South Florida East Coast Rail Corridor Transit Analysis

Final DRAFT
Technical Memorandum

Task 2.20:
Freight Integration Analysis

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1. INTRODUCTION

To support the development and evaluation of passenger transportation service alternatives along the SFECC, a narrowly defined freight integration analysis has been prepared for the FEC and SFRC/CSXT corridors. The primary objective of the freight integration analysis is to identify and explore options available to shift or restructure freight operations in the event that proposed passenger services present substantial conflicts with current and future freight use of the lines. The analysis considers the physical, operational, competitive, economic and institutional viability of configuring the region's rail freight network in several ways. Three scenarios/options are presented in this document.

1. **Status Quo** – No substantial change in SFRC/CSXT and FEC rights and networks. Maintain the FEC and SFRC/CSXT railways as two independent freight corridors, similar to current conditions.
2. **SFRC Freight Spine** – Improve connections between FEC and SFRC/CSXT to allow through mainline FEC operations between Miami and Palm Beach to be shifted to the SFRC/CSXT line while maintaining access to FEC yards, ports and FEC online customers.
3. **Western Bypass (WBP)** – Develop a new freight rail route along the Route 27 right of way. The new route would be used by all through freights to and from CSXT and FEC Hialeah yards.

All scenarios assume that SFRTA's present plans for increased passenger service and capacity on the SFRC would remain in force. At this point in the analysis, no passenger operations on the FEC or substantial changes in intercity rail service are assumed. For all integration scenarios the analysis assumes that mainlines freed from through freight operations would be maintained in a manner that would allow freight carriers to temporarily shift operations onto the line as backup in the event of a line blockage or other emergency.

For the purposes of this analysis, the SFRC refers to the former Seaboard Air Line (SAL) alignment through southern Florida between Mileposts SX 1036.5 and SX 965.0, a point near the south end of CSXT Dyer siding. The CSXT mainline refers to the SAL alignment north of that point, from SX 965.0 north to Jacksonville and beyond.

The FEC mainline is the entire 371-mile alignment between FEC's Hialeah Yard and FEC's Bowden Yard in Jacksonville. SFECC refers to a segment of the FEC between downtown Miami on the Miami Port Industrial Lead (Milepost PL 6.2), Little River Junction (Milepost 360.7 on the mainline), and Jupiter, Fla. in Northern Palm Beach County (MP 283.3).

The Western Bypass (WBP) is a proposed extension between 116th Way and South Bay, Fla., via Andytown, Deem City, and Okeelanta along the U.S. Route 27 corridor. This proposed new route connects to the South Central Florida Express's (SCFE, formerly FEC) K-Branch. The K-Branch runs along the eastern shore of Lake Okeechobee and crosses the SFRC at Marcy, before joining the FEC mainline at Fort Pierce. At its southern end the WBP connects with FEC's Medley Lead. The FEC Medley lead connects FEC's Hialeah Yard with the present end of FEC track at 116th Way (Milepost ML 5.4).

Conceptually, there are three operating plans corresponding to these scenarios:

Table 1.1
Conceptual Overview of Operating Alternatives

Scenario	FEC through freights	CSXT through freights
Status Quo	Operate north on the FEC main line to Jacksonville	Operate north on the SFRC to SX 965.0; thence continue north on CSXT
SFRC Freight Spine	Operate north on the FEC as far as CP-IRIS; thence north on SFRC; return to the FEC via a short connector in the vicinity of Palm Beach.	No change
Western Bypass	Operate north to Gator Switch, thence via FEC's Medley Lead, the Western Bypass, and the FEC/SCFE K-Branch across the Marcy diamond. Rejoin the FEC mainline at Fort Pierce.	Operate south to CP-IRIS, then operate west to Gator Switch, thence via FEC's Medley Lead, the Western Bypass, and the FEC/SCFE K-Branch to Marcy (SX 922.2) to regain access to the SAL.

For each scenario the analysis considers the following factors:

1. **Freight Operations:** numbers, timing and lengths of through and local trains by line segment for a "typical" day.
2. **Infrastructure Needs:** for line capacity and improved or new connections. Estimated needs include minimum infrastructure requirements for additional tracks, switches, signals, and structures as indicated.
3. **Highway safety:** number of typical daily train crossings (exclusive of switching moves) at each highway grade crossing in the study area. Using information on a "typical" day as previously described, the study estimates the number of daily trains by period of the day crossing each area railway grade crossing.[1]
4. **Economics:** changes in the numbers of train starts, engines, infrastructure maintenance required to operate each scenario.
5. **Competition:** discussion of how integration alternatives would affect competitive balance between the two carriers.
6. **Institutional:** discussion of institutional factors that would affect each integration scenario. The discussion will describe CSXT's and FEC's rights and obligations under the status quo arrangement and then discuss what rights each carrier would need to surrender under the alternative scenarios.

This draft has been presented to Florida DOT, FEC, SFRTA and CSXT for their comments. This revised report reflects input from FEC and SFRTA. The detailed results will be used to frame options to preserve and enhance freight operations in the course of refining passenger service corridor alternatives.

As work on the design and evaluation of passenger service alternatives is advanced in the overall project, EK will coordinate and consult to determine the most appropriate strategies to provide desired passenger service and maintain adequate freight services in a manner that optimizes use of rail infrastructure and reduces investments on potentially redundant facilities.

[1] Traffic engineers will be able to integrate this information with FRA crossing safety records and state AADT information to estimate changes in exposure to potential highway-rail grade crossing accidents that would result from each alternative future scenario.

2. SUMMARY OF FINDINGS

The freight integration study explores options available to shift or restructure freight operations on both the FEC and the SFRC in the event that proposed passenger services present substantial conflicts with current and future freight use of the lines. The analysis considers the physical, operational, economic, competitive and institutional viability of configuring the region's rail freight network in several ways. This work focuses on the development and evaluation of three scenarios:

- Status Quo
- SFRC Freight Spine
- Western Freight Bypass (WBP)

A fourth option, not analyzed in this freight integration task, would provide sufficient capacity on the SFECC to allow track-sharing between FEC freight trains and the proposed SFECC commuter rail service. In effect this would result in a "SFECC Spine" scenario. This option may be analyzed as part of the commuter rail operations analysis.

Up to 18 daily FEC trains are candidates for potential rerouting, based on current traffic patterns. Four local trains, four trains based in Fort Lauderdale serving Port Everglades, and two rock trains between Dade County and West Palm Beach are not viable candidates for rerouting.

On average two daily CSXT trains are candidates for potential rerouting, but on any given day there may be between one and four. Four local trains, and two general merchandise trains are not viable candidates for rerouting from the SFRC.

In a future scenario that assumes current FEC rates of growth, up to 24 FEC daily trains would become candidates for rerouting. In the future scenario, the number of CSXT trains assumed to be viable candidates for rerouting is six. The FEC has indicated that their traffic patterns may change in future as markets respond to global economic forces.

2.1 SFRC Freight Spine

- Two new connections between the SFRC and FEC would be required: a northern connection in the vicinity of Mangonia Park, and a southern connection at Iris near the Tri-Rail MetroRail intermodal station. The analysis assumes that no other infrastructure improvements to the SFRC are made to provide capacity for the FEC operations.
- The analysis indicates operational feasibility of rerouting up to 24 FEC through freight trains onto a prospective weekday SFRC operation in the near future that includes 50 Tri-Rail trains, four Amtrak trains, six CSXT road freights, appropriate CSXT local freight train access and required maintenance of way windows. The SFRTA has indicated that expansion of Tri-Rail service in the longer term may include express or skip-stop services, extensions north to Jupiter, south to Kendall, or onto the SFECC alignment. Those expansion options may push the total daily Tri-Rail train path requirement over the 50 currently planned.
- Train performance calculations for the FEC trains indicate that all southbound and most northbound operations are generally compatible for interoperation with local passenger service. Most FEC trains would be only ten minutes slower than local passenger services over the route, allowing the FEC trains to be slotted between passenger trains during most periods of the day. All southbound FEC trains would be prohibited from operating on the SFRC for a total of 214 minutes each day during the two periods when passenger trains are operating at 20 minute headways. The corresponding northbound restrictions would total 210 minutes each day.
- The northbound movement of heavily loaded rock trains as presently operated is not suitable for interoperation with passenger services on the line, taking as much as 45 minutes longer than a local passenger train to traverse the corridor. Adding a fourth locomotive to the rock trains

would increase velocity allowing them to operate during off peak periods. The northbound evening restriction on rock trains would be 210 minutes long from approximately 15:20 to 18:50. No northbound rock trains are operated in the morning peak.

- Relative to highway safety, the SFRC Spine would reduce train crossings on the SFECC by 80% on the typical weekday but increase train crossings on the SFRC by 47%. Each highway crossing on the SFRC may tend to carry more automobile traffic than the average SFECC crossing. The SFECC has three times more crossings than the SFRC but experiences only twice as many collisions.
- The SFRC Spine scenario would send 22 trains through SFRC grade crossings during the morning rush hour, and 16 trains during the evening peak. This results in 500 additional daily grade crossing activations (about 25% more) on the SFRC during the peak commuter hours. SFRTA is concerned that SFRC grade crossings currently function with short Tri-Rail trains, but the introduction of longer FEC trains many affect service levels on local roadways.
- The SFRTA is concerned that additional wear caused by FEC freight trains could require additional windows for maintenance-of-way (MOW). This could lead to a reduction in available train paths. Requirements for MOW were not analyzed in detail in this freight integration study. It was assumed that the provision of the status quo MOW windows would suffice.
- A possible mitigation allowing freight trains to interoperate more freely with passenger operations would entail construction of one or two long sidings in the vicinity of Cypress Creek where passenger trains could overtake slower freight trains operating on the line. With such a facility, peak period prohibitions on operation of through freight services could be relaxed or possibly rescinded.
- For the typical FEC through freight train, the SFRC route could be up to 30 minutes faster than current operation by avoiding meet-pass delays on the current route. Some of these delays may be ameliorated by the planned project to expand passing tracks in the vicinity of Hypoluxo/Villa Rica (Boynton Beach/Delray Beach). Some of the increased speed on the SFRC would be eroded waiting for operating windows between passenger trains.
- The FEC is concerned that its relationship with express clients could be eroded if its routes are not under its absolute and direct control. The loss of control may limit the FEC's options for handling exceptions in an expeditious manner.
- Variability in the times that southbound FEC trains arrive at the northern end of the shared corridor will cause dispatchers to hold some southbound freights to operate between scheduled passenger movements. In aggregate these delays would be less than the typical meet-pass delays presently experienced on the single track FEC line.
- With respect to the current schedule of FEC train-starts, the current pattern of FEC operations can be maintained with adjustments of less than 15 minutes for all but two northbound rock trains.
- FEC train cycles would not be materially affected by the timing adjustments.
- Crews of a very limited number of southbound FEC trains arriving late at the north end of the shared track segment may need to be replaced with a fresh crew to avoid violations of federal hours of service regulations on the shared track segment. Presently only one daily train from Jacksonville poses a substantial risk in this regard.
- The difference in mileage between the FEC and SFRC routes is negligible for the purposes of economic route costing algorithms.

- Within the limits of available data, the team could not accurately assess how the introduction of up to 24 FEC freight trains on the SFRC corridor would affect the reliability of passenger service delivery. However, increase in overall train traffic would increase the opportunity for delays. The SFRTA is concerned that FEC trains added to the SFRC could affect Tri-Rail rush hour revenue and deadhead trains.
- The FEC has numerous concerns about the SFRC Spine scenario, relating to additional costs of operating over the SFRC. They fear that duplicative maintenance costs would be paid by the FEC through track access fees. FEC train crews would be required to qualify on SFRC/CSX rules and territory. On the SFRC, the FEC trains would operate without ATC signal protection, possibly increasing risks and liability.
- Amtrak may develop future plans to offer more intercity services in the corridor. This would require more train paths than accounted for on the SFRC Spine scenario. To provide additional train paths for future intercity aspirations, additional investment in the SFRC may be required, if the freight integration program is fully implemented.
- The SFRTA has other operational concerns relating to the SFRC Spine scenario, including: the increased need to "wrong-rail", potential conflict with deadhead movements, platform occupancy issues at Mangonia Park, and increased potential for noise complaints. These issues were not explicitly considered in this summary study.

2.2 Western Bypass

- The Western Bypass is practically equivalent to constructing 130 miles of new Class 4 mainline track. The construction of the Western Bypass requires 60 miles of new right of way, at least three new bridges, 31 control points, 43 new turnouts, six new grade crossings, and 51 upgraded grade crossings. In total 13 new or rebuilt passing sidings would be needed.
- As envisioned in this preliminary analysis, the Western Bypass would entail developing a new right-of-way in the Everglades approximately 1,200 ft to the west of the current U.S. 27 alignment and/or substantial reconstruction of at least six highway interchanges. Substantial drainage management and environmental mitigation may be required. The potential disruption to the sensitive Everglades ecosystem may prove simply unacceptable.
- The difference in mileage between the original routes and the Western Bypass is negligible for the purposes of economic route costing algorithms. The resulting overall route mileage between FEC Hialeah and Fort Pierce would increase by four miles. The distance between CSXT Hialeah and Marcy would reduce by seven miles.

Table 2.1
Mileages via Alternative Routes

Origin-Destination Pair	Status Quo	Western Bypass	% Change
CSXT Hialeah to Marcy	112	105	-6.3%
FEC Hialeah to Fort Pierce	126	130	+3.2%

- It would be operationally feasibility to reroute up to 24 FEC through freight trains and six CSXT through freight trains onto the infrastructure envisioned for the Western Bypass.
- The present FEC mainline is equipped with an ATC signal system that automatically enforces speed limits and signal aspects on all trains. ATC requires specially equipped locomotives. To the extent that the WBP is developed as a replacement mainline for the FEC, it is likely that a compatible ATC signal system would be required to provide equivalent safety. CSXT trains operating on an ATC equipped line would require an upgrade in train control technology.

- The present owner of the Western Bypass alignment in the Everglades has not been determined, and it is not clear that cooperation from the current railway controlling the Northern 44.5 miles of the new alignment would be forthcoming. The South Central Florida Express has a long-term lease over the former FEC Kissimmee Valley Subdivision that expires in 2025. Routing FEC and CSX trains over the K-Branch between MP K-60 and MP K-15.5 prior to that date would require an agreement with the SCFE.
- For the typical FEC and CSXT through freight trains, the trip times on the Western Bypass will remain fairly similar to that achieved on the current routes. FEC and CSXT train cycles would not be materially affected by the timing adjustments.
- All current patterns of freight train-starts can be maintained with adjustments of less than 15 minutes.
- The construction of a new infrastructure and upgrade of branch line track will result in a substantial additional ongoing maintenance burden. The Western Bypass is equivalent to operating 130 miles of new Class 4 mainline track. The FEC is concerned that it may be saddled with unproductive and duplicative maintenance burden (whether directly or through track-access charges) under this scenario.
- The SFRTA notes that the environmental impacts and costs of upgrading the SFECC corridor to provide both freight and transit service may be greater than the environmental opposition and expenses encountered in constructing the Western Bypass.
- When complete, the new plant could feature 155 fewer grade crossings than the FEC, and 15 fewer than the SFRC. Trains moving from Hialeah to Fort Pierce could encounter only 57 grade crossings.

Table 2.2
Grade Crossing Counts by Route

Origin-Destination Pair	Status Quo	Western Bypass	% Change
CSXT Hialeah to Dyer	72	30	-58%
FEC Hialeah to Jupiter	212	57	-73%

- The FEC is concerned that it would be difficult in future for the FEC to grow on-line businesses and/or expand intermodal terminal capacity along the Western Bypass. The Status Quo offers much better opportunities for growth due to proximity of existing infrastructure and lesser environmental concerns. The FEC would prefer not to disturb the sensitive ecosystem in the Everglades as it grows its mainline rail businesses.

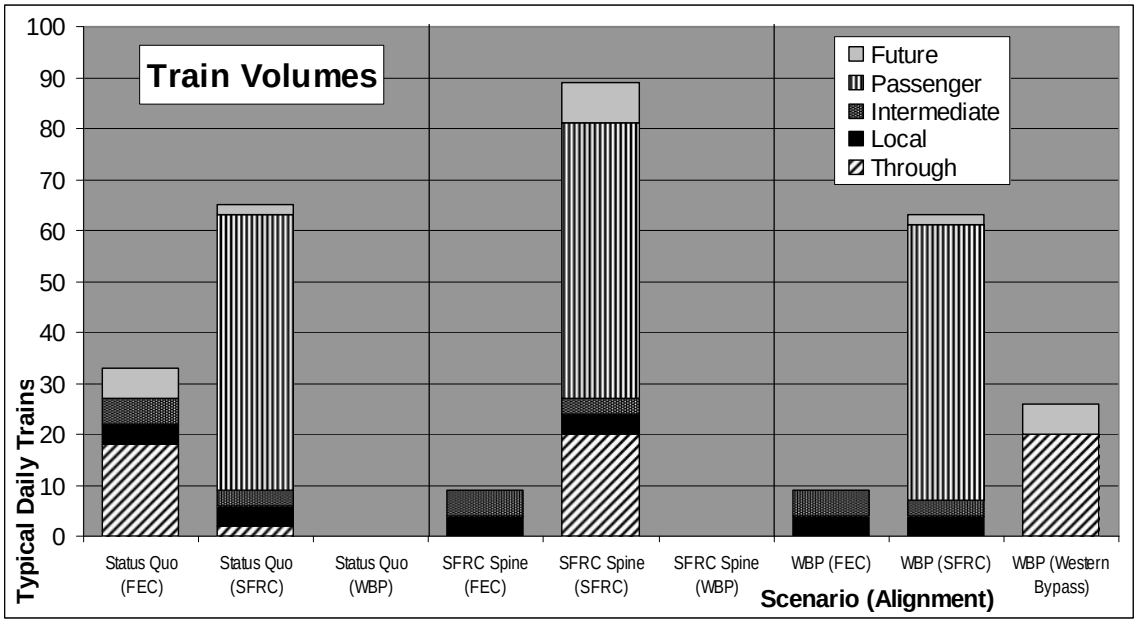
2.3 Comparative Analysis

The study evaluates the three scenarios on six dimensions. Comparative findings on each dimension are provided below.

2.3.1 Freight Operations and Train Movements

On a typical day under the Status Quo scenario the SFECC would operate 18 through freight trains, five intermediate freight trains and four local freight trains. With the SFRC Spine scenario, all 18 through freight trains would be rerouted to the SFRC. Under the WBP scenario the same 18 trains would be rerouted to the Western Bypass. Also under the WBP scenario two CSXT through freight trains would be rerouted to the new line. Figure 2.1 presents typical daily train counts by carrier for each corridor under each scenario.

Figure 2.1
Typical Daily Trains Volumes by Scenario and Alignment



Under the Status Quo, the SFRC sees twice the train volume of the FEC. FEC carries mainly freight whereas SFRC carries mainly passenger trains. The SFRC Spine scenario shifts all through FEC freight to the SFRC, bringing its future daily train count to 88. Under the Western Bypass Scenario, the through FEC trains are absorbed by a new bypass alignment instead of the SFRC.

In both scenarios, train volumes on the SFECC are reduced by 67% from a typical 27 daily trains to nine daily trains. The WBP scenario reduces SFRC train volumes by 3% whereas the SFRC Spine scenario increases SFRC train volumes by 29% from a typical 63 daily trains to 81 trains.

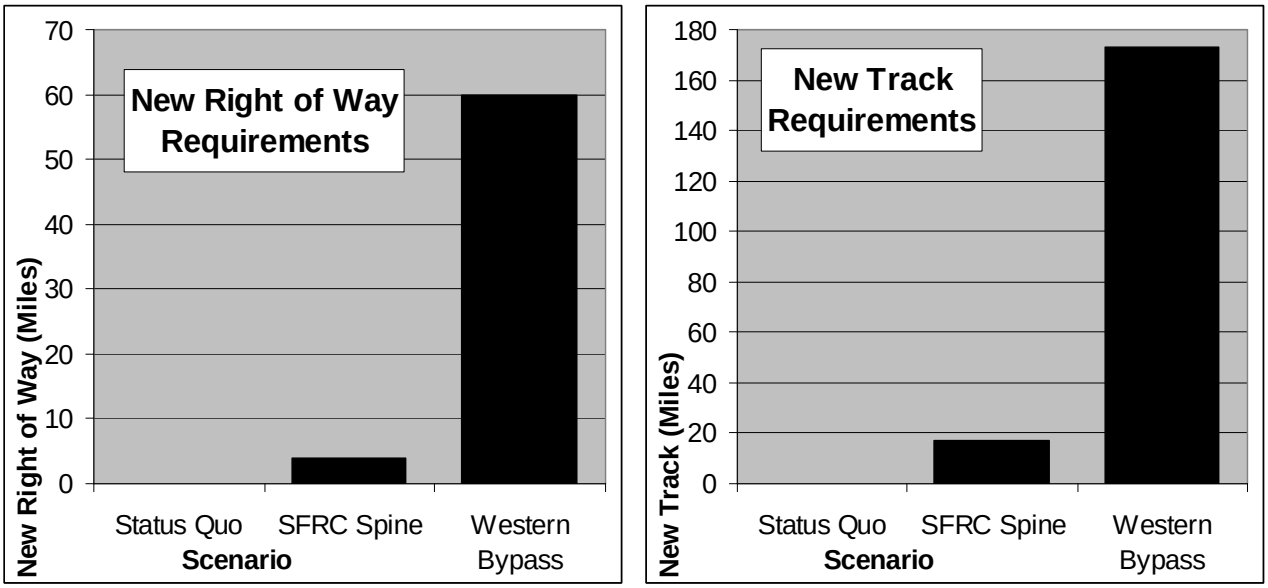
2.3.2 New Infrastructure Required

No new infrastructure is required for the Status Quo freight operations, but maintaining the Status Quo may require substantial investment on the SFECC to allow frequent passenger commuter rail service in that corridor. The alternative two freight integration scenarios require investment in freight facilities, however, the Western Bypass is by far the more expensive alternative. Table 2.3 details the new route miles and track miles required under each scenario. Figure 2.2 visualizes the requirements graphically.

Table 2.3
New Infrastructure Required

	Right of Way (Miles)	Track (Miles)
Status Quo	0	0
SFRC Spine	4	17
Western Bypass	60	173

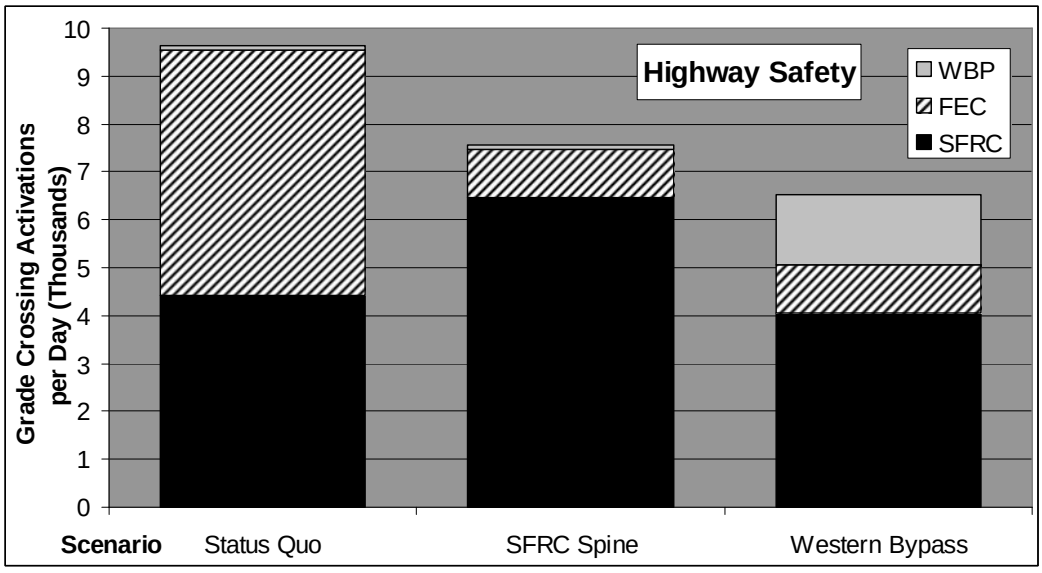
Figure 2.2
New Infrastructure Required



2.3.3 Highway Safety

One of the stated goals of the freight integration plan is to reduce the grade crossing risk exposure of motorists in South Florida. One way to assess grade crossing accident risk is to consider the total number of daily grade crossing activations due to train activity. Figure 2.3 provides an illustration of how daily grade crossing activations would vary under different freight integration operating plans.

Figure 2.3
Typical Daily Train Crossings



Under the Status Quo, SFECC accounts for about half of all grade-crossing activations despite hosting only a third of total train volumes. This is due to the more frequent grade crossings on the SFECC right of way. Each train travelling from Miami to West Palm Beach on the SFECC triggers 140 more grade-crossing activations than a train moving via the parallel SFRC over the same stretch.

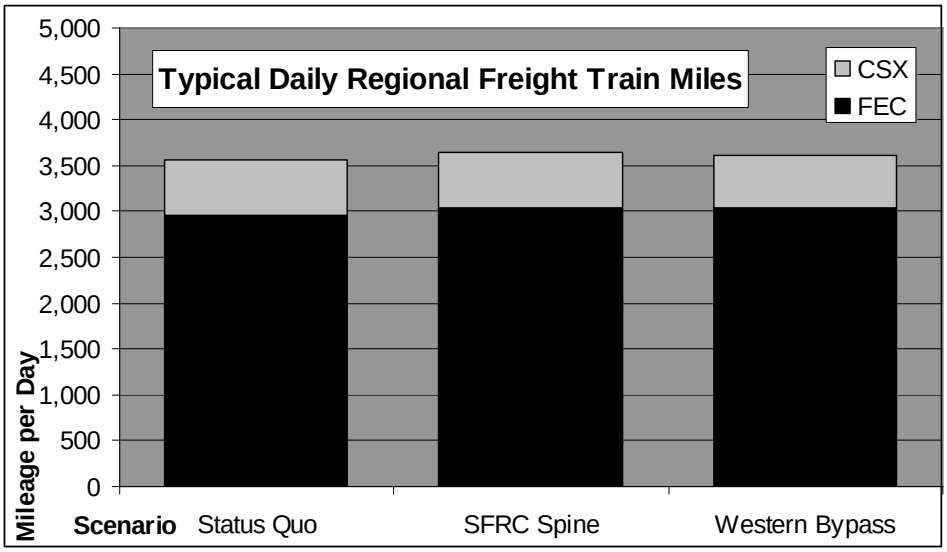
The SFRC Spine scenario shifts many through freight trains onto the SFRC, reducing grade-crossing activation counts for those trains. Although the total number of activations increased on the SFRC, the activations on the SFECC decreased much more. The result is a lower grade crossing risk exposure for South Florida as a whole, although it leads to higher risk exposure for those motorists who regularly cross the SFRC.

The Western Bypass scenario reduces grade crossing risk exposure even further. However, it does not reduce the grade-crossing risks in the South Florida Rail Corridor substantially below the Status Quo, as much of the SFRC grade-crossing activations (and accident risk) stems from the many daily Tri-Rail passenger trains that are not candidates for rerouting.

2.3.4 Economics

All three scenarios are essentially identical with respect to the operating mileage and travel times required for service. Figure 2.4 provides a measure of economic impact by freight carrier of different freight integration plans. The chart shows that the chosen operating plans do not have a substantial impact on the carrier's mileage base. Mileage base is often correlated with cost base in freight operations. CSXT continues to incur lower mileage because of their lower volume of business. Both of the carriers are unlikely to incur substantially different "above the rail" operating costs due to the proposed reroutings.

Figure 2.4



However, development of WBP would dramatically increase "below the rail" (infrastructure) cost for rail infrastructure in the region by adding almost 175 new main line miles of track to the regional rail network. It is assumed that most track added by this new route would not be offset by reductions in mainline track elsewhere since the route would still be required to provide passenger service, provide freight service to intermediate terminals (including the Ports of Palm Beach and Port Everglades), service local customers, and provide a redundant back-up route. FEC is very concerned that construction of WBP would result in duplicative and economically-unproductive capital and maintenance costs.

2.3.5 Competitive and Institutional Concerns

The Florida East Coast Railway is a very successful regional freight carrier in Florida. It carries at least four times more traffic in the corridor than CSXT, including all the premium intermodal, express and automobile traffic. CSX Transportation is a major Class I railroad, but its South Florida franchise suffers from the lower costs of the FEC.

The presence of CSXT in the South Florida is an important competitive force in the region. CSXT's operation provides a service floor and a price ceiling for rail freight services. Without the CSXT, the market forces limiting the FEC pricing and service strategy would be relaxed. South Florida would be well advised to preserve and encourage rail freight competition.

Institutionally, both the FEC and CSXT are federally regulated railroads engaged in interstate commerce. The railroads are private property with special protections from regulation and interference by states and localities. States and localities in most matters must deal with the railroads as peers since they are immune from many state powers. In exchange for these protections, the railways have common carrier obligation that prohibits them from denying service to freight customers or from closing a freight line.

The most salient institutional considerations that will circumscribe the possible integration of regional freight operations revolve around three points. First, Florida's power to coerce CSXT or FEC to reroute any of their trains to an alternative route is very limited or nonexistent. Second, neither FEC nor CSXT are free to abandon freight operations on their lines. Third, CSXT is free to block FEC trains from using the SFRC. Conversely FEC is free to block to CSXT trains from using the SFECC.

The regional competitive impacts of the SFRC Spine operation would be neutral at best. FEC and CSXT service would share infrastructure but remain essentially unchanged. However, FEC's flexibility to unilaterally innovate and grow would be curtailed by the need to coordinate with other users of the Spine. The institutional hurdles associated with the SFRC Spine scenario are formidable. It seems that the SFRC Spine scenario would only be attractive if circumstances surrounding development of passenger services along the SFECC were sufficiently grave to force the State to consider a fallback option.

The Western Bypass would create uncertainty and risk for the FEC in many of the same areas as the SFRC Spine. FEC still would demur rerouting a key segment of its network over a mainline shared with other operations and dispatched/maintained by a third party as long the FEC had the option to use its current route. The new route would not relieve FEC or CSXT of their obligations to customers on their existing mainlines and would therefore be redundant. However, in contrast to the SFRC Spine, the Bypass would not be shared with 54 passenger trains. Consequently the risk for freight train delays due to conflicts with passenger trains would be ameliorated.

Institutionally, it has not been determined how the South Central Florida Express Railroad on the northern end of the Bypass would interact with CSXT and FEC in the creation and operation of the WBP. SCFE's lease for the former FEC K-branch expires in 2025. The study team understands that the lease is structured such that for any carrier, including the FEC, to operate over the 44.5 miles controlled by the SCFE, a trackage-rights agreement would be required. Assuming that SCFE is amenable to cooperating with Florida to build and operate the Bypass, the State would not be enjoined from inviting both FEC and CSXT to use the new facility. However, the State still could not *force* either carrier to use the new facility. Neither CSXT nor FEC would be able to completely abandon the lines they are currently using for freight service, due to obligations to serve communities and stations that are not on the Bypass route.

3. THE STATUS QUO

The current operations of the FEC mainline and the SFRC (CSXT) mainline are described separately in turn. The current competitive dynamics and institutional issues are described in the last section.

The Status Quo may require substantial infrastructure investment on the SFECC to support an attractive commuter passenger operation. The SFECC will continue to carry the current typical mix of 23 road freight trains (four of which terminate/originate in Fort Lauderdale) and 4 local trains. The SFRC will continue to support the current and future passenger operations, with local trains operating mainly in the off-peak hours and during the overnight period, and with road freights operating at night. No passenger rail schedule for the SFECC is evaluated in this phase of the freight integration study.

3.1 The FEC Mainline

The South Florida East Coast rail corridor is the southernmost of 93 route miles of a 371 mile freight rail corridor extending between Miami and Jacksonville. The corridor is owned and operated by the Florida East Coast Railway (FEC) based in Saint Augustine. Overall the FEC operates a freight only rail operation focusing on four principal markets in South Florida:

- the movement of intermodal containers and trailers to serve local markets or through movement to/from ports in South Florida,
- the movement of rock and stone used for construction from quarries in Dade County to concrete plants and construction depots along the east coast of the state,
- the delivery of automobiles for local use or export to southern destinations, and
- the provision of carload freight service to a limited number of local customer warehousing facilities along the line.

Florida East Coast Railway, L.L.C. (FEC) is the current owner and operator of the railway as part of its overall 371 mile system running between the Port of Miami and Hialeah Yard in Dade County and Bowden Yard in Jacksonville, Florida. The railroad has been in continuous operation in the study corridor for 110 years when the first trains ran to Miami in 1896. There have been no regularly scheduled passenger trains on the line for last 38 years.

3.1.1 Freight Operations and Train Movements

Data from December 2005 indicates that on a typical weekday the FEC operated 12 to 13 northbound and 11 to 14 southbound road trains. One train in each direction did not operate in the study area.[2] On a typical day, 23 road trains are operated.

Among the regularly scheduled trains, the car type data indicated that five southbound trains and four northbound trains carried mostly intermodal cargo. Four southbound and five northbound trains are in consistent, but not daily, service, engaged wholly in the local transport of aggregates (rock). The remaining nine trains were of a generally mixed nature, carrying multiple types of traffic including intermodal and express, merchandise, automobiles, and rock.

A summary of road trains operated is presented in Table 3.1.

