

3.5 Noise

3.5.1 WHAT IS NOISE AND HOW COULD NOISE IMPACT PEOPLE?

Noise is typically defined as "any sound that is undesired or interferes with one's hearing of something."¹ The basic parameters of noise that affect humans are:

- Intensity or level
- Frequency content
- Variation with time

Typical urban and suburban environments are comprised of "background noise" that consists of common sounds such as traffic, air conditioners, cell phones, bird calls, and other familiar sounds. People's reaction to sounds above normal background noise depends on the intensity, the frequency, and the variation in the sound level.

Intensity is determined by the level of sound, which is expressed in units of decibels (dB). On a relative basis, a 3dB positive change in sound level generally represents a barely perceptible change in a common outdoor setting, to someone with average hearing. A 5-dB positive change presents a "noticeable" change, and a 10-dB positive change is typically perceived as a doubling in the loudness.

Because the sensitivity of human hearing varies with frequency, the A-weighting system is commonly used. Sound levels measured using this weighting system are called "A-weighted" sound levels, dBA, are widely accepted as a proper unit for describing environmental noise.

Many factors affect noise. Traffic noise level at a site depends on many site features (distance, land cover, topography, etc.) and traffic characteristics (volume, vehicle type, speed, truck numbers, etc.) of proposed roadways. Noise levels from trucks are much greater than noise levels from automobiles. Assuming similar vehicle mix and travel speeds, a doubling in traffic volume produces a doubling in the sound energy. A doubling in sound energy corresponds to a barely perceptible 3-dBA increase in noise level.

Noise is measured in a logarithmic unit called a decibel (dBA), measured on a scale of 1 to 180, providing a range for the sound levels that fall within the normal range of hearing. Figure 3.5-1 provides an overview of several different types of noises and what the sound level is in dBA.

¹ Merriam-Webster Dictionary



	SOUND SOURCE	dBAª	RESPONSE DESCRIPTOR	
	CARRIER DECK JET OPERATION	140	LIMIT OF AMPLIFIED SPEECH	
	JET TAKEOFF (200 FEET)	130	PAINFULLY LOUD	
	RIVETING MACHINE	120	THRESHOLD OF FEELING AND PAIN	
A A A A A A A A A A A A A A A A A A A	NEW YORK SUBWAY STATION	110		
	HEAVY TRUCK (50 FEET)	100	VERY ANNOYING	
	PASSENGER TRAIN (100 FEET)	090	HEARING DAMAGE (8-HOUR EXPOSURE)	
	HELICOPTER (IN-FLIGHT, 500 FEET)	080	ANNOYING	
	FREEWAY TRAFFIC (50 FEET)	070	INTRUSIVE	
	AIR CONDITIONING UNIT (20 FEET)	060		
	LIGHT AUTO TRAFFIC (50 FEET)	050	QUIET	
	NORMAL SPEECH (15 FEET)	040		
13.5.	LIVING ROOM, BEDROOM, LIBRARY	030	VERY QUIET	
	SOFT WHISPER (15 FEET)	020		
	BROADCASTING STUDIO	010	JUST AUDIBLE	
		000	THRESHOLD OF HEARING	

Figure 3.5-1 Weighted Noise Levels and Human Response

^a Source: CEQ 1970. Typical A-weighted noise levels taken with a sound-level meter and expressed as decibels on the "A" scale. The "A" scale approximates the frequency response of the human ear.

3.5.2 HOW ARE NOISE IMPACTS ESTIMATED?

The Federal Noise Control Act of 1972 requires that all federal agencies administer their programs in a manner that promotes an environment free from noises that could jeopardize public health or welfare. The federal regulation that the Federal Highway Administration (FHWA) uses to assess noise impacts is 23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. The South Carolina Department of Transportation (SCDOT) Traffic Noise Abatement Policy constitutes the official SCDOT noise policy and procedures for the purpose of meeting the requirements of 23 CFR Part 772. Noise-abatement criteria (NAC) are used to define the noise levels that are considered an impact (in hourly A-weighted sound-level decibels) for each land-use activity category. SCDOT defines traffic noise impacts as occurring when future noise levels exceed the NAC, or when the difference between existing and future traffic noise levels is 15 dBA or more. The NAC are summarized in Table 3.5-1. Noise impacts would also occur if the difference between the existing noise level and the predicted noise level under the build condition is 15 dBA *L*_{eq} or greater.



