TPO

Miami-Dade Transportation Planning Organization

TPO WO-VII-38 EMERGING TUNNELING TECHNOLOGIES FEASIBILITY STUDY

February 2022

Table of Contents

List of Tables

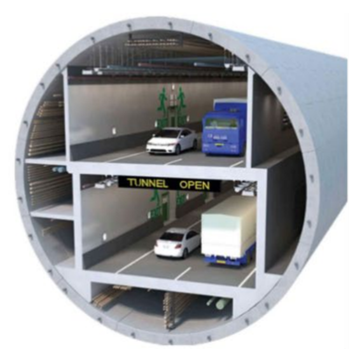
List of Figures

Executive Summary

This study evaluated emerging tunnel technology to assess the implementation of transit tunnel corridors in Miami-Dade County. The tunnels are intended to accommodate public transportation via electric multi-passenger transit vehicles for the advancement of mobility options in Miami-Dade County. The tunnels are proposed for use by transit vehicles to accommodate a range of up to 60 passengers per vehicle. In general terms, the methods that are used today to construct tunnels can be broadly categorized as:

- Sequential excavation method by conventional means (SEM, drill, and blast etc.)
- Excavation by Tunnel Boring Machine (TBM)
- Cut-and-cover
- Pipe jacking
- Jacked box tunneling

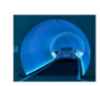
Among all methods, tunnel construction by TBM is often the preferred tunneling method for its ability to cause the least amount (if any) of surface disruption. See examples below of tunnels with varying dimensions.



SR-99
Alaskan Way Viaduct
(57 ')

Parallel Thimble
Shoal Tunnel
(42')

Zurich Airport
Skymetro
(20.5')



Las Vegas Convention
Center Loop
(14')

This study utilized a tiered level analysis using the process illustrated in below. The study documents the results of the Tier 1 and Tier 2 levels analysis and identified the next steps to be addressed in Tier 3.

Tier 1

Initial Transit Tunnel Corridors

- **Base Network -** Long Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Previous Studies, Other Corridors
- **Criteria -** Coverage – service to population and employment hubs, Connection to existing transit systems, Environmental Justice – service to potentially underserved communities, Efficiency – provide most direct route between areas

Tier 2

Potential Transit Tunnel Corridors

- **Base Network -** 25 Corridors from Tier 1 Level Analysis
- **Criteria** – Cost (Estimated Capital Cost), Land-Use (Transit Supportive Land Use, Community Redevelopment Areas, Access to Major Activity Centers), Mobility (Projected Daily Traffic Volume, Projected Ridership, Connects to SMART Plan Corridor, Connects to Existing/Proposed Rail Stations), Technical (Interface with Underground Utilities, Crosses Under Water, Constructability (Routing and MOT))

Tier 3

Transit Tunnel Corridor Development

- **Base Network -** 8 Corridors from Tier 2 Level Analysis
- **Next Steps -** Partner Coordination, Vehicle Identification and Specification/Envelope, Tunnel Sizing from Space-Proofing Analysis for Specific Vehicle Envelope, Fire and Life Safety Design Criteria, Subterranean Rights, Land-Use Policies to Support Transit, Transit Service Plan (alignment, stations, frequency, service span), Ridership Estimates, Operating and Maintenance Plan, Capital Cost Estimate, Environmental Permitting, Public Involvement, Financial Plan, Inter-agency Agreements

The Tier 1 level screening analysis resulted in the identification of two Strategic Miami Area Rapid Transit (SMART) Plan corridors and six Long Range Transportation Plan (LRTP) priority corridors for potential tunnel application as demonstrated below and illustrated on Table 1.

Table 1: Tier 1 Level Potential Corridor Identification

Corridor Number	Tier 1 Potential Transit Tunnel Corridors		Tier 2 Potential Transit Tunnel Corridors
	Description	Length (miles)	
1	Aventura Brightline Station to Sunny Isles	2.4	
2	Golden Glades to Sunny Isles	6	
3	Opa-locka to Miami Lakes	4.6	
4	Metrorail Transfer Station to Collins Avenue	8.8	
5	Miami Central to PortMiami	1.3	LRTP Priority Corridor
6	Brickell Avenue to FTX Arena	1.2	
7	FTX Arena to Design District	2.5	LRTP Priority Corridor
8	Miami Central to Design District	2.8	LRTP Priority Corridor
9	Design District/ Magic City Loop	4.4	
10	Miami Intermodal Center to Wynwood	4.1	
11	Overtown Connector	1	LRTP Priority Corridor
12	Miami Intermodal Center to Miami Central	4.9	
13	Magic City Casino to Douglas Road	3.2	LRTP Priority Corridor
14	Gables Connector	4.1	
15	Douglas Road Metrorail Station to Coconut Grove	1.1	
16	Douglas Road Metrorail Station to Coral Gables City Hall	1.6	
17	Ludlum Corridor	10.9	LRTP Priority Corridor
18	Flagler Corridor	7	SMART Plan Corridor
19	Downtown Doral to Miami International Airport	6.5	
20	Downtown Doral to East-West NW 87 Street Station	1.9	
21	Dolphin Terminal to East-West NW 107 Avenue Station	1.6	
22	East-West NW 107 Avenue Station to Florida International University	2.4	
23	South Miami Metrorail Station to Tropical Park	4.4	
24	University Metrorail Station to University of Miami	2.5	
25	Kendall Corridor - Dadeland South Metrorail Station to Baptist West	9.3	SMART Plan Corridor

The tunnel system proposed and evaluated in this study is based on operation of a closed system of tunnels, open only to publicly operated or publicly contracted electric vehicles for transit purposes. The system would be accessible via stations located at street-level approximately one mile apart, with an open platform underground for vehicle distribution and transfer between transit routes. The underground platforms would also be used for fire and life safety emergency vehicles to access the tunnel and for evacuation purposes. In addition, and following the requirements of National Fire Prevention Association, a combination of emergency egress shafts and cross-passageways or connection between the two running tunnels will be provided between stations. The cross-passageways will facilitate access between the two tunnels and strategically placed at a maximum spacing that allows motorists/riders to escape to an exit in an acceptable time-frame. Other emergency egress shafts would be included in accordance with specific design criteria. The tunnels would also be equipped with exhaust/ventilation fans.

For the purposes of this study, small diameter tunnels and large diameter tunnels were reviewed for use by electric transit vehicles. The small diameter tunnel was based solely on the Las Vegas Convention Center (LVCC) Loop. The large diameter tunnel was develop based on accommodating an electric bus. Overall tunnel characteristics by typical sections were obtained from research and should be further verified through a space-proofing analysis based on specific vehicle envelope and applied to Miami-Dade County conditions.

The characteristics of small diameter tunnels and large diameter tunnels are summarized in Table 2, described in detail in the following paragraphs, with Table 2 illustrating the typical sections.

Table 2: Overall Tunnel Characteristics

Small Diameter Tunnel (Las Vegas Convention Center)	Large Diameter Tunnel
Tunnel size 12-foot inside diameter	Tunnel size 24 to 27-foot inside diameter
Two side-by-side tunnels for two-way operation	Two side-by-side tunnels for two-way operation
Tunnel bottom approximately 40 feet below grade	Tunnel bottom approximately 52-55 feet below grade
Vehicles 6 to 7-passenger capacity	Vehicles 60-passengercapacity
At-grade stations with electric charging stations	Electric charging station at bus maintenance facility
Fire and safety, emergency egress, emergency vehicle access	Ventilation, fire and safety, emergency egress, emergency vehicle access

Small Diameter Tunnel (LVCC) - The smaller 12-foot inside diameter tunnel is provided as an example from The Boring Company, the tunnel boring company who constructed the Las Vegas Convention Center (LVCC) Loop. **This tunnel profile is provided as-is, as an example of an existing application and should be further evaluated for application in Miami-Dade County and for accordance with established roadway geometrics standards (i.e., AASHTO, APTA or NFPA).** The dimensions shown are approximate and inferred based on information publicly available. The dimensions indicated are approximate and not based on detailed segmental lining or finished tunnel dimensions for the LVCC Loop.

Large Diameter Tunnels - A 24-foot inside diameter single lane, electric bus tunnel is a rough possible layout considering the roadway geometrics guidelines of the American Public Transportation Association in addition to an AASHTO conformant alternative. The dimensions in Figure 2 are based on the American Public Transit Association (APTA) model for Bus Rapid Transit (BRT).

For both cases small and large diameter tunnels, a depth of 1.5 to 2 times the tunnel outer diameter, is indicated as typical minimum required which can vary from case to case.

The study concludes by identifying next steps for implementing transit tunnel corridors profiled in this report. The recommended next steps include extensive coordination with TPO Committees and partner agencies, identification of the specific vehicles that will use the tunnel, space-proofing analysis to determine the appropriate tunnel size to accommodate the identified vehicle, development of life and safety design criteria, development of engineering concept, development of design criteria including fire and life safety requirements and development of an extensive public input strategy.

The finished LVCC Loop tunnel is shown in Figure 3. Figure 4 and Figure 5 illustrate the small diameter Earth Pressure Balance Machines (EPB) used to construct the LVCC Loop tunnels.

In conclusion, Emerging Tunneling Technologies show potential to increase speed and reliability by providing dedicated and unobstructed exclusive lanes for transit only vehicles.

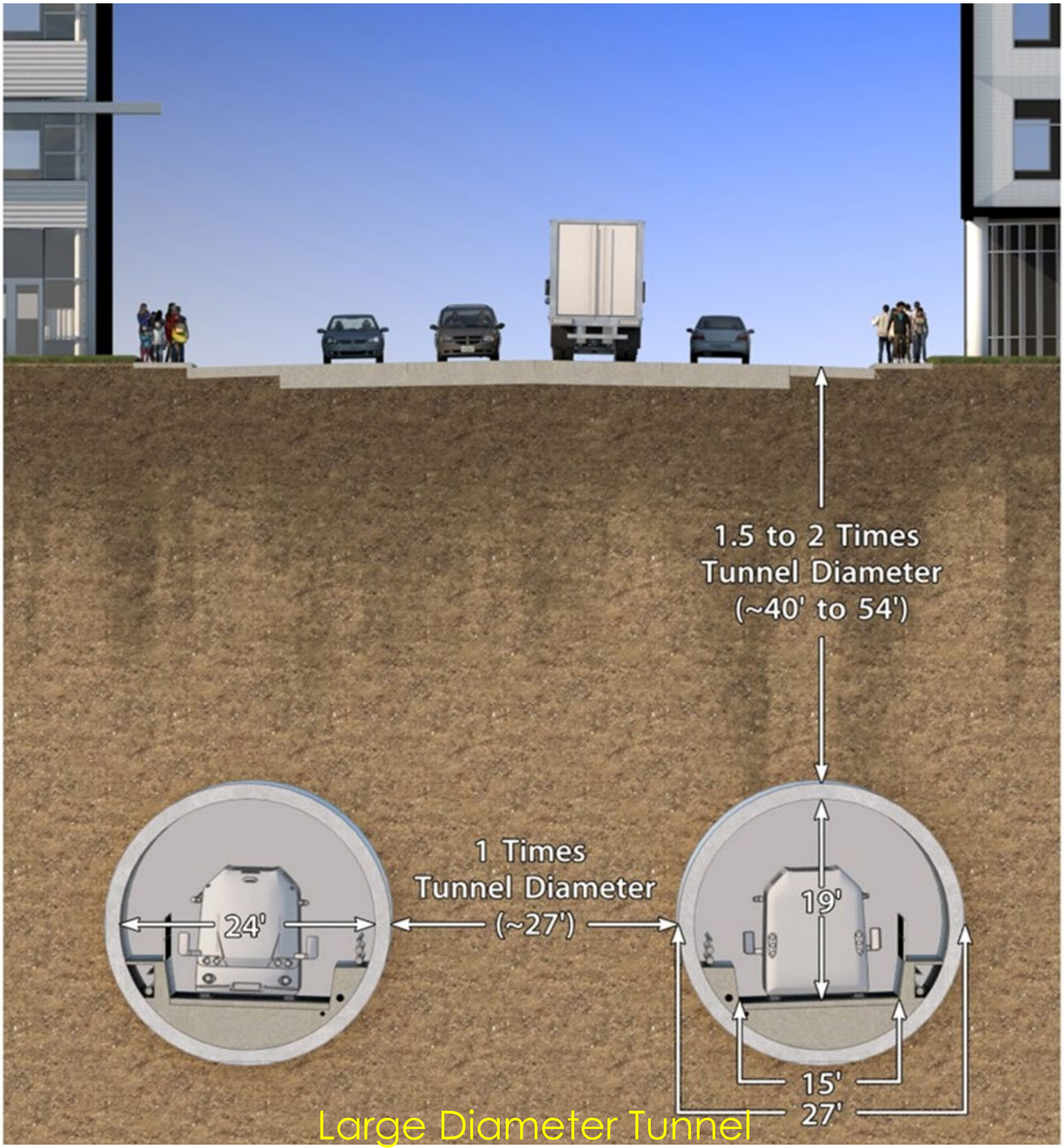
High level next steps include:

- Engineering concept development on selected corridors to develop cost estimates based on localized data.
- Estimated ridership verification based on refined operating plan and service frequency.
- Land-use policy development to support the system.
- Extensive TPO Committee and partner agency coordination.
- Design criteria development including fire and safety requirements.

Figure 1: Transit Tunnel Cross Section - Small Diameter Tunnel

Dimensions shown are approximate and inferred based on information publicly available. The dimensions indicated are approximate and not based on detailed segmental lining or finished tunnel dimensions for the LVCC Loop.

Figure 2: Transit Tunnel Cross Section - Large Diameter Tunnel



Based on roadway geometrics guidelines of the American Public Transportation Association in addition to an AASHTO conformant alternative

Figure 3: A Tesla automated electric vehicle inside the LVCC Loop (LVCC, 2021)

Figure 4: The EPB shield in one of the portal cut excavations (reviewjournal.com,2020)

Figure 5: The frontal shield of the EPB transportation to the LVCC portal site (TBC, 2019)

Page Intentionally Left Blank

1. Introduction

The purpose of this study is to evaluate emerging transit tunnel technologies and identify potential corridors in Miami-Dade County in which these emerging transit tunnel technology could be implemented to improve mobility in the region. A tiered analysis was used to screen potential transit tunnel corridors within Miami-Dade County based on a comprehensive review of the current Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Strategic Miami Area Rapid Transit (SMART) Plan, and previous TPO studies.

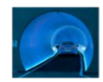
Potential transit tunnel corridors identified in Tier 1 were screened in Tier 2, based on a set of criteria for the future underground system, taking into consideration LRTP priorities, existing and future transit systems, land use, and activity centers. Tier 3 level analysis consists of further planning and design identified in the next steps section of this report.

2. Tunneling Technologies Characteristics

This study evaluated emerging tunnel technology to assess the implementation of transit tunnel corridors in Miami-Dade County. The tunnels are intended to accommodate public transportation via electric multi-passenger transit vehicles for the advancement of mobility options in Miami-Dade County. The tunnels are proposed for use by transit vehicles to accommodate a range of up to 60 passengers per vehicle. In general terms, the methods that are used today to construct tunnels can be broadly categorized as:

- Sequential excavation method by conventional means (SEM, drill, and blast etc.)
- Excavation by Tunnel Boring Machine (TBM)
- Cut-and-cover
- Pipe jacking
- Jacked box tunneling

Among all methods, tunnel construction by TBM is often the preferred tunneling method for its ability to cause the least amount (if any) of surface disruption See examples below of tunnels with varying dimensions.



SR-99
Alaskan Way Viaduct
(57 ‘)

Parallel Thimble
Shoal Tunnel
(42‘)

Zurich Airport
Skymetro
(20.5‘)

Las Vegas Convention
Center Loop
(14‘)

The tunnel system proposed and evaluated in this study is based on operation of a closed system of tunnels, open only to publicly operated or publicly contracted electric vehicles for transit purposes. The system would be accessible via stations located at street-level approximately one mile apart, with an open platform underground for vehicle distribution and transfer between transit routes. The underground platforms would also be used for fire and life safety emergency vehicles to access the tunnel and for evacuation purposes. In addition, and following the requirements of National Fire Prevention Association, a combination of emergency egress shafts and cross-passageways or connection between the two running tunnels will be provided between stations. The cross-passageways will facilitate access between the two tunnels and strategically placed at a maximum spacing that allows motorists/riders to escape to an exit in an acceptable time-frame. Other emergency egress shafts would be included in accordance with specific design criteria. The tunnels would also be equipped with exhaust/ventilation fans.

For the purposes of this study, small diameter tunnels and large diameter tunnels were reviewed for use by electric transit vehicles. The small diameter tunnel was based solely on the Las Vegas Convention Center (LVCC) Loop. The large diameter tunnel was develop based on accommodating an electric bus. Overall tunnel characteristics by typical sections were obtained from research and should be further verified through a space-proofing analysis based on specific vehicle envelope and applied to Miami-Dade County conditions.

The following sections describe the ancillary infrastructure that should be considered when developing a conceptual underground transit tunnel alignment in Miami-Dade County.

These considerations include operational and physical characteristics necessary for an underground transit tunnel service.

2.1 Ancillary Infrastructure Considerations – Small Diameter Tunnel (LVCC)

As a peer underground tunnel transit system, the characteristics of the Las Vegas Convention Center (LVCC) Loop were used to identify ancillary facilities for a small diameter transit tunnel. The following considerations should be incorporated into infrastructure and system design.

2.1.1 Maximum Operating Speed

Current LVCC Loop tunnel speed limits are set at 10 mph at the stations and at 40 mph in straight tunnels. Because the proposed Miami-Dade County transit tunnel system also is a two-tunnel system like the LVCC Loop, similar speed limits are anticipated at 10 mph at the stations and at 40 mph in straight tunnels.

However, operating speed is tied to the geometry and conditions of the alignment and may vary from the LVCC Loop example when applied to Miami-Dade conditions.

2.1.2 Horizontal Envelope

Based on the dimension of the LVCC Loop, the transit tunnel is bored approximately 40 feet (bottom of tunnel) below grade with a horizontal envelope of 12 feet inside tunnel diameter, 13.5 feet outside tunnel diameter tunnel envelope. An envelope 9 feet wide by 12 feet high is used for the vehicle. This envelope is based the envelope of automated people mover (APM) vehicles and commonly applied by design engineers to accommodate vehicles within transit tunnels.

