BEACH CORRIDOR TRANSIT CONNECTION STUDY—FINAL REPORT

PREPARED FOR:

MIAMI-DADE METROPOLITAN PLANNING ORGANIZATION

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TABLE OF CONTENTS

4.0 REFINEMENT OF 2004 LOCALLY PREFERRED ALTERNATIVE (LPA)

5.0 AFFECTED ENVIRONMENT

EXISTING WILDLIFE IN STUDY AREA


INTER-CONTINENTAL

1.0 INTRODUCTION

1.1 Project Background and Purpose of this Study

Over the past 27 years, several detailed studies were conducted to examine the feasibility of a fixed guideway transit connection between downtown Miami and Miami Beach. The last of these studies, the *Bay Link Study* completed in 2004, recommended construction of a light rail transit (LRT)/modern streetcar line along a Locally Preferred Alternative (LPA) utilizing the MacArthur Causeway; however, local decision-makers were not prepared to make a commitment to a major transit investment at that time. Over the ensuing decade, downtown Miami and south Miami Beach (South Beach), key economic engines of Miami-Dade County, experienced an extended surge in growth across residential, commercial, and tourism sectors that is projected to accelerate in the coming years. This growth has generated travel demand that the area's transportation network, both roadway and transit, can no longer meet. Local elected officials realize that for the area between downtown Miami and South Beach, and for the South Florida region to grow economically, there is a clear need for adding core transportation capacity through a major transit investment.

As a result of growth and increased demand for improved transportation in downtown Miami and the tourist district of South Beach, the Miami-Dade MPO, in partnership with Miami-Dade Transit (MDT), Miami Downtown Development Authority (DDA), Florida Department of Transportation (FDOT) and the Cities of Miami and Miami Beach, agreed in 2013 to conduct the Beach Corridor Transit Connection Study. The purpose of this study was to update the *2004 Bay Link Study* by refining the 2004 LPA. This effort included updating existing conditions; updating capital and operating and maintenance costs; identifying a location for a maintenance facility; conducting a high level environmental screening; performing a funding and financial analysis; examining wireless streetcar technologies; refining the alignment and station locations; and evaluating implementation strategies for a fixed guideway rapid transit project.

This update was intended neither to conduct a new Alternatives Analysis (AA) nor to prepare an Environmental Impact Statement (EIS). The intent was to validate that the 2004 LPA is still viable, refine the LPA with additional service to/from Miami Beach, and identify a low-cost first phase to facilitate implementation. It did not revisit discarded modal technologies; did not prepare new transit ridership estimates; did not include public involvement; and did not resolve all concerns previously identified. These will be addressed in subsequent phases of project development as necessary.

1.2 Prior Studies

Four major studies of an improved high capacity transit connection between Miami and Miami Beach have been conducted over the last 27 years. Summaries of these studies are provided in the succeeding sections in chronological order.

1988 – Miami Beach Light Rail Feasibility Study

In 1988, the *Miami Beach Light Rail Transit (LRT) System Feasibility Study* was conducted to determine the feasibility of constructing an LRT line to connect downtown Miami to Miami Beach via the MacArthur Causeway. The proposed line was an 8.6-mile link from the Bayside/Omni area to the Miami Beach Convention Center and then northward to 63rd Street. One of the goals of the project was to support the revitalization efforts of the City of Miami Beach in the South Beach area. As a result of the study, state law was amended to allow the expenditure of the Tourist Development Tax for construction of an LRT system. Opposition from residents north of the Miami Beach Convention Center effectively stopped the progress of the project.

1993 – Transit Corridors Transitional Analysis

In the Year 2010 *Miami-Dade Long Range Transportation Plan*, six major corridors were identified as "Priority Transit Corridors" within Miami-Dade County. These six corridors included: North Corridor; East-West and Beach Corridors (combined and evaluated in the Major Investment Study/ Final Environmental Impact Statement (MIS/FEIS) for the East-West SR 836 Multimodal Corridor Study); Northeast Corridor; Kendall Corridor; and the South Corridor (operated in conjunction with Stage 1 Metrorail, and built by FDOT as the South Dade Busway). A preliminary evaluation of costs, impacts and ridership was conducted for each corridor and the results were presented in the *Transit Corridors Transitional Analysis* completed by the Miami-Dade County MPO in 1993. The studies performed under the *Transit Corridors Transitional Analysis* served to satisfy a portion of Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) requirements for System Planning, which is the first step in the federal capital investment project development process. These planning studies provided the technical basis for the selection of corridors for additional analysis. The East-West and the Beach corridors were identified as a higher priority than other corridors at the time and were to be examined jointly as a single corridor.

1995 – East-West Multimodal Corridor (DEIS) Study

The East-West Multimodal Corridor Draft Environmental Impact Statement (DEIS) Study addressed possible solutions to extreme congestion along SR 836/Dolphin Expressway, which is considered to be the most traveled east-west roadway in Miami-Dade County. Potential solutions included a Metrorail line that would extend from Florida International University (FIU) in the west to PortMiami in the east. A separate LRT system was proposed from downtown Miami to Miami Beach. The LRT portion of the project extended from Flagler Street, along Biscayne Boulevard in downtown Miami, across the MacArthur Causeway to south Miami Beach, and then north along Washington Avenue to the Miami Beach Convention Center. The segment along the MacArthur Causeway was to be built on the south side of the roadway entirely on a special structure constructed on fill.

2002 – Miami-Miami Beach Transportation Corridor (Bay Link) Study

The *Miami-Miami Beach Transportation Corridor Study*, commonly referred to as the *Bay Link Study*, analyzed project modifications and impact changes from what was previously studied in the East-West Multimodal Corridor Study Draft Environmental Impact Study (DEIS). Unlike the East-West study, which covered a broader geographic area, the Bay Link DEIS study area included downtown Miami, the MacArthur Causeway, and South Beach. This is because the Miami-Miami Beach segment was not part of the LPA adopted for the East-West Multimodal Corridor Study. Extensive coordination was done with the City of Miami Streetcar Study being conducted at the same time, whereby alignments and stations were shared wherever possible. The adopted LRT/modern streetcar system was endorsed by the cities of Miami and Miami Beach.

2004 – Phase 2 Miami-Miami Beach Transportation Corridor (Bay Link) Study

In April of 2004, the MPO Board approved the conduct of a second phase of the *Bay Link Study* that consisted of refining the LPA description and preparing the Preliminary Engineering (PE) and Final Environmental Impact Statement (FEIS). The Refined LPA consisted of a two-way loop within downtown Miami, partly following separate streets, a two-track connector line across the MacArthur Causeway on the south side, and a counter-clockwise one-way loop within South Beach. In addition, a clockwise one-way loop called the Beach Circulator was also part of the Refined LPA, providing additional circulation on the Beach. It is this Refined LPA that was revisited in this current study.

The LPA approved by the Miami-Dade MPO Board in April 2004 was based on a refinement of the LPA that started with station area planning through a series of "Form and Fit" meetings in Miami and Miami Beach. In total, 44 station area planning meetings were conducted to obtain input from project stakeholders and the public; over 25,000 public information newsletters were distributed; a project video was prepared; and the website was regularly updated. Modifications to the LPA resulted in the Refined LPA. These modifications increased the length of the project from 8.6 route miles to 18.04 route miles; shifted the alignment in several locations; shifted station locations; and added 17 new stations. Recommendations made during this process included:

1. Accept the Refined LPA (as developed during Phase 2) as the basis for the application to the FTA for Preliminary Engineering (PE)/Final Environmental Impact Statement (FEIS).
2. Reiterate that the technology of the Bay Link LPA is LRT/modern streetcar.
3. Assure that the Bay Link LRT/modern streetcar provides easily accessible connections to all existing and proposed modes of transportation within Miami-Dade County.
4. Direct that the submittal of the PE/FEIS be completed by mid August 2004 in order to be included in FTA's next New Starts cycle.
5. Upgrade the Bay Link LRT/modern streetcar corridor priority in the current Miami-Dade County Long Range Transportation Plan.
6. Continue the Bay Link LRT/modern streetcar project development process, in cooperation with Miami-Dade Transit (MDT), through future phases such as preliminary engineering, final design and construction.[1]

The study noted several suggestions that were not defined as formal "recommendations", but were documented for the next phase of project development. These included:

- The use of off-wire (wireless) transit vehicles due to the threat posed by hurricanes and the potential visual impacts of the overhead wire.
- No elevated structures on Miami Beach.
- Design and construction of station shelters should be at a smaller (pedestrian) scale.

The 2004 Refined LPA is discussed in detail in Section 3.1 of this document.

1 Locally Preferred Alternative Report, September 2004, Miami-Dade Metropolitan Planning Organization and U.S. Department of Transportation Federal Transit Administration

2.0 EXISTING CONDITIONS/ CHANGES FROM 2004

2.1 Description of the Study Area

The Beach Corridor Transit Connection Study area is located in the urban core of Miami-Dade County in south Florida. The study area boundaries are as follows:

- Northern boundary – NW 41st Street, I-195/SR 112;
- Eastern boundary – the Atlantic Ocean from 41st Street to South Pointe in Miami Beach;
- Southern boundary – SE/SW 13th Street;
- Western boundary – I-95.

The 2014 Beach Corridor Transit Connection Study area, along with the 2002 study area, are illustrated in **Figure 2.1**.

FIGURE 2.1: 2014 BEACH CORRIDOR TRANSIT CONNECTION STUDY AREA

2.2 Demographics/Changes from 2004

2.2.1 Population

The Beach Corridor Transit Connection Study (herein after referred to as the Beach Corridor Study) area is an epicenter for population and economic growth in a region that experienced significant growth over the past ten years. Miami-Dade County has undergone rapid population increases, a pattern that is projected to continue over the next 20 years as illustrated in **Table 2.1**. Between 2000 and 2010, the County population increased 10.8 percent and is projected to increase another 31 percent by 2035. However, this County growth rate is still less than that found in the study area. The 2002/2004 *Bay Link Study* area, which overlaps the vast majority of this project's study area, reported over 62,000 residents in 2000. By 2010, the study area population rose to over 100,000, a 10-year increase of over 60 percent. The downtown Miami portion of the study area saw a particularly large population increase over that decade, from 18,500 to over 74,000 (Source: Miami Downtown Development Authority).

As reported in the Miami-Dade MPO 2035 Long Range Transportation Plan, the study area expects to grow another 75 percent to 175,800 residents in the next 20 years. Despite being only 1.4 percent of the total land area in Miami-Dade County, the study area accounted for just over 4 percent of the total population in 2010 and will grow to 5.4 percent by 2035. The population densities in the study area are among the highest in the nation, with downtown Miami at 17,800 persons/square mile and Miami Beach at 11,500 persons / square mile, per the 2010 US Census. Downtown Miami saw a dramatic 172 percent increase in population density over the last decade, though Miami Beach density fell slightly from 12,500 persons / square mile in 2000.

2.2.2 Visitor Population

Due to the region's appealing qualities such as its temperate climate, attractive beaches and convenient access to the Caribbean and Latin America, south Florida has become a primary tourist destination for both national and international visitors. Miami-Dade County in general, and the study area in particular, hosts millions of annual visitors and seasonal residents. Visitors typically access the study area by tour bus, taxi and rental cars. The Greater Miami Convention and Visitors Bureau's 2012 Visitor Industry Overview report stated that there were an estimated 13.9 million overnight visitors to the region in 2012, an increase of over 1 million from just two years ago. Miami Beach and downtown Miami were the two most popular locations for overnight stays, combining to lodge 60 percent of all 2012 visitors, with approximately 5.8 million and 2.4 million overnight guests, respectively. Additionally, four of the six most visited attractions were in the study area (South Beach, the Beaches, Lincoln Road, and downtown Miami). The study area also contains PortMiami. In 2013, 4.1 million cruise ship passengers used the port, up from 3.4 million in 2000.

The visitor population is critical to the local economy, with overnight visitors to greater Miami estimated to have spent approximately $21.8 billion in direct expenditures during 2012. This large amount of visitor expenditure provides economic benefit to a number of industries such as hotels, restaurants, transportation, entertainment and shopping. This high rate of tourism also generates additional demand for travel, produces additional trips within the study area, and contributes to traffic and subsequently roadway congestion.

A visitor survey is conducted annually for the Visitor Industry Overview. This survey reached 13.4 percent of all visitors in 2012 and found that traffic congestion is the top listed negative aspect of trips to greater Miami. Traffic congestion has been the top ranked problem in each of the last five years surveyed.

TABLE 2.1: POPULATION GROWTH, 2000 - 2035

Year	Miami-Dade County		Beach Corridor Study Area	
	Population	Growth (%)	Population	Growth (%)
2000	2,253,362	na	62,256	na
2010	2,496,435	11%	100,286	61%
2035	3,278,155	31%	175,769	75%

Source: US Census Bureau (2000 and 2010 Decennial Census), Miami-Dade MPO (2035 Long Range Transportation Plan)

2.2.3 Employment

Miami-Dade County's active economic base is composed of diverse elements including major sectors of international finance and trade, real estate, services, technology, health care, and education.

The study area is the heart of Miami-Dade County's employment base. In 2011, there were 189,000 total jobs in the study area, which accounted for 14 percent of the county's total jobs, despite being barely 1 percent of the total land area. Job growth is relatively unchanged since 2005, down less than 2 percent over this time despite a national recession from 2008 to 2009. Downtown Miami and Miami Beach remain the hub of arts and entertainment, tourism, and public administration jobs. There are also major educational and financial employers in the area.

While the study area is projected to see three times the population increase as the county, employment projections are distributed evenly between the county and the study area, at 45 percent and 35 percent, respectively (see **Table 2.2**).

However, recent employment numbers may suggest that employment growth is still pronounced in the study area. Data collected by the Miami Beach Economic Development Department indicates that the total number of jobs In South Beach has increased from 27,900 in 2007 to 33,400 in 2012, a jump of 19.5 percent in only 6 years. Notable increases occurred in the hospitality, retail, and professional service sectors. These increases are particularly impressive given the slowdown in the economy between 2007 and 2010.

The vast majority of study area jobs are in the service industry, which includes finance, real estate, professional services, healthcare arts and entertainment, accommodation, and public administration. Wholesale and retail trade make up a small percentage of jobs, while industrial businesses, such as utilities and manufacturing, account for less than one percent of jobs. This pattern is expected to become more pronounced, with 2035 employment projections forecasting the largest increases in service and commercial industries.

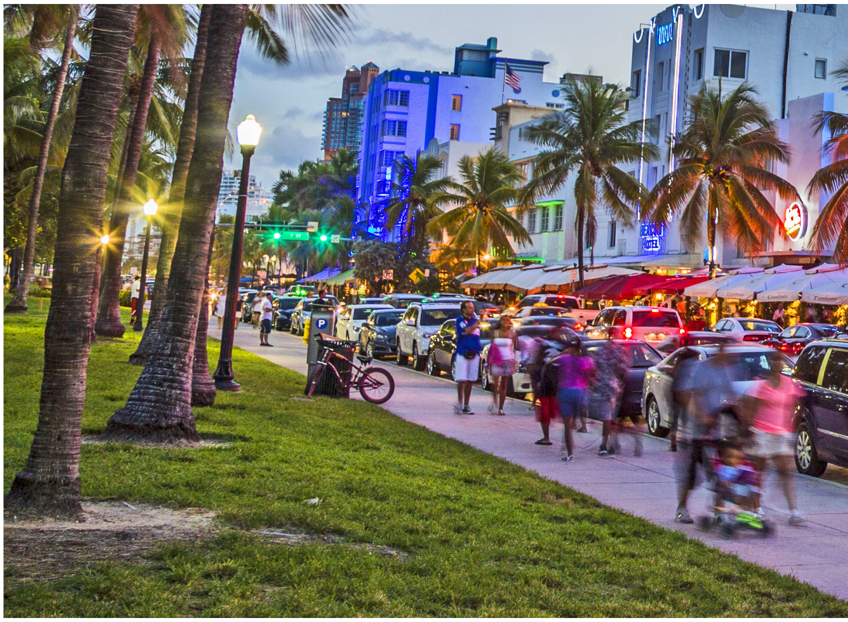
The upsurge in tourism, residential growth and economic redevelopment in the study area have all generated additional demand for travel. Yet, the study area's growth and development is constrained by its natural geographic boundaries that significantly limit the availability of land for additional roadways and parking. To retain and continue to attract such growth, the region and study area will need to improve its transportation system by adding core capacity to maintain the mobility essential to sustainable growth.

OTHER HIGHLIGHTS FROM THE DECADE OF CHANGE REPORT:

Development within the Brickell area submarket over the last decade was focused on residential units as evidenced by the addition of 11.07 million square feet. However, coupled with a 37 percent or 3 million square feet increase in office space over the same period, it is evident that an effort was exerted to establish a true live/work environment.

The CBD area has always been and continues to be known as the employment center of Downtown as it is home to many of the national and multinational corporations and businesses located in South Florida. However, the lack of residential space has been a key factor in preventing the submarket from realizing its full potential as a key part of the urban core. Over the last decade, the CBD submarket has increased residential building space by more than 970 percent or 5.58 million square feet. This coupled with growth in the hotel sector (102 percent or 720,000 square feet increase) have made the CBD a preferred location with the Downtown corridor for visitors, residents, and employers.

The Arts & Entertainment submarket realized the largest gain in gross square feet within the residential building space type with an increase of 3.2 million square feet or 130 percent over the last decade. However, the largest percentage change within this area of Downtown was in the arts and recreation building space type, which increased in size by 3000 percent with the delivery of the 240,000+square feet Adrienne Arsht Center in 2006.



2.3 Land Use and Development

The study area is the most densely developed in Miami-Dade County and has historically provided the economic foundation for the development of the entire county. The tremendous private investment in the study area, including high-rise condominiums, entertainment venues, and office and retail space, is being augmented by significant public investment.

Downtown Miami

The Miami Downtown Development Authority's Decade of Change: downtown Miami Area 2001-2011 Report highlights the development growth in the study area. Overall, the total square footage of building space in the downtown Miami side of the study area increased rapidly in the last decade. In 2000, there was 51.7 million square feet of building space; by 2011, figures had risen to 79.8 million square feet, an extraordinary 54 percent increase. The districts surrounding the Central Business District (CBD), namely Brickell and the Arts & Entertainment District, increased 67.1 percent and 79.4 percent, respectively. A breakdown of square footage by land use is provided in **Table 2.3**.

TABLE 2.2: EMPLOYMENT GROWTH, 2005 - 2035

Year	Miami-Dade County		Beach Corridor Study Area	
	Employment	Growth (%)	Employment	Growth (%)
2005	1,379,355	na	192,551	na
2035	1,994,215	45%	260,455	35%

Source: Miami-Dade Long Range Transportation Plan

TABLE 2.3: TOTAL SQUARE FEET OF BUILDING SPACE (IN MILLIONS) BY LAND USE TYPE—DOWNTOWN MIAMI

Year	Residential	Office	Retail - Other Com.	Hotel	Industrial	Public	Arts & Ent.	TOTAL
2000	14.52	20.99	4.01	2.55	0.64	8.93	0.06	51.7
2011	34.37	25.73	4.53	4.28	0.81	9.72	0.36	79.8

Source: Decade of Change: Downtown Miami Area 2001-2011

Miami Beach

In Miami Beach, development is focused on residential and tourism growth. Residential building permits increased nearly 25 percent between 2010 and 2012, to 12,580 permits, back to levels seen before the 2008-2009 recession. The number of hotel rooms increased 19 percent between 2007 and 2012, up to over 16,000 rooms. Additional development is proposed or underway in the Miami Beach part of the study area as of this writing, as shown in **Table 2.4**. These investments all share the need for continued mobility in the study area if the return on these investments is to be realized.

TABLE 2.4: PROPOSED OR CURRENT STUDY AREA DEVELOPMENT, 2013—MIAMI BEACH

Residential Units	Hotel Rooms	SF office	SF retail
10,989	16,001	1,290,500	1,353,127

While the integration of land use and transportation planning has been as demonstrated by the Comprehensive Master Development Plans developed by the County and cities, attention must be paid to implement the premium transit link needed to expand the core capacity that will provide safe, efficient and integrated connections for pedestrians and public transit. The concurrency requirements are good indicators of the stress that rapid growth is placing on public infrastructure.

2.4 Traffic Changes from 2004

Between 2004 and 2012 the McArthur Causeway and Julia Tuttle Causeway experienced approximately 4.5 percent and 6.0 percent growth in annual average daily traffic (AADT) respectively. Other primary roadways within the study area also experienced similar growth during the same time period.

2.5 Parking Changes from 2004

Significant changes have occurred in the parking supply and pricing of parking in Miami Beach, and particularly in South Beach (See **Tables 2.5 and 2.6**). In 2004, the total parking supply in South Beach was approximately 4,800 spaces. Hourly parking rates were generally $1 per hour. By 2014, the parking supply had increased to over 7,700 spaces. Parking in garages remains at $1 per hour while surface lots are priced at $1.75 per hour. Several new garages were constructed, in some instances, on the sites of former public parking lots.

TABLE 2.5: 2004 PARKING INVENTORY AND COST (MIAMI BEACH)

Parking Facility	Number of Spaces	Hourly Parking Fee
Lots: South of 5th St.: South Pointe		
South Pointe Park	215	$1
Ocean Dr. and 1st St.	62	$1
Miami Beach Marina (Alton Rd. S. of 5th St.)	200	
Lots: From 5th St. to 15th St.: Historic District		
Collins Ave. and 6th St.	34	$1
Meridian Ave. and 6th St.	25	$1
Washington Ave. and 9th St.	24	$1
Washington Ave. and 10th St.	30	$1
Collins Ave. from 10th St. to 11th St.	30	$1
Collins Ave. and 13th St.	53	$1
Garages: From 5th St. to 15th St.: Historic District		
7th St. Garage (Washington Ave. & Collins Ave.)	656	$1
12th St. Garage (1/2 block west of Washington Ave.)	134	$1
13th St. Garage (1/2 block east of Collins Ave. on 13th St.)	279	$4
15th St. to Dade Blvd. (Convention Center-Jackie Gleason Theater-City Hall-Lincoln Rd.)		
Washington Ave. and 15th St.	68	$1
Washington Ave. and 17th St. (Enter at Drexel Ave. or Pennsylvania Ave.)	556	$1
Lenox Ave. and Lincoln Rd. N. (1 block south of 17th St.)	107	$1
Michigan Ave. and Lincoln Rd. N. (1 block south of 17th St.)	155	$1
Meridian Ave. and Lincoln Rd. N. (1 block south of 17th St.)	144	$1
Lenox Ave. and Lincoln Rd. N. (1 block south of 17th St.)	86	$1
Lincoln Rd., S and Jefferson Ave. (2 blocks south of 17th St.)	21	$1
Lincoln Rd., S and Euclid Ave. (2 blocks south of 17th St.)	40	$1
Lincoln Rd., S and Michigan Ave. (2 blocks south of 17th St.)	19	$1
17th St./Convention Center Dr. (Jackie Gleason Theater of Performing Arts)	85	$1
18th St. and Meridian Ave. (behind City Hall)	117	$1
19th St. and Meridian Ave. (adjacent to Holocaust Memorial)	51	$1
Garages: From 15th St. to Dade Blvd.		
17th St. Garage (between Pennsylvania Ave. and Meridian Ave.)	1,460	$1
Parking Lots - West of Alton Rd.		
West Ave. and 16th St.	30	$1
West Ave. and 17th St.	71	$1
West Ave. and 18th St.	40	$1
	4,792	

TABLE 2.6: 2014 PARKING INVENTORY AND COST (MIAMI BEACH)

Lot Designation	Parking Facility	Number of Spaces	Hourly Parking Fee (first hour)
P1	South Pointe Park	215	$1.75
P2	South Pointe Drive & Ocean Drive	62	$1.75
P3	Washington & Commerce	12	$1.75
P4	1st Street & Washington Avenue	30	$1.75
P5	4th Street & Alton Road	23	$1.75
G8	**5th Street & Alton Road - Garage**	**500**	**Free**
G1	**7th Street & Collins Avenue - Garage**	**646**	**$1.00**
P9	11th Street & Jefferson Avenue	120	$1.75
P10	15th Street & Michigan Ave (Softball Lot)	134	$1.75
P11	6th Street & Meridian Avenue	25	$1.75
P12	9th Street & Washington Avenue	24	$1.75
P13	10th Street & Washington Avenue	30	$1.75
P14	6th Street & Collins Avenue	34	$1.75
P15	10th Street & Collins Ave	33	$1.75
G2	**12th Street & Drexel Avenue - Garage**	**134**	**$1.00**
P16	13th Street & Collins Avenue - West Side	55	$1.75
G3	**13th Street & Collins Avenue - Garage**	**286**	**$1.00**
G4	**16th Street & Collins Avenue - Garage**	**803**	**$1.00**
P18	Lincoln Lane S & Meridian Avenue	40	$1.75
P19	Lincoln Lane S & Jefferson Ave - East Side	21	$1.75
P20	Lincoln Lane S & Jefferson Ave - West Side	62	$1.75
P21	Lincoln Lane S & Michigan Avenue	19	$1.75
P22	Lincoln Lane S & Lenox Avenue	18	$1.75
P23	16th Street & West Avenue	31	$1.75
P24	17th Street & West Avenue (Epicure)	71	$1.75
P25	Lincoln Lane N & Lenox Avenue - West Side	86	$1.75
P26	Lincoln Lane N & Lenox Avenue - East Side	107	$1.75
P27	Lincoln Lane N & Meridian Avenue	144	$1.75
P28	Lincoln Lane N & Pennsylvania Avenue	195	$1.75
G5	**17th Street & Pennsylvania Ave - Garage**	**1,460**	**$1.00**
G9	**Pennsylvania Avenue (17th Street) - Garage**	**550**	**$1.00**
G7	**City Hall Garage (18th Street & Meridian)**	**650**	**$1.00**
P29	17th Street & Convention Center Drive	160	$1.75
P32	18th Street & Meridian Avenue	886	$1.75
P33	19th Street & Meridian Avenue (Holocaust)	26	$1.75
P46	18th Street & Purdy Avenue	41	$1.75
		7,733	

Note: Garages shown in bold text. Special events rates apply for garages. 5th & Alton Garage rate is $3 for the third hour and $2 for each additional hour.

The public parking supply in downtown Miami has changed very little between 2004 and 2014 (see **Table 2.7**). All municipal garages and lots, with the exception of one, remain in operation. That parking lot that no longer exists is now the site of the Federal Court House. The primary change is that the Miami Parking Authority no longer offers a street parking decal.

Monthly parking rates in Miami have increased by between approximately 20 and 100 percent. Rates still vary by distance from the core of the Downtown with the most expensive parking closest to the center and lowest rates on the periphery.