Table 3.5-1 Noise-Abatement Criteria

Activity Category	L _{eq} (h) ² Noise Levels (dBA)	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
В	67 (exterior)	Residential
C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	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.

Source: 23 CFR Part 772, Table 1

 $^{^{2}}$ L_{eq} , or equivalent sound pressure level, denotes a steady-state sound pressure level that, within a given time period, contains an equal amount of acoustic energy to the actual, fluctuating sound pressure level measured during that period. L_{eq} (h) denotes the L_{eq} for a one-hour period.



The evaluation of impacts was completed in compliance with 23 USC Section 109(h) and (i), the FHWA established guidelines (23 CFR Part 772) for the assessment of highway traffic-generated noise. The noise assessment for the I-20/I-26/I-126 project was prepared in accordance with 23 CFR Part 772 and SCDOT Noise Abatement Policy (September 1, 2014). The I-20/I-26/I-126 Noise Impact Assessment Technical Report is in Appendix I and contains the technical details of the modeling and impact analysis.

Noise for this project was modeled using the FHWA's Transportation Noise Model (TNM), version 2.5. To ensure the model is accurate in calculating noise levels at these sensitive receivers, the model is validated by

SCDOT's policy states that the preliminary traffic noise analysis shall include the following for each alternative under detailed study:

- Identification of existing activities, developed lands, and undeveloped lands for which development is planned, designed and programmed, which may be affected by noise from the highway;
- Measurement of existing noise levels;
- Model validation;
- Noise model analysis of existing and future noise levels;
- Identification of traffic noise impacts; and
- Consideration of noise abatement.

collecting field measurements with a sound level meter and counting the traffic volumes on the roads during the field data collections. If results from the TNM model are within a 3+/- decibels (dB) tolerance of the measurement collected in the field, the model is considered valid to calculate noise levels for the project. For the I-20/I-26/I-126 project all of the field measurements were within tolerance of the modeled results. For further information about the measurement of the existing noise levels and validation of the TNM 2.5 model, please refer to Section 3 of the Noise Technical Report, which can be found in Appendix I of this DEIS. Appendix I of the DEIS also presents figures that show the noise receptor locations, and model validation locations.

3.5.3 WHAT ARE THE ANTICIPATED NOISE IMPACTS?

3.5.3.1 How did we assess expected noise under the preliminary analysis?

According to 23 CFR §772.5 (g), traffic noise impacts occur when either a) the predicted traffic noise levels approach or exceed the FHWA NAC for the applicable activity category, or b) when the predicted traffic noise levels substantially exceed the existing noise levels. SCDOT considers noise levels within 1 dBA *L*_{eq} of the FHWA NAC as "approaching" the criteria and a 15 dBA increase as a substantial increase.⁴ Table 3.5-1 summarizes the NAC used to define the noise levels that are considered an impact for each land-use activity category.

Noise receptors in the project area within approximately 500 feet of the outside lane were identified through field reconnaissance and GIS parcel map information. A total of 2,621 individual noise receptors were identified

⁴ "Traffic Noise Abatement Policy", South Carolina Department of Transportation, September 1, 2014.



in the project area. The SCDOT defines a noise receptor as a discrete or representative location of a noise sensitive area. For example, receptors are placed on trails based on trail use information per SCDOT policy.

The Saluda Riverwalk Extension is a Section 4(f) resource currently under construction in the project study area adjacent to I-126 and I-26 (refer to Section 3.11 for further information). Typically, a Section 4(f) resource is modeled as a receptor as required by SCDOT's Traffic Noise Abatement Policy. However, a preliminary noise analysis was conducted for the DEIS for the reasonable alternatives, which does not include ground elevations, terrain features, etc. that would affect how noise from the roadway would travel to the resource, in this case the trail. Thus, SCDOT commits to conduct noise modeling for the Saluda Riverwalk Extension as part of the detailed noise analysis. The detailed noise analysis will include elevation data, as well as other features such as ground zones and terrain, which would provide a more accurate depiction of the effects of noise on the trail. Once the detailed noise analysis is completed, the results of the noise analysis for the trail will be available for a 15-day public comment period, as per Section 4(f) requirements. Comments received during the 15-day public comment period on the noise analysis for the 4(f) resource will be addressed in the FEIS/ROD and Section 4(f) documentation.

