | 1 | 934 S HARBOR VW | 52 | 52 | 53 | 1 |
| R-207 | Residential | B | 2-16 | 1 | 932 S HARBOR VW | 53 | 53 | 54 | 1 |
| R-208 | Residential | B | 2-16 | 1 | 930 S HARBOR VW | 53 | 53 | 54 | 1 |
| R-209 | Residential | B | 2-16 | 1 | 928 S HARBOR VW | 53 | 53 | 54 | 1 |
| R-210 | Residential | B | 2-16 | 1 | 924 COROLLA DR | 60 | 60 | 60 | 0 |
| R-211 | Residential | B | 2-16 | 1 | 928 COROLLA DR | 62 | 62 | 61 | -1 |
| R-212 | Residential | B | 2-16 | 1 | 932 COROLLA DR | 61 | 61 | 61 | 0 |
| R-213 | Residential | B | 2-16 | 1 | 934 COROLLA DR | 60 | 60 | 59 | -1 |
| R-214 | Residential | B | 2-16 | 1 | 936 COROLLA DR | 62 | 62 | 60 | -2 |
| R-215 | Residential | B | 2-16 | 1 | 938 COROLLA DR | 64 | 64 | 61 | -3 |
| R-216 | Residential | B | 2-16 | 1 | 940 COROLLA DR | 61 | 61 | 59 | -2 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-217 | Residential | B | 2-16 | 1 | 947 N HARBOR VW | 67 | 67 | 64 | -3 |
| R-218 | Residential | B | 2-15 | 1 | 954 N HARBOR VW | 67 | 67 | 65 | -2 |
| R-219 | Residential | B | 2-15 | 1 | 956 N HARBOR VW | 64 | 64 | 64 | 0 |
| R-220 | Residential | B | 2-15 | 1 | 960 N HARBOR VW | 67 | 67 | 65 | -2 |
| R-221 | Residential | B | 2-15 | 1 | 958 N HARBOR VW | 67 | 67 | 65 | -2 |
| R-222 | Residential | B | 2-15 | 1 | 964 N HARBOR VW | 59 | 59 | 63 | 4 |
| R-223 | Residential | B | 2-15 | 1 | 966 N HARBOR VW | 64 | 64 | 64 | 0 |
| R-224 | Residential | B | 2-15 | 1 | 968 N HARBOR VW | 67 | 67 | 64 | -3 |
| R-225 | Pool | C | 2-16 | 1 | 924 S HARBOR VW | 67 | 67 | 67 | 0 |
| R-226 | Residential | B | 2-15 | 1 | 965 SUNSET CRES | 53 | 54 | 54 | 1 |
| R-227 | Residential | B | 2-15 | 1 | 963 SUNSET CRES | 47 | 47 | 48 | 1 |
| R-228 | Residential | B | 2-15 | 1 | 964 SUNSET CRES | 52 | 53 | 54 | 2 |
| R-229 | Residential | B | 2-15 | 1 | 962 SUNSET CRES | 46 | 47 | 47 | 1 |
| R-230 | Residential | B | 2-15 | 1 | 955 SEA VIEW CT | 52 | 53 | 55 | 3 |
| R-231 | Residential | B | 2-15 | 1 | 952 SEA VIEW CT | 53 | 54 | 55 | 2 |
| R-232 | Residential | B | 2-15 | 1 | 951 N HARBOR VW | 53 | 53 | 54 | 1 |
| R-233 | Residential | B | 2-15 | 1 | 947 N HARBOR VW | 56 | 56 | 56 | 0 |
| R-234 | Residential | B | 2-16 | 1 | 942 COROLLA DR | 55 | 55 | 53 | -2 |
| R-235 | Residential | B | 2-16 | 1 | 944 COROLLA DR | 55 | 55 | 53 | -2 |
| R-236 | Residential | B | 2-16 | 1 | 946 COROLLA DR | 50 | 50 | 49 | -1 |
| R-237 | Residential | B | 2-16 | 1 | 948 COROLLA DR | 48 | 48 | 47 | -1 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-238 | Residential | B | 2-16 | 1 | 950 COROLLA DR | 46 | 46 | 45 | -1 |
| R-239 | Residential | B | 2-16 | 1 | 927 COROLLA DR | 51 | 51 | 51 | 0 |
| R-240 | Residential | B | 2-16 | 1 | 929 COROLLA DR | 49 | 49 | 50 | 1 |
| R-241 | Residential | B | 2-16 | 1 | 931 COROLLA DR | 49 | 49 | 49 | 0 |
| R-242 | Residential | B | 2-16 | 1 | 933 COROLLA DR | 48 | 48 | 48 | 0 |
| R-243 | Residential | B | 2-16 | 1 | 935 COROLLA DR | 50 | 50 | 49 | -1 |
| R-244 | Residential | B | 2-16 | 1 | 937 COROLLA DR | 48 | 48 | 48 | 0 |
| R-245 | Residential | B | 2-16 | 1 | 939 COROLLA DR | 45 | 45 | 45 | 0 |
| R-246 | Residential | B | 2-16 | 1 | 941 COROLLA DR | 47 | 47 | 47 | 0 |
| R-247 | Residential | B | 2-16 | 1 | 943 COROLLA DR | 46 | 46 | 45 | -1 |
| R-248 | Residential | B | 2-16 | 1 | 949 COROLLA DR | 40 | 40 | 40 | 0 |
| R-249 | Residential | B | 2-15 | 1 | 953 SEA VIEW CT | 46 | 47 | 48 | 2 |
| R-250 | Residential | B | 2-16 | 1 | 935 S HARBOR VW | 53 | 53 | 54 | 1 |
| R-251 | Residential | B | 2-16 | 1 | 939 SOUNDSIDE CT | 56 | 56 | 54 | -2 |
| R-252 | Tennis court | C | 2-16 | 1 | 924 S HARBOR VW | 64 | 64 | 64 | 0 |
| R-253 | Residential | B | 2-16 | 1 | 947 SUN BURST CT | 59 | 59 | 55 | -4 |
| R-254 | Residential | B | 2-16 | 1 | 932 SOUNDSIDE CT | 53 | 53 | 55 | 2 |
| R-255 | Tennis court | C | 2-16 | 1 | 924 S HARBOR VW | 65 | 65 | 64 | -1 |
| R-256 | Residential | B | 2-16 | 1 | 931 SOUNDSIDE CT | 61 | 61 | 62 | 1 |
| R-257 | Residential | B | 2-16 | 1 | 954 COROLLA DR | 44 | 44 | 45 | 1 |
| R-258A | Recreational | C | 2-17 | 1 | 808 OCEAN TRL | 57 | 57 | 57 | 0 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-258B | Recreational | C | 2-17 | 1 | 808 OCEAN TRL | 62 | 62 | 62 | 0 |
| R-258C | Recreational | C | 2-17 | 1 | 808 OCEAN TRL | 58 | 58 | 58 | 0 |
| R-258D | Recreational | C | 2-17 | 1 | 808 OCEAN TRL | 56 | 56 | 56 | 0 |
| R-259 | Restaurant | E | 2-17 | 1 | 804 OCEAN TRL | 67 | 67 | 67 | 0 |
| R-260 | Restaurant | E | 2-17 | 1 | 807 OCEAN TRL | 64 | 64 | 64 | 0 |
| R-261 | Restaurant | E | 2-17 | 1 | 807 OCEAN TRL | 62 | 62 | 62 | 0 |
| R-262 | Residential | B | 2-17 | 1 | 797 BROAD ST | 58 | 59 | 59 | 1 |
| R-263 | Residential | B | 2-17 | 1 | 799 BROAD ST | 58 | 59 | 59 | 1 |
| R-264 | Residential | B | 2-17 | 1 | 791 W MEETING ST | 58 | 58 | 58 | 0 |
| R-265 | Residential | B | 2-17 | 1 | 789 W MEETING ST | 50 | 51 | 51 | 1 |
| R-266 | Residential | B | 2-17 | 1 | 792 BROAD ST | 49 | 49 | 49 | 0 |
| R-267 | Tennis court | C | 2-17 | 1 | ORIONS WAY | 60 | 60 | 60 | 0 |
| R-268 | Residential | B | 2-17 | 1 | 790 W MEETING ST | 54 | 55 | 55 | 1 |
| R-269 | Residential | B | 2-17 | 1 | 790 W MEETING ST | 53 | 53 | 53 | 0 |
| R-270 | Residential | B | 2-17 | 1 | 788 W MEETING ST | 52 | 52 | 53 | 1 |
| R-271 | Pool | C | 2-17 | 1 | ORIONS WAY | 60 | 60 | 60 | 0 |
| R-272 | Basketball court | C | 2-17 | 1 | ORIONS WAY | 60 | 60 | 60 | 0 |
| R-273 | Residential | B | 2-17 | 1 | 788 W MEETING ST | 52 | 52 | 52 | 0 |
| R-274 | Residential | B | 2-17 | 1 | 790 BROAD ST | 45 | 45 | 45 | 0 |
| R-275 | Residential | B | 2-17 | 1 | 788 BROAD ST | 45 | 45 | 45 | 0 |
| R-276 | Residential | B | 2-17 | 1 | 786 W MEETING ST | 52 | 52 | 52 | 0 |

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |
| R-277 | Residential | B | 2-17 | 1 | 786 W MEETING ST | 53 | 53 | 53 | 0 |
| R-278 | Residential | B | 2-17 | 1 | 783 W MEETING ST | 45 | 46 | 45 | 0 |
| R-279 | Residential | B | 2-17 | 1 | 784 W MEETING ST | 53 | 55 | 55 | 2 |
| R-280 | Residential | B | 2-18 | 1 | 5228 BIRCH LN | 59 | 60 | 60 | 1 |
| R-281 | Residential | B | 2-18 | 1 | 711 WINSOR PL | 57 | 58 | 58 | 1 |
| R-282A | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 66 | 67 | 68 | 2 |
| R-282B | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 67 | 67 | 68 | 1 |
| R-282C | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 62 | 63 | 63 | 1 |
| R-282D | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 62 | 63 | 64 | 2 |
| R-282E | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 58 | 59 | 60 | 2 |
| R-282F | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 58 | 59 | 59 | 1 |
| R-282G | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 62 | 63 | 63 | 1 |
| R-282H | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 59 | 59 | 60 | 1 |
| R-282I | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 56 | 57 | 58 | 2 |
| R-282J | Golf course | C | 2-18 | 0.1 | 50 DOGWOOD TRL S | 56 | 57 | 57 | 1 |
| | | | | | **Predicted Traffic Noise Impacts[3]** | **N/A** | **N/A** | **59[4]** | **0[5]** |

Impact = Right-of-Way Acquisition =

1. Existing and No-Build ambient noise levels based on long-term measurements at 115 Lighthouse View Rd, Aydlett between February 26 and February 28, 2018. The measured existing loudest-hour noise level was determined to be 47 dB(A) $L_{eq(h)}$.
2. Existing and No-Build ambient noise levels based on long-term measurements at 983 Ocean Forest Court, Corolla between February 27 and March 1, 2018. The measured existing loudest-hour noise level was determined to be 47 dB(A) $L_{eq(h)}$.