TABLE 2.7: COMPARISON OF PARKING IN MIAMI - 2004 TO 2014

Name	Location	Monthly Rate 2004	Monthly Rate 2014
Municipal Garage #1	40 NW 3rd St. (NW 1st Ave. and N. Miami Ave.)	$87.86	$ 99.00
Municipal Garage #2	90 SW 1st St. (at SW 1st Ave.)	$117.58	$ 140.00
Municipal Garage #3	190 NE 3rd St. (at NE 2nd Ave.)	$93.29	$ 135.00
Municipal Garage #4	100 SE 2nd St. (Nations Bank Tower)	$121.41	$ 155.00
Street Decal #(807)	Miami Arena, NW 2nd Ave. and 8th St.	$31.95	
Street Decal #(820)	Southside Elementary SW 1st Ave. (10th St. and 12th St.)	$26.63	
Street Decal #(821)	Entertainment District NW 11th St. (Miami Ct and NE 1st Ave.)	$31.95	
Lot #19	Biscayne Blvd. at NE 4th St.-5th St.	$75.00	$ 65.00
Lot #33	Under I-95, SW 1st St. (2nd Ave. and 1st Ct.)	$57.51	$ 90.00
Lot #41	Gesu Church 130 NE 2nd St.	$57.51	
Lot #10	NW 4th St.-5th St., 1st Ave. and Miami Ave.	$44.73	
Lot #11	NW 1st St.-2nd St. (NW 3rd Ave.) under I-95	$38.34	$ 65.00
Lot #12	NW 2nd St.-3rd St. (NW 3rd Ave.) under I-95	$38.34	$ 65.00
Lot #13	NW 3rd St.-4th St. (NW 3rd Ave.) under I-95	$38.34	$ 65.00
Lot #14	Under I-95 between Flagler St. and SW 1st St.	$42.17	$ 65.00
Lot #15	Under I-95 between Flagler St. and SW 2nd Ave. and W. side of 2nd and 1st St.	$42.17	$ 65.00
Lot #34,36,38	Under Metrorail Guideway between SW 2nd Ave. and 3rd St.	$57.51	$ 90.00
Lot #49-51	NE 12th St. between NE 1st Ave. and 2nd Ave.	$19.17	$ 40.00
Lot #55	Under I-95 between NE 2nd Ave. and railroad	$19.17	$ 40.00

Note: Price for Lot #41 not published. Lot #10 was eliminated with the construction of the Federal Court House. Street decals are no longer offered by the Miami Parking Authority.


BEACH WARNING FLAGS
Water Closed to Public
High Hazard
Medium Hazard
Low Hazard
Dangerous Marine Life
RIP CURRENTS
5 ST
MIAMI BEACH

3.0 DESCRIPTION OF THE 2004 LOCALLY PREFERRED ALTERNATIVE

Based on the goals and objectives supporting the Purpose and Need and the Draft Environmental Impact Statement (DEIS) analysis from 2003, the MPO Board adopted the Locally Preferred Alternative (LPA), an LRT/modern streetcar system on September 25, 2003. The cities of Miami and Miami Beach endorsed this decision. In 2004, the adopted LPA was refined in a report called the *Phase 2 Locally Preferred Alternative*. An extensive public involvement process was conducted. Following the completion of this report, a Preliminary Engineering/Final Environmental Impact Statement (PE/FEIS) application was prepared and submitted to the Federal Transit Administration (FTA) along with the necessary supporting documentation. The PE/FEIS phase of project development was never started since consensus could not be achieved.

3.1 2004 Locally Preferred Alternative

This section provides a summary of the Locally Preferred Alternative (LPA) refined in the *2004 Bay Link Study*: a description of the approved alignment, station locations, maintenance facility sites and transit technologies considered. The 2004 Refined LPA, shown in **Figure 3.1**, was laid out to serve the City of Miami, the City of Miami Beach and destinations along the MacArthur Causeway with three interconnected transit lines: the LRT/modern streetcar line with two loops in downtown Miami; the (Intercity) Causeway Connector, a one-way loop serving destinations along the MacArthur Causeway and in Miami Beach; and the Beach Circulator, a one-way loop line in Miami Beach.

FIGURE 3.1: 2004 REFINED LPA

The LRT/modern streetcar line was proposed as a single-track, double loop providing a regional connection to the Causeway Connector and MDT buses. The Causeway Connector line was proposed as a single-track counterclockwise loop providing a regional connection to Miami, the Beach Circulator and MDT buses. The Beach Circulator was proposed as a large single-track clockwise loop in Miami Beach with convenient transfers to the Causeway Connector line or MDT bus routes serving the Beach.

The following is a description of the systems, their alignments, and their interconnections. (See **Figure 3.2**). The line comes into the City of Miami crosses Biscayne Bay on structure on the south side of the MacArthur Causeway and rises to an aerial side platform station at Watson Island. The station is located on the south side of the causeway with access to venues on the north side, such as Jungle Island, by a pedestrian bridge. The first station on the mainland is located at Museum Park/Performing Arts Center adjacent to and north of the existing Bicentennial Park Metromover Station. A pedestrian bridge or specially designed walkway will provide access to the Performing Arts Center on the north side of I-395.

FIGURE 3.2: DOWNTOWN MIAMI SEGMENT OF THE LPA

At NE 9th Street, the service splits with half the trains turning west (counterclockwise) on NE 9th Street and half continuing south (clockwise) along Biscayne Boulevard/ US 1. Counterclockwise loop service continues curbside along NE 9th Street to Miami Avenue with a station at Park West located just east of NE 2nd Avenue. The alignment turns south and remains curbside on Miami Avenue to NE 3rd Street with stations just south of NE 8th Street and NE 5th Street. At NE 3rd Street, the alignment turns west where a station is located prior to turning south on NW 1st Avenue. On NW 1st Avenue, the alignment transfers to the west side curb lane and continues south to SW 1st Street. A station at Government Center provides a convenient transfer point to the Metrorail, Metromover and bus transfer facility. The alignment turns east on SW/ SE 1st Street to the south curbside traffic lane continuing to Biscayne Boulevard.

Stations are located to the west of Miami Avenue and SE 3rd Avenue. At Biscayne Boulevard, the alignment turns north and transitions to the east curbside travel lane with stations at Bayfront Park, Bayside and the American Airlines Arena. At the American Airlines Arena, or just to the south along the FEC Railroad right-of-way, special provisions provide for the storage of additional trains to handle special events and facilitate schedule markup/ recovery. An optional station is located just south of NE 11th Street for analysis during PE/FEIS. The counterclockwise loop terminates at Biscayne Boulevard and NE 9th Street.

The clockwise loop on Biscayne Boulevard transitions at NE 9th Street from the median alignment to continue southbound in the median travel lane to NE 1st Street. Split inside curb stations serve the American Airlines Arena and Bayside. At NE 1st Street, the track turns west into the south side curb lane and continues to NW 1st Avenue with stations serving Bayfront Park (at NE 3rd Avenue), at NE 1st Avenue and serving Government Center (at NW 1st Avenue). The alignment continues curbside north on NW 1st Avenue to NW/NE 3rd Street where it turns east into an exclusive right-of-way running on the south curb (3rd Street is currently one-way westbound). A split curbside station is located on NW 3rd Street opposite the counterclockwise loop station. At NE 1st Avenue, the alignment turns north to the east curb line and continues on to NE 9th Street with side platform stations at NE 5th Street and NE 8th Street. At NE 9th Street, the alignment heads east and merges back with the northbound track on the east side of Biscayne Boulevard. The Park West Station is located opposite the counterclockwise loop station on NE 9th Street.

The Miami Streetcar is also depicted in **Figure 3.2**. The 2004 LPA assumed the Miami Streetcar project would be constructed and therefore coordinated the LPA alignment with the Miami Streetcar system. The Miami Streetcar was designed to serve as the City's transit circulator made up of an east-west loop along NE 20th Street and NE 17th Street, and a north-south alignment utilizing primarily NE 2nd Avenue. The Miami Streetcar project did not move forward due to a lack of funding and other local project priorities. The City of Miami is still interested in pursuing this project in the future and would closely coordinate with the Beach Corridor Transit Connection project as it moves forward.

(See **Figure 3.3**). The Causeway Connector segment of the alignment proceeds east from Watson Island on the south side of the MacArthur Causeway on special structure on exclusive trackway to an aerial center platform station on Terminal Island. The Terminal Island Station provides a convenient transfer point for the Terminal Island Ferry passengers and employees who work on the island. The alignment continues east to Miami Beach crossing to the south side of the bridge over Biscayne Bay.

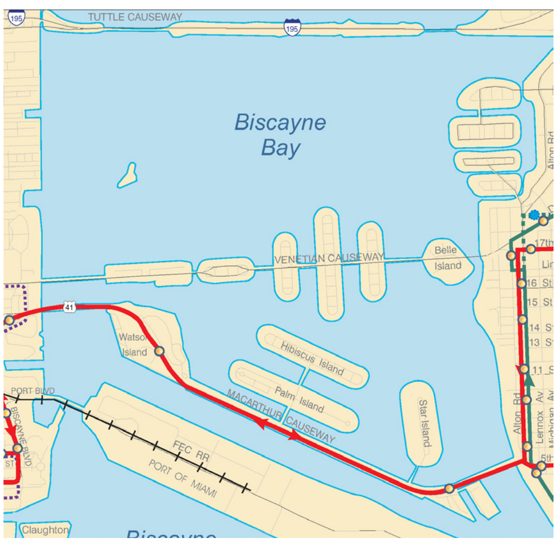


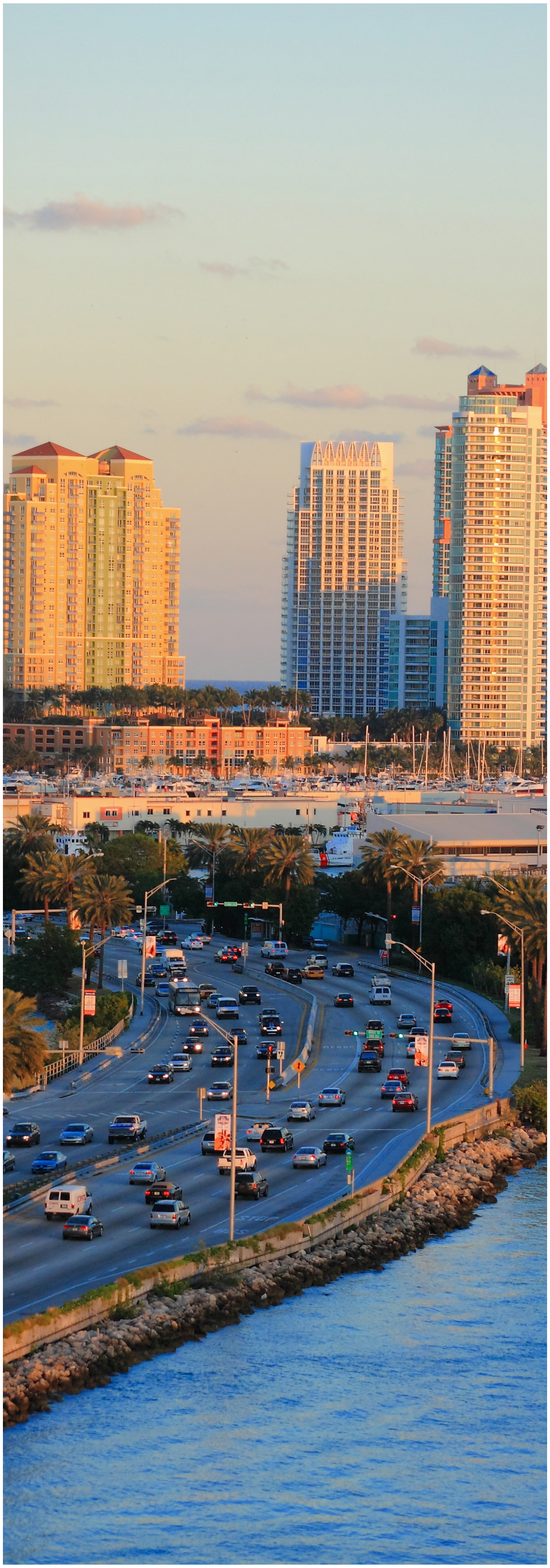
FIGURE 3.3: CAUSEWAY CONNECTOR SEGMENT OF THE LPA

The Causeway Connector departs the exclusive right-of-way at the traffic signal at Alton Road and 5th Street and crosses the Beach Circulator track to the first station on Miami Beach, a curbside station just east of Alton Road as shown by the red line in **Figure 3.4**. This station provides the first opportunity to transfer between the Causeway and Circulator lines from a Circulator station just south of 5th Street on Alton Road. The alignment continues east along the curbside lane and at Jefferson Street transitions to the median travel lane on a special phase of the traffic signal to a median side platform station just west of Euclid Avenue. The alignment proceeds east, crossing the Beach Circulator track as it turns north onto Washington Avenue where it runs north in the median travel lane to 17th Street.

This section of the connector alignment includes center platform stations in the median of Washington Avenue, which are shared with and provide convenient cross platform transfers to the Beach Circulator at 7th Street, 10th Street, 14th Street and Lincoln Road. Just north of Lincoln Road, a bus transfer facility located on the west side of Washington Avenue provides for a convenient transfer to Bay Link, Electrowave bus service and MDT bus routes. (The Beach Corridor transit system replaces a number of MDT bus routes in Miami Beach.)

FIGURE 3.4: MIAMI BEACH SEGMENT OF THE LPA

At 17th Street, the alignment turns west and runs in the median travel lane to Alton Road. Center platform stations are located in the median at Drexel Avenue, Meridian Avenue and Alton Road. A double-track spur north from 17th Street along Convention Center Drive to a station at the Convention Center is included for special events. The spur includes a siding providing the capacity to store additional transit cars for special events at the Convention Center and also to provide for make-up train service/ schedule adherence. The spur extends through to Dade Boulevard to provide additional operational flexibility.



At Alton Road, the alignment turns south transitioning to the median traffic lane on a special phase of the traffic signal and continues south crossing the Beach Circulator tracks at Lincoln Road. There are center platform stations in the median at 16th Street, Espanola Way, 12th Street and 9th Street providing convenient transfer to the Beach Circulator system. At 8th Street, the Causeway Connector line uses a special phase of the traffic signal to transition from the median to the curbside travel lane and continue south to a split curbside platform station just north of 6th Street. The alignment crosses 5th Street on a special traffic signal phase and re-enters the exclusive right-of-way onto westbound MacArthur Causeway to complete the Miami Beach loop.

The clockwise Beach Circulator provides a continuous loop to access many primary destinations in Miami Beach as shown by the green line in **Figure 3.3**. Starting at the station on Alton Road just south of 5th Street, which is a major transfer point between the Causeway Connector and Circulator systems, the alignment crosses 5th Street and proceeds north on Alton Road along the curbside travel lane to a station just south of 6th Street. The alignment continues north on Alton Road to 8th Street where it transitions to the median traffic lane on a special phase of the traffic signal and proceeds north to Lincoln Road with stations at 9th Street, 12th Street, Espanola Way and 16th Street. These stations would be shared with, and offer convenient transfer points to, the Causeway Connector.

At Lincoln Road, the Beach Circulator alignment turns west, crossing the Causeway Connector track, into the Lincoln Road median travel lane and then turns north onto West Avenue. On West Avenue, the alignment runs north in the curbside lane to a station just south of 17th Street. The alignment proceeds across a new auto/transit bridge to Dade Boulevard and turns to follow Dade Boulevard to the northeast in the median travel lane to 22nd Street. Three median stations along Dade Boulevard are located at Michigan Avenue, Meridian Avenue and Washington Avenue.

At 22nd Street, the Beach Circulator alignment turns southeast onto a new transit bridge over the Dade Canal and continues on 22nd Street to Collins Avenue. A station is located just to the northwest of Collins Avenue. The alignment turns south on Collins Avenue, transitions to the west curb lane and continues south to 17th Street. A curbside station is located just north of 18th Street. At 17th Street the alignment turns to the west and proceeds to Washington Avenue. The Circulator turns south on Washington Avenue crossing the Causeway Connector track and transitions to the median south bound travel lane. Center platform median stations at Lincoln Road, 14th Street, 10th Street and 7th Street are shared with the Causeway Connector line.

The Beach Circulator continues south in the median lane to South Pointe Drive crossing the Causeway Connector at 5th Street. A station is located at 3rd Street on Washington Avenue. The alignment turns west on South Pointe Drive and then north onto Alton Road. The alignment continues north on Alton Road to a median station at 2nd Street. At 2nd Street, using a special traffic signal phase, the alignment transitions to the curbside traffic lane and completes the loop at the 5th Street Station just south of Alton Road.

3.2 2004 LPA Stations

Station Area Planning

The refinement of the LPA in 2004 started with a "Form and Fit" meeting with the City of Miami Planning and Public Works departments and a similar meeting with the City of Miami Beach. The purpose of the meetings was to reach agreement on the starting point for the LPA refinement and to agree on the process to involve the public in its refinement.

The geographic area covered by the Bay Link alignment was divided into eight station area groups and two station area planning meetings were scheduled for each of the station area groups. The first set of meetings presented the location of the stations. A second set of meetings reviewed the responses to the citizen's request, asked for comments on canopy design concepts and sought general agreement on station locations and configurations. More than 200 attendees participated in these four meetings. The stations and station area groups are displayed in **Figure 3.5**.

Notes:
1) An Additional Alignment spur and station are provided at the Convention Center for large special events.
2) Of the 42 total stations, 26 are located in the City of Miami Beach and 16 are located in the City of Miami.
3) Nineteen Circulator stations are located in Miami Beach with 9 Stations being shared with the Causeway Connector line.
4) Eight stations are shared with the Miami Streetcar project in the City of Miami.

FIGURE 3.5: STATION PLANNING GROUPS AND STATIONS IN 2004 REFINED LPA

3.3 Transit Vehicle Modal Technology

Several transit technologies were considered in the 2004 Miami -Miami Beach Transportation Corridor Study (*Bay Link Study*) based on recommendations from the study team and from the public. All of the technology options were analyzed through a two-tier screening process. Ferry service, extension of the Metrorail and Metromover systems, monorail and the suspended cable car options were discarded as a result of the Tier 1 screening process. LRT/modern streetcar and bus rapid transit (BRT) advanced through the Tier 2 process. The results of the screening process were documented in the Technology Assessment Report and are shown in **Table 3.1**.

3.4 Streetcar Maintenance Yard and Shop

Two potential maintenance yard and shop facility locations were identified during the 2003 DEIS process and a third site was identified in the Phase 2 LPA Refinements. The yard and shop options are shown in **Figure 3.5**.

TABLE 3.1: TIER 1 TECHNOLOGY EVALUATION SUMMARY IN 2004 STUDY

	BRT	LRT	AGT	RRT	Ferry	Cable Car	Monorail
Operational Flexibility	●	⭘	◐	⭘	◉	◉	◉
Future Expansion	●	⭘	◉	◐	◉	○	◉
Capital Cost	●	⭘	◐	◐	⭘	U	◐
O&M Cost	⭘	⭘	◐	●	◐	U	◐
Distribution	●	●	◉	◉	◉	◉	◉
ROW	●	⭘	◐	◐	◐	◐	◐
Fixed Investment	◐	●	●	●	◐	◐	●
Image	◉	●	◐	◐	⭘	◐	⭘
Environmental	◐	●	●	●	◐	◐	●
Urban Integration	◐	●	◐	◐	●	⭘	◐
Proprietary Technology	●	●	◐	●	●	○	◐
Capacity	⭘	●	●	●	◐	⭘	◐
Fire Life Safety	●	●	●	●	◐	○	◐

Best ● ⭘ ◐ ◉ ○ Worst | U-Unknown

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We'll take you there!
14

4.0 REFINEMENT OF 2004 LOCALLY PREFERRED ALTERNATIVE (LPA)

The refinements to the 2004 LPA performed as part of this study were broken down into three broad geographic areas in order to simplify the alternative development and evaluation process. These areas included: (1) the area of downtown Miami, (2) the MacArthur Causeway, and (3) the South Beach area of Miami Beach. The primary objectives of the 2004 LPA refinement process were to:

- Update the alignments based on current known conditions.
- Make the alignments operationally more efficient and cost effective.
- Incorporate the preferences and recommendations of the project's Technical Steering Committee (TSC) and Policy Executive Committee (PEC).

In addition, the PEC embraced a key recommendation: any alignment considered would have to operate on exclusive right-of-way (ROW) or exclusive travel lanes, except at street crossings. This recommendation was based on the fact that without exclusive ROW, transit would not operate any faster or more reliably than it does today in mixed traffic. The impacts on traffic operations have not been analyzed and will be addressed during the next phase of the study.

4.1 Alignment Options in Downtown Miami

Based on an analysis of the 2004 LPA alignment, a wide range of downtown Miami area alignment alternatives were developed and evaluated in a two-step process to determine an initial set and final alternatives.

4.1.1 Initial Set of Alignment Alternatives

The initial set of alignment alternatives was grouped into four categories based on their alignment configuration. These included Single Line (Direct Connection) options, One-Way (Operational) Loop options, Two Independent Lines options, and Split Two-Way (Circulation) Loop options.

4.1.1.1 Single Line (Direct Connection) Options

The Single Line (Direct Connection) options consisted of LRT/modern streetcar track alignments that would utilize a single street (either Flagler Street or NE 2nd Street) in the southern portion of downtown Miami to connect Biscayne Boulevard with the Government Center. All Single Line (Direct Connection) options would utilize Biscayne Boulevard as the preferred north-south roadway alignment, similar to the 2004 LPA. The two Single Line (Direct Connection) options included were:

- Flagler Street as a two-way LRT/modern streetcar transit mall. This would entail converting Flagler Street from a two-lane two-way mixed-traffic street into a two-way transit only street/mall.
- NE 2nd Street as a two-way LRT/modern streetcar transit mall. This would entail converting NE 2nd Street from a three lane one-way eastbound mixed-traffic street into a two-way transit only street/mall.

These two options are illustrated in **Figure 4.1**.

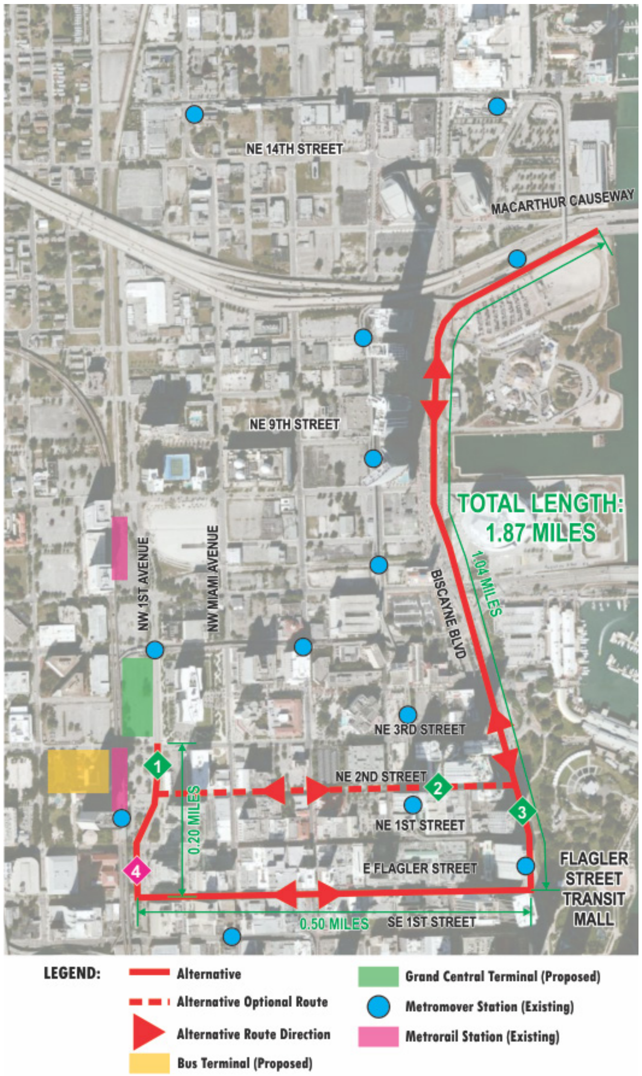


FIGURE 4.1: SINGLE LINE (DIRECT CONNECTION) OPTIONS DOWNTOWN MIAMI

4.1.1.2 One-Way (Operational) Loop Options

The One-Way (Operational) Loop options consisted of LRT/modern streetcar track alignments that would utilize east-west one-way street couplets in the southern portion of downtown Miami to connect Biscayne Boulevard with the Government Center in downtown Miami. All One-Way (Operational) Loop options would utilize Biscayne Boulevard as the preferred north-south roadway alignment, similar to the 2004 LPA. The Technical Steering Committee suggested looking at a 5th and 6th Street loop. This loop was not advanced for a number of reasons: it does not directly serve the historic downtown area; it does not have a stop at Government Center, a major employment and transit hub downtown Miami; it serves fewer employment and tourist attractions located along Biscayne Boulevard; 6th Street is a highly used as an alternate thoroughfare into PortMiami; and while this alternative directly serves the proposed Miami World Center, all of the preferred loop options serve it equally well. During these discussions the option of serving PortMiami was raised and it was determined that a future extension off of Biscayne Boulevard could serve the Port with all of the options.

The three One-Way (Operational) Loop options considered were:

- SE 1st and NE 1st Streets each being a one-way street with a single directional LRT/modern streetcar lane. This would entail converting one lane on each one-way street for transit use only with NE 1st Street operating westbound and SE 1st Street operating eastbound, in parallel with current traffic flow conditions.

- NE 1st and NE 2nd Streets each being a one-way street with a single directional LRT/modern streetcar lane. This would entail converting one lane on each one-way street for transit use only with NE 1st Street operating westbound and NE 2nd Street operating eastbound, in parallel with current traffic flow conditions.
- NE 2nd and NE 3rd Streets each being a one-way street with a single directional LRT/modern streetcar lane. This would entail converting one lane on each one-way street for transit use only with NE 2nd Street operating eastbound and NE 3rd Street operating westbound, in parallel with current traffic flow conditions.

These three options are illustrated in **Figure 4.2**.

