Noise and Vibration Study Report

National Environmental Policy Act (NEPA) Study

Broward Commuter Rail South

Broward County, Florida

June 1, 2024

Financial Project ID: 452240-1

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1. Project Description and Purpose and Need

1.1 Project Description

The proposed Broward Commuter Rail (BCR) South Project will add commuter service to the existing freight rail and intercity passenger rail services that currently operate on the Florida East Coast Railway Corridor (FEC Corridor) between the City of Aventura, located in Miami-Dade County and the City of Fort Lauderdale, located in Broward County, approximately 11.5 miles. The project proposes three new passenger stations depicted on **Figure 1.1** and at the following locations:

- Hollywood (between Tyler Street and Taylor Street),
- Fort Lauderdale-Hollywood International (FLL) Airport, and
- South Fort Lauderdale (between SW 15th Street and SW 17th Street).

The proposed BCR South weekday commuter service is intended to have 60-minute base headways, with 30-minute peak service, and 60-minute weekend and holiday service. The weekday peak hours are estimated to be between 5 AM and 9 PM and 4 PM to 8 PM. Detailed schedules will be based on additional corridor modeling and adjusted during subsequent phase. The BCR South project entered Federal Transit Administration's (FTA) Project Development (PD) phase in December of 2022.

1.2 Purpose and Need

The purpose of this project is to implement commuter service along the existing FEC Corridor from Aventura in Miami-Dade County into Broward County, Florida. The project would provide a new and reliable option for north-south commuters by connecting to major activity centers and neighborhoods adjacent to the line and support economic development and land use plans and policies in eastern Broward County.

BCR South will provide a sustainable and permanent transportation investment that is strongly supported by local land use plans, Broward County, the City of Hollywood, the City of Hallandale, the City of Dania Beach, the City of Fort Lauderdale, and the surrounding communities. The primary needs for the project are based on providing an alternate mode of transportation for critical north–south regional and local travel capacity and serving the existing and future population growth in the region and corresponding sustainable land use and economic development in the study area.

Figure 1.1: BCR South Project Location and Alignment Map

The secondary needs for the project are based on enhancing intermodal connectivity by developing a seamlessly integrated multimodal network and improving transit service in the eastern high-density travel market. The project enhances intermodal connectivity by providing quality access to transit-dependent populations and improving the environment and transportation safety. It will help address congestion issues by providing person trip capacity via a regional commuter rail transit option in the FEC Corridor.

2. Build Alternative

This section provides a description of the Build Alternative used to evaluate the environmental impacts of the BCR South project.

2.1 General

The Build Alternative includes track modifications at the approaches to the proposed commuter rail station, proposed commuter rail stations, and commuter parking improvements. Three stations are proposed along the corridor with the northern termini occurring at the South Fort Lauderdale Station in Broward County. The BCR South platforms will be located next to siding tracks and an additional dwell track is proposed north of the South Fort Lauderdale station.

2.1.1 Stations

The proposed BCR South stations include:

- Hollywood Station located between Fillmore Street and Tyler Street,
- Fort Lauderdale-Hollywood International Airport (FLL) Station located between the two Terminal Drive overpasses that access the airport from I-595 and US 1, and
- South Fort Lauderdale Station located between SW 15th Street and SW 17th Street.

All three stations include the following amenities:

- Ticket Zone with at least two Ticket Vending Machines (TVM) (Operator Specific),
- Staff Information Booth,
- ADA Compliant Clear Zone(s),
- Fixed Canopy,
- Benches for Seating Compliant with Department of Justice 28 CFR Part 36 ADA Standards for Accessible Design,
- Lighting (direct with minimum 5-foot candles (FC) on all portions of platform and off-platform areas),
- Information Sign(s) (e.g., passenger information, logo, route maps, and schedules)
- Station Stop ID Sign(s),
- Trash Receptacle(s),
- Hose bibs along platform for maintenance,
- Emergency Fire Hydrant,
- Wayfinding Totem,
- Public-Address System (Operator Specific),
- Emergency Call Boxes,
- CCTV (Operator Specific),
- Wi-Fi Access,

- Handrails as necessary along platform, ramps, and sloping sidewalk,
- Inter-Track Fence,
- Level-Boarding Platform (Operator Specific), and
- Staff and Customer Bathroom Facilities

2.1.2 Track Work

The corridor consists of existing double mainline tracks previously constructed by FEC Corridor and Brightline for freight and intercity passenger service. Track work proposed in the Build Alternative includes adding sidings for the station platform locations and mainline track shifts at Hollywood Station. The sidings run the length of the stations and extend an addition to the length needed to tie back into the mainline double tracks. See **Figure 2-1** for example of dual side platform with sidings. Crossovers are included in the vicinity of the stations to allow for flexibility of train operations as the commuter trains approach the stations.

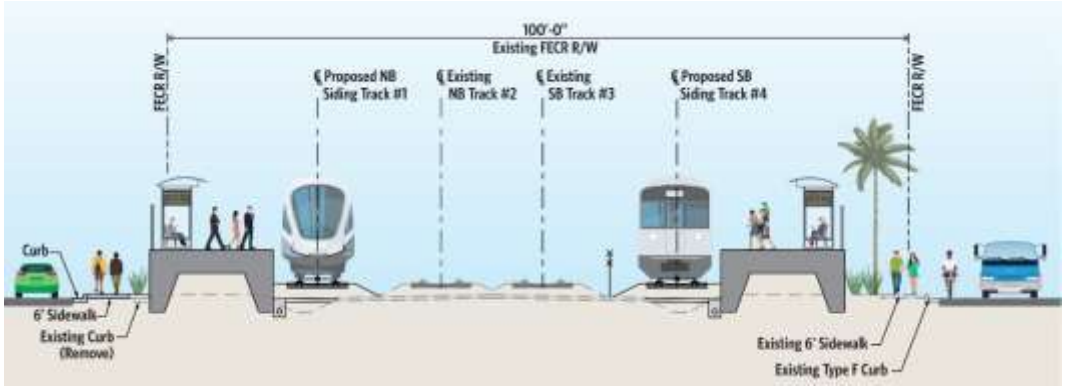


Figure 2.1: Example of Dual Side Platform Station Typical Section

2.1.3 Parking

Provisions for commuter parking at two of the three stations proposed were also examined in developing the Build Alternative. These parking alternatives are further described below in detailing station improvements proposed.

The following sections describe the Build Alternative in detail at each station.

2.2 Hollywood Station

The Hollywood Station is located between Filmore Street and Tyler Street in Hollywood, FL, west of downtown. At this station the rail corridor is bordered by North 21st Avenue to the east and Dixie Highway to the west.

The station concept includes providing the following:

- Two track sidings with two mainline track shifts to center the tracks and platforms within the FEC Corridor Right-of-way (ROW),
- Two 17 feet wide by 500 feet long side platforms,
- 150 feet bus drop-offs along North 21st Avenue and Dixie Highway (south of Fillmore Street),
- 100 feet vehicle drop-offs along North 21st Avenue and Dixie Highway (south of Fillmore Street),
- Sidewalk connectivity between the parking garage alternatives, the bus drop-off, and the vehicle drop-offs; this includes existing sidewalk repairs or reconstruction along the route and ADA ramps at the intersections along the route,
- In coordination with the City of Hollywood and Broward County Traffic Department, the project will reconstruct two existing through lanes (one-way traffic) on North 21st Avenue and Dixie Highway between Fillmore Street and Tyler Street to accommodate bus and vehicle drop-offs,
- Mill and overlay work at all at-grade highway-rail grade crossings,
- Pedestrian access via Filmore Street and Tyler Street highway-rail grade crossings (no pedestrian overpass). Platform will be end loaded 17 feet wide platforms, and
- The City's Complete Streets program was reviewed, and the station concept should accommodate future City construction without having to impact the main BCR South features.

2.2.1 Track Layout

Per the Timetable Speeds chart dated 3/18/2021 and the Track Charts dated 3/22/2021 provided by Brightline, the following existing train speeds are running through Hollywood Station:

- 60 Miles per Hour (MPH) Freight (FEC Corridor), and
- 79 MPH Passenger (Brightline).

Due to the close highway-rail grade crossing spacing, the siding / dwell tracks are extended south of Van Buren / Harrison Street before they can connect back to the mainline tracks. To accommodate the four tracks in the station area, the existing FEC Corridor mainline tracks will be shifted to be centered within the FEC Corridor ROW. Crossovers are proposed on either side of the stations to provide flexibility on accessing either siding for commuter service. The Hollywood Station track schematic is shown in **Figure 2.2**. Refer to the Preliminary Engineering Report (PER) for Attachment H-1 for track layout details, Attachment H-2 for roadway detailed layouts and dimensioning, and Attachment H-3 & H-4 for typical sections.

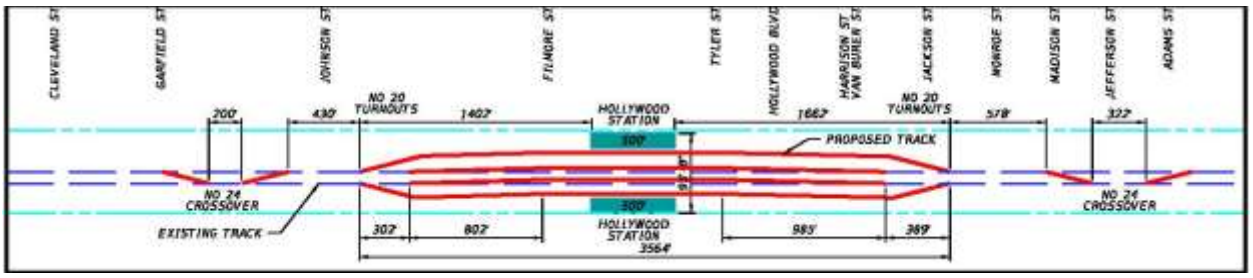


Figure 2.2: Hollywood Station Track Schematic

2.2.2 Parking

The City of Hollywood has indicated they can provide the BCR South parking spaces with their University Station project jointly developed by the city and private sector for attainable housing and 15,000 square feet of retail space for Barry University's College of Health Sciences. No additional improvements to the parking garage shown in purple in **Figure 2.3** are proposed as part of this project.