Traffic noise modeling receptors were also placed at tees and greens at golf courses in the study area. Figures 3.5-2 and 3.5-3 present closer views of these locations, including impacted and relocated receptors. The project area was divided up into Noise Sensitive Areas (NSA) to make the noise analysis process more organized and easier to follow by laypersons and decision makers. An NSA is usually defined as a group of receptors that are geographically situated in a single, continuous geographic area, without large gaps and which might reasonably be protected by a single noise barrier. A typical NSA might encompass a residential area with a few dozen homes within a few hundred feet of the highway that extend between two interchanges. It is also common that an NSA will have fairly consistent land use (such as single family homes), but some NSAs may have mixed use areas. In this sense an NSA may consist of a single isolated noise sensitive structure, or a mile long stretch of closely spaced, uninterrupted homes alongside the project highway.

3.5.3.2 Existing Condition

The FHWA TNM version 2.5 was used to calculate existing noise levels and predict future design year noise levels. Inputs to this model include noise sensitive receiver locations, existing and future roadway alignments, and traffic volumes and posted speeds. The following was assumed:

- Where required, multiple travel lanes were included in the TNM model;
- Peak hour traffic volumes and truck percentages;
- Ground elevations for all inputs to the model, including roadways, receptors, and barriers in the barrier analyses were assumed to be 0 feet per the preliminary noise analysis requirements in Section 3.5 of SCDOT's Traffic Noise Abatement Policy; and
- A land use survey was conducted for the project area. The corresponding NAC category from the SCDOT Traffic Noise Abatement Policy was used.

The existing land use consists of primarily single-family and multi-family residences (Category B) as well as some places of worship, apartment pools, golf courses, trails (Category C), interiors of medical facilities and places of



worship (Category D⁵), and restaurant patios (Category E). For the I-20/I-26/I-126 project, noise sensitive receivers were assigned a NAC category B, C, D, E, or F. Based on this preliminary noise analysis for the existing condition, noise levels would approach or exceed the NAC established in the *SCDOT Traffic Noise Abatement Policy* for 1,605 receivers. The majority of the impacts are to NAC Category B (residences). Noise levels for the existing condition ranged from 38 to 76 dBA. Table 3.5-2 presents a summary of impacts by alternative.

Activity Category	Existing	Future No-build	Reasonable A RA1	lternatives RA5 Modified
А	0	0	0	0
В	1590	1596	1864	1827
С	12	14	24	25
D	0	0	0	0
E	3	3	4	6
TOTAL	1605	1613	1892	1858

Table 3.5-2 Summary of Impacts by Alternative

3.5.3.3 No-Build Alternative

Based on this preliminary noise analysis for the No-Build alternative, noise levels would approach or exceed the NAC established in the *SCDOT Traffic Noise Abatement Policy* for 1,613 receivers. The majority of the impacts are to NAC Category B (residences). Noise levels for the No-build alternative ranged from 38 to 76 dBA.

3.5.3.4 RA1 (Recommended Preferred Alternative)

For RA1, 2040 noise levels would approach or exceed the NAC established in the SCDOT Traffic Noise Abatement Policy for 1,892 receivers. Additionally, relocated receivers are not included in the impact count; refer to Appendix H for additional information on relocated properties. The majority of the impacts would be to NAC Category B (residences). Noise levels for the RA1 ranged from 41 to 77 dBA and are predicted to increase over existing noise levels from 0 to 6 dBA. There were no substantial increase impacts. Figure 3.5-2 presents the RA1 noise receptors, highlights those receptors that are predicted to approach or exceed the NAC, and shows the locations of preliminary noise walls that were studied in this analysis. More detailed figures are in Appendix A of the Noise Tech Study, which is Appendix I of the DEIS (Figure A3, Page 1 – 20).

