3.5 Noise

3.5.1 CHANGES TO THIS CHAPTER SINCE THE DEIS

Since the publication of the Draft Environmental Impact Statement, this chapter has been revised to include the results of the Detailed Noise Analysis performed on the Refined Recommended Preferred Alternative (RPA). Results include updated impact totals, maps, and analyses.

3.5.2 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 3-dB 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

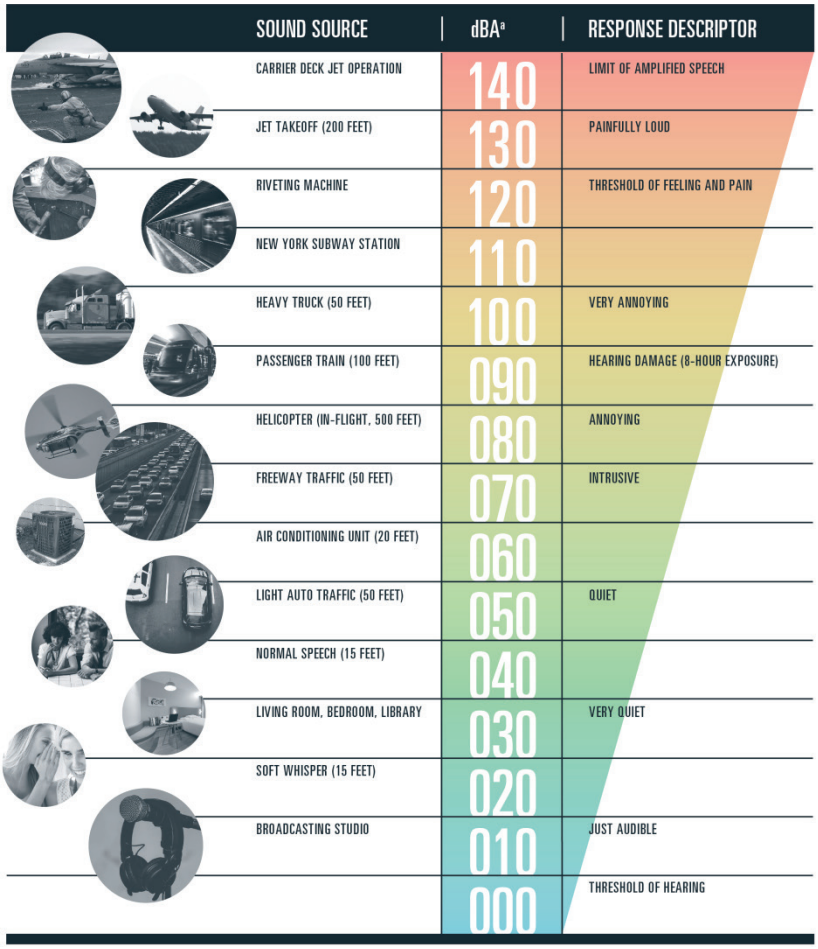


Figure 3.5-1 Weighted Noise Levels and Human Response

[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.

3.5.3 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
B	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 J and contains the technical details of the modeling and impact analysis.

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.**

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 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 J of this FEIS. Appendix J of the FEIS also presents figures that show the noise receptor locations, and model validation locations.

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.[3]

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;

[3] "Traffic Noise Abatement Policy", South Carolina Department of Transportation, September 1, 2014.

- 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 3.5-2Error! Reference source not found. 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 Error! Reference source not found. 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 3.5-2 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.
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 interiors of public use or nonprofit institutional structures would be impacted by the proposed project.
Noise Barriers	Carried forward for further consideration.

3.5.5 WHAT ARE THE RESULTS OF THE PRELIMINARY ANALYSIS?

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

In accordance with SCDOT's *Traffic Noise Abatement Policy*, the noise analysis performed for the DEIS was considered preliminary and adhered to the requirements of the preliminary noise analysis in the *Policy*.

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 in the project area for the preliminary analysis. The SCDOT defines a noise receptor as a discrete or representative location of a noise sensitive 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.

3.5.5.1.1 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 for the preliminary analysis:

- 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.

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

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 D[5]), 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). Preliminary noise levels for the existing condition ranged from 38 to 76 dBA. Table 3.5-3 presents a summary of impacts by alternative.

Table 3.5-3 Summary of Impacts (Preliminary Analysis)

Activity Category	Existing	Future No-build	Recommended Preferred Alternative (from the DEIS)
A	0	0	0
B	1590	1596	1864
C	12	14	24
D	0	0	0
E	3	3	4
TOTAL	**1605**	**1613**	**1892**

3.5.5.1.2 No-Build Alternative

Based on the 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). Preliminary noise levels for the No-build alternative ranged from 38 to 76 dBA.

3.5.5.1.3 Recommended Preferred Alternative (from the DEIS)

For the RPA, 2040 noise levels would approach or exceed the NAC established in the SCDOT Traffic Noise Abatement Policy for 1,892 receivers under the preliminary noise analysis. Receivers that would be relocated are not included in the impact count; refer to Appendix I for additional information on relocated properties. The majority of the impacts would be to NAC Category B (residences). Preliminary noise levels for the RPA 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 (i.e., a 15 dBA increase as described in Section 3.5.5.1). Figure 3.5-2 presents the RPA noise receptors that are predicted to approach or exceed the NAC, and shows the locations of noise walls that were studied in the preliminary analysis.

