



## **TRAFFIC NOISE ANALYSIS ADDENDUM**

Proposed Widening of I-26 from US 25 south of  
Hendersonville to I-40 near Asheville:  
US 25 (Asheville Highway) Interchange Modifications

STIP Project I-4400/I-4700  
Henderson and Buncombe Counties

Prepared for:

North Carolina Department of Transportation  
Project Development and Environmental Analysis Unit  
Human Environment Section  
Traffic Noise & Air Quality Group

Prepared by:

HNTB North Carolina, P.C.

February 2016

# TRAFFIC NOISE ANALYSIS ADDENDUM

Proposed Widening of I-26 from US 25 south of  
Hendersonville to I-40 near Asheville:  
US 25 (Asheville Highway) Interchange Modifications

STIP Project I-4400/I-4700

Henderson and Buncombe Counties

Prepared By:

HNTB North Carolina, P.C.

Prepared for:

North Carolina Department of Transportation  
Project Development and Environmental Analysis Unit  
Human Environment Section  
Traffic Noise & Air Quality Group

Accepted by:

---

Human Environment Section  
Traffic Noise and Air Quality Group

---

Harold "Trey" Jordan, EIT  
Noise Modeler

---

Date

---

Tracy Roberts, AICP  
Quality Assurance

---

Date

---

Paige Hunter, P.E.  
Supervising Engineer

---

Date



## **EXECUTIVE SUMMARY**

North Carolina Department of Transportation (NCDOT) State Transportation Improvement Program (STIP) Project I-4400 / I-4700 proposes improvements to a 22.2-mile segment of the Interstate 26 corridor in Henderson and Buncombe Counties. The proposed improvement project would extend from US 25 south of Hendersonville in Henderson County to I-40 near Asheville in Buncombe County. A Traffic Noise Analysis (TNA) was prepared for the project in March 2015. The proposed widening of I-26 will require modifications to the US 25 (Asheville Highway) interchange in Henderson County. The March 2015 TNA assumed the existing interchange would not be changed. This TNA Addendum assesses traffic noise impacts and potential noise abatement measures at the I-26 / US 25 (Asheville Highway) interchange. NCDOT identified a partial cloverleaf interchange design as the build alternative.

A federal Environmental Impact Statement is being prepared. The Date of Public Knowledge will be the approval date of the Record of Decision. 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. It is the responsibility of local governments and private landowners to ensure noise-compatible designs are used for development with an approved building permit after the Date of Public Knowledge.

There are three (3) detailed study alternatives under consideration for the widening of I-26: 1) 6-Lane Widening, 2) 8-Lane Widening, and 3) Hybrid Widening. Base Year 2011 traffic noise impacts four (4) receptors in the vicinity of the I-26 / US 25 interchange. For Design Year 2040 traffic volumes, the No-Build, 6-Lane, 8-Lane, and Hybrid Alternatives are predicted to result in four (4), eight (8), 11, and eight (8) traffic noise impacts respectively.

Consideration of noise abatement measures was given to all impacted receptors in each of the build alternatives. NCDOT Policy requires the identification of whether it is “likely” or “unlikely” that noise abatement measures will be provided for each noise study area identified. “Likely” does not mean a firm commitment. The following noise abatement measures are currently considered to be “likely” in the vicinity of the I-26 / US 25 interchange for all build alternatives:

NW12: Located along the I-26 westbound off ramp at the US 25 (Asheville Highway) interchange and provides traffic noise abatement for residences along November Lane and Hickory Flats Drive.

NW26: Located along the I-26 eastbound off ramp at the US 25 (Asheville Highway) interchange and provides traffic noise abatement for residences along Cuerton Place and Alverson Lane.

This Traffic Noise Analysis Addendum presents a preliminary analysis of all traffic noise impacts and consideration of noise abatement measures for feasibility and reasonableness in accordance with the NCDOT *Traffic Noise Abatement Policy* (July 13, 2011). The final decision on the installation of noise abatement measures will be made upon completion of the project design, the public involvement process, concurrence with the NCDOT Policy and FHWA approval.

# Table of Contents

<b>1.0</b>	<b>PROJECT LOCATION AND DESCRIPTION .....</b>	<b>1</b>
<b>2.0</b>	<b>PROCEDURE.....</b>	<b>2</b>
<b>3.0</b>	<b>CHARACTERISTICS OF NOISE .....</b>	<b>3</b>
<b>4.0</b>	<b>NOISE ABATEMENT CRITERIA .....</b>	<b>6</b>
4.1	Title 23 Code of Federal Regulations, Part 772 (23 CFR 772) .....	6
4.2	North Carolina Department of Transportation Traffic Noise Abatement Policy .....	8
4.3	Noise Abatement Criteria .....	8
<b>5.0</b>	<b>AMBIENT NOISE LEVELS.....</b>	<b>8</b>
<b>6.0</b>	<b>PROCEDURE FOR PREDICTING FUTURE NOISE LEVELS .....</b>	<b>9</b>
<b>7.0</b>	<b>TRAFFIC NOISE IMPACTS AND NOISE CONTOURS .....</b>	<b>11</b>
<b>8.0</b>	<b>POTENTIAL TRAFFIC NOISE ABATEMENT MEASURES .....</b>	<b>13</b>
8.1	Highway Alignment Selection.....	13
8.2	Traffic System Management Measures .....	14
8.3	Buffer Zones .....	14
8.4	Building Insulation .....	14
8.5	Noise Barriers .....	14
<b>9.0</b>	<b>CONSTRUCTION NOISE.....</b>	<b>19</b>
<b>10.0</b>	<b>CONCLUSION .....</b>	<b>20</b>
<b>11.0</b>	<b>REFERENCES .....</b>	<b>22</b>

## Figures

Vicinity Map

Figure 1: 6-Lane Widening Alternative

Figure 2: 8-Lane Widening Alternative

Figure 3: 6/8-Lane Hybrid Widening Alternative

## **Appendices**

Appendix A: Ambient Noise Level Monitoring	
Appendix B: Hourly Equivalent Traffic Noise Levels	
Appendix C: Traffic Noise Models	
Appendix D: Noise Barrier Analyses	
Appendix E: Predicted Traffic Volumes	
Appendix F: North Carolina Department of Transportation Traffic Noise Abatement Policy	