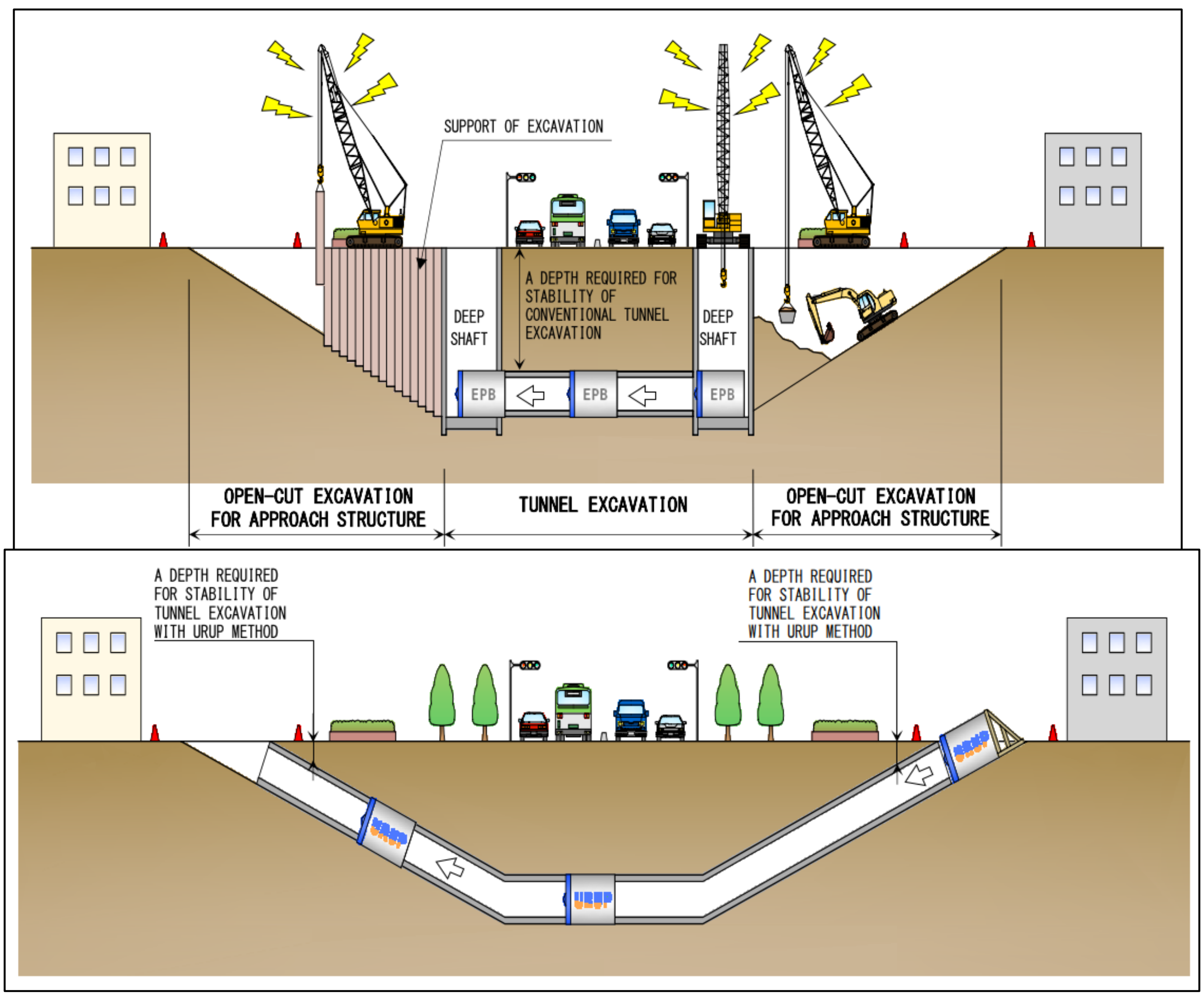
Because the Miami-Dade County transit tunnel system would operate in urban conditions and under utilities like the LVCC Loop, the dimensions of the LVCC Loop transit tunnels provide a guide to the envelope of the transit tunnel.

Autonomous electric vehicles (AEVs) operate on a pavement surface constructed at the bottom of the transit tunnels as shown in Figure 6.

An example diagram of horizontal transit envelopes from the LVCC Loop is shown in Figure 7. URUP refers to Ultra Rapid Underpass in this figure, which shows two approaches to transit tunnel surface connections.

Figure 6: A Tesla AEV traveling inside the LVCC Tunnels (Source: LVCVA, 2021)

Figure 7: Schematic of the URUP method (Source: Mino, S. et al, 2010)



The characteristics of small diameter tunnels and large diameter tunnels are summarized in Table 3, described in detail in the following paragraphs, with Figure 8 and Figure 9 illustrating the typical sections.

Table 3: Overall Transit Tunnel Characteristics

Small Diameter Tunnel (LVCC)	Large Diameter Tunnel
Tunnel size 12-foot inside diameter	Tunnel size 24 to 27-foot inside diameter
Two side-by-side tunnels for two-way operation	Two side-by-side tunnels for two-way operation
Tunnel bottom approximately 40 feet below grade	Tunnel bottom approximately 52 to 55 feet below grade
Vehicles 6 to 7-passenger capacity	Vehicles 60-passenger capacity
At-grade stations with electric charging stations	Electric charging station at bus maintenance facility
Fire and safety, emergency egress, emergency vehicle access	Ventilation, fire and safety, emergency egress, emergency vehicle access

Small Diameter Tunnel (LVCC) - The smaller 12-foot inside diameter tunnel is provided as an example from The Boring Company, the tunnel boring company who constructed the Las Vegas Convention Center (LVCC) Loop. **This tunnel profile is provided as-is, as an example of an existing application and should be further evaluated for application in Miami-Dade County and for accordance with established roadway geometrics standards (i.e., AASHTO, APTA or NFPA).** The dimensions shown are approximate and inferred based on information publicly available. The dimensions indicated are approximate and not based on detailed segmental lining or finished tunnel dimensions for the LVCC Loop.

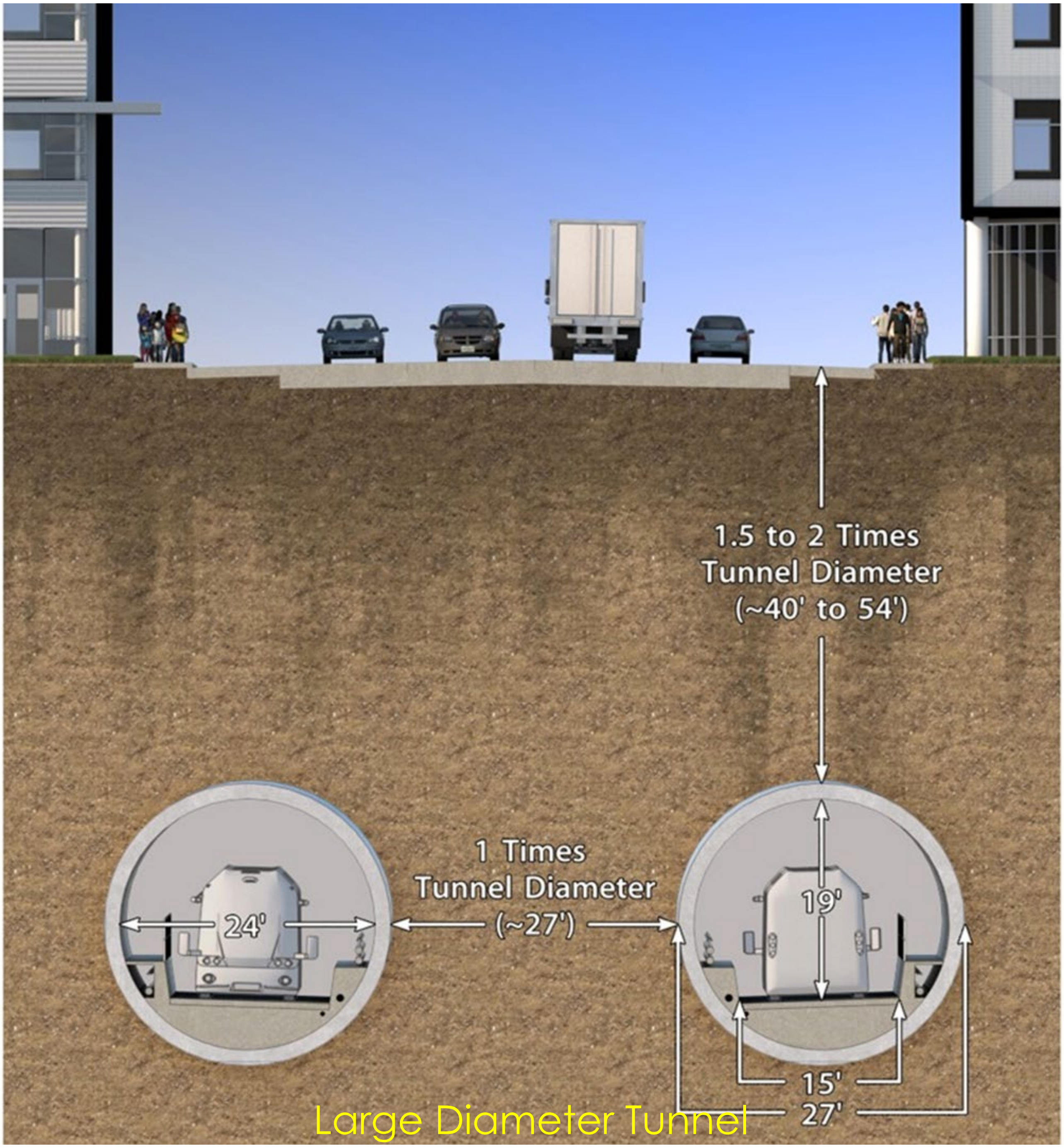
Large Diameter Tunnels - A 24-foot inside diameter single lane, electric bus tunnel is a rough possible layout considering the roadway geometrics guidelines of the American Public Transportation Association in addition to an AASHTO conformant alternative. Figure 9 is based on the American Public Transit Association (APTA) model for Bus Rapid Transit (BRT).

For both cases small and large diameter tunnels, a depth of 1.5 to 2 times the tunnel outer diameter, is indicated as typical minimum required which can vary from case to case.

Figure 8: Transit Tunnel Cross Section - Small Diameter Tunnel

Dimensions shown are approximate and inferred based on information publicly available. The dimensions indicated are approximate and not based on detailed segmental lining or finished tunnel dimensions for the LVCC Loop.

Figure 9: Transit Tunnel Cross Section - Large Diameter Tunnel



Based on roadway geometrics guidelines of the American Public Transportation Association in addition to an AASHTO conformant alternative

2.1.3 Maximum Grade

The American Association of State Highway and Transportation Officials (AASHTO) roadway standard of 8% may apply to small diameter transit tunnels. Based on the LVCC Loop example, cars are currently the primary vehicle used in the LVCC Loop tunnel.

For comparison purposes, the LVCC Loop travels from -40 feet at Central Station to the West Station/ South Station in 0.4 miles, a grade of approximately 10 percent.

2.1.4 Maximum Curvature

Transit tunnel curvature varies from 700-900 feet in the tightest situation. 1,000 feet- 2,000 feet curvatures are more common. Specifics depend on the individual transit tunnel alignment.

2.1.5 Station Spacing

Transit tunnel stations are generally spaced about 1 mile apart, and at major social/cultural resource locations. Some variations may occur for transit tunnel stations at larger local activity centers and social/cultural resource locations.

2.1.6 Terminal Locations

Two types of terminal locations are discussed in this section: primary transit tunnel terminals and end of the line transit terminals.

2.1.6.1 Primary Transit Tunnel Terminals

Primary transit terminal include location that provide connection to the existing Miami-Dade County transit terminals, existing Metrorail stations, and future SMART Plan stations. Transit tunnel stations are anticipated to be offset from existing Metrorail, Metromover, or Brightline stations in order to preserve their structural integrity. Primary terminal connections are the Dolphin Terminal, Dadeland South Metrorail Station, Dadeland North Metrorail Station, University Metrorail Station, Douglas Road Metrorail Station, Miami Central, Golden Glades Transit Terminal, Miami Intermodal Center, and the future Aventura Brightline Station.

2.1.6.2 End-of-the-Line Transit Tunnel Terminals

End of the line transit tunnel terminals are located at major activity centers including Baptist Health at SW 162 Avenue and SW 88 Street/Kendall Drive, Florida International University, Dolphin Terminal, Downtown Doral, Tropical Park, Coral Gables City Hall, PortMiami, Design District/Magic City, Collins Avenue in the Cities of Sunny Isles and Miami Beach, and the Town of Miami Lakes.

2.1.7 Station Footprints

This section describes the two types of stations envisioned to serve the transit tunnel corridors, below and at-grade and overall vehicular and passenger circulation.

2.1.7.1 Below Grade Stations

Based on the LVCC Loop example, below grade transit tunnel stations are 92 feet wide by 210 feet long with an approximately 34 feet central platform/passenger queuing area, 10 feet wide parking area, and 10 feet outer vehicle access. If there are space constraints, a narrower 15 feet to 20 feet center platform transit tunnel station could be considered. Figure 10, Figure 11 and Figure 12 show examples of below grade stations for the LVCC Loop.

2.1.7.2 At-Grade Stations

Based on the LVCC Loop example, at-grade transit tunnel stations are 48 feet wide and 240 feet long with a center platform/passenger queuing area, 10 feet wide parking area, and 10 feet outer vehicle access. The transit tunnel is accessed via a spiral, angled ramp. Figure 13 shows an example of at-grade stations and Figure 14 of spiral ramps that can be used to provide access down to the underground statins and tunnels.

2.1.7.3 Vehicular and passenger Circulation

Passengers enter and exit the LVCC Loop via a station. At-grade stations provide access to the transit tunnel via an angled loop. Passenger access to below grade transit tunnel stations is via an elevator to an underground station, connected to multiple small diameter transit tunnels.

In the LVCC Loop, passengers travel between stations via the transit tunnels aboard 6-7 passenger class autonomous electric vehicles (AEV's) or specially designed electric multi-person vehicles. The transit tunnel stations can be either underground or at grade with ramped roadway (or guideway) leading traffic to and from the underground transit tunnels. Transit tunnel stations include waiting and embarking/disembarking areas or surface platforms. There is also a turnaround loop in the transit tunnel system to help manage traffic flow and emergency situations.

2.1.7.4 Electric Vehicle Charging Stations

The vehicles used in this small diameter transit tunnel system are anticipated to be electric 6 to 7-person vehicles, based on the LVCC Loop example.

The goal is to include one electric charging station per station. The final number and type of electric vehicle charging stations should be based on vehicle specifications, amount of vehicle charging required and location of vehicle charging stations at vehicle maintenance facilities, park-and-ride facilities and within the system alignment. Location of vehicle charging stations may also be dependent on high ridership locations and real estate availability.

Figure 10: Conceptual rendering of the hotel side Resorts World loop station (Source: news3lv.com)

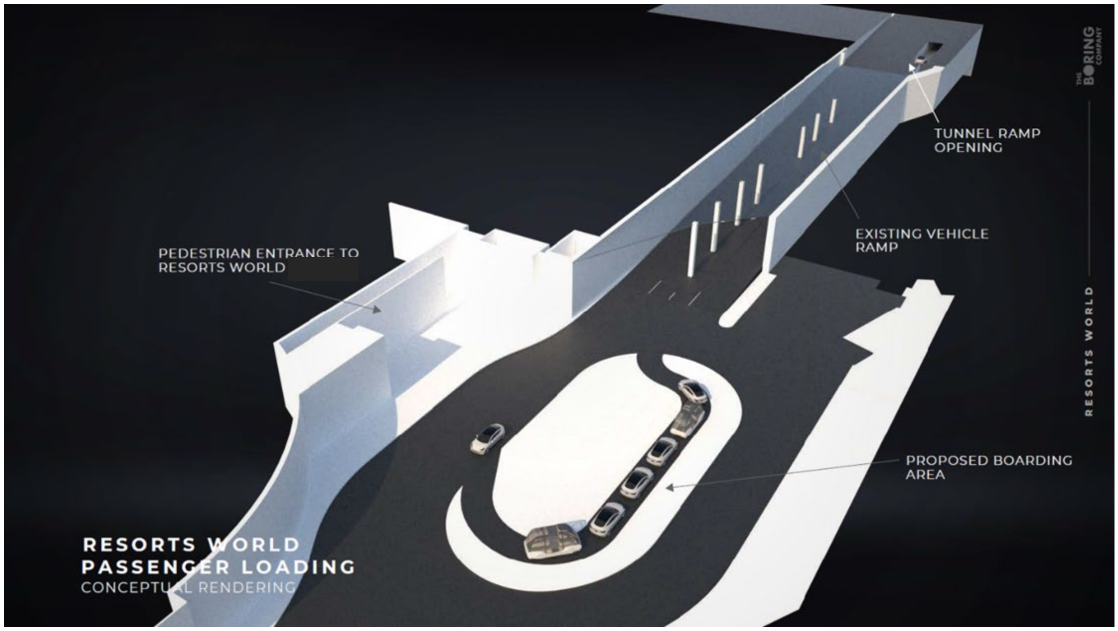


Figure 11: LVCC's Central station (Source: TBC, 2021)

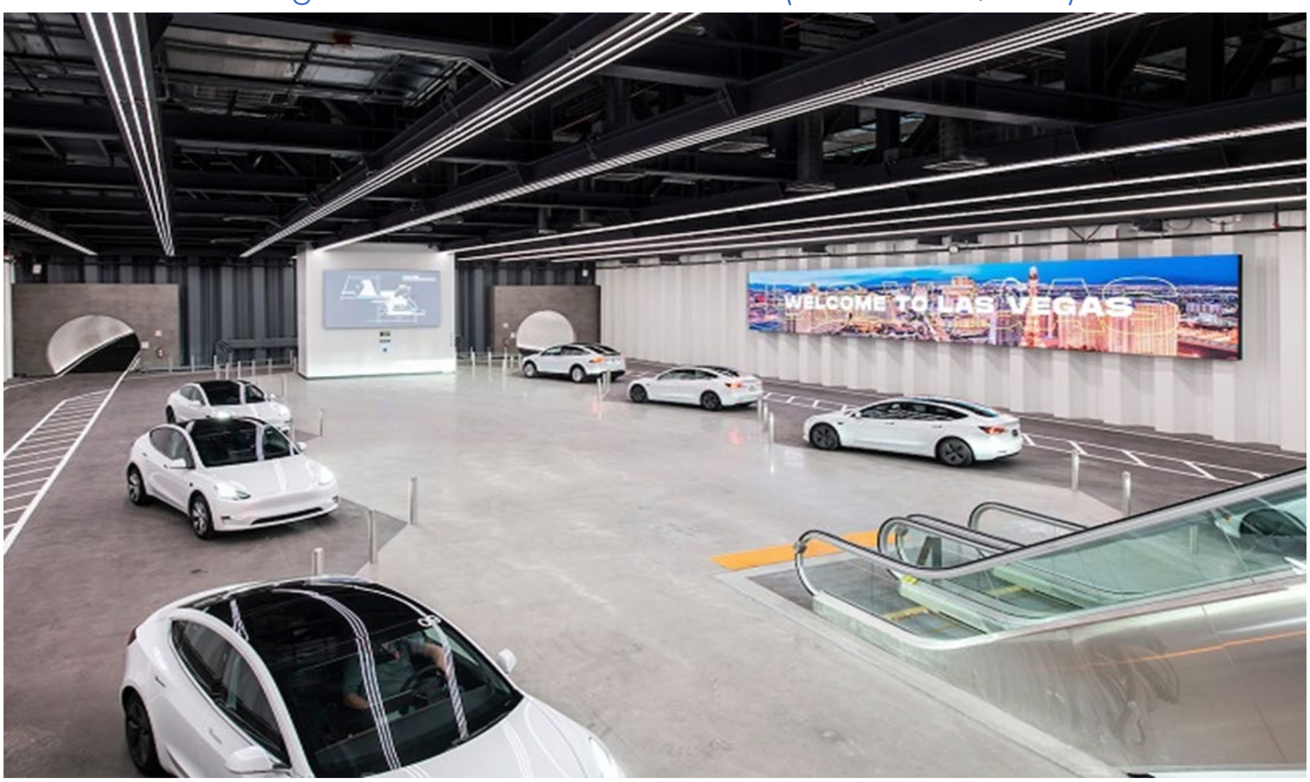


Figure 12: LVCC Below Grade Station (Clark County 2020, digitized public record)

