Port of Miami Freight Access Study
Final Report

Prepared for

Miami-Dade Metropolitan Planning Organization

Prepared by

Cambridge Systematics, Inc.

February 2007

final report

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Table of Contents

List of Tables

List of Figures

List of Figures
(continued)

Executive Summary

Since its inception in the 1960s the Port of Miami (POM) has grown into a substantial transportation and economic hub for the City of Miami, Miami-Dade County and the rest of South Florida, contributing over $12 billion to the local economy annually.[1] Port terminals handle more than nine million tons of cargo each year, including over one million 20-foot equivalent units (TEU), making it the largest container port in Florida. In addition, the POM is considered the cruise capital of the world, handling over 3.6 million multi-day cruise passengers each year. The POM expects to handle more than 1.5 million TEUs and more than 5 million passengers annually by 2015. Currently, the majority of containerized cargo moves to western Miami-Dade County via truck drayage service to the warehousing and distribution district in Doral or to Florida East Coast Railway's (FEC) intermodal facility in Hialeah. The reliance on trucks for regional cargo distribution as well as for servicing the cruise ships in port has created a long history of community conflicts given the required use of local city streets to access the POM.

In response to restricted port access and worsening downtown congestion, local leaders continue to explore a range of improvements that would support both port growth and downtown redevelopment, while reducing traffic conflicts. Currently, the preferred alternative moving forward is a tunnel that would connect the POM with I-395 on Watson Island, providing direct Interstate access.[2] Figure ES.1 illustrates the existing Strategic Intermodal System connectors for the POM.[3] As shown, the facility currently is served by roadway (solid red) and rail (dashed red) connections, with the new highway tunnel planned for the future (dashed red with yellow). As proposed, this would be one element to alleviate a portion of the truck traffic that currently traverses the downtown. A number of other access improvements are actively being discussed by community and industry leaders.

Figure ES.1 SIS Connectors

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[1] The Four Gates Company, "The Economic Impact of the Dante Fascell Port of Miami-Dade County," May 2006.

[2] Effective November 1, 2006, the Florida Department of Transportation released a RFP for the Port of Miami Tunnel and Access Improvement Project.

[3] The Strategic Intermodal System (SIS) consists of a network of transportation corridors, hubs, and connectors designated by the Florida Department of Transportation which are eligible for new capacity funding.

The purpose of the *Port of Miami Freight Access Study* was to explore the feasibility of developing a rail-only tunnel connection to the POM. Study motivation grew out of local interest in the success of the Alameda Corridor in Southern California. This is a 20-mile rail corridor developed specifically to provide the Ports of Long Beach and Los Angeles with inland connections while eliminating over 200 at-grade conflicts with congested city streets. Figure ES.2 illustrates the Alameda Corridor. This corridor serves the largest seaport container facilities in the United States. The Ports of Los Angeles and Long Beach function as a gateway to the entire U.S. market for foreign trade. The capacity and service of the Alameda Corridor is predicated on this type of service and volumes.

Figure ES.2 Alameda Corridor

The *Port of Miami Freight Access Study* ultimately was initiated to evaluate the potential for a similar facility in Miami-Dade County. Figures ES.3 and ES.4 illustrate the current rail access to the POM. Currently, the POM handles a small fraction of the volume and primarily serves a Southeast Florida regional market. This study explores the potential application of this type of infrastructure project within these parameters.

Figure ES.3 Rail Access Corridor at Biscayne Boulevard

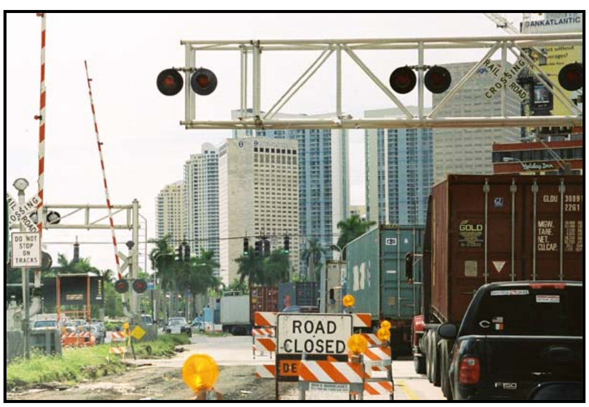

Figure ES.4 Rail Access Corridor West of Biscayne Boulevard

Key Considerations

Waterborne transportation at all U.S. ports has increased approximately 15 percent in the past 25 years.[4] This growth is anticipated to continue indefinitely as globalization expands.

[4] U.S. DOT, "Freight in America," January 2006.

At the local level, the POM serves as a critical link between the 5.5 million residents of South Florida and the global economy. As the region continues to grow and expand within an increasingly global economy, the POM and its peers throughout the Southeastern U.S. will be challenged to increase both throughput and quality of service. Since the majority of waterborne freight relies on at least one additional mode of transportation to reach its final destination, the POM will be directly impacted by its access to the region's intermodal system, as well as the reach of that system. The POM helps the region compete for affordable goods and services, minimizes the impact of long-haul rail and truck traffic, and provides a significant number of high-paying jobs. However, without reliable access to the landside transportation system, the POM will lose its competitive edge and will not achieve its potential in an increasingly global community.

Potential Access Improvements

As the POM has continued to grow both its cargo and cruise operations, Miami also has grown. Today, the only access to the port requires the use of city streets through mixed use developments. As a result, community leaders have promoted a variety of port access improvement strategies. The following briefly summarizes the three rail-specific proposals, followed by four non-rail-based options. While this Study was charged with evaluating a grade separated rail connection, it is critical that the community acknowledges and understands each of the alternatives.[5]

Rail Access Improvements

- **On-Port Intermodal Container Transfer Facility (ICTF) with Existing At-Grade Rail Service.** FEC has developed a service profile utilizing existing at-grade service. This would require development of an ICTF on POM property as well as significant upgrades to the POM rail lead. FEC has proposed to provide one train in and one out daily between 1:00 and 5:00 a.m. This service is designed to handle the existing traffic currently being drayed to the Hialeah rail terminal for northbound service. Port staff and tenants are resistant to give up on-port land for an ICTF with limited service.

- **On-Port ICTF with New Tunnel – Traditional Long-Haul Intermodal Service.** This service would consist of a new 18-acre ICTF on port property and a grade separated connection (tunnel) to FEC's intermodal network. Traditional long-haul intermodal traffic would be loaded/unloaded directly at the POM for hinterland market service.

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[5] Note that it was not the intent or scope of this Study to provide detailed engineering or economic impact analysis for each potential access improvement. The intent was to focus on the conceptual feasibility of a grade separated rail connection to the Port of Miami, while acknowledging other proposals.

This service would handle existing demand and would be used stimulate additional rail traffic.

- **On-Port ICTF with New Tunnel – Short-Haul Shuttle Service.** This service would consist of a new 18- to 25-acre ICTF on port property and a grade separated connection (tunnel) to the FEC system. Frequent, short shuttle trains would connect the POM with the western Miami-Dade County distribution infrastructure via the FEC facility (or a new transfer facility). This service would be designed to significantly reduce truck dray moves in downtown Miami. ***This access improvement project represents the primary focus of this study.***

Other Potential Access Improvements

- **6th Street Slip Ramp at Interstate 95 and Other Local Street Enhancements.** The 6th Street slip ramp project would construct a new northbound on-ramp to I-95 at 6th Street, providing trucks exiting the port with direct access to I-95 northbound and SR 836 westbound. Local community opposition originally killed this project; currently FTAC members are working to build the necessary political support to move the project back into the MPO and FDOT work programs.

- **Port of Miami Tunnel (Highway).** This project would provide a new highway connection to the POM that provides direct access to the Interstate System by connecting the Port to I-95 via a tunnel connection to I-395 on Watson Island. The project has been endorsed by state and local leaders, although funding commitments remain unmet. The tunnel would eliminate or significantly reduce conflicts in the downtown, however it does not improve mobility along the region's expressway system. ***This access improvement project currently represents the preferred regional alternative.***

- **Operational Improvements.** There are several options for non-infrastructure-based improvements, including reservation systems, time-of-day-specific operations, congestion pricing (PierPass), traffic modifications along key access routes, mass transit for person trips, as well as embracing various cutting edge software in order to augment day-to-day operations by streamlining information flows. Operational enhancements tend to be low capital investments with emphasis on outreach, consensus building, enforcement, and regulatory activities. Although discussion has taken place on several of these topics, none currently are moving forward.

- **Short-Sea Shipping/Barge Transfer to Port of Miami River.** Miami River industry representatives proposed a new short-sea shipping service that would reduce truck drayage movements at the POM by transferring them to barge. The barges would move containers from the POM up the Miami River to a terminal; trucks would pick up the containers at this terminal to complete the drayage move to a western terminus. This service would help reduce trucks in the downtown. The economics (e.g., additional handling/lift fees) have not been defined, nor has stakeholder support been generated.

■ Rail Corridor Analysis

The rail tunnel assessment included the conceptual development of a grade separated freight rail corridor connecting a proposed new ICTF on the POM's Dodge and Lummus Islands with the FEC. This rail corridor would utilize a combination of tunneling and open-cut-below-grade techniques to bypass Miami's central business district and provide the POM with unrestricted intermodal freight rail access to the region's intermodal rail system. The northern limit of this rail corridor assessment extends to NE 20th Street, a point north of Interstate 395 where the below-grade cut section would transition and meet the existing FEC at-grade rail line.

The existing FEC rail line serving the POM travels south from North Miami parallel to the Atlantic shoreline where it diverges at a point north of NE 6th Street. At this point the rail line turns east and travels to a point where it crosses over Biscayne Bay on a rail causeway and onto Dodge Island. The rail line is single-track in this area and no support track or yard tracks are available south of Interstate 195.

Figure ES.5 Conceptual Rail Alignment

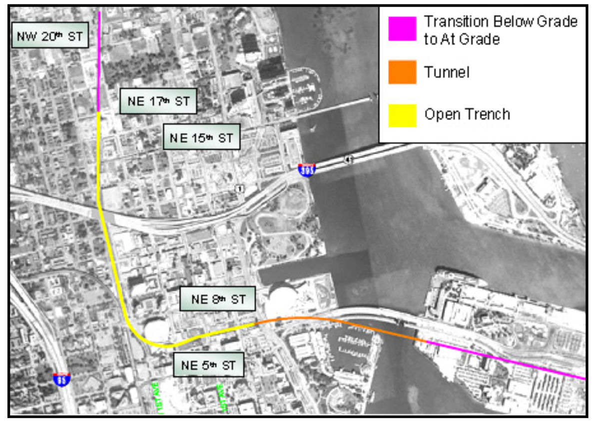
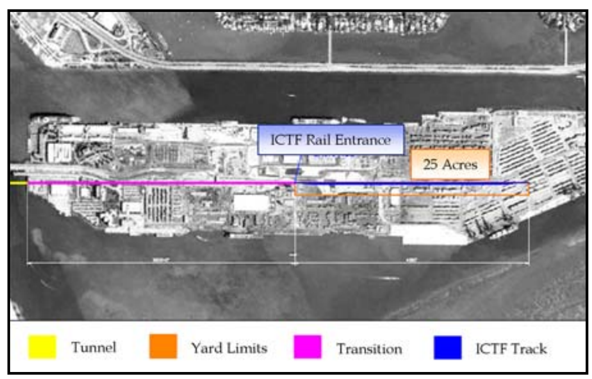


Figure ES.6 On-Port Facilities with Bored Tunnel Access



For a rail tunnel to be operationally feasible, grade separations must be extended through Miami to a point outside the immediate area of congestion and support track must be developed to manage train flows and train lengths into and out of the port. To provide for this separation, a point along the FEC right-of-way was identified as a possible grade transition point for a depressed rail corridor at the intersection of NE 17th Street. The depressed rail corridor would extend south from NE 17th Street along the existing FEC right-of-way to a point where it would intersect the proposed tunnel under Biscayne Bay. The rail corridor would continue under Biscayne Bay and surface on Dodge Island and connect to the proposed ICTF (see Figures ES.5 and ES.6).

Key Findings

- **Technical Feasibility.** All other factors notwithstanding, a grade separated rail corridor, including an on-port ICTF, and a rail tunnel and trench, is technically possible. Analysis shows the corridor could be built within existing rights-of-way, along with a 25-acre terminal footprint on Dodge Island. Based upon the service characteristics, additional infrastructure improvements and new facilities would be required in western Miami-Dade County. Detailed engineering analyses are required to define more specific project characteristics.

- **Economic Feasibility.** A conservative $1 billion cost estimate was developed for the conceptual rail corridor required for traditional intermodal service. This cost would increase if a rail shuttle service was developed due to additional ICTF capacity, stricter operational requirements, and significant off port costs to grade separate the corridor from NE 20th Street to the Doral area, and develop a sister facility (off port costs past NE 20th Street are not included in the cost estimate). Currently, only 11 percent of the POM's containers are drayed to the Hialeah rail yard for northbound service. This limited volume would translate into a significant cost per container ($250 or more). For a shuttle train service that handles 90 percent or more of all POM's containers, the cost per container would be much lower ($40 or more).[6]

- **Environmental Feasibility.** Environmental permitting and approval processes will be an obstacle for this project. From an operational perspective, it was determined that the preferred tunnel technology would be an immersed tube tunnel. This approach has a less steep grade, shortening the length of the tunnel on Dodge Island. Bored tunnel technology would require a significantly larger footprint on Dodge Island due to the length of track required to return to grade. The EPA already has ruled that the proposed highway tunnel must use the bored approach and community leaders insist this holds true for the rail tunnel. This significantly impacts on-port land and operations. In addition, the FEC right-of-way, as an industrial corridor, may have contaminated material that would complicate the excavation activities of the open trench, not to mention the impact of the water table.

- **Constructability.** Among all of the considerations that go into this analysis, the constructability issue is critical. This factor deals with the likelihood that the tunnel will be or can be built. It includes the funding and environmental issues, as well as building stakeholder and political support. It also covers the construction activities. The conceptual design presented in this report calls for the development of a below

[6] Over a 25-year life, assuming a 5 percent per year growth in containers, the cost for each container could be between $40 (shuttle) and $250 (traditional) for the conceptual rail corridor defined by this analysis. This does not include any costs other than construction. Carrier transportation costs for the move, ongoing maintenance and operations, and additional costs to upgrade inland corridors and transfer facilities would all be additional.

grade rail corridor directly underneath Port Boulevard. This could significantly restrict port access during construction.

- **Funding Competition.** The ability to finance the project will be impacted by the advancement of the highway tunnel. At present, it is reasonable to assume that the highway tunnel project will continue to be advanced. Given that the State already has committed funding for a portion of the $1 billion plus project, it is unlikely to assume that a second $1 billion plus project would receive similar state support.

- **Rail Corridor Capacity.** The FEC Corridor currently is being studied for both passenger and cargo use. This study did not account for how a highly trafficked freight rail corridor would interact with some yet undefined new passenger service along the same corridor. Joint operations would need to be studied in detail, including the engineering requirements associated with at or above grade and below grade operations. In addition, there are equipment and operational requirements for rail corridors handling both freight and passenger service. The capacity will be significantly impacted by the rail service selected (shuttle or limited long-haul).

- **Political Support.** As has been seen with the proposed highway tunnel, political support will make or break a project of this magnitude. In fact, this study was the result of local political leadership striving to resolve the POM's conflicts with surrounding communities. Currently, there is limited support for development of a grade separated rail corridor connection to the POM. For this project to advance, support from local and state leaders would be critical.

- **Industry Support.** Building shipper support for a rail corridor will be a challenge. On-port terminal operators are reluctant to sacrifice already limited acreage for any type of ICTF; the vast majority of cargo originates or terminates within 50 to 100 miles making rail uncompetitive with truck in both cost and service; and a rail shuttle service would add additional handling costs to the supply chain.

■ Recommendations

- **Continue to Support Port Access Initiatives.** The POM continues to struggle with landside access. Community opposition, limited funding, and delays in project implementation contribute to this situation. The MPO should remain active with port staff to assist where appropriate.

- **FTAC Should Continue to Advocate for Port Access Improvements.** The FTAC has emerged as a strong supporter for freight transportation. Its leadership should continue to engage the community in discussions for port access improvements.

- **Use the truck Route Study to Further Explore Port Access.** The truck route study underway now by the MPO should ensure that port access routes are designated as part of the county's truck route system and recommendations should directly address both specific port access routes and key regional corridors connection the port with western Miami-Dade County.

- **Investigate Opportunities for Reduced Passenger Traffic to the POM.** Currently, only 15 percent of port traffic is generated by cargo operations. The balance serves other port activities, including cruise operations and port administration. The cruise infrastructure currently houses significant parking capacity. The MPO should study the feasibility for relocating parking off port and providing mass transit service to eliminate congestion and increase cargo capacity.

- **Monitor Highway Tunnel Progress.** The highway tunnel will be a major factor in funding availability and stakeholder attitudes. If this project advances, a high-capacity rail corridor is unlikely. If it fails, all access alternatives should be reevaluated. It is critical the MPO and its port partners are prepared to provide immediate recommendations and input should the highway tunnel project falter.

- **Participate in Key Regional Freight Initiatives.** Regional freight investments could impact the POM and the MPO should monitor and participate in these projects. For example, the State currently is evaluating the feasibility of an inland port in south Florida. This could change regional distribution patterns for all ports in the region. In addition, the Atlantic Commerce Corridor Study will likely be updated in 2007, providing additional opportunities for regional investments in ports. Finally, FDOT currently is working to develop a statewide strategic seaport investment framework.

1.0 Background

1.1 Introduction

Since its inception in the 1960s the Port of Miami (POM) has grown into a substantial transportation and economic hub for the City of Miami, Miami-Dade County and the rest of South Florida; contributing over $16 billion to the local economy annually. Port terminals handle more than nine million tons of cargo each year, increasing from just under 6 million tons in 1995.[1] The POM moves over 1 million 20-foot equivalent units (TEU) annually, making it the largest container port in Florida. In addition, the POM is considered to be the cruise capital of the world, handling over 3.6 million multi-day cruise passengers each year. These trends are not expected to decline, rather the POM expects to handle more than 1.5 million TEUs and more than 5 million passengers annually by 2015.

The POM primarily serves a regional market. Port officials estimate that 65 percent of its cargo is destined for locations within a radius of 50 miles; the remaining 35 percent moves north, with the majority staying within Florida. Currently, the majority of containerized cargo moves to western Miami-Dade County via truck drayage service to the warehousing and distribution district in Doral or to Florida East Coast Railway's (FEC) intermodal facility in Hialeah. The reliance on trucks for these movements, as well as the use of local city streets, has created a long history of community conflicts and opposition to port operations and development opportunities.

Historic and ongoing growth of the POM continues to challenge the landside transportation infrastructure. The Port itself is an island; access to its markets is provided by one highway bridge and one rail bridge. These facilities in turn place port traffic on local downtown streets, requiring trucks to traverse a maze of segments and signalized intersections in an effort to access Interstates 395 and 95. Key roadways include U.S. 1/ Biscayne Boulevard, 1st and 2nd Avenues, and 5th and 6th Streets. Currently, rail service is infrequent and used exclusively for delivery of heavy machinery. The existing rail corridor also traverses the downtown at-grade, crossing the port entrance, U.S. 1, and 1st and 2nd Avenues before turning north. Current redevelopment projects adjacent to the POM have further magnified port access issues with lane and street closures, construction vehicles, detours, and new traffic patterns. The American Airlines Arena, located at the Port entrance, and the new Carnival Center for the Performing Arts, just north of the entrance, along with extensive residential development illustrate the continued mixed use expansion of the downtown area, and challenges Port and County officials to identify and implement port access improvements that minimize or eliminate current conflicts.