## **Tables**

Table 1: Comparison: Flat vs. A-Weighted Frequency Scaling	4
Table 2: Common Indoor and Outdoor Noise Levels	5
Table 3: Noise Abatement Criteria	7
Table 4: NCDOT “Substantial Increase” Noise Impact Criteria	8
Table 5: Traffic Noise Model (TNM) Vehicle Classification Types	10
Table 6: Traffic Noise Impact Summary	12
Table 7: 2040 Noise Contours	13
Table 8: Preliminarily Recommended Noise Barriers	17

**Traffic Noise Analysis Addendum****I-26 Widening Project****Henderson and Buncombe Counties, STIP #I-4400/I-4700****1.0 PROJECT LOCATION AND DESCRIPTION**

North Carolina Department of Transportation (NCDOT) State Transportation Improvement Program (STIP) Project I-4400 / I-4700 proposes improvements to a 22.2-mile segment of the Interstate 26 corridor in Henderson and Buncombe Counties. The proposed improvement project would extend from US 25 south of Hendersonville in Henderson County to I-40 near Asheville in Buncombe County.

A Traffic Noise Analysis (TNA) was prepared for the project in March 2015. The proposed widening of I-26 will require modification of the interchange with US 25 (Asheville Highway) in Henderson County. The March 2015 TNA assumed the existing interchange configuration would not be changed. This TNA Addendum assesses traffic noise impacts and potential noise abatement measures at the I-26 / US 25 (Asheville Highway) interchange. NCDOT identified a partial cloverleaf interchange design as the build alternative.

I-26 is currently a four-lane, median-divided interstate facility with full control of access. The speed limit of I-26 is 65 miles per hour (mph) south of the US 25 (Asheville Highway) interchange and 60 mph north of the interchange. The design speeds for these segments of the I-26 corridor are 70 and 65 miles per hour respectively, five miles per hour above the posted speeds. The speed limit of US 25 (Asheville Highway) is 45 mph. The design year is 2040.

There are three detailed study alternatives under consideration for the widening of I-26: 1) 6-Lane Widening, 2) 8-Lane Widening, and 3) Hybrid Widening. The 6-Lane Widening Alternative would widen I-26 within the study area from two to three lanes in each direction. Similarly, the 8-Lane Widening Alternative would widen I-26 to four lanes in each direction. The Hybrid Widening Alternative would widen I-26 to three lanes in each direction from the eastern terminus of the project study area (US 25 [Exit 54]) to the I-26/US 25/Asheville Highway interchange where it would then transition to an 8-lane facility to the western terminus at the I-26/I-40/I-240 interchange (Exit 31). All alternatives would be situated to best fit within the existing right of way limits for I-26. Best fit alignments would be evaluated and selected to improve the existing highway alignment, minimize impacts, and accommodate maintenance of traffic during construction. The additional traffic lanes would increase capacity and reduce congestion.

Existing land use in the vicinity of the I-26 / US 25 interchange predominantly consists of commercial and residential uses with some large, undeveloped tracts of land. Land uses include but are not limited to single family residential dwellings, a recreation facility, gas stations, and restaurants.

Ambient noise monitoring data, corresponding traffic count data, photographs, event logs, and field sketches were obtained throughout the project corridor from June 2, 2014 through June 5, 2014 during preparation of the March 2015 TNA. Weather conditions varied between sunny and mostly cloudy and wind speeds were calm to five miles per hour. There was no precipitation. Information on the ambient noise monitoring data can be found in Appendix A.

## **2.0 PROCEDURE**

This Traffic Noise Analysis Addendum represents the analysis of the probable traffic noise impacts and the identification of “likely” noise abatement measures in the vicinity of the I-26 / US 25 (Asheville Highway) interchange for the I-26 Widening project.

This analysis is consistent with Title 23 Code of Federal Regulations, Part 772, U.S. Department of Transportation, Federal Highway Administration (FHWA), *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, the NCDOT *Traffic Noise Abatement Policy*, dated July 13, 2011, and the accompanying NCDOT *Traffic Noise Analysis and Abatement Manual* dated August 22, 2011.

This Traffic Noise Analysis Addendum utilized validated computer models created with FHWA’s Traffic Noise Model<sup>®</sup> (FHWA TNM v.2.5) to predict Base Year 2011, Design Year 2040 No-Build, and Design Year 2040 Build hourly equivalent traffic noise levels,  $L_{eq(h)}$ , to identify impacted receptors near the I-26 / US 25 interchange as part of the I-26 Widening project.

In addition to reporting, the procedure by which this Traffic Noise Analysis Addendum was conducted was as follows:

- *Initial project scoping*: Obtain project preliminary design; review project mapping, GIS data, aerial photography, traffic data, and other available pertinent information.
- *Baseline TNM model*: Create a comprehensive but efficient TNM model representation of the existing condition project corridor utilizing receptors, roadways, terrain lines, ground zones, barriers (to represent structures), and tree zones; validate the baseline TNM model at all ambient noise monitoring locations for which traffic noise was dominant (refer to Section 5.0); process traffic forecast data into three TNM-designated vehicle classifications; add the project preliminary design to the baseline TNM model. Refer to Appendix C for general descriptions of the TNM model(s), and also for a description of the TNM model validation process.
- *Impact assessment*: Input Base Year 2011 and Design Year 2040 No-Build condition traffic volumes and speeds into the validated baseline TNM model(s); calculate and document TNM-predicted traffic noise levels; evaluate loudest hourly equivalent noise levels; assess predicted traffic noise NAC and Substantial Increase impacts (refer to Section 7.0 and Appendix A).



- *Noise barrier analysis*: Identify areas in the vicinity of predicted Design Year 2040 traffic noise impacts for which abatement may be feasible; model traffic noise barriers; calculate TNM-predicted with-barrier traffic noise levels; evaluate with-barrier noise level reductions (NLRs); and optimize potential sound barriers (refer to Section 8.5, and Appendix D).