⁵ Receivers representing places of worship and medical facilities were only considered as Category D if no exterior area of frequent human activity was identified.



3.5.3.5 RA5 Modified

For RA5 Modified, 2040 noise levels would approach or exceed the NAC established in the *SCDOT Traffic Noise Abatement Policy* for 1,858 receivers. Additionally, relocated receivers are not included in the impact count; refer to Appendix H for additional information on relocated properties. The majority of the impacts are to NAC Category B (residences). Noise levels for RA5 Modified ranged from 41 to 77 dBA and are predicted to increase over existing noise levels from 0 to 6 dBA. There were no substantial increase impacts. Figure 3.5-3 presents the RA5 Modified noise receptors, highlights those receptors that are predicted to approach or exceed the NAC, and shows the locations of preliminary noise walls that were studied in this analysis. More detailed figures are in Appendix A of the Noise Tech Study, which is Appendix I in the DEIS (Figure A4, Page 1 – 20).













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3.5.4 WHAT HAPPENS WHEN NOISE IMPACTS OCCUR?

In accordance with 23 CFR §772.13 (c) and SCDOT's Noise Abatement Policy, noise abatement measures must be considered for reducing or eliminating noise levels to impacted receivers.⁶

When considering noise abatement measures, primary consideration shall be given to exterior areas where frequent human use occurs. Since South Carolina is not part of the FHWA-approved Quiet Pavement Pilot Program, the use of quieter pavements was not considered as an abatement measure for the proposed project. In addition, the planting of vegetation or landscaping was also not considered as a potential abatement measure, since it is not an acceptable Federal-aid noise abatement measure due to the fact that only dense stands of evergreen vegetation planted 100 feet deep will reduce noise levels. The following measures were considered and evaluated as a means to reduce or eliminate the traffic noise impacts:

- Acquisition of rights-of-way;
- Traffic management;
- Alteration of horizontal and vertical alignments;
- Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development;
- Noise insulation of public use or nonprofit institutional structures; and,
- Noise barriers.

Table 3.5-3 outlines the different types of noise abatement measures considered and whether they were eliminated from consideration or carried forward. Of the possible noise abatement measures considered for the proposed project, only noise barriers were carried forward for consideration due to the constraints listed in Table 3.5-3 for the other options, primarily because the preliminary design was modified to minimize impacts to the greatest extent to the natural and human environment. The acquisition of additional right-of-way to alter the alignment or create a buffer zone would result in an increase in impacts.

Table 3.5-3 Mitigation Types Considered for Noise Impacts

Mitigation Type	Status
Traffic management	Eliminated. Measures such as exclusive lane designations and signing for prohibition of certain vehicle type would prevent the project from serving its intended purpose, such as moving people, goods and services.

⁶ "Traffic Noise Abatement Policy", South Carolina Department of Transportation, September 1, 2014.



Mitigation Type	Status
Alteration of horizontal and vertical alignments	Eliminated. Alignment modifications as a means of noise abatement may result in disruptive relocations for this project and may affect other natural resources.
Acquisition of real property or interests therein (predominantly unimproved property)	Eliminated. The taking of adequate property to create an effective buffer zone would most likely involve taking the impacted receivers and would require purchasing additional right-of- way. Additionally, receivers that are farther from the road are likely not impacted.
Noise insulation of public use or nonprofit institutional structures	Eliminated. No public use or nonprofit institutional structures would be impacted by the proposed project.
Noise Barriers	Carried forward for further consideration.

3.5.5 HOW WERE NOISE BARRIERS ASSESSED FOR MITIGATION?

The use of structural barriers (freestanding walls) was considered for impacted receivers. There are feasibility and reasonableness criteria that must be met for construction of noise walls. Noise walls are assessed under the feasibility criteria first, and if all conditions are met are then considered for reasonableness.

There are two feasibility criteria. Per SCDOT policy, acoustic feasibility means that a noise reduction of at least 5 dBA must be achieved for 75% of impacted receivers. There are also seven engineering and design considerations that must be achieved to meet the engineering feasibility criteria. These considerations include topography, safety, drainage, utilities, maintenance, access, and wall height which was determined using the FHWA Traffic Noise Model.