[2] Train 119 originates in Bowden and terminates at Fort Pierce, north of the study area. Vice-versa, its opposite number (Train 220) originates at Fort Pierce.

Table 3.1
Study Area Road Trains in the Study Area

Southbound				
Type of train	**Trains operated per typical day**	**Train Numbers**	**Schedule Variability[3]**	**Average Train Length (feet)**
Daily Intermodal [4]	5	101, 107, 117, 121, 123	Low to Medium	8,000
Relief Intermodal	1	105 (Mo-Th)	Low	7,000
General Purpose Freight Train [5]	1	125	Medium	8,000
Automobile	0.5	141, 143 (Extras)	High	8,500
Empty Rock [6]	3	191, 193, 195 (We-Sa)	Low to Medium	4,500
Unit Empty Rock	1	335	Medium	5,000
Total	**11.5**			
Northbound				
Type of train	**Trains operated per typical day**	**Train Numbers**	**Schedule Variability**	**Average Train Length (feet)**
Daily Intermodal	4	206, 218, 222, 226	Medium	7,000
Relief Intermodal	2	202, 224 (Tu-Sa)	Low to Medium	8,000
Daily Rock	1	208	Low	6,500
Empty Automobile	0.5	240, 242 (Extras)	Medium to High	8,500
Rock	3	290, 292, 294	Medium	4,500
Unit Rock Train	1	336	Medium	5,000
Total	**11.5**			

Despite the general designations listed above, the majority of FEC trains operate with a mix of traffic. General merchandise cars carrying commodities such as building materials, food products or paper are often added to trains that are predominately carrying intermodal flat cars, autoracks and/or empty gravel hoppers. It is not uncommon to see empty rock cars running south with a mix of intermodal flats and general freight cars.

The FEC operates road trains in the study area during all portions of the day but the density of operations is generally greatest after 4:00pm each afternoon until 9:00am the following morning. The reduced density of road operations in the midday period provides an opportunity to serve local customers and perform maintenance of way work with reduced interference by long distance freight trains. Table 3.2 reports typical mainline freight traffic densities by time of day along the most heavily used portion of the study corridor in the vicinity of Fort Lauderdale.[7]

[3] Schedule variability is defined as follows: if the standard deviation of the train's arrival time (in hours) at Port Sewall is less than one hour, it has a low schedule variability. If it is more than an hour but less than two hours, the train has a medium schedule variability. If it is more than two hours, the train has a high schedule variability.
[4] Defined as having greater than 50% by car count of intermodal and express traffic.
[5] A train was deemed to be a general purpose freight train if it carried less than 33% of intermodal traffic, and more than 10% of traffic in every other category (auto racks, rock cars, and others types of cars).
[6] A train was defined as a rock train if it carries more than 80% of rock cars on average.
[7] Airport Interlocking (MP 345.1) north to South Pompano Beach (MP 332.4)

Table 3.2
Fort Lauderdale Freight Traffic Densities by Time of Day

Time period	Average Road Trains per Hour	Average Local Trains On Main
Midnight to 6am	1.8	0
6am to 9am	1.3	0.7
9am to 4pm	0.5	1.0
4pm to 7pm	1.0	0.3
7pm to Midnight	1.0	0

Overall in 2005 the FEC carried 550,000 carloads of traffic. It is assumed that traffic could increase by up to 15% in the next two or three years. With such a growth in traffic it is likely that FEC could add up to four trains to their current average lineup leading to 27 daily trains in the 2007-2009 timeframe.

The FEC maintains three principal yards in the study area, Hialeah (in Miami), Fort Lauderdale and West Palm Beach. Each yard has local trains which serve online customers with carloads of various commodities. On a typical weekday one or two local trains serve customers on the mainline in the vicinity of Fort Lauderdale. Further north, one local train serves customers on the mainline in the vicinity of West Palm Beach. One local train also reportedly serves local customers along the mainline in the vicinity of Miami. Local trains tend to operate on the mainline during the midday period between 9:00am and 4:00pm.

Trains Affected – All non-stop road freight trains operating to and from CSX's Hialeah Yard and FEC's Hialeah Yard, originating from or destined for points north are candidates to be rerouted to the other lines. Based on the review of existing conditions surveyed in Project Task 2.12, the current freight service on the FEC can be divided into seven groups. Some trains cannot be rerouted from the FEC due to intermediate set-outs, pick-ups, originations, or terminations. These trains are labelled 'Immovable'.

1. Eight Intermodal Trains between Bowden and Miami (FEC Southbound Trains 101, 105, 107, 121, Northbound Trains 202, 206, 222, 226)
2. Two Auto Carrier Trains between Bowden and Miami
3. One General Purpose Freight from Bowden to Miami (FEC Southbound Train 125, may carry intermodal trailers as required)
4. Seven Rock Trains (including Unit Trains) and corresponding empties between Southern Dade County and points north of Palm Beach County.
5. **Immovable** – Four Intermodal Trains between Bowden and Fort Lauderdale, which picks-up in the northbound direction as required at the Port of Palm Beach (FEC Southbound Trains 117, 123; Northbound Trains 218, 224)
6. **Immovable** – Two Rock Trains between Southern Dade County and West Palm Beach.
7. **Immovable** – Four Local Trains based in Fort Lauderdale and West Palm Beach serving the SFECC Corridor.

Up to 18 daily FEC trains (nine northbound, nine southbound) are candidates for rerouting to the SFRC or WBP. Twelve of those trains travel the whole length of the railway from Miami to Bowden. Given forecast growth in FEC traffic, the study team made the conservative assumption that future through freight operations by the FEC maybe as high as 24 daily trains. The table below shows train numbers, typical origination and terminations, train frequencies, typical departure times, and other information for each of the service groups.

Table 3.3
Typical Train Information and Schedule by Service Group and Carrier

Service Group	Train Numbers	Can be Moved	Direction	Origin	Destination	Daily Train Volume[8]	CP-IRIS Time	North end Time[9]	Trip Duration	Mileage	Average Speed (mph)
Northbounds											
CSXT Rock	K97x, K916/K966, K94x	Yes	North (Loads)	Southern Dade	North of Palm Beach	2	22:00 00:15	01:40 03:50	3:40 3:35	111	30
CSXT Merchandise	Q452	No	North	CSXT Hialeah	North of Palm Beach	1	02:25	05:45	3:20	111	35
FEC Miami Intermodal	202, 206, 222, 226	Yes	North (Backhaul)	FEC Hialeah	FEC Bowden	4	09:00 05:40 19:40 22:30	13:00 09:05 23:50 02:40	3:50	124	33
FEC Auto Carrier	24x	Yes	North (Empties)	FEC Hialeah	FEC Bowden	0.5	04:55	09:30	4:35	124	27
FEC Rock	208,[10] 290, 292, 336	Yes	North (Loads)	Southern Dade	North of Palm Beach	4	15:20 17:15 22:00 02:45	19:00 22:39 02:50 07:45	5:10	124	25 [11]
FEC Ft. Lauderdale Intermodal	218, 224	No	North (Backhaul)	Fort Lauderdale	FEC Bowden	2	N/A	21:35 01:30			
FEC Rock to West Palm	294	No	North (Loads)	Southern Dade	West Palm Beach	1	23:45	N/A			

[8] Each road train is counted as one train (so that one round-trip is counted as two trains). Local trains are counted such that each shift, which may involve a round-trip, a one-way trip, or a local switcher trip, is counted as one train. For trains that operate regularly but not daily, average train counts are shown.
[9] Typical time at Fort Pierce is quoted for trains currently operating on the FEC corridor, and at Marcy is quoted for CSXT trains.
[10] FEC Train 208 carried nearly all rock during December 2005, despite having a train number that suggests its classification as an intermodal train. Train 125 appears to carry empties from Train 208 in addition to intermodal trailers as-required.
[11] The lower average speeds on these trains are due to a combination of set-out and pick-ups, a low horsepower-to-tonnage ratio resulting in low train performance, and lower dispatching priority. With current assigned power and tonnage levels, the trains have a balancing cruising speed in the range of 30-35 mph.

Table 3.3 (continued)

Service Group	Train Numbers	Can be Moved	Direction	Origin	Destination	Daily Train Volume	CP-IRIS Time	North end Time	Trip Duration	Mileage	Average Speed (mph)
Southbounds											
CSXT Rock	K97x/K99x, K94x	Yes	South (Empties)	North of Palm Beach	Southern Dade	2	03:10 04:10	00:10 02:10	3:00	111	37
CSXT Merchandise	Q453	No	South	North of Palm Beach	CSXT Hialeah	1	23:10	20:10	3:00	111	37
FEC Miami Intermodal	101, 105,[12] 107, 121	Yes	South (Headhaul)	FEC Bowden	FEC Hialeah	4	22:30 23:00 01:35 07:25	19:10 19:15 22:10 03:40	3:30	124	35
FEC Auto Carrier	14x	Yes	South (Loads)	FEC Bowden	FEC Hialeah	0.5	11:05	05:20	5:45	124	22
FEC General Freight	125	Yes	South	FEC Bowden	FEC Hialeah	1	16:15	12:30	3:45	124	33
FEC Rock	191, 193, 335	Yes	South (Empties)	North of Palm Beach	Southern Dade	3	05:20 07:30 09:40	00:40 02:55 04:20	5:00	124	25 [13]
FEC Ft. Lauderdale Intermodal	117, 123	No	South (Headhaul)	FEC Bowden	Fort Lauderdale	2	23:20 05:40	N/A			
FEC Rock	195	No	South	West Palm	Southern Dade	1	8:50	N/A			
Locals											
CSXT Locals	O722, O717/718, O716	No	Local	Ft. Lauderdale Pompano Miami Plant.	Ft. Lauderdale Pompano Miami Plant.	3	N/A	N/A			
FEC Locals	945/950/955, 960, 965 [14]	No	Local	West Palm Ft. Lauderdale	West Palm Ft. Lauderdale	5	N/A	N/A			

[12] Train 105 invariably operate in a similar timeslot to Train 101, and does not operate daily. It appears to be a 'second section', operating as freight levels demand.
[13] The lower average speeds on these trains are due mostly to lower dispatching priority.
[14] The West Palm Local operates three shifts daily, round-the-clock, although only one shift regularly uses the main track. There are two Fort Lauderdale Locals, one serves customers north of the yard, the other serves south of the yard. Other locals run as required.

3.1.2 Infrastructure Needs

Between Jupiter and downtown Miami, the corridor generally consists of a 100 foot wide railway right of way. The vertical profile of the line is very gentle with mainline grades seldom exceeding 0.3%. The present track configuration of the SFECC is primarily a single track FRA Class 4 railway. The average distance between controlled sidings in the study area is 7.5 miles with a minimum of 4.3 miles and maximum of 10.2 miles between passing opportunities. Most of the railway (77 miles in the study area) is equipped with a sophisticated cab signal technology – Automatic Train Control (ATC). FEC's installation of ATC includes cab signaling with automatic enforcement of speed limits and signal aspects. Under ATC rules, all tracks are bidirectional allowing trains to operate at maximum allowable speeds in both directions on the line. All study area mainline track in the ATC territory is constructed with continuous welded rail (CWR) using relatively heavyweight rail in the general range of 115 to 136 pounds per linear yard of rail. Nearly all mainline ties are fabricated with concrete.

There are 16 bridges in the study area where the railway passes over waterways. Two of these bridges are moveable drawbridges. The remaining 14 bridges are fixed bridges generally of through-girder construction with wooden decking.

For FEC freight operations over FEC infrastructure, no additional infrastructure requirements are considered necessary. For future line capacity needs and improved or new connections, it is expected that the current FEC infrastructure can absorb at least four extra through trains per day to accommodate traffic growth without unduly impeding current operations. Estimated needs will include minimum infrastructure requirements for additional tracks, switches, signals, and structures as indicated to provide future capacity.

Interviews with FEC officials did not reveal many pressing concerns about operations and infrastructure in the study area. Among the concerns that were elicited were matters related to:

- grade crossing safety,
- terminal capacity at Hialeah and Fort Lauderdale to respond to growing traffic levels, and
- line capacity south of West Palm Beach to allow for an overall increase in density of road trains while allowing time for local operations and maintenance of way operations.

In March 2004, the FEC submitted a report at the request of the Florida Department of Transportation describing six capital investment projects in the study area (and 14 projects outside the study area) for consideration in developing Florida's Strategic Intermodal System (SIS). Projects identified in the study area included:

Table 3.3
Study Area Infrastructure Projects Identified in FEC's Strategic Intermodal System Project Needs Report (March 1, 2004)

Project	**Description and Justification**
Combine Hypoluxo and Villa Rica Sidings	Combine two passing sidings into a single longer passing siding by constructing 9.3 miles of new track to reduce delays to trains at these commonly used sidings and to reduce delay to motorists at the 22 grade crossings on the existing Hypoluxo and Villa Rica sidings.
Upgrade Speed through West Palm Beach	Increase maximum allowable speed for 2.7 miles through West Palm Beach from 45 mph to an unspecified higher limit to increase operational efficiency and reduce delay time. Work would entail improvements to the signal system and 25 grade crossings.

Table 3.3
Study Area Infrastructure Projects Identified in FEC's Strategic Intermodal System Project Needs Report (March 1, 2004)

Project	Description and Justification
Upgrade Speed though Lake Worth	Increase maximum allowable speed for 5.7 miles through Lake Worth from 45 mph to an unspecified higher limit to increase operational efficiency and reduce delay time. Work would entail improvements to the signal system and 26 grade crossings.
Port Everglades Intermodal Facility	Build two new side tracks to store and service up to 26 additional intermodal cars in the vicinity of Port Everglades in Fort Lauderdale.
Double Track from South Ojus to North Miami	Extend the double track from North Miami by a total of 4.3 miles to the southern limit of Ojus siding. The project would entail track, signal, crossing and bridge improvements to provide for more efficient railroad operations and reduce traffic delays at crossings.
Close Grade Crossings in West Palm Beach, Lake Worth, Fort Lauderdale and Miami	Work with FDOT and localities to close an unspecified number of grade crossings in high density areas to reduce railway/roadway conflicts, increase safety, reduce noise, and reduce maintenance costs.

FEC officials indicate that the combination of Hypoluxo and Villa Rica sidings has been approved for state funding, and that additional FEC projects north of the study area have also been designated for state funding in cooperation with the FEC. All these projects create capacity for the FEC corridor.

3.1.3 Highway Safety

There are 230 locations between the Port of Miami and Jupiter where highways or paths cross the railway at grade, 212 of which are between Hialeah and Jupiter. Overall, the density of grade crossings is 2.5 crossings per mile. The density of crossings is generally greater in more urbanized areas. The greatest density of crossings is found in West Palm Beach where ten crossings are found along less than one mile of railway.

Table 3.4
Grade Crossings on the Florida East Coast Railway

Segment	Southern Limit	Northern Limit	Centroid	Length (miles)	Grade Crossings
1	Port of Miami	Little River Junction		6.9	18
2	Hialeah Yard	Little River Junction	Iris	9.0	22
3	Little River Junction	North Miami	North Miami	3.3	8
4	North Miami	Airport Interlocking	Ojus	12.4	33
5	Airport Interlocking	South Pompano Beach	Wilton Manors	12.7	37
6	South Pompano Beach	South Villa Rica	Deerfield Beach	10.8	18
7	South Villa Rica	West Palm Beach	Hypoluxo	22.6	71
8	West Palm Beach	Jupiter	Lake Park	15.7	23

Grade crossings provide opportunities for conflict between railroad operations and other traffic. A review of grade crossing accidents for the eleven year period between 1995 and 2005 indicates there had been 149 reported collisions at the 230 crossings that resulting in 50 injuries and 30 fatalities. Four of the 30 fatalities were ruled suicides.

Over the 4,017 days in the reporting period, the study area rail corridor has experienced a crossing collision an average of every 27 days with an accidental injury every 87 days and an accidental fatality every 155 days. Increasing the density of trains on the rail corridor without reducing the number of crossings, taking measures to modify motorist behavior or improving crossing safety would likely increase the frequency of collisions, accidental injuries and fatalities.

Table 3.5
Status Quo FEC Train Counts by Segment (Typical Day, Including Locals)

Time of Day Centroid Location	Night 0000-0559	AM 0600-0859	Midday 0900-1559	PM 1600-1859	Evening 1900-2359	Typical Train Count	Total Grade Crossings in Segment	Daily Train Crossings
Iris	8	3	3	3	5	22	22	484
North Miami	8	3	3	3	5	22	8	176
Ojus	8	3	3	3	5	22	33	726
Wilton Manors	9	4	3	4	5	25	37	925
Deerfield	10	4	2	3	5	24	18	432
Hyperluxo	10	4	2	3	7	26	71	1,846
Lake Park	9	4	2	3	6	24	23	552
						Total	212	5,141

As shown in Table 3.5, the Status Quo FEC typically sends four trains through grade crossings during the morning rush hour, and four trains during the evening peak. This results in a total of approximately 1,450 daily grade crossing activations in the study area during the peak commuter hours. The number of train crossings in the study area for the entire day is about 5,150.

3.1.4 Economics

Status Quo operation of the FEC between Fort Pierce and FEC's Hialeah Yard in Miami entails 27 daily train starts (local and road trains) covering 2,900 daily train miles in the study area. The Status Quo route is approximately 126 miles long with 168 track miles of mainline infrastructure.

Table 3.6
Operating Economics of the Florida East Coast Railway

Daily Train Miles (South of Fort Pierce)	2,950
Approximate Daily Car Miles	327,324
Typical Daily Train Starts	27
Route Miles Fort Pierce to Hialeah	126
Track Miles Fort Pierce to Hialeah	168

3.2 The SFRC Mainline

The South Florida Rail Corridor (SFRC) is the southernmost of 72 route miles of a 1,037 mile freight rail line extending between Miami and Richmond, Virginia. The corridor is owned by the Florida Department of Transportation, and maintained and dispatched by CSX Transportation (based in Jacksonville). Tri-Rail passenger operations are operated by Herzog Corporation under contract to SFRTA. Amtrak operates two daily round trips to New York on the line. CSXT operates freight rail services focusing on two principal markets in South Florida:

- the movement of rock and stone used for construction from quarries in Dade County to concrete plants and construction depots within the state, and
- the provision of carload freight service to local customer warehousing facilities along the line.

CSXT moves virtually no containers and trailers on intermodal trains in South Florida. All of the rail intermodal traffic in the region moves on the parallel FEC rail corridor.

CSX Transportation (CSXT) currently dispatches and maintains the railway as part of its overall 22,000-mile rail network linking commercial markets in 23 states and the District of Columbia. The railroad (and predecessors) has been in continuous operation in the study area for approximately 80 years since the first trains ran to Miami via the "Seaboard Air Line" in 1927. There has been commuter rail service in the corridor in the study area since Tri-Rail service began in January 1989. Amtrak's 'Silver' services have been operating in the corridor since 1971. The Amtrak service is a continuation of passenger services previously operated by the Seaboard Air Line Railway and the Seaboard Coast Line Railroad. CSXT serves freight customers on the railway.

CSXT sold the corridor to the State of Florida (Florida Department of Transportation) in 1988 for $264 million. Under the terms of the 1988 agreement transferring ownership of the corridor to Florida DOT, CSXT retained perpetual exclusive freight trackage rights over the railway. A project was completed in 2006 to expand the railroad to a nearly full double-track railway between Mangonia Park and Miami. Tri-Rail commuter rail service is the dominant user of the line with forty weekday trains.

CSXT train dispatchers based in Jacksonville monitor and control all mainline operations. Under the 1988 CSXT Florida DOT purchase and sale agreement, CSXT must maintain and dispatch the line until either party invokes "Phase B". The state is reportedly planning to invoke Phase B in 2007-8 and assume direct maintenance and dispatching control on the corridor, once the last element of the SFRTA double-tracking project is complete. On August 2, 2006, Florida DOT announced that an agreement had been reached "in principle" that provides for transfer of operational control of the SFRC to the state.[15] As of this writing, details on the final agreement and implementation plan are not available.

3.2.1 Freight Operations and Train Movements

Freight service on the SFRC is divided into four groups:

1. Northbound Rock Trains moving from Southern Dade County to points north of Palm Beach County, and corresponding southbound empties. There were generally 14 trains a week (seven loads, seven empties) in 2000. Between one and four trains may be operated on a given day.
2. **Immovable** – Northbound Rock Trains moving from Southern Dade County to Yelvington, a point south of Palm Beach, and corresponding southbound empties. There were generally 4 trains a week (2 loads, 2 empties) in 2000.
3. **Immovable** – General Merchandise Trains moving in both directions between CSXT Hialeah and classification yards north of Palm Beach County. There were on average one northbound and one southbound train each weekday in 2000. These trains were observed to have made intermediate pick-ups and set-outs and appear to be the principal method for moving long distance CSXT traffic into Broward County.
4. **Immovable** – Local Trains based in Hialeah, Fort Lauderdale, and Dyer serving the SFRC Corridor (CSXT Trains O722, O717/718/719, O716 respectively.)

In addition to freight trains operating on the corridor, there are up to four Amtrak trains each day (with a possible expansion to six, but not in the near future) and 40 (soon 50) Tri-Rail trains daily. Tri-Rail

[15] Florida DOT and CSX joint news release, *http://www.dot.state.fl.us/publicinformationoffice/moreDOT/spenews/governor.htm*, reported in "*South Florida Gets Some Plum Crumbs*" by Larry Lebowitz, Miami Herald, August 7, 2006, *http://www.miami.com/mld/miamiherald/15214795.htm*.

plans to begin operating a 50-weekday-trains schedule as soon as additional equipment is ready for service.

On a typical weekday the road trains include both merchandise and rock trains as summarized in Table 3.7. Most trains on the SFRC run the railroad between points north of Marcy (SX 922.2) and Miami. However, many road trains require access to intermediate locations along the SFRC. The general merchandise trains were frequently observed to set-out cars en-route, mainly in Fort Lauderdale. Some rock trains originate and terminate south of Marcy. Trains requiring access south of Marcy are not candidates for the freight diversion plan.

Table 3.7
SFRC Study Area Road Freight Trains by Type

Train Type	Number Operated on Typical Weekday		Candidates for Rerouting	
	Southbound	Northbound	Southbound	Northbound
Intermodal	0	0	0	0
Merchandise	1.2	1.2	0	0
Automobile	0	0	0	0
Rock	1.3	1.3	1.0	1.0
Total	**2.5**	**2.5**	**1.0**	**1.0**

CSXT operates road trains in the study area during all portions of the day but in 2000 the density of operations was generally greatest between 8:00pm each evening and 5:00am the following morning.

Overall in 2004 CSXT carried 14.9 million gross tons of train equipment and lading on the SFRC. Over the past ten years, freight traffic had increased by over 50%. CSXT forecasts are unavailable.

CSXT maintains three principal yards in the study area, Hialeah (in Miami), Dania (near Fort Lauderdale) and Pompano Beach. Each yard has local trains which serve online customers with carloads of various commodities. CSXT local train operations are somewhat variable. On a typical weekday one local train served customers in the vicinity of Miami Plantations, one local train served customers on the mainline in the vicinity of Fort Lauderdale. Further north, one local train served customers on the main in the vicinity of West Palm Beach.

Local trains tend to operate on the mainline during all hours of the day, however, an effort seems to be made to avoid the commuter rush hours. In 2004, only the Miami Plantation local and the Dyer-West Palm local (both operating in the extremities of the study area; neither impact the Fort Lauderdale area) was scheduled to operate during daylight hours.

3.2.2 Infrastructure Needs

Within the limits of the study area, Mangonia Park and downtown Miami, the vertical profile of the line is very gentle with mainline grades seldom exceeding 0.3%. The horizontal profile of the track is generally tangent with no mainline curve exceeding four degrees. The present track configuration of the SFRC is primarily a double-track FRA Class 4 railway. The one short single track section between CP-Whalen (MP 1011.6) and CP-N.E. Dania (MP 1014.4) through Fort Lauderdale will be double-tracked before April 2007. The average distance between crossovers in the study area is 3.9 miles with a minimum of 2.0 miles and maximum of 8.1 miles between opportunities to cross over from one main track to another.

Most of SFRTA's portion of the corridor (71.4 miles in the study area) is equipped with Centralized Traffic Control (CTC) technology. SFRTA's installation of CTC provides for bi-directional operation

on both tracks. Under CTC rules, all tracks are bidirectional allowing trains to operate at maximum allowable speeds in both directions on the line. The maximum allowable passenger speed in the corridor varies between 79mph and 45mph. The maximum allowable freight speed in the corridor is 60 mph with substantial stretches where speeds are limited to 45 mph or below.

There are 18 bridges in the study area where the railway passes over waterways. Two of these bridges are moveable drawbridges. The remaining sixteen bridges are fixed bridges.

CSXT did not participate in planning for Florida Department of Transportation's Strategic Intermodal System (SIS).[16] However, Tri-Rail has submitted thirteen projects in the study area for consideration. All projects identified focus on northward extension of passenger service or renovation/expansion of passenger facilities (station, parking, storage). None of the proposed improvements relate to expanded freight capacity.

Table 3.8
Study Area Projects Identified in SFRTA's Strategic Intermodal System
Project Needs Report (January 20, 2005)

Location	Description
South Florida Rail Corridor	Tri-Rail Extension from Mangonia Park to Scripps (13.8 miles) – Tri-Rail capital budget funded
SFRC Corridor	Tri-Rail Extension from Mangonia Park to Jupiter – TIP funded
SFRC Corridor	Tri-Rail Maintenance Facility needed for either Scripps or Jupiter extension
Cypress Creek	Tri-Rail Facility renovation and intermodal improvements – TIP funded
Boca Raton	Tri-Rail Facility renovation
Fort Lauderdale	Amtrak/Tri-Rail Intermodal center, including development of people mover to downtown
Hollywood	Amtrak/Tri-Rail – Develop intermodal facilities including pedestrian bridge over I-95 to parking garage
Lake Worth	Tri-Rail Lake Worth Station Parking Improvements - land acquisition, design, construction
Mangonia Park	Tri-Rail Intermodal station/park n ride facilities
Metrorail Transfer	Tri-Rail Station Parking Improvements
West Palm Beach	Amtrak/Greyhound/Tri-Rail Intermodal center
SFRC Corridor	Additional station work to bring all stations to Segment 5 standards
SFRC Corridor	Additional storage trackage

It is understood from SFRTA officials and the SFRTA Transit Development Plan that some of the study area projects listed above have "TIP funding" and others are funded from Tri-Rail's capital budget. The Jupiter Extension has received TIP funding while the Scripps Project is expected to be funded internally by Tri-Rail. Other projects appear to be unfunded at this time.

3.2.3 Highway Safety

There are 72 locations on the passenger portion of the rail corridor where highways or paths cross the railway at grade. Overall, the density of grade crossings is 1.0 crossings per mile. The density of

[16] Preliminary Investment Needs, Florida's Strategic Intermodal System – List of Unprogrammed Needs on SIS and Emerging SIS Facilities, Florida DOT, January 2005. The summary found at *http://www.dot.state.fl.us/planning/SIS/needs/prelim/seneeds.pdf* shows a placeholder for CSXT only. It contained details on Tri-Rail projects in the corridor.

crossings is generally greater in more urbanized areas. The greatest density of crossings is found in Opa Locka where four crossings are found along a 1.5 mile segment of the railway.

Table 3.9
Grade Crossings on the South Florida Rail Corridor

Segment	Northern Limit	Southern Limit	Length (miles)	Grade Crossings	Average Crossing Density (per Mile)
1	Mangonia Park Station (MP 966.3)	Pompano Beach Station (MP 1001.5)	35.2	33	1.0
2	Pompano Beach Station (MP 1001.5)	Opa Locka Station (MP 1030.0)	28.5	27	0.9
3	Opa Locka Station (MP 1030.0)	SFRC Junction at MP 1036.6	6.6	8	1.2
4	SFRC Junction at MP 1036.6	Miami Airport Station	0.8	4	5.0
		Main Line Totals/Averages	71.1	72	1.0
5	SFRC Junction at MP 1036.6 *(Freight Only)*	End of Track at N.W.7th Avenue (MP 1040.4)	3.8	36	9.5

A review of grade crossing accidents for the eleven year period between 1995 and 2005 indicates there have been 70 reported collisions at the 72 crossings that resulting in 22 injuries and 13 fatalities. One fatality was ruled a suicide. Over the 4,017 days in the reporting period, the SFRC has experienced a crossing collision an average of every 57 days with an accidental injury every 183 days and an accidental fatality every 309 days. In comparison with the FEC railway, the SFECC has three times more highway grade crossings but the incidence of collisions is only 100% greater than the SFRC.

Table 3.10
Status Quo SFRC Train Counts by Segment (50 Tri-Rail trains per day)

Time of Day / Segment Centroid	Night 0000-0559	AM 0600-0859	Midday 0900-1559	PM 1600-1859	Evening 1900-2359	Typical Train Count	Total Grade Crossings in Segment	Daily Train Crossings
Boynton	10	15	16	13	9	63	33	2,079
Fort Lauderdale	9	15	16	15	8	63	27	1,701
Metrorail	5	12	16	12	8	53	8	424
25th St	3	13	16	12	8	52	4	208
						Total	72	4,412

Including local trains, the Status Quo SFRC sends about 14 trains through grade crossings during the morning peak period, and 14 trains during the evening peak (mostly passenger). This results in almost 2,000 daily grade crossing activations in the study area during the peak commuter hours. The number of train crossings in the study area for the entire day is about 4,400.

3.2.4 Economics

Status Quo freight operation on the SFRC between Marcy and CSX's Hialeah Yard in Miami entails nine daily train starts (five road trains and four locals) covering 606 daily train miles in the study area. The Status Quo route is approximately 111 miles long with 176 track miles of mainline infrastructure.

Table 3.11
CSXT Operating Economics of the South Florida Rail Corridor

Daily Train Miles (South of Marcy)	606
Approximate Daily Car Miles	48,928
Typical Daily Train Starts	9
Route Miles Marcy to CSXT Hialeah	111
Track Miles Marcy to CSXT Hialeah	176

3.3 Status Quo Competitive and Institutional Concerns

3.3.1 Competition

FEC – The Florida East Coast Railway is a regional Florida based railway that has managed carefully to tune its service offerings in Florida to provide low cost high quality service to shippers in Eastern Florida. As a result, the FEC is a very successful freight carrier in South Florida. It carries at least four times more traffic in the corridor than its major corridor rail competitor (CSXT), including all the premium intermodal, express and automobile traffic in the corridor. By providing high quality intermodal service it moves 309,000 annual trailers and containers units to and from the region that would otherwise move on I-95. By most objective standards, it is the dominant rail freight carrier in South Florida. Nearly all FEC long distance trains originate or terminate in Dade County. Consequently the SFECC is vitally critical segment of the FEC overall network.

The FEC has indicated that its commercial relationships with intermodal clients could be jeopardized if the FEC loses absolute and direct control over its routes. The FEC is in a strong position to compete for the time-sensitive business due to its single point of accountability for potential service failures. Thanks to direct control of resources, the FEC's reliability for express shipments has been eviable. Loss of this control could make the FEC vulnerable to inability to protect its intermodal express trains against unforeseen delays and handle exceptions in an expeditious manner.

CSXT – CSX Transportation is a major Class I railroad operating in 23 states east of the Mississippi River. While CSXT is quite successful on the national scale, its South Florida franchise suffers from the lower costs of the FEC. Most traffic that CSXT carries in South Florida is for shippers with warehouses and plants along the SFRC. It carries no premium intermodal, express or automobile traffic. It would appear that most of CSXT's study area traffic is captive to the railway by virtue of its location.

Over the last 20 years, CSXT has from time to time publicly discussed abandoning its South Florida operations or selling them to a low cost short line operation. CSXT's sale of the SFRC to Florida DOT in 1988 reflects the relatively low importance of this route segment to the performance of CSXT's overall network. Nontheless, CSXT's traffic in South Florida is growing as the regional economy burgeons.

The presence of CSXT in the South Florida is an important competitive force in the region. CSXT's operation several miles to west of the FEC's line provides a service floor and a price ceiling for premium rail freight services. Without the CSXT, the market forces limiting the FEC pricing and service strategy for many lines of business would be relaxed perhaps leading to higher prices and poorer service. Most regional economies served by only one rail freight carrier actively seek to get a second carrier into the region. South Florida would be well advised to preserve and encourage rail freight competition in the overall corridor.

3.3.2 Institutional

Institutionally, both the FEC and CSXT are federally regulated railroads engaged in interstate commerce. As railroads the two businesses operate within a relatively unique web of rights and obligations that circumscribe the options for regional rail freight integration.

- **Rights** – The railroads are private property with special protections from regulation and interference by states and localities. Most pertinently, states and localities have extremely limited recourse to the powers of eminent domain to gain access to railways. Similarly the state's power to unilaterally regulate, relocate or close a railway is very limited. For instance the US Supreme Court ruled in the last decade that states cannot require railroads to prepare environmental impact statements for investments on railroad operations relating to railroad uses[17]. More recently, federal courts have denied localities jurisdiction over the routing and carriage of shipments of hazardous commodities or hours of operation. Consequently, states and localities in most matters must deal with the railroads as peers since they are outside the control of the state and immune from many of the powers that states can apply to most businesses.

- **Obligations** – In partial exchange for these protections, the railway also has common carrier obligations that prohibit it from denying service to potential freight customers or from closing a freight service without an extensive demonstration of economic hardship. (All US railroads were relieved of the general obligation to offer local passenger service in the early 1970's.) The railroad cannot walk away from its freight customers.