**Table B.1: Mid-Currituck Bridge Study (STIP#: R-2576)**
**Noise-Sensitive Receptors and Hourly Equivalent Noise Levels**

| Receptors | | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rec. No. | Land Use | NAC | Figure # | ERs | Address | 2015 Existing | 2040 No-Build | 2040 Build Alternative | Δ |

3. Total number of predicted traffic noise impacts for the Build Alternative is 59. The number of predicted impacts is not duplicated if receptors are predicted to be impacted by more than one criterion (e.g., if a receptor is impacted by NAC "C" and NAC "D", it is counted as only one impact).
4. Predicted traffic noise level impacts are due to approaching or exceeding NAC (refer to Table 2, page 8).
5. No impacts are predicted due to a substantial increase above existing noise levels (refer to Table 4, page 14).

| Table B-2: Currituck County High School Tennis and Soccer Fields (Activity Category C) Equivalent Receptor Calculations NSA 1 – R-35 Receptor Array | | |
|---|---|---|
| **Description:** | Used Monday – Friday for 34 weeks per year. Team sizes: tennis - 14, JV soccer - 20, varsity soccer - 28. | |
| Line | **For an Average Single Family Residential Unit in North Carolina** | |
| A | People per Residence | 3.0 |
| B | Hours Available for Use per Year | 8,760 |
| C | **Person-hours per Year Available for Use = A x B** | **26,280** |
| | **For the Park Area Being Evaluated** | |
| D | Percent of Usable Area of Park Impacted by Project Noise | 47% |
| E | Percent of Usable Area of Park Benefited by Proposed Noise Wall | 80% |
| F | **Maximum of D and E** | **80%** |
| G | Average Number of Visitors per Day | 62 |
| H | Number of Park Staff | 0 |
| I | **Total Number of Occupants per Day = G + H** | **62** |
| J | Average Hours per Day Used by Each Visitor | 4 |
| K | Operational Days per Week | 5 |
| L | Operational Weeks per Year | 34 |
| M | **Person-hours per Year Available for Use = F x I x J x K x L** | **38,366** |
| N | **EQUIVALENT RESIDENCE VALUE = M/C** | **2** |
| O | A grid of receptor points at 100-foot spacing (represented by 15 points) was developed to represent the impacted or benefited park usage area. | 15 |
| P | **Equivalent Residence Value Assigned to Each Grid Point = N/O** | **0.13** |
| Q | Number of Votes Assigned to Park in Barrier Voting Process = N | 2 |

Source: Currituck County High School Athletic Director, January 2018.

| Table B-3: Duck Woods Country Club Golf Course (Activity Category C)<br>Equivalent Receptor Calculations<br>NSA 6 – R-282 Receptor Array | | |
|---|---|---|
| **Description:** | 70 players per day. Open 7 days per week, 52 weeks per year. | |
| Line | **For an Average Single Family Residential Unit in North Carolina** | |
| A | People per Residence | 3.0 |
| B | Hours Available for Use per Year | 8,760 |
| C | **Person-hours per Year Available for Use = A x B** | **26,280** |
| | **For the Park Area Being Evaluated** | |
| D | Percent of Usable Area of Park Impacted by Project Noise | 1% |
| E | Percent of Usable Area of Park Benefited by Proposed Noise Wall | 1% |
| F | **Maximum of D and E** | **1%** |
| G | Average Number of Visitors per Day | 70 |
| H | Number of Park Staff | 10 |
| I | **Total Number of Occupants per Day = G + H** | **80** |
| J | Average Hours per Day Used by Each Visitor | 5 |
| K | Operational Days per Week | 7 |
| L | Operational Weeks per Year | 52 |
| M | **Person-hours per Year Available for Use = F x I x J x K x L** | **1,456** |
| N | **EQUIVALENT RESIDENCE VALUE = M/C** | **1** |
| O | A grid of receptor points at 100-foot spacing (represented by 10 points) was developed to represent the impacted or benefited park usage area. | 10 |
| P | **Equivalent Residence Value Assigned to Each Grid Point = N/O** | **0.10** |
| Q | Number of Votes Assigned to Park in Barrier Voting Process = N | 1 |

Source: Duck Woods Country Club, January 2018.

# Appendix C

# TRAFFIC NOISE MODELS

**General**
This appendix documents the TNM Model Input used in this traffic noise analysis. The TNM Models utilized four TNM object types to approximate the traffic noise environment for Mid-Currituck Bridge Traffic Noise Analysis:

Roadways
Receptors (Receivers)
Barriers
Terrain Lines
Ground Zones

**Coordinate System**
Each of the TNM Objects was modeled using the North American Datum 1983 (NAD83) horizontal coordinate system, and North American Vertical Datum 1988 (NAVD88).

**Modeling Procedure**
Roadways:
TNM Roadway Element widths were selected based upon representation of one lane of traffic per TNM roadway element. For the proposed highway facility, TNM Roadway vertices were selected to represent interval lengths that appropriately represent fluctuations in the horizontal and vertical roadway geometry. For highways in which more than one parallel TNM roadway element were modeled, the modeled roadway lane widths were set to ensure horizontal overlapping of adjacent modeled roadway elements. Overlapping TNM roadway elements is necessary to accurately represent the continuous paved surface. TNM roadway elements of various widths were also modeled to represent the existing local roadways.

Terrain Lines (Elevation Contours):
Elevations (vertical, "Z" coordinates) were input into TNM as coordinate values of vertices (in units of feet) that define significant changes in grades and/or slopes throughout the study areas. Terrain lines were also used to model proposed retaining walls and define the edges of roadways on structure.

Receivers (Receptors):
TNM Receiver Elements were modeled by assigning a point location to the most sensitive likely 'area of frequent human use' for all residential and recreational land uses within the project limits. All receivers in the TNM models were assigned a height of 4.92 feet above ground. Noise levels at each discrete receptor were determined by modeling an individual TNM receiver at all representative locations for 'loudest-condition' Existing Year 2015, Design Year 2040 No-build, and Design Year 2040 Build condition predicted traffic.

Barriers:
Buildings throughout the project corridor that shield receptors from roadways were modeled as barriers. Existing and proposed concrete safety barriers (shoulder and median) were modeled as barriers along several bridge sections in the project area.

Ground Zones:
TNM Ground Zone elements were modeled to represent large areas of acoustically reflective ground surfaces, such as water and pavement, located between roadways and receptor locations.

**TNM Model Traffic Noise Level Assessment**
The TNM model traffic noise level assessment is divided into four tasks:

1. Creation of Validated TNM Computer Model(s)
2. Assessment of Existing Loudest-Hour Traffic Noise Levels
3. Assessment of Predicted Loudest-Hour Design Year No-Build and Build Condition Without-Barrier Levels

**Table C-1: Mid-Currituck Bridge TNM Validation Table**

| Setup | Receptor | Monitored $L_{eq(h)}$ dB(A)[1] | TNM-Predicted $L_{eq(h)}$ dB(A) [1] | Validation Delta (Pred. – Meas.) [1] |
|---|---|---|---|---|
| 1 | V-1A | 69.2 | 68.6 | -0.6 |
| | V-1B | 61.4 | 59.0 | -2.4 |
| | V-1C | 57.9 | 56.5 | -1.4 |
| 2 | V-2A | 64.8 | 63.8 | -1.0 |
| | V-2B | 59.2 | 58.6 | -0.6 |
| | V-2C | 59.0 | 57.0 | -2.0 |
| 3 | V-3A | 62.3 | 64.0 | 1.7 |
| | V-3B | 55.6 | 58.3 | 2.7 |
| 4 | V-4A | 58.2 | 60.6 | 2.4 |
| | V-4B | 52.3 | 54.1 | 1.8 |
| | V-4C | 48.3 | 51.3 | 3.0 |
| 5 | V-5A | 68.2 | 66.5 | -1.7 |
| | V-5B | 59.3 | 58.2 | -1.1 |
| 7 | V-7A | 57.2 | 58.9 | 1.7 |
| | V-7B | 45.4 | 44.1 | -1.3 |
| | V-7C | 43.0 | 40.2 | -2.8 |
| 8 | V-8A | 51.1 | 48.6 | -2.5 |
| | V-8B | 47.7 | Ambient measurement[2] | |
| 9 | V-9A | 55.6 | 57.0 | 1.4 |
| | V-9B | 43.8 | 42.6 | -1.2 |
| | V-9C | 39.8 | 31.1 | -8.7[3] |

1. Hourly equivalent noise levels, $L_{eq(h)}$, are expressed to the nearest one-tenth decibels to demonstrate that TNM-predicted noise levels validate to within ± 3.0 dB(A) of measured noise levels without the benefits of rounding. Accuracy of the TNM model at the modeled traffic noise monitoring locations was validated in the TNM runs "MCB_NSA 1_V-1", "MCB_NSA 1_V-2", "MCB_NSA 2_V-3", "MCB_NSA 2_V-4", "MCB_NSA 4_V-7", "MCB_NSA 4_V-9", "MCB_NSA 5_V-8", and "MCB_NSA 6_V-5".
2. At measurement location V-8B traffic noise was audible but overall ambient noise was a significant contributor to the overall measured noise level, so an ambient measurement was taken to represent the area of NSA 5 that is more distant from NC 12.
3. Third-row receptor V-9C would not validate due to the distance from NC 12 and shielding from traffic noise by two rows of dense building structures, which increased the contribution of ambient (non-traffic) noise sources so that it dominated the overall measured noise level.

**Figure C.1: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 1 (North) – Existing, No Build, and Build Alternative Conditions***

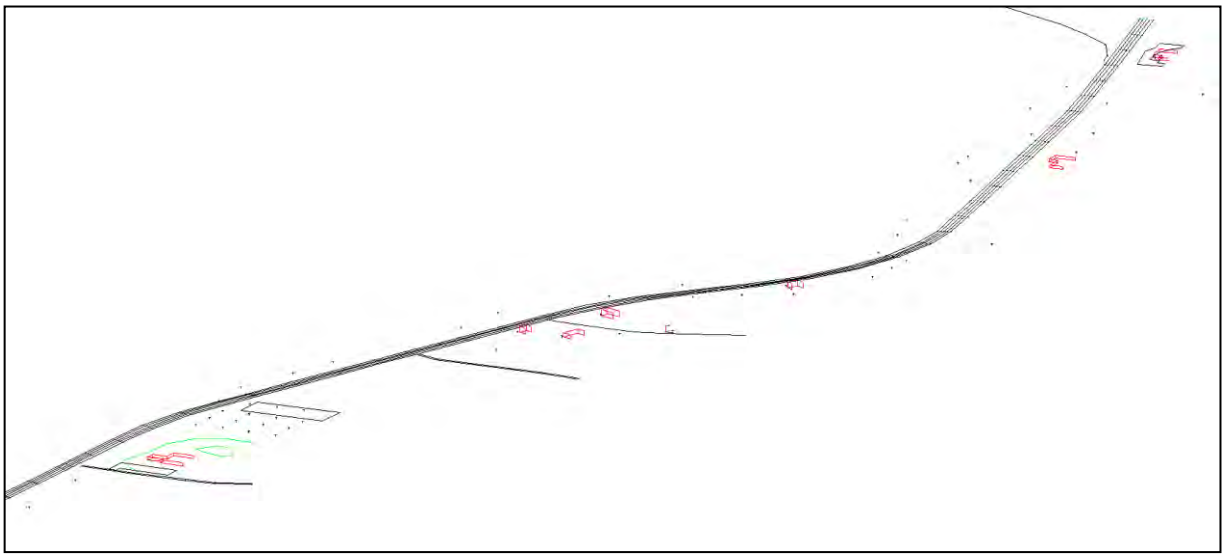
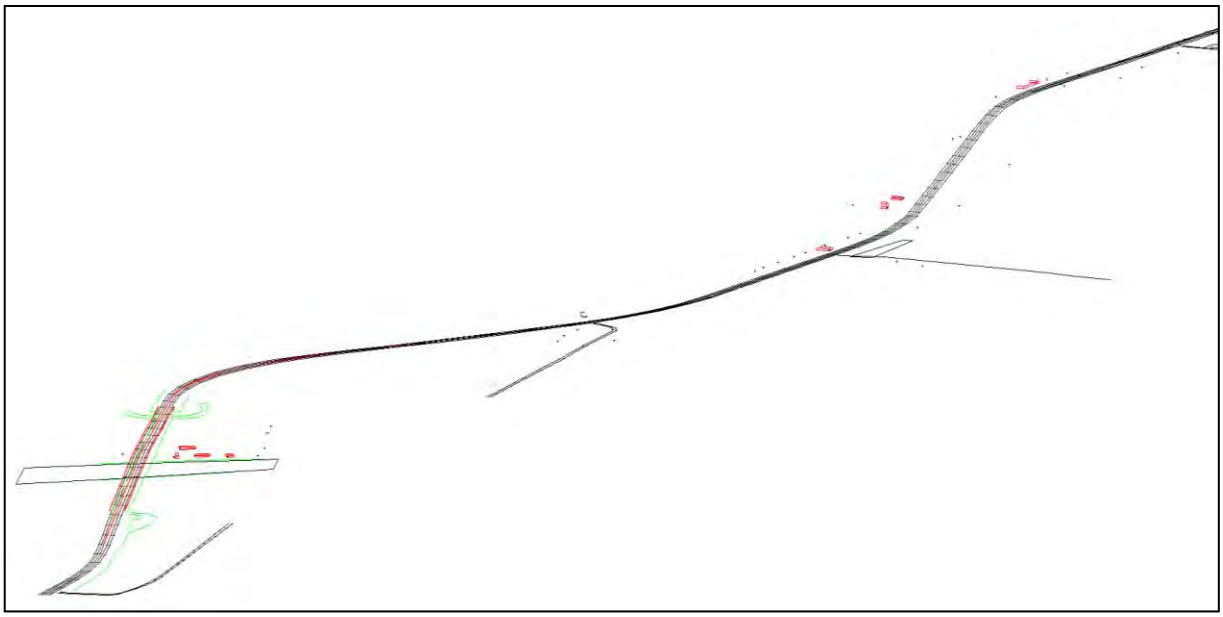


**Figure C.2: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 1 (South) – Existing, No Build, and Build Alternative Conditions***



* Note: There are no physical roadway improvements proposed in NSA 1, so the Existing, No Build, and Build Alternative TNM models only differ in traffic input.

