



SOUTH FLORIDA
EAST COAST CORRIDOR
TRANSIT ANALYSIS STUDY

North End Railroad
Connection Alignments

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**South Florida East Coast Corridor Transit Analysis Study
Technical Memorandum
North End Railroad Connection Alternatives**

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INTRODUCTION

The South Florida East Coast Corridor (SFECC) extends almost 100 miles from Tequesta in Palm Beach County through Broward County to two potential termini: (Downtown Miami and the Miami Intermodal Center) in Dade County. The SFECC study area is roughly centered upon the alignment of the Florida East Coast Railroad (FEC) and paralleled in large part by the South Florida Rail Corridor (SFRC), Interstate 95, Dixie Highway and US Route 1.

This memorandum describes potential north end cross connections between the FEC and SFRC. Such a connection would be required in the vicinity of the north end of the SFECC study area between CSXT Milepost SX 971 and SX 965 and between FEC Milepost 300 and MP 291¹ to provide for the possibility of:

- A Jupiter Extension of existing Tri-Rail service north of West Palm Beach;
- Rerouting some FEC freight trains south of West Palm Beach via the SFRC; and/or
- Rerouting Amtrak Intercity Passenger Rail services between Jacksonville and West Palm Beach via the FEC.

The work to identify and document the connections is largely based on analysis of aerial photography and railway track charts, verified through a rudimentary field review. This memorandum presents preliminary findings and further work would be required to advance any of these conceptual plans beyond a planning level of understanding of feasibility.²

BACKGROUND

Several options for connecting the FEC to the SFRC have been proposed in earlier studies.³ The following section discusses routing alternatives that could be used for both passenger and freight services interlining between the SFRC and the FEC in the directions of: FEC southward to SFRC southward and SFRC northward to FEC northward. All existing and historical connections between FEC and SFRC were laid out in the opposite direction, SFRC southward to FEC southward and vice versa.

The FEC main line was the first railroad to arrive in southern Florida in 1896 and as a result developments have been constructed along the railroad. Over time, this meant that the FEC had many rail-highway grade crossings. The SFRC alignment was built in 1926 and ran along the outskirts of the urban developments. The grade crossings on the SFRC are substantially fewer in number, making it a potentially more attractive route for heavy through freight train movements.

DESIGN CRITERIA

Several design criteria were used to design and screen the alignment alternatives. The main design criteria were:

- The maximum acceptable degrees of curvature on any proposed curve is 12 degrees. The current general system of railroads state of practice allows no curve sharper than six degrees on mainlines, and 12 degrees in yard service. A six degree curve typically

¹ Except for the existing K-Branch connection, which is too far north for use by a Jupiter passenger service.

² The primary author of this technical memorandum was Alex Lu of Edwards and Kelcey (EK) with advice and assistance from EK's David Nelson, Zeta-Tech's Randy Resor, Gannett Fleming's Tom Hickey and EK track engineers.

³ Jupiter Corridor Alternatives Analysis, Parsons, 2004; *Joint Study to Rationalize Rail Transportation Assets in Southeast Florida, Phase 1*, Florida DOT/Wilbur Smith Associates, September 1995.



supports a maximum permissible operating speed of 35 mph.⁴ Although the proposed connection would be a mainline railroad connection, up to 12 degrees of curvature was allowed due to the highly constrained urban fabric through which the new connection must pass.

Table 1
Approximate Maximum Speeds through Curves (mph)

Degrees of Curvature	Equivalent Curving Radius	No superelevation 3" unbalance	3" superelevation 3" unbalance
3 degrees	1,910 ft	35 mph	50 mph
6 degrees	955 ft	25 mph	35 mph
9 degrees	637 ft	20 mph	30 mph
12 degrees	470 ft	15 mph	25 mph

- Best efforts were made to avoid encroaching on existing land uses, in the following order of priority:
 - Avoid homes
 - Avoid wetlands
 - Avoid public buildings in active commercial or governmental uses
 - Avoid other buildings
 - Avoid recreational uses (e.g. parks, footpaths, etc.)
 - Avoid grade crossings
 - Avoid open lots currently used for industrial purposes (e.g. open storage)
 - Minimize impacts on undeveloped woodland and other open spaces
- Alternatives that involved relocation of homes, rivers, lakes, certain highly-utilized public buildings, were unacceptable.
- Alternatives north of the existing Mangonia Park Station were generally preferred in order to avoid an operationally problematic and potentially costly splitting of Tri-Rail trunk line services north of West Palm Beach should an extension of that service to Jupiter be selected as the preferred alternative.

ALIGNMENT OPTIONS OVERVIEW

Possible alignments for the north end crossing were identified in six locations. More than one possible alignment was identified at four of the six locations. The northernmost location, Option 1 via FEC's K-Branch, lies 39.8 miles north of Jupiter and does not seem reasonable for local passenger services. Option 2 via Canal C-17 would require some passenger stations to be constructed outside the FEC's current alignment. All other locations may be used by all proposed passenger services. The possible connections are shown in Figure 1 and described in Table 2. Existing land use in the area encompassing Options 2 through 6 are illustrated in Figure 2.

⁴ FRA Track Safety Standards, 49 CFR Part 213, Subpart 57.

Figure 1. Possible North End Connections between FEC and CSXT



Figure 2. Existing Land Uses (Options 2 through 6)