### 3.0 CHARACTERISTICS OF NOISE

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

The magnitude of noise is usually described by a ratio of its sound pressure to a reference sound pressure, typically twenty micro-Pascals (20 $\mu$ Pa). Since the range of sound pressure ratios varies greatly – over many orders of magnitude, a base-10 logarithmic scale is used to express sound levels in dimensionless units of decibels (dB). The commonly accepted limits of detectable human hearing sound magnitudes is between the threshold of hearing at 0 decibels and the threshold of pain at 140 decibels.

Sound frequencies are reported in units of Hertz (Hz), which correspond to the number of vibrations per second of a given tone. A cumulative ‘sound level’ is equivalent to ten times the base-10 logarithm of the ratio of the sum of the sound pressures of all frequencies to the reference sound pressure. To simplify the mathematical process of determining sound levels, sound frequencies are grouped into ranges, or ‘bands.’ Sound levels are then calculated by adding the cumulative sound pressure levels within each band – which are typically defined as one ‘octave’ or ‘1/3 octave’ of the sound frequency spectrum.

The commonly accepted limitation of human hearing to detect sound frequencies is between 20 Hz and 20,000 Hz, and human hearing is most sensitive to the frequencies between 1,000 Hz – 6,000 Hz. Although people are generally not as sensitive to lower-frequency sounds as they are to higher frequencies, most people lose the ability to hear high-frequency sounds as they age. To accommodate varying receptor sensitivities, frequency sound levels are commonly adjusted, or ‘filtered’, before being logarithmically added and reported as a single ‘sound level’ magnitude of that filtering scale. The ‘A-weighted’ decibel filtering scale applies numerical adjustments to sound frequencies to emphasize the frequencies at which human hearing is sensitive and to minimize the frequencies to which human hearing is not as sensitive, as shown in Table 1.

Table 1: Comparison: Flat vs. A-Weighted Frequency Scaling			
Octave-Band Center Frequency (Hz)	A-Weighted Adjustment <sup>1</sup>	Sample Frequency Sound Levels (Flat)	Sample Frequency Sound Levels (A-Weighted)
31	-39.53	90.00	50.47
63	-26.22	80.00	53.78
125	-16.19	70.00	53.81
250	-8.68	65.00	56.32
500	-3.25	60.00	56.75
1000	0.00	60.00	60.00
2000	+1.20	60.00	61.20
4000	+0.96	55.00	55.96
8000	-1.14	50.00	48.86
16000	-6.7	45.00	38.30
<b>Overall Sound Levels:</b>		<b>90.48 dB<sup>2</sup></b>	<b>66.32 dB(A)<sup>2</sup></b>
<p>1. Based on the ISO 226:2003 standard for normal equal-loudness contours, the A-weighted decibel network filtering scale is defined for a frequency, f, by the equation: <math>20 \times \log_{10}(A(f) / A(1000))</math>, where <math>A(f) = [12,200^2 \times f^4] / [(f^2 + 20.6^2) \times (f^2 + 12,200^2) \times (f^2 + 107.7^2)^{0.5} \times (f^2 + 737.9^2)^{0.5}]</math>.</p> <p>2. Although the energy in the flat sound source would create an <i>actual</i> sound level = 90.48 dB, it would be <i>perceived</i> as a sound level of 66.32 dB(A) by human hearing due to the decreased sensitivity of human hearing to lower sound frequencies.</p>			

The A-weighted scale is commonly used in highway traffic noise studies because the typical frequency spectrum of traffic noise is higher in magnitude at the frequencies at which human hearing is noise sensitive (1,000 Hz to 6,000 Hz).

Several examples of noise levels expressed in dB(A) are listed in Table 2. A review of Table 2 indicates that most individuals are exposed to fairly high noise levels from many sources on a regular basis. In order to perceive sounds of greatly varying pressure levels, human hearing has a non-linear sensitivity to sound pressure exposure. For example, doubling the sound pressure results in a three decibel change in the noise level; however, variations of three decibels (3 dB(A)) or less are commonly considered “barely perceptible” to normal human hearing. A five decibel (5 dB(A)) change is more readily noticeable. By definition, a ten-fold increase in the sound pressure level correlates to a 10 decibel (10 dB(A)) noise level increase; however, it is judged by most people as only a doubling of the loudness – sounding “twice as loud”.

<b>Table 2: Common Indoor and Outdoor Noise Levels</b>		
<b>Common Outdoor Noise Levels</b>	<b>Noise Level (dB(A))</b>	<b>Common Indoor Noise Levels</b>
	110	Rock Band
Jet Flyover at 1,000 feet	100	Inside Subway Train (NY)
Gas Lawn Mower at 3 feet		
Diesel Truck at 50 feet	90	Food Blender at 3 feet
Noisy Urban Daytime	80	Garbage Disposal at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theater, Large Conference Room (Background)
Quiet Suburban Nighttime		Library
	30	
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	20	
	10	Broadcast and Recording Studio
	0	Threshold of Hearing

Adapted from Guide on Evaluation and Attenuation of Traffic Noise, American Association of State Highway and Transportation Officials (AASHTO), 1974 (revised 1993).

The degree of disturbance or annoyance from exposure to unwanted sound (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 or not it is offensive.

For example, noises that occur during nighttime (sleeping) hours are typically considered to be more offensive than the same noises occurring in the daytime.

With regard to 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 a 60 dB(A) environment, 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 accept the noises that intrude into their lives on a regular basis. However, exposure to prolonged and/or extremely loud noise(s) can prevent use of exterior and interior spaces, and has been theorized to pose health risks. Appropriately, regulations exist for noise control or mitigation from many particularly offensive sources, including airplanes, factories, railroads, and highways. For all “Type I” federal, state, or federal-aid highway projects in the State of North Carolina, traffic and construction noise impact analysis and abatement assessment is dictated by the North Carolina Department of Transportation *Traffic Noise Abatement Policy* (NCDOT Policy). The definition of a Type I project can be found in the NCDOT Policy contained in Appendix F of this report. The I-26 Widening project is a Type I project because it proposes the addition of through-traffic lanes.