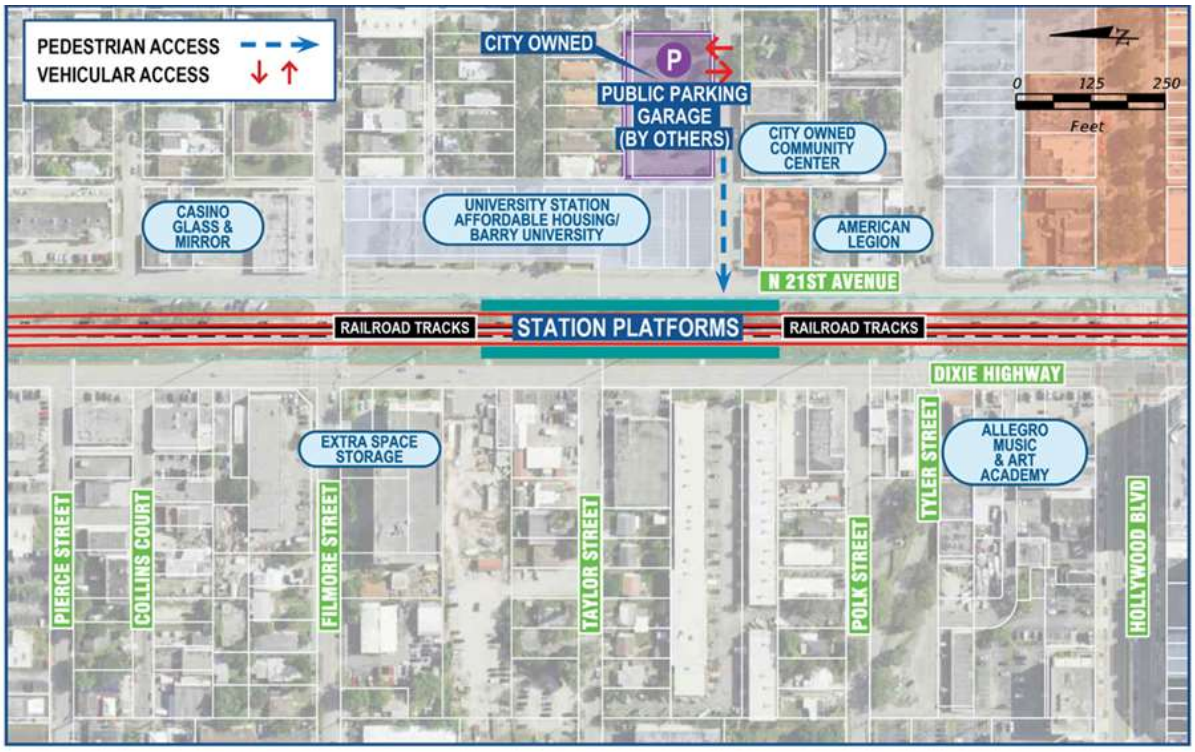


Figure 2.3: Hollywood Station Parking Build Alternative

The Build Alternative includes additional ADA parking spaces provided on either side of Polk Street just east of the North 21st Avenue intersection. Pedestrian connectivity between parking and the station is included as part of this Build Alternative.

2.2.3 Bus Stops/Vehicle Drop-offs

Planned and existing bus stops, as identified below, will meet the same style as the recently constructed Hollywood Boulevard Complete Streets project (2023), as shown in **Figure 2-4**, if practicable. The following is a summary of the bus stops near Hollywood Station.

- The recently constructed Hollywood Boulevard complete streets eastbound and westbound bus stops just west of Dixie Highway will remain.
- A southbound bus stop will be added at Dixie Highway on the far side of Fillmore Street.
- To provide for passenger and ride share vehicles, a drop-off is proposed on the far side of the new Dixie Highway bus stop.
- The existing northbound bus stop along North 21st Avenue on the near side of Fillmore Street will be moved to the far side to allow for the left turn lane on the narrower North 21st Avenue Complete Streets roadway section at the station.
- A new North 21st Avenue northbound vehicle drop-off will be located on the far side of Polk Street.

Figure 2.4: Hollywood Boulevard Complete Streets Bus Stop

2.2.4 Traffic Signals / Crosswalks

Due to the track shifts and additions for the station, several of the parallel street traffic signals and crosswalks will be affected.

- Eleven relocated or new traffic signals including pedestrian push buttons, mast arms, loop detection, signal preemption, signal timings, etc.
- New pedestrian mid-block signal across North 21st Avenue at Polk Street.
- New pedestrian mid-block signal across Dixie Highway at Polk Street.

2.2.5 Railroad Crossings

The Build Alternative includes upgraded highway-rail grade crossings at Filmore Street, Tyler Street, Hollywood Boulevard and Van Buren / Harrison Street, including:

- New railroad flashers / gates set outside the new siding track on the east and west sides,
- New or relocated advance warning devices (signs, detectable warning surface, etc.),
- New and reconstructed sidewalks for station access and connectivity,
- Additional railroad crossing panels for siding and on mainline FEC Corridor track shifts, and,
- Other safety features to be determined from the Safety Analysis Memorandum and coordination with FEC Railway, Brightline and FRA.

Safety and traffic analysis were performed, and the results show that the Build Alternative would have no significant impact on safety or traffic.

2.3 Fort Lauderdale-Hollywood International Airport (FLL Airport) Station

Passengers at the BCR South FLL Airport Station will primarily be airport travelers who have arrived via airplane to the station terminal or passengers who are departing the commuter train to reach the airport terminal. The FLL Airport station will support commuter passengers arriving by car but no additional parking is being provided at the station for commuters. In this way, the FLL Airport Station will function as a connecting commuter service to bring commuter rail passengers to the airport and take airport passengers to other stations on the BCR South commuter rail line.

The curved platform will be elevated with a pedestrian walkway to connect to the bus-drop off area on the west side of the tracks, shown in **Figure 2.5**. See Attachment A-2 in the PER for roadway concept and dimensions.

Pedestrians will be able to take a designated shuttle bus going to and from the station covered platform to the airport terminals. County buses may also access the drop-off area for the station.

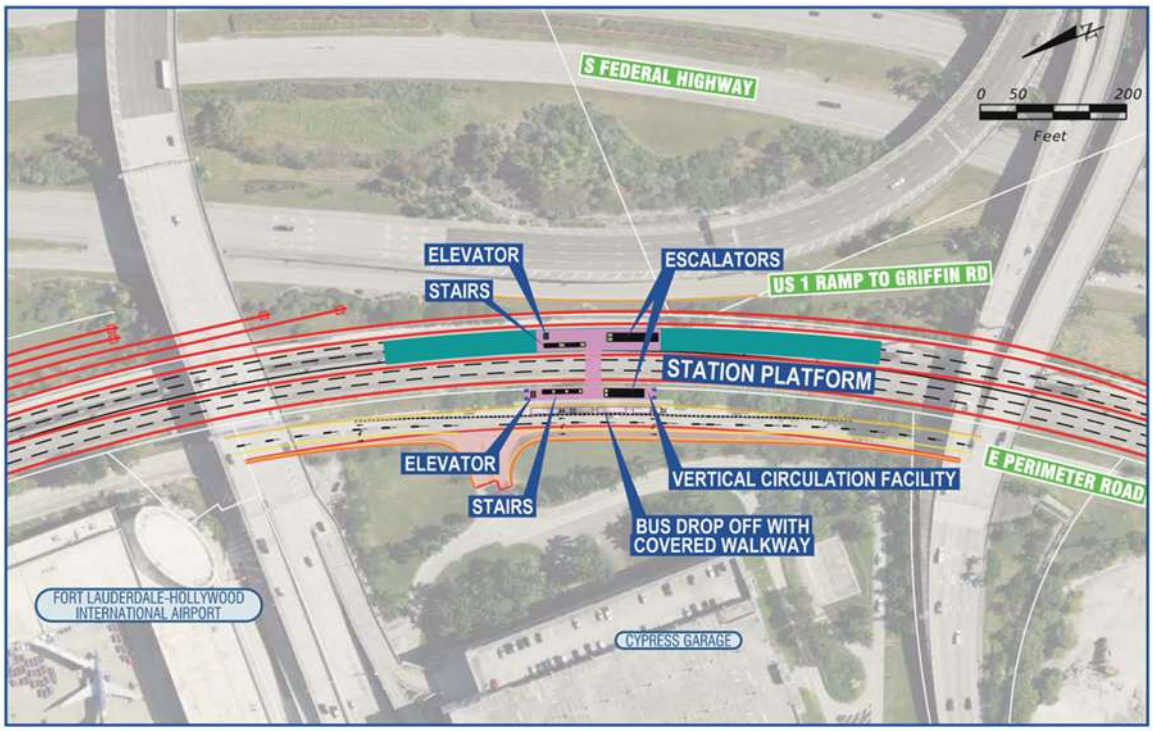


Figure 2.5: FLL Station Layout (No Parking)

The station concept includes providing the following:

- A single 30-foot wide 675-foot-long station platform centered between sidings/dwell tracks,
- Relocated freight storage tracks via several ladder tracks north of westbound Terminal Drive bridge to offset the storage lost from introducing the platform and sidings/dwell tracks,
- Reconfigured existing stormwater pond due to relocated freight storage tracks,
- Vertical circulation on platform to/from pedestrian overpass (escalator, stairs, elevator),
- Pedestrian overpass (23'-6" vertical clearance over tracks, 58' span, 20' wide),
- Staff parking spaces next to the bus drop-off,
- Vehicle drop-off for commuters,
- Sidewalk connectivity to the airport terminals is being evaluated for potential inclusion,
- Widening of Perimeter Road between Terminal Drive overpasses to accommodate bus drop-off lane,
- Shuttle bus drop-off facility with vertical circulation (escalator, stairs, elevator) includes 195-foot bus drop-off lane along Perimeter Road,

- Upgraded highway-rail grade crossing at Griffin Road due to mainline track shifts,
  - New railroad flashers / gates on the east and west sides,
  - New or relocated advance warning devices (signs, detectable warning surface, etc.),
  - Additional railroad crossing panels for mainline FEC Railway track shifts, and
  - Other safety features to be determined from Safety Analysis Memorandum and coordination with FEC Railway, Brightline and FRA.

2.3.1 Track Layout

Refer to the PER Attachment A-1 for more detailed track layouts with dimensions and stationing and Attachment A-3 and A-4 for typical sections. Per the Timetable Speeds chart dated 3/18/2021 and the Track Charts dated 3/22/2021 provided by Brightline, the following existing train speeds are running through FLL Airport Station:

- 40 MPH Freight (FEC Railway), and
- 40 MPH Passenger (Brightline).

The existing mainline and storage track curvature limits the ability of trains to travel fast through this airport area. The proposed station platform is in the center of two new siding / dwell tracks with the two mainline tracks relocated to the outside. The station work and existing bridge piers will require the existing FEC Railway storage tracks to be reconfigured. Refer to **Figure 2.6** for a schematic of track work.

