CSX Southwest Railroad Corridor Assessment

Final Report

Miami-Dade Transportation Planning Organization

Prepared by

TRANSYSTEMS

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Miami-Dade Transportation Planning Organization

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Executive Summary

Findings and Recommendations

The findings and recommendations of the CSX Southwest Railroad Corridor Assessment for further actions are summarized below:

Recommendations

The CSX Southwest Railroad Corridor is recommended to be incorporated into the Miami-Dade 2045 Long Range Transportation Plan (LRTP), Priority IV unfunded section, for future use as a shared freight/passenger rail corridor.

A corridor-wide land-use visioning initiative is recommended to evaluate transit supportive land-use policies that will provide increased mobility while expanding ridership and goods movement by freight service.

Interoperability between the different modes, including service, fare integration policies, balancing of ridership, and operational costs, should be coordinated in advance of implementing additional new passenger rail projects. This will result in significantly higher ridership system-wide across the region.

It is recommended that initiatives to preserve and/or expand corridor be identified and implemented, as necessary.

Findings

Joint freight and passenger rail services can be operated within the study corridor safely and efficiently provided infrastructure improvements are made in accordance with the findings of this study.

- Existing and expanded freight service can operate without significant impact with the implementation of passenger service
- A suitable level of passenger rail service can be implemented to serve the mobility needs within the corridor

All infrastructure and safety upgrades and investments required to operate passenger service will also serve freight operations.

- Initial service can be implemented as a single track with passing sidings level of infrastructure investment operating on 30/60-minute headways.
- A longer-term strategy will require full double track infrastructure to allow for more frequent service as the need arises based on corridor ridership.

Implementation of passenger service in the corridor will not significantly impact other corridor initiatives in the region including the South Dade TransitWay.

Access to CSX right-of-way will require some form of access agreement or outright purchase based on fair market value as noted in correspondence obtained from CSX dated July 24, 2023.

Providing higher frequency passenger service than 30-minute peak-period and 60 minute off peak-period requires double tracking the full corridor and a significantly larger fleet of trains.

Purpose and Alternatives

Purpose

This study was initiated by the Miami-Dade Transportation Planning Organization (TPO) to explore the possibility of establishing passenger rail service in the region. The primary study corridor runs southwestward from the Miami Intermodal Center (MIC), near the Miami International Airport (MIA), to the City of Homestead. Based on the insights gained from previous studies, TPO developed three alternatives to evaluate for joint passenger and freight rail service that could aid Miami-Dade County (MDC) with resiliency, congestion, goods movement and offer additional mobility options for residents and visitors.

Alternatives Analyzed

Building off several previous studies that evaluated all or parts of the CSX Homestead Subdivision for implementing transit service the TPO identified three distinct variations of the corridor for further evaluation. All three corridors start at the MIC at the airport and extend to the south terminating at three different locations. A brief description of these variations is described below and graphically depicted on the following page.

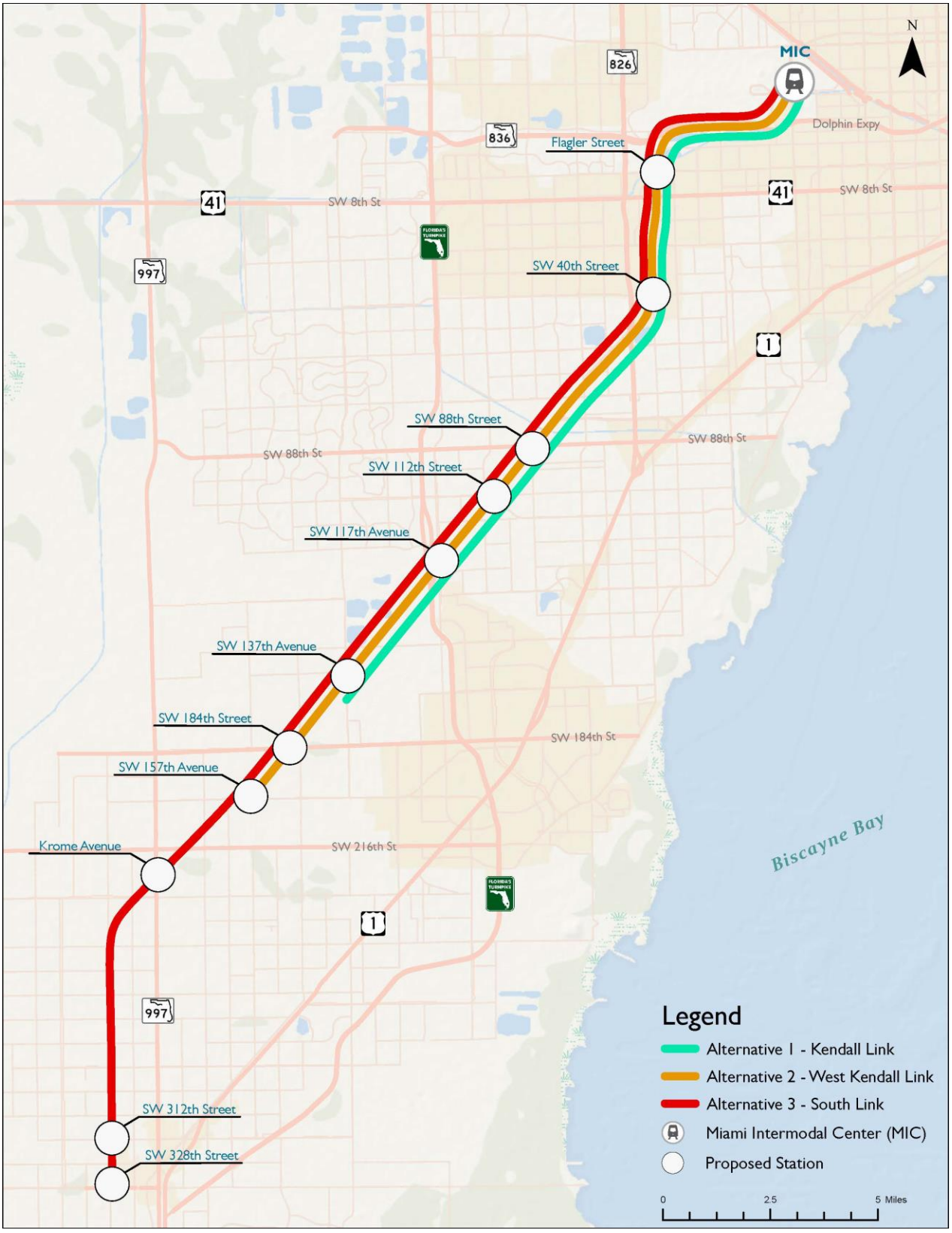
Alternative 1 Kendall Link - Corridor connects the Kendall (SW 137th) area to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative is a variation of an alternative evaluated as part of the Kendall Corridor Alternatives Analysis (Kendall Link Study).

Alternative 2 West Kendall Link - Corridor connects the West Kendall (SW 157TH) area to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative is a variation of an alternative evaluated as part of the Kendall Corridor Alternatives Analysis (Kendall Link Study).

Alternative 3 South Link - Corridor connects Florida City/Homestead (SW 328th) to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative was adapted for this study based on the South Corridor Alternatives Analysis (South Link Study).

The three alternatives are shown in Figure 1.

Figure 1 - Alternatives Evaluated



Existing Conditions

Data collected for this study included key items such as population growth, land use, operating entities, railroad rights-of-way (ROW), and infrastructure which included tracks, highway-rail at-grade crossings (HRGC), and structures (bridges) were analyzed to support informed decision-making and strategic planning regarding the three alternatives.

- **Population -** MDC has experienced an eight percent (8%) population increase between 2010 to 2021, emphasizing the need for expanded transit options
- **Land Use -** MDC has evolved from an agricultural area to a densely populated residential metropolis with high-density commercial and employment centers found along the rail corridor
- **Operating Entities -**The study illustrates that both State-operated and CSX-owned tracks extend from the MIC to the City of Homestead
- **Railroad ROW -** The width of available right-of-way varies, with urban areas having less room to work with, impacting potential project concepts and designs
- **Infrastructure –** Tracks, HRGCs, and structures were derived for the study:
    - A single set of tracks classified as "Excepted," permitting low-speed freight operations exist but will require upgrades to accommodate passenger rail
    - There are 83 open HRGCs within the study corridor, presenting potential conflict points and opportunities for enhancing safety
    - Structures were identified (bridges, culverts, and overpasses) which may impose height or weight restrictions for passenger rail vehicles
- **Existing Rail Freight Movements -** The analysis of a freight rail corridor for a potential shared use investment with passenger rail must consider the existing freight movements and future considerations are as follows:
    - For this study it was determined that that two daily round trip freight trains are in operation and for planning purposes a doubling of freight movements was assumed
    - The corridor is currently considered a "dark territory," which means it lacks signal control and relies on track warrants and train dispatchers for managing movements.

Alternatives Analysis

This study builds off several planning efforts that analyzed the potential to introduce commuter rail, light rail, or bus rapid transit to underutilized freight rail corridors southwest of Miami. These studies include the Kendall Corridor Transportation Alternatives Analysis (2007) and the CSX East-West Rail Feasibility Study (2016). A Service Plan Validation was used to develop three service plans for potential future passenger rail service along the CSX Homestead subdivision, which connects the MIC at the northern end of the corridor with the City of Homestead at the southern end. The service planning assumptions and approach were as follows:

- **Freight Operations** -
  - Two freight rail trains, round trip, per day
    - One travels down the Lehigh Spur (westward)
    - One travels down Homestead Subdivision towards Sterling Junction (south westward)
  - Trains carry approximately 20-30 cars
  - No service south of SW 152nd Street
  - Freight operations were assumed to be during off-peak periods
- **Passenger Operations** –
  - Operating hours are 5:30 AM to 11:00 PM
  - Assumed service will have 30 minute headways during peak morning (6:00 AM to 9:00 AM) and evening travel (3:00 PM to 7:00 PM)
  - All other times headways will be 60 minutes
  - Rolling stock assumed to be a push-pull consist with one diesel locomotive and two bilevel coaches and one bilevel cab car, like what is currently operated by Tri-Rail (Figure 2)
  - Assumed maximum operating speed for passenger trains is 60-mph, provided the number of stations and grade crossings along the corridor, actual average operating speed is in the range of 30-mph
  - New passenger services could use the CSX Hialeah Yard for maintenance and storage of vehicles, which is also currently utilized for those functions by Tri-Rail and Amtrak

Figure 2 - Tri-Rail Unpowered Bilevel Cab Car

- **Alternative Run Times –** For each alternative, the total mileage, and end to end travel time, viewed on Table 1.

Table 1 – Mileage and Travel Time

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Total Mileage	18	21.5	30.5
End to End Travel Time (minutes)	36	44	57

Ridership Forecasts

This section provides preliminary ridership forecasts for the alternatives using the Federal Transit Administration's (FTA) Simplified-Trips-on-Project Software (STOPS), a computer program that predicts transit travel patterns for specific scenarios. The STOPS model used in this analysis was calibrated for the region and has a base year of 2019 and a horizon year of 2045, serving as the basis for ridership forecasting for the Miami Dade SMART Plan corridors. The results are presented in terms of daily boardings.

- **Ridership Forecasts -** The 2045 trips projected by alternative are summarized in Table 2:

Table 2 - 2045 Station Level Boarding Forecasts

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Daily Trips Base Alternative (30/60)	2,700	3,000	3,800

- **Sensitivity Tests -** The sensitivity of ridership forecasts to transfer fares and improved service frequency were evaluated as part of this effort to provide stakeholders with an understanding of how specific changes in fare policy and/or service frequency could impact ridership. The project team performed an analysis to determine the potential increase in ridership over the base projection show in the above tables under two scenarios:
    - Increasing the frequency from 30/60 (peak/off-peak) to 15/30 is expected to increase the trips on project by about 55 percent. This increase in operations requires a full double tracking of the corridor.
    - Changing the transfer fares (integrated fares) to allow for free transfers between all Miami-Dade Transit routes and the project results in an increase in the trips on project by about 80 percent.

Table 3 provides the results of the sensitivity tests on each alternative evaluated.

Table 3 - 2045 Key Ridership Forecasting Metrics with Sensitivity Test Applied

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Daily Trips Base Alternative (30/60)	2,700	3,000	3,800
Daily Trips with increased frequency (15/30)	4,200	4,700	5,800
Daily Trips with integrated fares	4,900	5,500	6,800

Infrastructure Requirements and Costs

As noted previously the existing infrastructure is not in a condition to meet required federal railroad standards for passenger rail operations and as such requires a significant upgrade to provide safe and efficient operations. Based on the assessment of existing infrastructure and the need to bring that infrastructure to meet current Federal Railroad Administration (FRA) requirements the following investments will be necessary:

- **Infrastructure Needs** -
    - Track replacement or renewal to meet FRA Class 3, which allows for a maximum speed of 60 mph, although average speeds are in the 30-mph range
    - Track undercut, ballast renewal, and track surfacing
    - Construction of missing track segment linking the spur to the MIC
    - Station and siding track installation
    - Potential upgrades to existing Hialeah Yard
    - Installation of Centralized Traffic Control (CTC) signal system reinforced with Positive Train Control (PTC) system
    - All bridges reconstructed to allow for safe operation
    - New stations with low boarding passenger platforms and mini-high platforms
    - All grade crossings to be brought up to current standards with modern equipment and deployment of necessary infrastructure for "quiet zones" if possible
    - New rolling stock (train sets) to meet operational demands

The preliminary estimates of the capital costs have been developed in general accordance with FTA guidelines for estimating capital costs. Part of the FTA's guidelines call for cost estimates to be prepared and reported using the latest revision for the FTA's Standard Cost Categories (SCC). These cost categories form the basis for the format and structure that were used for the conceptual capital cost detail and summary sheets developed for this project. FTA's Capital Cost Database (CCD) was utilized to obtain historical costs reported in the database, this date was supplemented by planning level costs that have been utilized on recent projects in the greater Miami-Dade region. The unit costs are shown in 2023 dollars.

In accordance with the latest version of the FTA's SCC, the capital cost components for each proposed expansion project are be classified into the following cost categories:

- **Capital Costs Components -**
  - 10 Guideway and Track Elements
  - 20 Station, Stops, Terminals, Intermodal
  - 30 Support Facilities: Yards, Shops, and Administration Buildings
  - 40 Sitework and Special Conditions
  - 50 Systems
  - 60 Right-of-Way (ROW), Land, Existing Improvements
  - 70 Vehicles
  - 80 Professional Services
  - 90 Unallocated Contingency
  - 100 Finance Charges

These preliminary capital cost estimates do not include:

- Right-of-way access costs/access fees
- Property acquisition
- Finance Charges

Table 4 depicts the anticipated capital cost for each alternative represented in 2023 dollars.

Table 4 – Planning Level Capital Cost by Alternative

Single Track w/Sidings 30/60 min. Service Plan	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Planning Level Capital Costs	$640 - $720 Million	$731 - $860 Million	$1.07 - $1.2 Billion
Double Track 15/30 min. Service Plan	**Alternative 1 – Kendall Link**	**Alternative 2 – West Kendall Link**	**Alternative 3 – South Link**
Planning Level Capital Costs	$900 Million - $1.1 Billion	$1.1 - $1.3 Billion	$1.65 - $1.8 Billion

Table 4 demonstrates the capital cost implications of operating a high frequency service. The need for double track infrastructure combined with the for more trainsets significantly

increases the cost, the benefit of additional ridership gained verses the added expense needs to be carefully evaluated.

Once comparable operations were identified average costs were developed for application to the three alternatives under study. Utilizing the service plans developed and the average O&M costs identified costs for the various alternatives were developed as shown on Table 5. A range of costs have been presented to be conservative given the level of planning associated with this evaluation.

Table 5 - - Planning Level O&M Costs by Alternative (in 2023 Dollars)

	Alternative 1 Kendall Link	Alternative 2 West Kendall Link	Alternative 3 South Link
Annual Revenue Hours	10,000-10,500	12,000-13,000	15,000-16,500
Cost Per Revenue Hour	$1,700	$1,700	$1,700
Annual O&M Cost	$17m-$18m	$21m-$22m	$27m-$28m

Next Steps

This initial planning level analysis was performed to determine the merits of a strategy involving the implementation of a shared freight and passenger rail within the corridor. While this initial review reveals promise for such use of the corridor further steps remain in the project development process. Next steps include:

- Incorporating the corridor into the current adopted Miami-Dade TPO's 2045 Long Range Transportation Plan (LRTP) Priority IV unfunded section for future use as a shared freight/passenger corridor.
- Undertaking a land use visioning initiative to evaluate transit supportive land use policies along the corridor to provide for increased transit ridership and goods movement by freight service.
- Continue to work with Stakeholder Groups including CSX to refine the strategy for and needs of the corridor.
- At the appropriate time advance the corridor initiative through FDOT's Transit Concept and Alternatives Review (TCAR) process.
- Develop a financial strategy for project development and implementation.