[1] The Beacon Council.

1.2 Purpose of This Study

In response to restricted port access and worsening downtown congestion, local leaders have become dedicated to exploring a range of improvements that would support port growth, downtown redevelopment, and reduced traffic conflicts. Currently, efforts are underway to establish a process for the future development of a tunnel that would connect the port with I-395 on Watson Island, providing direct Interstate access.[2] As proposed, this tunnel would be on element to alleviate a portion of the truck traffic that currently traverses the downtown. A number of improvements, in addition to the POM tunnel, have been suggested and considered, including: the 6th Street slip ramp at Interstate 95; a more effective congestion management program for downtown, including port-specific access tools; development of an on-port intermodal container transfer facility (ICTF); and a Port of Miami River drayage service (short-sea shipping).[3]

The purpose of this study was to explore in more detail the feasibility of developing a rail intensive solution. The motivation for this analysis grew out of local interest in the success of the Alameda Corridor in Southern California; this analysis sought to determine the suitability of a similar large-scale consolidated rail corridor facility to process POM cargo. Figure 1.1 describes the Alameda Corridor. In response, the Miami-Dade MPO undertook the ***Port of Miami Access Study***, which documents the full range of access improvements, but focuses on the feasibility of a rail solution designed to eliminate truck trips in the downtown – both as some type of high-volume shuttle service to an off-port facility; or as traditional long-haul intermodal service.

1.3 Study Organization

This report is organized as follows:

- **Section 2.0, Port of Miami Profile –** Provides a detailed profile of the current cargo and passenger operations and facilities of the POM.
- **Section 3.0, Key External Factors Impacting Port Growth –** Discusses factors driving port growth based on freight trends at local, state, national, and global levels.
- **Section 4.0, Potential Landside and Waterside Access Improvements –** Presents and discusses the full range of access improvements being discussed.

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[2] Effective November 1, 2006, the Florida Department of Transportation released a RFP for the Port of Miami Tunnel and Access Improvement Project.

[3] Note that it was not the intent or scope of this Study to provide Detailed engineering or economic impact analyses for each potential access improvement. The intent was to focus on the conceptual feasibility of a grade separated rail connection to the Port of Miami, while acknowledging other proposals.

- **Section 5.0, Potential Rail Access Improvements –** Presents and discusses the potential of on-port rail access improvements.
- **Section 6.0, Findings, Conclusions, and Key Recommendations –** Summarizes study findings and provides recommendations relating to port access**.**

Figure 1.1 Highlights of the Alameda Corridor

Successful port-related rail cargo projects tend to be found in regions with major seaports, direct connections to the national rail network, and significant transportation conflicts or bottlenecks. The Alameda Corridor is a "series of bridges, underpasses, overpasses and street improvements that separate freight trains from street traffic and passenger trains," and has for the most part, fulfilled expectations, reducing congestion and air pollution levels, and removing hundreds of thousands of containers from the LA roadways.[a] Documented benefits include: more efficient freight rail movements; reduction in traffic congestion by eliminating at-grade crossings; improvements to Alameda Street; multiple community beautification projects; significant reduction of train emissions; reduced delays at railroad crossings; cut noise pollution from trains; and reduced emissions from idling automobiles and trucks. It is tempting to look at the Alameda example and envision a similar solution for Miami's cargo movement issues, it is important to point out a few of the Alameda Corridor's key characteristics:

- **Major Port Infrastructure.** Corridor links two ports, Port of Los Angeles and Port of Long Beach; these ports represent the largest container port in the United States, receive the 3rd highest general cargo vessel calls, and rank 2nd behind the Port of Houston in total vessel calls (all types) in the United States; Port of LA/Long Beach ranks 12th in the world (2005) for vessel calls (all types);

- **Major Server of U.S. Hinterland.** The Port of LA/Long Beach, serves as a major import/export hub for cargo in much of the United States; and
- **Direct Connection to Multiple Class I Railroads.** Both Union Pacific and Burlington Northern are partners in this project, providing world class intermodal service.
- **Investment Supported by Large Market.** This project developed a 20-mile corridor for 2.4 billion dollars to serve the largest intermodal hub in the United States.

[a] Alameda Corridor Transportation Authority.

2.0 Port of Miami Profile

In order to understand the current and future access needs for the POM, it is necessary to understand how the port operates today and how planned growth will impact future operations. This section includes: a brief description of existing on-port infrastructure; a discussion of port operations (both cruise and cargo); a detailed assessment of the water-side and landside access situation; and a brief summary of the economic impact that port operations pose to the region.

As indicated in Figure 2.1, major goals and objectives for the POM for the upcoming five years revolve around expanding cruise and container market shares, continuing to pursue new trade opportunities, strengthening relationships with new partners, and increasing trade with established shippers in Caribbean, and Central and South American markets.

To succeed in the stated goals, a number of capital improvements have been identified and are in various states of development. Among them are: more efficient security facilities (partially complete), direct port-interstate access via tunnel or bridge (RFP for tunnel released in fall 2006), deeper and wider channel and turning basin (in process), development of an on- or near-dock intermodal logistics transfer facility (under study), and cruise terminal and cargo berthing expansion (in process).[1]

The remainder of this section provides detailed summaries of port infrastructure, operations, access, and economic impact.

■ 2.1 Port Infrastructure

Port of Miami Facilities: Terminals and Terminal Operators

Three cargo terminal facilities currently operate at the POM: Maersk-Sealand (A.P. Moeller – Maersk), Seaboard Marine, and POMTOC (Port of Miami Terminal Operating Company). All three have traditionally been in long-term lease agreements at the port. The Table 2.1 provides the basic characteristics of each of the operations.[2] In addition, the POM has developed significant cruise facilities, primarily along the northwest quadrant of Dodge

[1] A Five-Year Plan to Achieve the Mission of Florida's Seaports: 2005-2006/2009-2010.

[2] Port of Miami – Cargo Development Office. Note: Figures do not include performance report adjustments.

Island. Berths, passenger terminals, parking facilities, and administrative offices all contribute to the cruise infrastructure. The cruise terminal operations located on the POM include: Carnival, Celebrity, Costa, Crystal, Norwegian, Oceania, Royal Caribbean, and Windjammer Barefoot Cruise lines. Figure 2.2 illustrates the layout of cargo and cruise terminals.

Figure 2.1 Excerpt from "A Five-Year Plan to Achieve the Mission of Florida's Seaports" Appendix

MISSION STATEMENT

"To be an economic generator for both Miami-Dade County and South Florida, projecting a positive world-class image for our local community. To ensure that the Port has the capabilities to provide both the cruise and cargo industries with the necessary infrastructure for continued growth well into the 21st century"

CURRENT (FY 04/05) AND PROJECTED (FY 09/10) THROUGHPUTS

Cargo (tons): Current –9.5 million. Projected - 10.7 million.
Cargo (TEUs): Current – 1,054,462. Projected - 1.2 million.
Cruise (revenue passengers): Current – 3.6 million. Projected – 4.5 million.

STRATEGIC DEVELOPMENT PROGRAM

Major Goals and Objectives:

- Expand cruise market share by restoring existing facilities and constructing new terminals and berths required for new generation ships.
- Expand container market share by providing cargo-handling and railroad facilities required for efficient intermodal container operations.
- Enhance position as transshipment hub of the Caribbean and Central and South America.
- Pursue new trade opportunities and strengthen existing ties.

Capital Improvements Needed to Achieve Port's Mission:

- Security facilities.
- Direct Port-Interstate access via tunnel or bridge.
- Deeper and wider channel and turning basin.
- Development of an on- or near-dock intermodal logistics transfer facility.
- Cruise terminal and cargo berthing expansion.

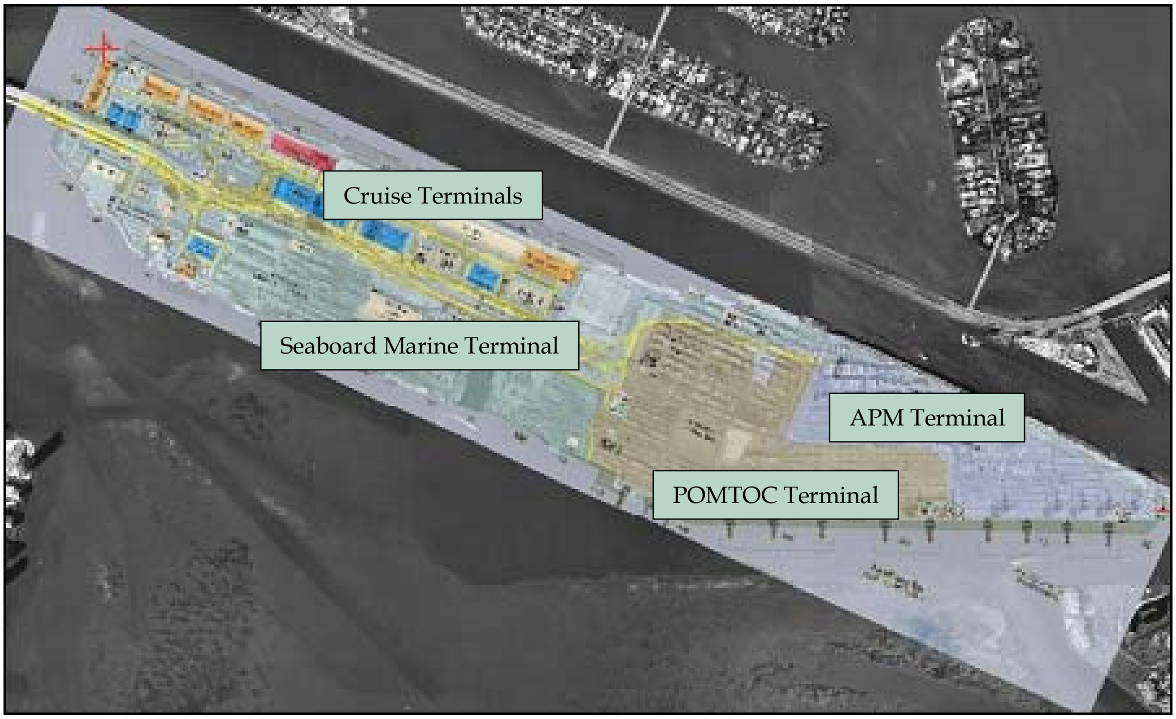
Source: Florida Ports Council.

Table 2.1 POM Terminal Operations

Terminal Operation	Footprint	Fiscal Year 2006 Percent of Total Tonnage	Annual Tonnage (Fiscal Year) 2006	2005	2004	Total Change 2004-2006
Maersk-Sealand (APM)	72 acres	19.7%	1,690,010	1,872,780	2,398,718	-708,708
Seaboard Marine Line	66 acres	35.3%	3,033,942	3,155,469	2,933,926	100,016
POMTOC	115 acres	45.0%	3,872,763	4,588,966	3,988,616	-115,853

Source: Port of Miami Cargo Development Office.

Figure 2.2 Illustration of Port Layout



Source: Port of Miami.

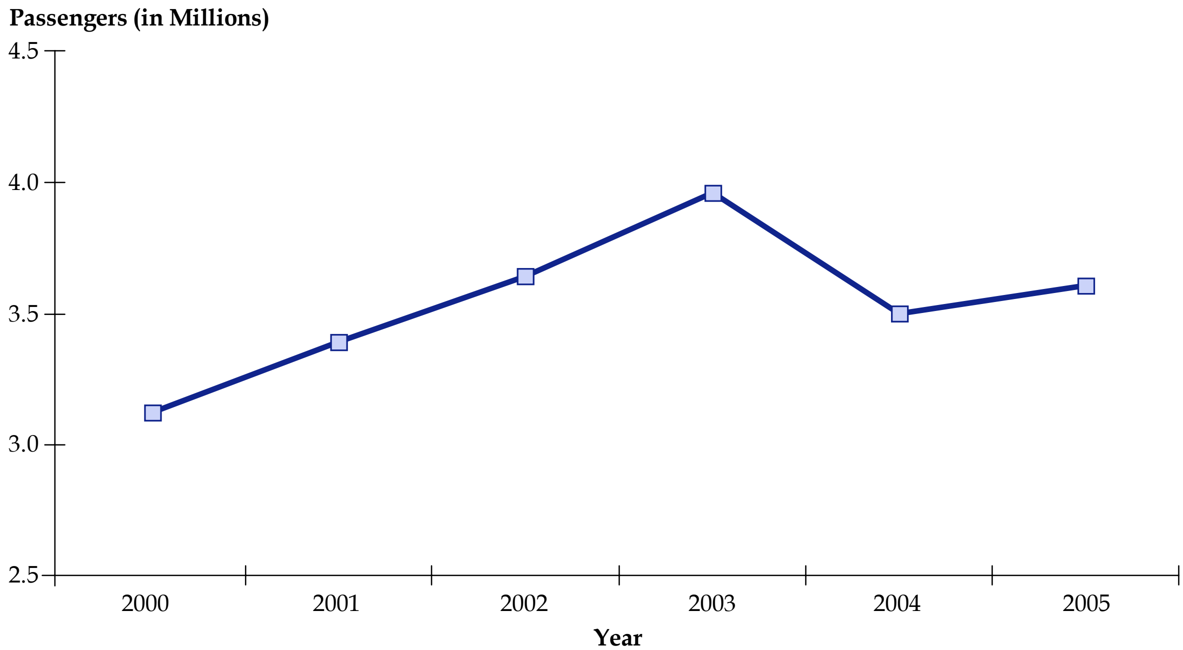
2.2 Port Operations and Background

Port of Miami Cruise Line Operations

Although the nature of this study is to analyze methods of increasing freight traffic access to the port, it is impossible to ignore the presence of the cruise operations, which generate a significantly higher amount of traffic than the cargo operations. Considering that one of the most popular alias' of the POM is "The Cruise Capital of the World," it is understandable that the vast majority of port-related traffic is actually *cruise*-related. Justification for this title stems from the combination of the eight cruise line operations – which are home-port to 19 cruise ships at the POM – who produce nearly four million passengers annually. As illustrated in Figure 2.3, the annual cruise passenger boardings have fluctuated slightly but appear to remain on a consistent upward trend. In 2005, over 3.6 million passengers traveled on cruises originating at the POM.[3]

[3] 2006 State of the Port.

Figure 2.3 Growth in Cruise Passengers

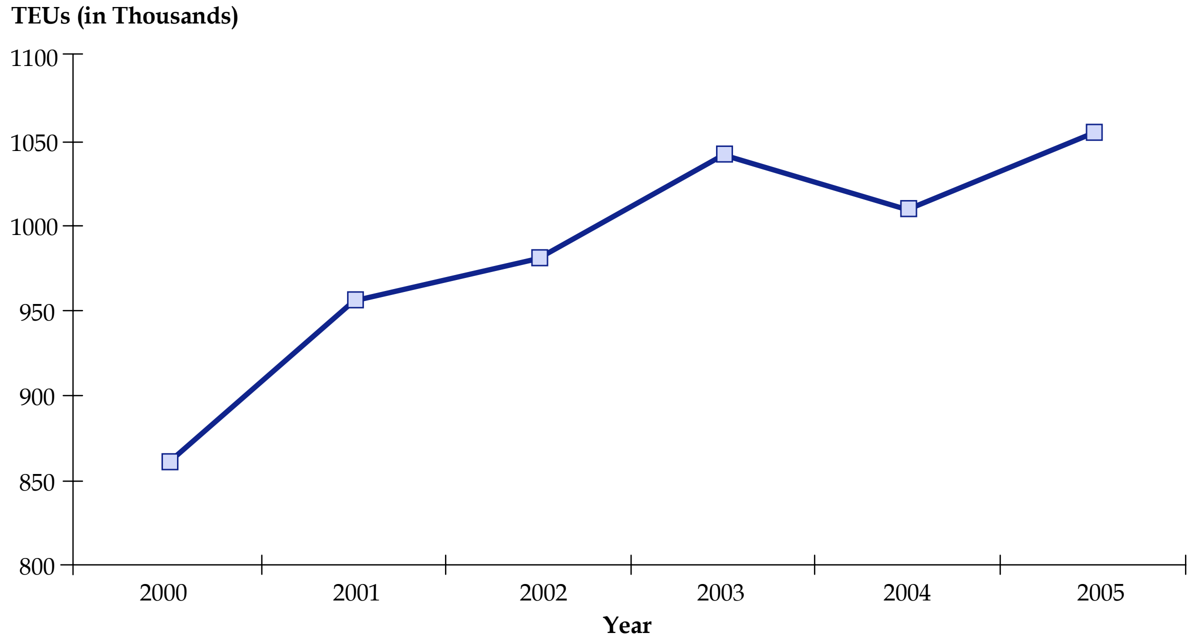


Source: http://www.miamidade.gov/portofmiami/.

Port of Miami Cargo Operations

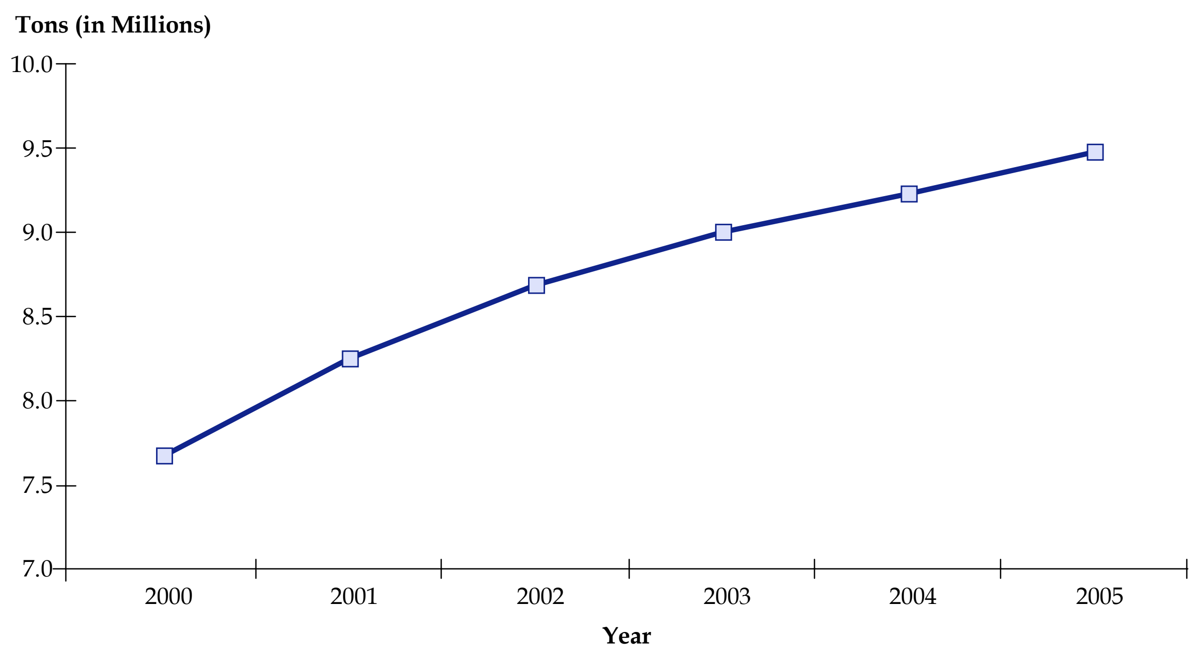
The POM currently is the largest container port in Florida, and the 9th largest in the United States. The port facilities process 9 million tons of cargo (1 million TEUs) annually. POM serves markets in Africa, Asia/Far East, Caribbean, Central America, Europe, the Mediterranean, Middle East, South America, and Southwest Asia, among others. The chief competitors to large-scale cargo business at the POM are located in Savannah, Georgia, and Charleston, South Carolina. Neighboring Florida ports, such as Port Everglades and Port of Jacksonville also complete for prospective freight traffic. POM cargo volumes have increased steadily over the past several years, and are projected to maintain this trend into the foreseeable future. See Figures 2.4 and 2.5.