**Figure C.3: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 2 – Existing and No Build Conditions**

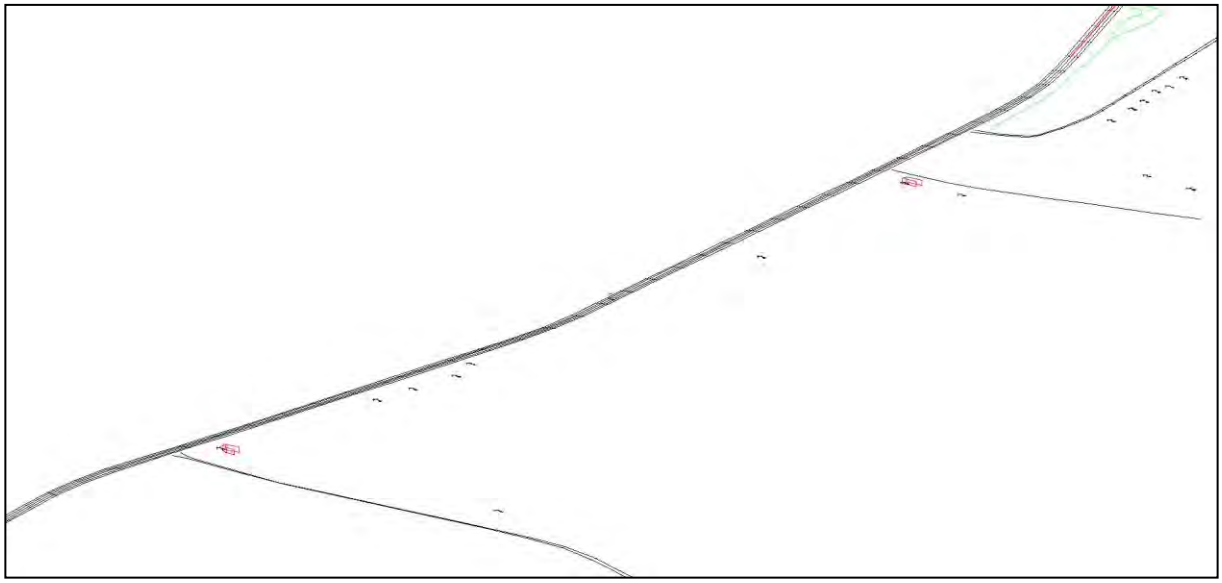


**Figure C.4: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 2 – Build Alternative Condition**

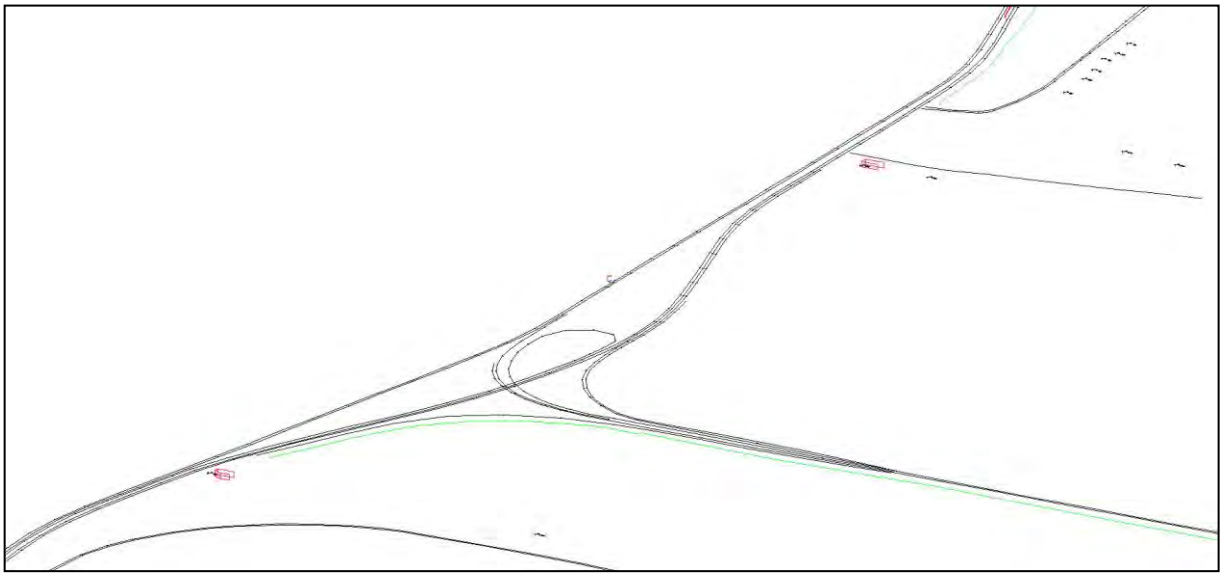
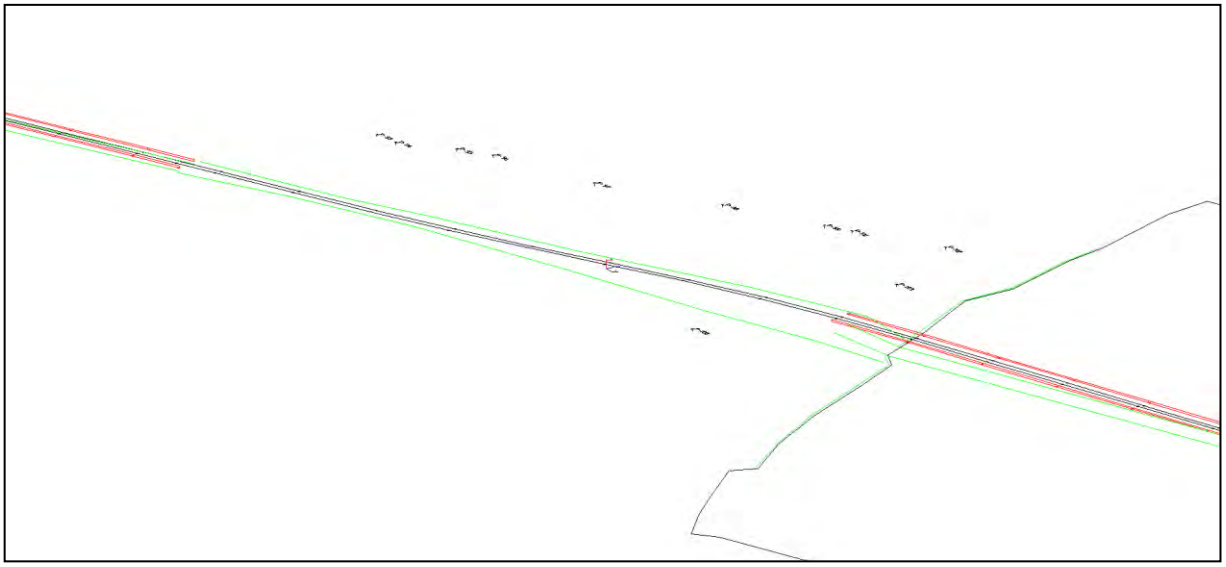


**Figure C.5: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 3 – Build Alternative Condition***



* Note: There are no major roadways in NSA 3 for the Existing and No-Build conditions. Because of this, Existing and No-Build condition noise levels were established with long-term noise measurements and TNM models were not developed.