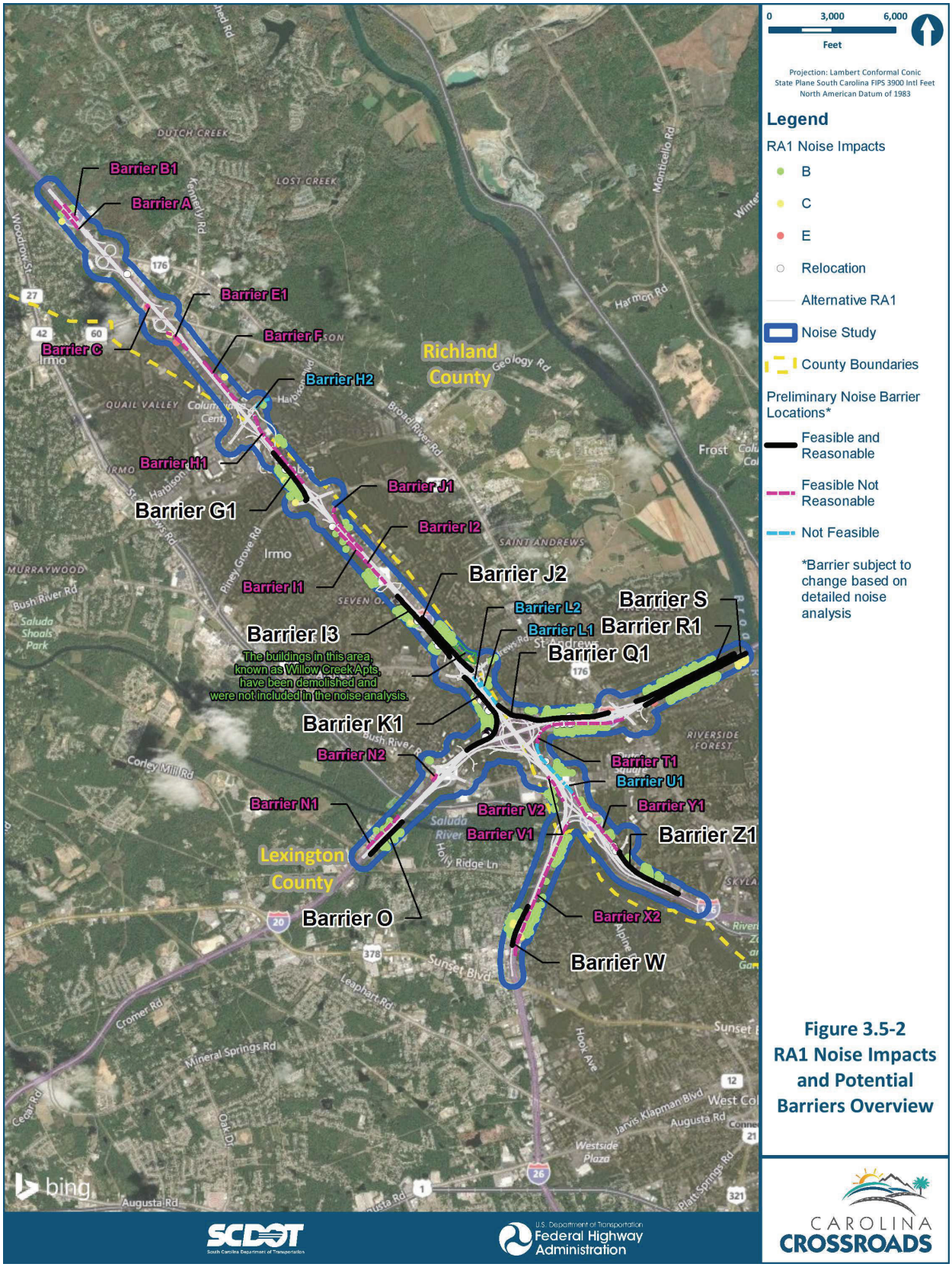
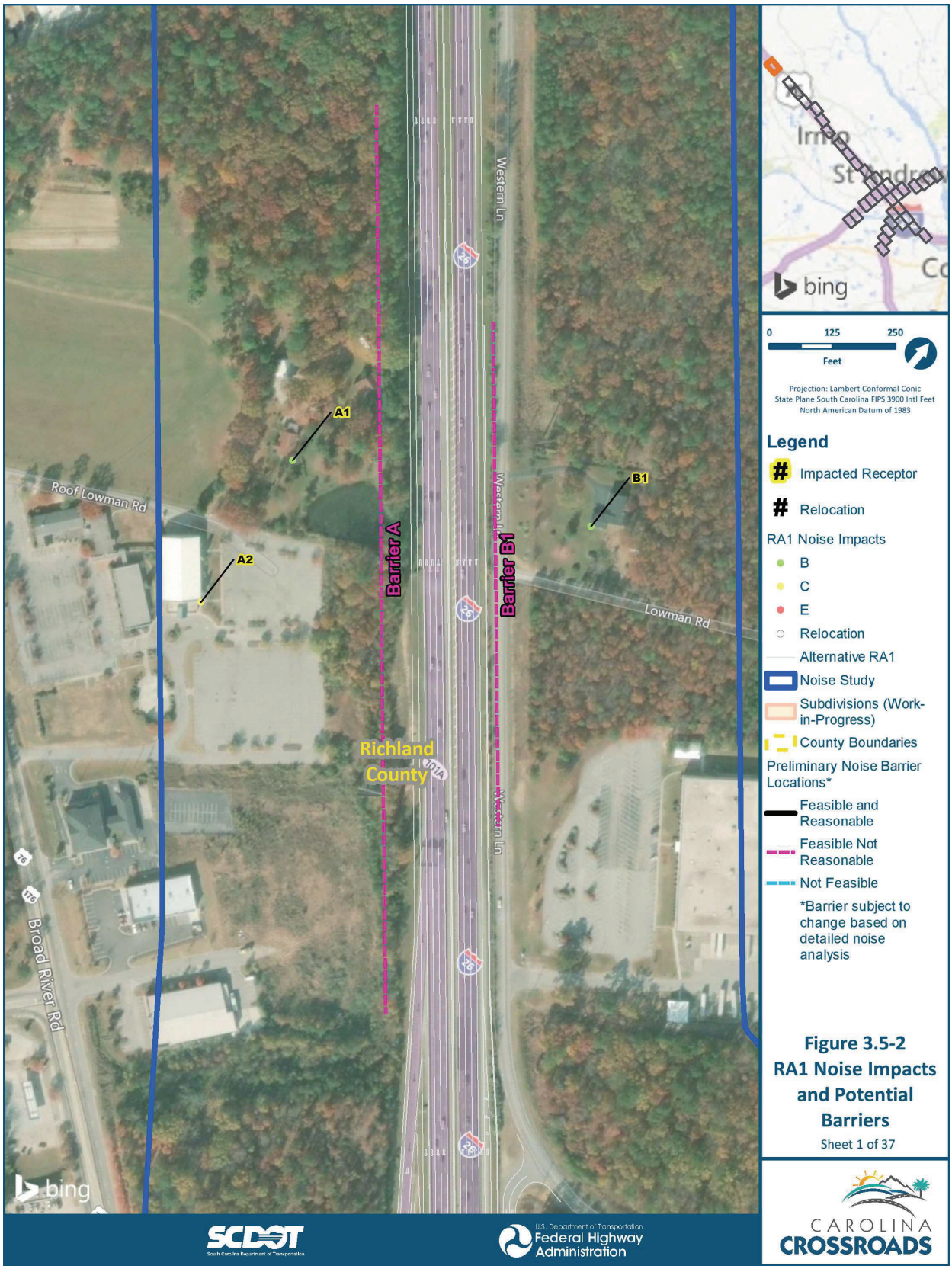