Table 2. Possible Locations for North End FEC-SFRC Crossings

Option	Brief Description	Length (Approx)	Constraining Curve Radius	Potential Acquisitions
1	FEC K-Branch via Marcy and Ft. Pierce	30 miles ⁵	None	Minor (new connection at Marcy)
2A	New Canal C-17 Alignment via MacArthur Blvd to FEC at MP 291.8	4 miles	<6 degrees	1 recreational park 1-2 industrial facilities 1 open storage lot
2B	New Canal C-17 Alignment via Silver Beach Road to FEC at Lake Park	3 miles	6 degrees	1-2 industrial facilities
2C	New Canal C-17 Alignment via Canal Frontage to FEC at MP 291.8	4 miles	11½ degrees	1-2 industrial facilities possible minor Garden Road relocation
3A	Existing Lewis Terminals Connector	1.7 miles ⁶	12 degrees	2 commercial buildings
3B	New FP&L Right of Way Alignment	1.2 miles	9 degrees	1 surface parking lot 1 impoundment yard
3C	New West 13 th Street Frontage Alignment	1.8 miles	6½ degrees	1 realignment of plant siding Realignment of W 13th St 1 impoundment yard 1 community park
4A	Existing Northwood Connector (avoiding Cemetery)	0.4 miles	18 degrees	Vacant industrial parcels
4B	Revised Northwood Connection (major re-alignment)	0.5 miles	6 degrees	Two commercial buildings 1 plot of open space in downtown (flood memorial)
5A	Waterworks Connection at Banyan Boulevard	0.5 miles	10 degrees	1 commercial building in the right of way
5B	Banyan Boulevard, via Oblique Alignment	0.8 miles	4½ degrees	Red Cross building on Clematis St. Two buildings on 2 nd St.
5C	Waterworks, north of Courthouse hybrid	0.6 miles	10 degrees	2 unidentified buildings
6	Okeechobee Boulevard Median	0.6 miles	9 degrees	1 commercial building

OPTION 1: FEC K-BRANCH CONNECTION

Option 1 would employ the 30-mile Lake Okeechobee Cut-Off (known as the "K-Branch") between the FEC at Fort Pierce (about 53 miles north of West Palm Beach) and CSXT Auburndale Subdivision at Marcy, 14 miles south of Okeechobee. The K-Branch was opened by the FEC in 1947 as a substitute means of access to markets previously served via its Kissimmee Valley Extension. The K-Branch from Fort Pierce to Lake Harbor is currently under a long-term lease to the South Central Florida Railroad.

The existing turnout to the K-Branch at Fort Pierce would likely need to be upgraded for higher operating speeds. The construction of a new connection at Marcy also would be required in the eastern quadrant of the level crossing between the FEC and CSXT. There is no indication that there was a past connection in this quadrant of the crossing, so new right-of-way may be needed. The land abutting the crossing appears to be undeveloped and a connection with a

⁵ Actual track construction is limited to a new connection between the FEC and CSXT at Marcy.

⁶ Actual new track construction is limited to an 800 foot connecting track. The length of the connection is 1.7 miles.

reasonable operating speed would probably be easy to construct. In addition to the investment in new or improved connections, the FEC K-Branch must be upgraded to mainline standards.

Of all the options considered in this memorandum, the K-Branch option is likely to have the least constraint on the operating speeds of rerouted Amtrak or freight trains. It is, however, the most circuitous option, extending the journey between Fort Pierce and West Palm Beach by about 40 percent (about 21 miles) compared to staying on the FEC Main Line.

OPTION 2: EARMAN RIVER CANAL (C-17) CONNECTIONS

The Earman River Canal (C-17) in northeastern Palm Beach County flows through Riviera Beach from Clear Lake in West Palm Beach to a flood control structure near US-1 in Palm Beach Garden. The main section of the canal is 4.4 miles long and ranges from 50 to 130 feet in width. In 1955, when the US Army Corps of Engineers completed its General Design Memorandum for the C-17, most of the surrounding land was unimproved or in agricultural production. The area surrounding the C-17 today is well developed, generally with industrial, retail and other non-residential land uses on the west bank and a mixture of residential and retail land uses on the east bank.

Figure 3 shows the possible alignments for Options 2A, 2B, and 2C. The alignments generally follow Canal C-17 from CSXT at Milepost SX 965.3, one mile north of Mangonia Park and west of Congress Avenue, to FEC Milepost 291.8 (near Lighthouse Drive) or Milepost 292.5 (north of Silver Beach Road and near Park Avenue), near the Lake Park Interlocking. The precise location of the northern connection would depend on the alignment selected.



Earman River Canal (C-17) Looking North

The SFRC/CSXT alignment is shown in black on the left of Figure 3, heading due north from West Palm Beach before turning north-west and following the alignment of the Bee Line Highway. The FEC Main Line is shown to the right, maintaining an approximately northerly heading paralleling the alignment of the Old Dixie Highway. Through West Palm Beach and southward for almost 80 miles, the FEC and the SFRC run in substantially parallel rights of way with between half and three miles between them.

Figure 3 shows the area where the FEC and the SFRC diverge and is the northernmost point at which the SFRC and the FEC could be connected without substantial detours. Part of the regional canal system is shown in light blue lines. State highways and major local thoroughfares are shown in grey. Green boxes represent constraining land uses and development to be avoided.

ALIGNMENT DESCRIPTIONS

Both Options 2A and 2B diverge northward from the SFRC at SX 965.3 (north of the Congress Avenue grade crossing). From there, both cross an industrial parcel and cross Martin Luther King Jr. Boulevard and Canal C-17. The railroad alignment would run on the west bank of the canal in the 100-foot frontage area between Garden Road and the canal. To avoid the canal crossing, Option 2C diverges from the SFRC north of the Canal C-17 crossing, at SX 965.2.