**Figure C.6: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 4 – Existing and No Build Conditions**

**Figure C.7: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 4 – Build Alternative Condition**

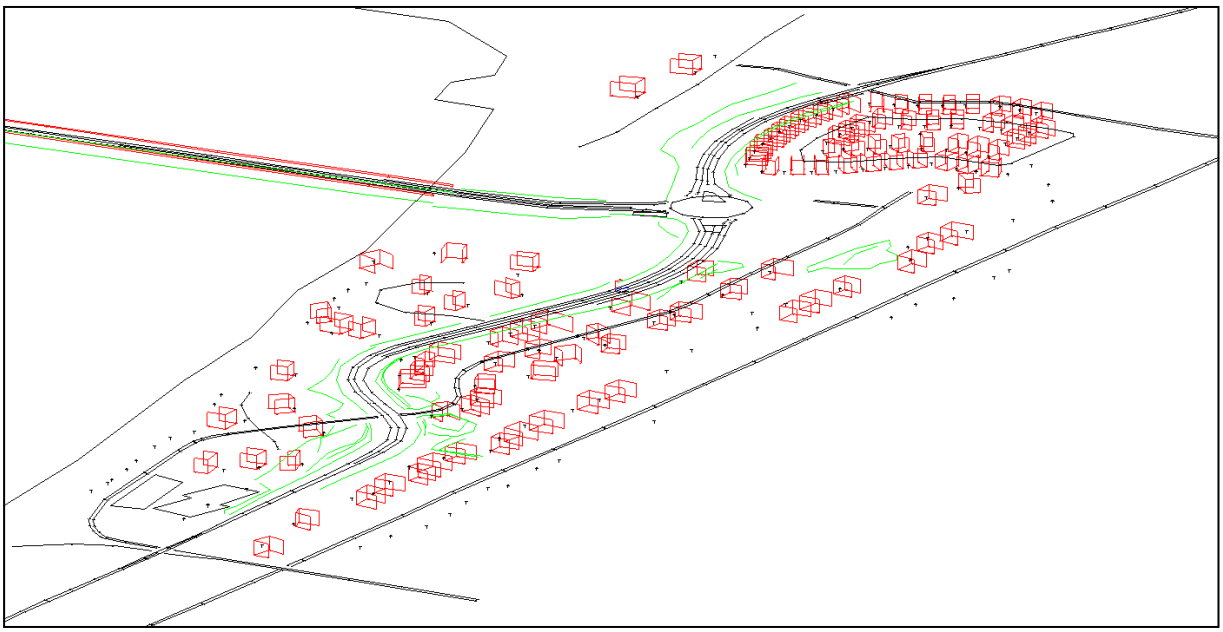


**Figure C.8: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 5 – Existing and No Build Conditions**

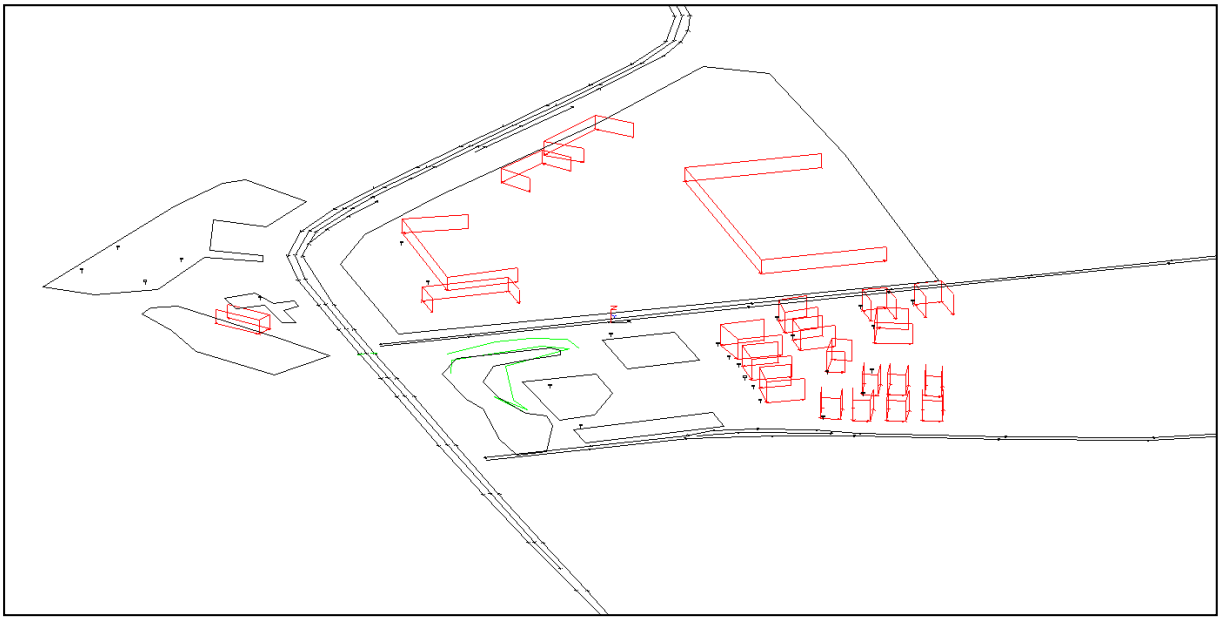


**Figure C.9: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 5 – Build Alternative Condition**

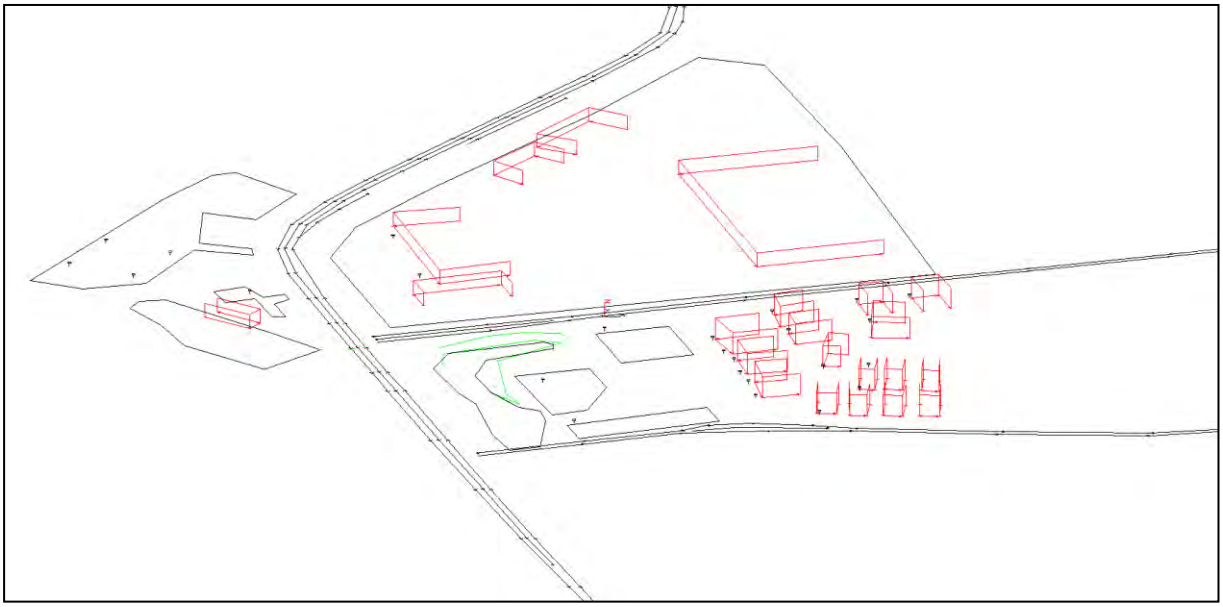


**Figure C.10: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 6 – Existing and No Build Conditions**

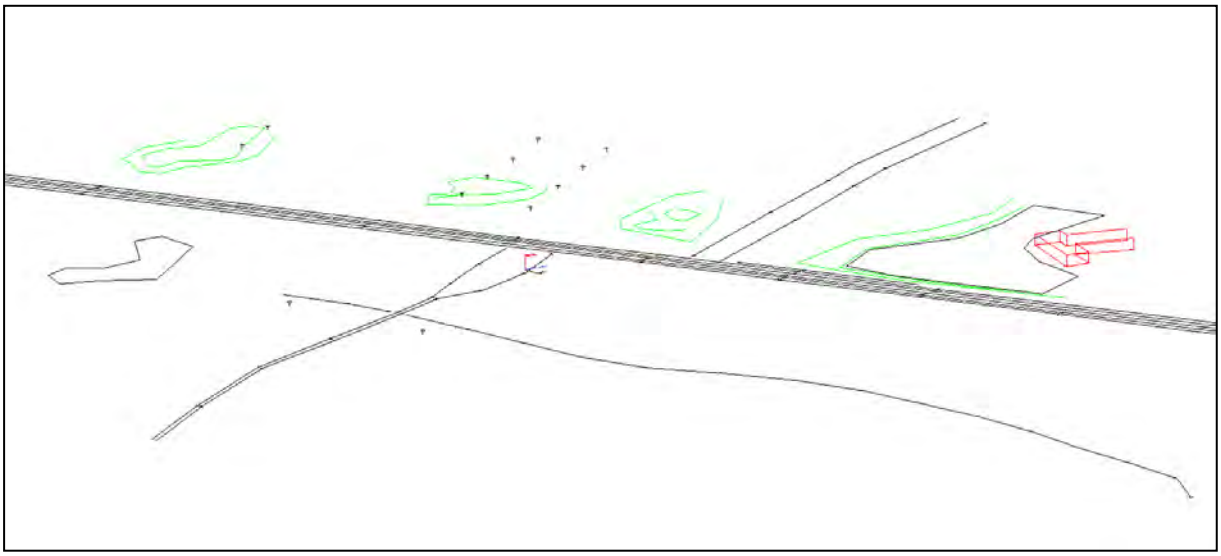


**Figure C.11: Mid-Currituck Bridge TNM Model (Perspective View)**
**NSA 6 – Build Alternative Condition**

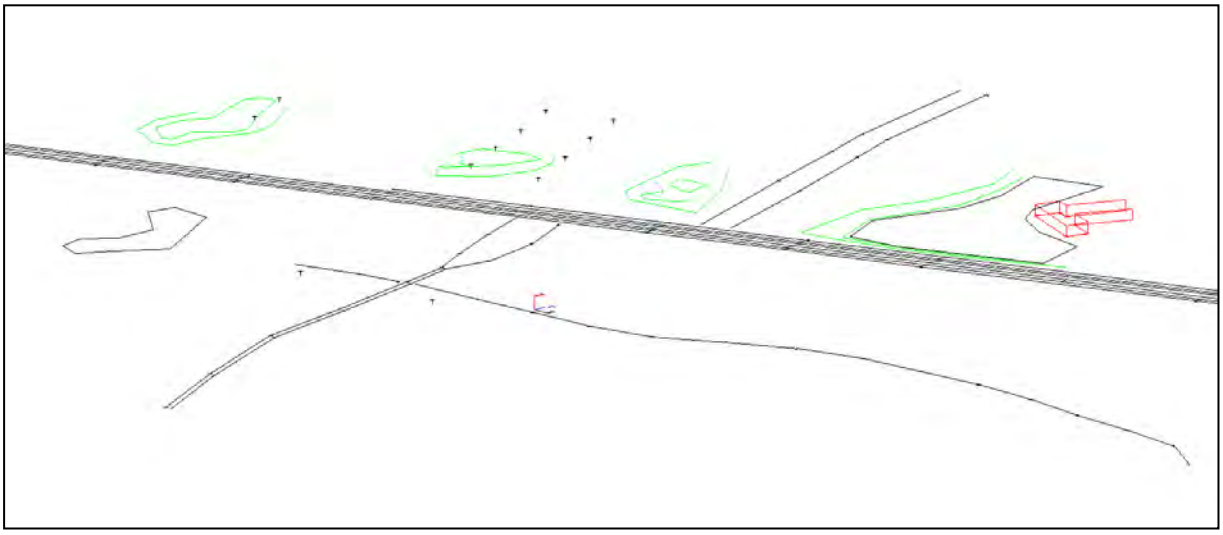


**Figure C.12: Mid-Currituck Bridge TNM Model (Perspective View)**
**Noise Barrier -NW1.1-**

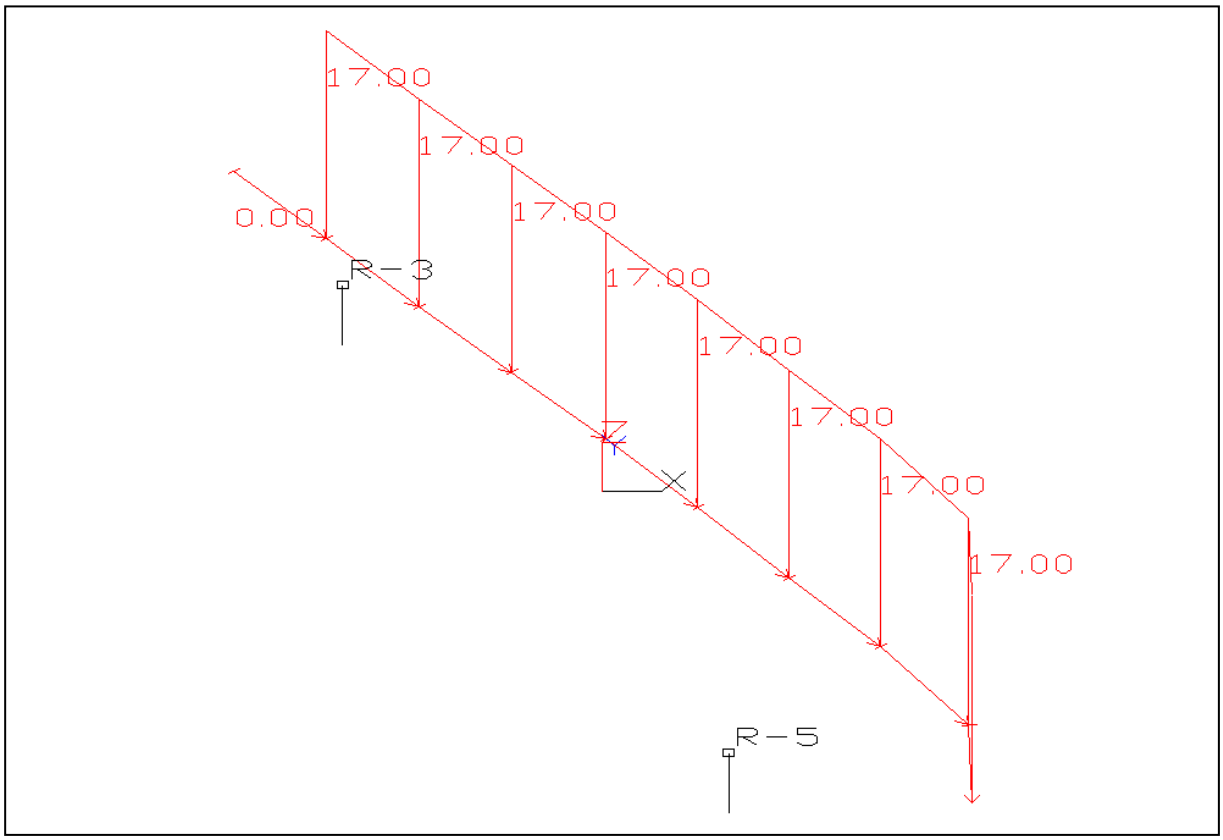



**Figure C.13: Mid-Currituck Bridge TNM Model (Perspective View)**
**Noise Barrier -NW1.2-**

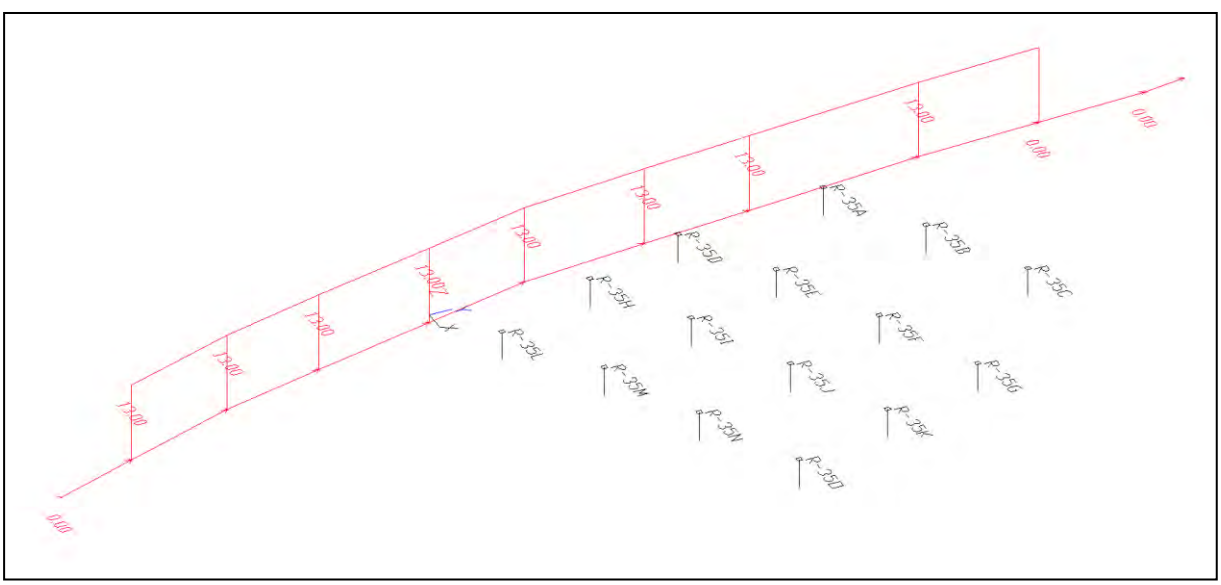
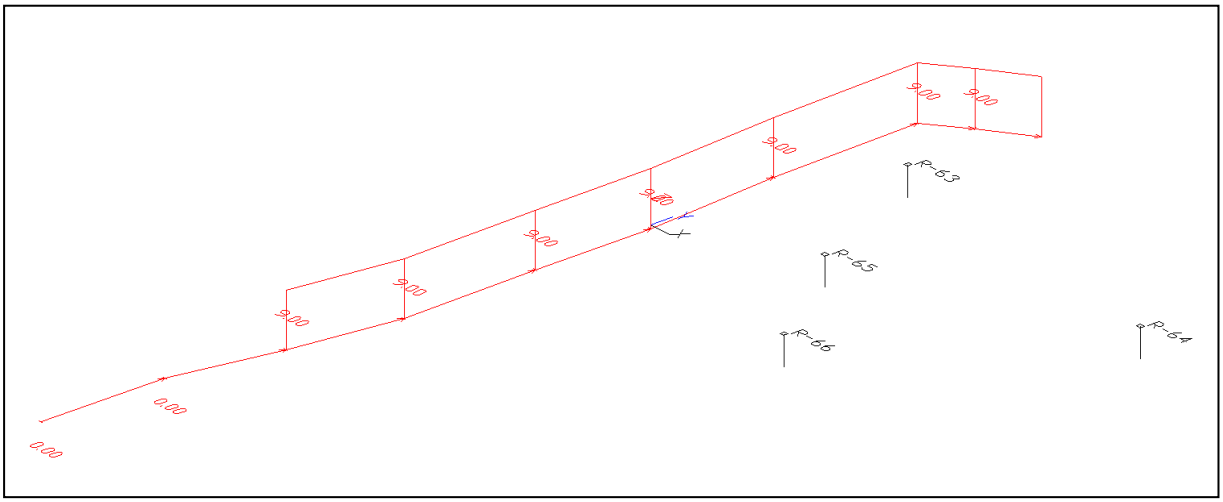