Figure 3.5-2 RA1 Noise Impacts and Potential Barriers Overview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Barrier B1
Western Ln
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Lowman Rd
Broad River Rd
Richland County
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Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
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Columbiana Dr
Wyman Way
D1
Richland County
Columbiana Dr
Bluebird Trail
Shady Ln
Evergreen Dr
C1
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Projection: Lambert Conformal Conic
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C1
Barrier C
Evergreen Dr
Gaillard St
Lake Murray Blvd
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Columbiana Dr
Cape Lookout Ct
Crown Point Ct
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Federal Highway Administration
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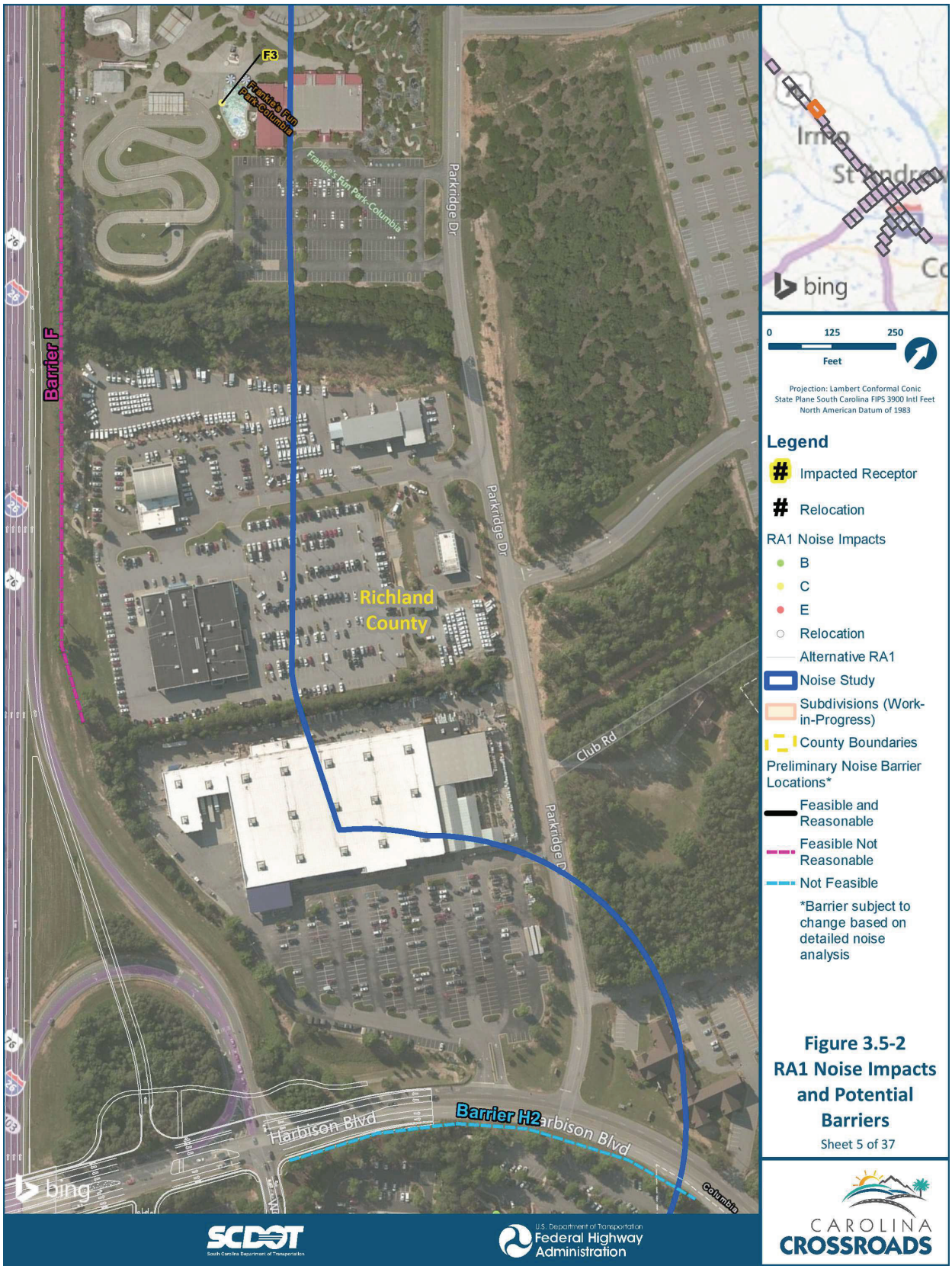
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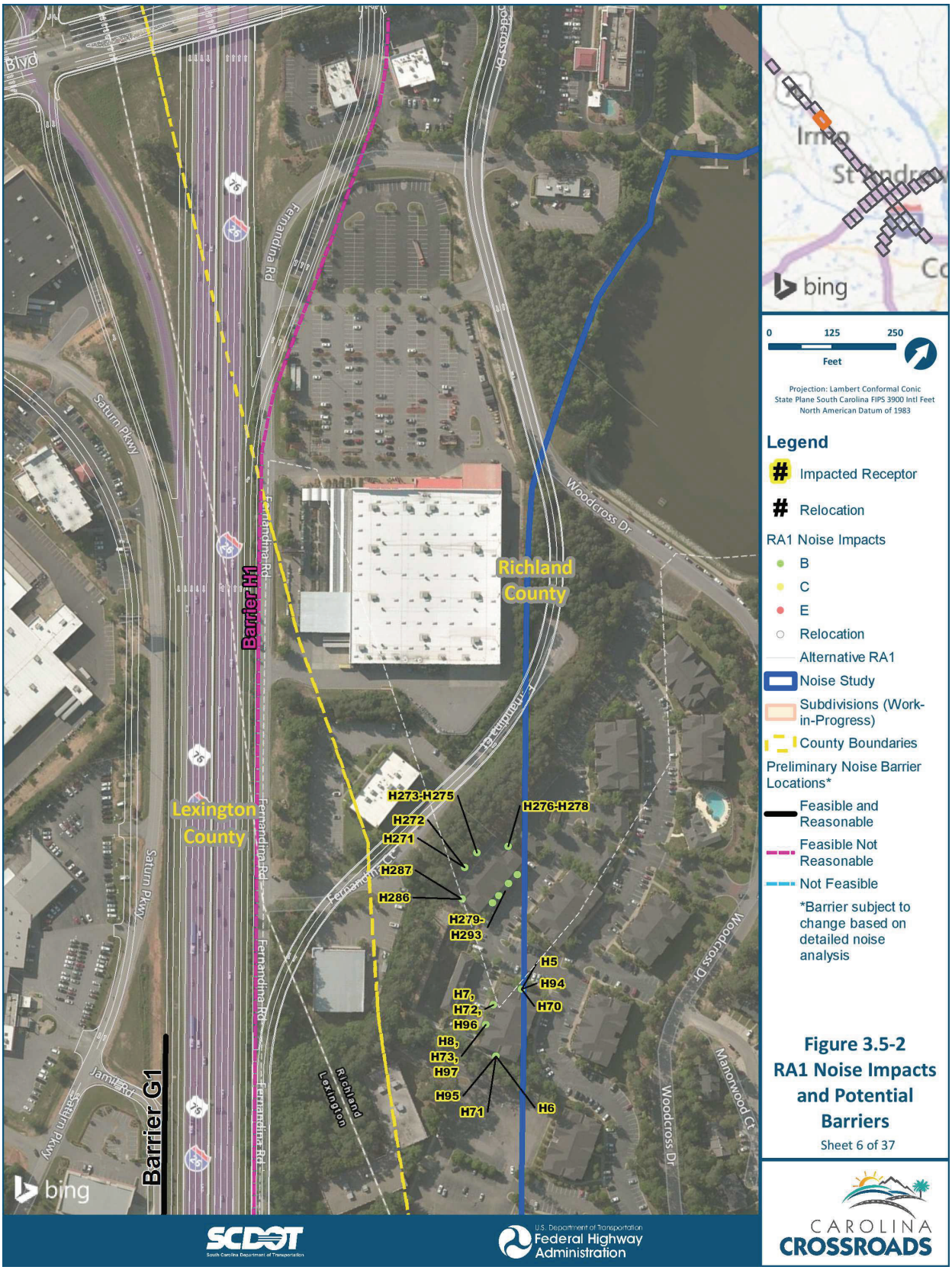
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H287
H286
H279-H293
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H94
H70
H7, H72, H96
H8, H73, H97
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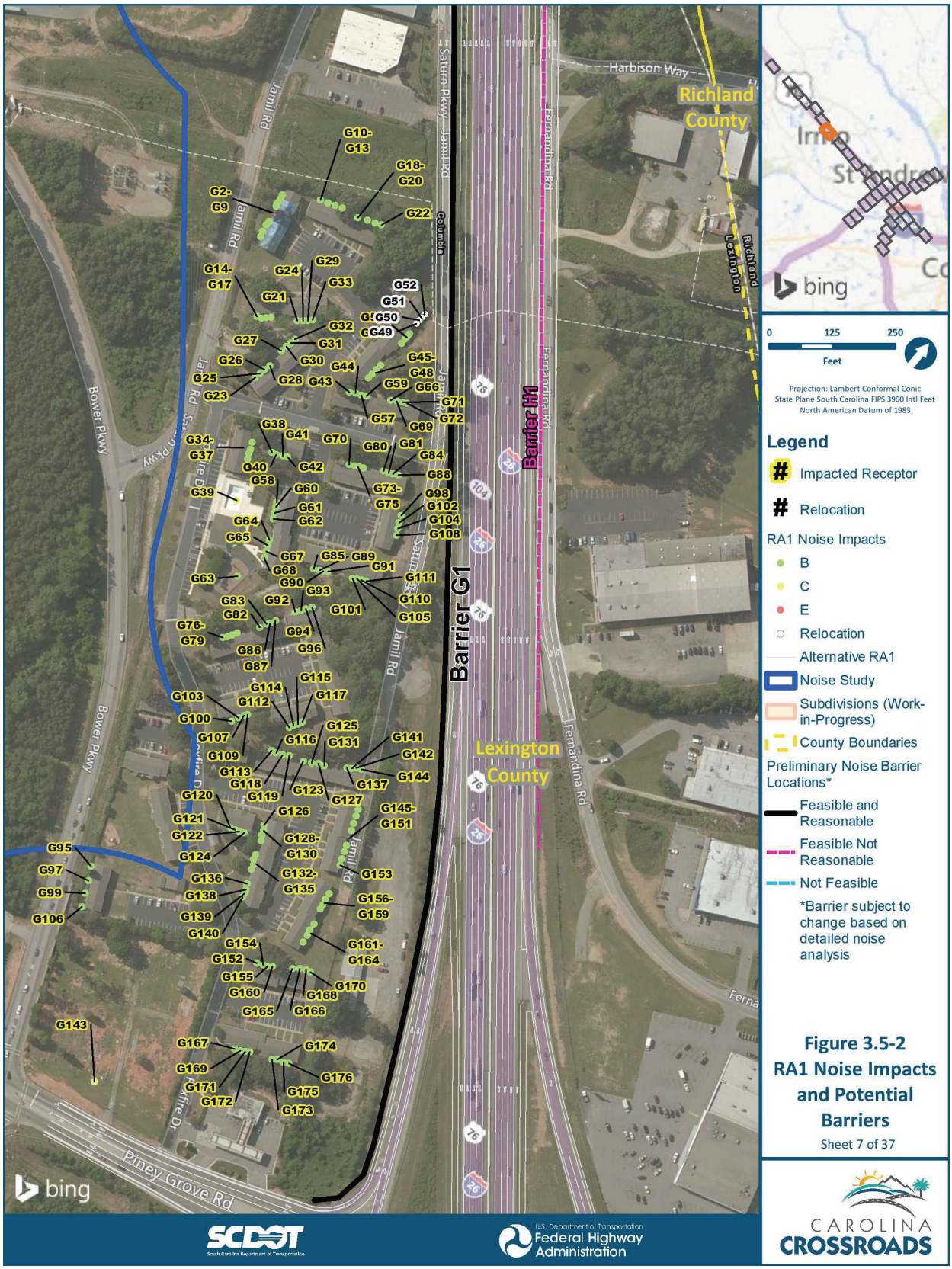
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Barrier H1
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Fernandina Rd
Jamil Rd
Saluda Pkwy
Columbia
Bower Pkwy
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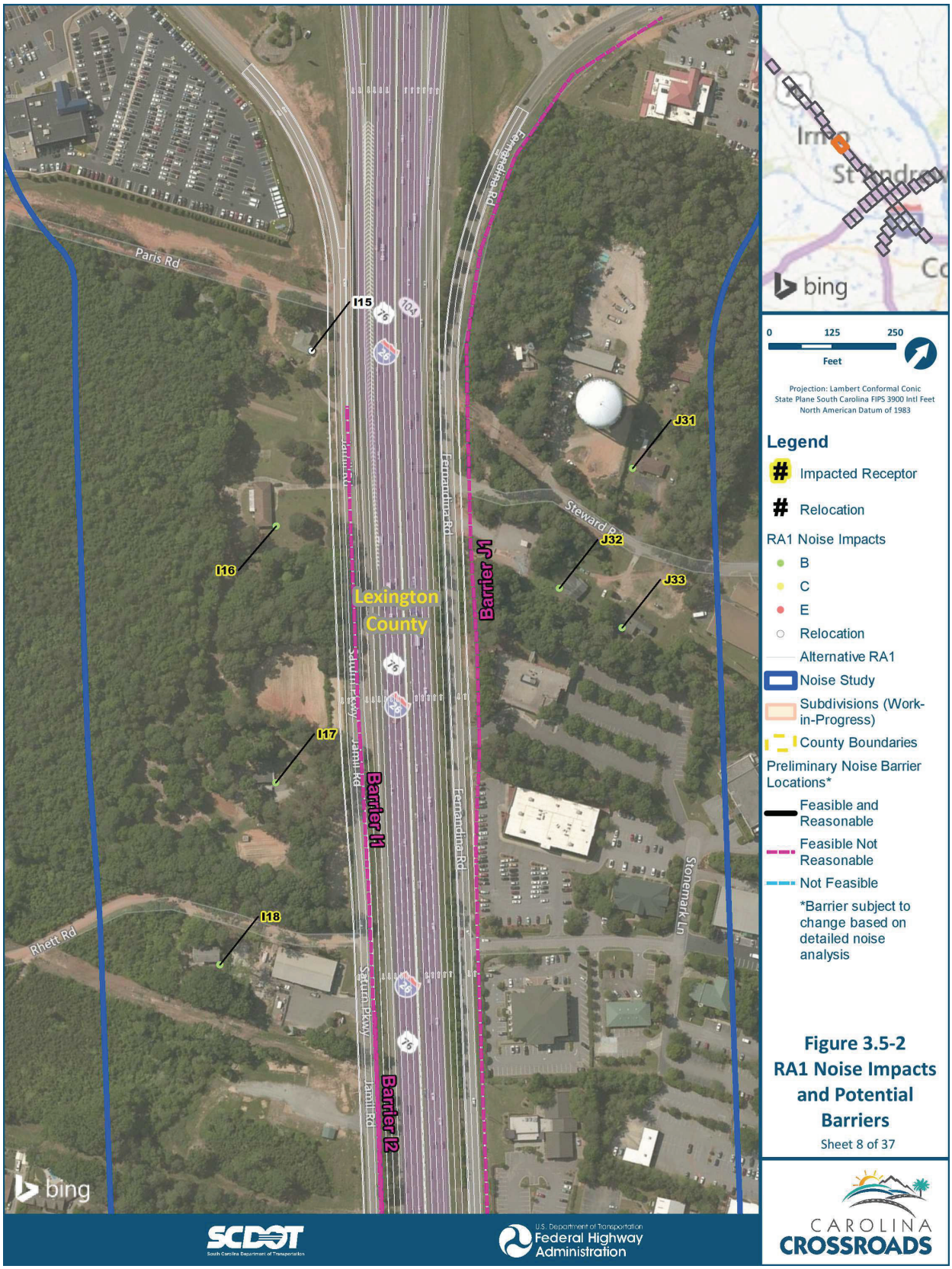