Figure 3. Option 2—Earman River Canal (C-17) Connections

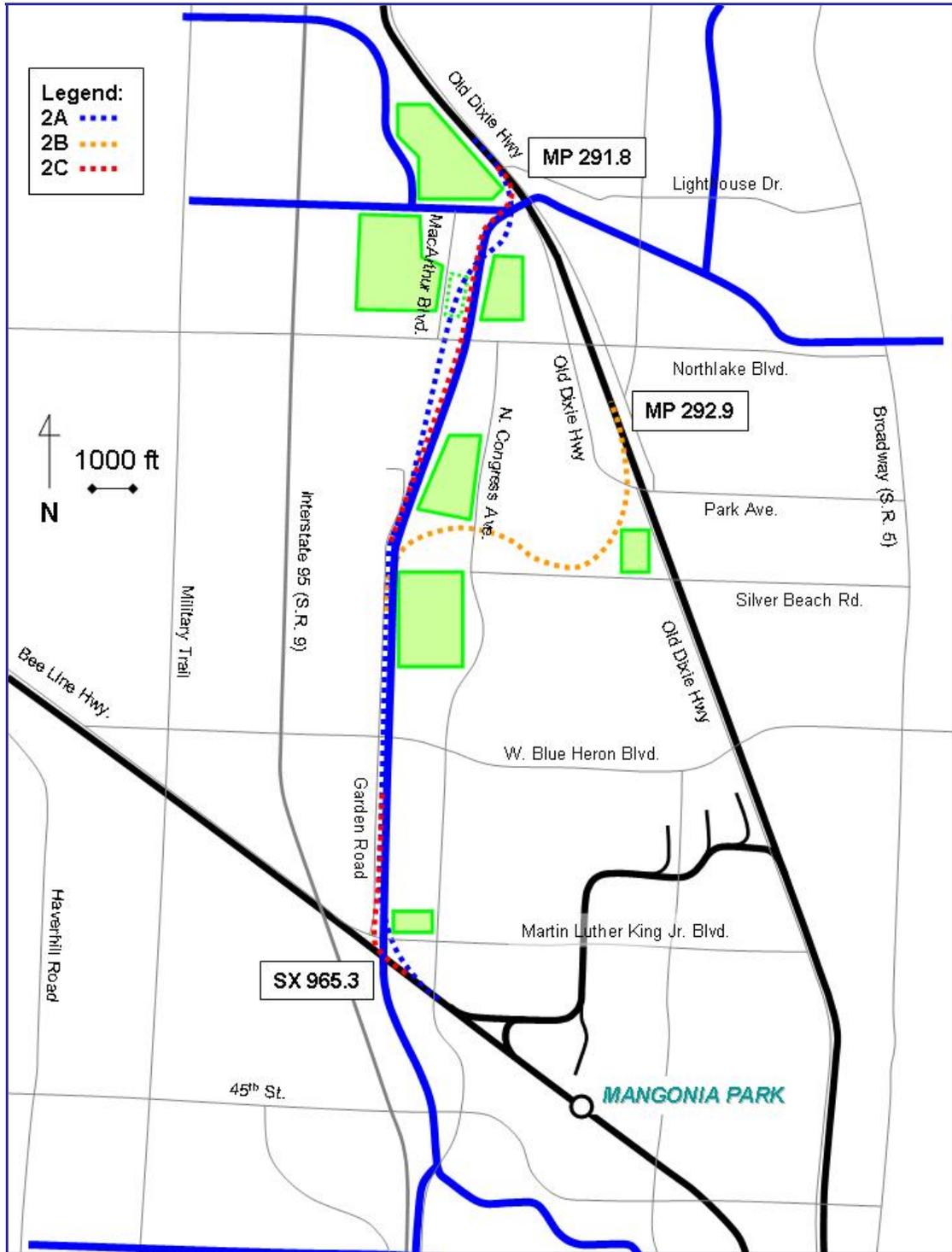


Table 3
Possible Sub-Options for Earman River Canal (C-17) Connections

Option	Description	Constraining Curve Radius	Potential Acquisitions
2A	Canal C-17 Alignment via MacArthur Blvd and FEC Junction at Milepost 291.8	> 1,000 ft (<six degrees)	1 recreational park 1-2 industrial facilities 1 open storage lot
2B	Canal C-17 Alignment via Silver Beach Road and FEC at Lake Park	1,000 ft (six degrees)	1-2 industrial facilities
2C	Canal C-17 Alignment via Frontage Only and FEC Junction at Milepost 291.8	500 ft (11½ degrees)	1-2 industrial facility possible minor Garden Road relocation

Option 2A—MacArthur Boulevard. Option 2A runs through in the undeveloped frontage of the canal, crossing Investment Lane at grade, and following the alignment of the canal. An industrial building near Consumer Street and Garden Road may be affected. As Garden Road diverges from the canal alignment, the railroad continues to follow the canal, across some open-air storage south of Northlake Boulevard and then crosses Northlake Boulevard at grade. The alignment continues across a park on MacArthur Boulevard and turns north-east to cross the canal at an oblique angle. On the east bank of the canal, Option 2A turns on an empty grassy parcel and crosses a canal for a third time. The alignment joins the FEC in the vicinity of the Lighthouse Drive grade crossing (at Milepost 291.8, north of the Northlake Boulevard grade crossing). The reverse curvature at that juncture is necessary to avoid the densely developed residences at the junction of the canals, as outlined on the map.

Option 2B—Silver Beach Road. Option 2B diverges from Option 2A at Shares Place, south of Park Avenue West. This alignment turns east, crossing the canal for the second time, and crosses a wooded undeveloped area. The alignment then turns right through an angle of 135 degrees, avoiding a rectangular body of water, and across an unoccupied sandy parcel (south of Kinetic Road and 12th Street). At this point the alignment points southeast. Without crossing Silver Beach Road, the alignment turns left through an angle of 135 degrees, and across more woodland and faces north. The alignment crosses Old Dixie Hwy within 200 ft of the FEC crossing and joins the FEC north of the grade crossing at Milepost 292.5 (north of Silver Beach Road), near the Lake Park Interlocking. The reverse curvature is necessary to negotiate a 1,500 ft strip of undeveloped woodland to reach the FEC mainline. However, due to the relative width of the woodland, the curves can be made relatively sweeping. A field check of this alternative indicated residential and retail development is underway adjacent to the Option 2B alignment east of the canal, although the actual alignment did not presently seem to be encroached.

Option 2C—Canal C-17 Frontage. Option 2C is a modification of Option 2A that seeks to avoid canal crossings while further minimizing impacts by introducing curvature radius that would constrain operating speeds. At the SFRC Junction, it may be possible to use the SFRC crossing over the canal and use a 10 to 12-degree curve for the diverging junction.⁷ Minor relocation of Garden Road near the junction may be required. At the northern end of the connector, the railroad would closely follow the canal. This would yield a lower operating speed but avoid cutting through the park on MacArthur Boulevard while avoiding a second canal crossing. To join the FEC with this alignment, a set of tight reverse curves likely would be necessary in order to avoid affecting the homes at the north end of the canal.

⁷ To facilitate freight movements, SFRC might be realigned to give a straight-through connection to the canal connector and thence to the FEC while requiring a turnout to access the original SAL mainline.