## **4.0 NOISE ABATEMENT CRITERIA**

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

The Federal Highway Administration (FHWA) has developed Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways. The purpose of Title 23 CFR Part 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 abatement criteria and procedures are set forth in Title 23 CFR Part 772, which also states, “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 3. The Leq, or equivalent sound level, is the equivalent steady-state

sound level which in a stated period of time contains the same acoustic energy as a time-varying sound level during the same period. With regard to traffic noise, fluctuating sound levels of traffic noise are represented in terms of  $L_{eq}$ , the steady, or ‘equivalent’, noise level with the same energy.

<b>Table 3: Noise Abatement Criteria</b>			
<b>Hourly Equivalent A-Weighted Sound Level (decibels (dB(A)))</b>			
<b>Activity Category</b>	<b>Activity Criteria<sup>1</sup> <math>L_{eq(h)}</math><sup>2</sup></b>	<b>Evaluation Location</b>	<b>Activity Description</b>
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B <sup>3</sup>	67	Exterior	Residential
C <sup>3</sup>	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, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E <sup>3</sup>	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

- 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.

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

The NCDOT *Traffic Noise Abatement Policy*, effective July 13, 2011, establishes official policy on highway noise. 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 traffic noise abatement. Where the FHWA has given highway agencies flexibility in implementing the Title 23 CFR 772 standards, this policy describes the NCDOT 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) those that “approach” (defined by the NCDOT Policy as reaching one decibel less than) or exceed the FHWA Noise Abatement Criteria (NAC), as shown in Table 3, and 2) those that represent a “substantial increase” over existing noise levels as defined by NCDOT. An impact that represents a “substantial increase” is based on a comparison of the existing noise level [ $L_{eq(h)}$ ] with the predicted increase in noise levels in Design Year 2040 of between 10 and 15 dB(A) or more, as shown in Table 4.

Table 4: NCDOT “Substantial Increase” Noise Impact Criteria	
Hourly Equivalent A-Weighted Sound Level (decibels (dB(A)))	
Existing Noise Level <sup>1</sup> ( $L_{eq(h)}$ )	Predicted Design Year Noise Level Increase <sup>2</sup> ( $L_{eq(h)}$ )
50 or less	15 or more
51	14 or more
52	13 or more
53	12 or more
54	11 or more
55 or more	10 or more

<sup>1</sup> Loudest hourly equivalent noise level from the combination of natural and mechanical sources and human activity usually present in a particular area.

<sup>2</sup> Predicted hourly equivalent Design Year traffic noise level minus existing noise level.

## 5.0 AMBIENT NOISE LEVELS

Ambient noise is that noise which is all around us caused by natural and manmade events. It includes the wind, rain, thunder, birds chirping, insects, household appliances, commercial operations, lawn mowers, airplanes, automobiles, etc. It is all noise that is present in a particular area.

Existing traffic noise exposure is varying in the vicinity of the I-26 / US 25 interchange. I-26 is the dominant noise source for receptors in proximity to the existing roadway facility. The purpose of noise monitoring is to gather data that is used to develop a comparison between the monitored results and the output obtained from the noise prediction model. This exercise is performed to validate the model to local conditions so that it can be used with confidence to predict the future noise levels.

Ambient noise monitoring data (20-minutes) was collected at three different locations for one (1) site near the I-26 / US 25 interchange for the I-4400/I-4700 TNA. Ambient noise levels ranged from 56 dB(A) to 63 dB(A) at this site. The ambient noise monitoring locations are shown in Figures 1 through 4. The noise monitoring results, concurrent traffic counts, estimated vehicle speeds, and weather information for the monitoring sites are included in Appendix A.

For this traffic noise analysis addendum, loudest-hour existing noise levels were assessed as the TNM- predicted noise levels based on existing loudest-hour traffic estimates. 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.

To validate the accuracy of the model for the I-4400/I-4700 TNA, TNM 2.5 was used to compare measured traffic noise levels to modeled noise levels at the field measurement locations. For each monitoring location, traffic volumes counted during the ambient noise monitoring (20-minute) periods were normalized to 1-hour volumes. These normalized volumes were assigned to the corresponding project area roadways to simulate the noise source strength at the roadways during the actual measurement period. Modeled and measured noise levels were then compared to determine the accuracy of the model. The FHWA-accepted tolerance for TNM model validation is  $\pm 3.0$  dB(A). The NCDOT goal for TNM model validation is  $\pm 1.7$  dB(A). All three (3) of the measurement locations near the I-26 / US 25 interchange fell within the  $\pm 1.7$  dB(A) tolerance specified by NCDOT. The results of TNM model validation relevant to this addendum are included in Appendix C.

## **6.0 PROCEDURE FOR PREDICTING FUTURE NOISE LEVELS**

Traffic noise emission is composed of several variables, including the number, types, and travel speeds of the vehicles, as well as the geometry of the roadway(s) on which the vehicles travel. Additionally, variables such as weather and intervening topography affect the transmission of traffic noise from the vehicle(s) to noise sensitive receptors.

In accordance with industry standards and accepted best-practices, detailed computer models were created using the FHWA TNM 2.5. The computer models were validated to within acceptable tolerances of field-monitored traffic noise data and were used to predict traffic noise levels for receptor locations in the vicinity of the I-26 Widening project. Traffic noise

consists of three primary parts: tire/pavement noise, engine noise, and exhaust noise. Of these sources, tire/pavement noise is typically the most offensive at unimpeded travel speeds. Sporadic traffic noises such as horns, squealing brakes, screeching tires, etc. are considered aberrant and are not included within the predictive model algorithm. Traffic noise is not constant; it varies in time depending upon the number, speed, type, and frequency of vehicles that pass by a given receptor. Furthermore, since traffic noise emissions are different for various types of vehicles, the TNM algorithm distinguishes between the source emissions from the following vehicle types: automobiles, medium trucks, heavy trucks, buses, and motorcycles, as shown in Table 5. The computer traffic noise prediction model uses the number and type of vehicles on the planned roadway, vehicle speeds, the physical characteristics of the road (curves, hills, depressions, elevations, etc.), receptor location and height, and, if applicable, barrier type, barrier ground elevation, and barrier segment top elevations. This analysis determines the traffic volumes that yield the loudest hourly noise levels as the lesser of forecasted PM peak hour traffic volumes and the maximum vehicle capacity that can maintain Level of Service “C” (LOS C) for mainline interstate roadway segments. Refer to Appendix E for the project traffic forecasts used in this study. Interior noise levels are determined for NAC Category D land uses, such as hospitals, medical facilities and places of worship, by applying building noise reduction factors based on building type and window treatment that can be found in FHWA publication *Highway Traffic Noise: Analysis and Abatement Guidance*. However, because Table 2 indicates that the common indoor background noise level for large rooms is approximately 40 dB(A), this analysis assumes that interior noise levels are not reduced below this value.