**Figure C.14: Mid-Currituck Bridge TNM Model (Perspective View)**
**Noise Barrier -NW1.3-**



# Appendix D

# TRAFFIC VOLUMES

**Table D-1: Predicted Existing Year 2015 Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| US 158 | NC 168 and Currituck County HS Road | NB | 2,148 | 1,758 | 50 | 95 | 4 | 1 |
| US 158 | Currituck County HS Road and Worth Guard Rd | NB | 2,158 | 1,766 | 50 | 95 | 4 | 1 |
| US 158 | Worth Guard Rd and Old US 158 S | NB | 2,168 | 1,774 | 60 | 95 | 4 | 1 |
| US 158 | Old US 158 S and Aydlett Rd | NB | 2,158 | 1,766 | 60 | 95 | 4 | 1 |
| US 158 | South of Aydlett Road | NB | 2,129 | 1,742 | 60 | 95 | 4 | 1 |
| NC 12 | North of Herring St/Devil's Bay | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Herring St/Devil's Bay to N Harbor View | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | N Habor View to Ocean Forest Ct | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Ocean Forest Ct to N/S Harbor View | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | N/S Harbor View to Monteray Dr N/Bonita St | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Monteray Dr N/Bonita St to Monteray Dr S/Dolphin St | SB | 517 | 517 | 50 | 94 | 6 | 0 |
| NC 12 | Monteray Dr S/Dolphin St to Food Lion N Access | SB | 517 | 517 | 50 | 95 | 5 | 0 |
| NC 12 | Food Lion N Access to Albacore St/Sunset Blvd N | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd N/Albacore St to Sunset Blvd S/Orion's Way | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd S/Orion's Way to Crown Point Rd | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| US 158 | West of Birch Ln | WB | 1,499 | 1,499 | 55 | 95 | 4 | 1 |
| US 158 | Birch Ln to Duck Woods Dr | WB | 1,499 | 1,499 | 55 | 95 | 4 | 1 |
| US 158 | Duck Woods Dr to Cypress Knee Trail | WB | 1,499 | 1,499 | 55 | 95 | 4 | 1 |

**Table D-1: Predicted Existing Year 2015 Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| US 158 | Cypress Knee Trail to Juniper Trail | WB | 1,499 | 1,499 | 55 | 93 | 5 | 2 |
| Currituck County HS Road | east of US 158 | WB | 29 | 19 | 25 | 95 | 4 | 1 |
| Worth Guard Rd | east of US 158 | WB | 48 | 32 | 45 | 95 | 4 | 1 |
| Old US 158 S (Waterlily) | east of US 158 | WB | 67 | 45 | 45 | 95 | 4 | 1 |
| Aydlett Rd | east of US 158 | WB | 48 | 32 | 45 | 95 | 4 | 1 |
| Devil's Bay | west of NC 12 | EB | 10 | 6 | 25 | 94 | 6 | 0 |
| Herring St | east of NC 12 | WB | 42 | 22 | 25 | 94 | 6 | 0 |
| N Harbor View (N section) | east of NC 12 | WB | 10 | 6 | 25 | 94 | 6 | 0 |
| Ocean Forest Ct | west of NC 12 | EB | 10 | 6 | 25 | 94 | 6 | 0 |
| S Harbor View | west of NC 12 | EB | 10 | 6 | 25 | 94 | 6 | 0 |
| N Harbor View (S section) | east of NC 12 | WB | 10 | 6 | 25 | 94 | 6 | 0 |
| Monteray Dr N | west of NC 12 | EB | 38 | 26 | 25 | 94 | 6 | 0 |
| Bonita St | east of NC 12 | WB | 106 | 70 | 25 | 94 | 6 | 0 |
| Albacore St | east of NC 12 | WB | 308 | 252 | 25 | 92 | 7 | 1 |
| Orion's Way | east of NC 12 | WB | 44 | 36 | 25 | 94 | 6 | 0 |
| Duck Woods Dr | north of US 158 | SB | 67 | 45 | 25 | 95 | 4 | 1 |
| Birch Ln | south of US 158 | NB | 96 | 64 | 25 | 95 | 4 | 1 |

Note: Loudest-hour traffic volumes were determined by identifying the lower of the predicted Design Hour Volume and the Level of Service (LOS) C upper threshold volume for all sections of NC 12 and US 158. See report Section 7.1 for additional details.

**Table D-2: Predicted Design Year 2040 No-Build Condition Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| US 158 | NC 168 and Currituck County HS Road | NB | 2,570 | 2,570 | 50 | 95 | 4 | 1 |
| US 158 | Currituck County HS Road and Worth Guard Rd | NB | 2,570 | 2,570 | 50 | 95 | 4 | 1 |
| US 158 | Worth Guard Rd and Old US 158 S | NB | 2,570 | 2,570 | 60 | 95 | 4 | 1 |
| US 158 | Old US 158 S and Aydlett Rd | NB | 2,570 | 2,570 | 60 | 95 | 4 | 1 |
| US 158 | South of Aydlett Road | NB | 2,570 | 2,570 | 60 | 95 | 4 | 1 |
| NC 12 | North of Herring St/Devil's Bay | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Herring St/Devil's Bay to N Harbor View | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | N Habor View to Ocean Forest Ct | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Ocean Forest Ct to N/S Harbor View | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | N/S Harbor View to Monteray Dr N/Bonita St | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Monteray Dr N/Bonita St to Monteray Dr S/Dolphin St | SB | 517 | 517 | 50 | 94 | 6 | 0 |
| NC 12 | Monteray Dr S/Dolphin St to Food Lion N Access | SB | 517 | 517 | 50 | 95 | 5 | 0 |
| NC 12 | Food Lion N Access to Albacore St/Sunset Blvd N | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd N/Albacore St to Sunset Blvd S/Orion's Way | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd S/Orion's Way to Crown Point Rd | SB | 517 | 517 | 50 | 93 | 6 | 1 |
| US 158 | West of Birch Ln | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Birch Ln to Duck Woods Dr | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Duck Woods Dr to Cypress Knee Trail | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Cypress Knee Trail to Juniper Trail | WB | 1,827 | 1,827 | 55 | 93 | 5 | 2 |

**Table D-2: Predicted Design Year 2040 No-Build Condition Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| Currituck County HS Road | east of US 158 | WB | 38 | 26 | 25 | 95 | 4 | 1 |
| Worth Guard Rd | east of US 158 | WB | 67 | 45 | 45 | 95 | 4 | 1 |
| Old US 158 S (Waterlily) | east of US 158 | WB | 96 | 64 | 45 | 95 | 4 | 1 |
| Aydlett Rd | east of US 158 | WB | 77 | 51 | 45 | 95 | 4 | 1 |
| Devil's Bay | west of NC 12 | EB | 31 | 17 | 25 | 94 | 6 | 0 |
| Herring St | east of NC 12 | WB | 73 | 39 | 25 | 94 | 6 | 0 |
| N Harbor View (N section) | east of NC 12 | WB | 21 | 11 | 25 | 94 | 6 | 0 |
| Ocean Forest Ct | west of NC 12 | EB | 10 | 6 | 25 | 94 | 6 | 0 |
| S Harbor View | west of NC 12 | EB | 21 | 11 | 25 | 94 | 6 | 0 |
| N Harbor View (S section) | east of NC 12 | WB | 31 | 17 | 25 | 94 | 6 | 0 |
| Monteray Dr N | west of NC 12 | EB | 48 | 32 | 25 | 94 | 6 | 0 |
| Bonita St | east of NC 12 | WB | 134 | 90 | 25 | 94 | 6 | 0 |
| Albacore St | east of NC 12 | WB | 387 | 317 | 25 | 92 | 7 | 1 |
| Orion's Way | east of NC 12 | WB | 70 | 58 | 25 | 92 | 7 | 1 |
| Duck Woods Dr | north of US 158 | SB | 86 | 58 | 25 | 95 | 4 | 1 |
| Birch Ln | south of US 158 | NB | 154 | 102 | 25 | 95 | 4 | 1 |

Note: Loudest-hour traffic volumes were determined by identifying the lower of the predicted Design Hour Volume and the Level of Service (LOS) C upper threshold volume for all sections of NC 12 and US 158. See report Section 7.1 for additional details.

**Table D-3: Predicted Design Year 2040 Build Condition Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| US 158 | NC 168 and Currituck County HS Road | NB | 2,570 | 2,570 | 50 | 95 | 4 | 1 |
| US 158 | Currituck County HS Road and Worth Guard Rd | NB | 2,570 | 2,570 | 50 | 95 | 4 | 1 |
| US 158 | Worth Guard Rd and Old US 158 S | NB | 2,570 | 2,570 | 60 | 95 | 4 | 1 |
| US 158 | Old US 158 S and Mid-Currituck Bridge | NB | 2,570 | 2,570 | 60 | 95 | 4 | 1 |
| US 158 | Mid-Currituck Bridge and Aydlett Rd | NB | 2,376 | 1,944 | 60 | 95 | 4 | 1 |
| US 158 | South of Aydlett Road | NB | 2,327 | 1,904 | 60 | 95 | 4 | 1 |
| Mid-Currituck Bridge | US 158 and NC 12 | WB | 242 | 242 | 60 | 93 | 6 | 1 |
| NC 12 | North of Herring St/Devil's Bay | SB | 517 | 517 | 50 | 93 | 7 | 0 |
| NC 12 | Herring St/Devil's Bay to NC 12 - MCB Roundabout (4-lane section) | SB | 588 | 392 | 35 | 93 | 7 | 0 |
| NC 12 | NC 12 - MCB Roundabout to Ocean Forest Ct (4-lane section) | NB | 950 | 778 | 35 | 93 | 6 | 1 |
| NC 12 | Ocean Forest Ct to Harbor View (4-lane section) | NB | 950 | 778 | 35 | 93 | 6 | 1 |
| NC 12 | Harbor View to Monteray Dr N/Bonita St | NB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Monteray Dr N/Bonita St to Monteray Dr S/Dolphin St | NB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Monteray Dr S/Dolphin St to Food Lion N Access | NB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Food Lion N Access to Albacore St/Sunset Blvd N | NB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd N/Albacore St to Sunset Blvd S/Orion's Way | NB | 517 | 517 | 50 | 93 | 6 | 1 |
| NC 12 | Sunset Blvd S/Orion's Way to Crown Point Rd | NB | 517 | 517 | 50 | 93 | 6 | 1 |