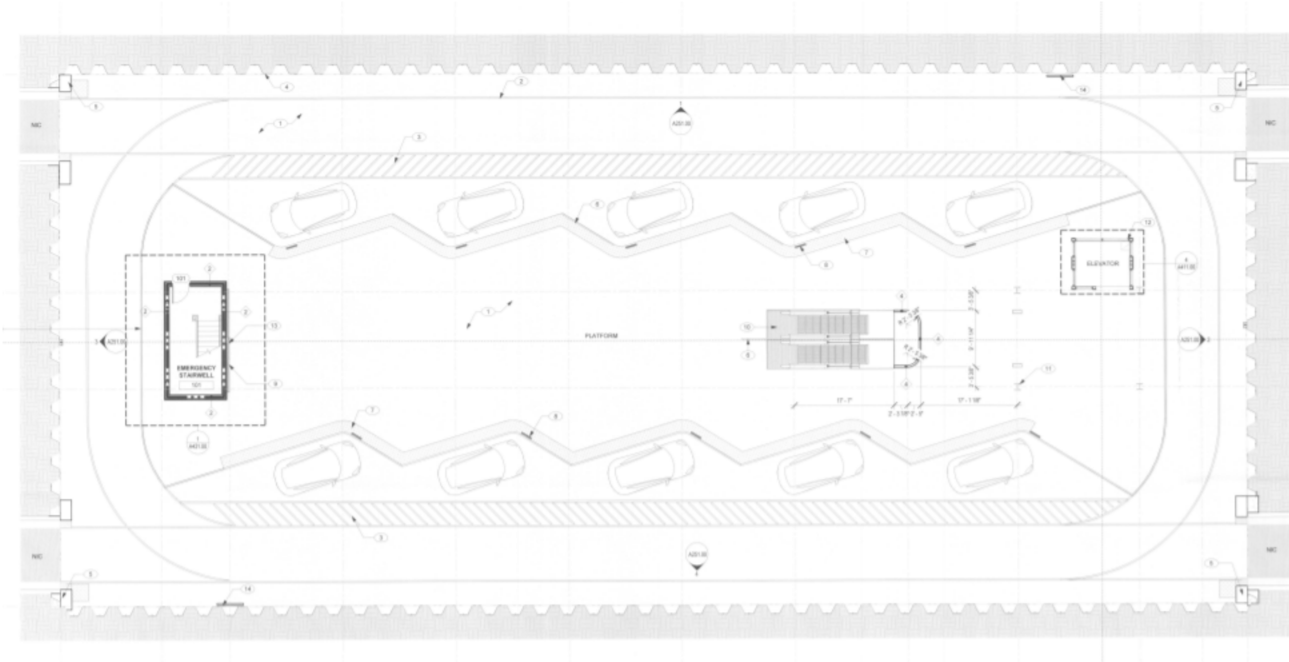


Figure 13: LVCC Loop At Grade Station (Source: Clark County 2019, digitized public record)

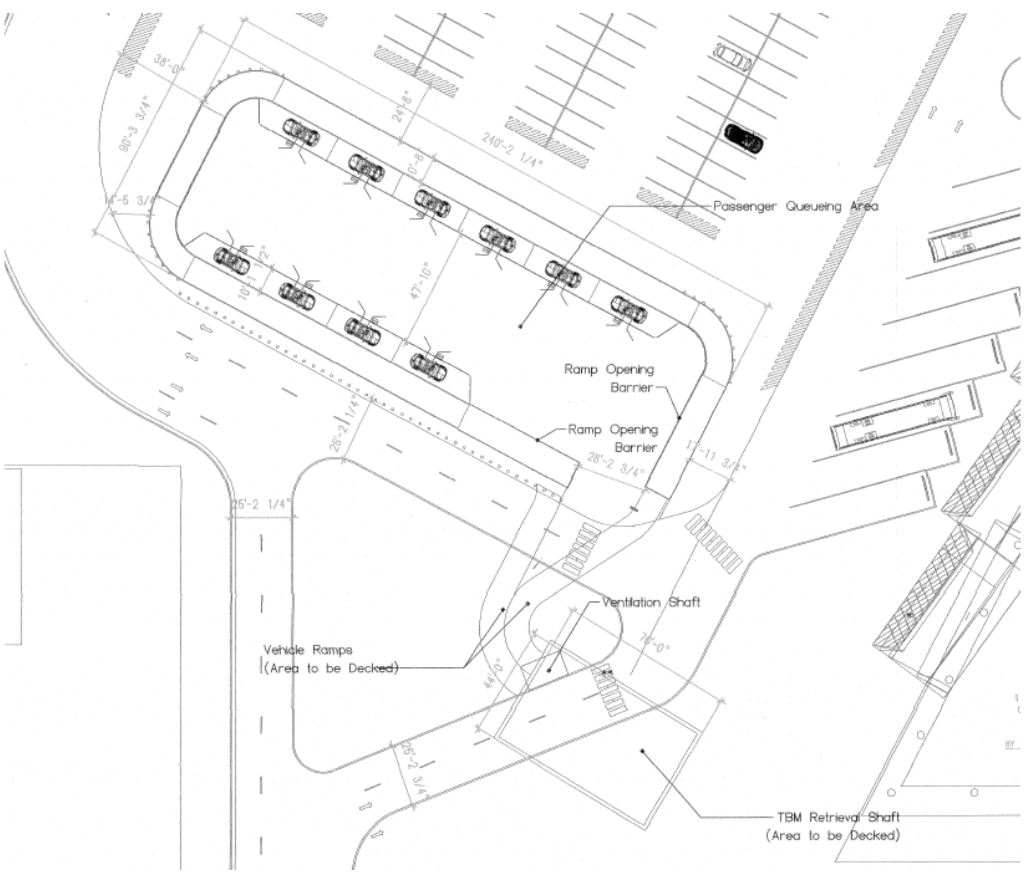


Figure 14: Example of Spiral Parking Ramp

2.1.8 Required Accommodation

The Miami-Dade County transit tunnel alignment should be designed to meet current ADA requirements. Per the LVCC Loop Contract the LVCC Loop is ADA compliant.

2.1.9 Emergency Egress and Fire Safety

The LVCC Loop did not provide additional emergency egress walkways (emergency catwalk) on the sidewall of the transit tunnels separated from the pavement grade.

No additional LVCC Loop information is available as to the accessibility and safety design features of the tunnels and integrated systems.

Additional, general design information regarding emergency egress and fire safety is discussed Section 6:

3. Tier 2 Level Analysis

In Tier 2, the identified transit tunnel corridors were screened using various evaluation criteria.

3.1.1 Groundwater Considerations

Advances in tunneling technology have helped to address the impacts of groundwater on tunnels. The following are ways that project engineers manage groundwater considerations.

- Mechanized tunneling under high groundwater conditions is feasible with closed face (pressurized) tunnel boring machine (TBM) shield technology, such as Slurry Shields, Earth Pressure Balanced (EPB) shields and other hybrid types of machines (i.e., Variable Density TBMs) able to tunnel in soft ground and/or under high water pressures;
- Gasketed precast concrete segmental lining forms a watertight final lining for the tunnel. Any areas of observed leakage through the joints of the installed segmental lining can be addressed using grouting through the segments, which should be designed to allow grouting through ports;
- Depending on the ground conditions, tunneling depth and proximity to surface structures, grouting from the surface may be required so as to decrease the permeability of the tunneled ground; and
- Construction logistics and TBM maintenance should be coordinated by the contractor so as to minimize or eliminate the likelihood of TBM downtime in areas of suspected high groundwater pressures or combined with poor ground conditions. Selecting the TBM which would allow rapid cutting tool replacement under atmospheric conditions can aid in maintaining schedule without reverting to more complex hyperbaric cutterhead interventions.

3.1.2 Geotechnical Considerations

Geotechnical considerations are identified and addressed in project planning. The following are ways that project engineers managed geotechnical considerations.

- The water pressure profile and the subsurface profile along the tunnel alignment (which would be the focus of an extensive subsurface investigation program and Geotechnical Baselining) would inform the selection of the alignment in terms of both vertical and lateral position, so as to avoid, if possible, potentially high risk areas or areas with known limestone solution features;
- The investigations should be comprehensive and detailed enough, to assess the frequency of solution features in limestone (karst, landscape underlain by limestone which has been eroded by dissolution, producing ridges, towers, fissures, sinkholes, and other characteristic landforms), their content (i.e., water bearing unconsolidated soft soils) and the probability of the alignment encountering such features. A comprehensive risk assessment study should focus on the ground variability, the rock mass conditions and consider all ground surface conditions (infrastructure, buildings, utilities etc.);
- Although modern properly and project specific-designed TBMs can bore successfully through a multitude of conditions both in soil and rock with or without high groundwater pressures, it is the rapid ground variability or unforeseen transition from hard medium to water bearing soft soils (i.e., filled karst cavities) that can create serious problems and downtimes;
- Grouting from the ground surface should be explored for all high risk areas suspected of solution features in limestone; and
- The Contractor should -in accordance with baseline geotechnical documents, select appropriate TBM technology that allows for well controlled and timely transition between operation modes, and allows for fast response when transitioning from hard medium (i.e., rock) to soft (i.e., soft soil deposits).

3.2 Ancillary Infrastructure Considerations – Large Diameter Tunnel

As battery technologies advance, the composition of the Miami-Dade transit's fleet will include more electric buses. The County is acquiring electric buses to operate on the South Corridor of the SMART Plan. The acquired vehicles will consist of standard 40 and articulated 60-foot buses. This section assesses the tunnel infrastructure requirements for such transit vehicle uses.

Larger vehicles such as buses require additional considerations when operated in transit tunnels, particularly as they pertain to the greater vehicle size and life safety measures (ventilation and emergency egress, emergency vehicle access) requirements.

Two concept tunnel cross-sections were prepared to assess the dimensional requirements of a transit tunnel. The first section shown in Figure 15 was designed using AASHTO tunnel design guidelines, whereas the second section shown in Figure 16 uses the North American City Transportation Official (NACTO) Bus Rapid Transit (BRT) lane dimensions as a guideline.

Figure 15 AASHTO Compliant Section

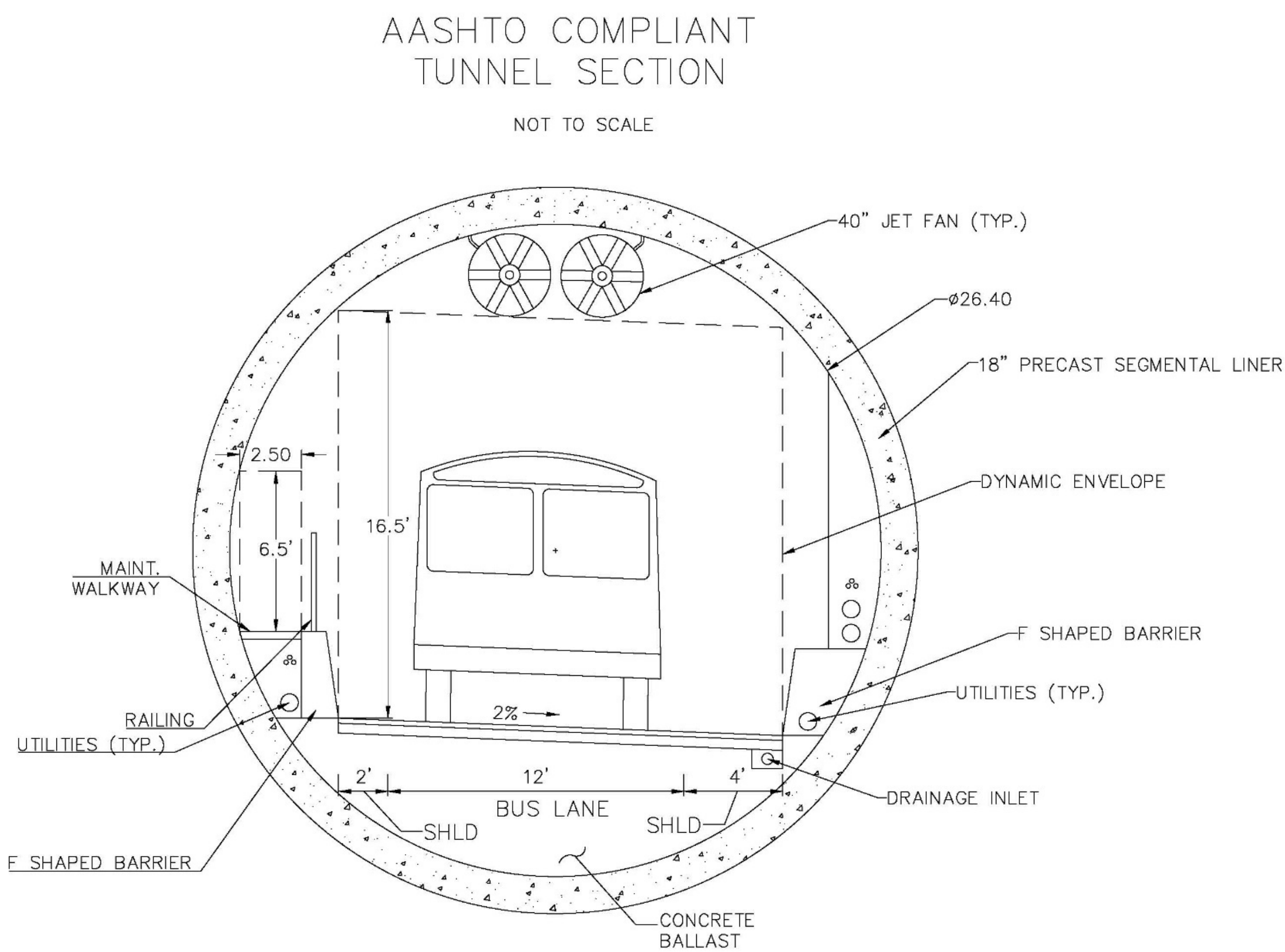
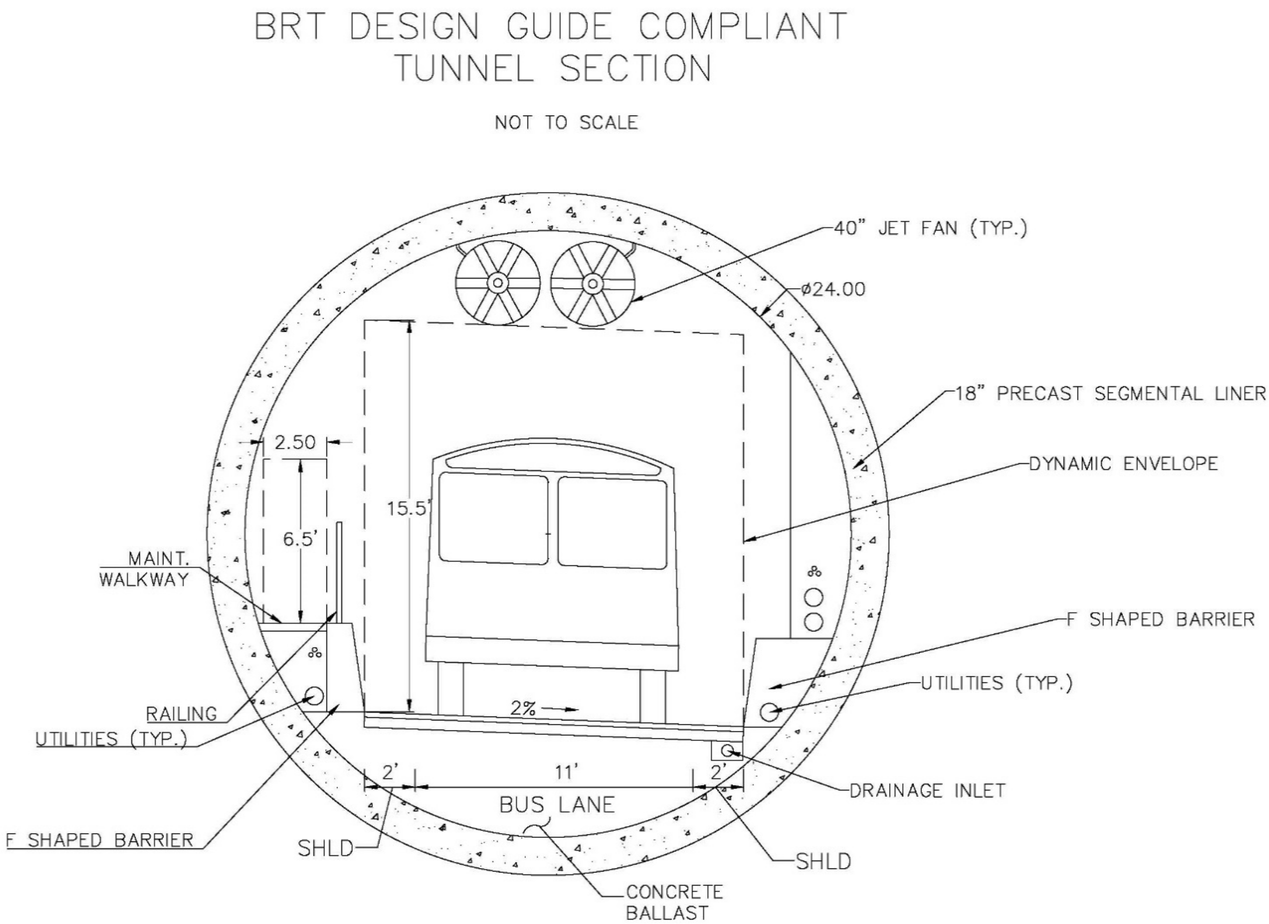


Figure 16 NACTO BRT Guide Compliant Section



The tunnel dimensions were developed with the following assumptions:

1. The tunnels would only be used by buses;
2. The buses would operate without the assistance of a guideway;
3. Egress from the tunnel in an emergency would be undertaken by the use of cross pathways connecting to parallel tunnels (tunnels operating in tandem);
4. The tunnels will be ventilated with jet fans; and
5. Additional vertical clearance is included to allow for emergency vehicle access.

The AASHTO tunnel requires a total dimension of 29.4 feet. This includes 26.4 for the tunnel, plus an additional 18 inches for the tunnel liner on each side. Under the AASHTO guidelines, the section includes a 12 feet travel lane, a 4 feet shoulder on one side and a 2 feet shoulder on the other. The tunnel also includes a 2.5 feet maintenance walkway.

The NACTO tunnel requires a total dimension of 27 feet – 24 for the tunnel, and the same 18 inches for the precast segmental liner on each side. The roadway section includes an 11 foot lane, 2 foot shoulders on each side, and a 2.5 foot maintenance walkway.

In both tunnels, the maintenance walkway is included because there is sufficient space – these tunnels are designed with the vertical clearance which will allow emergency vehicle access in the case of emergencies. Because of the resulting larger dimensions of the tunnel, there is sufficient horizontal clearance for the maintenance walkways.