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Barrier I1
Barrier I2
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Jamil Rd
Saturn Pkwy
Steward Pl
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Barrier I1
Barrier I2
Barrier I3
Saturn Pkwy
Jamil Rd
Fernandina Rd
Lexington County
Laurelhurst Ave
Tram Rd
Beatty Rd
Fredricksburg Way
Whittington Ct
I1
I2
I3
I4
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I6
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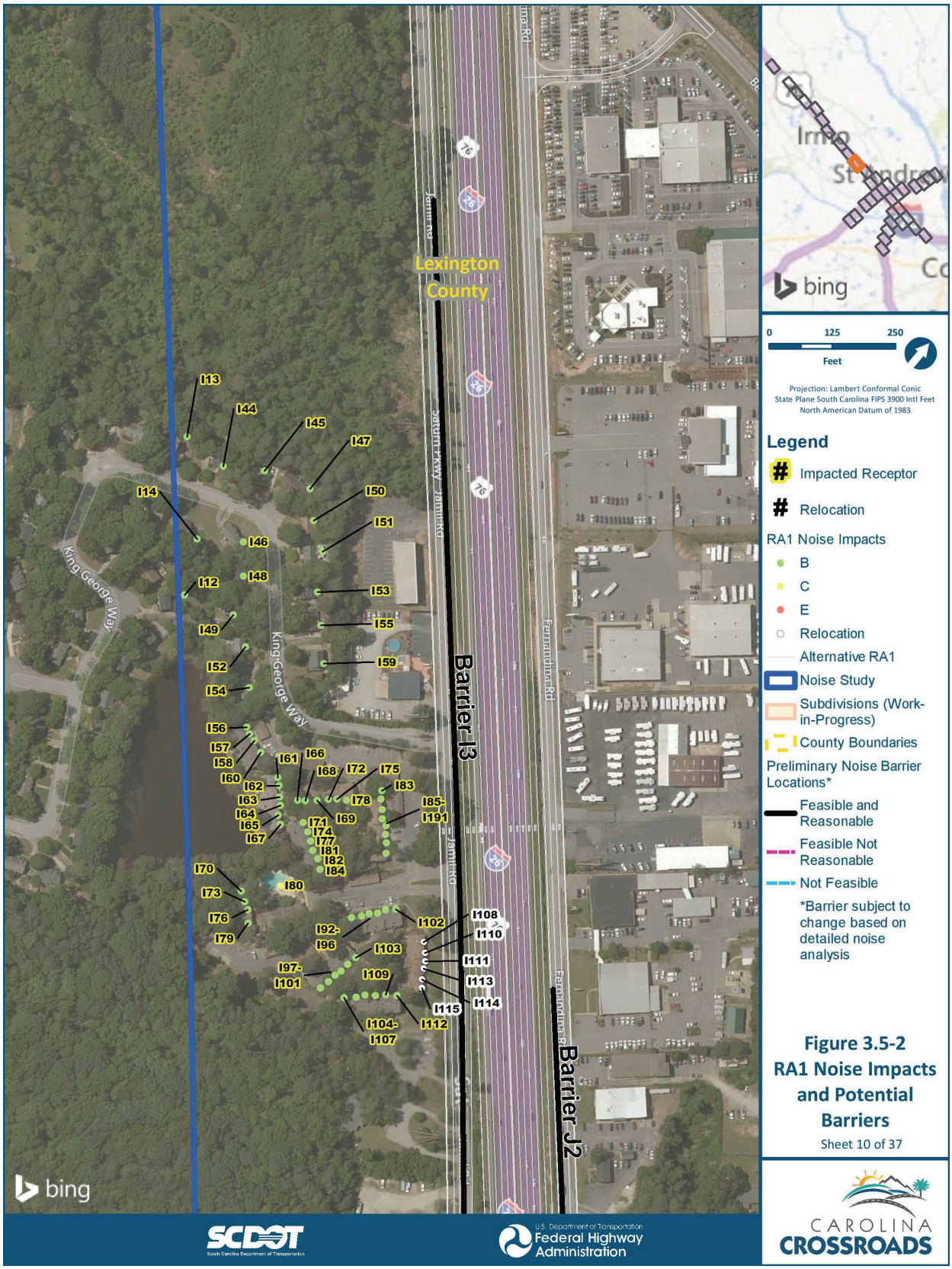
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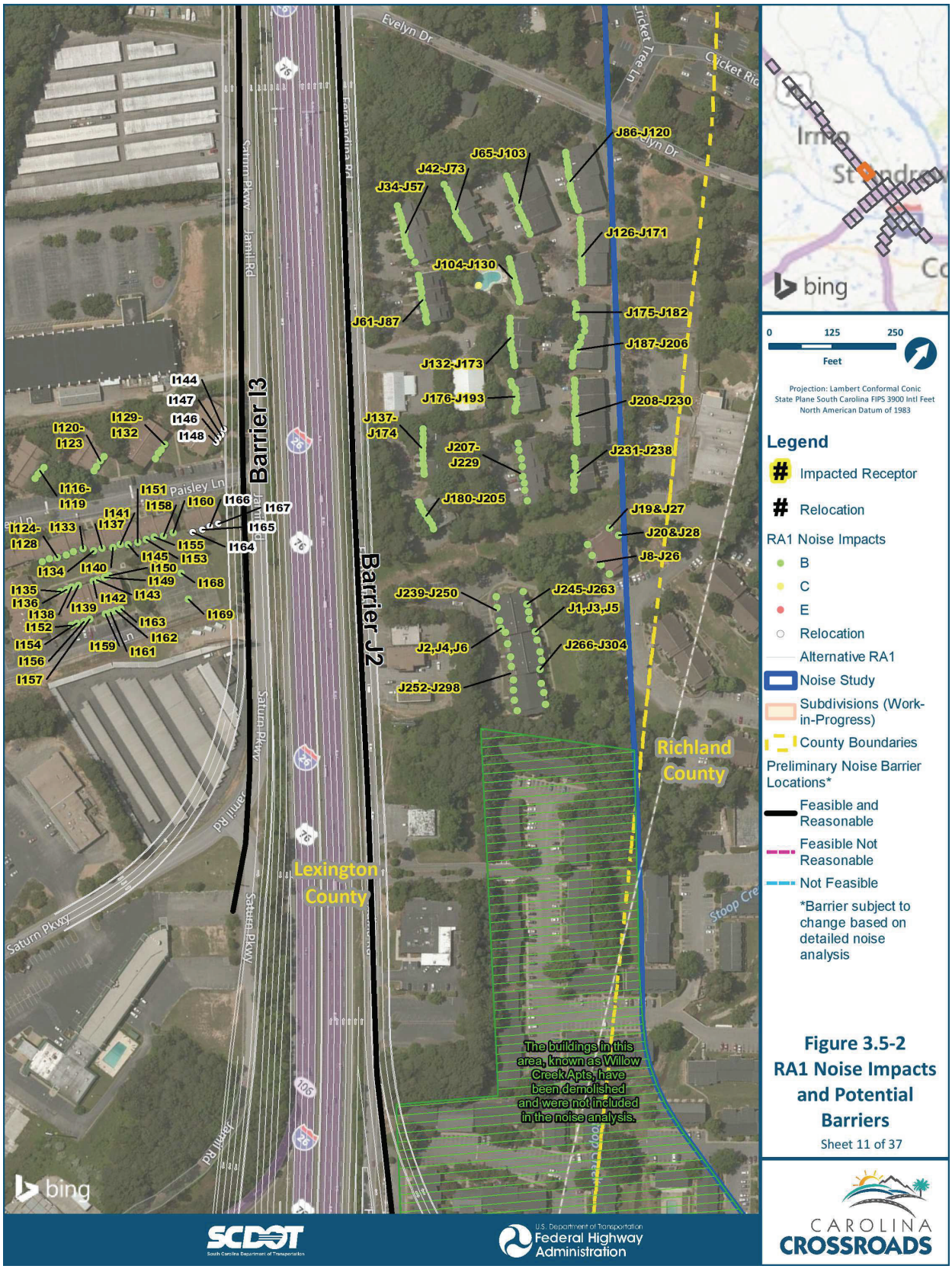
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J34-J57
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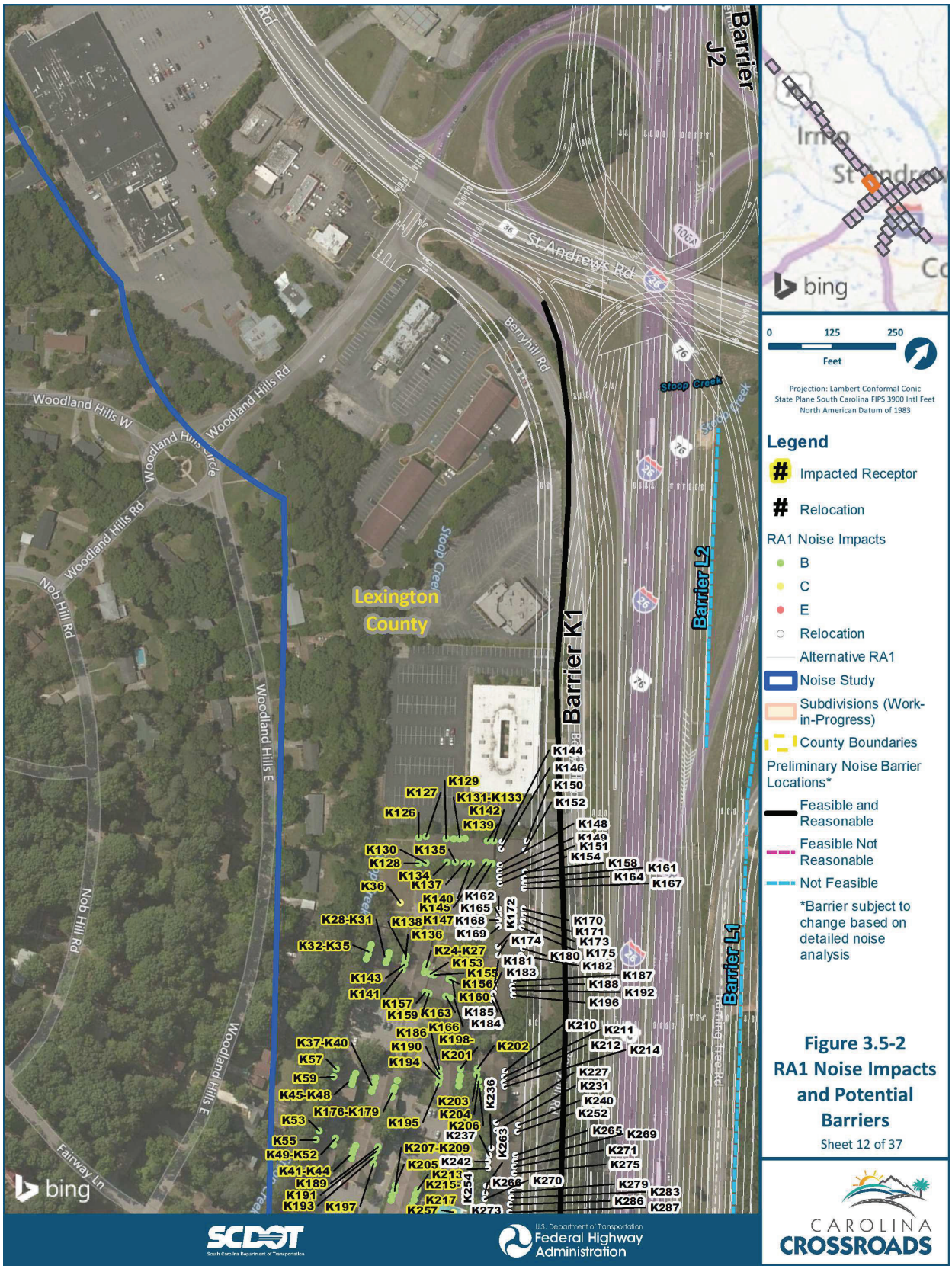
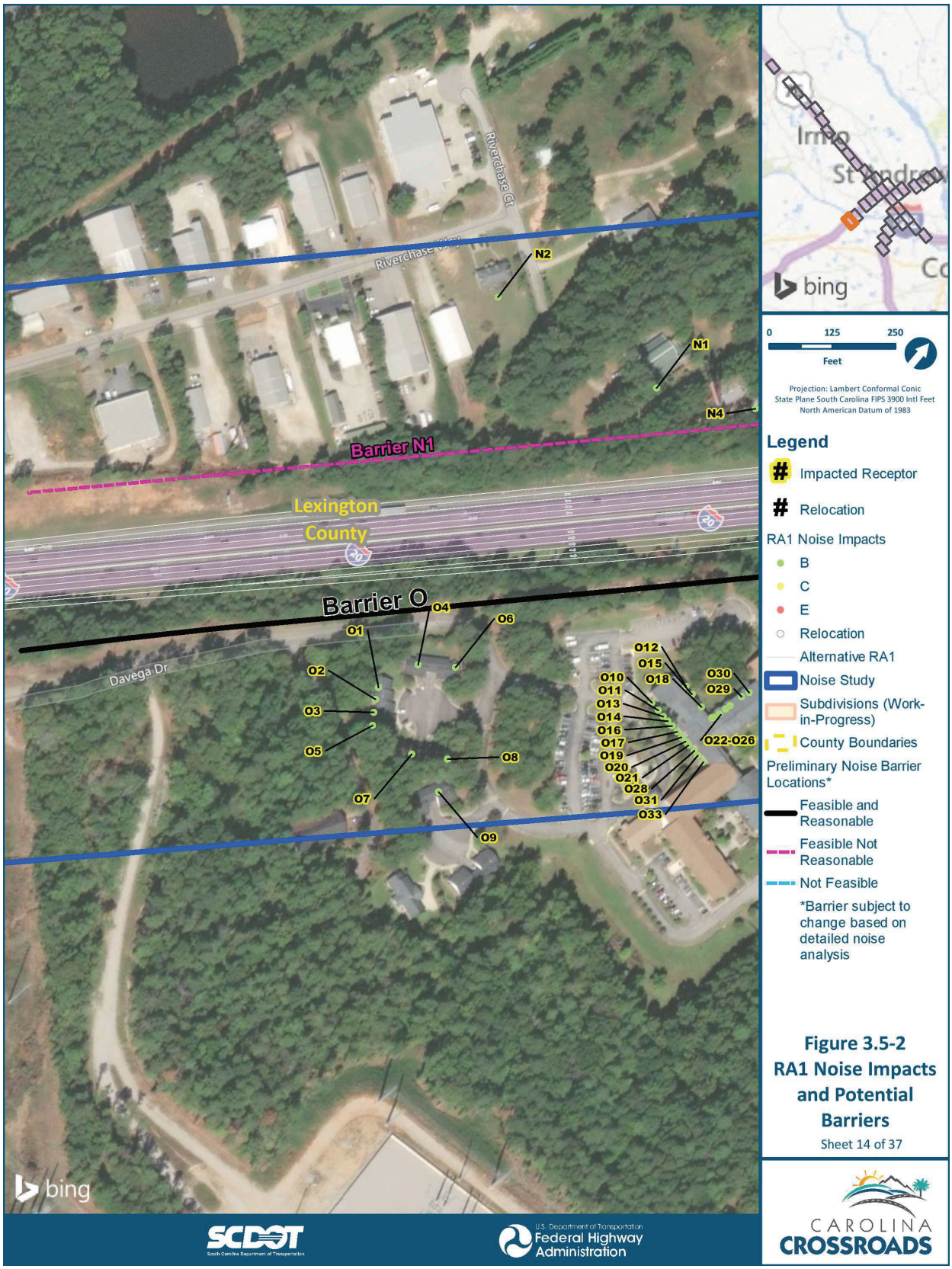
J180-J205
J19&J27
J20&J28
J8-J26
J239-J250
J245-J263
J1,J3,J5
J2,J4,J6
J266-J304
J252-J298
I144
I147
I129-I132
I146
I148
I120-I123
I116-I119
I151
I158
I160
I166
I167
I165
I164
I155
I153
I145
I150
I149
I168
I169
I163
I162
I161
I159
I154
I156
I157
I135
I136
I138
I152
I139
I142
I143
I141
I137
I124-I128
I133
I134
I140
The buildings in this area, known as Willow Creek Apts, have been demolished and were not included in the noise analysis.
bing
0 125 250
Feet
Projection: Lambert Conformal Conic
State Plane South Carolina FIPS 3900 Intl Feet
North American Datum of 1983
Legend
Impacted Receptor
Relocation
RA1 Noise Impacts
B
C
E
Relocation
Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
Sheet 11 of 37
SCDOT
U.S. Department of Transportation
Federal Highway Administration
CAROLINA CROSSROADS


