SOUTH FLORIDA EAST COAST
CORRIDOR TRANSIT ANALYSIS STUDY

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Phase 2 Noise Technical Memorandum

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MEMORANDUM

To: Scott Seeburger

From: Rob McMullen

Date: May 21, 2010

Subject: South Florida East Coast Corridor Transit Analysis (SFECCTA) Study: Noise Technical Memorandum

This technical memorandum presents analyses based on an initial set of operating assumptions. As the TSM, BRT and rail alternatives were refined, service frequencies were reduced. Since the changes in proposed operations were reductions, we concluded that the noise analysis as presented remains an accurate assessment by which to support the conclusion of the AA Report's comparative analysis between alternatives.

Introduction

Purpose

The purpose of this technical memorandum is to outline the methods used to identify resources that could be affected by noise associated with various alternatives and subsequent results. The results of this analysis were incorporated into the Environmental Screening Model and published in the Draft Detailed Environmental Screening Report (ESR).

Project Description

The Florida Department of Transportation (FDOT) initiated the multi-phased South Florida East Coast Corridor Transit Analysis (SFECCTA) study in December 2005 recognizing that the Florida East Coast (FEC) Railway was and is a unique transportation asset that should be evaluated and developed in the context of regional transportation issues, priorities and needs. The SFECCTA study is designed to evaluate the reintroduction of passenger service along a portion of the FEC Railway corridor from Miami to Jupiter. In its second phase, the SFECCTA study continued the Alternative Analysis (AA) – Early Scoping process that was initiated in Phase 1. A discussion of the Phase 1 AA may be found in the Phase 1 Conceptual Alternatives Analysis/Environmental Screening Report (AA/ESR) on the project website (http://www.sfeccstudy.com/).

Phase 2 of the SFECCTA was initiated in January 2009 and was designed to build upon the Phase 1 AA to refine and further develop through an iterative process the alternatives identified at the conclusion of the first phase. The primary focus of Phase 2 was to identify a locally preferred alternative (LPA) within the study area, in accordance with Federal Transit Administration (FTA) and FDOT project development processes, that could ultimately be submitted to FTA for federal assistance in the form of New Starts funding. A Phase 2 Draft Detailed ESR has been prepared to describe the detailed environmental screening approach conducted as part of the Phase 2 AA and is supported by a series of technical memoranda and reports like the one presented here.

Project Area

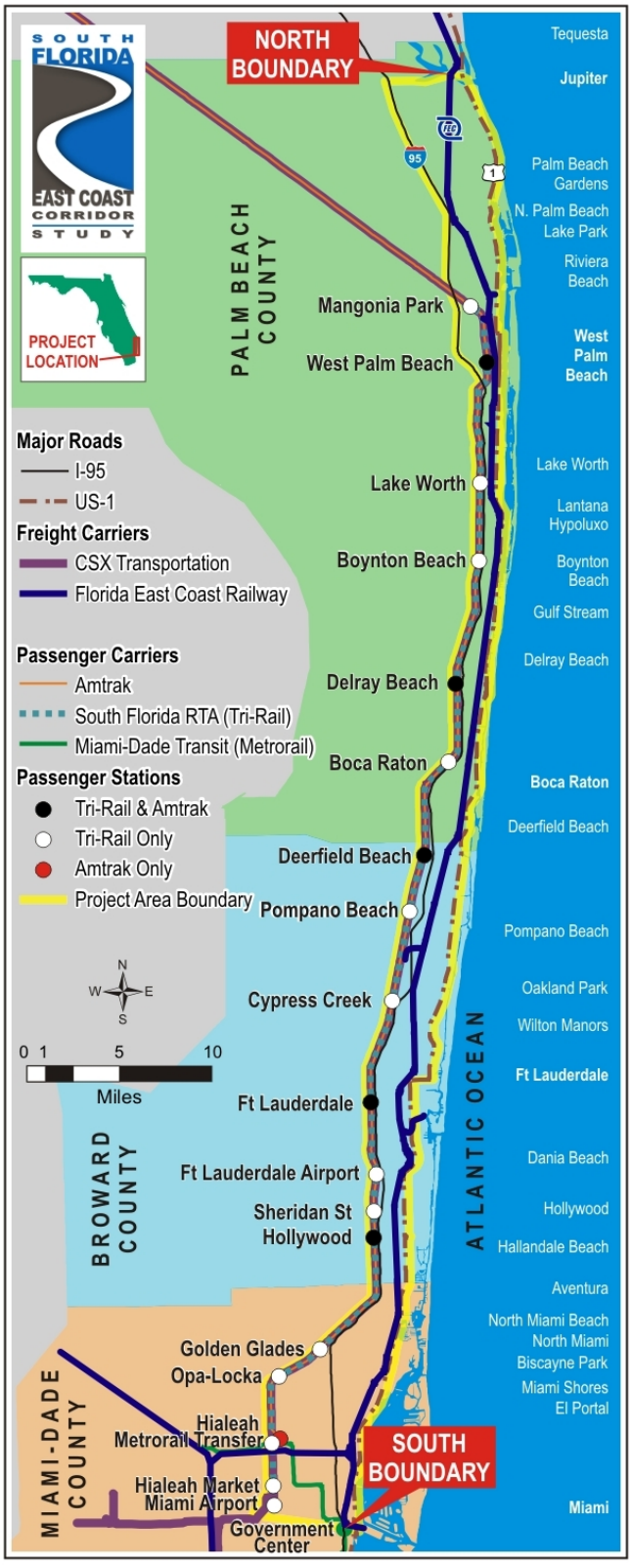
The SFECCTA project area, illustrated on the Project Location Map (**Figure 1**), is bounded on the south by Flagler Street, just south of the Miami-Dade Government Center, in the City of Miami and on the north by the southern shoreline of the Loxahatchee River in the Town of Jupiter.