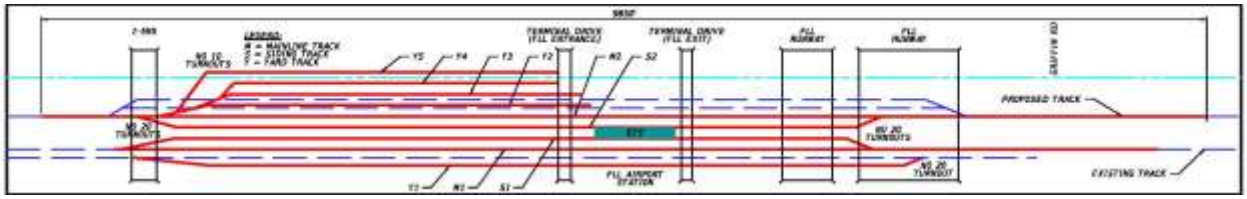


Figure 2.6: FLL Station Track Layout

To accommodate the storage track reconfiguration, the following will be provided:

- Proposed single storage track 14 feet to the west of the west Mainline track.
- Continuation of the northeast ladder storage tracks to the east to add four new storage tracks at 14 feet centers. These storage tracks will be stubbed out prior to the passenger station area near the Terminal Drive Overpass.
- Crash protection walls will be provided at the Terminal Drive overpass structures and under I-595, as required.
- The additional ladder storage tracks will require the modification of the existing US 1 pond on the east side of tracks to fill in more to the south infield area. The offset storage will be achieved by expanding the pond to the south and reconnecting the airport's irrigation facilities. See **Figure 2.7** for the pond modifications and ladder track layout.

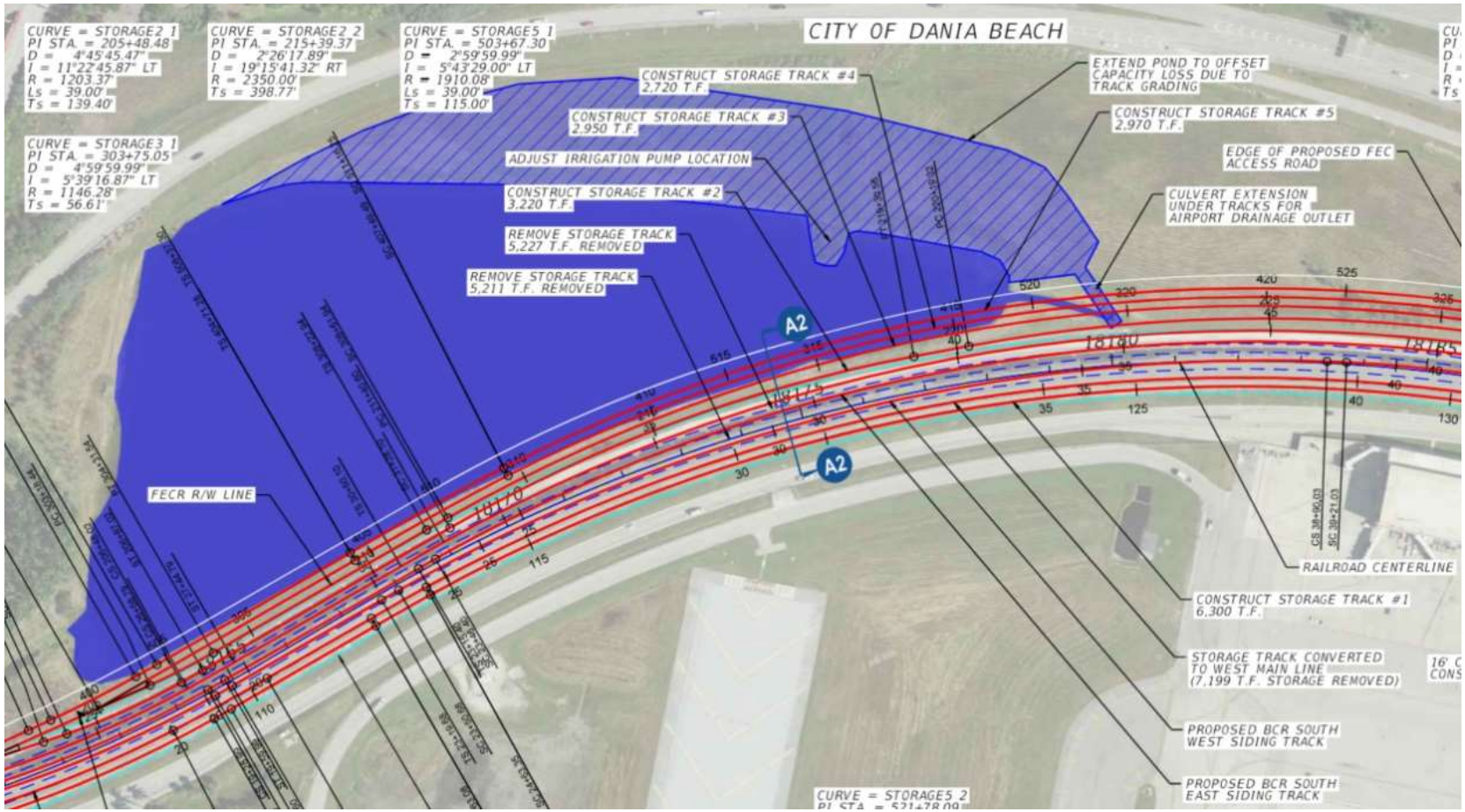


Figure 2.7: FLL Station Pond Modification

2.3.2 Parking

Parking will not be provided at the FLL Airport station.

2.3.3 Bus Stops/Vehicle Drop-offs

The FLL Airport station will have a covered walkway leading from the bus stop to the vertical circulation/pedestrian bridge to access the platform. Pedestrians will only be able to take a designated shuttle bus circulating to and from the platform to the airport terminals. The County buses will have limited access to the bus drop-off areas for the station.

Passenger vehicle drop-off areas will also be available at the station for commuters.

2.3.4 Traffic Signals/Crosswalks

There are no existing traffic signals nor crosswalks in the vicinity of the FLL Airport station.

2.3.5 Railroad Crossings

There are no railroad crossings in the vicinity of the FLL Airport station. However, the Griffin Road highway-railway grade crossing, south of the FLL Airport, will have profile adjustments related to the main track shifts.

2.4 South Fort Lauderdale Station (SFTL Station)

The SFTL Station is located between SW 15th Street and SW 17th Street in Fort Lauderdale, south of downtown. The platform is centered on SW 16th Street between Flagler Avenue and the FEC Railway tracks. Flagler Avenue remains an alley from SW 16th Street to SW 17th Street.

The station concept includes providing the following:

- A single 17 feet wide by 500 feet long side platform on the east side.
- A temporary dwell track extension of the siding on the east side of mainline tracks, all within existing rail ROW.
- Separate 150 feet bus drop-off lane either along Andrews Avenue or SW 1st Avenue (Broward County is holding internal transit meetings to determine various services)
- 100 feet vehicle drop-off along SW 16th Street circular drive.
- Sidewalk connectivity between the parking garage, the bus drop-off, and the vehicle drop-offs; this includes existing sidewalk repairs or reconstruction along the route and ADA ramps at the intersections along the route.
- Accommodation for a future City Complete Streets typical section at SW 17th Street will include the new warning devices and railroad crossing surface (concrete panels) placed so the City does not have to rework these elements with the future project.

- Pedestrian access via SW 15th Street and SW 17th Street highway-rail grade crossings (no pedestrian overpass). Platform will be end loaded and have a center access point in line with the SW 16th Street Plaza vehicle drop-off area.
- Parking garage with access from SW 1st Avenue.
  - Turn lane into the proposed SW 1st Avenue parking garage.

2.4.1 Track Layout

Per the Timetable Speeds chart dated 3/18/2021 and the Track Charts dated 3/22/2021 provided by Brightline, the following existing train speeds are running through SFTL Station:

- 60 MPH Freight (FEC Railway), and
- 79 MPH Passenger (Brightline).

A single platform and siding/dwell track are proposed on the east side of the mainline tracks. A 845 foot dwell track (575 functional length) stub out will be provided on the north side of the station north of SW 15th Street. This component will provide a location for holding a commuter train as needed to meet operational goals and safety inspections.

BCR South track work construction will require coordination with FEC Railway for "track windows" to accomplish the mainline track connections at the No. 20 turnouts and No. 24 crossover south of the station. See **Figure 2.8** for track schematic and refer to the PER Attachment F-1 for full track layout details, Attachment F-2 for roadway layout details, and Attachment F-3 & F-4 for typical sections.

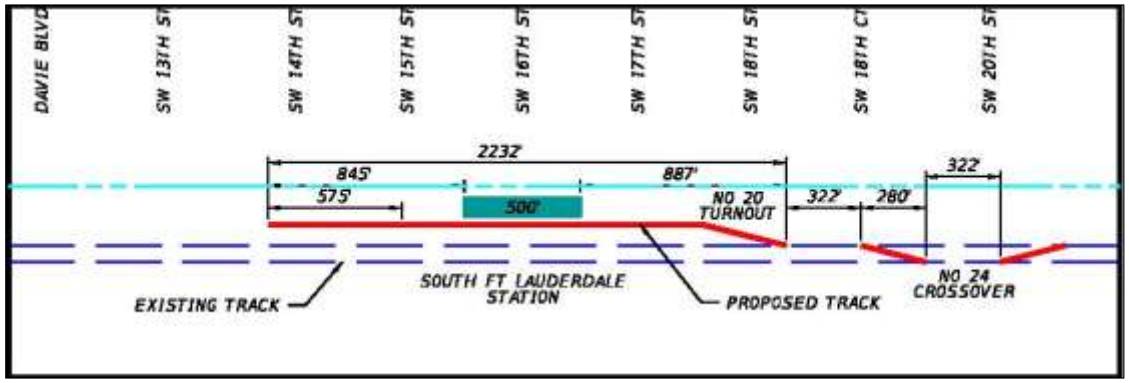


Figure 2.8: SFTL Station Track Schematic

2.4.2 Parking

The City of Fort Lauderdale does not have any large public parking facilities within the ¼-mile area of the station, only on-street parking. Therefore, parking alternative screening was analyzed for this station. Two candidate sites within ¼ mile of the station location were identified that could be developed as parking structures and are shown in **Figure 2.9**. Both sites screened and evaluated can accommodate the required parking for the station. Note that each parking alternative site will be accommodated within the current zoning height of 100 feet.

A new parking garage would be constructed, as part of the project, to accommodate the parking needs of the station.

Figure 2.9: SFTL Station Location & Parking Alternatives

Parking Alternative 1: Parking Alternative 1 is located between SW 1st Avenue and Flager Avenue alley close to the station platform in the block south of SW 16th Street (shown in purple). This potential parking site has no historic resources, has one property owner, and would require the relocation of two separate business tenants. There is an existing historic resource, the (former) Fort Lauderdale Antique Car Museum/1527 SW 1st Avenue (shown in orange), across the street from Alternative 1. The proposed parking garage Alternative 1 would have no adverse effects on the historic resource.

Parking Alternative 2: Alternative 2 is located between Andrews Avenue and SW 1st Avenue and is further away from the station platform in the block south of SW 16th Street (shown in yellow). This potential parking site is accessible from SW 17th Street via SW 1st Avenue entrance. This potential parking site has no historic resources, has three property owners, and may require two business relocations. The proposed parking garage Alternative 2 would also have no adverse effects on the existing historic resource, the (former) Fort Lauderdale Antique Car Museum/1527 SW 1st Avenue (shown in orange).

The BCR South proposes to build a new parking garage for the commuter station on one of these sites. A Preferred Parking Alternative will be selected during final design.