<b>Table 5: Traffic Noise Model (TNM) Vehicle Classification Types</b>	
<b>TNM Vehicle Type</b>	<b>Description</b>
Autos	All vehicles with two axles and four tires, including passenger cars and light trucks, weighing 9,900 pounds or less
Medium Trucks	All vehicles having two axles and six tires, weighing between 9,900 and 26,400 pounds
Heavy Trucks	All vehicles having three or more axles, weighing more than 26,400 pounds
Buses	All vehicles designed to carry more than nine passengers
Motorcycles	All vehicles with two or three tires and an open-air driver / passenger compartment

Sources: FHWA Measurement of Highway-Related Noise, § 5.1.3 Vehicle Types.  
 FHWA Traffic Monitoring Guide, § 4.1 Classification Schemes

Preliminary plans of the I-26 Widening project were used in this traffic noise analysis addendum. Per FHWA guidance, the predictions documented in this report are based upon the



Design Year 2040 Build-condition traffic conditions resulting in the loudest predicted hourly-equivalent traffic noise levels for each receptor. Refer to Appendix B for a comprehensive list of traffic noise receptors, and Base Year 2011 and predicted Design Year 2040 No-Build and Design Year 2040 Build for the 6-Lane Widening Alternative, 8-Lane Widening Alternative and the Hybrid Widening Alternative hourly equivalent traffic noise levels.

As noted in the March 2015 Traffic Noise Analysis, the project was divided into six Noise Study Areas (NSAs) for modeling purposes. The I-26 / US 25 (Asheville Highway) interchange study area analyzed in this addendum is located within NSA 3 (Areas O and NN) and NSA 4 (Area P) identified in the Traffic Noise Analysis report.

The NCDOT Relocation Report for the proposed partial cloverleaf design at the I-26 / US 25 (Asheville Highway) interchange was not available at the time of this addendum report. Therefore, for the purposes of this traffic noise analysis addendum, relocation assumptions were made based on proposed right-of-way in the preliminary design and engineering judgment. It was assumed that the properties identified below will be relocated as a result of each I-26 Widening build alternative in combination with the partial cloverleaf interchange alternative. If additional or different relocations are identified, the “likely” noise abatement measures identified in this addendum should be reevaluated.

- 526 Old Hendersonville Road (R-296)
- 522 Old Hendersonville Road (R-297)
- 39 November Lane (R-299)
- 37 November Lane (R-300)
- 65 November Lane (R-301)
- 244 Hickory Flats Drive (R-302)
- 146 Hickory Flats Drive (R-303)
- 60 November Lane (R-304)
- 42 November Lane (R-305)
- 211 Hickory Flats Drive (R-307)
- 97 Hickory Flats Drive (R-308)
- 71 Hickory Flats Drive (R-309)
- 143 Maxwell Drive (R-311)
- 109 Maxwell Drive (R-312)

## **7.0 TRAFFIC NOISE IMPACTS AND NOISE CONTOURS**

Traffic noise impacts occur when the predicted traffic noise levels either: [a] approach or exceed the FHWA noise abatement criteria (with "approach" defined in the NCDOT Noise Policy as reaching one decibel less than the NAC values listed in Table 3), or [b] substantially exceed the existing noise levels (refer to Table 4). FHWA and NCDOT require that feasible and reasonable measures be considered to abate traffic noise at all predicted traffic noise impacts. Measures to be considered include alteration of horizontal and vertical alignments, traffic management measures, establishment of buffer zones, construction of noise barriers, and noise insulation (of Activity Category D land uses).

As shown in Table 6, traffic noise currently impacts four (4) receptors along the I-26 corridor. Traffic noise is predicted to result in four (4) traffic noise impacts due to predicted Design Year 2040 No-Build condition noise levels. Traffic noise is predicted to result in eight (8) impacts in the Design Year 2040 Build condition for the 6-Lane Widening Alternative, 11 impacts for the 8-Lane Widening Alternative, and eight (8) impacts for the Hybrid Widening Alternative.

**Table 6: Traffic Noise Impact Summary**

Alternative	APPROXIMATE # OF IMPACTED RECEPTORS APPROACHING OR EXCEEDING FHWA NAC <sup>2</sup>							SUBST'L NOISE LEVEL INCR. <sup>3</sup>	IMPACTS DUE TO BOTH CRITERIA <sup>4</sup>	TOTAL IMPACTS PER 23 CFR 772
	A	B	C	D	E	F	G			
Existing	0	4	0	0	0	0	0	NA	NA	4 <sup>5</sup>
No-Build	0	4	0	0	0	0	0	0	0	4 <sup>5</sup>
6-Lane	0	8	0	0	0	0	0	0	0	8 <sup>5</sup>
8-Lane	0	11	0	0	0	0	0	0	0	11 <sup>5</sup>
Hybrid	0	8	0	0	0	0	0	0	0	8 <sup>5</sup>

1. This table presents the number of build-condition traffic noise impacts as predicted for the build- condition alternatives and no-build alternative presently under consideration. Refer to Appendix B for a detailed analysis of traffic noise impacts at each noise sensitive receptor location.
2. Predicted traffic noise level impact due to approaching or exceeding NAC (refer to Table 3).
3. Predicted “substantial increase” traffic noise level impact (refer to Table 4).
4. Predicted traffic noise level impact due to exceeding NAC *and* “substantial increase” in build-condition noise levels.
5. The total number of predicted impacts is not duplicated if receptors are predicted to be impacted by more than one criterion.