3.3 Tunnel Dimensions Framework

The following sections provide additional information on the assumptions used in assessing tunnel dimensions for both the small and large diameter tunnels.

3.3.1 Small Diameter Tunnel (LVCC)

The smaller 12 feet internal diameter tunnel is provided as an "as-is" example of an existing application from The Boring Company. This is not a recommendation by WSP. Please consider that based on observation, this is not in accord with any established roadway geometrics standards (i.e., AASHTO, APTA or NFPA). The dimensions shown are approximate and inferred based on information publicly available. WSP is not in possession of detailed segmental lining or finished tunnel dimensions for the LVCC Loop, so the dimensions indicated are approximate.

3.3.2 Large Diameter Tunnel

A 24 feet internal diameter single lane, BRT tunnel was provided as a rough possible layout considering ONLY the roadway geometrics guidelines of the American Public Transportation Association in addition to an AASHTO conformant alternative. For the graphics, the APTA model is shown only.

For both cases, a tunnel depth of 1.5x outer diameter, is indicated as typical minimum required which can vary from case to case.

4. Potential Corridors Identification Process

This study utilized a tiered level analysis using the process illustrated in below. The study documents the results of the Tier 1 and Tier 2 levels analysis and identified the next steps to be addressed in Tier 3.

Tier 1

Initial Transit Tunnel Corridors

- **Base Network** - Long Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Previous Studies, Other Corridors
- **Criteria** - Coverage – service to population and employment hubs, Connection to existing transit systems, Environmental Justice – service to potentially underserved communities, Efficiency – provide most direct route between areas

Tier 2

Potential Transit Tunnel Corridors

- **Base Network** - 25 Corridors from Tier 1 Level Analysis
- **Criteria** – Cost (Estimated Capital Cost), Land-Use (Transit Supportive Land Use, Community Redevelopment Areas, Access to Major Activity Centers), Mobility (Projected Daily Traffic Volume, Projected Ridership, Connects to SMART Plan Corridor, Connects to Existing/Proposed Rail Stations), Technical (Interface with Underground Utilities, Crosses Under Water, Constructability (Routing and MOT))

Tier 3

Transit Tunnel Corridor Development

- **Base Network** - 8 Corridors from Tier 2 Level Analysis
- **Next Steps** - Partner Coordination, Vehicle Identification and Specification/Envelope, Tunnel Sizing from Space-Proofing Analysis for Specific Vehicle Envelope, Fire and Life Safety Design Criteria, Subterranean Rights, Land-Use Policies to Support Transit, Transit Service Plan (alignment, stations, frequency, service span), Ridership Estimates, Operating and Maintenance Plan, Capital Cost Estimate, Environmental Permitting, Public Involvement, Financial Plan, Inter-agency Agreements

5. Tier 1 Level Analysis

Projects included in the LRTP, TIP, and previous studies were used as a base network for identification of the initial corridor to be considered for implementation of transit tunnel technology. Each of the corridors were screened against the following goals to support improved mobility in the region:

1. **Coverage** – provide service to population hubs in Miami-Dade County, such as Downtown Miami, Doral, Miami Lakes, North Miami, Kendall, and South Dade.
2. **Connection** – connect to existing premium transit service in Miami-Dade County, including Metrorail, and regional transit lines such as Tri-Rail, Amtrak, and Brightline.
3. **Equity** – provide service to all sectors of the population equally, particularly under-served and low-income communities .
4. **Efficiency** – provide the most direct route between the activity center/hub to be served and the transit service.

The Tier 1 level screening analysis resulted in the identification of two Strategic Miami Area (SMART) Plan corridors and six Long Range Transportation Plan (LRTP) priority corridors for potential tunnel application as summarized in Table 4 below.

Table 4: Potential Transit Tunnel Corridors

Corridor Number	Tier 1 Potential Transit Tunnel Corridors		Tier 2 Potential Transit Tunnel Corridors
	Description	Length (miles)	
1	Aventura Brightline Station to Sunny Isles	2.4	
2	Golden Glades to Sunny Isles	6	
3	Opa-locka to Miami Lakes	4.6	
4	Metrorail Transfer Station to Collins Avenue	8.8	
5	Miami Central to PortMiami	1.3	LRTP Priority Corridor
6	Brickell Avenue to FTX Arena	1.2	
7	FTX Arena to Design District	2.5	LRTP Priority Corridor
8	Miami Central to Design District	2.8	LRTP Priority Corridor
9	Design District/ Magic City Loop	4.4	
10	Miami Intermodal Center to Wynwood	4.1	
11	Overtown Connector	1	LRTP Priority Corridor
12	Miami Intermodal Center to Miami Central	4.9	

Table 4: Potential Transit Tunnel Corridors (Continued)

Corridor Number	Tier 1 Potential Transit Tunnel Corridors		Tier 2 Potential Transit Tunnel Corridors
	Description	Length (miles)	
13	Magic City Casino to Douglas Road	3.2	LRTP Priority Corridor
14	Gables Connector	4.1	
15	Douglas Road Metrorail Station to Coconut Grove	1.1	
16	Douglas Road Metrorail Station to Coral Gables City Hall	1.6	
17	Ludlum Corridor	10.9	LRTP Priority Corridor
18	Flagler Corridor	7	SMART Plan Corridor
19	Downtown Doral to Miami International Airport	6.5	
20	Downtown Doral to East-West NW 87 Street Station	1.9	
21	Dolphin Terminal to East-West NW 107 Avenue Station	1.6	
22	East-West NW 107 Avenue Station to Florida International University	2.4	
23	South Miami Metrorail Station to Tropical Park	4.4	
24	University Metrorail Station to University of Miami	2.5	
25	Kendall Corridor - Dadeland South Metrorail Station to Baptist West	9.3	SMART Plan Corridor

The 25 potential transit tunnel corridors evaluated are illustrated in Figure 17. Detailed information on the corridors is also included in Chapter 9 of this report including LRTP ID number and priority. The corridors were further grouped by region of Miami-Dade County as follows:

- North Miami-Dade County
- East Central Miami-Dade County
- Central Miami-Dade County
- West Central Miami-Dade County

In the subsequent sections, the alignment, corridor length, station locations, existing and future transit connections, major attractions are identified for each corridor by region.

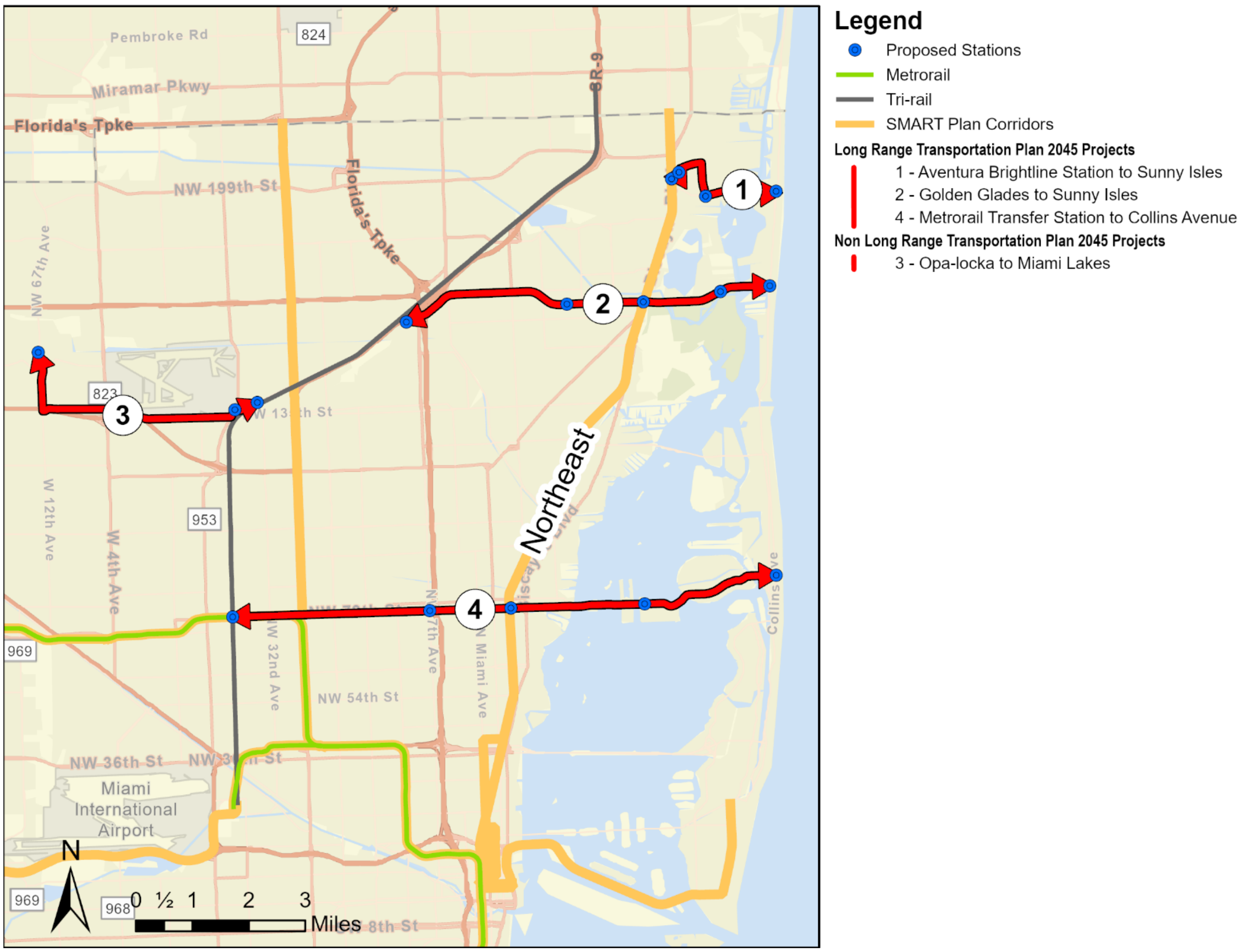
.

Figure 17: Miami-Dade County Corridors

5.1 North Miami-Dade County

The potential transit tunnel corridors identified in the North Miami-Dade area are illustrated in Figure 18 and described in the sections bellow.

Figure 18: North Miami-Dade County Corridors



5.1.1 Aventura Brightline Station to Sunny Isles (Corridor 1)

Alignment: Aventura Brightline Station (19700 West Dixie Highway), east to Aventura Mall transit terminal, east to W Country Club Drive, south to City of Aventura City Hall, east along NE 192 Street to Heritage Park public parking lot (19200 Collins Avenue, Sunny Isles) at the NW corner of SR A1A and NE 192 Street

Length: 2.4 miles

Tunnel Stations: Brightline Station (Aventura Brightline Station), Aventura Mall Transit Terminal (Aventura Transit Terminal), City of Aventura City Hall (Aventura City Hall Station), Heritage Park (Heritage Park Station) public parking lot at the NW corner of A1A and NE 192 Street

Transit Connections: Aventura Brightline Station

Major Attractions: Aventura Mall, Heritage Park, Atlantic Ocean

Special Considerations: Tunneling under the Intracoastal Waterway

5.1.2 Golden Glades to Sunny Isles (Corridor 2)

Alignment: Golden Glades Transit Terminal, east along NW 165 Street Road, continue east along NW 167 Street/163 Street, to either Gateway Center Park at 151 Sunny Isles Blvd, Sunny Isles Beach, or Pier Park at 16501 Collins Avenue, North Miami Beach

Length: 6.0 miles

Tunnel Stations: Golden Glades Transit Terminal (Golden Glades Station), The Mall at 163 Street (NE 13 Avenue Station), Oleta River State Park/The Intracoastal Mall (NE 35 Avenue Station), and Pier Park (Pier Park Station)

Transit Connections: Golden Glades Transit Terminal, potential FEC Commuter Rail Station at 163 Street and W Dixie Highway

Major Attractions: Golden Glades Transit Terminal, The Mall at 163 Street, The Ancient Spanish Monastery, Oleta River State Park/The Intracoastal Mall, Atlantic Ocean

Special Considerations: Tunneling under the Intracoastal Waterway

5.1.3 Opa-locka to Miami Lakes (Corridor 3)

Alignment: Opa-locka Tri-rail Station, west along Ali-baba Boulevard to Douglas Road, south to NW 135 Street, north on NW 57 Avenue, west on East Miami Lakes Drive to NW 67 Avenue, north to Main Street

Length: 4.6 miles

Tunnel Stations: Opa-locka Tri-Rail Station Opa-locka Station), Opa-locka Executive Airport (Opa-locka Executive Airport Station), downtown Miami Lakes (Miami Lakes Station)

Transit Connections: Opa-locka Tri-Rail Station, potential extension west to future NW 27 Avenue North Corridor station at NW 135 Street

Major Attractions: City of Opa-locka, Opa-locka Executive Airport, Town of Miami Lakes

Special Considerations: Future connection with North Corridor at NW 135 Street, high percentage of low-income population

5.1.4 Metrorail Transfer Station to Collins Avenue (Corridor 4)

Alignment: Metrorail Transfer Center east along 79 Street to Collins Avenue on Miami Beach

Length: 8.8 miles

Tunnel Stations: Metrorail Transfer Station, NW 7 Avenue Station, Little River Station, North Bay Village, and North Beach Town Center

Transit Connections: Amtrak, Metrorail Transfer Station, Little River FEC Corridor Station

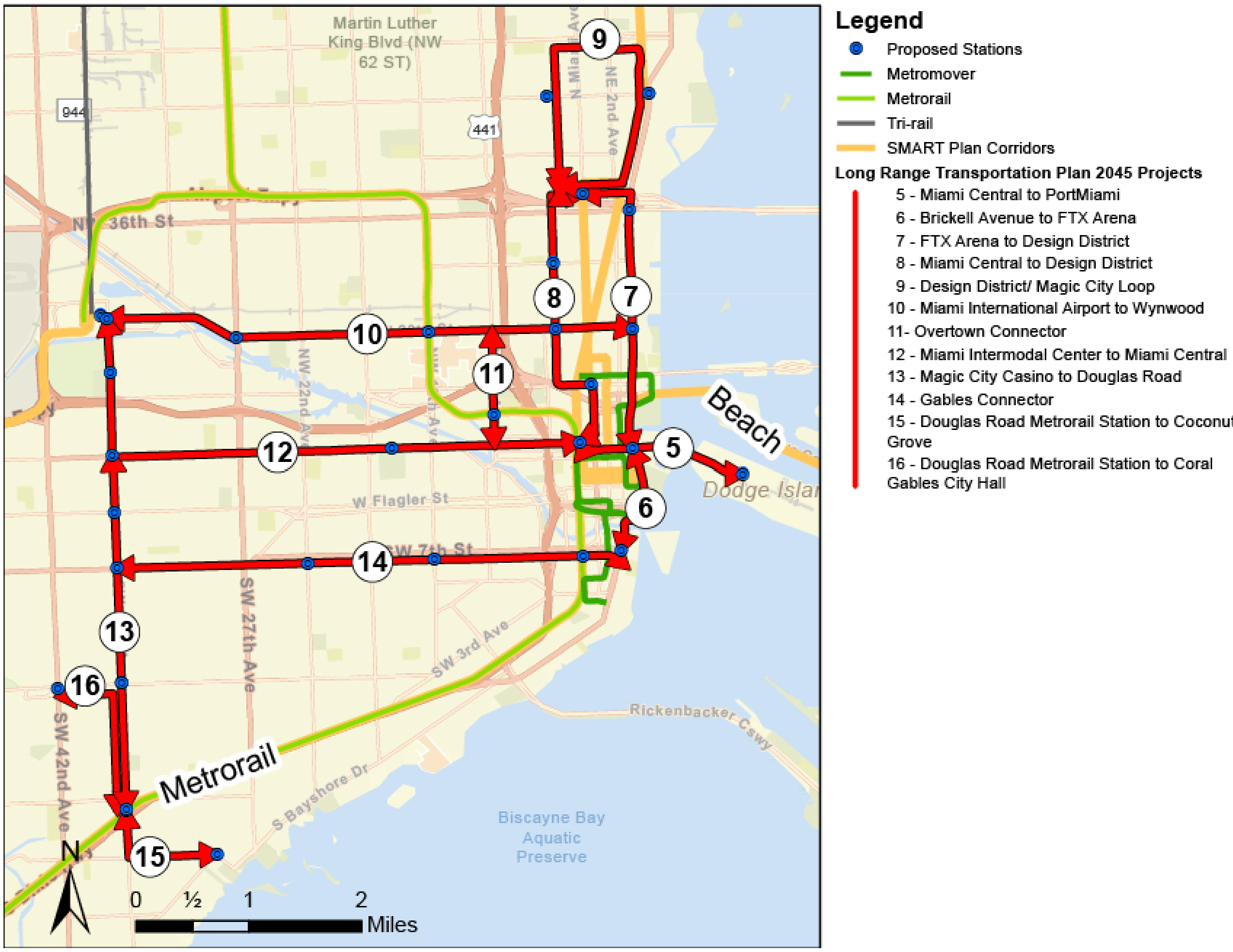
Major Attractors: North Beach Town Center

Special Considerations: Possible Future North Corridor Station

5.2 East Central Miami-Dade County

The corridors included in the East Central Miami area are illustrated on Figure 19 below.

Figure 19: East Central Miami-Dade County Corridors



5.2.1 Overtown Transit Village/Miami Central to PortMiami (Corridor 5)

Alignment 1: Overtown Transit Village/Miami Central east adjacent to the FEC rail spur alignment (or potentially NW 5 and NW 6 Streets on each side for the FEC Rail spur, underneath the Port Boulevard to the Port Miami passenger cruise terminals.

Alignment 2: Overtown Transit Village/Miami Central east adjacent to the FEC rail spur alignment (or potentially NW 5 and NW 6 Streets on each side for the FEC Rail spur, come above ground in the vicinity of the FTX arena and travel at grade to the Port Miami passenger cruise terminals.

Length: 1.4 miles.

Tunnel Stations: Overtown Transit Village, Freedom Tower, PortMiami Cruise Terminal

Transit Connections: Overtown Transit Village, Brightline, SMART Plan NE Corridor, Downtown Miami Link at Miami Central

Major Attractors: Miami Central, Future Miami World Center, Port Miami

Special Considerations: Avoid bridge pilings for the Port Boulevard bridge.

5.2.2 Brickell Avenue to FTX Arena (Corridor 6)

Alignment: Brickell Avenue at SW 7 Street north underneath the Miami River, east in front of the Epic Hotel, north at Biscayne to the FTX Arena.

Length: 1.0 miles

Tunnel Stations: SW 7 Street and Brickell Avenue, Biscayne Boulevard and Flagler Street, FTX Arena

Transit Connections: Metromover at Knight Center, Bayfront Park, Wolfson Campus of MDCC, and Freedom Tower

Major Attractions: Knight Center, Intercontinental and Epic Hotels, Bayside Marketplace, and FTX arena.

Special Considerations: Consider location of major utilities along Biscayne Boulevard in future studies.