As with feasibility, there are several reasonableness criteria that must be met. These include:

- Noise Reduction Design Goal It is SCDOT's policy that a noise reduction of at least 8 dBA must be achieved for 80% of those receivers determined to be in the first two building rows and considered benefited.
- Cost Effectiveness The allowable cost of the abatement is based on \$35.00 per square foot. This allowable cost is based on the cost effectiveness criteria found in SCDOT's Traffic Noise Abatement



Policy (2014)⁷. This construction cost will be divided by the number of benefited receptors. If the cost per benefited receptor is less than \$30,000 then the barrier is determined to be cost effective.

 Property Owners and Residents - SCDOT will solicit the viewpoints of all of the benefited receivers and document a decision on either desiring or not desiring the noise abatement measure. A noise wall will be constructed unless a majority (greater than 50% of the benefited receptors) of votes is received not desiring noise abatement (p. 24 of SCDOT's Traffic Noise Abatement Policy). This third criterion is only considered if the noise wall meets the first two criteria.

The three mandatory reasonable factors must be collectively achieved in order for a noise abatement measure to be deemed reasonable. Failure to achieve any one of the reasonable factors will result in the noise abatement measure being deemed not reasonable. Figure 3.5-4 summarizes the reasonability and feasibility criteria used to assess traffic noise mitigation measures.



Figure 3.5-4 Reasonability and Feasibility Criteria

SCDOT's policy requires completion of a "Feasibility and Reasonableness Worksheet" for each barrier evaluated. These worksheets can be found in Appendix B and C of the Noise Analysis Technical Report located in Appendix I of this document.

3.5.5.1 What were the assumptions made for feasibility and reasonableness

considerations?

This section discusses the evaluations of feasibility and reasonableness performed on the barriers that could potentially mitigate projected traffic noise impacts on RA1. Numerous barriers were evaluated as described below. In some instances (i.e. a single impacted receiver behind a proposed barrier), one barrier was evaluated and the results were considered representative of other barriers that only shield one impacted receiver. In some instances, the barrier analysis for Alternative RA5 Modified was applied to RA1 because the project design is the same and RA5 Modified yielded the worst-case traffic volumes and impacts between the two alternatives.

⁷ "Traffic Noise Abatement Policy", South Carolina Department of Transportation, September 1, 2014.



Following are the results of the evaluation of feasibility and reasonableness for barriers identified under Alternative 1.

3.5.5.2 What were the results of the feasibility and reasonableness considerations for

RA1?

A summary of the results of the evaluation of feasibility and reasonableness for barriers identified under Alternative RA1 can be found in Table 3.5.5. Traffic noise impacts are not projected to occur at Activity Category D receivers; refer to the noise technical report in Appendix I for additional details.

Table 3.5-4 Summary of Preliminary Noise Mitigation Analysis for RA1

	Alternative RA1 (Preferred)					
Barrier	Dimensions (length x height, feet)	Cost ⁸	Feasible	Reasonable	Proposed	
A	1,800x25	\$1,575,035	Yes	No	No	
B1		See C				
С	229x10	\$80,150	Yes	No	No	
E1	1,312x15	N/A	Yes	No	No	
F	See C					
G1	2,604x20	\$1,823,395	Yes	Yes	Yes	
H1	4,085x20	\$2,859,500	Yes	No	No	
H2	845x25	N/A	No	N/A	No	
11	2,006x20	\$1,403,465	Yes	No	No	
12	2,404x25	N/A	Yes	No	No	
13	4,003x20	\$2,801,015	Yes	Yes	Yes	
J1	2,600x15	\$1,365,245	Yes	No	No	
J2	3,210x15	\$1,685,600	Yes	Yes	Yes	
K1	4,742x25	\$4,146,170	Yes	Yes	Yes	
L1/L2	2,054x25	N/A	No	N/A	No	
N1	2,200x15	\$1,155,014	Yes	No	No	
N2			See C			
0	2,200x15	\$1,154,930	Yes	Yes	Yes	
Q1	5,327x20	\$3,731,665	Yes	Yes	Yes	
R1	5,200x15	\$2,729,860	Yes	Yes	Yes	
S	5,400x25	\$4,725,035	Yes	Yes	Yes	

⁸ (Note: Instances where the noise wall cost does not exactly equal to the wall area multiplied by \$35/sq ft. are due to rounding that occurs during barrier dimension calculations performed by TNM).