Within this institutional context, the FEC is obligated to offer freight service to customers along its SFECC route and is protected from any unilateral action by the State of Florida to attempt to use some or all of its operating realty. Relative to the goals of the freight integration analysis, the state can use influence, but not authority, to induce the FEC to move some of its operations to a new corridor. The FEC, on the other hand, is not free to abandon the SFECC without making provisions for continuing freight service to current customers along the route. In the end, the State of Florida cannot require the FEC to move any of its freight operations onto a new alternative route. Nor as a practical matter can the state or the railroad elect to stop offering freight service on the SFECC so long as the customer base is sufficient to offer the hope of economic operation.

When Florida DOT acquired the SFRC operating realty in 1988, CSXT was not relieved of its obligation to provide freight service on the line. Florida DOT is obliged to maintain the SFRC for continuing freight use by CSXT. Most importantly, CSXT and its successors were granted a perpetual and exclusive freight easement over the line. Florida DOT does not have the right to allow FEC to operate freight trains over the SFRC without explicit permission from CSXT.

SFRTA is concerned that maintaining the Status Quo may present a difficult challenge to provision of commuter rail services on the SFECC. It may also increase the cost of constructing any type of transit in the SFECC right-of-way.

In summary, the most salient competitive and institutional considerations that will circumscribe any attempt to integrate regional freight operations include:

- FEC is the dominant rail freight carrier in the region for intermodal and automotive traffic.
- CSXT carries more of the corridor's carload traffic.

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[17] Railroads however are subject to environmental regulations relating to safe handling of hazardous materials.

- Operation of the two carriers in parallel corridors provides a level of competition that may have favorable impacts on the growing regional economy.
- Florida's power to coerce CSXT or FEC to reroute any of their trains to alternative route is very limited or nonexistent.
- Neither FEC nor CSXT are free to abandon freight operations on their lines without demonstrating that continued operations pose an undue economic hardship.
- CSXT is free to block FEC trains from using the SFRC.
- FEC is free to block to CSXT trains from using the SFECC.

4. SFRC FREIGHT SPINE

This scenario would relocate all FEC through freight trains to operate on the publicly-owned SFRC as a regional freight spine. The analysis describes the operational, infrastructure, highway, safety, economic competitive, and institutional concerns related to this scenario.

Integrated operating plans for freight traffic sharing track with Tri-Rail and Amtrak between Southern Dade County and north of Palm Beach County for the region's two freight carriers, Florida East Coast Railway (FEC) and CSX Transportation (CSXT), are described. An integrated SFRC Spine operation would require an investment in connectivity between the SFRC/CSXT main line and the FEC main line.

In preparing the analysis, the following assumptions were supported with empirical observations:

- No local trains can be moved from their current corridors, but it may be possible to change their timeslots if required. There are four local trains each on the SFECC and the SFRC.
- None of the long-distance FEC trains that serves Palm Beach or Fort Lauderdale can be moved. These include four daily intermodal trains and two daily rock trains. The Port of Palm Beach is currently serviced by the Fort Lauderdale trains.
- The typical total daily train count that could be rerouted from the SFECC to the SFRC is 18. The current maximum traffic train path requirement is 21 paths per day. The maximum traffic condition arises when an auto carrier train is operating, and that southbound intermodal traffic level is such that a second section of Train 101 is required.
- In future, up to four extra FEC intermodal train paths, and two additional rock train paths, might be required for expansion. This would bring the typical "rerouteable" daily train count to 24.
- Two present daily CSXT trains are candidates for rerouting. On peak days the number of rerouteable CSXT trains is presently four.
- In future, up to two extra CSXT train paths may be required for expansion.

Train path requirements for both freight and passenger trains are summarized in the Table 4.1.

Table 4.1
Total Train Path Requirements by Type of Train

	FEC			CSXT			South Florida Totals		
	Current Average	**Current Maximum Traffic**	**Future**	**Current Average**	**Current Maximum Traffic**	**Future**	**Current Average**	**Current Maximum Traffic**	**Future**
Movable Trains	18	21	24	2	4	6	25	29	34
Immovable Trains:	10	10	12	51	62	67	58	69	74
Road Freights	6	6	8	3	3	5	6	6	8
Local Freights	4	4	4	4	5	6	8	9	10
Intercity Passenger	0	0	0	4	4	6	4	4	6
Commuter Trains	0	0	0	40	50	50	40	50	50
Total Train Path Requirements	28	31	36	53	66	73	83	98	108

4.1 Freight Operations and Train Movements

The SFRC Spine would reroute 18 current daily trains from the SFECC, which leaves a less extensive freight operation that could share track with new passenger services.

At present 18 'rerouteable' trains operate over the SFECC daily. However, 24 trains are added to the SFRC Spine in this plan. The extra six FEC trains represent capacity for future growth.

An SFRC schedule representing the future maximum traffic condition with 50 daily Tri-Rail trains, four daily Amtraks, six CSXT road freights, up to 24 FEC through freights, and appropriate CSXT local freight train access is designed and evaluated. Impacts on Tri-Rail, CSXT, and FEC operations are documented.

Several design criteria were used to design the operating plan for the SFRC Freight Spine:

1. Must maintain existing FEC and CSXT freight end-to-end (Miami to Jacksonville) run-times.
2. Existing and options for future passenger rail service on the SFRC must be maintained. The future (2007) Tri-Rail operating plan calls for 50 daily trains.
3. Existing local freight access for customers must be maintained. Some perturbation of local train service slots will be permitted.
4. Existing Amtrak service on the SFRC must be maintained, although minor perturbations of schedules will be permitted. Provisions will be made for Amtrak service between Miami and Jacksonville.
5. FEC and CSXT train operations will move from an unscheduled or scheduled basis to a window-adherence basis. Trains that are ready to enter the spine will wait for a 'window' on the SFRC prior to departure.

Running Times – To ensure realistic schedule adherence, a two-pronged approach was used to estimate possible FEC freight train runtimes over the SFRC routes. A train performance model was used to estimate run-times under simulated conditions. Actual run-times from CSXT and FECR dispatchers' stringline data was then used to verify and inform the train performance calculations. Compromise schedules and non-stop (ideal) sectional run-times (SRTs) were then determined based on the combination of the two data sources.

Train Performance Simulator – EK staff used the U.S. DOT Transportation Systems Center Train Performance Simulator (TPS)[18] to calculate train performance for a variety of train types and loading conditions. The TPS calculates run-times based on an array of input variables including motive power type, car weight, line curvature, line gradient, permanent speed restrictions, and wind resistance. For the representative sample of runs submitted for this task, the analyst assumed:

- Level gradient, no wind resistance, no line curvature
- Existing motive power type (and future motive type where power upgrades are proposed)
- Observed maximum train loads and weight
- Existing permanent speed restrictions (including both civil restrictions and municipal slow zones)

The results from the representative sample runs are summarized in the Table 4.1:

Table 4.1
Train Performance Simulator Results for Typical Consists

Timing Profile Informed	Motive Power	H.P.	Loads	Empties	Estimated Tonnage [19]	hp/ton	Balancing Speed [20]	Average Speed [21]
FEC-NB-ROCK	3 SD-40	9,000	150	0	18,360	0.49	33	32
FEC-NB-ROCK	3 GP-40	9,000	135	0	16,560	0.54	38	34
FEC-SB-ROCK	3 SD-40	9,000	0	150	4,110	2.20	49	45
FEC-SB-IMX	3 GP-40	9,000	7,500 ft of train		9,360	0.96	44	41

Review of Actual Train Performance – The train performance actually achieved by Florida East Coast Railway over the SFECC was analyzed and used as a guide to inform run-time determination. This task was complicated by the fact that the SFECC is a single track railroad, and as such existing run-times are subject to meet-and-pass delays for which there would be none on the SFRC. Several FEC trains were found that operated on the SFECC during the off-peak hours and some provided data on non-stop runs between Iris and Jupiter. The run time and train characteristics of these trains are reported in Table 4.2:

[18] USDOT/TSC TRAIN PERFORMANCE SIMULATOR Version 5C (009) Revised March, 1988, based on the Missouri Pacific Railroad TPS Program, Version of 8/6/74. Transportation Systems Center, U.S. Department of Transportation, Kendall Square, Cambridge, Massachusetts 02142.

[19] Assuming 120 ton loaded freight car, 25 ton empty freight car, 120 ton locomotive.

[20] This is the speed in mph at which all of the power generated by the prime mover (in Run 8) is used to overcome the train's rolling contact resistance on flat terrain and tangent track. With modern diesel-electric locomotives, the acceleration is adhesion/tractive effort constrained at low speeds, and horsepower-constrained at speeds close to the balancing speed. The actual speed achieved would be lower when climbing a hill or negotiating curvature.

[21] This the predicted average speed for an unblemished run over 50 miles, starting from a dead stop and braking to a dead stop at the end of the run.

Table 4.2
Representative Sample of Observed Train Performance

Timing Profile	Train Number and Date	Departure Time and Location	Arrival Time and Location	Motive Power	Loads	Empties	Feet of Train	Mileage Covered	Time Elapsed (Min.)	Avg. Speed (mph)
FEC-NB-ROCK	Train 290 2005/12/09	17:20 at N. Miami	19:20 at Jupiter	2 GP-40 1 SD-40	132	0	6,490	74	120	37
FEC-NB-ROCK	Train 290 2005/12/12	16:40 at Iris	19:30 at Jupiter	3 SD-40	144	0	6,855	82	170	29
FEC-NB-IMX	Train 202 2006/12/10	22:00 at Iris	23:50 at Jupiter					82	110	45
FEC-SB-ROCK	Train 191 2005/12/14	01:40 at Jupiter	03:45 at N. Miami	2 GP-40	2	149	7,202	74	125	36
FEC-SB-IMX	Train 101 2005/12/14	19:00 at Fort Pierce	21:55 at Iris	2 GP-40 1 SD-40	131	1	7,660	124	175	43
FEC-SB-IMX	Train 105 2005/12/14	18:35 at Fort Pierce	21:30 at Iris	2 SD-40	107	0	5,455	124	175	43
FEC-SB-IMX	Train 101 2006/12/09	20:20 at Jupiter	22:30 at Iris	2 GP-40 1 SD-40	176	0	9,060	82	130	38
CSX	K944 2000/04/11	01:25 at CSXT Hialeah	03:20 at Mangonia					66.5	125	32
CSX	Q453 2000/04/15	21:05 at Mangonia	23:05 at Hialeah					66.5	120	33

Running Times – Based on the information described above, several timing profiles were created for freight trains operating over the SFRC. The times at each timepoint for different train types traveling over the SFRC Spine and the portion of FEC between Lake Park and Fort Pierce are shown in Table 4.3. The times were rounded to the nearest five minutes.

The assumptions that underpin each timing profile are described below:

1. **FEC-SB-ROCK:** This timing profile represents the maximum load performance for an FEC rock train traveling south with empty equipment. Empty southbound rock trains are train-length constrained, as the traffic on the FEC tends to require more northbound power than southbound power.
2. **FEC-SB-IMX:** The intermodal trains travelling south each day can vary considerably in length, from between 6,000 ft to over 9,000 ft. The FEC will occasionally use two locomotives instead of three on shorter intermodal trains, especially on 'second sections'. This timing profile represents the typical southbound FEC intermodal train performance, routinely attained by Train 101 and Train 105.
3. **CSX-SB:** The CSXT southbound trains in 2000 (merchandise and empty rock) have tended to travel at similar speeds over the SFRC. As such, only one timing profile was created for the southbound CSXT trains.
4. **PASS-SB:** Based on the current speed restrictions and train performance, Tri-Rail trains could cover the entire distance between Mangonia Park and Miami Airport (MIA) making all station

stops in just a little over 1 hour 35 minutes. However, based on discussion with SFRTA,[22] it is understood that the SFRTA intends to maintain the current 1 hour 50 minute running time between Mangonia and MIA for a variety of reasons including: reliability, passenger bus connections, and flexibility for wrong-railing and platforming. As such, in this exercise, the 1 hr 50 min schedule is retained (i.e. 1 hr 45 mins between Mangonia and CP-IRIS).

Table 4.3
Train Timing Profiles and Sectional Running Times for SFRC Spine scenario
(FEC Fort Pierce to Riviera; SFRC Mangonia to Iris)

	Miles from Fort Pierce	Timing Profile „	FEC-SB-ROCK	FEC-SB-IMX	CSX-SB	PASS-SB	FEC-NB-ROCK	FEC-NB-POWERUP	FEC-NB-IMX	CSX-NB	PASS-NB
		Location ,	,	,	,	,	•	•	•	•	•
Schedule	0.0	Ft. Pierce	0:00	0:00	–	–	4:10	3:50	3:20	–	–
	23.2	Port Sewall	0:30	0:35	–	–	3:30	3:10	2:45	–	–
	41.8	Jupiter	1:00	1:05	–	–	2:55	2:40	2:15	–	–
	55.7	Mangonia	1:20	1:25	0:00	0:00	2:30	2:15	1:55	2:00	1:45
	77.6	Delray	1:55	2:05	0:30	0:30	1:50	1:35	1:20	1:25	1:15
	90.9	Pompano	2:15	2:30	0:55	0:50	1:20	1:10	0:55	1:00	0:50
	103.8	N.E. Dania	2:35	2:50	1:15	1:10	0:50	0:40	0:30	0:35	0:30
	121.0	CSXT Hialeah (CP-TOMPKINS)	3:00	3:20	1:45	1:35	0:10	0:05	0:05	0:00	0:05
	123.6	CP-IRIS	3:05	3:25	–	1:45	0:00	0:00	0:00	–	0:00
Resulting Average Speed (mph) „			40	36	38	42	30	33	37	33	42
Sectional Running Times	Length	Section ,	,	,	,	,	•	•	•	•	•
	23.2	Ft. Pierce-Port Sewall	0:30	0:35	–	–	0:40	0:40	0:35	–	–
	18.6	Port Sewall-Jupiter	0:30	0:30	–	–	0:35	0:30	0:30	–	–
	13.9	Jupiter-Mangonia	0:20	0:20	–	–	0:25	0:25	0:20	–	–
	21.9	Mangonia-Delray	0:35	0:40	0:30	0:30	0:40	0:40	0:35	0:35	0:30
	13.3	Delray-Pompano	0:20	0:25	0:25	0:20	0:30	0:25	0:25	0:25	0:25
	12.9	Pompano-Dania	0:20	0:20	0:20	0:20	0:30	0:30	0:25	0:25	0:20
	17.2	Dania-CSXT Hialeah	0:25	0:30	0:30	0:25	0:40	0:35	0:25	0:35	0:25
	2.6	CSXT Hialeah-Iris	0:05	0:05	–	0:10	0:10	0:05	0:05	–	0:05

5. **FEC-NB-ROCK:** This timing profile represents the maximum load performance for an FEC rock train traveling north with heaviest loads (approximately 150 loaded cars), such as Train 290. This represents the heaviest actually observed in the FEC data. Actual rock train performance shows some degree of variation day-to-day as shown in the table of actual train performance. Variation in motive power assignments, actual weight of loads, and the number of cars carried all affect train performance. In particular, the FEC apparently adds a fourth locomotive onto its heaviest rock trains when extras are available at the southern end of the railroad.
6. **FEC-NB-POWERUP:** During the process of designing the operating plan, it was found that some rock trains could not maintain their train paths without additional power. Due to the low speed performance of the maximum load rock train, it was found to be unadvisable to operate a heavy FEC rock train on the SFRC between hourly Tri-Rail passenger services. As FEC advised

[22] Telephonic Interview with Gadek Marcin, Operations Planner at the South Florida Regional Transportation Authority, conducted by Alex Lu on June 13, 2006 at 14:30 hours.

that it is critical to retain the present departure time windows[23] for these rock trains, it was determined that additional power would be necessary to power these heavy trains *when carrying maximum loads*. It is possible to achieve comparable performance without additional power by instituting tonnage limits per-train. The assumed average speed of 33 mph can be achieved by adding an additional 3,000 hp unit to the heaviest rock trains, or by restricting rock trains to approximately 120 cars.

There are three ways of dealing with the rock trains. The railroad can "power up", install overtake sidings, or both. Possible sites for overtake sidings are analyzed in Section 4.2.

7. **FEC-NB-IMX:** This timing profile describes the typical northbound FEC intermodal train performance, routinely attained by Train 202 and Train 206.
8. **CSX-NB:** The CSXT northbound trains in 2000 (loaded rock) have tended to travel at speeds slower than its southbound opposite numbers over the SFRC. As such, two hours are allowed between CSXT Hialeah and Mangonia Park. The merchandise train are assumed to use the same speed profile.
9. **PASS-NB:** The current 1 hr 50 mins Tri-Rail schedule is retained for the northbound direction.

Validation of Approximate Sectional Running Times – To further validate the sectional running times, sectional average speeds were calculated as shown in Table 4.4. Average station-to-station speeds were compared with the train class's maximum load performance. Adjustments were made accordingly. Some allowances were made for rounding errors due to the simulation tools' error margin.

Table 4.4
Station-to-Station Average Speeds for Each Train Class

Section	Mileage	FEC-SB-ROCK	FEC-SB-IMX	CSX-SB	PASS-SB	FEC-NB-ROCK	FEC-NB-POWERUP	FEC-NB-IMX	CSX-NB	PASS-NB
Ft. Pierce-Port Sewall	23.2	46	40	–	–	35	35	40	–	–
Port Sewall-Jupiter	18.6	37	37	–	–	32	37	37	–	–
Jupiter-Mangonia	13.9	42	42	–	–	33	33	42	–	–
Mangonia-Delray	21.9	38	33	44	44	33	33	38	38	44
Delray-Pompano	13.3	40	32	32	40	27	32	32	32	32
Pompano-Dania	12.9	39	39	39	39	26	26	31	31	39
Dania-CSXT Hialeah	17.2	41	34	34	41	26	29	41	29	41
CSXT Hialeah-Iris	2.6	31	31	–	16	16	31	31	–	31

These average speeds are consistent with what is routinely achieved by the trains today, and would be achieved if the FEC trains were routed via the SFRC.

Train performance calculations for the FEC trains indicate that all southbound and most northbound operations are generally compatible for interoperation with local passenger service. FEC trains would be only ten minutes slower than local passenger services over the route allowing the FEC trains to be slotted between passenger trains during most periods of the day.

[23] David Nelson meeting with Heidi Eddins, Senior Manager, Florida East Coast Railway, June 2006.

Operations Planning and Scheduling Methods – A four-step process was used in this project to develop the operating plan:

1. **Run Time Determination** – Train performance models, historical run-time data, and current schedules are used together to determine the average run time for each section within the schedule district based on typical operating conditions. This process was described above.
2. **Train Scheduling** – Based on train operators' departure time preferences, train-paths representing the progress of a train under typical conditions on a time-space diagram are laid out. This diagram, called a "stringline", depicts scheduled position of every train on the line at every time. It is invaluable for the development and evaluation of schedules. Inspection of the string line allows the scheduler to identify and adjust train-paths to make the most efficient use of crews, equipment, and physical plant.

   When constructing the schedule, the trains with the highest priority and/or time-specificity are laid down first, followed by trains with less time-sensitivity. Each meet and pass on the stringline (shown as an intersection of two train-paths), are then checked for movement conflicts to ensure no trains are scheduled to use the same track space at the same time. Conflicts are resolved by assigning trains to use different main tracks, or by adjusting the departure or intermediate time of one or more trains. For Scenario 2, the priority order was:

   - Tri-Rail,
   - Amtrak,
   - Existing CSXT road freight trains,
   - Rerouted FEC freight trains, and
   - CSXT local trains and maintenance of way duties.
3. **Delay Analysis** – The impact of unexpected delays to trains on the operating plans are analyzed, and the prospects of delays are considered. Train-paths that are likely prone to delay due to the presence of other trains, and train-paths that cause many conflicts when delayed, are adjusted. These adjustments aim to reduce the likelihood of delays.

   For the freight integration study, it is assumed that Tri-Rail passenger trains will generally leave the terminal no more than five minutes late, and that northbound Amtrak trains will leave Hialeah no more than 10 minutes late. The FEC train delay data in terms of minutes' delay and departure time variability is based on statistical analysis of historical operating data provided by the FEC.[24]
4. **Vehicle and Crew Cycle Analysis** – The impact of the potential schedule on vehicle and crew schedules are analyzed. In this study, it was assumed that the Tri-Rail and Amtrak schedules are constrained by pre-determined vehicle cycles. The impact of the new schedule on the FEC's equipment cycle was analyzed, and adjusted if the impacts were not considered reasonable.

These four steps are conducted in an iterative fashion until a workable operating plan is found. Because of the mutually-dependent nature of the train-paths, delay impacts, and vehicle cycles, it was necessary to perform the steps in an iterative fashion.

[24] Should Florida DOT wish to further advance the freight integration, a larger sample of FEC operating data would enhance development of the overall plan.

Delay Analysis Methods – Several basic concepts are used in schedule delay analysis. The terminologies are defined in the following section:

1. **Average run-time –** This is the time it typically takes for a train to travel between two given points. It is not the best or the worst performance achievable by the train. Most train schedules are based on the average run-time.
2. **Variability –** This is the extent to which the run-time varies on a day to day basis. A highly reliable operation has a low time-variability. An unreliable operation has a high time-variability. Variability arises for a number of reasons: track capacity constraints, yard delays, unexpected events, track work, train performance characteristics, and human factors.[25]
3. **Percentile –** This term is used to describe a value that indicates the percent of a distribution that is equal to or below it.[26] When applied to run-time, it indicates the percentage of trains which would arrive early or on-time. For example, if the 80th percentile run-time is 8 hours, that means 80% of all trains can complete the run in 8 hours or less. The remaining 20% of trains will take longer than 8 hours to complete the run.
4. **Train Path** – If a train is ready to depart at a pre-determined time, and the train is able to proceed through an area without being impeded by another train, then a *train path* is said to be available to that train. A train path assumes average running times and does not address the stochasticity[27] of actual train operations. It is available to exactly one train. If two or more trains attempt to use the same train path, one or the other train will be delayed. Train paths are typically separated from each other by the minimum operable headway constraint of the signalling plant typically 2 to 5 minutes.
5. **Departure Window** – The departure window acknowledges that trains, especially long-distance trains, do not always arrive on-time. When planning for long-distance arrivals, instead of assigning a specific train path to a specific train, the scheduler assigns a departure window comprising multiple train paths collected together to form a 'window of opportunity' for train passage. Many trains may use the same departure window provided that sufficient train paths are available within that window. Departure windows for southbound FEC freights joining the SFRC are generally at least half-hour in length.

For southbound traffic operating on the SFRC Spine, there are three sources of time-variability:

- Variability due to terminal delays at northern yards, affecting departure time from that yard,
- Variability due to en-route delays, such as meets and passes, and unexpected operating conditions, and
- Delays arising as a result of missing the scheduled window of train paths.

Not all of these sources of delay necessarily compound one another. Early departures from the yard will result in a longer wait at Lake Park[28] for the scheduled path, for example, but it would reduce the

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[25] For a detailed discussion of run-time variability and its implications for scheduling, see Heimburger, D.E., A.Y. Herzenberg, and N.H.M. Wilson, "Using Simple Simulation Models in the Operational Analysis of Rail Transit Lines: A Case Study of the MBTA's Red Line," *Transportation Research Record 1677*, pp. 21-30 (1999), and Shen, S. and N.H.M. Wilson, "Optimal Integrated Real-Time Disruption Control Model for Rail Transit Systems", in *Computer-Aided Scheduling of Public Transport, Lecture Notes in Economics and Mathematical Systems #505*, pp. 335-364 (2001).

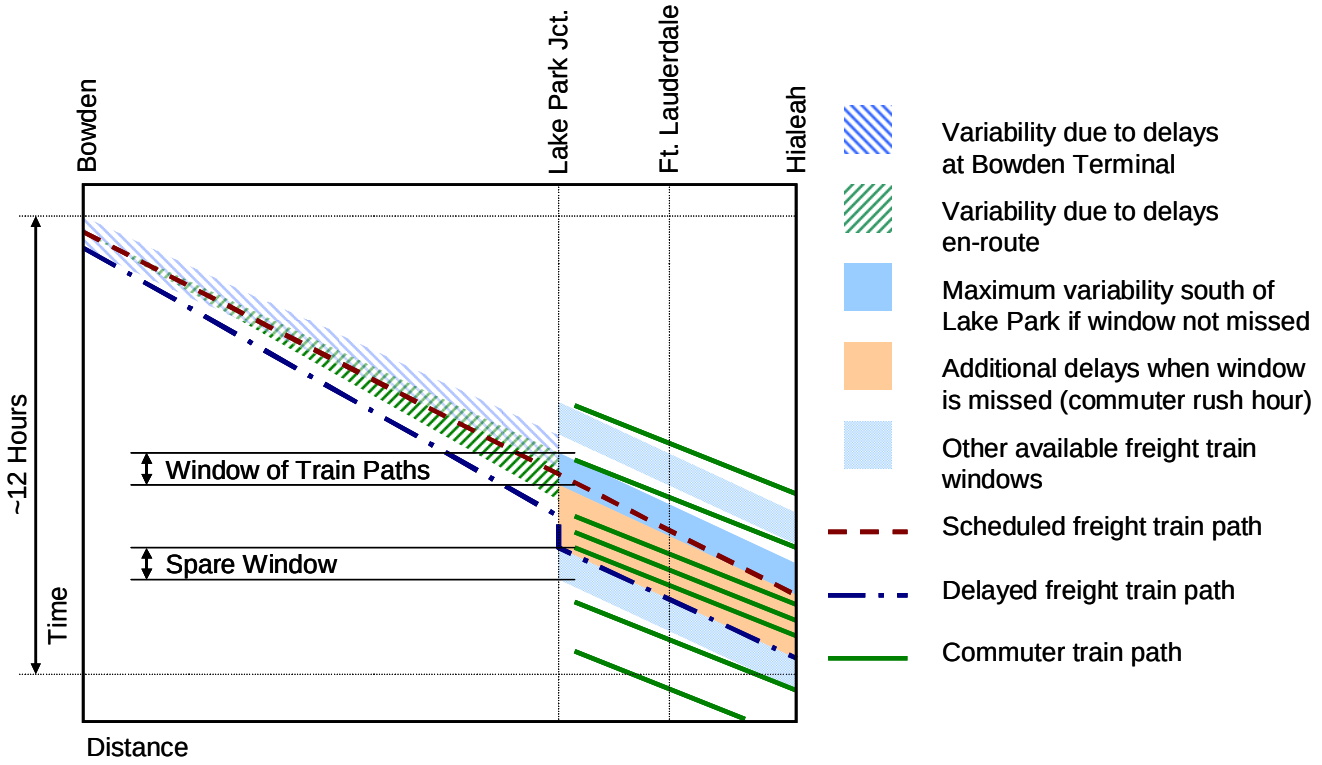
[26] See standard statistics textbook.

[27] Inherent level of random variability.

[28] Lake Park is an interlocking at MP 292.6 on the FEC. At Lake Park, there is a short section of double track in shared use by the Palm Beach local and for train meets. It is the location where southbound FEC arrivals desiring to join the SFRC must wait for a train-path for procession over the connector and thence onto the SFRC at CSXT Milepost SX 966.0, about a half-mile north of Mangonia Park.

probability of the train missing its assigned window. Figure 1 is a stringline schematic that explains the relationship between these different sources of schedule variability:

Figure 4.1
Relationship between Different Sources of Delay



The red line is the freight train scheduled path. The scheduled path acknowledges that a combination of terminal and en-route delays will slow the train, and it has a slope that is slightly steeper than the train's minimum-time performance. The choice of the departure time from FEC Jacksonville area yard, Bowden, and the window at Lake Park is determined based on the scheduled path. The width of departure window is constrained by the paths of Tri-Rail trains. If that window is missed, additional freight delays occur. The width of the window constrains the variability of delays once the train is south of Lake Park.

Trains arriving outside the window of train paths due to delays between Bowden and Lake Park (such as the heavy blue line shown) will have to wait at the junction for the next available window to continue to move southwards. As such, they are subject to additional delay shown as the orange region. However, because the timing of paths is basically constant, the accumulated delays north of Lake Park do not affect the run-time southwards on the SFRC. Although the blue path shown departed Bowden much later than scheduled, and lost further time en-route, its arrival time at Hialeah is no worse than a train that left on time but misses its window of paths due to en-route delays. The arrival timing at Hialeah is therefore constrained almost entirely by whether the freight train makes its scheduled path south from Lake Park. No trains may operate in the orange region, which is used exclusively by peak commuter trains.

Thus, when designing FEC schedules for this line, every effort is made to ensure that departures from Bowden can make their window of train paths at Lake Park. When evaluating the impacts on FEC operations of southbound trains, the probability of not making train paths at Lake Park is evaluated.

Train Scheduling Results – Table 4.5 shows a possible new schedule of the FEC future train-starts, including the paths reserved for expansion or for flexibility in timing.[29] Figure 4.2 shows train paths and operating windows at the northern and southern limits of the shared track spine. Table 4.6 shows a train-by-train comparison of the observed Base Case FEC train-starts and the proposed SFRC Spine train-starts. A more detailed schedule containing all trains is shown in Table 4.7.

Table 4.5
Simplified FEC Schedule for SFRC Spine Operations

Southbounds				**Northbounds**			
Train Number	**Fort Pierce**	**Mangonia**	**Iris**	**Train Number**	**Iris**	**Mangonia**	**Fort Pierce**
191	0:40	2:04	3:45	336	1:30	4:05	5:43
193	2:55	4:19	6:00	2230	4:10	6:04	7:30
121	3:40	5:10	7:06	2206	4:45	6:39	8:07
335	4:20	5:44	7:25	240	5:10	7:06	8:32
141	5:35	7:02	8:59	206	5:45	7:39	9:05
2127	6:05	7:34	9:29	202	7:50	9:44	11:10
2131	10:20	12:03	13:58	2202	8:15	10:09	11:35
2129	11:10	12:51	14:46	2232	9:12	11:06	12:32
125	12:20	13:50	15:46	**208**	15:15	17:34	19:05
2105	17:10	18:45	20:41	222	18:55	20:49	22:15
105	18:15	19:45	21:41	**290**	19:00	21:19	22:50
2101	18:55	20:25	22:21	2228	19:55	21:49	23:15
101	19:15	20:45	22:41	226	22:20	0:14 *n*	1:40 *n*
107	22:00	23:30	1:26 *n*	292	22:40	1:15 *n*	2:53 *n*

Notes: *n* = Next Day. Shaded cells indicate train-starts reserved for future intermodal expansion.
Bold numbers indicate rock trains requiring extra power units.

[29] Stringlines for this schedule are found in an appendix to the report.