5.2.3 FTX Arena to Design District (Corridor 7)

Alignment: FTX arena north to 39 Street, west to NW 1 Avenue

Length: 2.6 miles

Tunnel Stations: FTX Arena, Biscayne Boulevard at 20 Street and 36 Street, NW 39 Street and NE 1 Avenue

Transit Connections: SMART Plan NE Corridor Design District Station

Major Attractions: Design District, FTX Arena, Midtown Miami

Special Considerations: Obtain information between Arena and Arsht to see if tunnels can be installed up to 39 Street. Get the utility information from W&S and perhaps signature bridge foundation plans.

5.2.4 Miami Central to Design District (Corridor 8)

Alignment: Overtown Transit Village/Miami Central east along NW 8 Street to North Miami Avenue, North on north Miami Avenue to 14 Street, west on 14 Street, north on NW 2 Avenue to NW 39 Street, east to NE 1 Avenue

Length: 2.7 miles

Tunnel Stations: Overtown Transit Village/Miami Central, Miami Avenue and 14 Street, NW 2 Avenue and NW 20 Street, NW 2 Avenue and NW 29 Street, NW 39 Street and NE 1 Avenue

Transit Connections: Overtown Transit Village/Miami Central Station, future NE Corridor N. Miami Avenue, and 14 Street Station

Major Attractions: Miami Central, Wynwood, Midtown Miami, Design District

5.2.5 Design District/Magic City Loop (Corridor 9)

Alignment: From NE 39 Street and NE 1 Avenue, west to NW 2 Avenue, north to 62 Street, east to 61 Street, continue east, south on NE 4th Court to approximately NE 55th Terrace, connect with and continue south on Biscayne Boulevard to NE 39 Street, then head west to NE 1 Avenue.

Length: 4.2 miles

Tunnel Stations: NE 39 Street and NE 1 Avenue, 54 Street and NW 2 Avenue, 62 Street and NE 2 Avenue, Biscayne Boulevard and 54 Street

Transit Connections: Future NE Corridor Design District Station

Major Attractions: Design District, Magic City, Biscayne Station entertainment complex at 54 Street

5.2.6 Miami International Airport to Wynwood (Corridor 10)

Alignment: From 20t Street and NE 2 Avenue east to the east side of the SFRC, potentially via the rail spur in Allapattah, then south adjacent to the SFRC to the MIC.

Length: 4.2 miles

Tunnel Stations: MIC, 27 Avenue and 20 Street, 12 Avenue and 20 Street, NW 2 Avenue and NW 20 Street, Biscayne Boulevard and NE 20 Street

Transit Connections: MIC, Allapattah Metrorail Station

Major Attractions: MIA and Miami Intermodal Center, Wynwood, Biscayne Corridor

5.2.7 Overtown Connector (Corridor 11)

Alignment: Along NW 7 Avenue from NW 7 Street to NW 20 Street

Length: 1.0 miles

Tunnel Stations: Culmer Station

Transit Connections: Corridor 10: Miami international Airport to Wynwood and Corridor 12: MIA to Miami Central

Major Attractions: Spring Garden Historic District, MIA, and Miami Intermodal Center, Wynwood, Biscayne Corridor

5.2.8 MIA to Miami Central (Corridor 12)

Alignment: MIC south to NW 37 Avenue, east at NW 7 Street to Overtown Transit Village/Miami Central

Length: 4.9 miles

Tunnel Stations: MIC, NW 37 Avenue and Melreese/Soccer Stadium, NW 37 Avenue and NW 7 Street, ~15 Street and NW 7 Street, Miami Central

Transit Connections: MIC, Miami Central Station

Major Attractions: MIC, Melreese Golf Course, Magic City Casino, Marlins Park, Miami Central

5.2.9 Douglas Road Metrorail Station to Magic City Casino (Corridor 13)

Alignment: North along NW 37 Avenue, from US1 to NW 7 Street

Length: 3.1 miles

Tunnel Stations: NW 37 Avenue and NW 7 Street, SW 8 Street, and SW 22 Street, and US1

Transit Connections: Douglas Road Metrorail Station

Major Attractions: Magic City Casino, The Roads, The Village of Merrick Park, Coconut Grove via the City of Miami Trolley

5.2.10 Gables Connector (Corridor 14)

Alignment: Douglas Road Metrorail Station, north along NW 37 Avenue, east along NW 8 Street to Brickell Avenue, then north to NE 7 Street

Length: 4.1 miles

Tunnel Stations: Douglas Road Metrorail Station, NW 37 Avenue and SW 8 Street, SW 8 Street and 22 Avenue, 12 Avenue and NW 2 Avenue, and Brickell Avenue and NE 7 Street

Transit Connection: Eighth Street Metromover Station

Major Attractions: Gables Entrance, Little Havana, Brickell Avenue

5.2.11 Douglas Road Metrorail Station to Coconut Grove (Corridor 15)

Alignment: Douglas Road Metrorail Station, south on Douglas Road/NW 37 Avenue to Grand Avenue, east to Cocowalk/Streets of Mayfair

Length: 1.1 miles

Tunnel Stations: Douglas Road Metrorail Station (Douglas Road Station), the intersection of Grand Avenue, Main Highway and McFarland Road (Cocowalk Station)

Transit Connections: Douglas Road Metrorail Station

Major Attractions: Coconut Grove

5.2.12 Douglas Road Metrorail to Coral Gables City Hall (Corridor 16)

Alignment: Douglas Road Metrorail Station, north along Douglas Road/NW 37 Avenue, west on Coral Way to LeJeune Road/NW 42 Avenue

Length: 1.6 miles

Tunnel Stations: Douglas Road Metrorail Station (Douglas Road Station), the intersection of

Coral Way and NW 37 Avenue, the intersection of Coral Way (Coral Way Station) and NW 42 Avenue (Coral Gables City Hall)

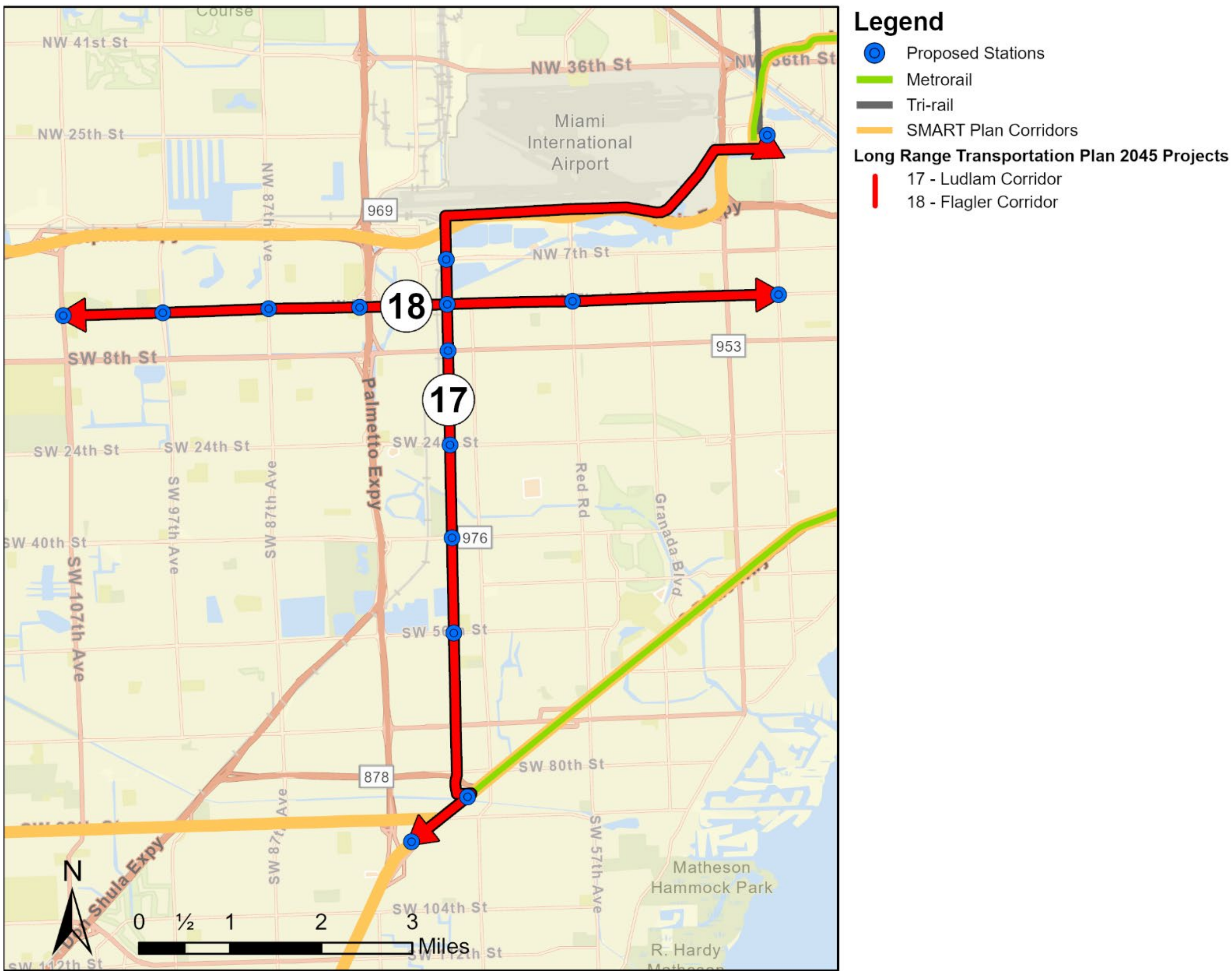
Transit Connections: Douglas Road Metrorail Station

Major Attractions: Miracle Mile, Coral Gables City Hall at Coral Way

5.3 Central Miami-Dade County

The Central Miami-Dade corridors are illustrated in Figure 20 below.

Figure 20: Central Miami-Dade County Corridors



5.3.1 Ludlam Corridor (Corridor 17)

Alignment: MIC, west along NW 21 Street, southwest along Fuel Farm Road, west along Perimeter Road, south at ~66 Avenue along the Ludlam Corridor to the Dadeland North Metrorail Station

Length: 10.9 miles

Tunnel Stations: MIC, intersections of Flagler Street, SW 8 Street, Coral Way, Bird Road, Miller Road, Sunset Drive, Dadeland North Metrorail Station, Dadeland South Metrorail Station

Transit Connections: MIC and Dadeland North Metrorail Station
Major Attractions: MIC, shopping centers at the intersection of SW 8 Street, Coral Way, A. D. Barnes Park, South Miami High School, and Dadeland Station shopping center

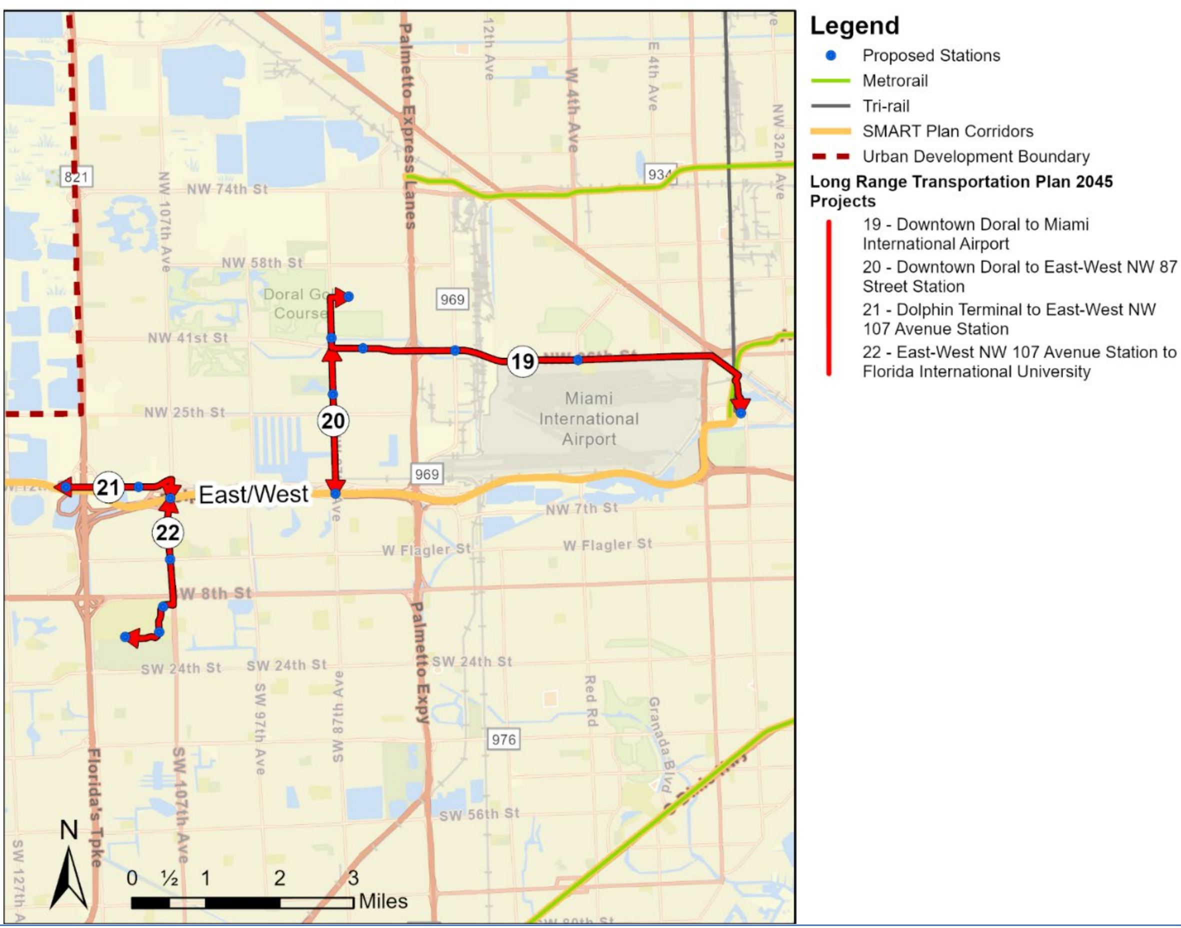
5.3.2 Flagler Corridor (Corridor 18)

Alignment: Flagler Street from NW 107 Avenue to NW 37 Avenue
Length: 7.0 miles
Tunnel Stations: SW 107 Avenue (FIU Engineering Station), SW 97 Avenue (SW 97 Avenue Station), SW 87 Avenue (SW 87 Avenue Station), Mall of the Americas (SW 78 Avenue Station), Ludlam Corridor (Ludlam Corridor Station), 57 Avenue (SW 57 Avenue Station), and SW 37 Avenue (SW 37 Avenue Station)
Transit Connections: Future East-West Corridor Mall of the Americas Station
Major Attractions: FIU College of Engineering, Pinecrest Academy North Campus, Mall of the Americas, Robert King High Park, Kinloch Middle School

5.4 West Central Miami-Dade County

Figure 21 shows the corridors included in West Central Miami-Dade.

Figure 21: West Central Miami-Dade County Corridors



5.4.1 Downtown Doral to Miami International Airport (Corridor 19)

Alignment: Downtown Doral Park west to NW 87 Avenue and NW 53 Street, south along NW 87 Avenue to NW 36 Street, east to NW South River Drive, southeast along NW 28 Street to NW 37 Avenue, south to the MIC

Length: 6.5 miles

Tunnel Stations: NW 53 Street and Downtown Doral Park (Doral Station), Doral Golf Resort and Spa (Doral Golf Resort and Spa Station) at 4400 NW 87 Avenue, NW 83 Avenue and NW 36 Street (83 Avenue Station), NW 72 Avenue and NW 36 Street (72 Avenue Street Station), Curtis Parkway and NW 36 Street (Curtis Parkway Station), and MIC

Transit Connections: MIC

Major Attractions: Downtown Doral, Doral Golf Resort and Spa, Cisco Systems, Turner Guilford Knight Corrections Center, Miami-Dade County Public Works Offices, Miami Springs, Miami International Airport

5.4.2 Downtown Doral to East-West NW 87 Street Station (Corridor 20)

Alignment: NW 87 Avenue and NW 36 Street, south along NW 87 Avenue to SR 836

Length: 1.9 miles

Tunnel Stations: Intersection of NW 87 Avenue and 36 Street, NW 87 Avenue and NW 29 Street (29 Street Station) and Future East-West NW 87 Street Station (NW 87 Street Station)

Transit Connections: MIC

Major Attractions: Downtown Doral, Doral Golf Resort and Spa, Turner Guilford Knight Corrections Center, Miami Springs, Miami International Airport

Special Considerations: Connection to future East-West NW 87 Street Station

5.4.3 Dolphin Terminal to East-West NW 107 Avenue Station (Corridor 21)

Alignment: Dolphin Terminal to east along NW 12 Street, south along NW 107 Avenue to SR 836 NW 107 Avenue Station

Length: 1.6 miles

Tunnel Stations: Dolphin Terminal, Dolphin Mall/Florida Department of Transportation (NW 111 Avenue Station), East West NW 107 Street Station

Transit Connections: Dolphin Terminal, East-West NW 107 Street Station

Major Attractions: Dolphin Terminal, Dolphin Mall Florida Department of Transportation

Special Considerations: Connection to future East-West NW 107 Street Station

6. Tier 2 Level Analysis

In Tier 2, the identified transit tunnel corridors were screened using various evaluation criteria. The criteria were developed and applied based on opportunities and challenges associated with the proposed Miami-Dade transit tunnel corridors. Evaluation criteria are listed below and described in detail in this section:

1. Cost Criteria;
2. Land Use Criteria;
3. Mobility Criteria; and
4. Technical Criteria.

A rating system was developed for each criteria using a qualitative scale ranging from low to high. For each corridor, the number of low, medium, and high ratings were tabulated and used to identify the corridors for potential implementation of transit tunnel, pending further development as part of the Tier 3 level analysis identified in the next steps section of this study.

6.1 Cost Criteria

In order to develop a typical corridor cost per mile, capital cost unit costs and assumptions were developed for one of the transit tunnel corridors as described in the following sections. These unit costs were then applied to other potential corridors to develop order of magnitude capital cost estimates. For purposes of this analysis, costs for Corridor 10 (Miami International Airport to Wynwood) were developed then applied to the system as a whole. Corridor 10 was chosen because it includes all of the elements present in other corridors such as turns in the alignment, utility conflicts and congested roadways.

6.1.1 Corridor 10 Transit Tunnel Capital Costs

The alignment for Corridor 10 extends from the Miami International Airport eastward to Biscayne Boulevard. The corridor is approximately 4.2 miles (22,700 ft). The estimated costs are based on twin 14-foot outside diameter tunnels with five (5) stations proposed for this route spaced as shown below:

- MIC to 27 Avenue Station / 1.1 miles (5,800 ft)
- 27 Avenue Station to Santa Clara Station / 1.53 miles (8,078 ft)
- Santa Clara Station to Overtown Station / 1.0 mile (5,280 ft)
- Overtown Station to Biscayne Station / 0.6 miles (3,168 ft)

It is expected that all tunnels will be excavated by a closed-face tunnel boring machine (TBM) and thus require gasketed precast concrete segmental lining as the permanent tunnel support. It is assumed that any transition tunnels other than TBM-bored will not be required. It is also assumed that enlarged cross-over type (or bifurcation) tunnel or cavern structures are not required and all vehicle interconnectivity and "local loop" functions will be housed within the stations. It is assumed that the whole length of this corridor will be segmentally lined (22,700 feet per tunnel or 45,400 feet for both)

Placement of the two tunnels by TBM will require the construction of a temporary open cut excavation at one end of the alignment, which will serve for launching the TBM. The TBM may be received, rotated, and relaunched for construction of the second tunnel, at the other end of the alignment which will also require the construction of an open cut excavation.