1. Study Introduction

Local officials, stakeholder agencies, and the Miami Dade Transportation Planning Organization (TPO) have undertaken the CSX Rail Corridor Study to examine the feasibility of developing a passenger rail service along the CSX Homestead Subdivision, located in Miami-Dade County, Florida. The principal study area for this study is located from east to west, from the Miami Intermodal Center (MIC) near the Miami International Airport (MIA) in the vicinity of NW 37th Avenue to the City of Homestead. The eastern portion of the rail corridor is owned by the Florida Department of Transportation (FDOT), while the Homestead Subdivision segment is owned privately by CSX.

This section outlines the existing conditions related to the corridor. Information was gathered through a series investigations including previous studies and reports, discussions with stakeholders and individual on-site investigations. The existing conditions is used to establish a baseline for use in the remainder of the report.

2. Previous Studies

Several previous study efforts have examined the potential of employing shared freight and passenger rail services in the past. The following is a list of studies conducted in the region were reviewed and relevant information was gathered for this planning effort:

2.1. Miami-Dade MPO, Dade County Railroad Rights-of-Way Assessment (1993)

A study of the existing railroad network in the county, with an overall goal of determining which alignments might be useful for future development as transportation corridors, with particular emphasis on transit applications. The study goals were to: inventory all existing railroad rights-of-way in Dade County; examine these rights-of-way for their potential use in public transportation; and develop recommendations for which right-of-way corridors to study in more detail.

2.2. Miami-Dade MPO, Rail Convertibility Study (2004)

Study updates the Railroad Rights-of-Way Assessment conducted in 1993 and presents an assessment of the existing rail corridors and facilities in the County. In addition, the study assessed the potential in both the short- and long-term for using the corridors for public transportation and/or bicycle/pedestrian activities and identified innovative strategies that can maximize the potential benefits of these corridors.

2.3. Miami-Dade MPO, Kendall Corridor Transportation Alternative Analysis Final Report (2007)

This study developed short, medium, and long range rapid transit recommendations within the Kendall area in Miami-Dade County. The study area stretches from SR 836 / Dolphin Expressway in the north, SW 152nd Street in the south, US 1 to the east, and Krome Avenue

to the west. The goal of the study was to identify cost-effective, productive, and affordable means to use major transit capital investments and service improvements to strengthen mobility connections between the Kendall area and other key regional activity centers in Miami-Dade County and beyond. Portions of the CSX East-West Corridor were evaluated for passenger service.

2.4. SFRTA, Strategic Regional Transit Plan Summary (2008)

This document identifies Homestead Subdivision as possible corridor for future transit service development.

2.5. Miami-Dade MPO, Miami-Dade County CSX Corridor Evaluation Study (2009)

This is a study of possible uses for the CSX tracks and right-of-way that link the South Miami-Dade and Kendall areas with the CSX main line at Oleander Junction south of MIA. These tracks are owned by the CSX railroad and currently carry limited freight movements. This study focused on developing CSX's Homestead Subdivision for local passenger transportation. One key concern in this study was potential conflicts between existing freight and proposed passenger trains along the northern of the Homestead Sub. The study identified that most freight traffic along the Homestead originated west or south of the portion under consideration for passenger development. It therefore considered a number of options to divert freight from the Homestead by linking CSX's GPC and Lehigh Spurs with a new connecting rail line to be built on new right-of-way generally shared with a new highway.

3. Adapted Alternatives

TPO developed three alternatives to improve resiliency of the transportation network, reduce automotive congestion, and provide the citizens and visitors of Miami Dade County with another option to move throughout the region. This study will evaluate these alternatives to prepare for transit along the CSX corridor from the MIC to SW 328th Street in Homestead, Florida (Figure 3). Each alternative has the following characteristics:

3.1. Kendall Link (Alternative 1)

Corridor connects the Kendall (SW 137th Avenue) area to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative is a variation of an alternative evaluated as part of the Kendall Corridor Alternatives Analysis (Kendall Link Study). The proposed rail corridor is primarily owned by CSX with a smaller segment owed by the State of Florida.

Table 6 - Kendall Link Characteristics

Project Limits
MIC – SW 137 Avenue
Transit Mode
FRA Compliant Passenger Rail Vehicles
Stations
Sevel (7) proposed stations, including the MIC
Service Level
Proposed 30-minute peak/ 60-minute off-peak headways

Source: Miami-Dade TPO

3.2. West Kendall Link (Alternative 2)

Corridor connects the West Kendall (SW 157th Avenue) area to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative is a variation of an alternative evaluated as part of the Kendall Corridor Alternatives Analysis (Kendall Link Study). The proposed rail corridor is primarily owned by CSX with a smaller segment owed by the State of Florida.

Table 7 – West Kendall Link Characteristics

Project Limits
MIC – SW 157th Avenue
Transit Mode
FRA Compliant Passenger Rail Vehicles
Stations
Nine (9) proposed stations, including the MIC
Service Level
Proposed 30-minute peak/ 60-minute off-peak headways

Source: Miami-Dade TPO

3.3. South Link (Alternative 3)

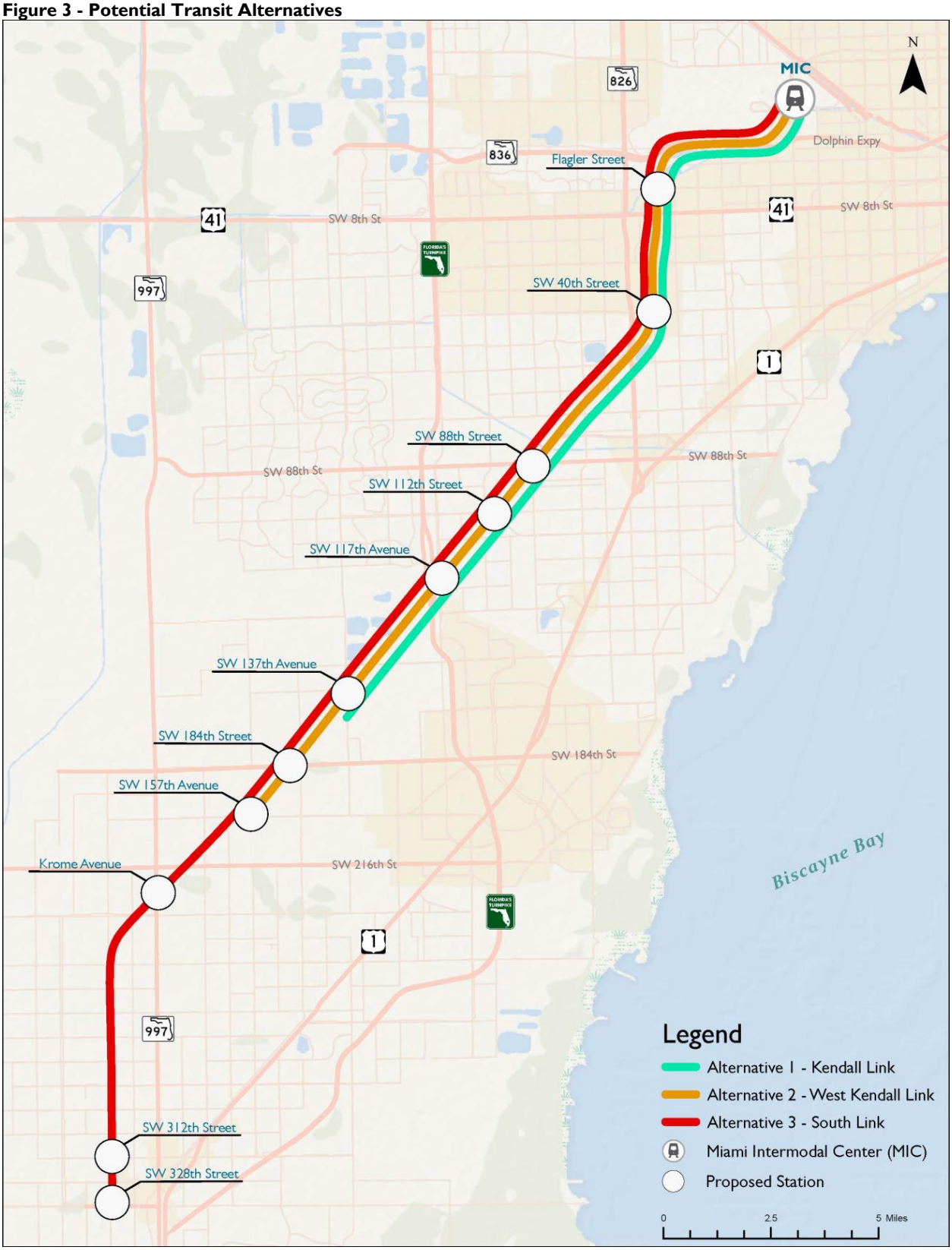
Corridor connects Florida City/Homestead (SW 328th Street) to Metrorail, Tri-Rail, and MIA, at the MIC. This alternative was adapted for this study based on the South Corridor Alternatives Analysis (South Link Study). The proposed rail corridor is primarily owned by CSX with a smaller segment owned by the State of Florida.

Table 8 - South Link Characteristics

Project Limits
MIC – SW 328th Street
Transit Mode
FRA Compliant Passenger Rail Vehicles
Stations
Eleven (11) proposed stations, including the MIC
Service Level
Proposed 30-minute peak/ 60-minute off-peak headways

Source: Miami-Dade TPO

Figure 3 - Potential Transit Alternatives



Source: Miami-Dade TPO

4. Existing Conditions

The existing conditions provide a baseline for data collection along the Study Corridor and within Miami-Dade County. Understanding the existing conditions as it relates to the population, land uses, and rail infrastructure provides a foundation for effective decision-making and strategic planning. By analyzing these key aspects, policymakers, public servants, and the community's stakeholders can work together to shape a sustainable, well-connected, and vibrant community that meets the needs of both current and future generations in Miami-Dade County.

4.1. Population

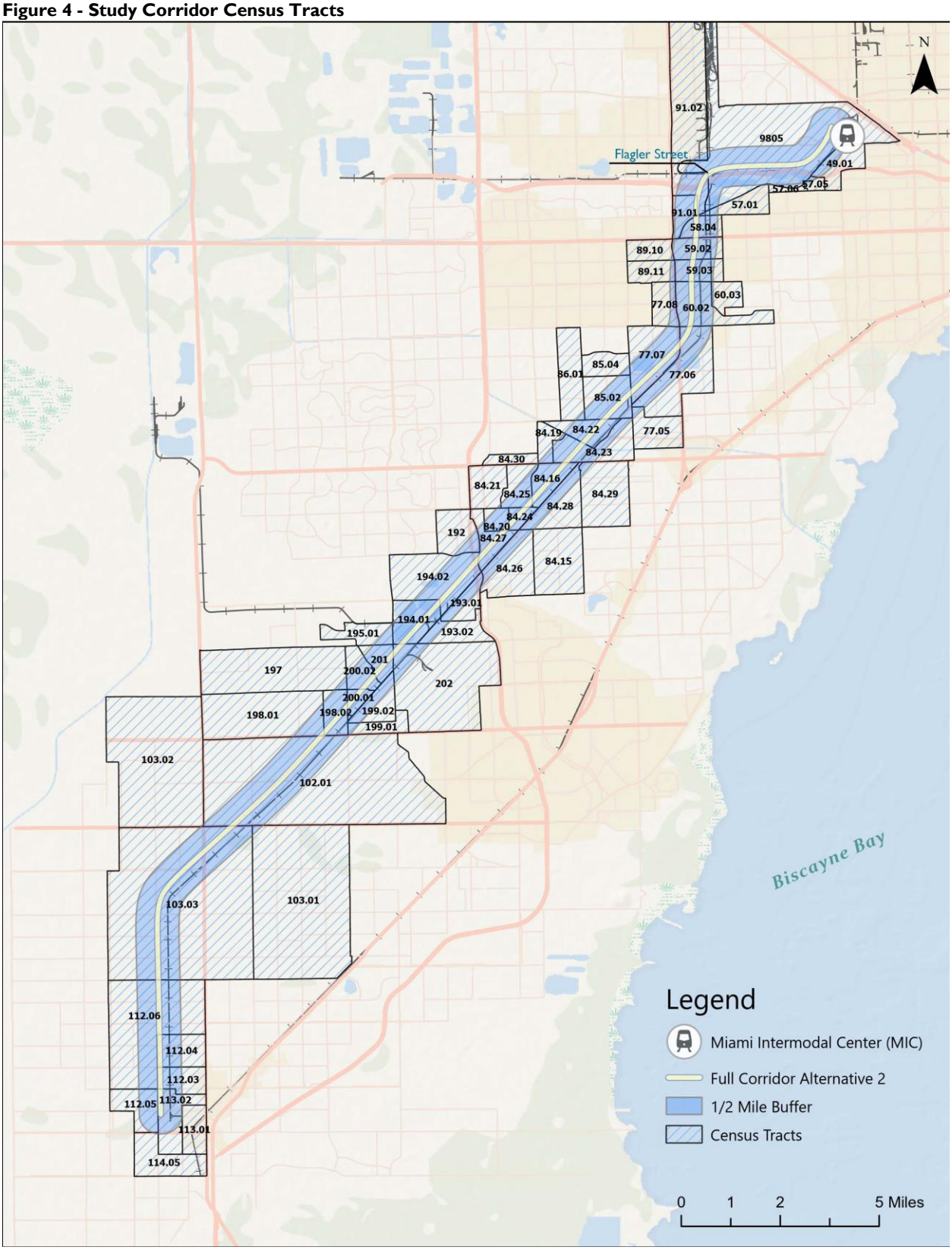
The population in Miami-Dade County continues to grow and has increased by just over eight percent (8%) from 2010 to 2021 as shown in Table 9. As the population continues to expand, more transit options are needed. Figure 4 shows a half mile radius buffer around the proposed transit corridor. Each US Census Tract that touches the half mile buffer was then used to build a population that surrounds the proposed study transit corridor. Table 9 shows the entire population within the study corridor area which has grown by approximately 2.83% between 2010 and 2021.

Table 9 - Population Statistics

Year	Study Corridor Census Tracts	Miami-Dade County
2021	241,911	2,690,113
2010	235,064	2,474,676
Percent Increase	2.83%	8.01%

Source: US Census Bureau – American Community Survey 5 Year Estimates

Figure 4 - Study Corridor Census Tracts



Source: US Census Bureau

4.2. Land Use

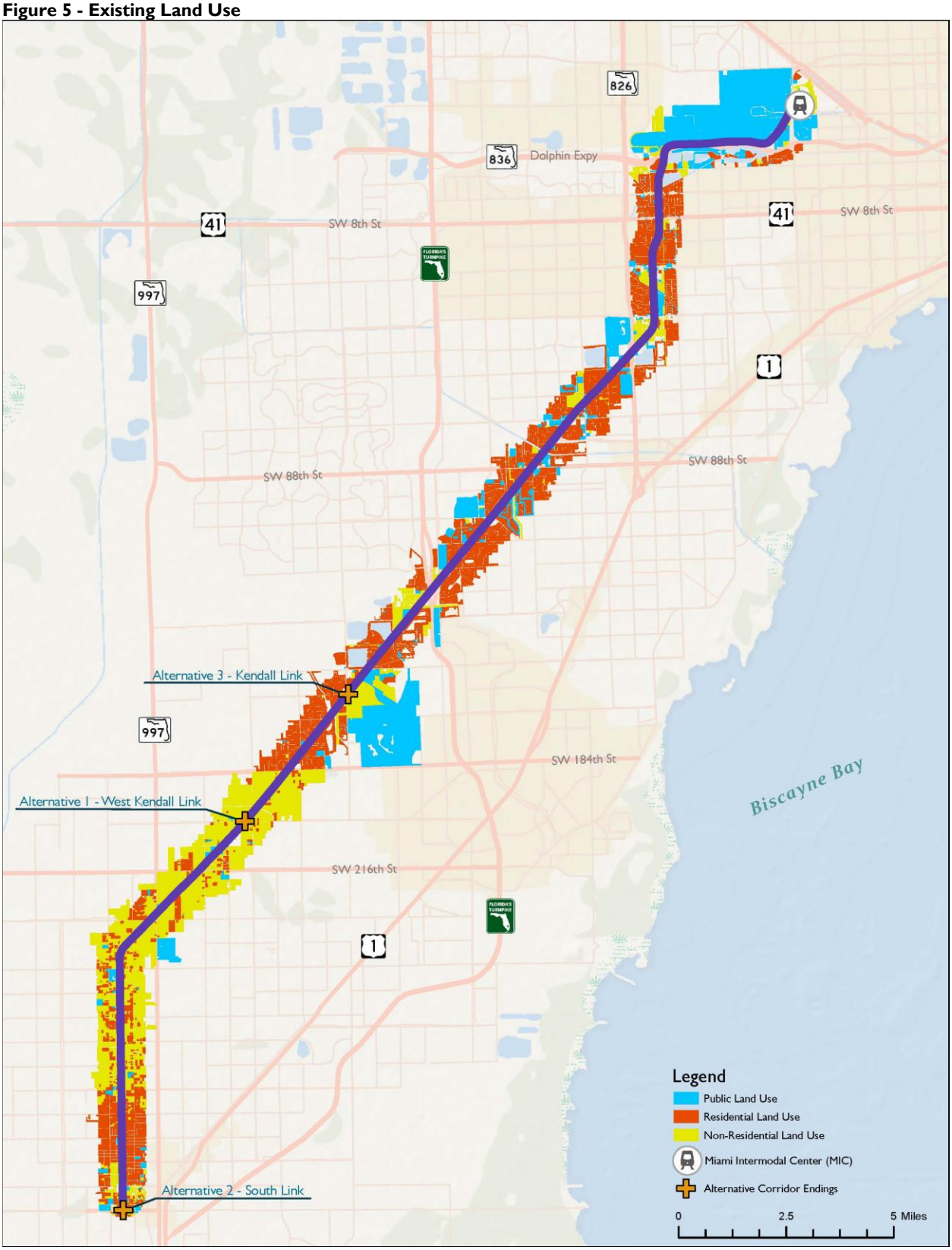
Historically, the area has predominantly been agricultural land. Beginning in the 1970s and continuing to present day, the area has developed into a major residential community in Miami-Dade County and is one of the fastest growing, densely populated regions in all of Florida. The study area is roughly bordered by US 1 and SW 67th Avenue on the east, SR 836/Dolphin Expressway on the north, SW 177th Avenue (Krome Avenue) to the west, and SW 328th Street to the South for the most southerly, South Link alternative. Downtown Miami is east of the assessment area and MIA and industrial areas are to the north, so this corridor connects the far west of Miami-Dade County with the MIC South of the study area lie suburban communities of Homestead and Florida City.