**Table D-3: Predicted Design Year 2040 Build Condition Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| US 158 | West of Birch Ln | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Birch Ln to Duck Woods Dr | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Duck Woods Dr to Cypress Knee Trail | WB | 1,827 | 1,827 | 55 | 95 | 4 | 1 |
| US 158 | Cypress Knee Trail to Juniper Trail | WB | 1,827 | 1,827 | 55 | 93 | 5 | 2 |
| MCB-US 158 interchange | ramp US 158 NB to MCB EB | N/A | 39 | N/A | 50 | 95 | 4 | 1 |
| MCB-US 158 interchange | ramp US 158 SB to MCB EB | N/A | 259 | N/A | 50 | 95 | 4 | 1 |
| MCB-US 158 interchange | ramp MCB WB to US 158 SB | N/A | 58 | N/A | 50 | 93 | 6 | 1 |
| MCB-US 158 interchange | ramp MCB WB to US 158 NB | N/A | 259 | N/A | 50 | 93 | 6 | 1 |
| Currituck County HS Road | east of US 158 | WB | 38 | 26 | 25 | 95 | 4 | 1 |
| Worth Guard Rd | east of US 158 | WB | 67 | 45 | 45 | 95 | 4 | 1 |
| Old US 158 S (Waterlily) | east of US 158 | WB | 96 | 64 | 45 | 95 | 4 | 1 |
| Aydlett Rd | east of US 158 | WB | 77 | 51 | 45 | 95 | 4 | 1 |
| Devil's Bay | west of NC 12 | EB | 31 | 17 | 25 | 94 | 6 | 0 |
| Herring St | east of NC 12 | WB | 73 | 39 | 25 | 94 | 6 | 0 |
| N Harbor View (N section) | east of NC 12 | WB | 21 | 11 | 25 | 94 | 6 | 0 |
| Ocean Forest Ct | west of NC 12 | EB | 10 | 6 | 25 | 94 | 6 | 0 |
| S Harbor View | west of NC 12 | EB | 21 | 11 | 25 | 94 | 6 | 0 |
| N Harbor View (S section) | east of NC 12 | WB | 31 | 17 | 25 | 94 | 6 | 0 |
| Monteray Dr N | west of NC 12 | EB | 48 | 32 | 25 | 94 | 6 | 0 |
| Bonita St | east of NC 12 | WB | 134 | 90 | 25 | 94 | 6 | 0 |

**Table D-3: Predicted Design Year 2040 Build Condition Loudest-Hour Traffic Volumes**

| Route | Between | Peak Hr Direction | Loudest-hour volume (vph) | | Speed (mph) | Vehicle Percentages | | |
|---|---|---|---|---|---|---|---|---|
| | | | Peak Direction | Non-Peak Direction | | Auto | Med Truck | Hvy Truck |
| Albacore St | east of NC 12 | WB | 387 | 317 | 25 | 92 | 7 | 1 |
| Orion's Way | east of NC 12 | WB | 83 | 45 | 25 | 94 | 6 | 0 |
| Duck Woods Dr | north of US 158 | SB | 86 | 58 | 25 | 95 | 4 | 1 |
| Birch Ln | south of US 158 | NB | 154 | 102 | 25 | 95 | 4 | 1 |

Note: Loudest-hour traffic volumes were determined by identifying the lower of the predicted Design Hour Volume and the Level of Service (LOS) C upper threshold volume for all sections of NC 12 and US 158. See report Section 7.1 for additional details.

# Appendix E

# Noise Barrier Analyses

Consideration for noise abatement measures was given to all impacted receptors. To be effective, a sound barrier must be long enough and tall enough to shield the impacted receptor(s). Generally, the noise wall length must be eight times the distance from the barrier to the receptor. For example, if a receptor is 200 feet from the roadway, an effective barrier would be approximately 1,600 feet long – with the receptor in the horizontal center. On roadway facilities with direct access for driveways sound barriers are typically not feasible because the openings render the barrier ineffective in impeding the transmission of traffic noise.

The project corridor was analyzed to identify all areas with traffic noise impacts and determine if there was sufficient area without driveway breaks where a noise barrier could be constructed if found to be feasible and reasonable. Traffic noise impacts were identified in four (4) Noise Study Areas (NSAs). In evaluating these NSAs, all four of the NSAs had reasons why a noise barrier would be either not feasible and / or not reasonable at an impacted site and a barrier was not analyzed in TNM at these locations. Those locations are described below:

- NSA 1 – There is frequent direct-access to US 158 in NSA 1 from residential driveways, side streets, or parking lots as can be seen in Figures 2-1 to 2-5. Noise barriers for impacted receptors R-4, R-7 – R-12, R-14 – R-21, R-23 – R-25, R-27 – R-34, R-36 – R-45, R-47, R-49 – R-55, and R-58 – R-62 were determined not to be feasible because a barrier would adversely impact property access. In addition, many of the impacted receptors are isolated and a single noise barrier would not be able to benefit two impacted receptors. Therefore, these sites are not eligible for noise abatement and noise abatement is **Unlikely**.

- NSA 2 – Two residences (R-84 and R-91) were identified as impacted in NSA 2. Both residences, shown in Figures 2-9 and 2-10, are isolated from other impacted receptor locations. A noise barrier at either site would not be able to benefit at least two impacted receptors, so noise barriers were determined not to be feasible per NCDOT policy. Therefore, these sites are not eligible for noise abatement and noise abatement is **Unlikely**.

- NSA 4 – One (1) residence and a community pool were identified as impacted in NSA 4. The impacted residence (R-173), shown in Figure 2-15, is isolated from other impacted locations. A noise barrier at this site would not be able to benefit at least two impacted receptors, so a noise barrier was determined not to be feasible per NCDOT policy. Therefore, this site is not eligible for noise abatement and noise abatement is **Unlikely**.

  The impacted pool (R-225), shown in Figure 2-16, is located west of NC 12 north of Bonita Street/Monteray Drive. The receptor is 300-feet south of the NC 12 project improvement limits. There are no differences between the NC 12 roadway design or traffic forecasts for the Existing, No Build, and Build conditions in this area. Further, no increase in Build condition noise level relative to the Existing condition is predicted at this receptor. Therefore, the noise impact at this site has been determined not to be

caused by the project, so this site is not eligible for noise abatement and noise abatement is **Unlikely**.

- NSA 6 – A section of the Duck Woods Country Club golf course (R-282 receptor array) was identified as impacted in NSA 6. This site can be seen in Figure 2-18. Equivalent Receptors (ERs) are used to represent non-residential land uses such as golf courses. The calculation of Equivalent Receptors for this site can be found in Appendix B. The ER calculations show that this site has an ER value of 1. A noise barrier at this site would not be able to benefit at least two receptors, so a noise barrier was determined not to be feasible per NCDOT policy. Therefore, this site is not eligible for noise abatement and noise abatement is **Unlikely**.

Three (3) noise barriers were evaluated for NSA 1 to provide abatement to impacted receptors. However, none of the barriers meet the reasonableness criteria for allowable area per benefit. These noise barriers are described below:

- -NW1.1- was evaluated to provide noise abatement for two impacted residential receptors (R-3 and R-5) west of US 158 to the north of Swains Lane, as shown in Figure 2-1. A 17-foot tall and 396-foot long wall would benefit both impacts with an average of 3,366 square-feet per benefitted receptor. -NW1.1- was found to meet NCDOT feasibility criteria but did not meet NCDOT criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Thus, this site is not eligible for noise abatement and noise abatement is **Unlikely**.

- -NW1.2- was evaluated to provide noise abatement for the impacted Currituck County High School tennis courts and soccer field (R-35 receptor array) to the east of US 158, as shown in Figure 2-3. Equivalent Receptors (ERs) are used to represent non-residential land uses such as sports fields. The calculation of Equivalent Receptors for this site can be found in Appendix B. The ER calculations show that this site has an ER value of 2. A 13-foot tall and 848-foot long wall would benefit 2 ERs with an average of 5,512 square-feet per benefitted receptor. -NW1.2- was found meet NCDOT feasibility criteria but did not meet criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Therefore, this site is not eligible for noise abatement and noise abatement is **Unlikely**.

- -NW1.3- was evaluated to provide noise abatement for two impacted residences (R-63 and R-65) along Worth Guard Road directly east of US 158, as shown in Figure 2-5. A 9-foot tall and 602-foot long wall would benefit both impacts with an average of 2,709 square-feet per benefitted receptor. -NW1.3- was found to meet NCDOT feasibility criteria but did not meet criteria for reasonableness because the area of barrier per benefited receptor exceeded the allowable area of 1,500 square-feet per benefitted receptor. Thus, this site is not eligible for noise abatement and noise abatement is **Unlikely**.

The following tables include the Performance Without-Barrier and With-Barrier for all analyzed noise barriers and indicate whether the barrier is Likely or Not Likely. The Feasibility and Reasonableness Worksheet for each barrier is included at the end of the section.

**Table E-1: Mid-Currituck Bridge Project Noise Barrier –NW1.1-**
**NSA 1, West of US 158, north of Swains Lane**
**Not Likely[4]**

**Performance**
**Without-Barrier and With-Barrier Noise Levels**

| Receptors | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | |
|---|---|---|---|---|---|---|---|
| **ID#** | **Use** | **NAC** | **ERs** | **Address** | **Build[1]** | **With-Bar** | **NLR** |
| R-3 | Residential | B | 1 | 4016 CARATOKE HWY | 73 | 65 | 8 |
| R-5 | Residential | B | 1 | 106 SWAINS LN | 69 | 64 | 5 |
| | | | | | | Predicted "Build-Condition" With-Barrier Benefits:[2] | 2[2] |

1. Predicted traffic noise levels impact 2 receptors due to approaching or exceeding NAC (refer to Table 2, pg 8). No predicted impacts are due to a predicted "substantial increase" in noise levels.

2. The optimized Mid-Currituck Bridge project noise barrier –NW1.1- is predicted to provide at least 5 decibels (5 dB(A)) in noise level reduction (NLR) to 2 receptors.

3. The optimized Mid-Currituck Bridge project noise barrier –NW1.1- is predicted to provide at least 7 decibels (7 dB(A)) in noise level reduction (NLR) to 1 first-row receptor.

4. The optimized Mid-Currituck Bridge project noise barrier –NW1.1- is considered Not Likely because the area of barrier per benefitted receptor exceeds the allowable area and the barrier does not meet NCDOT reasonableness criteria.

**Table E-2: Mid-Currituck Bridge Project Noise Barrier –NW1.2-**
**NSA 1, Currituck County High School and Middle School Sports Fields, East of US 158**
**Not Likely[4]**

**Performance**
**Without-Barrier and With-Barrier Noise Levels**

| Receptors | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | |
|---|---|---|---|---|---|---|---|
| ID# | Use | NAC | ERs | Address | Build[1] | With-Bar | NLR |
| R-35A | Tennis court | C | 0.13 | 4263 CARATOKE HWY | 73 | 63 | 10 |
| R-35B | Tennis court | C | 0.13 | 4263 CARATOKE HWY | 68 | 62 | 6 |
| R-35C | Tennis court | C | 0.13 | 4263 CARATOKE HWY | 65 | 60 | 5 |
| R-35D | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 74 | 62 | 12 |
| R-35E | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 68 | 61 | 7 |
| R-35F | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 65 | 59 | 6 |
| R-35G | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 62 | 58 | 4 |
| R-35H | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 72 | 62 | 10 |
| R-35I | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 67 | 60 | 7 |
| R-35J | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 64 | 59 | 5 |
| R-35K | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 61 | 57 | 4 |
| R-35L | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 71 | 62 | 9 |
| R-35M | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 66 | 60 | 6 |
| R-35N | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 63 | 58 | 5 |
| R-35O | Soccer field | C | 0.13 | 4263 CARATOKE HWY | 60 | 56 | 4 |
| | | | | | | Predicted "Build-Condition" With-Barrier Benefits:[2] | 2[2] |

1. Predicted traffic noise level impacts 1 receptor due to approaching or exceeding NAC (refer to Table 2, pg 6). No predicted impacts are due to a predicted "substantial increase" in noise levels.

2. The optimized Mid-Currituck Bridge project noise barrier –NW1.2- is predicted to provide at least 5 decibels (5 dB(A)) in noise level reduction (NLR) to 2 receptors.

3. The optimized Mid-Currituck Bridge project noise barrier –NW1.2- is predicted to provide at least 7 decibels (7 dB(A)) in noise level reduction (NLR) to 1 first-row receptor.

4. The optimized Mid-Currituck Bridge project noise barrier –NW1.2- is considered Not Likely because the area of barrier per benefitted receptor exceeds the allowable area and the barrier does not meet NCDOT reasonableness criteria.

**Table E-3: Mid-Currituck Bridge Project Noise Barrier –NW1.3-**
**NSA 1, East of US 158 to the south of Worth Guard Road**
**Not Likely[4]**

**Performance**
**Without-Barrier and With-Barrier Noise Levels**

| Receptors | | | | | Predicted Noise Levels, $L_{eq(h)}$ (dB(A)) | | |
|---|---|---|---|---|---|---|---|
| **ID#** | **Use** | **NAC** | **ERs** | **Address** | **Build[1]** | **With-Bar** | **NLR** |
| R-63 | Residential | B | 1 | 106 WORTH GUARD RD | 72 | 63 | 9 |
| R-64 | Residential | B | 1 | 117 WORTH GUARD RD | 61 | 60 | 1 |
| R-65 | Residential | B | 1 | 112 WORTH GUARD RD | 68 | 63 | 5 |
| R-66 | Residential | B | 1 | 118 WORTH GUARD RD | 65 | 61 | 4 |
| | | | | | | Predicted "Build-Condition" With-Barrier Benefits:[2] | 2[2] |

1. Predicted traffic noise level impacts 2 receptors due to approaching or exceeding NAC (refer to Table 2, pg 6). No predicted impacts are due to a predicted "substantial increase" in noise levels.