For the tunneling works only, excluding construction of the temporary open cut shafts that are to be used for the station construction, the estimated cost for a twin 14 feetbored diameter tunnel along the entire length of the corridor (4.2 miles) is estimated at $280M or approximately $30M/mile of tunnel. This estimate includes contracting of a single TBM, mobilization, excavation works, ancillary plants for the TBM operation, precast concrete segmental lining, launching works, materials, and TBM maintenance costs, temporary TBM related utilities, demobilization, and cleanup.

6.2 Corridor 10 Underground Station Costs

Five (5) stations are proposed along the Corridor 10 alignment. Station design and dimensions depend on many factors including the required passenger capacity and ridership support, internal space proofing requirements for the specific transit system, fire and life safety criteria, ventilation requirements, and accessibility requirements. Space proofing ensures that all required functions can be accommodated within the planned tunnel volume. Station dimensions that would satisfy these requirements are currently unknown. It is assumed that the stations will be constructed by the cut-and-cover method and will require temporary earth retaining system and a final waterproof concrete structure within the supported excavation.

The estimated station costs are based on the footprint and elements included in the Central Station of LVCC Loop Campus Wide People Mover project in Las Vegas. This was a 45 feet deep cut-and-cover structure of an approximate 210 feet by 92 feet footprint, encompassing a total of 10 berthing AEV stations, one elevator, one escalator, one emergency egress point, and one integrated roadway loop at each end. Conceptual stations with a three-way or four-way tunnel connection configuration, would likely result in additional space requirements. The depth of the tunnel alignment is not presently known, but for the purposes of this estimate it is assumed that the stations will be approximately 60 feet deep with a 250 feet by 95 feet approximate footprint.

The mean base total cost for a single station of the assumed dimensions is estimated at $150M, which includes temporary earth retaining works, dewatering, backfill, and the station final concrete structure including passenger access works, and passenger service areas, station-only ventilation and fire systems, and electrical systems.

6.2.1 Emergency Egress

Given the aforementioned running tunnel lengths, fire and life safety emergency egress points will be required. As is typical design practice in underground transit tunnel design, such facilities can be a combination of emergency egress shafts and cross-passageways between the two running tunnels. Conceptually following the requirements of National Fire Prevention Association, cross-passageways may be used in lieu of other emergency exits, provided they are constructed at a maximum spacing that allows motorists/riders to escape to an exit in an acceptable time-frame. Other emergency egress shafts may be required in accordance with specific design criteria. For this length of tunnel, it can be estimated that up to twenty-four (24) tunnel cross-passages may be required.

Cross passageways will likely be constructed by conventional tunneling methods utilizing significant ground improvement such as ground-freezing or grouting. The costs will be highly variable. It is assumed that a direct unit cost between $5M and $10M per cross-passageway applies. This equates to a minimum of $240M direct cost for all cross-passageways under the above assumptions.

6.2.2 Corridor 10 Total Costs

Based on high-level assumptions, a system of tunnels and stations along the 4.2-mile corridor between MIA and Biscayne Boulevard is estimated to cost between about $1B and $1.5B. Table 5 shows a more detailed breakdown.

Table 5: Range of Capital Costs

Construction Element	Low	Median	High
Underground Stations (5)	$635M	$750M	$975M
Running tunnels	$235M	$280M	$365M
Emergency egress (cross passage only)	$205M	$240M	$310M
Total	$1.08 B	$1.27 B	$1.65B

6.2.3 Unit costs

While each section of transit tunnel and each particular station will have unique costs due to corridor specific constraints and characteristics, the following high-level unit costs are estimated for discussion:

- Running Tunnels (including cross passages): $30M/mile (tunnel)
- Stations: $150M/each
- Egress/Cross Passages: $5M - $10M/each

6.2.4 Capital Cost Ratings

The capital cost rating system is shown below. Generally, higher cost projects area rated low, reflecting that these projects require a larger share of available funding resources, and takes longer to construct. Respectively, lower coat projects were rated higher than higher coat projects. Rating was based on the following scale:

- Cost under $1B: High;
- Cost between $1B and $2 B: Medium; and
- Cost over $2B: Low.

Table 6 summarized the estimated capital cost and rating for each potential transit tunnel corridor.

Table 6: Planning Level Capital Cost Estimate

Planning Level Cost Estimate	Corridor 1: Aventura Brightline Station to Sunny Isles	Corridor 2: Golden Glades to Sunny Isles	Corridor 3: Opa-locka to Miami Lakes	Corridor 4: Metrorail Transfer Station to Collins Avenue	Corridor 5: Miami Central to PortMiami	Corridor 6: Brickell Avenue to FTX Arena	Corridor 7: FTX Arena to Design District	Corridor 8: Miami Central to Design District	Corridor 9: Design District/ Magic City Loop	Corridor 10: Miami Intermodal Center to Wynwood	Corridor 11: Overtown Connector	Corridor 12: Miami Intermodal Center to Miami Central	Corridor 13: Magic City Casino to Douglas Road
Corridor Length	2.4	6.0	4.6	8.8	1.3	1.2	2.5	2.8	4.4	4.1	1.0	4.9	3.2
Corridor Cost- Low[1]	$118.1	$295.2	$226.3	$433.0	$63.0	$60.5	$123.0	$136.3	$215.5	$202.7	$50.2	$240.6	$155.5
Corridor Cost - Medium	$144.0	$360.0	$276.0	$528.0	$76.8	$73.8	$150.0	$166.2	$262.8	$247.2	$61.2	$293.4	$189.6
Corridor Cost - High[2]	$187.2	$468.0	$358.8	$686.4	$99.8	$95.9	$195.0	$216.1	$341.6	$321.4	$79.6	$381.4	$246.5
Underground Stations	4	4	3	5	3	3	3	5	4	5	1	5	4
Shared Stations	0	0	0	0	2	1	2	2	1	3	0	3	2
Station Cost - Low[1]	$492.0	$492.0	$369.0	$615.0	$369.0	$369.0	$369.0	$615.0	$492.0	$615.0	$123.0	$615.0	$492.0
Station Cost - Medium	$600.0	$600.0	$450.0	$750.0	$450.0	$450.0	$450.0	$750.0	$600.0	$750.0	$150.0	$750.0	$600.0
Station Cost -High[2]	$780.0	$780.0	$585.0	$975.0	$585.0	$585.0	$585.0	$975.0	$780.0	$975.0	$195.0	$975.0	$780.0
Emergency Egress Tunnels	14.4	36.0	27.6	52.8	7.7	7.4	15.0	16.6	26.3	24.7	6.1	29.3	19.0
Emergency Egress Cost - Low[1]	$118.1	$295.2	$226.3	$433.0	$63.0	$60.5	$123.0	$136.3	$215.5	$202.7	$50.2	$240.6	$155.5
Emergency Egress Cost - Medium	$144.0	$360.0	$276.0	$528.0	$76.8	$73.8	$150.0	$166.2	$262.8	$247.2	$61.2	$293.4	$189.6
Emergency Egress Cost - High[2]	$187.2	$468.0	$358.8	$686.4	$99.8	$95.9	$195.0	$216.1	$341.6	$321.4	$79.6	$381.4	$246.5
Cost - Low[1]	$728.2	$1,082.4	$821.6	$1,480.9	$495.0	$490.0	$615.0	$887.6	$923.0	$1,020.4	$223.4	$1,096.2	$802.9
Cost - Medium	$888.0	$1,320.0	$1,002.0	$1,806.0	$603.6	$597.6	$750.0	$1,082.4	$1,125.6	$1,244.4	$272.4	$1,336.8	$979.2
Cost - High[2]	$1,154.4	$1,716.0	$1,302.6	$2,347.8	$784.7	$776.9	$975.0	$1,407.1	$1,463.3	$1,617.7	$354.1	$1,737.8	$1,273.0

[1] Low is 18% less than M

[2] High is 30% more than M medium

[3] Cross Passages Only

[4] All Costs in Millions. Mean corridor cost is 30 M per mile. Mean station cost is 150M. Mean egress tunnels are 6 per mile.

Table 6 Planning Level Capital Cost Estimates (Continued)

Planning Level Cost Estimate	Corridor 14: Gables Connector	Corridor 15: Douglas Road Metrorail Station to Coconut Grove	Corridor 16: Douglas Road Metrorail Station to Coral Gables City Hall	Corridor 17: Ludlam Corridor	Corridor 18: Flagler Corridor	Corridor 19: Downtown Doral to Miami International Airport	Corridor 20: Downtown Doral to East-West NW 87 Street Station	Corridor 21: Dolphin Terminal to East-West NW 107 Avenue Station	Corridor 22: East-West NW 107 Avenue Station to Florida International University	Corridor 23: South Miami Metrorail Station to Tropical Park	Corridor 24: University Metrorail Station to University of Miami	Corridor 25: Dadeland South Metrorail Station to Baptist West
Corridor Length	4.1	1.1	1.6	10.9	7.0	6.5	1.9	1.6	2.4	4.4	2.5	9.3
Corridor Cost- Low[1]	$200.2	$54.1	$78.7	$536.3	$344.4	$319.8	$93.5	$78.7	$118.1	$216.5	$123.0	$457.6
Corridor Cost - Medium	$244.2	$66.0	$96.0	$654.0	$420.0	$390.0	$114.0	$96.0	$144.0	$264.0	$150.0	$558.0
Corridor Cost - High[2]	$317.5	$85.8	$124.8	$850.2	$546.0	$507.0	$148.2	$124.8	$187.2	$343.2	$195.0	$725.4
Underground Stations	5	2	3	8	7	6	4	3	4	6	9	8
Shared Stations	2	1	1	3	1	1	1	2	1	1	1	1
Station Cost - Low[1]	$615.0	$246.0	$369.0	$984.0	$861.0	$738.0	$492.0	$369.0	$492.0	$738.0	$1,107.0	$984.0
Station Cost - Medium	$750.0	$300.0	$450.0	$1,200.0	$1,050.0	$900.0	$600.0	$450.0	$600.0	$900.0	$1,350.0	$1,200.0
Station Cost -High[2]	$975.0	$390.0	$585.0	$1,560.0	$1,365.0	$1,170.0	$780.0	$585.0	$780.0	$1,170.0	$1,755.0	$1,560.0
Emergency Egress Tunnels	24.4	6.6	9.6	65.4	42.0	39.0	11.4	9.6	14.4	26.4	15.0	55.8
Emergency Egress Cost - Low[1]	$200.2	$54.1	$78.7	$536.3	$344.4	$319.8	$93.5	$78.7	$118.1	$216.5	$123.0	$457.6
Emergency Egress Cost - Medium	$244.2	$66.0	$96.0	$654.0	$420.0	$390.0	$114.0	$96.0	$144.0	$264.0	$150.0	$558.0
Emergency Egress Cost - High[2]	$317.5	$85.8	$124.8	$850.2	$546.0	$507.0	$148.2	$124.8	$187.2	$343.2	$195.0	$725.4
Cost - Low[1]	$1,015.5	$354.2	$526.4	$2,056.6	$1,549.8	$1,377.6	$679.0	$526.4	$728.2	$1,171.0	$1,353.0	$1,899.1
Cost - Medium	$1,238.4	$432.0	$642.0	$2,508.0	$1,890.0	$1,680.0	$828.0	$642.0	$888.0	$1,428.0	$1,650.0	$2,316.0
Cost - High[2]	$1,609.9	$561.6	$834.6	$3,260.4	$2,457.0	$2,184.0	$1,076.4	$834.6	$1,154.4	$1,856.4	$2,145.0	$3,010.8

[1] Low is 18% less than M

[2] High is 30% more than M medium

[3] Cross Passages Only

[4] All Costs in Millions. Mean corridor cost is 30 M per mile. Mean station cost is 150M. Mean egress tunnels are 6 per mile.

6.3 Land Use Criteria

Under the land use criteria, three parameters were used to identify potential transit tunnel corridors under this criteria: transit oriented development, community redevelopment, and access to major activity centers.

6.3.1 Transit Supportive Land Use in Place Along Corridor

Higher density and intensity land uses are more transit supportive because more people live and work in these areas. Accordingly, higher density and intensity land uses were rated higher, as shown below:

- Higher density and intensity land uses: High;
- Moderate density and intensity land uses: Medium; and
- Lower density and intensity land uses: Low.

To identify transit tunnel corridors that fall under this parameter, the potential corridors were overlayed onto the Miami-Dade County land use map. Each corridor was then screened, and a rating assigned based on the level of residential and employment land use density.

6.3.2 Community Redevelopment Area in Place near Station(s)

Each corridor was screened based on their proximity to nearby community redevelopment area which were identify on the Miami-Dade County land use map.

Community redevelopment areas most often result in higher transit use as they promote higher residential and employment density where higher number of people live and work. Corridors with stations located near community redevelopment areas were rated higher, as shown below:

- No community redevelopment area: Low; and
- Adjacent community redevelopment area: High.

6.3.3 Access to Major Activity Centers

Major activity centers are areas that attract a large number of people for entertainment, shopping, education, and other. These include town centers, hospitals, universities, beaches, PortMiami, Miami International Airport, and stadiums. Each of the potential corridor was overlayed on the Miami-Dade County land use map and ranked based on the proximity and access to major activity centers in the region. The following ranking was used:

- Up to 2 Major Activity Centers: Low;
- 3 to 4 Major Activity Centers: Medium; and
- Over 5 Major Activity Centers: High.

6.4 Mobility Criteria

The proposed transit tunnel corridors would be implemented to provide additional transportation service in the region and increase mobility for residents and visitors. The four measures described below were used to screen potential transit tunnel corridors.

6.4.1 Projected Daily Traffic Volume

Corridor service volumes for the underground systems were assumed to be positively correlated to surface street traffic volume above ground. The greater the number of surface street traffic volume, the more likelihood that additional transportation solution provided by the transit tunnels would be used.

Service volume thresholds were based on projected 2045 annual average daily traffic volumes (AADT) from the regional SERPM model, as shown below:

- <10,000 AADT: Low;
- 10,000-30,000 AADT: Medium; and
- >30,000 AADT: High.

6.4.2 Projected Ridership

Projected 2045 stop-level boardings were obtained from the SERPM along each of the identified corridors. Higher ridership was assumed to be positively correlated to transit propensity or the probability of higher transit use. The greater the estimated ridership, the more likelihood that additional transportation solution provided by the transit tunnels would be used. The following thresholds were used for rating of the various corridors identified:

- <5,000 riders: Low;
- <5,000 up to 10,000 riders: Medium; and
- >10,000 riders: High.

6.4.3 Connects to and Supports SMART Plan Corridor

To identify the corridors meeting this criteria, the potential corridors were overlayed with the SMART Plan corridors (see Figure 22) and connection points were noted. The greater the level of connections to future SMART Plan corridors, the more robust the future transit network will be, and more riders will be attracted.

Connections to SMART Plan corridors were evaluated as shown below:

- 0 SMART corridor connections: Low;
- 1 SMART corridor connection: Medium; and
- Two or more SMART corridor connections: High.

6.4.4 Connects to Existing/Proposed Rail Stations

To identify the corridors meeting this criteria, the potential corridors were overlayed with existing and proposed passenger rail corridors (see Figure 22) and connection points were noted. The greater the level of connections to existing and proposed passenger rail corridors (Tri-rail, Metrorail, Brightline, Amtrak), the more robust the future transit network will be, and more riders will be attracted. Connections to existing and proposed passenger rail stations were evaluated as shown below:

- 0 passenger rail connection: Low;
- 1 passenger rail connection: Medium; and
- Two or more passenger rail connections: High.

6.5 Technical Criteria

This criteria looked at major elements that would impact and should be considered in the physical implementation transit tunnel corridors. These elements are described below.

6.5.1 Interface with Underground Utilities

Corridors were evaluated based on the level of interface and potential conflict point with underground utilities using the Miami-Dade County utility maps. The fewer potential points of conflict noted, the easier corridor design and construction will be and the higher the ranking.

Interface with underground utilities were evaluated as shown below:

- More than 10 points of conflict: Low;
- 10 to 5 points of conflict: Medium; and
- 0 to 5 points of conflict: High.

6.5.2 Crosses Under Water

The Miami-Dade County base layer with water features (see Figure 22) was used to identify location of water crossings along each of the potential transit tunnel corridors. The fewer water crossings noted, the easier corridor design and construction will be and the higher the ranking.

Crossing under water was evaluated as shown below:

- > or equal to 2 water crossings: Low;
- 1 water crossing: Medium; and
- 0 water crossings: High.

6.5.3 Constructability (Routing and MOT)

In addition to such factors as the ground conditions, the ground water conditions, the length and diameter of the tunnel drive, the depth of the tunnel, and the logistics of supporting the tunnel excavation, tunnel alignment (routing) and maintenance of traffic during the construction of the tunnel are critical elements to consider for implementation. This criterium was evaluated on the number of turns necessary to accommodate the proposed transit tunnel corridor alignment or routing. The fewer turns noted, the easier corridor design and construction will be and the higher the ranking.

Constructability was evaluated as shown below:

- > or equal to 4 turns: Low;
- 1 to 3 turns: Medium; and
- 0 turns: High

A summary map of the evaluation outcomes is shown in Figure 22. Table 7 provides a detailed matrix.