2.4.3 Bus Stops/Vehicle Drop-offs

Any new or relocated bus stop for BCR South will meet the same style as the recently constructed Andrews Avenue bus stop project, if practicable. The following is a summary of the bus stops and new vehicle drop-offs near the South Fort Lauderdale Station.

- New northbound and southbound bus stops may be added at SW 1st Avenue on the far side of SW 16th Street (BCT is developing a revised regional transit operation plan).
- New vehicle drop-offs will be accommodated along the reconstructed SW 16th Street as a horseshoe turn around with a pedestrian plaza in the median.
- The existing northbound and southbound bus stops along Andrews Avenue on the far side of SW 16th Street will remain. These sites have a covered waiting area for customers.

2.4.4 Traffic Signals/Crosswalks

The existing traffic signals will remain along Andrews Avenue and SW 17th Street in the project vicinity. The following crosswalks will be included in the project:

- Potential new mid-block pedestrian signal and crosswalk on Andrews Avenue to the north of SW 16th Street to provide pedestrian connectivity between the station and Broward Health complex.
- Potential new pedestrian signal and crosswalk on SW 17th Street at SW 1st Avenue to provide connectivity between the station and Poinciana Crossings affordable housing site.
- Potential modifications or new traffic signal interconnection with railroad active warning device systems, existing fire station emergency signal and new pedestrian signal.

2.4.5 Railroad Crossings

Upgraded highway-rail grade crossings at SW 15th Street and SW 17th Street, including:

- New railroad flashers / gates set outside the new siding track on the east side.
- New or relocated advance warning devices (signs, detectable warning surface, etc.).
- New and reconstructed sidewalks for station access.
- Additional railroad crossing panels for siding and on mainline FEC Railway tracks.
- Other safety features to be determined from Safety Analysis Memorandum and coordination with FEC Railway, Brightline and FRA.

3. Overview and Inventory of Noise/Vibration-Sensitive Sites

As described in **Section 1.1**, the BCR South project will add commuter service to the existing freight rail and intercity passenger rail services that currently operate on the FEC Corridor between the City of Aventura, located in Miami-Dade County and the City of Fort Lauderdale, located in Broward County, approximately 11.5 miles. In addition, three new passenger stations are proposed at the following locations: Hollywood (between Tyler Street and Taylor Street); Fort Lauderdale-Hollywood International Airport; and South Fort Lauderdale (between SW 15th Street and SW 17th Street). The BCR South project platforms will be located next to the new sidings/dwell tracks, not on the mainline. The locations of the three stations and platforms are shown in **Figure 4.5** (**Sheets 1, 4, and 10**).

The commuter train operations associated with the BCR South project represent an additional source of noise and vibrations along the FEC Corridor. Therefore, an inventory of residential and other noise and vibration sensitive land uses was performed to identify noise and vibration sensitive receivers or receptors of interest along the FEC Corridor and to facilitate the assessment of potential noise and vibration impacts. FTA's Land Use Categories were used to classify the types of noise and vibration sensitive land uses along the FEC Corridor (see **Table 4.2** and **Table 5.1**, respectively). Based on FTA's Noise and Vibration Screening Procedures, noise sensitive sites within 750 feet and vibration sensitive sites within 200 feet are potentially impacted by commuter rail projects.

A review of aerial photographs and parcel information from Broward County Property Appraiser Website and site reviews were used to identify, confirm, and document the noise and vibration sensitive land uses in the project study area. The noise and vibration sensitive land uses identified along the FEC Corridor are shown in **Figure 4.5** by FTA's Land Use Categories. Blue shading was used to identify FTA's Category 2 Land Uses representing residential land uses and buildings where people normally sleep such as hospitals and hotels. Light orange shading was used to identify FTA's Category 3 Land Uses representing institutions and offices where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material (e.g., schools, churches, passive recreational areas) or that have vibration-sensitive equipment. No Category 1 or High Sensitivity Land Uses representing locations where quiet is an essential element of its intended purpose such as outdoor amphitheaters and concert pavilions or any Special Buildings that are sensitive to vibrations such as TV and recording studios, concert halls, and theaters were identified along the FEC Corridor.

To facilitate the noise and vibration analysis and selection of receivers or receptors of interest to assess potential noise and vibration impacts, the BCR South project corridor was divided into five Segments (i.e., 1 through 5):

- Segment 1: Davie Road to Old Griffin Road (Cities of Fort Lauderdale and Dania Beach);
- Segment 2: Old Griffin Road to Sheridan Street (City of Dania Beach);
- Segment 3: Sheridan Street to Pembroke Road (City of Hollywood);
- Segment 4: Pembroke Road to SE/SW 11th Street (City of Hallandale Beach); and
- Segment 5: SE/SW 11th Street to Aventura Boulevard (City of Aventura).

Segment 1 (Davie Road to Old Griffin Road)

Segment 1 includes both the proposed South Fort Lauderdale and the Lauderdale-Hollywood International Airport Stations and includes the land associated with the Fort Lauderdale-Hollywood International Airport. The noise and vibration sensitive land uses and receptors of interest (i.e., Receptors 1-S1 through 8-S1) within Segment 1 are shown in **Figure 4.5** (**Sheets 1 through 6**). Low density residential land use occurs between Davie Road and SW 24th Street and generally behind commercial businesses adjacent to the FEC Railway tracks. Five of the closest residences were selected as receptors of interest to be evaluated for potential impacts (i.e., Receptors 1-S1, through S3-S1 and S6-S1 through S8-S1). Poinciana Crossing Apartments, a recently constructed multi-family residential building, is located adjacent to FEC Railway tracks (Receptor 5-S1). Croissant Park with recreational facilities (i.e., athletic fields, pool, recreation center and playground) is located adjacent to the west of the FEC Railway tracks and south of SW 17th Street (Receptor 3-S1). The MUSE Center for the Arts building is one of the closest institutional land uses in the vicinity of the FEC Railway tracks (Receptor 4-S1). Broward Health Medical Center and other medical facilities are also located to the east of the FEC Railway tracks and the proposed South Fort Lauderdale Station.

Segment 2 (Old Griffin Road to Sheridan Street)

Segment 2 is located within the City of Dania Beach and does not include one of the proposed BCR South Stations or any track improvements. The noise and vibration sensitive land uses and receptors of interest (i.e., Receptors 1-S2 through 67-S2) within Segment 2 are shown in **Figure 4.5** (**Sheets 6, 7, and 8**). Low and medium residential land uses occur both east and west but not adjacent to the FEC Railway tracks. Existing two-lane roads (i.e., NW and SW 4th Avenues, and Phippen Waiters Road) with posted speeds of 30 MPH are located directly adjacent to the FEC Railway ROW. There are several multi-family buildings including College Gardens Apartments (Receptors 36-S2 and 37.1-S2) located northwest of Sheridan Street. There are several hotels that are located to the east of the FEC Railway tracks and north of Stirling Road including Comfort Suites, Holiday Inn Express & Suites (Receptor 11-S2), Wyndam Garden Hotel (Receptor 13-S2) and Hotel Morrison as well as several community/assisted living facilities including Dismas

Charities Dania Center (Receptor 12-S2) and Residences at Dania Beach (Receptor 22-S2). There are also several institutional land uses along this segment of the FEC Corridor including Holocaust Documentation and Education Center (Receptor 9-S2), Dania Lions Club (Receptor 48-S2), Chester Byrd Park (Receptors 32-S2 and 33-S2), West Lawn Memorial Cemetery (Receptors 34-S2 and 35-S2) and Dania Memorial Park (Receptors 58-S2 and 59-S2) and places of worship including New Dania Church, Dania Church of God (Receptor 5-S2), Saint Beth Missionary Baptist Church, and Lael Baptist Church (Receptor 60-S2).

Segment 3 (Sheridan Street to Pembroke Road)

Segment 3 is located within the City of Hollywood and includes the proposed Hollywood Station and associated track improvements to be located north of Hollywood Boulevard. The noise and vibration sensitive land uses and receptors of interest (i.e., Receptors 1-S3 through 47-S3) within Segment 3 are shown in **Figure 4.5** (**Sheets 8 through 12**). Due to existing roads, none of the noise and vibration sensitive land uses are located adjacent to FEC Corridor. Dixie Highway is located along the west side with 3- to 4-southbound lanes and posted speed of 40 MPH. 21st Avenue is located along the east side with 2- to 3-northbound lanes with a posted speed of 35 MPH and with on street parking. Low and medium density residential land uses occur east and west of the FEC Corridor and are generally behind commercial businesses/developments. There are several multi-family buildings including Warrenton House Condominiums (Receptor 21-S3), University Station (Affordable Housing) currently under construction (Receptor 28-S3), Hollywood Station Condominiums (Receptor 31-S3) and the Lofts at Hollywood Condominiums (Receptor 32-S3). There is also a community facility, The Caring Place Broward Outreach Center (Receptor 11-S3) located on the east of the FEC Corridor and north of Taft Street. There are also several institutional land uses along this segment of the FEC Corridor including Avant Garde Academy (Receptor 12-S3), American Legion Post (Receptor 30-S3), Dowdy Field (Receptor 19-S3), and Poinciana Park (Receptor 43-S3) and several places of worship including Russian-Ukrainian Baptist Church (Receptor 9-S3) and Romanian Temple Seventh Day Adventist (Receptor 15-S3).

Segment 4 (Pembroke Road to SE/SW 11th Street)

Segment 4 is located within the City of Hallandale Beach and does not include one of the proposed BCR South Stations or any track improvements. The noise and vibration sensitive land uses and receptors of interest (i.e., Receptors 1-S4 through 35-S4) within Segment 4 are shown in **Figure 4.5** (**Sheets 12, 13, and 14**). Due to existing roads, none of the noise and vibration sensitive land uses are located adjacent to FEC Corridor. Dixie Highway is located along the west side with 4 southbound lanes and a posted speed of 35 MPH. 1st Avenue is located on the east side with 2 northbound lanes and a posted speed of 30 MPH. Low and medium density residential land uses occur east and west of the FEC Corridor and are generally behind commercial businesses/ developments. There are a couple of multi-family buildings including Hallandale Village (Receptor

Site 16-S4) and Hallandale Gardens Apartments (Receptor S21-S4). There are also several institutional land uses along this segment of the FEC Corridor including American Legion (Receptor 18-S4), Hallandale Beach YMCA (Receptors 23-S4 and 24-S4), Learning Academy, Aventura Surgery Center (Receptor 27-S4), and Learning Corner (Receptor 28-S4) and several places of worship including Ebenezer Baptist Church (Receptor 2-S4), Hallandale Church of Christ (Receptor 6-S4), Spirt of Life Church (Receptor 11-S4), Victory Christian Church Ministries (Receptor 12-S4) and Maranatha Christian Church (Receptor 25-S4).