The western boundary of the project area runs parallel to and 0.5-mile west of the South Florida Rail Corridor (SFRC)/Tri-Rail corridor from the Miami Intermodal Center (MIC) north to Mangonia Park then continues in a northwesterly direction parallel to and 0.5-mile west of I-95 to the southern shoreline of Southwest Fork of the Loxahatchee River (C-18). The eastern boundary of the project area runs parallel to and 0.5-miles east of Highway US-1 from the Central Business District (CBD) of the City of Miami north to the southern shoreline of the Loxahatchee River in Jupiter.

Within the SFECCTA project area are several unique study areas that were developed specifically to define the affected environment and screen/evaluate the various project alternatives. Generally, the affected environment is a Geographic Information System (GIS) inventory of environmental, social, and cultural resources that could be affected by the proposed improvements. The affected environment and screening process are defined and documented in the Draft ESR.

The primary study area, where most of the improvements are expected to occur, is the FEC Railway corridor that extends from the CBD of the City of Miami north to the Town of Jupiter in Palm Beach County (a linear distance of approximately 83 miles). A detailed description of each study area and environmental screening methodology is provided in Chapter 3 and Appendix A, respectively, of the Draft ESR.

Figure 1: Project Location Map



Introduction to Noise Concepts

Noise is typically defined as unwanted or undesirable sound, where sound is characterized by small air pressure fluctuations above and below the atmospheric pressure. The basic parameters of environmental noise that affect human subjective response are: (1) intensity or level; (2) frequency content; and (3) variation with time. The first parameter of intensity or level is determined by how greatly the sound pressure fluctuates above and below the

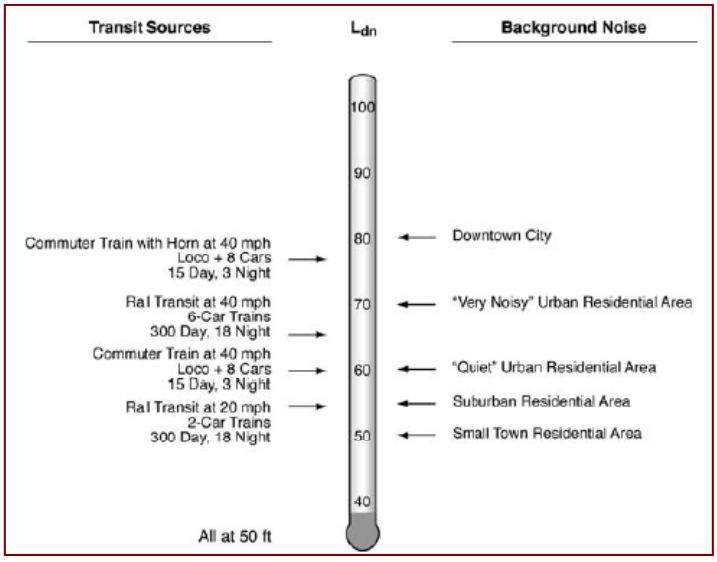
atmospheric pressure, and is expressed on a compressed scale in units of decibels (dB). By using this scale, the range of normally encountered sound can be expressed by values between 0 and 120 dB. On a relative basis, a 3-dB change in sound level generally represents a barely-noticeable change perceived by the human ear, whereas a 10-dB change in sound level would typically be perceived as a doubling (or halving) in the loudness of a sound.

The frequency content of noise is related to the tone or pitch of the sound, and is expressed based on the rate of the air pressure fluctuation in terms of cycles per second (called Hertz and abbreviated as Hz). The human ear can detect a wide range of frequencies from about 20 Hz to 17,000 Hz. However, because the sensitivity of human hearing varies with frequency, the A-weighting system is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response. Sound levels measured using this weighting system are called "A-weighted" sound levels, and are expressed in decibel notation as "dBA." The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise.

Time is an important parameter in environmental noise considerations because most sound fluctuates from moment to moment. Therefore, it is common practice to condense all of this information into a single number, called the "equivalent" sound level (Leq). The Leq can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period (typically 1 hour or 24 hours). Often the Leq values over a 24-hour period are used to calculate cumulative noise exposure in terms of the Day-Night Sound Level (Ldn).

The Ldn is the A-weighed Leq for a 24-hour period with an added 10-dB penalty imposed on noise that occurs during the nighttime hours (between 10 p.m. and 7 a.m.). Many surveys have shown that Ldn is well correlated with human annoyance, and, therefore, this descriptor is widely used for environmental noise impact assessment. **Figure 2** provides examples of typical noise environments and criteria in terms of Ldn, as shown in the FTA guidance "Transit Noise and Vibration Impact Assessment, May 2006". While the extremes of Ldn are shown to range from 50 dBA in a small residential environment to 80 dBA in noisy urban environments, Ldn is generally found to range between 55 dBA and 75 dBA in most communities.

Figure 2: Typical Transit and Background L_{dn} Sound



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

Noise Criteria and Methodology

The noise criteria and descriptors used by the FTA to determine impact assessment depend on land use (**Table 1**). Category 2 consists of buildings where people normally sleep (e.g., residences, hospitals). Therefore, nighttime sensitivity to noise is of utmost importance.