Per 23 CFR 772.9(c) and the NCDOT Noise 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 should assist local authorities in exercising land use control over the remaining undeveloped lands (NAC “G”), so as to avoid development of incompatible activities adjacent to the I-26 Widening project.

Correlating to the traffic noise impact threshold for FHWA NAC “E” land uses, the 71 dB(A) noise level contour is predicted to occur between 250 and 300 feet from the centerline of I-26 in the vicinity of the I-26 / US 25 interchange. The 66 dB(A) noise level contour, which correlates to the traffic noise impact threshold for FHWA NAC “B” and “C”, is predicted to occur between 300 and 400 feet from the centerline of I-26. See Table 7 for more detailed noise contour estimates. To represent worst case conditions, all distances are based on the 8-Lane Widening Alternative in the westbound direction (For PM peak hour, westbound has higher traffic volumes than eastbound).

<b>Table 7: 2040 Noise Contours</b>		
I-26 Mainline Segment	Maximum Contour Distances (feet)	
	66 dB(A)	71 dB(A)
Naples Road to US 25 (Asheville Highway)	400	300
US 25 (Asheville Highway) to Butler Bridge Road	300	250

Given the variation in cross sections and elevations adjacent to the project, it is recommended that any future development proposed in the area of the project be modeled with accurate survey data to avoid creating incompatible land uses adjacent to the project.

## 8.0 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 and separate considerations. Feasibility is the consideration as to whether noise abatement measures *can* be implemented. Reasonableness is the consideration as to whether noise abatement measures *should* be implemented.

Acceptable noise abatement measures considered include highway alignment selection, traffic system management measures, establishment of buffer zones, building insulation of NAC category D land use facilities, and noise barriers. Consideration for noise abatement measures was given to all impacted receptors.

### 8.1 Highway Alignment Selection

Highway alignment selection for traffic noise abatement measures involves modifying the horizontal and /or vertical geometry of the proposed facility to minimize traffic noise to noise-sensitive receptors. For noise abatement, horizontal alignment selection is primarily a matter of locating the roadway at a sufficient distance from noise-sensitive receptors. Appreciable reductions in traffic noise transmission to sensitive receptors can be made by adjusting the vertical highway alignment and /or section geometry. For example, lowering a roadway below existing grade creates a cut section which could act similarly as an earth berm, depending upon the relative location(s) of noise sensitive receptors.

The project proposes to construct additional lanes along I-26 within the project limits from US 25 to I-40. No further changes to the horizontal or vertical alignment beyond what is proposed in the preliminary plans would be feasible or reasonable due to the constraints of the existing

right of way and adjacent development, and the need to maintain traffic on existing lanes as much as possible during construction.

## **8.2 Traffic System Management Measures**

Traffic management measures such as prohibition of truck traffic, lowering speed limits, limiting of traffic volumes, and/or limiting time of operation were considered as possible traffic noise impact abatement measures. The purpose of the I-26 Widening project is to increase the functional capacity of the highway facility. Prohibition of truck traffic, reduction of the speed limit below the existing speed limit, or screening total traffic volumes along the interstate would diminish the functional capacity of the interstate highway facility and are not considered practicable.

## **8.3 Buffer Zones**

Buffer zones are typically not practical and/or cost effective for noise mitigation due to the substantial amount of right-of-way required, and would not be a feasible noise mitigation 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 Policy reasonable abatement cost threshold per benefited receptor.

## **8.4 Building Insulation**

Certain indoor areas may be impacted by exterior traffic noise (see Table 3). If impacted, an assessment as to whether building insulation meets applicable feasibility and reasonableness criteria must be made. Traffic noise is not predicted to impact any NAC category D land uses in the vicinity of the proposed project; therefore, consideration of noise insulation as a measure of noise abatement was not warranted.

## **8.5 Noise Barriers**

Passive noise abatement measures are effective because they absorb, reflect, and/or diffract (redirect) sound energy, and because they extend the source-to-receptor sound propagation path. Sound absorption and reflection are functions of abatement medium (e.g. earth berms absorb more sound energy than comparably tall concrete sound barriers because earth berms are substantially more massive). Sound diffraction is a function of the abatement medium and shape. The source-to-receptor path is extended by placement of an obstacle – such as a concrete wall – that blocks the propagation of sound waves except for those waves that travel from the source, over the obstacle, and to the receptor.

Highway noise barriers are primarily constructed as earth berms or solid-mass walls, between partial, de-facto, or full control of access roadways and noise-sensitive land uses. To be effective, a noise barrier must be long enough and have a sufficient vertical profile to shield the impacted receptor(s). Noise barriers are typically not economical for isolated or low density land-use areas because the area of a noise wall or volume and footprint of an earth berm would

not be economical.

Due to proximity of development to I-26, area topography, and the limited right of way along the project corridor, there is insufficient space to construct earth berms as noise abatement for the project. Therefore, earth berms are no considered feasible for noise abatement for the project.

### **Noise Study Areas (NSAs)**

The I-26 / US 25 (Asheville Highway) interchange study area is located within NSA 3 (Areas O and NN) and NSA 4 (Area P) identified in the I-4400/I-4700 Traffic Noise Analysis. These NSAs are defined as follows:

NSA 3: US 64 interchange to US 25 (Asheville Highway) interchange

NSA 4: US 25 (Asheville Highway) interchange to NC 280 interchange

### **NSA 3 Westbound (Area O)**

#### **Area O (Recommended Barrier – NW12)**

Area O is located just south of the US 25 (Asheville Highway) interchange along I-26 westbound. The primary noise sensitive land use in this area is residential. There were 52 residences modeled in this area, mostly along Old Hendersonville Road, November Lane, Hickory Flats Drive, and Community Road.

