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Value Engineering for Transportation Improvements

Sunrail Phase 3

November 7-10, 2016

Value Engineering
For Transportation Improvements

SunRail Phase 3

Value Engineering Study Final Report

FM Number:	
Fed. Aid Project:	Yes
Project Description:	SunRail Phase 3
Study Dates:	November 7 – 10, 2016

Project Development Phase				Study Identification Number		
PD&E	Design	Other		VE Item No.		
HDR, Inc.				Yr.	Dist.	No.
				17	005	0_

This study has been performed in accordance with current applicable FDOT Value Engineering Procedures and Techniques

Richard L. Johnson, CVS No. 20030201, PE No. 38681

Date: February 3, 2017

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EXECUTIVE SUMMARY 1

1.1 INTRODUCTION

A Value Engineering (VE) Study was conducted November 7 – 10, 2016 using the VE methodology to improve the Project Development and Environment (PD&E) for the SunRail Phase 3 project that is 5.35 miles in length comprising approximately 3.35 miles of the existing OUC Stanton Spur and 2.0 miles of property controlled by Greater Orlando Aviation Authority (GOAA), both of which are owned by City of Orlando, as well as potential modifications to the existing and proposed SunRail Phase I and Phase II corridor. The preliminary proposed improvements consist of realigning SunRail Phase II South Mainline, a transfer station with two additional tracks located on the Strates Property adjacent to the SunRail Phase II South corridor, proposed additional track along the existing OUC Stanton Spur and proposed double track through the GOAA property to the Orlando International Airport (OIA) Intermodal Transit Facility (ITF). The proposed improvements will also include grade crossing improvements, two new crossings, track crossover, culvert, new bridges and extending the existing concrete trestle bridges. The VE study analyzed value improvements for the PD&E documents, prepared by HDR, Inc.

The OUC Stanton Spur corridor is a critical component of the proposed SunRail Extension to the OIA corridor (**Figure 1.1 - 1 Project Location Map**) as it is an existing heavy rail (freight) corridor connecting the Central Florida Rail Corridor (CFRC) and the OIA property. The rail spur connects to the CFRC at an existing wye turnout approximately one mile north of the Meadow Woods Station (currently under construction). Surrounding land uses along the existing spur corridor include agricultural land, light manufacturing operations and transportation support services. The existing Stanton Spur corridor consists of a single track within 120 to 150 ft. of existing right of way. Up to two parallel tracks would be constructed within the existing railroad right of way to allow for frequent commuter service to extend from the existing SunRail main line to OIA. The existing Stanton Spur is not a Class 1 freight facility. The new parallel passenger tracks would meet standards for passenger service speeds up to 65 mph and improvements to the existing spur track would be considered as operational analysis is completed on the corridor.

A transfer station is proposed near the wye, shown in **Figure 1.1 -1,** and will allow direct passenger transfers from the SunRail Commuter Rail Transit (CRT) system main line to the SunRail Extension to OIA. This transfer station will serve only rail passenger transfers and local bus service connections; it does not provide any type of parking or kiss-and-ride at the station. It truly serves as a transfer station and is neither an origin nor destination station. The eastern two miles of the corridor would be located on GOAA property. GOAA recently began construction on the South Terminal including the ITF, a parking garage and an extension of the Automated People Mover (APM) System connecting to the existing North Terminal. The right of way for this two mile section has been a part of the GOAA Master Plan; and much of the corridor has previously been environmentally permitted and mitigated.

Up to two tracks would be constructed to extend from the Stanton Spur to the ITF including a rail bridge over Boggy Creek and elevated track connecting to a second level station platform at the ITF. This section of track may consist of fill, retaining wall or bridge structure. The right of way width in this section will be approximately 120 feet wide. The existing rapid infiltration basin (RIB) ponds are already impacted by Brightline and will be relocated or removed by others.

The SunRail Extension to OIA will connect with the SunRail commuter rail service and will include either the same or compatible rail vehicles as the existing SunRail trains. The existing Phase 1 stations and proposed Phase 2 South stations also will be evaluated to determine long-term (airport) parking impacts to these facilities. The existing Vehicle Storage and Maintenance Facility (VSMF) constructed as part of Phase 1 in Sanford and the Vehicle Storage and Light Maintenance Facility (VSLMF) under construction adjacent to the Poinciana Station will be evaluated further to determine any impacts of storing additional rail vehicles for the new service.

Table 1.1-1 Preliminary Construction Cost Estimate shows the Planning Level Estimate that included preliminary construction costs. This estimate did not include costs for utility relocations, wetland mitigation, potential contamination cleanup, CEI, Engineering and other FDOT costs. Construction is programmed to begin in 2018. As of 2016, the right of way cost estimates were $37.98 million for the corridor and GOAA property.

Figure 1.1 – 1 Project Location Map

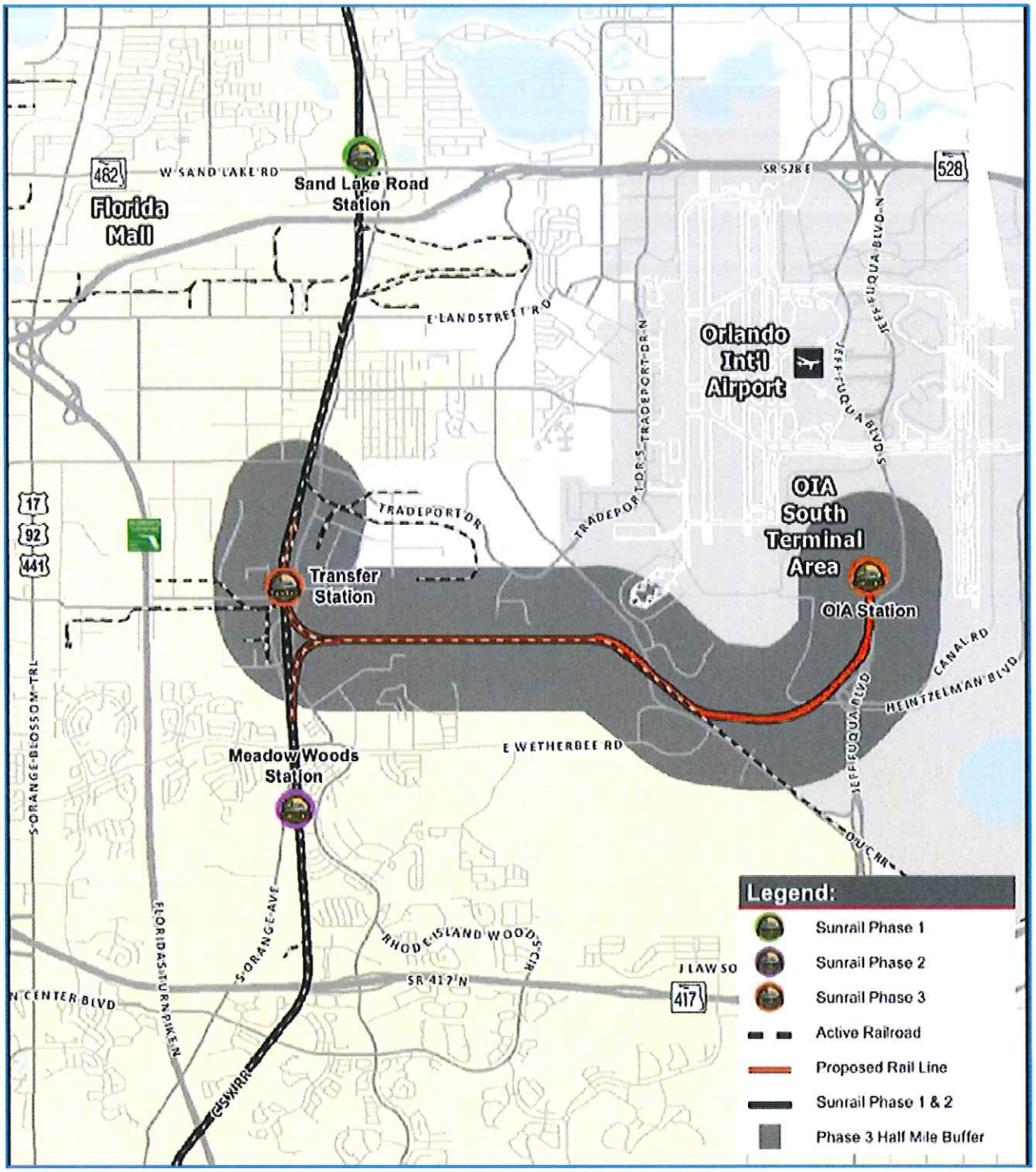


Table 1.1 – 1

Preliminary Construction Cost Estimates

FTA CATEGORY No.	DESCRIPTION	2015 BASE YEAR COST W/O CONTINGENCY	2015 ALLOCATED & Unallocated CONTINGENCY		2015 ESTIMATE WITH CONTINGENCY
10	GUIDEWAY AND TRACK ELEMENTS	$52,133,670	$16,485,101	31.6%	$68,618,771
20	STATIONS, STOPS, TERMINALS, INTERMODALS	$10,284,780	$3,085,434	30.0%	$13,370,214
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN BLDGS	$0	$0	0.0%	$0
40	SITEWORK & SPECIAL CONDITIONS	$14,253,415	$4,276,024	30.0%	$18,529,439
50	SYSTEMS	$17,148,980	$5,144,694	30.0%	$22,293,673
	CONSTRUCTION SUBTOTAL (10-50)	**$93,820,844**	**$28,991,253**	**30.9%**	**$122,812,097**
60	RIGHT-OF-WAY, LAND, EXISTING IMPROVEMENTS	$0	$0	0.0%	$0
70	VEHICLES	$31,521,645	$6,246,431	19.8%	$37,768,077
80	PROFESSIONAL SERVICES	$32,203,025	$8,105,599	25.2%	$40,308,624
	SUBTOTAL (SUM CATEGORIES 10-80)	**$157,545,514**	**$43,343,283**	**27.51%**	**$200,888,798**
90	UNALLOCATED CONTINGENCY (% of Base Cost)		$21,000,000	13.33%	$21,000,000
	SUBTOTAL (SUM CATEGORIES 10-90)	**$157,545,514**	**$64,343,283**	**40.84%**	**$221,888,798**
100	FINANCE CHARGES				$900,000
	TOTAL	**$157,545,514**	**$64,343,283**	**40.84%**	**$222,788,798**

Reference: HDR, Inc. Estimate provided November 7, 2016

1.2 GOALS AND OBJECTIVES

The objective of the study was to identify opportunities and recommend concepts that may increase value in terms of capital cost improvements, improve constructability, yet provide the basic functional requirements of the project. This report documents the value engineering analysis performed to support decisions related to the planned project concepts. Additionally, it includes other data related to the preliminary line and grade design concepts.

Although several pre-existing conditions were stated during the initial briefing at the beginning of the VE study, some of the major project constraints identified were as follows:

- Must connect at the second level of the Intermodal Transit Facility
- Cannot eliminate the Bus connection at the Transfer Station

The basic project functions are to create additional capacity and improve the Commuter Rail by optimizing construction and the Operating System. As shown in **Section 5**, the Functional Analysis System Techniques (FAST) Diagram illustrates the functions as determined by the VE team.

1.3 RESULTS OF THE STUDY

The VE Team generated 26 ideas of which two were determined to be design suggestions during the Creative Ideas phase of the VE Job Plan. The ideas were then evaluated based on the evaluation criteria for this project. The object of this evaluation was to identify ideas with the most promise to achieve savings while preserving functions or improving operations.

The team began the evaluation process of scoring the PD&E documents and the individual creative ideas. During this process it was agreed that the team had various ideas for all of the functions, but only certain ideas having the greatest potential value improvement were carried forward for further development. The remaining ideas either became design suggestions (many specific to a particular component within the project) or were eliminated as duplicate, not appropriate, or improbable for acceptance. The VE team ultimately categorized 12 ideas as recommendations and two design suggestions that should be further investigated, for the consultants and FDOT to consider. The developed ideas maintain the required functions while improving overall costs, constructability, minimizing time, minimizing utility conflicts and right-of-way issues, minimizing environmental impacts, as well as addressing regional issues, aesthetics and safety. The ideas and how they rated on a weighted scoring evaluation are listed in the table in **Section 6**. Those ideas that were eliminated are shown with strikeout font.

The VE Team presented design suggestions for FDOT's consideration and they are shown in **Section 6**. No specific action is normally required to accept or not accept the suggestions. It is helpful, for documentation purposes, to list those suggestions that will be acted upon by the FDOT.

1.4 RECOMMENDED ALTERNATIVES

The recommendations for further consideration are shown in **Table 1.4-1, Summary of Highest Rated Recommendations.** Potential cost savings are shown in present day dollars.

The proposed recommendations in the following table indicate the anticipated initial cost. Acceptance of these recommendations would improve the value and be incorporated in the design of the facility. These recommendations appear to be the most cost effective way to provide the required functions. Some of the recommendations can be taken with others, while others cannot.

The recommendations developed by the study team will directly affect the existing project design. The recommended alternatives have been presented to the FDOT, and no fatal flaws with the proposed recommendations were indicated at the presentation with the possible exception of the idea to purchase only two sets of cars. It is understood that further analysis of these recommendations may be needed in order to make a final decision to accept them. The FDOT will determine the acceptability of each recommendation. Each recommendation may be implemented individually or partially.

1.5 MANAGEMENT ACCEPTANCE & IMPLEMENTATION

Management action on each of the recommendations taken at the subsequent resolution meeting will be included in **Table 1.4 – 1** in the "Management Action" column. The FDOT Project Manager must ensure that all accepted recommendations are implemented and all pending actions are resolved for inclusion in the project design. Close coordination with the District Value Engineer is encouraged to insure timely resolution of management action.

TABLE 1.4 – 1
SUMMARY OF HIGHEST RATED RECOMMENDATIONS

		PRESENT WORTH (PW) OF COST (FUTURE COST)			
Rec. No.	**Description**	**Management Action**	**Comments**	**Potential Cost Savings/Non Overlapped Savings**	
1	For the section between 440 and 500+/- can we use the existing track instead of new	FS		$1,407,000	
2	Share Brightline track from the ITF to the OUC corridor	NA		$38,872,000	
3	Leave the existing CSX track and build a single center platform between OIA and SunRail tracks	NA		$213,000	
6	Increase the approach grade for the ITF from 2.5% to 3% and shift the start of grade to the north	FS		$2,584,000	$1,033,600
7	Maintain track centers approaching the ITF and provide side platforms	NA		$10,242,000	
8	Build the new Transfer Station and implement Bus Rapid Transit (BRT) service along the proposed Right of Way to the ITF	NA		$77,917,000	
11	Use 50-ft. spans instead of 24-ft. spans to save on substructure and use common substructure for opposing track directions	A		$6,528,000	$1,187,000
16	Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station	NA		($385,675,000)	
17	Purchase only two sets of cars and use the spares from the SunRail yard	NA		$10,522,000	$10,522,000
18	Shorten the bridge at Sta. 545+50 from 900 ft. to 200 ft. due to anticipated shrinking of the flood plain (by others)	A		$16,588,000	$8,294,000

TABLE 1.4 – 1 SUMMARY OF HIGHEST RATED RECOMMENDATIONS					
		PRESENT WORTH (PW) OF COST (FUTURE COST)			
Rec. No.	**Description**	**Management Action**	**Comments**	**Potential Cost Savings/Non-Overlapped Savings**	
25	Realign Heintzelman Canal to eliminate the RR Bridge (by others)	A		$4,739,000	$2,370,000
26	Revisit the RTC model to provide meets in the middle of the alignment	NA		$43,203,000	$43,203,000

Management Action Legend: A=Approved, R=Rejected, FS=Further Study (Costs shown with brackets indicated added value)

VALUE ENGINEERING METHODOLOGY 2

2.1 GENERAL

This section describes the value analysis procedure used during the VE study. A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) pre-study preparations, 2) VE workshop study, and 3) post-study.