2. The optimized Mid-Currituck Bridge project noise barrier –NW1.3- is predicted to provide at least 5 decibels (5 dB(A)) in noise level reduction (NLR) to 2 receptors.

3. The optimized Mid-Currituck Bridge project noise barrier –NW1.3- is predicted to provide at least 7 decibels (7 dB(A)) in noise level reduction (NLR) to 1 first-row receptors.

4. The optimized Mid-Currituck Bridge project noise barrier –NW1.3- is considered Not Likely because the area of barrier per benefitted receptor exceeds the allowable area and the barrier does not meet NCDOT reasonableness criteria.

**NCDOT NOISE WALL**

**FEASIBILITY & REASONABLENESS WORKSHEET**

**PROJECT -** Mid-Currituck Bridge **TIP# -** R-2576

**NOISE WALL # -** -NW1.1- **COUNTY(IES) -** Currituck, Dare

**# IMPACTS -** 2 **# BENEFITS -** 2 **NAC:** ☐ A ☑ B ☐ C ☐ D ☐ E

**A. FEASBILITY:**

1. Can a 5-dB(A) reduction in traffic noise levels be achieved for at least two impacted receptors? YES
2. Does topography negatively affect the proposed noise wall? NO
3. Does the proposed noise wall negatively affect property access, drainage, utilities or maintenance requirements? NO
4. Is there control of access in the vicinity of the proposed noise wall? NO

**B. REASONABLENESS**

1. Can a 7- dB(A) reduction in traffic noise levels be achieved for at least one benefited receptor? YES
2. Is the quantity per benefited receptor of 3,366 square feet less than the maximum allowable quantity per benefited receptor of 1,500 square feet? NO

**C. NOISE WALL PRELIMINARY DECISION**

1. Is the noise wall preliminarily feasible? YES
2. Is the noise wall preliminarily reasonable? NO
3. Is the noise wall likely? NO

**PREPARED BY:** Jacob Poling **DATE PREPARED:** 05/30/18

**NCDOT NOISE WALL**

**FEASIBILITY & REASONABLENESS WORKSHEET**

**PROJECT -** Mid-Currituck Bridge **TIP# -** R-2576

**NOISE WALL # -** -NW1.2- **COUNTY(IES) -** Currituck, Dare

**# IMPACTS -** 2 **# BENEFITS -** 2 **NAC:** ☐ A ☐ B ☑ C ☐ D ☐ E

**A. FEASBILITY:**

1. Can a 5-dB(A) reduction in traffic noise levels be achieved for at least two impacted receptors? YES
2. Does topography negatively affect the proposed noise wall? NO
3. Does the proposed noise wall negatively affect property access, drainage, utilities or maintenance requirements? NO
4. Is there control of access in the vicinity of the proposed noise wall? NO

**B. REASONABLENESS**

1. Can a 7- dB(A) reduction in traffic noise levels be achieved for at least one benefited receptor? YES
2. Is the quantity per benefited receptor of 5,512 square feet less than the maximum allowable quantity per benefited receptor of 1,500 square feet? NO

**C. NOISE WALL PRELIMINARY DECISION**

1. Is the noise wall preliminarily feasible? YES
2. Is the noise wall preliminarily reasonable? NO
3. Is the noise wall likely? NO

**PREPARED BY:** Jacob Poling **DATE PREPARED:** 05/30/18

**NCDOT NOISE WALL**

**FEASIBILITY & REASONABLENESS WORKSHEET**

**PROJECT -** Mid-Currituck Bridge **TIP# -** R-2576

**NOISE WALL # -** -NW1.3- **COUNTY(IES) -** Currituck, Dare

**# IMPACTS -** 2 **# BENEFITS -** 2 **NAC:** ☐ A ☑ B ☐ C ☐ D ☐ E

**A. FEASBILITY:**

1. Can a 5-dB(A) reduction in traffic noise levels be achieved for at least two impacted receptors? YES
2. Does topography negatively affect the proposed noise wall? NO
3. Does the proposed noise wall negatively affect property access, drainage, utilities or maintenance requirements? NO
4. Is there control of access in the vicinity of the proposed noise wall? NO

**B. REASONABLENESS**

1. Can a 7- dB(A) reduction in traffic noise levels be achieved for at least one benefited receptor? YES
2. Is the quantity per benefited receptor of 2,709 square feet less than the maximum allowable quantity per benefited receptor of 1,500 square feet? NO

**C. NOISE WALL PRELIMINARY DECISION**

1. Is the noise wall preliminarily feasible? YES
2. Is the noise wall preliminarily reasonable? NO
3. Is the noise wall likely? NO

**PREPARED BY:** Jacob Poling **DATE PREPARED:** 05/30/18

# Appendix F

# NORTH CAROLINA DEPARTMENT OF TRANSPORTATION TRAFFIC NOISE POLICY

# NORTH CAROLINA
# DEPARTMENT OF TRANSPORTATION

# TRAFFIC NOISE POLICY

**Effective Date: October 6, 2016**

**Noise Policy Committee:**

Glenn Mumford, PE .....Roadway Design Unit
Drew Joyner, PE.....Human Environment Section
Brian Hanks, PE.....Structures Management Unit
Daniel Keel, PE.....Division of Highways
Mike Mills, PE.....Division Engineer
Pat Ivey, PE.....Division Engineer
Greg Smith, PE.....Human Environment Section

**Sponsors:**

Clarence Coleman, PE .....Federal Highway Administration
Felix Davila, PE.....Federal Highway Administration
Edward L. Curran.....Board of Transportation

**APPROVED BY:**

10-6-16
Date of Approval

John F. Sullivan, III, PE, Division Administrator
Federal Highway Administration

10.6.16
Date of Approval

Nicholas J. Tennyson
Secretary of Transportation

10-5-16
Date of Approval

Edward L. Curran, Chairman
Board of Transportation

Person Responsible
for Policy:

Traffic Noise & Air Quality Supervisor
Human Environment Section
1598 Mail Service Center
Raleigh, North Carolina 27699-1598
(919) 707-6087

## DEFINITIONS

a) Decibel (dB) - The logarithmic unit for measuring sound pressure levels. For traffic noise measurements, decibels are most commonly reported in terms of the A-weighing frequency scale, which best includes the frequencies to which human hearing is typically most sensitive and is denoted by the abbreviation dB(A).

b) Leq – The equivalent steady -state sound level which, in a defined period of time, contains the same amount of acoustic energy as a time-varying sound level during the same period of time.

c) Receptor – Any location that receives traffic noise.

d) Impacted Receptor – A receptor for which the predicted hourly equivalent traffic noise level 1) meets or exceeds the approach criteria value found in Table 1 of this policy or 2) exceeds the existing ambient noise level by 10 dB(A) or more.

e) Benefited Receptor - All receptors, both impacted and non-impacted, that receive a noise level reduction of 5 dB(A) or more through placement of a noise abatement measure.

f) Noise Abatement Measure – Any method used to reduce traffic noise levels, such as noise walls and earthen berms.

g) Worst Noise Hour – The hour within a day in which the highest magnitude hourly equivalent sound level occurs. The worst traffic noise hour typically occurs when traffic is flowing freely at a high volume relative to the peak traffic hour volume, with a high percentage of trucks.

h) Practicable – Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

## INTRODUCTION

This document represents the North Carolina Department of Transportation (hereinafter NCDOT) policy on highway traffic noise and construction noise and describes the implementation of the requirements of the Federal Highway Administration (hereinafter FHWA) Noise Standard at 23 Code of Federal Regulations Part 772 (23 CFR 772) as they relate to federal-aid and select state-funded highway construction in North Carolina. This policy was developed by the NCDOT and reviewed and approved by the FHWA.

The North Carolina Department of Transportation Traffic Noise Manual and 23 CFR 772 are intended to be companion documents to this policy.

## PURPOSE

This policy describes the NCDOT process that is used in determining traffic noise impacts and abatement measures and the equitable and cost-effective expenditure of public funds for noise abatement. Where the FHWA has given highway agencies flexibility in implementing the 23 CFR 772 standards, this policy describes the NCDOT approach to implementation.

## APPLICABILITY

Projects with a Date of Public Knowledge on or after the effective date of this policy shall comply with the criteria of this policy.

### Federal–Aid Projects

This policy applies to all "Type I" federal or federal-aid highway projects in the State of North Carolina, including federal projects that are administered by local public agencies. Therefore, this policy applies to any highway project that is funded with federal-aid highway funds or requires FHWA approval regardless of funding sources. NCDOT does not participate in nor fund Type II (retrofit) projects along existing transportation facilities. Noise analyses are not required for Type III projects. Each of these project types are defined below. This policy shall be applied uniformly and consistently to all Type I federal projects throughout North Carolina.

### Type I Project

(a) The construction of a highway on new location; or,

(b) The physical alteration of an existing highway where there is either:
   (i) Substantial Horizontal Alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,
   (ii) Substantial Vertical Alteration. A project that removes shielding, therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,

(c) The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or,

(d) The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,

(e) The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,

(f) Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,

(g) The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

(h) If a project is determined to be a Type I project under this definition then the entire project area as defined in the environmental document is a Type I project.

### Type II Project.

A Federal or Federal-aid highway project for noise abatement on an existing highway. For a Type II project to be eligible for Federal-aid funding, the highway agency must develop and implement a Type II program in accordance with 23 CFR 772.7(e).

**Type III Project**

A Federal or Federal-aid highway project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in 23 CFR 772 and this policy constitute the noise standards mandated by 23 U.S.C. 109(1). All federally-funded highway projects which are developed in conformance with this policy shall be deemed to be in accordance with the FHWA noise standards.

**State-Funded Projects**

Projects that are State funded do not use the federal project type designation for applicability.

This policy will apply to State funded projects located on a US or Interstate route that is full control of access where the project involves adding a through-traffic lane.

All other State-funded projects for which a State Environmental Assessment (EA) or State Environmental Impact Statement (EIS) is prepared will comply with the North Carolina Environmental Policy Act (SEPA) and the North Carolina Administrative Code. For these projects, noise barriers will be considered where practicable.

## DATE OF PUBLIC KNOWLEDGE

The Date of Public Knowledge of the location and potential noise impacts of a proposed highway project is the approval date of the final environmental document, e.g., Categorical Exclusion (CE), State or Federal Finding of No Significant Impact (FONSI) or State or Federal Record of Decision (ROD).

NCDOT is not responsible for evaluating or implementing any noise barriers to protect developed lands that were not permitted before the Date of Public Knowledge.

The criterion for determining when undeveloped land is permitted for development is the approval date of a building permit for an individual lot or site. Approval of a development plat or any other development plan does not meet the permitted criteria.

NCDOT advocates use of local government authority to regulate land development, planning, design and construction in such a way that noise impacts are minimized.

## TRAFFIC NOISE PREDICTION

All traffic noise analyses performed by or for NCDOT must utilize the most current version of the FHWA Traffic Noise Model (TNM®) or any other model determined by the FHWA to be consistent with the methodology of the TNM® model, pursuant to 23 CFR 772.9.

Average pavement type shall be used in the FHWA TNM® for future noise level prediction.

Noise contour lines may be used only for project alternative screening or for providing information to local officials for their land use planning efforts associated with undeveloped lands as per 23 CFR 772.17. Noise contours shall not be used for determining highway traffic noise impacts or assessing noise barriers.

Traffic characteristics that yield the worst noise hour equivalent traffic noise levels, expressed in Leq(h), for the Design Year shall be used in predicting noise levels and assessing noise impacts.

Traffic noise prediction must adhere to all direction contained in the NCDOT Traffic Noise Manual.

## NOISE IMPACT DETERMINATION

Noise abatement measures for NCDOT highway projects must be considered when traffic noise impacts are created by either of the following two conditions:

(a) The predicted worst noise hour Leq(h) traffic noise levels for the Design Year approach (reach one decibel less than) or exceed the Noise Abatement Criteria (NAC) contained in 23 CFR 772 and in Table 1, found on page 4 of this policy, OR

(b) The predicted worst noise hour Leq(h) traffic noise levels for the Design Year substantially exceed existing noise by 10 dB(A) or more.

A receptor is a discrete or representative location within a noise sensitive area(s) for any of the land uses listed in Table 1. For multifamily dwellings, each residence shall be counted as one receptor when determining impacted and benefited receptors. Non-residential receptors shall be represented by Equivalent Receptors calculated according to direction contained in the NCDOT Traffic Noise Manual.

Primary consideration shall be given to exterior areas where frequent human use occurs in the determination of traffic noise impacts.