ALIGNMENT ANALYSIS

The study team found a number of serious deficiencies in the practicality of the implementation of Options 2A and 2B. Some of these difficulties were addressed in Option 2C, but not all have been eliminated:

- The construction of a major new railroad alongside a body of water may raise environmental permitting issues.
- Up to four miles of new trackage and right of way required.
- The alignments require between one to three canal crossings, some at oblique angles:
 - Option 2A requires three canal crossings.
 - Option 2B requires two canal crossings.
 - Option 2C requires one direct canal crossing (at the expense of much more restrictive curvature).
- The proposed canal crossings in Options 2A and 2B require construction of a curved bridge.
- A park on MacArthur Road would be affected by Option 2A.
- The undeveloped woodland Option 2B runs through appears to be under development.
- All of these alignments would by-pass some Riviera Beach and Lake Park neighborhoods, a potential source of ridership for a Jupiter Extension, but would provide better service to other neighborhoods on I-95 and along the Military Trail.

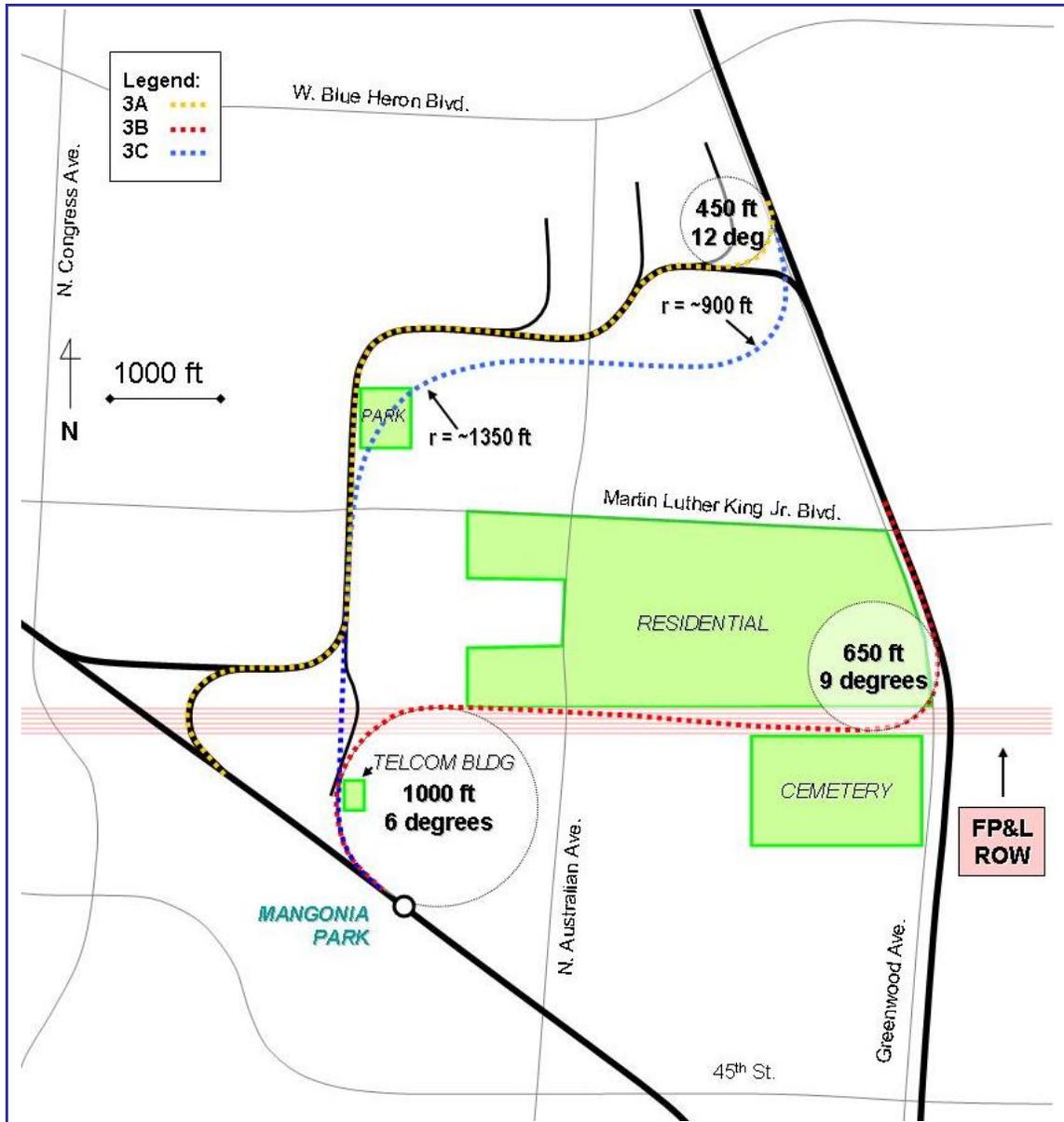
The Option 2 alignments represent a good compromise that can be done to avoid even more serious consequences:

- An alignment on the west bank of the canal would minimize disruption to planned residential developments on the east bank. The land-use pattern west of the canal appears to be mostly industrial.
- Option 2A comes within 500 feet of residential developments near MacArthur Boulevard. However, because the railroad travels through a park in Option 2A, it is isolated from the residences by open space, which could be used to create environmental mitigation barriers.
- Option 2B comes within 250 feet of residential developments near Congress Avenue and Park Avenue W., and also close to existing residences at Silver Beach Road and Old Dixie Highway. However, a variety of mitigation measures are possible due to the presence of undeveloped woodland in the area.
- All three options run close to residences under construction at Water Tower Road and Venetian Isles Drive, and the area south of Silver Beach Road (at Rose Gate Boulevard) where residential developments are apparently planned. However, the railway would be separated from the developments by the width of the canal.
- The alignment on the west side of the canal minimizes disruption to industry on the west side of the canal.
- All options use existing frontage, open spaces, woodland, voids, and minimal use of already developed industrial space. None involve relocation of homes.

OPTION 3: LEWIS TERMINALS CONNECTIONS

Option 3 would connect the SFRC and the FEC in the vicinity of the existing Lewis Terminals Connector (also known as "Mission Spur" or the "Riviera Beach Connection"). Figure 4 shows possible alignments for three options. The existing main lines and industry trackage are shown in black on the map. The two main lines are approximately one mile apart at this point.