Figure 4.2
SFRC Freight Spine Train Paths and Operating Windows By Time of Day

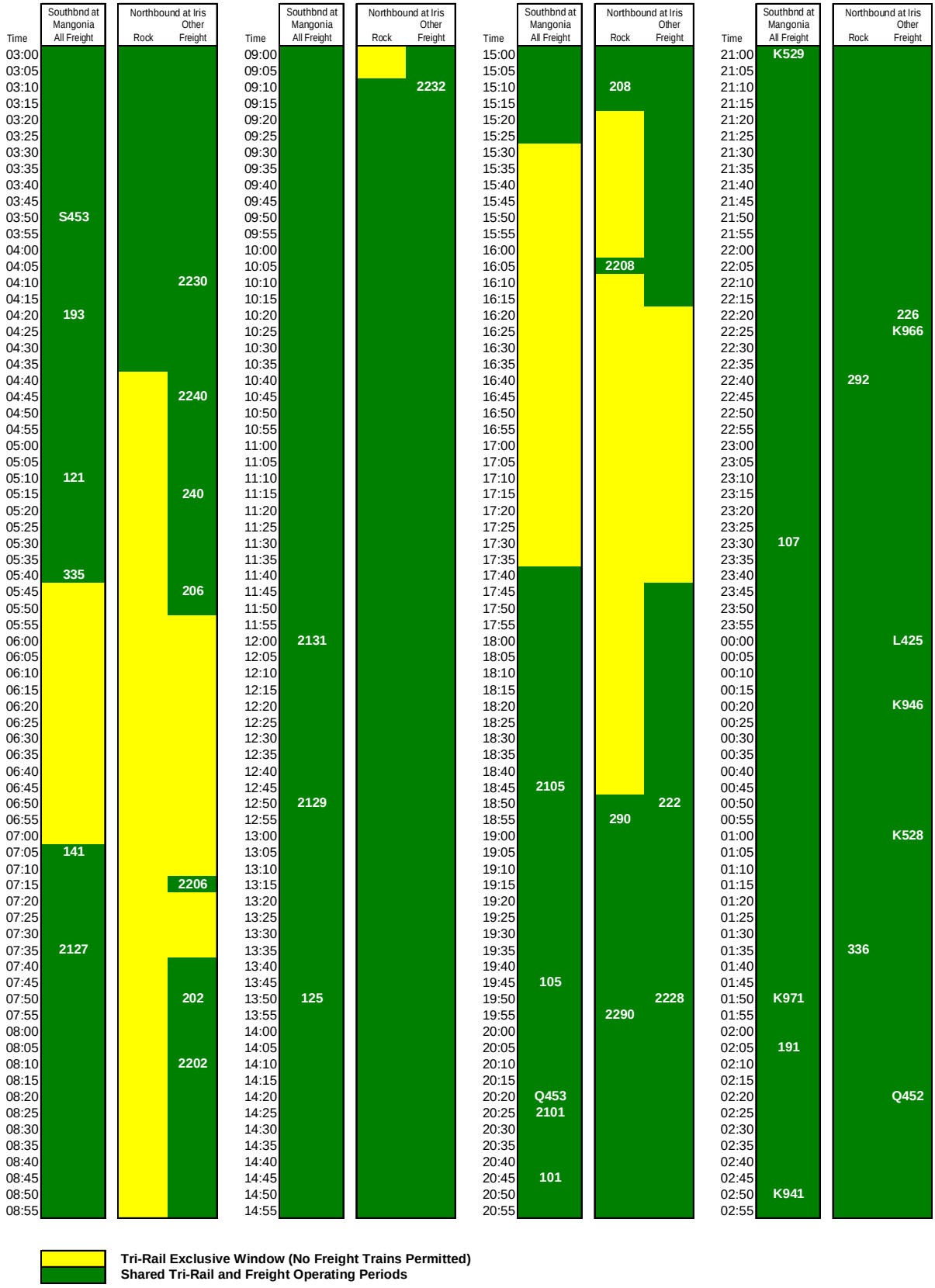


Table 4.6
Comparison of Status Quo Train-Starts with SFRC Spine Operating Plan

Southbound					Northbound				
FEC Train Number	**Current Train-Start at Ft Pierce**	**Current Variability (hours)**	**Option 2 Train-Paths Available**[30]	**Indicated Deviation**	**FEC Train Number**	**Current Train-Start at Iris**	**Current Variability (hours)**	**Option 2 Train-Paths Available**	**Indicated Deviation**
191	00:40	±1.0	… **00:40** …	0:00	336	02:45	±1.0	… 01:30 **02:45** …	0:00
193	02:55	±1.5	… **02:55** 03:00]	0:00	240	04:55	±6.0	… 04:15, **04:55**, 05:10, 05:50]	0:00
121[31]	03:40	±0.5	… **03:40,** 03:45, 03:50]	0:00	206	05:40	±2.0	[05:15, **05:40** 05:50, 07:15]	0:00
335	04:20	±1.5	… 03:45 **04:20**]	0:00	202	09:00	±0.5	[07:15 07:50, 08:15 08:35, **09:07**]	+0:07
141	05:20	±6.0	[**05:35** 05:40 06:05]	+0:15	208 [32]	15:20	±2.0	[**15:15**, 16:07,[33] 18:57 19:05 …	–0:05
125	12:30	±2.0	… 10:20, 11:10, **12:20,** 13:20 …	–0:10	222	19:40	±2.0	[18:20, 18:55, 19:10, **19:50** …	+0:10
105 (Relief)	19:15	±1.0	[17:10, **18:15** 18:25, 19:25]	+0:10	290	17:15	±1.5	[16:07, **19:00**, 20:00, 20:50 …	–1:08 +1:45
101	19:10	±1.5	[[34] 18:55 **19:15** 19:25][35]	+0:05	226	22:30	±1.5	… **22:20** …	0:00
107	22:10	±0.5	[**22:00** 22:30 …[36]	–0:10	292	22:00	±1.5	[**22:40** …	+0:40

[30] This column shows all of the available timeslots that the numbered train could use. The 'preferred' scheduled timeslot is shown in bold type. The required deviation assumes that the numbered train arrives on-time (to within 5 minutes) at Fort Pierce or Iris, and therefore could use the 'preferred' timeslot specifically reserved for its operation. This deviation may be higher if the train did not operate on-time.
[31] Train 121, a Bowden-Miami intermodal, is considered at risk for "canning" if its operating window is missed. See train crew hours-of-service analysis for more details.
[32] Shaded cells indicate rock trains. Northbound rock trains are loads, and southbound are empties.
[33] The 16:07 rock train path may impact Tri-Rail Train 634 near the northern terminus, delaying it by up to 2 minutes.
[34] This left square bracket ([ ) implies the train should not operate any earlier than shown.
[35] This right square bracket ( ]) implies the train should not operate any later than shown.
[36] The ellipsis symbol (…) in the timeslot column implies that a variety of paths are possible before or after the stated time essentially unconstrained by other trains operating. Where the ellipsis is not present, it is implied that if the train should miss its time-slot by more than about 10 minutes, a lengthy wait or delays to passenger trains may result. The timeslots for some trains are more restrictive than others due to their use of the SFRC during the passenger service hours.

Table 4.7a
Sample Weekday Southbound Schedule, SFRC Spine

Southbound Service		CSX	FEC	CSX	CSX	FEC	TCRA	TCRA	FEC	TCRA	FEC	TCRA	TCRA	TCRA	TCRA	FEC	TCRA	FEC	TCRA	TCRA	TCRA	TCRA	TCRA	FEC
		CSX	ROCK (E)	CSX	CSX	ROCK (E)	PASS	PASS	IMX	PASS	ROCK (E)	PASS	PASS	PASS	PASS	IMX	PASS	IMX	PASS	PASS	PASS	PASS	PASS	IMX
No	Station	MP	K971	191	K941	S453	193	P601	P603	121	P605	335	P607	P609	P611	P613	141	P615	2127	P617	P619	P621	P623	P625	2131
1	Fort Pierce FEC 241.5	911	--	0:40	--	--	2:55	--	--	3:40	--	4:20	--	--	--	--	5:35	--	6:05	--	--	--	--	--	10:20
4	Jensen Beach 256.6	926	--	0:59	--	--	3:14	--	--	4:03	--	4:39	--	--	--	--	5:58	--	6:28	--	--	--	--	--	10:43
6	South Rio FEC 259.3	928	--	1:04	--	--	3:19	--	--	4:07	--	4:44	--	--	--	--	6:02	--	6:32	--	--	--	--	--	10:47
9	S. Port Sewall 266.2	935	--	1:17	--	--	3:32	--	--	4:19	--	4:57	--	--	--	--	6:14	--	6:50	--	--	--	--	--	10:59
11	N. Camp Murphy 277.8	947	--	1:31	--	--	3:46	--	--	4:32	--	5:11	--	--	--	--	6:27	--	7:03	--	--	--	--	--	11:12
13	Jupiter FEC 283.3	952	--	1:43	--	--	3:58	--	--	4:44	--	5:23	--	--	--	--	6:39	--	7:14	--	--	--	--	--	11:38
14	Lake Park FEC 292.6	962	--	1:54	--	--	4:09	--	--	4:57	--	5:34	--	--	--	--	6:50	--	7:26	--	--	--	--	--	11:51
15	Lewis Terminals 295.1	964	--	1:56	--	--	4:11	--	--	5:01	--	5:36	--	--	--	--	6:54	--	7:30	--	--	--	--	--	11:55
18	SFRC Jct. SX 966.0	966	1:50	2:02	2:50	3:50	4:17	--	--	5:08	--	5:42	--	--	--	--	7:00	--	7:33	--	--	--	--	--	12:01
19	Mangonia SX 966.3	966	1:52	2:04	2:52	3:52	4:19	4:30	5:00	5:10	5:30	5:44	6:00	6:20	6:40	7:00	7:02	7:30	7:34	8:10	8:47	9:47	10:47	11:47	12:03
22	West Palm Beach	970	1:58	2:10	2:58	3:58	4:25	4:35	5:05	5:19	5:35	5:50	6:05	6:25	6:45	7:05	7:10	7:35	7:42	8:15	8:52	9:52	10:52	11:52	12:11
28	Delray Station	988	2:22	2:34	3:22	4:22	4:49	4:59	5:29	5:47	5:59	6:14	6:29	6:49	7:09	7:29	7:39	7:59	8:10	8:39	9:16	10:16	11:16	12:16	12:39
36	Pompano Beach	1002	2:40	2:52	3:40	4:40	5:07	5:16	5:46	6:04	6:16	6:32	6:46	7:06	7:26	7:46	8:00	8:16	8:27	8:56	9:33	10:33	11:33	12:33	12:56
40	Ft. Lauderdale Station	1012	2:55	3:08	3:55	4:55	5:23	5:30	6:00	6:18	6:30	6:48	7:00	7:20	7:40	8:00	8:15	8:30	8:42	9:10	9:47	10:47	11:47	12:47	13:11
42	NE-DANIA SX 1014.4	1014	2:59	3:12	3:59	4:59	5:27	5:34	6:04	6:22	6:34	6:52	7:04	7:24	7:44	8:04	8:19	8:34	8:46	9:14	9:51	10:51	11:51	12:51	13:15
46	Hollywood Station	1020	3:09	3:21	4:09	5:09	5:36	5:45	6:15	6:32	6:45	7:01	7:15	7:35	7:55	8:15	8:27	8:45	8:56	9:25	10:02	11:02	12:02	13:02	13:25
50	CSX/Amtrak Hialeah	1032	3:28	3:40	4:28	5:28	5:55	6:04	6:34	6:51	7:04	7:20	7:34	7:54	8:14	8:34	8:44	9:04	9:15	9:44	10:21	11:21	12:21	13:21	13:43
51	Metro Rail Transfer	1034	--	3:44	--	--	5:59	6:07	6:37	6:55	7:07	7:24	7:37	7:57	8:17	8:37	8:48	9:07	9:18	9:47	10:24	11:24	12:24	13:24	13:47
52	CP-IRIS 1034.2	1034	--	3:45	--	--	6:00	6:08	6:38	7:06	7:08	7:25	7:38	7:58	8:18	8:38	8:59	9:08	9:29	9:48	10:25	11:25	12:25	13:25	13:58
55	Miami Airport Station	1037	--	--	--	--	--	6:19	6:49	--	7:19	--	7:49	8:09	8:29	8:49	--	9:19	--	9:59	10:36	11:36	12:36	13:36	--

Southbound Service		CSX	TCRA	FEC	TCRA	FEC	TCRA	TCRA	AMT	TCRA	AMT	TCRA	TCRA	TCRA	TCRA	TCRA	FEC	TCRA	FEC	CSX	FEC	TCRA	FEC	CSX	FEC
		CSX	PASS	IMX	PASS	IMX	PASS	PASS	AMTK	PASS	AMTK	PASS	PASS	PASS	PASS	PASS	IMX	PASS	IMX	CSX	IMX	PASS	IMX	CSX	IMX
No	Station	MP	P627	2129	P629	125	P631	P633	P091	P635	P097	P637	P639	P641	P643	P645	2105	P647	105	Q453	2101	P649	101	K529	107
1	Fort Pierce FEC 241.5	911	--	11:10	--	12:20	--	--	--	--	15:25	--	--	--	--	--	17:10	--	18:15	--	18:55	--	19:15	--	22:00
4	Jensen Beach 256.6	926	--	11:43	--	12:43	--	--	--	--	15:49	--	--	--	--	--	17:33	--	18:38	--	19:18	--	19:38	--	22:23
6	South Rio FEC 259.3	928	--	11:47	--	12:47	--	--	--	--	15:52	--	--	--	--	--	17:37	--	18:42	--	19:22	--	19:42	--	22:27
9	S. Port Sewall 266.2	935	--	11:59	--	12:59	--	--	--	--	16:00	--	--	--	--	--	17:49	--	18:54	--	19:34	--	19:54	--	22:39
11	N. Camp Murphy 277.8	947	--	12:12	--	13:12	--	--	--	--	16:11	--	--	--	--	--	18:02	--	19:07	--	19:47	--	20:07	--	22:52
13	Jupiter FEC 283.3	952	--	12:24	--	13:24	--	--	--	--	16:25	--	--	--	--	--	18:19	--	19:19	--	19:59	--	20:19	--	23:04
14	Lake Park FEC 292.6	962	--	12:37	--	13:37	--	--	--	--	16:36	--	--	--	--	--	18:32	--	19:32	--	20:12	--	20:32	--	23:17
15	Lewis Terminals 295.1	964	--	12:41	--	13:41	--	--	--	--	16:39	--	--	--	--	--	18:36	--	19:36	--	20:16	--	20:36	--	23:21
18	SFRC Jct. SX 966.0	966	--	12:49	--	13:48	--	--	--	--	16:42	--	--	--	--	--	18:43	--	19:43	20:20	20:23	--	20:43	21:00	23:28
19	Mangonia SX 966.3	966	12:47	12:51	13:47	13:50	14:47	15:47	16:03	16:30	16:42	17:00	17:20	17:40	18:10	18:40	18:45	19:40	19:45	20:22	20:25	20:40	20:45	21:02	23:30
22	West Palm Beach	970	12:52	12:59	13:52	13:59	14:52	15:52	16:13	16:35	16:54	17:05	17:25	17:45	18:15	18:45	18:54	19:45	19:54	20:28	20:34	20:45	20:54	21:08	23:39
28	Delray Station	988	13:16	13:27	14:16	14:27	15:16	16:16	16:37	16:59	17:17	17:29	17:49	18:09	18:39	19:09	19:22	20:09	20:22	20:52	21:02	21:09	21:22	21:32	0:07
36	Pompano Beach	1002	13:33	13:44	14:33	14:44	15:33	16:33	16:58	17:16	17:36	17:46	18:06	18:26	18:56	19:26	19:39	20:26	20:39	21:10	21:19	21:26	21:39	21:50	0:24
40	Ft. Lauderdale Station	1012	13:47	13:59	14:47	14:58	15:47	16:47	17:12	17:30	17:54	18:00	18:20	18:40	19:10	19:40	19:53	20:40	20:53	21:25	21:33	21:40	21:53	22:05	0:38
42	NE-DANIA SX 1014.4	1014	13:51	14:03	14:51	15:02	15:51	16:51	17:16	17:34	17:58	18:04	18:24	18:44	19:14	19:44	19:57	20:44	20:57	21:29	21:37	21:44	21:57	22:09	0:42
46	Hollywood Station	1020	14:02	14:13	15:02	15:12	16:02	17:02	17:28	17:45	18:10	18:15	18:35	18:55	19:25	19:55	20:07	20:55	21:07	21:39	21:47	21:55	22:07	22:19	0:52
50	CSX/Amtrak Hialeah	1032	14:21	14:31	15:21	15:31	16:21	17:21	18:02	18:04	18:45	18:34	18:54	19:14	19:44	20:14	20:26	21:14	21:26	21:58	22:06	22:14	22:26	22:38	1:11
51	Metro Rail Transfer	1034	14:24	14:35	15:24	15:35	16:24	17:24	--	18:07	--	18:37	18:57	19:17	19:47	20:17	20:30	21:17	21:30	--	22:10	22:17	22:30	--	1:15
52	CP-IRIS 1034.2	1034	14:25	14:46	15:25	15:46	16:25	17:25	--	18:08	--	18:38	18:58	19:18	19:48	20:18	20:41	21:18	21:41	--	22:21	22:18	22:41	--	1:26
55	Miami Airport Station	1037	14:36	--	15:36	--	16:36	17:36	--	18:19	--	18:49	19:09	19:29	19:59	20:29	--	21:29	--	--	--	22:29	--	--	--

Abbreviations

Carriers: TCRA = Tri-Rail; FEC = Florida East Coast; AMT = Amtrak; CSX = CSX Transportation

Timing Profiles: PASS = Passenger; IMX = Intermodal; ROCK = Heavy Haul Train; ROCK (E) = Empty Heavy Haul Train; AMTK = Amtrak

Table 4.7b
Sample Weekday Northbound Schedule, SFRC Spine

Northbound Service			CSX	CSX	CSX	FEC	CSX	FEC	TCRA	FEC	TCRA	FEC	TCRA	FEC	TCRA	TCRA	TCRA	TCRA	AMT	TCRA	FEC	TCRA	FEC	AMT	TCRA
		CSX	CSX	CSX	CSX	ROCK	CSX	IMX (E)	PASS	IMX (E)	PASS	IMX (E)	PASS	IMX (E)	PASS	PASS	PASS	PASS	AMTK	PASS	IMX (E)	PASS	IMX (E)	AMTK	PASS
No	Station	MP	L452	K946	K528	336	Q452	2230	P600	2206	P602	240	P604	206	P606	P608	P610	P612	P098	P614	202	P616	2202	P092	P618
55	Miami Airport Station	1037	--	--	--	--	--	--	4:30	--	5:00	--	5:30	--	6:00	6:20	6:40	7:00	--	7:30	--	8:00	--	--	9:00
52	CP-IRIS 1034.2	1034	--	--	--	1:30	--	4:10	4:35	4:45	5:05	5:10	5:35	5:45	6:05	6:25	6:45	7:05	--	7:35	7:50	8:05	8:15	--	9:05
51	Metro Rail Transfer	1034	--	--	--	1:31	--	4:11	4:37	4:46	5:07	5:11	5:37	5:46	6:07	6:27	6:47	7:07	--	7:37	7:51	8:07	8:16	--	9:07
50	CSX/Amtrak Hialeah	1032	0:01	0:20	1:00	1:34	2:25	4:13	4:41	4:48	5:11	5:13	5:41	5:48	6:11	6:31	6:51	7:11	7:18	7:41	7:53	8:11	8:18	8:40	9:11
46	Hollywood Station	1020	0:21	0:40	1:20	1:55	2:45	4:31	4:57	5:06	5:27	5:31	5:57	6:06	6:27	6:47	7:07	7:27	7:38	7:57	8:11	8:27	8:36	9:00	9:27
42	NE-DANIA SX 1014.4	1014	0:36	0:55	1:35	2:11	3:00	4:42	5:08	5:17	5:38	5:42	6:08	6:17	6:38	6:58	7:18	7:38	7:45	8:08	8:22	8:38	8:47	9:07	9:38
40	Ft. Lauderdale Station	1012	0:41	1:00	1:40	2:21	3:05	4:50	5:13	5:25	5:43	5:50	6:13	6:25	6:43	7:03	7:23	7:43	8:00	8:13	8:30	8:43	8:55	9:17	9:43
36	Pompano Beach	1002	1:00	1:19	1:59	2:48	3:24	5:04	5:26	5:39	5:56	6:04	6:26	6:39	6:56	7:16	7:36	7:56	8:10	8:26	8:44	8:56	9:09	9:27	9:56
28	Delray Station	988	1:25	1:44	2:24	3:22	3:49	5:29	5:45	6:04	6:15	6:29	6:45	7:04	7:15	7:35	7:55	8:15	8:33	8:45	9:09	9:15	9:34	9:50	10:15
22	West Palm Beach	970	1:51	2:10	2:50	3:57	4:15	5:55	6:10	6:30	6:40	6:55	7:10	7:30	7:40	8:00	8:20	8:40	9:05	9:10	9:35	9:40	10:00	10:32	10:40
19	Mangonia SX 966.3	966	1:59	2:18	2:58	4:05	4:23	6:04	6:19	6:39	6:49	7:06	7:19	7:39	7:49	8:09	8:29	8:49	9:10	9:19	9:44	9:49	10:09	10:37	10:49
18	SFRC Jct. SX 966.0	966	2:01	2:20	3:00	4:07	4:25	6:05	--	6:40	--	7:07	--	7:40	--	--	--	--	9:11	--	9:45	--	10:10	--	--
15	Lewis Terminals 295.1	964	--	--	--	4:11	--	6:10	--	6:45	--	7:12	--	7:45	--	--	--	--	9:13	--	9:50	--	10:15	--	--
14	Lake Park FEC 292.6	962	--	--	--	4:16	--	6:13	--	6:50	--	7:15	--	7:48	--	--	--	--	9:16	--	9:53	--	10:18	--	--
13	Jupiter FEC 283.3	952	--	--	--	4:30	--	6:25	--	7:02	--	7:27	--	8:00	--	--	--	--	9:33	--	10:05	--	10:30	--	--
11	N. Camp Murphy 277.8	947	--	--	--	4:40	--	6:33	--	7:10	--	7:35	--	8:08	--	--	--	--	9:40	--	10:13	--	10:38	--	--
9	S. Port Sewall 266.2	935	--	--	--	4:55	--	6:47	--	7:24	--	7:49	--	8:22	--	--	--	--	9:52	--	10:27	--	10:52	--	--
6	South Rio FEC 259.3	928	--	--	--	5:12	--	7:02	--	7:39	--	8:04	--	8:37	--	--	--	--	10:00	--	10:42	--	11:07	--	--
4	Jensen Beach 256.6	926	--	--	--	5:16	--	7:08	--	7:45	--	8:10	--	8:43	--	--	--	--	10:03	--	10:48	--	11:13	--	--
1	Fort Pierce FEC 241.5	911	--	--	--	5:43	--	7:30	--	8:07	--	8:32	--	9:05	--	--	--	--	10:27	--	11:10	--	11:35	--	--

Northbound Service			FEC	TCRA	TCRA	TCRA	TCRA	TCRA	TCRA	FEC	TCRA	TCRA	TCRA	TCRA	TCRA	TCRA	TCRA	TCRA	FEC	FEC	TCRA	FEC	TCRA	FEC	CSX	FEC
		CSX	IMX (E)	PASS	PASS	PASS	PASS	PASS	PASS	POWER UP	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	IMX (E)	POWER UP	PASS	IMX (E)	PASS	IMX (E)	CSX	ROCK
No	Station	MP	2232	P620	P622	P624	P626	P628	P630	208	P632	P634	P636	P638	P640	P642	P644	222	290	P646	2228	P648	226	K966	292
55	Miami Airport Station	1037	--	10:00	11:00	12:00	13:00	14:00	15:00	--	16:00	16:40	17:00	17:20	17:40	18:10	18:40	--	--	19:40	--	20:40	--	--	--
52	CP-IRIS 1034.2	1034	9:12	10:05	11:05	12:05	13:05	14:05	15:05	15:15	16:05	16:45	17:05	17:25	17:45	18:15	18:45	18:55	19:00	19:45	19:55	20:45	22:20	--	22:40
51	Metro Rail Transfer	1034	9:13	10:07	11:07	12:07	13:07	14:07	15:07	15:16	16:07	16:47	17:07	17:27	17:47	18:17	18:47	18:56	19:01	19:47	19:56	20:47	22:21	--	22:41
50	CSX/Amtrak Hialeah	1032	9:15	10:11	11:11	12:11	13:11	14:11	15:11	15:19	16:11	16:51	17:11	17:31	17:51	18:21	18:51	18:58	19:04	19:51	19:58	20:51	22:23	22:30	22:44
46	Hollywood Station	1020	9:33	10:27	11:27	12:27	13:27	14:27	15:27	15:38	16:27	17:07	17:27	17:47	18:07	18:37	19:07	19:16	19:23	20:07	20:16	21:07	22:41	22:50	23:05
42	NE-DANIA SX 1014.4	1014	9:44	10:38	11:38	12:38	13:38	14:38	15:38	15:53	16:38	17:18	17:38	17:58	18:18	18:48	19:18	19:27	19:38	20:18	20:27	21:18	22:52	23:05	23:21
40	Ft. Lauderdale Station	1012	9:52	10:43	11:43	12:43	13:43	14:43	15:43	16:01	16:43	17:23	17:43	18:03	18:23	18:53	19:23	19:35	19:46	20:23	20:35	21:23	23:00	23:10	23:31
36	Pompano Beach	1002	10:06	10:56	11:56	12:56	13:56	14:56	15:56	16:24	16:56	17:36	17:56	18:16	18:36	19:06	19:36	19:49	20:09	20:36	20:49	21:36	23:14	23:29	23:58
28	Delray Station	988	10:31	11:15	12:15	13:15	14:15	15:15	16:15	16:57	17:15	17:55	18:15	18:35	18:55	19:25	19:55	20:14	20:42	20:55	21:14	21:55	23:39	23:54	0:32
22	West Palm Beach	970	10:57	11:40	12:40	13:40	14:40	15:40	16:40	17:26	17:40	18:20	18:40	19:00	19:20	19:50	20:20	20:40	21:11	21:20	21:40	22:20	0:05	0:20	1:07
19	Mangonia SX 966.3	966	11:06	11:49	12:49	13:49	14:49	15:49	16:49	17:34	17:49	18:29	18:49	19:09	19:29	19:59	20:29	20:49	21:19	21:29	21:49	22:29	0:14	0:28	1:15
18	SFRC Jct. SX 966.0	966	11:07	--	--	--	--	--	--	17:36	--	--	--	--	--	--	--	20:50	21:21	--	21:50	--	0:15	0:30	1:17
15	Lewis Terminals 295.1	964	11:12	--	--	--	--	--	--	17:40	--	--	--	--	--	--	--	20:55	21:25	--	21:55	--	0:20	--	1:21
14	Lake Park FEC 292.6	962	11:15	--	--	--	--	--	--	17:45	--	--	--	--	--	--	--	20:58	21:30	--	21:58	--	0:23	--	1:26
13	Jupiter FEC 283.3	952	11:27	--	--	--	--	--	--	17:56	--	--	--	--	--	--	--	21:10	21:41	--	22:10	--	0:35	--	1:40
11	N. Camp Murphy 277.8	947	11:35	--	--	--	--	--	--	18:05	--	--	--	--	--	--	--	21:18	21:50	--	22:18	--	0:43	--	1:50
9	S. Port Sewall 266.2	935	11:49	--	--	--	--	--	--	18:20	--	--	--	--	--	--	--	21:32	22:05	--	22:32	--	0:57	--	2:05
6	South Rio FEC 259.3	928	12:04	--	--	--	--	--	--	18:37	--	--	--	--	--	--	--	21:47	22:22	--	22:47	--	1:12	--	2:22
4	Jensen Beach 256.6	926	12:10	--	--	--	--	--	--	18:41	--	--	--	--	--	--	--	21:53	22:26	--	22:53	--	1:18	--	2:26
1	Fort Pierce FEC 241.5	911	12:32	--	--	--	--	--	--	19:05	--	--	--	--	--	--	--	22:15	22:50	--	23:15	--	1:40	--	2:53

Notes: Tri-Rail trains are numbered in the 6xx series. CSXT trains are numbered as per historical practice. FEC's existing trains are numbered according to the FEC's operating plan. New FEC trains added to allow for future capacity expansion are numbered in the 2xxx series.
If a freight train should miss its path, it is possible for it to utilize a later 'spare' path intended for future expansion (e.g. late #202 runs as #2202, late #222 runs as #2228). Spare capacity exists to schedule additional train-starts for future 'spare' paths. It is recommended that all traffic over the SFRC run in designated paths, and all trains over the SFRC carry sufficient motive power to conform to timing profiles used in scheduling design.

Train Scheduling Findings – The train planning exercise confirmed that rerouting of the current and future FEC trains onto the SFRC is operationally feasible. Specific findings are listed below:

- **Existing FEC Schedule Maintained** – The current FEC train-starts can maintain the existing 'typical' schedule, with adjustments of less than 15 minutes for most trains.[37]
- **Scheduled Paths Maximize Capacity Utilization** – FEC road trains should be planned to operate at designated times (on pre-defined train-paths) whenever possible. Operating on schedule maximizes capacity utilization.
- **Flexibility is Provided within a Window** – When it is not possible to operate on the scheduled path due to upstream delays, FEC trains can use other available paths within the operating time-window reserved for FEC road train operations. The windows are sufficiently finely divided that FEC train-starts would not be materially affected.
- **Shared-Use of SFRC not as Flexible as Exclusive Use of SFECC** – Requiring operations within designated time-windows will reduce timing flexibility, compared to status-quo operation over the SFECC. Some in-built flexibility is possible by switching and trading train-paths and operating windows between scheduled FEC trains, but FEC trains must be excluded from certain time periods. If additional flexibility is desired, then further mitigation measures would be necessary.
- **Southbound Intermodal Trains** would be forbidden from the SFRC during the peak of the peak. No southbound intermodal trains could operate between 20-minute commuter headways without impacting the on-time performance of Tri-Rail. Only one intermodal train path is available between 30-minute commuter headways. However, intermodal trains are not required to avoid the entire Tri-Rail rush hour when powered in the range of 1.0 hp/ton or above.[38]
- **Northbound Rock Trains** would be forbidden from the SFRC during the entire peak period. Rock trains must avoid train-starts during the Tri-Rail rush hours. Despite these restrictions, a set of additional mitigation measures would be necessary to 'make' the schedule. Rescheduling two out of four northbound FEC heavy rock trains (Trains 208 and 290) would be required. Mitigations entail: (a) addition of one extra locomotive when train exceeds 120 cars; (b) restriction of loads to 120 cars when only 3 locomotives are used, or the train must follow the last passenger departure of the day after 8:45 pm.

In summary, all southbound FEC trains would be prohibited from operating on the SFRC for a total of 214 minutes each day during the two periods when passenger trains are operating at 20 minute headways. The corresponding northbound restrictions would total 210 minutes each day.

The northbound movement of heavily loaded rock trains as presently operated is not suitable for interoperation with passenger services on the line, taking as much as 45 minutes longer than a local passenger train to traverse the corridor. Adding a fourth locomotive to the heaviest rock trains would allow them to operate during off peak periods. The northbound evening embargo of rock trains would be 210 minutes long from approximately 15:20 to 18:50. No northbound rock trains are operated in the morning peak.

[37] Except for two northbound rock trains. Trains 290 and 292 departs at 19:00 and 22:40, instead of 17:15 and 22:00 respectively. If Train 208 misses its slot at 15:15, the next available slot would be 16:07, and the one after that is 18:57. Train 290 could use the 16:07 slot, but the 16:07 slot carries a delay risk to Tri-Rail Train 634.

[38] This constraint could be relaxed allowing FEC intermodal trains to operate in the peak if they were "powered-up" with additional locomotives.

4.2 Infrastructure Needs

Two connections between the SFRC and the SFECC are required. A south-end connection, to divert northbound FEC traffic onto the SFRC, and a north-end connection, to divert the traffic back onto the FEC mainline to the north. The same process takes place in reverse for southbound FEC traffic.

South End Connection – For the SFRC Freight Spine, the two railroads will require connection via a new connection at CP-IRIS, near the south end of SFRC and SFECC. The Iris interlocking modification would add a new track between the north-south SFRC alignment and the east-west FEC alignment. This connection would require demolition of several buildings west of the current Metrorail Transfer facility, constructed in the quadrant north-west of the present diamonds. It appears possible to construct the connection without affecting the Metrorail station.

About 18 FEC trains pass over the Iris diamond on the FEC alignment on a daily basis. 40 (soon to be 50) daily Tri-Rail trains (and occasionally rock trains and local freights moving to and from CSXT's Homestead Division and/or downtown lead) use the Iris diamond on the SFRC alignment. CSXT's road freights to and from the north and Amtrak trains do not currently pass Iris interlocking.

The Iris modification is required unless it is possible to consolidate all of the yard activity of both carriers to an appropriate yard and re-route local train traffic accordingly. At present, this is considered unlikely, due to the very different nature of operations that take place at FEC's and CSXT's yards. FEC Hialeah is first and foremost an intermodal yard, whereas CSXT Hialeah is a classic classification yard used to sort loose freight cars.

North End Connection – A variety of alignment alternatives are possible for a north-end connection between SFRC and SFECC. A list of possible locations for the connector is given in Table 4.8. More details about these connections are found in a Technical Memorandum, "Alignment Alternatives for North-end Connection between SFRC and FEC", dated June 5, 2006.

Table 4.8
Possible Locations for North End FEC-SFRC Connections

Align. Option	Brief Description	Approx. Length (Miles)	Curve Radius Constraint	SFRC Junction Milepost	FEC Junction Milepost
1	FEC K-Branch via Marcy and Ft. Pierce	~28	~3º	SX 922.2	MP 243.6
2C	New Canal C-17 Alignment via Canal Frontage	~4	11.5º	SX 965.3	MP 291.8
3B	New FP&L Right of Way Alignment	~1.3	12º	SX 966.0	MP 295.5
4B	Revised Northwood Connection (major re-alignment)	0.5	6º	SX 968.3	MP 297.5
5C	Waterworks, north of courthouse hybrid	0.6	10º	SX 969.8	MP 299.2

For the purposes of this analysis Alignment 3B was assumed. With Alignment 3B, a southbound FEC train needing access to the SFRC would be routed into the West track (siding) at Lake Park, MP 292.6. Here, it will await for a train-path[39] on the SFRC. Once clearance is granted, the train will proceed

[39] If a train is able to proceed through an area without being impeded by another train, then a *train path* is said to be available to that train. A train path is a theoretical construct used in scheduling. It is available to exactly one train; if two or more

south to MP 295.5, where it would take the turnout to access the Florida Power & Light (FP&L) connector, and thence join the SFRC at CSXT Milepost SX 966.0 in the vicinity of a sand and gravel plant, approximately a half-mile north of Mangonia Park. A northbound train joining the FEC would wait for an FEC northbound train-path on the FP&L connector. Selection of another north end connection would affect some, but not all, conclusions of this analysis. The analysis assumes that no other infrastructure improvements to the SFRC are made to provide capacity for the FEC operations.