2.2 PRE-STUDY PREPARATIONS

Pre-study preparations for the VE effort consisted of scheduling study participants and tasks; reviews of documents; gathering necessary background information on the project; and compiling project data into a cost model. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning, operating needs, systems evaluations, basis of cost, production scheduling, and construction of the facility was also a part of the analysis.

2.3 VE WORKSHOP STUDY

During the four-day workshop, the VE job plan was followed. The job plan guided the search for high value areas in the project and included procedures for developing alternative solutions for consideration while at the same time considering efficiency. It includes these phases:

- Information Phase
- Function Identification and Cost Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation and Reporting Phase

2.3.1 Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the PD&E Consultant Project Manager provided design information about the project to the VE Team. Following the presentation, the VE team discussed the project using the documents listed in **Section 3.3**.

2.3.2 Function Identification and Cost Analysis Phase

Based on the bridge development report cost estimate, historical and background data, a cost model was developed for this project organized by major construction elements. It was used to distribute costs by project element in order to serve as a basis for alternative functional categorization. The VE team identified the functions of the various project elements and subsystems and created a Function Analysis System Technique Diagram to display the relationships of the functions.

2.3.3 Creative Phase

This VE study phase involved the creation and listing of ideas. During this phase, the VE team developed as many ideas as possible to provide a creative atmosphere and to help team members to "think outside the box." Judgment of the ideas was restricted at this point to insure vocal critics did not inhibit creativity. The VE team was looking for a large quantity of ideas and association of ideas.

FDOT and the PD&E team may wish to review the creative design suggestions that are listed in **Section 6**, because they may contain ideas, which can be further evaluated for potential use in the design.

2.3.4 Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed and a matrix developed to help determine the highest-ranking ideas. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were "carried forward" for further development.

The creative listing was re-evaluated frequently during the process of developing ideas. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single idea. For these reasons, some of the originally high-rated ideas may not have been developed.

2.3.5 Development Phase

During the development phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the idea and a descriptive evaluation of the advantages and disadvantages of each proposed idea. Each idea was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The developed VE ideas are summarized in the section entitled **Section 7 – Recommended Alternatives.**

2.4 POST STUDY

The post-study portion of the VE study includes the draft and final preparation of this Value Engineering Study Report and the discussions and resolution meetings with FDOT personnel. The PD&E consultant team should analyze each alternative and prepare a short response, recommending incorporating the idea into the project, offering modifications before implementation, or presenting reasons for rejection. The VE team is available for consultation after the ideas are reviewed.

2.4.1 Presentation and Reporting Phase

The final phase of the study began with the presentation of the ideas on the last day of the VE Study. The VE team screened the VE ideas before a draft copy of the report was prepared. The initial VE ideas were arranged in the order indicated to facilitate cross-referencing to the final recommendations for revision to the PD&E documents.

2.4.2 Final Report

The acceptance or rejection of ideas described in this report is subject to Brevard County and FDOT's review and approval. The VE team is available to address any final draft report comments for incorporation into the final report.

WORKSHOP PARTICIPANTS AND PROJECT INFORMATION 3

3.1 PARTICIPANTS

Representatives from FDOT and the PD&E team presented an overview of the project on November 7, 2016. The purpose of this meeting was to acquaint the study team with the overall project and outline the main VE study focus areas.

The VE facilitator also reviewed and explained the VE process improvement study agenda. They acquainted the team with the goals for the study based upon the process study that would be applied to improve the project. The study team included the following individuals who participated in the study:

Participant Name	Role	Affiliation
Chris Ray, PE	Structures	CH2M
Kennedy Simmonds, PE	Drainage	CH2M
Andrew Leong, PE	Constructability	CH2M
Erin Trahan, PE	Track Design	CH2M
Brad Luse,	Systems	CH2M
William Soehaili, EI	Geotechnical	FDOT, District 5
Gene Sansone	Rail Cars	CH2M
Ty Garner	VE Administrator	FDOT, District 5
Rick Johnson, PE, CVS-Life	Team Leader	PMA Consultants LLC

3.2 PROJECT INFORMATION

The purpose of the project orientation meeting on November7, 2016, in addition to being an integral part of the *Information Gathering Phase* of the VE study, was to bring the VE team "up-to-speed" regarding the overall project scope.

3.3 LIST OF VE STUDY MATERIAL REVIEWED

The PD&E consultant provided the following documents that the VE team reviewed prior to and during the study:

1. Draft Preliminary Engineering Report, SR 501 SunRail Extension to OIA (Phase 3) PD&E Study, prepared by HDR, Inc., dated August, 2016
2. Cultural Resources Desktop Screening, SunRail Extension To OIA, (PHASE 3) PD&E, prepared by SEARCH, dated August 2016
3. Central Florida Commuter Rail Transit Phase 3 OIA Connector, Financial Project ID 429215-2-22-01, Conceptual Design Plans, prepared by AECOM, dated September 26, 2016
4. Report of Preliminary Geotechnical Engineering Investigation, Central Florida Commuter Rail, SunRail Extension to Orlando International Airport (OIA), prepared by Geotechnical and Environmental Consultants, Inc., dated November 3, 2016
5. Noise and Vibration Technical Report, SunRail Extension to Orlando International Airport (OIA), Phase 3, prepared by AECOM, dated August 2016
6. Natural Resource Evaluation, SunRail Phase III Connector to Orlando International Airport, prepared by E Sciences, Inc., dated September 2016

7. Central Florida Commuter Rail Transit Project, Phase 3 OIA Connector Capital Cost Order Of Magnitude Estimate, prepared by AECOM, updated September 27, 2016
8. Central Florida Commuter Rail Transit Phase 3 OIA Connector, Financial Project ID 429215-2-22-01, Conceptual Design Plans, prepared by AECOM, dated August 16, 2016
9. Draft Drainage Summary Technical Memorandum, SunRail Phase 3, prepared by AECOM, dated August 2016
10. Central Florida Commuter Rail Transit (CFCRT) Phase 3, Traffic Control Plan, Wetherbee Rd, prepared by AECOM, dated September 2, 2016
11. Central Florida Commuter Rail Transit (CFCRT) Phase 3, Traffic Control Plan, Boggy Creek Rd, prepared by AECOM, dated September 2, 2016
12. SunRail Extension to OIA (Phase 3) PD&E, Station Parking Analysis Technical Memorandum, prepared by HDR, Inc., dated October 3, 2016
13. All Aboard Florida, Track and Drainage Plans Volume 1 of 4, prepared by TY Lin, dated April 22, 2016
14. RTC Summary (20 min), prepared by HNTB, dated May 27, 2015
15. WS-100 South Airport Passenger Drop-off Lobby, Orlando International Airport, prepared by HKS Architects, Inc., dated September 26, 2014
16. Design Criteria – Phase 2 South RFP, for the Central Florida Commuter Rail Transit Project, Revision #2, dated 5/29/15

3.4 SUMMARY OF GENERAL PROJECT INPUT - OBJECTIVES, POLICIES, DIRECTIVES, CONSTRAINTS, CONDITIONS & CONSIDERATIONS

The following is a summary of general project input, including the goals, objectives, directives, policies, constraints, conditions and considerations presented to the study team. Representatives from the FDOT and the design team provided a project background on the first day of the study.

3.4.1 Project Functions, Goals & Objectives (what the project should do as determined at the kickoff meeting and subsequent Workshops):

1. Move People
2. Connect ITF
3. Extend System
4. Let Contract
5. Acquire Right of Way
6. Secure Funds
7. Maintain Traffic
8. Determine Feasibility
9. Minimize Disruption
10. Relocate Utilities
11. Inspect Work
12. Design Project
13. Support Road
14. Provide Refuge
15. Add Track
16. Operate System
17. Design Alignment
18. Construct Station
19. Plan Project
20. Treat Stormwater
21. Convey Water
22. Inform Passengers
23. Upgrade Signals
24. Coordinate Intermodals
25. Satisfy Criteria
26. Protect Environment
27. Satisfy Shareholders
28. Comply with Standards
29. Control Costs
30. Justify Ridership
31. Ensure Quality
32. Ensure Safety
33. Minimize Maintenance
34. Satisfy Public
35. Recommend Alternatives
36. Study Alternatives
37. Gather Data
38. Analyze Data
39. Determine Needs

These functions were used by the VE team to create/brainstorm new ideas for potential improvement to the project.

3.4.2 Project Policies & Directives: (documented things the project must or must not do)

1. The project shall meet economic, engineering design, environmental and social/cultural criteria requirements
2. Meet the goals of the Long Range Transportation Plans and coordinate design with GOAA, County and City representatives for future development
3. Coordinate with and match to the planned improvements for the Ultimate Commuter Rail System.

3.4.3 General Project Constraints: (unchangeable project restrictions)

1. Must connect at the second level of the Intermodal Transit Facility
2. Cannot eliminate the Bus connection at the Transfer Station

3.4.4 General Project Conditions & Considerations:

Refer to the documents, report, and backup documentation prepared by the consultants.

3.4.5 Site Review Comments and other observations:

Notes at the Project Orientation

1. 15 minute headways
2. Share tracks with CSX and OUC
3. 9 minute travel time and 10 minute turnaround
4. The Boggy Creek Floodplain on GOAA property will change and could affect bridge length
5. Using the Meadow Woods Station and Bus Rapid Transit on Wetherbee Road has been considered as a cost savings options

Site Review Comments:

1. Platforms are passenger/luggage friendly
2. Trains were quiet on the inside but loud on the outside

TABLE 6.1 ECONOMIC DATA

The Study team developed economic criteria used for evaluation with information gathered from the FDOT. To express costs in a meaningful manner, the cost comparisons associated with alternatives are presented on the basis of total Life Cycle Cost and discounted present worth. Project period interest rates are based on the following parameters:

Year of Analysis:	2016
Economic Planning Life:	30 years (50 years for bridges) starting in 2018
Discount Rate/Interest:	5.00%
Inflation/Escalation Rate:	3.00%

The PD&E Preliminary Cost Estimate was used by the team for the major construction items as a baseline for cost comparison. The baseline estimate was determined based on a combination of the original Project Development & Environment for the Phase 3 alignment alternative concept.

The estimated cost for construction is $222,788,798. The estimated cost to acquire right of way for the proposed alignment alternative is $37,984,000 for a total project cost of $260,772,798.

Table 4.1 – 1
Preliminary Construction Cost Estimate

FTA CATEGORY No.	DESCRIPTION	2015 BASE YEAR COST W/O CONTINGENCY	2015 ALLOCATED & Unallocated CONTINGENCY		2015 ESTIMATE WITH CONTINGENCY	FUNCTION
10	GUIDEWAY AND TRACK ELEMENTS	$52,133,670	$16,485,101	31.6%	$68,618,771	Convey Vehicles
20	STATIONS, STOPS, TERMINALS, INTERMODALS	$10,284,780	$3,085,434	30.0%	$13,370,214	Connect Passengers
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN BLDGS	$0	$0	0.0%	$0	Maintain Infrastructure
40	SITEWORK & SPECIAL CONDITIONS	$14,253,415	$4,276,024	30.0%	$18,529,439	Prepare Area
50	SYSTEMS	$17,148,980	$5,144,694	30.0%	$22,293,673	Control/Monitor Operations
	CONSTRUCTION SUBTOTAL (10-50)	**$93,820,844**	**$28,991,253**	**30.9%**	**$122,812,097**	
60	RIGHT-OF-WAY, LAND, EXISTING IMPROVEMENTS	$0	$0	0.0%	$0	Provide Space
70	VEHICLES	$31,521,645	$6,246,431	19.8%	$37,768,077	Carry Passengers
80	PROFESSIONAL SERVICES	$32,203,025	$8,105,599	25.2%	$40,308,624	Ensure Quality
	SUBTOTAL (SUM CATEGORIES 10-80)	**$157,545,514**	**$43,343,283**	**27.51%**	**$200,888,798**	
90	UNALLOCATED CONTINGENCY (% of Base Cost)		$21,000,000	13.33%	$21,000,000	Anticipate Unknowns
	SUBTOTAL (SUM CATEGORIES 10-90)	**$157,545,514**	**$64,343,283**	**40.84%**	**$221,888,798**	
100	FINANCE CHARGES				$900,000	Address Design Changes
	TOTAL	**$157,545,514**	**$64,343,283**	**40.84%**	**$222,788,798**	

Notes: **The following is a list of Phases 3 project capital cost notes and items to be provided by others:**

1	Connector platform elements at the OIA South Airport Passenger Drop-Off Lobby (Platforms, Guideways, Track, Structural enhancements, furnishings, amenities, etc.) This estimate assumes cost of track & guideway up to the roof edge and does not include any costs to modify the platform on the roof or strengthen the structure supporting the roof.
2	Improvements to existing SunRail stations to accommodate long term parking.
3	Cost associated with CFRC use of OUC R/W
4	Improvements to the existing OUC track beyond what is required to provide the "connector service" on an adjacent track.
5	Cost associated with the use of the Strates properties or cure improvements to remainder parcels (replacement storage track, new water, new sewer, new turnouts, etc)
6	Improvements to the existing SunRail VSMF to store/maintain additional vehicles.
7	Costs associated with rerouting LYNX buses to provide service to the new transfer station.
8	Cost to address remediation of potential hazardous materials.
9	Cost to provide connections to All Aboard Florida facilities
10	Acquisition of additional right of way, mitigation of encroachments or relocation costs.
11	Phase 3 costs for the integration of PTC into the existing CFRC System – CFRC Dispatch/Backoffice Systems has not yet been determined and costs cannot be estimated for integration of Phase 3 into an unknown system.
12	New rolling stock (locomotives, Passenger Coach, etc) projected from 2011 costs
13	Costs associated with relocating or modifying the gas pipeline at Sta 603+00
14	Estimates, opinions of probable construction or implementation costs, financial evaluations, feasibility studies or economic analyses prepared by Engineer will represent its best judgment based on its experience and available information. The Client recognizes that Engineer has no control over costs of labor, materials, equipment or services furnished by others or over market conditions or contractors' methods of determining prices, and that any evaluation of a facility to be constructed or work to be performed is speculative. Accordingly, Engineer does not guaranty that proposals, bids or actual costs will not vary from opinions, evaluations or studies submitted by Engineer.