Figure 2.4 Growth in Container Traffic



Source: http://www.miamidade.gov/portofmiami/.

Figure 2.5 Growth in Total Tons

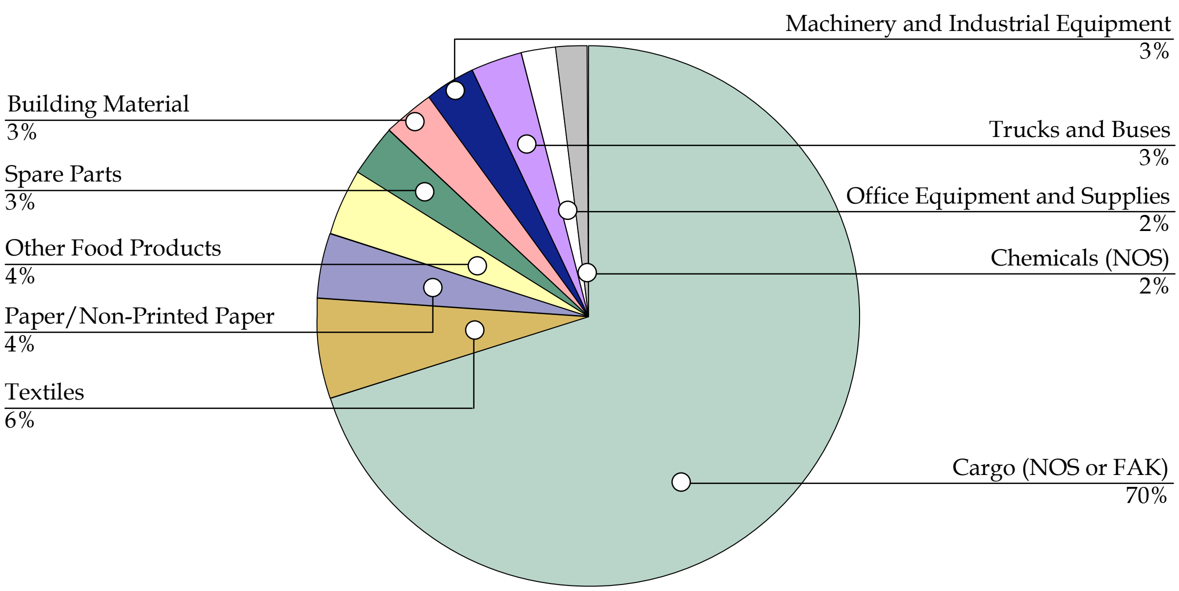


Source: http://www.miamidade.gov/portofmiami/.

Port of Miami Cargo Mix[4]

The POM handles a diverse mix of products. Figures 2.6 and 2.7 display the cargo mix for both imported and exported goods at the port. In 2003, the POM had 429,835 loaded foreign inbound, and 326,280 foreign outbound TEUs; while a total of 32,095 TEUs were domestic inbound/outbound.[5] When comparing the import and export levels, it is important to note that there is a fair amount of parity between the two. Typically exports are in the range of 40 percent of total cargo, while imports tend to fall in the 60 percent range. A common perception of the port is that cargo is dominated by imports, which is not necessarily true.

Figure 2.6 Top Export Commodities by Weight



Source: http://www.miamidade.gov/portofmiami/.
Note: NOS (Not Otherwise Specified), FAK (Freight All Kinds), and Chemicals NOS include Acetone, Freon, Epoxy, and Resin.

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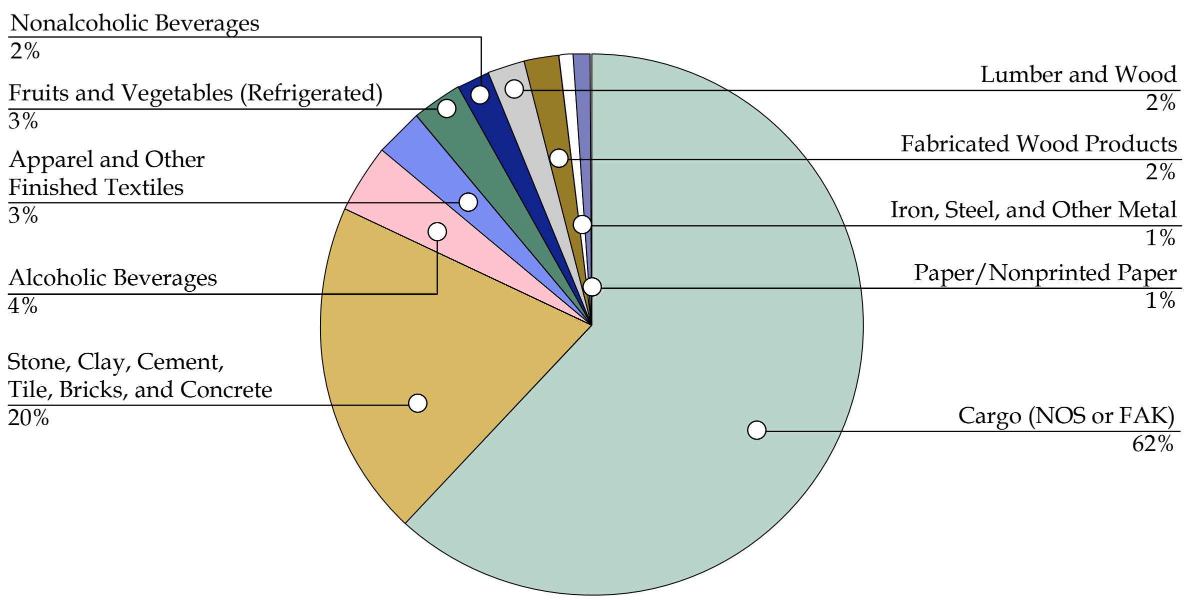
[4] 2006 Port of Miami, "State of the Port."

[5] U.S. Army Corps of Engineers, NDC.

Figure 2.7 Top Import Commodities by Weight

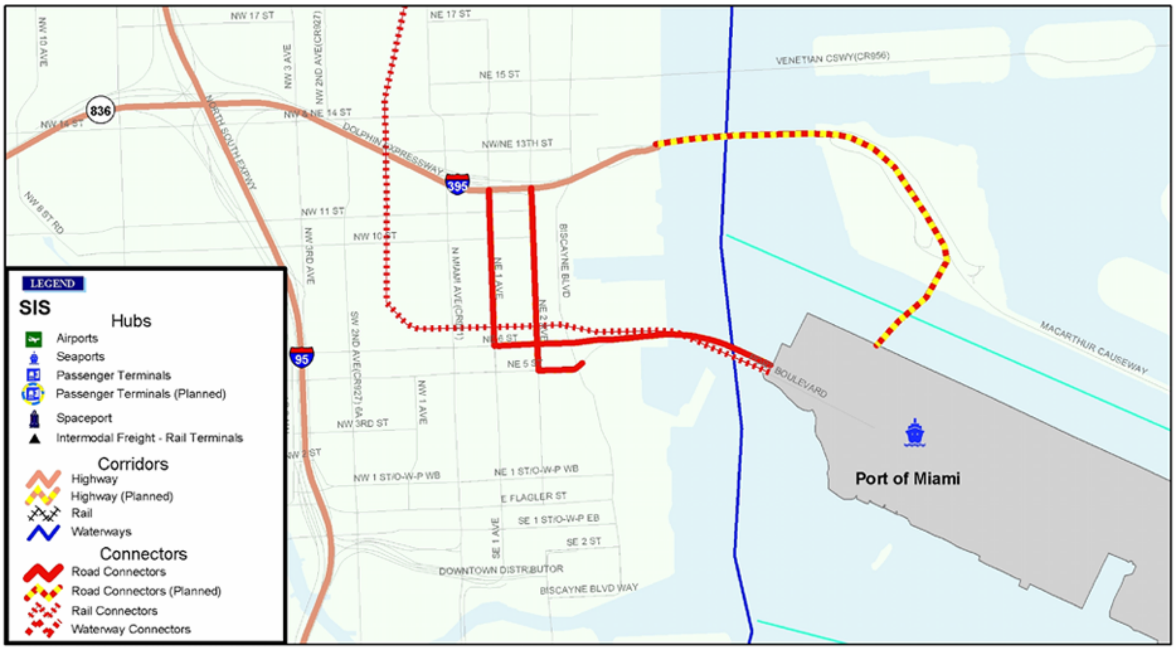


Source: http://www.miamidade.gov/portofmiami/.
Note: NOS (Not Otherwise Specified); FAK (Freight All Kinds).

■ 2.3 Port Access

Access to the POM has two key elements, consisting of landside and waterside transportation corridors. The landside access to the POM is provided by roadways and rail. Waterside access is provided by channels, turning basins, and berths. The Florida DOT, through the Strategic Intermodal System (SIS), has defined intermodal connectors to provide the POM with roadway, rail, and water service. Figure 2.8 illustrates these designations. This section describes each element.

Figure 2.8 Port of Miami's SIS Connectors



Source: Florida Department of Transportation.

Landside Access: General Truck Operations

The vast majority of heavy trucks going to and from the POM navigate downtown Miami streets to either I-95 heading north/south, or I-395/SR 836 going west to travel to their eventual destinations. Key roadways used to connect Port Boulevard to the regional highway system include 5th and 6th Streets, 1st and 2nd Avenues, and U.S. 1/Biscayne Boulevard. In 2006, 13,600 daily vehicle trips used the POM bridge, in each direction. Cargo traffic represented 15 percent, or 1,050 of these trips, with the remaining 11,450 trips being generated by cruise operations. This total number of daily trips is expected to grow to 24,350 in each direction by 2025.[6] Figures 2.9 through 2.11 show key truck access characteristics.

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[6] Port of Miami Traffic and Demand Study, September 8, 2003.

Figure 2.9 Truck Queue at POM Entrance Gate

Figure 2.10 View of Existing Roadway Connection to the POM

Figure 2.11 View of Biscayne Boulevard Outside the POM entrance in Downtown Miami

Landside Access: General Rail Operations[7]

The rail service in Miami-Dade County is provided by two line-haul carriers, Florida East Coast (FEC) and CSX. All incoming and outgoing Miami-Dade rail traffic is essentially carried on two active tracks: 1) CSX track along its alignment west of I-95; and 2) FEC tracks on its alignment west of Biscayne Boulevard. FEC is a regional rail railroad company that serves the east coast of Florida from Miami to Jacksonville along 442 route miles. CSX is a Class I carrier that provides service to 20 states, the District of Columbia, and one Canadian Province. FEC operates an Intermodal Facility in Hialeah that is west and northwest of Miami International Airport. On the facility is a 120-acre marshaling yard, a 1.25-acre auto-train handling and storage area. At present, FEC maintains a single track lead into POM. This track is used occasionally for oversized equipment and would require significant upgrading if it were to be used on a regular basis. In addition, the entire corridor is at grade, intersecting or impacting most major port access roadways. Figures 2.12 through 2.14 show various views of the existing rail corridor.

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[7] Port of Miami Traffic and Demand Study, Miami-Dade County Freight and Goods Movement Study.

Figure 2.12 Existing Rail Bridge (View from POM)

Figure 2.13 Rail Corridor at POM Entrance

Figure 2.14 Rail Corridor West of Biscayne Boulevard

Waterside Access: Cruise and Cargo

The POM is situated on 518 acres at Dodge and Lummus Islands. Berths are located along north and south sides of the islands. Primary sea access is gained through the Main Channel (as shown in Figure 2.15), which extends approximately 4.5 miles from the port to the Atlantic Ocean. The Main Channel is adjacent to the north side of both Dodge and Lummus Islands, and is 500 feet wide with a 36-foot controlled depth. On the south side of the port, the Fisherman's Channel serves the majority of the cargo terminals, and is 42 feet deep through the gantry berth area; with the western portion of the channel controlled to a 32-foot controlled depth and eventually 25 feet at the westernmost section of the island.[8] POM currently is working to deepen its channels, with the ultimate goal of attaining a 50-foot controlled depth.

[8] Port of Miami, "2006 State of the Port."

Figure 2.15 Illustration of POM Channels

2.4 Economic Impact of Port Operations[9,10]

The health of the regional economy rests heavily on-port operations. In this sense it can be deduced that a significant portion of Miami-Dade's economy is hinged upon a sufficient and capable POM transportation infrastructure. All indicators point to a port that is poised to continue consistent increases across all levels of service; including cruise line boardings and inbound and outbound cargo. These pressures will further stress a vehicular access system that regularly operates at or over capacity.

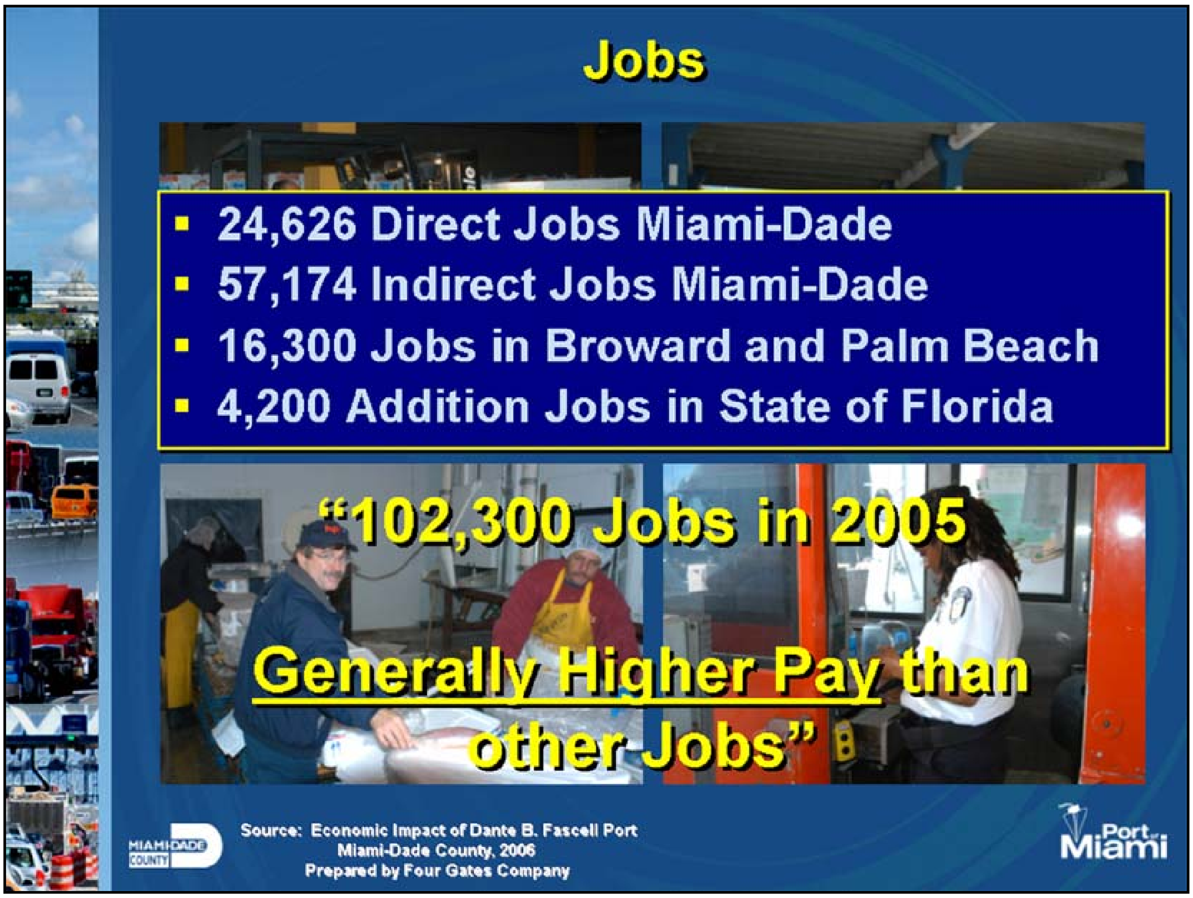
Results of a recent economic impact analysis of the Port of Miami confirms earlier speculation of the significant economic stimulus the POM provides to Miami and adjacent Broward and Palm Beach counties. The study completed by the Four Gates Company estimates that the POM generates approximately $12 billion in economic activity annually

[9] The Four Gates Company, "The Economic Impact of the Dante Fascell Port of Miami-Dade County," May 2006.

[10] The Washington Economics Group, "The Spatial Economic Impacts of the Port of Miami: A Key Enabler of Economic Development of Miami-Dade County," September 2006.

and supports nearly 100,000 jobs. A later study by The Washington Economic Group, which analyzed subregional economic impacts, found that each of the commission districts in Miami-Dade County realized positive economic impacts as a result of port activities. The relevance to these studies comes in the form of a direct correlation between the efficiency of the transportation system serving the port and the strength of the regional economy. Figure 2.16 describes one of the key economic benefits of the POM.

Figure 2.16 POM as a Creator of Jobs



Source: Port of Miami.

3.0 Key External Factors Impacting Port Growth

3.1 Overview

According to the recent U.S. Department of Transportation publication, *Freight in America*, "Goods movement is increasingly part of a complex logistical system that serves an increasingly globalized economy."[1] As the complexity of goods movement grows, so grows the importance of each individual transportation facility. Since port activities are common access points in trade at the international level, they tend to be thoroughly enmeshed in global economic issues. Waterborne transportation at all U.S. ports has increased approximately 15 percent in the past 25 years.[2] This growth is anticipated to continue indefinitely as globalization expands. At the local level, the POM serves as a critical link between the 5.5 million residents of South Florida and the global economy. As the region continues to expand in an increasingly global environment, the POM, along with its peers in Florida and neighboring states, will be challenged to provide increased throughput and improved quality of service. Since the majority of imported/exported freight relies on at least one additional mode of transport to reach its final destination, the POM will be directly impacted by its access to and connectivity of the region's intermodal system.

As identified by the Miami-Dade MPO 2030 Cost Feasible Plan, the region as a whole suffers from significant levels of congestion on its roadways. Consequently, the majority of roadways that serve the POM and downtown Miami have a volume to capacity ratio of .70 or above, and many operate regularly at the 1.00 range.[3] Projections indicate that annual TEUs and cruise passengers will expand to 3 million and 11.8 million, respectively by 2030.[4] This is more than double the current (2006) figures in both categories, which will further challenge an already congested system. The POM is a primary cargo source for the region while being located centrally within a densely populated urban area and leading tourist destination. As the POM works to effectively manage its needs, it is important to understand that there are a variety of pressures outside the port's boundary that have significant impacts on growth and the abilities of the port and region to respond in a timely manner.

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[1] U.S. Department of Transportation, "Freight in America," January 2006.

[2] As measured in ton-miles, (one ton of freight shipped one mile). U.S. DOT, "Freight in America," January 2006.

[3] Miami-Dade MPO: Cost Feasible Plan 2030.

[4] Port of Miami Freight Stakeholders Forum. Transystems Forecast.