High density commercial and employment centers are generally found along the rail corridor. The historic downtown areas are divided by rail lines with commercial on one side of the track and industrial uses on the other side of the tracks. Further from the downtown, the majority of the existing land use along the rail corridor is industrial. Residential areas also filled in along the rai line, but the majority of railroad related land use remain industrial.

The land use within a half-mile of the corridor was divided into three categories: non-residential, residential, and public land uses and can be visualized in Figure 5. The non-residential land use category contains parcels designated for industrial or agricultural purposes. Residential land use contains parcels where people inhabit a residence of a varied sort. Public land use contains parcels designated for commercial or educational purposes and anyone from the public may access.

The corridor itself is divided into mostly residential and non-residential land uses with public parcels scattered throughout. The corridor begins at the MIC, which neighbors MIA. MIA is shown as a large, public land use parcel. From SR 836/Dolphin Expressway, south towards SW 184th Street, the land use remains mostly residential with some public parcels. The other large, public land use parcel seen adjacent to SW 184th Street is Zoo Miami. After SW 184th Street, land use begins to change to mostly non-residential with some residential towards the corridor's southern terminus. The southern-most region is in Homestead and is known for being an agricultural hub for Miami-Dade County.

Figure 5 - Existing Land Use



Source: Florida Department of Revenue, County Property Appraisers, and the GeoPlan Center

4.3. Proposed Study Corridor

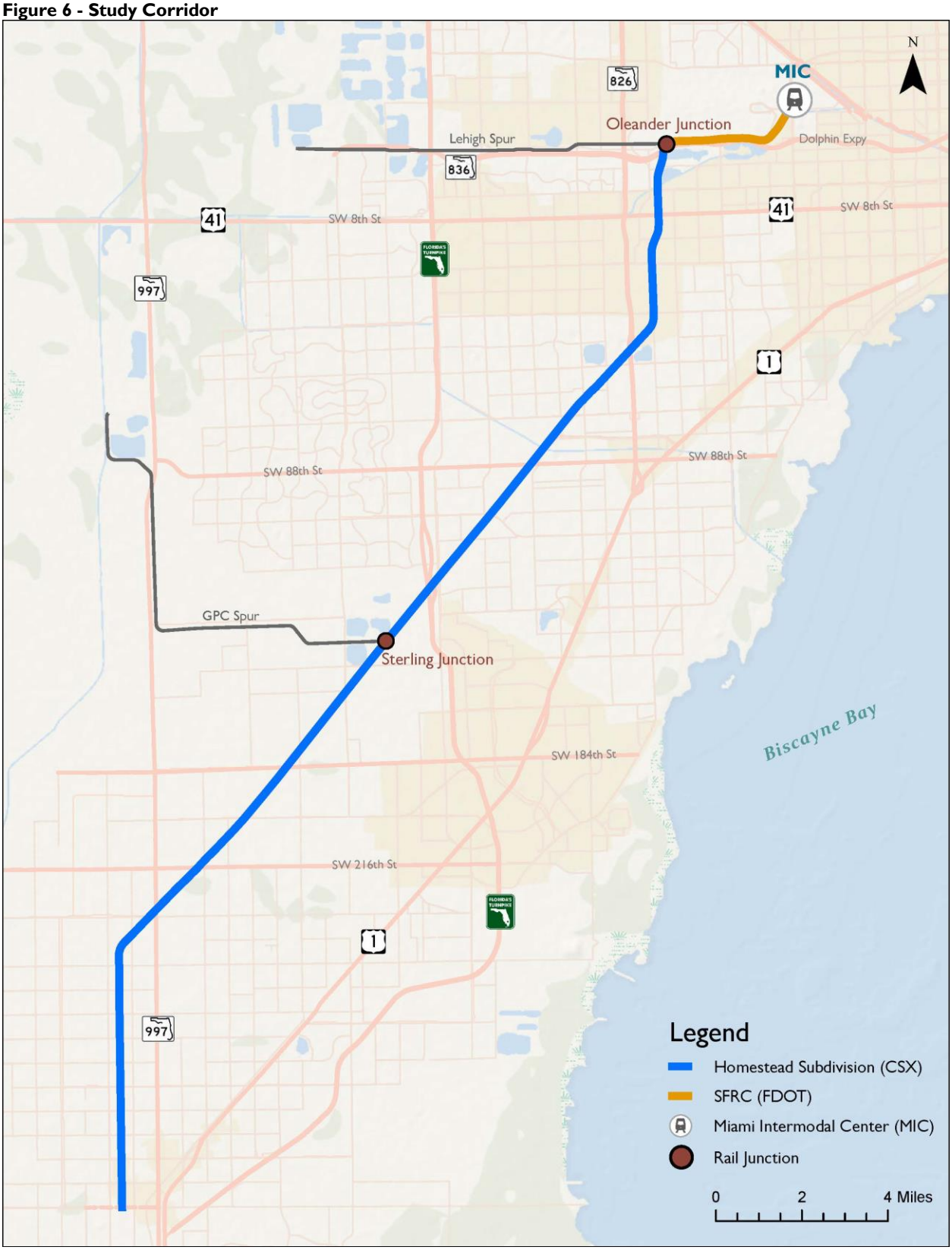
The study corridor for passenger rail service would use a combination of State operated tracks known as the South Florida Rail Corridor (SFRC), and CSX owned right-of-way (ROW) to expand passenger rail services while maintaining freight rail operations (Figure 6). The single-track corridor in this study runs in a southwesterly direction from the SFRC main line tracks near the MIC, along the southern boundary of MIA, and then south through the Oleander Junction along the CSX Homestead Subdivision towards the MetroZoo and eventually to Homestead, Florida ending at SW 328th Street.

Moving westward from the MIC, the track loops around a light industrial area before passing through a double at-grade crossing at both SR 953/Le Juene Road/NW 42nd Avenue and the SR 112/Airport Expressway in the vicinity of NW 29th Street. Both crossings are currently signalized, with grade-crossing protection in place. A consideration should be noted that the Airport Expressway runs in a contra-flow orientation in this area, with southbound traffic running on the east side of the divided road, while northbound traffic runs along the western side of the road. This could potentially be confusing to both motorists and transit operators potentially increasing conflicts.

The rail line then passes over a drainage canal and runs southwards next to an MIA freight handling facility to the west and a drainage canal and the elevated Airport Expressway to the east. There is one signalized at-grade crossing at Airport Expressway West and an MIA service road near McLaughlin Drive before passing underneath the main Airport Expressway/NW 21st Street corridor. A drainage canal runs under and along the corridor in a culvert near the overpass. An unsignalized grade crossing exists at NW 20th Street near an electrical substation, airport fuel tanks, and other airport support buildings. The track parallels the fuel tank farm to the west and the South Florida Water Management District (SFWMD) C-4 Tamiami Canal to the east.

After crossing a bridge over a small inlet, the tracks cross over NW 15th Street with a signalized, at-grade crossing with grade crossing protection. The rail line turns westwards and parallels the airport's Perimeter Road to the north and the SR 836/Dolphin Expressway and the Blue Lagoon to the south. An at-grade, signalized crossing with grade crossing protection exists at SR/959/Red Road/NW 57th Avenue near access ramps for SR 836.

Figure 6 - Study Corridor



Source: Miami-Dade TPO, Developed by TranSystems

Turning south, the CSX Homestead Subdivision passes through Oleander Junction. After passing underneath SR 836/Dolphin Expressway, the CSX line turns slightly southwest. The Florida East Coast (FEC) Railway tracks approach from the northwest and head due south under SR 836 and meets the CSX line just north of the NW 7th Street overpass. Connections within the signal-controlled Oleander Junction allow CSX trains to access the CSX Lehigh Spur, FEC Ludlam Branch and CSX connections through the SFRC, in addition to the Homestead Subdivision. The FEC line continues due south on the west side of Lake Mahar and east of Robert King High Park. The CSX tracks run to the west of Robert King High Park and east of a drainage canal and high-density residential neighborhood.

The tracks once again cross the SFWMD C-4 Tamiami Canal and a signalized, at-grade crossing with grade crossing protection at West Flagler Street before passing several light commercial and low-density residential properties and eventually enter a light-industrial district. Running due south, the line passes through the following at-grade crossings: SW 4th Street, SW 8th Street, SW 9th Street, SW 12th Street, SW 13th Street, SW 13th Terrace. The tracks turn southwest and passes through a single-family residential neighborhood with at-grade crossings at SW 16th Street, SW 21st Street, SW 22nd Street and SW 23rd Street. The line veers slightly southeast to run in the median of SW 72nd Avenue before crossing through the intersection with Coral Way/SW 24th Street to the east side of SW 72nd Avenue. The signalized intersection must contend with not only north-south and east-west vehicular traffic, but also with railroad tracks that pass across lanes of traffic.

On the south side of Coral Way, the tracks pass east of Brothers to the Rescue Memorial Park and parallel SW 72nd Avenue through a light industrial district. Continuing south, SW 72nd Avenue crosses from the west side of the tracks through a signalized at-grade crossing and turns south to parallel the tracks again before both pass over the SFWMD C-3 Coral Gables Canal. The tracks then continue east of a single-family residential neighborhood, then west of A.D. Barnes Park, before crossing SW 39th Street at an at-grade crossing. After passing through an at-grade crossing at SW 72nd Avenue and SR 976/Bird Road/SW 40th Street, the line once again turns southwest and passes through another light industrial district with at-grade crossings at SW 41st Street, SW 42nd Street and SW 75th Avenue.

At this location, the CSX tracks pass under the SR 826/Palmetto Expressway and run adjacent to the SR 874/Don Shula Expressway right-of-way. The underpass is constrained by access ramps, bridge supports and earthen and concrete bridge abutments. Running along the southern side of SR 874, the tracks pass multi-family residential properties before passing over SW 56th Street at a signalized, at-grade crossing with grade crossing protection. Both the tracks and SR 874 pass through a low-density residential area and Sunkist Estates Park for about one mile before reaching SW 87th Street. The rail line crosses the street at-grade, while SR 874 flies over both the tracks and the street, touching down south of the tracks. It then runs north of the expressway and to the south of a public water supply facility before meeting SR/986/Sunset Drive/SW 72nd Street at a signalized, at-grade crossing with grade crossing protection. The corridor then passes through a single-family residential neighborhood and

crosses over the SFWMD C-2 Snapper Creek Canal before meeting SR 94/Kendall Drive/SW 88th Street.

After passing through the signalized, at-grade crossing at Kendall Drive, the tracks pass several multi-family residential properties and then returns to a predominantly single-family residential district. The corridor passes just to the north of the Kendall Golf Course, crosses an electrical utility corridor and then over the SFWMD C-100 Cutler Drain Canal. A smaller drainage canal parallels the corridor to the northwest, before both the tracks and SR 874 pass under the Killian Parkway/SW 104th Street interchange. A multi-family residential neighborhood lies to the northwest of the corridor and a low-density single-family neighborhood lies to the southeast. The tracks then cross Killian Drive at-grade crossing and pass adjacent to a single-family residential neighborhood. A toll plaza for Florida's Turnpike controls access at SR 874 traffic traveling to and from the SR 821/Homestead Extension of Florida's Turnpike (HEFT toll road just three-quarters of a mile down the road.

Approaching the HEFT, the CSX rail tracks pass by several light industrial properties and then over the SFWMD C-100 Cutler Drain Canal. The Don Shula Expressway/ SR 874 terminates at the HEFT, while the tracks continue under the turnpike overpasses and to the east of a small light industrial district. The line runs past several vacant but developing parcels and into the new residential neighborhood of Three Lakes. The lakes in this area appear to be former rock mining pits that have become new waterfront residential areas. The tracks pass an electrical substation and a utility right-of-way as it passes between former quarries and new subdivisions.

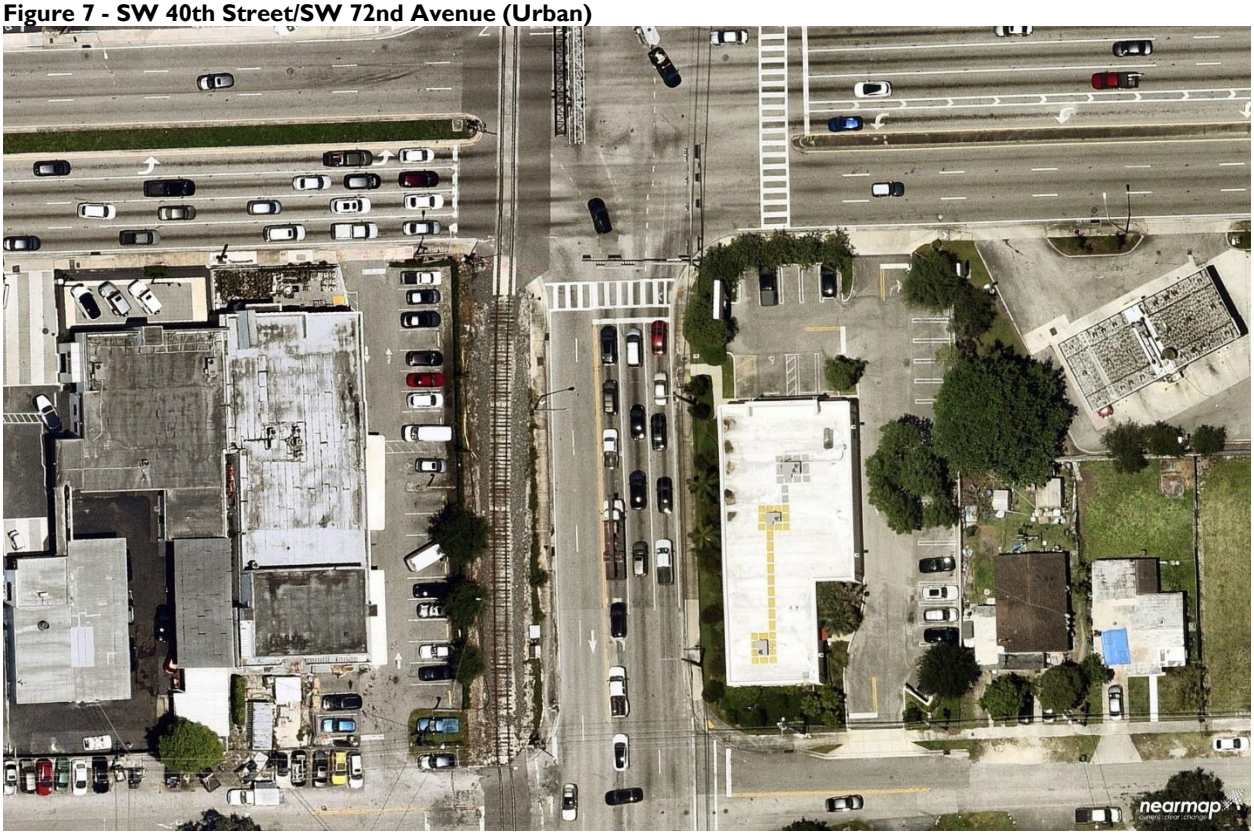
Just west of SW 144th Street, the Homestead Subdivision tracks meet the 11-mile Portland Spur segment of CSX track in a wye. From here, a single track runs to Krome Avenue where it turns north and terminates at SW 58th Street. One rock train a day serves the Rinker Plant at the terminus of this spur. Further south on the main line, the tracks cross the SFWMD C-1N Bel-Aire Canal and then SW 152nd Street in an at-grade crossing near the northwestern boundary of the Miami MetroZoo. The route continues and passes another at-grade crossing at SW 137th Avenue/Lindgren Road. The tracks of the Homestead Subdivision continue out of the study corridor in a southwesterly direction for approximately 7.5 miles crossing at-grades at 147th Avenue, Eureka Drive/SW 184th Street, SW 200th Street, SW 162nd Avenue, SW 167th Avenue, SW 220th Street, Krome Avenue, SW 232nd Street, and SW 182nd Avenue, before turning due south in the vicinity of SW 240th Street. The tracks continue for another five miles before terminating in the City of Homestead.