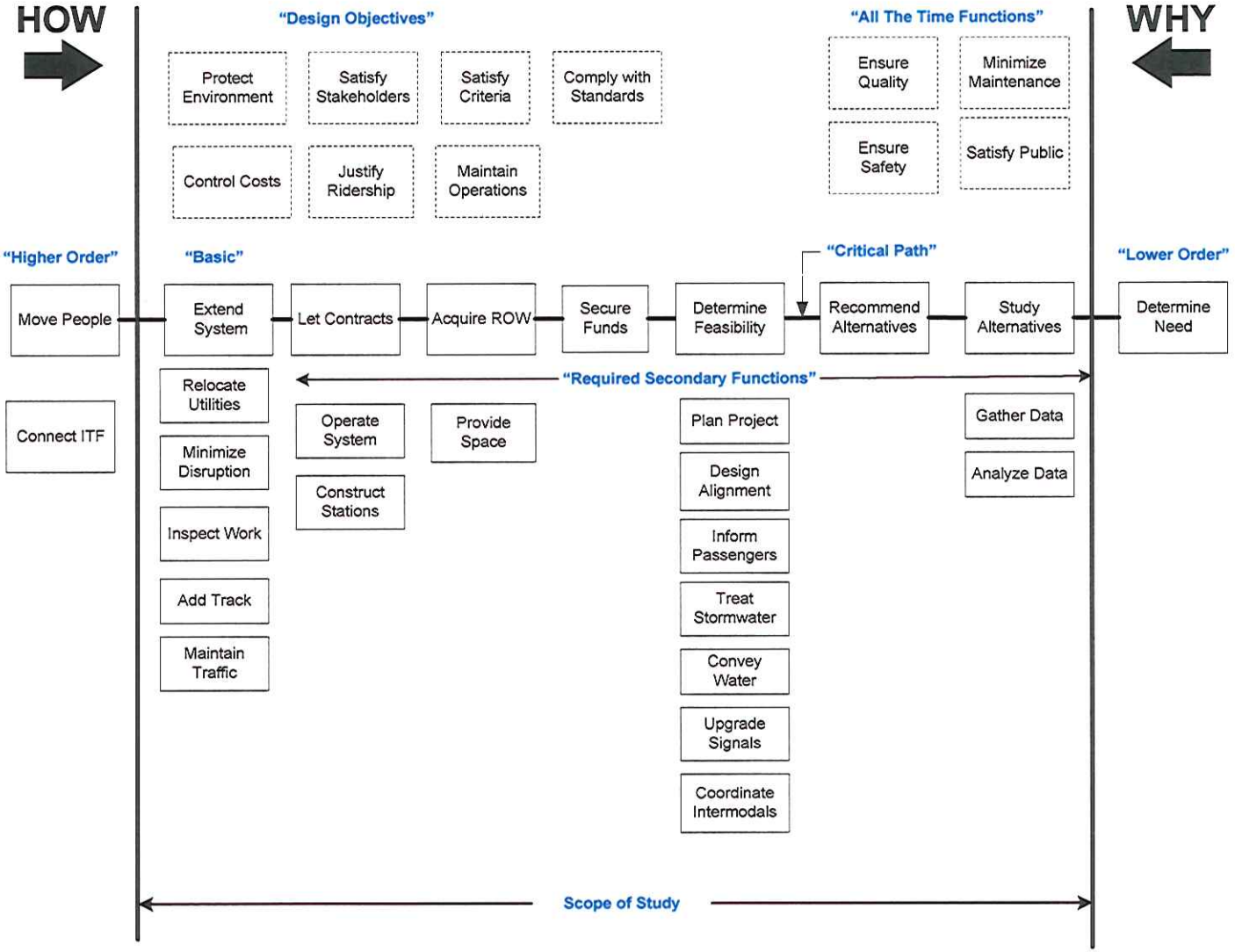
FUNCTION ANALYSIS AND F.A.S.T. DIAGRAM 5

This project's Function Analysis was reviewed and developed by the team to define the requirements for the overall project (and each project element, if required) and to ensure that the Study Team had a complete and thorough understanding of the functions (basic and others) needed to satisfy the project requirements. The primary Function Analysis System Technique (FAST) diagram for the project is included. The development of FAST diagrams help stimulate team members to think in terms of required functions, not just normal solutions, to enhance their creative idea development. The project's primary tasks, the critical path functions, the project's primary basic functions and other required functions that must be satisfied were identified and are indicated in the report.

A Functional Analysis was prepared to determine the basic function of the overall project and each area shown in the cost model. Functional Analysis is a means of evaluating the functions of each element to see if the expenditures for each of those elements actually provide the requirements of the process, or if there are disproportionate amounts of money being proposed to be spent for support functions. These elements add cost to the final product, but have a relatively low worth to the basic function. This creates a high cost-to-worth ratio.

A FAST diagram was developed to identify and display the critical functions path for the overall project. The basic and supporting secondary functions are illustrated on the following FAST Diagram.

Figure 5.1-1 FAST Diagram
SunRail Phase 3



EVALUATION 6

During the Creative Phase numerous ideas and alternative proposals and/or recommendations were generated for each required function using conventional brainstorming techniques and are recorded on the following pages. These ideas were discussed and evaluation criteria were determined. The team identified seven weighted evaluation criteria that included Capital Cost, Construction Schedule, Operations and Maintenance, Passenger Satisfaction, Agreement Compliance, and Maintenance of Traffic. The evaluation criteria were assigned a weighted value from one to six based on the VE team's consensus on the importance of each item. Criteria with the most importance received a six weight and the least important received a one weight. The ideas were then individually discussed and given a score, on a scale of one to five with one being the least beneficial and five the most beneficial. The score for each item is multiplied by the weighted criteria value and each multiplication product is added to obtain a total score for the idea.

Table 6.1 – 1 contains a list of ideas that were generated during the creative phase and how each idea scored in the individual evaluation criteria. **Table 6.1 – 2** illustrates the weighted values for the evaluation criteria and **Table 6.1 – 3** shows the evaluation matrix for Idea Ranking total scores for all ideas carried forward. The ideas that scored equal to or greater than the original design concepts total score were sufficiently rated to warrant further development. The ideas in the table with strike-throughs were not developed because they were combined with other ideas, not feasible, or were eliminated from consideration for other reasons.

There were 26 creative ideas and 19 that were evaluated and scored with two of the 26 being added during development. The VE Team discussed each of the evaluated ideas with the PD&E Project Manager during a mid-point review meeting on Tuesday, November 8, 2017. The VE team and the PD&E Project Manager discussed each idea before developing the final group of ideas for final development and analysis.

The write-ups for those ideas are included in **Section 7**. The tables that follow show the 26 ideas, with the ideas that survived the evaluation, analysis and development phases of the study becoming viable recommendations for value improvements. During the evaluation process the VE Team redefined some of the creative ideas as questions for the designers or design suggestions. Ideas that became design suggestions or design questions for the mid-point review are designated as "DS" on the evaluation worksheets. The major additional design suggestions identified by the VE Team are listed below (in addition to the design suggestions shown on the following pages and in **Section 7**):

DS-1 Use no-fines/cellular concrete where muck is encountered
DS-2 Preferred options are the push-pull DMUs and BRT

The VE Team presents design suggestions for the design consultant and FDOT's consideration. No specific action is normally required to accept or not accept the suggestions, though it is often helpful, for documentation purposes, to formally list those suggestions that will be acted upon by the FDOT. Readers are encouraged to review the Creative Idea Listing and Evaluation Worksheets that follow since they may suggest additional ideas that can be applied to the design or construction.

TABLE 6.1 –1 Value Engineering Study Ideas

Idea No.	Ideas	Capital Costs	Construction Schedule	Operation and Maintenance	Passenger Satisfaction	Agreement Compliance	MOT
	Original Concept						
	PD&E Documents	3	3	3	3	3	3
	Guideway and Tracks						
1	For the section between 440 and 500+/- can we use the existing track instead of new	3.5	3.25	2.5	3	2.75	3
2	Share Brightline track from the ITF to the OUC corridor	4	3	3.5	3.25	2.75	3.5
	Stations						
3	Leave the existing CSX track and build a single center platform between OIA and SunRail tracks	3.5	3.25	2.25	3.5	3	3
4	Move the transfer station south approximately 0.6 miles and put it between the SunRail mainline and the southern spur with bus access off of E. Wetherbee Road	3	3	3	3	3	3
5	~~Ask GOAA to move the connection point for the passenger platform further~~						
6	Increase the approach grade for the ITF from 2.5% to 3% and shift the start of grade to the north	3.25	3.1	3.1	3	3	3
7	Maintain track centers approaching the ITF and provide side platforms	3.5	3.1	3	3	3	3
8	Build the Meadow Woods station and construct BRT service down the median of Wetherbee Road to the ITF	5	4	4	2	1	1
9	~~Build the OIA Transfer station and construct BRT service down the median of Wetherbee Road to the ITF~~						
	Drainage						
10	~~Eliminate the 50% TMDL requirement from the drainage requirement calculations~~						
	Structures						
11	Use 50-ft. spans instead of 24-ft. spans and save on substructure on the new bridges	4	3.5	3	3	3	3
12	~~Use geotextile subbase as opposed to limerock subbase~~						
DS-1	Use no-fines/cellular concrete where muck is encountered	2	4.5	3.5	3.1	3	3

TABLE 6.1 –1 Value Engineering Study Ideas

Idea No.	Ideas	Capital Costs	Construction Schedule	Operation and Maintenance	Passenger Satisfaction	Agreement Compliance	MOT
	Original Concept						
	PD&E Documents	3	3	3	3	3	3
	Systems						
14	Create an absolute block from one end to the other and with PTC you can run at civil speed	3.25	3.25	3.25	2.5	2.5	3
	Vehicles						
DS-2	Preferred options are the push-pull CRTs and BRT						
16	Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station	0.5	1	4.5	5	3.5	4.5
17	Purchase only two sets of cars and use the spares from the SunRail yard	4	3	3.25	3	3	3
	Other						
18	Shorten the bridge at Sta. 545+00 from 850 ft. to 200 ft. due to anticipated shrinking of the flood plain (by others)	4.5	3.5	3.5	3	3	3
19	~~Install culverts at Sta. 560+00 instead of a bridge~~						
20	Depart from the OUC rail further south and cross the canal at less of a skew to shorten the bridges over the Boggy Creek Canal and the Heintzelman Road Canal	2.9	2.5	2.75	2.9	2.75	2.5
21	Lower the commuter approach to the ITF 5-10 ft. and ramp/escalator passengers up to level 2	3.25	3.1	3	2.75	2.5	3
22	Move the grade transition north toward the ITF to reduce the required fill and MSE walls	3.25	3.1	3	3	3	3
23	Leave the gas main in place and bridge over it instead of relocating	4.5	3.5	2.9	3	3	3
24	Consider Design-Build versus Design-Bid-Build	2.75	3.5	3	3	3	3
25	Realign Heintzelman Canal to eliminate the RR Bridge (by others)						
26	Revisit the RTC model to provide metes in the middle of the alignment						

TABLE 6.1 –2 Value Engineering Study Weighted Values

Capital Costs	Construction Schedule	Operation and Maintenance	Passenger Satisfaction	Agreement Compliance	MOT
5	2	4	6	3	1

TABLE 6.1 –3 Value Engineering Study Evaluation Scores

Idea No.	Ideas	Capital Costs	Construction Schedule	Operation and Maintenance	Passenger Satisfaction	Agreement Compliance	MOT	TOTAL
	Original Concept							
	PD&E Documents	15	6	12	18	9	3	**63**
	Guideway and Tracks							
1	For the section between 440 and 500+/- can we use the existing track instead of new	17.5	6.5	10	18	8.25	3	**63.25**
2	Share Brightline track from the ITF to the OUC corridor	20	6	14	19.5	8.25	3.5	**71.25**
	Stations							
3	Leave the existing CSX track and build a single center platform between OIA and SunRail tracks	17.5	6.5	9	21	9	3	**66**
4	~~Move the transfer station south approximately 0.6 miles and put it between the SunRail mainline and the southern spur with bus access off of E. Wetherbee Road~~	15	6	12	18	9	3	**63**
5	~~Ask GOAA to move the connection point for the passenger platform further south~~	0	0	0	0	0	0	**0**
6	Increase the approach grade for the ITF from 2.5% to 3% and shift the start of grade to the north	16.25	6.2	12.4	18	9	3	**64.85**
7	Maintain track centers approaching the ITF and provide side platforms	17.5	6.2	12	18	9	3	**65.7**
8	Build the Meadow Woods station and construct BRT service down the median of Wetherbee Road to the ITF	25	8	16	12	3	1	**65**
9	~~Build the OIA Transfer station and construct BRT service down the median of Wetherbee Road to the ITF~~	0	0	0	0	0	0	**0**
	Drainage							
10	~~Eliminate the 50% TMDL requirement from the drainage requirement calculations~~	0	0	0	0	0	0	**0**

TABLE 6.1 –3 Value Engineering Study Evaluation Scores

Idea No.	Ideas	Capital Costs	Construction Schedule	Operation and Maintenance	Passenger Satisfaction	Agreement Compliance	MOT	TOTAL
	Original Concept							
	PD&E Documents	15	6	12	18	9	3	**63**
	Structures							
11	Use 50-ft. spans instead of 24-ft. spans and save on substructure on the new bridges	20	7	12	18	9	3	**69**
12	~~Use geotextile subbase as opposed to limerock subbase~~	0	0	0	0	0	0	**0**
DS-1	Use no-fines/cellular concrete where muck is encountered	10	9	14	18.6	9	3	**63.6**
	Systems							
14	Create an absolute block from one end to the other and with PTC you can run at civil speed	16.25	6.5	13	15	7.5	3	**61.25**
	Vehicles							
DS-2	Preferred options are the push-pull CRTs and BRT	0	0	0	0	0	0	**0**
16	Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station	2.5	2	18	30	10.5	4.5	**67.5**
17	Purchase only two sets of cars and use the spares from the SunRail yard	20	6	13	18	9	3	**69**
	Other							
18	Shorten the bridge at Sta. 545+00 from 850 ft. to 200 ft. due to anticipated shrinking of the flood plain (by others)	22.5	7	14	18	9	3	**73.5**
19	~~Install culverts at Sta. 560+00 instead of a bridge~~	0	0	0	0	0	0	**0**
20	Depart from the OUC rail further south and cross the canal at less of a skew to shorten the bridges over the Boggy Creek Canal and the Heintzelman Road Canal	14.5	5	11	17.4	8.25	2.5	**58.65**
21	Lower the commuter approach to the ITF 5-10 ft. and ramp/escalator passengers up to level 2	16.25	6.2	12	16.5	7.5	3	**61.45**
22	~~Move the grade transition north toward the ITF to reduce the required fill and MSE walls~~	16.25	6.2	12	18	9	3	**64.45**
23	~~Leave the gas main in place and bridge over it instead of relocating~~	22.5	7	11.6	18	9	3	**71.1**
24	Consider Design-Build versus Design-Bid-Build	13.75	7	12	18	9	3	**62.75**
25	Realign Heintzelman Canal to eliminate the RR Bridge (by others)	0	0	0	0	0	0	**0**
26	Revisit the RTC model to provide metes in the middle of the alignment	0	0	0	0	0	0	**0**

RECOMMENDATIONS 7

The results of this VE study are shown as individual alternatives developed for each area of the project. These alternatives include a comparison between the VE team's proposal and the designer's original concept. Each proposal consists of a summary of the original design, a description of the proposed change, and descriptive evaluation of the advantages and disadvantages of the proposed alternative. Sketches and calculations are shown, if appropriate. The estimated cost comparisons reflect unit prices and quantities on a comparative basis. Value improvement is the primary basis for comparison of competing ideas. To ensure that costs are comparable within the ideas proposed by the VE team, the Preliminary Cost Estimate, statewide average costs, and preliminary right of way cost estimates were used as the pricing basis.

7.1 EVALUATION OF ALTERNATIVES

Some of the VE alternatives' potential savings are interrelated, if one is accepted another one may or may not need to be added, or acceptance of one may mutually exclude another. The VE Team identified potential savings as shown on **Table 1.4 – 1, Summary of Highest Rated Recommendations**. The write-ups for the individual developed ideas are included in this section and are presented in idea numerical order.

The FDOT and the design team should evaluate and determine whether to accept or not accept each alternative. The alternatives that are accepted should be identified and listed for documentation purposes. For each idea that will not be accepted, the design team normally documents, in writing, the reason or reasons for non-acceptance. The design suggestions are for consideration by FDOT and the designers. No specific action is normally required to accept or not accept the suggestions, though it is often helpful, for documentation purposes, to formally list those suggestions that will be incorporated by the designers.