■ 3.2 Key Considerations

The following provides examples of local, regional, state, national, and global characteristics, as they apply to and impact the Port of Miami.

Local and Regional

- **Continued Growth.** The majority of the goods from the port is distributed within a 50-mile radius. Given the continued growth in population and ongoing development and redevelopment activities, there will be increased demand for cargo into the foreseeable future. Population levels in the Miami-Fort Lauderdale-West Palm Beach Metropolitan Statistical Area (MSA) has increased by nearly 400,000 from 2000 to 2005. The current population of this MSA currently is at about 5.5 million. Current projections call for an increase of 43 percent by 2030.

- **Downtown Redevelopment.** Over the last several years downtown Miami has undergone significant redevelopment and densification of older industrial/commercial properties. Although this is ultimately a positive trend from a community standpoint, it places additional traffic on the few access routes to the port.

- **Construction Work Zones.** An additional externality of downtown development is the temporary lane blockage at construction sites for material deliveries. Local law enforcement is charged with enforcing strict procedures for lane blockage, but it has been noted that congestion issues occasionally arise from this issue.

- **Cultural Centers.** Miami has worked hard to support the development of cultural centers, many of which have been developed on properties adjacent to or in close proximity of the POM, such as the American Airlines Arena and the newly constructed Carnival Center for the Performing Arts. These create wonderful opportunities for the City, but have created traffic conflicts for the POM.

- **Distribution Patterns.** The majority of cargo moving through the POM is handled by logistics professionals in western Miami-Dade County. The focused development of warehouses and distribution centers, combined with the rail intermodal facility, has created the need for cargo to be moved across the county between the POM on the east and its landside counterparts on the west.

State, National, and Global

- **Largest Container Port in Florida.** The POM is the largest container port in Florida and it serves a multicounty region. As globalization continues and the markets in South and Central Florida continue to grow, the POM will need to grow capacity and ensure accessibility to meet Florida's needs.

- **Gateway to Latin America.** The POM has strong connections throughout the Caribbean Basin, including Central and South America. This is a strong growth market and recent trade agreements, such as DR-CAFTA, should stimulate additional trade opportunities.

- **Cruise Industry Leader.** Cruise travel has been expanding in popularity worldwide over the past several years. POM has a mature cruise infrastructure and has successfully maintained its position as a leader. Future expansion will be required to meet industry expansion and new vessel construction.

- **Competition**. The vast opportunities for growth in trade are not unchallenged. The POM competes with 13 other Florida ports for state funding and competes with ports in other states and countries for business.

- **Globalization**. Containerized cargo has grown steadily for more than a decade. Even world terrorism cannot stop increases in international trade and overall globalization. The POM is home to a multinational community well positioned to remain leader in international trade and international tourism.

3.3 Summary of Key Port-Related Trends

The above identifies some of the key factors impacting the POM as it works to position itself for future growth and development activities. Having an understanding of trends in freight and cruise transportation also is important. The movement of people and goods in the context of South Florida directly corresponds to people and goods movement on larger scales. Although the POM largely serves markets in the State of Florida and the South Atlantic Coastal Region of the United States, national and global trade still significantly impact operations at the port. For this reason it is important to address trade issues at the POM as a component of a much larger national and world trade system – both directly and indirectly. Identifying historical trends and future projections assists in providing critical indicators as to how the role of the POM has changed and likely will be changing in the coming years. The following identifies several examples of transportation-related statistics and trends.

- **Total vessel calls at U.S. ports have increased nearly 5 percent from 2001 to 2005.** This increase has been accompanied by an increase in container capacity (29 percent) and capacity of all vessel types (11 percent) during this same time period.[5] In addition, the number of cruise ship departures and passenger boardings has increased worldwide over the past 3 years. Total departures from all ports rose from 4,094 to

[5] U.S. DOT MARAD. "Vessel Calls at U.S. Ports 2005," April 2006.

4,463, or 8 percent, while the total number of cruise passengers expanded from 8,349 in 2003 to 9,747 in 2005 for a 14 percent increase.[6]

- **By the year 2020, net freight tons across all modes are projected to increase to 20 billion tons annually,** and expand to 25 billion tons by 2035 – an increase of more than 65 percent over present-day levels. Figure 3.1 illuminates the trend in freight tons for the next three decades. This national freight trend is reflected on smaller scales throughout the country, and is perhaps more evident in Florida.

- **Florida's international trade is expected to reach $97.6 billion by 2008.**[7] Statewide, Florida's combination of airborne and waterborne international trade totaled $95.3 billion in 2005; an increase of 17 percent over 2004. Of this total, nearly $63 billion moved through the 14 seaports of the State.[8] This total is projected to reach $97.6 billion by 2008.

- **Over the past few years, the POM's growth has mirrored that of global increases of waterborne cargo and cruise statistics.** In 2005, the POM ranked 13th in the United States in ports of call (all vessel types), with 1,299; and 7th in the country for container ship ports of call. It is important to note that 3 of the top 7 container ports of call are situated in the South Atlantic region, and account for 20 percent of U.S. container ports of call, and 9 percent of all ports of call in the United States.[9]

- **Ports in Florida tend to serve their respective regions,** while deepwater ports in other areas of the south, such as in Texas, Louisiana, and Georgia tend to serve as national gateways which service extensive portions of the country. Figure 3.2 demonstrates the relative port volume (in short tons) among all major ports in the United States. It is clear from this figure that pressures being placed on the Port of Miami are common among numerous coastal ports, particularly in the Southeastern U.S. As the population of Florida continues to increase at a substantial pace – particularly in Central and South Florida – additional pressures will be placed on centrally and southern located seaports to serve market demands.

- **As recently as 2005, it had been estimated that at any given time, 3,500 cargo ships were sailing the Pacific, Atlantic, and Indian Oceans**, while transporting 15 to 18 million shipping containers.[10] The POM surpassed 1 million TEUs in 2003 and has been increasing ever since.

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[6] U.S. DOT MARAD.

[7] Florida Ports Council. "A Forecast of Florida International Trade Flows" The Washington Economics Group, November 2003.

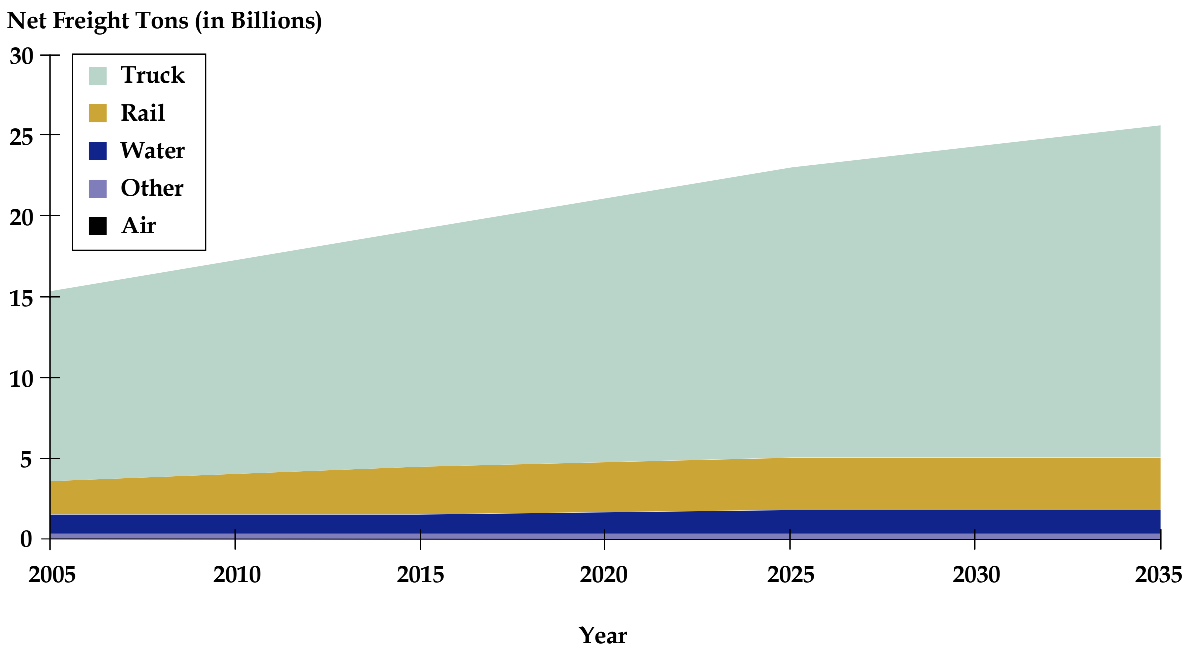
[8] A Five-Year Plan to Achieve the Mission of Florida's Seaports, February 2006.

[9] U.S. DOT MARAD.

[10] Jung, Alexander. "The Box That Makes The World Go Round," Der Speigel Magazine, November 25, 2005.

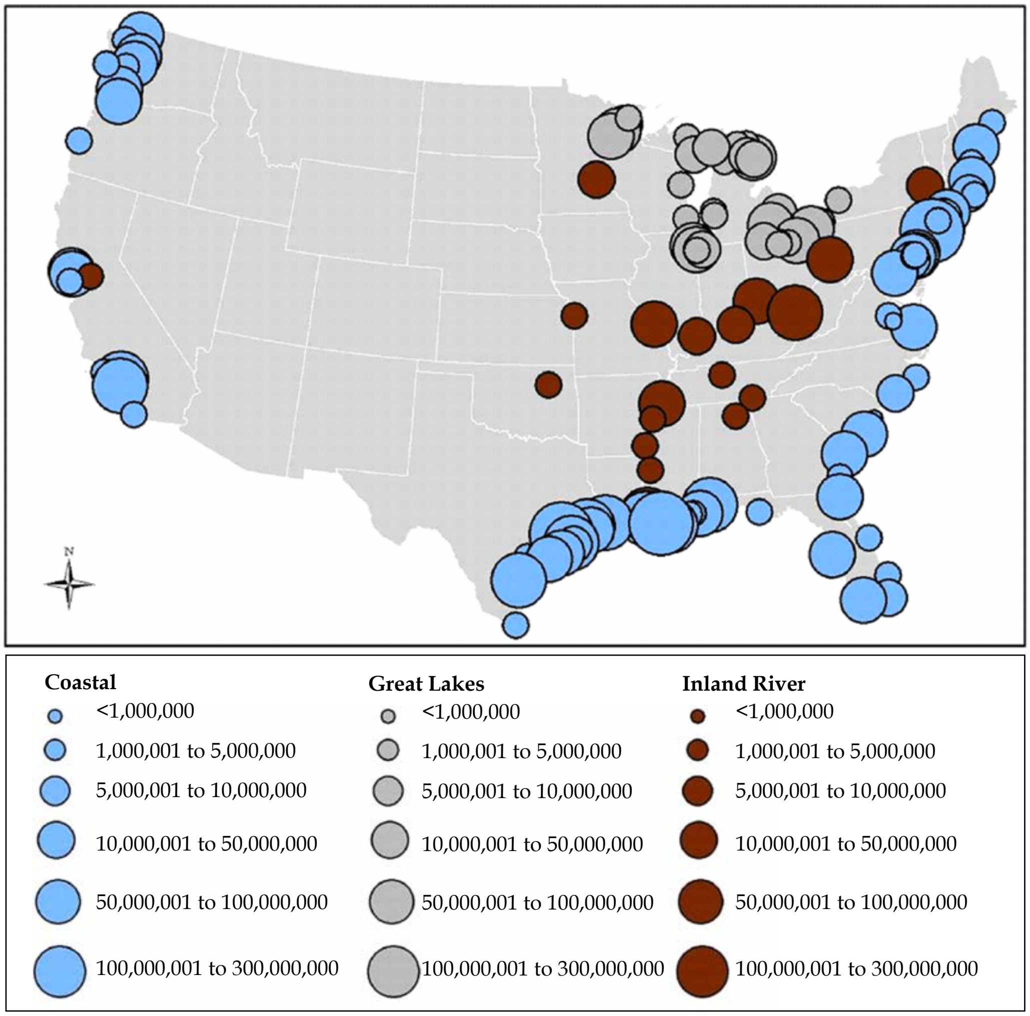
- **POM has solidified its role in the global market place both in terms of volume processed and diversity of trading partners.** Figure 3.3 provides a breakdown of the top 25 trading countries with the POM. The combination of the top 25 trading partners accounts for more than 93 percent of the total tonnage processed by the POM. Inbound cargo, which accounts for about 60 percent of total tonnage arrives primarily from China, Italy, Hong Kong, Honduras, Brazil, Spain, Columbia, Netherlands, Dominican Republic, and Guatemala. Forty percent of total tonnage is outbound and is largely destined for: Honduras, Dominican Republic, Guatemala, Brazil, Hong Kong, Venezuela, Jamaica, China, Colombia, and Panama. In 2004, the total tonnage was approximately 9.5 million.

Figure 3.1 U.S. Freight Trends by Mode



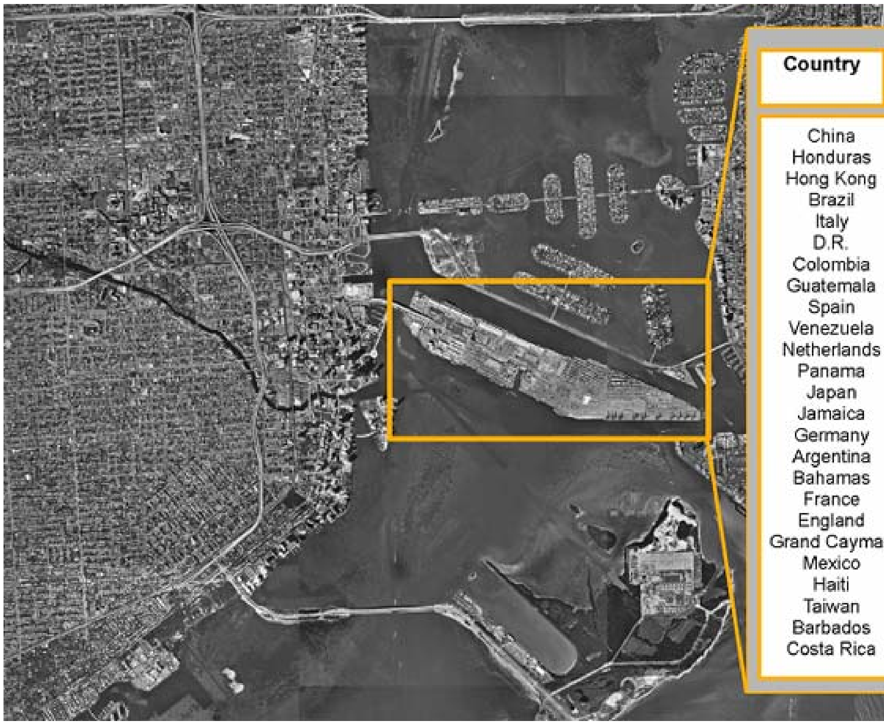
Source: Global Insight, Inc., TRANSEARCH, 2004.

Figure 3.2 Total Tonnage by Port



Source: Analysis by Cambridge Systematics, Inc.

Figure 3.3 Top 25 International Trading Partners



Country	Tons	Percent of Total
China	996,802	10.52%
Honduras	746,334	7.88%
Hong Kong	685,571	7.24%
Brazil	645,261	6.81%
Italy	638,324	6.74%
D.R.	563,468	5.95%
Colombia	494,504	5.22%
Guatemala	458,328	4.84%
Spain	418,305	4.42%
Venezuela	417,911	4.41%
Netherlands	360,022	3.80%
Panama	334,091	3.53%
Japan	304,434	3.21%
Jamaica	301,098	3.18%
Germany	260,310	2.75%
Argentina	182,940	1.93%
Bahamas	158,577	1.67%
France	156,459	1.65%
England	128,837	1.36%
Grand Cayman	128,128	1.35%
Mexico	111,063	1.17%
Haiti	103,748	1.10%
Taiwan	101,800	1.07%
Barbados	93,906	.99%
Costa Rica	89,408	.94%

Source: Port of Miami, "2006 State of the Port."

4.0 Potential Landside and Waterside Access Improvements

As is the case with most major ports around the world, congestion and access issues in Miami have long been on the radar of city staff, public officials, and the port community. Given that congestion is a multifaceted issue with no simple remedy, a number of potential remedies have been and currently are being explored as a means of determining viable solutions to downtown capacity issues. Although the focus of this particular study aims to fully explore the viability of a rail tunnel and/or grade-separated rail corridor, it is important to acknowledge other identified access improvement options. Again, as noted earlier, the potential improvements described below have not been fully developed as part of this study. Additional work would be required to evaluate technical and economic feasibility for each improvement.

This section identifies and briefly discusses the array of port access improvement strategies that have been proposed by a variety of stakeholders. Broadly speaking the strategies fall into one of four categories: roadway-based, operational, waterway-based, and rail-based improvements. All are described and evaluated in the following sections; save for rail-based improvements, which are analyzed in Section 5.0.

4.1 Roadway-Based Improvements

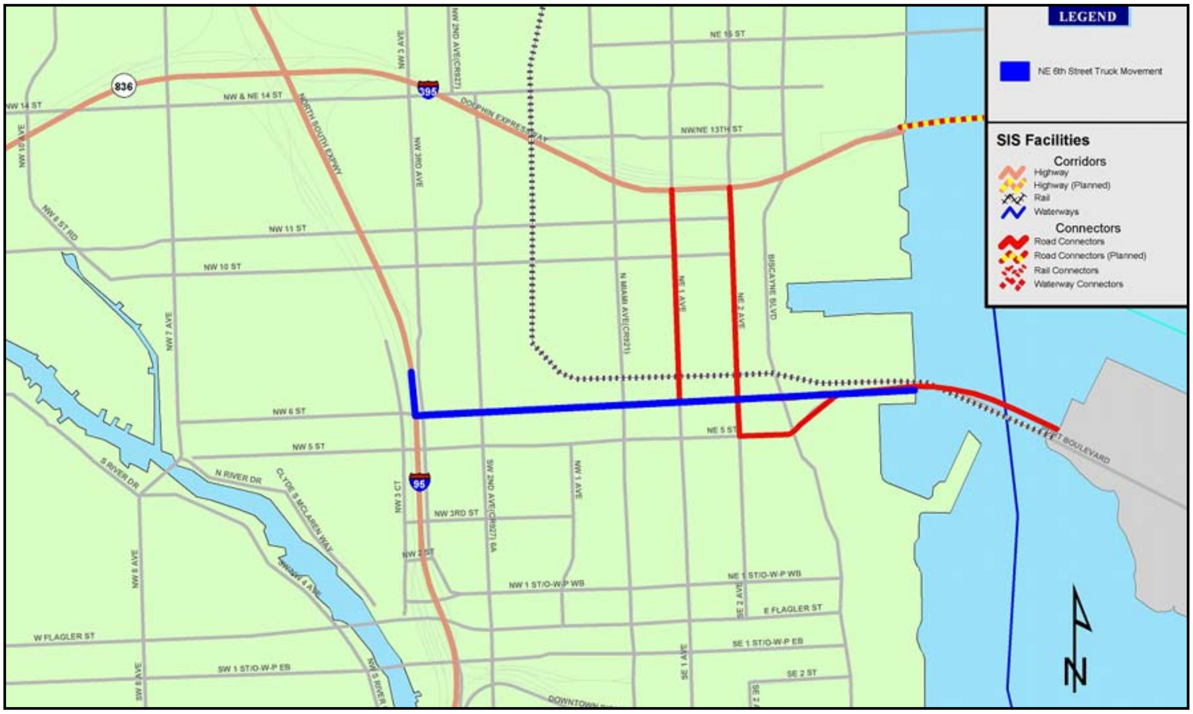
6th Street Slip Ramp at Interstate 95 and Other Local Street Enhancements

The 6th Street slip ramp project has been around for several years. This project would construct a new northbound on-ramp to I-95 at 6th Street. This is a significant project because it provides trucks with a SR 836 westbound connection. Local community opposition originally killed this project. It was brought back in 2006. It has FTAC and seaport staff and industry support; however, local leaders again tabled the project. It is unclear whether advocates will be able to revive the project again. If successful, this project would provide relief to port traffic within five years. Table 4.1 and Figure 4.1 describe and illustrate this improvement.