Figure 4. Option 3—Lewis Terminals Connections



Option 3A (Existing Connector Option) would mostly use existing industry-owned Lewis Terminals trackage. Option 3B (FP&L Option) would create a new east-west connector within a 200 feet wide Florida Power & Light (FP&L) right-of-way. Option 3C (West 13th Street Option) would create a new southwest-northeast connection using portions of existing Lewis

Terminals trackage, West 13th Street’s northern frontage and vacant parcels. The green boxes represent major constraints identified from aerial photographs. Summaries of the sub-options are provided in Table 4.

All alignments generally leave the SFRC near the existing connection at CSXT Milepost SX 966.0, a half mile north of Tri-Rail’s Mangonia Park Station, and join the FEC at Milepost 295.1 (near the existing Lewis Terminals connection) or Milepost 295.5 (near West 4th Street and south of the SR 710 grade crossing). The precise location of connections would depend on the alignments selected.

Table 4. Possible Sub-Options for Lewis Terminals Connections

Option	Brief Description	Constraining Curve Radius	Possible Acquisitions
3A	Existing Lewis Terminals Industrial Tracks	450 feet (12 degrees)	2 commercial buildings
3B	FP&L Right of Way (New SFRC Connection)	650 feet (9 degrees)	1 surface parking lot 1 impoundment yard
3C	New West 13 th St Frontage Alignment	900 feet (6½ degrees)	1 realignment of plant siding Realignment of W 13th St 1 impoundment yard 1 community park

ALIGNMENT DESCRIPTION

Options 3A and 3C join the FEC at Milepost (near the existing Lewis Terminals connection). The alignments generally leave the SFRC near the existing wye at CSXT Milepost SX 966.0, where a variety of speeds can be attained by progressively widening out the existing 12-degree wye to the east, encroaching on some industrial development. Option 3B joins the FEC at Milepost 295.5, south of the SR 710 grade crossing near West 4th Street.

Option 3A—Existing Lewis Terminal Connector. The Lewis Terminals Connector is the only connection between the FEC and the SFRC in this area that is currently active. However, the connection at the FEC end faces south. Current track geometry for the Connector is summarized in Table 5. Northbound trains leaving the SFRC have to execute a restrictive right turn (about 12 degrees) to get onto the Lewis Terminals Connector, then make a right-angle left turn, a right-angled right turn (both in excess of 12 degrees), negotiate a reverse curve, and then turn south to gain access to the FEC in a southwards direction. There is at present no northward access to the FEC without reversing the train. The Lewis Terminals connector is identified in the Florida DOT SFRC Industry Inventory as being “owned by industry”.



Lewis Terminals Track and Commercial Buildings along SR 710, Looking North

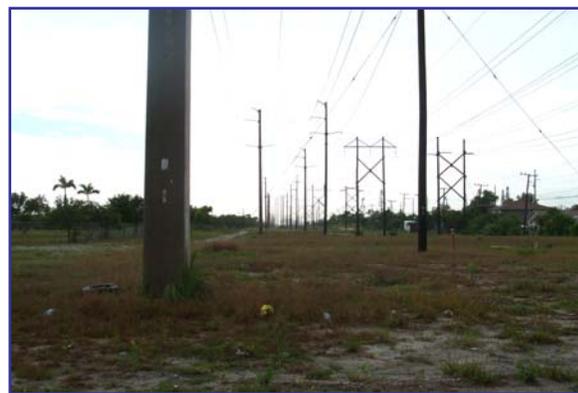
Table 5. Existing Lewis Terminals Connector Geometry

Distance from SFRC Jct	Angle	Direction (South to North)	Degrees of Curvature	Approximate Curve Speeds ⁸
0 feet	135°	Right	~12°	20 mph
1,750 feet	90°	Left	~12°	25 mph
2,500 feet	Tangent (straight) Section			40 mph
4,500 feet	90°	Right	~12°	25 mph
6,500 feet	60°	Left	~10°	20 mph
7,300 feet	60°	Right	~10°	20 mph
8,000 feet	60°	Right	~12°	20 mph
8,500 feet	FEC Junction			

Northward-oriented train movements on the FEC Main Line could be achieved by constructing new north-facing connection at the FEC end of the Lewis Terminals Connector. Space for the new connection is presently restricted by existing commercial buildings on the west side of SR 710. To attain the required 12 degrees of curvature would necessitate the destruction of at least two of these buildings. The Option 3A alignment would be approximately 1.7 miles long and will likely have a 20 mph speed restriction throughout. A passenger train would take approximately five minutes to traverse the segment, resulting in a six-minute trip time between Mangonia Park and new Riviera Beach Station located adjacent to SR 710 north of the new connection. While this connection would be physically feasible for freight and passenger trains, curvature is severe and would result in slow operating speeds, high track maintenance requirements and train operating costs.

Option 3B—Florida Power & Light Right of Way. Better geometry may be attained by using the 200-foot wide Florida Power & Light power right of way immediately south of West First Street. Three possible alternatives were investigated for this sub-option, differentiated by their means of access to the SFRC at the south end of the alignment (use of the existing SFRC connection and two new alignments. The alternative that would provide a new connection with the least severe curvature (6½ degrees) was selected to represent this sub-option. This new connection would leave the SFRC in the vicinity of 53rd Street and Hill Avenue. It would require relocation of an existing vehicle impoundment yard and office building surface parking lot.

At the FEC end, the broadest curve that fit within the 200-ft right of way without impinging on the homes to the north and the cemetery to the south of the ROW is a nine degree curve. Part of this curve would cross SR 710 (Greenwood Avenue/Old Dixie Highway) at grade. This may further restrict operating speeds as the available amount of superelevation that can be introduced in the curve would be limited. The maximum allowable speed through this curve and grade crossing is likely to be about 25 mph.



*Florida Power & Light Right of Way
 Looking West from SR 710*

The connection is physically feasible for both freight and passenger trains, and

⁸ Hypothetical speeds per FRA Track Safety Standards §213.57 at three inches of unbalance and three inches of elevation. Given the length of the Lewis Terminals Connector, the proximity of adjacent industrial activities and the spacing of industrial spurs and grade crossings, it is unlikely most of these speeds can be achieved in practice.

could avoid demolition of any significant existing structures.