		Alternative RA1 (Preferred)			
Barrier	Dimensions (length x height, feet)	Cost ⁸	Feasible	Reasonable	Proposed
T1	4,569x25	\$3,998,225	Yes	No	No
U1	2,833x25	N/A	No	N/A	No
V1/V2	2,916x25	N/A	Yes	No	No
w	2,000x25	\$1,749,650	Yes	Yes	Yes
X2	6,851x20	\$4,795,280	Yes	No	No
Y1	3,508x25	N/A	Yes	No	No
Z1	3,535x20	\$2,474,395	Yes	Yes	Yes

Based on the preliminary analysis of RA1, of the 28 walls assessed for feasibility and reasonableness criteria, fourteen barriers were determined to be feasible but not reasonable; ten barriers were determined to be reasonable and feasible; and three barriers were determined to not be feasible (and therefore no reasonableness assessment occurred). The location of the proposed noise walls is shown on Figure 3.5.3. Refer to Appendix B of the Noise Analysis Technical Report (Appendix I) for more detailed analysis and information including the worksheets for the barrier determinations under each alternative.

Following the public hearing, a detailed noise analysis will be completed to verify these results. The detailed noise analysis may modify where barriers are located, as well as if barriers are warranted in certain locations. If a barrier is feasible and reasonable in the preliminary analysis and it is determined not to be feasible and reasonable in the detailed analysis, SCDOT will notify the benefited receptors of that barrier that the barrier is no longer warranted per the SCDOT Noise Policy requirements. If a barrier that is determined not to be feasible and reasonable in the preliminary analysis, but is determined to be feasible and reasonable in the detailed analysis, but is determined to be feasible and reasonable in the detailed analysis, but is determined to be feasible and reasonable in the detailed by SCDOT.

Please refer to the RA5 MODIFIED worksheets in Appendix C of the noise technical report (Appendix I of the DEIS) for barriers that apply to RA1 as analyzed under the RA5 Modified alternative. A summary of the barrier analysis is presented in Table 5.2. The location of the proposed noise walls is shown on Figure A3 in Appendix A of the noise technical report.

3.5.5.3 What were the results of the feasibility and reasonableness considerations for

RA5 Modified?

A summary of the results of the evaluation of feasibility and reasonableness for barriers identified under Alternative RA5 Modified can be found inTable 3.5-5.



Table 3.5-5 Summary of Preliminary Noise Mitigation Analysis for RA5 Modified

	Alternative RA5 Modified				
Barrier	Dimensions (length x height.	Cost ⁹	Feasible	Reasonable	Proposed
	feet)				
Α	1,800x25	\$1,575,035	Yes	No	No
B1	1,000x25	\$875,049	Yes	No	No
B2			See B1		
С			See B1		
E2	1,820x25	N/A	Yes	No	No
E3			See B1		
F			See B1		
G1	2,780x20	\$1,945,650	Yes	Yes	Yes
G2	See B1				
H1	3,492x20	\$2,444,575	Yes	No	No
H2	844x25	N/A	No	N/A	No
11	2,000x20	\$1,399,930	Yes	No	No
12	2,400x25	N/A	Yes	No	No
14	4,200x20	\$2,939,755	Yes	Yes	Yes
J1	2,600x15	\$1,365,245	Yes	No	No
J2	3,400x15	\$1,785,000	Yes	Yes	Yes
К2	4,177x25	N/A	No	N/A	No
L2/L3	2,330x25	N/A	Yes	No	No
N1	2,200x15	\$1,155,014	Yes	No	No
N2			See B1		
о	2,200x15	\$1,154,930	Yes	Yes	Yes
Q2	5,047x25	N/A	Yes	No	No
R2	5,200x15	\$2,729,860	Yes	Yes	Yes
S	5,400x25	\$4,725,035	Yes	Yes	Yes
Т2	3,201x15	\$1,645,735	Yes	Yes	Yes
U2	2,669x25	N/A	No	N/A	No
V3/V4	2,406x25	N/A	Yes	No	No
w	2,000x25	\$1,749,650	Yes	Yes	Yes
X1	7,998x20	\$5,597,795	Yes	No	No
Y2	3,399x25	N/A	Yes	No	No
Z2	3,985x25	\$3,486,455	Yes	Yes	Yes

