MIAMI-DADE
METROPOLITAN
PLANNING
ORGANIZATION

CSX East-West Rail Feasibility Study

Final Report

JACOBS®

March 2016

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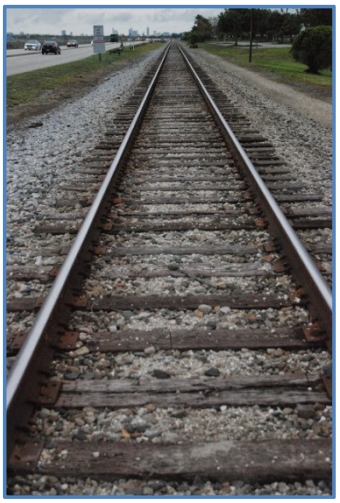
Executive Summary



Overview

Local officials, stakeholder agencies, and the Miami Dade Metropolitan Planning organization (MPO) have undertaken the *CSX East-West Rail Feasibility Study* to examine the feasibility of developing a passenger rail service along the CSX East-West Lehigh rail spur, located in Miami-Dade County, Florida. The principal study area for this study is located generally along the SR 836 corridor west from Miami International Airport. The eastern portion of the rail corridor is owned by FDOT, while the western segment is owned privately by CSX. The secondary study area includes the area west of NW 137 Avenue Krome Avenue and south of the corridor to Florida International University (FIU). The study presents technical details for the primary study area. General considerations for the secondary study area are presented.

SFRTA Commuter Rail Vehicle

This document presents findings for various transit options in the primary study and in the secondary study area that could be developed in the mid-term with a longer implementation period and a greater investment.

Alternatives considered in the CSX East-West corridor included various transit mode technologies and alignment options. The modes examined were screened for potential applicability in the CSX East-West corridor and it was determined that two modes, DMU/diesel light rail and commuter rail, were to be carried forward for further evaluation in the CSX East- West corridor. For each mode and alignment option, costs were developed and ridership was estimated.

DMU/Diesel Light Rail in Austin, Texas

Three different alignment options were examined in this study:

- Starter Service Options, services that could be developed in the short-term using commuter rail equipment in the study corridor east of 137th Avenue,
- Western Service Options, services that could be developed in the mid-term using commuter rail equipment in the study corridor west of 137th Avenue, and
- FIU Service Options, services that could be developed in the mid-term using diesel light rail equipment in the study corridor and south to FIU.

Long-term service options were also discussed during the conduct of the study as future considerations. Possible long-term expansions markets were identified to the West Dade and Kendall areas.

Starter Service Options

Three concepts were developed to meet the objectives of initial starter service (Figure ES-1):

- Concept #1 MIC to Dolphin Station
- Concept #2 MIC to 132nd Avenue
- Concept #3 MIC to 137th Avenue

All three concepts would terminate at the MIC sharing a station with Tri-Rail and Amtrak. Along the route to the west the passenger trains would share tracks with infrequent local freight trains running to and from industrial customers to the west and south. Many travelers using the potential new rail service would transfer to and from the Metrorail system at the MIC (airport) station collocated with the Amtrak and Tri-Rail station tracks. The following assumptions were used in the development of all initial Starter Service Concepts:

- Access to CSX-owned right-of-way for passenger rail operations can be achieved,
- CSX continues to serve freight customers accessed from the line,
- Starter service uses surplus conventional locomotive hauled push-pull trainsets from Tri-Rail,
- No changes to existing Metrorail schedules,
- Six minutes allowed for transfer at MIC,
- Eight minutes to turn a train at the end of its trip for schedule reliability, and
- Independent, shuttle-type service with equipment dedicated for this line. The service would not be interlined with existing Tri-Rail service.

Two different operating scenarios were analyzed for each of the Concepts 1) 30 minute peak and 60 minute off peak headways, and 2) 15 minute peak and 30 minute off peak headway.

Figure ES-1: Starter Service Options

Concept #1 – MIC to Dolphin Station Alignment

Concept #2 – MIC to SW 132nd Avenue Alignment

Concept #3 – MIC to 137th Avenue Alignment

Source: Jacobs Engineering, 2015.

Western Service Options

Western service options were analyzed assuming use of commuter rail equipment operating every 30 minutes during the peak and hourly in the off peak. Three concepts were developed to the western part of the project study area (Figure ES-2):

- MIC to 147th Avenue
- MIC to 157th/Krome Avenue
- MIC to Krome Avenue

Concept #4 would provide rail service originating at the MIC, using the CSX right-of-way to 137th Avenue. The Concept would turn south at 137th Avenue on new right-of-way, turn west at SW 8th Street, and terminate at a proposed station at 147th Avenue. This Concept would require new right-of-way south and west of 137th Avenue, where the Concept leaves the CSX right-of-way.

Concept #5 would provide rail service originating at the MIC, using the CSX right-of-way to its western terminus, turn south on new right-of-way to 157th Avenue, turn west at SW 8th Street, and terminate at a proposed station at Krome Avenue. This Concept would require new right-of-way south between SW 8th Street and theoretical NW 12th Street and west of 157th Avenue, where the Concept leaves the CSX right-of-way.

Concept #6 would provide rail service originating at the MIC, using the CSX right-of-way to its western terminus, continue west on new right-of-way, and terminate at a proposed station at Krome Avenue. West of the CSX right-of-way terminus at theoretical 167th Avenue, new right-of-way would have to be acquired.

Figure ES-2: Western Service Options

Concept #4 – MIC to 147th Avenue Alignment

Concept #5 – MIC to 157th Avenue Alignment

Concept #6 – MIC to Krome Avenue Alignment

Source: Jacobs Engineering, 2015.

FIU Service Options

Three concepts were developed to evaluate the feasibility of rail service options from the CSX corridor to the south to Florida International University (FIU):

- MIC to East Side of FIU
- MIC to Center of FIU
- MIC to West Side of FIU

The FIU service options analyzed would operate every 30 minutes during the peak and hourly in the off peak using diesel light rail cars. The FIU Concepts would require new right-of-way south of where they leaves the CSX right-of-way.

These concepts are described below and depicted in Figure ES-3.

Concept #7 – MIC to East Side of FIU

This Concept accesses the east side of FIU via SW 107th Avenue.

Concept #8 – MIC to Center of FIU

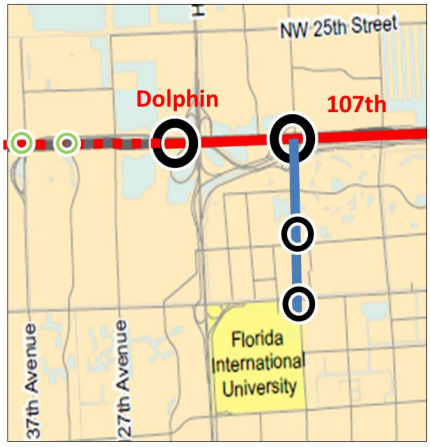
This Concept accesses the center of FIU via the Turnpike / SW 112th Avenue.

Concept #9 – MIC to West Side of FIU

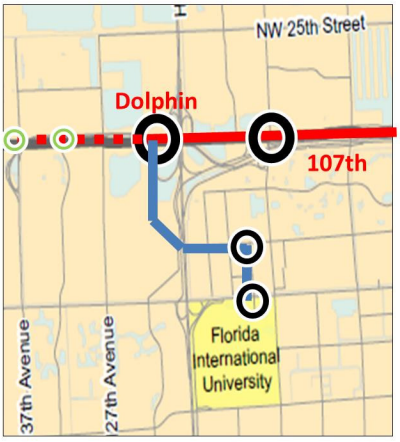
This Concept accesses the west side of FIU via the Turnpike / SW 114th Avenue.

Figure ES-3: FIU Concepts

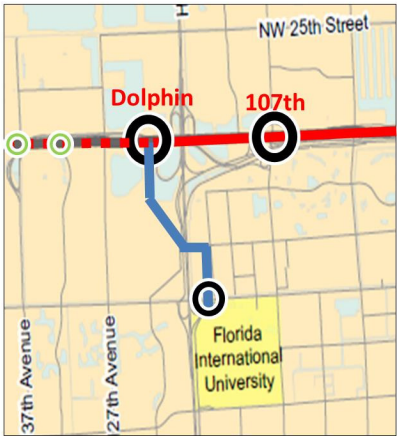
MIC to East Side of FIU



MIC to Center of FIU



MIC to West Side of FIU



Source: Jacobs Engineering, 2015.

Summary of Corridor Concepts

The following table summarizes the features, travel times, cost and ridership for each of the operating scenarios for the Service Concepts.

Table ES-1: Summary of Corridor Concepts

	Miles	Stations	Travel Time (MIC to Terminus)	Capital Costs (2015 $s)*	Annual O&M Costs (2015 $s)	Average Weekday Boardings	O&M Cost per Boarding
STARTER SERVICE OPTIONS							
Concept #1: MIC to Dolphin Station							
30/60 Service Plan	9.4 miles	4	18 minutes	$87.0 million	$8.2 million	4,450	$6.58
15/30 Service Plan	9.4 miles	4	18 minutes	$125.0 million	$15.8 million	6,650	$8.48
Concept #2: MIC to 132nd Avenue							
30/60 Service Plan	10.5 miles	5	21 minutes	$100.0 million	$8.6 million	4,600	$6.68
15/30 Service Plan	10.5 miles	5	21 minutes	$141.5 million	$16.3 million	6,850	$8.50
Concept #3: MIC to 137th Avenue							
30/60 Service Plan	11.1 miles	5	22 minutes	$103 million	$8.9 million	4,900	$6.49
15/30 Service Plan	11.1 miles	5	22 minutes	$145.0 million	$16.9 million	7,200	$8.38
WESTERN SERVICE OPTIONS							
Concept #4: MIC to 147th Avenue							
30/60 Service Plan	14.5 miles	6	29 minutes	$122.0 million	$10.0 million	--	--
Concept #5: MIC to 157th/Krome Avenue							
30/60 Service Plan	16.0 miles	7	36 minutes	$175.0 million	$11.6 million	--	--
Concept #6: MIC to Krome Avenue							
30/60 Service Plan	15.0 miles	6	30 minutes	$123.0 million	$10.8 million	--	--
FIU SERVICE OPTIONS							
Concepts #7-#9: MIC to FIU							
30/60 Service Plan	10.0 miles	5	22 minutes	--	--	--	--

Source: Jacobs Engineering, 2015.

*Capital costs do not include vehicles, SFRTA vehicles assumed, and right-of-way, acquisition/fees unknown.

Service Concept Evaluation Results

The initial starter service concepts were analyzed for two different operating scenarios for each of the Concepts 1) 30 minute peak and 60 minute off peak headways, and 2) 15 minute peak and 30 minute off peak headway. Western service options and FIU service options would operate every 30 minutes during the peak and hourly in the off peak. Starter service uses surplus conventional locomotive hauled push-pull trainsets from Tri-Rail. Western service options also use commuter rail equipment. The FIU service would be operated with diesel light rail cars.

The implementation of all concepts would require the improvements to the physical infrastructure along the alignment, including track upgrades, a new signal system, new stations, structural rehabilitation, utilities, and grade crossing improvements. Rail service to any point west of theoretical 167th Avenue or south of NW 12th Street would require assembling new right-of-way. Costs for right-of-way were not included for any of the options. Concepts # 5 and #6 would require new railroad infrastructure west of the Urban Development Boundary (UDB) established by Miami-Dade County in their Comprehensive Development Master Plan (CDMP) and within an area designated for environmental protection in the CDMP. Therefore, these concepts would have CDMP policy implications that would need to be addressed in the future if pursued.

Features, travel times, cost and ridership for each of the operating scenarios for the Service Concepts were analyzed as depicted in Table ES-1. Generally, the longer the route miles and the more frequent the service, the higher the estimated capital costs, O&M costs, and ridership. For Concepts #1, #2 and #3, increasing the frequency of service from 30/60 minute headways to 15/30 minute headways increases the capital cost by 41 to 44 percent and increases the O&M cost 90 to 93 percent, while only increasing the ridership by 47 to 49 percent.

Accommodations with CSX for use of the corridor right-of-way would need to be negotiated to develop the proposed passenger rail service. There are several approaches to the joint use of right-of-way for the provision of both freight rail services and passenger rail services, including purchase of right-of-way, access agreement, and operating agreement.

Financial Plans

Should this project be advanced for further study, a detailed financial analysis would need to be developed. A detailed financial analysis would focus on identifying potential sources of funding, estimating the relative level of funding likely to be available and the size of the resulting additional funding required for project local funding sources. While in most circumstances some type of Federal funding source is desired, it is plausible to advance a transit project without the use of Federal funding by tapping State and local sources. While Federal money may look attractive it can extend the delivery schedule and does include many requirements upon the grantee. A thorough cost/benefit and risk analysis is recommended to be performed to best inform decision makers on the most prudent funding strategy.

Implementation Actions

Upon completion and acceptance of this feasibility study a decision may be made to advance one of the service development alternatives. If so, there are a number of steps that need to be addressed by the project sponsor(s) in order to initiate passenger rail service within the corridor (Figure ES-4):

- Environmental and Outreach
- Finance Plan
- Access Agreement
- Governance Plan
- Preliminary Engineering
- Vehicle Engineering and Procurement
- Federal Coordination
- Project Delivery
- Final Design and Construction
- Commissioning
- Start Revenue Service

Figure ES-4: Implementation Process

Source: Jacobs Engineering, 2016

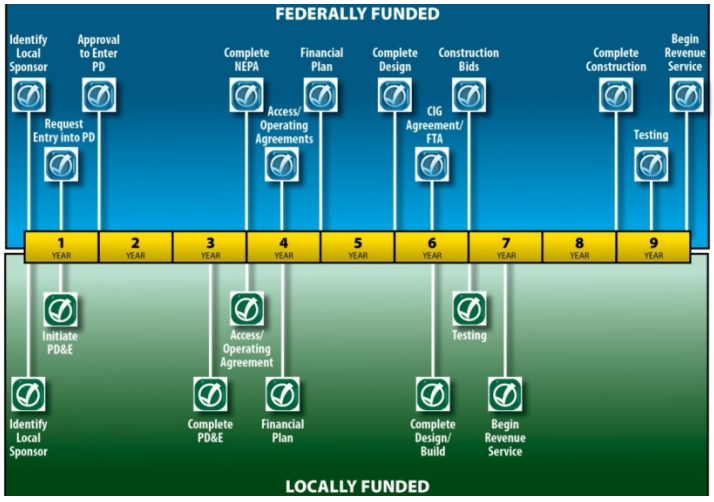
Conclusions

Transit projects typically follow one of two project implementation paths depending on whether or not federal capital improvement grant (CIG) funding will be sought for the project. If CIG funding is sought for the project, the project will be required to proceed through a multi-step, multi-year process to be eligible for funding with FTA evaluation and rating required at various points in the process. Projects such as the potential CSX passenger rail service that are less than $300 million in capital cost and seeking less than $100 million are eligible for Small Starts CIG funding, which can streamline the project delivery process as compared to New Starts projects. The Small Starts process consists of two phases, *Project Development* and *Expedited Grant Agreement*, while the New Starts process consists of three phases, *Project Development*, *Engineering*, and 3) *Full Funding Grant Agreement*. Therefore, it is likely that if this project seeks CIG funding it will follow the Small Smarts process.

The FTA Project Development process includes specific, defined steps which the project sponsors must follow in order to be eligible for CIG grants, as depicted at the top of Figure ES-5. These include:

- request to Enter Project Development,
- completion of environmental documentation in accordance with NEPA,
- completion of design,
- submittal of technical requirements,
- submittal of project justification and financial criteria for project evaluation and rating, and
- CIG agreement with the FTA.

Figure ES-5: Federal and Local Project Implementation Process



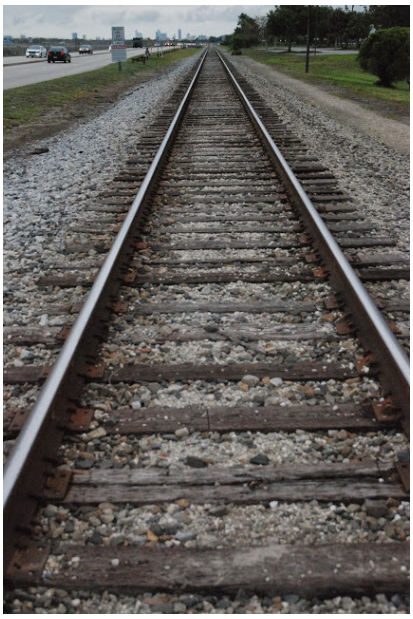
Source: Jacobs Engineering, 2016.

Projects that address regional travel concerns, but do not perform as well as other projects under the federal criteria, can be implemented using state and local funding. The local project implementation process, depicted at the bottom of Figure ES-5, is similar to the federal process, with several differences:

- federally required steps such as requesting entry into Project Development are not required,
- NEPA documentation is not required, instead, Florida PD&E documentation is required,
- submittal of federal technical requirements are not required,
- submittal of project justification and financial criteria for project rating are not required, and
- commitment to the federal grant agreement, and associated obligations, are not required.

Passenger rail service in the CSX East-West Rail corridor should be considered together which other transit improvement projects in the region to determine which projects are best suited for federal CIG funding, and which projects should be advanced using state funds. After this determination is made, the project can advance for further environmental and engineering evaluation under the appropriate federal or state/local implementation process.

1. Introduction

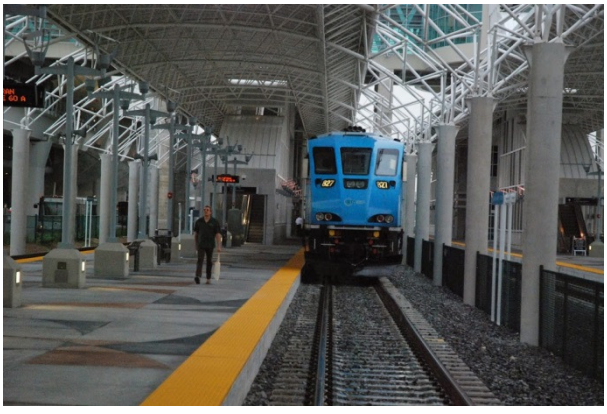


Local officials, stakeholder agencies, and the Miami Dade Metropolitan Planning organization (MPO) have undertaken the *CSX East-West Rail Feasibility Study* to examine the feasibility of developing a passenger rail service along the CSX East-West Lehigh rail spur, located in Miami-Dade County, Florida. The principal study area for this study is located from east to west, from the Miami Intermodal Center (MIC) near the Miami International Airport in the vicinity of NW 37th Avenue to NW 137 Avenue centered along the CSX tracks which mostly parallel NW 12th Street and the Dolphin Expressway. The eastern portion of the rail corridor is owned by FDOT, while the western segment is owned privately by CSX. The secondary study area includes the area west of NW 137 Avenue Krome Avenue and south of the corridor to Florida International University (FIU). The study presents technical details for the primary study area. General considerations for the secondary study area are presented.

This document presents findings for starter service options in the primary study area that could be developed in the short-term with minimal lead time and a smaller investment, as well as service options in the secondary study area that could be developed in the mid-term with a longer implementation period and a greater investment.

1.1 Study Purpose

This Final Report for the *CSX East-West Rail Feasibility Study* documents the feasibility of service options in the East-West corridor. There has been a long standing recognition in the MPO's LRTP of a need for a rapid transit connection to serve numerous key activity centers located along the East-West Corridor.



The CSX branch rail line, known as the Lehigh Spur, has long been identified as a possible public transport route linking the western end of the Dolphin Expressway (SR 836) with destinations in eastern Miami-Dade County. As early as 1993, the Miami MPO recognized that despite challenges related to width, circuity, adjoining land uses and grade crossings that the 11-mile rail branch offers ridership potential. Since that time, various planning initiatives have considered the Lehigh Spur or parallel alignments, to host commuter rail, heavy rail transit, bus rapid transit and/or light rail services. Each of these planning studies was encouraging but insufficient to engender the ground swell of support necessary to implement the recommended service(s). At this time, the MPO wishes to revisit its service concepts to determine the feasibility of passenger rail service along the corridor.

The eastern terminus for all service options evaluated in this study is the MIC. At the MIC, the service options would have a direct connection to Metrorail, Tri-Rail, Amtrak, Metrobus routes, MIA Connector, and Miami International Airport (MIA), a major hub for numerous domestic and international air carriers. The 11-mile rail line runs west from the MIC, skirting the eastern and southern fringe of Miami's International Airport and paralleling the often congested Route 836 toll road known as the Dolphin Expressway (Figure 1). The Dolphin Expressway (SR 836), a major arterial in the area, is one of Miami-Dade's most congested corridors serving over 200,000 vehicles per day.