Barrier J2
Barrier K1
Barrier L2
Barrier L1
St Andrews Rd
Berryhill Rd
Woodland Hills W
Woodland Hills Rd
Woodland Hills Circle
Woodland Hills E
Nob Hill Rd
Stoop Creek
Lexington County
Fairway Ln
Spring Tree Rd
bing
0 125 250
Feet
Projection: Lambert Conformal Conic
State Plane South Carolina FIPS 3900 Intl Feet
North American Datum of 1983
Legend
Impacted Receptor
Relocation
RA1 Noise Impacts
B
C
E
Relocation
Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
Sheet 12 of 37
CAROLINA CROSSROADS
SCDOT
U.S. Department of Transportation
Federal Highway Administration


The buildings in this area, known as Willow Creek Apts, have been demolished and were not included in the noise analysis.
Barrier J2
Fernandina Rd
Greenore Dr
Kay St
St Andrews Rd
Chartwell Rd
L60
L70
Lexington County
Richland County
Barrier L1
Lexington
Richland
Bunting Tree Rd
L54
L53
L55
Burning Tree Dr
Chelveston Dr
bing
0 125 250
Feet
Projection: Lambert Conformal Conic
State Plane South Carolina FIPS 3900 Intl Feet
North American Datum of 1983
Legend
Impacted Receptor
Relocation
RA1 Noise Impacts
B
C
E
Relocation
Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
Sheet 13 of 37
SCDOT
U.S. Department of Transportation
Federal Highway Administration
CAROLINA CROSSROADS