Segment 5 (SE/SW 11th Street to Aventura Boulevard)

Segment 5 is located within the City of Aventura/Miami-Dade County and does not include one of the proposed BCR South Stations or any track improvements. The existing Aventura Brightline Station is located just south of Aventura Boulevard and the BCR South project limits (see **Figure 4.5 Sheet 16**). The noise and vibration sensitive land uses and receptors of interest (i.e., Receptors 1-S5 through 16-S5) within Segment 5 are shown in **Figure 4.5** (**Sheets 14, 15, and 16**). Due to existing roads, none of the noise and vibration sensitive land uses are located adjacent to FEC Corridor. West Dixie Highway is located on the west side and is a 2-lane road with a posted speed of 35 MPH. East Dixie Highway is located along the east side and is a 2-lane road with a posted speed of 30 MPH. Low and medium density residential land uses occur east and west of the FEC Corridor with some located behind commercial businesses/developments. There are a couple of multi-family buildings including Aventura Place Apartments (Receptors 2-5S and 3-5S) and Midtown Aventura Apartments (Receptors 14-S3, 15-S3, and 16-S3). There is also a medical facility, The Palm Gardens Health & Rehabilitation Center (Receptor 9-S5). There are also several other institutional land uses along this segment of the FEC Corridor including Aventura Waterways K-8 Center (Receptor 6-S5), Beth Torah Benny Rock Campus, and Kids Learning Adventure Schools.

4. Noise Assessment

This section includes an introduction to basic noise concepts and common noise sources (**Section 4.1**), noise impact criteria (**Section 4.2**), existing or ambient noise levels (**Section 4.3**), noise impact assessment and consideration of noise abatement measures if warranted (**Section 4.4**).

4.1 Human Perception of Noise

Various descriptors are used to quantify noise from commuter rail sources including a sound's loudness, duration, and tonal character. Overall noise level is commonly based on the A-weighted decibel [dB(A)]. The A-weighting takes into account the human ear's response to audible frequencies. Typically, a 3 dB(A) change in sound level is barely perceptible to the human ear. A 5 dB(A) change is more readily noticeable. A 10 dB(A) increase is perceived as twice as loud.

The two main dB(A) descriptors or metrics used to determine impacts related to rail projects are the hourly equivalent sound level [Leq(h)] and the day-night sound level (Ldn). Leq(h) is the steady-state sound level that contains the same amount of acoustic energy as the actual time-varying sound level over a one-hour period. Ldn represents the cumulative noise exposure from all events over a full 24 hours, with events between 10 PM and 7 AM increased by 10 decibels to account for greater nighttime sensitivity to noise.

For reference, sound levels of typical noise sources and environments are provided in **Table 4.1**. **Figure 4.1** shows some comparisons of typical sound levels [dB(A)] between transit and non-transit sources. **Figure 4.2** shows some comparisons of hourly Leq(h) between transit and non-transit sources. Examples of typical Ldns for transit and non-transit sources are shown in **Figure 4.3**. Typical Ldns range between 35 dB(A) and 85 dB(A) depending upon whether the environment is rural or urban and the presence of existing transportation sources such as railroads, highways, and airports. Ldn of 50 is a relatively quiet 24-hour period whereas 70 Ldn is extremely loud.

4.2 Noise Exposure Impact Criteria

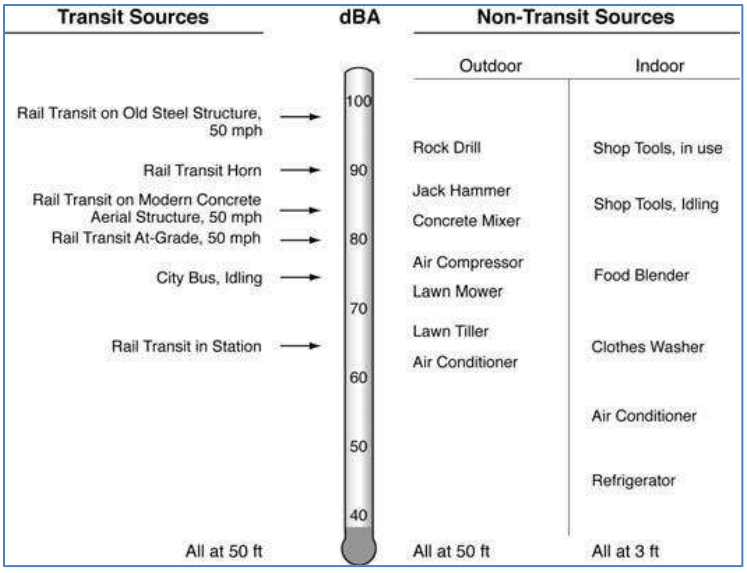
Noise impacts from the proposed BCR South project were based on the criteria defined in FTA's Transit Noise and Vibration Manual (September 2018) for new sources of transit noise in the adjacent communities within the project area (i.e., Option A). Noise impact criteria for transit sources and descriptors depend on land use and are designated Category 1, Category 2, or Category 3 by FTA (see **Table 4.2**). Category 1 includes uses where quiet is an essential element in their intended purpose, such as Indoor concert halls or outdoor concert pavilions or National Historic Landmarks where outdoor interpretation routinely takes place. Category 2 includes residences and buildings where people sleep. Category 3 includes institutional land uses with

Table 4.1: Sound Levels of Typical Noise Sources and Environments

COMMON OUTDOOR ACTIVITIES	NOISE LEVEL dB(A)	COMMON INDOOR ACTIVITIES
	---110---	Rock Band
Jet Fly-over at 1000 ft		
	---100---	
Gas Lawn Mower at 3 ft		
	---90---	
Diesel Truck at 50 ft, at 50 mph		Food Blender at 1 m (3 ft)
	---80---	Garbage Disposal at 1 m (3 ft)
Noise Urban Area (Daytime)		
Gas Lawn Mower at 100 ft	---70---	Vacuum Cleaner at 10 ft
Commercial Area		Normal Speech at 3 ft
Heavy Traffic at 300 ft	---60---	
		Large Business Office
Quiet Urban Daytime	---50---	Dishwasher Next Room
Quiet Urban Nighttime	---40---	Theater, Large Conference
Quiet Suburban Nighttime		Room (Background)
	---30---	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall
	---20---	(Background)
	---10---	
		Lowest Threshold of Human
Lowest Threshold of Human Hearing	---0---	Hearing

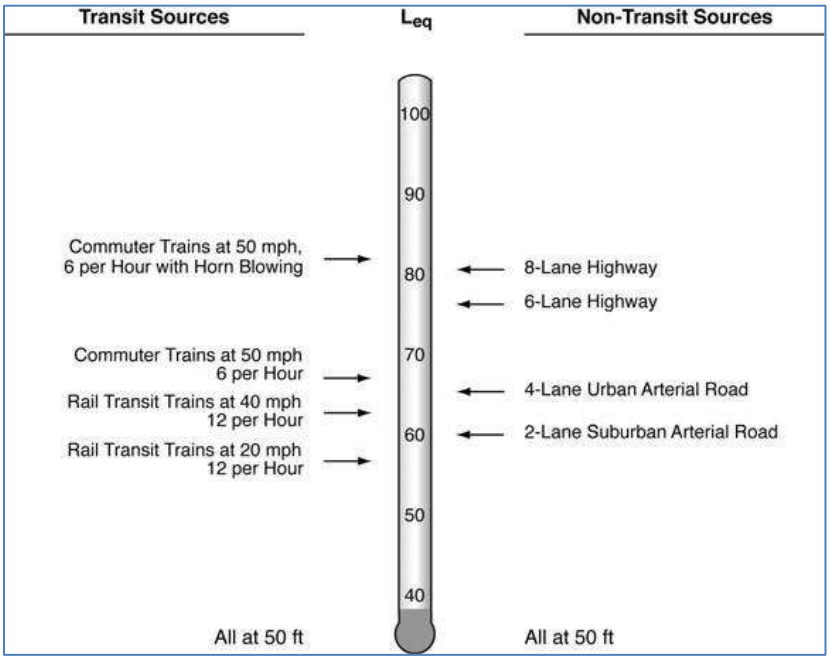
Source: California Dept. of Transportation Technical Noise Supplement, Oct. 1998, Page 18.

Figure 4.1: Comparisons of Typical Sound Levels for Transit and Non-Transit Sources



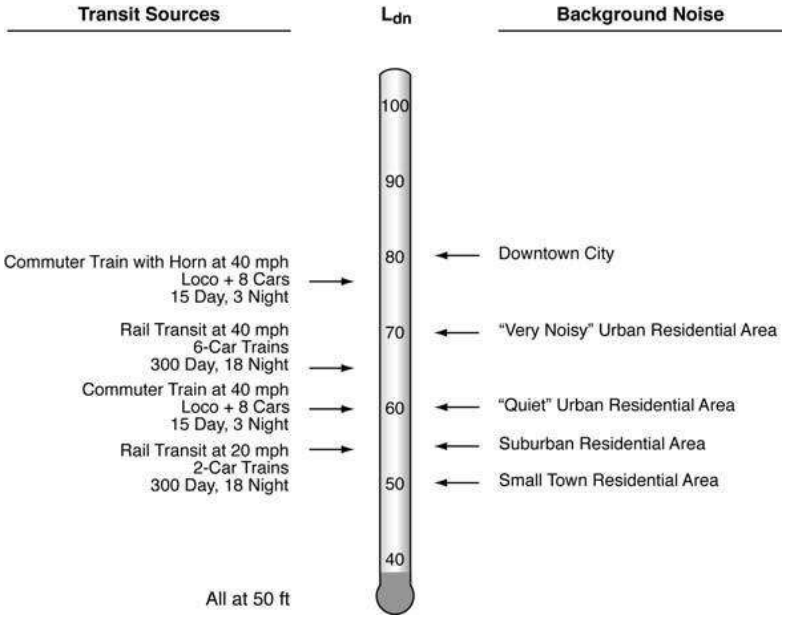
Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

Figure 4.2: Typical Hourly Leq's Sound Levels for Transit and Non-Transit Sources



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

Figure 4.3: Typical Ldn's



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018

Table 4.2: Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Land Use Type	Noise Metric, dBA	Description of Land Use Category
1	High Sensitivity	Outdoor $L_{eq(1hr)}$*	Land where quiet is an essential element of its intended purpose. Example land uses include preserved land for serenity and quiet, outdoor amphitheaters and concert pavilions, and national historic landmarks with considerable outdoor use. Recording studios and concert halls are also included in this category.
2	Residential	Outdoor Ldn	This category is applicable all residential land use and buildings where people normally sleep, such as hotels and hospitals.
3	Institutional	Outdoor $L_{eq(1hr)}$*	This category is applicable to institutional land uses with primarily daytime and evening use. Example land uses include schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also included in this category.