Figure 1
Study Area Overview

Source: Jacobs Engineering, 2015.

The objectives of the proposed options evaluated within this study are:

- Identify services to meet the needs of travelers in the study corridor with destinations near the airport and downtown,
- Develop services that would have a seamless transfers to and from Metrorail at the MIC,
- Identify and evaluate a starter service in the corridor that can be implemented with minimal lead time,
- Identify services for key markets in the western area of the study corridor, and
- Identify services to FIU.

1.2 Agency Coordination

An integral component of any transportation study is agency coordination. Transportation investments transcend a multitude of decision-makers as such bringing involved stakeholders together early and throughout the process is an important element of the study. To accomplish this coordination effort the Miami-Dade MPO established a Study Advisory Committee (SAC) to help guide the technical studies and to provide input to the project team at key decision points along the way. The SAC was comprised of individuals from various public agencies and political entities having interest in the corridor (Table 1).

Table 1
Members of the Study Advisory Committee

Agency/Organization	Representative(s)
Florida Department of Transportation – District 6	Harold Desdunes, PE
Florida Department of Transportation – District 4	Stacy Miller Birgit Olkuch Maurice Borrows
Florida Department of Transportation – Central Office	Todd Gruenemeier
South Florida Regional Transportation Authority	William Cross, PE Joe Quinty
Miami-Dade Transit	Albert Hernandez, PE Monica Cejas
Miami-Dade Regulatory and Economic Resources (RER)	Mark Woerner Lee Hefty
Miami-Dade Expressway Authority (MDX)	Javier Rodriguez, PE
Citizens Independent Transportation Trust (CITT)	Charles Scurr
Miami-Dade Public Works and Waste Management	Octavio Marin
Miami-Dade Aviation (MDAD)	Jose Ramos
City of Sweetwater	Carlos Lanza
City of Doral	Rick Carbonell
CSXT	Marco Turra Gina Clark Bob O'Malley

Stakeholder and agency coordination was conducted throughout the study to identify key issues, assess markets to be served, develop corridor limits, and evaluate potential station locations. The project team held a series of meetings with the SAC to gain input and guidance on the direction of the study (Table 2). The input received was instrumental in identifying preferences and key concerns. At each step in the study process the team presented findings to the SAC and sought feedback prior to moving forward on the technical aspects of the study.

Table 2
Study Advisory Committee (SAC) Meeting Schedule

Meeting Date	Topics of Discussion
May 14, 2015	• Role of the SAC • Purpose of the study • Previous studies • Initial project team on potential transit concepts
July 16, 2015	• Potential start up concepts • Preliminary costs • Project work plan
August 25, 2015	• Infrastructure needs and costs • Forecasted demand • Potential enhancements to start up concept
December 14, 2015	• Ridership forecasts • Future considerations
March 23, 2016	• Study findings • Potential funding • Implementation strategies

Key decisions made during through the SAC process included:

- The CSX East-West passenger rail alternatives should be developed to allow for expansion in the future for service to the edge of the Urban Development Boundary.
- The alternatives should be developed with consideration of future plans being put forth by MDT, MDX, and FDOT.
- All alternatives considered must consider the freight network in place today and the future.
- Initial and detailed focus of this study should be on an initial starter service.
- The initial starter service should minimally extend from the Miami Intermodal Center (MIC) to the Dolphin Station being planned by MDT.
- Future extension plans should focus on going further west and possibly serving the west Kendall area.

The *CSX East-West Rail Feasibility Study* was not intended to include a formal public outreach program but rather to use the various agencies to develop the feasibility of such service implementation. If the project advances to further project development activities a more robust stakeholder outreach program would be implemented.

2. Literature Review

2.1 Previous Studies

Several previous study efforts have examined a premium transit connection to serve the East-West Corridor since the inception of Metrorail service. The FDOT East-West Multimodal Corridor Study, conducted during the 1990's, examined a variety of transit options in this study area; an extension of Metrorail was proposed for advancement in a parallel corridor but was not implemented. Within the CSX East-West corridor itself, in 2002 Miami-Dade Transit conducted a study that focused on the implementation of commuter rail service from the MIC to Florida's Turnpike (HEFT). More recently, there have been several efforts to identify and fund express and bus rapid transit (BRT) along the East-West Corridor.

The following is a list of studies conducted by the Miami-Dade MPO, MDT, and South Florida Regional Transportation Authority (SFRTA) addressing possible introduction of passenger rail service along existing rail corridors:

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. This study considered possible public transport use of the railroad west of 137th Avenue but concluded that segment west of 137th is located in the Everglades area near no major residential area or roadway system, concluding that it has extremely limited development potential.

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. This study considered possible rail transit service along the Lehigh Spur west to the Turnpike but did not recommend service investments west of the Turnpike (122nd Avenue).

MDT, *Dolphin Corridor Description of Commuter Rail Options* (2005)
This study, prepared to support the People's Transportation Plan, considered rail service west to 137th Street but not beyond that point.

Miami-Dade MPO, *Kendall Corridor Transportation Alternatives 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

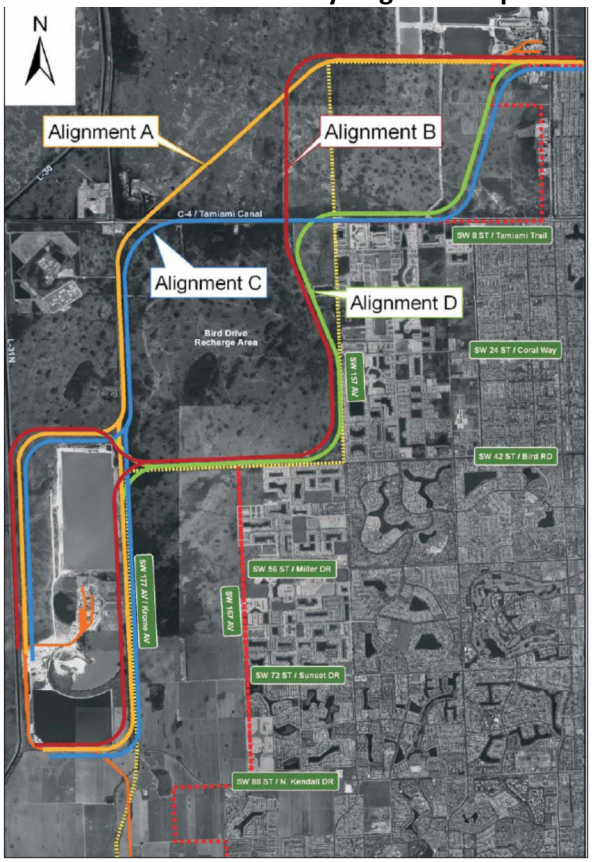
and service improvements to strengthen mobility connections between the Kendall area and other key regional activity centers in Miami-Dade County and beyond. Portions of the CSX East-West Corridor were evaluated for passenger service.

SFRTA, *Strategic Regional Transit Plan Summary* (2008)
This document identifies Lehigh Spur as possible corridor for future transit service development serving the west and connecting to Ludlum Corridor.

Miami-Dade MPO, *Florida East Coast (FEC) Transit Connection Study From Dadeland North Metrorail Station To Miami International Airport (MIA) Final Report* (2009)
Conceptual plans for trail and transit improvements along Ludlum Corridor running 7 miles along a partially-abandoned inactive railroad corridor connecting the Dadeland area with the existing South Florida Rail Corridor (SFRC) near Miami International Airport (MIA).

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 Miami International Airport. 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. Various options were considered (Figure 2). None of the options would have been used for passengers.

Figure 2
CSX Corridor Evaluation Study Alignment Options



Source: Miami-Dade MPO, *Miami-Dade County CSX Corridor Evaluation Study, 2009.*

SFRTA, *Dolphin Tri-Rail Extension Fact Sheet* (2011)
Identifies Dolphin Expressway (SR 836) as the heaviest traveled east-west highway in South Florida and notes that an existing rail corridor runs immediately parallel to the Dolphin Expressway that could be developed as a commuter rail connection to the MIC.

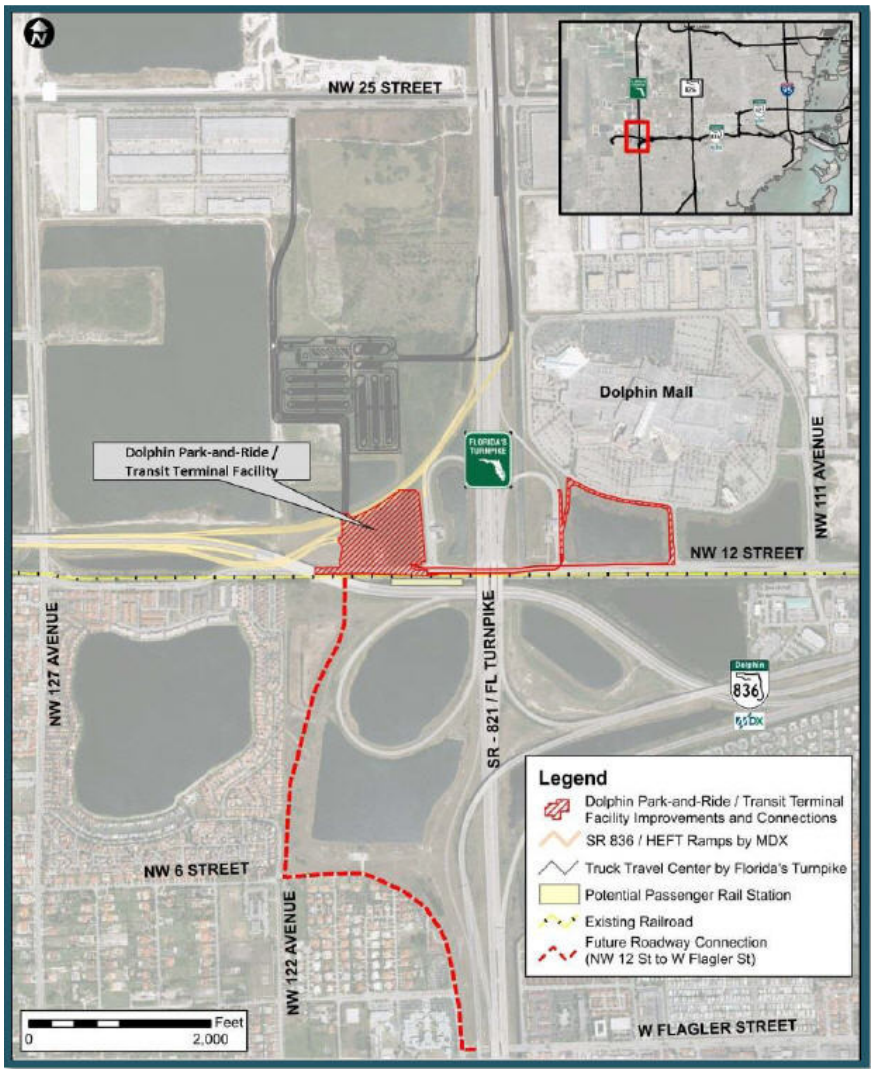
2.2 Related Studies

The following are on-going studies related to the CSX East-West Corridor project.

MDX, Dolphin Park & Ride/Transit Terminal Facility "Dolphin Station" Project Development & Environment (PD&E) Study

Miami-Dade Expressway Authority (MDX), in partnership with MDT and FDOT, is conducting a Project Environmental Impact Report (PEIR) to evaluate a park and ride/terminal facility to be called the Dolphin Station (Figure 3). The site is approximately 15 acres of publicly owned land located on NW 12th Street, west of the Turnpike and east of the NW 122nd Avenue in Miami-Dade County. The Dolphin Station will support MDT's SR 836 Express Bus project, other Express Bus routes, future commuter rail service and provide a potential terminus or stop for several local bus routes serving the nearby cities of Sweetwater and Doral.

Figure 3
Dolphin Station Project Location



Source: MDX, MDT, FDOT, Dolphin Station Fact Sheet, 2015.

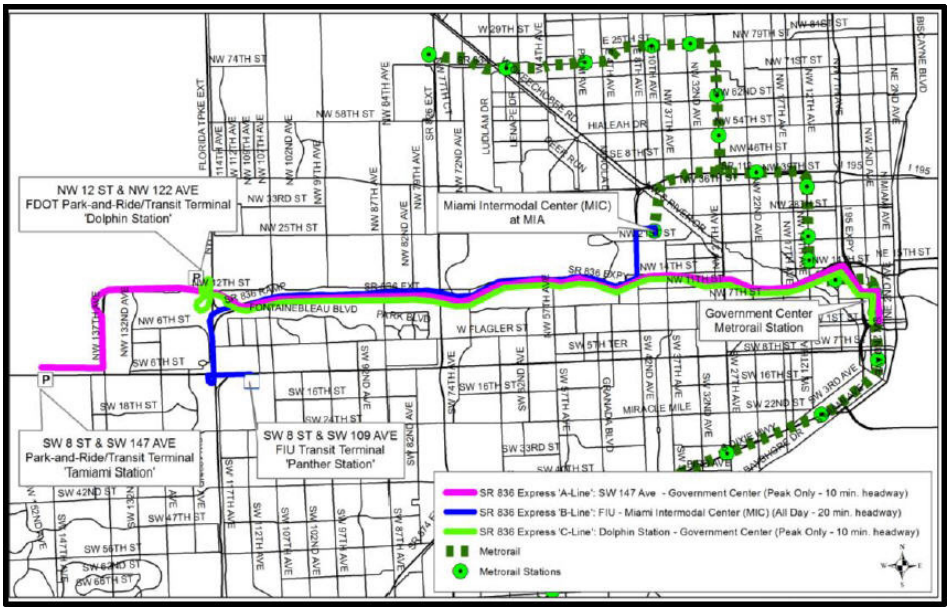
MDT, SR 836 Express Bus Project

In 2015, MDT, in coordination with the Miami-Dade MPO, the MDX, FDOT, and other stakeholders, proposed the SR 836 Express Bus Service as part of an incremental approach to implement rapid transit services in the East-West Corridor (Figure 4). This project proposes a network of new express bus services operating along SR 836 linking the study corridor with all day service to the MIC and peak only service to downtown Miami[1]. The network would provide express service from the western suburbs to the Miami Intermodal Center (MIC) at Miami International Airport and to downtown Miami along SR-836 (The Dolphin Expressway). When operating on the Dolphin Expressway the bus services would be allowed to bypass congestion by travelling on the shoulders of the roadway when travel speeds fall below 25 miles per hour.

The SR 836 Express will operate three routes primarily on the Dolphin Expressway. One route would run all day between FIU Panther Station at SW 8th Street and 109th Avenue along the HEFT and the Dolphin to the MIC. One peak only service would run from a proposed Tamiami Station (SW 8th Street and 147th Avenue) to downtown Miami. South and west of the Dolphin Expressway the Tamiami service would operate on existing surface streets. Another peak only route would run between the proposed Dolphin Station and MGC. The existing MDT 8M bus route would serve Panther and Tamiami Stations during the off peak with local service along 8th Street. Vehicles for this service will be branded for easy identification. Other vehicle characteristics include increased bus seating capacity, free on-board Wi-Fi, and real-time bus tracking equipment to provide a greater level of comfort and convenience to passengers. The CSX East-West Rail Corridor parallels the SR 836 Express Bus Route that starts at the Dolphin Station and provides direct service to the Government Center in downtown Miami.

Figure 4

SR 836 Express Bus Project Location



Source: Miami Dade County, SR 836 Express Fact Sheet, 2015.

[1] Miami Dade Transit Planning and Development, *Final Draft Categorical Exclusion Report: State Road Express Bus Service*, January 2015.

3. Existing Conditions

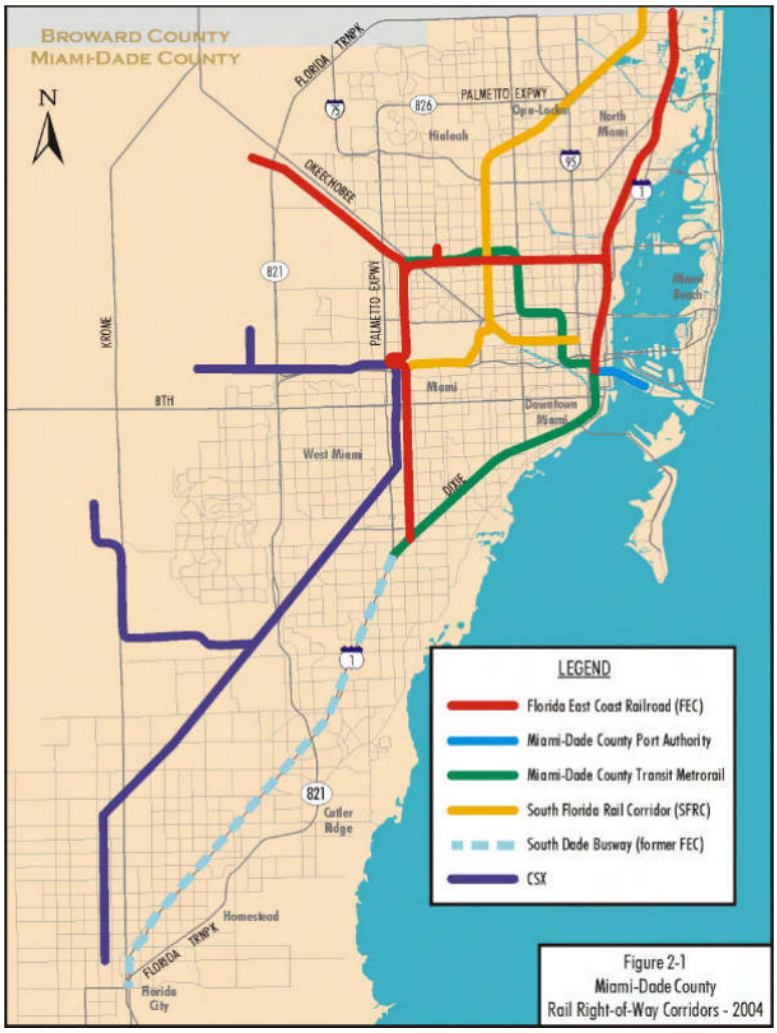
3.1 Right-of-Way and Infrastructure

The corridor under consideration for passenger rail service would use a combination of state-owned industrial tracks and CSX-owned right-of-way to extend a passenger rail route west from the MIC at the Miami International Airport along a route parallel to the Dolphin Expressway. The right-of-way is generally 100 feet in width, level, well-graded and free of vegetation. Two areas with challenges include the Oleander Junction and the MIC. Challenges at Oleander Junctions involve missing track connections and access to the MIC is potentially a challenge involving coordination with Tri-Rail and MDT.

The portion of the route adjacent to the airport is owned by FDOT. Further west, the line is owned by CSX Corporation of Jacksonville (Figure 5). CSX uses the route to access rock quarries and cement plants along the route and at its western terminus. Freight traffic is handled by one or two local trains each day that deliver cement and collect loaded gondolas for carriage eastward and northward. With such infrequent service, there are clearly opportunities to share tracks and the expense for their maintenance with CSX.

The CSX tracks are currently classified as “Excepted” by the Federal Railroad Administration (FRA) (Table 3). 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. The rail is primarily 115 pound continuous welded rail (CWR) rolled in the year 2000. Most or all of the ties have been replaced when the new rail was installed. The ballast in most locations is thin and scattered. It does not appear that the track has been undercut or the ballast renewed since the new rail was installed.

Figure 5
Rail Right-of-Way Ownership



Source: Miami Dade MPO, Rail Convertibility Study, 2004.

Table 3
FRA Track Classes

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.

There are multiple grade crossings in the corridor. All crossings are equipped with gates, bells, flashers, and crossbucks. Most crossings have cantilevers. None of the crossings have four quadrant gates. Most crossings are by divided highways where opposing lanes of traffic are separated by a median. Potentially significant grade crossings include:

- Le Jeune Road
- NW 82nd Avenue
- NW 84th Avenue
- NW 87th Avenue
- NW 107th Avenue
- NW 12th Street
- NW 127th Avenue
- NW 137th Avenue

Given the frequency of commuter rail service proposed for the Concepts examined in this study and the relatively brief duration of each closure for passing trains, grade crossing closures will likely not have a significant impact on traffic; however, if a concept is advanced for further study, the potential for impacts would be analyzed further. An indicator of the potential for impacts at grade crossings is the volume of the existing traffic. Traffic counts were not conducted as part of this study. Traffic counts for the closest available location for potentially significant grade crossings are presented in Table 4.