Table 1: Land Use Categories and Metrics for Transit Noise Impact Criteria

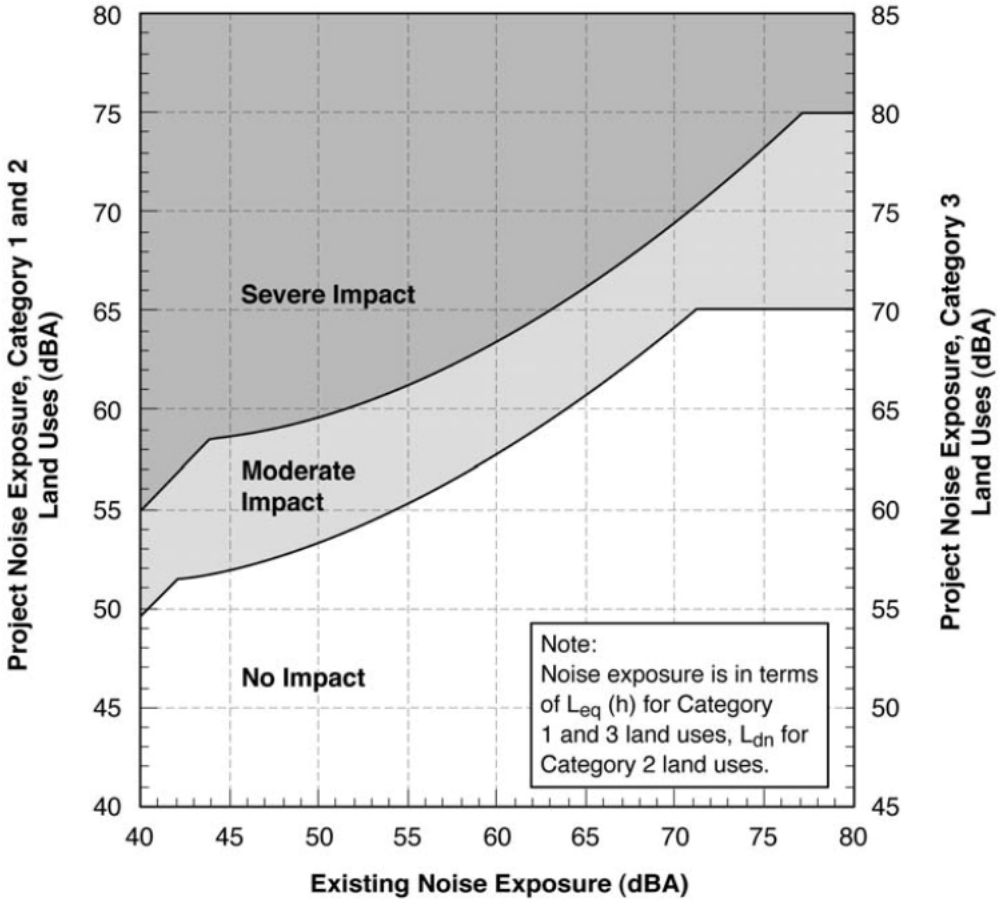
Land Use Category	*Noise Metric(dBA)*	*Description of Land Use Category*
1	Outdoor $L_{eq(h)}$*	Tracts of land where quiet are an essential element in their intended purpose. This category includes lands set aside for serenity and quiet and such land uses as outdoor theater and concert pavilions.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Active parks. Buildings with interior spaces where quiet is important, such as medical offices and conference rooms, recording studios and concert halls, fall into this category. Places of worship, meditation or study associated with cemeteries, monuments, museums, and certain historical sites are also included.

** L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity. Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006*

The noise metric used for Category 2 land use is the Ldn, the day-night sound level. The Ldn is the descriptor of choice because: 1) it correlates well with surveys measuring the public attitude towards noise impacts, 2) it increases with the duration of transit events, and 3) it considers the number of transit events over a full day.

The FTA Noise Impact Criteria define the severity of impact for various noise exposure levels for Category 2 land uses (**Figure 3** and **Table 2**). The criteria are based on a comparison of existing and future project related outdoor noise levels. They incorporate both absolute criteria (noise from the proposed project alone), and relative criteria (annoyance as a result of project induced changes in noise levels). Impacts are assessed based on a combination of the existing ambient noise exposure and the additional noise exposure from the project, which have been determined to be noise levels exceeding 65 dBA and an increase of 3 dBA above existing sound levels.

Figure 3: Noise Impact Criteria for Transit Projects



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

Table 2: Noise Levels Defining Impact for Transit Projects

Existing Noise Exposure* L_{eq}(h) or L_{dn} (dBA)	Project Noise Impact Exposure,* L_{eq}(h) or L_{dn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
<43	< Ambient+10	Ambient + 10 to 15	>Ambient+15	<Ambient+15	Ambient + 15 to 20	>Ambient+20
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	<59	59-64	>64
50	<54	54-59	>59	<59	59-64	>64
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

* L_{dn} is used for land use where nighttime sensitivity is a factor; L_{eq} during the hour of maximum transit noise exposure is used for land use involving only daytime activities.

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

The noise evaluation conducted for the SFECCTA study consisted of applying screening distances to determine if there is a likelihood of noise impact from a project in accordance with FTA guidance. The areas defined by the screening distances are meant to be sufficiently large to encompass all potentially impacted locations. They were determined using relatively high-capacity scenarios for a given project type. The project land use description and the corresponding noise descriptors are defined in **Table 1**. The Ldn is used as descriptor for category 2 land use, while Leq is used as descriptor for category 3 land use.

No Build Alternative

There are significant sources of existing noise along the FEC Railway from Miami to Jupiter, Florida. FEC freight trains operate within this rail corridor. The FEC Railway is primarily used for heavy freight transport of containers, gravel and other heavy loads, and long train consists which make the existing heavy freight operations the dominant noise source on this line. The heavy freight operations typically include eighteen operations per day based on the latest figures provided by the FEC rail operators.

Nine 24-hour noise measurements were conducted to determine the baseline noise levels within the FEC Railway corridor. These nine measurements were conducted between August 24, 2009 and August 27, 2009. Three 24-hour noise measurements were conducted in each county: Palm Beach County, Broward County, and Miami Dade County. These noise measurements were conducted on different land uses to provide a good evaluation of the background baseline noise levels. **Table 3** provides a summary of the existing noise levels that were measured and used as a baseline to predict future noise levels in the FEC Railway corridor.