Design of Overtaking Siding – In lieu of "powering-up" FEC freight trains (especially northbound rock trains) to improve the match in speed and performance between freight and passenger trains, it would be possible to construct an overtake siding on the SFRC that would allow faster passenger trains to overtake (pass) slower freight trains ahead on the same track. The overtake sidings could also be employed in conjunction with "powered up" trains to provide additional flexibility in the interoperation of freight and passenger movements. Preliminary investigation indicated three potential available sites for a passing siding designed for overtaking. The sites are shown in Table 4.9 and Figure 4.3:

Table 4.9
Potential Sites for "Overtake" Sidings

Site	North End	South End	Length (miles)	Features
1	Deerfield SX 998.5	Pompano SX 1001.4	2.9	SX 998.7: Publix Spur SX 999.2: Parker Interlocking SX 1000.2: Grade Crossing SX 1001.3: Grade Crossing
2	Pompano SX 1001.5	Atlantic Blvd. SX 1004.4	2.9	SX 1001.8: Home Depot Spur SX 1002.4: Grade Crossing SX 1002.6: Rinker Spur SX 1002.8: Bonsal Spur SX 1003.2-SX 1004.3: Existing "freight village" – short 3 track section SX 1003.4: Grade Crossing SX 1003.9: Grade Crossing
3	Oakland Park Blvd. SX 1009.0	SX 1011.9 (North of North Fork New River Bridge)	2.9	SX 1009.6: Overbridge SX 1010.7: Jones Chemicals Spur, Grade Crossing SX 1011.1: Bradco Spur, and Overbridge SX 1001.6: Grade Crossing

Any of the sites allow a 1.5-mile long (8,000 ft) freight train to stop without blocking any grade crossings. The typical maximum train length operated in South Florida by both CSXT and FEC is 8,000 feet, although this is not a strict limit and is exceeded as traffic conditions dictate. None of the sites located would allow a 1.8-mile long (9,500 ft) train to stop without blocking any crossings. The operating rules governing the exit from siding at both ends could be designed such that a 8,000 feet train would not block any crossings. For instance, travelling southbound in the siding at Site 1, trains would be stopped north of N.W. 48th Street while waiting for another train to pass. Only when the main track ahead is clear, would the freight train then be permitted to operate across the N.W. 48th Street crossing.

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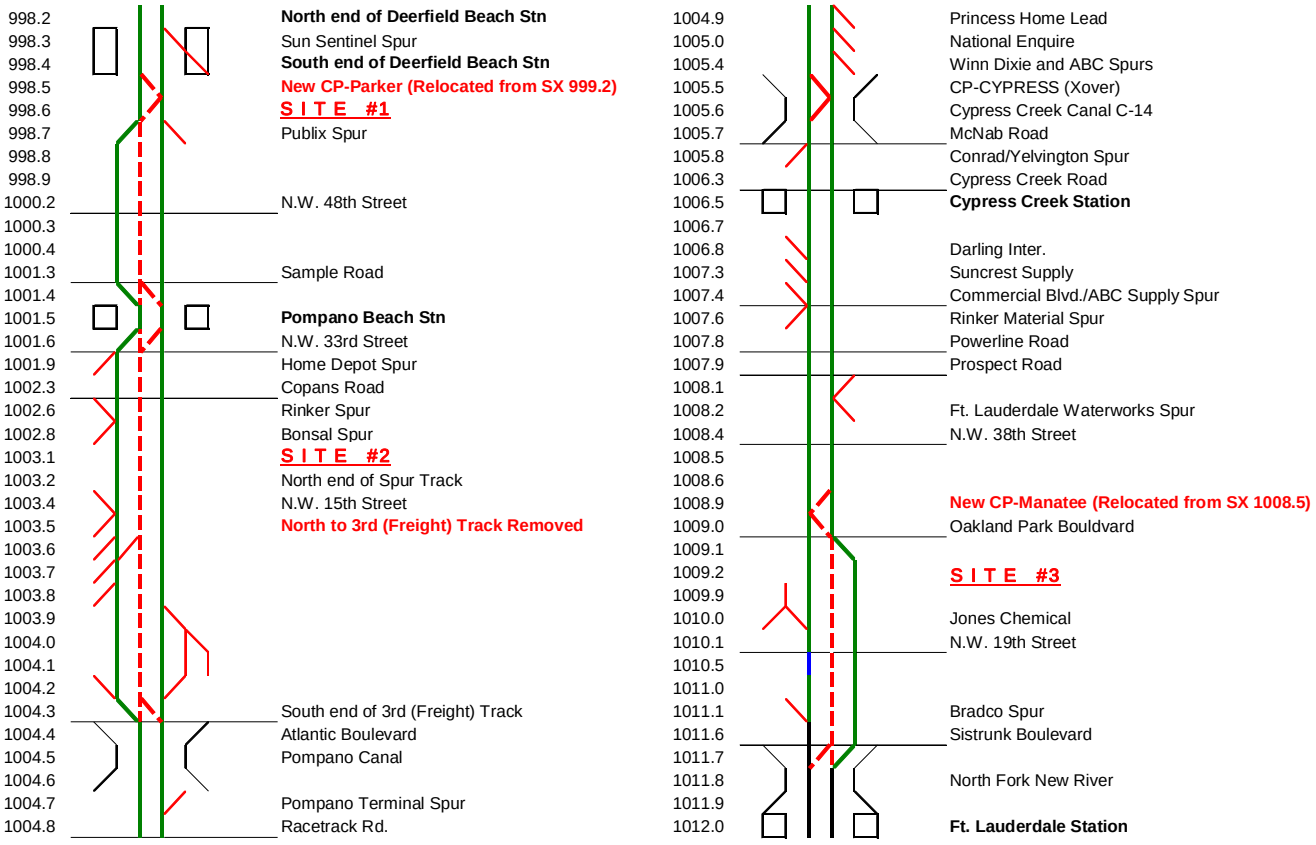
trains attempt to use the same train path, one or the other train will be delayed. Train paths are typically separated from each other by the minimum operable headway constraint of the signalling plant (typically between 2 to 5 minutes).

Figure 4.3
Track Layouts for Potential Overtake Sidings



4.3 Highway Safety

The SFRC Spine scenario would send about 22 trains through SFRC grade crossings during the morning rush hour, and 16 trains during the evening peak. This results in about 2,500 daily grade crossing activations on the SFRC during the peak commuter hours, or 500 more than the Status Quo. The resulting number of train crossings on the SFRC for the entire day would be about 6,500, up from 4,500 in the Status Quo.

Table 4.10
SFRC Spine Local and Road Train Counts by Segment (FEC Future Train Counts)

Time of Day / Segment Centroid	Night 0000-0559	AM 0600-0859	Midday 0900-1559	PM 1600-1859	Evening 1900-2359	Typical Train Count	Total Grade Crossings in Segment	Daily Train Crossings
Boynton	16	21	23	14	20	94	33	3,102
Fort Lauderdale	14	22	22	16	20	94	27	2,538
Metrorail	9	17	22	13	16	77	8	616
25th St	3	13	16	12	8	52	4	208
						Total	72	6,464

The total number of daily train crossings on the SFRC is increased by about 2,050 activations. However, the number of train crossings on the SFECC would be reduced by 4,150.

Table 4.11
Increased Crossing Use between Status Quo and SFRC Spine

Time of Day / Segment Centroid	Night 0000-0559	AM 0600-0859	Midday 0900-1559	PM 1600-1859	Evening 1900-2359	Increase in Typical Train Count	Total Grade Crossings in Segment	Increase in Daily Train Crossings
Boynton	6	6	7	1	11	31	33	1,023
Fort Lauderdale	5	7	6	1	12	31	27	837
Metrorail	4	5	6	1	8	24	8	192
25th St	0	0	0	0	0	0	4	0
						Total	72	2,052

The benefits of the SFRC in reduced SFECC grade crossing activations are evident. Under this scenario, the FEC would send only two trains through the grade crossings in West Palm Beach during the peak hours. The scenario brings the total peak period crossings generated by the SFECC down from 1,450 to 400, a crossing activation reduction of 1,050. Therefore, the SFRC Spine plan would reduce the number of peak-hour train crossings by half. The number of train crossings on the SFECC in the study area for the entire day is about 1,000, down more than 4,000 compared with the Status Quo on the SFECC.

Table 4.12
FEC Train Counts by Segment – SFRC Spine Scenario

Time of Day / Segment Centroid	Night 0000-0559	AM 0600-0859	Midday 0900-1559	PM 1600-1859	Evening 1900-2359	Typical Train Count	Total Grade Crossings in Segment	Daily Train Crossings
Iris	0	1	1	0	1	3	22	66
North Miami	0	1	1	0	1	3	8	24
Ojus	0	1	1	0	1	3	33	99
Wilton Manors	1	2	1	1	2	7	37	259
Deerfield	1	1	1	1	1	5	18	90
Hyperluxo	1	1	1	1	1	5	71	355
Lake Park	1	1	1	1	1	5	23	115
						Total	212	1,008

Table 4.13 summarizes the grade-crossing risk comparison for the SFRC Spine scenario. By and large, the FEC trains operate in the evening and at night. Those were the time periods that saw the most dramatic changes in grade crossing activations. However, the reduction in grade crossing risk during the peak hours and day time is substantial, because the removal of a small number of trains from the FEC would result in a large reduction in activation count. Overall, regional daily total grade crossing activations are reduced by 2,100 (approximately 22%).

Table 4.13
Daily Train Grade Crossings by Time Period for All Alternatives

Alternative	Status Quo		SFRC Spine		Change		
Time Of Day	**SFRC**	**FEC**	**SFRC**	**FEC**	**SFRC**	**FEC**	**Net**
Night 0000-0559	625	1,934	990	149	365	–1,785	–1,420
AM 0600-0859	1,048	785	1,475	249	427	–536	–109
Midday 0900-1559	1,152	524	1,593	212	441	–312	129
PM 1600-1859	978	673	1,046	149	68	–524	–456
Evening 1900-2359	609	1,225	1,360	249	751	–976	–225
Daily Total	4,412	5,141	6,464	1,008	2,052	–4,133	
Total for Alternative	9,553		7,472		–2,081		

4.4 Economics

SFRC Freight Spine operation between Fort Pierce and FEC's Hialeah Yard in Miami entails 27 daily train starts (23 road trains and four locals) covering 3,030 daily train miles in the study area. For FEC trains, the SFRC Spine route is approximately 130 miles long, four miles longer than the Status Quo.

Table 4.14
Operating Economics by Carrier Under SFRC Spine Scenario

Item		FEC Status Quo	FEC Using SFRC Spine	Change	% Change	CSXT (Unchanged)
Daily Train Miles (South of Fort Pierce/Marcy)		2,950	3,035	85	3%	606
Approximate Daily Car Miles		327,324	337,100	9,776	3%	48,928
Typical Daily Train Starts		27	27	0	0%	9
Distance from Hialeah to Fort Pierce or Marcy	Route Miles	126	130	4.7	4%	111
	Track Miles	168	176	7.3	4%	176

The overall impacts of operating the SFRC as a regional freight spine on users of the SFRC are modest:

- **CSXT Freight Trains:** The current CSXT train-starts can maintain the existing 'typical' schedule.
- **Commuter Trains:** The current and planned Tri-Rail train-starts for up to 50 trains daily can be accommodated without deviations.
- **Amtrak Trains:** The current Amtrak service can be accommodated without deviations. Reasonable future changes in Amtrak schedules are possible.
- **Local Freight Trains:** Local trains would be required to operate between hourly passenger trains and occasional freight trains during the passenger midday period between 10:20 am and 3:40 pm, when they could have mostly exclusive use of one track (shared only with MOW requirements). They could also operate between road freight trains during the overnight period between 9:50 pm and 5:15 am.
- **Maintenance of Way:** The maintenance of way personnel continue to work on track during the daytime hours, when train densities are sufficiently low to permit one of the main tracks to be taken out of service without substantially delaying operations. In the off-peak, the railroad is operated in 'Bi-directional' mode; road train traffic in either direction operate on one main track while the other is reserved for maintenance.

If deviation from scheduled paths is required, additional operating costs for freight carriers would occur. The discussions of cost impacts for all of the necessary mitigation measures, and for the consequences of the necessary operating restrictions, are presented below.

Operating Cost Impacts – Rerouting of FEC trains can affect operating costs relating to: motive power requirements, vehicle cycle impacts, crew on-duty time impacts, mileage impacts, and other miscellaneous operating cost impacts.

- **Motive Power Requirements** – As discussed in the previous section, two rock trains would require additional power. A total of four locomotives would need to be added to FEC's peak power requirement to meet this need for additional power north from Miami. It is assumed that

five locomotives would need to be added to the FEC fleet to achieve the necessary level of power availability.[40]

- **Vehicle Cycle Impacts** – None of the trains on the FEC suffered substantial delay as a result of being routed via the SFRC. Trains generally held the same departure time ranges as they did previously, to within 10 minutes. It is expected that the revised timings will not materially affect the equipment cycles.

- **Rock Trains –** Two rock trains departing during the evening peak were rescheduled due to potential passenger train impact considerations. Maintaining rock train vehicle cycles is critical to operation. The proposed SFRC spine operating plan allows all FEC rock trains to operate without lengthening their equipment cycles, and appears operable without adverse impacts to FEC's aggregates business.[41] FEC train cycles would not affected by the timing adjustments.

- **Crew Time Impacts** – Crews of a very limited number of southbound FEC trains arriving late at the north end of the shared track segment may need to be replaced with a fresh crew to avoid violations of federal hours of service regulations on the shared track segment. Presently only one daily train from Jacksonville poses a substantial risk in this regard.

- **"Meet-Me" Trains** – Some of FEC's trains are operated as "meet-me" trains, where a train swaps crew with its opposite number during a train-meet approximately half-way between the origin and the destination.[42] The SFRC Spine operating plan allows current FEC intermodal trains to retain their scheduled departure windows, and scheduled trip times between Iris and Fort Pierce. This allows existing "meet-me" train pairs to be maintained.

- **Maintenance Costs** – The FEC is concerned that operating heavy freight trains over the SFRC may lead to increased maintenance costs that may be charged to the FEC via track access fees. They note that maintenance costs on the SFECC would not decrease commensurately, leading to duplicative and economically unproductive increase in maintenance costs.

Time Saved on Double-Track Infrastructure – On average, each meet and pass on FEC's single track territory consumes approximately 30 minutes[43] (range: 10 to 60 minutes). The delay per meet is likely to increase[44] as the FEC adds new trains to the corridor responding to traffic growth. The use of the

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[40] Conceptually it may be possible to avoid this extra power requirement. An overtaking siding in the vicinity of Cypress Creek or Pompano (Milepost SX 1004) might be lengthened to allow trains to 'pull over' and allow a commuter train to pass. The construction of this facility would also allow all freight trains to interoperate more freely with passenger operations. With such a facility, peak period prohibitions on operation of through freight services could be relaxed or possibly rescinded. However, this is a complicated arrangement. The rock train, once stopped, would take a long time to re-start and reach balancing speed. The siding may need to be sufficiently long to allow the freight train to keep moving while Tri-Rail trains passed. Further studies are needed to determine the costs and feasibility of adding power versus constructing the siding to allow same-direction passes.

[41] The operation of Train 208 precludes the possibility of adding a 15:30 Tri-Rail northbound departure from Miami Airport to Mangonia Park. Operation of a 15:30 departure from Miami Airport to Fort Lauderdale (and short-turning there) remains possible. Thus far, Tri-Rail has not expressed interest in operating a 15:30 departure. The Tri-Rail afternoon peak period (for the 50-daily-trains operating plan) begins at 16:00.

[42] Stagl, Jeff. "Florida East Coast and Beyond", *Progressive Railroading* interview with Charles R. Lynch, September 2004, p.42.

[43] See Task 2.12, SFECC Existing Railroad Facilities and Operations, Table 3.2, p.49 (version of March 9, 2006.)

[44] As the traffic on a single-track railroad approaches capacity, the number of meets and passes required increases in proportion with the square of the number of trains (see Memo on "Passenger Rail Level of Service Concepts and Application to SFECC Corridors"). If the run-time between sidings is not integral multiples of each other, the delays to trains per meet also increases nonlinearly. In general, single-track railroads are built with sidings at discrete run-time intervals as much as

double-track SFRC between Iris and Mangonia allows running-meets for the southernmost 70 miles of the overall route, saving valuable time for the FEC road train crews. Table 4.15 offers a list of the observed number of single-track train meets on Friday, December 09, 2005. The estimated potential time saved if the trains operated on the double-track SFRC is shown in the right hand column.

Table 4.15
Observed Train Meets and Potential SFRC Spine Time Savings,
(FEC, December 09, 2005)

Train Number [45]	Number of Meets South of Lake Park [46]	Estimated Time Saved on SFRC Spine
292 08	2	57.4
226 08	1	28.7
191 08	1	28.7
193 08	1	28.7
206 09	1	28.7
240 09	1	28.7
202 09	2	57.4
143 09	1	28.7
222 09	1	28.7
292 09	1	28.7
Totals:	**12**	**344**
Southbound	3	86
Northbound	9	258

This table indicates that at the current traffic levels, the FEC could save almost six daily crew-hours per 24-hour period if the trains were routed on the SFRC Spine. However, SFECC improvement programs with committed state funds are scheduled for implementation by 2011. These improvements would tend to reduce the forecast time savings. The double-tracking between Hypoluxo and Villa Rica sidings could reduce the daily number of "stopped meets" from the 12 reported here to as few as eight, eroding the time-advantage of using the SFRC Spine.

For the typical FEC through freight train operating on the current SFECC infrastructure, the SFRC route could be up to 30 minutes faster by avoiding meet-pass delays. However, some of these time savings may be offset by time consumed waiting for operating windows between passenger trains at the interchange points, Iris and Lake Park. The time consumed by train pathing at the interchanges is discussed below.

Time Consumed by Train Pathing at Interchanges – With the SFRC Spine operating, freight trains must depart in designated windows to avoid impacting the passenger services. In the northbound direction, a train ready to leave Hialeah must await for the next suitable path on the SFRC, operate north to Mangonia, and again await on the connector for a suitable northbound path on the FEC. Southbound trains might also be delayed on the connector, while it awaits a suitable southbound path. Analysis

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possible. However, for a variety of historical reasons, this is not the case on the entire length of the FEC. The net result is that longer waits at sidings will result when train traffic is very busy. This condition is routinely observed on Wednesday, Thursday, and Friday nights between Piñeda and Lake Park.

[45] Only trains that could be diverted to the SFRC are counted. Trains that must remain on the SFECC under the freight integration plan are not counted.

[46] Only train meets at sidings in single track territory where the train is actually stopped while waiting for an opposing train to pass is counted. Passes in the same direction, or a run-by (where one train is already stopped in a siding and another train simply passes by at linespeed on the main line) are not counted.

indicates that these delays would be generally much less than delays currently experienced due to meets and passes on the current single track SFECC.

In the Status Quo, 86 southbound daily delay minutes for meets and passes are expected on a typical day. With the SFRC Spine the corresponding delays waiting for available path are expected at 63 minutes. In the northbound direction, 258 daily delay minutes is expected on SFECC on a typical day. With the traffic rerouted over the SFRC, the corresponding delays waiting for available path at Iris is expected at about 40 minutes. The observed northbound delay minutes for the SFECC is much higher than the southbound delay minutes due to dispatching priority being given to southbound trains. For details on this analysis refer to Appendix A.

Table 4.15
Changes in Total Expected Daily Delay Minutes

Direction	Status Quo Meet/Pass Observed Daily Delays	SFRC Pathing Projected Daily Delays	Change	% Change
Northbound	86	63	–23	–27%
Southbound	258	~40	–218	–84%

Analysis of FEC's Current Use of Relief Crews – The current FEC road train operations between Miami and Jacksonville are scheduled for up to ten hours (implying an average delay of 60 to 90 minutes above non-stop run-time). This matches the average delay within that service group as reported in FEC Morning Reports, currently about 90 minutes. If the scheduled trip times exceed 10½ hours, there would be a concern that federal 12-hour limits on crew on-duty times will be exceeded if unusual circumstances arise. However, only one current daily FEC train poses a substantial risk of outlawing on SFRC Spine. A relief crew might be required for this train on some mornings before it is allowed to enter the shared track territory.

Mileage Impacts – The mileage impacts to FEC trains and to CSXT trains will depend on the choice of connector, particularly at the north end. The additional run-time required (independent of any scheduling-related delays) will depend on the mileage. In designing the SFRC Spine Scenario, the non-stop runtime between Iris and Fort Pierce for FEC trains was evaluated for the purposes of scheduling. In this section, the mileages are compared for a variety of infrastructure options, to determine the likely impact to FEC's car-mileages.

Table 4.16
Comparison of Mileage Impacts for FEC and CSXT Trains

Carrier		FEC		CSXT	
Align. Option	Brief Description	Miles to Fort Pierce	Change vs Base Case	Miles to Marcy	Change vs Base Case
Status Quo	FEC trains to operate via the FEC; CSXT trains to operate via the SFRC	125.1	–	111.7	–
1	FEC K-Branch via Marcy and Ft. Pierce	145.5	20.4		
2C	New Canal C-17 Alignment via Canal Frontage	124.7	–0.4		
3B	New FP&L Right of Way Alignment	125.7	0.6		
4B	Revised Northwood Connection (major re-alignment)	124.5	–0.6		
5C	Waterworks, north of courthouse hybrid	124.2	–0.9		

As shown in Table 4.16, the choice of any of the north end connections in the vicinity of West Palm or Riviera would not dramatically affect mileage for FEC trains. The K-Branch connection at Fort Pierce

represents a major detour for FEC trains, adding 20 miles to every FEC trip. The difference in mileage between the FEC and SFRC routes is negligible for the purposes of economic route costing algorithms.

4.5 Competitive and Institutional Considerations

Operation of the SFRC Spine scenario was briefly discussed with FEC officials who were wholly unsupportive. FEC's concerns included: control of the railway, potential for conflicts with non-FEC trains, and costs for redundant facilities. In FEC's view, each of these considerations would tend to make the FEC less competitive in South Florida.

Presently, the FEC operates on a railway which it owns, controls, maintains, dispatches, and does not share with other carriers. The SFRC is owned by Florida DOT, maintained and dispatched by CSXT, jointly controlled by CSXT and Florida DOT and shared by Tri-Rail, CSXT and Amtrak. FEC indicated that it would be completely unwilling to route its mainline operations over a railway dispatched and maintained by its largest competitor. With the advent of "Phase B", Florida DOT could take control of dispatching and maintenance. However, FEC still would demur rerouting a key segment of its network over mainlines shared with other operations and dispatched/maintained by a third party as long the FEC had the option to use its current route.

Rerouting FEC through freight operations would interleave up to 24 FEC through trains with 54 passenger trains and all CSXT operations in the corridor. While the capacity for such an operation has been demonstrated, the risk for FEC operations to be delayed by train movements and crews outside their control would be dramatically increased. The fear of systematic delays due to potential future deficiencies in the operation of trains by SFRTA, Amtrak and CSXT would be a substantial concern for the FEC. FEC is also concerned about the loss of flexibility of train departure slots due to the need to accommodate the needs of other carriers, particularly Tri-Rail.

If the FEC were to reroute its through trains onto the SFRC, it would retain its common carrier obligation and market incentives to maintain its SFECC route. Under federal law, the FEC is obliged to provide freight service along the SFECC as long as it remains economically feasible. It is difficult to conceive of a circumstance where the FEC's South Florida mainline could be portrayed to federal regulators as a financially debilitated freight line. With the Port of Palm Beach and the Port Everglades receiving their only direct service from FEC it very unlikely that the FEC would be able to abandon the freight route. If the route is still active, maintained and controlled by the FEC, the SFRC spine scenario places the FEC in the position of forsaking capacity it owns and controls to use a redundant second facility where it would be one of several tenants. This circumstance would tend to add to FEC's costs of operation with no substantial benefits to offset the costs.

As noted in the discussion of the Status Quo condition, Florida DOT is not free to offer use of the SFRC to FEC without explicit permission from CSXT. It is unlikely that CSXT would freely allow FEC onto the SFRC without some compensating allowance. The nature of that compensation has not been explored with CSXT.

Similarly Florida DOT cannot force FEC to reroute any of its trains from the SFECC. Independent of an incentive from Florida to reroute trains, FEC is extremely unlikely to use the SFRC for any of its operations. The nature and magnitude of such an incentive has not been explored with FEC.

The regional competitive impacts of the SFRC Spine operation would be neutral at best. FEC and CSXT service would operate over the same infrastructure but remain essentially unchanged. However, FEC's flexibility to unilaterally innovate, grow and offer superior service to entice premium traffic would be circumscribed by the need to coordinate with other users of the spine. Moreover, FEC's costs

for serving its local customers, the ports and its intermodal terminal in Fort Lauderdale would be increased as it defrays the fixed costs for the SFECC over fewer units of traffic.

In summary, the competitive impacts and institutional hurdles associated with the SFRC Spine are not attractive. It seems that implementation of elements of the SFRC Spine scenario would only seem worthwhile if circumstances surrounding development of passenger services along the SFECC were sufficiently grave to force the State to consider this as fallback option.

4.6 Conclusions

Based on this analysis, the following conclusions are possible:

- **Adequate capacity exists on the SFRC to carry all through SFECC freight traffic.** The scheduling analysis demonstrated that more than 14 northbound train paths and 14 southbound train paths are available to carry rerouted FEC trains at times they have historically moved. The total 28 train paths found (and more are available) exceed the highest projected future FEC requirement of 24 daily paths.
- **The SFRC is a high capacity facility.** In addition to providing the 28 train paths for displaced FEC trains, the SFRC would also be able to host 6 daily CSXT trains, 50 daily Tri-Rail trains, 4 daily Amtraks. Despite the operation of more than 88 daily "scheduled" trains, the corridor continues to have capacity to host CSXT local freight trains between 10:20 am and 3:40 pm, and between 9:50 pm and 5:15 am, in addition to allowing windows for maintenance of way activities. This high capacity arises from the CTC signalling system that permits full bi-directional operations, with complete double-track and numerous crossovers.
- **Scheduling on high usage facilities require pre-determined operating windows.** To maximize capacity utilization, all trains operating on the SFRC should have very similar performance characteristics. This is not the case with typical current FEC trains. The SFRC was therefore divided into discrete windows for freight and passenger use. Southbound intermodal trains are prohibited from the SFRC during the height of the peak period. Northbound rock trains are forbidden from the SFRC during the entire peak.
- **'Parade' operations of rock and passenger trains require further study.** One of the main findings of the train performance simulation was that the maximum-load condition northbound rock train with a power-to-weight ratio of 0.5 hp/ton would have difficulty clearing the SFRC between half-hourly scheduled passenger trains, and that the maximum-load southbound intermodal with 1.0 hp/ton would have difficulty clearing the SFRC between scheduled passenger services at 20 minute headways. To further improve flexibility for FEC operations, more study could explore the load limits or motive power requirements necessary to allow less restrictive operations for both intermodal and rock trains.
- **Dispatching rules.** The smooth operation of the SFRC spine will frequently require dispatcher intervention. The dispatcher will need to be acutely aware of timekeeping of trains arriving from the north (both CSXT and FEC), the status of their crews (in relation to hour-of-service limits), any unusual circumstances occurring in Tri-Rail operations, and any events that may cause delays to pull-outs from both CSXT Hialeah and FEC Hialeah. A clear and fair set of decision rules is needed to allow the dispatcher to resolve conflicting needs for SFRC train paths with the least possible disruption to both passenger and freight services.
- **Competitive and institutional concerns.** There are substantial institutional hurdles to implement the SFRC Spine and few, if any, competitive advantages perceived by the freight railroads to induce their cooperation with the institutional challenges.

5. THE WESTERN BYPASS (WBP)

This section describes a feasible operating plan to reroute through-freight traffic between Southern Dade County and north of Palm Beach County. Trains are rerouted from the SFECC and the SFRC onto a proposed Western Bypass alignment. The analysis describes the operational, infrastructure, highway, safety, economic, competitive, institutional, and environmental concerns related to this scenario.

The operating plans for the region's two freight carriers, Florida East Coast Railway (FEC) and CSX Transportation (CSXT), are described. Such planned operations would require substantial infrastructure investment in the new freight by-pass alignment.

5.1 Freight Operations and Train Movements

The Western Bypass would remove 18 current daily trains from the SFECC, and 2 daily trains from the SFRC, based on current traffic patterns. This leaves a less extensive freight operation that could share track with new passenger services. The FEC has indicated that their traffic patterns may change in the future as markets respond to global economic forces. In particular, Fort Lauderdale is not currently served by Miami-based trains but this operating plan may change in future, requiring more Miami trains to be routed via the SFECC.

At present 18 'rerouteable' trains operate over the SFECC daily. However, 24 trains are added to the Western Bypass in this plan. The extra six FEC trains represent capacity needed for future growth. Two average daily CSXT trains (between one and four current trains a day[47]) are removed from the SFRC, but six trains are added to the Western Bypass. The six CSXT trains also represent capacity for growth.

A Western Bypass schedule was designed and evaluated. In this analysis, the study team assumed that two daily trains used the Medley Lead for local access in addition to the FEC road trains. One round-trip local a day was assumed to work the northern end of the route on the SCFE/FEC K-Branch, starting in Fort Pierce and running around near South Bay. The impacts of the operating plan are documented.

As explained earlier not all freight services could be rerouted. FEC road trains that serve Fort Lauderdale and West Palm Beach (six trains daily), FEC local trains (four daily trains), CSXT general merchandise trains (two daily trains, serving Fort Lauderdale), and CSXT local trains (four daily trains) could not be removed from their present routing due to the need for local shipper access.

The bypass would likely reduce grade crossing conflicts on the SFECC and SFRC and reduce freight train interference for passenger operations. However, it will require the construction of a new 60-mile long railway on a new right of way 1,200 ft west of the existing U.S. 27 corridor. This new right-of-way would cut through an environmentally sensitive major wetland, the Florida Everglades.[48]

Trains Rerouted – All non-stop road freight trains operating to and from CSXT's Hialeah Yard and FEC's Hialeah Yard, and originating from or destined for points north of the SFECC study area (Tequesta/Jupiter), are candidates for rerouting to the Western Bypass.

1. Nine FEC General Freight Trains between Bowden and Miami (FEC Southbound Trains 101, 105, 107, 121, 125; Northbound Trains 202, 206, 222, 226)
2. Two FEC Auto Carrier Trains between Bowden and Miami
3. Seven FEC Rock Trains and corresponding empties between Southern Dade County and points north of Palm Beach County

[47] About 20% of the rock trains could not be rerouted to the Western Bypass because they are consigned to Yelvington, a location south of West Palm Beach. There may be between two to four rock trains per day. The net result is that two trains could be rerouted evey day on average.

[48] The analysis did not consider the capacity of Hialeah Terminal Area and the impact on Tri-Rail operations, as the impacts of rerouting six trains between 10:00 pm and 5:00 am the following morning was thought to be minor.

4. Two CSXT Northbound Rock Trains moving from Southern Dade County to points north of Palm Beach County, and corresponding southbound empties

In sum, the current average total daily FEC train count that can be moved from the SFECC to the Western Bypass is 18. The current average total daily CSXT train count that can be removed from the SFRC is two. These train counts form the basis of calculations to determine the reduction in grade crossing activations.

Operating Plan Results for Western Bypass – Table 5.1 shows a schedule of future freight trains on the Western Bypass, including paths reserved for expansion or for flexibility in timing.[49] The extra paths are identified by a four-digit FEC train number (i.e. 2101, 2202, etc.) and are shown shaded in the table. The extra paths reserved for CSXT aggregate business growth are shown as K993 and K994, also shaded. A more detailed schedule containing all trains is shown in Table 5.2.

Table 5.1
Freight Schedule on the Western Bypass

Southbounds					Northbounds				
Owner	**Train Number**	**Fort Pierce**	**Marcy**	**Gator Switch**	**Owner**	**Train Number**	**Gator Switch**	**Marcy**	**Fort Pierce**
CSX	K973	–	0:10	2:42	CSX	K946	0:40	3:27	–
FEC	191	0:45	1:19	3:55	FEC	336	2:41	5:28	6:09
CSX	K943	–	2:28	4:48	CSX	K994	2:55	5:35	–
FEC	193	2:55	3:29	5:50	FEC	240	4:46	7:25	8:01
FEC	121	3:55	4:29	6:50	FEC	206	5:11	7:55	8:31
FEC	335	4:32	5:06	7:27	FEC	202	8:55	11:16	11:52
FEC	141	5:19	5:35	8:20	FEC	2202	9:30	11:50	12:30
FEC	2101	6:00	6:40	9:00	FEC	2204	10:30	12:50	13:30
FEC	2103	7:00	7:40	10:00	FEC	2206	11:30	13:50	14:30
FEC	2105	8:00	8:40	11:00	FEC	208	15:12	17:59	18:40
FEC	125	12:31	13:05	15:26	FEC	290	17:11	19:58	20:39
FEC	101	19:19	19:53	22:14	FEC	222	19:26	21:58	22:51
FEC	105	19:26	20:00	22:21	FEC	292	22:17	1:04 *n*	1:45 *n*
CSX	K993	–	20:07	22:27	FEC	226	22:23	1:10	1:52 *n*
FEC	107	22:27	23:01	1:44 *n*	CSX	K966	22:32	1:19 *n*	–

Notes: *n* = Next Day. Timing at CSXT Hialeah is 8 minutes before or after Gator Switch. Timing at FEC Hialeah is one minute before or after Gator Switch.

Train Scheduling Findings – The train planning analysis indicates that the Western Bypass is operationally feasible based on the proposed infrastructure design.

- **Freight Schedules** – The current FEC and CSXT train-starts can maintain the existing 'typical' schedule, with adjustments of less than 15 minutes for all trains.
- **Even More Future Capacity** – The FEC can easily schedule an extra six road trains per day (bringing total daily WBP-FEC train count to 24 trains) without reaching capacity on the route. More capacity is available on the route above-and-beyond 24 FEC trains.
- **The Minimum Operable Headway without Fleeting is 30 Minutes** – The sidings are sited such that equal numbers of opposing moves may occur on 30 minute headways. The signals should allow following trains in the same direction at 5 minute headways.

[49] Stringlines for this schedule are found in an appendix to the report.