Table 4
Annual Average Daily Traffic (AADT), 2014

Road	Location	2014 AADT
Le Jeune Road	@ NW 25th Street	89,500
NW 82nd Avenue	@ NW 25th Street	14,800
NW 84th Avenue		Not Available
NW 87th Avenue	@NW 8th Street	59,000
NW 107th Avenue	@SR 836	59,500
NW 12th Street	@ Turnpike	23,900
NW 127th Avenue	@ SW 8th Street	18,000
NW 137th Avenue	@ NW 17th Street	8,100

Source: FDOT, 2014.

The industrial branch is un-signaled and controlled with track warrants west of Oleander. It appears that Oleander is remote controlled to allow movements from the SFRC to be routed to FEC's Ludlam Branch, CSXT's Homestead Sub, and the Lehigh Spur which all converge at this location in the rough vicinity of 69th Avenue.

The line crosses two waterways on single track bridges near NW 15th Street/Perimeter Road and NW 137th Avenue/12th Street. The railway is traversed by numerous overhead bridges carrying roadways.

The existing CSX tracks extend approximately one mile west of 137th Avenue (Figure 6). CSX's right-of-way extends west beyond the end of track for approximately an additional two miles. The CSX right-of-way does not extend to Krome (177th) Avenue. Rail service options west of 167th Avenue or south of NW 12th Street would require assembling new right-of-way.

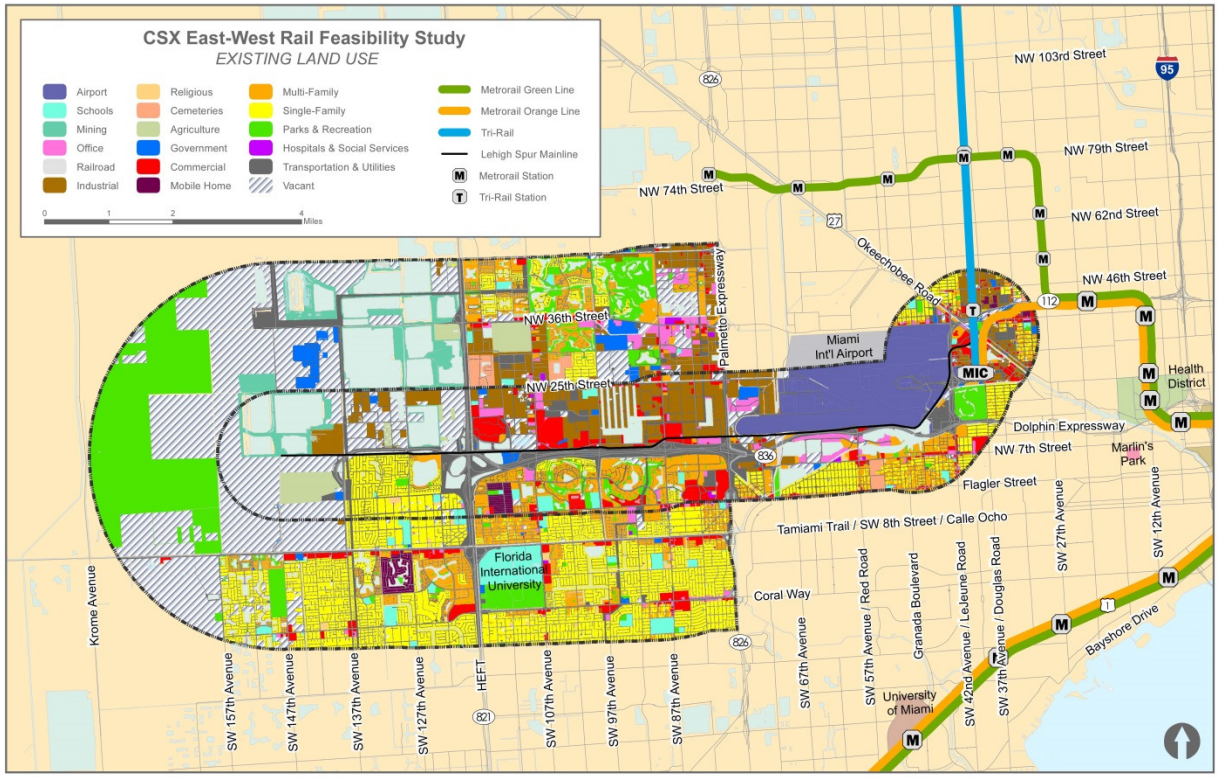
Figure 6
Right-of-Way Constraints

3.2 Land Use and Density

3.2.1 Land Use

Figure 7 below depicts the land use in the corridor for a one-mile area around the corridor, as well as a three-mile area west of Palmetto Expressway. Mixed employment and residential centers are located north of the CSX rail corridor. The majority residential uses are located south of the CSX rail corridor. Located west and northwest of the CSX rail corridor are areas of vacant and undeveloped land.

Figure 7
CSX Rail Corridor Existing Land Use

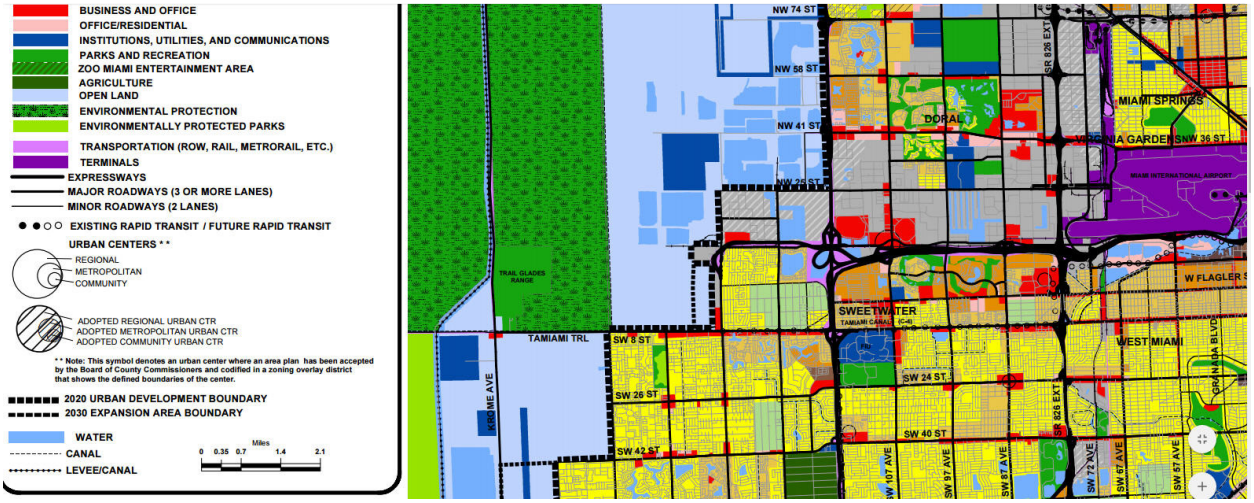


Source: Jacobs Engineering, 2015.

Miami-Dade County's general objectives and policies of where and how it intends development or conservation of land during the next 10-20 years is documented in the Comprehensive Development Master Plan (CDMP). The CDMP establishes an Urban Development Boundary (UDB). The Adopted 2020 and 2030 Land Use Plan Map depicting the study area and surrounding vicinity is presented in Figure 8. As depicted in the Land Use Plan Map, the 2020 UDB is located in the western portion of the project study area west of 137th Avenue. Land west of SW 157th Avenue and north of SW 8th Street/Tamiami Trail has been designated for environmental protection.

Land west of 137th Avenue is generally undeveloped and zoned "GU". Allowable development with the GU or "Interim District" designation depends on the character of the neighborhood. However, absent a contrary ruling on the character of the neighborhood, GU zoning allows a minimum development density of five acres. To support a fixed guideway transit service, denser development west of 137th Avenue would be necessary than what the current zoning permits. A change in public policy regarding land density in the area would be necessary to support rail service in the western part of the study area.

Figure 8
Urban Development Boundary in Study Area



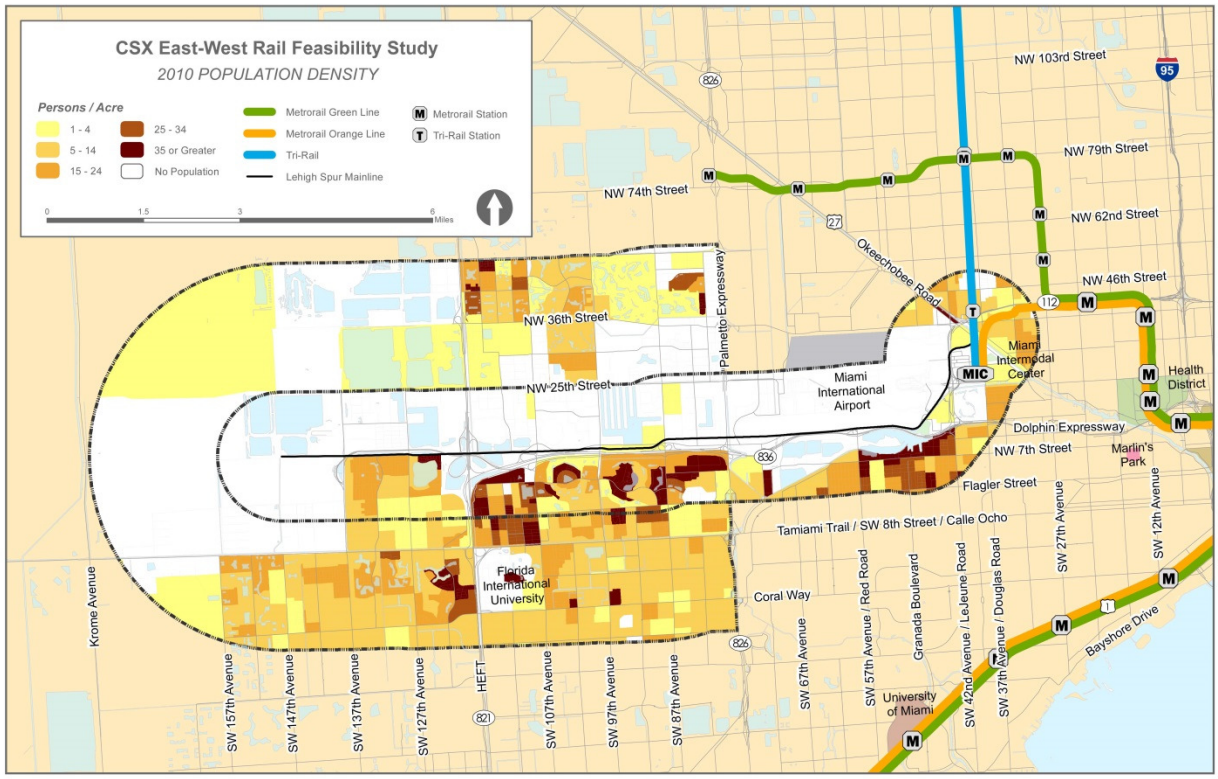
Source: Miami-Dade County, Adopted 2020-2030Comprehensive Development Master Plan (CDMP), 2014.

3.2.2. Population Density

Figure 9 below depicts population density in the corridor for a one-mile area around the entire corridor, as well as a three-mile area west of Palmetto Expressway. The highest density of residences is located predominantly south of the CSX rail corridor. There are 139,876 residents located within a one-mile corridor buffer (2010 census). Major population centers along the corridor include:

- Fontainebleau
- South of the CSX Corridor between NW 122nd and NW 137th

Figure 9
CSX Rail Corridor Population Density



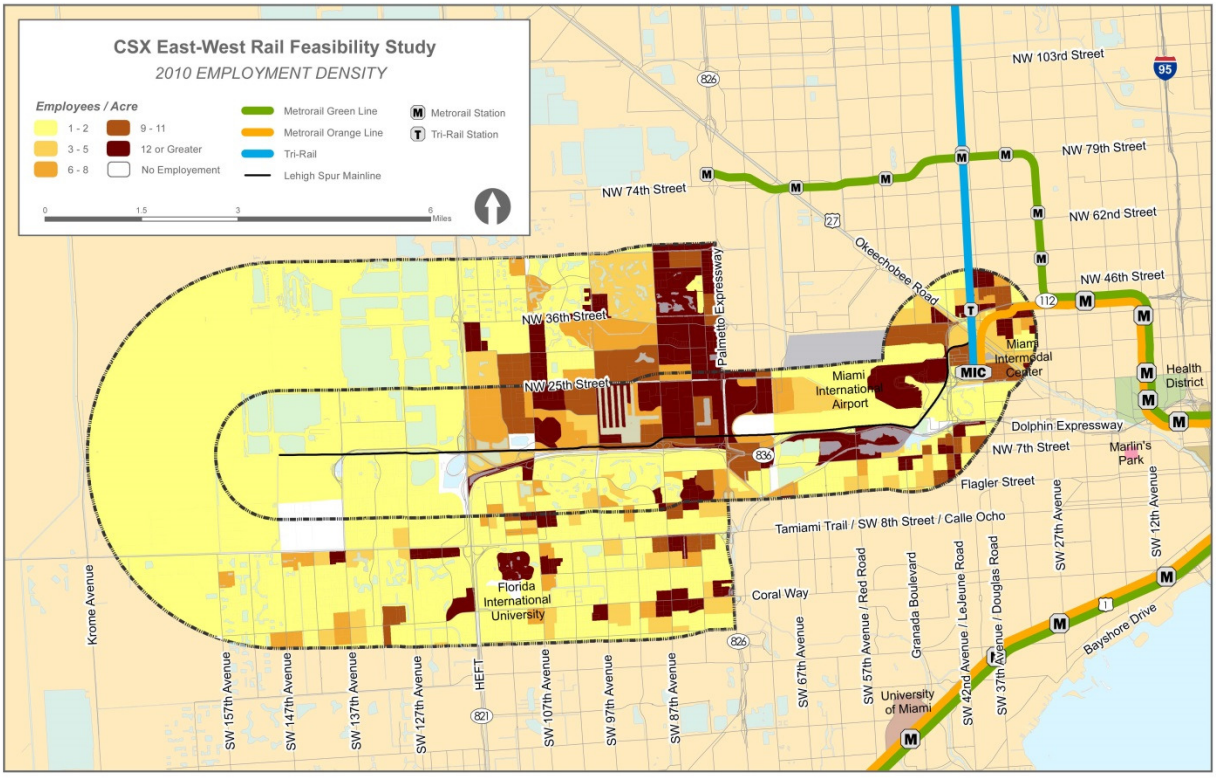
Source: Jacobs Engineering, 2015.

3.2.3 Employment Density

Figure 10 below depicts employment density in the corridor for a one-mile area around the entire corridor, as well as a three-mile area west of Palmetto Expressway. A higher concentration of jobs and employment centers are located north of the CSX rail corridor and west of the airport. There are 135,524 jobs located within a one-mile corridor buffer (2010 census). Major employment centers along the corridor include:

- Blue Lagoon
- Doral
- FIU
- Dolphin and Miami International Malls

Figure 10
CSX Rail Corridor Employment Density



Source: Jacobs Engineering, 2015.

The population and employment within the one and three mile buffers of the corridor are presented in the following table.

Table 5
Population and Employment, 2010

	Within One Mile of Corridor	Within Three Miles of Corridor
Population	139,876	529,921
Employment	135,524	355,694

4. Alternatives Considered

Alternatives considered in the CSX East-West corridor included various transit mode technologies and alignment options, as described in the following sections.

4.1 Transit Technologies

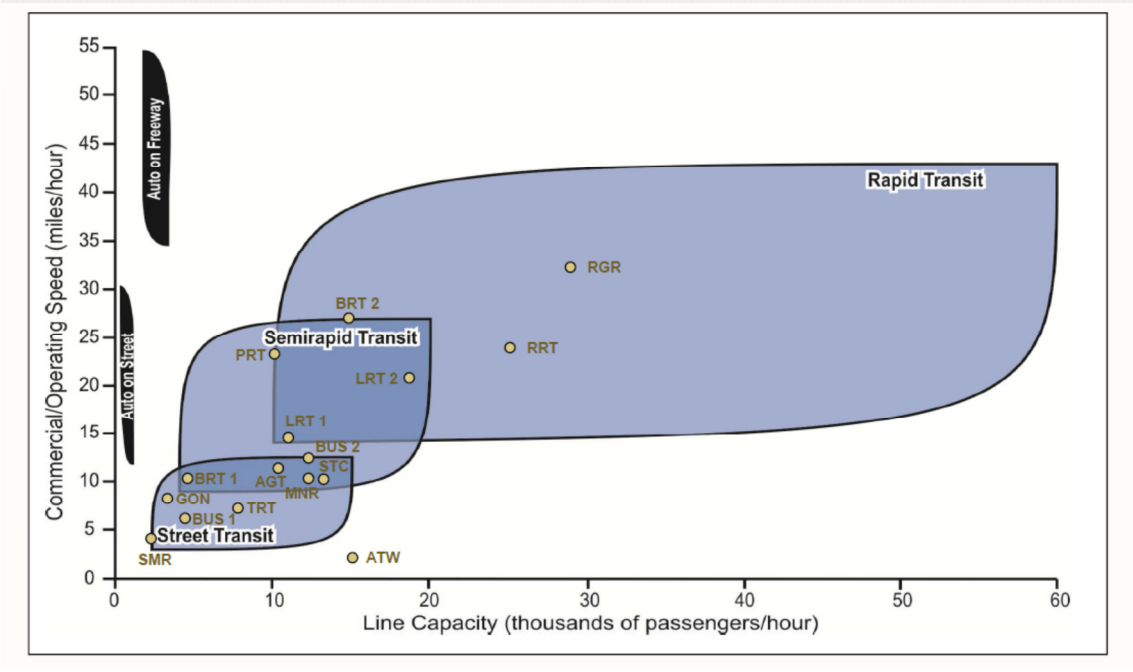
This section describes the various transit mode technologies evaluated for the CSX East-West corridor. The selection of the appropriate transit mode technology is based upon operating characteristics such as ability to interface or share alignment with other modes, the range of capital and operating costs, passenger capacity, operating speed, propulsion technology, and impacts to traffic, noise, air and water.

The transit mode technologies that described on the following pages are:

- Light Rail Transit (LRT)
- Diesel Multiple Units (DMU)
- Heavy Rail (Metrorail)
- Commuter Rail (Tri-Rail)

The following chart compares the operating speed (mph) of various transit mode technologies with the capacity (thousands of passengers/hour) and groups the modes in to three categories (Figure 11). Street transit modes such as bus, bus rapid transit, streetcar and gondola tend to operate at slower speeds and have a lower passenger capacity. Semi-rapid transit modes such as bus rapid transit, personal rapid transit and light rail transit modes operate at higher speeds and carry more passengers that street transit modes. Finally, the rapid transit category includes transit modes such as regional rail (commuter rail) or rail rapid transit (Metrorail).

Figure 11
Modal Operating Speed Versus Capacity



4.1.1 Light Rail Transit (LRT)

Description

Light rail transit utilizes light weight passenger rail cars to serve medium levels of passenger traffic. Light rail may use shared or exclusive rights-of-way, high or low platform loading and multi-car trains or single cars. For safety reasons, light weight LRT vehicles are not permitted to operate on the same railroad tracks at the same time as freight or commuter rail trains. Light rail vehicles are typically electrically powered from an overhead electric line via a trolley pole or pantograph. LRT systems typically connect activity centers within an urbanized area. Though technically descended from the streetcars and interurban railways of an earlier era, modern LRT vehicles offer high levels of performance (acceleration, braking, speed) and passenger comfort. Passenger capacity is about 75 persons seated, with room for as many standees for vehicles in the typical vehicle. There are many examples of currently operating LRT systems in cities such as Boston, Charlotte, Dallas, Houston, Minneapolis, Portland, Salt Lake City, San Diego, Seattle and in communities throughout New Jersey.

System Characteristics

- Capacity: 130-170 passengers per car, 2-6 cars per train
- Operational Speed: 20-65 mph
- Service Frequency: 5-15 minutes during peak and 10-30 minutes during other periods
- Operates on tracks that run along the streets and share space with road traffic, or along exclusive right-of-way and separated from road traffic, or a combination of both alternatives
- Power Supply: electric motor power by overhead wires

4.1.2 Diesel Multiple Units (DMU)

Description

Diesel Multiple Units (DMU's), or Diesel Light Rail, utilize passenger trains that resemble light rail vehicles but differ in two important ways. The vehicles are powered by diesel internal combustion engines as opposed to overhead electrical wires. Secondly, DMU vehicles are typically built to Federal Railroad Administration (FRA) standards, and are authorized to share track or right-of-way with intercity or freight trains.