⁹ (Note: Instances where the noise wall cost does not exactly equal to the wall area multiplied by \$35/sq ft. are due to rounding that occurs during barrier dimension calculations performed by TNM).



Based on the preliminary analysis of RA5 Modified, of the 31 walls assessed for feasibility and reasonableness criteria, nineteen barriers were determined to be feasible but not reasonable; nine barriers were determined to be reasonable and feasible; and three barriers were determined to not be feasible (and therefore no reasonableness assessment occurred). The location of the proposed noise walls is shown on Figure 3.5.4. Refer to Appendix C of the Noise Analysis Technical Report (Appendix I) for more detailed analysis and information including the worksheets for the barrier determinations under each alternative.

Following the public hearing, a detailed noise analysis will be completed to verify these results. The detailed noise analysis may modify where barriers are located, as well as if barriers are warranted in certain locations. If a barrier is feasible and reasonable in the preliminary analysis and it is determined not to be feasible and reasonable in the detailed analysis, SCDOT will notify the benefited receptors of that barrier that the barrier is no longer warranted per the SCDOT Noise Policy requirements. If a barrier that is determined not to be feasible and reasonable in the preliminary analysis, but is determined to be feasible and reasonable in the detailed analysis per the requirements in the SCDOT noise policy, the benefited receptors of the barrier will be notified by SCDOT.

3.5.6 REFINEMENTS TO THE NOISE ANALYSIS

In accordance with SCDOT's *Traffic Noise Abatement Policy*, the noise analysis performed for this DEIS is considered preliminary and it adheres to the requirements of the preliminary noise analysis in the *Policy*. Per the Policy, a detailed traffic noise analysis will be performed on the recommended preferred alternative. Refinements included in a detailed analysis include the following features of the recommended preferred alternative alternative and study area: elevations of sensitive receivers; elevations for existing roadway; elevations for recommended preferred alternative; coordinates of roadway shoulders for existing and recommended preferred alternative, and; building rows, terrain lines, ground zones, or tree zones. The detailed traffic noise analysis is therefore more refined than the preliminary traffic noise analysis, and the results are considered to be more acurrate and suitable for making final decisions about traffic noise mitigation measures.

3.5.7 WILL THERE BE NOISE DURING CONSTRUCTION?

Temporary increases in noise levels would occur during the time period that construction takes place. Noise levels due to construction, although temporary, can impact areas adjacent to the project. The major noise sources from construction would be the heavy equipment operated at the site. However, other construction site noise sources would include hand tools and trucks supplying and removing materials.

Typical noise levels generated by different types of construction equipment are presented in Appendix D of the Noise Technical Report. Construction operations are typically broken down into several phases including clearing and grubbing, earthwork, erection, paving and finishing. Although these phases can overlap, each has their own noise characteristics and objective.

SCDOT's "2007 Standard Specifications for Highway Construction" includes various references to construction noise, including Sections 107.6-paragraph 3, 606.3.1.6.3-paragraph 1, 607.3.1.6.3-paragraph 1, 607.3.2.6.3-



paragraph 1, and 702.4.15-paragraph 3. The SCDOT specifications cited above are generalized for nuisance noise avoidance. Detailed specifications suggested for consideration for inclusion in the project's construction documents may consist of the following:

- Construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.
- Air compressors shall meet current US EPA noise emission exhaust standards.
- Air powered equipment shall be fitted with pneumatic exhaust silencers.
- Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive areas without portable noise barriers placed between the equipment and noise sensitive sites. Noise sensitive sites include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas.
- Portable noise barriers shall be constructed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).
- Powered construction equipment shall not be operated during the traditional evening and/or sleeping hours within 150 feet of a noise sensitive site, to be decided either by local ordinances and/or agreement with the SCDOT.