Figure 22: Potential Corridors Identified

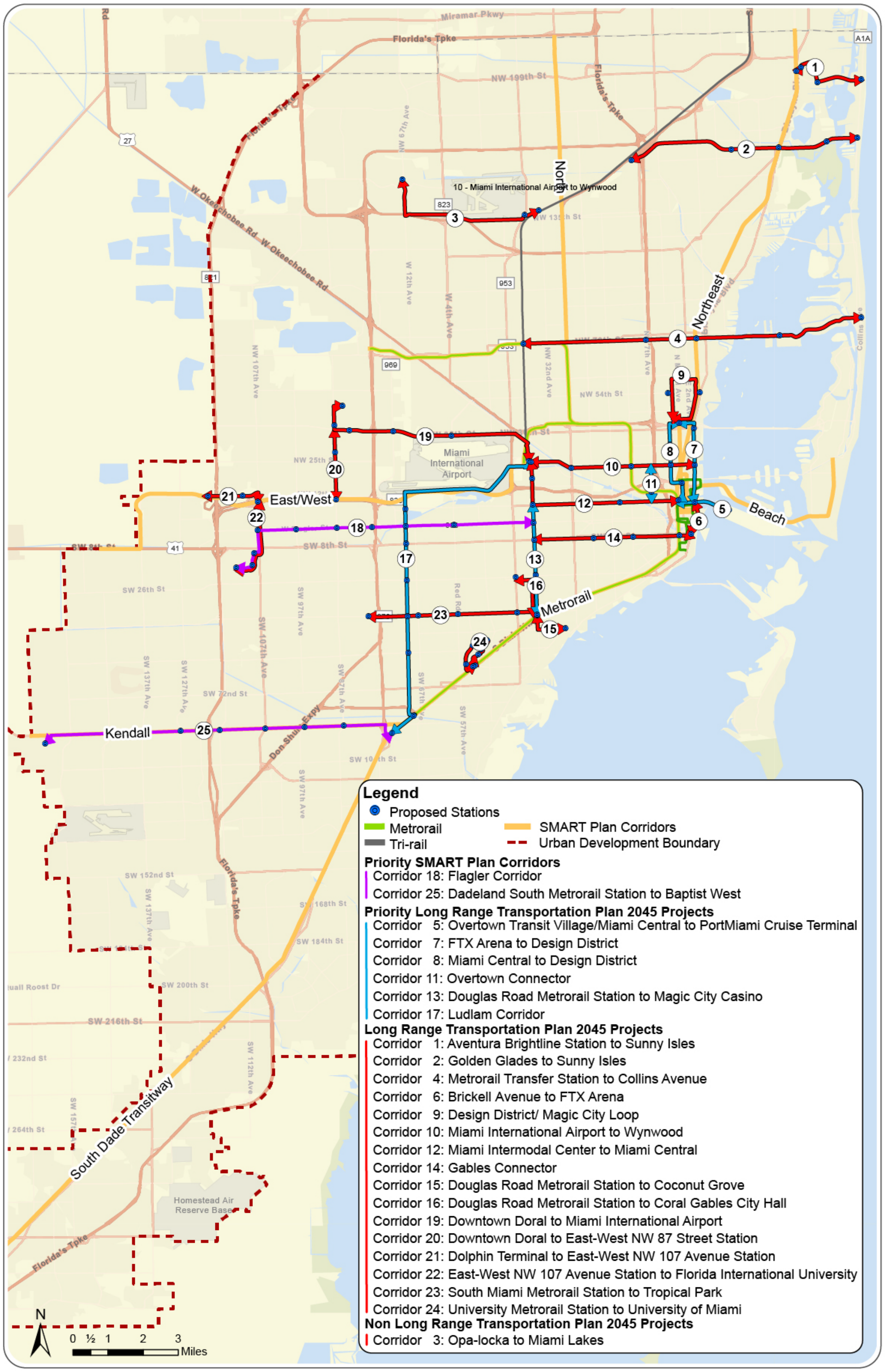


Table 7: Potential Corridors Evaluation Criteria Matrix

Evaluation Criteria	North				Central-East								
	Corridor 1: Aventura Brightline Station to Sunny Isles	Corridor 2: Golden Glades to Sunny Isles	Corridor 3: Opa-locka to Miami Lakes	Corridor 4: Northside Metrorail to Collins Avenue	Corridor 5: Miami Central to PortMiami	Corridor 6: Brickell Avenue to FTX Arena	Corridor 7: FTX Arena to Design District	Corridor 8: Miami Central to Design District	Corridor 9: Design District/ Magic City Loop	Corridor 10: Miami International Airport to Wynwood	Corridor 11: Overtown Connector	Corridor 12: Miami Intermodal Center to Miami Central	Corridor 13: Magic City Casino to Douglas Road
Cost Criteria													
Estimated Capital Cost	M	M	M	H	L	L	L	M	M	M	L	M	M
Estimated Capital Cost (for Ranking)	M	M	M	L	H	H	H	M	M	M	H	M	M
Land Use Criteria													
Transit Supportive Land Use in Place	H	L	L	L	H	H	H	H	M	M	M	H	M
Community Redevelopment Area in Place	L	H	H	H	H	H	H	H	L	H	H	H	L
Access to Major Activity Centers	M	H	M	M	M	M	M	M	M	M	L	H	M
Mobility Criteria													
Projected Daily Traffic Volume	L	M	M	L	M	L	L	H	M	L	M	M	M
Projected Ridership	M	L	L	M	M	H	L	L	M	M	M	L	H
Connects to SMART Plan Corridor	M	M	L	H	M	M	M	M	H	L	H	M	L
Connects to Existing/Proposed Rail Stations	M	H	M	H	H	M	M	H	L	H	M	H	H
Technical Criteria													
Interface with Underground Utilities	H	M	M	L	H	M	H	H	H	M	H	L	H
Crosses Under Water	L	L	M	L	M	M	H	H	H	L	H	L	H
Constructability (Routing and MOT)	L	L	L	M	M	M	H	H	H	M	H	M	H
Ranking													
H	2	3	1	3	5	4	6	7	4	2	6	4	5
M	5	4	6	3	6	6	3	3	5	6	4	4	4
L	4	4	4	5	0	1	2	1	2	3	1	3	2
Ranking (top six in blue)	23	16	25	19	5	7	3	1	8	22	2	9	6

Table 4 – Evaluation Criteria Matrix (Continued)

Evaluation Criteria	Central-East			Central		West-Central				South		
	Corridor 14: Gables Connector	Corridor 15: Douglas Road Metrorail Station to Coconut Grove	Corridor 16: Douglas Road Metrorail Station to Coral Gables City Hall	Corridor 17: Ludlam Corridor	Corridor 18: Flagler Corridor	Corridor 19: Downtown Doral to Miami International Airport	Corridor 20: Downtown Doral to East-West NW 87 Street Station	Corridor 21: Dolphin Terminal to East-West NW 107 Avenue Station	Corridor 22: University Metrorail Station to University of Miami	Corridor 23: South Miami Metrorail Station to Tropical Park	Corridor 24: East-West NW 107 Avenue Station to Florida International University	Corridor 25: Dadeland South Metrorail Station to Baptist West
Cost Criteria												
Estimated Capital Cost	M	L	L	H	H	H	M	L	M	M	H	H
Estimated Capital Cost (for Ranking)	M	H	H	L	L	L	M	H	M	M	L	L
Land Use Criteria												
Transit Supportive Land Use in Place	M	H	M	H	M	M	M	M	H	L	M	M
Community Redevelopment Area in Place	L	L	L	L	L	L	L	L	L	L	L	L
Access to Major Activity Centers	M	L	L	H	M	H	H	M	L	H	M	H
Mobility Criteria												
Projected Daily Traffic Volume	L	M	M	H	H	L	M	H	M	M	L	M
Projected Ridership	H	L	H	H	L	L	H	L	L	H	M	H
Connects to SMART Plan Corridor	L	L	L	H	M	H	M	M	L	L	M	H
Connects to Existing/Proposed Rail Stations	H	M	M	H	L	H	L	L	M	M	M	H
Technical Criteria												
Interface with Underground Utilities	M	H	M	M	H	M	H	H	H	L	H	M
Crosses Under Water	H	H	H	L	L	L	M	H	M	M	H	L
Constructability (Routing and MOT)	H	M	M	L	H	L	M	M	H	H	L	M
Ranking												
H	4	4	3	6	3	3	3	4	3	3	2	4
M	4	3	5	1	3	2	6	4	4	4	5	4
L	3	4	3	4	5	6	2	3	4	4	4	3
Ranking (top six in blue)	10	13	15	4	20	21	14	11	17	18	24	12

7. Tier 2 Level Analysis Potential Transit Tunnel Corridors

The second tier level analysis was used to identify potential corridors for implementation: corridors supporting SMART Plan implementation and corridors which support implementation of LRTP projects. Both groups are described in this section.

7.1 SMART Corridors

The following SMART corridors were identified for potential transit tunnel technology implementation and are illustrated Figure 23.

7.1.1 Corridor 18: Flagler Corridor

This corridor should be extended to serve FIU (southern leg of Corridor 24: East-West NW 107 Avenue Station to Florida International University), and is recommended for these reasons:

- SMART Plan corridor
- high traffic volume
- interfaces with few utilities
- few turns

This corridor could be extended to include the southern leg of Corridor 24: East-West NW 107 Avenue Station to Florida International University to serve the FIU engineering and main campuses.

7.1.2 Corridor 25: Dadeland South Metrorail Station to Baptist Health

This corridor is recommended for these reasons:

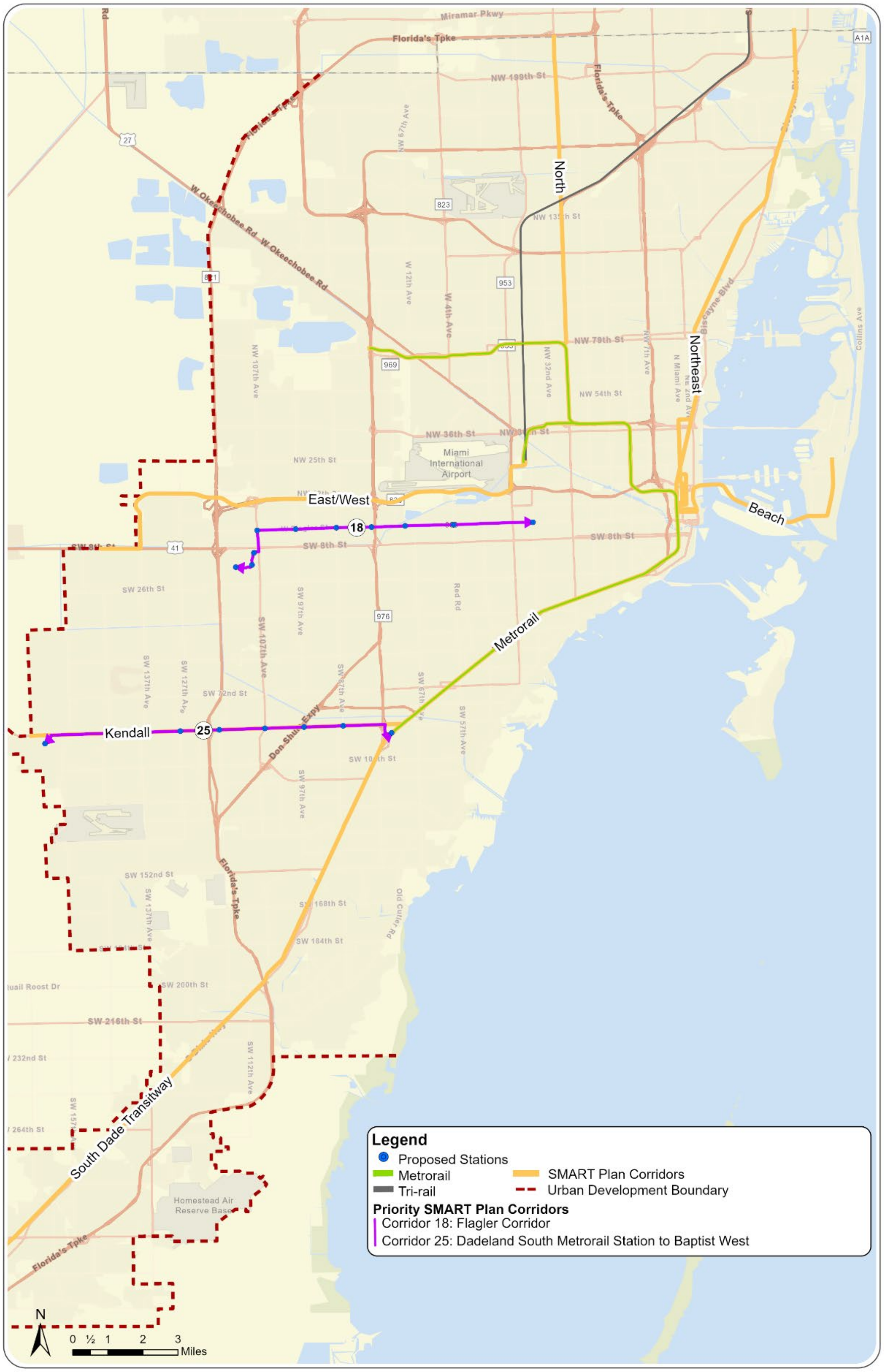
- SMART Plan corridor
- access to activity centers
- high ridership
- connects to existing premium transit

An option for the Kendall Corridor is to have transit tunnels at key locations along the corridor, and not necessarily a transit tunnel along the whole corridor.

Another potential option is for the corridor to run from the Baptist West (West Kendall Terminal at 9155 SW 162 Ave) to the SR 874/Shula Expressway. This could shorten the length of the tunnel, eliminate turns, lower potential costs, and increase its feasibility. There could also be a one seat ride between Dadeland North and Baptist West, with quick access to the expressways from the Dadeland North Station.

.

Figure 23: Potential Priority SMART Plan Corridors



7.2 LRTP Corridors

The following LRTP funded and unfunded corridors were identified for potential transit tunnel technology implementation and are illustrated in Figure 24.

7.2.1 Corridor 8: Miami Central to Design District

Ranking: 1 H 7 | M 3 | L 1

This corridor ranks high for these reasons:

- transit supportive land uses
- near a community redevelopment area
- high traffic volume
- connections to existing/proposed transit stations
- interfaces with few utilities
- few water crossings
- few turns

7.2.2 Corridor 11: Overtown Connector

Ranking: 2 H 6 | M 4 | L 1

This corridor ranks high for these reasons:

- short length
- near a community redevelopment area
- connections to a SMART Plan corridor
- interfaces with few utilities
- few water crossings
- few turns

7.2.3 Corridor 7: FTX Arena to Design District

Ranking: 3 H 6 | M 3 | L 2

This corridor ranks high for these reasons:

- short length
- transit supportive land uses
- proximity to a community redevelopment area
- interfaces with few utilities
- few water crossings
- few turns

7.2.4 Corridor 17: Ludlam Corridor

Ranking: 4 H 6 | M 1 | L 4

This corridor ranks high for these reasons:

- transit supportive land uses
- connections to major activity centers
- high traffic volume
- high ridership
- connections to a SMART Plan corridor
- connections to existing/future transit stations

7.2.5 Corridor 5: Miami Central to PortMiami

Ranking: 5 H 5 | M 6 | L 0

This corridor ranks high for these reasons:

- short length
- transit supportive land uses
- proximity to a community redevelopment area
- connection to Miami Central
- interfaces with few utilities

7.2.6 Corridor 13: Magic City Casino to Douglas Road

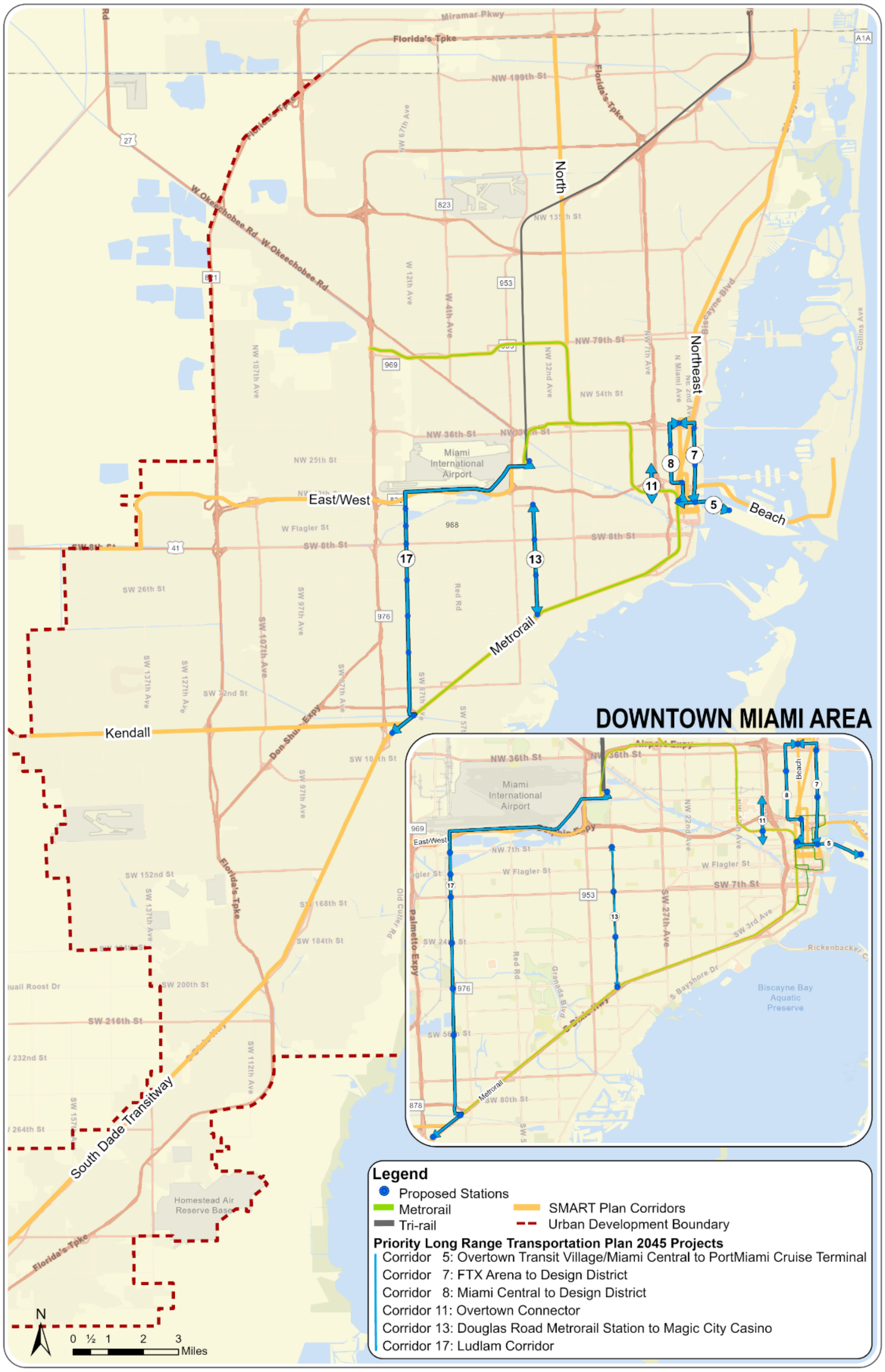
Ranking: 6 H 5 | M 4 | L 2

This corridor ranks high for these reasons:

- high ridership
- connections to an existing transit station
- interfaces with few utilities
- few water crossings
- few turns

Corridors 5, 7 and 8 could implemented as phases of single project creating a transit tunnel downtown loop.

Figure 24: Potential Priority LRTP Corridors



8. Next Steps – Tier 3 Level Analysis

The Tier 1 and Tier 2 levels analysis in this report is a high level initial evaluation of the transit tunnel corridors performed with the best available information. The Tier 3 level analysis would focus on concept development for the transit tunnel corridors identified in Tier 2.

Should Miami-Dade County wish to proceed further with vetting the transit tunnel technology and the transit tunnel corridors profiled in this report, the following next steps are recommended:

- Efficient Transportation Decision Making (ETDM) Planning Screening - Identify potential environmental issues on the selected corridors
- Concept Development – type of transit vehicle, life safety and emergency design criteria, process of construction under public and private properties
- Concept Layouts – roadway alignment, station footprints
- Transit Service – headway, hours of operation, number of vehicles required
- Partner Coordination – establishment of a Project Working Group, presentation at TPO Board and Committees, and briefings

Detailed analysis supporting these elements include:

1. Efficient Transportation Decision Making (ETDM) Planning Screening - identify potential environmental effects of proposed corridor improvements. This process provides stakeholders the opportunity for early input, involvement, and coordination.
2. Partner Coordination: Review of study options with transportation partners through the TPO's technical advisory committees (i.e., TPC, TPTAC, etc.).
3. Vehicle Specifications: Identify the type of vehicles to be operated in the potential transit, their passenger capacity, and envelope to aid in the design of the tunnel itself.
4. Tunnel Sizing: perform an in-depth space proofing analysis based on the identified vehicle envelope, tunnel function, and life safety and emergency design criteria.
5. Fire and Life Safety: develop design criteria based on national and local standards including City of Miami fire codes. Criteria should identify elements to be included and accounted for in the design of the tunnel.
6. Subterranean Rights: Identify and evaluate process for constructing and operating tunnels underneath existing public right-of-way and private property.
7. Land Use: Analyze which land uses best support premium transit investment along viable corridors.
8. Service Plan: Develop a service plan. The service plan should identify hours of service (weekdays, weekends, peak periods) and service frequency (weekdays, weekends,

and peak periods. Adjustments to the existing transit service should also be evaluated which will maximize ridership on the new and existing transit options. Maintenance facility needs should also be taken into consideration. Potential route refinements should be developed to minimize impacts based on alignment and station design.