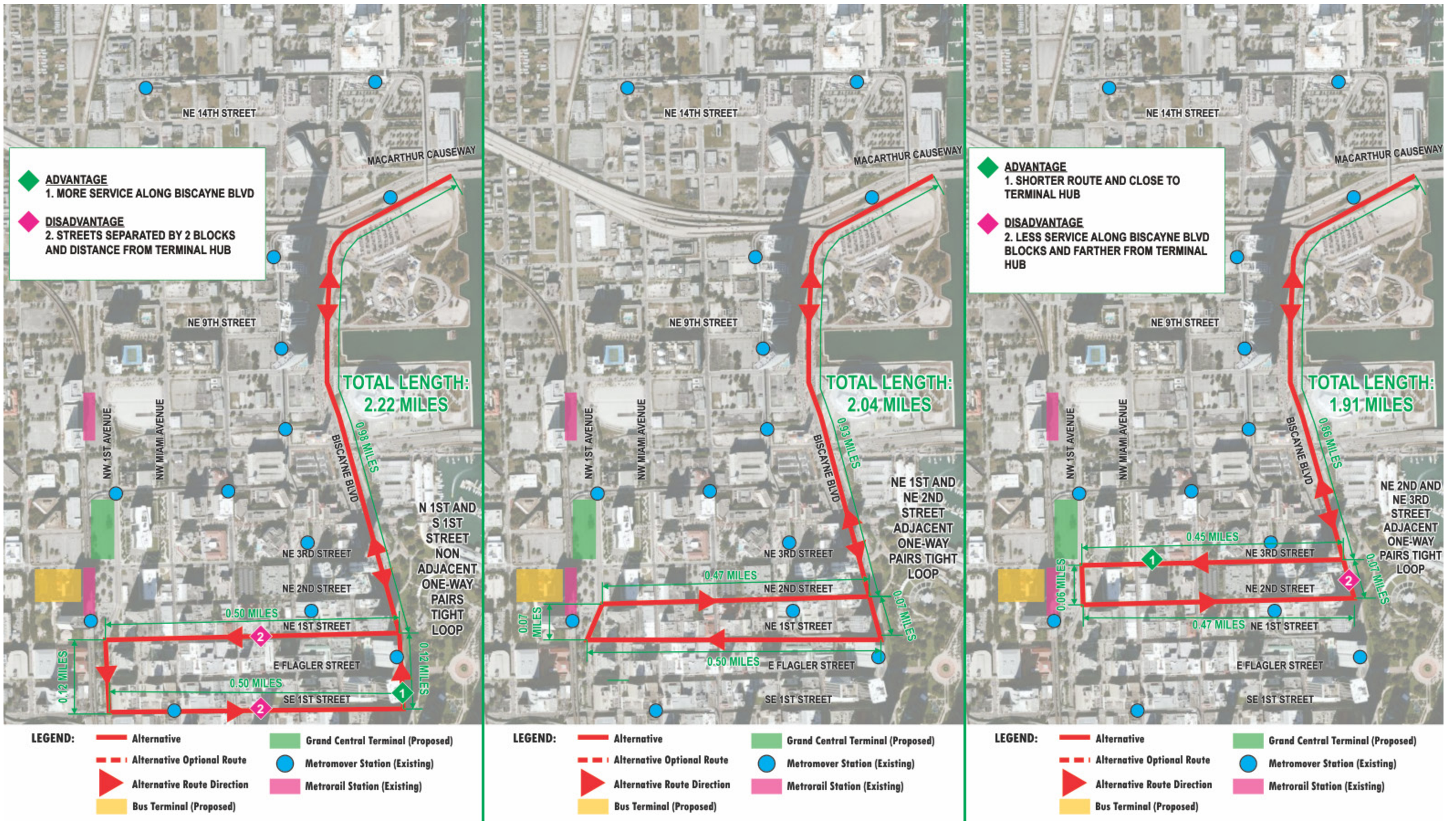
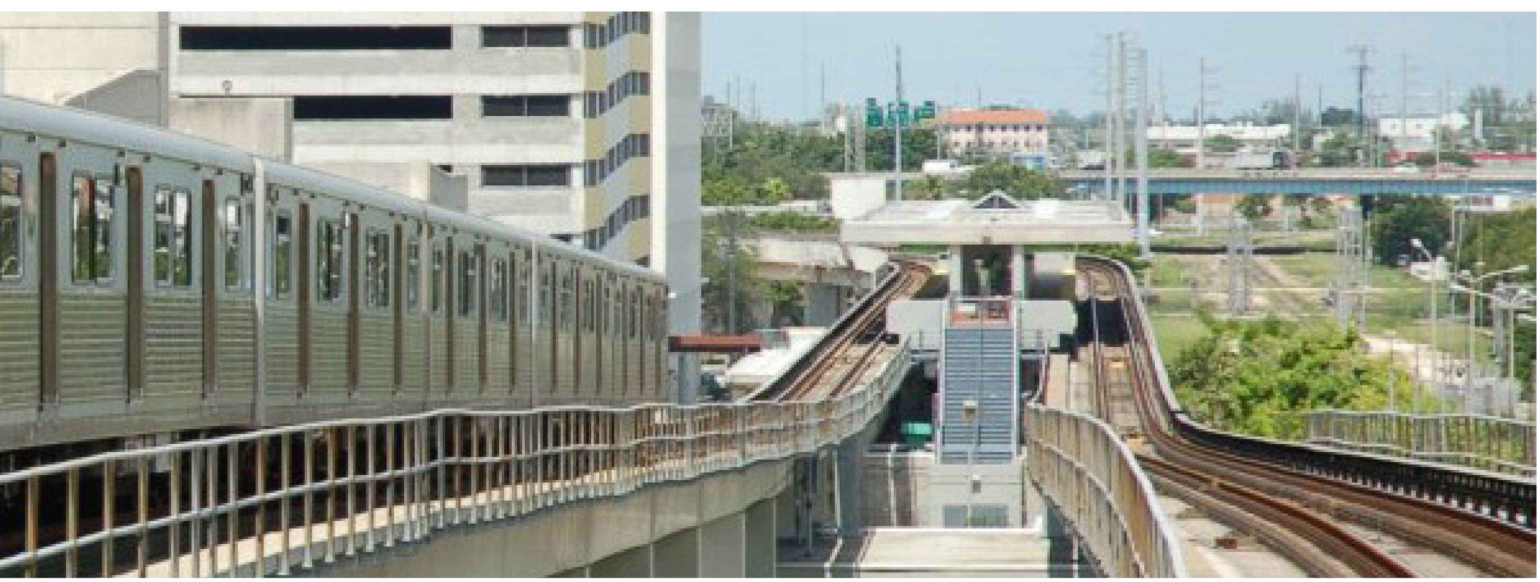


FIGURE 4.2: ONE-WAY (OPERATIONAL) LOOP OPTIONS DOWNTOWN MIAMI



4.1.1.3 Two Independent Lines Options

The Two Independent Lines options consisted of LRT/modern streetcar track alignments that would utilize two north-south streets (Biscayne Boulevard to the east and NW 2nd Avenue to the west) and either a single east-west street or a pair of east-west streets. These options are essentially a combination of the Single Line (Direct Connection) options and the One-Way (Operational) Loop options. In the southern portion of downtown Miami, an alignment would utilize either SE 1st Street, NE 1st Street, NE 2nd Street, NE 3rd Street, and/or Flagler Street as the east-west street(s) to connect Biscayne Boulevard with the Government Center in downtown Miami. An additional line would utilize either NW/NE 9th Street, NW/NE 6th Street, or NE 14th Street as the east-west streets to connect Biscayne Boulevard with NW 2nd Avenue and a portion of NE 3rd Street to connect NW 2nd Avenue with the Government Center. Another additional line extending north from the MacArthur Causeway to Midtown and the Design District area was proposed. These combinations created a large number of Two Independent Lines permutations. The Two Independent Lines options could be developed as either a single initial LRT/modern streetcar construction phase (one double-track line only) or as an initial LRT/modern streetcar phase (first double-track line) followed by a future LRT/modern streetcar expansion phase (second double-track line). Some of these alignment options are illustrated in **Figure 4.3** in order to convey the concept.

None of the Two Independent Lines options were selected for further consideration in downtown Miami because they do not penetrate the core of the downtown. The northern (blue) route options necessitate crossing the Florida East Coast (FEC) Railway a second time, (with the first crossing along Biscayne Boulevard across the PortMiami access track) resulting in an increase for potential conflicts with freight traffic and the future All Aboard Florida and Tri-Rail Coastal Link trains.

4.1.1.4 Split Two-Way (Circulation) Loop Options

The Split Two-Way (Circulation) Loop options consisted of LRT/modern streetcar track alignments that would utilize two major north-south streets (Biscayne Boulevard to the east and NW 1st Avenue to the west), one east-west street (SE 1st Street, Flagler Street, or NE 2nd Street) in the southern portion of downtown Miami, and an east-west street (either NE/NW 9th Street or NE/NW 6th Street) north of downtown. The Split Two-Way (Circulation) Loop options would utilize two-way streets with a single LRT/modern streetcar lane in each direction. The service

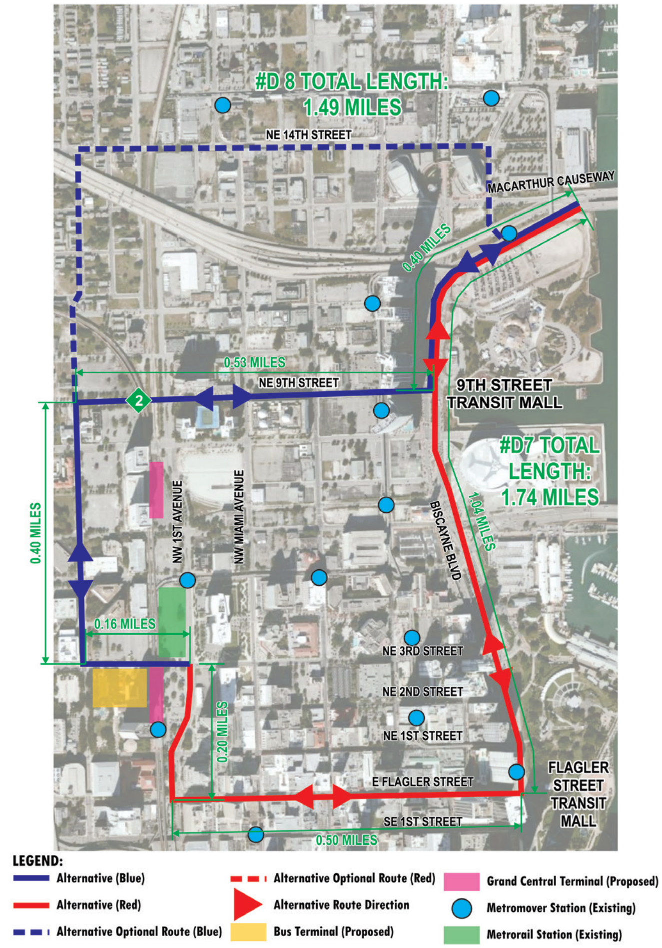


FIGURE 4.3: TWO INDEPENDENT LINES OPTIONS DOWNTOWN MIAMI

line coming from the MacArthur Causeway would have to split as it reaches the two-way loop in order to maintain the two-way LRT/modern streetcar service. These options are illustrated in **Figure 4.4**.

The idea of two lines in downtown Miami generated no support from project committee members and it was ultimately assumed that the Miami Streetcar would complement this service obviating the need for split circulation. Therefore, none of the split Two-Way (Circulation) Loop options were selected for further consideration in downtown Miami.

4.2 Alignment Options across the MacArthur Causeway

The alignment options for the MacArthur Causeway were developed and evaluated in a single-step process to determine the initial and final alternative. Based on an analysis of the 2004 LPA alignment, only a single alignment option was considered viable for the MacArthur Causeway.

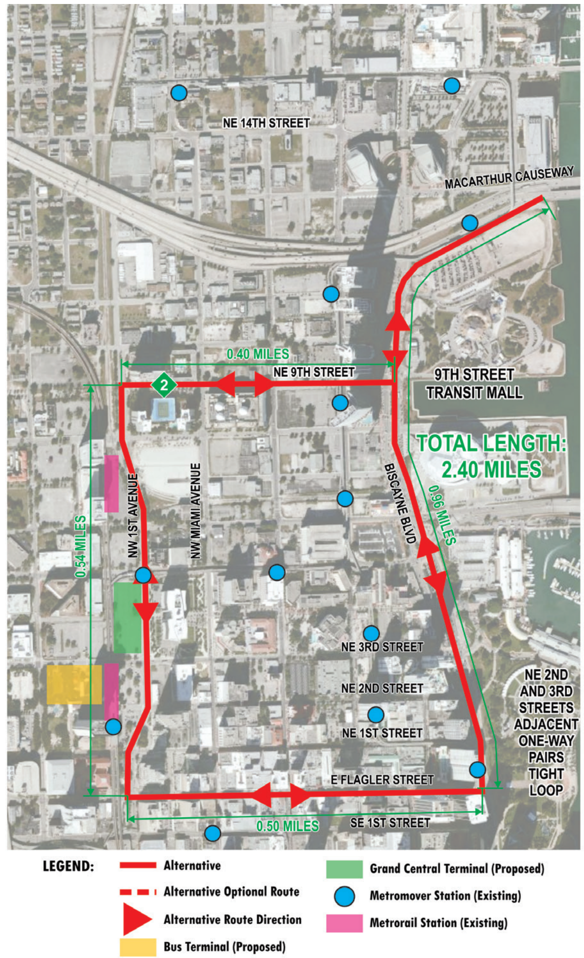


FIGURE 4.4: SPLIT TWO-WAY (CIRCULATION) LOOP OPTIONS DOWNTOWN MIAMI

- Single Line (Direct Connection) - The alignment across the MacArthur Causeway parallels the south side of the MacArthur Causeway as an independent and exclusive LRT/modern streetcar guideway. This alignment can be combined with any of the alignment options for downtown Miami or Miami Beach.

4.3 Alignment Options in Miami Beach

The alignment options for the Miami Beach area were developed and evaluated in a two-step process including an initial and final phase.

4.3.1 Initial Set of Miami Beach Alternatives

Based on an analysis of the 2004 LPA alignment, a wide range of Miami Beach alignment alternatives were developed and evaluated. The initial set of alternatives was grouped into four categories based on their alignment configuration.

FINAL SET OF DOWNTOWN MIAMI ALTERNATIVES

Based on an analysis of the initial set of alignment alternatives in this study, the following were selected as the most viable downtown Miami alignment options to advance to the next phase of study:

- Single Line (Direct Connection) – The single line direct connection option would utilize Biscayne Boulevard and NE/NW 2nd Street, include a Transit Mall on NE/NW 2nd Street, and locate the western terminus at Government Center with an extension north along NW 1st Avenue to NW 6th Street (Miami Conference Center connection to be proposed). This option is the most direct, with two-way transit service on each street.
- One-Way Operational Loop - The one-way operational loop option would utilize NE/NW 2nd Street and NE/NW 3rd Street, also reaching as far west as Government Center with an extension north along NW 1st Avenue to NW 6th Street (Miami Conference Center connection to be proposed). This option is very direct utilizing a pair of east-west one-way streets.

This included Single Line (Direct Connection) Options, One-Way (Operational) Loop Options, Two Independent Lines Options, and Two-Way (Circulation) Loop Options.

4.3.1.1 Single Line (Direct Connection) Options

The Single Line (Direct Connection) options consisted of LRT/modern streetcar track alignments that would utilize a single north-south street and a single east-west street to connect the MacArthur Causeway at 5th Street with the Miami Beach Convention Center. Two north-south street alignments were considered; one using Alton Road to the west and one using Washington Avenue to the east. The Single Line (Direct Connection) options that would utilize a very short portion of 5th Street and Alton Road included:

- 17th Street to Collins Avenue as a two-way street with a single LRT/modern streetcar lane in either direction.
- 16th Street to Collins Avenue as a two-way street with a single LRT/modern streetcar lane in either direction.
- 17th Street to Washington Avenue and Dade Boulevard as a two-way street with a single LRT/ modern streetcar lane in either direction.
- 16th Street to Washington Avenue and Dade Boulevard as a two-way street with a single LRT/ modern streetcar lane in either direction.

These four options are illustrated in **Figure 4.5** (with extension to Dade Boulevard).

The Single Line (Direct Connection) options that would utilize a portion of 5th Street (or South Pointe Drive to the south) and Washington Avenue included:

- Dade Boulevard as a two-way street with a single LRT/modern streetcar lane in either direction.
- 17th Street to Alton Road (or West Avenue) as a two-way street with a single LRT/modern streetcar lane in either direction.
- 16th Street to Alton Road (or West Avenue) as a two-way street with a single LRT/modern streetcar lane in either direction.
- 17th Street to West Avenue to Sunset Harbor as a two-way street with a single LRT/modern streetcar lane in either direction.
- 16th Street to West Avenue and Sunset Harbor as a two-way street with a single LRT/modern streetcar lane in either direction.

These five options and their variations are illustrated in **Figure 4.6**.

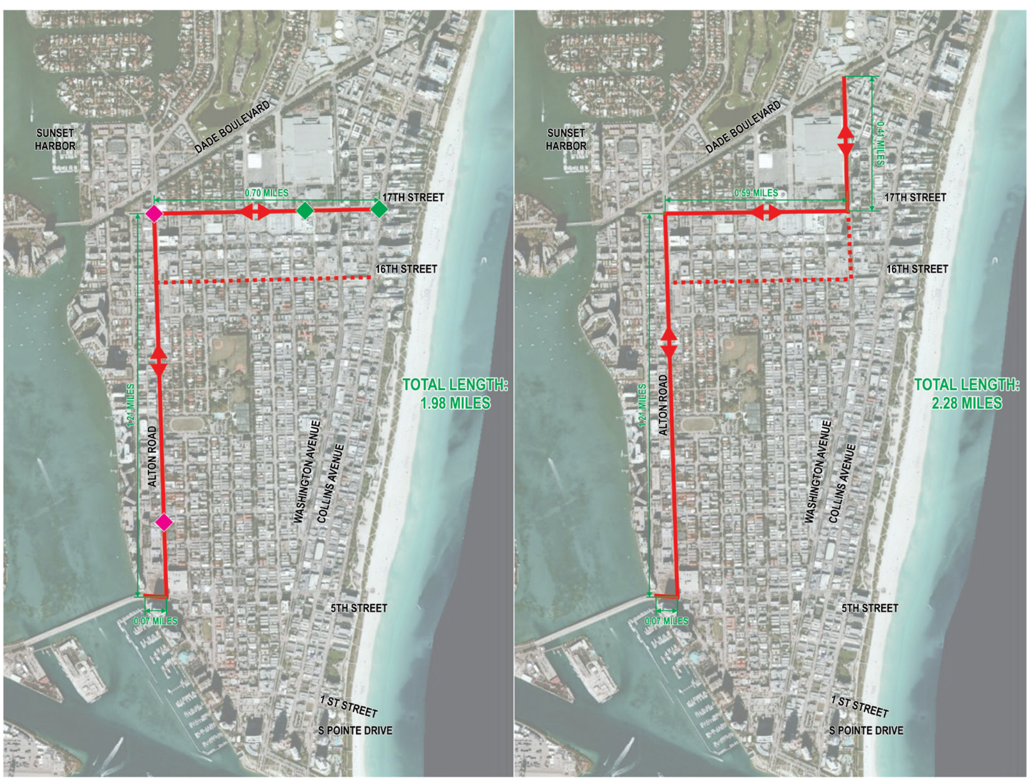


FIGURE 4.5: SINGLE LINE (DIRECT CONNECTION) OPTIONS MIAMI BEACH – ALTON ROAD

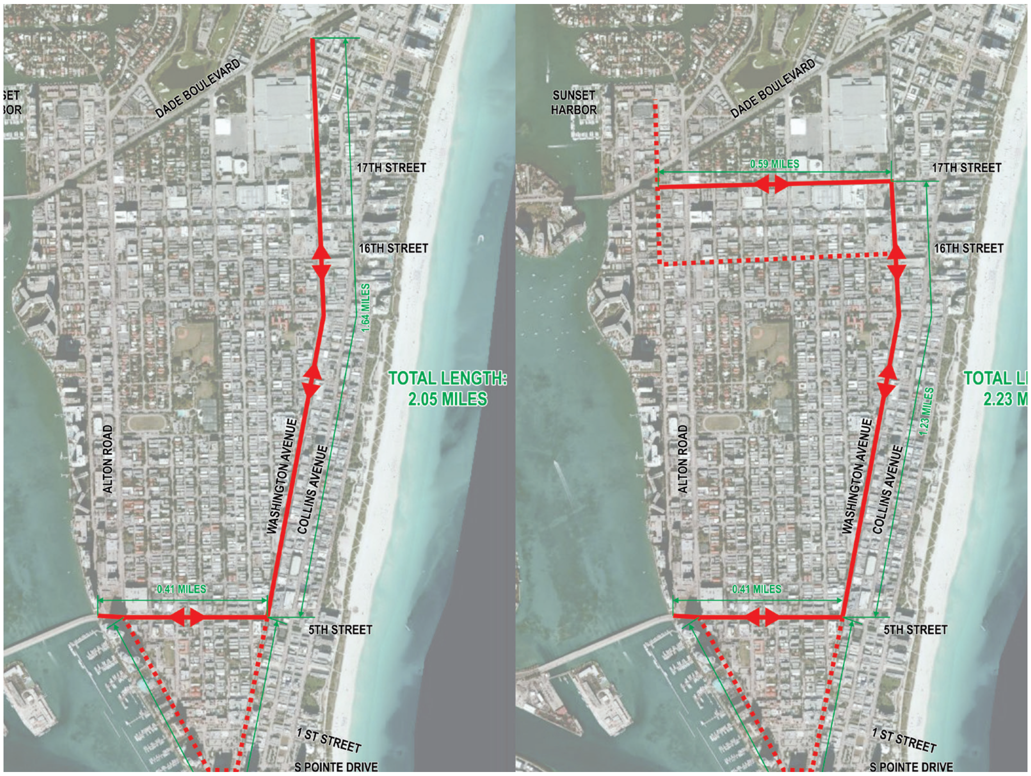


FIGURE 4.6: SINGLE LINE (DIRECT CONNECTION) OPTIONS MIAMI BEACH – WASHINGTON AVENUE

4.3.1.2 One-Way (Operational) Loop Options

The One-Way (Operational) Loop options consisted of LRT/modern streetcar track alignments that would utilize a pair of two-way east-west streets in the northern portion of South Beach. The One-Way (Operational) Loop options that would utilize a very short portion of 5th Street, Alton Road, and a short portion of Washington Avenue (or a short portion of Meridian Avenue) included:

- 16th Street and 17th Street, each as a two-way street with a single directional LRT/modern streetcar lane. 16th Street would serve the eastbound direction and 17th Street would serve the westbound direction.
- 17th Street and Dade Boulevard, each a two-way street with a single directional LRT/modern streetcar lane. Dade Boulevard would serve the eastbound direction and 17th Street would serve the westbound direction.

These two options and the variations are illustrated in **Figure 4.7**.

The One-Way (Operational) Loop options that would utilize a portion of 5th Street (or South Pointe Drive to the south), Washington Avenue, and a short portion of Alton Road included were:

- 16th Street and 17th Street, each as a two-way street with a single directional LRT/modern streetcar lane. 16th Street would serve the eastbound direction and 17th Street would serve the westbound direction.
- 17th Street and Dade Boulevard, each a two-way street with a single directional LRT/modern streetcar lane. 17th Street would serve the eastbound direction and Dade Boulevard would serve the westbound direction.

These two options are illustrated in **Figure 4.8**.

None of the One-Way (Operational) Loop options was selected for further consideration in Miami Beach primarily due to an expressed preference to provide two-way transit service along each street.

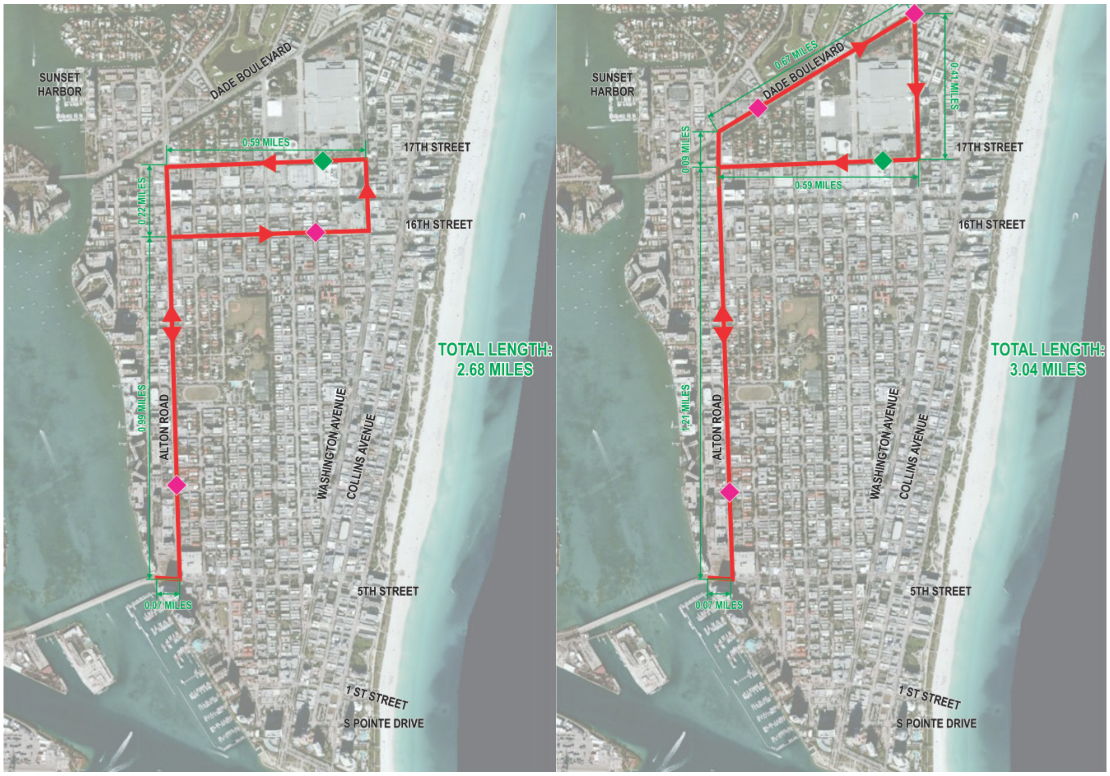


FIGURE 4.7: ONE-WAY (OPERATIONAL) LOOP OPTIONS MIAMI BEACH – ALTON ROAD

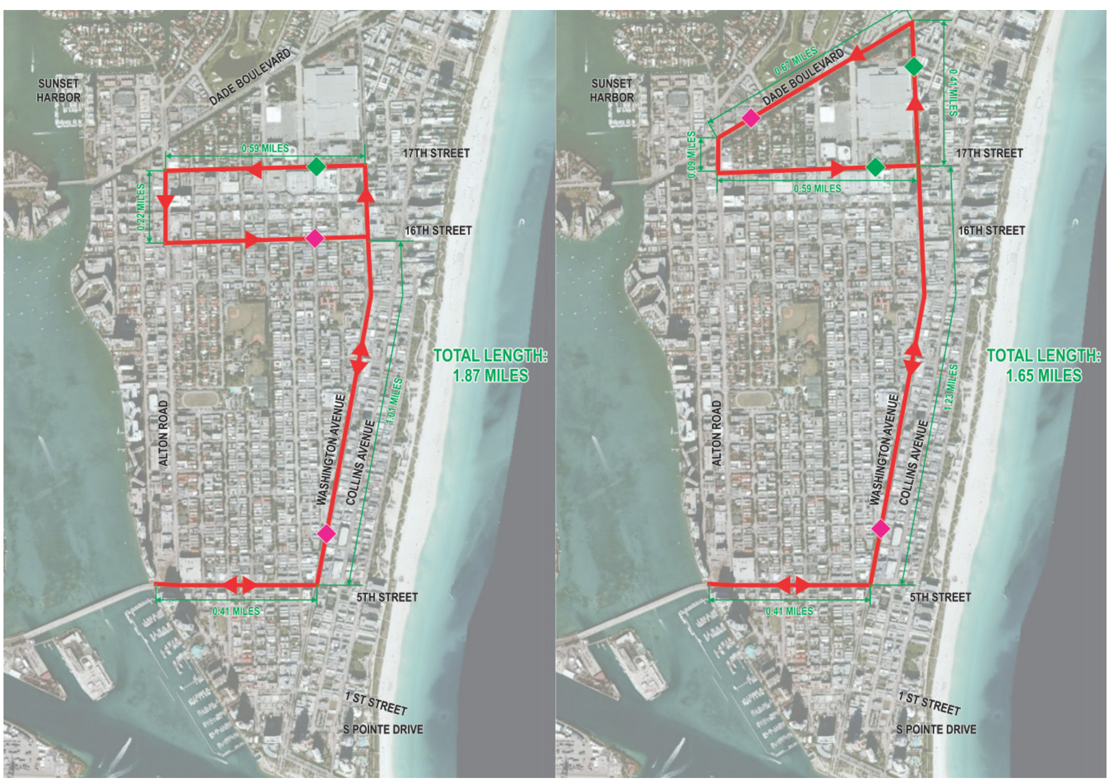


FIGURE 4.8: ONE-WAY (OPERATIONAL) LOOP OPTIONS MIAMI BEACH – WASHINGTON AVENUE

4.3.1.3 Two Independent Lines Options

The Two Independent Lines options consisted of LRT/modern streetcar track alignments that would utilize two north-south streets (both Alton Road and Washington Avenue) and either a single east-west street or a pair of east-west streets in South Beach. These options are essentially a combination of the Single Line (Direct Connection) options and the One-Way (Operational) loop options for Alton Road and Washington Avenue which created a large number of Two Independent Lines permutations. The Two Independent Lines options could be developed as either a single initial LRT/modern streetcar construction phase (one line only) or as an initial LRT/modern streetcar phase (first line) followed by a future LRT/modern streetcar expansion phase (second line). The most viable of the Two Independent Lines options selected for further consideration was:

- Alton Road to 17th Street and Collins Avenue (red line) with Washington Avenue to Dade Boulevard (blue line) as two independent two-way streets with a single LRT/modern streetcar lane in either direction.