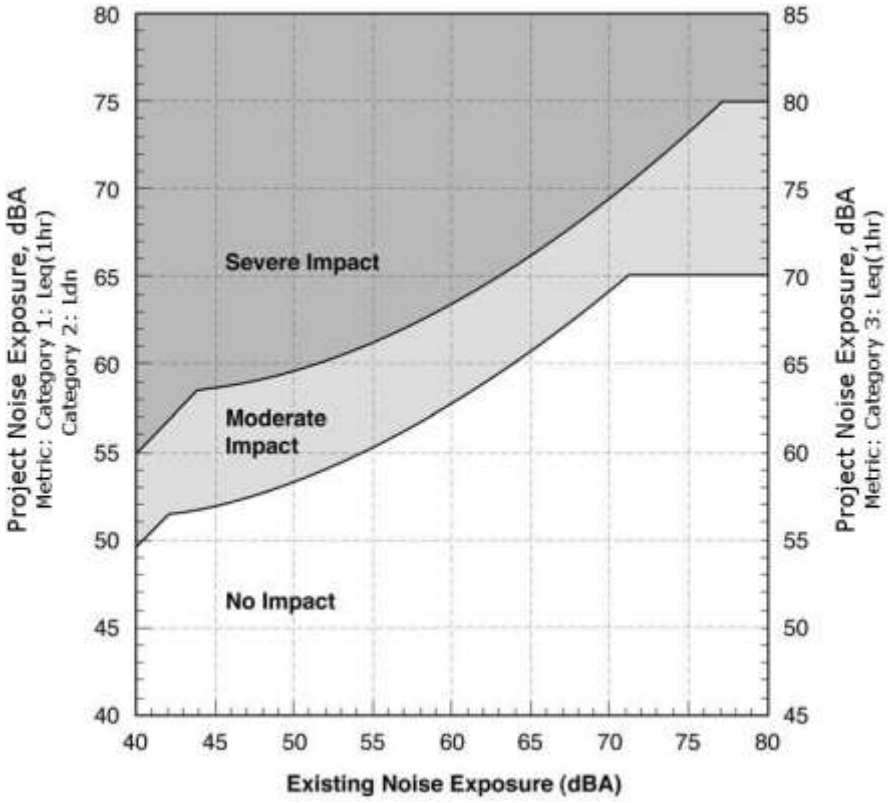
*Leq(1hr) for the loudest hour of project-related activity during hours of noise sensitivity.

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

primarily daytime and evening use such as schools, places of worship and libraries. The appropriate noise metrics for the assessment of potential impacts are dependent upon the land use category. The noise metric for residential (Land Use Category 2) is the Ldn (i.e., day-night sound level) and for outdoor institutional and highly sensitive land uses (Land Use Categories 1 and 3) is the Leq(h) (i.e., the hourly equivalent sound level). The type of noise-sensitive land uses within the project area described in **Section 3** include noise-sensitive land uses in Categories 2 and 3, but not Category 1 (i.e., Highly Sensitive).

FTA's noise impact criteria for new transit sources are based on comparison of future project noise levels to existing noise levels. As illustrated in **Figure 4.4**, the severity of noise impact is characterized by two curves. The left vertical axis in **Figure 4.4** applies to FTA's land use Categories 1 and 2 and the right vertical axis to Category 3. Noise levels above the top curve are considered to cause *Severe Impact,* resulting in a substantial percentage of people living in the area to be highly annoyed by the new noise source. Noise levels in the range between the two curves are deemed to cause *Moderate Impacts* and levels below the bottom curve are deemed to result in *No Impact* to the community. The same information in tabular format is provided in **Table 4.3**.

Figure 4.4: Noise Impact Criteria for Transit Projects



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

4.3 Measurements of Existing Noise Conditions

Noise measurements were performed at representative noise-sensitive receptors of interest within the adjacent communities to estimate the existing or ambient noise levels, also referred to as existing cumulative noise exposure levels, at these locations. As described in **Section 4.2**, calculated existing noise levels are based on measurements at representative noise sensitive receptors and are compared to project noise levels to assess potential impacts of the proposed BCR South project improvements including the additional train operations on the FEC Corridor. Existing noise measurements were performed in accordance with *Section 4.5* of *FTA's Transit Noise and Vibration Manual* (September 2018). Measurements were performed using Larson-Davis Model 870 sound-level meters using the A-weighted frequency scale dB(A) with the microphone approximately 5 feet above the land surface.

Noise measurements were performed at 27 representative sites at 12 locations along the FEC Corridor to provide an estimate of the existing noise levels at the adjacent noise-sensitive receptors of interest. At each of the 12-monitoring locations (i.e., MS-1 through MS-12), 2 to 3

Table 4.3: Noise Levels Defining Impacts for Transit Projects

Existing Noise Exposure, dBA	Project Noise Impact Exposure, dBA					
	Category 1 ($L_{eq(1hr)}$) or 2 (L_{dn}) Sites			Category 3 Sites ($L_{eq(1hr)}$)		
$L_{eq(1hr)}$ or L_{dn}	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

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

sites were selected to represent the closest noise receptors of interest, noise receptors between 200 to 400 feet, and those noise receptors located behind existing buildings (i.e., MS-1.1 through MS-12.2). Noise monitoring was performed for 1- to 3-hour intervals at each of the 12 monitoring locations as summarized in **Table 4.4**.

The locations of the 27 monitoring sites are described in **Table 4.4** and depicted in **Figure 4.5** located at the end of **Section 4.4**. **Table 4.4** includes the dates and times of the noise measurements, FTA's Land Use Category, distances to nearest major noise source(s) (e.g., FEC Railway tracks), the number of noise sensitive sites represented, as well as the monitored hourly noise levels and the calculated existing Ldn noise level. Description of the train operations during these hourly monitoring events are also summarized in **Table 4.4** (i.e., the type, number of locomotives, number of cars, and average speeds).

The primary source of noise along the FEC Corridor is from existing Brightline and FEC Railway freight trains and traffic on the nearby roads. Due to the existing Quiet Zones along this segment of the FEC Corridor, the use of warning horns was limited during the noise monitoring periods. The measured Leq(h) ranged from 54 dB(A) at MS-2.2 and MS-5.2 to 73 dB(A) at MS-8.1. The loudest measured existing cumulative noise levels [i.e., Leq(h)] were associated with the monitoring periods that included noise from a freight train and two to three Brightline trains including Monitoring Locations: MS-1, MS-2, MS-3, MS-8, MS-9, MS-11, and MS-12. Since these monitored levels represent the loudest hour of project-related activity, per FTA's procedures, they were used to determine existing noise exposure levels for the representative receptor used to assess for the potential noise impacts.

The existing noise levels to be used in the assessment of noise impacts were based on methods described in Appendix E: Determining Existing Noise of the FTA's *Transit Noise and Vibration Impact Assessment Manual* (September 2018). Existing noise levels for non-residential land uses (i.e., Land Use Category 3) were determined using Option 1 that is based on one-hour noise measurements [i.e., leq(hr)] between 7 AM and 7 PM. For residential areas (i.e., Land Use Category 2), existing noise levels were determined using Option 4 and considered appropriate due to the numerous noise-sensitive sites along the project corridor potentially impacted by the BCR South project. As identified in **Section 3**, 186 representative noise-sensitive receptors were selected to represent the closest residential and other noise sensitive land uses adjacent to the FEC Corridor. Option 4 computes existing noise levels (i.e., Ldn) based on one-hour noise measurements [i.e., Leq(hr)] at residential sites and then adjusted to represent when measurements were performed. For measurements between 7 AM and 7 PM, Ldn = Leq(h) – 2 (Equation E-2), for measurements between 7 PM and 10 PM, Ldn = Leq(h) +3 (Equation E-3), and for measurements between 10 PM and 7 AM, Ldn = Leq(h) +8 (Equation E-4).

Table 4.4: Monitored Existing Cumulative Noise Exposure Levels at Representative Noise Sensitive Land Uses

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BROWARD COMMUTER RAIL (BCR) SOUTH
PROJECT DEVELOPMENT & ENVIRONMENT (PD&E) STUDY

BROWARD COMMUTER RAIL (BCR) SOUTH
PROJECT DEVELOPMENT & ENVIRONMENT (PD&E) STUDY

4.4 Noise Impact Assessment and Noise Mitigation Considerations

As described in **Section 3**, noise sensitive land uses are located along the FEC Corridor and are potentially impacted by the BCR South project since they are within FTA's Screening Distances for Noise Assessments of 750 feet for commuter rail projects. Therefore, FTA's Detailed Noise Analysis procedures were used to estimate the project related noise at representative noise-sensitive receptors of interest along the FEC Corridor to determine the extent and severity of impacts associated with the BCR South project. As identified in **Section 3**, 186 representative noise-sensitive receptors were selected within the five noise study segments to represent the closest residential and other noise sensitive land uses adjacent to the FEC Corridor potentially impacted by the BCR South project. The locations of these representative noise-sensitive receptors (i.e., Receptors 1-S1 through 16-S5) are shown in **Figure 4.5** and described in **Table 4.5** including FTA Land Use Category, number of noise sensitive sites represented (e.g., dwelling units for residential land uses), and distance to the centerline of the nearest FEC Railway tracks.

The project noise levels associated with BCR South train operations at the representative receptors were calculated using FTA's Noise Impact Assessment Spreadsheet (October 1, 2018) and procedures from FTA's *Transit Noise and Vibration Impact Assessment Manual* (September 2018). This includes the use of the default reference sound exposure level (SEL) at 50 feet from the track, for diesel-electric locomotives (92 SEL) and rail cars (82 SEL) in the FTA's Spreadsheet per Table 4-9 *Reference SEL's 50 feet from Track and at 50 mph, One Vehicle* in FTA's 2018 Manual. The analysis performed to determine the project noise and impacts is based on the existing noise level (see **Section 4.3**), type/description of trains (i.e., locomotive(s) and number of cars), average number of train events or operations per hour during the daytime and nighttime, train operating speed, the distance to the noise receptor, and the number of the intervening rows of buildings. The analysis also includes the idling times at stations and the duration of the warning bells at crossings. As described in **Section 4.2** and shown on **Figure 4.4**, FTA's noise impact criteria for new transit sources are based on comparison of future project noise levels to existing noise levels.

The following summarizes the types, numbers, and characteristics of the train operations used to calculate the noise levels associated with the BCR South project. The typical BCR South train will include one Diesel-Electric locomotive with an average of 4 cars and operate with 60-minute base headways, with 30-minute peak service, and 60-minute weekend and holiday service. The weekday peak hours are estimated to be between 5 AM and 9 AM and 4 PM to 8 PM as described in **Section 1.1**. Based on preliminary train schedules, the average number of BCR South train operations per hour will be 2.57 between 7 AM and 10 PM and 1.14 trains per hour between 10 PM and 7 AM. An average operating speed of the BCR South Trains of 79 MPH were used in the noise analysis except south of the Fort Lauderdale-Hollywood International Airport where the speed used was

reduced to 55 MPH and in the vicinity of the three stations where the speeds were reduced to 20 MPH. The noise from idling locomotives at the proposed BCR South Stations were based on an average idling time of 3 minutes. Stationary warning bells at crossings are expected to operate for 20 seconds prior to and after every train passes by.