There are a handful of American transit systems currently operating DMU vehicles, along routes that exhibit features of both rapid transit (connecting activity centers within an urbanized area) and commuter rail lines (operating between a central city, its suburbs and/or another central city). The systems are the New Jersey River Line operates along a 34 mile freight rail line connecting Trenton and Camden with 21 stations in both urban and suburban locations. The Sprinter in northern San Diego County provides service along a 22 mile corridor with 15 stations between Oceanside and Escondido. DMU trains are also operated as commuter rail systems in Austin and Denton County, Texas.

System Characteristics

- Capacity: 80 – 110 passengers for single-level cars and 145-170 for double-level cars
- Operational Speed: 30-100 mph
- Service Frequency: 15-60 minute headways
- Operate on standard gauge track which can be shared with freight and/or other passenger trains
- Power Supply : diesel or electric

4.1.3 Heavy Rail (Metrorail)

Description

Heavy rail rapid transit is an electric railway with the capacity for a heavy volume of traffic and characterized by exclusive rights-of-way, multi-car trains, high speed and rapid acceleration, sophisticated signaling and high-platform loading. Also, high-speed, passenger rail cars operating singly or in trains of two or more cars on fixed rails in separate rights-of-way from which all other vehicular and pedestrian traffic is excluded.

Heavy rail rapid transit service uses rail cars powered by electricity which is drawn from an electrified third rail or overhead catenary wires. It generally uses longer trains and has longer spacing between stations than light rail. It can be operated at-grade, underground or on an elevated railway (such as in Miami or Chicago). Examples of heavy rail rapid rail transit include Metrorail in Miami; MARTA in Atlanta, GA; the Metro in Washington, DC; and the New York City Subway. Currently, Metrorail operates on a 22.4 mile elevated rail and serves 23 stops between the Dadeland South and Palmetto stations and between Dadeland South and the Airport via the two mile branch Orange Line from the Earlington Heights station.

System Characteristics

- Capacity: 145-170 passengers per car, 4-10 cars per train
- Operational Speed: 25-60 mph
- Service Frequency: 3-10 minutes during peak and 10-20 minutes during other periods
- Exclusive grade-separated right-of-way, that is not shared with other freight or passenger trains
- Power Supply: typically electrified third rail

4.1.4 Commuter Rail (Tri-Rail)

Description

Commuter rail utilizes passenger trains which typically operate between a central city, its suburbs and/or another central city. It is operated with locomotive-hauled coaches (like Tri-Rail or VRE) and it is typically characterized by multi-trip tickets, specific station-to-station fares, railroad employment practices, and usually only one or two stations in the central business district(s). Additionally, commuter rail trains are built to Federal Railroad Administration (FRA) standards, and often share track or right-of-way with intercity or freight trains. The ability to connect suburban communities with the central business district of metropolitan areas has solidified commuter rail service as a popular transportation alternative. Within southeastern Florida, the South Florida Regional Transportation Authority operates the 72-mile, 18 stations commuter rail service known as Tri-Rail, which links Miami, Fort Lauderdale and West Palm Beach along the Southeast Florida coastline.

System Characteristics

- Capacity: 80 – 110 passengers for single-level cars and 145-170 for double-level cars
- Operational Speed: 30-100 mph
- Service Frequency: 20-60 minute headways
- Operate on standard gauge track which can be shared with freight and/or other passenger trains
- Power Supply : diesel or electric

4.1.5 Modal Screening and Advancement

The modes examined were screened for potential applicability in the CSX East-West corridor and the following assessments were made:

- LRT is not an appropriate technology for application along the East-West corridor due to its inability to share tracks with the freight trains that also travel along the East-West corridor.
- The DMU/diesel light rail mode has potential applicability particularly for shorter length trips or alternatives with more frequent stopping patterns. DMU/Diesel Light Rail service could be coordinated with feeder services, park and ride lots and connecting bus services.
- Heavy rail already operates in Miami-Dade in the form of Metrorail. Extension of Metrorail had previously been proposed for a corridor parallel to the East-West corridor in another study, but was eliminated from further consideration due to the significant construction and operations costs. Heavy rail technology would not be appropriate in the CSX East-West corridor because third rail power cannot be used in an at-grade alignment and the vehicles do not meet FRA safety requirement for operations in a joint use passenger and freight rail corridor.
- The commuter rail mode has potential applicability, particularly for longer haul trips. Commuter rail could be coordinated with feeder services, park and ride lots and connecting bus services. Commuter rail is appropriate for further consideration within the CSX corridor.

Therefore, two modes, DMU/diesel light rail and commuter rail, were carried forward for further evaluation in the CSX East- West corridor.

4.2 Alignment Options

Three different alignment options were examined in this study:

- Starter Service Options, services that could be developed in the short-term using commuter rail equipment in the study corridor east of 137th Avenue,
- Western Service Options, services that could be developed in the mid-term using commuter rail equipment in the study corridor west of 137th Avenue, and
- FIU Service Options, services that could be developed in the mid-term using diesel light rail equipment in the study corridor and south to FIU.

Long-term service options were also discussed during the conduct of the study as future considerations. Possible long-term expansions markets were identified to the West Dade and Kendall areas. Technical details on these options were not developed as part of this study. Technical evaluation of these markets would be required if these options were pursued in the future to determine their feasibility.

4.2.1 Starter Service Options

Three concepts were developed to meet the objectives of initial starter service:

- MIC to Dolphin Station
- MIC to 132nd Avenue
- MIC to 137th Avenue

Starter service evaluated in this report assumes use of surplus conventional locomotive hauled push-pull trainsets from Tri-Rail.

This section outlines these three alternative service design concepts that could be developed in the rail corridor as an initial starter service. All Concepts would terminate at the MIC sharing a station with Tri-Rail and Amtrak. Along the route to the west the passenger trains would share tracks with infrequent local freight trains running to and from industrial customers to the west and south.

Many travelers using the potential new rail service would transfer to and from MDT's Metrorail system at the MIC (airport) station collocated with the Amtrak and Tri-Rail station tracks. MDT's Metrorail Orange Line serves the airport with 161 weekday revenue trips (81 departures and 80 arrivals) between 5am and midnight each weekday. The service operates at 10 minute headways during the peak with 15 minute headways during the midday and early evening, shifting toward 30 minute headways after 8:30 pm. Passengers boarding Orange Line trains at the airport can ride 9 minutes to the Civic Center, 15 minutes to Government Center, and 16 minutes to Brickell.

The following assumptions were used in the development of all initial Starter Service Concepts:

- Access to CSX-owned right-of-way for passenger rail operations can be achieved,
- CSX continues to serve freight customers accessed from the line,
- Starter service uses surplus conventional locomotive hauled push-pull trainsets from Tri-Rail,
- No changes to existing Metrorail schedules,
- At least six minutes allowed for transfer at MIC, and
- At least eight minutes to turn a train at the end of its one way trip for schedule reliability.

The following is a description of the three Concepts examined. All three would be independent, shuttle-type service with equipment dedicated for this line. The service would not be interlined with existing Tri-Rail service.

Concept #1 – MIC to Dolphin Station

Concept #1 would provide rail service originating at the MIC and terminating at the proposed 122nd Street Dolphin Park and Ride Lot, as depicted in Figure 12 below.

Figure 12
Concept #1 – MIC to Dolphin Station Alignment

Source: Jacobs Engineering, 2015.

Concept #2 – MIC to 132nd Avenue

Concept #2 would provide rail service originating at the MIC and terminating at 132nd Avenue with four stations, as depicted in Figure 13 below.

Figure 13
Concept #2 – MIC to SW 132nd Avenue Alignment

Source: Jacobs Engineering, 2015.

Concept #3 – MIC to 137th Avenue

Concept #3 would provide rail service originating at the MIC and terminating at SW 137th Avenue, as depicted in the Figure 14 below.

Figure 14
Concept #3 – MIC to 137th Avenue Alignment

Source: Jacobs Engineering, 2015.

4.2.2 Western Service Options

Three concepts were developed to evaluate the feasibility of rail service options to the western part of the project study area beyond SW 137th Avenue:

- MIC to 147th Avenue
- MIC to 157th/Krome Avenue
- MIC to Krome Avenue

These concepts are described in the following sections

Concept #4 – MIC to 147th Avenue

Concept #4 would provide rail service originating at the MIC, using the CSX right-of-way to 137th Avenue. The Concept would turn south at 137th Avenue on new right-of-way, turn west at SW 8th Street, and terminate at a proposed station at 147th Avenue, as depicted in Figure 15 below. This Concept would require new right-of-way south and west of 137th Avenue, where the Concept leaves the CSX right-of-way.

Figure 15
Concept #4 – MIC to 147th Avenue Alignment

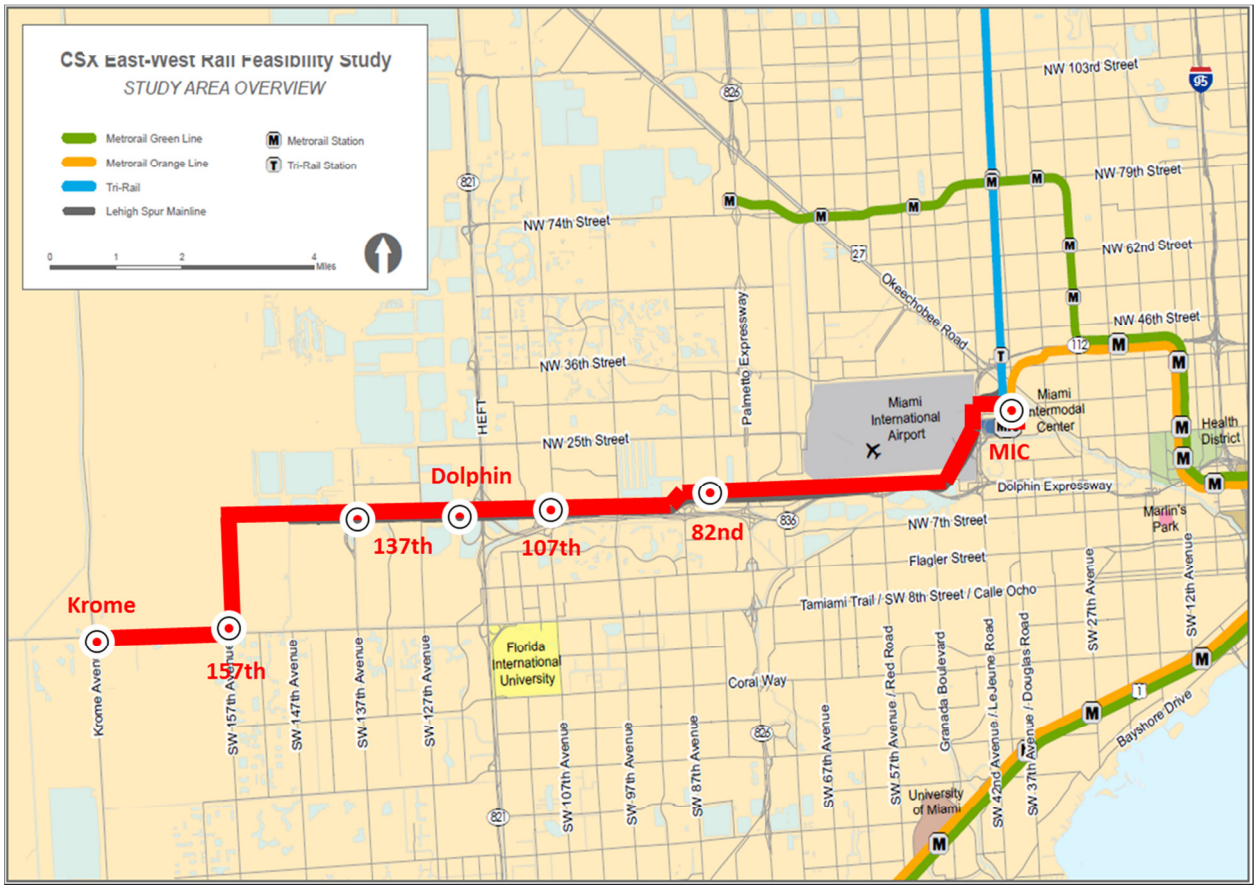
Source: Jacobs Engineering, 2015.

Concept #5 – MIC to 157th Avenue

Concept #5 would provide rail service originating at the MIC, using the CSX right-of-way to its western terminus, turn south on new right-of-way to 157th Avenue, turn west at SW 8th Street, and terminate at a proposed station at Krome Avenue, as depicted in Figure 16 below. This Concept would require new right-of-way south between SW 8th Street and theoretical NW 12th Street and west of 157th Avenue, where the Concept leaves the CSX right-of-way.

This concept would require construction of new railroad infrastructure west of the Urban Development Boundary (UDB) established by Miami-Dade County in their Comprehensive Development Master Plan (CDMP) and within an area designated for environmental protection in the CDMP. Therefore, this concept would have policy implications with regard to the CDMP that would need to be addressed in the future if this rail concept is pursued.

Figure 16
Concept #5 – MIC to 157th Avenue Alignment



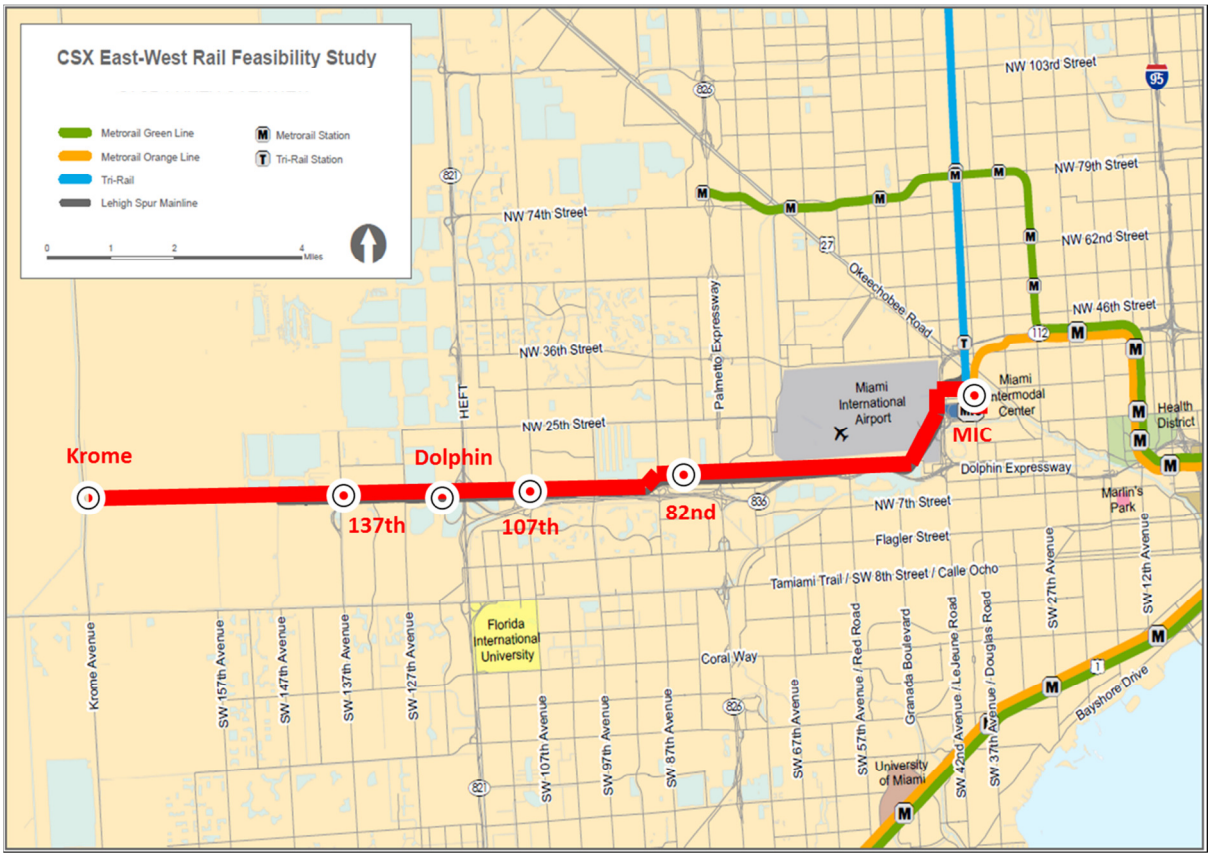
Source: Jacobs Engineering, 2015.

Concept #6 – MIC to Krome Avenue

Concept #6 would provide rail service originating at the MIC, using the CSX right-of-way to its western terminus, continue west on new right-of-way, and terminate at a proposed station at Krome Avenue, as depicted in Figure 17 below. West of the CSX right-of-way terminus at theoretical 167th Avenue, new right-of-way would have to be acquired to Krome Avenue for this Concept. This Concept affords the opportunity for residents of the West Kendall area located to the south of the study area to access potential rail service in the East-West corridor via Krome Avenue to the proposed Krome Avenue Station.

Similar to Concept #5, this concept would require construction of new railroad infrastructure west of the UDB and within an area designated for environmental protection established by Miami-Dade County in their CDMP. Therefore, this concept would have policy implications with regard to the CDMP that would need to be addressed in the future if this rail concept is pursued.

Figure 17
Concept #6 – MIC to Krome Avenue Alignment



Source: Jacobs Engineering, 2015.

4.2.3 FIU Service Options

Three concepts were developed to evaluate the feasibility of rail service options from the CSX corridor to the south to Florida International University (FIU):

- MIC to East Side of FIU
- MIC to Center of FIU
- MIC to West Side of FIU

The FIU Concepts require new right-of-way south of where they leaves the CSX right-of-way.

These concepts are described below and depicted in Figure 18.

Concept #7 – MIC to East Side of FIU

This Concept accesses the east side of FIU via SW 107th.

Concept #8 – MIC to Center of FIU

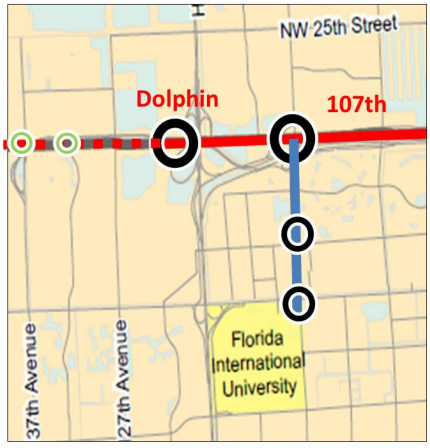
This Concept accesses the center of FIU via the Turnpike / SW112th Avenue.

Concept #9 – MIC to West Side of FIU

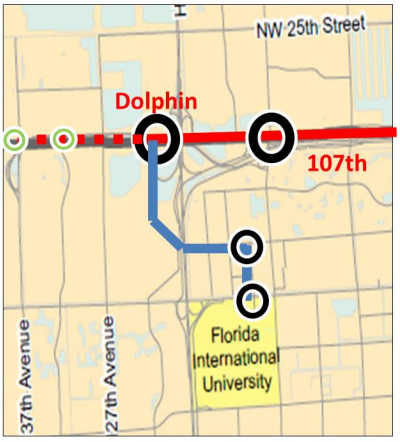
This Concept accesses the west side of FIU via the Turnpike / SW114th Avenue.

Figure 18
FIU Concepts

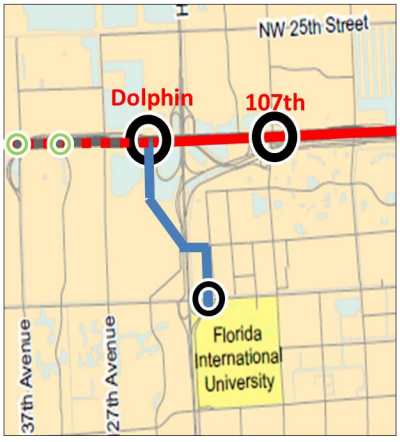
MIC to East Side of FIU



MIC to Center of FIU



MIC to West Side of FIU



Source: Jacobs Engineering, 2015.

4.3 Station Locations

Integral to the success of any transit service is the location and accessibility of stations. Locating stations that are convenient to either residential populations or employment centers is key to the planning process. In this instance the planning team and the project SAC evaluated a number of station locations based upon the presence of concentrations of resident population, employment activity centers or regional access routes. As a result a number of potential station locations were deemed appropriate for service in the corridor, described below.