This option is illustrated in **Figure 4.9**.

4.3.1.4 Split Two-way (Circulation) Loop Options

The Split Two-Way (Circulation) Loop options consisted of LRT/streetcar track alignments that would utilize two major north-south streets (Alton Road and Washington Avenue) and two east-west streets in the southern and northern portion of South Beach (5th Street with a variation utilizing South Pointe Drive and 17th Street, respectively). The Split Two-Way (Circulation) Loop options would utilize two-way streets with a single LRT/modern streetcar lane in each direction. The service coming across the MacArthur Causeway would have to split as it reaches the two-way loop in order to maintain the two-way LRT/modern streetcar service. This option is illustrated in **Figure 4.10**.

None of the Split Two-Way (Circulation) Loop options were selected for further consideration in Miami Beach primarily due to an expressed preference to not split the service and to avoid transit loops for a premium service.

FIGURE 4.9: TWO INDEPENDENT LINE OPTIONS MIAMI BEACH

FIGURE 4.10: SPLIT TWO-WAY (CIRCULATION) LOOP OPTIONS MIAMI BEACH

FINAL SET OF MIAMI BEACH ALTERNATIVES

Based on an analysis of the initial set of alignment alternatives in this study, the following were selected as the most viable Miami Beach alignment options to advance to the next phase of study:

- Single Line (Direct Connection) – The Single Line (Direct Connection) option utilizing Washington Avenue to Dade Boulevard. This option is the most direct while also concentrating transit service onto a single street.
- Two Independent Lines - The Two Independent Lines option utilizing Alton Road to 17th Street and Collins Avenue combined with Washington Avenue to Dade Boulevard. This option is direct and provides a split transit service on two parallel streets within South Beach.

4.4 Combined Alignment Alternatives

In order to provide a single alignment alternative for the entire study area, the most viable options for each geographic area were combined and evaluated using engineering judgment. This resulted in two viable combined alternatives:

- Direct Connection (DC) – A Single Line (Direct Connection) option utilizing Biscayne Boulevard and NE 2nd Street in downtown Miami combined with the Single Line (Direct Connection) option utilizing Washington Avenue to Dade Boulevard in Miami Beach. This combined alternative provides the shortest, two-way transit service with the fewest number of stations between Government Center and the Miami Beach Convention Center. This makes this option the least costly and is consistent with the Policy Executive Committee's guidance to consider the most direct option at the lowest cost that connects Government Center to the Miami Beach Convention Center. The proposed operating plan for this alignment alternative would include 5-minute peak headways and 10-minute off-peak headways.
- Operational Loop + Alton (OLA) – The One-Way (Operational) Loop option utilizing NE 2nd Street and NE 3rd Street in downtown Miami combined with Two Independent Lines utilizing Alton Road to 17th Street and Collins Avenue with Washington Avenue to Dade Boulevard in Miami Beach. This combined alternative utilizes a pair of one-way streets in downtown Miami and a split two-line service in south Miami Beach while connecting Government Center and the Miami Beach Convention Center. This is a cost effective and somewhat efficient alignment alternative. The proposed operating plan for this alignment alternative would include a combined 5-minute peak and off-peak headway in downtown Miami, 10-minute peak and off-peak headways across the MacArthur Causeway on Alton Road and on Washington Avenue.

The two combined alignment alternatives are illustrated in **Figures 4.11** and **4.12**, respectively.

To address concerns raised by the study's Technical Steering Committee (TSC), a Miami Beach Hybrid alignment alternative was developed. This alignment would include an independent LRT/modern streetcar line that would utilize Alton Road and extend service further south and east along South Pointe Drive, avoiding the need to split the service from the MacArthur Causeway into Miami Beach. This alternative would also allow more frequent transit service within Miami Beach compared to the OLA alignment, but would require transfers from the Alton Road line to the trunk line traversing the MacArthur Causeway. The Miami Beach Hybrid alignment alternative is illustrated in **Figure 4.13**. This alignment alternative was conceived as a variation to the OLA alignment alternative and can also be combined with the DC alignment. Characteristics of these alternatives are shown in **Table 4.1**.

FIGURE 4.11: MIAMI BEACH HYBRID ALIGNMENT ALTERNATIVE

FIGURE 4.12: DIRECT CONNECTION (DC) ALIGNMENT ALTERNATIVE

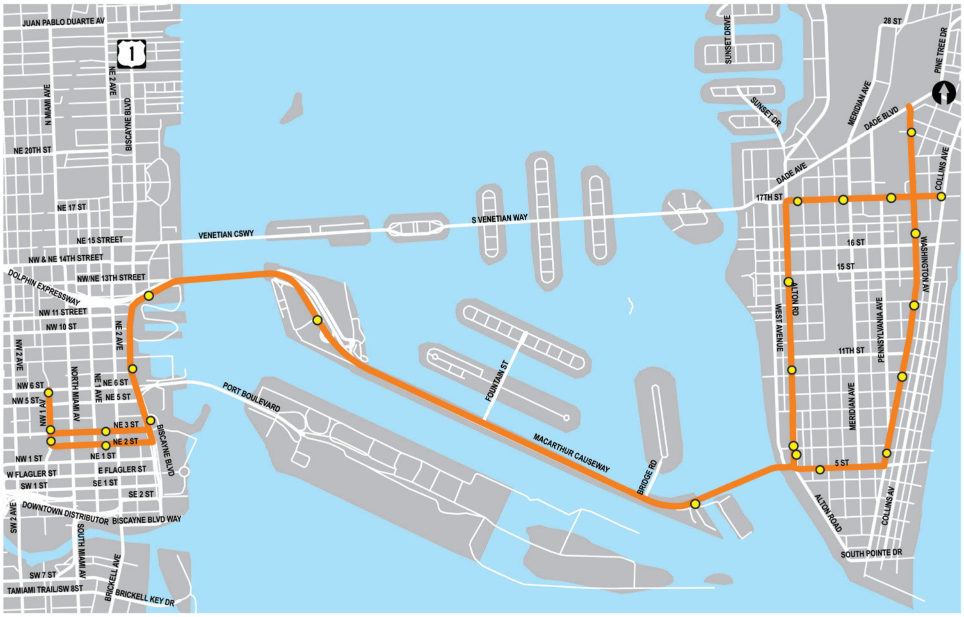


FIGURE 4.13: OPERATIONAL LOOP +ALTON (OLA) ALIGNMENT ALTERNATIVE

TABLE 4.1: CHARACTERISTICS OF THE ALTERNATIVES

	2004 LPA	DC	OLA	MB Hybrid
Number of Routes	3	1	2	2
Round Trip Distance	30.3 route miles*	13.5 route miles*	27 route miles*	13.5 Route + 2.7 Miles*
Round Trip Travel Time	55-minutes each for regional routes (35-minutes for Beach Circulator)	41 minutes	41 minutes each route	41 Minutes / 16 Minutes
Number of Stations	42	14	23	24
Number of Trains	18 in peak 18 in off-peak	8 in peak 4 in off-peak	8 in peak 8 in off-peak	8 in peak 4 in off-peak 8 in peak 8 in off-peak

Note: Route miles refers to the total round trip miles

4.5 Alignment Alternatives Evaluation Criteria

The screening of alignment options consisted of objective evaluation measures combined with the preferences of the project's TSC and PEC. The objective measures included consideration of the following:

- Adjacent Land Uses.
- LRT/modern streetcar Operations.
- Existing Street Traffic Operations.
- Features, Constraints, and/or Impacts.
- Cost.

The PEC preferences reflected in the evaluation of alignment options included the following:

- Direct routes were preferred over routes that circulate (loops) and/or that are split. This was one of the most influential factors in establishing the preferred alignment alternatives.
- Exclusive transit lanes were preferred over mixed-traffic operations.
- The alignments should be oriented to facilitate future extensions.
- Right of Way (ROW) acquisition should be minimized and avoided where possible.
- Converting existing on-street parking or a mixed-traffic travel lane into an exclusive transit lane was recognized as a necessity; a preference between these two options was not made.
- The alignments should attempt to serve as high a demand travel market as feasible.
- Phasing of multi-line options was seen as a logical way to proceed.
- Utilizing the MacArthur Causeway to directly connect the downtown Miami CBD to South Beach was preferred over connecting the airport via the Julia Tuttle Causeway to Mid and South Beach.

4.6 Alignment Alternatives Typical Sections

The viable LRT/modern streetcar alignments can be placed in one of six at-grade configurations relative to the roadway cross section and ROW. All of these configurations were considered for the various streets under evaluation. The following typical section configurations were examined:

- **Right Lane or Curbside Lane** – The outermost travel lane located immediately adjacent to the right side curb would be utilized by the LRT/modern streetcar via embedded tracks. This configuration is prone to some operational interference from right turning traffic, cross streets, driveway connections, and pedestrians. Transit stations would be provided to the right (two "staggered" far-side platforms per stop) within the sidewalk area. The lane can be operated in one of two ways:
  - » Reserved exclusively or predominantly for transit (LRT/modern streetcar and/or bus) use only, or
  - » As a mixed-traffic lane with transit priority features.
- **Second Lane or Off-set Lane** – Where curbside on-street parking is present, the travel lane located adjacent to the parking lane would be utilized by the LRT/modern streetcar via embedded tracks.

This configuration is prone to some operational interference from right turning traffic, cross streets, driveway connections, parking and loading/delivery vehicles, and pedestrians. Transit stations would be provided to the right (two "staggered" far-side platforms per stop) within a curb extension (bulb-out) adjacent to the sidewalk. The lane can be operated in one of two ways:

   » Reserved exclusively or predominantly for transit (LRT/modern streetcar and/or bus) use only, or

   » As a mixed-traffic lane with transit priority features.

- **Left Lane or Inside Lane** – The innermost travel lane located immediately adjacent to the median of a divided roadway or adjacent to the left side curb on a one-way street would be utilized by the LRT/modern streetcar via embedded tracks. This configuration is prone to some operational interference from left turning traffic (when the movement is allowed). Transit stations would be provided to the left (two "staggered" far-side platforms per stop) within the relatively narrow median of a two-way street or to the left (one far-side platform per stop) within the sidewalk area of a one-way street. The lane can be operated in one of two ways:

   » Reserved exclusively or predominantly for transit (LRT/modern streetcar and/or bus) use only, or

   » As a mixed-traffic lane with transit priority features.

- **Median-Running** – Where a wide median is present on a two-way street, the median would be converted into one or two embedded or turf tracks to be utilized by the LRT/modern streetcar. This configuration is prone to some operational interference from left turning traffic (when the movement is allowed), unless median openings are eliminated. The physically segregated median-running two-way running way would operate exclusively for transit (LRT/modern streetcar and/or bus) use. Transit stations would be provided to the right (two "staggered" far-side platforms per stop) or left (one center island platform per stop) within the median.
- **Adjacent or Side-Aligned** – Where right-of-way adjacent to the travel lanes is available, such as the roadside border area buffer strip, or can be made available by shifting travel lanes into the median, the area would be converted into embedded, turf, ballasted, or direct fixation tracks to be utilized by the LRT/modern streetcar. This configuration is prone to some operational interference from cross streets or driveway connections when present on the applicable side of the roadway and when the LRT/modern streetcar is operated at-grade. This configuration lends itself to providing grade separation at specific locations, e.g. navigable waterway, railroad crossing, etc., if necessary. The adjacent two-way physically segregated running way would operate exclusively for the LRT/modern streetcar. Transit stations could be provided on either side (two right side "tandem" or "staggered" platforms per stop) or within the center of the two tracks (one left side center island platform per stop).
- **Transit Mall or Transit Only Street** – The entire street is reserved exclusively or predominantly for transit (LRT/modern streetcar and/or bus) use only (via embedded track(s) for the LRT/modern streetcar). Intersecting cross street access could be maintained with traffic signals (resulting in interrupted flow for transit vehicles) or the transit mall could be given full priority with two-way stop control for side streets (resulting in uninterrupted flow for transit vehicles). Transit stations could be provided on either side (two right side "staggered" far-side platforms per stop) or within the center of the two tracks (two left side "staggered" far-side platforms per stop for narrow medians or one left side center island platform per stop for wide medians).

Typical section configurations were evaluated for each street along the LPA and one or two typical section configurations were determined to be the most viable options for further consideration as the project advances into the project development stage. The PEC directed that all LRT/modern streetcar running ways are to be exclusive transit lanes. The most viable typical sections are described for the primary streets (Biscayne Boulevard, NE/NW 2nd Street / NE/NW 3rd Street, MacArthur Causeway, 5th Street and Washington Avenue) and illustrated in **Figures 4.14** through **4.21**.

4.6.1 Biscayne Boulevard

- **Right Lane or Curbside** – For either the DC or OLA alternatives, two roadway modification options to accommodate right lane or curbside transit lanes are potentially viable: (1) conversion of the outside mixed-traffic lanes into transit-only lanes at potentially the lowest cost and least impact; (2) narrowing of the median by reducing the number of parking spaces and adding a transit lane in each direction as a higher cost and more complex option. One track per directional lane would be provided. Transit stations would be provided to the right (two "staggered" far-side platforms per stop) within the sidewalk area. This configuration would require that the tracks cross over Biscayne Boulevard into the median after departing the MacArthur Causeway. This configuration would result in two LRT/modern streetcar tracks crossing across the Florida East Coast (FEC) railroad spur to/from PortMiami. (See **Figure 4.14**). This crossing of an active railroad would require close coordination with the FEC railway. As part of this study, preliminary conversations with representatives from FEC industries have occurred regarding the location of the All Aboard Florida station in downtown Miami.

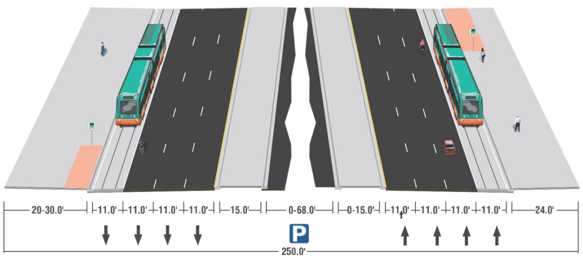


FIGURE 4.14: BISCAYNE BLVD. RIGHT LANE/CURBSIDE TYPICAL SECTION

- **Adjacent or Side-Aligned on the East Side** – For either the DC or OLA alternatives, two roadway modification options to accommodate adjacent or side-aligned transit lanes are potentially viable: (1) converting the east side mixed-traffic lanes into transit-only lanes, or (2) narrowing the median by reducing parking to create space on the east side of Biscayne Boulevard. Both options would require shifting the alignment of Biscayne Boulevard to the west. Two tracks would be provided adjacent and immediately to the east of Biscayne Boulevard. Transit stations would be provided on either side (two right side "split" platforms per stop) or within the center of the two tracks (one left side center island platform per stop). (See **Figure 4.15**). This configuration is compatible with the proposed configuration for the MacArthur Causeway. In this configuration, the crossing of the FEC track is done at a single location, as opposed to the Curbside configuration where there are two independent crossings.

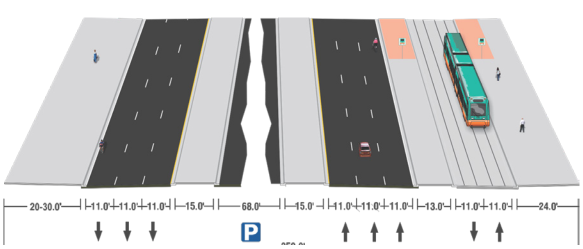


FIGURE 4.15: BISCAYNE BLVD. ADJACENT/SIDE ALIGNED TYPICAL SECTION

4.6.2 NE/NW 2nd Street / NE/NW 3rd Street Alignment Options

- North Lane or Inside Lane – For the OLA alternative, the north lane of each one-way pair of streets would be converted to an exclusive single-track transit lane. Transit stations would be provided within the sidewalk area. (See **Figure 4.16**.)
- Transit Mall Or Transit Only Street – For the DC alternative, the entire NE/NW 2nd Street would be converted to a two-way, two-track transit only street. Two far side "split" platforms would be provided within the median. (See **Figure 4.17**.)

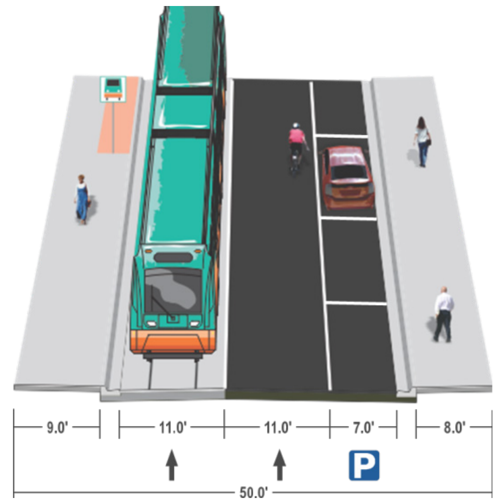


FIGURE 4.16: NE/NW 2ND STREET – LEFT LANE/INSIDE LANE TYPICAL SECTION (OLA)

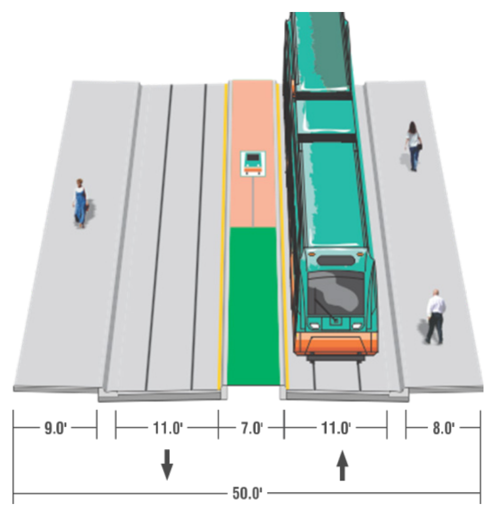


FIGURE 4.17: NE/NW 2ND STREET – TRANSIT MALL/TRANSIT ONLY STREET TYPICAL SECTION (DC)

4.6.3 MacArthur (and Julia Tuttle) Causeway

- Adjacent or Side-Aligned on the South Side – For either the DC or OLA alternatives, a new structure would be built adjacent and immediately to the south of the existing MacArthur Causeway structure. (This same typical section was considered for the extension options that would run along the Julia Tuttle Causeway.) Transit stations would likely be elevated above grade, requiring vertical circulation elements (elevators, escalators, stairs). (See **Figure 4.18**.)

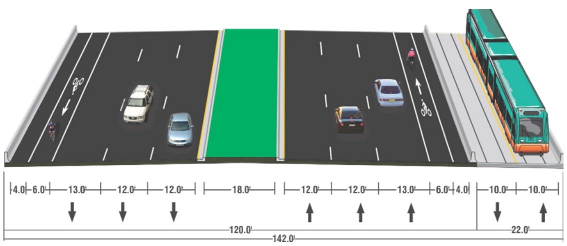


FIGURE 4.18: MACARTHUR (AND JULIA TUTTLE) – ADJACENT/ SIDE ALIGNED TYPICAL SECTION

4.6.4 5th Street

- South Curbside Lane – For either the DC or OLA alternatives, a portion of the green space between the sidewalks and curb would be converted into exclusive transit lanes with one track per directional lane and requiring outside roadway widening. This configuration would require a crossover approaching the MacArthur Causeway. Transit stations would be provided within the sidewalk area (two "split" far-side platforms per stop). (See **Figure 4.19**.)

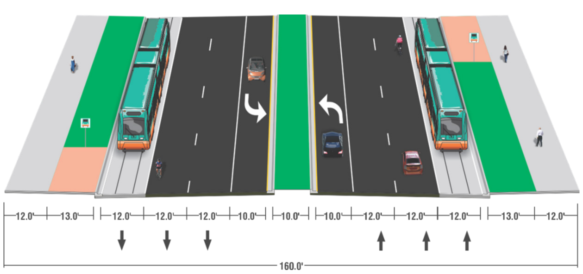


FIGURE 4.19: 5TH STREET – RIGHT LANE/CURBSIDE TYPICAL SECTION

- Adjacent or Side-Aligned on the South Side – For either the DC or OLA alternatives, the green space between the sidewalks and the curb would be converted on the north side into a mixed-traffic lane and on the south side into an exclusive transit lane. This option would require shifting the alignment of 5th Street to the north. Two tracks would be provided adjacent and immediately to the south of 5th Street. This configuration is compatible with the proposed configuration for the MacArthur Causeway. Transit stations would be provided on either side (two south side "split" platforms per stop) or within the center of the two tracks (one left side center island platform per stop). (See **Figure 4.20**.)

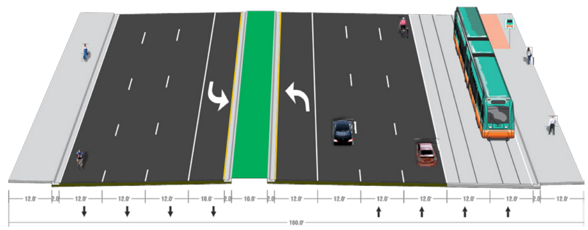


FIGURE 4.20: 5TH STREET – ADJACENT/SIDE ALIGNED TYPICAL SECTION

4.6.5 Washington Avenue (and Alton Road)

- Left Lane or Inside Lane – For either the DC or OLA alternatives, the left-most lane would be converted to an exclusive transit lane with one track per directional lane. Left turn prohibitions from Washington Avenue (or Alton Road) should be considered in order to give transit greater priority. Transit stations would be provided to the left (two "staggered" far-side platforms per stop) within the median. (See **Figure 4.21**.)

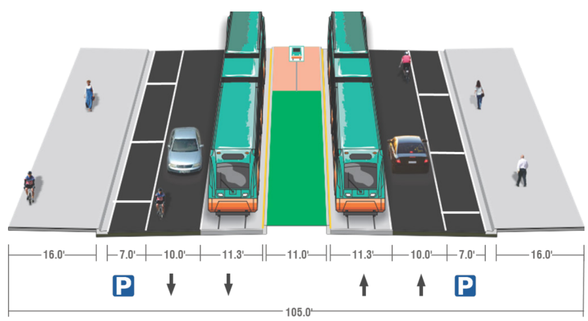


FIGURE 4.21: WASHINGTON AVE. – LEFT LANE/INSIDE ALIGNED TYPICAL SECTION

4.7 Alignment Extensions

The potential to provide future extensions in downtown Miami, across Biscayne Bay and within Miami Beach was also considered for both the LRT/modern streetcar and express bus modal technologies. These alignment extension alternatives were determined by the PEC to be part of future phases of the Beach Corridor Project. The alignment extension alternatives are illustrated alongside the DC alignment alternative in **Figure 4.22**.

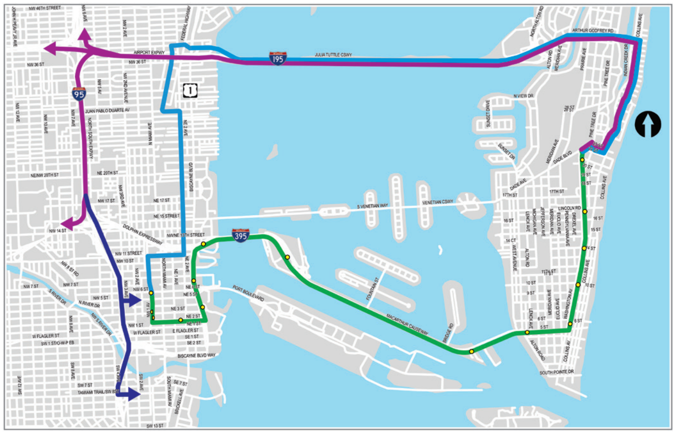


FIGURE 4.22: DIRECT CONNECTION (DC) ALIGNMENT WITH EXTENSIONS

Downtown Miami Extension Alternatives

Within the downtown Miami area, the following were considered:

- Midtown LRT/modern streetcar Extension utilizing Biscayne Boulevard/US 1.
- Midtown LRT/modern streetcar Extension utilizing NE 2nd Avenue.
- Express bus via I-95 south to the Miami CBD.

Causeway Extension Alternatives

For crossing Biscayne Bay the following were considered:

- LRT/modern streetcar Extension via the Julia Tuttle Causeway/I-195 and 41st Street.
- Express Bus via Julia Tuttle Causeway/I-195.
- Miami Beach Extension Alternatives

Within the Miami Beach area, the following were considered:

- Mid-Beach LRT/modern streetcar Extension utilizing Collins Avenue.
- Mid-Beach Express Bus via Collins Avenue.

4.8 Stations

In conjunction with the refinement of the LPA, station locations were also evaluated within downtown Miami and Miami Beach. No changes in station locations were considered along the MacArthur Causeway. This evaluation took into account the following:

- The need for efficient travel speeds and, therefore, distances between stations consistent with industry operating practices (1/4 mile to 1 mile), which resulted in some station consolidation.
- Consistency with the proposed typical sections to provide operational compatibility.
- New stations provided along new or modified alignments compared to the 2004 LPA alignment.
- Maintaining LPA station locations as much as possible.

The selected stations per alignment alternative are summarized in **Table 4.2**. The refined station locations for the DC and OLA alternatives in downtown Miami are illustrated in **Figure 4.23**; refined station locations for the DC and OLA alternatives in Miami Beach are illustrated in **Figure 4.24**. Station locations are illustrated with a yellow circle in each figure.