Table 3: Summary of Existing Noise Levels within the FEC Corridor

Date	*County*	*Address*	L_{dn} **(dBA)**	L_{eq} **(dBA)**
8.24.09	Palm Beach	Intersection of Lakeview Ave and Alabama Ave.	81	78
8.24.09	Palm Beach	502 Park Place	73	67
8.24.09	Palm Beach	591 Valley Forge Rd.	*80*	*72*
8.25.09	Broward	Hardy Park	79	72
8.25.09	Broward	130 W. Broward Blvd.	75	70
8.25.09	Broward	210 SW 11th Ct.	79	73
8.26.09	Miami Dade	19392 W. Dixie Hwy.	78	71
8.26.09	Miami Dade	NE 101 St and Park Drive	77	71
8.26.09	Miami Dade	9076 NE 4th Ave.	73	68

In addition, the freight operator (CSX) and the South Florida Rail Transit Authority (SFRTA) share a rail corridor, called the South Florida Rail Corridor (SFRC), which is west of I-95. Passenger conventional commuter rail (Tri-Rail) and freight rail operates on this corridor with several heavy freight operations and fifty roundtrip passenger rail operations per day.

The baseline noise levels for the SFRC were determined by conducting nine 24-hour noise measurements. These nine measurements were conducted between February 1st, 2010 and February 3rd, 2010. Three 24-hour noise measurements were conducted in each county: Palm Beach County, Broward County, and Miami Dade County. These noise measurements were conducted on different land uses to provide a good evaluation of the background baseline noise levels. **Table 4** provides a summary of the existing noise levels that were measured and used as a baseline to predict future noise levels in the SFRC.

Table 4: Summary of Existing Noise Levels within the Tri-Rail Corridor

Date	*County*	*Address*	L_{dn} **(dBA)**	L_{eq} **(dBA)**
2.1.10	Palm Beach	NW 18th Avenue	73	69
2.1.10	Palm Beach	SW 35th Avenue	72	67
2.1.10	Palm Beach	11th Street	69	65
2.2.10	Broward	N 30th Road	72	68
2.2.10	Broward	TY's Park	73	72
2.2.10	Broward	N 30th Terrace	77	66
2.3.10	Miami Dade	E 11th Avenue	78	75
2.3.10	Miami Dade	E 55th Street	72	70
2.3.10	Miami Dade	Burlington Street	82	76

Transportation System Management (TSM) Alternative

According to the FTA manual, measured background noise levels and available future bus operation information are required to evaluate the TSM Alternative. An evaluation was performed which determined buffer distances that were incorporated into a Geographic Information System (GIS) platform (i.e., ArcgGIS Desktop© version 9.3) to determine the number of parcels that could be potentially affected by the TSM alternative.

Based on the average of limited existing background measurements, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. The bus fleet maximum speed was assumed to be ***60 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 5**.

Table 5: TSM Noise Buffer Distance (feet)

Land use Category	*Severe Impact Buffer*	*Moderate Impact buffer*
Category 2	6	27
Category 3	2	8

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category were determined and are shown in **Table 6**. Furthermore, during subsequent phases, a detailed noise study will evaluate all impacts along the corridor.

Table 6: TSM Number of Potentially Noise Affected Parcels

Land use Category	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Category 2	0	0
Category 3	0	0

Modally Generic Alternatives

Alternatives in Phase 2 of the SFECCTA study were screened in an iterative, stepwise manner, including a series of modally generic alternatives that were developed and analyzed. The term "modally generic" means that a consistent generic transit mode, or vehicle type, was used for transit ridership transit planning modeling purposes. These alternatives were designed primarily to explore the different characteristics of transit services such as maximum speed, number of station stops, fare, park-and-ride access, and service frequency. These five premium modal technologies are:

- Regional Rail Transit (RGR)
- Rail Rapid Transit (RRT)
- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)
- Regional Bus (RGB)

According to the FTA manual, measured background noise levels and available future operation characteristics are required to evaluate the different modal technology alternatives. An evaluation was performed to determine buffer distances that were incorporated into GIS to determine the number of parcels that could be affected along the FEC Railway corridor (North-South mainline) between Miami and Jupiter, Florida.

The noise evaluation consisted of three categories: 1) ***Mainline***: trains and buses operating at normal speed on the mainline with no horn blown, 2) ***Transit Stations***: trains and buses approaching transit stations at low speed, and 3) ***Crossings***: trains and buses operating at normal speed at the transitway-highway grade crossings with horn blown.

Mainline

Based on the average of the limited existing background noise measurements along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. The operational characteristics for each technology are outlined in **Table 7** and assume no train horns will be blown. The operational maximum speed was assumed to be ***60 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 8** and **Table 9** respectively.

Table 7: Number of Rail/Bus Operations for Modally Generic Alternatives (Mainline)

Type of Technology	*Number of Daytime Operations*	*Number of Nighttime Operations*
Regional Rail (Push-Pull)	80	18
Regional Rail (DMU)	80	18
Light Rail	80	18
Rail Rapid Transit	80	18
Bus Rapid Transit	160	36
Regional Bus	160	36

Table 8: Category 2 Noise Buffer Distance (feet) for Modally Generic Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	20	88
Regional Rail (DMU)	15	65
Light Rail	8	37
Rail Rapid Transit	24	109
Bus Rapid Transit	6	27
Regional Bus	6	27

Table 9: Category 3 Noise Buffer Distance (feet) for Modally Generic Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	6	25
Regional Rail (DMU)	4	19
Light Rail	2	11
Rail Rapid Transit	7	32
Bus Rapid Transit	2	8
Regional Bus	2	8

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 10** and **Table 11**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 10: Category 2 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Mainline)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	0	838
Regional Rail (DMU)	0	660
Light Rail	0	0
Rail Rapid Transit	0	1,151
Bus Rapid Transit	0	0
Regional Bus	0	0

Table 11: Category 3 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Mainline)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	0	0
Regional Rail (DMU)	0	0
Light Rail	0	0
Rail Rapid Transit	0	0
Bus Rapid Transit	0	0
Regional Bus	0	0

Transit Stations

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each technology are outlined in **Table 12** and assume no train horns will be blown. The train and bus maximum operational speed was assumed to be ***10 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 13** and **Table 14** respectively.