A traffic noise analysis shall be completed for each project alternative under detailed study and for all receptors and Equivalent Receptors defined to represent land use activities A, B, C, D, and E listed in Table 1 that are present in the study area. FHWA approval is required for designating a Category A Activity on federally-funded projects. Traffic noise analyses are not required for Activity Category F land uses. Noise predictions are required for Activity Category G land uses to the extent needed to develop estimated noise levels to provide to local officials for planning purposes.

**Table 1**

**Noise Abatement Criteria**

Hourly Equivalent A-Weighted Sound Level (decibels (dB(A))

| Activity Category | Activity Criteria[1] Leq(h)[2] | Evaluation Location | Activity Description |
|---|---|---|---|
| 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 [3] | 67 | Exterior | Residential |
| C [3] | 67 | Exterior | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section4(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 [3] | 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 |

[1] The Leq(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

[2] The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq.

[3] Includes undeveloped lands permitted for this activity category.

## ANALYSIS OF NOISE ABATEMENT MEASURES

When traffic noise impacts are identified, noise abatement measures shall be considered and evaluated for feasibility for all impacted receptors and reasonableness for all benefited receptors. All of the following conditions must be met in order for noise abatement measures to be justified and incorporated into project design, as applicable. Failure to achieve any single element of feasibility or reasonableness will result in the noise abatement measure being deemed not feasible or not reasonable, whichever applies.

NCDOT will provide noise barriers for all possible impacted receptors that meet the feasibility and reasonableness criteria found in this policy. Noise barriers will not be extended solely to provide noise reduction for non-impacted receptors. Benefits for non-impacted receptors will only occur when they are incidental in noise barriers designed for impacted receptors.

### Feasibility

The combination of acoustical and engineering factors considered in the evaluation of a noise barrier.

(a) Any receptor that receives a minimum noise level reduction of five dB(A) due to a noise barrier shall be considered a benefited receptor. Noise reduction of five dB(A) must be achieved for at least two impacted receptors.

(b) Engineering feasibility of noise barriers shall consider adverse impacts created by or upon property access, drainage, topography, utilities, safety, and maintenance requirements.

### Reasonableness

The combination of social, economic, and environmental factors considered in the evaluation of a noise barrier.

(a) Property owners and tenants of all benefited receptors shall be solicited to obtain their preferences for or against a proposed noise barrier. No tenant ballots are distributed for vacant rental property. Points per ballot shall be distributed in the following weighted manner:

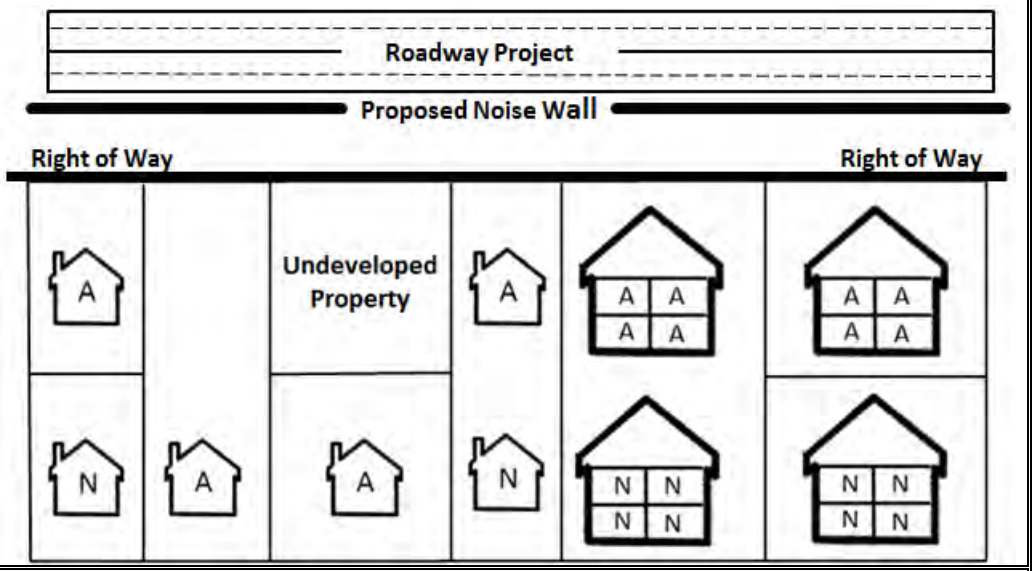
- 5 points/ballot for adjacent property owners who reside at property
- 4 points/ballot for adjacent property owners who rent property to others
- 3 points/ballot for all non-adjacent property owners who reside at property
- 2 points/ballot for all non-adjacent property owners who rent property to others
- 1 point/ballot vote for all tenants of rental property

Adjacent Receptor is a benefited receptor that 1) represents a property that abuts the highway right of way or 2) has no benefited receptor between it and the highway. Where multiple buildings containing benefited receptors are on the same property, such as an apartment or condominium complex, only the building closest to the highway is an adjacent receptor. Adjacent receptors will most often, but not always, be part of the front row of benefited receptors. Figure 1 provides graphic examples of Adjacent Receptors.

Owners of multi-unit rental locations will receive the applicable number of owner points for each individual benefited receptor (rental unit) owned.

**Figure 1**

**Examples of Adjacent Receptors**




A = Adjacent Receptor N = Non-Adjacent Receptor
Undeveloped Property = Vacant property for which no building permit has been issued and is not a park or recreation area

If 50% or greater of all possible voting points from benefited receptors for each noise barrier are received on the first solicitation, a simple majority of voting points cast will be used to determine if the proposed noise barrier will be constructed.

If less than 50% of all possible points for each noise barrier are received on the first solicitation, a second solicitation will be sent to benefited receptors who did not respond to the first solicitation.

If a second solicitation is conducted and 50% or greater of all possible voting points for each noise barrier are received after the second solicitation, a simple majority of voting points cast will be used to determine whether or not the proposed noise barrier will be constructed.

If less than 50% of total possible points for a noise barrier are received after the second solicitation, the noise barrier will not be constructed.

Noise barriers will be constructed in the case of a tie (equal number of points for and against a noise barrier).

All balloting soliciting the viewpoints of benefited property owners and applicable residents/tenants that occurs after the effective date of this policy, regardless of the Date of Public Knowledge, shall comply with the criteria of this policy.

(b) The allowable quantities for noise barriers per benefited receptor, with allowances for incremental increases based upon existing and predicted noise levels of all impacted receptors within each noise study area, are shown in Table 2.

For the purpose of calculating the incremental increase, the Noise Abatement Criteria (NAC) values for Activity Categories A, B, C, D, and E, as shown in Table 1, are to be used and not the NCDOT "approach" values used in traffic noise impact determinations.

**Table 2**

**Allowable Noise Barrier Base Quantities**

| Maximum Allowable Base Quantity | Noise Level Consideration | Noise Wall | Earthen Berm |
|---|---|---|---|
| | | 1,500 $ft^2$ | 4,200 $yd^3$ |
| Average dB(A) Increase Between Existing and Future Build for All Impacted Receptors | < 5 dB(A) | + 0 $ft^2$ | + 0 $yd^3$ |
| | 5-10 dB(A) | + 500 $ft^2$ | + 1,400 $yd^3$ |
| | > 10 dB(A) | + 1,000 $ft^2$ | + 2,800 $yd^3$ |
| Average Exposure to Absolute Noise Levels for All Impacted Receptors | < 5 dB(A) Over NAC Activity Category | + 0 ft2 | + 0 $yd^3$ |
| | 5-10 dB(A) Over NAC Activity Category | + 500 $ft^2$ | + 1,400 $yd^3$ |
| | > 10 dB(A) Over NAC Activity Category | + 1,000 $ft^2$ | + 2,800 $yd^3$ |

(c) A noise reduction design goal of at least 7 dB(A) must be evaluated for all benefited receptors. At least one benefited receptor must achieve the noise reduction design goal of 7 dB(A) to indicate the proposed noise barrier effectively reduces traffic noise.

**Other Considerations**

Prior to CE approval or issuance of a FONSI or ROD, NCDOT shall identify in all applicable environmental documents:

(a) Noise barriers that are feasible and reasonable,

(b) Noise impacts for which no noise barrier appears to be feasible and reasonable;

(c) Locations where noise impacts will occur, where noise barriers are feasible and reasonable, and the locations that have no feasible and reasonable noise barriers.

(d) Whether it is “likely” or “unlikely” that noise barriers will be installed for each noise sensitive area identified. "Likely" does not mean a firm commitment. The final decision on the installation of noise barriers shall be made upon completion of the project design, the public involvement process, compliance with the NCDOT Policy, and FHWA approval.

**Third Party Participation**

(a) Third party funding of noise barriers cannot be used to make up the difference between the reasonable quantity allowance and the actual quantity of noise barriers. Third party funding is allowed only by local, state and federal government agencies, and can only be used to pay for additional features such as landscaping and aesthetic treatments for noise barriers that meet all feasible and reasonable criteria previously detailed in this policy. Private parties may freely enter into agreements with government agencies to develop noise barrier enhancements; however, all funding for enhancements paid to NCDOT must come from government agencies

(b) Traditional highway construction resources pay for required noise barriers. Should a local government request that materials be used that are more costly than the standard materials proposed by NCDOT, the requesting entity must assume 100% of the actual additional construction cost.

(c) If a local government insists on the provision of a noise barrier deemed not reasonable by NCDOT, a noise barrier may be installed provided the local government assumes 100% of the costs and obtains an encroachment permit from NCDOT to perform the work. These costs include, but are not limited to, preliminary and final engineering, actual construction and all related maintenance. In addition, local governments must ensure that NCDOT's material, design and construction specifications are met. The local government must also assume 100% of the liability associated with the measure and hold harmless the NCDOT.

(d) For (b) and (c) above, the settlement agreement shall be signed before third party noise barrier design begins and payment shall be made to NCDOT in accordance with N.C.G.S. 136-66.3(e).

## ARCHITECTURAL TREATMENT OF NOISE WALLS

The standard noise wall architectural treatment consists of:

(a) Concrete columns; Steel piles may be used when necessary to address site conditions adverse to the use of concrete columns;

(b) Precast concrete panels textured on both sides;

(c) No texture on the uppermost foot of each wall segment;

(d) A single color of stain in brown or gray tones applied to both sides of textured panels;

(e) No stain applied to the uppermost foot of each wall segment and the concrete columns.

All enhancements to this standard noise wall must be paid for in accordance with Third Party Participation provisions in this policy.

NCDOT Division Engineers are responsible for determining noise wall textures and colors in their respective Divisions.

## PUBLIC INVOLVEMENT

Communication with the community regarding noise impacts and possible noise abatement shall occur at the start of the noise study process and continue throughout the development of the project. NCDOT will communicate with citizens to present information on the nature of highway traffic noise and discuss the effects of noise abatement and how public preferences for noise abatement is solicited via a balloting process.

Noise study areas showing "likely" noise barriers and/or proposed locations of any "recommended" noise barriers will be presented and discussed when holding Public Hearings and Public Meetings. Likely noise barriers are based on preliminary design traffic noise analyses and are described in environmental documents. Recommended noise barriers are based on final design noise analyses and are usually identified after the environmental document is completed. Property owners and tenants who are being balloted for a recommended noise barrier will be provided a visual of the noise barrier location prior to their casting a ballot.

## COORDINATION WITH LOCAL OFFICIALS

NCDOT will provide all traffic noise analyses to local government officials within whose jurisdiction a highway project is proposed as early in the project planning process as possible to protect future development from becoming incompatible with traffic noise levels. Specifically, environmental documents and design noise reports will contain information identifying areas that may be impacted by traffic noise, predicted noise level contour information, the best estimation of future noise levels for developed and undeveloped lands or properties in the immediate vicinity of the project and other appropriate design information. If requested, NCDOT will assist local officials with coordination and distribution of this information to residents, property owners and developers. NCDOT will provide information to assist local jurisdictions in the development of local noise controls, when requested. NCDOT strongly advocates the planning, design and construction of noise-compatible development and encourage its practice among planners, building officials, developers and others.

## CONSTRUCTION NOISE

To minimize the impacts of construction noise on the public, NCDOT shall:

(a) Identify land uses or activities that may be affected by noise from construction of the project.

(b) Determine the measures that are needed in the plans and specifications to minimize or eliminate adverse construction noise impacts to the community. This determination shall consider the benefits achieved and the overall adverse social, economic, and environmental effects and costs of the abatement measures.

(c) Consider construction techniques and scheduling to reduce construction noise impacts to nearby receptors and incorporate the needed abatement measures in the project plans and specifications.

## FEDERAL PARTICIPATION

The costs of noise barriers may be included in federal-aid participating project costs with the federal share being the same as that for the system on which the project is located when:

(a) Traffic noise impacts have been identified; and

(b) Noise barriers have been determined to be feasible and reasonable pursuant to 23 CFR 772 and this policy.

## REVIEW OF POLICY

This policy shall be reviewed by the NCDOT Board of Transportation at least every five years.