TABLE 4.2: STATION COUNTS

2004 LPA:	**Total Stations:**	**42**
Downtown Miami:	16	
MacArthur Causeway:	2	
Miami Beach:	24	
Direct Connection (DC):	**Total Stations:**	**14**
Downtown Miami:	6	
MacArthur Causeway:	2	
Miami Beach:	6	
Operational Loop + Alton:	**Total Stations:**	**24**
Downtown Miami:	8	
MacArthur Causeway:	2	
Miami Beach:	14	

The number of stations was reduced compared to the 2004 LPA primarily for two reasons:

- A shorter and more direct LRT/modern streetcar alignment.
- A slightly increased station spacing in select locations.

DC

OLA

FIGURE 4.23: DOWNTOWN MIAMI STATION LOCATIONS (DC AND OLA)

DC

OLA

FIGURE 4.24: MIAMI BEACH STATION LOCATIONS (DC AND OLA)

4.9 Maintenance Yard and Shop

The *2004 Bay Link Study* identified three potential sites as viable for the placement of the maintenance yard and shop:

- East of Miami Avenue and north of NW 17th Street.
- North of NW 29th Street and east of Miami Avenue.
- West of I-95 and north of NW 17th Street.

All three of these locations are no longer available and therefore new potential sites were identified as part of this study. The evaluation of new potential sites took into consideration the following requirements:

- Approximately 12 acres of available/undeveloped land
- The shape of the parcel(s) needed to operationally accommodate a yard and shop (cannot be too narrow).
- Suitable access to the site.
- Proximity to the Miami Streetcar alignment.
- Minimal impacts to sensitive resources.
- Land ownership.

The 2004 LPA assumed that a 12-acre site was the minimum acreage needed for this facility. This assumption was not changed since available land is scarce in these urban areas and future system expansion would require land to house more transit vehicles. Based on these criteria, 12 potential sites were identified and screened (See **Table 4.3**). Three of the 12 sites were retained for further evaluation but none were selected at this stage.

Potential sites are not being illustrated primarily for two reasons:

- Only a preliminary assessment was performed at this stage of analysis to ensure feasibility.
- Illustrating sites could adversely affect the public acquisition of private property.

4.10 Vehicle Technology Assessment

Concerns for aesthetic and other impacts associated with a conventional overhead power supply were identified during the development of the Bay Link 2004 LPA study. The use of alternative vehicle power supply technologies was proposed as a potential mitigation for aesthetic and other impacts associated with a conventional overhead power supply. The purpose of this assessment is to summarize state-of-the-art streetcar vehicle technologies, identify issues for implementing these technologies in the Beach Corridor, and to provide recommendations on further study.

TABLE 4.3: POTENTIAL MAINTENANCE FACILITY SITES

CHARACTERISTICS				
Site #	**Size**	**Shape**	**Distance from DC Alternative**	**Ownership**
I-395 Vicinity				
Site 1	12 ac	L shaped	2016 ft	Private
Site 2	5 ac	Long, thin	2475 ft	Public
Site 3	14 ac	Rectangular	1691 ft	Private
Site 4	9 ac	Rectangular	572 ft	Private
I-95 Vicinity				
Site 5	17 ac	Rectangular	2554 ft	Public
Site 6	12 ac	L shaped	1132 ft	Private/Public
Site 7	9 ac	L shaped	551 ft	Public
Site 8	9 ac	L shaped	1377 ft	Private
South of NE 2nd Street				
Site 9	8 ac	Polygon	1159 ft	Private/Public
Site 10	5 ac	Polygon	1626 ft	Private/Public
Site 11	12 ac	Polygon	1149 ft	Private
Site 12	4 ac	Polygon	2096 ft	Private

Note: Three of the 12 sites were retained for further evaluation but none were selected at this stage.

4.10.1 Baseline – Conventional Traction Electrification

The term "power supply" is used in this report to refer broadly to the various components comprising the Traction Electrification System (TES) and related apparatus on the vehicle. A conventional TES provides electrical power to the vehicles by means of the Traction Power System (TPS) (substations and related connections) and the Overhead Contact System (OCS) (overhead wires and related support structures). The following excerpt from the American Public Transportation Association (APTA) Modern Streetcar Vehicle Guideline document (APTA 2013) provides a description of this baseline, and highlights the issue of OCS aesthetics:

"OCS has become accepted over the past 120 years as the preferred power distribution method for modern streetcar and modern streetcar systems. The OCS system of power distribution is well proven and non-proprietary, with components available from multiple suppliers. The principal objections to it, where they exist, are aesthetic. Good OCS design practice recognizes the importance of context-sensitive aesthetics and treats in-street and other sensitive areas accordingly. Where this effort is not made, whether for cost or other reasons, the resulting installations can be seen by the public as inappropriate for their surroundings and generally unattractive."

"OCS design is also an iterative process that must be closely coordinated with track design and other alignment elements. TCRP Report 7, *Reducing the Visual Impact of Overhead Contact Systems*, advises that "the visual impact of OCS can only be reduced if such reduction is made a specific goal throughout the design process." Commonly used approaches for improving OCS aesthetics include minimizing pole counts by using alternative anchor points on buildings and other structures, and by combining lighting, traffic signal and OCS poles where possible. Synthetic span wires (whose insulating properties may permit a reduction in the number of fittings) have also been used as the basis for more aesthetically pleasing designs."

"For urban modern streetcar applications, a single contact wire over each track (instead of a multi-wire "catenary" arrangement) is acceptable operationally, though it requires a greater number of support points. When using a single contact wire, current draw considerations may also require the additional expense of an underground parallel feeder, but this item has a long, low maintenance life, and cross connections to the contact wire can be neatly handled. Alternately, some new LRT/modern streetcar systems use "feederless" systems that use a larger number of small, closely spaced substations in place of a parallel feeder."

A CONTINUOUSLY EVOLVING MARKETPLACE

During the 10 years since the previous studies for the Beach Corridor were completed, the LRT/streetcar market in the United States has evolved significantly. There is increased competition among vehicle suppliers (carbuilders), including new entrants into the field and increased willingness to compete for the smaller order quantities typical of startup projects. Low-floor vehicle and power supply technologies have also developed considerably, with a growing list of LRT/streetcar systems adopting alternative power supply technologies around the globe.

It is also important to look at the US LRT/streetcar marketplace in a global context. The US has only about 10 percent of the world's 400+ LRT/streetcar systems. This global market is served by a relatively small group of increasingly international carbuilders, all of whom utilize largely the same pool of sub-suppliers for vehicle systems and components. The global nature of the supply industry highlights the importance of considering "industry practice", taking into consideration the standard "ranges" of vehicle capabilities and approaching system design / vehicle selection accordingly.

"Although OCS is the most common and reliable method of power distribution, developing technology is now offering some significant new options. Technology advances originally driven by the need for energy savings, combined with the desire to eliminate the visual impact of overhead wires in certain areas, have led to the development of "off-wire capable" vehicles. This term refers to a vehicle that can operate from traditional OCS (or ground-level power system) as well as over-line segments that have no external power supply. The elimination of overhead wires may be desired for aesthetic concerns in a historically sensitive area or for route optimization (e.g. simplifying a complicated OCS junction or other wire arrangement, mitigating conflicts with traffic signal infrastructure, or to permit an alignment to pass under a severely restricted vertical clearance such as a low bridge)."

As shown in **Figure 4.25**, OCS can be applied in a context sensitive manner, significantly reducing its visual impact. Note the absence of poles in this figure, where span wires have been connected directly to building faces.

FIGURE 4.25: OVERHEAD CONTACT SYSTEM (OCS) IN REIMS, FRANCE

4.10.2 Alternate Power Supply Technologies

The alternatives to conventional overhead power supply have been grouped into three categories, and further detailed in the following sections:

- Onboard Energy Storage Systems (OESS)
- Ground Level Power Systems (GLPS)
- Onboard Energy Generation (OEG)

4.10.2.1 Onboard Energy Storage Systems (OESS)

By carrying a sufficient amount of energy storage capacity onboard, the vehicle can be designed to operate "off wire" as shown in **Figure 4.26** as well as use a conventional overhead power supply. Batteries and/or super-capacitors are the most common energy storage devices in use at this time. A variety of approaches (e.g. batteries alone, super caps with battery backup, or hybridized battery / super cap combinations) are in use, though patents and various other proprietary issues exist at the vehicle supplier / sub-supplier levels. Other energy storage technologies, including flywheels, are also in development with prototype vehicles now in use.

FIGURE 4.26: ONBOARD ENERGY STORAGE SYSTEM IN NICE, FRANCE

The OESS is recharged enroute by capturing energy generated during the vehicle braking cycle and when the vehicle is operating on powered alignment sections. Stationary "charging stations" (with either overhead or ground-level charging) can also be used, typically in conjunction with passenger stops or terminal locations where vehicles will normally be stopped. **Figure 4.27** depicts a charging station using a short section of overhead wire.

FIGURE 4.27: SHENYANG, CHINA

The distance a vehicle can travel off-wire will depend on local operating conditions and the installed capacity of the onboard energy storage system. Operating conditions such as the number of stops per mile (directly related to the degree of separation from other traffic) and energy demands, e.g. HVAC equipment, will have a significant influence on off-wire range and the longevity of energy storage components. Rather than being an "off-the-shelf" module that is simply added to a vehicle, the OESS is a semi-custom design for each application, with designers seeking to balance space, weight and performance requirements.

Vehicles will often operate in a reduced performance mode while "off-wire" in order to minimize energy consumption and lengthen range. Acceleration rates may be reduced, and the vehicle will typically be configured to automatically shed auxiliary loads when necessary, for example by reducing or turning off HVAC equipment (a significant consumer of energy).

It is also worth noting that OESS has multiple uses, including reduction of energy costs through peak shaving (using a relatively small amount of energy storage to help provide power for the "peaks" associated with acceleration and other heavy current draws) and other techniques. Another point to consider is the physical space needed to house onboard energy storage devices, particularly where extra air conditioning capacity is also needed (as in Miami). Because low-floor transit vehicles have all major components (other than running gear) located on the roof, it may be difficult to fit all of the equipment on a vehicles less than 98 feet (30 m) in length.

As with other aspects of system design, the decision to use an OESS to power vehicles over portions of the alignment involves a series of trade-offs. If the wires are removed for the purpose of improving aesthetics and eliminating conflicts with other users of the shared (street) right-of-way, the vehicle becomes more complex, and other infrastructure elements (e.g. charging stations) may need to be introduced. It may also be necessary to accept some degree of reduced performance in the off-wire sections, although certain aspects (e.g. slightly reduced acceleration) may be negligible trade-offs in a dense urban operating environment. Other trade-offs, such as the need to reduce air conditioning loads may be unpalatable and need to be compensated for with additional over-sizing of the energy storage capacity. For all of these reasons, the design of off-wire capabilities is an iterative process, requiring multiple inputs and a system-level understanding of the trade-offs involved.

FOLLOW-UP TECHNICAL ISSUES FOR OESS APPLICATIONS

As the Beach Corridor Transit Connection advances, several technical issues will need to be explored in detail to implement OESS applications in Miami. These issues include:

- Performance reductions in off-wire mode, specifically with regard to air conditioning needs in the Miami climate.
- Temperature control and battery management / maintenance requirements for battery-based solutions in the Miami climate.
- Location of energy storage devices and physical protection / separation from passenger compartment.
- Impact on life cycle costs of renewing energy storage components, including long-term availability of the selected battery chemistry (as applicable).
- Limiting depth of discharge; method of enforcing operating restrictions when energy storage level drops below minimum level (e.g. during a temporary line blockage), relation to life expectancy of energy storage devices.
- Transition process between wired and off-wire sections, automated vs. manual, impacts on pantograph life (as applicable). To include consideration of any charging stations (ground vs. overhead power).
- Cost effectiveness of OESS applications compared to traditional overhead electric systems.

4.10.2.2 Ground-Level Power Systems (GLPS)

Ground-level power systems (GLPS) are external to the vehicle and require specialized infrastructure and vehicle equipment. They effectively take the traditional overhead power source and locate it at ground level, using a segmented power rail or induction coil system located between the running rails and energized only when a vehicle is present. **Figure 4.28** shows an example of GLPS from Zaragoza, Spain. The safety requirements resulting from the use of ground level power add significant complexity to the system versus that of conventional overhead, where the overhead wire is simply left energized.

FIGURE 4.28: ZARAGOZA, SPAIN

Within the line segments where GLPS is utilized (a portion of the alignment may still utilize overhead wire), it may be continuous (installed over the full length of the segment, just like an OCS), or combined with OESS to minimize infrastructure impacts (installed on only a portion of the segment, at locations where the vehicles would typically be stopped or in need of supplemental power, e.g. accelerating/climbing grades).

There are presently three variations of the GLPS concept, as summarized in **Table 4.4**. GLPS systems still require traction power substations and the related electrical distribution found in a conventional traction power system, and in a contact-type system, propulsion current is still returned via either the running rails (as with an overhead contact system) or the power rail segments themselves. On the GLPS systems in service to date, the ability to use regenerative braking to return energy to the power distribution system is lost for safety reasons, although this energy may instead be captured by on-board energy storage in future evolutions of the technology.

GLPS systems have significant underground infrastructure including contactor boxes installed at regular intervals along the trackway to energize the power rail segments. **Figure 4.29** shows an in-ground contactor box. Segments cannot be energized if they are covered with standing water; in such cases the segment is turned off from central control, and vehicles are required to switch to battery power for passage over the outage area. Systems built to date have minimized alignments in shared traffic lanes, reducing the exposure of the power rail to roadway traffic.

FIGURE 4.29: ALSTOM APS GROUND-LEVEL SYSTEM IN REIMS, FRANCE

Regardless of whether the GLPS is combined with onboard energy storage, a small battery "reserve" capacity is typically provided as a backup power supply in the event that individual power segments fail to operate or need to be switched off for maintenance or temporary standing water on the trackway.

GLPS systems can be expected to cost considerably more than conventional OCS. The systems are also highly proprietary, potentially complicating system expansion due to single source procurement needs. To date, all such systems source vehicles and guideway power infrastructure together as a system from a single supplier. GLPS also makes the track engineer's and installer's jobs significantly more challenging, particularly where it must be installed through special trackwork, due to the complexity in routing the guideway power source. GLPS systems also require a section of GLPS track at the system's maintenance facility for vehicle testing purposes.

As with all new technology, GLPS systems are continuing to evolve as additional experience is gained. The Alstom system, for example, has now been in commercial service for 10 years and has developed a second generation of equipment, incorporating lessons learned from the initial installations. **Figure 4.30** shows an example of the Alstom system used in Reims, France, where a segmented power rail is located between the running rails.

4.10.2.3 Onboard Energy Generation (OEG)

A third approach to off-wire operation is to augment the onboard energy storage system with some type of power generation, such as a fuel-electric generator or a fuel cell, in order to create a vehicle that operates either independently or via a conventional OCS system. At present, there has been less progress with this technology in the LRT/modern streetcar field in comparison to ground level power and onboard energy storage.

FIGURE 4.30: IN-GROUND CONTACTOR BOX

TABLE 4.4: GROUND-LEVEL POWER SYSTEMS CONCEPT VARIATIONS

System	Technology Description	Pick-up Type	Applications to Date
Alstom APS (Alimentation par Sol)	Segmented third rail, electronic activation	Contact shoe	6 systems in commercial service, 3 systems under contract
AnsaldoBreda Tramwave	Segmented third rail, mechanical activation	Contact shoe	2 prototype installations, 0 systems in commercial service, 2 systems under contract
Bombardier Primove	Inductive	Inductive coil (contactless)	Prototype installations only (for rail application)

FOLLOW-UP TECHNICAL ISSUES FOR GLPS APPLICATIONS

As the Beach Corridor Transit Connection advances, several technical issues will need to be explored in detail to implement GLPS applications in Miami. These issues include:

- Space requirements for the underground infrastructure associated with the different types of GLPS systems.
- Impacts on performance and reliability of the system due to poor trackway drainage, i.e. periodic salt water flooding of alignment.
- Longevity of the power rail (as applicable) when exposed to heavy road traffic (both crossing and parallel traffic). Also replacement process for worn / damaged conductor rail segments.
- Differential for maximum speed when operating from ground supply vs. overhead.
- Control of emissions for inductive systems.
- Use of onboard energy storage to improve energy efficiency, and other evolutions of the technology.
- Safety certification of a ground level power system (new to the US).

FOLLOW-UP TECHNICAL ISSUES FOR OEG APPLICATIONS

As the Beach Corridor Transit Connection advances, several technical issues will need to be explored in detail to implement OEG applications in Miami. These issues include:

- Technology level of development
- Commercial availability of components
- Wayside fuelling infrastructure

Although research and application of fuel cells in rubber-tired transport vehicles continues worldwide, the use of this concept in rail vehicles has been limited. In the United States, a few such vehicles have been developed experimentally in the form of heritage trolleys for use in tourist-orientated operations. These examples do not have air conditioning requirements and have a less-demanding duty cycle than would be encountered in full-scale transit operations. In other parts of the world, there have been a number of prototype equipment installations as well as some relatively small scale applications. These include notable applications of diesel generators to trams and tram-trains in Germany and Spain. In these European examples, existing tram vehicle design platforms have been adapted to incorporate a diesel generator. This technology has not yet been developed on a wider scale however, and only a relatively small number of examples are in use. The weight, space and noise impacts of the diesel power plant may be viewed as impediments to wider adoption of this technology.

In 2011, Spanish national rail operator FEVE promoted a hydrogen fuel cell tram prototype. Despite the assembly of a prototype vehicle, the testing phase of the program was apparently never conducted due to economic issues and the restructuring of the Spanish national rail system. This vehicle is depicted in **Figure 4.31**. Other firms continue to pursue the technology, and additional prototype vehicles and demonstration projects are expected.

This assessment draws a distinction between DMU (Diesel Multiple Unit) and LRT/modern streetcar technology. While DMUs and LRT/modern streetcars share some common characteristics, DMU technology in the US is typically designed to operate as commuter rail, differentiated by greater distances between stops and a general orientation towards a mainline railway operating environment.

FIGURE 4.31: SPANISH NATIONAL RAIL OPERATOR FEVE'S PROTOTYPE HYDROGEN FUEL CELL TRAM .

However, there are a small but growing number of European "tram trains" equipped to operate from conventional power supply in city centers and onboard diesel generators on non-electrified track outside the city. While these examples appear somewhat distinct from the type of technology discussed to date for the Beach Corridor, they reinforce the value of "defining the need" (rather than the solution) and letting the marketplace come forward with the best solutions.

4.10.3 Evaluation of Alternative Technologies

Table 4.5 presents a high-level summary of the three alternative technologies discussed in the previous sections. The mitigation of aesthetic and other impacts by removing the overhead wire for the relevant line sections are assumed to be common to all and are not re-stated. Street car systems with off-wire segments in service or under construction are identified in Appendix A.

Building on the preliminary information presented above, it is recommended that the following criteria, based on those developed by UITP[1], be utilized as the basis for further evaluation of the power supply alternatives as the project advances to the next phase of study:

- Level of Development
- Performance (including tolerance of adverse weather conditions)
- Recharge Time (Storage-Based Solutions)
- Energy Efficiency
- Environment & Safety
- Impact on Infrastructure and Vehicle
- Procurement Issues (including proprietary technology)
- Capital and Operational Costs & Benefits

1 The International Association of Public Transport (L'Union International des Transports Publics)

TABLE 4.5: SUMMARY OF ENERGY TECHNOLOGY TYPES

Technology Type	Level of Development	Performance	Pros / Cons
Onboard Energy Storage System (OESS)	Medium-High	Depending on length of off-wire segments, likely to require load-shedding, reduced acceleration.	Pro: • No current return through the running rails in the off-wire sections • Fewer impacts from proprietary technology as compared to GLPS Con: • Added weight • Performance impacts • Limited life of energy storage units (life cycle cost impact)
Ground Level Power System (GLPS)	Medium	Full performance for continuous GLPS. Performance impacts for a non-continuous system are TBD.	Pro: • Continuous GLPS offers full vehicle performance Con: • Increased cost • Increased system complexity, including special trackwork • Proprietary technology • Significant underground infrastructure may be a challenge for a flood-prone region such as Miami
Onboard Energy Generation (OEG)	Low	Difficult to quantify due to lower level of development for this technology in the rail sector	Pro: • Avoids charging along route as with OESS Con: • Immature technology (fuel cell) • Space / weight / noise impacts (fuel-electric generator)

4.10.4 Recommendations for Further Study

The following section is based on the assumption that the project will utilize an alternate project delivery method (e.g. public-private partnership) in which prospective concessionaires would respond to performance-level specifications and supply vehicles/infrastructure and maintenance/operations as a complete package. Even if a more conventional project delivery method were ultimately sought, these key concepts are still applicable, though the project sponsor would be taking on more detailed design responsibilities.

Fundamental Decisions Impacting Vehicle Selection

For the design of any new LRT/modern streetcar system, regardless of whether or not off-wire operation is utilized, certain decisions relating to vehicle selection need to be addressed in the initial phases of project design, i.e. prior to issuing a Request for Proposal (RFP). While these aspects focus on LRT/modern streetcar vehicles, they are actually system-level design and operation decisions:

Vehicle width – The two most prevalent industry-standard vehicle widths for LRT/modern streetcars are 7.87 ft (2.4 m) and 8.69 ft (2.65 m). The selection of vehicle width will be alignment specific, and will require consideration of travel lane widths and other urban integration points.

Vehicle length/capacity - As noted elsewhere in the report, the vehicle length/capacity decision is related to the carbuilder's ability to install both extra air conditioning and OESS, or to meet the minimum length requirement for a GLPS system, i.e. the vehicle must cover two segments at once. For purposes of addressing the corridor's capacity needs and for maximizing competition, it is recommended that a 98 ft (30 m) minimum vehicle length be investigated for use as the design vehicle.

Vehicle turning radius – A 82 ft (25 m) vehicle turning radius is common, though a smaller 59 ft (18 m) or 66 ft (20 m) radius is possible. This decision will generally be alignment specific and will require an iterative process based on available right-of-way and track design. The turning radius will also have some impact on vehicle selection; a turning radius smaller than 18-m could require a custom vehicle.

Partial or 100% low-floor – There are advantages and disadvantages for both the partial and 100% low-floor approaches. This decision could be specified in the RFP or left to the marketplace to propose its best solutions.

Level boarding method – The decision regarding "fully level" or "near level" (bridgeplate) boarding will also be alignment specific, and will require an overall system-level vision for accessibility that addresses integration of the LRT/modern streetcar with other transit services, including bus operations at any shared stops.

Other key early questions are off-wire capability and procurement method, both of which the project is already addressing.

Duty Cycle

Understanding the "duty cycle" to be demanded of the vehicle, and communicating it as part of the RFP process, is a key issue. The operating conditions for both the initial phase and foreseeable future expansion lines will influence a variety of vehicle subsystems, including the OESS. Duty cycle is also closely related to the topic of exclusive guideway vs. mixed traffic running, and so it will be important for the RFP to provide clear direction to potential proposers on this point. The key components of duty cycle will be:

- Operating speeds and stops per mile (both for passenger stops and other), dwell times
- Alignment details including stop locations, curvature and grades
- Climate (HVAC)

Full vs. Partial Off-Wire

Maximum flexibility in the procurement response is linked directly to maximizing competition. If advanced as a fully off-wire system, the various options for the Beach Corridor (at 6.8 miles or longer) would place it among the world's longer off-wire systems. In addition to pushing the bounds of the technology, just as importantly it might reduce the number of solutions offered in the procurement. Instead, a system architecture where off-wire "segments" are defined (instead of a hard requirement for the full system to be off-wire) would allow maximum flexibility for proposers. For proposers with an OESS-based solution, this approach would provide important flexibility for optimizing the amount of on-board energy storage, which is one of the primary design trade-offs (time spent under wire is time spent charging). Further, any flexibility that can be offered with regard to where the off-wire section segments are located (particularly relative to the location of any significant gradients) will also be of great interest to proposers, particularly those offering an OESS-based solution.

4.10.5 Conclusions and Recommendations

1. **Define the business case for off-wire.** The adoption of new technology always presents some level of risk. An understanding of the offsetting benefits for such an approach is needed to justify the risk. Aesthetics have already been identified as a primary factor, but reaching an internal consensus on the "big picture" of why this approach is being pursued, along with priorities on where off-wire segments would have the greatest benefits, will help to clarify the perceived benefits and help manage stakeholder expectations.

2. **Define the need (performance-based specification) and let the marketplace propose solutions.** Given the relative newness and rapid evolution of the power supply technologies involved, it is preferable to focus on the required system performance and let the marketplace propose its best solutions in an open, competitive process in which the technology provider is also the operator/maintainer, either directly or by virtue of its membership in the consortium delivering the project.

   Each off-wire technology has its own trade-offs and each installation has unique, project-specific design requirements. Because there is no "one size fits all" solution, keeping a measure of flexibility with regard to the use of off-wire technology will help maximize competition. It will also be highly beneficial to address other design decisions that impact energy demand in advance. While there are likely limits to what can be done to reduce energy demand from air conditioning in Miami's climate, reducing energy demand by keeping the LRT/modern streetcar out of mixed traffic wherever possible is desirable. This will also improve service reliability and help reduce operating costs.

3. **Start with a design vehicle that is long enough to accommodate GLPS or OESS.** Use of vehicles longer than the current US LRT/modern streetcar "norm" of 67 ft (20 m) will provide more room for installing OESS-based solutions in addition to the needed extra air conditioning capacity, further helping to maximize competition. Use of GLPS would also require a vehicle longer than 67 ft (20 m) because of the necessity to cover multiple power rail segments.

   A minimum vehicle length of 98 ft (30 m) would provide additional room for installation of OESS components and meet minimum requirements for use of GLPS (i.e. requirement to cover multiple segments). This length is quite common outside the US, and the greater passenger capacity will likely be put to good use in the corridor, with attendant operating and passenger comfort benefits.

4. **Separate the alignment from traffic wherever possible.** A transit only alignment will help maximize competition by providing important flexibility in right-sizing energy storage for OESS-based solutions, and will help reduce issues with power rail wear in GLPS-based solutions. It will also help improve schedule speed and service reliability, and help to reduce operating costs.

5. **Gather further technical and commercial input on off-wire operation.** As these technologies are constantly evolving, it would be appropriate for the project to further advance its understanding of the most recent improvements in performance, safety, reliability and interoperation.

   An industry "best practice" approach is to conduct a formalized round of industry input as part of the near-term project development process. This would provide the opportunity to ask carbuilders for initial feedback on design decisions raised in this report, and for input on the detailed information about project alignment and operations that they would need to effectively respond to an RFP. This process could be supplemented with independent conversations with projects agencies that have implemented these technologies, and by conducting a thorough review from a procurement standpoint to consider the long-term impacts of proprietary technologies.

5.0 AFFECTED ENVIRONMENT

The refinements to the 2004 LPA evaluated for this study can have direct and indirect effects on the social, economic, and natural environment of Miami-Dade County and the Beach Corridor Transit Connection study area. This chapter provides an update in the principal environmental categories that may be affected by the Refined LPA.