4.4. Railroad ROW

The availability of ROW dictates how a corridor may be used and what types of uses may share the corridor at one time. Understanding the width of available ROW in segments is important for planning and feasibility studies to develop eventual concepts and designs for a project. Urban areas, such as shown in Figure 7, have less room to work within as the approximate width from the parking lot on the west to the edge of the sidewalk on the east is only 32 feet. According to the TPO Rail Convertibility Study (2004), the SFRC rail corridor from the MIC to the Oleander Junction is 50 feet wide. Continuing southwards down the CSX Homestead

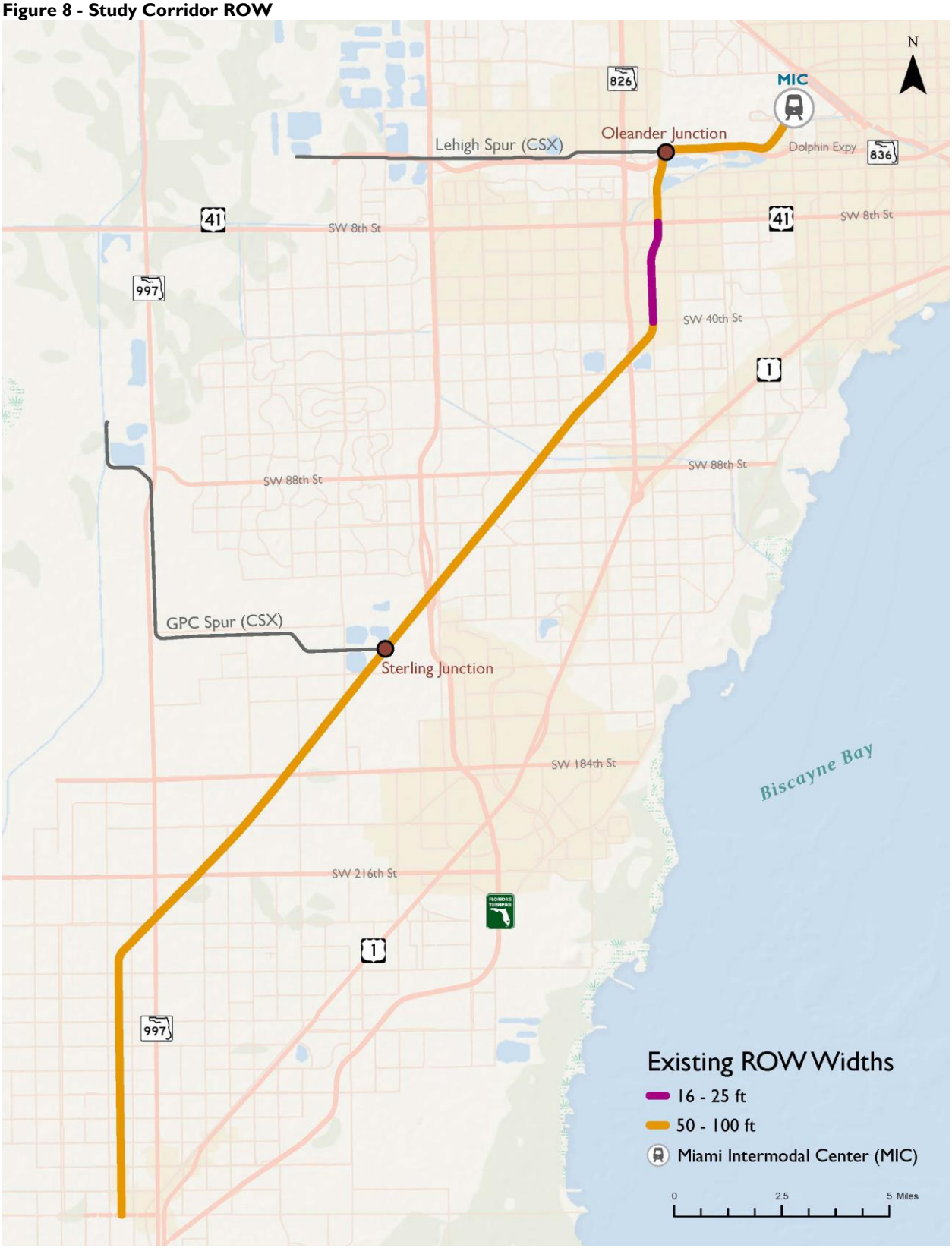
Subdivision, the ROW continues to be 50 feet wide until crossing Tamiami Trail/SW 8th Street. The ROW then transitions to a very tight 16 feet before returning to a 50 foot wide corridor at SW 11th Street. At SW 40th Street, the ROW again narrows to a width of 25 feet as it passes through a light industrial district before transitioning to a 100 wide ROW as it parallels the SR 874 corridor. Figure 8 depicts the ROW along the study corridor with 16-26 foot and 50 to 100 foot sections.

Figure 7 - SW 40th Street/SW 72nd Avenue (Urban)



Source: NearMap

Figure 8 - Study Corridor ROW



Source: TPO Rail Convertibility Study, 2004

4.5. Track and Infrastructure

The corridor currently operates with a single set of tracks allowing for freight traffic. The tracks are currently classified as "Excepted" by the Federal Railroad Administration (FRA) as shown in Table 10. Excepted tracks permit low speed freight operations, but passenger operations are not permitted; therefore, tracks must be upgraded to permit the operation of passenger rail in this corridor.

Table 10 - FRA Track Classification

Track Type	Maximum allowable operating speed for freight trains (mph)	Maximum allowable operating speed for passenger trains (mph)
Excepted track	10	Not Allowed
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	80	90
Class 6 track	110	
Class 7 track	125	
Class 8 track	160	
Class 9 track	200	

Source: Federal Railroad Administration, 2014

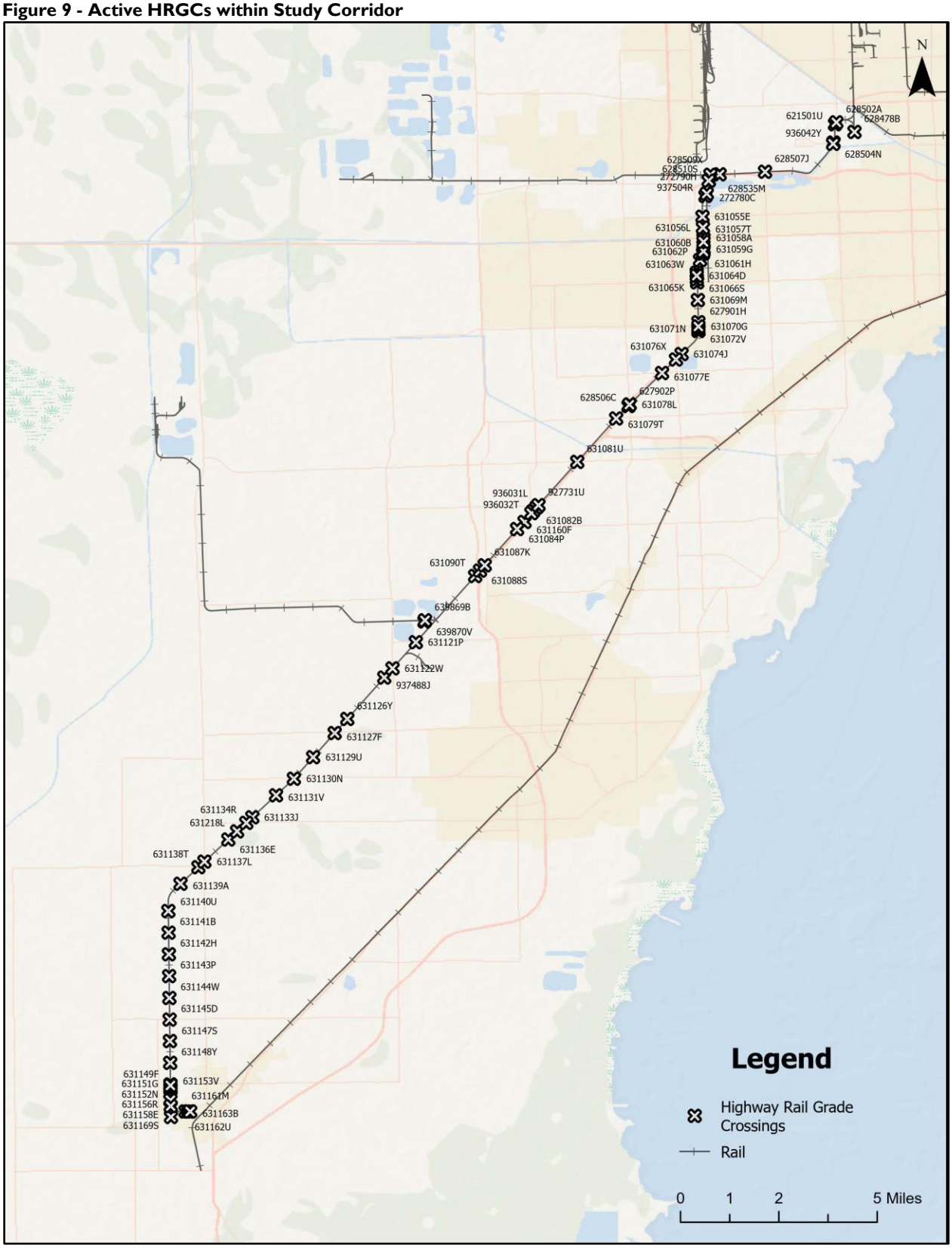
Two areas with challenges include the Oleander Junction and the MIC. These include missing track connections and access to the MIC; this may pose coordination challenges with Tri-Rail and Miami-Dade Department of Transportation and Public Works (DTPW).

4.6. At-Grade Railroad Crossings

Highway-rail at-grade crossings (HRGCs) or simply, at-grade crossings, are potential conflict points where rail traffic, motorists and pedestrians converge. The potential for conflicts between rail vehicles and other modes of travel is greatest at or near these locations. At-grade crossings with significant rail and vehicular traffic can also negatively impact the levels of service for either mode. HRGCs may be signed, signaled, and protected with grade crossing protection but conflicts still occur with high regularity due to driver error, trespassing, and other incursions within active rail rights-of-way. A remedy for minimizing conflict between trains and vehicles can occur by enhancing active safety equipment or grade-separating (usually roadway over rail line) the intersection. However, grade separation projects significantly increase project costs.

There are 83 open HRGCs throughout the study corridor as shown in Figure 9 with Table 11 providing more details for each crossing.

Figure 9 - Active HRGCs within Study Corridor



Source: FRA Grade Crossing Inventory Data

Table 11 - Active HRGCs within Study Corridor

Count	USDOT Crossing ID	Railroad	Street Location	RR Subdivision
1	628478B	SFRV	NW 25TH ST	SFRC
2	631084P	CSX	SW 112TH ST	HOMESTEAD
3	631079T	CSX	SW 72ND STREET	HOMESTEAD
4	631077E	CSX	SW 56TH STREET/MILL DRIVE	HOMESTEAD
5	631161M	CSX	SW 5TH AVE	HOMESTEAD
6	628506C	SFRV	NW 15TH ST	#N\A
7	631090T	CSX	FL TURNPIKE HOMESTEAD EXT	HOMESTEAD
8	627901H	CSX	SW 39TH STREET	HOMESTEAD
9	631059G	CSX	SW 12TH STREET	HOMESTEAD
10	631142H	CSX	SW 264TH ST/BAUER DR	HOMESTEAD
11	631072V	CSX	SW 42ND STREET	HOMESTEAD
12	631066S	CSX	SW 24TH STREET/CORAL WAY	HOMESTEAD
13	628507J	SFRV	NW 57TH AVE	#N\A
14	631139A	CSX	SW 182ND AVE/ROBERTS RD	HOMESTEAD
15	936031L	CSX	SW 104TH ST/KILLIAN PKWY	HOMESTEAD
16	631136E	CSX	SW 172 AVENUE	HOMESTEAD
17	936042Y	SFRV	WESTBOUND AIRPORT EXIT RAMP	#N\A
18	631153V	CSX	PRIVATE	HOMESTEAD
19	631127F	CSX	SW 184TH ST/EUREKA DR	HOMESTEAD
20	631160F	CSX	PRIVATE ROAD	HOMESTEAD
21	631162U	CSX	SW 4TH AVENUE	HOMESTEAD
22	631148Y	CSX	SW 304TH ST/KINGS HWY	HOMESTEAD
23	631057T	CSX	SW 8TH STREET	HOMESTEAD
24	628535M	SBD	PRIVATE ROAD	HOMESTEAD
25	631131V	CSX	FARMLIFE RD	HOMESTEAD
26	631126Y	CSX	SW 147TH AVE/NARANJA RD	HOMESTEAD
27	628509X	CSX	PERIMETER RD	HOMESTEAD
28	631163B	CSX	SW THIRD TERRACE	HOMESTEAD
29	631121P	CSX	SW 152ND ST	HOMESTEAD
30	631062P	CSX	SW 16TH STREET	HOMESTEAD
31	631130N	CSX	QUAIL ROOST DR	HOMESTEAD
32	631152N	CSX	PRIVATE	HOMESTEAD
33	631071N	CSX	SW 41ST STREET	HOMESTEAD
34	631218L	CSX	PRIVATE ROAD	HOMESTEAD
35	631156R	CSX	NW 10TH AVENUE	HOMESTEAD
36	639870V	CSX	132ND COURT/SW CARIBE WAY	HOMESTEAD
37	631151G	CSX	PRIVATE	HOMESTEAD
38	631082B	CSX	KILLIAN PKWY	HOMESTEAD
39	628504N	SFRV	NW 21ST ST	#N\A

Count	USDOT Crossing ID	Railroad	Street Location	RR Subdivision
40	631133J	CSX	SW 167TH AVE	HOMESTEAD
41	621501U	SFRV	AIRPORT EXPY	#N\A
42	631074J	CSX	SW 75TH AVENUE	HOMESTEAD
43	631149F	CSX	SW 312TH ST/W CAMPBELL DR	HOMESTEAD
44	631055E	CSX	W FLAGLER STREET	HOMESTEAD
45	631070G	CSX	SW 40TH STREET/BIRD ROAD	HOMESTEAD
46	631063W	CSX	SW 21ST STREET	HOMESTEAD
47	631140U	CSX	SW 248TH ST	HOMESTEAD
48	631138T	CSX	SW 232ND STREET/SILVER PALM DRIVE	HOMESTEAD
49	631076X	CSX	PALMETTO EXPY	HOMESTEAD
50	631065K	CSX	SW 23RD STREET	HOMESTEAD
51	631143P	CSX	SW 272ND ST	HOMESTEAD
52	631144W	CSX	SW 280TH ST/WALDIN DR	HOMESTEAD
53	272790H	FEC	DOLPHIN EXPY	
54	627902P	CSX	DON SHULA EXPY	HOMESTEAD
55	631150A	CSX	PRIVATE	HOMESTEAD
56	631137L	CSX	SW 177TH AVE	HOMESTEAD
57	631134R	CSX	SW 216TH ST	HOMESTEAD
58	631088S	CSX	FL TURNPIKE HOMESTEAD EXT	HOMESTEAD
59	628502A	SFRV	NW 42ND AVE	#N\A
60	631069M	CSX	SW 72ND AVE	HOMESTEAD
61	631061H	CSX	SW 13TH TERRACE	HOMESTEAD
62	631083H	CSX	DON SHULA EXPY RAMP	HOMESTEAD
63	936032T	CSX	DON SHULA EXPY RAMP	HOMESTEAD
64	631060B	CSX	SW 13TH ST	HOMESTEAD
65	631058A	CSX	SW 9TH STREET	HOMESTEAD
66	631129U	CSX	PRIVATE ROAD	HOMESTEAD
67	631141B	CSX	SW 256TH ST	HOMESTEAD
68	631169S	CSX	SW 4TH ST	HOMESTEAD
69	631064D	CSX	SW 22ND ST	HOMESTEAD
70	631081U	CSX	SW 88TH ST	HOMESTEAD
71	631147S	CSX	SW 296TH ST/AVOCADO DR	HOMESTEAD
72	631145D	CSX	SW 288TH ST/BISCAYNE DR	HOMESTEAD
73	272780C	FEC	MILAM DAIRY RD	
74	628510S	SFRV	DOLPHIN EXPY	#N\A
75	927731U	CSX	PRIVATE	HOMESTEAD
76	639869B	CSX	132ND COURT/SW CARIBE WAY	HOMESTEAD
77	631056L	CSX	SW 4TH STREET	HOMESTEAD
78	937488J	CSX	PRIVATE	HOMESTEAD

Count	USDOT Crossing ID	Railroad	Street Location	RR Subdivision
79	631087K	CSX	SW 117TH AVE	HOMESTEAD
80	631122W	CSX	SW 137TH AVE	HOMESTEAD
81	631078L	CSX	SW 87TH AVENUE	HOMESTEAD
82	631158E	CSX	SW 320TH ST/W MOWRY DR	HOMESTEAD
83	937504R	CSX	NW 7TH STREET	HOMESTEAD

Source: FRA Grade Crossing Inventory Data

4.7. Structures

Structures refer to bridges, culverts, and over/underpasses that may present height or weight restrictions for passenger or freight vehicles. Along the study corridor, there are nine bridges/culverts over canals and 17 underpasses or road bridges that cross over the Homestead Subdivision railroad corridor. All the rail bridges are single-track, wooden structures that require major rehabilitation, and many will need to be replaced before any passenger services could proceed (Figure 10). The available right-of-way may vary from structure to structure with some constrained by earthen and concrete bridge abutments, others restricted by narrow bridge structures.