3.5.8 WHAT COORDINATION OCCURRED WITH LOCAL OFFICIALS?

SCDOT has no authority over local land use planning and development. SCDOT can only encourage local officials and developers to consider highway traffic noise in the planning, zoning and development of property near existing and proposed highway corridors. The lack of consideration of highway traffic noise in land use planning at the local level has added to the highway traffic noise problem which will continue to grow as development continues adjacent to major highways long after these highways were proposed and/or constructed.

In order to help local officials and developers consider highway traffic noise in the vicinity of a proposed Type I project, SCDOT will inform them of the predicted future noise levels and the required distance from such projects needed to ensure that noise levels remain below the NAC for each type of land use per 23 CFR §772.17. The contour distances to the 66 and 71 dBA sound levels are presented in the Noise Technical Report (Appendix I of the DEIS). Please note that the values in the table do not represent predicted levels at every location at a particular distance back from the roadway. Sound levels will vary with changes in terrain and will be affected by the shielding of objects such as buildings and tree zones.

3.5.9 HOW WAS THE PUBLIC INVOLVED?

Through a call for volunteers at project information and public input meetings, the project team identified neighborhood contacts to serve on a Noise Advisory Board (NAB). The purpose of the NAB is to involve representatives from each subdivision/community within the project study area. NAB members, who represented a variety of non-governmental and civic organizations, were invited to participate in meetings designed to provide the project team with specific feedback related to noise concerns. NAB representatives were requested to share information with the community at-large.



At the onset of the project, it was determined that members of the NAB were volunteers from subdivisions and neighborhoods that fall within the noise study area boundary. This boundary is a 500-foot buffer outside of the project study area boundary and consists of 49 identified subdivisions and neighborhoods. During the Community Kickoff and Public Input meetings, a station was set up to explain the NAB and its purpose. If a person was interested in serving on the NAB, he or she could express their interest by leaving their name and contact information on the sign-in Sheet that was located at the station. Between the two meetings, 17 individuals expressed an interest in being part of this advisory board. Of the 17 individuals, nine live within, or just outside of, the noise study area boundary. Those nine individuals are primarily located near to the I-20/26 interchange. These individuals represent 9 subdivisions out of the 49 identified subdivision and neighborhoods within the project study area boundary. These include the subdivisions and neighborhoods of Friarsgate, Woodland Hills, Woodland Hills West, Saluda Hills, Belmont Estates, and Emerald Valley.

In order to identify additional potential board members for greater geographic coverage within the noise study area, information was drawn from the public involvement database to determine active participants in the project. Active participants were identified as having attended the Community Kickoff Meeting, Public Input Meeting, and/or submitted a comment via online, email, in-person comment form, or hotline voicemail. Approximately 230 individuals were identified, with an approximately 54 of them being located within or just outside of the noise study area boundary.

Following the identification of potential members, a letter/postcard was distributed with information regarding the NAB, the anticipated commitment, and a request for an alternative candidate if they were uninterested. Social media outlets were used to solicit participation as well. Content was posted on Facebook, Twitter and Instagram requesting that interested parties contact the project hotline or project email with their information and interest in volunteering on the NAB.

An initial NAB meeting was held on March 15, 2016 to review the proposed project, the goals and objectives of the NAB, and to provide greater understanding of the noise evaluation process. Meeting materials and minutes from the initial NAB meeting were provided prior to and after, respectively, the NAB meeting, which is located in Appendix N. It is important to note, NAB participants were made aware during outreach and meetings that the function of the NAB is not to vote on a noise abatement, rather to inform the analysis process. SCDOT follows its Traffic Noise Abatement Policy on every project to determine impacts, and whether abatement is warranted or not. The next NAB meeting will be held following the public hearing comment period for the DEIS.

Additionally, it should be noted that questions and comments about the environmental process, and specifically potential noise impacts, led the project team to post a video describing the noise analysis process. This video may be accessed at http://www.scdotcarolinacrossroads.com/ under "Project Resources".