Option 3C—West 13th Street Frontage. The least restrictive alignment in the vicinity of Lewis Terminals is attained by creating a new Lewis Terminals Connector along the frontage of West 13th Street. This option would leave the SFRC using the connection described in Option 3B, but continue north rather than turning east along the FP&L right of way.

The alignment would parallel an existing sand and gravel delivery track, and some of that facility may need to be reconfigured to give a straight move for trains traveling on to the Lewis Terminal Connector. The alignment would intersect the tangent section of the existing Connector, but relax the current 12 degree curve at Avenue P and West 13th Street to four degrees (or best possible) by crossing a local pair of baseball fields. It may be possible to reconfigure the ball fields using the unaffected portion of the site and a vacant parcel to the north.



*Looking East on West 13th Street
 From Existing At-Grade Crossing*

The existing Lewis Terminals Connection travels north of the industries along West 13th Street. The new alignment would travel along the north side of West 13th Street, taking advantage of undeveloped frontage land. The frontage eventually connects to a former Drive-In Movie Theatre abutting SR 710, now used as an auto scrapping facility. The best-possible curve at the FEC Junction is constrained by an industrial building at West 15th Street and Old Dixie Highway, resulting in a connection crossing SR 710 at grade with about 6½ degrees of curvature.

Table 7. New Lewis Terminals Connector Geometry

Distance from SFRC Jct	Angle	Direction (South to North)	Degrees of Curvature	Approximate Curve Speeds
0 feet	30°	Right	6°	35 mph
3,500 feet	Grade Crossing (MLK Blvd)			N/A
3,500 feet	90°	Right	4°	45 mph
6,500 feet	Grade Crossing (N Australian Av)			N/A
7,500 feet	120°	Left	6½°	35 mph
9,500 feet	FEC Junction			

The resulting new alignment would be approximately 1.8 miles long and likely have a maximum authorized speed of about 35 mph speed. It offers the highest operating speeds of all the options considered in the vicinity of Lewis Terminals. A passenger train would take approximately three minutes to traverse the segment, resulting in a four-minute travel time between Mangonia Park and a new Riviera Beach Station.

ALIGNMENT ANALYSIS

The alignment outlined in Options 3A and 3B represent very low impact alignments that deliver a low to medium level of passenger train performance. Option 3C represents a medium impact alignment that delivers the highest level of performance for all north-end connections studied.

- Option 3B requires no building Acquisitions, and fits entirely within existing rights of way. However, it comes within 50 feet of some existing residences and a cemetery.

- Options 3A and 3C travel through essentially light industrial areas and maintains a 400-foot separation from any residential developments.
- The Option 3C alignment on the frontage of West 13th Street minimizes disruption to existing industry.
- The relocation of the ball fields required for Option 3C appears possible using the unaffected portion of the site and a vacant parcel immediately to the north.
- All sub-options provide opportunity to serve Lake Park with passenger rail service.
- All sub-options use existing frontage, and vacant parcels with minimal use of already developed industrial space. None involve relocation of homes.

The study team also identified the following deficiencies with these sub-options.

- At-grade crossings of major state routes (SR 704A and 710) by all three sub-options.
- Option 3B may generate objections from nearby abutters due to noise and sight issues.
- Option 3C may generate objections from the relocation of the baseball park and vehicular access changes to business located along West 13th Street.

OPTION 4: NORTHWOOD CONNECTIONS

Option 4 would connect the SFRC and FEC in the vicinity of the existing Northwood Connector. Figure 5 shows the two possible sub-options investigated. Option 4A (Existing Connector Option) would reorient the FEC end of the existing connection⁹ permitting through movements to and from the north. Option 4B (Realigned Northwood Connector) would provide a new alignment for the Northwood Connector specifically oriented for movements oriented to and from the north on the FEC and to and from the south on the SFRC. Land uses in the vicinity of the alignments are mostly light industrial, but new residential uses have been introduced north of the existing connector and 27th Street. Both ends of the alignments are also constrained by two significant cemeteries.

Both alignments would leave the SFRC in the general vicinity of the existing wye at CSXT Milepost SX 968.3, one-and-a-half miles north of West Palm Beach Station, and join the FEC at Milepost 297.5 (about 750 ft south of the 30th Street grade crossing). The two main lines are approximately a half mile apart at this point. The main lines and existing industry trackage is shown in black on Figure 5. The green boxes represent major constraints.

Option 4A mostly follows existing trackage except for the addition of a northward-oriented connection to the FEC. The location of the connection is constrained by historically significant Evergreen Cemetery at the head of North Rosemary Avenue, west of the FEC mainline.