Figure 10 – Wooden Structure (Don Shula Expressway & SW 83rd Street)

Source: NearMap

4.8. Existing Rail Freight Movements

Any analysis of a freight rail corridor for potential investment for shared use must consider the density of freight traffic that exists currently and what the future may hold. The study team held discussions with representatives of CSX. CSX indicated that their focus is moving freight and

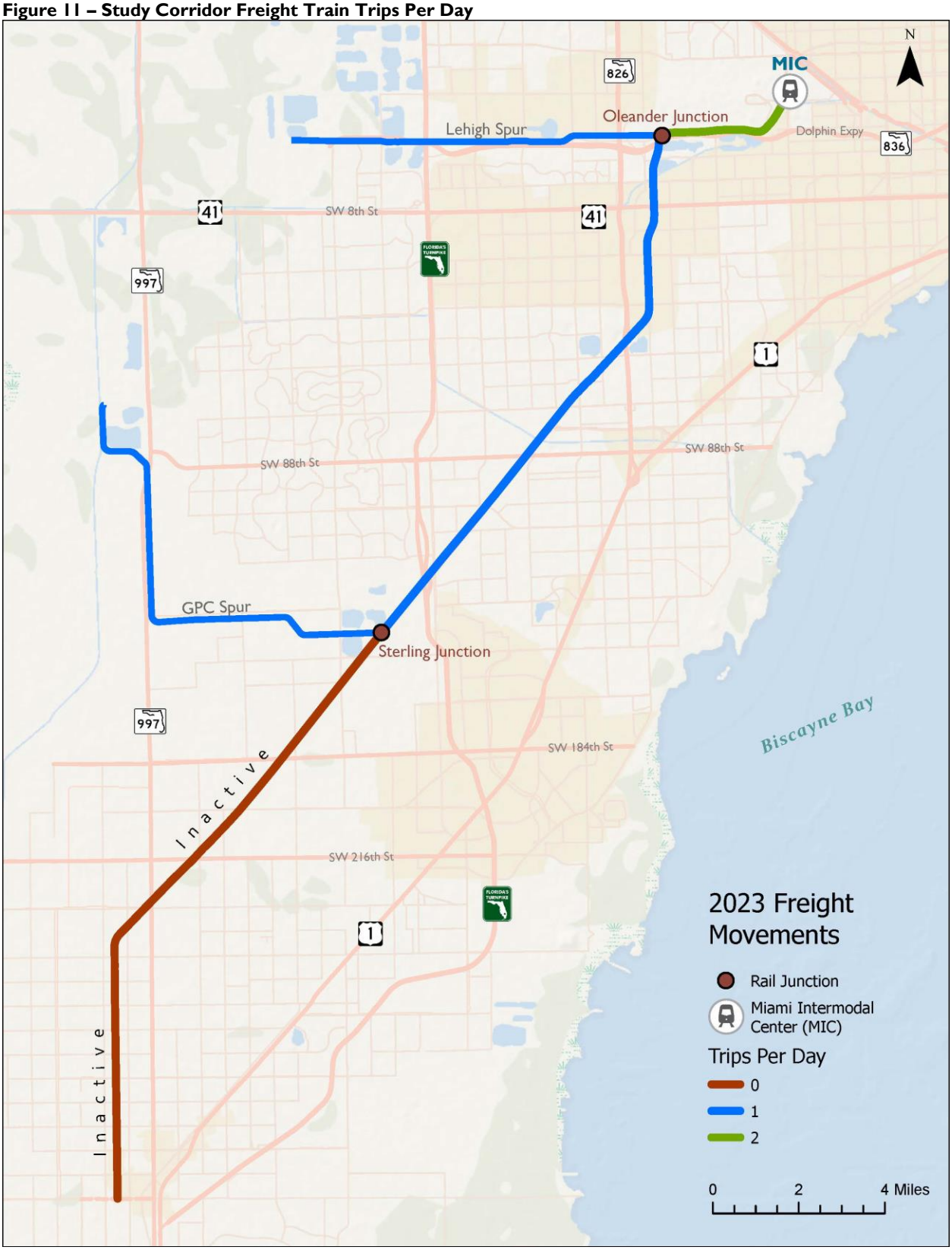
not passengers and most importantly they are concerned with potential safety issues. As was previously noted CSX owns the Homestead Subdivision and operates on the SFRC owned by FDOT through an operating agreement. CSX referred the study team to SFRTA to obtain train movement data within the corridor. Previous reports indicate that the corridor is a relatively low density of operations with between two and four round trip freight trains utilizing the corridor daily.

Subsequent discussions with SFRTA staff indicated that currently and for the past several years there are two daily round trip trains operating on the SFRC portion of the corridor running between Oleander Junction and Hialeah Yard north of the MIC. At Oleander Junction one train continues south onto the Homestead Subdivision and one continues to the west on the Lehigh Spur. In both instances the trains are transporting rock and cement from the quarries to the south and west to Hialeah Yard. The current freight trains are scheduled to arrive and depart Hialeah Yard during the shoulders of Tri-Rail Service to avoid conflicts and delays during peak passenger operations. The length of the freight trains on average are 20-30 cars, approximately 55 to 68 feet long and travel at the maximum track speed of 10 miles per hour (mph).

The corridor operates in a "dark territory." Dark territories are known in the railroad industry as a section of running track not controlled by signals. Train movements in dark territories controlled by track warrants and direct traffic control, with train dispatchers managing train movements directly. Today most dark territory consists of lightly used secondary branch lines and industrial tracks. The introduction of shared passenger service on the corridor would require full signaling including Positive Train Control (PTC).

For planning purposes, this study uses two daily round trip freight trains on the Homestead Subdivision portion of the corridor and four round trips on the SFRC portion of the corridor representing a doubling in freight traffic over current operations (Figure 11). This will allow for future growth in freight operations.

Figure 11 – Study Corridor Freight Train Trips Per Day



Source: NearMap, Google Maps, Previous Miami-Dade TPO Studies, & US DOT HRGC Inventory Data

5. Service Plan Validation

The objective of this section is to validate three service plans for potential future passenger rail service along the CSX Homestead subdivision, which connects the MIC at the northern end of the corridor with the City of Homestead at the southern end. A description is detailed of the approach to, and assumptions for, the service planning analysis, yielded preliminary results to compare potential passenger rail operations for three different service scenarios. The operations described are strictly a planning exercise based on a high-level analysis and review of the current Homestead Subdivision right-of-way, Tri-Rail operations, and best practices for commuter rail design and operation.

5.1. Service Planning Assumptions

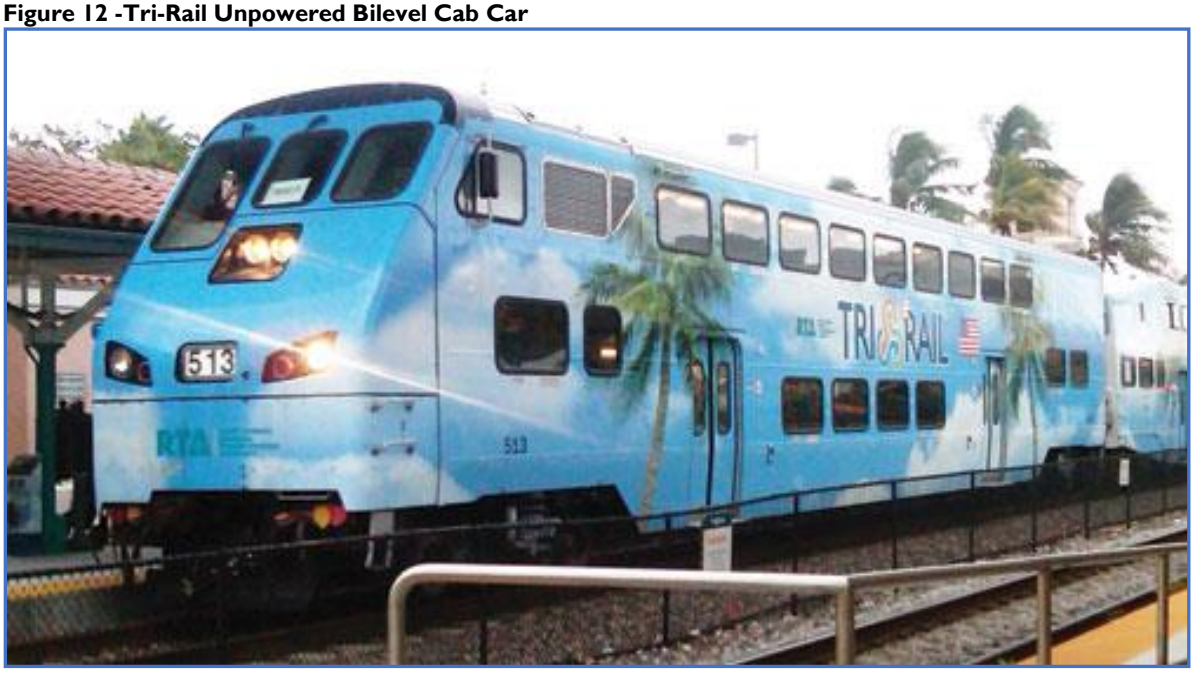
5.1.1. Freight Operations

As previously mentioned in the existing conditions section, there are currently two round trip freight trains per day between CSX's Hialeah Yard, which is located approximately 3.5-miles directly north of the MIC, and points south and west. Both freight trains leave Hialeah yard in the morning traveling south on the SFRC and the northern part of the Homestead Subdivision up to Oleander Junction, with one train that proceeds west on the Lehigh spur to a quarry to the west, and another that proceeds south on the Homestead Subdivision to Sterling Junction onto the GPC spur heading to the Cemex Quarry near Krome Ave. Both trains average between 20-30 cars and generally carry material from the quarries with an occasional delivery of chlorine to the Miami Water Treatment plant. There is no active freight service south of Sterling Junction, which is located just north of SW 152nd Street. Coordination between the future operator of passenger rail service in this corridor and CSX would be required to ensure that freight and passenger services can operate within the same railroad right of way with minimal delay to both. According to input from CSX, although they operate a limited freight schedule south and west from the Hialeah Yard, passenger service with proposed 30-minute headways at peak times, as proposed in this service plan could not be accommodated at the same time as the freight movements. Therefore, freight operations for this analysis are assumed to be during off-peak periods, when passenger train headways are reduced to 60-minutes, or to the overnight night period during which passenger trains would not operate.

5.1.2. Passenger Operations

Passenger trains in this corridor are proposed to operate every 30-minutes in each direction during the morning and afternoon/evening peak periods and every 60-minutes in each direction all other times. The operating period for passenger trains would be from 5:30 AM until 11:00 PM. The morning peak period is assumed to be 6:00 AM to 9:00 AM and the afternoon/evening peak period is assumed to be 3:00 PM to 7:00 PM. Rolling stock is assumed to be a push-pull consist with one diesel locomotive and two bilevel coaches and one bilevel cab car, like what is currently operated by Tri-Rail. The assumed maximum operating speed for passenger trains is 60-mph, which includes passing through at-grade railroad crossings. A station dwell time of 60 seconds is assumed at each intermediate station between MIC and the respective termini for each alternative. New passenger services could use the CSX Hialeah Yard for maintenance and storage of vehicles, which is also currently utilized for those functions by Tri-Rail.

Figure 12 -Tri-Rail Unpowered Bilevel Cab Car



5.2. Service Planning Approach

The service planning effort considered track condition along the proposed route from the MIC to Homestead and incorporated the operating assumptions previously described. This assessment considered operations at a high-level for the planning evaluation of three potential commuter rail service alternatives that would use various portions of the CSX Homestead subdivision. Travel times were calculated using station-to-station distances and average travel speeds for a Tri-Rail push-pull locomotive with three unpowered coaches.

5.2.1. Proposed Route and Track Conditions

The proposed service would originate at the MIC and operate on the existing CSX Homestead Subdivision. All track on the proposed passenger service corridor would be updated to Class 3,

which allows passenger trains to run at a maximum authorized speed (MAS) of 60 miles per hour, although lower speeds are assumed in some sections of the route based on track geometry or other constraints.

5.2.2. Distance between Stations

Historic Tri-Rail and SFRC track charts (MIC to Oleander Junction) were used to determine the distance between proposed stations along the route and supplemented by mileposts at grade crossings from the FRA Grade Crossing database. Aerial maps were used to determine curve radii and identify areas requiring speed restrictions below the Class 3 track maximum of 60 mph.

5.2.3. Travel Speeds

Train speed calculations in each area consider several factors including the anticipated MAS and train acceleration and deceleration, which are adjusted to account for track alignment features (i.e., tight radius curves). This study assumed that trains would be able to operate at track speed MAS, which is generally 60 mph throughout the corridor because the proposed service is assumed to operate in dedicated right-of-way with active treatment at all at-grade crossings (gates and flashing lights) that provides priority to trains. It is assumed with the provided number of stations and grade crossings along the corridor, actual average operating speed is in the range of 30-mph.

The northern 4.6 miles of the alignment, which runs between the MIC and Oleander Junction, is the most circuitous portion of the route. This section of the route curves north out of the MIC before turning south and west along the perimeter of MIA. In its current condition it is comprised of a single track with one siding just north of Oleander Junction. There are no intermediate stations in this section. There are three 750-foot radius curves in this section, which are assumed to limit the maximum speed to 25mph.

There are also two 2,000-foot radius curves along the route – one just south of SW 40th Street and the other approximately one mile south of Krome Avenue. The MAS through each 2,000-foot radius curve was assumed to be 50mph, each with 2.5 inches of actual superelevation.

5.2.4. Train Meets

The travel time calculations did not account for train meets, which would be necessitated by a primarily single-track railroad. Passing sidings would need to be located strategically to accommodate the proposed peak and off-peak schedules for the route. Meets would require passing sidings or double track, which can only be in areas with sufficient right-of-way width. Train meets would add time at locations where trains that are traveling in opposing directions need to pass each other. Double track could be constructed at some stations to allow meets to occur while trains are dwelling at the station. If sidings are too short, one train would need to hold and wait while the opposing train passes, which would increase travel times. Longer sidings and sections of double track can help to reduce delay because of meets. Ideally, switches at the

interface of single and double track would be at least No. 15 and preferably No. 20 turnouts to avoid unnecessarily slowing travel speeds. It is assumed that freight trains would be limited to specific windows and would be dispatched to minimize impacts to passenger operations. Up to four daily freight trains are expected on the segment between Hialeah and Oleander Junctions and up to two daily freight trains (one round trip) between Oleander Junction and Sterling Junction. Freight trains are not expected to operate south of Sterling Junction.