5.1 Parkland and Recreational Areas

In 2004, thirteen parks were identified in the study area. This number was updated to twenty four parks in 2014. These include Gibson Park; Dorsey Park; Margaret Pace Park; Bicentennial Park; Bayfront Park; Watson Island Park; Palm Island Park; Flamingo Park; Clemente Park; Rainbow Village Park; Town Park; Williams Park and Pool; Biscayne Park; Paul S. Walker Mini Park; Fort Dallas Park; Brickell Park; Allen Morris Park; Southside Park; Lummus Park; South Pointe Park; Pier Park; Marjory Stoneman Douglas Ocean Beach Park; Buoy Park; and Miami River Walk.

It is not anticipated that the reduced alignment for the Refined LPA will require acquisition of public parklands as transit service would operate within the street rights-of-way or on bridges.

5.2 Air Quality

As indicated in **Tables 5.1**, peak carbon monoxide (CO) levels have declined since 2001, thus air quality levels have improved. In addition, the CO levels shown did not exceed the National Ambient Air Quality Standards in 2001 or 2010. The proposed fixed guideway transit improvements are anticipated to result in overall air quality benefits.

TABLE 5.1: CARBON MONOXIDE LEVELS (2001 AND 2010)

Year	Period	First Highest	Second Highest	NAAQS	Exceedances
2001	8-hour	4.7 ppm	4.2 ppm	9 ppm	none
	1-hour	8.5 ppm	7.3 ppm	35 ppm	none
2010	8-hour	3 ppm	3 ppm	9 ppm	none
	1-hour	2 ppm	1 ppm	35 ppm	none

Note: Monitor Location: 2201 SW 4 Street, Miami, FL
Source: Florida Department of Environmental Protection

EXISTING WILDLIFE IN STUDY AREA

In the past ten years, much of the existing wildlife in the study area has not changed. In 2004, 15 species of concern were identified as endangered or threatened by the US Fish and Wildlife Service (USFWS) or the State of Florida. Since then, five of 15 species have changed status, as indicated in **bold text** in the following descriptions:

American Alligator

The American alligator (*Alligator mississippiensis*) is classified by the USFWS **and the State of Florida as a threatened species** by similarity of appearance (to the more endangered crocodilians). In 2002, it was classified as "species of special concern" by the USFWS and had no status with the State of Florida.

American Crocodile

The American crocodile (*Crocodylus acutus*) is classified as **threatened** by both the USFWS and the State of Florida resource agencies. Its status change from "endangered" to "threatened" is considered an improvement.

Southern Bald Eagle

The southern bald eagle (*Haliaeetus leucocephalus*) is **no longer listed as threatened**. In 2002, it was considered threatened.

White-Crowned Pigeon

The white-crowned pigeon (*Columba leucocephala*) is **not listed** by the USFWS but is considered threatened by the State of Florida. It was considered a species of special concern by the state in 2002, so its status has worsened.

Arctic Peregrine Falcon

The arctic peregrine falcon (*Falco peregrinus tundrius*) **has been removed from the endangered species list** by the State of Florida and the USFWS. In 2002, it was considered threatened and a species of special concern by the USFWS and State of Florida, respectively.

5.3 Aquatic Preserves/Outstanding Florida Waters

Biscayne Bay is designated as an Aquatic Preserve and outstanding Florida Water by the Florida Administrative Code. All of the alternatives as proposed would likely encroach upon the Bay and have the same level of potential impact.

5.4 Aquatic Habitat/Ecology

Impacts to aquatic ecological resources as a result of the 2004 LPA or the Refined LPA would be the same and primarily associated with the crossing of the MacArthur Causeway. There are several protected species that are water-dependent, including the manatee, sea turtles and water-associated birds, such as the southern bald eagle. Their habitat would be obstructed by the introduction of the structures associated with crossing the Bay.

5.5 Historic Resources

In downtown Miami, eight historic resources have been added to the National Register of Historic Places (NRHP) since 2004. They include:

- Central Baptist Church
- City National Bank Building
- City of Miami Cemetery
- Congress Building
- Huntington Building
- Ingraham Building
- Meyer-Kiser Building
- Security Building

In Miami Beach, two resources were added to the NRHP since 2004; they include the Beth Jacob Social Hall and Congregation and Lincoln Road Mall.

The historic resources may be visually impacted by the integration of new elements. However, the introduction of these new elements will not diminish the integrity of the buildings or affect the characteristics that make other historic buildings eligible for listing in the NRHP. Stations could be designed to be compatible with the character of the historic districts. It does not appear that the alignment or stations will directly impact, i.e. have physical contact or share viewsheds with, any of the historic resources or districts.

5.6 Utilities

No significant differences are anticipated for the type of impact on overhead or underground utilities. However, fewer utility impacts can be expected since the amount of track miles are significantly reduced with the Refined LPA. The single-way track length for the 2004 LPA is 30.3 miles and for the Refined LPA is 13.5 miles. Additionally, the following factors will affect the impact to utilities:

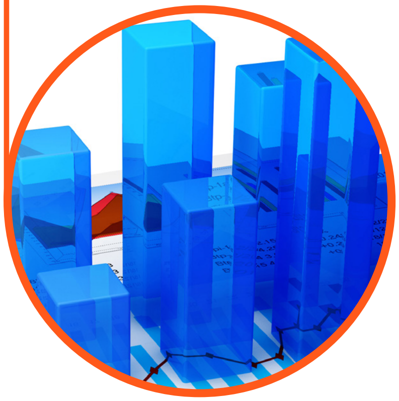
- Final track alignment location within the roadway cross section
- The specific type of vehicle power supply technology (overhead, ground-level or onboard)
- Transit vehicle axle design loads and corresponding track slab depth/thickness.

5.7 Major Issues For Next Phase

The following are the most significant issues that will need to be addressed under the NEPA study phase:

- Potential impacts to Biscayne Bay along the MacArthur Causeway
- Roadway/track drainage and sea level rise
- Potential utility relocations and associated impacts
- Potential right-of-way impacts at stations or at a yard and shop site
- Potential traffic and/or on-street parking impacts associated with exclusive on-street transit lanes
- Potential conflicts and impacts associated with crossing the FEC railroad in downtown Miami
- Potential temporary construction impacts


Commodity
Futures
Chart
19 20 21 22 23 24 25 26 27 28 29 30
0 5 10 15 20 25 30 35
23 24 25 26 27 28 29 30
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25



6.0 FINANCIAL ANALYSIS AND FUNDING PLAN

Most LRT/modern streetcar projects in North America have relied on a diverse mix of capital funding sources. This financing approach is a reflection of the fiscal realities facing transit capital projects. Most sources contribute a modest share and single-handedly fall short of covering all costs, and furthermore require time to ramp up. As a result, many financial plans are a mix of federal, state, local, and private funds. For example, tax increment financing (TIF) and benefit assessment district revenues, which help LRT/modern streetcar projects capture increases in property values that are expected to occur along corridors they serve, can be considered feasible supplemental local funding sources when legislatively enabled and combined with extensive property owner outreach.

This section presents the capital, operating, and maintenance costs for this project and describes a preliminary funding and finance plan that charts a course to achieve a regional transit investment with supportive land use strategies. Both federal and non-federal funding scenarios were evaluated for viability and potential yield. It is important to note that funding and financing considerations are preliminary and dynamic at this stage of the project.

6.1 Cost Estimates

Capital Cost Estimates

Capital costs are one-time expenditures incurred in the implementation of a system until such time as it becomes fully operational and achieves revenue service.

The capital cost estimate spreadsheets from the *2004 Bay Link Study* were updated to reflect current year (2013) capital cost values. The year 2013 estimates were calculated for the eight major transit categories defined by FTA in their Capital Cost Workbook (guideway elements, yards and shops, system elements, passenger stations, vehicles, special conditions, right-of-way, and soft costs); these were based on cost values obtained from the FTA Capital Cost Database by comparing costs on six similar projects built between the years 2004 and 2013. This database is recommended by FTA for "Performing historical cost analysis, and developing order-of-magnitude cost estimates for conceptual transit projects", which is what was required for this study. (http://www.fta.dot.gov/12305_11951.html)

The seven similar projects in the FTA database are Charlotte, Seattle, Minneapolis, Houston, Dallas, Salt Lake City and Denver. The FTA cost database program calculated the updated costs between 2004 and 2013, resulting in a 55% increase/cost escalation over the past ten years.

Additionally, reasonableness checks were performed by structural engineers for bridge structure costs and transit vehicle costs based on recent values. Light Rail Vehicle (LRV) costs reported at the 2013 APTA Rail Conference were used ($4.4 M/car). "Per linear foot of track" costs were calculated using length quantities and adjusted costs from the *2004 Bay Link Study* that were updated to year 2013 values and applied to the three major project segments of the Refined LPA (i.e. downtown Miami, MacArthur Causeway, and Miami Beach); Refined LPA segment lengths were derived using GIS. For the Extension Alternatives, capital costs were also developed by applying the cost per linear foot of track. The updated capital cost estimates are shown in **Table 6.1**.

TABLE 6.1: CAPITAL AND OPERATING & MAINTENANCE COSTS (2013, MILLIONS OF DOLLARS)

	2004 LPA	DC	OLA	MB Hybrid	Extensions
Capital Cost	$774	$532	$646	$694	$529
Annual O&M Cost	$45	$22	$34	$49 *	$28

* 5-min peak and off-peak headways both segments.

Note: All costs are based on the *2004 Bay Link Study* that were escalated to current year dollars.

Operating and Maintenance Cost Estimates

The refinements made to the 2004 LPA were considerable and required new calculations for updating the Operating and Maintenance (O&M) costs. A simple spreadsheet model was developed that calculated round trip totals; number of trains based on headways; link capacity; peak link demand and load factor; peak and off peak hours by day of week; total revenue vehicle hours; and vehicle miles. As inputs to the spreadsheet, new station to station distances were calculated, as well as travel times and speeds based on the Bay Link factors, peak and off peak headways, and number of hours operating during the peak and off peak. Operating hours were assumed the same as for the 2004 LPA. A conservative 20% increase in speeds was assumed since the 2004 LPA used operating speeds for the Skoda vehicle, which is a slower vehicle than the larger LRT/modern streetcars.

Due to similarity in operating costs, the rolled up cost factors used in the 2012 Charlotte Area Transit Agency O&M Cost Model were applied in the spreadsheet model to arrive at total O&M costs for each alternative. Rolled up costs include:

- cost per vehicle revenue hour
- cost per vehicle revenue mile
- cost per peak vehicle
- cost per directional guideway mile

The DC Alternative (low cost alternative) was assumed to operate at 5-minute headways in the peak and 10- minute headways in the off peak. Only one route would operate on this alternative.

The OLA Alternative (high cost alternative) was assumed to operate at combined 5-minute headways where two lines would converge and 10-minute headways on the South Beach branches. Two routes would operate on this alternative, hence, the need to prepare two spreadsheets, one for the Alton Road route, and one for the Washington Road route, and add the results for total O&M costs.

The Miami Beach Hybrid Alternative was assumed to operate at 5-minute headways all day with two independent routes.

For each of the extensions, three spreadsheets were prepared: the first calculating the DC Alternative plus the Collins Extension to 41st Street; the second adding the extension across the Julia Tuttle Causeway; and the third extending the alignment from the Julia Tuttle Causeway south to meet up with the downtown Miami line on Biscayne Boulevard. The low cost alternative was assumed as the base alternative. The updated O&M costs are found in **Table 6.1**.

6.2 Summary of the Capital and O&M Plan

The estimated costs for each of the three refined alternatives (plus extensions) and the 2004 LPA are summarized in **Table 6.1**. Based on the service plan and operating parameters defined for the project alternatives, the annual O&M costs range from $22 million to $49 million ($2013). The operating service parameters assume an average 6.5 mile alignment.

6.3 Overview of Funding/Financing Context

An array of federal and non-federal public and private sector funding avenues were evaluated for the financing plan. Additionally, alternative delivery and public-private partnership (P3) arrangements were explored to understand the degree of project “readiness” that is needed before a P3 can be considered. It should be emphasized that this funding plan is a preliminary identification of the most promising traditional and innovative funding and financing mechanisms suitable to the Beach Corridor project.

Like many other counties and localities around the nation, Miami-Dade County continues to face a challenging environment for long-range transportation investments. These challenges include:

- **Continuing uncertainty regarding federal transportation policy and the availability of long-term funding appropriation.** With the uncertainty of the federal role in long-term transportation funding, the states' role in funding transportation needs is increasing. In addition to the political uncertainty regarding the future federal transportation appropriations, the magnitude of transportation investment needs nationwide has grown over the years. While the annual growth rate in federal transportation formula funds in the pre-MAP-21 era was 4 to 5 percent, the magnitude of recognized investment needs increased over this period at a higher rate. The needs continue to grow, but funding within the MAP-21 two-year authorization and currently being discussed in Congress are diminishing. Spreading limited federal dollars over an increasing number of projects in need of funding is today's transportation planning reality.

- **A slow economic recovery in Florida and nationwide.** In 2012, Florida's economic growth was positive for the third year after declining two years in a row. At the same time, most state transportation funding sources; gas taxes, property taxes, sales taxes, tolls, rental car taxes, and more; were also experiencing a recovery. This growth is expected to continue and as a result, the revenues for the Florida State Transportation Trust Fund (December 2013 Forecast by the Revenue Estimating Conference) are projected to grow from $2.9 billion in 2014 to $3.9 billion in 2023[1].

As of the date of this report, federal transportation policies and funding remain in an unprecedented state of flux.

Fortunately, there are also new funding initiatives such as the Generating Renewal, Opportunity, and Work with Accelerated Mobility, Efficiency, and Rebuilding of Infrastructure and Communities throughout America Act, or GROW AMERICA Act. The GROW AMERICA Act, is a $302 billion, four-year transportation reauthorization proposal that provides increased and stable funding for our highways, bridges, transit, and rail systems across the US. The Administration's proposal is funded by supplementing current revenues with $150 billion in one-time transition revenue from pro-growth business tax reform. This will prevent Trust Fund insolvency for four years and increase investments to meet national economic goals[2]. It is generally recognized as a short-term measure, not a long-term solution to federal transportation funding needs.

6.4 Funding and Financing Sources

Today's constrained funding environment requires consideration of multiple funding types and sources to successfully implement major public transportation projects. In addition, the capacity of the project sponsor and its stakeholder partners to leverage private sector investment must be considered. A variety of discretionary funding sources are available, although there is considerable competition for these limited funds. This section describes potential funding sources.

Table 6.2 summarizes potential funding and financing mechanisms for the Beach Corridor project. These are not stand-alone funding sources but are best used in a package of sources with a dominant or primary revenue stream. Typically, in today's funding environment, implementable projects weave together an array of federal, state and local funding sources, but in all cases there is a predominant, stable funding source. Discussion of these sources and mechanisms follows **Table 6.2**.

The brief program-by-program review of public funding sources and models of financing in this section provides a high-level recommendation to the project sponsor and its stakeholder partners regarding the most promising mechanisms. Most of the funding sources described here can support the capital cost of constructing and implementing the Beach Corridor project, but are not availabe for the day-to-day operation of the service.

The next phase of study will evaluate the operating and maintenance (O&M) funding needs in conjunction with establishing the following: 1) more detailed ridership estimates and service schedule, 2) refined operating costs, 3) fare policy (to estimate revenue), and 4) information on approaches to integrated design at station areas where development occurs and the potential for joint development arrangements at each stations. An analysis of the financial capacity of the project sponsor to implement the locally preferred alternative (LPA) will also be included in the next phase of study; this will be a requirement of any grant application pursued.

1 Revenue Estimating Conference, December 2013 Forecast at http://edr.state.fl.us/Content/conferences/transportation/Transresults.pdf

2 Information on the Grow America Act can be found at http://www.dot/gov/grow-america/fact-sheets/overview

TABLE 6.2: POTENTIAL FUNDING AND FINANCING SOURCES

Operating Revenues	Capital Revenues	Financing Mechanism
Passenger Revenue • Fare box operations **Traditional/Existing Sources** • FHWA Congestion Management and Air Quality (CMAQ) Improvement program funds (operating; 3 yr. limit) • Dept. of Public Works (DPW) • 6 cent Local Option Gas Tax • County Gas Tax • 9th cent Gas Tax **Miami-Dade Transit (MDT)** • Direct Operating Revenues • Federal/State Grants incl. FDOT Transit • People's Transportation Plan (PTP) Surtax **Innovative/New Sources** • Advertising (pillars/kiosks); marketing; naming rights • Right-of-Way / Air rights • Digital Ecosystem • Station revenues • Concessions (travel retail; food; ATMs) • FL State Energy Program (SEP) for station facilities	**Traditional/Existing Sources** • USDOT Transportation Investment Generating Economic Recovery (TIGER) Grants (8th or 9th cycle) • FTA New Starts Capital Grants • TA Formula Grants • Real Property Ad Valorem Tax • Local Option Gas Tax (LOGT) • County Option Sales Tax Surtax • Local Gov't Infrastructure Sales Surtax • HEFT/MDX Toll Revenue Share • DDA or County transportation fees • FDOT transit funding (New Starts) • PTP Surtax • County General Funds **Innovative/New Sources** • Transit Oriented Development (TOD)/joint development • Special assessment districts • Tax increment finance districts (TIFD) • Tourist and Convention Development • Parking surcharge • Vehicle Miles Traveled (VMT) toll or fee • Partner agencies (e.g., CRAs) • Causeway Tolling (MacArthur and Julia Tuttle)	**Traditional/Existing** • Debt and General Obligation (GO) Bonds **Alternative Delivery & Innovative Mechanisms** • Florida State Infrastructure Bank (SIB) loans • Tax credit bonds • Transportation Infrastructure Finance and Innovation Act (TIFIA) loans/lines of credit **P3 Mechanisms** • Availability payments • Private activity bonds (PAB) • Private equity

Most of the federal funding sources use core formulas, based on various demographic and/or transit service metrics, to determine project funding values. The grant programs typically require a minimum 50 percent local/state funding commitment (match) to a maximum 50 percent federal funding commitment for capital expenses. In today's competitive grant environment, the local commitment can be interpreted as an expression of positive stakeholder and elected official support for the project. Therefore, the greater the local match, the better the likelihood of securing federal funding.

6.5 Operating Revenues

Potential operating revenue sources include annual revenues from the farebox, FTA grants (for maintenance), FDOT funds, local general fund, innovative sources from value-capture mechanisms and joint development arrangements, parking surcharge at large lots and garages, retail concessions at stations, and/or advertising and naming right revenues.

Parking: There is some potential to monetize the parking revenue stream that could accrue to the cities of Miami and Miami Beach, respectively, from the operation of public and private sector public facilities. The expansion of the parking supply at the new Miami Beach Convention Center development site could also present on opportunity for new sources of parking revenues.

For sizeable parking operations, another arrangement could be to monetize the entire future revenue stream into a one-time upfront cash payment to a prospective private entity or funding trust company, or serve as collateral to guarantee financing.

Retail Concessions: Retail concession agreements could be executed at locations around certain stations/stops. This enhancement and capture of the station's revenue stream could be allocated for O&M needs.

Advertising and Naming Rights: A revenue capture option could be from potential new advertising revenues associated with well-designed and attractive advertising kiosks that also function as sources of information; naming rights; or combinations associated with retail offerings are all potential options that capitalize on advertising content.

Naming rights could be arranged in connection with high volume passenger stations in the project corridor such as the American Airlines Arena station. This revenue enhancement opportunity incorporates the use of names and corporate branding into the current ordinances' naming rules.

6.6 Private Investment: Joint Development

Joint development is an incentive to form of public-private partnership as it creates a private funding mechanism for public infrastructure. The joint development, when associated with transit improvements, is generally transit oriented development (TOD). Stations offer three potential joint development opportunities: the station or stop itself, adjacent land parcels, and, where applicable, air rights. All are potentially available funding options for contributions to the project's capital expenditure and, in some cases, to operating expenses.

The Beach Corridor is the most densely developed area in Miami-Dade County and has historically provided the economic foundation for the development of the entire county. The tremendous private investment in the study area, including high rise condominiums, entertainment venues, and office and retail space, is being augmented by significant public infrastructure investments, including the PortMiami Tunnel and water and sewer system upgrades, which will sustain private interest in the region.

The development in downtown Miami is largely retail, office, residential and government services with Flagler Street and Bayside Marketplace serving as large retail magnets.

The amount of development that is proposed or currently underway in the study area is significant, and is summarized in **Table 6.3**.

TABLE 6.3: DEVELOPMENT PROPOSED OR CURRENTLY UNDERWAY IN THE STUDY AREA

Residenital Units	Hotels Rooms	Office Square Feet	Retail Square Feet
10,989	2,000	1,290,500	1,353,127

Additional private investment is anticipated to occur in the study area such as at station areas proposed along Biscayne Boulevard and at the All Aboard Florida and Miami Conference Center sites. Private development interest could be a way to realize significant value from real estate and be utilized for joint development arrangements and revenue sources.

6.7 Precinct / District Area Value Capture

Value capture mechanisms are public financing tools that "capture" increases in appreciated property values resulting from public investments in infrastructure, transit and transportation. These captured values ("tax increments" or "incremental taxable value") are then used to help fund investments in public infrastructure or repay debt incurred to fund the public investment. An escalation in land values "due to the transit improvements" (driving the increase in taxable value above the historic rate) is likely to occur only when the project begins full revenue service operations.

Tax Increment Financing (TIF): TIF captures the increase in property tax revenue that occurs in a designated area after a set year. The tax increment is collected for a set period (usually between 15 and 30 years) and can be used to secure a bond, allowing the issuer to access the value up front, or it can be used to pay for services or debt repayment over time.

Figure 6.1 illustrates the concept of TIF over the life span of a project.

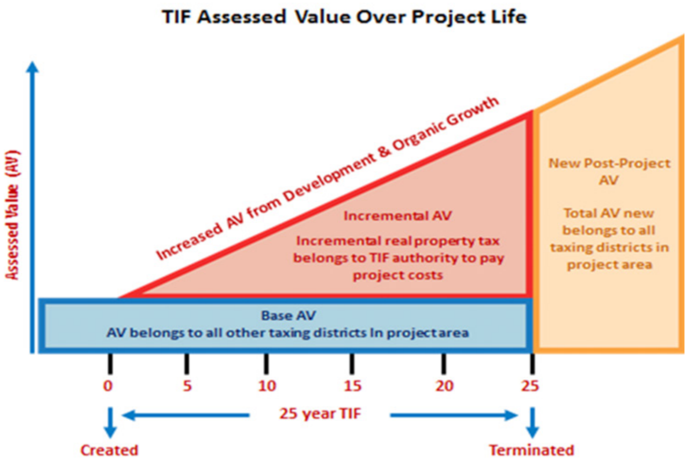


FIGURE 6.1: ILLUSTRATION OF TIF MECHANISM

Special Assessment Districts (SADs): SADs are designated geographical areas in which property owners agree to pay an assessment to fund a proposed improvement or service from which they expect to benefit directly. These districts can be used either for improvements as they occur or to finance the issuance of bonds backed by the assessment revenue.

Both TIF and SADs are administered across a designated geographic district by a special authority. The former benefits from the incremental increase in property value and therefore property taxes generated by development. The latter is a separate tax applied to properties within a specific geographic area.

To estimate the potential revenue yield, the financial analysis assumed creation of TIF and SAD Districts within one-quarter mile from the proposed corridor alignment on either side, which for general estimating purposes approximates the 2014 study area. Parcel level assessor data on property attributes and assessment values were assembled for all commercial, residential and industrial properties located within the boundaries of the hypothetical district.

The leveraging of TIF revenues or (SAD revenues) with other funding sources and options can provide avenues for direct funding of the project, or for gap financing arrangements. The utilization of this program would require direct authorization and agreement by the State of Florida, Miami-Dade County, and both cities of Miami and Miami Beach. Given the structure of such arrangements, it is viewed as a potential long-term arrangement that supplements other funding sources.

The operation of new or enhanced rapid transit service increases land values by:

- changing the desirability of a property's location
- enhancing the proximity and access to transit services
- increasing the expectation of future value for the redevelopment of the property to a more intensive use
- fostering activity to incentivize joint or secondary development near stations, ranging from air-rights development, parking structures, or right-of-way donations.

As a result, the increased property tax can be viewed as a direct benefit of the new transit service and therefore a candidate for funding the operation.

In practice, the greatest opportunity to capture value stems from new development near a mobility hub, station or stop where there is a concentration of pedestrian activity and density with enhanced connectivity to access jobs, housing, emerging centers and other travel destinations.

This report is consistent with the policy framework and description of innovative funding tools that are documented in the Miami-Dade County Citizens' Independent Transportation Trust (CITT) reports. The funding reports are available at http://www.miamidade.gov/citt/strategic-financial-studies.asp. Additionally, this report is consistent with the Miami-Dade 2040 Long Range Transportation Plan (October 23, 2014). The Miami-Dade MPO successfully completed its federally required (every four-year) certification process of the LRTP in late April 2015.

The property value balance between Miami and Miami Beach is approximately 65 percent and 35 percent, respectively based on year 2014 Florida Department of Revenue information. The Miami-Dade total assessed property value is approximately $262 Billion ($2014).

6.8 Funding Plan – Potential Sources and Uses

Assembling a cohesive and unified funding plan is an iterative process involving organizational/institutional structures, new or modified legislative provisions, selection of project sponsor, and extensive community and stakeholder outreach. This section summarizes a high-level, preliminary funding plan scenario that integrates the above-listed potential sources of funding, implementation pathways, and leveraging opportunities in support of the this proposed LRT/streetcar project.

Funding Strategy Plan

The preliminary funding plan provides funding avenues on uses of the funds as identified in **Table 6.4**.

TABLE 6.4: POTENTIAL CAPITAL EXPENDITURE REVENUE SOURCES ($2014)

Local Revenue Source	Annual Yield ($2014 Millions)	Applicability
Causeway Tolling	$150	USDOT allows interstate tolling. Tolls require USDOT and local approval. Toll revenues at $2/vehicle from un-tolled MacArthur (95,500 ADT) Causeway and the Julia Tuttle Causeway (108,500 ADT) would generate $70M and $80M annually, respectively. Additional tolls for 3-axle or more vehicles would offset toll collection/operations costs.
Tax Increment Financing (TIF) District	$18	Not currently authorized. State enabling legislation for TIF for transit is required; taxing jurisdictions may challenge it; actual revenues lag behind TIF district designation, thus bridge financing is needed until funds ramp up; potential varies with land use and increment captured. Applicable to all properties and land uses abutting alignment. Downtown Miami and Miami Beach TIF districts would contribute 60 percent and 40 percent of annual yield, respectively, based on total property market value share. The conservative estimate assumes current development trends and could be higher.
Special Assessment District	$10	Requires state authorization and local enabling act for special project; early and extensive property owner outreach program required. Applicable to all properties and land uses abutting alignment at $200 per unit and $0.50/sq. ft. per year Nonresidential. Downtown Miami would contribute 60 percent and Miami Beach would contribute 40 percent of annual yield based on distributional share of total value. The conservative estimate assumes current development trends, and could be higher amount derivative of the net apportionment formula of total costs.
Parking Surcharge	$2	City of Miami is authorized for parking surcharge (on-street parking exempt) for commercial garages. Requires a change in Florida State statue 166.271 for Miami Beach to qualify and to raise allowable surcharge. If statute change occurs, there is potential for a much greater revenue yield.
Convention and Tourist and Development Tax	$10	One of the funding sources is the Tourist and Convention Development Taxes on Transient Rentals (bed taxes). The six percent (6%) tax collected is made up of a three (3%) percent Convention Development Tax (CDT), two percent (2%) Tourist Development Tax (TDT), and a one percent (1%) Professional Sports Facilities Franchise Tax collected throughout Miami-Dade County, with the exception of Miami Beach. This one percent (1%) tax is used only for debt service payments on county debt for professional sports facilities. The Beach Corridor Transit Connection Project is eligible to receive CDT/TDT funds. Approximately $90M is collected county-wide, with 40% from Miami Beach. For all tourism-related local option taxes, an increase by another 1% could generate a $10 million or more of added revenue. The estimation was calculated from the base revenue yield.
Sales Tax (Charter Co. Transit Surtax)	$17	Authorized but not in use. Local surtax passage could be difficult. An additional half cent ($0.05) or half-penny sales tax increase could generate $170M from a broad base. Conservatively, assume 10 percent capture of robust source, and could be higher per policy decision and regional priorities.
Vehicle Miles Traveled (VMT) Tax	$20	No current authority exists to use a VMT tax. Has the potential to generate major new funding; could be politically difficult to establish. Conservatively, a 1-cent per mile county-wide tax could generate $200M. The yield estimates assumes a 10 percent share of $200 million.