Due to the presence of designated quiet zones along this segment of the FEC Corridor, horn noise from trains approaching crossings were not evaluated. In a Quiet Zone, engineers have been directed to cease the routine sounding of their horns when approaching public highway-rail grade crossings except for emergency situations. It should also be noted that the BCR South project will not substantially increase vehicular traffic, the capacity of any roadways, nor does it change the horizontal or vertical geometry of any roadways. Therefore, the potential for traffic noise impacts associated with the proposed action including any new parking facilities was considered minimal and was not evaluated. The proposed new parking facility (i.e., garage) and drop-off-lanes at the proposed South Fort Lauderdale Station (see **Figure 2.2**) that will be designed to accommodate 400 parking spaces, is expected to increase the traffic along SW 1st Avenue between SW 15th Street and SW 17th Street slightly during the AM and PM peak hours. However, there are not any noise-sensitive sites located in this area that are potentially impacted by the change in traffic along SW 1st Avenue (see **Figure 4-5 Sheet 1**). Also, traffic volumes would have to double in the surrounding areas to result in a noticeable change [i.e., a 3 dB(A)] which would not be expected since this project involves a parking facility and does not increase roadway capacity. As mentioned in **Section 3**, typically, a 3 dB(A) change in sound level is barely perceptible to the human ear.

The results of the detailed noise impact assessment for the representative noise-sensitive receptors within the five noise segments are summarized in **Table 4.5**. For each of the representative receptors, the existing noise levels, and future project noise levels as well as the project noise level when moderate or severe impacts occur are presented in **Table 4.5**. The future project noise levels at each of the noise-sensitive receptors were compared to the levels that would result in moderate or severe noise impacts. None of the future noise levels associated with the BCR South project were equal to or exceeded FTA's moderate or severe impact criteria. Therefore, the BCR South project is not expected to result in any moderate or severe noise impacts or require consideration of noise abatement measures. The project noise levels at the representative noise-sensitive receptors that ranged from 46 dB(A) to 63 dB(A) were less than the existing Leq(h) and Ldn noise levels, ranging from 53 dB(A) to 73 dB(A).

The cumulative noise levels with the project ranged from 55 dB(A) to 73 dB(A) and were similar to the range of the existing Leq(h) and Ldn noise levels. In addition, many of the representative noise-sensitive receptors along the FEC Corridor will not experience an increase in cumulative noise exposure levels with the BCR South project as summarized in **Table 4.5**. Some receptors will experience a slight increase of cumulative noise exposure levels of 1 to 3 dB(A). The slight

increase is not considered a significant change since a 3 dB(A) change in sound level is barely perceptible to the human ear. The low number of trains per hour/day and the speeds of the BCR South commuter trains help minimize the duration of the noise event minimizing the change to the existing ambient or cumulative noise exposure levels.

Table 4.5: Noise Impact Analysis at Representative Receptors

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BROWARD COMMUTER RAIL (BCR) SOUTH
PROJECT DEVELOPMENT & ENVIRONMENT (PD&E) STUDY

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BROWARD COMMUTER RAIL (BCR) SOUTH
PROJECT DEVELOPMENT & ENVIRONMENT (PD&E) STUDY

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BROWARD COMMUTER RAIL (BCR) SOUTH
PROJECT DEVELOPMENT & ENVIRONMENT (PD&E) STUDY

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Figure 4.5: Noise and Vibration Analysis Map

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5. Vibration Assessment

Common sources of ground-borne vibration are trains, buses on rough roads, and construction (e.g., blasting, pile driving, and heavy earthmoving equipment). Ground-borne vibration can be an issue when it is perceptible to building occupants in the form of rattling objects, rumbling building surfaces, or causes structural damage. The rumbling sound caused by the vibration of room surfaces is called ground-borne noise. Building damage is not a concern for most transportation projects, with the occasional exception of blasting and pile driving during construction. Common vibration sources and the human and structural response to ground-borne vibration are shown in **Figure 5.1**.

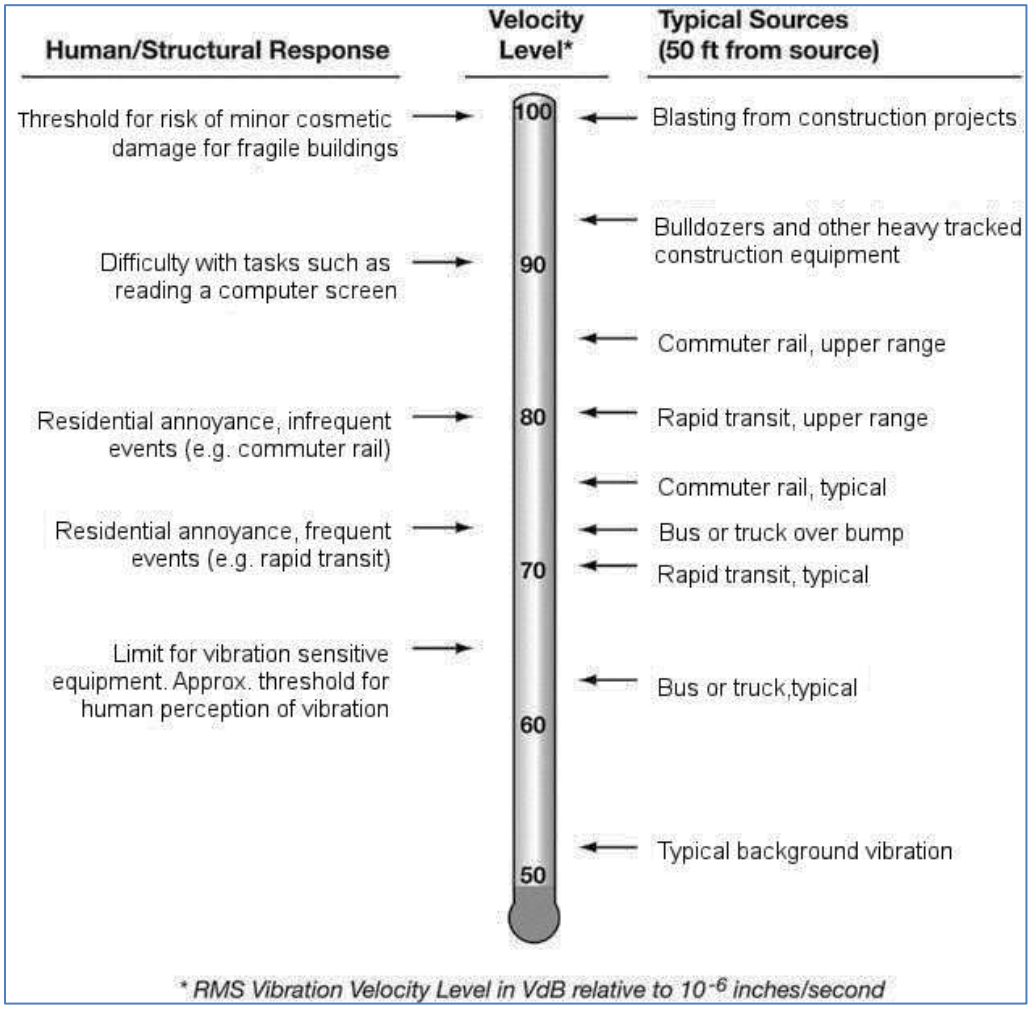
The BCR South project is anticipated to generate some ground-borne vibration and noise associated with train operations along the proposed FEC Corridor. The potential for the project to impact vibration sensitive land uses is dependent upon the type and distance from the railroad tracks. Vibration sensitive land uses are grouped into "Special Buildings" and Categories 1 (High Sensitivity), 2 (Residential), and 3 (Institutional) by FTA. Descriptions of each of these land use types are summarized in **Table 5.1**.

5.1 Vibration Screening Procedure

FTA's Vibration Screening Procedures were used to assess the likelihood of significant ground-borne vibration and noise impacts associated with the proposed BCR South project. FTA has developed screening distances for each of the land use categories. The trains associated with BCR South project fall under the Conventional Commuter Railroad category. The screening distances for this category are depicted in **Table 5.2**.

As described in **Section 3**, representative noise- and vibration-sensitive receptors were selected within the five noise study segments to represent the closest residential and other noise sensitive land uses adjacent to the FEC Corridor potentially impacted by the BCR South project. The locations of these representative receptor sites are shown in **Figure 4.5**. The type, description, and distance to the centerline of the tracks of these sites are summarized in **Table 4.5** in **Section 4.4**. Most of these receptors represent residential land uses, Category 2, which has a vibration assessment screening distance of 200 feet (see **Table 5.2**). There are also institutional land uses that fall under Category 3, which has a vibration assessment screening distance of 120 feet. Since there are vibration sensitive sites within the vibration screening distances along the project corridor, there is a potential for vibration impacts; therefore, FTA's General Vibration Assessment was conducted for the vibration sensitive receptors along the FEC Corridor.

Figure 5.1: Typical Levels of Ground Borne Vibration



Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

5.2 General Vibration Assessment

The purpose of the general vibration assessment is to estimate the vibration level associated with the operation of the proposed BCR South trains at the closest vibration sensitive sites and to determine if these levels exceed FTA's ground-borne vibration and noise impact criteria. Unlike FTA's and Federal Highway Administration noise impact criteria which is based on noise exposure over a period of time, the vibration criteria is based on the maximum level for a single event, the frequency of events (see **Table 5.3**), and the existing vibration conditions. FTA's ground-borne vibration and noise impact criteria for these land use categories are presented in **Table 5.4**. The impact criteria for vibrations is specified by vibration velocity level (VdB) and dB(A) for ground-

Table 5.1: Land Use Categories for General Vibration Assessment Impact Criteria

Land Use Category	Land Use Type	Description of Land Use Category
-	Special Buildings	This category includes special-use facilities that are very sensitive to vibration and noise that are not included in the categories below and require special consideration. However, if the building will rarely be occupied when the source of the vibration (e.g., the train) is operating, there is no need to evaluate for impact. Examples of these facilities include concert halls, TV and recording studios, and theaters.
1	High Sensitivity	This category includes buildings where vibration levels, including those below the threshold of human annoyance, would interfere with operations within the building. Examples include buildings where vibration-sensitive research and manufacturing* is conducted, hospitals with vibration-sensitive equipment, and universities conducting physical research operations. The building's degree of sensitivity to vibration is dependent on the specific equipment that will be affected by the vibration. Equipment moderately sensitive to vibration, such as high resolution lithographic equipment, optical microscopes, and electron microscopes with vibration isolation systems are included in this category.** For equipment that is more sensitive, a Detailed Vibration Analysis must be conducted.
2	Residential	This category includes all residential land use and buildings where people normally sleep, such as hotels and hospitals. Transit-generated ground-borne vibration and noise from subways or surface running trains are considered to have a similar effect on receivers.***
3	Institutional	This category includes institutions and offices that have vibration-sensitive equipment and have the potential for activity interference such as schools, churches, doctors' offices. Commercial or industrial locations including office buildings are not included in this category unless there is vibration-sensitive activity or equipment within the building. As with noise, the use of the building determines the vibration sensitivity.