5.2.5. Terminal Stations

This service planning validation analysis assumes that terminal stations would consist of two stub-end tracks with a turnout (if single track) or universal crossover (if double track) approaching the terminal. This analysis assumed that tracks would not extend past the terminal station. Terminal operations and turnaround time were not considered in this service planning exercise. Future analyses may consider the need for tail tracks to extend beyond terminal platforms, although that may not be necessitated by the proposed service headways.

5.3. Alternatives

The service plan validation exercise was conducted for three alternatives based on the existing conditions, assumptions, and approach described above, which yielded the travel time results summarized in this section. Table 12 lays out the stopping pattern for each of the three alternatives, which are shown in Figure 6. The first station for each of the service alternatives is assumed to be Flagler Street, which is about 0.7 miles south of Oleander Junction and 5.3 miles from the MIC. Although not the greatest distance between stations, the journey time between the northern terminus and first station to the south is the longest of any interval because of the circuitous route of the tracks around the south and east sides of MIA as described previously.

Table 12 - Stopping Patterns for Three Proposed Service Alternatives

Alternative 1 Kendall Link	**Alternative 2** W Kendall Link	**Alternative 3** South Link
MIC	MIC	MIC
Flagler Street	Flagler Street	Flagler Street
SW 40 Street	SW 40 Street	SW 40 Street
SW 88 Street	SW 88 Street	SW 88 Street
SW 112 Street	SW 112 Street	SW 112 Street
SW 117 Avenue	SW 117 Avenue	SW 117 Avenue
SW 137 Avenue	SW 137 Avenue	SW 137 Avenue
	SW 184 Street	SW 184 Street
	SW 157 Avenue	Krome Avenue
		SW 312 Street
		SW 328 Street

5.3.1. Alternative 1 – Kendall Link

Alternative 1 – Kendall Link is the shortest of the three route alternatives, 18 miles as shown in Table 13. It would operate between the MIC and SW 137th Avenue making all seven proposed station stops. The forecasted end-to-end run time for this alternative is 35 minutes and 53 seconds including 60 second dwell times at all intermediate stations.

Table 13 - Alternative 1 – Kendall Link Mileage and Travel Time

Stations	Cumulative Mileage	Travel Time	Dwell Time	Cumulative Travel Time on Arrival
MIC	-	-	00:00	-
Flagler Street	5.26	10:11	01:00	10:11
SW 40 Street	7.89	03:55	01:00	15:06
SW 88 Street	11.93	05:30	01:00	21:36
SW 112 Street	13.90	03:22	01:00	25:58
SW 117 Avenue	15.07	02:20	01:00	29:18
SW 137 Avenue	18.08	05:35	00:00	35:53

5.3.2. Alternative 2 – West Kendall Link

Alternative 2 – West Kendall Link is the middle-distance alternative of the three, 21.5 miles as shown in Table 14. It would operate between the MIC and SW 157th Avenue making all nine proposed station stops. The forecasted end-to-end run time for this alternative is 44 minutes and 23 seconds including 60 second dwell times at all intermediate stations.

Table 14 - Alternative 2 – West Kendall Link Mileage and Travel Time

Stations	Cumulative Mileage	Travel Time	Dwell Time	Cumulative Travel Time On Arrival
MIC	-	-	00:00	-
Flagler Street	5.26	10:11	01:00	10:11
SW 40 Street	7.89	03:55	01:00	15:06
SW 88 Street	11.93	05:30	01:00	21:36
SW 112 Street	13.90	03:22	01:00	25:58
SW 117 Avenue	15.07	02:20	01:00	29:18
SW 137 Avenue	18.08	04:30	01:00	34:48
SW 184 Street	20.03	03:20	01:00	39:08
SW 157 Avenue	21.45	04:15	00:00	44:23

5.3.3. Alternative 3 – South Link

Alternative 3 – South Link is the longest of the three route alternatives, 30.5 miles as shown in Table 15. It would operate between the MIC and SW 328th Street in Homestead, making all station stops except for at SW 157th Avenue, 11 in total. The forecasted end-to-end run time for this alternative is 57 minutes and 29 seconds including 60 second dwell times at all intermediate stations.

Table 15 - Alternative 3 – South Link Mileage and Travel Time

Stations	Cumulative Mileage	Travel Time	Dwell Time	Cumulative Travel Time On Arrival
MIC	-	-	00:00	-
Flagler Street	5.26	10:11	01:00	10:11
SW 40 Street	7.89	03:55	01:00	15:06
SW 88 Street	11.93	05:30	01:00	21:36
SW 112 Street	13.90	03:22	01:00	25:58
SW 117 Avenue	15.07	02:20	01:00	29:18
SW 137 Avenue	18.08	04:30	01:00	34:48
SW 184 Street	20.03	03:20	01:00	39:08
Krome Avenue	24.11	05:26	01:00	45:34
SW 312 Street	29.58	07:01	01:00	53:35
SW 328 Street	30.43	02:54	00:00	57:29

5.4. Representative Operations Plan

Conceptual operations plans were developed based on the passenger service headway assumptions outlined in Section 5.1.2. This provided an understanding of equipment needs and track infrastructure required for trains to meet and pass each other.

For Alternative 3, stringlines were developed that simultaneously represent distance traveled and time spent by trains on the proposed Homestead Subdivision commuter rail line. As the alternative with the longest route and the most station stops, Alternative 3 would require the most infrastructure and equipment needed for passenger operations during peak periods when several trains would run simultaneously to provide 30-minute headway service in each direction. A one-way trip for Alternative 3 is approximately one hour. With a minimum of 10 minutes of recovery time assumed at each terminal, the total round-trip cycle time, rounded up to the nearest 30-minute increment, would be approximately 2 hours and 30 minutes. At peak service levels, five trainsets would be required for revenue service, not including spares. To maintain optimal service, both terminals should be assumed to have two tracks, and passing sidings or double main track sections are needed at three or four intermediate locations. This exercise assumes that sidings would be 1,000-feet long with number 15 turnouts at each end.

For Alternatives 1 and 2, four trainsets would be required for revenue service, not including spares. Alternative 1 would have a cycle time of approximately 1 hour and 30 minutes and Alternative 2 would have a cycle time of approximately 2 hours (after rounding up). Table 16 lays out the cycle time calculations that informed trainset need calculations and the representative operations plan for each alternative.

Table 16 - Cycle Times and Trainset Needs

Alternative	Alternative 1	Alternative 2	Alternative 3
Preliminary One Way Travel Time (minutes)	0:35:53	0:44:23	0:57:26
Assumed MINIMUM terminal dwell time	0:10:00	0:10:00	0:10:00
Preliminary Round Trip Travel Time w/Terminal Dwell	1:31:46	1:48:46	2:14:52
Round up cycle time to the nearest peak headway	2:00:00	2:00:00	2:30:00
Trainsets required to provide peak service	4	4	5

5.4.1. Meets

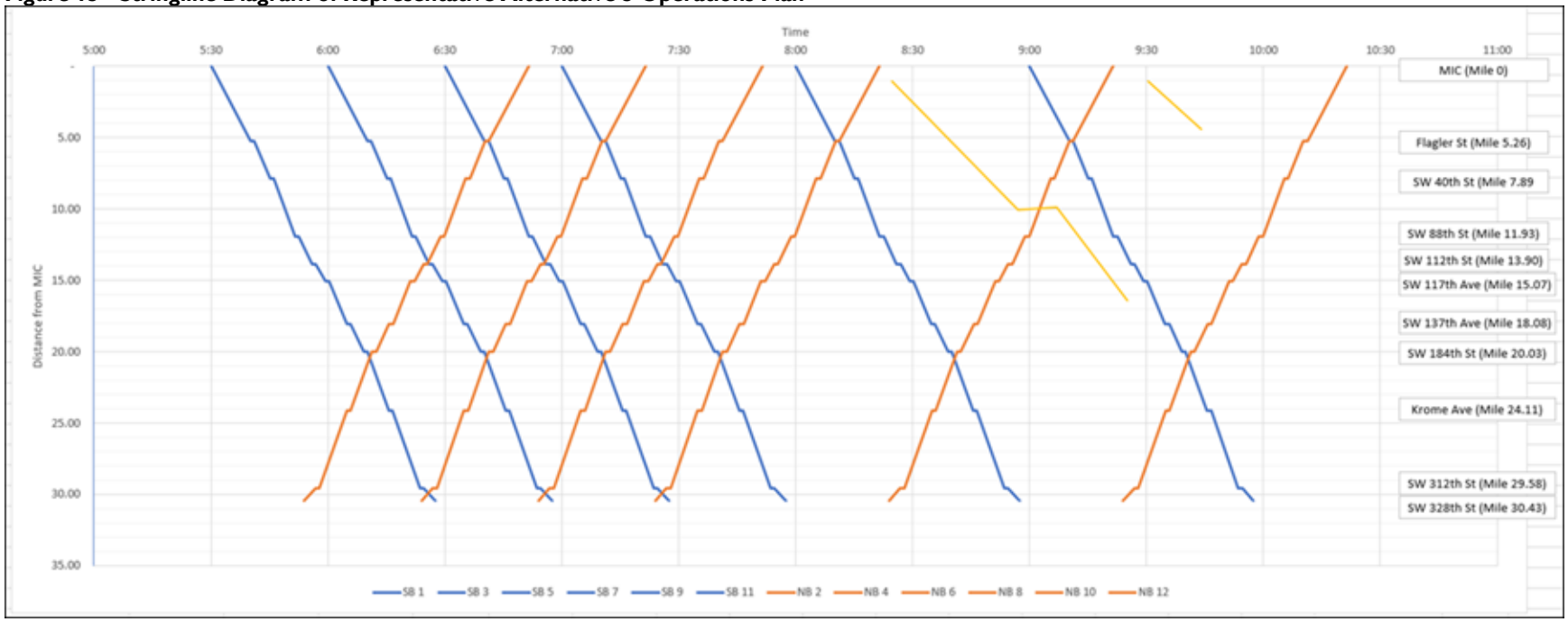
Opposing train meets can be located at a station with two platform tracks, with the meet occurring while the trains dwell to pick up and drop off passengers. Meets can also occur at sidings between stations, which minimizes station infrastructure, but adds travel time while a train waits in the siding, especially if one train is running late. Some pad time may need to be added to the schedule to accommodate meets and some delay.

5.4.2. Sidings

There is an existing siding just north of Oleander Junction, which is the only intermediate location for a meet to occur on existing infrastructure. The Homestead Subdivision right-of-way from 8th Street to 42nd Street in Miami-Dade towards the northern end of the alignment is one of the most constrained portions of the route at 16-25 feet in width, which limits the potential to add a siding in this segment to support future operations. In the representative operations stringlines exercise for Alternative 3, shown in Figure 13, infrastructure for meets would be needed at the following locations:

1. Double track at Flagler Street Station or the existing siding north of Oleander Junction
2. Double track at SW 112th Street Station OR a siding just north of the 112th Street station
3. Double track at SW 184th Street Station
4. Double track from just south of SW 312th Steet to SW 328th Street terminal

Figure 13 - Stringline Diagram of Representative Alternative 3 Operations Plan



6. Operational Analysis

This section summarizes the preliminary ridership forecasts for the three evaluated alternatives. The Federal Transit Administration's (FTA) Simplified-Trips-on-Project Software (STOPS) was used to develop ridership forecasts. STOPS is a stand-alone computer program that applies a set of travel models to predict detailed transit travel patterns for user-specified scenarios. It is a simplified method, developed by FTA, that project sponsors of FTA's Capital Investment Grant (CIG) ("New/Small Starts") projects can use, at their option, to predict the trips-on-project measures and the automobile Vehicle Miles of Travel (VMT) change required for the environmental measure.

The calibrated STOPS model has a base year of 2019 and a horizon year of 2045 and was used for ridership forecasting for the Miami Dade SMART Plan corridors. To best determine the potential of each alternative the model was run unconstrained as to parking availability.

No changes were made to the model calibration as part of this effort. For the transit network, the Build scenario was made identical to the No-Build scenario prior to running the alternatives. It should be noted that the No-Build scenario in this model includes the Tri-Rail extension to downtown Miami and the South Corridor Bus Rapid Transit (BRT).

In all the ridership forecasts discussed below, the Build scenario is the No-Build scenario plus the alternative. There were no other transit service changes specific to the alternatives made. All results are represented in daily boardings.

6.1. Alternatives

The three alternatives were evaluated and depicted in Figure 3. The operating characteristics for each alternative are shown in Table 17. A new Park-and-Ride (PNR) lot is assumed at all the stations, except the MIC. Further, all PNR lots are assumed to have a catchment area of 10 miles.

Table 17 - Operating Characteristics of the three Alternatives

	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Northern Terminal Station	Miami Intermodal Center		
Southern Terminal Station	SW 137th Avenue	SW 157th Avenue	SW 328th Street
Number of Stations	7	9	11
Station Locations	MIC, Flagler Street, SW 40th Street, SW 88th Street, SW 112th Street, SW 117th Avenue, SW 137th Avenue	MIC, Flagler Street, SW 40th Street, SW 88th Street, SW 112th Street, SW 117th Avenue, SW 137th Avenue, SW 184th Street, SW 157th Avenue	MIC, Flagler Street, SW 40th Street, SW 88th Street, SW 112th Street, SW 117th Avenue, SW 137th Avenue, SW 184th Street, Krome Avenue, SW 312th Street, SW 328th Street
Frequency (peak/mid-day)	30 minutes/60 minutes		
End-to-End Length	18 miles	21 miles	30 miles
End-to-End Travel Time	36 minutes	44 minutes	57 minutes
End-to-End Speed	30 miles/hour	29 miles/hour	32 miles/hour

Table 18 depicts the station-to-station travel times as developed through the operations planning work performed for this effort. Tri-Rail's current fare zone structure was assumed for these stations. Tri-Rail bases fares on the number of fare zones traveled. It was assumed three fare zones for this effort:

- Zone 1 - MIC to SW 40th Street Stations
- Zone 2 - SW 88th Street to SW 137th Avenue stations
- Zone 3 - SW 184th Street to SW 328th Street stations

Further, the transfer fares to and from Miami-Dade transit services are identical to those used in the model for the corresponding Tri-Rail transfer fares. The transfer fare is about 60 cents to/from Miami-Dade buses and $1.20 to/from Metrorail.

Table 18 - Station-to-Station Travel Times and Fare Zone Assumptions

Station Name	Fare Zone	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
MIC	1	00:00	00:00	00:00
Flagler Street	1	11:11	11:11	11:11
SW 40th Street	1	16:06	16:06	16:06
SW 88th Street	2	22:36	22:36	22:36
SW 112th Street	2	26:58	26:58	26:58
SW 117th Avenue	2	30:18	30:18	30:18
SW 137th Avenue	2	35:53	35:48	35:48
SW 184th Street	3	--	40:08	40:08
SW 157th Avenue	3	--	44:23	--
Krome Avenue	3	--	--	46:34
SW 312th Street	3	--	--	54:35
SW 328th Street	3	--	--	57:29

6.2. Ridership Forecasts

The 2019 and 2045 station level boardings forecasts are summarized in Table 19 and

Table 20, respectively. STOPS forecasts 2,950 boardings on the South Link (Alternative 3) on an average weekday in 2019, and 2,150 boardings on the Kendall Link (Alternative 1). The forecast on West Kendall Link (Alternative 2) is approximately 2,400 boardings.

The ridership forecasts are expected to increase by approximately 28 percent by 2045. The horizon year changes in this STOPS model are a function of population/employment growth and auto congestion. No other transit network changes are assumed for the horizon year forecasts. Both the population and employment in Miami-Dade County are represented in the model to grow by 29 percent.

Table 21 and Table 22 show additional ridership forecasting metrics for 2019 and 2045 respectively. Incremental linked transit trips are expected to be about 35 percent of the total trips on project. Trips from transit dependent households are expected to vary from 16 percent in the Kendall Link alternative to 24 percent in the South Link alternative.

Table 23, Table 24, and Table 25 show the station level boardings forecasts by access mode for 2019 and 2045 years for all three alternatives. About 55 percent of the total boardings are expected to occur due to transfers to and from other transit services. Route 11 and Metrorail are among the top 3 transfer routes in all the three alternatives.