Table 12: Number of Rail/Bus Operations for Modally Generic Alternatives (Transit Stations)

Type of Technology	*Number of Daytime Operations*	*Number of Nighttime Operations*
Regional Rail (Push-Pull)	80	18
Regional Rail (DMU)	80	18
Light Rail	80	18
Rail Rapid Transit	80	18
Bus Rapid Transit	160	36
Regional Bus	160	36

Table 13: Category 2 Noise Buffer Distance (feet) for Modally Generic Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	43	192
Regional Rail (DMU)	15	65
Light Rail	1	3
Rail Rapid Transit	2	10
Bus Rapid Transit	1	4
Regional Bus	1	4

Table 14: Category 3 Noise Buffer Distance (feet) for Modally Generic Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	12	55
Regional Rail (DMU)	4	19
Light Rail	0	3
Rail Rapid Transit	1	3
Bus Rapid Transit	0	1
Regional Bus	0	1

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 15** and **Table 16**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 15: Category 2 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Transit Stations)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	0	37
Regional Rail (DMU)	0	2
Light Rail	0	0
Rail Rapid Transit	0	0
Bus Rapid Transit	0	0
Regional Bus	0	0

Table 16: Category 3 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Transit Stations)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	0	8
Regional Rail (DMU)	0	0
Light Rail	0	0
Rail Rapid Transit	0	0
Bus Rapid Transit	0	0
Regional Bus	0	0

Crossings (Horn)

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each technology are outlined in **Table 17** and assume ***train horns will be blown***. The operational maximum speed was assumed to be ***60 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 18** and **Table 19** respectively.

Table 17: Number of Rail/Bus Operations for Modally Generic Alternatives (Crossings)

Type of Technology	*Number of Daytime Operations*	*Number of Nighttime Operations*
Regional Rail (Push-Pull)	80	18
Regional Rail (DMU)	80	18
Light Rail	80	18
Rail Rapid Transit	80	18
Bus Rapid Transit	160	36
Regional Bus	160	36

Table 18: Category 2 Noise Buffer Distance (feet) for Modally Generic Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	234	1,052
Regional Rail (DMU)	233	1,046
Light Rail	232	1,046
Rail Rapid Transit	N/A (Elevated)	N/A (Elevated)
Bus Rapid Transit	N/A	N/A
Regional Bus	N/A	N/A

Table 19: Category 3 Noise Buffer Distance (feet) for Modally Generic Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail (Push-Pull)	67	303
Regional Rail (DMU)	67	302
Light Rail	67	300
Rail Rapid Transit	N/A (Elevated)	N/A (Elevated)
Bus Rapid Transit	N/A	N/A
Regional Bus	N/A	N/A

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 20** and **Table 21**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 20: Category 2 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Crossings)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	542	18,101
Regional Rail (DMU)	536	17,919
Light Rail	527	17,919
Rail Rapid Transit	0	0
Bus Rapid Transit	0	0
Regional Bus	0	0

Table 21: Category 3 Number of Potentially Noise Affected Parcels for Modally Generic Alternatives (Crossings)

Type of Technology	*Number of Potential Severe Impacts*	*Number of Potential Moderate Impacts*
Regional Rail (Push-Pull)	76	706
Regional Rail (DMU)	76	706
Light Rail	76	697
Rail Rapid Transit	0	0
Bus Rapid Transit	0	0
Regional Bus	0	0

Summary

For the "Modally Generic" alternatives, the noise screening analysis has indicated that the lowest number of parcels that would potentially be impacted is near transit station areas where the trains and buses are operating at lower speed. Furthermore, the screening evaluation has shown that the train operations at the transitway-highway crossings are correlated with the highest number of potentially impacted parcels which is due to the train blowing their horns. Also, the numbers of potentially impacted parcels for Category 3 land uses are lower than the potentially impacted parcels for Category 2 land uses. This is because Category 2 land uses are based on a 24 hour assessment period as opposed to Category 3 land uses, which are assessed based on daytime operation only of 15 hours/day.

In addition, when comparing the five modal technologies considered within the "Modally Generic" alternatives, the analysis has indicated that "Regional Rail" is associated with the highest number of potentially impacted parcels, followed by "Light Rail" technology. Furthermore, "Regional Rail" technology based on "Push/Pull" operation is linked to higher affected parcels when compared to "Regional Rail" based on DMU operations.

Modally Specific Alternatives

Based on the results of the "Modally Generic" alternatives, a series of seven "Modally Specific" alternatives (including a TSM Alternative) were developed and analyzed. The term "Modally Specific" means that each alternative was based on a specific vehicle technology, but they were not fully developed in terms of all their characteristics. These alternatives represent a full range or spectrum of alternatives that could reasonably be implemented for this project. Detailed descriptions of these seven alternatives are available in the *Draft ESR*. These seven modal alternatives are:

- Bus Rapid Transit and Commuter Rail (DMU and Bus Rapid Transit)
- Integrated Network (DMU and Push/Pull)
- Metrorail and Commuter Rail (DMU and Rail Rapid Transit)
- Conventional Commuter Rail (Push/Pull)
- Local and Express (DMU)
- Urban Mobility (Light Rail)
- TSM w/Regional Bus (Bus)

An evaluation was performed to determine buffer distances that were incorporated into GIS to determine the number of parcels that could be affected along each alternative's respective linear corridor between Miami and Jupiter, Florida. In addition, the "Integrated Network" alternative could affect the SFRC between Miami and West Palm Beach, Florida.

The noise evaluation consisted of three categories: 1) ***Mainline***: trains and buses operating at normal speed on the mainline with no horn blown, 2) ***Transit Stations***: trains and bus approaching transit stations at low speed, 3) ***Crossings***: trains and buses operating at normal speed at the transitway-highway grade crossings **with only audible warning devices**, it was assumed that **no horn will be blown** for future operations.

Mainline

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along the SFRC, the existing Day-Night Sound Level (Ldn) is 76 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each modal technology are outlined in **Table 22** and assume no train horns will be blown. The operational maximum speed was assumed to vary between ***55 - 80 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 23** and **Table 24** respectively.