7.2 CONSIDERATIONS AND ASSUMPTIONS

In the preparation of this report and the alternatives that follow, the study team made some assumptions with respect to conditions that may occur in the future. In addition, the study team reviewed the listed project documentation, relying solely upon the information provided by the FDOT and the designer, and relying on that information as being true, complete and accurate. This value analysis and report are based on the following considerations, assumptions and conditions:

- The alternatives rendered herein are as of the date of this report. The study team or leaders assume no duty to monitor events after the date, or to advise or incorporate into any of the alternatives, any new, previously unknown technology.
- The study team or leaders assume that there are no material documents affecting the design or construction costs that the team has not seen. The existence of any such documents will necessarily alter the alternatives contained herein.

The study team or leaders do not warrant the feasibility of these alternatives or the advisability of their implementation. It is solely the responsibility of the designer in accordance with the FDOT to explore the technical feasibility and make the determination for implementation.

RECOMMENDATION No. 1: For the section between Stations 440 and 500+/- can we use the existing track instead of new

Proposed Alternative:
The PD&E Documents show constructing a new track to the north of the existing OUC (Stanton Spur) track between station 440+00 and 500+00.

VE Alternative:
The VE team recommends sharing the existing OUC (Stanton Spur) track between station 440+00 and 500+00. Upgrade OUC track to meet Class 4 standards.

Advantages:

- Reduction in cost
- Reduction in construction time
- No additional track crossing of Boggy Creek Road

Disadvantages:

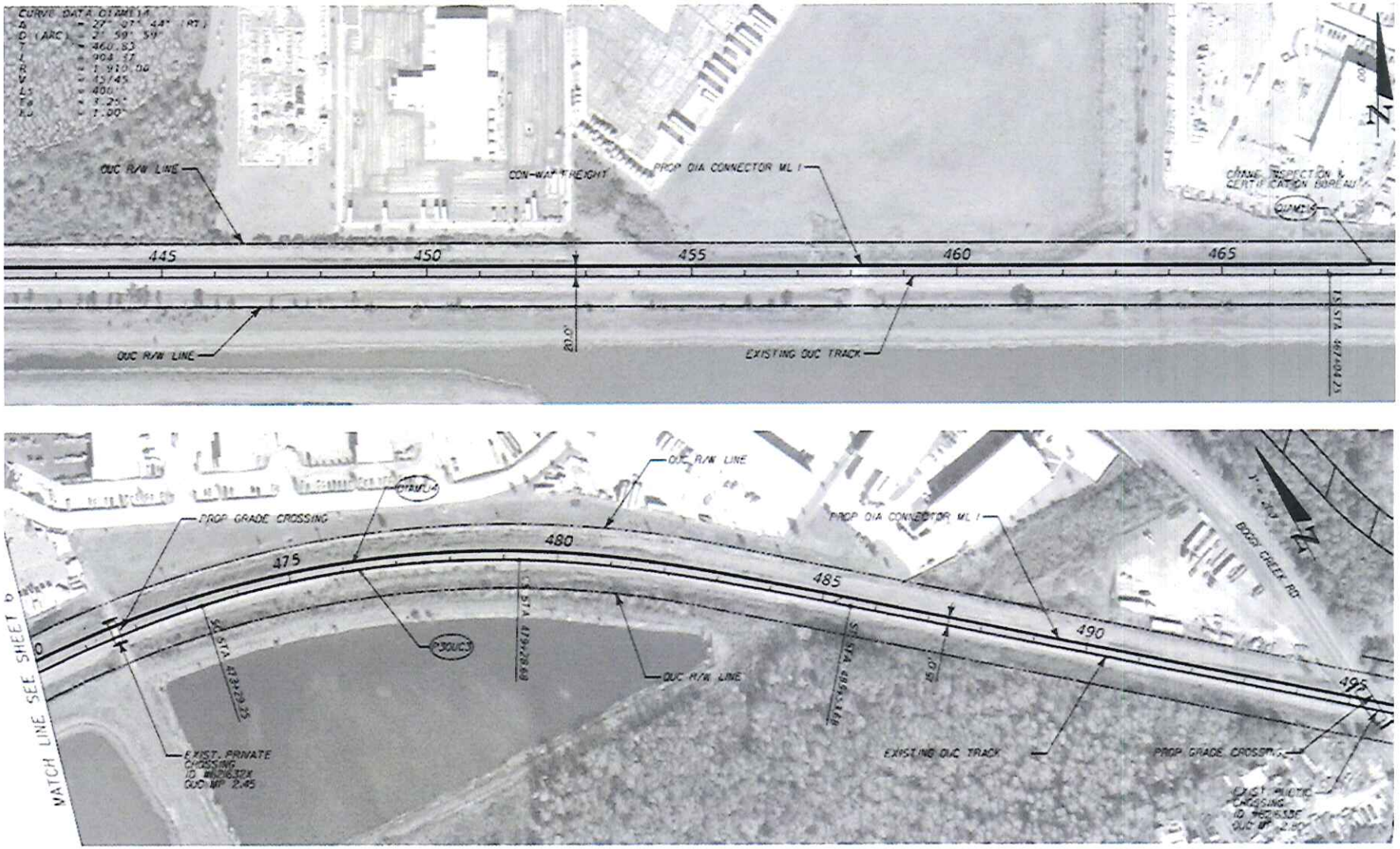
- Potential for conflicts with freight trains due to shared track
- Additional maintenance due to added turnout

Potential Cost Savings: $1,407,000

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Clear & Grub	-7	AC	$ 10,270.00	($70,730)
Ave. cost per track foot for subgrade & sub-ballast	-6,000	TF	$ 143.00	($858,000)
New Track	-6,000	TF	$ 182.00	($1,092,000)
Public Grade Crossing Civil Work	-0.333	LS	$ 241,031.70	($80,344)
Grade crossing gates/flashers - modify/upgrade	-1.000	LS	$ 348,351.90	($348,352)
#15 Turnout	1	EA	$ 262,600.00	$262,600
Re-build/upgrade existing track	6,000	TF	$ 110.50	$663,000
Added signal cost for additional turnout	1	LS	$ 300,000.00	$300,000
Subtotal				($1,223,826)
Unallocated Contingency (14.52% of Base Cost)				($177,700)
Finance Charges (0.41%)				($5,746)
			CONSTRUCTION TOTAL	**($1,407,272)**

RECOMMENDATION No. 1: For the section between Stations 440 and 500+/- can we use the existing track instead of new



RECOMMENDATION No. 2: Share AAF/Brightline track from the ITF to the OUC corridor

Proposed Alternative:
The PD&E Documents show new corridor for SunRail between Orlando International Airport ITF and the OUC (Stanton Spur) track corridor just north of E. Wetherbee Rd.

VE Alternative:
The VE team recommends sharing the All Aboard Florida (AAF)/Brightline tracks from SunRail Sta. 495+00 at Boggy Creek Rd to Sta. 575+00 on GOAA property at bottom of station approach ramps. Assume that AAF/Brightline carries cost for their facilities and SunRail is an incremental increase.

Advantages:

- Reduced cost
- Potential for construction schedule reduction (if AAF/Brightline builds the track ahead of SunRail service opening)
- Reduced maintenance (assume AAF/Brightline maintains track)
- Potential for reduction in travel time from OIA ITF to SunRail Transfer Station
- Elimination of two at-grade crossings: AAF maintenance facility access road and Canal Rd.
- Reduction in right of way acquisition on GOAA property

Disadvantages:

- AAF/Brightline may not be agreeable to sharing tracks
- Potential for conflicts between SunRail revenue service and AAF/Brightline non-revenue movements to maintenance facility.
- Maybe a use agreement fee

Potential Cost Savings: $38,872,000

RECOMMENDATION No. 2: Share AAF/Brightline track from the ITF to the OUC corridor

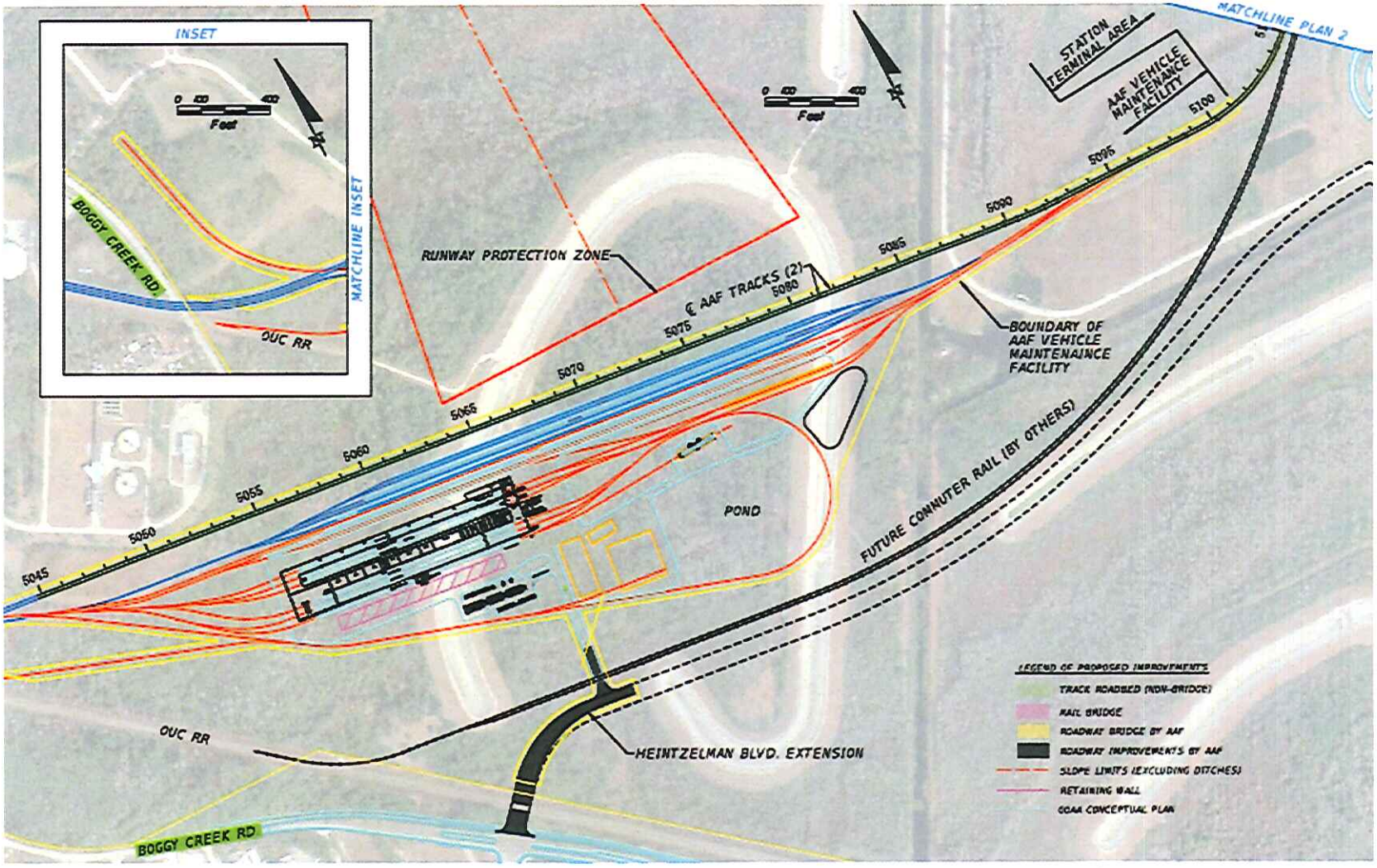
Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Clear & grub	-18.37	AC	$10,270.00	($188,660)
Ave. Cost per track foot for sugrade & sub-ballast	-16,000	TF	$143.00	($2,288,000)
Excavation for Swale for mainline track	-4000	CY	$ 4.33	($17,316)
Fill for 2 mailine tracks adjacent to OUC Spur prior to elevated track	-35,073	CY	$ 12.00	($420,876)
2 Bridges at sta 545+00 (830') and 560+35 (270') - 2 tracks	-2,200	LF	$ 10,322.00	($22,708,400)
East of East Branch Boggy Creek; subsurface organics @30-50 ft depth	-1	LS	$ 650,000.00	($650,000)
New track (2 tracks)	-16,000	TF	$ 182.00	($2,912,000)
#20 Turnout	4	EA	$ 352,300.00	$1,409,200
#20 Crossover	2	EA	$ 700,700.00	$1,401,400
2 Grade Crossing (LS is for 3 grade crossings)	-0.67	LS	$ 241,031.70	($160,688)
Grade crossing protection	-2.00	LS	$ 471,981.90	($943,964)
Interlocking	1.00	LS	$ 500,000.00	$500,000
Culvert Crossings	-2	EA	$ 97,500.00	($195,000)
Subtotal				($27,174,304)
Unallocated Contingency (14.52% of Base Cost)				($3,945,709)
Finance Charges (0.41%)				($127,592)
			CONSTRUCTION TOTAL	**($31,247,604)**

GOAA ROW: 18.37 acres at $415,078/acre = $7,624,982.86 savings

Potential Right of Way Savings	$ 7,624,982
Potential Capital Cost Savings	$31,247,604
	$38,872,586

RECOMMENDATION No. 2: Share AAF/Brightline track from the ITF to the OUC corridor



RECOMMENDATION No. 3: Leave the existing CSX track and build a single center platform between OIA and SunRail tracks

Proposed Alternative:
The PD&E Documents show realigning the SunRail\CSX eastern mainline track to accommodate a center platform. OIA Connector would come in on the east with two tracks and a center platform. Pedestrian grade crossing of eastern CSX track. Bus facility is east of OIA Connector tracks.

VE Alternative:
The VE team recommends eliminating realignment of SunRail/CSX mainline track, provide only a single platform to the east of the SunRail/CSX mainline. Provide single OIA Connector track east of the platform with tail track for connection to CSX Mainline (non-revenue service movement). Maintain placement of bus facility to east of OIA Connector track. Provide a turnout just south of the platform to allow the OIA Connector to utilize two tracks south of the station. Potential for tail track north of station for OIA Connector for flexibility. Add crossovers on SunRail/CSX mainline to allow access to platform from both tracks.

Advantages:

- Reduced cost
- Cross-platform transfer at station
- No pedestrian crossing of SunRail/CSX mainline (only OIA connector)
- No need to realign SunRail/CSX mainline
- Reduction of construction schedule

Disadvantages:

- Reduced flexibility in operations at station by only having a single platform track. Where OIA Connector trains pass must be scheduled outside of the station.
- SunRail trains on western track would have to utilize crossovers to access platform.