Table 19 - 2019 Station Level Boarding Forecasts

Station Name	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
MIC	730	778	923
Flagler Street	451	513	549
SW 40th Street	181	188	207
SW 88th Street	155	176	230
SW 112th Street	106	112	111
SW 117th Avenue	82	81	83
SW 137th Avenue	444	395	402
SW 184th Street	-	91	100
SW 157th Avenue	-	85	-
Krome Avenue	-	-	76
SW 312th Street	-	-	125
SW 328th Street	-	-	147
Total	**2,149**	**2,419**	**2,953**

Table 20 - 2045 Station Level Boarding Forecasts

Station Name	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
MIC	959	1,016	1,211
Flagler Street	574	652	705
SW 40th Street	234	242	268
SW 88th Street	170	197	274
SW 112th Street	134	138	140
SW 117th Avenue	105	101	104
SW 137th Avenue	537	463	472
SW 184th Street	-	117	133
SW 157th Avenue	-	117	-
Krome Avenue	-	-	107
SW 312th Street	-	-	155
SW 328th Street	-	-	215
Total	**2,713**	**3,043**	**3,784**

Table 21 - 2019 Key Ridership Forecasting Metrics

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Linked transit trips on project	2,150	2,418	2,953
Incremental linked transit trips	765	916	1,050
Transit-dependent linked transit trips on project	345	390	697
Delta Person Miles Traveled (PMT)	-13,109	-16,388	-22,328

Table 22 - 2045 Key Ridership Forecasting Metrics

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Linked transit trips on project	2,712	3,043	3,785
Incremental linked transit trips	900	1,073	1,281
Transit-dependent linked transit trips on project	440	495	887
Delta Person Miles Traveled (PMT)	-16,371	-20,301	-28,758

Ridership Forecasts By Access Mode

Table 23 - Alternative 1 – Kendall Link Forecasted Boardings by Access Mode by Station

Station	2019					2045				
	Walk	KNR	PNR	Transfer	Total	Walk	KNR	PNR	Transfer	Total
MIC	19	24	15	673	**730**	23	32	16	888	**959**
Flagler Street	133	41	15	262	**451**	171	55	21	327	**574**
SW 40th Street	100	22	8	51	**181**	127	30	11	66	**234**
SW 88th Street	84	18	8	45	**155**	75	24	11	60	**170**
SW 112th Street	70	10	8	18	**106**	90	12	11	22	**134**
SW 117th Avenue	13	25	43	-	**82**	16	31	58	-	**105**
SW 137th Avenue	111	102	113	118	**444**	142	121	147	126	**537**
SW 184th Street	-	-	-	-	-	-	-	-	-	-
SW 157th Avenue	-	-	-	-	-	-	-	-	-	-
Krome Avenue	-	-	-	-	-	-	-	-	-	-
SW 312th Street	-	-	-	-	-	-	-	-	-	-
SW 328th Street	-	-	-	-	-	-	-	-	-	-
Total	**530**	**242**	**210**	**1,167**	**2,149**	**644**	**305**	**275**	**1,489**	**2,713**

Note: KNR – Kiss-and-Ride Area Station
PNR – Park-and-Ride

Table 24 - Alternative 2 – West Kendall Link Forecasted Boardings by Access Mode by Station

Station	2019					2045				
	Walk	KNR	PNR	Transfer	Total	Walk	KNR	PNR	Transfer	Total
MIC	20	24	15	720	**778**	22	32	16	946	**1,016**
Flagler Street	136	41	15	321	**513**	174	55	20	402	**652**
SW 40th Street	100	24	8	57	**188**	127	31	11	73	**242**
SW 88th Street	97	18	8	52	**176**	93	25	11	68	**197**
SW 112th Street	72	10	8	22	**112**	91	13	11	23	**138**
SW 117th Avenue	14	26	41	-	**81**	16	32	53	-	**101**
SW 137th Avenue	117	87	87	104	**395**	150	100	103	110	**463**
SW 184th Street	59	19	13	-	**91**	70	28	18	-	**117**
SW 157th Avenue	12	26	47	-	**85**	7	43	67	-	**117**
Krome Avenue	-	-	-	-	-	-	-	-	-	-
SW 312th Street	-	-	-	-	-	-	-	-	-	-
SW 328th Street	-	-	-	-	-	-	-	-	-	-
Total	**627**	**275**	**242**	**1,276**	**2,419**	**750**	**359**	**310**	**1,622**	**3,043**

Note: KNR – Kiss-and-Ride Area Station
PNR – Park-and-Ride

Table 25 - Alternative 3 – South Link Forecasted Boardings by Access Mode by Station

Station	2019					2045				
	Walk	KNR	PNR	Transfer	Total	Walk	KNR	PNR	Transfer	Total
MIC	19	27	16	860	**923**	22	37	18	1,135	**1,211**
Flagler Street	137	41	16	355	**549**	175	55	21	454	**705**
SW 40th Street	100	24	8	75	**207**	128	32	11	98	**268**
SW 88th Street	103	19	8	100	**230**	101	25	11	137	**274**
SW 112th Street	72	10	8	21	**111**	91	13	11	25	**140**
SW 117th Avenue	15	26	41	-	**83**	18	32	54	-	**104**
SW 137th Avenue	118	88	87	110	**402**	151	101	104	117	**472**
SW 184th Street	60	21	19	-	**100**	71	32	30	-	**133**
SW 157th Avenue	-	-	-	-	**-**	-	-	-	-	**-**
Krome Avenue	5	14	58	-	**76**	5	27	76	-	**107**
SW 312th Street	89	15	16	4	**125**	104	21	24	6	**155**
SW 328th Street	115	9	16	6	**147**	157	18	30	9	**215**
Total	**833**	**294**	**293**	**1,531**	**2,953**	**1,023**	**393**	**390**	**1,981**	**3,784**

Note: KNR – Kiss-and-Ride Area Station
PNR – Park-and-Ride

6.3. Sensitivity Tests

The sensitivity of ridership forecasts to transfer fares and improved service frequency were evaluated as part of this effort to provide stakeholders with an understanding of how specific changes in fare policy and/or service frequency could impact ridership. The project team performed an analysis to determine the potential increase in ridership over the base projection show in the above tables under two scenarios:

- Increasing the frequency from 30/60 (peak/off-peak) to 15/30 is expected to increase the trips on project by about 55 percent.
- Changing the transfer fares to allow for free transfers between all Miami-Dade transit modes and the project results in an increase in the trips on project by about 80 percent.

Table 26 below provides the results of the sensitivity tests on each alternative evaluated.

Table 26 - 2045 Key Ridership Forecasting Metrics with Sensitivity Test Applied

Metric	Alternative 1 – Kendall Link	Alternative 2 – West Kendall Link	Alternative 3 – South Link
Linked transit trips on project Base Alternative (30/60)	2,700	3,000	3,800
Linked transit trips on project with increased frequency (15/30)	4,200	4,700	5,800
Linked transit trips on project with transfer penalty removed	4,900	5,500	6,800

Note: Forecasts are rounded

It should be noted that the potential increases in ridership noted above result additional costs related to both capital expenditures and annual operating and maintenance. These costs will be summarized in the next section.

7. Conceptual Cost Estimates

This section presents the capital costs for each of the three study alternatives evaluated for this effort:

- Kendall Link (Alternative 1)
- West Kendall Link (Alternative 2)
- South Link (Alternative 3)

Since not all design specifics have been developed to prepare detailed construction costs, capital cost estimates were prepared using representative unit costs or allowances on a per unit cost basis consistent with the current level of project feature and definition. These capital cost estimates will be further refined as the project advances into future phases of evaluation and development.

7.1. Methodology

The preliminary estimates of the capital costs have been developed in general accordance with FTA guidelines for estimating capital costs. Part of the FTA's guidelines call for cost estimates to be prepared and reported using the latest revision for the FTA's Standard Cost Categories (SCC). These cost categories form the basis for the format and structure that will be used for the conceptual capital cost detail and summary sheets developed for this project. FTA's Capital Cost Database (CCD) was utilized to obtain historical costs reported in the database. The database contains capital costs for a group of completed FTA-funded transit projects for which as-built cost information for each project was reviewed by the project sponsor or obtained from sponsor generated before and after study reports. An "Analysis Year" of 2023 was inserted into an input form to generate a report for which element level costs were inflated from the "Mid-Point of Construction" cost. The Cost Breakdown by Project can be selected within the database to view a report that provides a breakdown of costs of the selected project(s) at the SCC cost element top summary level and at the sub-category level. Within the database, the Average Unit Cost per Element for a Group of Projects provides a report that lists the average unit costs by SCC element for a user selected group of projects. This Cost Basis Averages Report provides the SCC element level averages of the unit quantities and unit costs for a selected cost basis. The unit costs are shown as "national average" costs and in the selected analysis year of 2023. While these unit costs are not representative of similar local rail projects, they provide a basis for which to start given limited project information at the conceptual level. These unit costs were supplemented by and compared against South Florida Regional Transportation Authority (SFRTA) unit costs for Tri-Rail Kendall to Homestead and Miami-Dade DPTW unit costs for the Smart Program Northeast Corridor Project.

7.1.1. Capital Cost Categories00

In accordance with the latest version of the FTA's SCC, the capital cost components for each proposed expansion project will be classified into the following cost categories:

10 Guideway and Track Elements
20 Station, Stops, Terminals, Intermodal
30 Support Facilities: Yards, Shops, and Administration Buildings
40 Sitework and Special Conditions
50 Systems
60 Right-of-Way (ROW), Land, Existing Improvements
70 Vehicles
80 Professional Services
90 Unallocated Contingency
100 Finance Charges

Cost Category 10 – Guideway and Track Elements

Guideway and track elements are subdivided into sub-categories, and these categories can be described by three primary types of construction: at-grade, aerial structure, and retained cut or fill/underground construction. This cost category is typically used for rail-based transit modes such as commuter passenger rail. This guideway cost category includes the foundational construction elements for rail and at-grade track crossings.

Cost Category 20 – Station, Stops, Terminals, Intermodal

This category includes costs associated with the at-grade passenger rail stations including grading, excavation, ventilation structures and equipment, station power and lighting, platforms, canopies, finishes, equipment, landscaping, mechanical and electrical components, access control, security, artwork, station furnishings, and signage.

Cost Category 30 – Support Facilities: Yards, Shops, and Administrative

Category 30 includes vehicle storage and upgrades to existing yards; track for storage of vehicles, office support areas, major shop equipment and bus maintenance facilities, clearing and grubbing, grading, excavation, drainage facilities, roadways, asphalt pathways, lighting, mechanical and electrical components, landscaping, access control, safety and security, fueling station, and other items necessary for construction and operation of a storage and maintenance facility.

Cost Category 40 – Sitework and Special Conditions

Sitework and special conditions is sub-divided into the following sections:

Demolition

This subcategory includes costs for the demolition of special features such as buildings (if not included as part of right-of-way), large structures (bridges or retaining walls), or other existing features that fall outside of the guideway construction envelope.

Utility Relocation

One of the largest cost elements within cost category 40 is the relocation of existing utilities from within the guideway construction envelope. Relocations can include both public and private utilities, subject to any agreements that may apply to franchised utilities that exist within public right-of-way. Utility relocation information is typically not available during the planning phase of project development and therefore, several levels of utility relocation allowances with average unit costs based on historic data and engineering judgement are applied.

Hazardous Material and Environmental Mitigation

Special hazardous material or environmental mitigation costs, such as contaminated soil or ground water, wetlands mitigation, etc. are included in this cost category. Since engineering and design information is not available during the planning phase, an allowance is applied based upon best engineering judgement.

Site Structures

This cost category includes structures such as retaining walls, sound walls, etc. that are outside of the guideway construction envelope. Structures such as retaining walls for retained cut or fill guideway and bridges used for elevated track are included in cost category 10 Guideway and Track Elements. For projects in the planning phase of development, site structures costs are typically applied on a cost per square foot basis.

Pedestrian Access, Landscaping

Several levels of pedestrian access and landscaping allowances with average unit costs based on historical data and engineering judgement are utilized because this information is not well developed during the planning phase. Landscaping costs associated with parking facilities are included in the composite cost developed for those items and included I other cost categories.

Automobile Accessways, Parking Lots

This category includes new and reconstructed roadways, streets, surface parking areas, sidewalks, curbs and gutters, and related roadway facilities associated with construction of the rail guideway. Roadway and parking area cost estimates will be based on parametric unit costs.

Temporary Facilities

This category includes costs for mobilization, demobilization, project phasing; temporary construction associated with weather, construction easements, or temporary site access and to mitigate construction impacts. For the planning phase of project development, these costs are included as a percentage allowance mark-up based on engineering judgement.

Cost Category 50 – Systems

The systems cost category includes capital costs for train control signals; traffic signals and crossing protection, communication systems; central control hardware and software; underground duct banks; fare collection; grade crossing protection; and roadway traffic signal systems. Systems costs are based upon historical data and engineering judgement.

Traffic Signals and Crossing Protection

For this project, there is a need for modifying existing traffic signals and constructing new traffic signals and cross protection, since the rail system is construction to operate within existing streets and with at-grade crossings of existing roadways. This category includes the signaling and control systems required for items such as vehicle and pedestrian signals, traffic signal pre-emption, and protection at hazardous at-grade crossings (flashing lights, bells, and signs).

Communications

The communications systems costs include subsystems such as two-way radios, public address systems, telephone systems, variable message signs, interfaces to fare collection and ticket vending equipment and equipment for the hearing impaired, etc.

Fare Collection

This costs for this category are based on self-service, barrier-free, proof of payment fare collection system. Ticket vending machines (TVM) costs are based on a microprocessor-controlled coin or bill accepting machine capable of optionally accepting credit, debit, and stored value cards. The unit cost for fare collection includes all equipment costs and installation costs. The hardware includes provisions for fare vending facilities.

Central Control

This cost category includes all the civil, structural, architectural, mechanical, electrical, and systems costs for providing for the remote monitoring of train operations, track conditions, substations, and station support facilities. The need for a central control facility is dependent on the operational analysis and assumptions that will be made for the given transit technology.

Cost Category 60 – ROW, Land, Existing Improvements

This cost category includes all land acquisition and acquisition related costs required to obtain various real property needed for the construction, operation, and maintenance of the proposed alignments. Costs include the fee acquisition of permanent and temporary easements, relocation costs, business damages and other miscellaneous costs. For this preliminary cost estimate, this cost category was not included.

Cost Category 70 – Vehicles

This cost category is generally subdivided into revenue and non-revenue vehicles (where non-revenue vehicles include maintenance-of-way vehicles, and agency trucks and automobiles). During the planning phase of project development, the costs for vehicles typically include costs for engineering, procurement, spare parts, etc. and based on historical data from recent transit projects.

Cost Category 80 – Professional Services

This cost category includes allowances for preliminary engineering, final design, project and construction management, agency program management, project insurance, surveys and testing and start-up costs. These allowances are computed by applying a percentage to the total construction cost estimated for each cost category (excluding right-of-way and vehicle costs). Right-of-way and vehicle costs typically are calculated to include the management and administration costs associated with these activities and are therefore excluded from the calculation of professional services.

Cost Category 90 – Unallocated Contingency

Unallocated contingency is primarily applied as an allowance for unknowns and uncertainties due to the level of project development completed. These contingencies are broader and address changes in project scope and schedule.

Cost Category 100 – Finance Charges

Finance charges are costs anticipated to be paid prior to the completion of a project or the fulfillment of the New Starts funding commitment, whichever occurs first. Typically, finance charges are determined from a project's financial plan that is based upon an analyses of funding sources and funding use. Therefore, finance charges are not included for conceptual capital costs estimates.

7.1.2. Cost Data

As mentioned above, the FTA CCD was used to search for projects similar in type and construction and document "as-built" costs. Planning level cost data has been developed based upon the level of conceptual planning which provides a basis for the development of a Unit Cost Library (UCL).

Unit Cost Library

Unit costs associated with civil and structural construction elements generally common to both transit and highway construction projects used cost data found in the CCD Average Unit Costs.

The unit costs do not include items such as engineering, construction management, owner's administrative costs and allowances for contingencies. These costs are included as percentage add-ons to the cost estimate under other cost categories.

Cost Development for Cost Category 10 – Guideway and Track Elements

The track cost estimates are based on parametric unit cost information on a per mile track unit cost basis. The CCD average unit costs and sample projects provided the basis for unit costs, since these projects represent similar project modes and grades to the CSX Alternatives. The group of projects used from the CCD to obtain average unit costs are listed below:

- Minneapolis Northstar Commuter Line Project

- Portland (Wilsonville to Beaverton) Commuter Rail Project
- Salt Lake City (Weber County to Salt Lake City) Commuter Rail
- Tri Rail Segment 5

Assumed quantities for the various category items are conceptual and based upon professional judgement for each of the alternatives for the purpose of comparing the three alternatives for extending passenger rail along the CSX Corridor.