9. Ridership Analysis: Using the latest SERPM model, a ridership analysis should be done for the no build and build alternatives. In this report, existing transit ridership and traffic volumes along the corridors were used as a proxy for ridership. A more detailed analysis using the latest SERPM model will provide estimates using the same methodology as other SMART Plan corridor studies. This will allow consistent route productivity comparisons between proposed SMART Plan corridors and the corridors proposed in this study. The more accurate ridership number can also be used to evaluate whether the capacity of emerging tunneling technology is sufficient to handle the potential ridership demand.

10. Operating and Maintenance Plan: A detailed operating and maintenance plan should be developed identifying operator and type of vehicle (private vehicles, public transit vehicles) allowed in the tunnel. Maintenance facility location and capacity should also be developed. Operating and maintenance costs should be prepared based on the operating plan.

11. Capital Cost Estimate: A detailed capital cost estimate should be prepared based on but not limited to the following items.

    a. Conceptual and design plan (horizontal and vertical profiles) development for tunnel alignment and stations. (Including maintenance of traffic, drainage, utilities, signing and pavement, landscaping, signage, permits, etc.)

    b. Right of way identification and costs.

    c. Fleet requirement (number of transit vehicles needed for operation).

    d. Subsurface Investigation and Geotechnical Baselining: The water pressure profile and the subsurface profile along the corridor should be investigated and baselined. This will identify areas of high risk or areas with known limestone solution features. The vertical and lateral corridor alignment of corridors should be adjusted to minimize areas of high risk and limestone solution features.

    e. Hydrological Investigation: Existing hydrology should be evaluated as well as impact of proposed tunnel(s) to the water flow and supply.

    f. TBM Technology Selection: Based on the geotechnical baseline, TBM technology should be selected that is appropriate for the conditions. The goal is well controlled and timely transitions between operation modes, and fast response when transitioning from hard medium (i.e., rock) to soft (i.e., soft soil deposits). The TBM technology selected may also have specific turning radius requirements than need to be selected. The TMB technology selected will be an important factor in developing a more detailed cost estimate.

g. Fire Prevention and Emergency Egress Analysis: Applicable fire and emergency egress standards for the new technology should be determined. The number of cross-access tunnels should be determined, as they will have an impact on project costs.

h. ADA Analysis: Applicable ADA requirements for the new technology should be determined and incorporated into the design plans and costs.

i. Stations: This will include number, location, function (terminal, transfer, or mid-block), and footprint of stations: Real estate availability and space constraints may limit the number of potential station locations. More specific station types should be developed, and parking and other facility needs identified. Station footprints should also account for ancillary and supporting facilities such as circulation, electric charging stations, fare vending facilities, restrooms, and security

j. Maintenance Facility: This will include but not be limited to location, sizing, elements, and potential environmental mitigation.

12. Environmental Permitting: NEPA requirements will need to be identified and corresponding documentation prepared, including coordination and consultation with federal, state, and local partners.
13. Public Involvement: A targeted outreach plan should be developed for planning, concept development, through construction phases.
14. Financial Plan to identify source of funds. If federally funded, federal regulations will apply.
15. Interagency agreements and memorandums of understanding.

9. Appendix A: LRTP Citations

A.1 Northern Miami-Dade County

A.1.1 Aventura Brightline Station to Sunny Isles (Corridor 1)

LRTP ID:
Table 7-01: Transit Projects, Priority II, Project 21,_Aventura Terminal - SMART Terminal (LRTP Page 07-12)
Table 7-09: Bicycle and Pedestrian Projects, Unfunded, 856 (William Lehman Causeway) (LRTP Page 07-105)
Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Unfunded, 2 Ave Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, 183 St Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Collins Ave Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, NW 199/203 St Enhanced Bus (LRTP Page 07-21)
Table 11-01: Illustrative Projects, Partially Funded, Northeast Corridor (LRTP Page 11-06)

A.1.2 Golden Glades to Sunny Isles (Corridor 2)

LRTP ID:
Table 7-01: Transit Projects, Priority II, Project 23, Golden Glades Multimodal Transportation Facility (GGMTF) - ITS Components, SMART Terminal (LRTP Page 07-12)
Table 7-01: Transit Projects, Priority II, Project 25, North Miami Beach Station, (LRTP Page 07-12)
Table 7-02: FDOT SIS Projects, Priority 1, Project 2, Golden Glades Multimodal Terminal
Table 7-09: Bicycle and Pedestrian Projects, Unfunded, Project 87, Golden Glades Bicycle-Ped Connector to Sunshine State Industrial Park_(LRTP Page 07-78)
Table 7-09: Bicycle and Pedestrian Projects, Unfunded, Project 87, NW 163 St (LRTP Page 07-119)

Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Priority I, Project 1, Beach Express North, (LRTP Page 07-06)
Table 7-01: Transit Projects, Unfunded, 22 Ave Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, North Miami Dade Express, (LRTP Page 07-21)
Table 7-01: Transit Projects, Unfunded, NW 7 Ave Enhanced Bus_(LRTP Page 07-21)
Table 7-01: Transit Projects, Unfunded, Palmetto Express Bus (East) (LRTP Page 07-21)

A.1.3 Opa-locka to Miami Lakes (Corridor 3)

LRTP ID: N/A

A.1.4 Metrorail Transfer Station to Collins Avenue (Corridor 4)

LRTP ID:
Table 7-01: Transit Projects, Unfunded, Little River Park-and-Ride (LRTP Page 07-20)
Table 7-04: FDOT Other Roads Projects, Priority II, SR 934 (NE/NW 79 St) (LRTP Page 07-26)
Table 7-04: FDOT Other Roads Projects, Priority II, SR 934 (NE/NW 81/82 St) (LRTP Page 07-26)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, NW 103 St Enhanced Bus (LRTP Page 07-21)

A.2 East-Central Miami-Dade County

A.2.1 Overtown Transit Village/Miami Central to PortMiami Cruise Terminal (Corridor 5)

LRTP ID:
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60, 11-07)

Premium Transit and Bus Route Terminus
Table 11-01: Illustrative Projects, Partially Funded, Northeast Corridor (LRTP Page 11-06)

A.2.2 Brickell Avenue to FTX Arena (Corridor 6)

LRTP ID:
Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, Coral Way (SR 972) Enhanced Bus_(LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Dolphin-Brickell Express (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Metromover Brickell Loop Extension (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, SW 8 St Enhanced Bus (LRTP Page 07-23)

A.2.3 FTX Arena to Design District (Corridor 7)

LRTP ID:
Table 7-01: Transit Projects, Priority II, Project 24, Midtown Station - SMART Terminal (LRTP Page 07-12)
Table 7-01: Transit Projects, Partially Funded, Project 40, Beach Corridor (LRTP Pages 07-16, 11-06)

A.2.4 Miami Central to Design District (Corridor 8)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 40, Beach Corridor (LRTP Pages 07-16, 11-06)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60, 11-07)

Premium Transit and Bus Route Terminus
Table 11-01: Illustrative Projects, Partially Funded, Northeast Corridor (LRTP Page 11-06)

A.2.5 Design District/Magic City Loop (Corridor 9)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 40, Beach Corridor (LRTP Pages 07-16, 11-06)

Premium Transit and Bus Route Terminus
Table 11-01: Illustrative Projects, Partially Funded, Northeast Corridor (LRTP Page 11-06)

A.2.6 Miami International Airport to Wynwood (Corridor 10)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 40, Beach Corridor (LRTP Pages 07-16, 11-06)
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)
Table 07-03: FDOT SIS Projects, Priority I, Miami Intermodal Center (MIC) Central Station (LRTP Page 07-24)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to Fort Lauderdale/Hollywood International Airport (FLL) Virgin Trains Connection (Pages 07-60)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60)

Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Unfunded, 27 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, 37 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, American Dream - MIC express (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Table 7-01: Transit Projects, Unfunded, Miami Gardens-MIC Express (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Okeechobee Enhanced Bus (LRTP Page 07-21)
Table 7-01: Transit Projects, Unfunded, Palmetto-MIC Express (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, West Kendall Express (LRTP Page 07-22)

A.2.7 Overtown Connector (Corridor 11)

LRTP ID:
Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, NW 7 Ave Enhanced Bus (LRTP Page 07-21)

A.2.8 MIA to Miami Central (Corridor 12)

LRTP ID: N/A
Table 7-01: Transit Projects, Partially Funded, Project 40, Beach Corridor (LRTP Pages 07-16, 11-06)
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)
Table 07-03: FDOT SIS Projects, Priority I, Miami Intermodal Center (MIC) Central Station (LRTP Page 07-24)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to Fort Lauderdale/Hollywood International Airport (FLL) Virgin Trains Connection (Pages 07-60)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60)
Table 11-01: Illustrative Projects, Partially Funded, Northeast Corridor (LRTP Page 11-06)

Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Unfunded, 27 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, 37 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, American Dream - MIC express (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Miami Gardens-MIC Express (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Okeechobee Enhanced Bus (LRTP Page 07-21)
Table 7-01: Transit Projects, Unfunded, Palmetto-MIC Express (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, West Kendall Express (LRTP Page 07-22)

A.2.9 Douglas Road Metrorail Station to Magic City Casino (Corridor 13)

LRTP ID:

Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, SW 40 St Enhanced Bus (LRTP Page 07-22)

A.2.10Gables Connector (Corridor 14)

LRTP ID:
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, SW 40 St Enhanced Bus (LRTP Page 07-22)

A.2.11 Douglas Road Metrorail Station to Coconut Grove (Corridor 15)

LRTP ID:
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, SW 40 St Enhanced Bus (LRTP Page 07-22)

A.2.12Douglas Road Metrorail Station to Coral Gables City Hall (Corridor 16)

LRTP ID:
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Coral Way (SR 972) Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, SW 40 St Enhanced Bus (LRTP Page 07-22)

A.3 Central Miami-Dade County

A.3.1 Ludlam Corridor (Corridor 17)

LRTP ID:

Table 7-09: Bicycle and Pedestrian Projects, Priority 1, Project 54, Ludlam Bike Path/Trail (LRTP Pages 07-72, 11-06)

Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)

Table 07-03: FDOT SIS Projects, Priority I, Miami Intermodal Center (MIC) Central Station (LRTP Page 07-24)

Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to Fort Lauderdale/Hollywood International Airport (FLL) Virgin Trains Connection (Pages 07-60)

Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60)

Table 7-01: Transit Projects, Priority II, Project 22, Dadeland South Intermodal Station – Ramps (BERT) (LRTP Page 07-12)

Table 7-01: Transit Projects, Priority II, Project 23, South Dade Transitway Park-and-Ride at Dadeland North (LRTP Page 07-14)

Table 7-01: Transit Projects, Priority II, Project 33, South Dade-Transitway- Park-and-Ride/Terminal at Dadeland South (LRTP Page 07-14)

Premium Transit and Bus Route Termini

Table 7-01: Transit Projects, Priority II, Project 36, Kendall Corridor (LRTP Page 07-16, 11-06)

Table 7-01: Transit Projects, Unfunded, 27 Ave Express Bus (LRTP Page 07-18)

Table 7-01: Transit Projects, Unfunded, 37 Ave Express Bus (LRTP Page 07-18)

Table 7-01: Transit Projects, Unfunded, American Dream - MIC express (LRTP Page 07-18)

Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)

Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)

Table 7-01: Transit Projects, Unfunded, Miami Gardens-MIC Express (LRTP Page 07-20)

Table 7-01: Transit Projects, Unfunded, Okeechobee Enhanced Bus (LRTP Page 07-21)

Table 7-01: Transit Projects, Unfunded, Palmetto-MIC Express (LRTP Page 07-22)

Table 7-01: Transit Projects, Unfunded, West Kendall Express (LRTP Page 07-22)

South

Table 7-01: Transit Projects, Priority I, Project 9, South Miami-Dade Express (BERT) (LRTP Page 07-08)

Table 7-01: Transit Projects, Priority I, Project 19, SW Miami-Dade Express (BERT) (LRTP Page 07-10)

Table 7-01: Transit Projects, Unfunded, 72 / 67 Ave Enhanced Bus (LRTP Page 07-18)

Table 7-01: Transit Projects, Unfunded, 252 Coral Reef Express (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Kendall BRT (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Palmetto Express Bus (South) (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, South Dade Transitway (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, South Dade Transitway Extension to Dadeland North (LRTP Page 07-23)
Table 11-11, Illustrative Projects, Partially Funded Projects, The Underline (LRTP Page 11-06)

A.3.2 Flagler Corridor (Corridor 18)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 42, Flagler Corridor (LRTP Pages 07-16, 11-06)

A.4 West Central Miami-Dade County

A.4.1 Downtown Doral to Miami International Airport (Corridor 19)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)
Table 07-03: FDOT SIS Projects, Priority I, Miami Intermodal Center (MIC) Central Station (LRTP Page 07-24)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to Fort Lauderdale/Hollywood International Airport (FLL) Virgin Trains Connection (Pages 07-60)
Table 7-8, Private and Developer Projects, Miami Intermodal Center (MIC) to PortMiami Virgin Trains Connection (Pages 07-60)

Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Unfunded, 27 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, 37 Ave Express Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, American Dream - MIC express (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) Enhanced Bus Service (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Douglas Rd (SW/NW 37 St) LRT (LRTP Page 07-19)
Table 7-01: Transit Projects, Unfunded, Miami Gardens-MIC Express (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Okeechobee Enhanced Bus (LRTP Page 07-21)
Table 7-01: Transit Projects, Unfunded, Palmetto-MIC Express (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, West Kendall Express (LRTP Page 07-22)

A.4.2 Downtown Doral to East-West NW 87 Street Station (Corridor 20)

LRTP ID:
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)

A.4.3 Dolphin Terminal to East-West NW 107 Avenue Station (Corridor 21)

LRTP ID:
Table 7-01: Transit Projects, Priority 1, Project 5, Florida's Turnpike Express (North) (LRTP Page 07-08)
Table 7-01: Transit Projects, Priority 1, Project 6, Florida's Turnpike Express (South) (LRTP Pages 07-08)
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)
Table 7-09: Bicycle and Pedestrian Projects, Unfunded, SMART Trails - Telemundo Way/NW 25 St- Route A (LRTP Pages 07-92)

A.5 South Miami-Dade County

A.5.1 University Metrorail Station to University of Miami (Corridor 22)

LRTP ID:
Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, Miller Dr (SW 56 St) Enhanced Bus (LRTP Page 07-20)

A.5.2 South Miami Metrorail Station to Tropical Park (Corridor 23)

LRTP ID:
Table 7-01: Transit Projects, Unfunded, Miller Dr (SW 56 St) Senator Villas Park-and-Ride (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, SW 40 St Enhanced Bus (LRTP Page 07-23)
Table 7-01: Transit Projects, Unfunded, Tropical Station - SMART Terminal (LRTP Page 07-23)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, Sunset Dr Enhanced Bus (LRTP Page 07-23)

A.5.3 East-West NW 107 Avenue Station to Florida International University (Corridor 24)

LRTP ID:

Table 7-01: Transit Projects, Priority 1, Project 5, Florida's Turnpike Express (North) (LRTP Page 07-08)
Table 7-01: Transit Projects, Partially Funded, Project 41, East-West Corridor (LRTP Pages 07-16, 11-06)

Premium Transit and Bus Route Terminus
Table 7-01: Transit Projects, Unfunded, SW 8 St Enhanced Bus (LRTP Page 07-23)

A.5.4 Dadeland South Metrorail Station to Baptist West (Corridor 25)

LRTP ID:
Table 7-09: Bicycle and Pedestrian Projects, Priority 1, Project 54, Ludlam Bike Path/Trail (LRTP Pages 07-72, 11-06)
Table 7-01: Transit Projects, Priority II, Project 22, Dadeland South Intermodal Station – Ramps (BERT) (LRTP Page 07-12)
Table 7-01: Transit Projects, Priority II, Project 23, South Dade Transitway Park-and-Ride at Dadeland North (LRTP Page 07-14)
Table 7-01: Transit Projects, Priority II, Project 33, South Dade-Transitway- Park-and-Ride/Terminal at Dadeland South (LRTP Page 07-14)
Table 7-01: Transit Projects, Priority II, Project 36, Kendall Corridor (LRTP Page 07-16, 11-06)
Table 7-01: Transit Projects, Priority IV, Project 37, Intermodal Terminal at SW 88 St (Kendall Dr) /SR 821 (HEFT) -SMART Terminal (LRTP Page 07-16)
Table 7-01: Transit Projects, Unfunded, Kendall BRT (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Kendall/SR-826 Station - SMART Terminal (LRTP Page 07-20)

Premium Transit and Bus Route Termini
Table 7-01: Transit Projects, Priority I, Project 9, South Miami-Dade Express (BERT) (LRTP Page 07-08)
Table 7-01: Transit Projects, Priority I, Project 19, SW Miami-Dade Express (BERT) (LRTP Page 07-10)
Table 7-01: Transit Projects, Unfunded, 72 / 67 Ave Enhanced Bus (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, 252 Coral Reef Express (LRTP Page 07-18)
Table 7-01: Transit Projects, Unfunded, Kendall BRT (LRTP Page 07-20)
Table 7-01: Transit Projects, Unfunded, Palmetto Express Bus (South) (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, South Dade Transitway (LRTP Page 07-22)
Table 7-01: Transit Projects, Unfunded, South Dade Transitway Extension to Dadeland North (LRTP Page 07-23)
Table 11-11, Illustrative Projects, Partially Funded Projects, The Underline (LRTP Page 11-06)
Table 7-01: Transit Projects, Unfunded, Sunset Dr Enhanced Bus (LRTP Page 07-23)

Table 7-01: Transit Projects, Unfunded, West Kendall Express (LRTP Page 07-23)
Table 7-01: Transit Projects, Unfunded, West Kendall Transit Terminal Improvements - SMART Terminal (LRTP Page 07-23)

The Miami-Dade TPO complies with the provisions of Title VI of the Civil Rights Act of 1964, which states: No person in the United States shall, on grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. It is also the policy of the Miami-Dade TPO to comply with all of the requirements of the Americans with Disabilities Act. For materials in accessible format please call (305) 375-4507.

The preparation of this report has been financed in part from the U.S. Department of Transportation (USDOT) through the Federal Highway Administration (FHWA) and/or the Federal Transit Administration (FTA), the State Planning and Research Program (Section 505 of Title 23, U.S. Code) and Miami-Dade County, Florida. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.