There are six (6) impacted receptors in the 6-Lane alternative. Sound barrier NW12 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 28 receptors. It is located along the I-26 westbound off-ramp to US 25 (Asheville Highway) beginning near the westbound bridge over railroad tracks and continuing along the edge of shoulder approximately 1,980 feet to the northwest. The portion of this wall along the bridge over railroad tracks is on structure. It is 1,980 feet long with an average height of 24 feet and a total area of 46,620 square feet.

There are nine (9) impacted receptors in the 8-Lane alternative. Sound barrier NW12 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 27 receptors. It is located along the I-26 westbound off-ramp to US 25 (Asheville Highway) beginning near the westbound bridge over railroad tracks and continuing along the edge of shoulder approximately 1,920 feet to the northwest. The portion of this wall along the bridge over railroad tracks is on structure. It is 1,920 feet long with an average height of 23 feet and a total area of 44,400 square feet.

There are six (6) impacted receptors in the Hybrid alternative. Sound barrier NW12 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 28 receptors. It is located along the I-26 westbound off-ramp to US 25 (Asheville Highway) beginning near the westbound bridge over railroad tracks and continuing along the edge of shoulder approximately 1,980 feet to the northwest. The portion of

this wall along the bridge over railroad tracks is on structure. It is 1,980 feet long with an average height of 23 feet and a total area of 45,900 square feet. Detailed analysis of preliminary sound barriers can be found in Appendix D.

### **NSA 4 Westbound (Area P)**

#### **Area P (No Recommended Barrier)**

The section of Area P in the vicinity of the I-26 / US 25 interchange is located just north of the US 25 (Asheville Highway) interchange along I-26 westbound. There are no noise sensitive land uses with outdoor areas of frequent human use in this area.

### **NSA 3 Eastbound (Area NN)**

#### **Area NN (Recommended Barrier – NW26)**

Area NN is located along I-26 eastbound on both sides of the US 25 (Asheville Highway) interchange. The primary noise sensitive land use in this area is residential. There were 33 residences modeled in this area, mostly along Cuerton Place and Alverson Lane.

There are two (2) impacted receptors in the 6-Lane alternative. Sound barrier NW26 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 13 receptors. It begins along the I-26 eastbound off-ramp to US 25 edge of shoulder and continues along the US 25 southbound edge of shoulder for a total distance of approximately 1,320 feet, ending prior to the Cuerton Place intersection with US 25. It is 1,320 feet long with an average height of 23 feet and a total area of 29,760 square feet.

There are two (2) impacted receptors in the 8-Lane alternative. Sound barrier NW26 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 13 receptors. It begins along the I-26 eastbound off-ramp to US 25 edge of shoulder and continues along the US 25 southbound edge of shoulder for a total distance of approximately 1,320 feet, ending prior to the Cuerton Place intersection with US 25. It is 1,320 feet long with an average height of 24 feet and a total area of 31,560 square feet.

There are two (2) impacted receptors in the Hybrid alternative. Sound barrier NW26 preliminarily meets feasibility and reasonableness criteria and would provide abatement for residences in this area, benefiting 15 receptors. It begins along the I-26 eastbound off-ramp to US 25 edge of shoulder and continues along the US 25 southbound edge of shoulder for a total distance of approximately 1,320 feet, ending prior to the Cuerton Place intersection with US 25. It is 1,320 feet long with an average height of 23 feet and a total area of 30,480 square feet. Detailed analysis of preliminary sound barriers can be found in Appendix D.

### **Barrier Evaluation Summary**

Based upon the preliminary design, two (2) noise walls are preliminarily recommended for the 6-Lane Widening Alternative, two (2) noise walls are preliminarily recommended for the 8-

Lane Widening Alternative, and two (2) noise walls are preliminarily recommended for the Hybrid Widening Alternative. Due to the preliminary status of the project design, noise wall alignment ground profiles are not sufficient for final design. It is the recommendation of this Traffic Noise Analysis Addendum that a comprehensive noise abatement design review be conducted as part of the project’s final design. Table 8 provides a summary of the preliminary feasible and reasonable noise barriers for each alternative. Appendix D contains a detailed assessment of all noise barriers.

<b>Table 8: Preliminarily Recommended Noise Barriers</b>						
<b>Barrier Name</b>	<b>Benefited Area</b>	<b>Approx Length (ft)</b>	<b>Approx Area (sq ft)</b>	<b>Number of Impacted Receptors</b>	<b>Total Number of Benefits</b>	<b>Quantity of Wall per Benefit (sq ft) / Allowable Quantity</b>
<b>6-LANE WIDENING ALTERNATIVE</b>						
NW12	Residences on Old Hendersonville Road, Pleasant Row Drive, November Lane, Hickory Flats Drive, Community Road and Fender Drive	1,980	46,620	6	28	1,665 / 2,640
NW26	Residences on Cuerton Place, Alverson Lane and Bicknell Drive,	1,320	29,760	2	13	2,289 / 2,605
<b>TOTALS</b>		<b>3,300</b>	<b>76,380</b>	<b>8</b>	<b>41</b>	<b>---</b>
<b>8-LANE WIDENING ALTERNATIVE</b>						
NW12	Residences on Old Hendersonville Road, Pleasant Row Drive, November Lane, Hickory Flats Drive, Community Road and Fender Drive	1,920	44,400	9	27	1,644 / 2,640

<b>Table 8: Preliminarily Recommended Noise Barriers</b>						
<b>Barrier Name</b>	<b>Benefited Area</b>	<b>Approx Length (ft)</b>	<b>Approx Area (sq ft)</b>	<b>Number of Impacted Receptors</b>	<b>Total Number of Benefits</b>	<b>Quantity of Wall per Benefit (sq ft) / Allowable Quantity</b>
NW26	Residences on Cuerton Place, Alverson Lane and Bicknell Drive,	1,320	31,560	2	13	2,428 / 2,605
<b>TOTALS</b>		<b>3,240</b>	<b>75,960</b>	<b>11</b>	<b>40</b>	<b>---</b>
<b>HYBRID WIDENING ALTERNATIVE</b>						
NW12	Residences on Old Hendersonville Road, Pleasant Row Drive, November Lane, Hickory Flats Drive, Community Road and Fender Drive	1,980	45,900	6	28	1,639 / 2,640
NW26	Residences on Cuerton Place, Alverson Lane and Bicknell Drive,	1,320	30,480	2	15	2,032 / 2,605
<b>TOTALS</b>		<b>3,300</b>	<b>76,380</b>	<b>8</b>	<b>43</b>	<b>---</b>