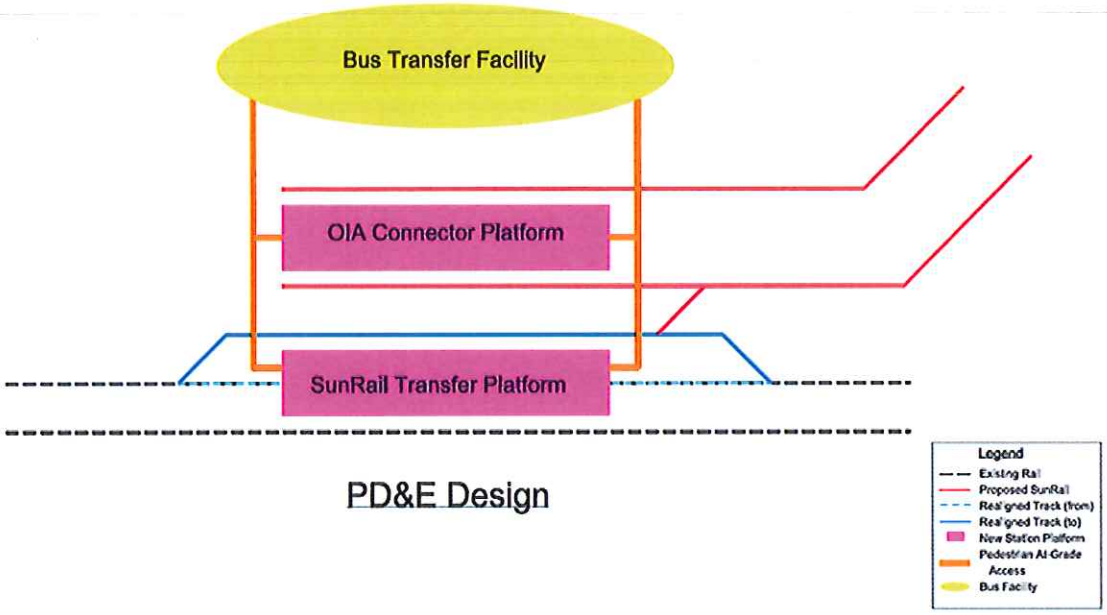
Potential Cost Savings: $213,000

RECOMMENDATION No. 3: Leave the existing CSX track and build a single center platform between OIA and SunRail tracks

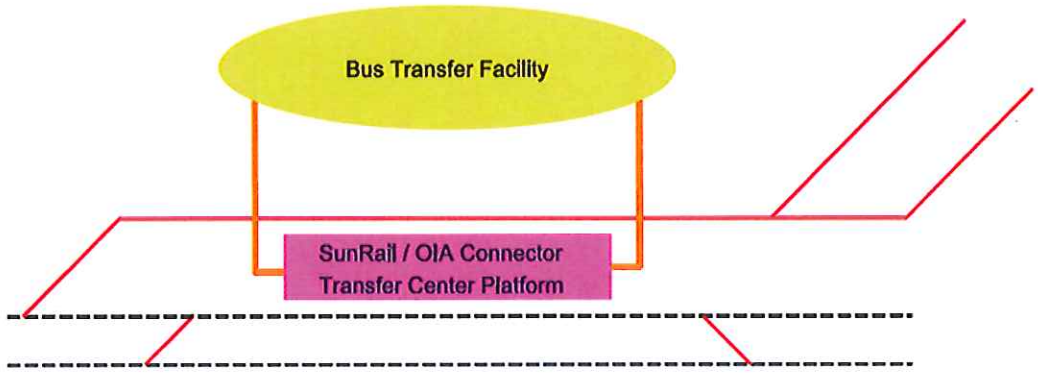
Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Re-line existing P2S track = .75 Miles of CFRC ML2 + .57 miles of OUC Spur Track)	-3,960	TF	$26.00	($102,960)
#15 Crossover	-1	EA	$533,000.00	($533,000)
Concrete Paving	-112	SY	$105.30	($11,779)
area	-5,304	SF	$12.48	($66,189)
Benches & Trash receptacles	-25	EA	$2,600.00	($65,000)
Concrete footings, fradebeams, ramps & slabs	-584	CY	$1,105.00	($644,768)
precast concrete column wraps	-25	EA	$2,340.00	($58,500)
canopy structural steel & deck	-6,750	SF	$143.00	($965,250)
canopy roof, plywood & it gauge framing	-6,750	SF	$35.10	($236,925)
plumbing, water platform drains & roof connection	-1	LS	$227,500.00	($113,750)
structure painting	-6,750	SF	$16.90	($114,075)
#20 Crossover	2	EA	$ 700,700.00	$1,401,400
#15 Turnout	2	EA	$ 262,600.00	$525,200
Signals at Transfer Station	1	LS	$ 800,000.00	$800,000
Subtotal				($185,595)
Unallocated Contingency (14.52% of Base Cost)				($26,948)
Finance Charges (0.41%)				($871)
			CONSTRUCTION TOTAL	**($213,414)**

RECOMMENDATION No. 3: Leave the existing CSX track and build a single center platform between OIA and SunRail tracks



PD&E Design



VE Team Suggested Study Alternative

RECOMMENDATION No. 6: Shift the Approach to the ITF farther north and Increase the Profile Grade from 2.5% to 3.0%

Proposed Alternative:
The PD&E Documents show a profile grade of 2.5% to attain the level grade of 0.00% at elevation 110.34 for connection to the ITF. The grade change is accomplished via a 1,000 ft. long vertical curve. The track alignment incline starts at approximately Station 589+00 and the guideway is on retained fill with MSE walls and a proposed 450-ft. long bridge spanning the access road and pond off of Jeff Fuqua Road.

VE Alternative:
The VE team recommends reducing the amount of retained earth fill within MSE walls by: 1) reducing the vertical curve from 1,000 ft. to 300 ft., and 2) increasing the alignment grade to 3.0%.

1) Section 5.5.3 of the SunRail Design Criteria states that the minimum length of vertical curve is derived from the formula: $L_{vc} = D\,V^2\,K / A$.

Assuming that D = .03 (for 3% grade difference), V = 35 mph (which would be high for approaching a station), K = 2.15 (conversion factor), and A = 0.60 ft./s^2 (vertical acceleration for passenger rail), the resulting minimum length is 132 ft.

2) Using a conservative vertical curve length of 300 ft., and holding the end of vertical curve from the PD&E drawings, located at Station 607+50, the revised point of vertical intersect would be at Station 606+00. Inclining the track profile at 3.0% from elevation 110.34 to elevation 77.00 requires a horizontal length of 1,124 ft. Therefore, the beginning of the approach would be at approximately Station 594+76.

Advantages:

- Reduced cost

Disadvantages:

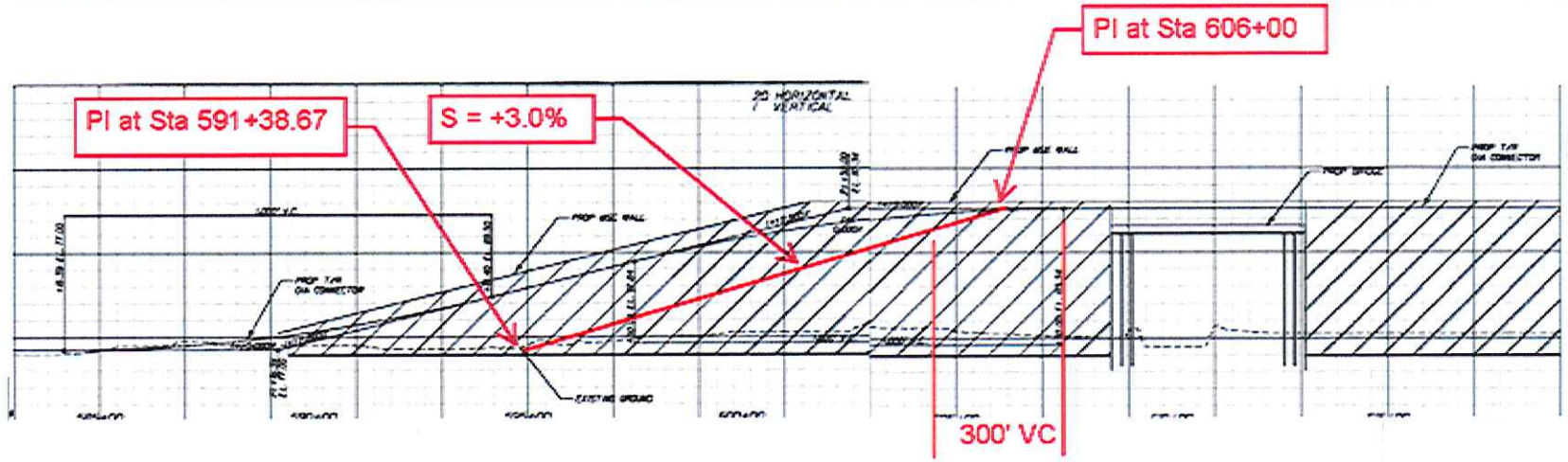
- Will require design variation from "absolute maximum grade" of 1.5% per Section 5.5.1 of Design Criteria.

Potential Cost Savings: $2,584,000

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Embankment	-39,330	CY	$12.00	($471,921)
MSE Wall	-30,340	SF	$58.50	($1,774,890)
Subtotal				($2,246,811)
Unallocated Contingency (14.52% of Base Cost)				($326,237)
Finance Charges (0.41%)				($10,549)
			CONSTRUCTION TOTAL	**($2,583,597)**

RECOMMENDATION No. 6: Shift the Approach to the ITF farther north and Increase the Profile Grade from 2.5% to 3.0%



RECOMMENDATION No. 7: Maintain Track Centers to ITF and Provide Side Platforms

Proposed Alternative:
The PD&E Documents show the tracks diverging from 15-ft. centers at approximately Station 607+00 to 69.5 ft. centers at the ITF to accommodate a 59.3 ft. wide center platform. Within this section of guideway there are twin 450-ft. long long bridges over the access road and pond off of Jeff Fuqua Road that flare from a width of 35 ft. on the south end to 50 ft. at the north end.

VE Alternative:
The VE team recommends maintaining the tracks at 15-ft. centers into the ITF and providing two 20-ft. wide side platforms, instead. In fact, SunRail Design Criteria Section 17.1 notes that "the side platforms configuration is preferred."

The proposed reconfiguration of the tracks and platforms at the ITF station reduces the overall guideway section from 89.5 ft. to 65.2 ft., and the retained fill within MSE walls is reduced, along with the elimination of the lateral MSE wall panels immediately adjacent and to the east of the bridge abutments. The bridge itself is also greatly simplified with the construction of a uniform 35-ft. wide structure instead of twin bridges, with one skewed to the other.

Advantages:

- Less cost
- Meets Design Criteria preference
- Simplified construction of 450-ft. bridge

Disadvantages:

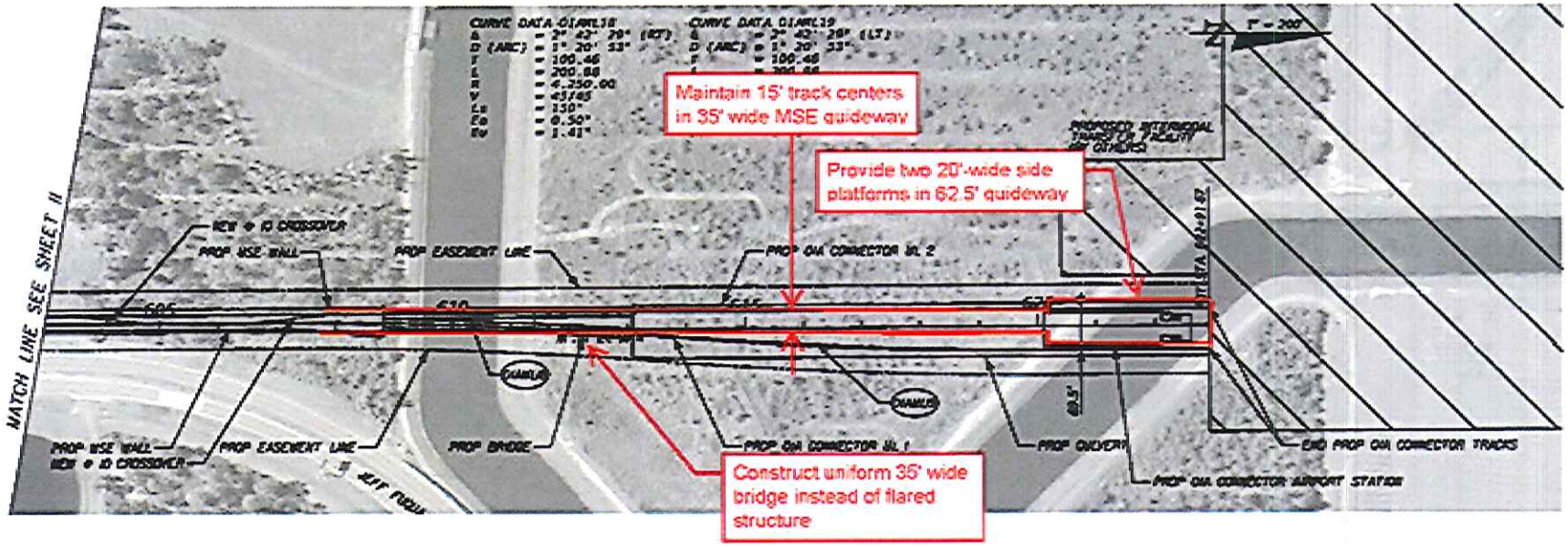
- Potential increased schedule to construct separate platforms

Potential Cost Savings: $10,242,000

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Embankment	-73,078	CY	$12.00	($876,936)
MSE Wall	-2,345	SF	$58.50	($137,183)
450' Dbl-track Bridge (assume cost is 30% more than one sgl-track bridge; i.e. savings is 65% of PD&E structures)	-585	FT	$10,322	($6,038,370)
Concrete Platform	-850	CY	$1,105	($939,250)
Platform Pavers (assume 78% of center platform quantity)	-1,980	SF	$12.48	($24,710)
Canopy Steel (assume 200' x 15' for ea platform)	-5,000	SF	$143	($715,000)
Canopy Roof (assume 200' x 15' for ea platform)	-5,000	SF	$35.10	($175,500)
Subtotal				($8,906,949)
Unallocated Contingency (14.52% of Base Cost)				($1,293,289)
Finance Charges (0.41%)				($41,821)
			CONSTRUCTION TOTAL	**($10,242,059)**

RECOMMENDATION No. 7: Maintain Track Centers to ITF and Provide Side Platforms



RECOMMENDATION No. 8: Build the new Transfer Station and implement Bus Rapid Transit (BRT) service along the proposed right of way to the ITF

Proposed Alternative:
The PD&E Documents show using Heavy Rail CRT (3 diesels, 3 cab cars and 3 coaches).

VE Alternative:
The VE team investigated the concept to use the Meadow Woods Station as a transfer station and then construct BRT service along the Wetherbee Boulevard corridor. During development the idea changed and the team now recommends constructing the Transfer Station and Green BRT service through the corridor to the ITF (3 articulated Green buses).