- **Krome (177th) Avenue (MP 15.0):** A terminus station with a park and ride. Two potential locations are considered depending on the alignment; the northern Krome station location due west of the terminus of the CSX right-of-way and the southern Krome station location at SW 8th Street.
- **157th Avenue (MP 13.0):** Station location at 157th Avenue and SW 8th Street with parking.
- **147th Avenue (MP 13.0):** Station location at 147th Avenue and SW 8th Street with parking. This location is proposed by MDT for the Tamiami Station.
- **NW 137th Avenue (MP 11.1):** Park and ride station with access from residential communities to the south. Primarily auto access.
- **NW 132nd Avenue (MP 10.5):** Walk/Bike station and limited parking to primarily serve residential community to the south. 55,000 people in 7.5 square miles (assumed 150 parking spaces)
- **Dolphin (NW 122nd Avenue – NW 12th St.) (MP 9.4):** Park and Ride station available for local residents but primarily for commuters coming from the Turnpike (Up to 1000 parking spaces assumed, to be provided by others). This location is proposed by MDT for the Dolphin Station.
- **NW 107th Avenue (NW 107th Ave – NW 12th St.) (MP 8.0):** Primarily a destination station served by MDT buses and connecting buses provided by the Malls and an FIU shuttle (assumed 300 parking spaces)
- **Doral (NW 82nd Avenue – NW 12th St.) (MP 5.5):** Walk/Bike and Park and Ride for residential community to the south and to intense industrial and warehousing employment to the north (assumed 300 spaces)
- **Miami Intermodal Center (MP 0.0):** Transfer to Metrorail Orange Line, Tri-Rail, MIA Mover, Amtrak, or buses.
- **Sweetwater:** Walk-up station serving business community in the vicinity of NW 107th Avenue and W. Flagler Street near the FIU engineering school. No station parking.
- **FIU:** Walk-up station serving the University. No station parking.

Proposed station locations for the project alternatives are presented in the following table.

Table 6

Proposed Station Locations

Station Location	Mile-post	Concepts								
		#1: MIC to Dolphin Station	#2: MIC to 132nd Avenue	#3: MIC to 137th Avenue	# 4: MIC to 147th Avenue	#5: MIC to 157th Avenue	# 6: MIC to Krome Avenue	#7: MIC to FIU East Side	#8: MIC to FIU Center	#9: MIC to FIU West Side
Krome (177th) Avenue	15.0					X	X			
157th Avenue	16.0					X				
147th Avenue	14.5				X					
NW 137th Avenue	11.1			X	X	X	X			
NW 132nd Avenue	10.5		X							
Dolphin NW 122nd Avenue	9.4	X	X	X	X	X	X		X	X
NW 107th Avenue	8.0	X	X	X	X	X	X	X		
Sweetwater	N/A							X	X	
FIU Campus	N/A							X	X	X
NW 82nd Avenue	5.5	X	X	X	X	X	X	X	X	X
Miami Intermodal Center	0.0	X	X	X	X	X	X	X	X	X

Source: Jacobs Engineering, 2015.

4.4 Operating Scenarios

4.4.1 Starter Service Options

The initial operation plans prepared for all starter service concepts assumed that a maximum of two sets of existing Tri-Rail equipment would be available for use for passenger service in the CSX East-West rail corridor. After reviewing preliminary results, the SAC requested that more frequent service be analyzed as part of the study and SFRTA committed to up to a maximum of four sets of existing Tri-Rail equipment to be available for more frequent passenger service in the CSX East-West corridor. Therefore, for each starter service concept, two operating plans were developed to analyze different frequencies of service:

- 30 minute intervals in the peak periods and at 60 minute intervals in the off peak periods, and
- 15 minute intervals in the peak periods and at 30 minute intervals in the off peak periods.

The operations plans developed for the proposed weekday service schedules use the following assumptions:

- Minimizes rolling stock and crew needs,
- Assumes FRA Class 3 track with 60 mph maximum speed on most segments,
- Service velocity limited by acceleration, braking and dwell times,
- Matches existing Metrorail schedules for positive connections,
- Uses only one track in the MIC Station, and
- Requires a single passing siding that allows peak trains to pass one another.

Using these assumptions, service plans were developed with:

- 46 scheduled trains per weekday (23 each inbound and outbound) using two peak train sets for all three concepts for the 30 minute peak/60 minute off peak operating plan, and
- 92 scheduled train per weekday (46 each inbound and outbound) using four peak train sets for all three concepts for the 15 minute peak/30 minute off peak operating plan.

The average travel time to the MIC Station would be approximately 22 minutes from 137th Avenue Station, 21 minutes from 132nd Avenue Station, and 18 minutes from Dolphin Station. A sample schedule for the 30 minute peak operating plan is presented in Figure 19. The schedule for 15 minute peak operating plan is similar but with more frequency.

Figure 19
Sample Starter Service Concept Schedule

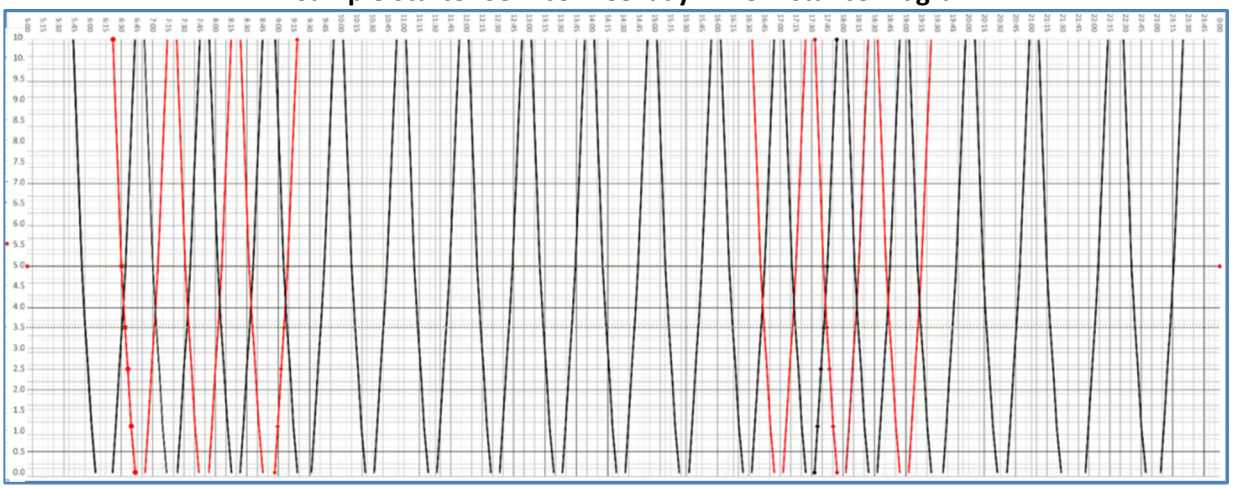
Eastward																										
Train Number											902		904		906		908		910							
Turn Time											0:16		0:09		0:10		0:09		0:08							
132nd Avenue - North Tamiami	10.5										6:21		6:52		7:23		7:53		8:23							
122nd Avenue - Turnpike	9.4										6:24		6:55		7:26		7:56		8:26							
Malls-FIU @ 107th Ave (SW Doral)	8.0										6:27		6:58		7:29		7:59		8:29							
Fountainebleu @97th Ave	7.0										6:30		7:01		7:32		8:02		8:32							
82nd Avenue (SE Doral)	5.5										6:33		7:04		7:35		8:05		8:35							
MIA Arrive	0.0										6:43	0:08	7:14	0:07	7:45	0:06	8:15	0:06	8:45	0:06						
MIA Depart		5:06	5:24	5:39	5:51	6:01	6:11	6:21	6:31	6:41	6:51	7:01	7:11	7:21	7:31	7:41	7:51	8:01	8:11	8:21	8:31	8:41	8:51	9:01		
Civic Center		5:15	5:33	5:48	6:00	6:10	6:20	6:30	6:40	6:50	7:00	7:10	7:20	7:30	7:40	7:50	8:00	8:10	8:20	8:30	8:40	8:50	9:00	9:10		
Government Center		5:21	5:39	5:54	6:06	6:16	6:26	6:36	6:46	6:56	7:06	7:16	7:26	7:36	7:46	7:56	8:06	8:16	8:26	8:36	8:46	8:56	9:06	9:16		
Bickell		5:22	5:40	5:55	6:07	6:17	6:27	6:37	6:47	6:57	7:07	7:17	7:27	7:37	7:47	7:57	8:07	8:17	8:27	8:37	8:47	8:57	9:07	9:17		
Dadeland South		5:39	5:57	6:12	6:24	6:34	6:44	6:54	7:04	7:14	7:24	7:34	7:44	7:54	8:04	8:14	8:24	8:34	8:44	8:54	9:04	9:14	9:24	9:34		
Westward																										
Train Number		901		903		905			907			909			911			913								
Turn Time		HIA		HIA		0:09			0:09			0:09			0:09			0:12								
Dadeland South		5:05	5:28	5:43	5:58	6:10	6:20	6:30	6:40	6:50	7:00	7:10	7:20	7:30	7:40	7:50	8:00	8:10	8:20	8:30	8:40	8:50	9:00	9:10		
Bickell		5:22	5:45	6:00	6:15	6:27	6:37	6:47	6:57	7:07	7:17	7:27	7:37	7:47	7:57	8:07	8:17	8:27	8:37	8:47	8:57	9:07	9:17	9:27		
Government Center		5:24	5:47	6:02	6:17	6:29	6:39	6:49	6:59	7:09	7:19	7:29	7:39	7:49	7:59	8:09	8:19	8:29	8:39	8:49	8:59	9:09	9:19	9:29		
Civic Center		5:29	5:52	6:07	6:22	6:34	6:44	6:54	7:04	7:14	7:24	7:34	7:44	7:54	8:04	8:14	8:24	8:34	8:44	8:54	9:04	9:14	9:24	9:34		
MIA Arrive		5:38	6:01	6:16	6:31	6:43	6:53	7:03	7:13	7:23	7:33	7:43	7:53	8:03	8:13	8:23	8:33	8:43	8:53	9:03	9:13	9:23	9:33	9:43		
MIA Depart	0.0	5:44		6:22	0:06	6:52	0:09		7:23	0:10		7:54	0:11		8:24	0:11		8:57	0:14							
82nd Avenue (SE Doral)	5.5	5:52		6:30		7:00			7:31			8:02			8:32			9:05								
Fountainebleu @97th Ave	7.0	5:55		6:33		7:03			7:34			8:05			8:35			9:08								
Malls-FIU @ 107th Ave (SW Doral)	8.0	5:58		6:36		7:06			7:37			8:08			8:38			9:11								
122nd Avenue - Turnpike	9.4	6:01		6:39		7:09			7:40			8:11			8:41			9:14								
132nd Avenue - North Tamiami	10.5	6:05		6:43		7:13			7:44			8:15			8:45			9:18								

Source: Jacobs Engineering, 2015.

The average travel time to the MDT Government Center Station, with transfer and wait time, would be approximately 40 minutes from 137th Avenue Station, 39 minutes from 132nd Avenue Station, and 36 minutes from Dolphin Station.

Maintaining reliability is very important for passenger rail service. With the equipment assumptions, 22 minute travel time and eight minutes for equipment turn-around, the 30 minute peak headway for Option #3 is very tight and has no cushion for delay. This may effect could create delay on the service. Option #2 has an additional minute for equipment turn-around and Option #1 three additional minutes and would therefore have more flexibility and schedule reliability. A sample weekday time distance diagram for the 30 minute peak operating plan is presented in Figure 20. The time distance diagram for the 15 minute peak operating plan is similar but with more frequency.

Figure 20
Sample Starter Service Weekday Time Distance Diagram



Source: Jacobs Engineering, 2015.

4.4.2 Western Service Options

There are several potential options for rail service to the western area of the study corridor. For the purposes of the operational analysis, Concept #6: MIC to Krome, was developed in detail. The operating plans for the other two concepts, Concept #4: MIC to 147th Avenue and Concept #5: MIC to 157th/Krome Avenue, would be similar operationally.

The western service to Krome Avenue extends the initial starter service concepts west of 137th Avenue by four miles to a terminus at Krome Avenue. The Krome Avenue service option would use traditional diesel push-pull rolling stock similar to that operated by Tri-Rail. The 15-mile diesel route would have between six and ten stations and would run from a park-n-ride station at Krome Avenue to the MIC. A variety of station locations and combinations were considered in this feasibility study for western service options. If this concept is further advanced, more work to evaluate station locations is recommended.

Western service options would operate every 30 minutes during the peak and hourly in the off peak. Approximately 42 trains would be operated each weekday, scheduled to offer timed transfers between the commuter railroad and the Orange Line. Specific northbound Orange Line trains could be marked in the MDT schedule as making connections to the CSX corridor commuter rail service. Five minutes would be allowed for each transfer. Commuter rail trains would be held up to five minutes for late arriving connections.

The service would require four train sets to offer a peak service frequency of two trains per hour in each direction – one train every 30 minutes. The route could be mostly single track with one or more passing and industrial sidings. With hourly off peak passenger train headways, freight operations could accommodated during the midday, evening and overnight periods.

Travel from Krome Avenue to Miami Government Center would take approximately 50 minutes including 30 minutes on the commuter railroad, five minutes to transfer and 15 minutes on the Orange Line. Preliminary travel times for Concept #6: MIC to Krome are presented in Table 7. These travel times assume the used of diesel push-pull rail equipment, 30 second dwell times at stations and an average speed of 60 miles per hour on the majority of the corridor and 45 miles per hour approaching the MIC.

Table 7
Concept #6: MIC to Krome Travel Times

Station	Milepost	Travel Time (minutes)
Krome Avenue	15	
157th Avenue	13	4
137th Avenue	11	8
Turnpike (122nd Ave)	9.5	9
Dolphin Mall	8.4	10
International Mall	7.7	13
87th Ave	6.0	16
67th Ave	4.2	20
57th Ave	3.1	23
MIC	0.0	30

Source: Jacobs Engineering, 2015.

4.4.3 FIU Service Options

There are several potential options for rail service to FIU. For the purposes of the operational analysis, Concept #7: MIC to East Side of FIU, providing access to the east side of FIU via SW 107th Avenue, was developed in detail. The operating plans for the other two concepts, accessing the center and the west side of FIU, would be similar operationally.

The FIU service would diverge from the CSX rail right-of-way just west of the International Mall Station transitioning to an alignment in the median of 107th Avenue running two miles southward with stops in Sweetwater at Flagler Street and at the entrance to the Main FIU campus at SW 16th Street. A trip from FIU to Miami Government Center would take 42 minutes including 22 minutes on the diesel light rail from FIU to the MIC, 5 minutes to transfer at the MIC and 15 minutes on the Orange Line. All service would be operated with diesel light rail cars as described in Section 4.1.2. These diesel light cars are currently used for street running in New Jersey and Texas.

The service would require approximately 4 train sets to operate. More operational analysis would be required to determine the feasibility of utilizing single track on the branch to FIU to reduce impacts on roadway traffic versus using double track. Preliminary travel times for Concept #7: MIC to FIU are

presented in Table 8. These travel times assume the used of high performance low floor diesel light rail equipment, 30 second dwell times at stations and an average speed of 25 miles per hour on the new street running right-of-way south of the CSX corridor, 60 miles per hour on the CSX portion of the corridor, and 45 miles per hour approaching the MIC.

Tri-Rail equipment would be not suitable for this service because commuter rail equipment cannot operate in roadways under FRA safety requirements. Therefore, equipment such as a diesel light rail/DMU must be used. There are, however, significant considerations for the use of diesel light rail equipment in the freight corridor, including safety requirements. These issues should be further considered if an option to FIU is considered for advancement.

Table 8
Concept #7: MIC to FIU Travel Times

Station	Milepost	Travel Time (minutes)
Florida International University (16th)	10.0	
Sweetwater (Flagler)	9.0	4
International Mall	7.7	8
87th Ave	6.0	11
MIC	0.0	22

Source: Jacobs Engineering, 2015.

4.4.4 Operating Summary

A summary of the operating statistics for each of the options evaluated is presented in Table 9.

Table 9

Operating Statistics

	Route Miles	Stations		Travel Time MIC to Terminus (minutes)	Travel Time Govt Center to Terminus (minutes)	Train Sets in Maximum Service
STARTER SERVICE CONCEPTS						
Concept #1: MIC to Dolphin Station						
30/60 Service Plan	9.4	4		18	36	2
15/30 Service Plan	9.4	4		18	36	4
Concept #2: MIC to 132nd Avenue						
30/60 Service Plan	10.5	5		21	39	2
15/30 Service Plan	10.5	5		21	39	4
Concept #3: MIC to 137th Avenue						
30/60 Service Plan	11.1	5		22	40	2
15/30 Service Plan	11.1	5		22	40	4
WESTERN CONCEPTS						
Concept #4: MIC to 147th Avenue						
30/60 Service Plan	14.5	6		29	49	4
Concept #5: MIC to 157th/Krome Avenue						
30/60 Service Plan	16.0	7		36	56	4
Concept #6: MIC to Krome Avenue						
30/60 Service Plan	15.0	6		30	50	4
FIU CONCEPTS						
Concepts #7-#9						
30/60 Service Plan	10.0	5		22	42	4

Source: Jacobs Engineering, 2015.

4.5 Infrastructure Needs

4.5.1 Overview

The implementation of all concepts would require the following improvements to the physical infrastructure along the alignment:

Track

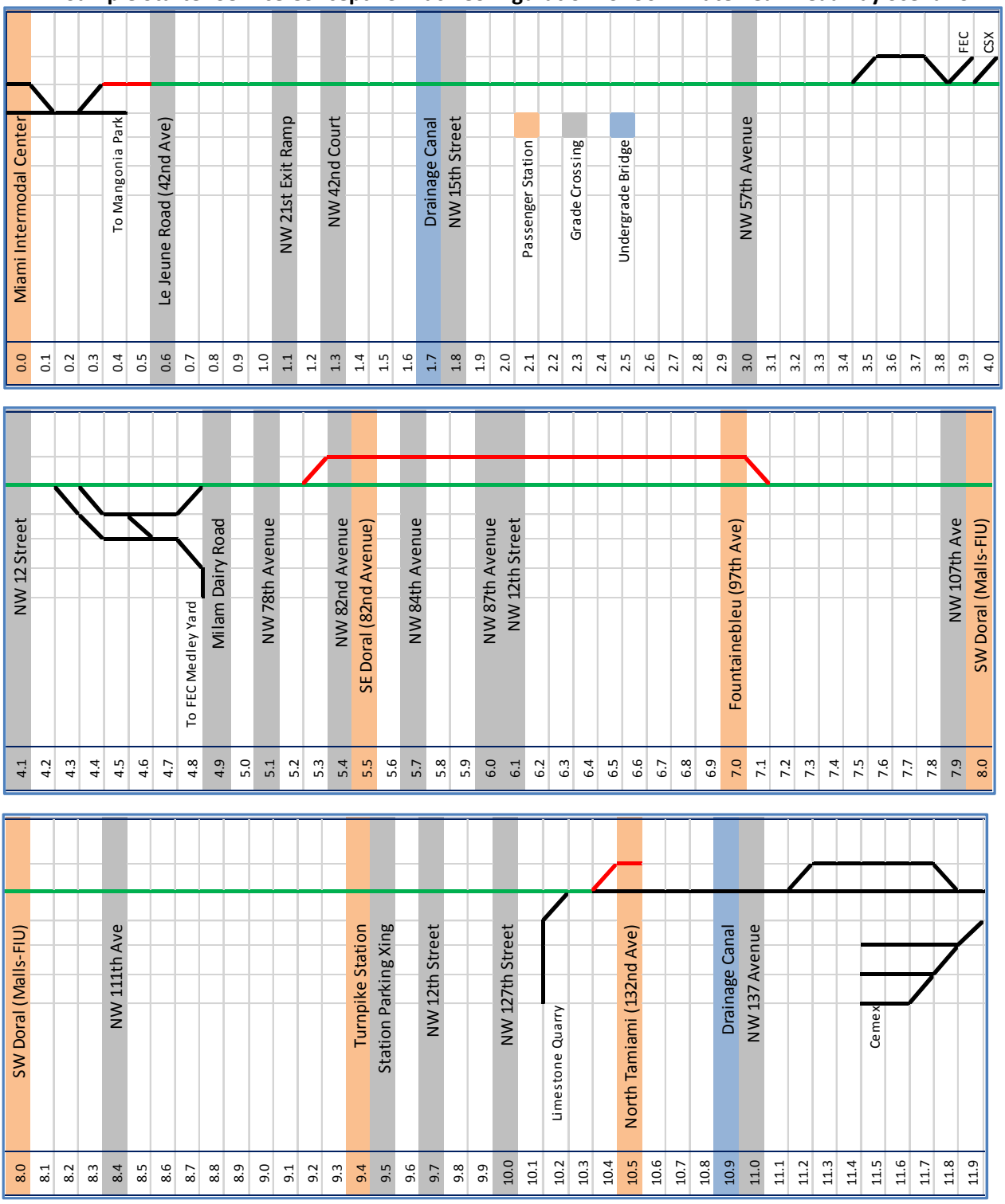
The existing track on the line would be upgraded with the following enhancements:

- Renew ties and ballast on existing main tracks to FRA Class 3
- Undercut track, renew ballast and surface track
- Minor adjustments to alignment and super elevation to increase comfortable speeds
- Adjust track circuits at grade crossings to allow for higher speeds.
- Raise speed limits for most to line to 60 mph. Curves would limit speeds at some locations east of the airport.
- The missing segment of track linking the spur to the MIC would be installed.
- Install limited sidings where necessary for meets and overtakes for 30 minute peak service.
- Install double track for 15 minute peak service.
- Rolling stock would be stored and maintained at existing Hialeah Yard

A sample track configuration depicting the single track with passing sidings for the 30 minutes peak headway scenario under Concept #3 is presented in Figure 21. The track configuration for the 15 minute peak operating plan is double track for the length of the project corridor.