Table 22: Number of Rail/Bus Operations for Modally Specific Alternatives (Mainline)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Conventional Commuter Rail	50	10
Urban Mobility	140	28
Local and Express	80	16
Integrated Network (FEC North/FEC South/Tri-Rail)	80	16
Metrorail and Commuter Rail (DMU/Metrorail)	80/240	16/48
BRT and Commuter Rail (DMU/BRT)	80/240	16/48
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 23: Category 2 Noise Buffer Distance (feet) for Modally Specific Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	12	56
Urban Mobility	10	46
Local and Express	15	70
Integrated Network (FEC North/FEC South/Tri-Rail)	7/10/16	34/44/63
Metrorail and Commuter Rail (DMU/Metrorail)	10/24	44/112
BRT and Commuter Rail (DMU/BRT)	10/7	44/33
TSM w/Regional Bus (Bus/Regional Bus)	5/4	23/19

Table 24: Category 3 Noise Buffer Distance (feet) for Modally Specific Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	8	17
Urban Mobility	6	14
Local and Express	10	21
Integrated Network (FEC North/FEC South/Tri-Rail)	5/6/9	10/13/19
Metrorail and Commuter Rail (DMU/Metrorail)	6/15	13/33
BRT and Commuter Rail (DMU/BRT)	6/5	13/10
TSM w/Regional Bus (Bus/Regional Bus)	2/3	7/6

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 25** and **Table 26**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 25: Category 2 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	577
Urban Mobility	0	96
Local and Express	0	674
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	0/28/460
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	22/190
BRT and Commuter Rail (DMU/BRT)	0/0	26/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 26: Category 3 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	0
Urban Mobility	0	0
Local and Express	0	0
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/0
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	0/0
BRT and Commuter Rail (DMU/BRT)	0/0	0/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Transit Stations

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along the SFRC, the existing Day-Night Sound Level (Ldn) is 76 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each modal technology are outlined in **Table 27** and assume no train horns will be blown. The operational maximum speed was assumed to be ***10 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 28** and **Table 29** respectively.

Table 27: Number of Rail/Bus Operations for Modally Specific Alternatives (Transit Stations)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Conventional Commuter Rail	50	10
Urban Mobility	140	28
Local and Express	80	16
Integrated Network (FEC North/FEC South/Tri-Rail)	80	16
Metrorail and Commuter Rail (DMU/Metrorail)	80/240	16/48
BRT and Commuter Rail (DMU/BRT)	80/240	16/48
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 28: Category 2 Noise Buffer Distance (feet) for Modally Specific Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	28	132
Urban Mobility	1	5
Local and Express	15	70
Integrated Network (FEC North/FEC South/Tri-Rail)	7/10/48	34/44/192
Metrorail and Commuter Rail (DMU/Metrorail)	10/16	44/73
BRT and Commuter Rail (DMU/BRT)	10/1	44/6
TSM w/Regional Bus (Bus/Regional Bus)	1/1	3/4

Table 29: Category 3 Noise Buffer Distance (feet) for Modally Specific Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	18	39
Urban Mobility	1	1
Local and Express	10	21
Integrated Network (FEC North/FEC South/Tri-Rail)	5/6/26	10/13/57
Metrorail and Commuter Rail (DMU/Metrorail)	6/10	13/22
BRT and Commuter Rail (DMU/BRT)	6/1	13/2
TSM w/Regional Bus (Bus/Regional Bus)	0/0	1/1

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 30** and **Table 31**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 30: Category 2 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	1
Urban Mobility	0	0
Local and Express	0	4
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/7
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	0/1
BRT and Commuter Rail (DMU/BRT)	0/0	0/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 31: Category 3 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	0
Urban Mobility	0	0
Local and Express	0	0
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/5
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	0/0
BRT and Commuter Rail (DMU/BRT)	0/0	0/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Crossings (No horn, only bells)

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along the SFRC, the existing Day-Night Sound Level (Ldn) is 76 dBA and the existing hourly noise level Leq is 71 dBA. The operation characteristics for each technology are outlined in **Table 32** and assume only ***audible gates warning devices (bells) and no train horns*** will be blown. The operational maximum speed was assumed to vary between ***55 - 80 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 33** and **Table 34** respectively.

Table 32: Number of Rail/Bus Operations for Modally Specific Alternatives (Crossings)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Conventional Commuter Rail	50	10
Urban Mobility	140	28
Local and Express	80	16
Integrated Network (FEC North/FEC South/Tri-Rail)	80	16
Metrorail and Commuter Rail (DMU/Metrorail)	80/240	16/48
BRT and Commuter Rail (DMU/BRT)	80/240	16/48
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 33: Category 2 Noise Buffer Distance (feet) for Modally Specific Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	20	68
Urban Mobility	19	60
Local and Express	22	79
Integrated Network (FEC North/FEC South/Tri-Rail)	18/19/24	52/59/74
Metrorail and Commuter Rail (DMU/Metrorail)	19/19	59/117
BRT and Commuter Rail (DMU/BRT)	19/NA	59/NA
TSM w/Regional Bus (Bus/Regional Bus)	NA/NA	NA/NA

Table 34: Category 3 Noise Buffer Distance (feet) for Modally Specific Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	12	22
Urban Mobility	10	20
Local and Express	14	25
Integrated Network (FEC North/FEC South/Tri-Rail)	10/11/12	17/19/23
Metrorail and Commuter Rail (DMU/Metrorail)	11/18	19/36
BRT and Commuter Rail (DMU/BRT)	11/NA	19/NA
TSM w/Regional Bus (Bus/Regional Bus)	NA/NA	NA/NA

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 35** and **Table 36**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 35: Category 2 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	42
Urban Mobility	0	29
Local and Express	0	59
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	10/4/10
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	23/19
BRT and Commuter Rail (DMU/BRT)	0/0	20/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 36: Category 3 Number of Potentially Noise Affected Parcels for Modally Specific Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Conventional Commuter Rail	0	0
Urban Mobility	0	0
Local and Express	0	0
Integrated Network (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/0
Metrorail and Commuter Rail (DMU/Metrorail)	0/0	0/0
BRT and Commuter Rail (DMU/BRT)	0/0	0/0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Summary