Advantages:

- Vehicle costs are considerably less
- Infrastructure cost is significantly less
- No train control signaling required with the exception of grade crossings
- No track required
- O&M costs will be significantly less
- Crew size is less (1 vs. 2)
- Flexibility (particularly with headway)

Disadvantages:

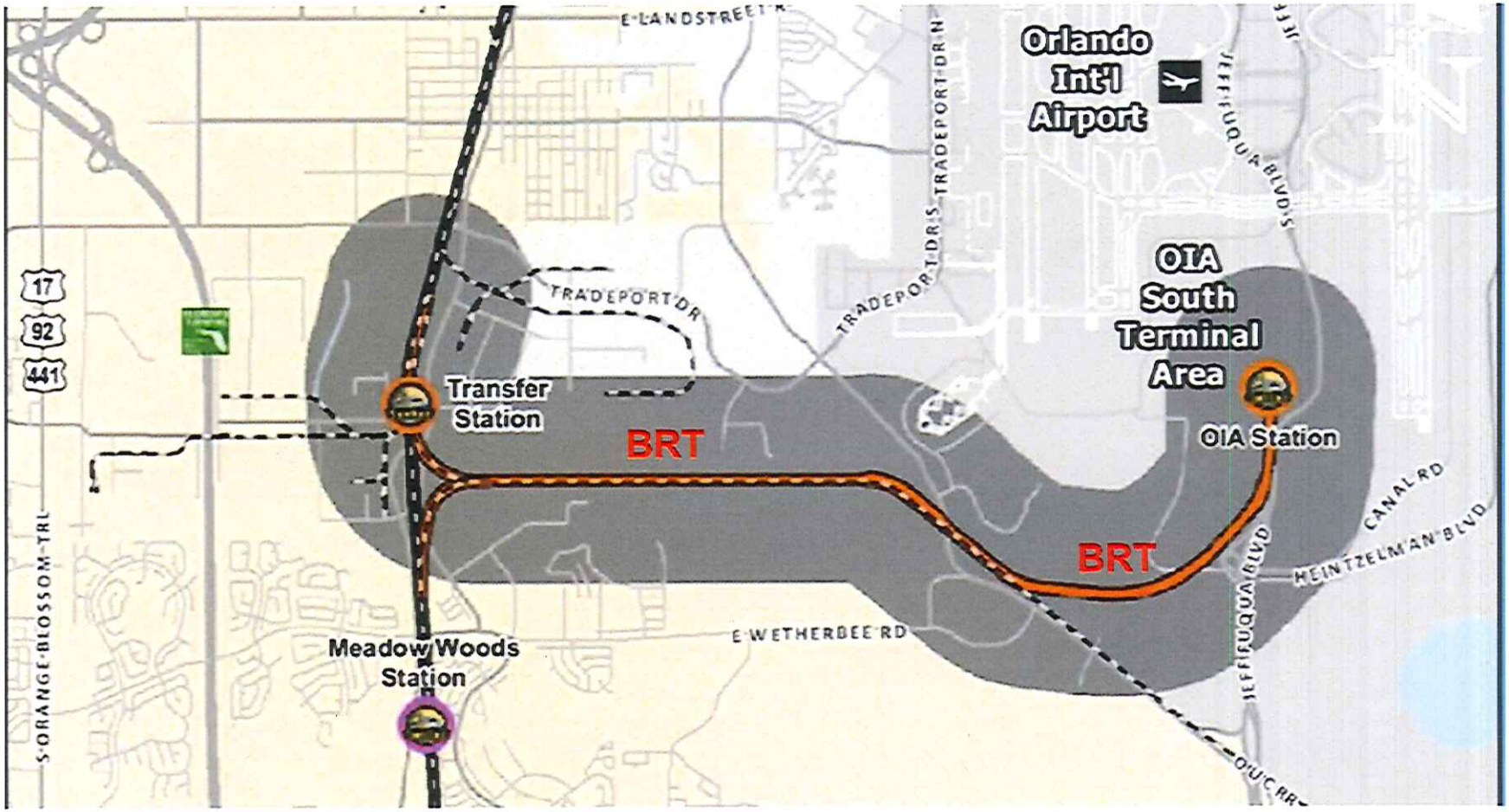
- Mixed traffic increases the potential for delay
- Manually operated
- Terminal operation (turn around required)
- Use of Lynx Bus Depot for maintenance and repair

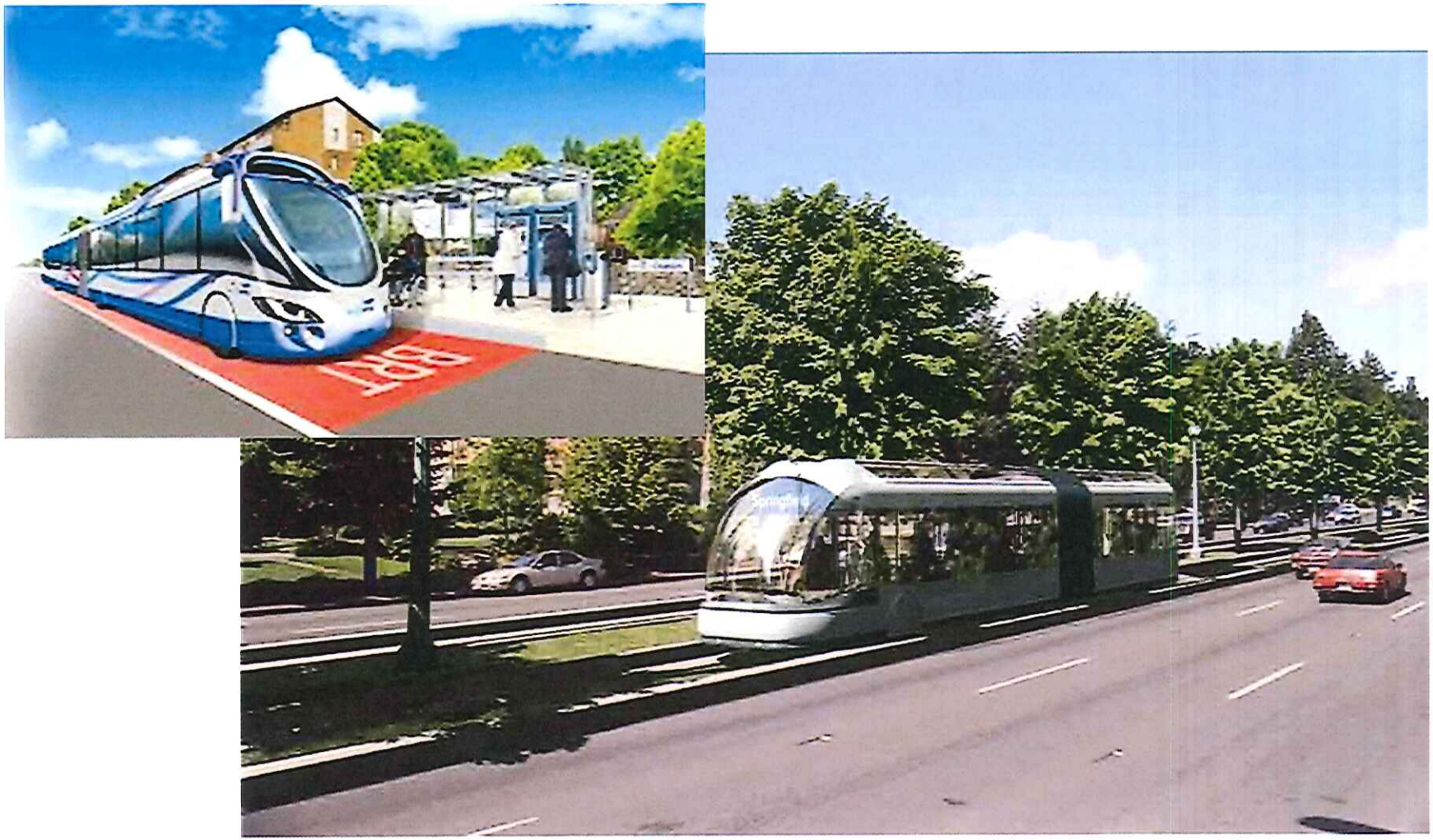
Potential Cost Savings: $77,917,000

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Vehilcles	-3		$8,000,000	($24,000,000)
Infrastructure	-1		$37,000,000	($37,000,000)
Annual O&M	-1		$6,760,000	($6,760,000)
Subtotal				($67,760,000)
Unallocated Contingency (14.52% of Base Cost)				($9,838,752)
Finance Charges (0.41%)				($318,155)
		CONSTRUCTION TOTAL		**($77,916,907)**

RECOMMENDATION No. 8: Build the new Transfer Station and implement Bus Rapid Transit (BRT) service along the proposed right of way to the ITF




BRT

RECOMMENDATION No. 11: Use 50-ft. spans instead of 24-ft. spans to save on substructure and use common substructure for opposing track directions

Proposed Alternative:
The PD&E Documents show the new bridges with 24-ft spans. The bridge at station 545+50 is 900-ft long with 38 spans. The bridge at station 560+00 is 200-ft long with 9 spans. The bridge at station 610+85 is 450-ft long. The PD&E does not identify the substructure elements for the 475-ft. bridge and therefore it is excluded from this analysis. These spans are likely based on voided deck slab beams which have a typical span length of between 20 and 25 feet. On the PD&E documents the bridges are assumed to be on separate substructures.

VE Alternative:
Voided slabs have been known to have corrosive serviceability challenges in Florida. A more robust girder which also can span longer is the precast I-girder shape. The girders cost more per foot, but by using this type of girder a more robust service life can be achieved with the elimination of half of the substructure, or pile bents. Many varieties of the I-girders are available with varying depths and potential span lengths, and an in-depth study must be undertaken to determine the optimal span arrangement based on specific savings in substructure costs and offset by a marginal increase in superstructure cost for the I-girder verses the voided deck slab beam. Long term cost benefits for the more robust service life of the I-girder could be considered but is not quantified as a hard cost in this analysis. These will be on the same substructures. **The team also noted that the 450-ft. bridge is not included in the cost estimate.**

Advantages:

- Eliminate 50% or more of substructure
- Enhance canal conveyance
- Decreases construction schedule
- Avoids the voided slab design

Disadvantages:

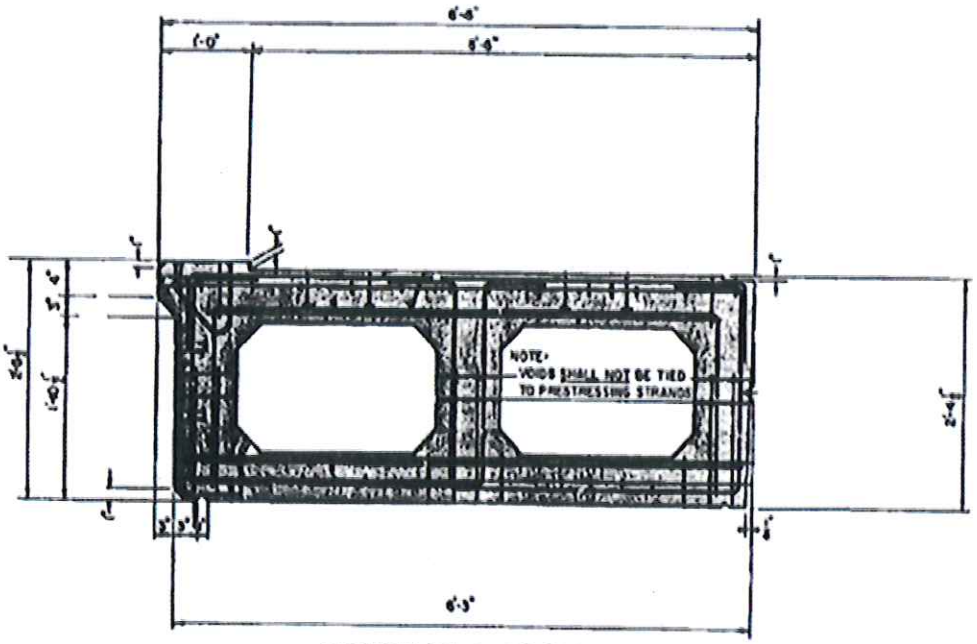
- None apparent

Potential Cost Savings: $6,528,000

Calculations:

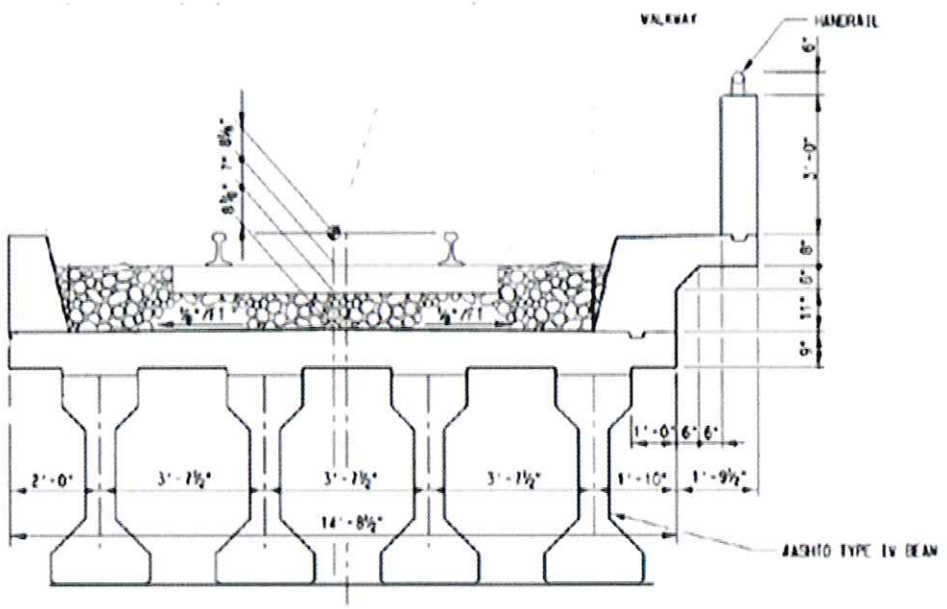
Description	Quantity	Unit	Unit Price	Extended Amount
Elimination of 50% substructure (Substructure = 50% cost), 900 lf + 200 lf	-2,200	LF	$2,580.50	($5,677,100)
Subtotal				($5,677,100)
Unallocated Contingency (14.52% of Base Cost)				($824,315)
Finance Charges (0.41%)				($26,656)
			CONSTRUCTION TOTAL	**($6,528,071)**

RECOMMENDATION No. 11: Use 50-ft. spans instead of 24-ft. spans to save on substructure and use common substructure for opposing track directions



SECTION ON ℄ OF SLAB
(CURB NOT SHOWN)

TYPICAL GIRDER FOR 24-FT SPAN LENGTH



TYPICAL BRIDGE SECTION FOR 90-FT SPAN LENGTH

(FIB GIRDERS USED IN FLORIDA, NOT SHOWN)

RECOMMENDATION No. 16: Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station

Proposed Alternative:
The PD&E Documents show Heavy Rail Commuter Rapid Transit.

VE Alternative:
The VE team recommends extending the GOAA Automated People Mover system and cars along the corridor to the SunRail Transfer station.

Advantages:

- Dedicated ROW
- Automatic Train Operation
- O & M cost is less
- No street level crossings
- Train Control signaling cost is less

Disadvantages:

- Infrastructure cost is significantly more
- Less seating
- Run time is more

Potential Value Added: ($385,675,000)

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Train Sets	-1		$2,000,000	($2,000,000)
Annual O & M	-1		$1,600,000	($1,600,000)
Signaling Costs	-1		$3,000,000	($3,000,000)
Infrastructure Costs	1		$342,000,000	$342,000,000
Subtotal			$2,000,000	$335,400,000
Unallocated Contingency (14.52% of Base Cost)				$48,700,080
Finance Charges (0.44%)				$1,574,810
	CONSTRUCTION TOTAL			**$385,674,890**

RECOMMENDATION No. 16: Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station

RECOMMENDATION No. 17: Purchase only two trains sets of cars and use the spares from the SunRail yard

Proposed Alternative:
The PD&E Documents show a new car procurement of 3 train sets (made up of a diesel locomotive, coach car and cab car). Two train sets are used for daily operation, one is a spare to allow preventive maintenance.

VE Alternative:
The VE team recommends procuring only 2 train sets and using the pool of mainline spares to provide one spare when required.