*Manufacturing of computer chips is an example of a vibration-sensitive process.
** Standard optical microscopes can be impacted at vibration levels below the threshold of human annoyance.
*** Even in noisy urban areas, the bedrooms will often be in quiet buildings with effective noise insulation. However, ground-borne vibration and noise are experienced indoors, and building occupants have practically no means to reduce their exposure. Therefore, occupants in noisy urban areas are just as likely to be exposed to ground-borne vibration and noise as those in quiet suburban areas.

Table 5.2: Screening Distances for Vibration Assessments

Type of Project	Critical Distance for Land Use Categories* [Distance from Right-of-Way or Property Line (feet)]		
	Land Use Category 1	Land Use Category 2	Land Use Category 3
Conventional Commuter Railroad	600	200	120

*For the Vibration Screening Procedure, evaluate special buildings as follows: Category 1 – concert halls and TV theaters and auditoriums.

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, FTA Report No. 0123, September 2018.

Table 5.3: Event Frequency Definitions

Category	Definition	Typical Project Types
Frequent Events	More than 70 events per day	Most rapid transit
Occasional Events	30–70 events per day	Most commuter trunk lines
Infrequent Events	Fewer than 30 events per day	Most commuter rail branch lines

Table 5.4: Ground-Borne Vibration (GBV) and Ground-Borne Noise (GBN) Impact Criteria for General Assessment

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch /sec)			GBN Impact Levels (dBA re 20 micro Pascals)		
	Frequent Events	Occasional Events	Infrequent Events	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB *	65 VdB *	65 VdB *	N/A **	N/A **	N/A **
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

*This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a Detailed Vibration Analysis must be performed.
** Vibration-sensitive equipment is generally not sensitive to ground-borne noise; however, the manufacturer's specifications should be reviewed for acoustic and vibration sensitivity.

borne noise. For existing rail corridors with more than 12 trains per day, FTA's Impact Criteria for Considering Existing Conditions is used to assess impacts (i.e., *Table 6-5, FTA's 2018 Transit Noise and Vibration Assessment Manual*). FTA's *Table 6-5* indicates that the project will not have a vibration impact if the existing vibration exceeds the standard vibration criteria, the number of events does not increase significantly (i.e., doubles), and the project vibration does not exceed the existing vibrations by 3 VdB or more.

General vibration assessments were performed for the closest receptors along the FEC Corridor to determine if these levels exceed FTA's ground-borne vibration and noise impact criteria. Receptors 9-S2 and 14-S2 represent the closest institutional and residential receptors, respectively. Receptor 9-S2 represents the Holocaust Documentation and Education Center, a one-story building located at 303 North Federal Highway in Dania Beach and ~60 feet east of the centerline of the closest existing FEC Railway tracks. Receptor 14-S2 represents a one-story multi-family residence (i.e., duplex) located at 29 NW 4th in Dania Beach. The location of Receptors 9-S2 and 14-S2 are shown in **Figure 4.5**, **Sheet 6 of 16**. FTA's impact criteria for existing rail corridors with more than 12 trains per day was used. The number of trains per day associated with the BCR South project (i.e., ~54) would not result in the doubling of trains on the FEC Corridor.

Currently, there are approximately 62 trains per day operating on the FEC Corridor including 40 Brightline and 22 FEC Railway freight trains.

The general vibration assessment performed at these two sites is based on FTA's Generalized Ground Surface Vibration Curves shown in *Figure 6-4 of the FTA's 2018 Transit Noise and Vibration Assessment Manual* that predicts the overall ground-borne vibration as a function of distance from the source (see **Figure 5.2**). The predicted vibration levels are then adjusted to site specific conditions including vehicle speed, track condition, local geology, building type, and receiver location within the building per *Table 6-11, FTA's 2018 Transit Noise and Vibration Assessment Manual*. FTA's baseline curves assume all equipment is in good condition and that trains operate at a speed of 50 MPH. These curves are used to predict the overall ground-surface vibration as a function of distance from the source. Equation 6-1 (shown below) from the FTA's 2018 Manual's Table 6-10 *Generalized Ground Surface Vibration Equations for Locomotive Powered Passenger or Freight Curve*, was used to predict the vibration levels based on reference levels of 92.28 VdB.

Equation 6-1 (Locomotive Powered Passenger or Freight Vibration Curve):

$L_V = 92.28 + 14.81 \log(D) - 14.17 \log(D)^2 + 1.65 \log(D)^3$

L_V = *velocity level, VdB*

D = *distance (feet)*

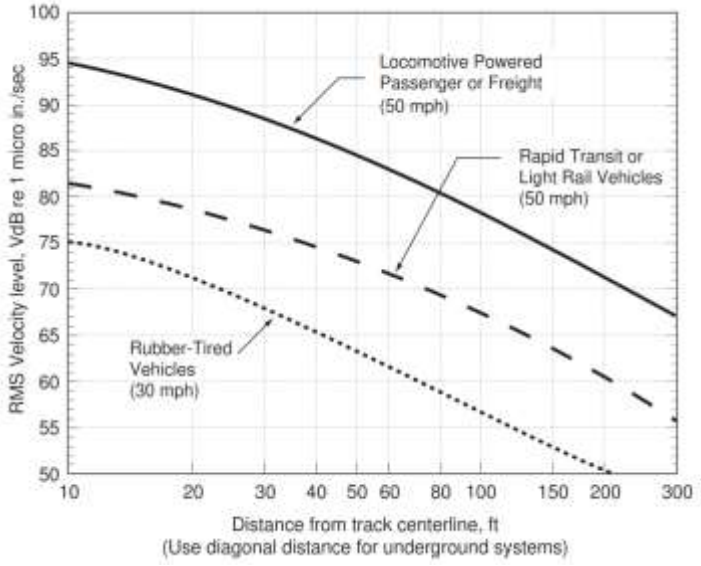
The results of the general vibration assessments for Receptors 9-S2 and 14-S2 for the BCR South project and the existing FEC Railway and Brightline train operations are summarized in **Tables 5.5 and 5.6**, respectively. These tables also include the location and description of these vibration sensitive sites, the number of trains and operating characteristics, descriptions of the adjustments to the baseline curves, and the predicted ground-borne vibration and noise levels. An estimate of the ground-borne noise was determined by reducing the predicted ground-borne vibration levels by a 50 dB adjustment factor for surface tracks as described by *Table 6-14, FTA's 2018 Transit Noise and Vibration Assessment Manual*.

As noted in **Tables 5.5 and 5.6**, the vibration levels were adjusted upward by 0.8 dB to reflect the 55 MPH operating speeds of the trains along this segment of the FEC Corridor, as opposed to 50 MPH. The subsurface conditions along this segment of the FEC Railway are unknown at this time; therefore, it was assumed that geologic conditions are such that they promote efficient vibration propagation, which added 10 dB to the baseline level. The type of building foundation also affects ground-borne vibration and noise levels. The general rule is the heavier the building the greater the coupling loss. The coupling loss for a one- and two-story masonry building represents a 7 dB reduction in the baseline level. Other factors affecting vibration levels include floor-to-floor attenuation (-2 dB) and amplification due to resonances of floors, walls, and ceilings (+6 dB).

Table 5.5: General Vibration Assessment for BCR South Project - Category 3 Land Uses (Institutional)

Table 5.6: General Vibration Assessment for BCR South Project - Category 2 Land Uses (Residential)

Figure 5.2: FTA's Generalized Gound Surface Vibration Curves



The estimated ground-borne vibration and noise levels at the closest sensitive institutional land use (Receptor 9-S2, Holocaust Documentation and Education Center) for the BCR South project, the FEC Railway freight, and Brightline train operations were 90.8 VdB and 40.8 dB(A), respectively (see **Table 5.5**). Although the 90.8 VdB exceeds the impact criteria of 78 VdB, it is not considered an impact. On existing rail lines, the build condition vibration levels need to be more than 3 VdB higher than the existing levels to be considered a vibration impact. Since the BCR South train operations are equal to those of FEC Railway freight and Brightline trains, the vibrations from BCR South train operations are not considered an impact at the closest institutional land use (Receptor 9-S2). The predicted ground-borne noise level of 40.8 dB(A) at Receptor 9-S2 is below the impact criteria of 43 dB(A).

The estimated ground-borne vibration and noise levels at the closest sensitive residential land use (Receptor 14-S2) were 87.8 VdB and 37.8 dB(A), respectively (see **Table 5.6)**. Although the 87.8 VdB exceeds the impact criteria of 75 VdB, it is not considered an impact. As noted above, to be considered a vibration impact on existing rail lines, the build condition vibration levels need to be more than 3 VdB higher than the existing levels. Since the BCR South train operations are equal to those of FEC Railway freight and Brightline trains, the vibrations from BCR South train operations are not considered an impact at the closest residential land use (Receptor 14-S2). The predicted ground-borne noise levels of 37.8 dB(A) at Receptor 14-S2 is below the impact criteria of 38 dB(A).

In summary, the BCR South train operations are not expected to result in ground-borne vibration or ground-borne noise impacts based on FTA's impact criteria for existing rail corridors with more than 12 trains per day. The vibration levels at the closest residential and institutional sensitive

receptors were not more than 3 VdB of the existing vibration conditions along the FEC Corridor associated with the FEC Railway freight and Brightline train operations. In addition, the BCR South project would not result in a significant increase in the number of train operations on the FEC Corridor (i.e., doubling).

6. Construction Noise and Vibration

Construction activities associated with the BCR South project will be limited to the areas in the vicinity of the proposed South Fort Lauderdale, Fort Lauderdale-Hollywood International Airport, and Hollywood stations. The locations of these three stations and proposed track improvements as well as the noise and vibration sensitive sites in the vicinity of these stations are shown **Figure 4.5** (**Sheets 1, 2, 4, 10, and 11**). There are no noise or vibration sensitive land uses in the vicinity of Fort Lauderdale-Hollywood International Airport. There are some noise and vibration sensitive land uses in the vicinity of the proposed South Fort Lauderdale and Hollywood Stations that may experience temporary increases in noise and vibrations levels during construction activities. This includes two multi-family residential developments, Poinciana Crossing (Receptor 5-S1) located to the south of the proposed Fort Lauderdale Station and University Station Affordable Housing (Receptor 28-S3) currently under construction adjacent to the proposed Hollywood Station. None of the adjacent land uses in the vicinity of these two stations are considered highly sensitive sites such as sound recording studios and eye centers. It is anticipated that the application of the control measures listed in the latest edition of the FDOT Standard Specifications for Road and Bridge Construction will minimize or eliminate potential construction noise and vibration impacts. Therefore, construction of the proposed stations, associated facilities, and track improvements are not expected to have any significant noise or vibration impact.

7. References

Federal Transit Administration (FTA). "Transit Noise and Vibration Impact Assessment Manual", FTA Report Number 0123, September 2018.

Florida Department of Transportation. "Highway Traffic Noise", Part 2, Chapter 18. Project Development and Environment Manual, July 1, 2023.

Florida Department of Transportation. "Standard Specifications for Road and Bridge Construction", January 2024.

Appendix A: Census Data