For the "Modally Specific" alternatives, the noise screening analysis has indicated that there are almost no potentially impacted parcels near station areas where the train and buses are operating at lower speed. For the "Modally Specific" alternatives, it was assumed that the trains will not blow the horn, and the only audible sounds at the transitway-highway crossings are the warning bells. This has resulted in much lower potentially impacted parcels when compared with the "Modally Generic" alternatives where it was assumed the train will blow the horn. The noise screening analysis has indicated that the highest number of potentially impacted parcels is due to train operating at full speed on the mainline. Also, the numbers of potentially impacted parcels for Category 3 land uses are lower than the potentially impacted parcels for Category 2 land uses. This is due to the fact that the Category 3 buffer distances fall within either the FEC or the SFRC rights of way, which is mainly attributed to Category 2 land uses, which are based on a 24 hour assessment period as opposed to Category 3 land uses, which are assessed based on daytime operation only of 15 hours/day.

In addition, when comparing the seven alternatives within the "Modally Specific" alternatives, the analysis has indicated that "Conventional Commuter Rail" and "Local and Express" options are associated with the highest number of potentially impacted parcels, followed by the "Integrated Network" option. It is clear that the options that are associated with "Push/Pull" and "DMU" technologies would result in higher numbers of potentially impacted parcels.

Finally, the analysis has indicated there are no potentially impacted parcels that fall within the "severe" impact buffer distances. Also, when you total the number of potentially impacted parcels, it is shown that the "Local and Express" option has 733 potentially impacted parcels, which is a reasonable number when considering the proposed transitway along the FEC Railway corridor is 83-miles long.

Modally Detailed Alternatives

The previous seven "Modally Specific" alternatives were presented to the stakeholders and the general public through a series of meetings and the public workshops. They were then evaluated in terms of a series of criteria based on: public input; the established goals and objectives of the project; and, the criteria established by the FTA for New Starts Funding. Based on this input and additional analyses, an overall concept was selected for further, more detailed study resulting in a set of pre-final alternatives ("Modally Detailed" alternatives). The overall concept entails combinations of the three highest ranking "Modally Detailed" alternatives from the above evaluation criteria.

A series of specific alternatives were developed and analyzed based on the screening performed on the "Modally Detailed" alternatives. This final evaluation will result in a recommendation of a locally preferred alternative (LPA) for presentation and adoption by the three Metropolitan Planning Organizations (MPO) within the study area. It is anticipated that based on the alternatives, public and agency review of the documents at the public hearing or through document circulation reviews, as well as MPO inputs, the LPA will be selected and presented in the *Final ESR*.

Detailed descriptions of the "Modally Detailed" alternatives are available in the *Draft ESR*. The three "Modally Detailed" alternatives are:

1) Regional Rail Network, options (1) or (2)
2) Bus Rapid Transit
3) TSM w/Regional Bus

An evaluation was performed to determine buffer distances that were incorporated into GIS to determine the number of parcels that could be affected along each alternative's respective linear corridor between Miami and Jupiter, Florida. In addition, the "Regional Rail Network" alternatives could affect the SFRC between Miami and West Palm Beach, Florida.

The noise evaluation consisted of three categories: 1) ***Mainline***: trains and buses operating at normal speed on the mainline with no horn blown, 2) ***Transit Stations***: trains and bus approaching transit stations at low speed, 3) ***Crossings***: trains and buses operating at normal speed at the transitway-highway grade crossings **with only audible warning devices**, it was assumed that **no horn will be blown** for future operations.

Mainline

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along the SFRC, the existing Day-Night Sound Level (Ldn) is 76 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each modal technology are outlined in **Table 37** and assume no train horns will be blown. The operational maximum speed was assumed to vary between ***60 - 80 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 38** and **Table 39** respectively.

Table 37: Number of Rail/Bus Operations for Modally Detailed Alternatives (Mainline)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Regional Rail Network (1) (FEC/Tri-Rail)	80	16
Regional Rail Network (2) (FEC/Tri-Rail)	80/40	16/8
Bus Rapid Transit	320	64
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 38: Category 2 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	12/18/13	54/85/54
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	12/15/14/29	57/70/57/116
Bus Rapid Transit	7	30
TSM w/Regional Bus (Bus/Regional Bus)	5/4	23/19

Table 39: Category 3 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	7/12/7	16/25/16
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	7/10/7/15	18/21/18/34
Bus Rapid Transit	4	9
TSM w/Regional Bus (Bus/Regional Bus)	2/3	7/6

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 40** and **Table 41**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 40: Category 2 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	501/253/236
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/0	506/214/171/194
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 41: Category 3 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Mainline)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/0
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/0	0/0/0/0
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Transit Stations

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Day-Night Sound Level (Ldn) is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along SFRC, the existing Day-Night Sound Level (Ldn) is 76 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each technology are outlined in **Table 42** and assume no train horns will be blown. The operational maximum speed was assumed to be ***10 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 43** and **Table 44** respectively.