- **Shared-Use of Western Bypass Offers Operational Flexibility Comparable to SFECC** – Because of provisions for train fleeting, the interleaving of CSXT and FEC trains departing in close temporal proximity is not a problem. The siding separation of seven miles offers equal or greater flexibility compared to the present-day FEC.
- **No Black Outs** – Freight train operations are restricted at no time during the 24-hour day. Trains may depart the yard as soon as they are ready. Compared to the SFRC's 210-minute 'black out' during the passenger rush hours, this is substantially more flexible. Since it is a dedicated freight facility, there are no freight train restrictions on the Western Bypass.

Table 5.2
Point-by-Point Freight Schedule

Northbound Service		WBP	FEC	FEC	FEC	FEC	FEC	FEC	FEC	FEC	CSX	CSX	FEC	CSX
No	Station	MP	240	206	202	208	290	222	292	226	K966	K946	336	K994
1	FEC Hialeah	0.0	4:45	5:10	8:54	15:10	17:09	19:25	22:15	22:22	–	–	2:39	–
2	Gator Switch	0.6	4:46	5:11	8:55	15:12	17:11	19:26	22:17	22:23	22:32	0:40	2:41	2:55
3	Western Bypass Jct.	5.2	4:54	5:19	9:03	15:21	17:20	19:34	22:26	22:31	22:40	0:48	2:50	3:03
4	Holly Lake	11.3	5:02	5:27	9:11	15:30	17:29	19:42	22:35	22:39	22:49	0:57	2:59	3:10
5	Andytown	17.3	5:10	5:35	9:19	15:39	17:38	19:50	22:44	22:47	22:58	1:06	3:08	3:18
6	Kink in the Road	23.3	5:17	5:42	9:26	15:48	17:47	19:57	22:53	22:59	23:07	1:15	3:17	3:26
7	Kink in the Canal	30.3	5:26	5:51	9:35	15:58	17:57	20:06	23:03	23:09	23:17	1:25	3:27	3:35
8	Deem City	33.3	5:30	6:05	9:39	16:04	18:03	20:10	23:09	23:14	23:23	1:31	3:33	3:39
9	MP 40	40.3	5:39	6:16	9:48	16:14	18:13	20:19	23:19	23:23	23:33	1:41	3:43	3:48
10	MP 45	45.3	5:51	6:32	9:55	16:21	18:20	20:26	23:26	23:29	23:41	1:49	3:50	3:54
11	MP 50	50.3	5:59	6:41	10:02	16:29	18:28	20:33	23:34	23:36	23:49	1:57	3:58	4:01
12	Another Kink in the Road	56.8	6:17	6:48	10:10	16:39	18:38	20:41	23:44	23:49	23:58	2:06	4:08	4:14
13	Okeelanta	60.8	6:24	6:55	10:16	16:46	18:45	20:47	23:51	23:56	0:05	2:13	4:15	4:22
14	South Bay Jct.	64.7	6:30	7:00	10:21	16:53	18:52	21:02	23:58	0:02	0:12	2:20	4:22	4:32
15	Belle Glade	66.1	6:33	7:03	10:24	16:57	18:56	21:07	0:02	0:05	0:16	2:24	4:26	4:37
16	Cardwell	69.3	6:38	7:08	10:29	17:03	19:02	21:11	0:08	0:15	0:22	2:30	4:32	4:42
17	Pahokee	73.2	6:44	7:14	10:35	17:10	19:09	21:17	0:15	0:22	0:29	2:37	4:39	4:47
18	Canal Point	76.4	6:49	7:19	10:40	17:16	19:15	21:22	0:21	0:27	0:35	2:43	4:45	4:52
19	Sand Cut	79.8	6:54	7:24	10:45	17:22	19:21	21:28	0:27	0:32	0:42	2:50	4:51	4:58
20	Dorset	82.4	6:58	7:28	10:49	17:28	19:27	21:32	0:33	0:37	0:47	2:55	4:57	5:07
21	Port Mayaca	84.7	7:02	7:32	10:54	17:33	19:32	21:36	0:38	0:41	0:52	3:00	5:02	5:12
22	Bessemer	88.0	7:07	7:37	10:58	17:39	19:38	21:41	0:44	0:51	0:59	3:07	5:08	5:17
23	K-Branch MP 30	94.8	7:16	7:46	11:07	17:49	19:48	21:50	0:54	1:01	1:08	3:16	5:18	5:26
24	Marcy	101.7	7:24	7:54	11:15	17:59	19:58	21:58	1:04	1:09	1:18	3:26	5:28	5:34
25	Bluefield	107.7	7:32	8:02	11:24	18:08	20:07	22:06	1:13	1:17	–	–	5:37	–
26	Cana	116.0	7:42	8:12	11:33	18:19	20:18	22:31	1:24	1:32	–	–	5:48	–
27	Carlton	121.3	7:49	8:19	11:41	18:27	20:26	22:39	1:32	1:41	–	–	5:56	–
28	Fort Pierce	130.5	8:00	8:30	11:51	18:40	20:39	22:50	1:45	1:51	–	–	6:09	–

Southbound Service		WBP	FEC	FEC	FEC	FEC	FEC	FEC	FEC	CSX	FEC	CSX	FEC	CSX
No	Station	MP	193	121	335	141	125	101	105	K993	107	K973	191	K943
28	Fort Pierce	130.5	2:55	3:55	4:32	5:19	12:31	19:19	19:26		22:27		0:45	
27	Carlton	121.3	3:04	4:04	4:41	5:28	12:40	19:28	19:35		22:36		0:54	
26	Cana	116.0	3:11	4:11	4:48	5:35	12:47	19:35	19:42		22:43		1:01	
25	Bluefield	107.7	3:21	4:21	4:58	5:45	12:57	19:45	19:52		22:53		1:11	
24	Marcy	101.7	3:29	4:29	5:06	5:53	13:05	19:53	20:00	20:07	23:01	0:10	1:19	2:28
23	K-Branch MP 30	94.8	3:37	4:37	5:14	6:01	13:13	20:01	20:08	20:15	23:09	0:18	1:27	2:36
22	Bessemer	88.0	3:46	4:46	5:23	6:10	13:22	20:10	20:17	20:24	23:18	0:27	1:36	2:45
21	Port Mayaca	84.7	3:51	4:51	5:28	6:15	13:27	20:15	20:22	20:28	23:23	0:31	1:41	2:49
20	Dorset	82.4	3:55	4:55	5:32	6:19	13:31	20:19	20:26	20:33	23:27	0:41	1:45	2:54
19	Sand Cut	79.8	3:59	4:59	5:36	6:28	13:35	20:23	20:30	20:37	23:31	0:45	1:49	2:58
18	Canal Point	76.4	4:05	5:05	5:42	6:35	13:41	20:29	20:36	20:42	23:37	0:50	1:55	3:03
17	Pahokee	73.2	4:09	5:09	5:46	6:40	13:45	20:33	20:40	20:47	23:41	0:55	1:59	3:08
16	Cardwell	69.3	4:15	5:15	5:52	6:46	13:51	20:39	20:46	20:53	23:47	1:01	2:05	3:14
15	Belle Glade	66.1	4:20	5:20	5:57	6:50	13:56	20:44	20:51	20:58	23:52	1:06	2:10	3:19
14	South Bay Jct.	64.7	4:23	5:23	6:00	6:54	13:59	20:47	20:54	21:01	23:55	1:09	2:13	3:22
13	Okeelanta	60.8	4:29	5:29	6:06	6:59	14:05	20:53	21:00	21:06	0:11	1:14	2:19	3:27
12	Another Kink in the Road	56.8	4:35	5:35	6:12	7:05	14:11	20:59	21:06	21:12	0:18	1:20	2:25	3:33
11	MP 50	50.3	4:43	5:43	6:20	7:13	14:19	21:07	21:14	21:20	0:26	1:33	2:33	3:41
10	MP 45	45.3	4:50	5:50	6:27	7:20	14:26	21:14	21:21	21:27	0:33	1:42	2:40	3:48
9	MP 40	40.3	4:56	5:56	6:33	7:27	14:32	21:20	21:27	21:34	0:40	1:48	2:46	3:55
8	Deem City	33.3	5:05	6:05	6:42	7:36	14:41	21:29	21:36	21:43	0:49	1:57	2:55	4:04
7	Kink in the Canal	30.3	5:10	6:10	6:47	7:40	14:46	21:34	21:41	21:47	1:03	2:01	3:00	4:08
6	Kink in the Road	23.3	5:19	6:19	6:56	7:49	14:55	21:43	21:50	21:56	1:13	2:10	3:24	4:17
5	Andytown	17.3	5:26	6:26	7:03	7:56	15:02	21:50	21:57	22:03	1:21	2:18	3:31	4:24
4	Holly Lake	11.3	5:34	6:34	7:11	8:04	15:10	21:58	22:05	22:11	1:29	2:26	3:39	4:32
3	Western Bypass Jct.	5.2	5:41	6:41	7:18	8:12	15:17	22:05	22:12	22:19	1:36	2:33	3:46	4:40
2	Gator Switch	0.6	5:50	6:50	7:27	8:20	15:26	22:14	22:21	22:27	1:44	2:42	3:55	4:48
1	FEC Hialeah	0.0	5:51	6:51	7:28	8:22	15:27	22:15	22:22		1:46		3:56	

The impact on existing local customers on the Medley Lead has not been reviewed in detail. The impact should not be severe since this segment would be upgraded to double track. For the scheduling exercise, it was assumed that two trains would require access to on-line customers on the Medley Lead, and one local round-trip a day works from Fort Pierce to South Bay and returns.

5.2 Infrastructure Needs

The Western Bypass entails constructing approximately 60 miles of new railroad. The resulting overall mileage between FEC Hialeah and Fort Pierce would be 130 miles (vs. 126 miles via the historic FEC alignment). The distance between CSXT Hialeah and Marcy would be 105 miles, compared to 112 miles via the historical SAL alignment.

Table 5.3
Mileages via Alternative Routes

Origin-Destination Pair	Status Quo	Western Bypass	% Change
CSXT Hialeah to Marcy	112	105	-6.3%
FEC Hialeah to Fort Pierce	126	130	+3.2%

The alignment requires connections to both the SFRC and SFECC at both north and south ends. The bypass itself begins at FEC MP ML-4.7, near the present N.W. 116th Way runaround. The new track then travels north along the U.S. Route 27 corridor to South Bay, Fla., via Andytown, Deem City, and Okeelanta. Northbound FEC trains would access the Western Bypass by traveling north out of FEC Hialeah and taking the Medley Lead to the north-west at Gator Switch (MP 368.6).[50] Northbound CSXT trains access the Western Bypass by departing due south from CSXT Hialeah, as if heading to the Homestead Subdivision. Instead of crossing over the FEC at CP-IRIS, the CSXT train would take the new Iris connection described for the SFRC Spine scenario to access the FEC due west (railroad south). At FEC MP368.5, the CSXT train takes the Medley Lead to the north-west thence joining the Western Bypass.

Northbound trains on the Western Bypass regain access to the existing FEC/SCFE K-Branch at South Bay (near former FEC Milepost K-60). The switch would be oriented such that the dominant direction of traffic is north-south, with the Lake Harbor-South Bay section of the K-Branch becoming a side track. From there, trains follow the SCFE K-Branch around the eastern shores of Lake Okeechobee. Northbound CSXT trains would join the CSXT main line at Marcy (near former[51] FEC Milepost K-28); northbound FEC trains would cross over the CSXT at the Marcy diamond and continue north-east towards the existing K-Branch connection to the FEC main line at Fort Pierce (MP K-0, mainline MP 243.6). Southbound trains would follow the same process in reverse.

The infrastructure requirement for the Western Bypass includes, from south to north:

1. The northwest connector at Iris, previously described,
2. Modernization of Gator Switch for mainline use,
3. Upgrade of FEC Medley branch to double track with ATC and Class 4 standards,
4. Construction of 60 miles of new right of way and Class 4 track from Medley to South Bay with 5 intermediate passing sidings,

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[50] The FEC Alligator Jct. lies immediately north of FEC Hialeah Yard. It is locally known as "Gator Switch". This is distinct from the SFRC's CP-GATOR which is an interlocking immediately south of Mangonia Park.
[51] Under long term lease to SCFE.

5. Two limited access highways crossings would require grade separation (either Florida's Turnpike or State Route 997, and I-75),
6. Four new water crossings would be required – based on the present alignment assumptions,
7. Construction of a new junction and a new siding at South Bay,
8. Upgrade of SCFE/FEC track between South Bay and Marcy to Class 4 mainline standards with 3 intermediate passing sidings,
9. Construction of a holding siding at south west of Marcy on the South Central Florida Express (SCFE)/FEC track,
10. Upgrade of FEC K-Branch track between Marcy and Fort Pierce and upgrade/rebuild/relocation of 3 passing sidings.

The construction of the Western Bypass in the U.S. 27 Right-of-Way is complicated by several issues.

- **Highway geometry is not suitable for railroad use.** Highway geometries (horizontal and vertical curvatures) cannot easily be adapted for railroad track use. Relaxation of curves will be required. There are three significant curves and six highway junctions which would need to be completely re-engineered or constructed from scratch to accommodate a railroad. This will entail reconstruction of one side of the roadway if the railroad is in the median, and both sides of the roadway if the railroad is on the outside of a curve. The junctions may involve grade-separating the train or reconstructing the highway ramps.
- **Signalization of intersections is an issue.** Not all intersections with crossing roadways by U.S. 27 are grade-separated. Re-engineering of junction layouts would be required at those junctions. A turn-lane and suitable grade crossing warning devices would be required. Grade crossings at turns onto minor arterials in a semi-limited access highway environment may be undesirable for reasons related to highway safety.
- **Reconstructed grade separated junctions** – For the new railway to share right of way with the limited access highway, all grade separated junctions between U.S. 27 and other roads would need to be redesigned.
- **Landowner cooperation** – No attempts were made as part of this study to determine the present owner of the Western Bypass alignment in the Everglades. It is far from clear that owner cooperation would be forthcoming, especially if the wetland is part of a federal land reserve or privately owned by land conservation trusts. The U.S. 27 alignment is presumably owned by Florida DOT. The shoulder and median might be available for transport use, but re-construction of the highway to railroad geometry and reconfiguration of highway junctions may require substantial easements from abutting landowners and potentially adverse environmental consequences.
- **Right-of-way is flanked by bodies of water.** Canals flank the highway on either side for a substantial distance, approximately 20 miles between Andytown and Deem City on the Palm Beach/Broward county line. These canals make it difficult if not impossible to construct a railroad right of way directly adjacent to the highway.

  An alternate approach assumed viable in this exploratory research places the railroad some distance away from the highway – approximately 1,200 ft to the west. The alignment assumed in this analysis lies 1,200 ft to the west of the U.S. 27 Right of Way. This plan avoids:

  a. junction related issues,
  b. curvature related issues,
  c. developments that abut U.S. 27 to the west,
  d. approximately 8 grade crossings due to access roads, and
  e. constructing more than four bridges over the canal system.

However, the environmental aspects of this siting on the sensitive Everglades ecosystem may prove unacceptable. Field inspection and environmental analysis may very well indicate that this simplified approach is not viable. Such a finding would likely increase the cost and complexity of constructing the bypass. On the other hand, SFRTA notes that construction of additional track capacity for transit in the SFECC right-of-way may also prove costly and could create adverse environmental impacts for the communities en-route.

In summary, the simplified Western Bypass entails constructing approximately 60 miles of single-track new railroad on a brand new right-of-way, with perhaps a separate drainage system. A complete rebuild of 70 existing miles of railroad would also be required. In total 13 new or rebuilt passing sidings would be needed. A total of 173 track miles would be constructed.

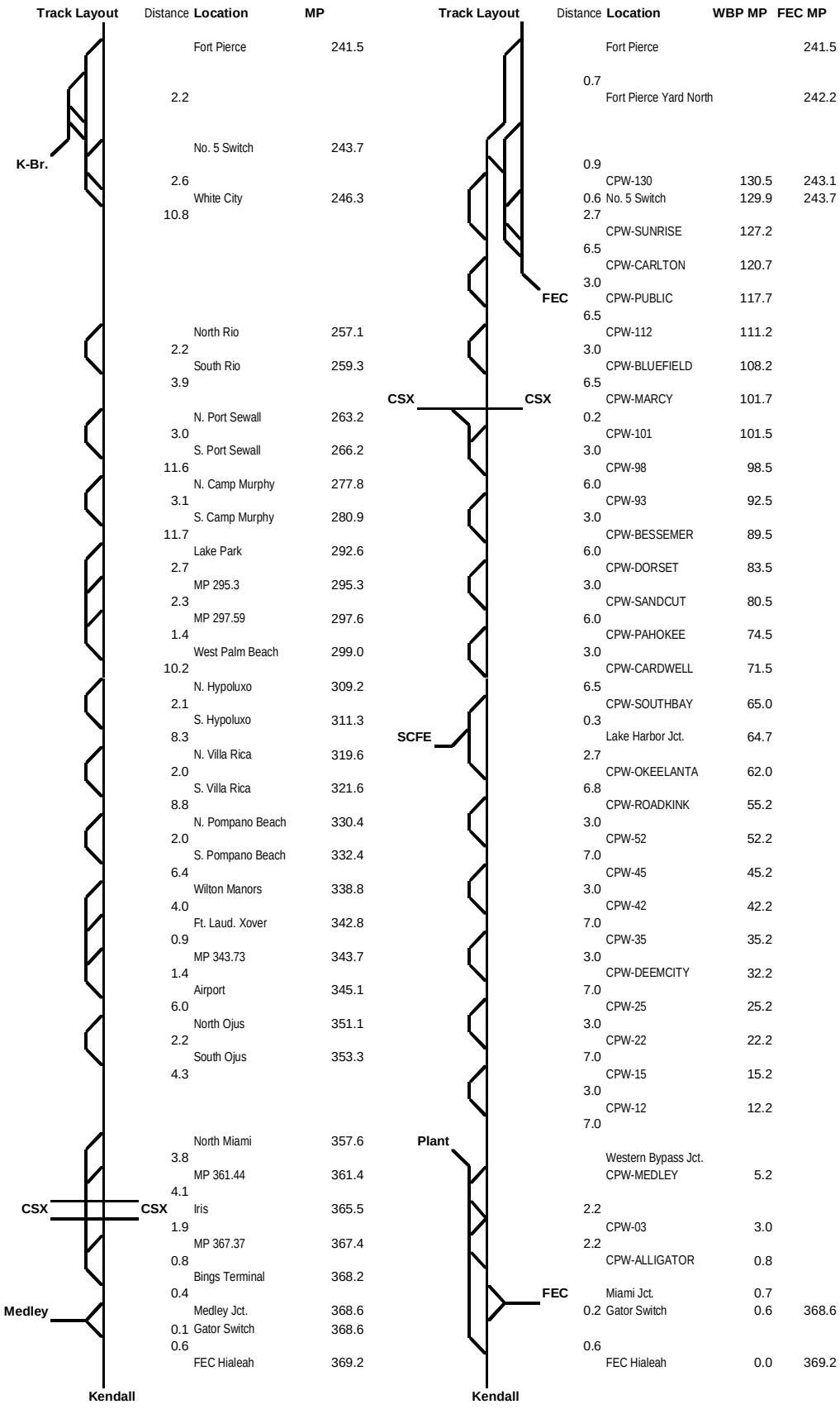
Table 5.4
Infrastructure Requirements for Western Bypass

Item	Units	Quantity
New Right of Way in U.S. 27 Corridor, Total:	**Route Miles**	**60**
New Track, Total:	**Track Miles**	**173**
Sidings	Miles	43
New Main Track	Miles	60
Upgrade Existing Track	Miles	70
Crossings, Total:	**Crossings or Bridges**	**32**
New	Grade Crossings	6
Upgraded	Grade Crossings	20
Highway Grade Separations	Overbridges	2
Bridges over Water	Underbridges	4
New Signals, Total:	**Controlled Points** **Block Signals**	**31** **13**
Sidings	Controlled Points	26
Crossovers	Controlled Points	3
Wyes and Turnouts	Controlled Points	2
Block Signals	Block Signals	13
New Turnouts	**Turnouts** **Diamonds**	**43** **1**
New Chords at Iris and Marcy	Turnouts	4
Upgraded Chords at Gator Switch, Western Bypass Jct.,	Turnouts	7
South Bay Jct., Marcy, and Fort Pierce	Diamonds	1
Turnouts for sidings	Turnouts	26
New Crossovers at Hialeah, Gator Switch, CP-03	Turnouts	6

FEC vs. WBP Comparison of Physical Plant – The upgrade of track and construction of a new railroad along the U.S. 27 entails constructing a plant substantially similar to the current-day FEC. When complete, the new plant would feature 155 fewer grade crossings than the FEC, and 15 fewer than the SFRC, on a different alignment. FEC trains moving from Hialeah to Fort Pierce would encounter only 57 grade crossings. However, functionally the plant will be very similar – a Class 4 single-track railroad with passing sidings.

The Bypass features 13 sidings instead of the ten on the SFECC. The FEC features sidings at irregular interval spacing along the main line. Spacing ranges between 3.9 miles (South Rio to North Port Sewall) and 11.7 miles (South Camp Murphy to Lake Park). These distances appear to have been determined by historic typical running times between locations. The maximum time separation between sidings dictates the minimum operable headway, on the FEC at approximately 30 minutes for appropriately powered trains.

Figure 5.1
Comparison of Physical Plant



The conceptual design for the Western Bypass provides sidings at regular intervals to promote maximum capacity for the single track railway. Assuming the track engineering in previously undeveloped terrain could achieve nominal 60 mph track speeds, the sidings are sited six to seven miles apart, allowing a minimum operable headway of about 20 minutes. Inevitably, there would be locations where permanent speed restrictions would be needed. Practically speaking, it is expected that the minimum operable headway on the completed plant would be approximately 30 minutes, allowing it to fit with the 'harmonic' of the FEC north of Fort Pierce.

A short CTC double track section between FEC Hialeah and CPW-MEDLEY is provided to allow proper train sequencing for northbound movements. There is local customer switching activity on the Medley Lead. The second track could also be used by local trains.

The maximum length of passing sidings on the FEC is about three miles, with 2.2 miles being typical. The 2.2 mile siding would hold a 10,000 ft train. The WBP's longer three mile sidings would allow two 7,500 ft freight trains to clear the main track simultaneously.

The present FEC mainline is equipped with an ATC signal system that automatically enforces speed limits and signal aspects on all trains. ATC requires specially equipped locomotives. To the extent that the WBP is developed as a replacement mainline for the FEC, it is likely that a compatible ATC signal system would be required to provide equivalent safety. CSXT does not employ ATC to control its trains in South Florida and may be reluctant to use the WBP if it requires an upgrade to ATC for all CSXT locomotives using the new alignment.

5.3 Highway safety

The assumed alignment for the Western Bypass will not substantially add to South Florida's overall railway grade crossing counts, because it crosses largely undeveloped land. However, there are 51 crossings on the existing rail corridors. Bringing the Western Bypass online will dramatically increase use on those branches and have significant impact on adjacent communities.

Table 5.5
Identified Grade Crossings on WBP

Section	Number of Crossings
FEC K-Branch	18
SCFE	20
New Alignment (U.S. 27)	6
Medley Branch	13
Total	57

However, the overall impact on South Florida is positive. The number of grade crossings encountered by a train travelling between north of Palm County and Hialeah would be reduced in both cases. A CSXT train would cross 42 fewer crossings – a 58% reduction. An FEC train would cross 155 fewer crossings – a 73% reduction.

Table 5.6
Grade Crossing Counts by Route

Origin-Destination Pair	Status Quo	Western Bypass	Percentage Reduction
CSXT Hialeah to Marcy	72	30	58%
FEC Hialeah to Fort Pierce	212	57	73%

The Western Bypass scenario would send approximately four trains through grade crossings during the morning peak, and three during the evening peak. This results in about 400 daily grade crossing activations on the Western Bypass during the peak commuter hours. Since the Western Bypass runs through sparsely settled territory, the likely impacts on highway travellers would be less than in the SFRC Spine scenario.

The total number of daily grade crossings on the SFRC is reduced slightly. However, the largest number of reductions occur in the overnight periods, since that is when CSXT freight trains are generally operated. The crossing impact on the SFRC is therefore modest. The benefits of the Western Bypass in terms of reducing SFECC grade crossing activations are identical to the SFRC Spine scenario.

Table 5.7 summarizes the grade-crossing risk comparison for the Western Bypass scenario. Overall, the daily total grade crossing activations is reduced by 3,100 – approximately 1,000 activations per day more than the SFRC Spine scenario.

Table 5.7
Daily Train Grade Crossings by Time Period for Western Bypass

Alternative	Status Quo		Western Bypass			Change			
Time Of Day	**SFRC**	**FEC**	**SFRC**	**FEC**	**WBP**	**SFRC**	**FEC**	**WBP**	**Net**
Night 0000-0559	625	1,934	405	149	399	–220	–1,785	399	–1,606
AM 0600-0859	1,048	785	1,015	249	228	–33	–536	228	–341
Midday 0900-1559	1,152	524	1,080	212	171	–72	–312	171	–213
PM 1600-1859	978	673	951	149	171	–27	–524	171	–380
Evening 1900-2359	609	1,225	609	249	399	0	–976	399	–577
Daily Total	4,412	5,141	4,060	1,008	1,368	–352	–4,133	1,368	
Total for Alternative	9,553		6,436			–3,117			

5.4 Economics

Impact on Other Users – One concern with diversion of through freight to the WBP is the operation of CSXT freights out of Hialeah over a short section of SFRC between Hialeah and CP-Iris. CSXT Hialeah is connected to the east main track of the SFRC, but the trains must turn onto the FEC from the west main track. Trains would therefore cross the SFRC at grade. However, due to the low number of current CSXT moves, and the late hours when these moves occur, it is anticipated that these trains would not unduly interfere with passenger operations.

The SFRTA reports that, in July 2006, 10 Tri-Rail trains were delayed by conflicts with FEC trains at Iris. The Western Bypass would in fact reduce this conflict because through trains between Hialeah and Jacksonville via the Western Bypass would no longer use Iris, instead turning west onto the Medley Branch after departing the yard. Iris would be used by only two daily CSXT rock trains and two daily FEC local trains.

Operating Cost Impacts – Rerouting of CSXT and FEC trains will have negligible impacts on operating costs relating to: vehicle cycles, crew schedules, mileage, and other miscellaneous operating costs. However, the new infrastructure and upgrade of branch line track will result in a substantial additional ongoing maintenance burden, which should be considered an operating cost. Each of these impacts is discussed below:

- **Vehicle Cycle Impacts** – No trains would suffer substantial delay as a result of being routed via the Western Bypass. The FEC trains must operate an extra five miles, but the timing differences are small and may be offset by the decreased meet/pass delays due to longer sidings and siding locations that are more evenly distributed. The CSXT train timings compares favorably with the

timings via Mangonia Park. No substantial car or locomotive cycle impact would result from the diversion of through freight trains to the Western Bypass.

- **Crew Time Impacts** – The diversion from both the FEC and the SAL alignments to the Western Bypass would not substantially lengthen trip times or increase meet/pass delays. No delays occur due to passenger train interference or 'black out' periods during which no freight train is permitted. The impact on crew time is expected to be negligible.

- **Mileage Impacts** – As previously discussed, the rerouting will increase FEC's train mileage by five miles per train, and reduce CSXT's train mileage by seven miles per train. A typical FEC train operates over 126 miles in the study area, from FEC Hialeah to Fort Pierce. A four-mile increase represents a less than 3% increase in mileages in the study area. For CSXT, there is a 6% reduction in mileage in the study area as the Western Bypass represents a more direct route between CSXT Hialeah and Marcy. No discernable impacts are expected.

Table 5.8
Mileages via Alternative Routes

Origin-Destination Pair	Status Quo	Western Bypass	% Change
CSXT Hialeah to Marcy	112	105	-6.3%
FEC Hialeah to Fort Pierce	126	130	+3.2%

- **Maintenance Burden** – The Western Bypass will require additional Class 4 track maintenance for 173 miles of main track, 43 miles of sidings, plus associated signals at 31 control points. The sidings and block signals are likely to require at least 63 track circuits. Approximately 60 miles of track is on new right-of-way. Track and signal on 70 miles of existing right of way would require dramatic upgrade likely equivalent to constructing an entirely new railroad.

Table 5.9
Maintenance Requirements Over and Above Status Quo, for Western Bypass

Maintenance Item	Units	Quantity
Right of Way	Route Miles	60
Class 4 Track	Track Miles	173
Grade Crossing	Crossings	26
Overbridge	Overbridges	2
Underbridge	Underbridges	4
Signal Masts	Signal Masts	~ 122
Interlocking Hardware	Control Points	31
Automatic Signals	Automatic Signals	13
Track Circuits	Track circuits	> 63
Turnouts	Turnouts	43
Diamond Crossings	Diamonds	1

Maintenance expenses must be bourne ultimately by the government or by the users of the infrastructure. The FEC, as predominant user of the proposed Western Bypass, is concerned that it would be saddled with duplicative maintenance costs that do not generate value in improved productivity or access to new markets and sources of revenue. The FEC is not relieved of its substantial maintenance expenditure on the SFECC, yet it may be expected to contribute towards the maintenance of the Western Bypass.

5.5 Competition and Institutional Concerns

In the last few months, the Western Bypass has been a lively topic in public discourse concerning transportation investment options in South Florida. The supporters of the Bypass are primarily interested in economic development for Western Palm Beach County. The FEC has expressed significant concerns about the line. CSXT has not publicly announced a position on the investment option.

From the perspective of freight railroad service delivery, the proposed new route for through freight operations as envisioned in this analysis would not offer any substantial advantages over the Status Quo. Route distance and travel times would be practically equivalent to the Status Quo or SFRC Spine.

Since the new line would not materially improve service or reduce freight transportation costs, there would be little inherent incentive for the region's freight railroads to use the line. The institutional ability of the State to influence the FEC (and CSXT) to use the new route would be limited. The construction and maintenance costs of the new route must be paid by private carriers or government agencies. If the FEC and CSXT do not choose to reroute most of their mainline trains onto the Western Bypass, positive impacts of reducing freight trains on the SFECC and SFRC would not materialize.

For the FEC, the Bypass would create uncertainty and risk in many of the same areas as the SFRC Spine. It should be expected that FEC still would demur rerouting a key segment of its network over a mainline shared with other operations and dispatched/maintained by a third party as long the FEC had the option to use its current route. The new route would not relieve FEC of it obligations to customers on its existing mainline and would therefore be redundant from a FEC perspective. However, in contrast to the SFRC Spine, the Bypass would not be shared with 54 passenger trains. Consequently the opportunity for delay due to conflicts with passenger trains would be ameliorated.

The FEC is concerned that shifting mainline operations onto the Western Bypass would severely restrict options for future expansion. The construction of the Western Bypass through a major wetland is in itself an environmental challenge, and much mitigation may be required to preserve the fragile Everglades ecosystem. If, in future, the FEC wishes to grow its business by expanding intermodal or transload terminal capacity, or encourage industries to relocate onto the new Western Bypass alignment, there would be further environmental consequences. These "induced" environmental impacts may be totally unacceptable, restricting further business development. From an environmental stewardship point of view, the FEC has indicated that it would like to develop its future business in a sustainable manner along the current SFECC alignment, rather than open up an environmentally sensitive area for industrial development.

For CSXT, the Bypass would also create uncertainty and risk, but perhaps less so than for FEC. In August 2006, both Florida DOT and CSX reached agreement in principle to initiate "Phase B". Once implemented, CSXT will no longer dispatch or maintain the SFRC. Consequently, rerouting CSXT trains to the Bypass would not materially change this service dimension for CSXT. A smaller total fraction of all CSXT trains in the study area would be candidates for rerouting to the Bypass since such a large fraction of CSXT trains make intermediate stops for service in Broward County. Less than half of CSXT trains would be candidates for rerouting so the impact on CSXT and SFRC operations would be so modest that CSXT may ponder if the benefits of the Bypass for such a small number of trains warrant the effort required to participate in the project and share the route. One attractive element of the Bypass for CSXT might be the opportunity to run on a freight-only line that is not shared with 54 passenger trains. With no passenger trains on the Bypass the opportunity for CSXT trains to be delayed in conflicts with passenger movements would be reduced.

Institutionally, it has not been determined how the South Central Florida Express Railroad (SCFE) on the northern end of the Bypass would interact with CSXT and FEC. SCFE has a lease on the former FEC Kissimmee Valley Subdivision between Mileposts K-60 (near South Bay, Fla.) and MP K-15.5 (near the FEC End of Track at Cana, Fla.) Any foreign trains operating over the K-Branch south of MP K-15.5 would require SCFE's explicit permission and a trackage-rights agreement. Substantial payments to the SCFE may be required. The SCFE was not contacted by the study team in preparing this analysis. Assuming that SCFE is amenable to cooperating with Florida to build and operate the Bypass, the State would not be enjoined from inviting both FEC and CSXT to use the new facility. On the other hand, the State would still not be in a position to force either carrier to use the new facility. Neither CSXT nor FEC would be in a position to completely abandon the lines they are currently using for freight service due to obligations to serve communities and stations that are not on the Bypass route.