Riverchase Ct
N2
N1
N4
Barrier N1
Lexington County
Barrier O
O1
O2
O3
O4
O5
O6
O7
O8
O9
O10
O11
O12
O13
O14
O15
O16
O17
O18
O19
O20
O21
O22-026
O28
O29
O30
O31
O33
Davega Dr
bing
0 125 250
Feet
Projection: Lambert Conformal Conic
State Plane South Carolina FIPS 3900 Intl Feet
North American Datum of 1983
Legend
Impacted Receptor
Relocation
RA1 Noise Impacts
B
C
E
Relocation
Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
Sheet 14 of 37
SCDOT
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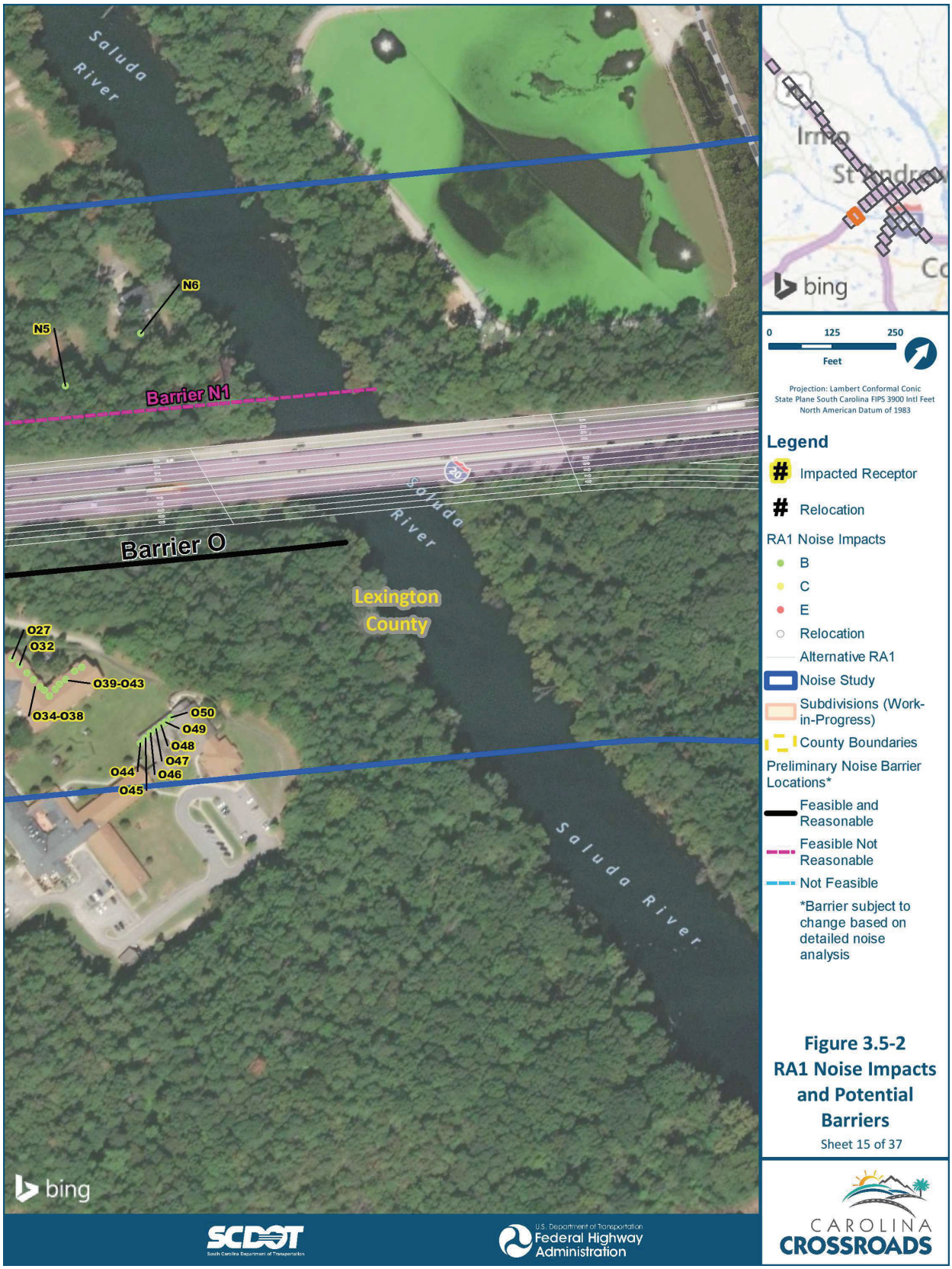
Federal Highway Administration
CAROLINA CROSSROADS


Saluda River
N6
N5
Barrier N1
Barrier O
Lexington County
O27
O32
O39-O43
O34-O38
O50
O49
O48
O47
O46
O44
O45
Saluda River
Saluda River
bing
0 125 250
Feet
Projection: Lambert Conformal Conic
State Plane South Carolina FIPS 3900 Intl Feet
North American Datum of 1983
Legend
Impacted Receptor
Relocation
RA1 Noise Impacts
B
C
E
Relocation
Alternative RA1
Noise Study
Subdivisions (Work-in-Progress)
County Boundaries
Preliminary Noise Barrier Locations*
Feasible and Reasonable
Feasible Not Reasonable
Not Feasible
*Barrier subject to change based on detailed noise analysis
Figure 3.5-2
RA1 Noise Impacts and Potential Barriers
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Federal Highway Administration
CAROLINA CROSSROADS