Notes: Allocations are preliminary order of magnitude estimates only. No funding or grant application commitments have been made by any agency or authorized by the project sponsor. Information was presented to the Technical Steering Committee (TSC) in June 2014 and Policy Executive Committee (PEC) in July 2014.

A preliminary estimate of annual yield is also indicated. These estimates are based on a preliminary analysis and experience among other transit system projects. For planning purposes, the capture base is an estimate of apportionment or contribution from the subject fund. As the Beach Corridor project moves forward, these potential sources warrant continued monitoring.

Funding Scenarios

A comparison of the benefits and drawbacks of a federal versus non-federal funding scenario is presented in **Table 6.5**. A common denominator to both scenarios is a fundamental requirement for a dedicated, stable, high yield, primary revenue stream. A patch work of multiple funding sources is valuable as supplemental sources only.

For the use of financing mechanisms, such as TIFIA, to provide immediate revenue while other revenue sources ramp up, a dedicated revenue source (e.g. tolls) must be pledged to secure debt service payments for both the TIFIA and senior debt financing. A pledge of federal funding, regardless of the source thereof, is not an acceptable dedicated source of revenue for this purpose.

TABLE 6.5: FUNDING SCENARIOS – FEDERAL VERSUS NON-FEDERAL

Federal New Starts Scenario	Non-Federal Scenario
Capital Cost: $532M to $774M (2013 dollars)	Capital Cost: $532M to $774M (2013 dollars)
O&M Cost: $22M to $49M (2013 dollars)	O&M Cost: $22M to $49M (2013 dollars)
FTA Grant: assume $194M (at 30 percent modest share; 50 percent maximum share)	Loss of notable subsidy boost
Causeway Tolls: $100M/year	Causeway Tolls: $100M/year
Local Value Capture (TIF or SAD): $10M/year	Local Value Capture (TIF or SAD): $10M/year
Tourist and Convention Development Tax (1 percent local option surtax): $10M/year	Tourist and Convention Development Tax (1 percent local option surtax): $10M/year
Pros: • Potential grant subsidy • Use of TIFIA for credit and financing while revenues ramp up • Enhanced eligibility for family of other federal funds • Defined process and timeline • Time savings benefits, resulting from the notable funding grant boost that reduces contribution from other project revenue sources.	**Pros:** • Flexibility though all steps of the process • Possibility for lower cost procurement • Use of TIFIA (with NEPA clearance) • Phased evaluation, development and selection of execution form • Possibility for better utilization of private sector skills (e.g., PDA type procurements) • Minimized risk for public sector • savings (could save many years; utilize PDA procurement) • Ability to package Capital Expenditures and Operations Expenditures, and optimize funding
Cons: • Absorbs time • Complexity of negotiations • Includes "Buy America" provisions • Has complicated procurement process that excludes negotiated deals • Funding award is uncertain • Stringent process with loss of flexibility • TIFIA commits funds after award	**Cons:** • Loss of federal funds (increased financing costs) • Partner selection is crucial • Dependable 3rd party audit may be necessary • Unique process may lead to exposure to criticism • Complexity of negotiation
Universal: • Collaboration and partnership • Need dedicated and stable revenues • NEPA and permitting requirements • Real Estate requirements • Lender requirements	**Universal:** • Collaboration and partnership • Need dedicated and stable revenues • NEPA and permitting requirements • Real estate requirements • Lender requirements

6.9 Findings and Recommendations

Recognizing the limits of available local and state funding, and the state of flux in federal transportation funding, the development of this proposed LRT/modern streetcar project will take time to define and select the locally preferred alternative (LPA) and to meet the standards for capital plan development. Several of the identified funding sources would require new legislation. All funding sources would require extensive property owner and stakeholder outreach. Fundamentally, the project needs a primary, dedicated, available, and stable funding source, not just a portion of revenues to supplement the funding stream. Furthermore, an identity for the project needs to be created by adding it fully into the Long Range Transportation Plan, Transit Development Plan and Transportation Improvement Program. Lastly, the latent capacity in existing funding sources (e.g., PTP) should be clarified in light of the prioritization of transportation investments. Based on the preceding analysis, these are the findings and recommendations regarding funding and financing:

- The project should be funded with a corridor-specific source. There are no county-wide revenue sources immediately available, and the benefits are mainly localized to the Miami and Miami Beach travel markets and future local development. A corridor-specific revenue source avoids competition with other projects and also avoids the county-wide prioritization process. Potential self-sufficient and viable corridor-specific funding sources (e.g., causeway tolls) are available. Other potential funding sources are supplemental to a dedicated, predictable, and bankable source including: value-capture (either special assessment or tax increment district, but these require new legislation and extensive stakeholder buy-in) or the use of the Tourist and Convention Center Development Tax for which a rail transit project is eligible. There is also the potential to apply a portion of the projected future bonding capacity of the existing PTP (projected to generate $200 million every two years), however that funding is subject to competition among other important projects.
- A mix of non-federal funding sources is potentially available to fund the full project cost. Several viable funding and financing mechanisms are available to the project and warrant for further consideration and study:
  - » Causeway Tolls could provide a large, primary revenue base for both capital and O&M costs that is stable, predictable, and dedicated. These attributes are a prerequisite for starting any P3 initiative. The projected annual yield from tolls on both causeways is approximately $150M (2013 dollars).

The potential for new tolls on the two causeways as a primary revenue source is contingent upon high-level policy approval. The USDOT procedures for interstate tolling (e.g., I-195, I-395) constrains this source, but the procedures are presently being considered for modification by the USDOT. For example, executive-level policy discussion and the GROW AMERICA legislation specifically mentions removing federal restrictions to interstate tolling, and adding the right to toll on interstate facilities as a new revenue source.

  - » Value-Capture could provide supplemental funding that is tailored to each City. For example, a special assessment district may be better suited to one city and a TIF district to the other. Value-capture would require significant community interface to achieve property owner buy-in and new legislation at the State and County levels.
  - » Tourist/Convention Center Development Tax (TDT/CDT) may have increasing potential given the projected new development anticipated to occur in the project area. The TDT/CDT sources would supplement a primary revenue source.

If the County and Cities can commit to a local, dedicated funding source that is stable and implementable within the near-term, then it may not be worthwhile to pursue Federal Transit Administration (FTA) New Starts grant funds. The FTA process is complicated, competitive, and over-prescribed. The federal grant scenario constrains flexibility in procurement opportunities, especially for the use of P3. The federal process typically adds two or more years to the anticipated opening day, which results in additional cost to the project.

- There are several benefits and opportunities for public-private-partnership (P3) in the corridor. P3 provides expedited and efficient project delivery, saving time and money, and allocates risks to parties best able to manage them. The Miami-Dade region is a national leader in successful P3 projects, with contract templates and experienced financial institutions. There are national best practices in P3 transit system delivery that demonstrate their effectiveness (e.g., Portland Streetcar; Baltimore Purple Line; or Denver RTD Eagle Line). The project should move forward with a near-term workshop and "readiness" checklist report to understand the gaps and process for entering into a P3 arrangement. Fundamentally, a primary revenue source will need to be dedicated for making availability payments to the P3 concessionaire.

7.0 STUDY COORDINATION

The Beach Corridor Transit Connection Study was not intended to include an extensive public outreach program but rather to engage key stakeholders in the update and refinement of the LPA and determine how best to advance this project. The Consultant, in cooperation with the MPO formed two project committees, the Technical Steering Committee (TSC) and the Policy Executive Committee (PEC), to provide guidance to the study team at major project milestones and to convey information and materials to their respective agencies. The consultant team held a combined total of ten (10) meetings of the TSC and PEC; highlights of each meeting are presented in the following sections. In addition, study findings and recommendations were presented to other bodies such as the MPO Governing Board, Miami Beach City Commission, and the Miami Beach City Commission Transportation and Parking Committee. The input received from these stakeholders was instrumental in guiding the study team and identifying preferences and key concerns. The information contained in this report was presented to the committees at key intervals along the study schedule.

7.1 Beach Corridor Advisory Committees

Technical Steering Committee

The Technical Steering Committee (TSC) included representation from the following key agencies and departments:

- Florida Department of Transportation, District 6 (FDOT)
- Miami Beach Department of Public Works and Miami Beach Parking Department
- Miami Department of Planning and Public Works
- Miami Downtown Development Authority (DDA)
- Miami Parking Authority
- Miami-Dade County Department of Public Works and Waste Management (PWWM)
- Miami-Dade County Department of Regulatory and Economic Resources (RER)
- Miami-Dade Expressway Authority (MDX)
- Miami-Dade Metropolitan Planning Organization (MPO)
- Miami-Dade Transit (MDT)
- PortMiami

As the study attracted increased interest, other agency staffs were invited to attend and the Miami-Dade Citizens' Independent Transportation Trust (CITT) sent a representative. TSC members are listed in on page 7-2. The TSC reviewed and provided guidance on project materials, content, strategic preferences, and results. **Table 7.1** presents the TSC meeting schedule and topics of discussion.

TSC Highlights and Study Contributions

Key recommendations and preferences were made at each meeting that provided significant direction towards updating the *2004 Bay Link Study*. The following summarizes the key observations, comments and preferences made by the TSC.

TSC - October 21, 2013

Comments on the 2004 LPA and the 2014 Study Purpose and Scope of Services

- Extensions to new areas within the corridor should be considered.
- The study is not revisiting any modal technologies previously rejected.
- New ridership estimates will be prepared in any subsequent study. This study is only identifying key issues and refinements to the prior study.
- This study will examine changes in the corridor and note potential effects to ridership.
- The South Beach Local would be maintained once the Beach Corridor is operational, an assumption in the *2004 Bay Link Study*.
- Miami Beach is heavily transit-dependent. Changing from the South Beach Local to LRT/modern streetcar would entail an increase in fares; the South Beach Local charges a fare of $0.25 versus an anticipated full fare for the LRT of at least $2.00. Some systems offer fare-free zones and require payment only beyond those areas.
- The LPA stations should be adjacent to existing Metrorail and Metromover stations to facilitate transfers between the two systems.
- The design should make transfers to emerging major hubs (e.g., All Aboard Florida Downtown station) convenient to overcome the downside of changing modes.
- The focus of this study should be on developing a quick connection between downtown Miami and Miami Beach.
- The proposed service would serve more than one market. Demand is balanced in both directions (inbound vs. outbound) with many different users.

TABLE 7.1: TECHNICAL STEERING COMMITTEE (TSC) MEETING SCHEDULE

Meeting Date	Topics of Discussion
October 21, 2013	• TSC Roles and Function • Background on Modern Streetcars, Prior Studies, and Description of 2004 Locally Preferred Alternative • Overview of the Study Purpose and Scope of Services
January 13, 2014	• Land Use Changes since 2004 • LPA Refinement Options for Miami Beach and Downtown • Extension Options for Midtown, the Causeway, and Mid Beach • Capital Cost Updates Consensus on Options to Carry Forward • Preferences Questionnaire
March 10, 2014	• Overview of TSC and PEC Preferences from Previous Meetings • Screened LPA Refinement Options • Capital and Operating and Maintenance Costs of the Refined Options and Extensions • Financial Strategies
March 24, 2014	• Refinements of the LPA, Station Locations, and Capital & Operating Conceptual Costs Estimates • TIGER Grant Application
June 9, 2014	• Technology Assessment of Off-wire Technology • Financial Analysis and Alternative Delivery Mechanisms • New Beach Alignment Options (Alton Circulator Alignment Beach) • Maintenance Facility Sites
January 12, 2015	• Study Results, Implementation Plan, and Next Steps

- There appears to be a lot of overlap between the LPA alignment and the existing Metromover alignment. It appears to be redundant.
- The outcome of this study should be an alternative that offers a downtown loop and a fast causeway crossing (Julia Tuttle is faster than the Mac Arthur).
- The recommendations from this study must also take into account the impact of the proposed system to the built environment.
- Operating in mixed traffic will not work. The recommended alternative needs to operate in exclusive transit lanes.
- If necessary, remove on-street parking to allow non-congested travel for transit. However, green space should not be removed.
- When the 2004 LPA study was conducted, Metrorail did not connect to the airport. Now Metrorail goes through Government Center. By connecting this project to Government Center, ridership would have a good connection from the Beach to the Airport.
- The study should consider extending the Metrorail Orange Line along the Julia Tuttle Causeway connecting the Beach and Midtown.
- The LPA refinements should simplify the loops in downtown Miami and on the Beach with a straight connection from Government Center in downtown Miami to the Convention Center on Miami Beach.

TSC - January 13, 2014

Comments on the LPA Refinement Options

Miami Beach

- The Collins Park Neighborhood alternative should go up Collins Avenue, not Washington Avenue which is the western border.
- Do not run line entirely up and down 16th Street. Run line up to Meridian Avenue only and then up to 17th Street.
- Phase in the Alton or Washington leg. Urban design of street is critical for either route.

Downtown

- Look into plans for New World Center development and what they are proposing along NW 9th Street.
- Flagler Street is a major street and should not be impacted by modifying lanes.
- Consider option with a large loop through Overtown, utilizing NW 14th Street instead of NW 9th Street.
- Extend the NW 1st Street line north to the old Arena site that is being redeveloped as the Miami Conference Center.

BEACH CORRIDOR TRANSIT CONNECTION STUDY TECHNICAL STEERING COMMITTEE (TSC)

Agency/Organization	Member Name
Miami-Dade MPO	Irma San Roman*, Wilson Fernandez
Miami Dade Transit	Ysela Llort*, Albert Hernandez, Monica Cejas
PortMiami	Felix Pereira*, Kevin Lynskey
Miami-Dade PWWM	Jeff Cohen*, Joan Shen
FDOT District 6	Dionne Richardson*
Miami DDA	Javier Betancourt*
MDX	Mayra Diaz*
Miami-Dade RER	Mark Woerner, Lee Hefty
City of Miami	Carlos Cruz-Casas*
City of Miami Beach	Kathie Brooks*, Jose Gonzalez
Miami Parking Authority	Art Noriega

* Indicates primary representative

Response to Questionnaire to Identify Preferences

During the Jan 13th TSC meeting, the group was asked to vote electronically on 21 questions to arrive at the TSC's preferences. Each member of the TSC provided input confidentially and their responses were instantaneously tallied and reviewed by the Committee. The results of this questionnaire are presented in Appendix B. A summary of the responses is as follows:

- Minimize travel distance by providing a short and direct alignment.
- Maximize speed and reliability by providing exclusive guideway or lane.
- Provide direct connections to premium transit such as Metrorail and Metromover.
- Avoid replicating existing premium transit service.
- Serve regional and local destinations focused on high activity areas.
- Configure alignment to facilitate future extensions.
- Avoid loops for the trunk service.
- If loops are present they should cover a wide area.
- Provide initial single line alignment with future line extensions.
- Minimize right-of-way acquisition.
- Minimize on-street parking impacts.
- Some impacts to auto traffic will be unavoidable.
- Serve all major travel markets.
- Maximize transit system ridership.

TSC - March 10, 2014

Comments on LPA Refinement Options

- To increase the ridership potential for the direct two-way line via NW/NE 2nd Street, extend the line along NE 1st Avenue further north to NW/NE 6th Street, adjacent to the future site of the Miami Conference Center and closer to the future Miami World Center.
- City of Miami supports looking at the single track one-way loop versus two-way service on a single street since it has fewer impacts to traffic. A detailed traffic study would be done in the next phase.
- Make sure the LRT/modern streetcar fits north of Port Boulevard on Biscayne Boulevard. The proposed side-aligned option can handle street closures. Removing the outer fourth lane on Biscayne Boulevard should be considered.
- Existing bike lanes along 5th Street on the beach side should be maintained and enhanced, if feasible.
- Look into a side alignment on the south side of 5th Street on the beach side.
- Florida statutes prevent transit stations within medians.
- Left turn prohibitions along Washington Avenue may be necessary. Look to shifting alignment near intersections to remove on-street parking and maintain left turns.
- NW/NE 2nd Street in downtown Miami is good for a transit mall since it is not a through street and carries less traffic than the other parallel streets.
- If NW/NE 6th Street is made into a transit mall, NW/NE 5th Street would have to be modified to allow two-way traffic.
- The center of gravity of downtown Miami is shifting north and should be served by the proposed LRT/modern streetcar alignment.
- Need to coordinate and interconnect with the All-Aboard Terminal Station and the proposed bus terminal.
- The Meridian Avenue option in Miami Beach will be removed from further study.
- Miami Beach needs a circulator more than downtown Miami since it does not have Metromover. Independent lines can be built in phases in Miami Beach and then a two-way loop created over time.
- Miami Beach wants small station shelters.
- Address intersection treatments especially at major gateway entry points on either end of the Macarthur Causeway.

TSC - March 24, 2014

Comments on Refinements of the LPA, Station Locations, and Capital & Operating Conceptual Costs Estimates.

- The precise location of the northern most station on Washington Avenue needs to be addressed in more detail at a later time.
- The two lines on the Beach side can be formed into a two-way loop in the future.
- In downtown Miami, optional east-west loops (small) should be considered along NE/NW 5th and 6th Streets. There are more lanes on NE/NW 5th and 6th Streets but also more traffic than NE/NW 2nd

and 3rd Streets. Flagler Street turning movements are restricted which results in more traffic along NE/NW 2nd Street. NE/NW 5th and 6th Streets could better support a value capture funding source.

- The proposed system should operate more like a modern streetcar on the Miami Beach side.
- Move the 5th Street station slightly west and closer to Alton Road. Consider an additional station along 5th Street.
- The revised number of stations is the right number for this phase.
- The Beach will likely need more service in the off-peak periods than assumed, which will increase the O&M costs.

TSC – June 9, 2014

Comments on the following: Technology Assessment of Off-wire Technology; Financial Analysis and Alternative Delivery Mechanisms; New Beach Alignment Options (Alton Circulator Alignment Beach); Maintenance Facility Sites.

- More information on the potential use of CNG should be explored.
- An order of magnitude O&M life cycle cost comparison for the new technologies versus established technologies was requested. This should take into account the length of the off-wire system as well as public versus private sector costs.
- Address the tolling constraints on the Julia Tuttle, an interstate facility. One easy solution appears to be that the County assumes full ownership of the two causeways.

TSC - September 8, 2014

Comments on the following: Draft Implementation Plan, Maintenance Facility Locations, Status of Study Documentation, Preparation of Project Development Activities.

- Were tolls on I-95 considered for funding this project?
- MPO Board endorsement will be required to go into the next phase of study.
- Should meet with FTA as soon as possible to clarify issue of federalization of project.
- FTA will have to review the Scope of Work if follow the federal process.
- The two implementation options were discussed. How long from the LPA to completion?
- The project will require federal permits for crossing the MacArthur Causeway.
- Reduce the number of sequential activities as much as possible.
- The CITT is willing to fund the PD&E phase.
- MPO is currently moving as fast as possible and will be going to the PEC and MPO Board.
- All agree that need to expedite this study and subsequent phases.
- How long did it take Denver to implement their rail expansion program going through a P3?
- FEC railroad crossing in downtown will need to be addressed in the next phase. Freight service could adversely impact LRT/Streetcar passenger service. Grade separation would have multimodal impacts in the area of the crossing.
- I-395 reconstruction design build needs to be considered and how it work with the proposed LRT/ modern streetcar alignment.
- Coordinate this project with Tri-Rail Coastal Link project.
- CITT has purchased right-of-way in the past and can do so if necessary.
- This project should be loaded into the ETDM screen as soon as possible.
- Involve the PEC only on major decisions.
- The PEC should continue to meet beyond this study.
- The public outreach process for this project should start as soon as possible.
- The MPO cannot use the existing GPC contract to perform the required additional work.
- The implementation options presented need to be simplified for the PEC meeting.
- Need to clarify the implications of not obtaining the Tiger Grant.

TSC - January 12, 2015

Comments on the following: Summary of Study Results, Implementation Strategy and Schedule, Funding and Agency Roles in the Next Phase, Confirmation on Decisions.

- Agreed with prior decisions, however the tolling option should remain on the table at least into the next phase of study.
- May not want to preclude Federal New Starts Funding

at approximately 50% capital funding at this time.

- Every effort should be made to reduce the overall implementation schedule.
- FDOT will lead the next phase of project development with other agencies and the two cities participating in the project committees. FDOT will also take the lead with funding the next phase. CITT will be a major financial contributor.
- FDOT indicated that the next study phase should consider a dedicated pedestrian and bicycle way facility along the entire MacArthur Causeway.

Policy Executive Committee (PEC)

A Policy Executive Committee (PEC) comprised elected officials and designees from the Miami-Dade MPO Governing Board (2), Miami-Dade County, City of Miami and the City of Miami Beach. PEC members are listed below. The PEC reviewed critical project information and played a major role in developing project consensus. **Table 7.2** presents the PEC meeting schedule and topics of discussion.

PEC - January 28, 2014

Comments on the 2004 LPA and the Refinement Options

- Mayor Regalado stated that the City of Miami prefers use of the MacArthur Causeway over the Julia Tuttle Causeway; the MacArthur Causeway has attractions that Julia Tuttle Causeway does not have. Improvements are also planned for Watson Island (Heliport, Chalks, and Jungle Island).
- Mayor Gimenez recommended keeping it simple with a straight two-way line that would be a low-cost starter system. He likes the Washington Avenue alignment as a single two-way line.
- Mayor Gimenez recommended that this project connect to Government Center where transfers to Metrorail, Metromover, Metrobus Terminal and All Aboard Florida can occur.
- Exclusive right-of-way or travel lanes is preferred to avoid mixing transit vehicles with general traffic.
- The Beach prefers some circulation in either the form of a two-way loop or two lines.
- Commissioner Moss supports the MacArthur Causeway and stated that it provides a great view of downtown Miami, Biscayne Bay and the cruise ships.
- The committee was undecided regarding the removal of on-street parking although they agreed that the project should operate on exclusive right-of-way or lanes.
- The committee suggested that right-of-way impacts and costs should be avoided and minimized where required.
- In terms of the markets, the objective should be to serve all markets as best as possible. The MacArthur Causeway route does this best.
- The project should be phased; therefore, future extensions should be facilitated by the first phase.

POLICY EXECUTIVE COMMITTEE (PEC)

Agency/Organization	Member Name
Miami-Dade County	Mayor Carlos Gimenez (Chair)
City of Miami	Mayor Tomas Regalado
City of Miami Beach	Mayor Philip Levine
Miami-Dade County	Commissioner Bruno Barreiro
Miami-Dade County	Commissioner Xavier Suarez

TABLE 7.2: POLICY EXECUTIVE COMMITTEE (PEC) MEETING LIST

Meeting Date	Topics of Discussion
January 28, 2014	• Description of 2004 MPO Adopted LPA Alignments, Mode, and Cost/Funding Sources) • Refinement Options to LPA (Downtown, South Beach, and Future Extensions)
April 2, 2014	• LRT/ Modern Streetcar Overview • Review of LPA Refinements and Extensions (Alignments and Typical Sections) • Conceptual Cost Estimates Review (Capital and Operating / Maintenance Costs) • TIGER Grant Application
July 8, 2014	• Presentation of Refined “Hybrid” Option • Assessment of Off-wire Technology • Financial Analysis Including Funding Scenarios, Revenue Sources and Alternative Project Delivery Approaches • TIGER Grant Status
March 31, 2015	• Study Results, Implementation Plan, and Next Steps

PEC - April 2, 2014

Comments on LPA Refinements and Extensions

- Commissioner Suarez suggested the Direct Connection (DC) option in Downtown is best and to rely on the existing Metromover as the circulation loop.
- Mayor Gimenez did not want to create additional impacts along Biscayne Boulevard, adding cost to the project. He mentioned coming across NW 11th Street as an option to avoid Biscayne Boulevard.
- Mayor Gimenez stated that in-street running in a mixed traffic lane is not a form of rapid transit. He said that this system must operate on dedicated right-of-way or transit only lane to have reliability and speed.

Comments on Conceptual Cost Estimates

- Mayor Levine said he wanted a state-of-the-art system that is best for all. He is open to all options at this time and wants to see what the financing plan shows.
- Mayor Gimenez calculated that the cost of the Direct Connect (DC) option was approximately $52 million per mile and that this was much less than heavy rail.
- Mayor Gimenez said that he was very interested in a concession project delivery model to implement this project.

Comments on a Potential TIGER Grant Application

- Mayor Regalado stated that they were supportive of the study and the TIGER grant application but that it was difficult for the City of Miami to come up with $250K from their general funds.
- Mayor Levine stated that this will be a partnership of the two cities, the County, and FDOT and this was reiterated by Mayor Gimenez.

PEC - July 8, 2014

Comments on Funding Scenarios

- Commissioner Suarez said he would support a toll on the causeways if the residents and workers were treated similar to the Key Biscayne toll where they pay a reduced fee.
- Commissioner Suarez asked for simple low-cost stations to keep the costs down.
- They asked FDOT Secretary Gus Pego about State funding sources and their processes for funding this project.
- Overall, the committee liked the underground wire as a power source saying that it could be properly designed for operation in rain.
- The group supported county-wide and corridor specific funding sources excluding tolls on the causeways. They also supported some type of P3 arrangement.
- Mayor Regalado indicated that he did not want to see the maintenance facility adversely affect Overtown.

- Mayor Regalado was not willing to pay a share for the next phase of study. He recommended that study money be requested from the Community Redevelopment Agencies (CRA) or the Downtown Development Authority (DDA) to cover the City of Miami portion.
- Miami Beach will support funding the next phase of study with City Commission approval.