Cost Development for Cost Category 20 – Stations, Stops, Terminals, Intermodal

Costs for proposed stations were developed based upon the same methodology as the previous category.

Cost Development for Cost Category 30 – Support Facilities, Yards, Shops, and Administrative Buildings

The proposed study alternatives are based upon the assumption that each would utilize the existing Hialeah Maintenance Yard and potential upgrades to the facility such as track construction necessary to accommodate additional vehicles.

Cost Development for Cost Category 40 – Sitework and Special Conditions

Assumed quantities for the various category items were determined with the assumption of work associated with reconstructing existing freight tracks, improvements to grade crossings, construction impacts to nearby neighborhoods and businesses, and implementation of "quiet zones." Unit costs for grade crossings were based on SFRTA average unit costs for a grouping of similar projects, and the two sample projects mentioned previously. For line items where information is limited at this stage of planning such as utility relocation and environmental mitigation, an allowance was applied to the total track cost category item based on engineering judgment.

Cost Development for Cost Category 50 – Systems

Assumed quantities for these category items were determined at a conceptual level for each alternative based on number of stations and grade crossings. Unit costs and allowances were applied to various items based upon related estimates for applicable category items based on average unit costs obtained from the CCD, as well as upon engineering judgement.

Cost Development for Cost Category 60 – ROW, Land, Existing Improvements

Land acquisition of right-of-way for stations, park-and-ride stations, support facilities, private property takes, and impacts of businesses, grade crossing improvements, finance charges and other infrastructure costs were not estimated as part of the conceptual cost estimate.

Cost Development for Cost Category 70 – Vehicles

Unit costs for locomotive and passenger car vehicles were obtained from unit costs from the Miami-Dade SMART Program Northeast Corridor Project.

Cost Development for Cost Category 80 – Professional Services

The following list of the professional services or soft costs percentage multipliers are being applied to the total construction costs for each proposed capital expansion project; these total 27 percent of construction costs:

80.01	Project Development	4.00%
80.02	Engineering	7.00%
80.03	Project Management for Design and Construction	2.00%
80.04	Construction Administration & Management	6.00%
80.05	Professional Liability and Other Non-Construction Insurance	3.00%
80.06	Legal; Permits; Review Fees, etc.	1.00%
80.07	Surveys, Testing, Investigation, Inspection	2.00%
80.08	Startup	2.00%
		27.00%

Cost Development for Cost Category 90 – Unallocated Contingency

Unallocated contingency will be calculated as a percentage of the total of cost categories 10 through 80. An unallocated contingency of 15 percent will be applied to professional services and track construction elements of the proposed capital expansion projects.

Cost Development for Cost Category 100 – Finance Charges

Finance charges will not be included due to the conceptual design stage of the project.

7.1.3. Estimating Assumptions

The basic assumptions and criteria used in developing the conceptual cost estimates are as follows:

Scope

For most cost items, the scope is determined by an evaluation of construction items and activities based on the CSX Railroad Corridor Assessment Scope of Services, previous studies, and technical working group meetings where continued guidance and feedback are provided during the four-month study.

Quantities

Construction items and quantities have been provided based upon available information given. Some construction items are estimated by applying an allowance when there is not sufficient detail to perform a direct quantity takeoff which is typical at this planning-level phase.

Cost

Unit prices for construction items or activities will utilize latest available information as related to the FTA CCD, SFRTA capital cost items from the Tri-Rail extension projects listed earlier, and the Miami-Dade SMART Program Northeast Corridor. For items where the scope of work cannot be readily determined, an allowance cost will be applied. Cost estimates are presented in 2023 dollars.

Contingencies

An unallocated contingency of 15 percent will be applied to both the professional services elements total estimate and track construction total estimate based on professional judgement.

The preliminary capital cost estimates include:

- Track replacement or renewal to FRA Class 3 (allows for maximum 60 mph with average speeds within range of 30 mph)
- Track undercut, ballast renewal, and track surfacing
- Construction of missing track segment linking the spur to the MIC
- Station and siding track installation
- Potential upgrades to existing Hialeah Yard

- Installation of Centralized Traffic Control (CTC) signal system, reinforced with Positive Train Control system
- All bridges reconstructed to allow for safe operation
- New stations with low boarding passenger platforms and mini-high platforms
- All grade crossings to be brought up to current standards with modern equipment and potential deployment of necessary infrastructure for "quiet zones"
- New rolling stock (train sets) to meet operational demands

These preliminary capital cost estimates do not include:

- Right-of-way access costs
- Property acquisition
- Finance Charges

The preliminary estimated capital cost for the alternatives is incrementally greater the longer the route is. The next section contains preliminary cost estimates in a range in greater details.

7.2. Proposed Alternatives Capital Cost Estimates

Table 27 demonstrates the capital cost implications of operating a high-frequency service for single track with sidings and for double track, for the three evaluated alternatives. The need for double track infrastructure combined with the additional train sets significantly increases the cost. The benefit of additional ridership gained versus the added expense needs to be carefully evaluated.

Table 27 - Planning Level Capital Costs by Alternative (in 2023 Dollars)

	Alternative 1 Kendall Link	Alternative 2 West Kendall Link	Alternative 3 South Link
Single Track w/ Sidings 30/60 Service Plan	$640 - $720.0 Million	$731 - $860 Million	$1.07 - $1.2 Billion
Double Track 15/30 Service Plan	$900 Million – $1.1 Billion	$1.1 - $1.3 Billion	$1.65 - $1.8 Billion

7.3. Annual Operations and Maintenance (O&M) Costs

To develop planning level annual O&M costs for the various alternatives baseline data was obtained from the 2021 National Transit Database (NTD). The data extracted from the NTD was used to develop average cost per vehicle revenue hour for similar commuter rail operations in Florida. Specifically, comparable systems utilized for the analysis include the SFRTA for the Tri-Trail operations and the Central Florida Commuter Rail for the SunRail operations. These two systems were determined to best represent the operating parameters being evaluated in this analysis.

Once comparable operations were identified average costs were developed for application to the three alternatives under study. Utilizing the service plans developed and the average O&M costs identified costs for the various alternatives were developed as shown on Table 28. A range of costs have been presented to be conservative given the level of planning associated with this evaluation.

Table 28 - - Planning Level O&M Costs by Alternative (in 2023 Dollars)

	Alternative 1 Kendall Link	Alternative 2 West Kendall Link	Alternative 3 South Link
Annual Revenue Hours	10,000-10,500	12,000-13,000	15,000-16,500
Cost Per Revenue Hour	$1,700	$1,700	$1,700
Annual O&M Cost	$17m-$18m	$21m-$22m	$27m-$28m

8. Next Steps

This initial planning level analysis was performed to determine the merits of a strategy involving the implementation of a shared freight and passenger rail within the corridor. While this initial review reveals promise for such use of the corridor further steps remain in the project development process. Next steps include:

- Incorporating the corridor into the current adopted Miami-Dade TPO's 2045 Long Range Transportation Plan (LRTP) Priority IV unfunded section for future use as a shared freight/passenger corridor.
- Undertaking a land use visioning initiative to evaluate transit supportive land use policies along the corridor to provide for increased transit ridership and goods movement by freight service.
- Continue to work with Stakeholder Groups including CSX to refine the strategy for and needs of the corridor.
- At the appropriate time advance the corridor initiative through FDOT's Transit Concept and Alternatives Review (TCAR) process.
- Develop a financial strategy for project development and implementation.

9. Appendix A: Existing Conditions Assumptions

The single-track CSX corridor under consideration in this study runs in a southwesterly direction from the SFRC main line tracks near the MIC, along the southern boundary of Miami International Airport (MIA), and then south through the Oleander Junction along the Homestead Subdivision towards the MetroZoo roughly near the intersection of SW 152nd Street and SW 137th Avenue.

Moving westward from the MIC, the track switches off the SFRC main line at Hialeah Junction and loops around a light industrial area. A double at-grade crossing exists across both Le Juene Road / NW 42nd Avenue / State Route (SR) 953 and the Airport Expressway / SR 112 in the vicinity of NW 29th Street. Both crossings are currently signaled, with active grade crossing protection in place. There is no short-term plan to improve or grade-separate this busy crossing as part of the roadway improvement program included within the MIC construction project. An additional potential conflict that could arise should the crossings remain in the future is that the Airport Expressway runs in a contra-flow orientation in this area, with southbound traffic running on the east side of the divided road, while northbound traffic runs along the western side of the road. This could potentially be confusing to both motorists and transit operators and could increase the incidence of conflicts.

The rail line then passes over a drainage canal and runs southwards next to an MIA freight handling facility to the west and a drainage canal and the elevated Airport Expressway to the east. The track then passes underneath the main Airport Expressway / NW 21st Street corridor and appears to have a drainage canal running under and along the corridor in a culvert. An unsignalized grade crossing exists at NW 20th Street near an electrical substation, airport fuel tanks and other airport support buildings. The track parallels the fuel tank farm to the west and the South Florida Water Management District (SFWMD) C-4 Tamiami Canal to the east.

After crossing a bridge over a small inlet, the tracks cross over NW 14th Street with a signalized, at grade crossing with grade grossing protection. The rail line turns westwards and parallels the airport's Perimeter Road to the north and the Dolphin Expressway / SR 836 and the Blue Lagoon to the south. An at-grade, signalized crossing with grade grossing protection exists at Red Road / NW 57th Avenue / SR 959 near access ramps for SR 836. The line passes through two switches, one that provides access to the Florida East Coast railway (FEC) Ludlam Branch and the other heads westward on to a short tail track. This tail track has been proposed to extend westward and connect to the CSX Lehigh Spur that heads towards the rock quarry operations west of 137th Avenue.

Turning south, the CSX Homestead Subdivision passes through Oleander Junction. After passing underneath the Dolphin Expressway / SR 836, the CSX line turns slightly towards the southwest. The FEC tracks approach from the northwest and head due south under SR 836 and meet the CSX line just north of the NW 7$_{th}$ Street overpass. Connections within the signal-controlled Oleander Junction allow CSX trains to access the CSX Lehigh Spur, FEC Ludlam Branch and CSX connections through the SFRC in addition to the Homestead Subdivision. The FEC line continues due south on the west side of Lake Mahar and east of Robert King High

Park. The CSX tracks run to the west of Robert King High Park and east of a drainage canal and high-density residential neighborhood.

The tracks once again cross the SFWMD C-4 Tamiami Canal and a signalized, at-grade crossing with grade grossing protection at West Flagler Street before passing several light commercial and low-density residential properties where they enter a light-industrial district. Running due south, the line passes through at-grade crossings with SW 4th Street, SW 9th Street, SW 12th Street, SW 13th Street, SW 13th Terrace. The tracks turn towards the southwest and pass through a single-family residential neighborhood with at-grade crossings at SW 16th Street, SW 21st Street, SW 22nd Street and SW 23rd Street. The line veers slightly towards the southeast to run in the median of SW 72nd Avenue before crossing through the intersection with Coral Way / SW 24th Street to the east side of SW 72nd Avenue. The signalized intersection must contend with not only north-south and east-west vehicular traffic, but also with railroad tracks that pass across lanes of traffic.

On the south side of Coral Way, the tracks pass east of Coral Way Park and parallel SW 72nd Avenue through a light industrial district. Continuing due south, SW 72nd Avenue crosses from the west side of the tracks through a signalized at-grade crossing and turns south the parallel the tracks again before both pass over the SFWMD C-3 Coral Gables Canal. The tracks then pass west of a single-family residential neighborhood and east of Ad Barnes Park and cross SW 39th Street at an at-grade crossing. After passing through the intersection of SW 72nd Avenue and Bird Road / SW 40th Street, the line once again turns southwest and passes through another light industrial district with at-grade crossings at SW 41st Street, SW 42nd Street and SW 75th Avenue.

At this location, the CSX tracks pass under the Palmetto Expressway / SR 826 and run adjacent to the Don Shula Expressway / SR 874 right-of-way. The underpass is constrained by access ramps, bridge supports and earthen and concrete bridge abutments. Running along the southern side of SR 874, the tracks pass multi-family residential properties before passing over SW 56th Street at a signalized, at-grade crossing with grade grossing protection. Both the tracks and the Don Shula Expressway pass through a low-density residential area and Sunkist Estates Park for about one mile before reaching SW 87th Street. The rail line crosses the street at-grade, while SR 874 flies over both the tracks and the street, touching down south of the tracks. It then runs north of the expressway and to the south a public water supply facility before meeting SW 72nd Street at a signalized, at-grade crossing with grade crossing protection. The corridor passes through a single-family residential neighborhood and crosses over the SFWMD C-2 Snapper Creek Canal before meeting Kendall Drive / SW 88th Street.

After passing through the signalized, at-grade crossing with Kendall Drive, the tracks pass several multifamily residential properties and then returns to a predominantly single-family residential district. The corridor passes just to the north of the Kendall Golf Course, crosses an electrical utility corridor and then over the SFWMD C-100 Cutler Drain Canal. A smaller drainage canal parallels the corridor to the interchange. A multi-family residential neighborhood lies to the northwest of the corridor and a low-density single-family neighborhood lies to the southeast. The tracks then cross SW 112th Street at-grade and pass adjacent to a single-family

residential neighborhood. A toll plaza for Florida's Turnpike controls access here for SR 874 traffic traveling to and from the HEFT just three-quarters of a mile down the road.

Approaching the HEFT, the CSX rail tracks pass by several light industrial properties and then over the SFWMD C-100 Cutler Drain Canal. The Don Shula Expressway/ SR 874 terminates at the HEFT, while the tracks continue under the turnpike overpasses and to the west of a small light industrial district. The line runs past several vacant but developing parcels and into the new residential neighborhood of Three Lakes. The lakes in this area appear to be former rock mining pits that have become new waterfront residential areas. The tracks pass an electrical substation and a utility right-of-way as it passes between former quarries and new subdivisions.

Just west of SW 144th Street, the Homestead Subdivision tracks meet the 11-mile Portland Spur segment of CSX track in a wye. From here, a single track runs to Krome Avenue where it turns north and terminates at SW 58th Street. Two rock trains a day serve the Rinker Plant at the terminus of this spur. Further south on the main line, the tracks cross the SFWMD C-1N Bel-Aire Canal and then SW 152nd Street in an at-grade crossing near the northwestern boundary of the Miami MetroZoo. The tracks of the Homestead Subdivision continue in a southwesterly direction for approximately 7.5 miles, before turning due south in the vicinity of SW 240th Street. The tracks continue for another five miles before terminating in the City of Homestead.

10. Appendix B: CSX Correspondence

Appendix B

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November 1, 2023

VIA E-MAIL

Jeff D. Stiles
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TranSystems
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Re: CSX Railroad Corridor Assessment

Thank you for including CSX in your planning efforts. Given the time limitations and early stages of the project, CSX recommends to use a streamlined approach to evaluate the potential infrastructure required to support the introduction of commuter trains on the Homestead Sub.

As you know the entire subdivision is "excepted track". This means that as of today passenger trains are not allowed to operate and no Positive Train Control ("PTC") is installed. Before initiating any new commuter operation, in compliance with FRA regulations, new tracks and additional capacity will need to be constructed including installing a PTC system.

It is CSX's recommendation to complete the study using, as a template, the same infrastructure characteristics that have been constructed and in service on the SFRC where TriRail operates its commuter service between West Palm Beach and Miami. The CSX trains that operate on the Homestead Sub also operate on the SFRC to reach Hialeah Yard. Providing the same capacity that is available on the SFRC should be sufficient to operate both freight and passenger trains on the Homestead Sub. The same engineering standards for track (including speed, weight, vertical and horizontal clearances, etc.), signals and PTC available on the SFRC should be planned on this new corridor.

CSX recommends that stations be designed using the same standards as those facilities on the SFRC.

As far as train counts and specs, SFRTA can provide the data since CSX trains operating on the Homestead Sub originate and terminate on the SFRC in Hialeah Yard.

At this point, given the uncertainties of any such transaction, CSX has not decided whether to entertain a deal involving the introduction of commuter passenger trains onto the Homestead

Sub, but, if in fact the project progresses, one of CSX's requirements will be fair market value compensation for the property necessary for the project and capacity that such new service would utilize.

Another major element of any potential transaction would also be indemnification protection against new liabilities associated with the introduction and operation of this new service. While the current agreement with FDOT for the SFRC provides an acceptable framework, there are several provisions that would need to be renegotiated to incorporate the potential new service. There are obviously other significant issues which any transaction would have to address in a satisfactory manner for CSX to consider progressing the introduction of commuter trains on the Homestead Sub, but I wanted to highlight these two large issues for your awareness.

Please let us know if you have additional questions.

Sincerely,

Marco Turra