Table 4.1 Overview of 6th Street Slip Ramp Project

Issue Area	Advantages	Disadvantages
Operational Characteristics	• Provides needed point of access to SR 836 westbound • Relieves existing congestion on 2nd Avenue	• Additional truck traffic on 6th Street
Cost and Design	• Preliminary engineering completed by FDOT • Relatively low-cost project	• Cost and engineering data is out of date
Traffic/Congestion Impacts	• Provides alternate route/added capacity to existing westbound truck traffic • Temporary relief of current congestion on 2nd Avenue	• Congestion related to construction activities • Temporary relief of current congestion on 2nd Avenue • Does not address larger issues of direct Interstate access for port traffic
Economic Impacts	• Improves port access for making truck drivers more efficient • Project-specific construction jobs	• NA
Impacts to Surrounding Community	• Project could be completed in relatively short period of time • Reduced truck traffic along 2nd Avenue	• Surrounding community has voiced concern over negative externalities, including air quality, noise, and pedestrian safety
Environmental Concerns	• Decreased emissions due to free flow traffic	• Redistribution of emissions
Security	• NA	• NA
Aesthetics	• Limited negative impact, if any.	• Community perception of visual impacts

Figure 4.1 Illustration of 6th Street Slip Ramp Project



Port of Miami Tunnel (Highway)

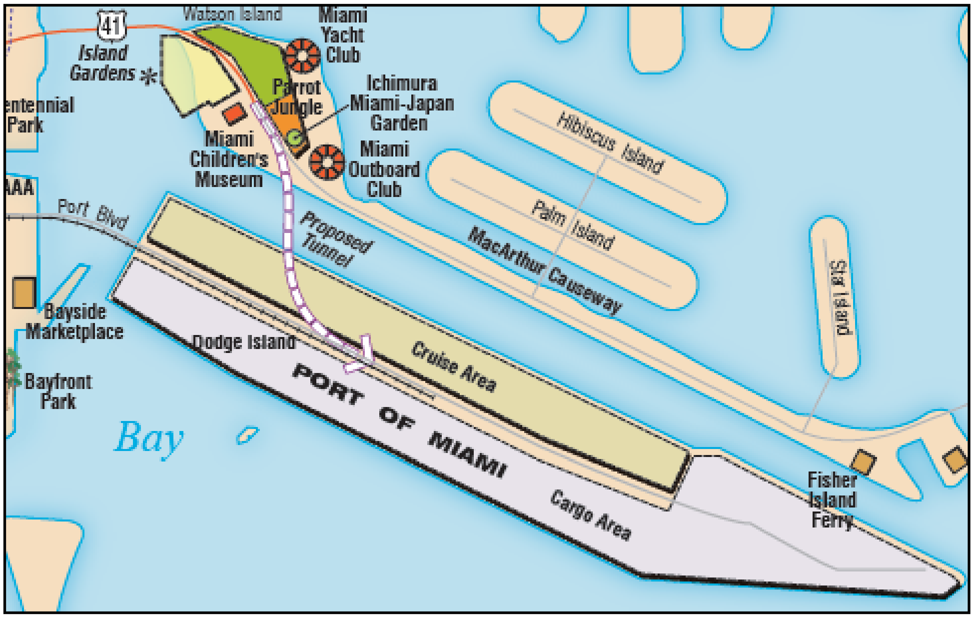
The development of a new highway connection to the POM that provides direct access to the Interstate System has been under development for several years. The current tunnel proposal connects the Port to I-95 via a tunnel connection to I-395 on Watson Island. The project was endorsed by state and local leaders, although funding commitments remain unmet. FDOT has pre-qualified three teams of firms interested in designing, building, maintaining, and operating the tunnel. Once the financial plan is completed, the project will advance. Preliminary estimates have the project complete as early as 2013. This project has received mixed reviews. It would eliminate or significantly reduce conflicts in the downtown, however it does not improve mobility along the region's expressway system. *This access improvement currently represents the preferred regional alternative.* Table 4.2 and Figure 4.2 describe and illustrate this project.

Table 4.2 Overview of Port of Miami Tunnel Project

Issue Area	Advantages	Disadvantages
Operational Characteristics	• Replaces primary port entrance with a direct connection to I-395 • Existing access will remain	• Tunnel grade is concern of drivers • Potential toll is concern of port and industry • Regional system congestion remains a concern
Cost and Design	• Design parameters were provided; successful team will complete design • Local endorsement of project with partial funding commitment	• In excess of $1 billion (preliminary estimate) • Currently, financing plan is incomplete
Traffic/Congestion Impacts	• Provides direct access to I-395 • Removes significant traffic from local streets • Provides long-term increase in capacity for port access	• Does not directly address congestion beyond the port and adjacent downtown routes
Economic Impacts	• Public/Private Partnership funding structure[a] • Potential to preserve/increase capacity of POM	• Significant costs likely requiring user fees of some type; could hurt port competitiveness
Impacts to Surrounding Community	• On-port traffic patterns will be disrupted during construction • New traffic patterns will provide better access to each area of the port • Reduces mixed traffic conflicts on local streets	• Impacts to Watson Island • Some traffic will continue to use Port Boulevard/Port Bridge
Environmental Concerns	• Initial proposals approved by FHWA and FDOT for environmental concerns • Reduces congestion-related emissions in downtown area	• Environmental impacts during construction • Driver concern over air quality in tunnel
Security	• NA	• Significant concern expressed over security and controlled access to the tunnel • Concern of impact of major disaster such as Hurricane surge
Aesthetics	• Poses minimal aesthetic impacts, as majority is underground	• NA

[a] www.PortofMiamiTunnel.com.

Figure 4.2 Illustration of Proposed Tunnel Project



Source: Port of Miami Tunnel Project web site (www.portofmiamitunnelproject.com).

■ 4.2 Operational Improvements

Operational improvements occur in multiple forms and could be interpreted to include strategies such as reservation systems, time-of-day-specific operations, congestion pricing (PierPass), traffic modifications (5th and 6th Streets), mass transit for person trips, as well as embracing various cutting edge software in order to augment day-to-day operations by streamlining information flows. The success of operational improvements essentially hinges on buy-in from all parties involved. In the case of 24/7 or "hoot shift" operations, one of the main challenges in shifting a significant amount of daytime gate-moves into the evening or early a.m. hours is the ability to motivate truck drivers to show up during those hours. Many drivers resist this shift due to lack of other ancillary port services during these times, and most importantly because shippers/receiver facilities are closed.[1]

The terminal operators at the POM have experimented to varying degrees with hours of operation with very limited success due to lack if trucking industry support. Discussions of PierPASS also have gone poorly due to regional competitiveness factors. More traditional enhancements, such as coordinated law enforcement activities are in place. POM

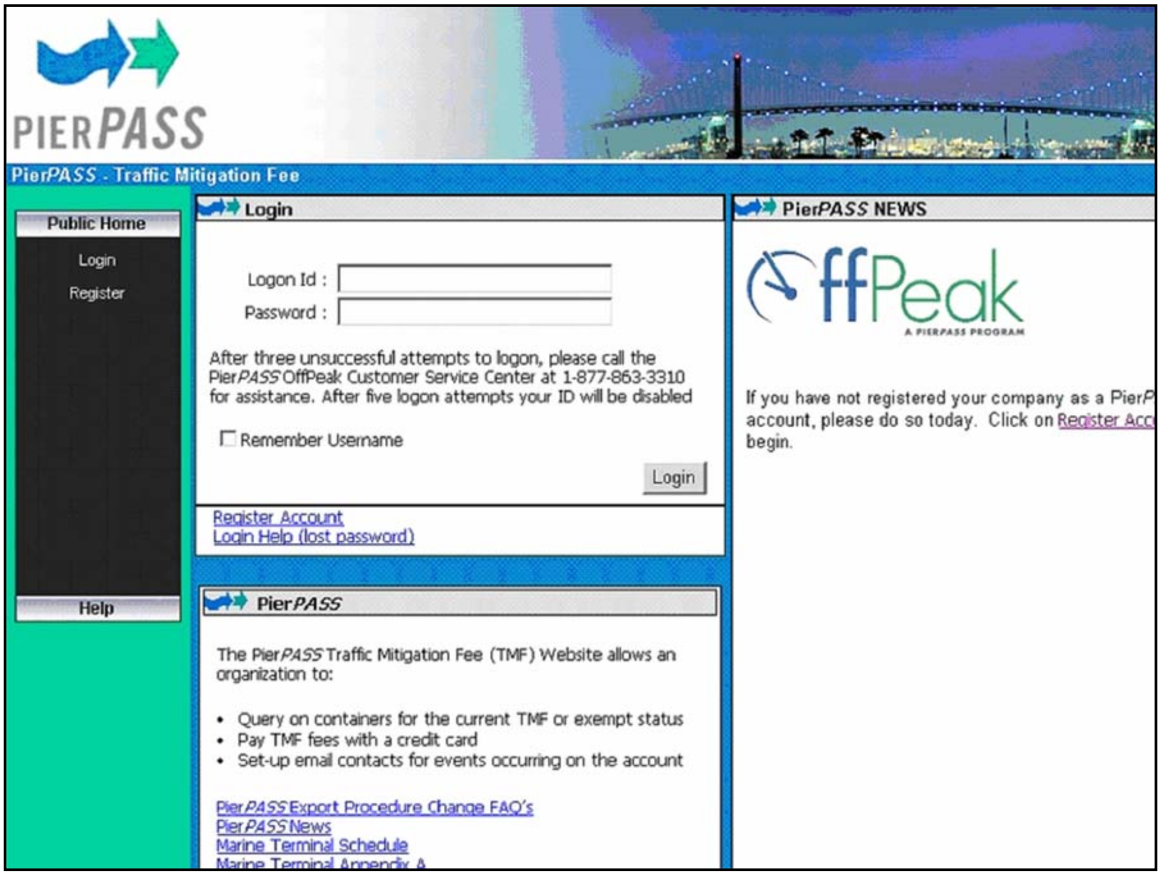
[1] New York Times 11/30/2003, "Are Late Nights the Answer" Eryn Brown.

Police and City of Miami Police routinely work together to manage and respond to local traffic incidents. Operational enhancements tend to be relatively low capital investments with more intensive in outreach, consensus building, enforcement, and regulatory activities. Table 4.3 and Figure 4.3 describe and illustrate these types of improvements.

Table 4.3 Overview of Operational Enhancements/Improvements

Issue Area	Advantages	Disadvantages
Operational Characteristics	• Can often be more malleable than options that involve significant investment in physical facilities • Can be implemented relatively short term • Can focus on appropriate corridors or activities	• Logistics practices are complex and require significant coordination • Regional coordination can be tedious (adjustments relating to operating hours, coordination with cruise lines for transporting passengers to/from port, Downtown event cooperation)
Cost and Design	• Cost and design vary depending on strategy • Conceptually, could be low cost in terms of using existing infrastructure	• Increased labor and technology requirements • Increased training • May require new funding sources
Traffic/Congestion Impacts	• Provide improved reliability • Reduce congestion	• Requires changes to person behavior • Data/information accuracy and reliability is critical
Economic Impacts	• Provides relatively low-cost investments • Can be employed only by those that find it beneficial	• Some operational adjustments may be cost-prohibitive for smaller volume operations, warehouses and companies
Impacts to Surrounding Community	• Flexibility could serve greatest number of stakeholders	• Can require a "give-and-take" attitude as operations are shifted to off-peak • Industry may not be accepting of new requirements
Environmental Concerns	• Potential for reduced emissions due to reduced congestion	• Potential to shift time of day for emissions; could impact residents
Security	• Use of technologies and real-time information can enhance security	• Additional enforcement resources may be required • Off-peak operations may compromise security
Aesthetics	• NA	• NA

Figure 4.3 Illustration of PierPASS Reservation System



■ 4.3 Sea-Based Improvements

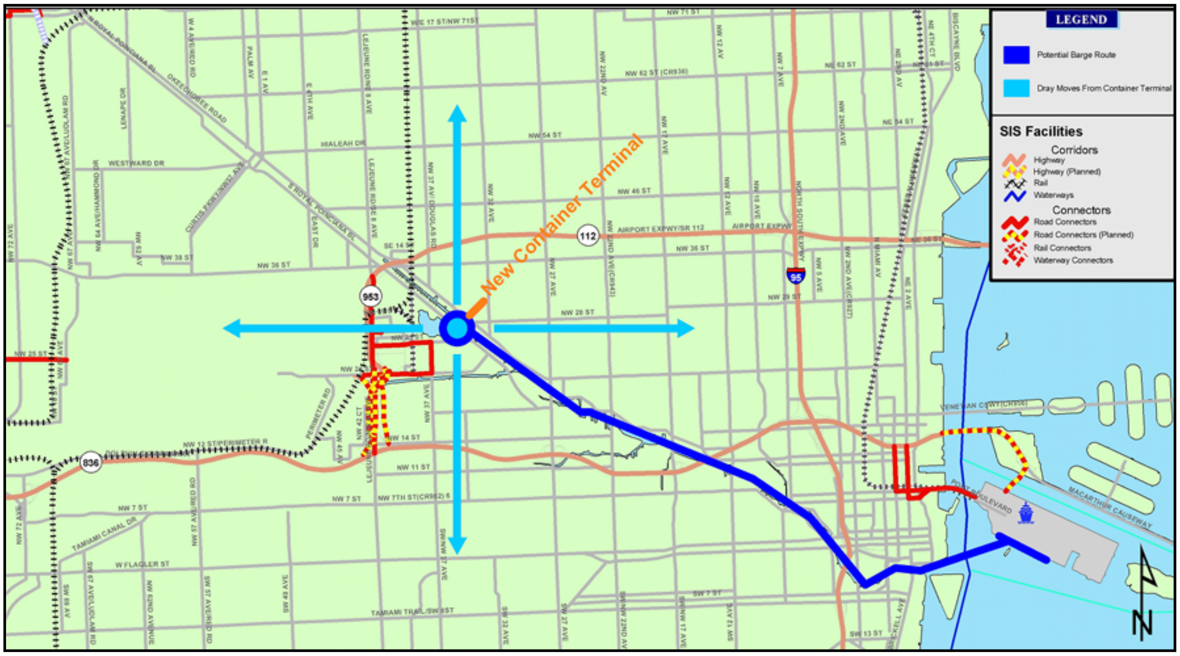
Short-Sea Shipping/Barge Transfer to Port of Miami River

Miami River industry representatives proposed a new short-sea shipping service that would reduce truck drayage movements at the POM by transferring them to barge. The barges would move containers from the POM up the Miami River to a terminal; trucks would pick up the containers at this terminal to complete the drayage move to a western terminus. Berthing space would be required at the POM; an existing terminal along the Miami River would be utilized as the new intermodal transfer point. This service would help reduce trucks in the downtown. The economics (additional handling/lift fees, etc.) have yet to be defined, nor has stakeholder support been generated. This service could be brought on line within a year. Table 4.4 and Figure 4.4 describe and illustrate this proposal.

Table 4.4 Overview of Miami River Drayage Proposal

Issue Area	Advantages	Disadvantages
Operational Characteristics	• Service could be implemented quickly	• Service has limited capacity • Additional handling; still requires truck dray • Draw bridges would impact regional mobility • Requires multiple logistics partners
Cost and Design	• Requires minimal design • Relatively low construction cost	• Potential for ongoing operational costs; potential subsidy
Traffic/Congestion Impacts	• Potential reduction in truck dray moves; reduced impact on-port gate and local streets	• Modal shift unlikely to have significant impact • Short term, limited capacity fix
Economic Impacts	• Business model has not been developed	• Subsidy may be required
Impacts to Surrounding Community	• Fairly low impact on affected communities	• Potential impact to other river users • Limited industry support
Environmental Concerns	• Potential reduction in truck emissions	• Limited marine impacts
Security	• Question of where Customs and Border Protection inspection takes place	• Question of where Customs and Border Protection inspection takes place • Would require new security services at POMR terminal
Aesthetics	• NA	• NA

Figure 4.4 Illustration of Miami River Drayage Proposal



5.0 Potential Rail Access Improvements

5.1 Introduction

This section presents a preliminary conceptual assessment of a grade separated rail corridor designed to provide direct service to the POM. As service development options are considered, it is important to acknowledge that FEC and POM buy-in and support will be critical for any new service. In addition, two other regional developments must be taken into consideration. First, the region is pursing funding commitments for the development of new highway-based tunnel connection to the POM. Second, the entire FEC corridor in South Florida is undergoing an in-depth analysis to investigate the feasibility of passenger service. Both of these potential projects would directly impact direct rail to the POM. The analysis presented in this section does not address these potential projects; it focuses on technical feasibility of a new grade separated rail corridor.

Currently, three separate service options have been discussed, including:

1. **On-Port ICTF with Existing At-Grade Rail Service.** FEC has developed a service profile utilizing existing at-grade service. This would require development of an ICTF on POM property as well as significant upgrades to the POM rail lead. FEC has proposed to provide two trains daily (one in and one out) between 1:00 and 5:00 a.m. This service is designed to handle the existing traffic currently being drayed to the Hialeah rail terminal. Port staff and tenants are resistant to provide on-port land given the limited capacity of the service.

2. **On-Port ICTF with New Tunnel (Traditional Long-Haul Intermodal Service).** This service would consist of a new 25-acre ICTF on-port property and a grade separated connection to FEC's intermodal network. Traditional long-haul intermodal traffic would be loaded/unloaded directly at the POM for hinterland markets.

3. **On-Port ICTF with New Tunnel (Short-Haul Shuttle Service).** This service would consist of a new 25-acre ICTF on-port property and a grade separated connection to the FEC system. Frequent, short shuttle trains would connect the POM with the western Miami-Dade County distribution infrastructure via an expanded FEC facility (or a combination of new and expanded transfer facilities). This service would be designed to significantly supplant truck dray service between these points. *This access improvement represents the primary focus of this study.*

The analysis presented in this section focuses on the infrastructure investments required to support the two grade separated service alternatives. As discussed earlier in this report, the primary motivation for this study was to consider the feasibility of a shuttle service similar to that developed in Southern California with the Alameda Corridor. This corridor provided an inland connection for containers moving through the Ports of Los Angeles and Long Beach. It was designed to significantly reduce at-grade conflicts and streamline congestion at the marine facilities. There are other examples of shuttle services throughout the world, such as the Sprint Train currently in use in Australia. This private service provides shippers with direct port access via short shuttle trains using specialized equipment. Both the Alameda Corridor and the Cargo Sprinter Train are illustrated in Figures 5.1 and 5.2 respectively.

Figure 5.1 Alameda Corridor (Southern California)

Source: http://www.acta.org/newsroom_photo.htm.

Figure 5.2 CRT Cargo Sprinter (Australia)

Source: Australasian Transport News, June 7, 2003.