PEC – May 4, 2015

Conclusions on Study Results, Implementation Plan and Next Steps

- Confirmed that the recommended LRT/modern streetcar alignment moving forward into the next phase of study is the Direct Connection (DC) alternative that utilizes the MacArthur Causeway along with the Hybrid alignment along Alton Road as an option in Miami Beach. Additionally, determined that the City of Miami section to be studied in the next phase will include a northern extension of the LRT/modern streetcar alignment to the Design District.
- Recommended that the LRT/modern streetcar alignment will move forward as three phases or operating sections of implementation (instead of one) with the understanding that they will be advanced under a single, unified, and fully integrated transit system with the same technology. Determined that the three sections moving forward include Miami Beach, MacArthur Causeway and Miami.
- Recommended that the Miami Beach section Project Environmental Impact Report (PEIR) Study will be led by the City of Miami Beach, the Miami section PEIR Study will be led by the City of Miami, and the MacArthur Causeway section Environmental Impact Statement (EIS) Study, and unifying analysis and documentation will be led by FDOT. Determined that all three entities agreed to work together to develop a single, unified Beach Corridor transit system.
- Recommended that a Memorandum of Understanding (MOU) document will be developed as soon as possible by the three entities for organizing future work. In addition, FDOT will report back to the PEC within 90 days with a detailed implementation plan. This implementation plan will include study funding entities and commitments as well as other areas of agreement.
- Confirmed that the proposed integrated LRT/modern streetcar will operate bi-directionally (with two tracks) in exclusive right-of-way or exclusive transit lanes throughout.
- Confirmed that transit station locations and/or spacing will be developed per the revised DC and Hybrid options and the shelters will be kept as simple as possible to minimize costs and impacts.
- Confirmed that the proposed LRT/modern streetcar system will maximize the amount of off-wire technology considering all state-of-the-art vehicle propulsion technologies.
- Determined that local and other funding sources and/or financing mechanisms will be identified and agreed upon as necessary for each operating section as part of a unified funding and financing plan.
- Determined that the PEC will meet in one year to give additional direction on how the three phases or operating sections will proceed.

7.2 Stakeholder Presentations

Comments from the City of Miami Beach Transportation and Parking Committee Meeting - November 4, 2013

- Note potential for flooding with an in ground power source.
- Remove parking only if you allow the LRT/modern streetcar, buses, taxis and bikes to use the converted lane.
- There are many markets that would be served by the LPA alignment: Beach employees from Metrorail, and Beach residents that work in Downtown. It would capture both local and regional trips.
- Connect to Midtown and Brickell areas, and to new residential areas such as Edgewater and Little Haiti.
- Workers on Miami Beach cannot afford the cost of daily parking. A viable transit option should be given to them and they would use it.
- The circulator portion must have a low fare and tolls on the Causeways would not be equitable.
- Tolls, if used exclusively for transit, could be good.
- Look into development impact fees for all types of new development or redevelopment.
- Look to increasing the local option gas tax at the State level for funding. Use the gas tax for the capital and another source for O&M.
- Look at the Beach Corridor Transit Connection as the final connectivity for trips from Metrorail, Tri-Rail Coastal Link and All Aboard Florida intercity service. Need to have branded new vehicles and use the local trolleys and buses as the local circulators and feeders.

- Look at the resort tax, surtax, and car rental fees for funding.
- Consider tolls on the causeways with residential permits similar to the Venetian Causeway.
- Could offer a transit fare free zone on the Beach but could charge to cross the causeways as an option.
- Look into getting funding from the proposed new casinos.
- Do not recommend "free" no-fare transit service since this would attract homeless individuals.
- Consider express lanes only tolling on the causeways so that some lanes remain toll free.

Comments from the Miami-Dade Transportation and Parking Committee Meeting May 12, 2014

A presentation on the status of the study was made to this Committee and no comments were made.

Comments from the South Florida Regional Transportation Authority Planning Technical Advisory Committee Meeting – June 10, 2014

A presentation on the status of the study was made to this Committee and no comments were made.

Comments from the City of Miami Beach Commission Meeting – September 10, 2014

- Mayor Levine suggested that Bus Rapid Transit (BRT) could also be looked at in the next study phase.
- All but one Commissioner voted to continue the study.
- Concerns were voiced by the former Citizen Advisory Committee Chair about the *2004 Bay Link Study*.

8.0 IMPLEMENTATION STRATEGY

The Implementation Plan developed for the *2004 Bay Link Study* presented a project development process schedule consistent with FTA's planning process and the project priority established in the then-current *Miami-Dade MPO Long Range Transportation Plan* (LRTP). These assumptions supportive of a federal New Starts funding scenario have significantly changed. The Policy Executive Committee (PEC) and the Technical Steering Committee (TSC) for this 2014 the Beach Corridor Transit Connection Study have established the following project implementation preferences:

- Phased implementation to build the project "affordably" and by sections including Miami, Miami Beach, and the causeway.
- Primarily locally funded (non-New Starts funded) project to expedite delivery.
- Preparation of a NEPA document to facilitate the permitting processes.
- Public-private partnership (P3) project delivery method.

8.1 Phased Implementation

The Direct Connection (DC) alignment alternative was selected as the best initial corridor option. Extensions could be considered in the future as funding becomes available. The two study committees understand the importance of this transit connection to the future mobility, growth, and sustainability of Miami Beach and downtown Miami area. Realizing this potential means constructing, as quickly as possible, an affordable "first line" that links these two important and dynamic centers. The LPA for the *Bay Link Study* recommended two loops in downtown Miami and Miami Beach that provided more extensive circulation than the Refined LPA recommended in this study. However, this alignment alternative also offered service already provided by the Metromover. The TSC quickly pointed out that downtown Miami LRT/ modern streetcar service should facilitate direct transfers to Metromover and Metrorail stations but not replicate service. This resulted in eliminating any duplicative loops, shortening the alignment, and eliminating stations. The PEC focus was on developing the most direct connection between Government Center in downtown Miami and the Miami Beach Convention Center, which would not only reduce costs but also expedite delivery.

8.2 Locally Funded

The *2004 Bay Link Study* offered two scenarios: a 20-year "General Implementation Schedule" based on a completion date of 2023, as reflected in the then current Miami-Dade MPO LRTP; and a nine-year "Accelerated Implementation Schedule," following FTA's development process. This accelerated plan assumed all funding would be available.

Following the federal New Starts process would add approximately two or more years to project completion. For this reason, the PEC strongly recommended local and state (non-federal New Starts) funding for the first phase. A comparison of the benefits and drawbacks of a federal versus non-federal funding scenario was previously shown in **Table 6.5**.

8.3 Prepare Environmental Documents

The benefits to preparing an environmental document following National Environmental Policy Act (NEPA) requirements are two-fold. First, the preparation would oblige the permitting agencies to be involved, resulting in an expedited permitting processes. Based on the Draft Environmental Impact Statement (DEIS) prepared for the *2004 Bay Link Study*, permits or a memorandum of understanding will be required from the following:

- U.S. Environmental Protection Agency (National Pollutant Discharge Prevention and Elimination System permit)
- U.S. Coast Guard (Bridge permit)
- U.S. Army Corp of Engineers (Section 10 permit)
- State Historic Preservation Officer (Memorandum of Understanding)

The NEPA process is considered complete when a Record of Decision (ROD) is signed by the lead federal agency. A ROD is required for a project to move forward and a strong element for P3 consideration. Second, in the event that sufficient local funds are not secured to construct the project, applying for some type of federal funding would be facilitated with a NEPA document in hand. Additionally, following the federal NEPA process will not require the project to go through the federal New Starts process which is a specific federal grant program. The proposed approach will be to follow the federal NEPA process for the causeway section (EIS) and the state process (PEIR) in either city.

8.4 Public-Private Partnership (P3) Delivery Method

P3 agreements related to project delivery are contracts between a public agency and a private sector entity that result in greater private sector participation in the financing and delivery of public services and facilities than is normal under traditional procurement practices, taking advantage of the private sector's profit motive and market discipline.

Procuring transportation facilities and services through P3s has advantages over the traditional publicly financed approach. In P3s, the private partners are generally infrastructure equity investors and lenders, developers, and construction/engineering firms.

Common features of P3s include:

- Payments are only made when an asset is built and operational.
- Pre-established, periodic payments from public funds to private investors/concessionaire group can also be through "availability payments", which the concessionaire earns via its ability to make the project available to the public at prescribed levels of service and/or contracted performance targets.
- Government costs are spread over the life of the asset.
- Public sector costs for the full project life-cycle are known upfront and fixed in the contract – often a minimum of 25 years.
- The private partner can be responsible not just for asset construction, but also asset performance for the length of the contract.
- P3s exist on a continuum of procurement options that are defined by the extent of risk transfer to the private party.

One specific P3 arrangement is known as Design-Build-Operate-Maintain (DBOM). Under DBOM, a project's implementing agency contracts with a private entity to construct the project and then operate and maintain it for a set period of time. In this type of arrangement, the user fees act as a return on the private entity's investment in the project. Examples of P3s in the form of DBOMs in the Florida region include the recently opened Port of Miami Tunnel Project (15-year owner financing).

Potential Advantages of DBOM:

- Cost-certainty for the life of contract for public sector (subject to inflation).
- Cost savings from a life-cycle approach to project development that integrates design, construction and operations.
- Time savings in project implementation.
- No recourse for project financiers to the public sector; the risks of cost overruns fall onto those financing the project.
- Attracts global leaders in project development and operations; the size of a decades-long opportunity can attract the top developers and operators from around the world that shorter contracts would not.
- Places performance risks onto the private party, meaning that they need to fund (and assume risk on) any required remediation or rehabilitation of assets, in performance-based contracts. As a relatively new mode, this is particularly important if the use of off-wire technology for the LRT/modern streetcar system is specified.

- Requires proactive and integrated asset management for the private sector to be profitable and can be strongly incentivized by the contract.
- Available state-specific experience; Florida has a P3 framework and standardized contractual structure and history of successful P3s.

Potential Disadvantages of DBOM:

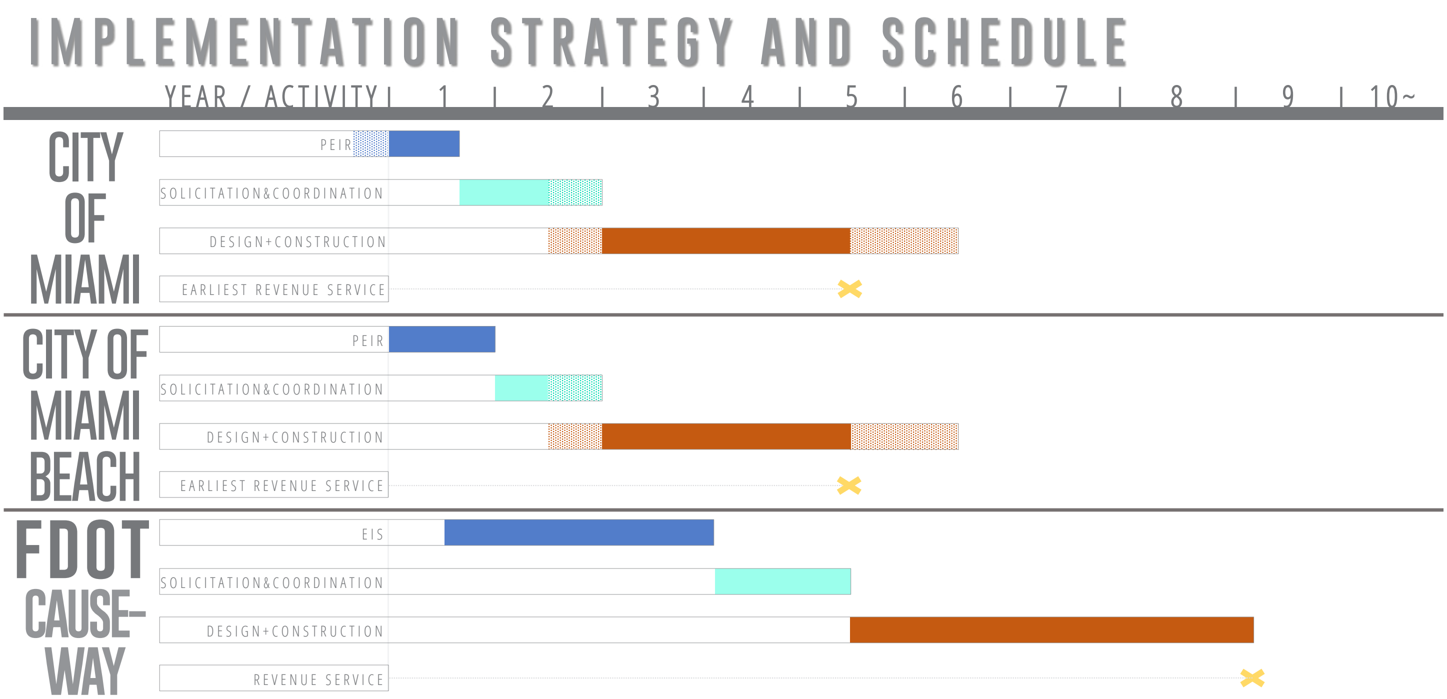
- Some loss of operational flexibility; the performance standards are fixed at the outset of the project and need to be renegotiated if significant changes are sought.
- Financing costs can be higher than publicly-issued debt, although there is no recourse to agency or county funds if project costs are higher than expected.
- Can reduce the opportunities for smaller local businesses to engage in opportunities unless mandated by the partnership contract.
- Limits the ability to define particular processes to accomplish outcomes because of the "performance-based" approach used for P3s. If specific processes are required in some instances for legal or regulatory reasons, then they can be accommodated.

If DBOM were pursued, the project sponsor would be required to secure environmental approvals, secure the right-of-way, and the other actions that rely on legal powers that cannot be delegated to private parties. The private partner would typically take responsibility for all aspects of construction and operations of the civil infrastructure. The implementation process following a P3/DBOM approach described is shown in **Figure 8.1**. This figure illustrates the proposed approach which includes three project sections advancing simultaneously that will have a coordinated and unified solicitation process.

8.5 Next Steps

- The Miami Dade MPO Board will have to endorse this project to move forward into the PEIR/EIS phase and beyond.
- The two City Commissions will have to endorse this project to move forward into the PEIR/EIS phase and beyond.
- Funding for the next phases needs to be secured and agency agreements will need to be developed and signed.

FIGURE 8.1: IMPLEMENTATION PROCESS



This chart represents the division strategy of project development and expected schedules between the two cities (City of Miami Beach & City of Miami) and the causeway, being done by FDOT, which connects them.

This schedule is contingent upon funding availability.

NOTE:
Assume start date Jan 2016
PEIR – Project Environmental Impact Report (State Process)
EIS – Environmental Impact Study (Federal Process)

APPENDIX A—MODERN STREETCAR SYSTEMS WITH OFF-WIRE SEGMENTS IN SERVICE OR UNDER CONSTRUCTION

TABLE A.1: MODERN STREETCAR SYSTEMS WITH OFF-W

City	Year	Length (of off-wire segments)	Supplier
Ground Level Power Supply			
Bordeaux, France	2003	14 km total segments of 44 km system	Alstom
Naples, Italy	2010	0.6 km test track	Breda
Angers, France	2011	1.5 km segment of total 12 km lines	Alstom
Reims, France	2011	2 km segment of total 12 km lines	Alstom
Augsburg, Germany	2011	0.8 km test track	Bombardier
Orleans, France	2012	2.1 km segment of total 12 km lines	Alstom
Tours, France	2013	2 km segment of total 15 km lines	Alstom
Dubai, UAE	2014	9.5 km (full system)	Alstom
Zhuhai, China	2015	8.7 km (full length of Line 1 of Zhuhai system)	Breda
Beijing, China	2015	Xijiao Line of Beijing system. 4 km of GLPS of total 9.4 km line.	Breda
Cuenca, Ecuador	2016	2 km segment of total 10 km line	Alstom
Lusail, Qatar	2018	19 km segment of 33 km 4-line network Note: catenary used for 7 km underground segments.	Alstom
Extended Range Off-Wire			
Nice, France	2007	0.9 km total line segments	Alstom
Seville, Spain	2011	0.6 km line segment of 2.2 km line	CAF
Zaragoza, Spain	2013	2 km off-wire segment of 12.8 km line, charging at stops	CAF
Shenyang, China	2013	Segments totalling 2.5 km (of total 64 km on 4 lines). Wireless segments are 80 - 240 m long. 700 m segment being converted to OCS in 2014.	CNR Changchun
Dallas, Texas	2014	1.6 km of 2.6 km line	Brookville
Kaohsiung, Taiwan	2014	22 km, 36 stops. Charging at stops	CAF
Nanjing, China	2014	Total 17 km. OCS only at stops and acceleration points	CSR Puzhen
Seattle, WA	2014	4 km Seattle First-Hill streetcar will have OCS on uphill track only	Inekon
Guangzhou, China	2014	First 7.7 km segment of Haizhu circle line, 10 stops. Off-wire operation except at stops?	CSR ZELC
Doha, Qatar	2015	11.5 km, 25 stations. Charging at stations	Siemens
Santos, Brazil	2015	11 km line, 0.4 km off-wire vehicle range	Vossloh
Detroit, MI	2016	segments (length tbd) of 5.1 km line	tbd (selection process underway)
Konya, Turkey	2015	new tram line with 1.8 km off-wire section	
Granada, Spain	tbd	4 segments totalling 4.95 km of 15.9 km line	CAF
Budapest, Hungary	tbd	BKK plans to remove wire on Kossuth ter, surrounding the Parliament building.	CAF

IRE SEGMENTS IN SERVICE OR UNDER CONSTRUCTION

Proto-type	Under Contract	In Service	Notes 1	Notes 2
		X	Alstom APS ground contact system	
X			"Tramwave" ground contact system	
		X	Alstom APS ground contact system	17 vehicles
		X	Alstom APS ground contact system	18 vehicles
X			Inductive system "Primove"	Also trials with buses
		X	Alstom APS ground contact system	21 vehicles (33 m length)
		X	Alstom APS ground contact system	21 vehicles (43 m length)
	X		Alstom APS ground contact system	11 vehicles (43 m length)
	X		"Tramwave" ground contact system	12 vehicles 32 m, 5-section
	X		"Tramwave" ground contact system	31 vehicles, 5-section
	X		Alstom APS ground contact system	14 vehicles. UNESCO world heritage listed town center
	X		Alstom APS ground contact system	35 vehicles (32 m length)
		X	Ni-MH battery	20 vehicles
		X	"ACR" Battery / supercap.	7 vehicles
		X	"ACR" Battery / supercap.	21 vehicles
		X	Supercap	30 vehicles using Voith drive technology. First 3 of 6 lines opened 2013.
	X		Battery (Li-Ion)	Dallas Oak Cliff streetcar, 2 vehicles
	X		"ACR" Battery / supercap.	9 vehicles
	X		Battery (Li-Ion)	15 vehicles using licensed Bombardier technology.
	X		Battery (Li-Ion)	6 vehicles
	X		Supercap	7 vehicles using licensed Siemens technology.
	X		Battery (Ni-MH) / supercap	19 vehicles,
	X		Battery	22 vehicles
	X		tbd	6 vehicles
	X			12 vehicles, ForCity Classic
	X		"ACR" Battery / supercap.	13 vehicles
	X		"ACR" Battery / supercap.	Budapest 2013 order includes 25 32-36m long cars capable of off-wire operation. BKK plans to remove wire on Kossuth ter, surrounding the Parliament building.

City	Year	Length (of off-wire segments)	Supplier
Demonstrator Vehicles			
Alstom	2005	Flywheel installed on production tram for tests	
Kawasaki	2007	prototype vehicle	
RTRI Japan	2007	prototype vehicle	
Kinkisharyo	2011	prototype vehicle	
Stadler	2011	ESS installed on production tram for tests	
Hyundai Rotem / KRRI	2012	prototype vehicle	
Skoda	2014	ESS installed on production tram for tests	
Brazil	2015	prototype vehicle	Bom Sinal

Proto-type	Under Contract	In Service	Notes 1	Notes 2
X			Flywheel	
X			Battery (Ni-MH)	Demonstrator vehicle completed 2007, trialed in Sapporo, Japan
X			Battery (Li-Ion)	Prototype vehicle completed 2007, trialed in Sapporo, Japan 2007-08
X			Battery (Li-Ion)	Demonstrator vehicle operated in several US cities 2011
X			Battery (Li-Ion)	Extended range off-wire prototype installation using Battery (Li-Ion) in Germany
X			Battery (Li-Ion)	Prototype vehicle developed 2007-2012 with Korea Railroad Research Institute
X			Battery (nano-lithium-titanium)	
	in dev	X	Battery	Prototype vehicle in development, due 2015


BREAKWATER
BREAKWATER
BREAKWATER

APPENDIX B—TSC RESULTS OF PREFERENCES QUESTIONNAIRE

TABLE B.1: TSC RESULTS OF PREFERENCES QUESTIONNAIRE

Questions	Total Participants = 15	
1. Should the preferred alignment serve Many activity centers or traverse the corridor quickly (Multiple Choice)	Responses	
	Percent	Count
Serve many centers	6.67%	1
↓	6.67%	1
–	20.00%	3
↑	53.33%	8
Minimize travel distance	13.33%	2
Totals	**100%**	**15**
2. Should the preferred alternative operate in Mixed Traffic vs Exclusive Guideway	Responses	
	Percent	Count
Increase travel time	0.00%	0
↓	6.67%	1
–	0.00%	0
↑	26.67%	4
Maximize speed and reliability	66.67%	10
Totals	**100%**	**15**
3. No Direct Connections vs Direct Connections to Premium Transit (Multiple Choice)	Responses	
	Percent	Count
No connections	0.00%	0
↓	0.00%	0
–	6.67%	1
↑	13.33%	2
Connect with Metrorail and Mover	80.00%	12
Totals	**100%**	**15**
4. Replicate Existing Transit vs Serve areas with no Premium Transit (Multiple Choice)	Responses	
	Percent	Count
Operates adjacent to premium transit service	6.67%	1
↓	0.00%	0
–	26.67%	4
↑	33.33%	5
Minimize travel distance	33.33%	5
Totals	**100%**	**15**
5. Primarily Serves Local Destinations vs Serves Regional Destinations (Multiple Choice)	Responses	
	Percent	Count
Does not connect with major Regional Destinations	0.00%	0
↓	13.33%	2
–	26.67%	4
↑	20.00%	3
Directly serves areas of high activity	40.00%	6
Totals	**100%**	**15**

Questions	Total Participants = 15	
6. 6. Extensions Constrained vs Future Possible Extensions (Multiple Choice)	Responses	
	Percent	Count
Ability to extend is constrained	0.00%	0
↓	0.00%	0
–	7.14%	1
↑	21.43%	3
Configured to facilitate future extensions	71.43%	10
Totals	**100%**	**14**
7. Limited Ability to Extend Service vs Accommodates Futures Extensions (Multiple Choice)	Responses	
	Percent	Count
Alignment limits ability to logically extend service	0.00%	0
↓	0.00%	0
–	14.29%	2
↑	7.14%	1
Alignment accommodates extensions logically	78.57%	11
Totals	**100%**	**14**
8. Loops vs No Loops (Multiple Choice)	Responses	
	Percent	Count
Alignment relies on loops to cover service area	23.08%	3
↓	0.00%	0
–	30.77%	4
↑	7.69%	1
Alignment is configured for two way operation	38.46%	5
Totals	**100%**	**13**
9. Large Loops vs Small Loops (Multiple Choice)	Responses	
	Percent	Count
Large loops with widely spaced legs	42.86%	6
↓	7.14%	1
–	28.57%	4
↑	7.14%	1
Small loops with closely spaced legs	14.29%	2
Totals	**100%**	**14**
10. Multiple Lines vs One Line (Multiple Choice)	Responses	
	Percent	Count
Alignment is configured with multiple lines to cover the service area	26.67%	4
↓	13.33%	2
–	20.00%	3
↑	20.00%	3
Alignment is configured as a single line	20.00%	3
Totals	**100%**	**15**

Questions	Total Participants = 15	
11. One-Way Pairs vs Bi-Directional Single Street (Multiple Choice)	Responses	
	Percent	Count
Alignment operates on adjacent one-way streets	35.71%	5
↓	7.14%	1
–	21.43%	3
↑	0.00%	0
Alignment operates two-way on a single street	35.71%	5
Totals	**100%**	**14**
12. Avoidance of Right-of-Way Impacts (Multiple Choice)	Responses	
	Percent	Count
Alignment requires corner clips and small ROW acquisitions	20.00%	3
↓	6.67%	1
–	26.67%	4
↑	26.67%	4
Avoids ROW acquisitions	20.00%	3
Totals	**100%**	**15**
13. Impacts on Street Parking (Multiple Choice)	Responses	
	Percent	Count
Alignment requires eliminating street parking	26.67%	4
↓	6.67%	1
–	40.00%	6
↑	0.00%	0
Avoids eliminating existing parking	26.67%	4
Totals	**100%**	**15**
14. Maintain Directional Flow (Multiple Choice)	Responses	
	Percent	Count
Streetcars would run contra-flow	7.14%	1
↓	0.00%	0
–	35.71%	5
↑	14.29%	2
Streetcars would run in same direction as traffic	42.86%	6
Totals	**100%**	**14**
15. Impacts on General Traffic (Multiple Choice)	Responses	
	Percent	Count
Converts existing travel lanes to exclusive or semi-exclusive transit use	28.57%	4
↓	21.43%	3
–	14.29%	2
↑	14.29%	2
Avoids reducing auto lanes	21.43%	3
Totals	**100%**	**14**

Questions	Total Participants = 15	
16. Visitor Service vs Traditional (Multiple Choice)	**Responses**	
	Percent	**Count**
Service oriented to serve visitors and tourists	0.00%	0
↓	14.29%	2
–	64.29%	9
↑	14.29%	2
Serves traditional home-to-work trips	7.14%	1
Totals	**100%**	**14**
17. High Trip Generating Businesses (Multiple Choice)	**Responses**	
	Percent	**Count**
Alignment serves low trip generating businesses	6.67%	1
↓	0.00%	0
–	13.33%	2
↑	33.33%	5
Alignment serves high trip generating businesses	46.67%	7
Totals	**100%**	**15**
18. Dense Residential and Mixed-Use Communities (Multiple Choice)	**Responses**	
	Percent	**Count**
Alignment serves low density residential areas	0.00%	0
↓	0.00%	0
–	7.14%	1
↑	21.43%	3
Alignment serves high density residential and mixed-use areas	71.43%	10
Totals	**100%**	**14**
19. Miles of Track and Number of Stations (Multiple Choice)	**Responses**	
	Percent	**Count**
Longer length and more stations increase costs	20.00%	3
↓	0.00%	0
–	46.67%	7
↑	13.33%	2
Shorter length and fewer stations reduce costs	20.00%	3
Totals	**100%**	**15**
20. MIA connection (Multiple Choice)	**Responses**	
	Percent	**Count**
Direct service to MIA not provided	46.67%	7
↓	6.67%	1
–	6.67%	1
↑	13.33%	2
Service to MIA through direct service or transfers provided	26.67%	4
Totals	**100%**	**15**

Questions	Total Participants = 15	
21. Ridership Potential (Multiple Choice)	Responses	
	Percent	Count
Limited potential for significant ridership	13.33%	2
↓	0.00%	0
–	0.00%	0
↑	6.67%	1
Potential for relatively high ridership	80.00%	12
Totals	**100%**	**15**