Rail service to any point west of theoretical 167th Avenue or south of NW 12th Street would require assembling new right-of-way. Costs for right-of-way were not included for any of the options.

Figure 21
Sample Starter Service Concept #3 Track Configuration for 30 Minute Peak Headway Scenario



Source: Jacobs Engineering, 2015

Signals

The route would be equipped with a bidirectional CTC signal system to enforce safe train separation and for remote control of switches. The signal system's controls would be reinforced with a federally mandated Positive Train Control system.

Stations

The existing MIC station would be used in the east. New stations would be constructed with low passenger platforms and mini-high platforms for access by disabled travelers.

Bridges

One single track bridge over a canal east of the airport would require inspection and possible renewal.

Utilities

The presence of underground utilities running within the rail right-of-way or crossing the railroad has an ability to impact overall capital costs. Depending on the type and nature of the utility and associated agreements the impact upon the projects budget and schedule can vary greatly. While it is unlikely that potential issues vary greatly among the alternatives additional utility investigations are warranted in the next phase of the project implementation if any of the alternatives are pursued.

Grade Crossings

There are 11 grade crossings located along the study right-of-way. While there is grade crossing protection equipment in place, the upgrading/replacement of such equipment would be required for implementation of passenger rail service. Additionally, the impact of more train service within the corridor on the roadway system needs to be further analyzed. In particular, the crossing at LeJeune Road, NW 87th Avenue, and NW 107th Avenue needs to be closely evaluated to determine what if any measurable roadway delay warranting traffic mitigation is the result of additional gate downtime.

The assumed capital investments associated with the study options are presented in the table below.

Table 10

Proposed Capital Investments

	Rehab Mainline Track	New Mainline Track	Passenger Stations	Turnouts Replaced or Upgrades	Grade Crossings
STARTER SERVICE OPTIONS					
Concept #1: MIC to Dolphin Station					
30/60 Service Plan	7.4 miles	2 miles	4 stations	10 turnouts	14 grade crossings
15/30 Service Plan	7.4 miles	7.4 miles	4 stations	10 turnouts	14 grade crossings
Concept #2: MIC to 132nd Avenue					
30/60 Service Plan	8.5 miles	2 miles	5 stations	11 turnouts	17 grade crossings
15/30 Service Plan	8.5 miles	8.5 miles	5 stations	11 turnouts	17 grade crossings
Concept #3: MIC to 137th Avenue					
30/60 Service Plan	9.1 miles	2 miles	5 stations	12 turnouts	18 grade crossings
15/30 Service Plan	9.1 miles	9.1 miles	5 stations	12 turnouts	18 grade crossings
WESTERN SERVICE OPTIONS					
Concept #4: MIC to 147th Avenue					
30/60 Service Plan	9.1 miles	7.4 miles	6 stations	16 turnouts	18 grade crossings
Concept #5: MIC to 157th/Krome Avenue					
30/60 Service Plan	10.1 miles	7.9 miles	7 stations	16 turnouts	18 grade crossings
Concept #6: MIC to Krome Avenue					
30/60 Service Plan	10.1 miles	6.9 miles	6 stations	16 turnouts	18 grade crossings
FIU SERVICE OPTIONS					
Concepts #7-#9: MIC to FIU					
30/60 Service Plan	7.0 miles	6.0 miles	5 stations	10 turnouts	13 grade crossings

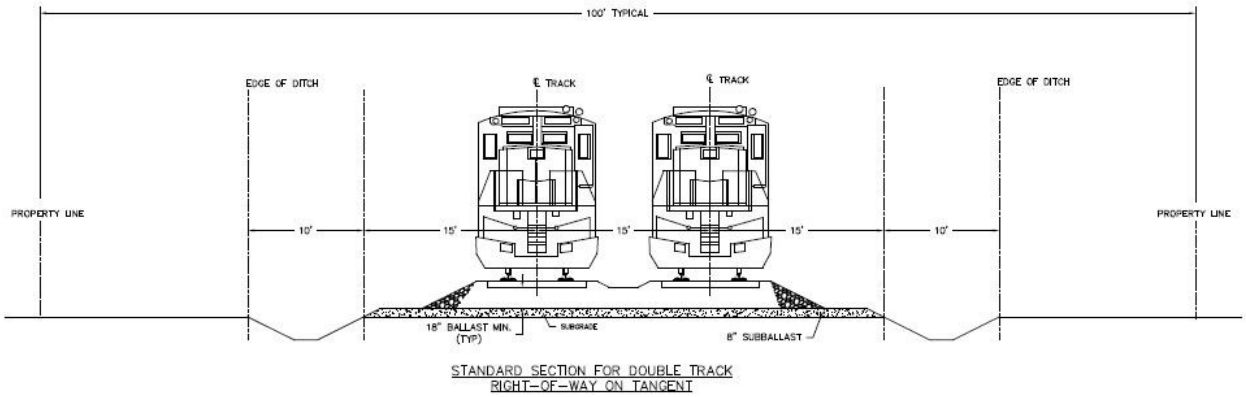
Source: Jacobs Engineering, 2015.

4.4.2 Concept Level Plans

Concept level plans were developed for a typical cross section along the right-of-way and for sample station locations. The typical visualizations for sample station locations along the CSX corridor were developed at NW 107th Avenue, Doral (NW 82nd Avenue), and NW 137th Avenue. The following Figures depict examples of potential stations along the corridor from various views. The concepts depict a single

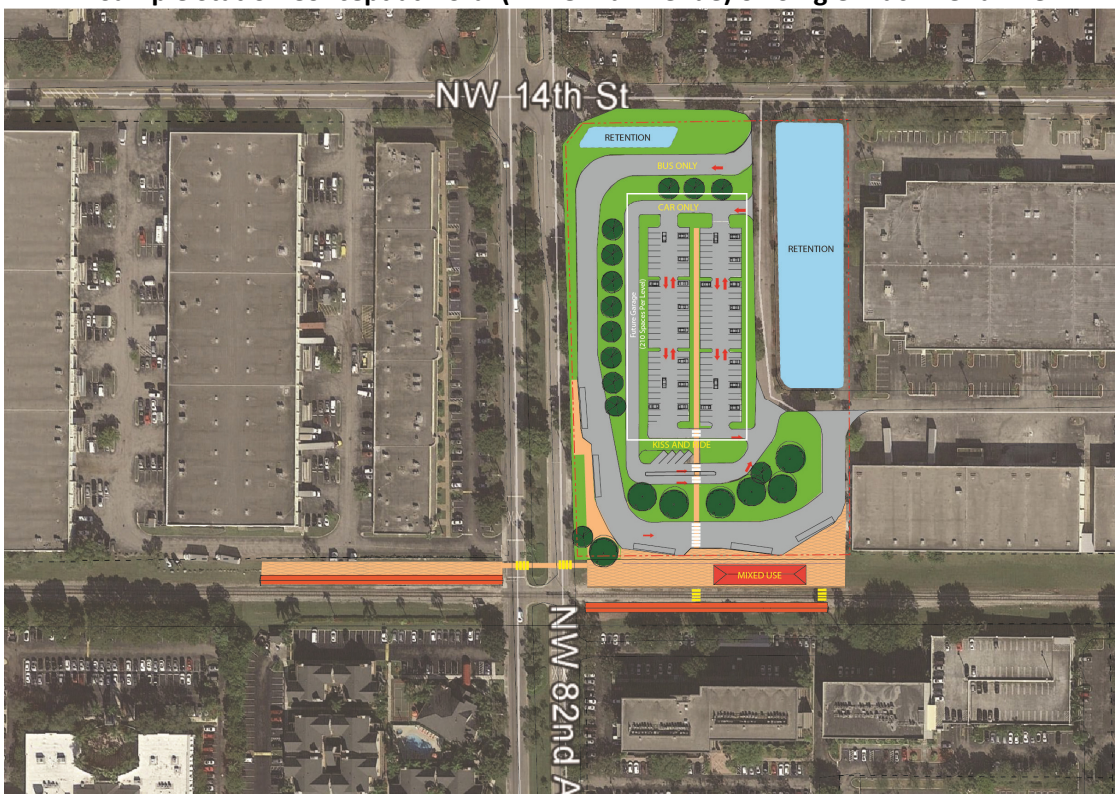
side station platform on a section of single track. Also depicted in the concept drawings is the option of a parking structure which could be pursued in the future if demand warrants.

Figure 22
Typical Section, Single Track with Passing Siding



Source: Jacobs Engineering, 2016.

Figure 23
Sample Station Concept at Doral (NW 82nd Avenue) on Single Track Aerial View

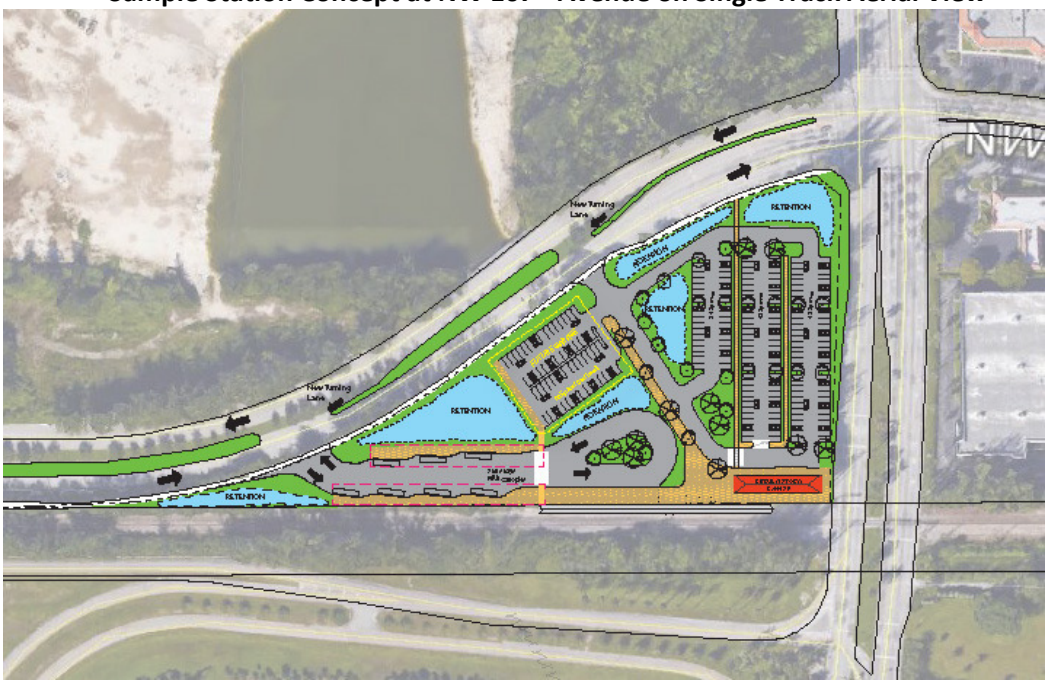


Source: Jacobs Engineering, 2016.

Figure 24
Sample Station Concept at NW 137th Avenue on Single Track Aerial View

Source: Jacobs Engineering, 2016.

Figure 25
Sample Station Concept at NW 107th Avenue on Single Track Aerial View



Source: Jacobs Engineering, 2016.

Figure 26
Sample Station Concept at NW 107th Avenue on Single Track Looking North

Source: Jacobs Engineering, 2016.

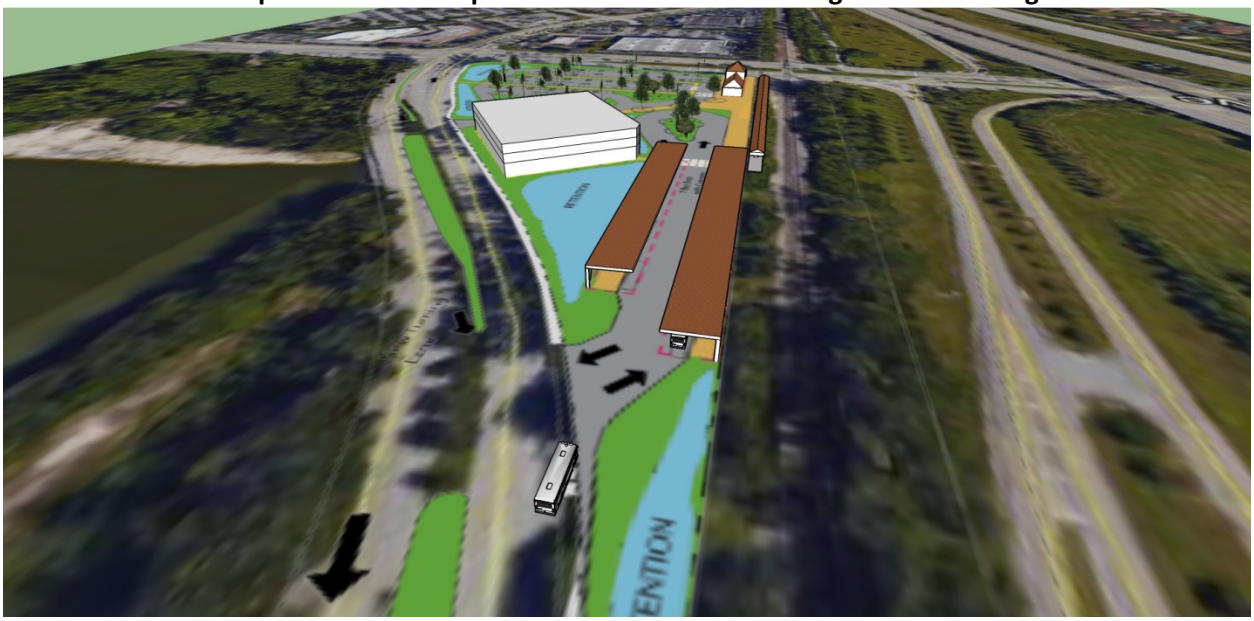
Figure 27
Sample Station Concept at NW 107th Avenue on Single Track Looking South

Source: Jacobs Engineering, 2016.

Figure 28
Sample Station Concept at NW 107th Avenue on Single Track Looking West

Source: Jacobs Engineering, 2016.

Figure 29
Sample Station Concept at NW 107th Avenue on Single Track Looking East



Source: Jacobs Engineering, 2016.

5. Impact Assessment

5.1 Capital Costs

The preliminary estimates of the capital costs are based on the FDOT Model for Tri-Rail Coastal Link. The preliminary capital cost estimates include:

- New track, upgrades to existing track, switch replacement
- Signals, positive train control, grade crossing upgrades
- Bridge rehabilitation
- Land for stations and parking
- Assumes service will use vehicles in Tri-Rail's existing fleet

These preliminary capital cost ***estimates do not include***:

- Right-of-way access costs from CSX
- Property acquisition
- Parking at the proposed Dolphin Station
- Rolling Stock; it is assumed that the project will use Tri-Rail existing fleet

The preliminary estimated capital cost for Concepts are incrementally greater the longer the route miles, with the shortest Concept at 9.4 route miles, Concept #1, having the least cost of $87 million for the 30/60 service plan, while the longest Concept at 16 miles, Concept #5 has the greatest cost of $175 million. Increasing the frequency of service from 30/60 minute headways to 15/30 minute headways increases the capital cost for Concept #1 by 44 percent, Concept #2 by 42 percent, and Concept #3 by 41 percent. FIU Extension Concepts were explored as longer term options and were developed in a generalized manner; therefore, costs were not developed for those concepts. Estimated capital costs for each of the Concepts evaluated are presented in the table below.

Table 11
Preliminary Capital Costs (2015 $s, millions)

		Capital Costs (2015 $s)
STARTER SERVICE OPTIONS		
Concept #1: MIC to Dolphin Station		
	30/60 Service Plan	$87.0 million
	15/30 Service Plan	$125.0 million
Concept #2: MIC to 132nd Avenue		
	30/60 Service Plan	$100.0 million
	15/30 Service Plan	$141.5 million
Concept #3: MIC to 137th Avenue		
	30/60 Service Plan	$103.0 million
	15/30 Service Plan	$145.0 million
WESTERN SERVICE OPTIONS		
Concept #4: MIC to 147th Avenue	30/60 Service Plan	$122.0 million
Concept #5: MIC to 157th/Krome Avenue	30/60 Service Plan	$175.0 million
Concept #6: MIC to Krome Avenue	30/60 Service Plan	$123.0 million

Source: Jacobs Engineering, 2015.

5.2 Operating and Maintenance Costs

The preliminary annual operating and maintenance cost estimates were based on the FDOT/SFRTA Model for Tri-Rail Coastal Link and used 2011 budget data. The model results in 2011 dollars were escalated to estimate 2015 dollars. The model forecasts the incremental cost to add service to existing Tri-Rail contracts for the following categories:

- Transportation: crews, fuel, supervision, fare collection, passenger information
- Mechanical: rolling stock maintenance parts and labor
- Maintenance of Way: track, signal, stations, right-of-way
- Other: insurance, legal, finance

The preliminary estimated annual operating and maintenance costs are incrementally greater the longer the route miles, with the shortest Concept at 9.4 route miles, Concept #1, having the least cost of $8.2 million for the 30/60 service plan, while the longest Concept at 16 mile, Concept #5 has the greatest cost of $11.6 million for the 30/60 service plan. Increasing the frequency of service from 30/60 minute headways to 15/30 minute headways increases the O&M cost for Concept #1 by 93 percent, Concept #2 by 90 percent, and Concept #3 by 90 percent. FIU Extension Concepts were explored as longer term options and were developed in a generalized manner; therefore, costs were not developed for those concepts. Estimated annual operating and maintenance costs for each of the Concepts evaluated are presented in the table below.

Table 12

Preliminary Annual Operating and Maintenance Costs (2015 $s, millions)

	Annual Operating and Maintenance Costs (2015 $s)
STARTER SERVICE OPTIONS	
Concept #1: MIC to Dolphin Station	
30/60 Service Plan	$8.2 million
15/30 Service Plan	$15.8 million
Concept #2: MIC to 132nd Avenue	
30/60 Service Plan	$8.6 million
15/30 Service Plan	$16.3 million
Concept #3: MIC to 137th Avenue	
30/60 Service Plan	$8.9 million
15/30 Service Plan	$16.9 million
WESTERN SERVICE OPTIONS	
Concept #4: MIC to 147th Avenue	$10.0 million
Concept #5: MIC to 157th/Krome Avenue	$11.6 million
Concept #6: MIC to Krome Avenue	$10.8 million

Source: Jacobs Engineering, 2015.

5.3 Ridership

The FTA's Simplified Trips on Project Software (STOPS) was used for the ridership analysis. STOPS is a sketch planning model to estimate transit project ridership utilizing streamlined procedures. It is based on census information and ridership statistics from existing rail and Bus Rapid Transit (BRT) systems. The primary benefit of using STOPS is that its methodology and structure have been approved by FTA. Projects seeking to advance in the FTA funding process that use STOPS only need to present to the FTA the reasonableness of inputs such as demographics and the reasonableness of the ridership forecast results for the proposed project. STOPS uses Journey to Work (JTW) data from the year 2010 Census Transportation Planning Package (CTPP) to estimate the zone-to-zone demand for travel. This data are adapted to represent current and future years by using MPO demographic forecasts.

The Western Extension and FIU Extension Concepts were explored as longer term options and were developed in a generalized manner; therefore, ridership was not developed for those concepts. In the Western Extensions Concepts, sparse travel demand west of 137th Avenue was identified as a potential concern for the western service options because land west of 137th Avenue is generally undeveloped and is zoned "GU" allowing no greater development density than five-acre estates, which would not generate sufficient demand to support passenger rail service. If pursued in the future a detailed demand analysis would be required.

The preliminary estimated daily ridership is incrementally greater the longer the route miles and more frequent the service. The shortest Concept at 9.4 route miles, Concept #1, with the 30/60 service plan, has the lowest ridership of 4,450. The extending the route increases the ridership in Concept #2 by three percent and Concept #3 by 10 percent compared to Concept #1 for the 30/60 service plan. Increasing the frequency to 15/30 increases the ridership by 49 percent for Concept #1, 49 percent for Concept #2, and 47 percent for Concept #3 as compared to the 30/60 service plan for the same Concept. Estimated ridership for the service options are presented in the table below.