■ 5.2 Potential Market

To determine rail capacity requirements for varying stages of Port container growth, current Port TEU volume was rounded to 1 million TEUs annually and then increased in increments of 500,000 to represent future Port projected growth. These TEU volumes were adjusted to reflect equivalent containers and then adjusted to represent percent of total containers currently moving by rail. At the time of this study, rail volume accounts for approximately 11 percent of all container traffic moving through the Port of Miami, per conversations with port staff. This percentage is not expected to exceed 15 percent in the future based on current market reach of the Port.

As identified in Table 5.1, the annual rail throughput requirements for 15 percent of traffic could range from 60,000 to 248,000 rail lifts. A rail lift can be described as the constructive movement of containers on and off of rail cars, where a container is classified as a box or unit. Unlike the TEU measurement, "rail lifts" are representative of the number of units, regardless of equivalent unit length. It was assumed for the purposes of this assessment that FEC could provide sufficient mainline rail service to support this level of traffic. A maximum annual rail capacity of 250,000 containers was used in the development of the rail corridor and the ICTF (traditional) concept.

Table 5.1 Traditional Rail Volume Projections

Total Annual Port TEUs	Annual Containers/ Units (TEU/1.81)	Percentage Total To Rail	Annual Rail Containers/ Lifts	Annual Trains	Containers/ Train	Equivalent Annual Gate Moves
1,000,000	552,486	0.11	60,773	290	210	75,967
1,500,000	828,729	0.15	124,309	593	210	155,387
2,000,000	1,104,972	0.15	165,746	790	210	207,182
2,500,000	1,381,215	0.15	207,182	988	210	258,978
3,000,000	1,657,459	0.15	248,619	1,186	210	310,773

Source: CH2M Hill, Inc.

For the potential rail shuttle service, a slightly different configuration would be required, along with requiring 12 or more trains per day initially to upwards of 35 trains per day (or well over 13,000 per year), each capable of transporting 100 to 115 containers. Under this service profile, 90 percent of port cargo moving by rail shuttle could range from 500,000 to 1.5 million annual containers. This profile would require cargo to be railed from an on-port facility to another inland facility. The on-port facility would be composed of 9 to 11 – 3,500-foot track segments, which would handle 90 percent of the containers, with the remaining 10 percent being drayed via truck. Projections of the rail shuttle concept are shown in Table 5.2 below.

Table 5.2 Rail Shuttle Rail Volume Projections

Total Annual Port TEUs	Annual Containers/Units (TEU/1.81)	Percentage Total To Rail	Annual Rail Containers/ Lifts	Annual Trains	Containers/ Train	Equivalent Annual Gate Moves
1,000,000	552,486	0.90	497,237	4,324-4,520	110-115	621,547
1,500,000	828,729	0.90	745,856	6,486-6,781	110-115	932,320
2,000,000	1,104,972	0.90	994,475	8,648-9,041	110-115	1,243,094
2,500,000	1,381,215	0.90	1,243,094	10,810-11,301	110-115	1,553,867
3,000,000	1,657,459	0.90	1,491,713	12,971-13,561	110-115	1,864,641

5.3 Rail Corridor Analysis

This rail tunnel assessment includes the conceptual development of a grade separated freight rail corridor connecting a proposed new ICTF on the Port of Miami's Dodge and Lummus Islands with the Florida East Coast Railway (FEC). This conceptual rail corridor would utilize a combination of tunneling and open-cut-below-grade techniques to bypass Miami's central business district and provide the Port with unrestricted intermodal freight rail access with connections to the region's intermodal rail system. The northern limit of this rail corridor assessment extends to NE 20th Street, a point north of Interstate 395 where the below-grade cut section would transition and meet the existing FEC at-grade rail line. The conceptual corridor is displayed in Figure 5.3 on the following page.

This conceptual rail corridor analysis identifies grade separation methodologies and operational feasibility to support intermodal rail service. The concept addresses ICTF rail operations specific to the movement of containers between the Port of Miami and destinations beyond the local tri-county delivery markets, as well as a new shuttle service to transfer cargo from the Port to western Miami-Dade County. These intermodal activities include the arrival and departure of mainline trains, loading and unloading of intermodal railcars, and the management of container interchange between the ICTF and port marine terminals. This conceptual rail configuration was developed based upon a number of important factors, including: rail access, ICTF length, rail service compatibility, proximity to marine terminal operations and the rail alignment impacts of grade separation techniques. Assumptions related to rail operation, construction and technical specifications were reviewed by technology experts and are believed to represent a reasonable best case scenario.

The existing FEC rail line serving the Port of Miami travels south from North Miami parallel to the Atlantic shoreline where it turns east at a point north of NE 6th Street, and then crosses over Biscayne Bay on a rail causeway to Dodge Island. Rail service to the island is restricted to off-peak hours due to surface traffic on local Miami roadways. The rail line is single-track in this area and no support track or yard tracks are available south of I-195.

For a rail tunnel to be operationally feasible, grade separations along the corridor will be critical. In addition, support track would be required to manage train flows and train lengths into and out of the port. To provide for this separation, a point along the FEC right-of-way was identified as a possible grade transition point for a depressed rail corridor at the intersection of NE 17th Street. The depressed rail corridor would extend south from NE 17th Street along the existing FEC right-of-way to a point where it would intersect the proposed tunnel under Biscayne Bay. The rail corridor would continue under Biscayne Bay and surface on Dodge Island and connect to the proposed ICTF. The selected tunnel technology, as described in detail below, will impact the on-port ICTF. In addition, the type of service (traditional versus shuttle train) will impact the size, configuration, and operation of the ICTF (see Figures 5.3 through 5.5).

Figure 5.3 Conceptual Rail Alignment

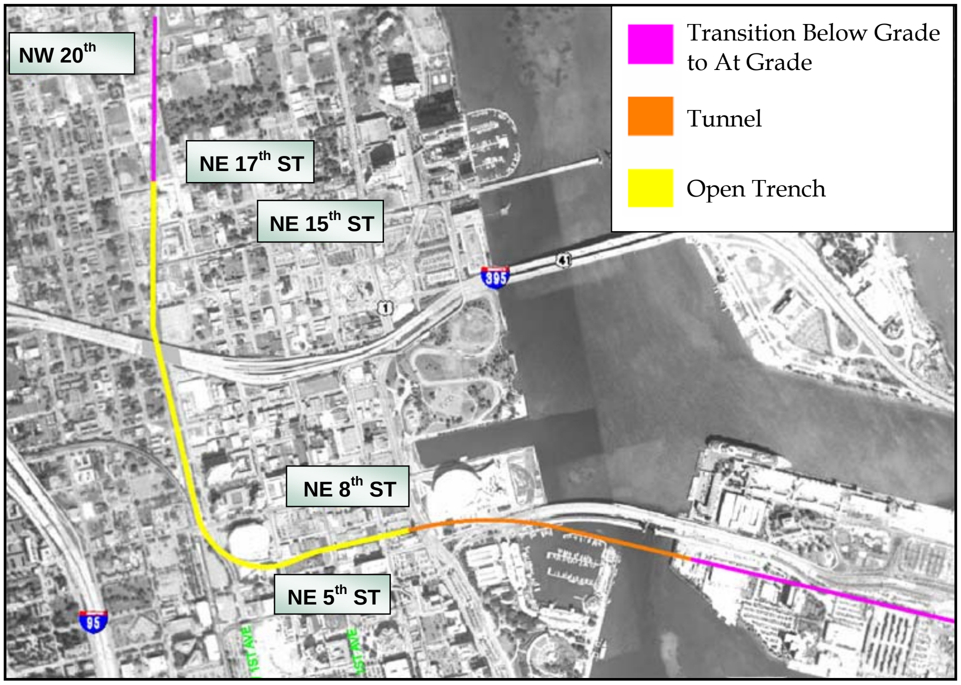


Figure 5.4 On-Port Facilities with Bored Tunnel Access

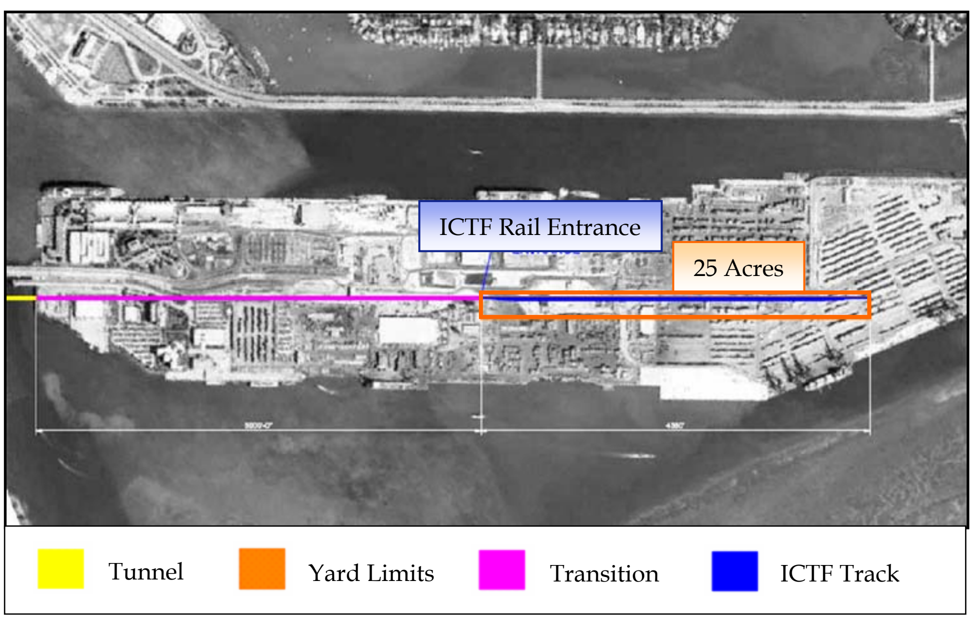
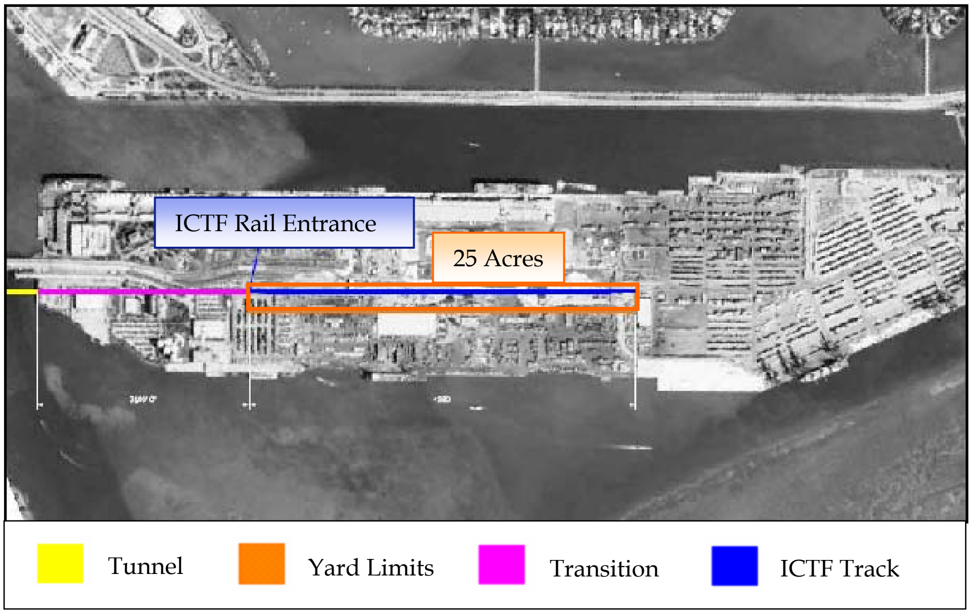
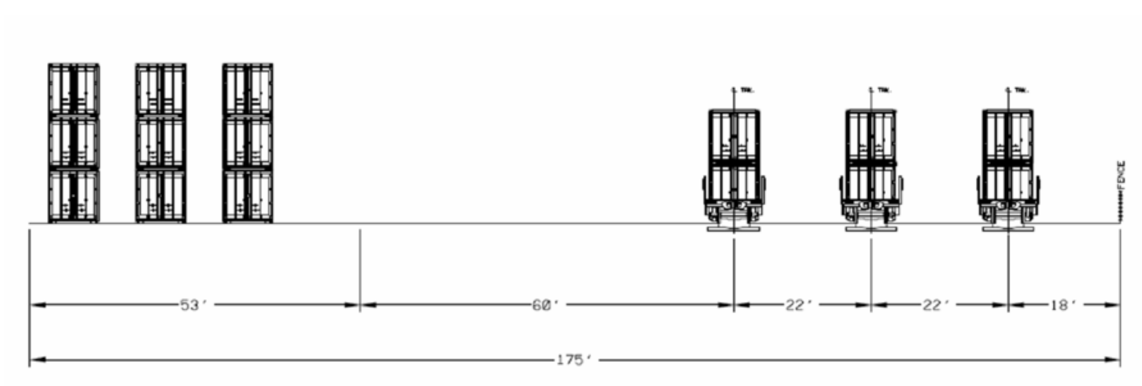


Figure 5.5 On-Port Facilities with Immersed Tube Access



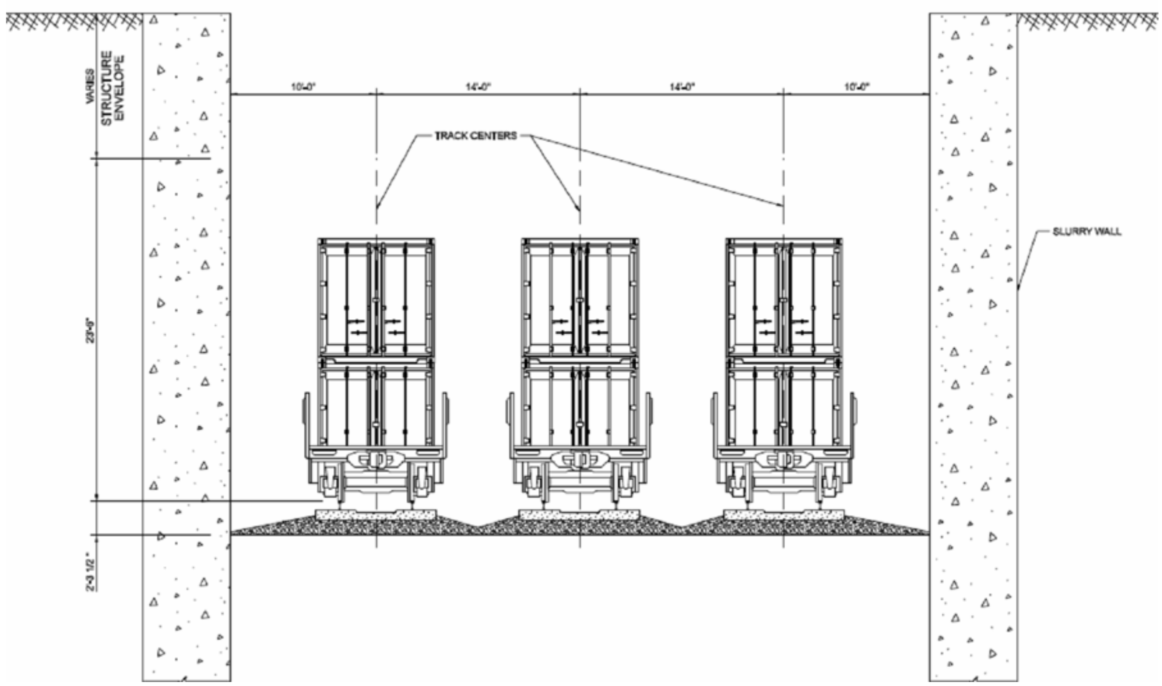
To minimize property requirements on Dodge Island for rail operations, only a high-velocity ICTF with a minimum footprint was considered. For traditional long-haul intermodal rail service, an ICTF accommodating 250,000 annual-rail-lifts would consist of three 3,500-foot tracks. As described above, the rail shuttle service capable of handling upwards of 35 short haul trains per day would require 9 to 11 3,500-foot tracks. These facilities would require upwards of 25 acres of land on Dodge Island (see Figures 5.4 through 5.6). No on-site container storage (within the ICTF) would be provided. Only operating areas for accepting and releasing containers and container staging areas for arriving and departing trains would be allowed. Daily container turnover would be 100 percent with dwell time not exceeding 16 hours.

Figure 5.6 General High-Velocity ICTF Cross Section



Rail support facilities would be required to sequence required train flows and to maximize ICTF throughput. Traditional long-haul intermodal train service arriving and departing this facility would be expected to consist of full train lengths between 6,000 and 7,000 feet long. These full train lengths cannot be accommodated in a single move into or out-of the intermodal facility and portions of these trains would need to be held in a rail support yard area. In addition, the shorter shuttle trains would require staging area capacity to manage the strict operating schedules required to accommodate 90 percent of port traffic. These rail facilities would be located west of the Biscayne Bay tunnel in a below-grade corridor cut section that would support three tracks wide, each 4,000-feet or longer (see Figure 5.7).

Figure 5.7 Open Trench Section



The following corridor characteristics were included in the development of the conceptual design:

- Rail grade transition between NE 20th Street and NE 17th Street would not exceed one percent;
- Three tracks would be provided below grade in a level open trench, between NE 17th Street and NE 1st Avenue;
- Rail grade transition between NE 1st Avenue and center of tunnel would not exceed two percent;

- Rail grade transition between the center of tunnel and Dodge Island would not exceed two percent;
- Two tracks would be provided through tunnel section;
- Rail lead tracks would connect to the ICTF on a level grade;
- Three loading and unloading tracks would be provided within the ICTF; each would be approximately 3,500 feet in length for a combined length totaling 10,500 feet;
- Total ICTF acreage, including working track area, would not exceed 25 acres;
- Rail lift operations would be performed with rubber-tired gantry (RTG) overhead cranes or straddle carriers, which would load directly to rail;
- Container interchange between ICTF and marine terminal would be via wheeled shuttles using straddle carriers, top-pick, or direct exchange with RTG at trackside;
- Annual intermodal rail volume totaling 250,000 units/lifts for a Traditional concept (see Table 5.1, Traditional Rail Volume Projections);
- Annual intermodal rail volume totaling 1,500,000 units/lifts for a Rail Shuttle concept (see Table 5.2, Rail Shuttle Rail Volume Projections);
- Rail facility operations considered to be a full 24-hour operation over a 7-day week; and
- No on-terminal parking would be provided for containers and there would be a 100 percent turnover within 24 hours.

5.4 Tunnel Technology Considerations

The conceptual rail corridor consists of approximately 13,000 linear feet of right-of-way within which a below grade track bed would be constructed. Of this distance, approximately 3,000 feet would be in a tunnel which would pass beneath the waterway channel separating Dodge Island from the Miami mainland. The remaining sections would consist of an open-cut corridor below street level as well as transitional track to return to existing grade. An additional 4,000 linear feet of right-of-way would be constructed on-level grade on Dodge Island to provide working track within the ICTF. Of the tunnel construction methods considered, the Immersed Tube Option provides the least intrusive return-to-grade distance on Dodge Island. Other options, including the Bored Tunnel Option, require a longer return-to-grade and below-grade rail section which pushes the ICTF rail entrance point further east onto the island and creates a greater on-dock development impact. When combined with a conceptual 25-acre Rail Shuttle ICTF, both tunneling methods have a significant impact on existing marine operations.