Option 4B entails constructing an entirely new connection that would reverse the

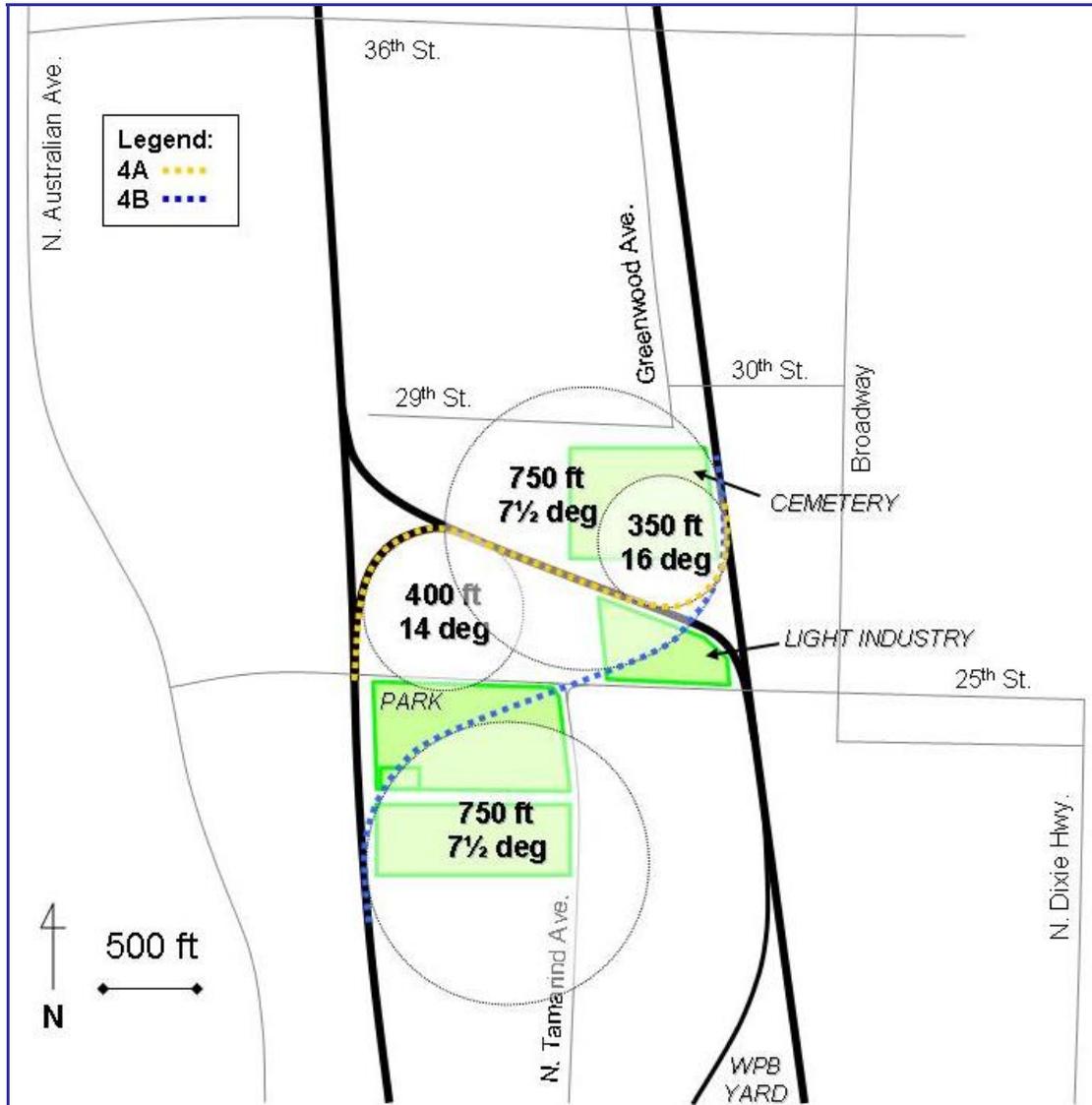


*Existing Northwood Connector
 Looking West from North Rosemary Avenue*

⁹ The existing connection at Northwood is oriented such that northward and southward traffic on the SFRC can easily access West Palm Beach Yard on the FEC, and northward traffic on the FEC can easily access the SFRC. The bias reflects historical traffic patterns; the FEC may send traffic via the SAL to Tampa and elsewhere, but the SAL seldom send traffic north on the FEC mainline as the SAL had its own connection to the north via Jacksonville.

orientation of the current connector. Many alternative alignments were investigated Option 4B, which was constrained on the FEC end by the location of Evergreen Cemetery and on the SFRC end by the mass grave site and memorial grounds for victims of the Hurricane of 1928. The alternative selected to illustrate this sub-option encroaches on the memorial grounds but stays clear of the mass grave site.

Figure 5. Option 4—Northwood Connections



ALIGNMENT DESCRIPTION

The construction of new connections need to avoid Evergreen Cemetery immediately north of the current connection at Milepost 297.5 on the FEC. Options 4A and 4B are constrained by the boundaries of the non-rectangular cemetery occupying land up to the FEC right-of-way. On the SFRC end, constraints are presented by the mass grave site and homes at the corner of 23rd St. and Windsor Avenue

Option 4A—Existing Connector Option. Construction of a standard curve between the existing Northwood connector and the FEC oriented towards the north is not likely possible without encroaching on Evergreen Cemetery. Curvature of 16 degrees would likely be necessary to avoid the cemetery, which exceeds the 12-degree maximum curvature typically employed on the general system of railroads.¹⁰ The curvature of the south leg of the SFRC wye is estimated to be at the limits of design standards and require a slow speed movement.

Option 4B—Realigned Connector Option. If major realignment work were considered, it would need to encroach on the memorial grounds bound by 25th Street, North Tamarind Avenue, 23rd Street and the SFRC. There is one unidentified building on the open space but it does not appear to be residential. The limiting case would provide 7½ degree curves on both the SFRC and the FEC sides of the new connector. The choice of curve radii would depend on maximization of speed during the engineering design phase. This alignment would require the railroad to bisect the open space and relocation of some light industrial activities east of North Tamarind Avenue and north of 25th Street.

ALIGNMENT ANALYSIS

A number of deficiencies were identified in Options 4A and 4B:

1. The geometry of Option 4A requires further engineering studies to determine if routine passage of 85-foot commuter rail cars and 89-foot autoracks would be permissible.
2. Option 4B requires disruptions to industry and a sensitive mass burial site. Curvature may be increased as a result of designing around the site.
3. In all options, alignments are constrained by the location of Evergreen Cemetery.

However, all options use existing open spaces or industrial space that may be willing to relocate. None involve relocation of homes, although both options come within 50 feet of existing residential areas.

OPTION 5: WATERWORKS CONNECTION

Option 5 would connect the SFRC and the FEC immediately north of West Palm Beach Station in the vicinity of the former FEC Waterworks Spur on the north side of Banyan Boulevard. Figure 6 shows two possible sub-options investigated. The SFRC is shown in black on the left of Figure 6 with the FEC Main Line on the right. The green boxes represent major physical constraints to be avoided.

Options 5A (Waterworks Connection) takes advantage of the former freight siding connecting the Palm Beach Water Works to the FEC mainline at Milepost 299.2. Option 5B (Realigned Waterworks Connection) reflects a new oblique alignment. Land uses in the vicinity are public and semi-public on either side of and to the south of Banyan Boulevard and residential to the north.