Table 13
Ridership (2015)

	Average Weekday Boardings
STARTER SERVICE OPTIONS	
Concept #1: MIC to Dolphin Station	
30/60 Service Plan	4,450
15/30 Service Plan	6,650
Concept #2: MIC to 132nd Avenue	
30/60 Service Plan	4,600
15/30 Service Plan	6,850
Concept #3: MIC to 137th Avenue	
30/60 Service Plan	4,900
15/30 Service Plan	7,200

Source: Jacobs Engineering, 2015.

5.4 Summary of Benefits and Costs

A summary of the features of each service concept is presented in the following table. Generally, the longer the route miles and the more frequent the service, the higher the estimated capital costs, O&M costs, and ridership. For Concepts #1, #2 and #3, increasing the frequency of service from 30/60 minute headways to 15/30 minute headways increases the capital cost by 41 to 44 percent and increases the O&M cost 90 to 93 percent, while only increasing the ridership by 47 to 49 percent.

Table 14

Summary of Corridor Concepts

	Miles	Stations	Travel Time (MIC to Terminus)	Capital Costs (2015 $s)*	Annual O&M Costs (2015 $s)	Average Weekday Boardings	O&M Cost per Boarding
STARTER SERVICE OPTIONS							
Concept #1: MIC to Dolphin Station							
30/60 Service Plan	9.4 miles	4	18 minutes	$87.0 million	$8.2 million	4,450	$6.58
15/30 Service Plan	9.4 miles	4	18 minutes	$125.0 million	$15.8 million	6,650	$8.48
Concept #2: MIC to 132nd Avenue							
30/60 Service Plan	10.5 miles	5	21 minutes	$100.0 million	$8.6 million	4,600	$6.68
15/30 Service Plan	10.5 miles	5	21 minutes	$141.5 million	$16.3 million	6,850	$8.50
Concept #3: MIC to 137th Avenue							
30/60 Service Plan	11.1 miles	5	22 minutes	$103 million	$8.9 million	4,900	$6.49
15/30 Service Plan	11.1 miles	5	22 minutes	$145.0 million	$16.9 million	7,200	$8.38
WESTERN SERVICE OPTIONS							
Concept #4: MIC to 147th Avenue							
30/60 Service Plan	14.5 miles	6	29 minutes	$122.0 million	$10.0 million	--	--
Concept #5: MIC to 157th/Krome Avenue							
30/60 Service Plan	16.0 miles	7	36 minutes	$175.0 million	$11.6 million	--	--
Concept #6: MIC to Krome Avenue							
30/60 Service Plan	15.0 miles	6	30 minutes	$123.0 million	$10.8 million	--	--
FIU SERVICE OPTIONS							
Concepts #7-#9: MIC to FIU							
30/60 Service Plan	10.0 miles	5	22 minutes	--	--	--	--

Source: Jacobs Engineering, 2015.

*Capital costs do not include vehicles, SFRTA vehicles assumed, and right-of-way, acquisition/fees unknown.

6. Project Implementation Plan

6.1 Right-of-Way

The study rail corridor runs approximately 12 miles west from the Miami Airport rail station. The eastern most four miles are in public ownership by FDOT and managed by SFRTA as part of the South Florida Rail Corridor. The eight miles west of Oleander Junction are owned by CSX Corporation and managed as part of CSX's Homestead Subdivision.

Accommodations with CSX for use of the corridor would need to be negotiated to develop the proposed passenger rail service. There are several approaches to the joint use of right-of-way for the provision of both freight rail services and passenger rail services:

- Purchase of right-of-way – The public entity can purchase the right-of-way for passenger rail service and develop an operating agreement with the freight operators to continue the provision of freight service over the right-of-way.
- Access agreement – The freight railroad can retain ownership of the right-of-way and enter into an access agreement with the passenger rail operator to operate passenger service over their right-of-way.
- Operating agreement – The freight railroad can retain ownership of the right-of-way and enter into an operating agreement with the public entity, whereby the freight operator would also operate the passenger rail service over their right-of-way.

CSX has been active in the project SAC and has indicated that it is potentially interested in selling the entire Homestead Subdivision to a public agency that may be interested in developing passenger service on the Lehigh Spur and other segments of the Homestead Subdivision.

When developing a new passenger rail service on a lightly used freight branch line like the Lehigh Spur the general literature on the development of passenger rail services[2,3] using lightly used freight lines recommends that the public sector transit operator acquire the necessary right-of-way from the railway in fee simple before starting the construction. The owning freight railroad in exchange is granted perpetual and exclusive freight trackage rights in addition to a cash payment. Once the rail line belongs to the transit agency it makes the infrastructure improvements necessary for higher speed/higher frequency passenger operation, then provides freight access to the satisfaction of the former owners of the line. When all the improvements are made, the essence of the shared-track operation is not so much operation of rail transit service on conventional railway lines as it is operation of branch freight service on passenger rail tracks. The transfer of ownership and control offers tangible benefits to both the transit operators and the freight railroad:

[2] Alan J. Bing et al, *Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors: NCHRP REPORT 657*,Transportation Research Board, Washington DC, 2010 (181 pages).
[3] Booz | Allen | Hamilton et al. *Shared Use of Railroad Infrastructure with Noncompliant Public Transit Rail Vehicles: A Practitioner's Guide: TCRP Report 130*, Transportation Research Board, Washington DC 2009 (122 pages)

- **Infrastructure Investment** –The transit operations will require substantial upgrades to the Lehigh Spur to raise operating speeds, improve ride quality, increase capacity by adding signals and sidings, and building stations. Public investment in infrastructure is protected and facilitated if the underlying corridor lies in public ownership and control. All systems in current operation or in final design entail public ownership, control, and maintenance of the shared track infrastructure.
- **High Density of Passenger Operations** – When passenger service is implemented on a lightly used freight branch line, the daily ratio of passenger trains to freight trains is generally at least twenty to one. At these relative traffic densities, it can be more appropriate for the passenger service operator to own and control the shared line.
- **Freight Railroad Becomes a Privileged Tenant** - When the shared-track system is in planning and development, the freight railroad owning the critical right-of-way is in a powerful position to negotiate. While the nature of the shared-track operation generally requires the freight railroad to relinquish dispatching and maintenance control, the participation of freight rail owners gives freight interests a powerful voice in determining when freight service will take precedence. Some freight service schedule adjustments may be necessary, but where this is impossible, there is incentive for the passenger transit authority to accommodate the freight carrier's needs or else risk having the process stalled. As a tenant of the transit system the freight operator enjoys the use of a substantially upgraded facility while it is simultaneously relieved of the burden of maintaining and operating its former freight only line.
- **Risks are Managed within the Transit System's Framework** - Risk management and insurance is part of the general administration of the shared-track operation. Transit insurance packages generally cover all operations or all rail operations. The transit agency often insures freight carriers against increased liability risks due to the presence of passengers.

If acquisition of the Lehigh Spur is considered in the future for the implementation of passenger rail service in the CSX East-West corridor, there are several of the key points that should be considered during the process[4]:

- The development of passenger rail service will likely not follow a sequential plan, rather, many different activities will move at different rates.
- The process will likely experience delays because a slow-moving process for one activity failed to yield timely information to enable another activity to move forward.
- Public and political support for implementing the new service is necessary for the process to advance. Many passenger rail initiatives fail to develop further because of a change in state government policy or a lack of consistent support at responsible government agencies.
- The state or local agency should be prepared to negotiate access and fees on its own with a freight railroad without assistance from federal agencies such as the FTA or FRA. However, the Surface Transportation Broad (STB) can assist with non-binding mediation should the parties fail

[4] Alan J. Bing et al, *Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors: NCHRP REPORT 657*,Transportation Research Board, Washington DC, 2010 (181 pages).

to agree on terms of access based upon a provision in the 2008 Passenger Rail Investment and Improvement Act (PRIIA).

- If funding for the Project is being sought from FTA's CIG program, the project sponsor is required to have the railroad access agreement in place before the grant can be approved. This requirement can create a difficult situation. The freight railroad may be reluctant to negotiate without the funding, but the passenger operator cannot assure funding before negotiations. This situation can more difficult for new agencies that do not have a record of successful grant applications than for existing passenger service agencies who are in a better position to provide credible assurances that their project is eligible for FTA funding.
- Typically, an active railroad property cannot be taken by eminent domain; therefore, an agreement acceptable to both parties is essential.
- Freight railroads are often concerned over their exposure to passenger-related liability. This concern is related to the general increase in liability costs related to railroad accidents. Changes in Florida liability law require action by the state legislature. A liability issue involving public transit use of the Florida East Coast railway is currently waiting for action by Tallahassee. Development is this area should be monitored for applicability to this project.
- The State's freight rail transportation programs should be considered. Many states, including Florida, have a freight rail program aimed at enhancing rail access for the region's industry and commerce and preserving lower-volume rail service where it is important to the local economy. It may be possible to incorporate both passenger and freight elements into a combined transportation initiative.
- Positive working relationships with a freight railroad on other projects or programs should be leveraged to enhance the chance of reaching agreement on a passenger rail project.
- Access will be provided at a cost to the commuter rail agency separate from sharing operating and maintenance costs. There can be several alternative approaches to determine access cost. Typically passenger rail project sponsors prefer the access payment to be in the form of a one-time capital investment, which can be part of a capital grant to the project, rather than annual payments for train miles operated.
- The purchase negotiations should be explicit regarding future freight access. The agreement should spell out any limits on freight use (number of trains, time-of-day restrictions, etc.) and how a request to expand freight use beyond the agreed-upon limits should be managed and financed. A recent example of a line purchase is a proposed agreement by Florida DOT in conjunction with the Central Florida Commuter Rail agency to purchase 61.5 miles of CSX's A-Line from De Land through Orlando to Kissimmee, Florida, for a proposed commuter service. The purchase agreement was accompanied by a related agreement to help CSX upgrade the parallel S-Line for diverted trains and establish a new intermodal terminal at Winter Haven between Orlando and Tampa.
- Discussions should focus on practical solutions to operating problems, supported by thorough and credible analysis.
- A staged infrastructure investment plan must be designed to accommodate expected growth for the planned passenger service development, as well as any expected freight growth. Beyond the

initial investment for the first stage in passenger service development, there should be a process for regular reevaluation of the infrastructure investment plan to adjust as circumstances change.

- Discussions should include balancing providing adequate physical clearance for freight operations while at the same time as meeting ADA requirements for passengers boarding trains.
- Liability concerns may cause a freight railroad host to restrict the use of non-FRA-compliant passenger equipment regardless of FRA approvals.
- Liability concerns can be a major barrier to the introduction of passenger rail services and one of the most difficult issues to resolve in negotiations. Local short-haul passenger services are operated on tracks shared with CSX in South and Central Florida. Liability arrangements for the Lehigh Spur should follow the established agreements reached to facilitate the Tri-Rail and Sun Rail services.

6.2 Funding and Financing

This section summarizes potential funding strategies that may be available to support the construction of the necessary infrastructure to implement a passenger rail transit investment as outlined in this report. The objective of the section is to identify possible funding for the starter service project and identify available revenues sources, both operating and maintenance and capital, to support construction, operation, and maintenance of the transit service.

Should this project be advanced for further study, a detailed financial analysis would need to be developed. A detailed financial analysis would focus on identifying potential sources of funding, estimating the relative level of funding likely to be available and the size of the resulting additional funding required for project local funding sources. While in most circumstances some type of Federal funding source is desired, it is plausible to advance a transit project without the use of Federal funding by tapping State and local sources. The discussion which follows lays out the various funding sources that may be available from Federal, State and local sources. The discussion starts with the Federal funding sources and concludes with local sources that may be available. TA final decision on funding sources needs to be carefully evaluated on a regional and project specific basis. While Federal money may look attractive it can extend the delivery schedule and does include many requirements upon the grantee. A thorough cost/benefit and risk analysis is recommended to be performed to best inform decision makers on the most prudent funding strategy.

Completion of a financial plan is a critical component of the requirements placed upon the project by the Federal Transit Administration (FTA) who could be a participant in the funding of the project. FTA's major source of funding is authorized within Section 5309 of 49 USC. Section 5309 Capital Investment Grant (CIG) projects are funded through annual appropriations. The amount of CIG program funding available is greatly exceeded by the combined total of grant applications from the many projects nationwide that are seeking this funding. FTA manages this intense competition through a technical oversight process that addresses many components of the project development process: design, environmental, project management, travel demand, land use, and financial.

A key financial consideration in FTA's oversight is the determination of the financial capacity of the implementing entity to continue its current transit operations (if any); maintain its transportation assets

in a state of good repair; and successfully construct, operate, and maintain the proposed project. Identifying sufficient revenues to cover transit operating and capital expenditures is critical to the analysis. Potential revenues sources—described later in this chapter—may include fares, other operating revenues, dedicated revenues, state and federal grants, and participation by the private sector. FTA's eventual commitment to participate in the funding of the project hinges in large part on complementary commitments by state and local partners to fund the project.

6.2.1 General Assumptions

Miami-Dade MPO is the agency currently conducting the CSX East-West Rail Feasibility Study; however, the implementing and operating entity for any proposed service is not yet known. There are a variety of potential options, including Miami-Dade Transit (MDT) or the South Florida Regional Transportation Authority (SFRTA), or another entity, such as a private company. In addition, the agency responsible for project delivery could differ from the entity that ultimately operates the transit services. Therefore, this report is general in describing "the project sponsor" which will be further defined as the project advances. The possible funding and revenue sources discussed within this document could potentially be used with any project sponsorship scenario.

6.2.2 Funding Sources

This section summarizes prospective sources of funds which may be available to support a new passenger service outlined in this report. Sources include Federal CIG program discretionary funds, other Federal grants, state and local funds, farebox revenues, and other/private funds.

Federal Capital Investment Grant Program Funds

The FTA administers two types of Section 5309 CIG program discretionary funds for major new fixed-guideway transit investments that are potentially relevant to this project. These are:

- *New Starts*: the largest share of the program, aimed at projects with a total capital cost of greater than $300 million or that are seeking $100 million or more in Section 5309 CIG program funds; and,
- *Small Starts*: for projects with a total capital cost of $300 million or less and seeking total Small Starts funding of less than $100 million.

In addition to the capital cost thresholds, there is a variety of other eligibility criteria for each program. These include such factors as mobility improvements, environmental benefits, congestion relief, cost-effectiveness, economic development, land use and local financial commitment.

On December 4, 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law. This bill is the first long-term surface transportation authorization in ten years, since the passage of SAFETEA-LU in 2005. Under the FAST Act, the maximum Section 5309 federal share is maintained from SAFETEA-LU at 80 percent for small start projects. However, the FAST Act changes the previous law for New Starts projects by reducing the maximum federal share allowed by law from 80 percent to 60 percent. Other federal funds, including the Surface Transportation Program (STP) within the Federal Highway Programs, can still be used to supplement full funding grant agreements up to 80 percent.

While the statutory maximum Federal participation for Section 5309 New Starts funds was previously 80 percent for New Starts, the actual amount applied in recent projects has been considerably less, generally 50 percent or less. This is because the demand for these funds significantly exceeds the level of funding currently authorized or anticipated to be authorized in the future, and projects with a lower percentage of Federal participation are viewed more favorably by FTA for funding. A match of less than 60 percent (in effect, up to 59.9 percent) is required for a project to be eligible for a "medium" financial capacity rating, which facilitates grant award. While the appropriate New Starts match will be considered during development of the financial plan, 50 percent is assumed in this document as a starting point.

Other Federal Funds

Other Federal funds include Section 5309 Fixed Guideway Modernization Grants, Section 5309 Bus and Bus Related grants, Section 5307 Urbanized Area Formula grants, Surface Transportation Program (STP) grants, Congestion Management/Air Quality (CMAQ) grants, and special Federal grant programs. Each of these programs is detailed below.

- *Section 5309 Fixed Guideway Modernization grants*: These discretionary grants are derived by formula, a function of fixed guideway vehicle revenue miles and route miles operating, and can be requested seven years after opening of the fixed guideway segment.
- *Section 5307 Urbanized Area Formula grants*: These urbanized area formula grants are based on various demographic, level-of-service, and ridership variables. Under the FAST Act, the Urbanized Area Formula program grows at a more modest rate, starting at $4.539 billion in FY 2016 and rising to $4.929 in FY 2020. Urban formula grants increase by 1.8 percent in FY 2016 and 10.56 percent by FY 2020. The application of these grants is limited for capital purposes, but preventative maintenance expenses in the operating budget may be, in some instances, considered as "capital." One percent of these grants must be applied for "enhancements," which includes new initiative capital projects.
- *Surface Transportation Program (STP) grants*: STP is a block grant type program that may be used by states and localities for any roads that are not functionally classified as local or rural minor collector roads. Transit capital projects are also eligible under this program. Metropolitan Planning Organization's (MPO) must direct the use of these highway funds for use by transit.
- *Congestion Management/Air Quality (CMAQ) grants*: CMAQ directs funds toward transportation projects in Clean Air Act non-attainment areas for ozone and carbon monoxide. Projects must contribute to meeting attainment of National Ambient Air Quality Standards (NAAQS). In general, the capital costs of transit system expansions/improvements that are projected to increase ridership are eligible under the CMAQ program, as are up to three years of operating costs for new services.
- *Special federal grant programs*: In recent years, FTA and the U.S. Department of Transportation (USDOT) have administered special discretionary grant programs initially created by the American Recovery and Reinvestment Act (ARRA). These include the USDOT Transportation Investment Generating Economic Recovery (TIGER), FTA Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER), and FTA Urban Circulator capital grant programs.

State of Florida Funds

The Florida New Starts Program (NSTP) provides transit agencies with up to a dollar for dollar match of the local (non-federal) share of project costs for transit fixed-guideway projects and facilities that qualify under the FTA New Starts Program. The definition of eligibility includes rail transit and bus rapid transit (BRT) systems. This program also allows a dollar for dollar match of local funds towards project costs for projects funded with state and local funds only. Under this program, a maximum of 25 percent of project costs can be funded for projects receiving federal funds and a maximum of 12.5 percent of projects costs can be funded for projects not receiving federal funds.

Local Funds

Local transit funding comes typically from local dedicated taxes. Their projections are a vital component of the financial analysis. A combination of new dedicated taxes or increments to existing taxes would be evaluated in detail in the financial plan analysis should the project be advanced. The following is a list of potential local revenue sources that have been used in other parts of the Country to fund transit investments.

Dedicated taxes are widely used by transit agencies across the country to fund local capital and operating expenditures. Sales taxes generate over 50 percent of all local dedicated funding for all transit agencies across the US, and nearly 80 percent of local dedicated funding for new fixed guideway systems. The following describes additional taxes or user fees that have been commonly applied to fund transit. The most common type of dedicated taxes used to support transit operations are:

- *Sales tax:* The sales tax is the most popular type of dedicated funding source used to support transit improvements and operations in the US. Sales tax revenue traditionally has been extremely reliable and relatively stable, and generally tracks well with inflation, but can be volatile as changes in local economic conditions tend to affect retail sales. Sales taxes tend to be labeled as regressive by opponents, but this characteristic can be eliminated by exempting food, clothing, and other necessities from sales taxes.
- *Payroll or income tax:* Revenue from payroll taxes is also used to support transit operations. This tax could be imposed on all employees within a transit district, or an income tax could be levied on all individuals who live or work within the district.
- *Real property tax:* Property taxes have also provided stable revenue streams to support transit capital and operations, as property taxes tend to track income levels more closely than local economic conditions. This type of tax could be levied on personal property and/or commercial property. Property taxes could also be used to structure benefit assessment districts whereby property owners within a specific geographic area pay a property tax surcharge to fund transit improvements within that area.
- *Motor fuels tax:* Tax collections on motor fuels usage can be applied on a per gallon or retail sales basis. The major difference between these two methods of collection is that changes in inflation are captured through the tax collected on retail sales of motor fuels.

Another type of funding that may be appropriate for this project is a form of value capture, which could include:

- *Joint Development:* Partnership between a public entity and a private developer to develop certain assets. Their properties must have a physical and a functional relationship. It is applied most often by transit agencies that may be able to attract private developers to land adjacent to stations because of the superior access offered by high quality transit service.
- *Impact Fees:* Charges assessed against developing property to offset the impact it has on existing infrastructure. These fees seek to recover the cost incurred by a local government in providing the public facilities required to serve the new or expanded development, and are generally one-time cash payments that are passed on to the purchasers of the developed property.
- *Benefit Assessments:* Districts formed to provide a specific service or benefit to lands contained within its boundaries. A district's charges are based on the benefit to property rather than value of the property. This method has relatively low revenue yield, with growth based on property values, which are not directly indexed to inflation.
- *Tax Increment Financing:* Allows jurisdictions to create special districts (tax increment areas) and to make public improvements that will generate private-sector development. The tax base is frozen at predevelopment level, and property taxes derived from increases in assessed values (the tax increment) either go into a special fund created to retire bonds issued to originate the development or leverage future growth in the district. There is a relatively low revenue yield initially that grows over time as property values escalate in value.