5.6 Conclusions

Based on this analysis, the following conclusions concerning the Western Bypass are possible:

- **Low freight impacts and reduced potential for passenger/freight conflicts.** The construction of a dedicated facility will reduce the likelihood of passenger-and-freight train interference. The FEC through trains would continue to have exclusive use of a single track railroad with passing sidings.
- **Expensive to construct and operate.** The construction of the Western Bypass requires 60 miles of new right of way, at least three new bridges, 31 control points, 43 new turnouts and a number of new grade crossings. The construction expense, plus the ongoing maintenance expense, makes the cost of the Western Bypass practically equivalent to constructing and operating 130 miles of new Class 4 mainline track.
- **Environmental impacts.** The WBP alignment assumed in this memo to minimize construction costs may prove to be environmentally unacceptable. Realignment to mitigate the environmental effects may substantially increase the costs to construct the Bypass.
- **Institutional and competitive concerns.** Compared with the Status Quo, the WBP would offer few, if any, competitive advantage to the region's freight railroads. The institutional mechanisms available to the State to persuade the railroads to support the construction and eventually use the proposed new route are limited.
- **Highway safety.** The WBP would reduce the number of daily train crossings of roadways in the region by approximately 32%.

South Florida East Coast Rail Corridor Transit Analysis

Final DRAFT

Technical Memorandum

Task 2.20: Appendices A, B, C, D, E, and F Crew, Schedule, and Competitive Analyses, Stakeholder Comments, and Stringlines

August 17, 2006

Prepared for:

Florida Department of Transportation

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Boston, Massachusetts

Under Contract to:

Miami, Florida

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APPENDIX A: TRAIN PATHING CONCEPTS

Under the SFRC Spine scenario, trains must depart in designated windows to avoid impacting the passenger services. In the northbound direction, a train ready to leave Hialeah must await for the next suitable path on the SFRC, operate north to Mangonia, and again await on the connector for a suitable northbound path on the FEC. Southbound trains might also be delayed on the connector while it awaits a suitable southbound path. These delays are inevitable when operating trains in busy territories. The resulting delays under maximum traffic conditions for southbound FEC trains at Lake Park are estimated in Table A.1.

Table A.1
Expected Delays Due to Train Pathing at Lake Park,
Southbound Trains, SFRC Spine Scenario

Train Number	Variability at Origin (hours)	Average Headway of Train Paths (minutes)	Length of Available Window (hours)	Expected Train Pathing Delay	Interchange Delay if Window is Missed
101	±1.5	15	0.5	7.5	30
107	±0.5	10	2.0	5.0	– [52]
121	±0.5	5	0.5	2.5	45
105	±1.0	35	2.5	15.0	–
125	±2.0	60	6.0	5~30 [53]	–
141	±2.0	15	0.5	7.5	15 [54]
191	±1.0	5	6.0	2.5	–
193	±1.5	5	0.5	2.5	30
335	±1.5	35	0.5	15.0	45
Scheduled Daily Totals, Southbound				**63**	**–**

Notes: (Explanation of the table columns)

1. **Train Number:** the first three digits of the train number as currently assigned by the FEC.
2. **Variability:** This is an estimate of the 85th-percentile range (approximately 1.5 standard deviations from the mean) of observed departure times based on a 10-day sample[55] operations data provided by the FEC. A larger sample of FEC operations data would be needed for further analysis to increase the statistical confidence in these estimates, if the plan is progressed beyond the feasibility stage.
3. **Average Headway:** The train paths under Option 2 is timed to the nearest 5-minute. The average headway is the average of time-between-train-paths during the entire departure window. For example, if there is a 'blackout' period (when no freight trains can depart) between 12:25 and 12:50, and that the departure window lies between 12:00 and 13:00, then the available train paths are: 12:00, 12:05, 12:10, 12:15, 12:20, 12:25, 12:50, 12:55, and 13:00. The headways are therefore 5, 5, 5, 5, 5, 25, 5, 5. The average headway in this case would be 7.5 minutes.
4. **Window of Train Paths:** This is the length of departure window when paths on the Option 2 schedule permits the SFRC to accept a freight train at Mangonia Park or Iris. Departure windows for some trains are narrower than others – for example, trains which operate in the middle of the night are subject to substantially less time constraints than those that must operate during the passenger rush hour.

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[52] These trains are unlikely to miss their time windows, due to historically small schedule variability and a wide window.
[53] The expected wait for this train depends on local train and MOW activities. If no tracks are out of service, the train can operate between hourly passenger trains. If tracks are out of service for MOW and the trains cannot pass on adjacent tracks during the mid-day off-peak hours, then it must wait to follow an hourly passenger train.
[54] This train is an unscheduled extra, as such displays high departure time variability. It is unlikely to require a long wait at Lake Park even though its departure window is fairly narrow, because its train performance characteristic (an autorack train) would allow it to operate between half-hourly commuter services.
[55] Statistical significance at this level of sampling ($n = 5$ to $n = 10$) is questionable. However, the data does give a rough range as to how reliable the current train departures are.

5. **Expected Pathing Delay:** Assuming that the train is ready to depart at a time that is randomly distributed within the 'departure window', the expected delay is half the average headway. This is analogous to the concept of average passenger wait time[56] in transit operations real-time control.
6. **Delay if Window Missed:** In the case where the available departure window is narrower than the 85th-percentile variability (e.g. Train 101), the train has a higher probability of missing its assigned departure window. If the train does not make its designated window, there will be a longer delay as the train must wait for regularly scheduled traffic to pass before it can proceed down the SFRC on a 'spare' path in the next window. The wait for a spare path is often more substantial and the expected delay is determined by inspecting the stringlines provided in the Appendix.

The results indicate that under normal conditions, the train pathing delays within a designated window would not be a major source of problems for FEC's operations. However, problems arise when a train misses its designated window of train paths entirely, due to substantial delays north of Lake Park. If this occurs, the train must operate on an unscheduled basis over the SFRC, and must be held to follow a commuter train. If a heavy or underpowered FEC train operates during the passenger peak period, it could delay a commuter train even if it is held to follow a commuter train departure.

The expected interchange delay shown in the table assumes a commonsense approach, where a dispatcher will let the FEC train follow a Tri-Rail train during the rush-hour only if the FEC train is adequately powered and the traincrew is short on hours. If the train arrives during the off-peak outside its normal operating window, the additional delay is still likely to remain less than a half hour. It may be possible to reduce the number of trains that miss its window by lengthening the operating schedules north of Lake Park.[57]

The train-pathing issues in the northbound direction are less severe. However, trains missing their window of train paths could be subject to similar delays of between 10 and 80 minutes while waiting for a 'spare' path in the next window. On the other hand, trains departing FEC Hialeah have a lower variability as they are not subject to en-route delays, only terminal delays. The FEC do not currently appear to tightly manage the northbound departure times (typical variability: ±1.5 hours). However, the FEC may be able to do so if the train-pathing requirement at Iris becomes a significant overall source of delays.

In sum, the variability in the times that southbound FEC trains arrive at the northern end of the shared corridor will cause dispatchers to hold some southbound freights to operate between scheduled passenger movements. In aggregate, these delays would be less than the typical meet-pass delays presently experienced on the single track FEC line.

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[56] See basic transit operations textbook, or recent literature on the subject – such as Eberlein, X.J.; Wilson, N.H.M.; Bernstein, D.; *The Holding Problem with Real Time Information Available*, Transportation Science Vol. 35 Issue 1, pp.1-18 (2001). Y, Ding; S.I. Chien; *Improving Transit Service Quality and Headway Regularity with Real-time Control*, TRB Paper #01-2150, available at http://transportation.njit.edu/nctip/publications/No01-2150.pdf .

[57] If 85th percentile running-times were used at Lake Park instead of the average running time, trains would be much less likely to miss its slot. However, that means 85% of all trains would arrive early at Lake Park and may have to wait for its scheduled path on the SFRC. Either way it has the effect of lengthening trip times between Bowden and Hialeah.

APPENDIX B: ANALYSIS OF RELIEF CREWS

The current FEC road train operations between Miami and Jacksonville are scheduled for up to 10 hours (implying an average delay of 60 to 90 minutes above non-stop run-time). This matches the average delay within that service group as reported in the Morning Reports, currently about 90 minutes. If the scheduled trip times exceed 10½ hours, there would be a concern that federal 12-hour limits on crew on-duty times would be exceeded if unusual circumstances arise. Analysis of FEC operations data show that only one daily train poses a substantial continuing risk of outlawing on SFRC spine. A relief crew[58] might be required for this train on some mornings before it is allowed to enter the shared track territory.

Between 2005/12/09 and 2005/12/18, a relief crew was required on eight occasions, seven of which were on northbound trains:

Table B.1
Observed Instances of FEC Road Crews Expiring on Federal Hours-of-Service Limits

Train Number	Location	Exceptional Circumstances (Delay Minutes)	Total Delay Mins	Reason	Road Crew On-duty Time	Road Crew Relieve Time	Road Crew Utilization
218 08	Magnolia FEC [59]	Train 290 08 ahead mechanical difficulties	413	main blocked	17:15	Unknown	
240 09	Bayard	None	187	5 long meets	5:00	16:53	11:53
240 12	Bayard	None	145	4 long meets	3:00	14:55	11:55
218 15	Magnolia FEC	Set-out and pick-up cars at Pompano and West Palm	299	road train doing local work + 5 long meets	17:45	5:35 *n*	11:50
222 15	Bayard	Terminal delay: fix loco's toilet at Hialeah	124		18:00	5:57 *n*	11:57
202 16	Saybrook	Saybrook siding blocked by 206 16	330	main blocked	7:30	20:26	11:56
206 16	Saybrook	None	352	154-minute long meet at Saybrook	4:30	Crew swapped at Pineda with 125	
101 17	Ojus	Struck tresspasser – 225 minutes (fatality at MP 186.5)	266	incident crew not relieved at scene	14:00	1:31 *n*	11:31

Federal Hours-of-Service (HOS) law requires railroad crews to be on-duty for no more than 12 hours continuously. It appears from this analysis that crews are more likely to run out of time prior to the 12-hour limit on empty unscheduled extras (such as Train 240) that do not have a pre-planned train path and have lower priority.[60] They are therefore more likely to be delayed due to train meets. The FEC generally gives southbound trains priority.

It is also apparent from the data that the dynamic crew-time management on the "meet-me" trains works reasonably well. Out of the more than 167 trains that operated during the ten day period, 29 pairs of crew swaps took place on 54 trains, and only one resulted in the crew outlawing prior to reaching their

[58] A "relief" crew drives in a van to a stopped or stranded train to relieve crews who are close to expiring on the federal hours-of-service limits. A train that has a set of crews that expire while in mainline service must stop immediately and may not move until a relief crew arrives. Such train is said to have "canned" or "outlawed".
[59] Magnolia is at MP 30.0 to MP 33.1 on the FEC, near St. Augustine, 40 miles south of Jacksonville. Magnolia is not the Tri-Rail location *Mangonia* Park.
[60] Train 240 12, delay 145 minutes; Train 240 14, delay 92 minutes, Train 240 16, delay 89 minutes.

home terminals. For all trains, patch crews were required in only four instances where there were no delays caused by exceptional circumstances.

The probability of a given train requiring a patch crew due to routine circumstances is currently about 1 in 40 train-starts, most likely on Train 240; if all patch crews were included, the probability increases to about 1 in 20, or 5%. For northbound trains alone, the probability is 8%. For southbounds alone, the number is 1% (1 in 80 trains).

Based on the table, the current schedules, and other run-time data, it appears that a train between Miami and Bowden is currently able to absorb about between 120 and 180 minutes' of total delay (i.e. 60 to 120 *extra* minutes of delay over-and-above the typical delays) before a patch crew becomes necessary to get the train to the terminal. This reflects 8½ to 9 hours of unimpeded run-time, 2 to 3 hours worth of delay, and ½ hour required for booking on and booking off at either end.

Northbound Train Crews' HOS not Affected by Rerouting – To determine the likely number of northbound trains that will require patch crews, the distribution of delay minutes on the Miami – Bowden service group was examined. 120 minutes' delay formed the 80th percentile and 180 minutes' delay formed the 90th percentile (i.e. 10% of trains[61] had in excess of 180 minutes' delay). Train crews at Hialeah are not called until the train is ready to depart, and required departure windows at Iris would make it easier for Hialeah yard managers to call the crews exactly three hours before the scheduled departure time. This means the train pathing at Iris will have virtually no effect on patch crew use.

At the northern end of SFRC, where the trains must merge onto the FEC at Lake Park, the stringline in the Appendix demonstrates that pathing to fit the FEC's pattern of meets and passes is generally not difficult. A train leaving Hialeah via the FEC is as likely to encounter delays at each single track segment as a train leaving Lake Park. However, a train leaving Lake Park has overall less likelihood of being delayed for meets, as it is able to take advantage of the double-track SFRC to pass some southbound trains and therefore avoid delays associated with those meets.

The overall impact of routing northbound FEC trains via the SFRC on crew utilization is therefore either zero or positive. In the best scenario, the FEC train will avoid two train-meets on the SFRC, saving approximately 57 en-route minutes. In the worst case, the FEC train will not avoid any train meets and the impact is therefore neutral.

Implications for Federal Hours-of-Service Regulations for Southbound Trains – For southbound trains, it is clear that a train which misses its window of possible train paths at Lake Park will either disrupt passenger service or have an increased probability of requiring a patch crew. The windows at Lake Park are timed such that about 60 to 90 minutes' delay between Bowden and Lake Park can be absorbed.

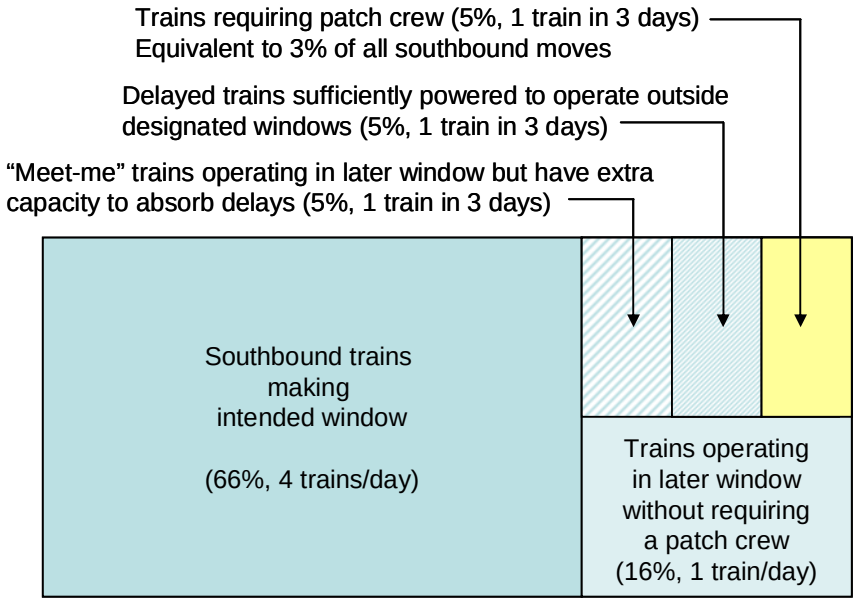
To determine the likely number of southbound trains that will miss its window, the distribution of delay minutes on the Bowden – Miami service group north of Lake Park was examined. 100 minutes' delay formed the 66th percentile and 180 minutes' delay formed the 90th percentile. Thus, about 33% of all southbounds would miss its window of train paths – about two trains a day.

The penalty for missing the operating window at Lake Park depends on upstream delays; if upstream delay is over 90 minutes, then the train will arrive at Lake Park missing its intended window, resulting in waits of between 0 and 90 minutes. If upstream delay is long, then the train might arrive at Lake Park

[61] This is consistent with the observed value of 8%.

just as the next window becomes available. This means trains that missing its intended window would encounter total delays in the 90 to 210 minute range. Some trains that do not change crews can sustain delays of up to 189 minutes without requiring a patch crew,[62] thus the team assumed approximately half of such trains (approximately 16%, or one train a day) can operate within a later window without requiring a patch crew. Two of the six daily trains (i.e. a third of all trains) operating in the Miami – Bowden service are "meet-me" trains and can have higher capacity to absorb delays.[63] Thus, the remaining 10% may either require a patch crew, or have to operate outside a designated window.

Figure B.1
Proportion of Southbound Trains Requiring Special Scheduling



If the train is powered to keep pace with the 40 mph average speed of scheduled commuter services, operation outside the designated window would not adversely affect the Tri-Rail service even at 20-minute headways. However, if the train is not sufficiently powered, creative dispatching involving same-direction passes would be necessary, or the passenger service will be disrupted. This study did not attempt to quantify the potential disruption to passenger service.

The overall impact of routing southbound FEC trains via the SFRC on crew utilization would therefore increase the need for patch crews at Fort Lauderdale. It is expected that the probability of requiring patch crews would increase from about 1 in 80 train-starts to about 1 in 30 (less than two trains a week). Unfortunately, the available FEC operating data does not allow the team to estimate the probability of requiring a patch crew beyond the 1 train in 30 ballpark number. The data is particularly sensitive to the maximum achievable schedule adherence at Lake Park, and operating delays relating to meets-and-passes on single track territory. Analysis of more extensive FEC historical operations data would improve the confidence in the estimate. It should be noted that these estimates are based on a fairly conservative view of when freight trains will be permitted to operate on the SFRC, sending only 5% of all trains outside designated windows.

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[62] Train 107 17 in December 2005.
[63] Train 125 13 absorbed 203 minutes' of delay without requiring a patch crew because there were extra time left to run on the Miami-based crew's watch – because the crew swap took place closer to Hialeah than to Bowden. Putting the crew change too close to Hialeah may increase the patch crew requirements at the north end.

Conclusion: Crew Impacts – Given the analysis of schedule adherence and expected delays from slot-keeping in the previous section, it is clear that the need to adhere to rigourous 'time windows' on the SFRC will have an impact on the need for patch crews. Southbound trains have a greater likelihood of being delayed at the entry to the SFRC, because their arrival time at the SFRC connector shows more variability, and result from lesser degree of control that the FEC is able to exercise over unavoidable delays arising en-route between Bowden and Lake Park. Fortunately, southbound trains have higher priority over the main line, and are less likely to be delayed due to meets and passes on the FEC north of Lake Park. The crews are therefore more likely to have a more time left to complete the last 70-miles of the run over the SFRC upon their arrival at Lake Park.

Crews of a limited number of southbound FEC trains from Bowden arriving late at the north end of the shared track segment may need to be replaced with a fresh crew to avoid violations of federal hours of service regulations on the shared track segment. Presently only one daily train poses a substantial risk in this regard. It is expected that the probability of requiring patch crews would increase from about 1 in 80 train-starts to about 1 in 30 (less than two trains a week in total).

APPENDIX C: COMPETITIVE MARKET BALANCE BETWEEN FEC AND CSX

The FEC and CSXT presently compete for traffic under the status quo by serving different market segments. Both the FEC and CSXT have carload business along their lines, but few shippers are connected to both carriers. Therefore the FEC and CSXT segregate traffic by geographic franchise in the carload sector. For large customers shipping unit-trainloads (aggregate customers) that have access to both mainlines, the FEC and CSXT appear to segregate traffic by final destination, service, and cost. It appears that FEC offers superior service and cost. It carries much more aggregate business than CSXT. For other specialized sectors, such as intermodal and automotive, each carrier has carved out a dedicated niche primarily due to service and cost advantages. FEC carries all intermodal traffic to South Florida, whereas CSXT does not offer intermodal service in Miami-based lanes. The dominance of the FEC in this area is almost certainly a reflection of lower costs. FEC also carries all finished-auto traffic to South Florida. CSXT carries bulk chemical transloads to CSXT Fort Lauderdale Yard via its TransFlo network terminal.[64] FEC does not operate an equivalent facility in South Florida.

FEC Carload Customers – FEC's customer base in South Florida includes three intermodal operations, three industrial warehousing districts, 26 local online customers or team tracks and four locations for the potential interchange of traffic with CSXT operations on the SFRC line.

- The intermodal operations include a major facility at Hialeah used for the local use and Miami port traffic, a ramp at Fort Lauderdale for local use and the service of Port Everglade traffic and the Port of Palm Beach which serves overseas traffic.
- The three industrial warehousing districts include the vicinity of Hialeah, the Pompano Market north of Fort Lauderdale and the Lewis Terminal district in the vicinity of West Palm Beach.
- The 26 local online customers and team tracks included 14 locations which were observed to be actively engaged in the shipment of building materials (10), food products (3) and paper (1). The remaining 12 sites were observed and reported to be inactive at the time of the inspection trip.

SFRC Carload Customers – CSXT's customer base in South Florida includes 16 industrial zones and more than 75 local online customers or team tracks, more than 20 of which are directly connected to one of the main tracks.

- The 16 industrial districts include the vicinity of Allendale, Lake Worth, Delray, Deerfield, Pompano, Cypress, Manatee, Fort Lauderdale, Dania, Miami Plantations, Golden Glades, Miami Gardens, Hialeah, Milepost SX 1035, 46th Street, and the Downtown Spur.
- The only CSXT TransFlo terminal in South Florida is in Fort Lauderdale. TransFlo provides customers with comprehensive logistics solutions to meet their product distribution needs. The company offers terminal services specializing in transfer and handling of bulk products. The Fort Lauderdale terminal has space for 55 car spots.

The current competitive balance between CSXT and FEC is fairly stable. Each serves its own semi-captive group of loose carload customers. CSXT does not compete for traffic in the intermodal and automotive sectors. Unit train customers have a choice of carriers with most selecting FEC. Maintenance and dispatching for both FEC and CSXT routes are vertically integrated, with each operator dispatching and maintaining their own routes.

CSXT has a perpetual and exclusive freight easement over the SFRC and appears unlikely to favor sharing its route with its largest competitor in Florida. The FEC enjoys a federally protected franchise to offer service on its existing route and is unlikely to participate in a plan that would shift their operations onto a new railway unless it offered significant advantages over its existing route.

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[64] Fort Lauderdale Transflo Terminal, 890 S.W. 21st Avenue, Fort Lauderdale, FL 33312.

APPENDIX D: WRITTEN COMMENTS REVEICED FROM STAKEHOLDERS

Comments from the SFRTA

From: Quinty, Joseph <quintyj@sfrta.fl.gov>
Sent: Wednesday, August 09, 2006 4:49 PM
To: Nelson, David
Cc: Cross, William
Subject: Re: South Florida Freight Integration Report

Dear David,

Thank you for providing SFRTA with a draft version of the South Florida Freight Integration Report on August 2. We appreciate this opportunity to review the document and submit comments. The report has been reviewed by SFRTA Operations, Engineering, and Planning staff members. I have consolidated all of their comments and would like to submit them below on behalf of the SFRTA. Most comments were specific to the SFRC Freight Spine option, but there is some input regarding the Status Quo and Western Bypass options, as well.

SFRC Freight Spine:

- A key SFRTA concern was already expressed in the text on page 8- "Within the limits of available data, the team could not accurately assess how the introduction of up to 24 FEC freight trains on the SFRC corridor would affect the reliability of passenger service delivery. However, increase in overall train traffic would increase the opportunity for delays." FEC trains added to the SFRC would affect Tri-Rail rush hour revenue and deadhead trains for 8 hours of the day.
- It is recommended that the report should incorporate the eventual expansion of Tri-Rail service beyond 50 trains per day, and Amtrak's plans to offer additional service on the SFRC between Miami and Tampa. Ideally, potential Tri-Rail skip-stop or express service in the future, as well as a future northern extension to Jupiter and service to Kendall to the south should also be factored into the analysis. There are concerns that future Tri-Rail expansions and enhancements could be compromised by the SFRC Freight Spine option.
- There will difficulty providing windows for MOW with the added FEC trains, especially considering the substantial wear caused by 20+ additional freight trains per day.
- Added freight traffic could result in passenger trains serving non-regular platforms, which with an overhead pedestrian system could result in further delays.
- The report should also address deadhead movements between the Hialeah Yard and MIA station, and between the West Palm Beach layover facility and Mangonia Park station.
- Also to be considered should be the requirement for Tri-Rail trains to occupy both mainlines at Mangonia Park during peak hours, and the infrastructure restrictions requiring CSXT to occupy mainline track for extended periods for switching moves.
- While the SFRC does have a lesser number of grade crossings, the locations of these crossings are often adjacent to I-95 entrance/exit ramps along major east-west arterial roads. These crossings currently function well due to the short length of Tri-Rail trains and the relatively low number of freight trains. This would change dramatically with the introduction of all of the FEC through trains, and could potentially affect LOS on a number of roads with regional significance.

- It was helpful that the report acknowledged on numerous occasions the rights of both FEC and CSXT and the limited power of the state to reroute their trains or coerce them to do so.
- SFRTA already receives numerous noise complaints from residents who live in close proximity to the SFRC. This would surely increase with implementation of the Freight Spine option, and some sort of mitigation measures would likely have to be pursued.
- The SFRC Freight Spine option would require FEC to be qualified on SFRC/CSX rules.

Status Quo:

- Maintaining the status quo would likely present a severe challenge to the provision of passenger service on the SFECC. A dedicated double tracked passenger rail system in the SFECC would likely require grade separation or a substantial relocation and rebuilding of the existing track. Combined with signal and crossing upgrades, this might carry a total expense comparable to the Western Bypass option. However, if the number of grade crossings can be reduced by a significant amount, this would be the most appealing option.

- An option that was not identified is increasing freight capacity by adding track, signals, and crossovers on the FEC line. With Automatic Train Control (ATC) and consistent ROW width, it should be obtainable.

Western Bypass:

- There are concerns with adding trains that utilize IRIS. Over the past three months, 10 Tri-Rail trains were affected by conflicts with FEC trains at IRIS. If CSX through trains were routed south to IRIS (rather than north out of the north end of the Hialeah Yard) it would add much congestion at the single access point at the south end of the yard for Tri-Rail deadhead moves to and from Miami Airport station, as well as revenue trips. Currently, Tri-Rail is the main user of the south end of the yard at Hialeah to the SFRC mainline, with only a few Homestead Subdivision or Leigh Branch CSX trains using the south end of the yard.
- While the Western Bypass option appears to be an expensive proposition, it should be considered in comparison to the construction of a dedicated double tracked passenger rail system in the SFECC. If the construction costs for a passenger system could be substantially reduced through use of existing capacity freed from freight traffic, it would somewhat offset the costs for building a western alignment. The reluctance of FEC to use that alignment might be overcome with an appropriate plan for fairly dispatching the corridor and lower liability costs due to the reduction in crossings.
- Environmental impacts to the Everglades from construction of a new rail alignment (that would be substantially parallel with an existing paved highway) should be considered in comparison to additional truck traffic and highway capacity that might be required over the next several decades if rail capacity is not enhanced. Track engineering could ensure that there is minimal disruption to water flow and wildlife in the area.
- Freeing capacity in the urbanized area for passenger rail may also have substantial positive impacts for regional air and water quality. A premium transit system located in the SFECC could redirect growth into already developed areas and thus remove pressure to extend settlement farther toward protected natural areas. The reduction in delay, congestion and pollution associated with freight movements in the metropolitan core could also be a significant positive impact. Despite substantial

upfront costs, a program to restructure rail movements along a new western alignment may offer a very good long term solution for the region.

Again, thank you for the opportunity to review this document and provide input. Please feel free to contact me if you need any clarification on these comments or if you require any further information.

Joseph J. Quinty, AICP
Transportation Planning Manager
South Florida Regional Transportation Authority
800 NW 33rd St, Suite 100
Pompano Beach, FL 33064
(954) 788-7928

Comments from the FEC

From: Eddins, Heidi (FECI.STA) <HEDDINS@FECI.COM>
Sent: Sunday, August 06, 2006 12:47:01 PM
To: Nelson, David
Subject: RE: South Florida Freight Integration Report

when would be convenient time to talk. I do have a few comments and corrections

Comments from CSX

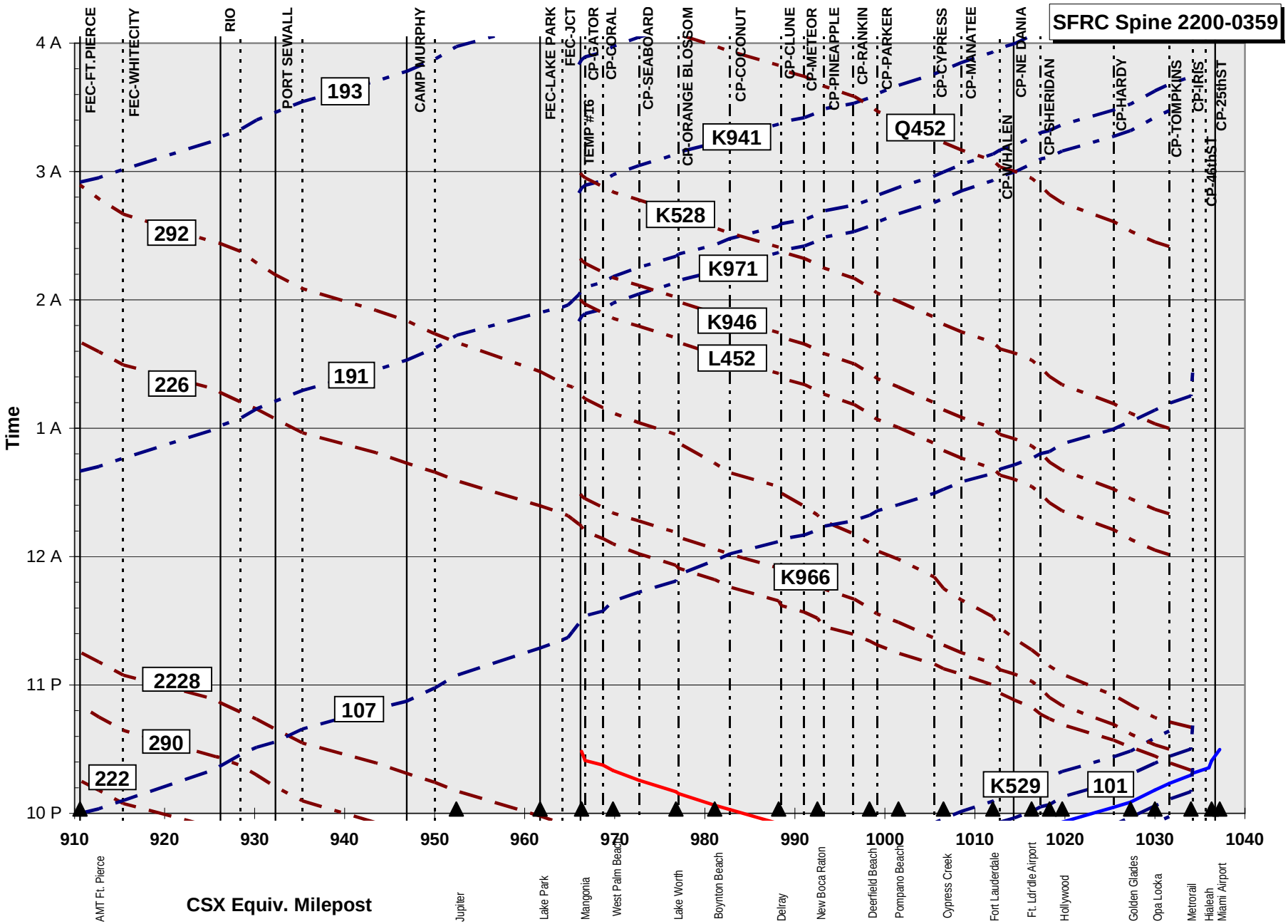
From: Gibson, John Jr. <John_Gibson@csx.com>
Sent: Thursday, August 03, 2006 1:08 PM
To: Nelson, David
Subject: RE: South Florida Freight Integration Report

Dave – thanks for the report. We will review it and make comments. What is the timeframe for your process?