Tunnel Construction

The development of water and land tunnels in the area of Miami between the FEC rail line and Dodge Island appears to be feasible from a construction standpoint using two types of tunneling methods. Methods considered include boring a tunnel using a tunnel boring machine (TBM) for both land and water, and an immersed tube tunnel (ITT) for water and possibly part of Dodge Island. The conceptual sections for a large bored tunnel and immersed tube tunnel, as shown in Figures 5.8 and 5.9, were developed for concept dimensional purposes only. These sections provide approximate sizes of the tunnel envelope; however no calculations have been performed.

Figure 5.8 Bored Tunnel Section

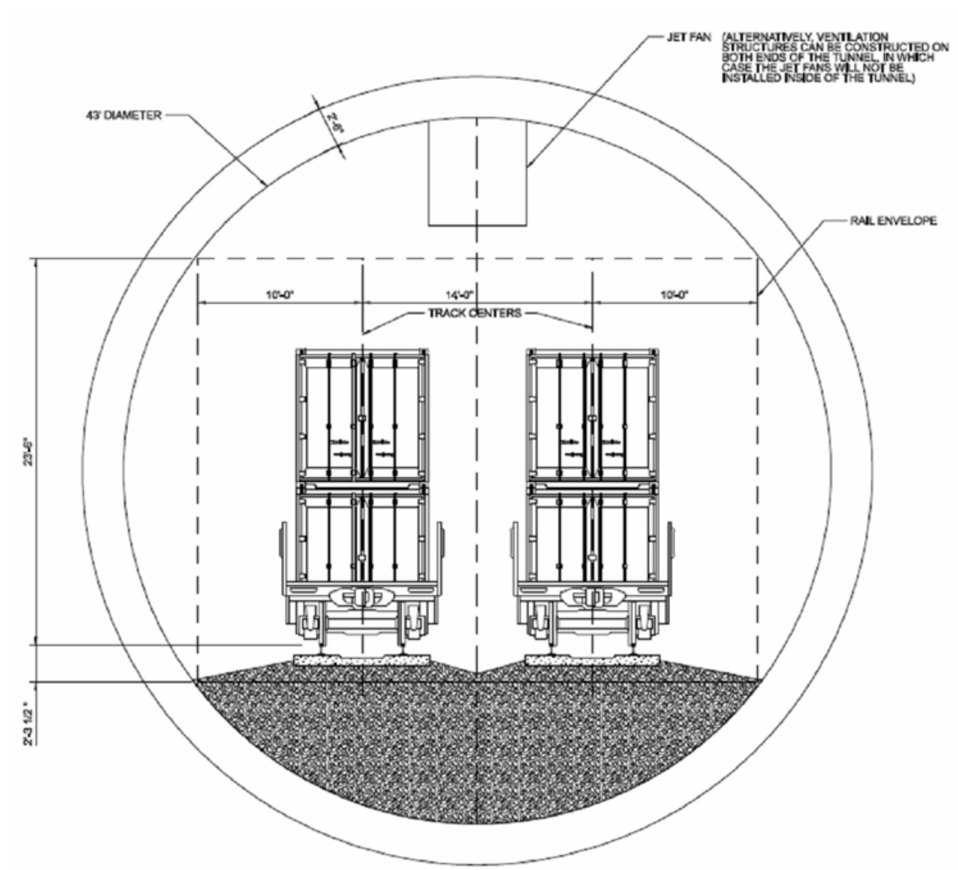
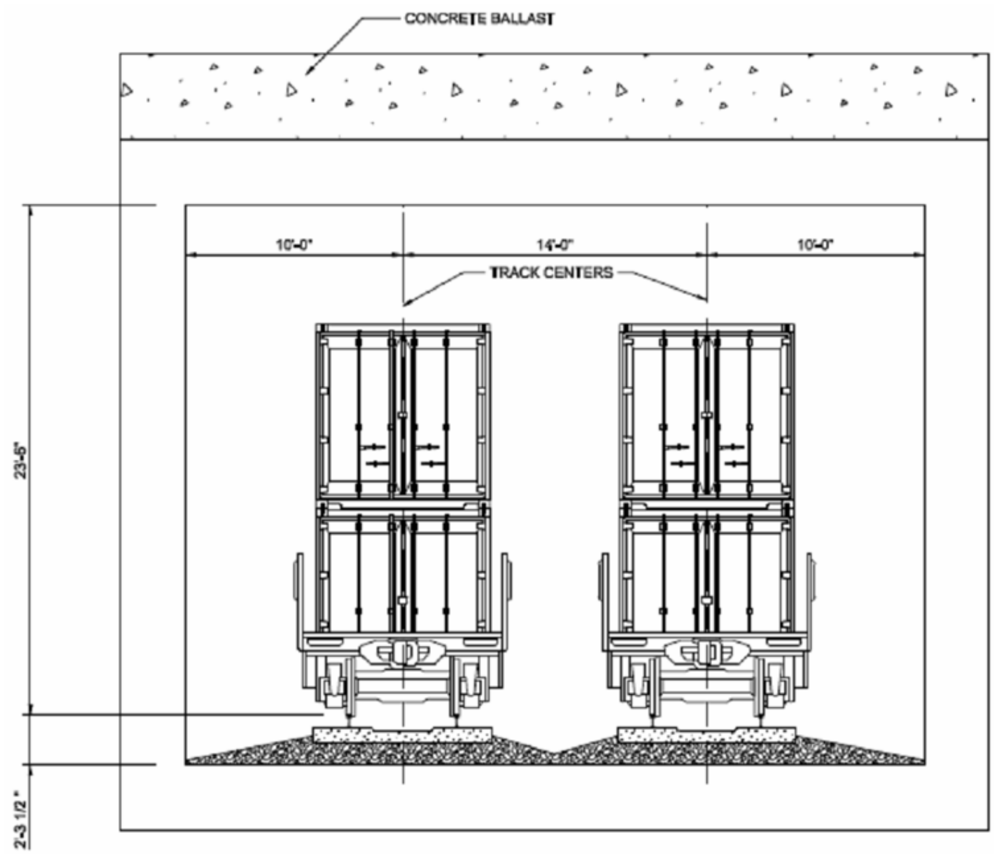


Figure 5.9 Immersed Tube Section



There are numerous tunnels built using TBMs and there also are a number of immersed tube tunnels in the United States (e.g., Third Harbor Tunnel crossing Boston Harbor, Fort McHenry Tunnel in Maryland, Trans-Bay Tube in San Francisco). In the Miami area, FDOT's documents were reviewed related to the proposed Port of Miami roadway tunnel. However, due to the limited scope of this assignment, no further case history investigation was performed to identify other tunnels in Florida or elsewhere with similar geology. This brief investigation has revealed that there is a lack of experience in constructing underground structures in South Florida and that developing this type of structure will be challenging. The following discussions describe the elements and construction method for each type of tunnel.

Bored Tunnel (TBM)

It was assumed that the bored tunnel would begin in a construction shaft within the existing FEC right-of-way located several blocks west of Biscayne Boulevard/U.S. 1. Tunnel construction using the TBM would progress to the east going under U.S. 1, Port Boulevard, the Intracoastal Waterway channel in Biscayne Bay, and a distance into Dodge Island.

A bored tunnel that is sufficiently large enough to enclose the rail envelop for two tracks would have an inside diameter requirement of approximately 43 feet. This will make the proposed tunnel one of the largest TBM tunnels in the world. In general tunnel practice, a minimum cover of one tunnel diameter above the bored tunnel is recommended. However, in order to limit the length of tunnel into Dodge Island, a minimum cover of 25 feet (about half tunnel diameter) is assumed to be sufficient. Using a maximum rail gradient of 2 percent and 25-foot minimum cover, it is estimated that the distance from the west edge of Dodge Island to where the track would meet existing grade will be in the order of 4,500 to 5,000 feet (see Figure 5.10). However, the final below grade portion may need to be lengthened if additional tunnel cover is required. The ends of the bored tunnel will be joined by rectangular-shaped cut-and-cover tunnels and open-cut areas where the rail returns to grade (see Figures 5.11 and 5.12).

Although the bored tunnel option appears to be feasible, the risk associated with bored tunnel construction is considered to be high. This is due to the highly permeable nature of soil and rock in this area. The less than typical cover for this bored tunnel also adds to risk of a "blow out" which could occur if the face pressure is too high. Shallow cover also may not resist floatation of the tunnel. There are measures to mitigate these problems, but regardless, this option involves relatively higher risks than other construction methods.

Figure 5.10 Bored Tunnel Option

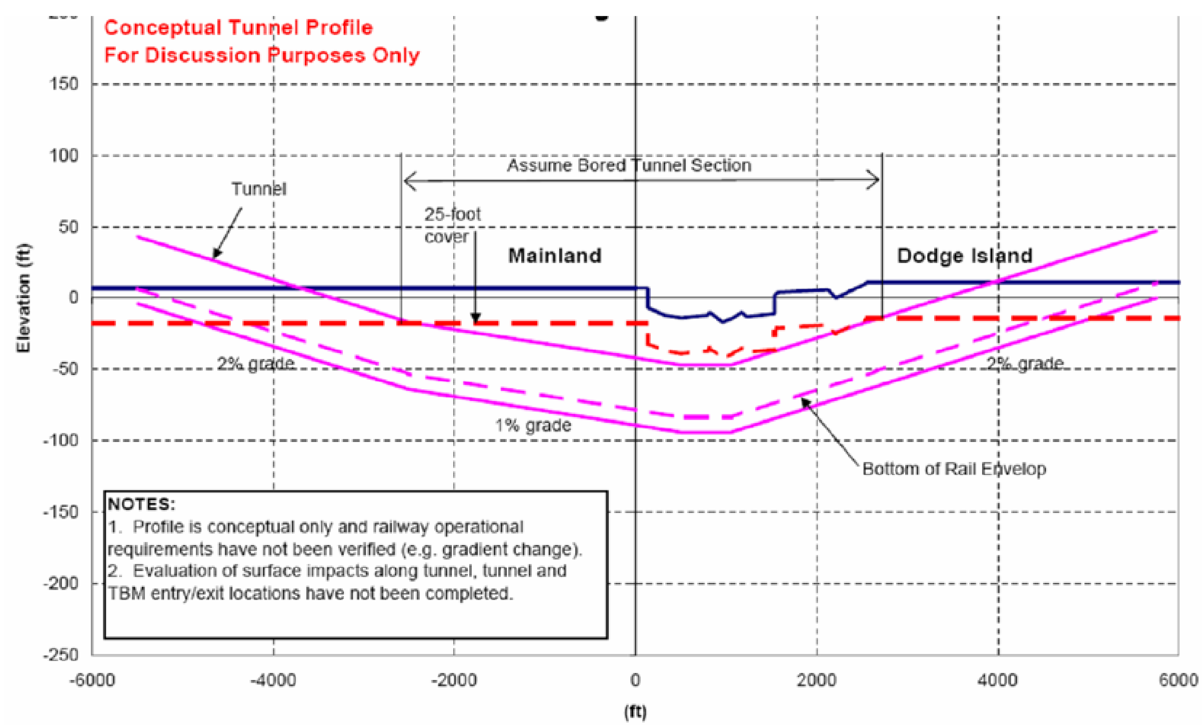


Figure 5.11 Open Trench Section

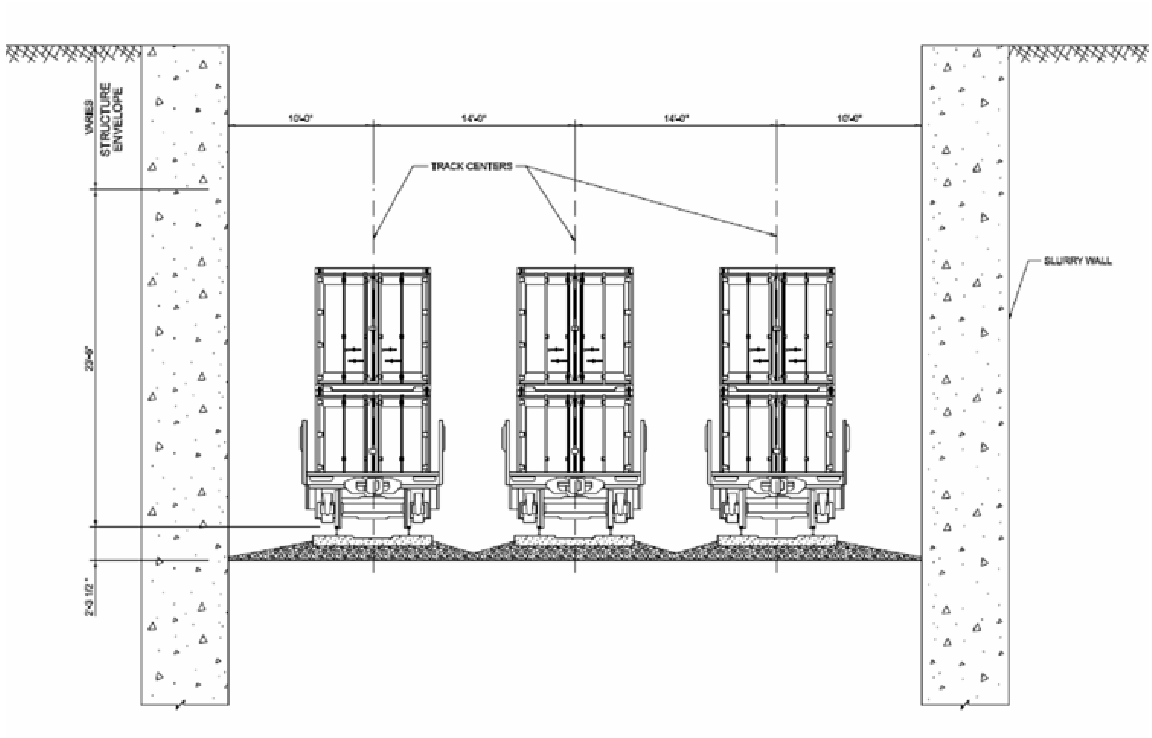
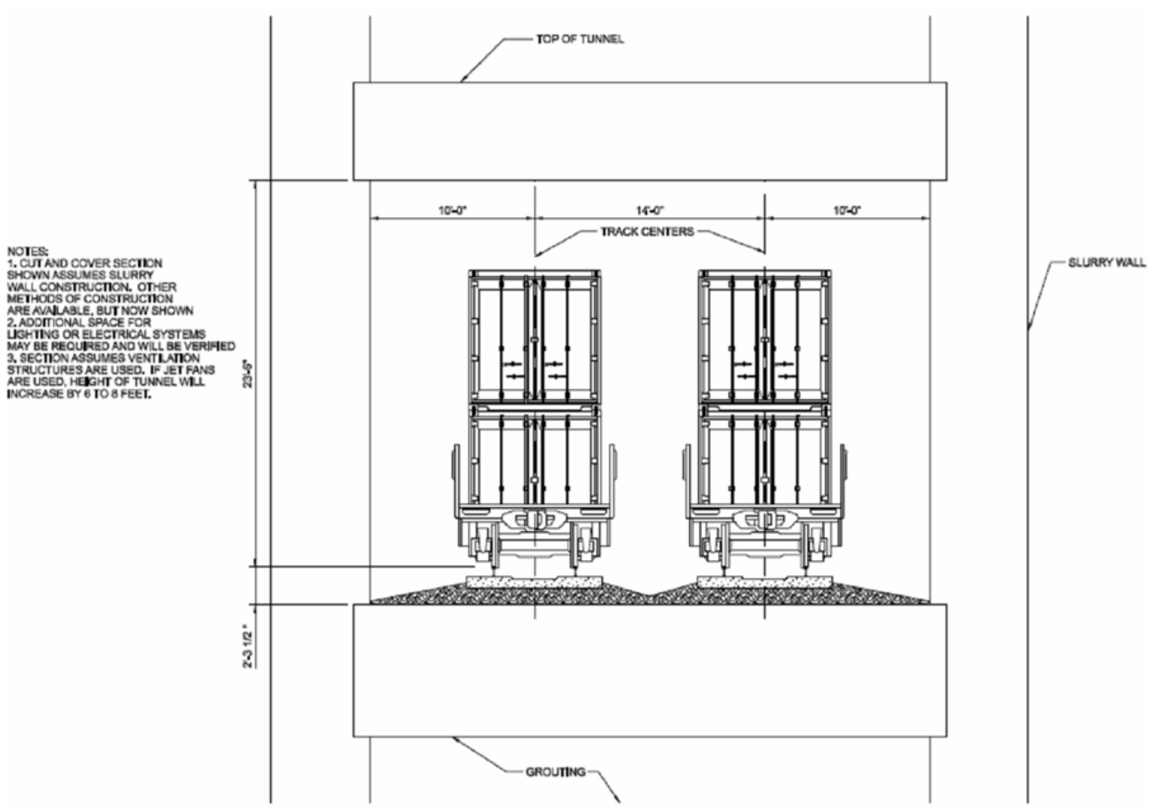


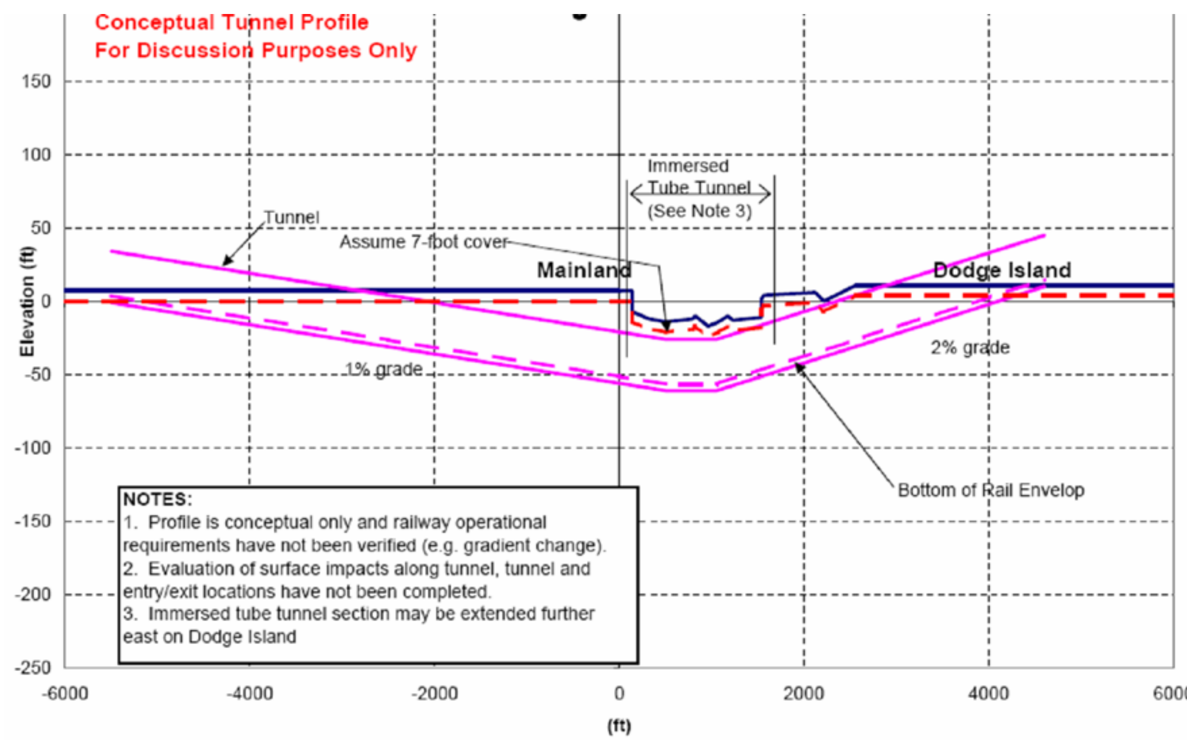
Figure 5.12 Cut and Cover Section



Immersed Tube Tunnel

An Immersed Tube Tunnel (ITT) option also was evaluated. The advantage of this method of tunnel construction is that the length of the tunnel transition onto Dodge Island could be limited to approximately 2,400 to 3,000 feet (see Figure 5.13). Again, the tunnel length may need to be increased to accommodate construction and train operating requirements. There are significant construction issues with this tunnel method which are not present with the TBM method. First, this method requires open trenching both in the water as well as on the mainland. Construction could pose significant obstruction to surface activities on the mainland in the area where the right-of-way alignment goes under Port Boulevard. Streets, intersections and the Port Boulevard itself could be significantly impacted during tunnel construction. Second, this method of construction may be no more cost-effective than TBM due to the relatively short distance needed to cross under the waterway. Finally, the Environmental Protection Agency (EPA) would not approve this technology for the port tunnel project currently advancing with bored tube technology due to significant environmental impacts in Biscayne Bay due to dredging requirements.