Advantages:

- Less capital cost (6 vs. 9 new cars)
- Less annual maintenance costs (3 less cars to maintain)
- Less impact on the O&M facility

Disadvantages:

- Lower spare ratio
- Higher risk to make full service only during peak hours

Potential Cost Savings: $10,522,000

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Procure 1 less train set	-1		$9,000,000	($9,000,000)
less maintenance cost	-3	SF	$50,000	($150,000)
Subtotal				($9,150,000)
Unallocated Contingency (14.52% of Base Cost)				($1,328,580)
Finance Charges (0.41%)				($42,962)
			CONSTRUCTION TOTAL	**($10,521,542)**

RECOMMENDATION No. 18: Shorten the bridge at Sta. 545+50 from 900 ft. to 200 ft. due to anticipated shrinking of the floodplain (by others)

Proposed Alternative:
The PD&E Documents show a proposed bridge (900 ft.) spanning the current regulated floodway area at station 545+50 (approx.).

VE Alternative:
GOAA is in the process of modifying the floodplain map in the area and anticipate that the floodway boundary shall be contained within the banks of the existing stream. In light of these efforts, the VE team recommends constructing a bridge that spans the existing stream channel. This results in an approximately 700 ft. reduction in bridge length (proposed 200-ft. bridge). Additional floodplain area compensation may be required, however this may be offset by providing in-kind excavation within the existing floodplain area.

Advantages:

- Less capital cost
- Less Maintenance costs
- Reduced Construction Schedule

Disadvantages:

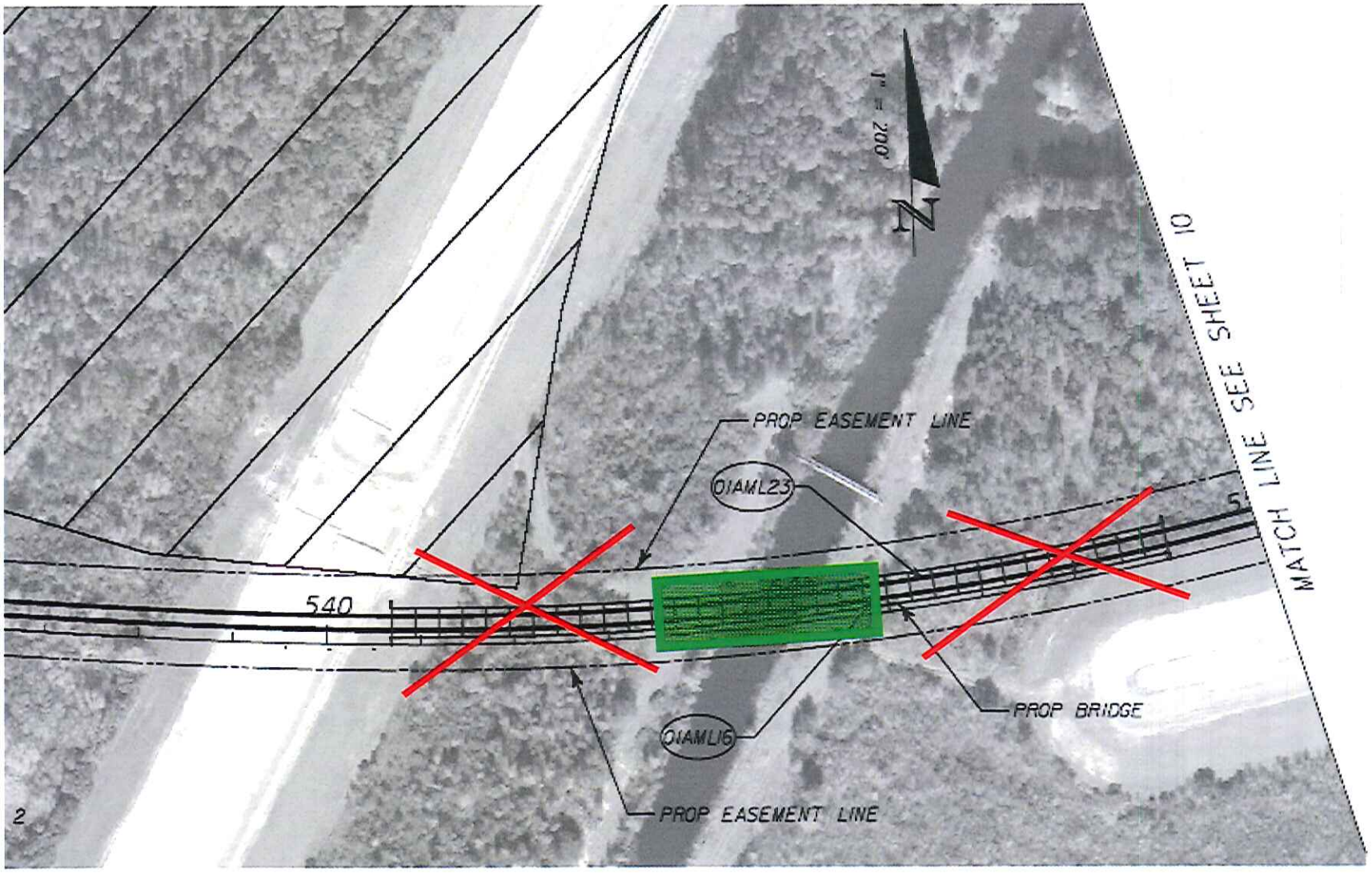
- None apparent

Potential Cost Savings: $16,588,000

Calculations:

Description	Quantity	Unit	Unit Price
Reduction in Bridge Length @ Sta 545+50 crossing	-1,400	LF	$10,322.00
Subtotal			
Unallocated Contingency (14.32% of Base Cost)			
Finance Charges (0.41%)			

RECOMMENDATION No. 18: Shorten the bridge at Sta. 545+50 from 900 ft. to 200 ft. due to anticipated shrinking of the floodplain (by others)



RECOMMENDATION No. 25: Realign Heintzelman Canal (by others) to eliminate the RR Bridge

Proposed Alternative:
The PD&E Documents show a proposed bridge (200 ft.) spanning the Heintzelman canal at station 560+00.

VE Alternative:
AAF is conceptually planning to build a maintenance facility within the project limits, which includes a connection between Canal Road and Wetherbee Road. Consequently, a realignment of the Heintzelman canal is anticipated to maintain existing hydraulic patterns. As a result the bridge at station 560+00 can be eliminated. Moreover, this would reduce the hydraulic load upstream of the bridge at station 545+00 as well as the floodplain area described in Recommendation No.18.

Advantages:

- Less capital cost
- Less Maintenance costs
- Reduced Construction Schedule

Disadvantages:

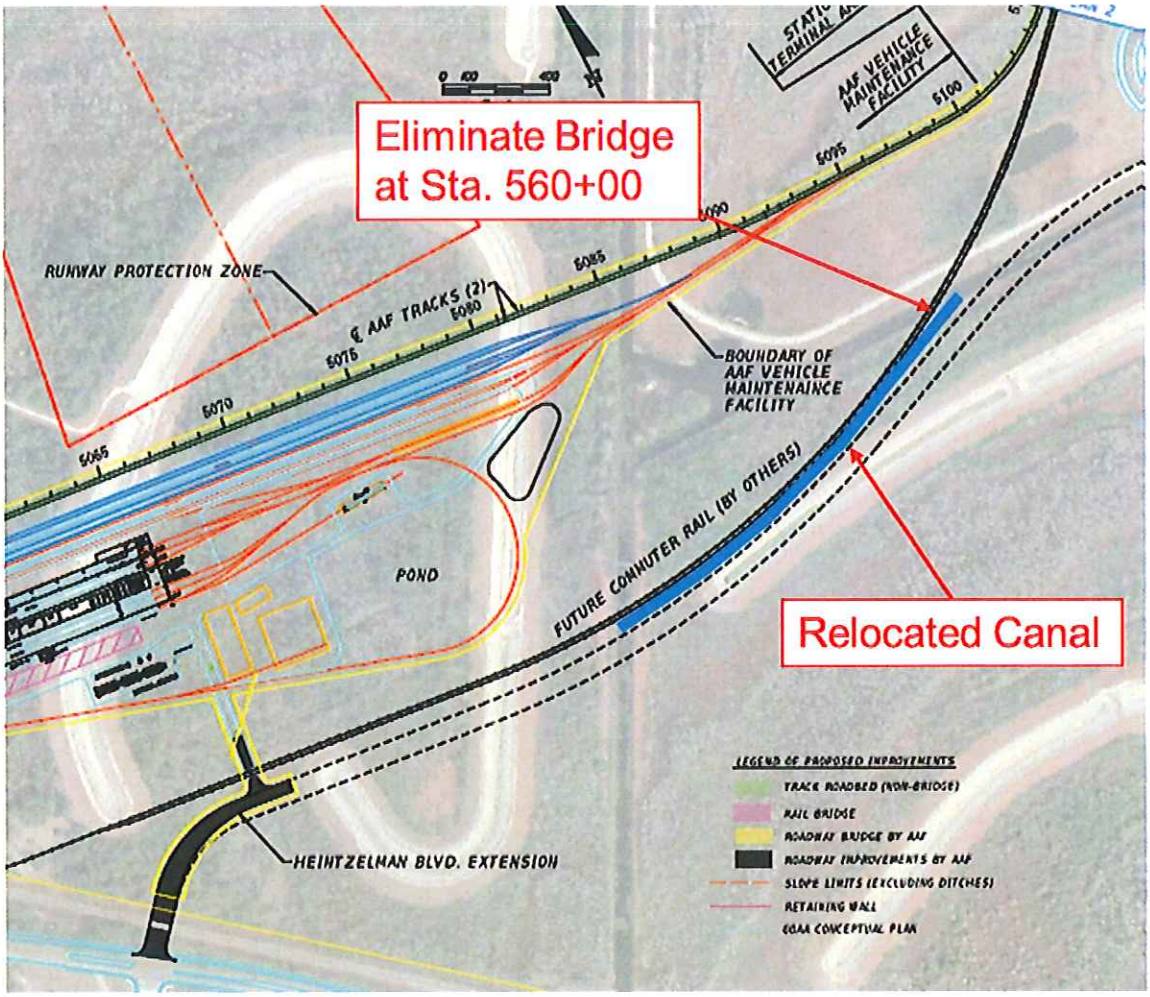
- None apparent

Potential Cost Savings: $4,739,000

Calculations:

Description	Quantity	Unit	Unit Price
Eliminate Bridge @ Sta 560+00 crossing	-400	LF	$10,322.00
Subtotal			
Unallocated Contingency (14.32% of Base Cost)			
Finance Charges (0.41%)			

RECOMMENDATION No. 25: Realign Heintzelman Canal (by others) to eliminate the RR Bridge



RECOMMENDATION No. 26: Revisit RTC runs and move double track section to center of alignment.

Proposed Alternative:
The PD&E Documents show the RTC Runs indicate a need for double tracking at the east and west ends of the alignment (at the stations) resulting in 4.25 miles of the 5.35 mile corridor being double tracked.

VE Alternative:
The VE team recommends revisiting RTC Run and modify schedules so the trains pass in the middle of the alignment. With less than 10 minute run time and 5 minute turn time on a 15 minute schedule, there is no need for 2 station tracks at each end of the alignment. If an eastbound train leaves the SunRail Transfer Station at 9:00 am and a westbound train leaves the OIA ITF at 9:00 am they will meet in the middle of the alignment and arrive at their destinations at 9:10 am. A 5 minute turnaround/dwell would result in the next departure from both stations at 9:15 am, hence meeting the 15 minute headway. This reduction will save on track costs as well as allow for single track stations at either end.

Assumptions:

- Assume double tracking from 428+00 to 534+50.
- Assume OIA Connector track extends north to tie into existing SunRail/CSX mainline.
- Assumes reuse/upgrade of OUC track within project limits.
- Bridges
    - 385+00 – 48 ft. existing, 2nd track is removed from estimate
    - 409+00 – 96 ft. existing, 2nd track is removed from estimate
    - 437+35 – 48 ft. existing, 2nd track remains in
    - Following go from 2 track to 1 track structures
        - 545+00 – 900 ft.
        - 560+35 – 200 ft.
        - 622+20 – 450 ft.
- Assumes single 20-ft. platform at SunRail/OIA Transfer station
- Assumes single 30-ft. platform at OIA ITF station
- Note, this recommendation includes all elements from recommendation No. 3 except turnout to 2nd OIA Connector track
- SunRail still acquires the same ROW on GOAA property
- Assume SunRail can revisit train turn procedure to reduce turn time or 15 minute headway can be adjusted accordingly

Advantages:

- Reduced costs
- Single track stations
- Reduced double track
- Reduction of construction schedule
- Reduction in structure width and costs
- No realignment under Orange Ave
- No realignment of existing CSX/SunRail mainline at transfer station
- Cross platform Transfer
- No pedestrian crossing of SunRail/CSX mainline (only OIA connector)

RECOMMENDATION No. 26: Revisit RTC runs and move double track section to center of alignment.

- No modifications to Wetherbee Rd.
- No additional track on 4 of 5 farm crossings
- Single track crossing at Canal Rd

Disadvantages:

- Potential for rolling delays if one train is delayed (schedule recovery issues).
- SunRail trains on western track would have to utilize crossovers to access platform.
- Increase in wayside maintenance costs due to reduced double tracking.
- In the event of a rail break, car or other malfunction, operations may be stopped.

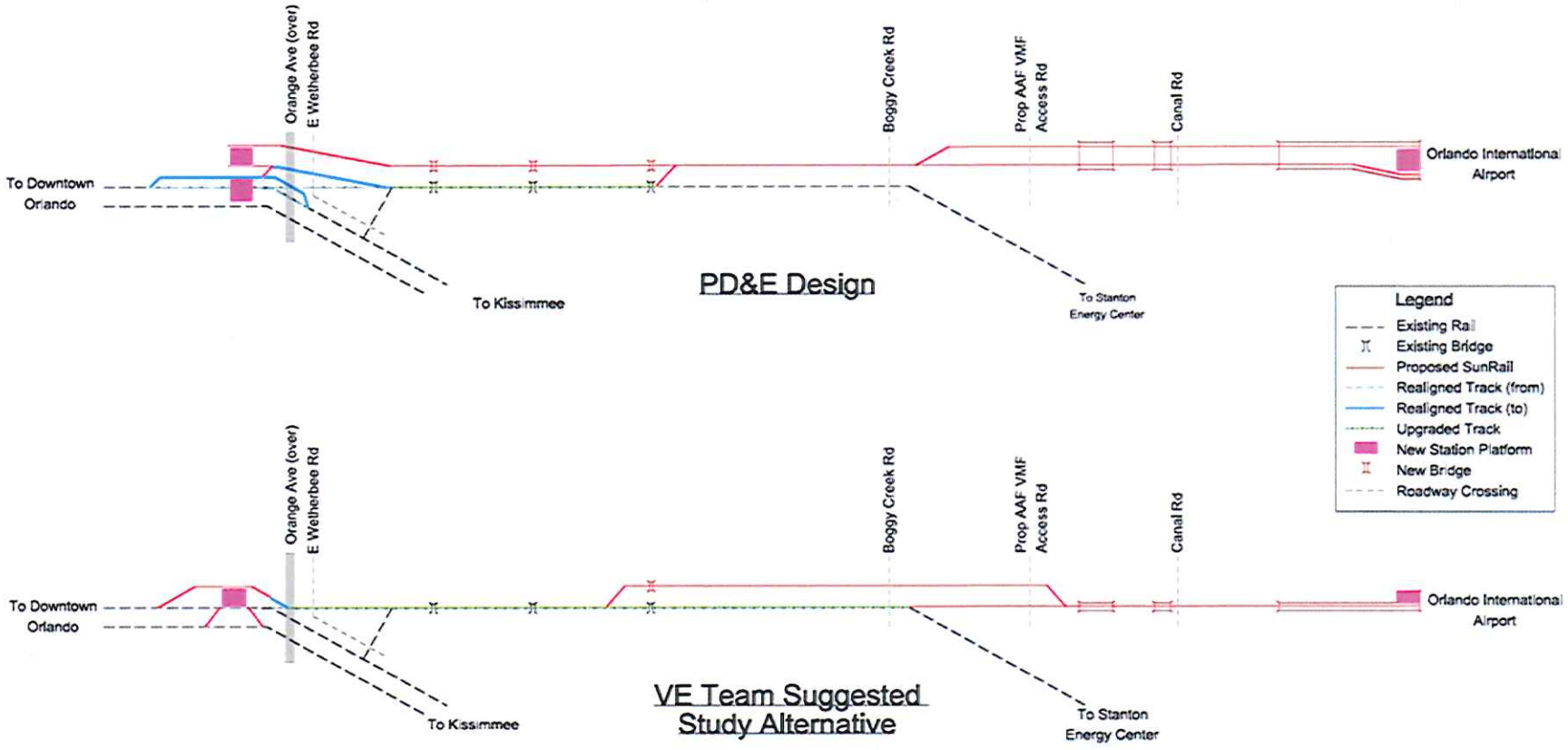
Potential Cost Savings: $43,203,000

RECOMMENDATION No. 26: Revisit RTC runs and move double track section to center of alignment.