*Former Waterworks Spur
 Looking East from North Tamarind Avenue*

¹⁰ Coal railroads in West Virginia employ curves in excess of 25 degrees using modern locomotives and 60-foot coal cars. Rolling stock longer than 60 feet are barred from those coal lines, however. A typical passenger car is 85 feet long.

Figure 6. Option 5—Waterworks Connections



ALIGNMENT DESCRIPTION

Option 5A would diverge from the SFRC immediately north of West Palm Beach Station at CSXT Milepost SX 969.8. It would join the FEC south of the courthouse garage structure at Third Street and North Rosemary Avenue. Option 5B would diverge from the south end of the station at SX 969.9 and required substantial reconstruction work. It crosses a mostly open tract of land slated for transit oriented development.¹¹ It joins the FEC to the north of courthouse garage in the vicinity of the intersection of Fourth Street and Railroad Avenue West.

The two railroads lay less than a half-mile apart at this point. This would be a poor location for a freight connection as long freight trains would tie up traffic at many of crossings in West Palm Beach simultaneously. Shorter commuter trains, however, would be less disruptive.

Option 5A—Waterworks Connection. This option represents the best possible alignment along the original Waterworks Spur right-of-way along the north frontage of Banyan

¹¹ *Plan Seeks to Leverage Tri-Rail Stop*, South Florida Business Journal – April 7, 2006, by Brian Bandell.

Boulevard. It would diverge from the SFRC immediately north of West Palm Beach Station, which may require minor realignment of trackwork, then cross at grade through the intersection of North Tamarind Avenue and Banyan Boulevard. Continuing around a 10-degree curve, a train would make a right-angle turn and proceed parallel to Banyan Boulevard. It would make another 10-degree right-angle turn to the left and cross North Rosemary Avenue at grade north of Banyan Boulevard, proceeding through the surface courthouse parking lot south of the garage structure before connecting to the FEC.

Option 5B—Realigned Waterworks Connection. Option 5B represents an attempt to define an alternative to the original Waterworks Spur alignment that would provide a higher speed connection between the two main lines using publicly-held or vacant parcels. It would require relocation of some state and federal office buildings as well as reconfiguration of the current passenger station. Option 5B would diverge from the SFRC near the intersection of Fern Street and South Tamarind Avenue via a 4½-degree right turn through a 45-degree angle, then travel obliquely across downtown West Palm Beach. This would create more at-grade crossings than Option 5A. The alignment would execute a 4½-degree left turn north of Third Street before connecting to the FEC in the vicinity of West Palm Beach Interlocking at Milepost 296.6.

ALIGNMENT ANALYSIS

A number of deficiencies were identified regarding Options 5A and 5B:

- The geometry of Option 5A is restricting and slow, although it does not exceed railroad design standards.
- Option 5A crosses the intersection of Banyan Boulevard and North Tamarind Avenue at grade and requires the demolition of one building at Banyan Boulevard and North Rosemary Avenue
- Option 5B requires relocation of several public office buildings.
- All options are basically constrained by the location of the courthouse garage and by the many at-grade crossings resulting from the smaller block size in this section of West Palm Beach.

OPTION 6: OKEECHOBEE BOULEVARD

Option 6 would connect the SFRC and the FEC via the median of Okeechobee Boulevard (SR 704). The alignment was proposed to take advantage of the wide median of Okeechobee Boulevard and its relatively open intersection with South Tamarind and Parker Avenues. It would diverge from the SFRC at a point south of the West Palm Beach Station, offering the opportunity for a radically different approach to passenger service design.

The alignment demonstrates curve radii superior to many of the other options developed in this exercise. A station could be placed in the median east of South Tamarind Avenue, which would provide direct service to CityPlace, a major regional retail center, and the Convention Center complex. Unfortunately, field review of the concept identified potential traffic and grade concerns that would substantially



*Median of Okeechobee Boulevard
 Looking East from South Tamarind Avenue*

diminish the practicality of this alignment as a functioning railroad corridor. Further, a new building is under construction in the median of Okeechobee Boulevard. Based on these concerns, Option 6 was eliminated from consideration at this time. The median alignment could be useful, however, for an alternative employing light rail or bus rapid transit technologies and therefore may be reconsidered later in the process.

ALIGNMENT CONCLUSIONS

Based on this cursory analysis, three of the potential north end connections identified between the FEC and SFRC appear to warrant further investigation:

- **Option 2C—Canal C-17 Frontage.** This option offers a reasonably unencumbered and direct connection between the two main lines suitable for freight, Amtrak and local passenger trains, assuming that no insurmountable environmental and community issues are identified in subsequent, more detailed analysis.
- **Option 3B—Florida Power & Light Alignment at Riviera Beach.** This option offers a relatively short connection between the two main lines suitable for freight, Amtrak and local passenger trains, albeit at the expense of operating performance through two restrictive curves. Use of the existing utility right of way has minimal impacts on surrounding land uses.
- **Option 5A—Waterworks Connection.** This option offers the shortest connection (a half mile) with minimal impacts, albeit at low operating speed. It would be suitable for local passenger trains and possibly for Amtrak trains, but would not be suitable for regular use by freight trains.

The other options were considered less suitable due to the following considerations:

- **Option 1 (K-Branch):** while possibly useful for rerouting freight or Amtrak trains, it is too remote for local passenger rail service.
- **Option 2A (MacArthur Boulevard):** realignment of local streets and multiple canal crossings make it less attractive than the Option 2C variation.
- **Option 2B (Silver Beach Road):** circuitous alignment with multiple canal crossings and possibly significant impacts on adjacent residential communities.
- **Option 3A (Existing Lewis Terminal Connector):** circuitous alignment with weak operational performance.
- **Option 3C (West 13th Street Frontage):** complicated interfaces with local vehicle traffic and possible negative impact on local businesses, coupled with weak operational performance.
- **Option 4A (Existing Northwood Connector):** unacceptable curvature and possible negative impact on adjacent residential community.
- **Option 4B (Realigned Northwood Connector):** significant impacts on mass grave site and memorial grounds as well as adjacent residential communities.
- **Option 5B (Realigned Waterworks Connection):** substantial impacts on downtown commercial development and existing public buildings.
- **Option 6 (Okeechobee Boulevard):** poor operating performance and significant traffic conflicts.