John

APPENDIX E AND F: STRINGLINES FOR THE SFRC SPINE AND FOR THE PROPOSED WESTERN BYPASS

The stringlines are appended to the end of this report. Stringlines are laid out such that as many pages join together to form an all-day graph. The headings indicate the alignment and time period. Six graphs first describe the SFRC Spine scenario. The remaining three graphs describe the Western Bypass scenario. The graphs are read from bottom to top timewise (top is later in time), and left to right geographically.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3 A
2 A
1 A
12 A
11 P
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FEC-FT.PIERCE
FEC-WHITECITY
RIO
PORT SEWALL
CAMP MURPHY
FEC-LAKE PARK
FEC-JCT
TEMP "16"
CP-GATOR
CP-CORAL
CP-SEABOARD
CP-ORANGE BLOSSOM
CP-COCONUT
CP-CLUNE
CP-METEOR
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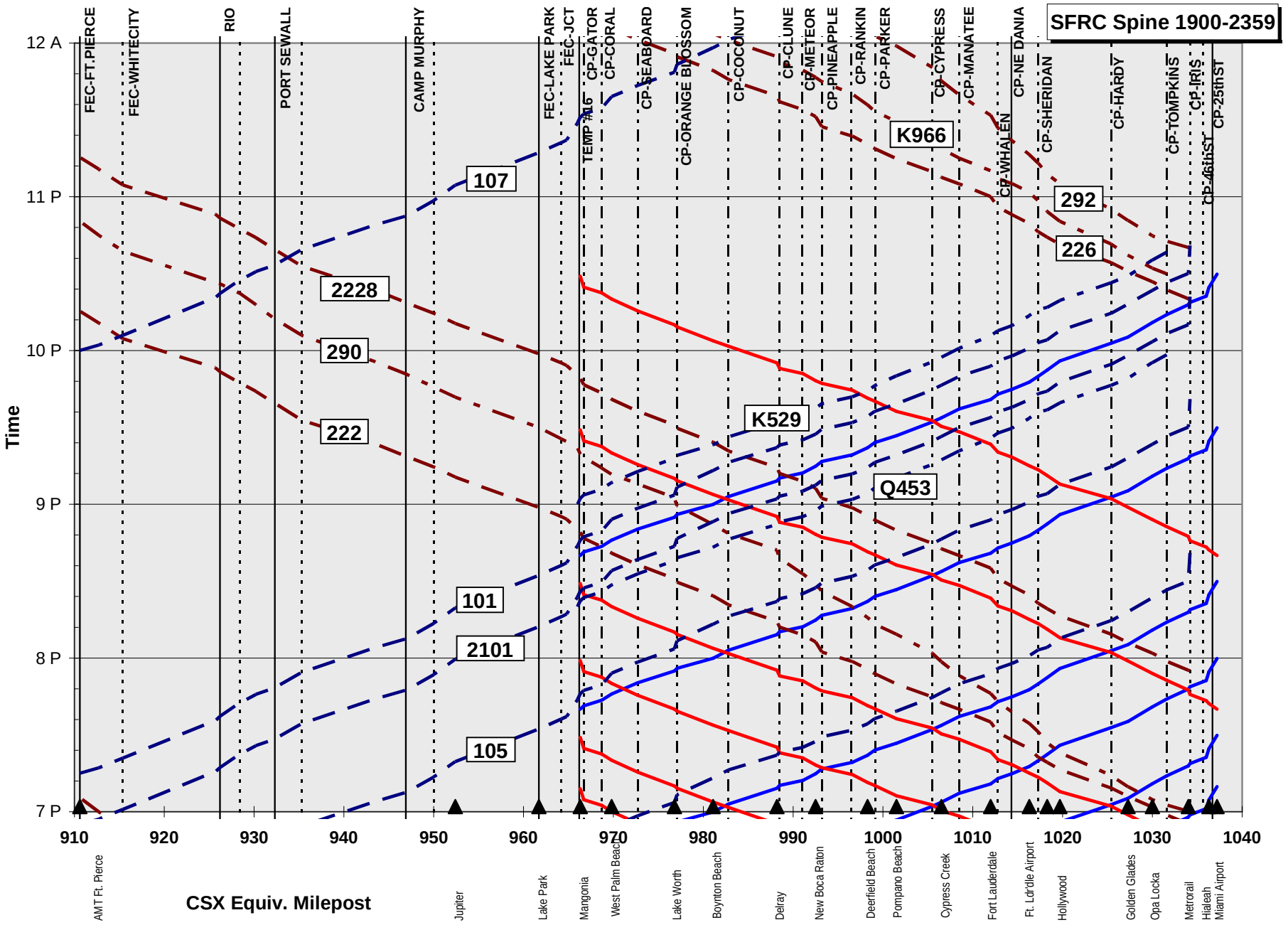
AMT Ft. Pierce
Jupiter
Lake Park
Mangonia
West Palm Beach
Lake Worth
Boynton Beach
Delray
New Boca Raton
Deerfield Beach
Pompano Beach
Cypress Creek
Fort Lauderdale
Ft. Ldr'dle Airport
Hollywood
Golden Glades
Opa Locka
Metrorail
Hialeah
Miami Airport


SFRC Spine 1900-2359
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7 P
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FEC-WHITECITY
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CAMP MURPHY
FEC-LAKE PARK
FEC-JCT
TEMP #16
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CP-CORAL
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CP-ORANGE BLOSSOM
CP-COCONUT
CP-CLUNE
CP-METEOR
CP-PINEAPPLE
CP-RANKIN
CP-PARKER
CP-CYPRESS
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AMT Ft. Pierce
Jupiter
Lake Park
Mangonia
West Palm Beach
Lake Worth
Boynton Beach
Delray
New Boca Raton
Deerfield Beach
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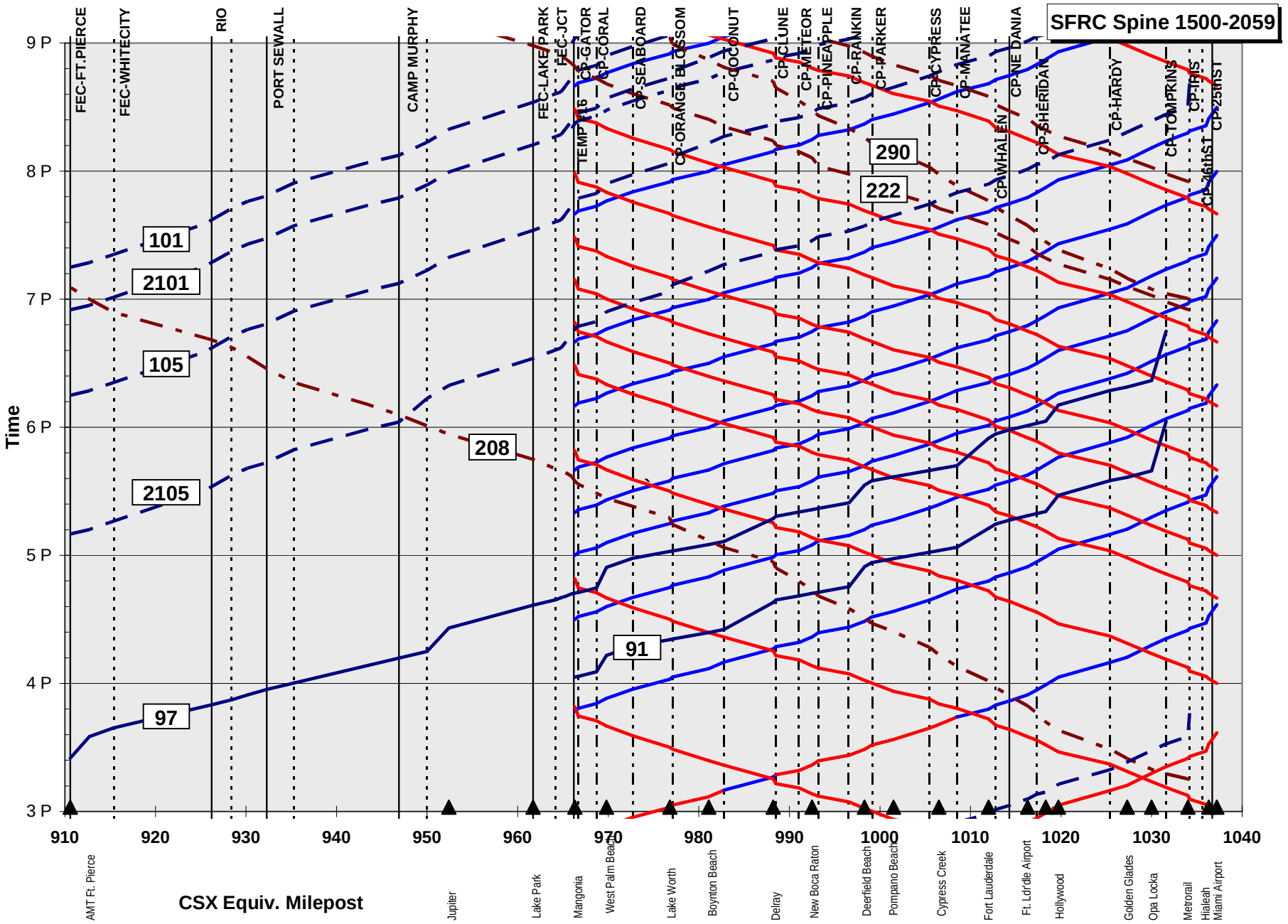
Ft. Ldrdle Airport
Hollywood
Golden Glades
Opa Locka
Metrorail
Hialeah
Miami Airport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AMT Ft. Pierce
Jupiter
Lake Park
Mangonia
West Palm Beach
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Delray
New Boca Raton
Deerfield Beach
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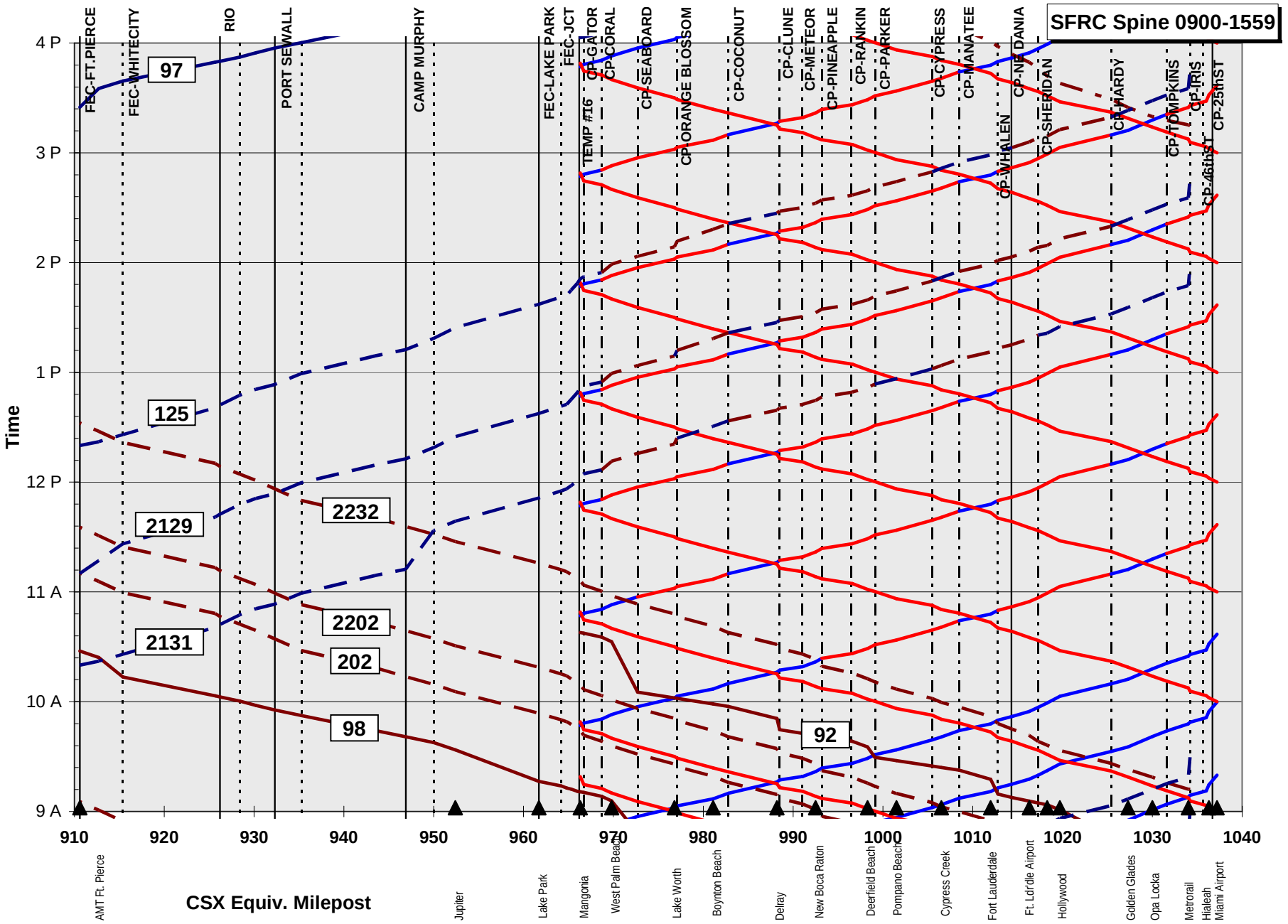
Fort Lauderdale
Ft. Ldrdle Airport
Hollywood
Golden Glades
Opa Locka
Metrorail
Hialeah
Miami Airport


SFRC Spine 0900-1559
Time
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2 P
1 P
12 P
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9 A
FEC-FT.PIERCE
FEC-WHITECITY
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PORT SEWALL
CAMP MURPHY
FEC-LAKE PARK
FEC-JCT
TEMP #16
CP-GATOR
CP-CORAL
CP-SEABOARD
CP-ORANGE BLOSSOM
CP-COCONUT
CP-CLUNE
CP-METEOR
CP-PINEAPPLE
CP-RANKIN
CP-PARKER
CP-CYPRESS
CP-MANATEE
CP-WHALEN
CP-NE DANIA
CP-SHERIDAN
CP-HARDY
CP-TOMPKINS
CP-IRIS
CP-46thST
CP-25thST
97
125
2129
2131
2232
2202
202
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92
910
920
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1010
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1030
1040
CSX Equiv. Milepost
AMT Ft. Pierce
Jupiter
Lake Park
Mangonia
West Palm Beach
Lake Worth
Boyriton Beach
Delray
New Boca Raton
Deerfield Beach
Pompano Beach
Cypress Creek
Fort Lauderdale
Ft. Ldr'dle Airport
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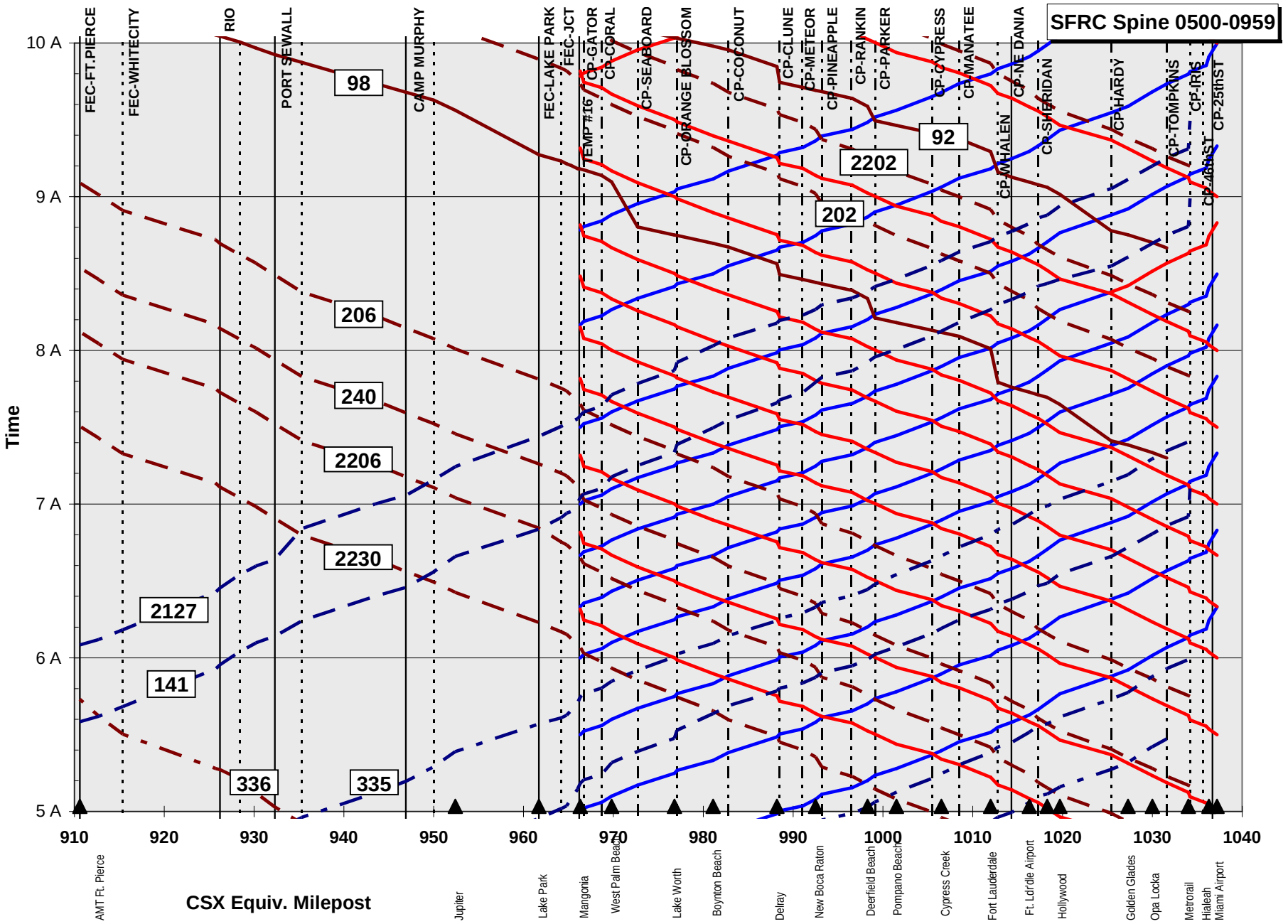
Opa Locka
Metrorail
Hialeah
Miami Airport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FEC-LAKE PARK
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CP-SEABOARD
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CP-CLUNE
CP-METEOR
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CP-PARKER
CP-CYPRESS
CP-MANATEE
CP-MIALEN
CP-NE DANIA
CP-SHERIDAN
CP-HARDY
CP-TOMPKINS
CP-IRIS
CP-28thST
CP-25thST
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336
335
92
2202
202
AMT Ft. Pierce
Jupiter
Lake Park
Mangonia
West Palm Beach
Lake Worth
Boyinton Beach
Delray
New Boca Raton
Deerfield Beach
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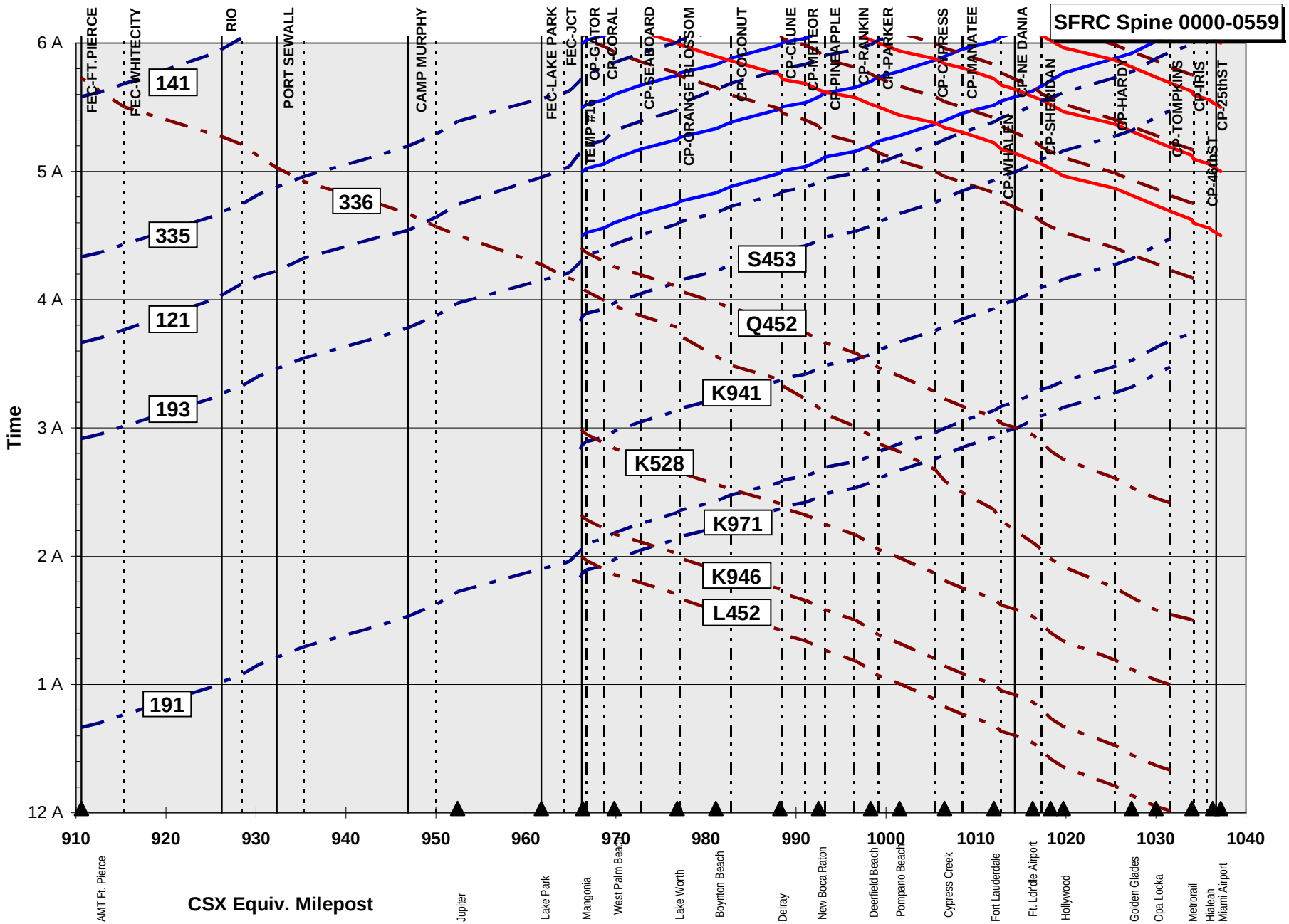
Miami Airport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Time
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K941
K528
K971
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L452
191
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FEC-WHITECITY
RIO
PORT SEWALL
CAMP MURPHY
FEC-LAKE PARK
FEC-JCT
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CSX Equiv. Milepost
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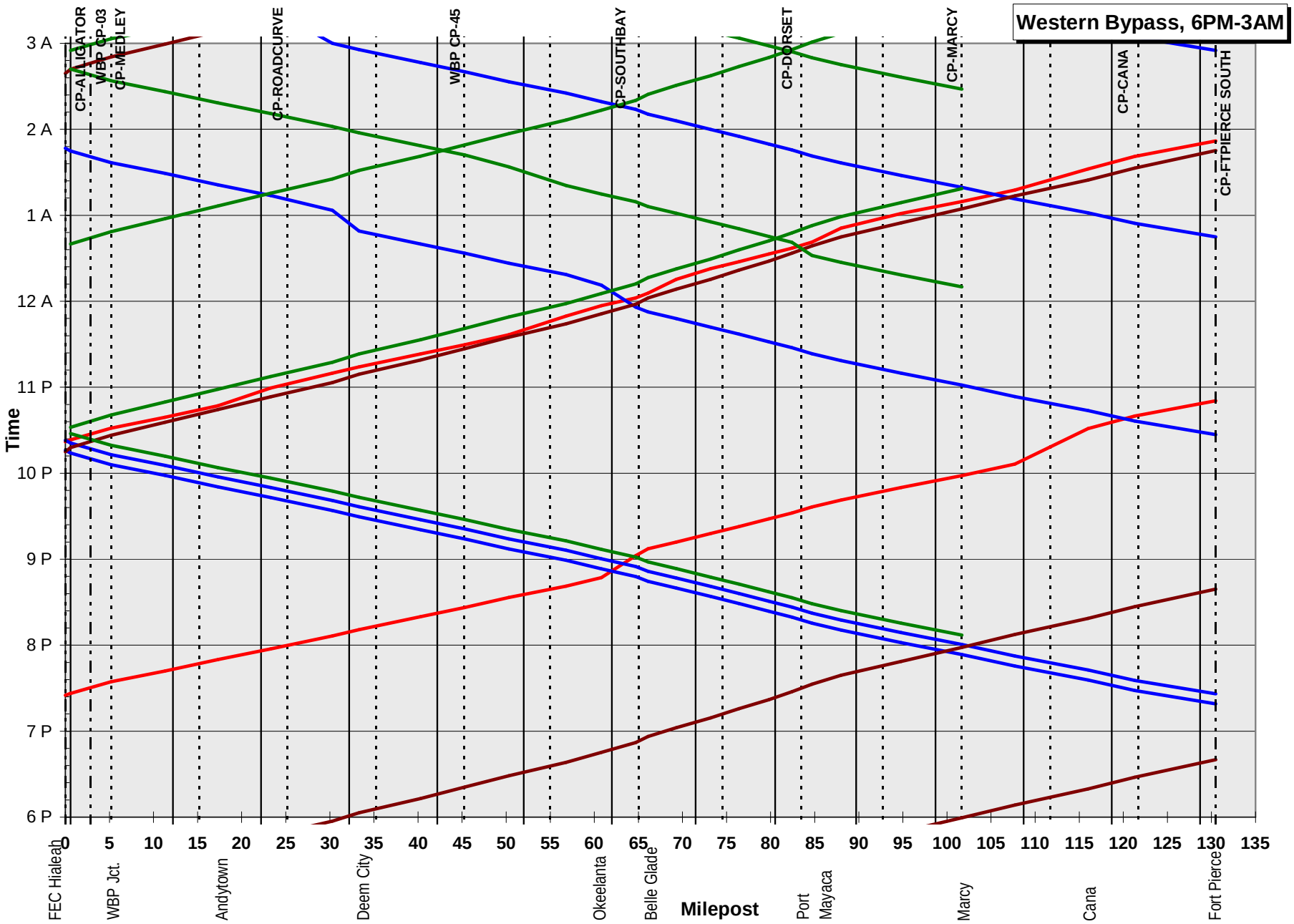
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CP-ALLIGATOR
WBP CP-03
CP-MEDLEY
CP-ROADCURVE
WBP CP-45
CP-SOUTHBAY
CP-DORSET
CP-MARCY
CP-CANA
CP-FTPIERCE SOUTH
Time
3 A
2 A
1 A
12 A
11 P
10 P
9 P
8 P
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6 P
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135
Milepost
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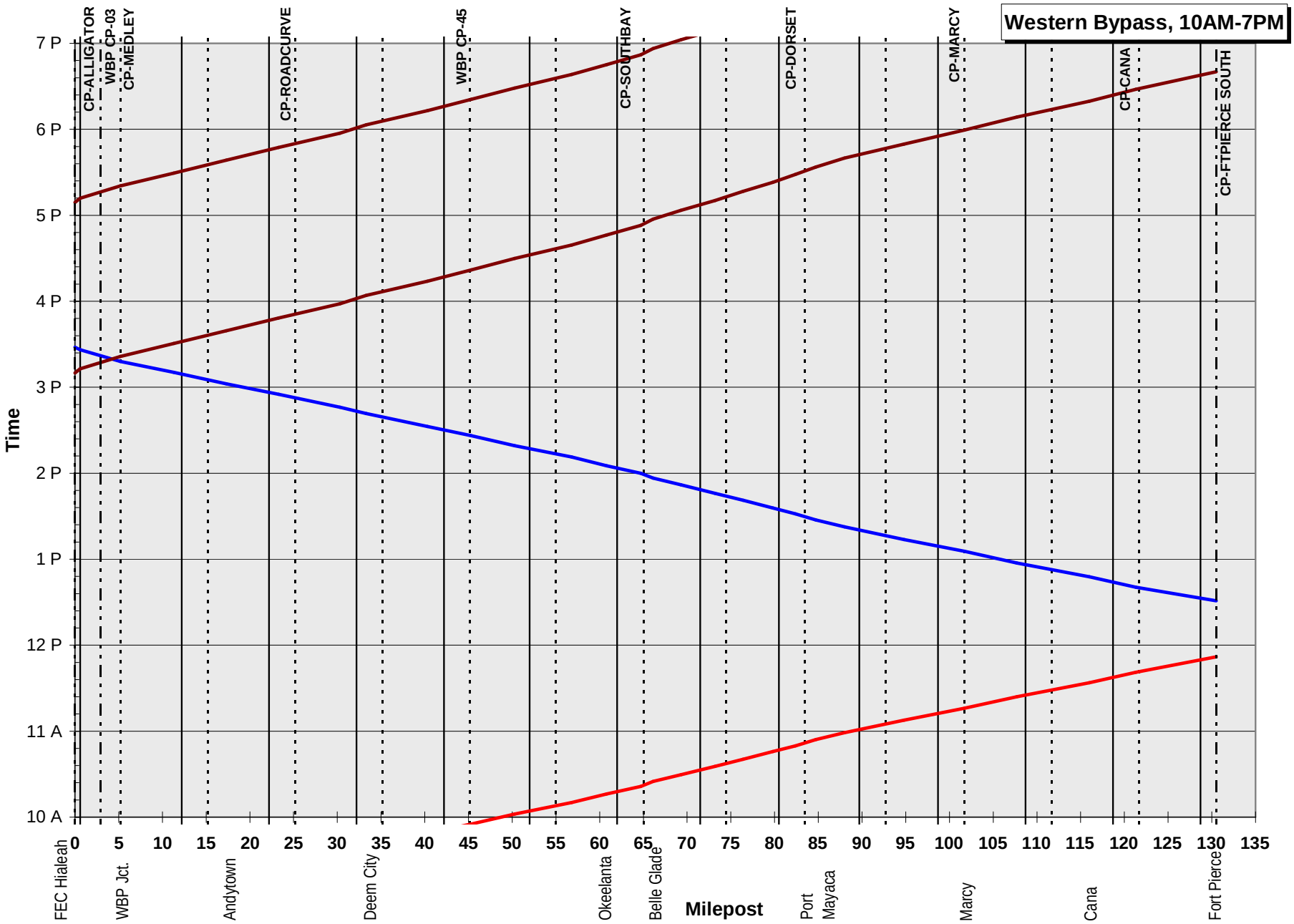
WBP Jct.
Andytown
Deem City
Okeelanta
Belle Glade
Port Mayaca
Marcy
Cana
Fort Pierce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WBP CP-03
CP-MEDLEY
CP-ROADCURVE
WBP CP-45
CP-SOUTHBAY
CP-DORSET
CP-MARCY
CP-CANA
CP-FTPIERCE SOUTH
Time
7 P
6 P
5 P
4 P
3 P
2 P
1 P
12 P
11 A
10 A
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135
Milepost
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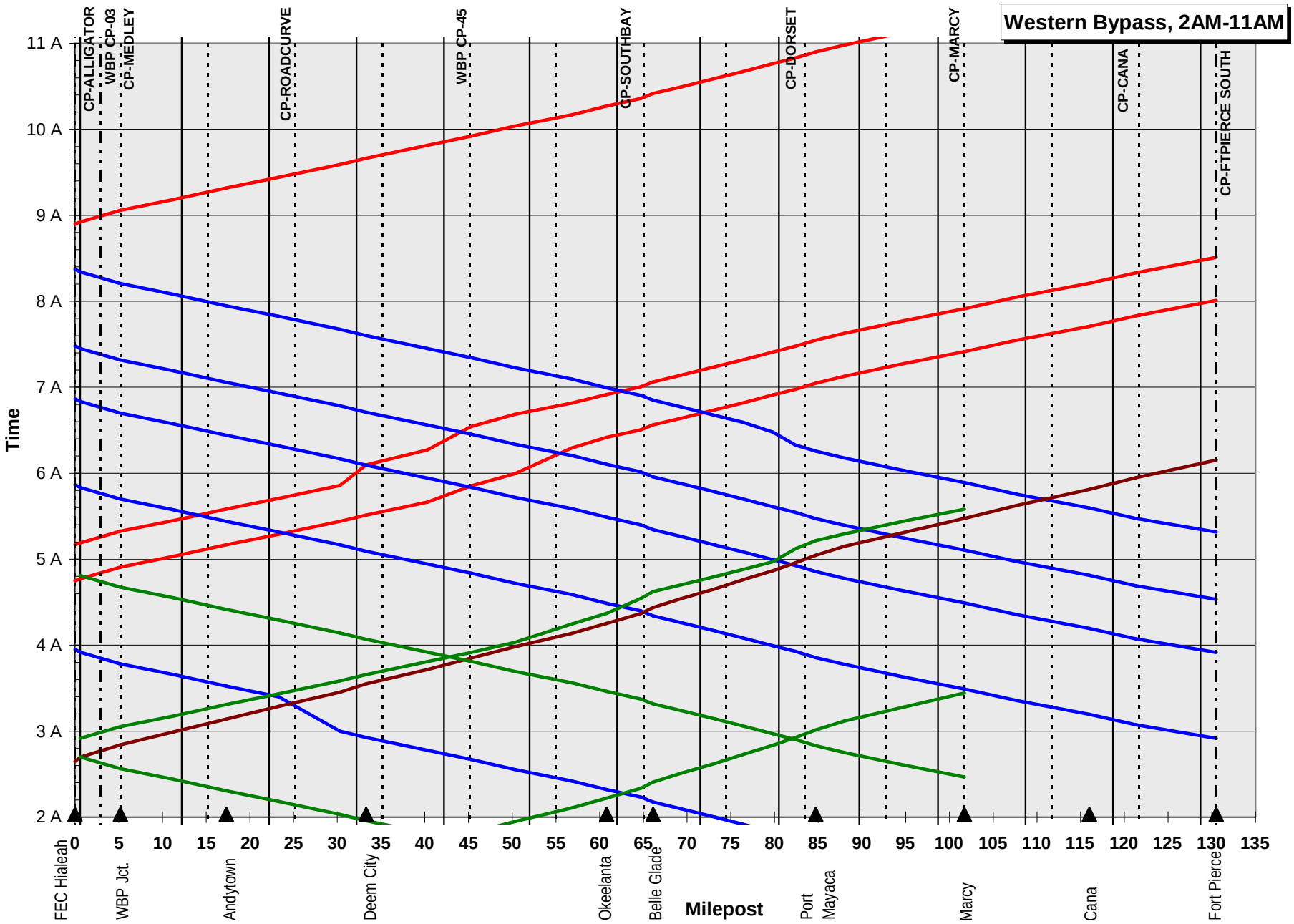
WBP Jct.
Andytown
Deem City
Okeelanta
Belle Glade
Port Mayaca
Marcy
Cana
Fort Pierce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WBP CP-03
CP-MEDLEY
CP-ROADCURVE
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CP-SOUTHBAY
CP-DORSET
CP-MARCY
CP-CANA
CP-FTPIERCE SOUTH
Time
11 A
10 A
9 A
8 A
7 A
6 A
5 A
4 A
3 A
2 A
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135
Milepost
FEC Hialeah
WBP Jct.
Andytown
Deem City
Okeelanta
Belle Glade
Port Mayaca
Marcy
Cana
Fort Pierce