Other less common non-Federal dedicated sources of transit funding applied throughout the US are generated from the following economic activity: employer payroll, mortgage recordation, corporate income, vehicle emission fees, rental car fee, surface parking, luxury and amusement tax, hotel tax, and tobacco and alcohol taxes.

Farebox Revenues

Represents the revenue derived from system riders from ticket sales. This revenue source represents a stable funding stream and could represent upwards of 30 percent of the annual operating costs.

Other / Private

These revenues include other transit related revenues, private revenue sources, and interest earnings.

Other transit-related revenues would be based on budget values for similar transit services, and can be adjusted annually to account for growth in inflation, level of service, ridership, and demographics. Additional operating revenues may include the following:

- *Advertising*: This includes revenues generated from advertising on vehicles and in stations. Advertising revenues are generally based on contract rates negotiated with national advertising firms. Rates are based on “exposure,” which is generally related to ridership and, thus, level of service. For exterior rail advertising, revenues can be based on the number of stations and peak-hour railcars.
- *Concessions*: This includes income from automated teller machines, vending machines, and (potentially) retail operations within station space.

- *Station parking*: Parking revenues could be projected based on parking fees assumed in the travel demand analysis and the projected parking lot usage. Parking fees could be determined with the agreement of the jurisdiction in which the station is located, and fees could be based on historical parking lot usage and local government objectives regarding traffic volumes in station areas.
- *Lease income*: Including contracted rentals and private utilities (cellular towers, fiber optics, etc.). Lease revenues can be projected on any combination of growth in ridership, route-miles, vehicle-miles, and/or inflation.

It should be noted that while these sources can provide additional funding for projects, these revenues typically only yield only a small share of the total funds required.

6.2.3 Financing Options

Funding the construction program effectively will require a careful balance of potential financing strategies. This section describes potential financing tools as well as entities for financing.

Financial analysis models are capable of applying a number of different financing strategies. The instruments that are appropriate for this project would be determined during development of the financing plan if the project is advanced. A description of each strategy and the motivations for their application are described below.

Conventional Debt Financing

These bonds may be general obligation bonds or dedicated revenue bonds and feature level combined principal and interest payments. General obligation bonds are issued by a local, county, or state jurisdiction, which pledges its full faith and credit that the bonds will be repaid as promise. Dedicated revenue bonds are issued by the governmental jurisdiction against a projected revenue stream dedicated to bond repayment; if revenues are insufficient to cover debt service, bondholders have no recourse to repayment via other governmental revenue streams.

Innovative Debt Financing

Innovative financing provides opportunities to increase capital revenues and reduce annual capital costs, thereby improving debt service coverage ratios and thus increasing financial capacity by taking advantage of Federal laws and regulations and current capital market conditions. Several types of innovative financing may be available:

- *Tax-exempt commercial paper (TECP) for construction*: The use of short-term debt is advantageous because debt instruments of shorter maturity generally have lower interest rates than longer-term debt.
- *Construction bonds with capitalized interest*: These are long-term bonds where the amount borrowed includes debt service payments during the construction period. During that period, only interest payments are made.
- *Full-Funding Grant Agreement (FFGA) Bonds*: The ability to borrow against Federal 5309 funds committed to the project could provide significant opportunities to stabilize the cash flows during construction, and may also provide for the construction of the project to be accelerated. The FFGA

provided by the FTA is only a guarantee of the total dollars to be provided by the Federal government, and does not guarantee the timing of Federal payments.

- *Transportation Infrastructure Finance and Innovation Act (TIFIA) Loan*: TIFIA was established to provide federal assistance in the form of credit (direct loans, loan guarantees, and standby lines of credit) to major surface transportation projects of critical national importance. These projects include intermodal facilities, border crossing infrastructure, trade corridors, and other investments generating substantial regional and national economic and other benefits.
- *Public Private Partnerships – Private Debt:* A Public-Private Partnership (P3) uses private financing as both a financing and a delivery mechanism. Under this approach, a public agency enters into a contract with a private developer who, depending on the contract type, can assume responsibility over the design, construction, financing, operations, and maintenance of a transportation facility. This approach can help reduce public funding shortfalls and accelerate project development.

6.3 Implementation Actions

Upon completion and acceptance of this feasibility study a decision may be made to advance one of the service development alternatives (Figure 30). If so, there are a number of steps that need to be addressed by the project sponsor(s) in order to initiate passenger rail service within the corridor. These steps include:

a. **Environmental and Outreach** - Should Federal funding or involvement be likely, environmental documentation would have to be performed under National Environmental Policy Act (NEPA). If a decision is made to exclusively fund and implement the project with State and local funding the environmental review would be processed under the Florida requirements, including a possible PD&E study. Environmental permits may be necessary and would be identified in the NEPA or PD&E study process. Public and agency outreach must also be conducted to receive feedback from stakeholders.

b. **Finance Plan** - A financial plan would need to be prepared that identifies sources of funding for the capital expenditures related to building the system and procuring materials, and identifies the annually reoccurring source of funds to pay for the ongoing operations and maintenance of the system including transit vehicles. In order to use state and federal funds for project development, the project also needs to be included in the MPO funding and approval process involving the TIP, STIP, LRTP, etc.

c. **Access Agreement** – State and / or local project sponsors need an agreement with CSXT to use the portion of the corridor that is CSX ownership. It is currently understood that CSXT would consider the sale of the entire Homestead Subdivision to state or local government, not just the portion of the overall subdivision necessary for this service. This may add substantially to the up-front cost of implementing the service.

d. **Governance Plan** – The project needs a sponsor to oversee engineering, permitting, construction and operation. Stakeholders need to determine how the service will be operated and governed. Options for consideration include:

- operated under SFRTA
- operated under MDT
- part of the existing Tri-Rail operation
- operated as a standalone service
- operated by a contractor
- operated by another government agency
- oversight and finance by which government agency (agencies)

e. **Preliminary Engineering** – Plans must be developed to confirm and expand the understandings reached in the feasibility study. More detailed station plans will identify land requirements. More detailed track and signal plans will better detail costs and required investment. Storage and maintenance facility needs will be addressed.

f. **Vehicle Engineering and Procurement** – The service can be operated with traditional Tri-Rail push-pull trains or lighter (and more environmentally friendly) self-powered cars. The use of self-powered cars; however, will add expense to the capital costs and require longer lead times for vehicle specifications and procurement. The vehicle specification needs to be performed in concert with the preliminary engineering and environmental permitting.

g. **Federal Coordination** – The service could potentially be a candidate for FTA Capital Investment Grant funding. If so, federal coordination is required to ensure that all planning and engineering is consistent with FTA requirement. As the service reaches its service date, coordination and permits from the Federal Railroad Administration will be required to ensure system safety.

h. **Project Delivery** – Decisions are required on the project delivery mechanism. Options for consideration include traditional government construction (design, bid, build); accelerated construction (design-build or design, build, operate and maintain); or other approaches. The project delivery mechanism decision will affect how the project is managed and financed once preliminary engineering is complete.

i. **Final Design and Construction** – Once a project delivery method has been specified and the preliminary engineering is completed to the satisfaction of the project sponsor(s), final design and construction will require 18 to 36 months

j. **Commissioning** – Once the construction is complete and the vehicles have been delivered a program of testing is required before revenue service can begin. This process can be as short as several weeks or as long as three months.

k. Start Revenue Service – Once commissioning and pre-revenue testing is complete, revenue service can begin.

Figure 30
Implementation Process

Source: Jacobs Engineering, 2016.

7. Conclusion

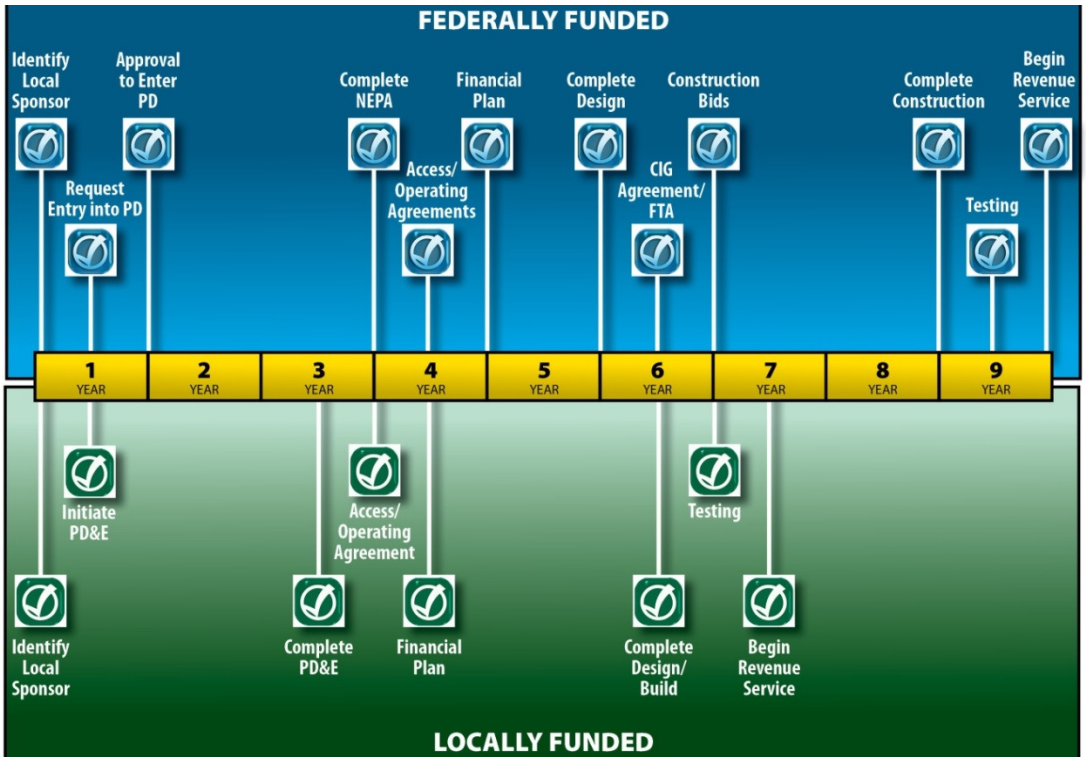
Transit projects typically follow one of two project implementation paths depending on whether or not federal capital improvement grant (CIG) funding will be sought for the project. If CIG funding is sought for the project, the project will be required to proceed through a multi-step, multi-year process to be eligible for funding with FTA evaluation and rating required at various points in the process. Projects such as the potential CSX passenger rail service that are less than $300 million in capital cost and seeking less than $100 million are eligible for Small Starts CIG funding, which can streamline the project delivery process as compared to New Starts projects. The Small Starts process consists of two phases, *Project Development* and *Expedited Grant Agreement*, while the New Starts process consists of three phases, *Project Development*, *Engineering*, and 3) *Full Funding Grant Agreement*. Therefore, it is likely that if this project seeks CIG funding it will follow the Small Smarts process.

The FTA Project Development process includes specific, defined steps which the project sponsors must follow in order to be eligible for CIG grants, as depicted at the top of Figure 31. These include:

- request to Enter Project Development,
- completion of environmental documentation in accordance with NEPA,
- completion of design,
- submittal of technical requirements,
- submittal of project justification and financial criteria for project evaluation and rating, and
- CIG agreement with the FTA.

Figure 31

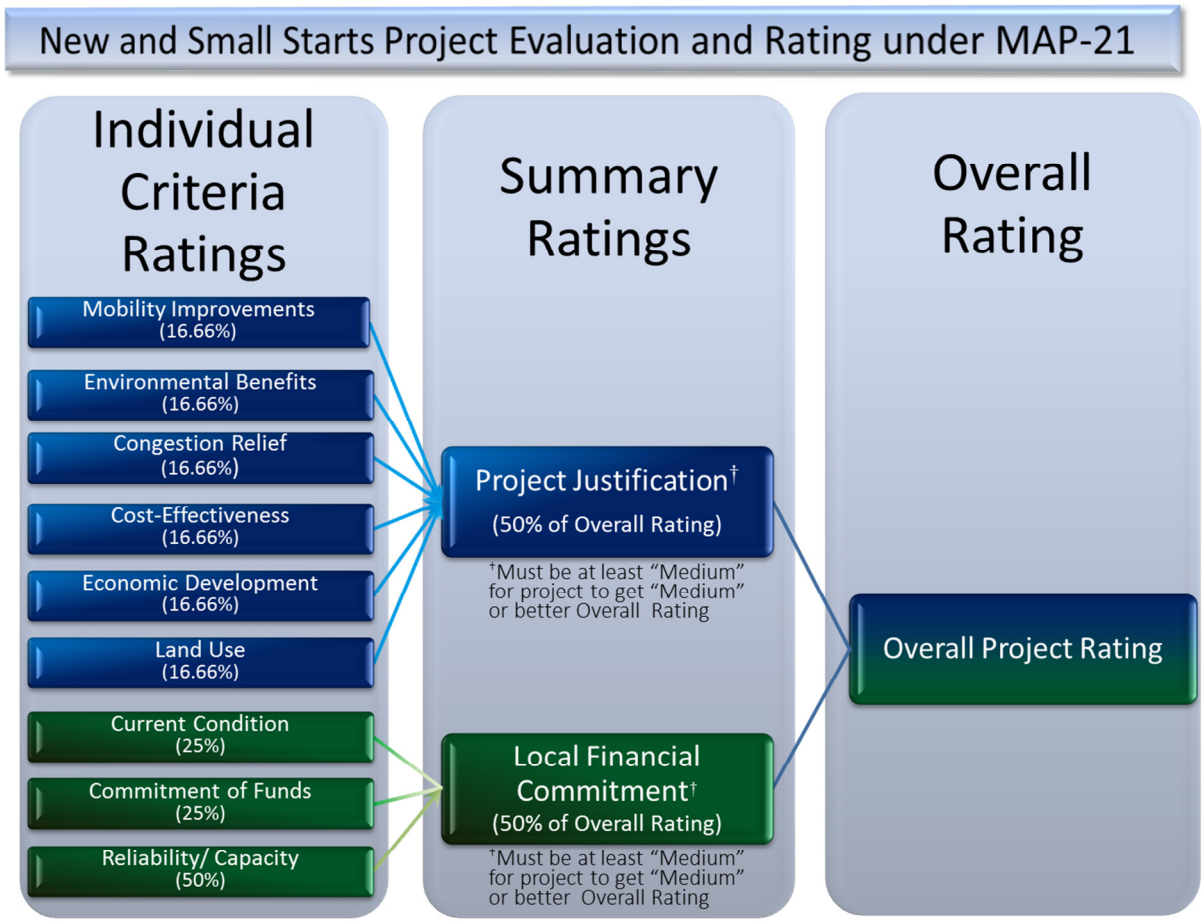
Federal and Local Project Implementation Process



Source: Jacobs Engineering, 2016.

The CIG program is a competitive, discretionary program. Therefore, project sponsors are encouraged to submit projects that are likely to receive favorable ratings. An overall rating of a "medium" or higher is required for the FTA to recommend a project to Congress for funding. Therefore, project sponsors should consider for CIG funding projects in their region that are likely to perform well under the evaluation and rating criteria presented in Figures 32 and 33.

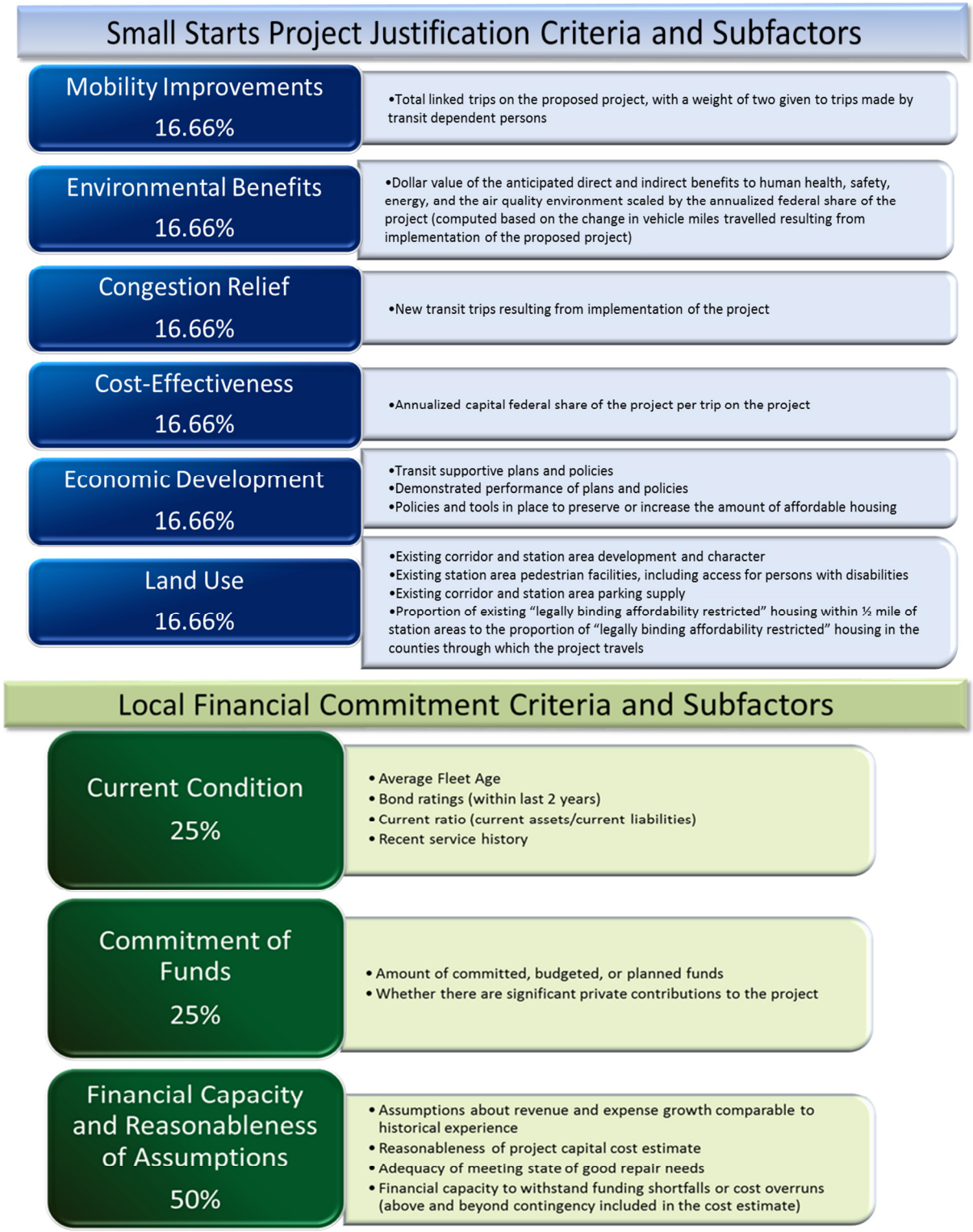
Figure 32
FTA New and Small Starts Project Evaluation and Rating



Source: U.S. Department of Transportation, Federal Transit Administration, Final Interim Policy Guidance Federal Transit Administration Capital Investment Grant Program, August 2015.

Figure 33

FTA Small Starts Project Justification and Local Financial Commitment Criteria and Subfactors



Source: U.S. Department of Transportation, Federal Transit Administration, Final Interim Policy Guidance Federal Transit Administration Capital Investment Grant Program, August 2015.

Projects that address regional travel concerns, but do not perform as well as other projects under the federal criteria, can be implemented using state and local funding. The local project implementation process, depicted at the bottom of Figure 31, is similar to the federal process, with several key differences:

- federally required steps such as requesting entry into Project Development are not required,
- NEPA documentation is not required, instead, Florida PD&E documentation is required,
- submittal of federal technical requirements are not required,
- submittal of project justification and financial criteria for project evaluation and rating are not required, and
- commitment to the federal grant agreement, and associated federal obligations, are not required.

Passenger rail service in the CSX East-West Rail corridor should be considered together which other transit improvement projects in the region to determine which projects are best suited for federal CIG funding, and which projects should be advanced using state funds. After this determination is made, the project can advance for further environmental and engineering evaluation under the appropriate federal or state/local implementation process.