Figure 5.13 Immersed Tube Option



Combination of Bored and Immersed Tube Tunnel

A third option could use a combination of TBM and ITT tunnels to minimize surface impacts. This alternative would use an ITT to cross the water and minimize the tunnel length onto to Dodge Island and a bored tunnel under the mainland to minimize impact on Port Boulevard, local streets and adjacent structures. The approach minimizes tunnel depth under water with shallow underwater cover, and the risks associated with ITT are considered to be lower than a bored tunnel. The disadvantages of this approach includes construction of a coffer dam at the point where the ITT section connects with the bored section, and costs are likely to be higher than the bored tunnel option because two very different methodologies are being used.

Ventilation

Ventilation may be required given the type of train (diesel-powered) and the potential length of tunnel envisioned. The total length of covered tunnel could exceed 7,000 feet between the two tunnel ends where the right-of-way becomes an open-cut. There are several options for ventilation. One option is to install jet fans along the tunnel. The jet fans, with a cross-section of about 6 to 8 feet deep and 6 feet wide, would be spaced about every 500 feet. With this configuration, electrical rooms would be necessary for power transformation. These rooms would need to be spaced in the order of every 3,000 feet and could be fairly large (e.g., 12 feet x 15 feet x 25 feet) depending on the number of fans required. Another option would be to install a ventilation structure on each end of the tunnel. This option would eliminate the need for the jet fans and electrical rooms inside the tunnel.

Cut-and-Cover and Open-Cut Construction Method

The connecting cut-and-cover tunnels and open-cut sections of right-of-way leading up to the Bored Tunnel portals or the Immersed Tube Tunnel sections will be a major part of any construction effort for this proposed rail corridor. Excavation depths for the tunnel, whether for the bored tunnel or the immersed tube tunnel sections, may require excavation to depths in excess of 21.3 meters (70 feet) below the groundwater level (elevation 0 or sea level of Biscayne Bay). Feasible methods for constructing an excavation support system to control water inflows at this depth will be essential. Several methods for construction have been studied. With high bedrock and sand layer permeability, combined with an unlimited reservoir of water in Biscayne Bay, groundwater control will be a major consideration for any proposed means and methods of construction for this work. In addition, groundwater control impacts on these means and methods will be major cost factors in the overall project budget.

■ 5.5 Dredging Considerations for an Immersed Tube Tunnel

As mentioned earlier, the ITT construction option provides the least intrusive ICTF rail entrance point on Dodge Island for tunneling methods examined. This option requires only shallow cover and would be executed as a cut-and-cover construction method. For the purposes of this evaluation, the proposed tunnel alignment will follow the existing abandoned roadway and railroad causeways south of the current Port Boulevard Bridge. For the Immersed Tube Tunnel option a 1,400-foot-long trench will be required, 50 feet wide, and 40 feet deep creating approximately 110,000 CY of surplus material. This assumes vertical slopes dredged in rock across the Atlantic Intracoastal Waterway (AIWW) from Dodge Island to Miami. This method will need to contend with small pleasure traffic coming in and out of Bayside Marketplace located immediately to the south as well as commercial tugs, barges, and small pleasure craft along the AIWW.

Issues to be considered with this dredging project in Miami-Dade County include: environmental and permitting; geology/geotechnical conditions; dredging market; implementation; and a possible range of cost and schedule. These are discussed in more detail below.

- **Environmental and Permitting.** Environmental issues will dictate much in the way tunnel construction is performed, as well as the tunnel technology selected. Previous work in Biscayne Bay suggests that the Immersed Tube Tunnel is not feasible due to the environmental impacts associated with dredging. If it were pursued, it would face the following issues. Sea grass is prevalent in the area, and grows to depths of approximately -15 feet MLW. Mitigation would be required for both reefs and sea grass (i.e., construct sea grass beds and perhaps some sponge beds and surplus rock from dredging can be used to build reefs elsewhere in Biscayne Bay to improve or develop additional habitat). Turbidity would be highly scrutinized during construction and there would be a zero NTU limit. It is likely that silt curtains would be required. Work scheduling should be prepared for daylight hour operations only. Manatees are always a concern, but no manatee has ever been injured or killed due to a dredging project. The project will employ manatee observers as required.

- **Geology and Geotechnical.** This area is characterized by the yellow to white massive limestone and sandstone of the Miami Olite formation, which has many solution channels and is highly permeable, porous and contains many voids. The area is overlain by silts and sands in most locations. The closest unconfined compression test is from a sample approximately 2,000 LF to the south-southeast of the proposed work area, and broke at 956 psi (this is considered soft for a large dredge). Core samples should be taken with unconfined compression tests to verify the breaking strengths at the work location. This should be done when developing plans and specifications to identify any potential need for blasting.

- **Dredging Market.** Based upon the available geological information for this area, there are a number of dredges that could be used to excavate this material without blasting. These dredges include:

- Bean Excavation “Tauracavor” (Excavator);
- Bean Excavation “Maracavor” (Excavator);
- Great Lakes Dredge and Dock “New York” (Excavator);
- Jay Cashman, Inc. “Jay Cashman” (Excavator);
- Great Lakes Dredge and Dock “Carolina” (Cutter);
- Great Lakes Dredge and Dock “Alaska” (Cutter);
- Great Lakes Dredge and Dock “Texas”; and
- Weeks Marine “George D. Williams” (Cutter).

Although the cutters can ostensibly excavate these materials, the desired tunnel alignment may present difficulties for a cutter based on geometry (narrow and deep trench) and the high volume of ship traffic in this area (it is difficult for a cutter to move). It would appear that this project would be best performed by excavators only. This limits the dredges suitable for this project to Bean, Great Lakes, and Cashman (see Figure 5.14). The project should be bid on an RFP basis if at all possible, with a schedule predicated on each company’s availability. Currently, all of these excavators are in New York working on the KVK deepening projects.

Figure 5.14 Bean Excavation “Maracavor”

- **Implementation**. The project would likely be executed with one excavator dredge, one dump scow, one tug, one survey boat/crew boat, a staff consisting of a project manager, project engineer, surveyor and staff, superintendent, and dredge crew. If work was only allowed during daylight hours, it could start on the mainland and work towards Dodge Island in order to get production going and to work into a routine. It is estimated that production would be about 200 CY per working hour, and approximately 8.4 working hours per day (factoring in ship traffic). Dredging the proposed trench is not a technical problem either in width or depth but work is expected to progress slowly and considered difficult to execute due to tight working quarters, plenty of small boat and AIWW traffic, close proximity to Port Boulevard, and environmental issues. Suitable offshore disposal also will need to be located.

5.6 Preliminary Cost Estimate

Total development costs for this conceptual rail corridor, including an ICTF on Dodge Island, can be expected to exceed $1 billion. For the assessment illustrated in Table 5.3, the ITT construction technique was used as the basis for estimating purposes. Costs for similar construction projects were reviewed and a cost per unit pricing was developed. Although construction using the tunnel boring machine (TBM) method is considered feasible, no similar bored tunnel projects of this size were available for comparison or cost development purposes. Significant design efforts and a thorough cost analysis would be needed to prepare a comparable TBM estimate. It is reasonable to assume however, that the TBM option will cost at least as much as the ITT option and most likely will exceed the cost of the ITT. This assumption is based upon the "Port of Miami Tunnel Study: Bored or Immersed Tubes?" prepared by Parsons Brinckerhoff Quade and Douglas, Inc.[1] for a roadway proposal between Dodge Island and Watson Island. Although there are differences between the rail project and the roadway project, the estimates presented in the Parsons Brinckerhoff report indicated an 8 to 10 percent construction cost variance between these two tunneling methods. This variance is viewed as contingency for this level of conceptual planning.

Other factors that will cause unit rates in this cost estimate to vary include economy, cost/availability of workforce, cost/availability of materials, and phasing, staging and mitigation of construction specific to this area of Miami. This estimate does not include site-specific encumbrances such as property acquisitions, site demolition and remediation or any associated utility relocation. In addition, development of a rail shuttle service would further increase the cost estimate based on the stricter equipment, facilities, and operating requirements as well as a larger footprint (25 acres with 9 to 11 – 3,500-foot tracks). A shuttle service also would rely on a grade separated corridor from the port to the western Miami-Dade County transfer point. The current estimate only grade separates to NW 20th Street.

[1] Port of Miami Tunnel Study: Bored or Immersed Tubes? 2005 RETC Proceedings.

It is critical to acknowledge and discuss the impact of this infrastructure investment on-port operations. Although a detailed benefit/cost analysis has not been completed as part of this study, a conservative estimate has been developed to illustrate the project cost as measured by cost per container. The impact is based on the following assumptions: 25-year life cycle of tunnel; 5 percent annual growth in containerized cargo beginning with current volume of 1 million TEUs; 15 percent long-haul intermodal market share; 90 percent shuttle train market share; and $1 billion project cost. The results of this analysis are not meant to be an exact cost, but rather an illustration of potential project costs on a per container basis. As noted above, the cost estimate is conservative at best given the items not included as well as recent experience throughout Florida in construction cost increases for future programmed projects. Based upon this approach, the additional costs (excluding existing carrier transportation rates) per container could be $250 or more under the traditional intermodal service model, or $40 or more under a shuttle train operation. Table 5.4 illustrates this calculation.

Table 5.3 Conceptual Cost Estimate: Immersed Tube

Immersed Tube and Cut and Cover Tunnels Using Slurry Diaphragm Wall				
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Construction				
Immersed Tube Tunnel	1,600	LF	60,000	$96,000,000
Slurry Wall	940,440	SF	150	$141,066,000
Grouting	595,925	CY	350	$208,573,750
Reinforced Cover	15,833	CY	1,000	$15,833,333
Concrete Facing	553,200	SF	30	$16,596,000
Subtotal				$478,069,083
Rail Structure and ICTF Development				
ICTF Complete	18	AC	900,000	$16,200,000
New Track Complete	30,000	LF	300	$9,000,000
Subtotal				$25,200,000
Design	1	LS	50,326,908	$50,326,908
Construction Engineering and Inspection	1	LS	50,326,908	$50,326,908
Permitting and Miscellaneous	1	LS	100,000,000	$100,000,000
Contingency	1	LS	20%	$140,784,580
Total				**$844,707,480**
Total with Cost of Inflation (Assume construction in 2012, with annual inflation @ 3%)				**$979,247,482**

Table 5.4 Illustration of Per Container Costs for a Rail Tunnel
Bases upon a Twenty-Five Year Life Cycle

Year	TEUs	Containers (TEU/1.81)	Traditional Service (15%)	Shuttle Service (90%)
1	1,000,000	552,486	82,873	497,238
2	1,050,000	580,110	87,017	522,099
3	1,102,500	609,116	91,367	548,204
4	1,157,625	639,572	95,936	575,615
5	1,215,506	671,550	100,733	604,395
6	1,276,282	705,128	105,769	634,615
7	1,340,096	740,384	111,058	666,346
8	1,407,100	777,404	116,611	699,663
9	1,477,455	816,274	122,441	734,646
10	1,551,328	857,087	128,563	771,379
11	1,628,895	899,942	134,991	809,948
12	1,710,339	944,939	141,741	850,445
13	1,795,856	992,186	148,828	892,967
14	1,885,649	1,041,795	156,269	937,616
15	1,979,932	1,093,885	164,083	984,496
16	2,078,928	1,148,579	172,287	1,033,721
17	2,182,875	1,206,008	180,901	1,085,407
18	2,292,018	1,266,308	189,946	1,139,678
19	2,406,619	1,329,624	199,444	1,196,661
20	2,526,950	1,396,105	209,416	1,256,495
21	2,653,298	1,465,910	219,887	1,319,319
22	2,785,963	1,539,206	230,881	1,385,285
23	2,925,261	1,616,166	242,425	1,454,550
24	3,071,524	1,696,974	254,546	1,527,277
25	3,225,100	1,781,823	267,273	1,603,641
Total Containers	**47,727,099**	**26,368,563**	**3,955,284**	**23,731,707**
Tunnel Cost	**$1,000,000,000**			
Cost Per Container			**$253**	**$42**

6.0 Findings and Recommendations

The Port of Miami is a major economic engine providing significant benefits to South Florida. Its ability to continue providing competitive service and achieve realistic growth is compromised by current access constraints and redevelopment efforts. Further, congestion throughout the region impacts overall freight mobility. This study has reviewed a full range of transportation issues impacting the POM, with a particular focus on improved or new rail service. Port access is not a new topic for the region. In fact, it has been the topic of discussion by community leaders for decades. The current highway tunnel connection project moving forward is primarily the result of these discussions. However, there are some that believe an intermodal approach will provide the port and region with new capacity while reducing community impacts. This section highlights the findings or this study and provides the Miami-Dade MPO with a set of recommendations for consideration.

6.1 Key Findings

- **Technical Feasibility.** All other factors notwithstanding, a grade separated rail corridor, including an on-port ICTF, and a rail tunnel and trench, is technically possible. Analysis shows the corridor could be built within existing rights-of-way, along with a 25-acre terminal footprint on Dodge Island. Based upon the service characteristics, additional infrastructure improvements and new facilities would be required in western Miami-Dade County. Detailed engineering analyses are required to define more specific project characteristics.

- **Economic Feasibility.** A conservative $1 billion cost estimate was developed for the conceptual rail corridor required for traditional intermodal service. This cost would increase if a rail shuttle service was developed due to additional ICTF capacity, stricter operational requirements, and significant off port costs to grade separate the corridor from NE 20th Street to the Doral area, and develop a sister facility (off port costs past NE 20th Street are not included in the cost estimate). Currently, only 11 percent of the POM's containers are drayed to the Hialeah rail yard for northbound service. This limited volume would translate into a significant cost per container ($250 or more). For a shuttle train service that handles 90 percent or more of all POM's containers, the cost per container would be much lower ($40 or more).[1]

[1] Over a 25-year life, assuming a 5 percent per year growth in containers, the cost for each container could be between $40 (shuttle) and $250 (traditional) for the conceptual rail corridor defined by this analysis. This does not include any costs other than construction. Carrier transportation

(Footnote continued on next page...)

- **Environmental Feasibility.** Environmental permitting and approval processes will be an obstacle for this project. From an operational perspective, it was determined that the preferred tunnel technology would be an immersed tube tunnel. This approach has a less steep grade, shortening the length of the tunnel on Dodge Island. Bored tunnel technology would require a significantly larger footprint on Dodge Island due to the length of track required to return to grade. The EPA already has ruled that the proposed highway tunnel must use the bored approach and community leaders insist this holds true for the rail tunnel. This significantly impacts on-port land and operations. In addition, the FEC right-of-way, as an industrial corridor, may have contaminated material that would complicate the excavation activities of the open trench, not to mention the impact of the water table.

- **Constructability.** Among all of the considerations that go into this analysis, the constructability issue is critical. This factor deals with the likelihood that the tunnel will be or can be built. It includes the funding and environmental issues, as well as building stakeholder and political support. It also covers the construction activities. The conceptual design presented in this report calls for the development of a below grade rail corridor directly underneath Port Boulevard. This could significantly restrict port access during construction.

- **Funding Competition.** The ability to finance the project will be impacted by the advancement of the highway tunnel. At present, it is reasonable to assume that the highway tunnel project will continue to be advanced. Given that the State already has committed funding for a portion of the $1 billion plus project, it is unlikely to assume that a second $1 billion plus project would receive similar state support.

- **Rail Corridor Capacity.** The FEC Corridor currently is being studied for both passenger and cargo use. This study did not account for how a highly trafficked freight rail corridor would interact with some yet undefined new passenger service along the same corridor. Joint operations would need to be studied in detail, including the engineering requirements associated with at or above grade and below grade operations. In addition, there are equipment and operational requirements for rail corridors handling both freight and passenger service. The capacity will be significantly impacted by the rail service selected (shuttle or limited long-haul).

- **Political Support.** As has been seen with the proposed highway tunnel, political support will make or break a project of this magnitude. In fact, this study was the result of local political leadership striving to resolve the POM's conflicts with surrounding communities. Currently, there is limited support for development of a grade separated rail corridor connection to the POM. For this project to advance, support from local and state leaders would be critical.

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costs for the move, ongoing maintenance and operations, and additional costs to upgrade inland corridors and transfer facilities would all be additional.

- **Industry Support.** Building shipper support for a rail corridor will be a challenge. On-port terminal operators are reluctant to sacrifice already limited acreage for any type of ICTF; the vast majority of cargo originates or terminates within 50 to 100 miles making rail uncompetitive with truck in both cost and service; and a rail shuttle service would add additional handling costs to the supply chain.

6.2 Recommendations

- **Continue to Support Port Access Initiatives.** The POM continues to struggle with landside access. Community opposition, limited funding, and delays in project implementation contribute to this situation. The MPO should remain active with port staff to assist where appropriate.

- **FTAC Should Continue to Advocate for Port Access Improvements.** The FTAC has emerged as a strong supporter for freight transportation. Its leadership should continue to engage the community in discussions for port access improvements.

- **Use the Truck Route Study to Further Explore Port Access.** The truck route study underway now by the MPO should ensure that port access routes are designated as part of the county's truck route system and recommendations should directly address both specific port access routes and key regional corridors connection the port with western Miami-Dade County.

- **Investigate Opportunities for Reduced Passenger Traffic to the POM.** Currently, only 15 percent of port traffic is generated by cargo operations. The balance serves other port activities, including cruise operations and port administration. The cruise infrastructure currently houses significant parking capacity. The MPO should study the feasibility for relocating parking off port and providing mass transit service to eliminate congestion and increase cargo capacity.

- **Monitor Highway Tunnel Progress.** The highway tunnel will be a major factor in funding availability and stakeholder attitudes. If this project advances, a high-capacity rail corridor is unlikely. If it fails, all access alternatives should be reevaluated. It is critical the MPO and its port partners are prepared to provide immediate recommendations and input should the highway tunnel project falter.

- **Participate in Key Regional Freight Initiatives.** Regional freight investments could impact the POM and the MPO should monitor and participate in these projects. For example, the State currently is evaluating the feasibility of an inland port in south Florida. This could change regional distribution patterns for all ports in the region. In addition, the Atlantic Commerce Corridor Study will likely be updated in 2007, providing additional opportunities for regional investments in ports. Finally, FDOT currently is working to develop a statewide strategic seaport investment framework.