In accordance with the 2011 NCDOT *Traffic Noise Abatement Policy*, these noise barriers preliminarily meet feasibility and reasonableness requirements, based on available information. The final decision on feasibility and reasonableness and installation of the noise barriers will be made upon completion of the project design and the public involvement process. Changes may occur as more detailed information on mapping and final design becomes available. Any changes in noise abatement measures as detailed in this report must be approved by the FHWA prior to implementation. Final survey mapping and final design, which were not available for this report, may reveal issues related to feasibility or reasonableness not known at this time.



## **9.0 CONSTRUCTION NOISE**

The predominant construction activities associated with this project are expected to be earth removal, hauling, grading, paving and pile driving for bridge construction. Temporary and localized construction noise impacts may occur as a result of these activities (refer to Table 7). During daytime hours, the predicted effects of these impacts could be temporary speech interference for passers-by and those individuals living or working near the project. During evening and nighttime hours, steady-state construction noise emissions such as from paving operations could be audible, and may cause impacts to activities such as sleep. Sporadic evening and nighttime construction equipment noise emissions such as from backup alarms, lift gate closures (“slamming” of dump truck gates), etc., will be perceived as distinctly louder than the steady-state acoustic environment, and could impact the general peace and usage of noise-sensitive areas – particularly residences, hospitals and hotels.

Extremely loud construction noise activities such as usage of pile-drivers and impact-hammers (jack hammer, hoe-ram) will provide sporadic and temporary construction noise impacts in the near vicinity of those activities. Construction activities that will produce extremely loud noises should be scheduled during times of the day when such noises will create as minimal disturbance as possible.

Generally, low-cost and easily implemented construction noise control measures should be incorporated into the project plans and specifications to the extent possible. These measures include, but are not limited to, 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.

While discrete construction noise level prediction is difficult for a particular receptor or group of receptors, it can be assessed in a general capacity with respect to distance from known or likely project activities. For this project, earth removal, grading, hauling, and paving is anticipated to occur in the vicinity of noise-sensitive receptors. Although construction noise impact mitigation 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 Analysis Addendum that:

- Earth removal, grading, hauling, and paving activities in the vicinity of residences should be limited to weekday daytime hours.
- If meeting the project schedule requires that earth removal, grading, hauling and / or paving must occur during evening, nighttime and / or weekend hours in the vicinity of residences, 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 mitigation of the predicted construction noise impacts upon the affected property owners and / or residents.

- If construction noise activities must occur during context-sensitive hours in the vicinity of noise-sensitive areas, discrete construction noise abatement measures including, but not limited to portable noise barriers and / or other equipment-quieting devices should be considered.
- Some construction activities could create extreme noise impacts for nearby noise-sensitive land uses. For example, pile driving activities can pose an extreme noise impact for distances of up to one-quarter mile. It is the recommendation of this Traffic Noise Analysis Addendum that considerations be made for any nearby residences for all evening and/or nighttime periods (7:00 p.m. – 7:00 a.m.) throughout which extremely loud construction activities might occur.

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](http://www.fhwa.dot.gov/environment/noise/cnstr_ns.htm).

## **10.0 CONCLUSION**

Traffic noise impacts and temporary construction noise impacts can be a consequence of transportation projects, especially for noise-sensitive land uses in close proximity to high-volume and/or high-speed existing steady-state traffic noise sources. This Traffic Noise Analysis Addendum utilized computer models created with the Federal Highway Administration Traffic Noise Model<sup>®</sup> (FHWA TNM v.2.5) to determine existing and to predict future noise levels and identify impacted receptors resulting from the I-26 Widening project at the US 25 (Asheville Highway) interchange.

Base Year 2011 traffic noise impacts four (4) receptors in the vicinity of the I-26 / US 25 interchange. For Design Year 2040 traffic volumes, the No-Build Alternative is predicted to result in four (4) traffic noise impacts, the 6-Lane Widening Alternative is predicted to result in eight (8) traffic noise impacts, the 8-Lane Widening Alternative is predicted to result in 11 traffic noise impacts and the Hybrid Widening Alternative is predicted to result in eight (8) traffic noise impacts.

Furthermore, construction noise impacts may occur due to the proximity of noise-sensitive residential receptors to project construction activities. It is the recommendation of this traffic noise analysis addendum 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. For the 6-Lane Widening Alternative, traffic noise abatement measures are preliminarily recommended as feasible and reasonable in two (2) locations for the benefit of 41 receptors in the vicinity of the project, based on available information. For the 8-Lane Widening Alternative, traffic noise abatement measures are preliminarily recommended as feasible and reasonable in two (2) locations for the benefit of 40 receptors in the vicinity of the project, based on available information. For the Hybrid Widening Alternative, traffic noise abatement measures are

preliminarily recommended as feasible and reasonable in two (2) locations for the benefit of 43 receptors in the vicinity of the project, based on available information.

In accordance with the 2011 NCDOT *Traffic Noise Abatement Policy*, the two (2) recommended noise barriers for each build alternative preliminarily meet feasibility and reasonableness requirements based on available information. The final decision on feasibility and reasonableness of the noise barriers will be made upon completion of the project design and the public involvement process. Changes may occur as more detailed information on mapping and final design becomes available. Any changes in noise abatement measures as detailed in this report must be approved by the FHWA prior to implementation.

## **11.0 REFERENCES**

HNTB North Carolina, P.C. *Traffic Noise Analysis STIP Project I-4400/I-4700*. March 2015.

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 Guidance*. 2011.

North Carolina Department of Transportation. *Traffic Noise Abatement Policy*. July 2011.

North Carolina Department of Transportation. *Traffic Noise Analysis and Abatement Manual*. August 2011.