Table 42: Number of Rail/Bus Operations for Modally Detailed Alternatives (Transit Stations)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Regional Rail Network (1) (FEC/Tri-Rail)	80	16
Regional Rail Network (2) (FEC/Tri-Rail)	80/40	16/8
Bus Rapid Transit	320	64
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 43: Category 2 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	12/18/13	54/85/54
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	8/15/8/95	39/70/39/383
Bus Rapid Transit	1	7
TSM w/Regional Bus (Bus/Regional Bus)	1/1	3/4

Table 44: Category 3 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	7/12/7	16/25/16
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	7/10/5/50	11/21/11/115
Bus Rapid Transit	1	2
TSM w/Regional Bus (Bus/Regional Bus)	0	1/1

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 45** and **Table 46**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 45: Category 2 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	3/3/0
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/0	0/0/0/30
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 46: Category 3 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Transit Stations)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/0
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/3	0/0/0/6
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Crossings (No Horn, only bells)

Based on the average of the limited existing background noise measurements conducted along the FEC Railway, the existing Ldn is 78 dBA and the existing hourly noise level (Leq) is 71 dBA. Furthermore, background noise measurements were conducted along the SFRC, the existing Ldn is 76 dBA and the existing hourly noise level (Leq) is 71 dBA. The operation characteristics for each technology are outlined in **Table 47** and assume only ***audible gates warning devices (bells) and no train horns*** will be blown. The operational maximum speed was assumed to vary between ***60 - 80 mph*** and with daytime operations between 7:00 a.m. and 10:00 p.m. and nighttime operations between 10:00 p.m. and 7:00 a.m. Based on the FTA guidance manual, the future buffer distances were calculated for Category 2 and 3 land uses with the results shown in **Table 48** and **Table 49** respectively.

Table 47: Number of Rail/Bus Operations for Modally Detailed Alternatives (Crossings)

Type of Technology	*Number of Daytime Operation*	*Number of Nighttime Operation*
Regional Rail Network (1) (FEC/Tri-Rail)	80	16
Regional Rail Network (2) (FEC/Tri-Rail)	80/40	16/8
Bus Rapid Transit	320	64
TSM w/Regional Bus (Bus/Regional Bus)	140/84	28/16

Table 48: Category 2 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	19/23/21	65/90/65
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	22/21/22/33	70/79/70/122
Bus Rapid Transit	NA	NA
TSM w/Regional Bus (Bus/Regional Bus)	NA/NA	NA/NA

Table 49: Category 3 Noise Buffer Distance (feet) for Modally Detailed Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	11/14/11	20/28/20
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	11/12/11/17	21/24/21/36
Bus Rapid Transit	NA	NA
TSM w/Regional Bus (Bus/Regional Bus)	NA/NA	NA/NA

Incorporating these buffer distances and appropriate land use classifications into GIS, the numbers of potentially affected parcels for each category was determined and are shown in **Table 50** and **Table 51**. These parcels are based on a GIS inventory of resources and represent parcels that could be impacted.

Table 50: Category 2 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	34/12/7
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/0	39/11/7/9
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Table 51: Category 3 Number of Potentially Noise Affected Parcels for Modally Detailed Alternatives (Crossings)

Type of Technology	*Severe Impact Buffer*	*Moderate Impact Buffer*
Regional Rail Network (1) (FEC North/FEC South/Tri-Rail)	0/0/0	0/0/0
Regional Rail Network (2) (FEC North/FEC South/Tri-Rail North/Tri-Rail South)	0/0/0/0	0/0/0/0
Bus Rapid Transit	0	0
TSM w/Regional Bus (Bus/Regional Bus)	0/0	0/0

Summary

For the "Modally Detailed" alternatives, the noise screening analysis has indicated that there are almost no potentially impacted parcels near transit station areas where the trains and buses are operating at lower speed. For the "Modally Detailed" alternatives, it was assumed that the trains will not blow the horn, and the only audible sounds at the transitway-highway crossings are the warning bells. This has resulted in much lower potentially impacted parcels when compared with the "Modally Generic" alternatives where it was assumed the train will blow the horn and similar to the "Modally Specific" alternatives which assumed only warning device bells will be audible at transitway-highway crossings. The noise screening analysis has indicated that the highest number of potentially impacted parcels is due to trains operating at full speed on the mainline.

Also, the numbers of potentially impacted parcels for Category 3 land uses are lower than the potentially impacted parcels for Category 2 land uses. This is due to the fact that the Category 3 buffer distances fall within either the FEC or the SFRC rights of way, which is mainly attributed to Category 2 land uses, which are based on a 24 hour assessment period as opposed to Category 3 land uses, which is assessed based on daytime operation only of 15 hours/day.

In addition, when comparing the four technologies considered within the "Modally Detailed" alternatives, the analysis has indicated that the "Regional Rail Network 1" and "Regional Rail Network 2" options are associated with the highest number of potentially impacted parcels. It is clear that the options that are associated "Push/Pull" and "DMU" technologies would result in higher numbers of potentially impacted parcels.

Finally, the analysis has indicated there are no potentially impacted parcels that are within the "severe" impact buffer distances. Also, when you total the number of potentially impacted parcels, it is shown that both the "Regional Rail Network 1" and "Regional Rail Network 2" options have comparable potentially impacted parcels, ***1,043 and 1,153*** respectively, which is a reasonable number when considering both the FEC and the SFRC corridors.

Conclusion

Phase 2 of the SFECCTA study has screened alternatives in an iterative, stepwise manner, including a series of alternatives that were developed and analyzed. Generally, when considering all three "Modally…" alternatives (i.e., Generic, Specific, and Detailed), the noise screening analysis has indicated that the lowest number of parcels that could be impacted is near transit station areas where the trains and buses are operating at lower speed. Furthermore, the screening evaluation has shown that the train operations at the transitway-highway crossings will be reduced significantly once the train horn noise is eliminated and only bells are considered near crossings.

Finally, as the "modal" alternatives developed and became more specific, the analysis has shown that there are no potentially impacted parcels that fall within the "severe" impact buffer distances.

Furthermore, the evaluation of the different modal technologies has clearly indicated that "Conventional Commuter Regional Rail", either Push/Pull or DMU technology, would result in the highest number of potentially noise impacted parcels. However, the numbers of parcels are not significant when compared to the vast number of receivers/parcels along both the FEC and SFRC corridors. Another reason for these relatively modest amounts of potentially impacted parcels is the high ambient noise levels on both corridors (discussed in the No Build Alternative section), primarily due to existing freight on FEC Railway and combined freight/heavy commuter rail on the SFRC.

During subsequent phases of the study, more detailed noise analyses will be conducted, more accurate numbers of impacted parcels will be determined, and possible noise mitigation would be considered.

References

U.S. Department of Transportation – Federal Transit Administration. Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, 2006.