Calculations:

Description	Quantity	Unit	Unit Price	Extended Amount
Clear & Grub	-6.24	AC	$10,270.00	($64,100)
Ave Cost per track foot for subgrade & sub-ballast	-27203	TF	$143.00	($3,890,029)
Bridges (see comments)	-1694	LF	$10,322.00	($17,485,468)
Crashwalls (MP 799.9 Orange Ave	-2	EA	$325,000.00	($650,000)
MSE Wall - single track (assume 25')	-60000	SF	$58.50	($3,510,000)
Fill (embankment)	-114755.5	CY	$11.70	($1,342,639)
Borrow Excavation	-114755.5	CY	$6.79	($779,178)
New Track	-27203	TF	$182.00	($4,950,946)
Re-line existing P2S track = .75 Miles of CFRC ML2 + .57 miles of OUC Spur Track)	-6,933	TF	$26.00	($180,258)
Re-Build/upgrade Existing Track of OUC Spur (115# rail @$1400 per ton)	7,135	TF	$26.00	$185,510
At-Grade Station				
Concrete Paving	-112	SY	$ 105.30	($11,779)
Platform pavers, placeholder @75% of platform area	-5,304	SF	$ 12.48	($66,189)
Benches & Trash receptacles	-25	EA	$ 2,600.00	($65,000)
Concrete footings, fradebeams, ramps & slabs	-584	CY	$ 1,105.00	($644,768)
precast concrete column wraps	-25	EA	$ 2,340.00	($58,500)
canopy structural steel & deck	-6,750	SF	$ 143.00	($965,250)
canopy roof, plywood & it gauge framing	-6,750	SF	$ 35.10	($236,925)
plumbing, water platform drains & roof connec	-0.5	LS	$ 227,500.00	($113,750)
structure painting	-6,750	SF	$ 16.90	($114,075)
Aerial Station				
Platform pavers, placeholder @75% of platform area	-4,500	SF	$ 12.48	($56,160)
Benches & Trash receptacles	-10	EA	$ 2,600.00	($26,000)
Concrete footings, fradebeams, ramps & slabs	-631	CY	$ 1,105.00	($696,703)
precast concrete column wraps	-20	EA	$ 2,340.00	($46,800)
canopy structural steel & deck	-5,500	SF	$ 143.00	($786,500)
canopy roof, plywood & it gauge framing	-5,500	SF	$ 35.10	($193,050)
plumbing, water platform drains & roof connec	-0.5	LS	$ 227,500.00	($113,750)
structure painting	-5,500	SF	$ 16.90	($92,950)
#20 Crossover	-1	EA	$ 700,700.00	($700,700)
#15 Crossover	-3	EA	$ 533,000.00	($1,599,000)
#15 Turnout	4	EA	$ 262,600.00	$1,050,400
Signal additions on CSX/SunRail mainline	1	LS	$ 500,000.00	$500,000
Subtotal				($37,704,556)
Unallocated Contingency (14.52% of Base Cost)				($5,474,702)
Finance Charges (0.44%)				($24,089)
			CONSTRUCTION TOTAL	**($43,203,346)**

RECOMMENDATION No. 26: Revisit RTC runs and move double track section to center of alignment.



Design Suggestion 1: Use no-fines/cellular concrete where muck is encountered

Proposed Alternative:
The Preliminary Engineering Report utilizes surcharge program for areas where deep pocket of organic material is present.

VE Alternative:
The VE team recommends utilizing a mix of no-fine/cellular concrete and (A-3 Soil) select material to reduce total settlement where organic materials is present.

Advantages:

- Less Construction Time (6-months saved)
- Increase Flexibility
- Less Long term Maintenance cost.
- Reduces total embankment weight

Disadvantages:

- Increased cost
- Cost of Fill 10$/CY vs Cellular Concrete 100$/CY

Calculations: Not Applicable

Design Suggestion 1: Use no-fines/cellular concrete where muck is encountered

APPENDICES

Agenda
Sign In Sheets
Resolution Memorandum
Presentation Slides

Agenda
November 7 – 10, 2016

Day One	Kickoff Intro by VE Team Leader	8:00 am – 8:15 am
	Team Review and Discussions of Documents	8:15 am – 9:00 am
	Designer Orientation	9:00 am – 10:00 am
	Cost Model & Function Analysis	10:00 am –10:30 am
	FAST Diagram	10:30 am – 11:15 am
	Intro to Creative Thinking	11:15 am – 11:30am
	Creative Idea Listing	11:30 am – 12:00 pm
	Lunch	12:00 pm – 1:00 pm
	Creative Idea Listing	1:00 pm – 3:30 pm
	Evaluation Phase	3:30 pm –5:00 pm
Day Two	Finish Evaluation	8:00 am – 10:00 am
	Mid-point review	10:00 am – 11:00 am
	Begin Development Phase	11:00 am – 12:00 pm
	Lunch	12:00 pm – 1:00 pm
	Continue Development	1:00 pm – 5:00 pm
Day Three	Continue Development and Prepare Oral Presentation	8:00 am – 1:30 pm
	Team Site Visit	1:30 pm -5:00 pm
Day Four	Finish Development/Oral Presentation	8:00 am – 10:00 am
	Oral Presentation to FDOT/others (at Operations & Control Center, 801 SunRail Drive, Sanford, FL)	10:00 am – 12:00 pm
	Lunch	12:00 pm – 1:00 pm
	Begin Draft Value Engineering Report	1:00 pm – 5:00 pm

FLORIDA DEPARTMENT OF TRANSPORTATION

VALUE ENGINEERING STUDY KICKOFF MEETING

SunRail Phase III

November 7, 2016

SIGN IN SHEET

Name	Representing	Phone Number	Email Address
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FLORIDA DEPARTMENT OF TRANSPORTATION

VALUE ENGINEERING STUDY MID-POINT REVIEW

SunRail Phase III

November 8, 2016

SIGN IN SHEET

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FLORIDA DEPARTMENT OF TRANSPORTATION

VALUE ENGINEERING STUDY PRESENTATION

SunRail Phase 3

November 10, 2016

SIGN IN SHEET

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Rick Johnson	PMA Consultants	321-418-8187	rjohnson@pmaconsultants.com

Florida Department of Transportation

RICK SCOTT
GOVERNOR

719 S. Woodland Blvd.
DeLand FL, 32720

JIM BOXOLD
SECRETARY

Value Engineering Final Resolution Memorandum

Date: January 9, 2017

To: Ty Garner, SunRail Phase 3 Project Manager

Copies: Nicola Liquori, Miguel Torres

Value Engineering Study
Financial Project ID#: 429215-2-21-01, SunRail Phase 3, OIA Connector

This memorandum is in response to the subject Value Engineering (VE) review conducted during the week of November 7th through November 10, 2016. We would like to thank the VE Team for their review of the study and their recommendations. Only recommendations that were detailed in the VE Report provided are discussed here.

Recommendation 1: For the section between 440 and 500+/- can we use the existing track instead of new.

Potential Cost Savings: $1,407,000

Response: This VE Recommendation will be given further consideration by the PD&E Team. The limits of the shared OUC track were established through coordination with OUC, their operational concerns and based on the RTC runs provided by the GEC. Additional coordination with OUC and revised RTC runs are required based on the need for 10 minute turn around times.

Recommendation 2: Share Brightline track from the ITF to the OUC corridor.

Potential Cost Savings: $38,872,000

Response: This VE Recommendation is not accepted by the PD&E Team. Currently the construction schedule for the Brightline extension from West Palm Beach to Orlando is not defined. Significant coordination and potential MOUs including negotiations for use of Brightline tracks would be required. SunRail would be responsible for implementation of Positive Train Control and other potential operational improvements for passenger service where Brightline operations for this section of potential shared track are for only non-passenger/maintenance use.

Recommendation 3: Leave the existing CSX track and build a single center platform between OIA and SunRail tracks

Potential Cost Savings: $213,000

Response: This VE Recommendation is not accepted by the by the PD&E Team. Current two platform/double track design recommended through RTC analysis with 15 minute headways. Center platform utilizing mainline track on one side presents additional operational and scheduling concerns with the IOS and Phase 2 South service.

Recommendation 6: Increase the approach grade for the ITF from 2.5% to 3% and shift the start of grade to the north.

Potential Cost Savings: $2,584,000

Response: This VE Recommendation will be given further consideration by the PD&E Team. Current design of 2.5% grade was coordinated with FDOT in review of plans. Maximizing grade and minimizing vertical curve lengths to extremes are not generally desirable until the project is more defined. A higher grade may have impact to power needs, rider comfort, design of safe braking distances and bumping post at the ITF station. Potential additional costs in track maintenance due to additional forces on track due to deceleration/acceleration from stopping and starting on sloped grade in close proximity to the ITF station. A change would also require an update to the CFRC Design Criteria.

Recommendation 7: Maintain track centers approaching the ITF and provide side platforms.

Potential Cost Savings: $10,242,000

Response: This VE Recommendation is not accepted by the PD&E Team. The preliminary engineering plans reflect the information provided to the PD&E Team from GOAA and the architectural civil site design plans that are currently under construction including the second level approach that connects the SunRail platform to the ITF building.

Recommendation 8: Build the new Transfer Station and implement Bus Rapid Transit (BRT) service along the proposed Right of Way to the ITF

Potential Cost Savings: $77,917,000

Response: This VE Recommendation is not accepted by the PD&E Team. The direction provided for this study was to utilize existing SunRail technology. A BRT project would require reevaluation.

Recommendation 11: Use 50-ft. spans instead of 24-ft. spans to save on substructure and use common substructure for opposing track directions

Potential Cost Savings: $6,528,000

Response: This VE Recommendation is accepted by the PD&E Team. Girder type, span length and substructure are based on E80 Live Load to provide flexibility on the types of rail equipment that would potentially be used for maintenance activities with the completion of construction. Geotechnical information/recommendations on allowable pile loads will be obtained at the time of design. Optimization of span length will be completed in the design phase to determine the most cost effective length.

Recommendation 16: Extend the GOAA APM system and cars along the corridor to the SunRail Transfer Station

Potential Value Added: ($385,675,000)

Response: This VE Recommendation is not accepted by the PD&E Team. The direction provided for this study was to utilize existing SunRail technology. An APM project would require reevaluation.

Florida Department of Transportation

RICK SCOTT
GOVERNOR

719 S. Woodland Blvd.
DeLand FL, 32720

JIM BOXOLD
SECRETARY

Recommendation 17: Purchase only two sets of cars and use the spares from the SunRail yard

Potential Cost Savings: $10,522,000

Response: This VE Recommendation is not accepted by the PD&E Team. The use of only two trains is based on the assumption of only 5 minute turnaround times and no operating spare. The need for 10 minute turnaround time will dictate a minimum of three trains for 15 minute headways plus a spare train.

Recommendation 18: Shorten the bridge at Sta. 545+50 from 900 ft. to 200 ft. due to anticipated shrinking of the flood plain (by others)

Potential Cost Savings: $16,588,000

Response: This VE Recommendation is accepted by the PD&E Team. GOAA has stated they are in the process of updating/revising floodplain limits in conjunction with the work on the South Terminal expansion at the northern limits of the SunRail project. Continued coordination is needed to capitalize on opportunities to manage water resources in this area and shorten the floodway crossing.

Recommendation 25: Realign Heintzelman Canal to eliminate the RR Bridge (by others)

Potential Cost Savings: $4,739,000

Response: This VE Recommendation is accepted by the PD&E Team. GOAA has stated they are in the process of updating/revising floodplain limits in conjunction with the work on the South Terminal expansion at the northern limits of the SunRail project. Continued coordination is needed to capitalize on opportunities to manage water resources in this area with the proposed Heintzelman Road extension (by others), that would remove the need for a bridge crossing of the proposed road and the SunRail bridge crossing.

Recommendation 26: Revisit the RTC model to provide meets in the middle of the alignment

Potential Cost Savings: $43,203,000

Response: This VE Recommendation is not accepted by the PD&E Team. Additional RTC modeling runs reducing the length of double track and providing the passing track in the middle of the project indicate that four trains would be required to meet 15 minute headways. The current location of new track and shared track has been coordinated with OUC.

_____ _____

Nicola Liquori
SunRail executive Director/CEO

Date

SLIDE PRESENTATION

SunRail Phase III

Team Members:

- Chris Ray, PE, Structures
- Kennedy Simmonds, PE, Drainage
- Andrew Leong, PE, Constructability
- Erin Trahan, PE, Track Design
- Brad Luse, Systems
- William Soehaili, EI, Geotechnical
- Gene Sansone, Rail Cars
- Ty Garner, VE Administrator
- Rick Johnson, PE, CVS, Team Leader

SAVE International and FDOT Job Plan

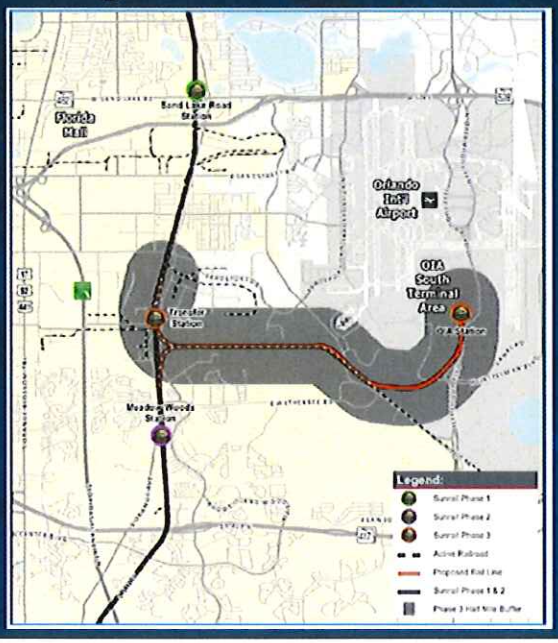
- Information/Function
- Creative Brainstorming
- Evaluation
- Development
- Recommendation/Presentation
- Report

Information

- Information Gathering
- Reviewed Project Information
- Site Visit
- Verified Constraints
- Identified Functions

Project Location

Project Location



Project Scope

Construct 5.35 miles realigning SunRail Phase II South Mainline, a transfer station, two additional tracks along the existing OUC Stanton Spur and double track through the GOAA property to the OIA transfer facility. Improvements include grade crossing improvements, two proposed crossings, proposed track crossover, proposed culvert, bridges and extending existing concrete trestle bridges.

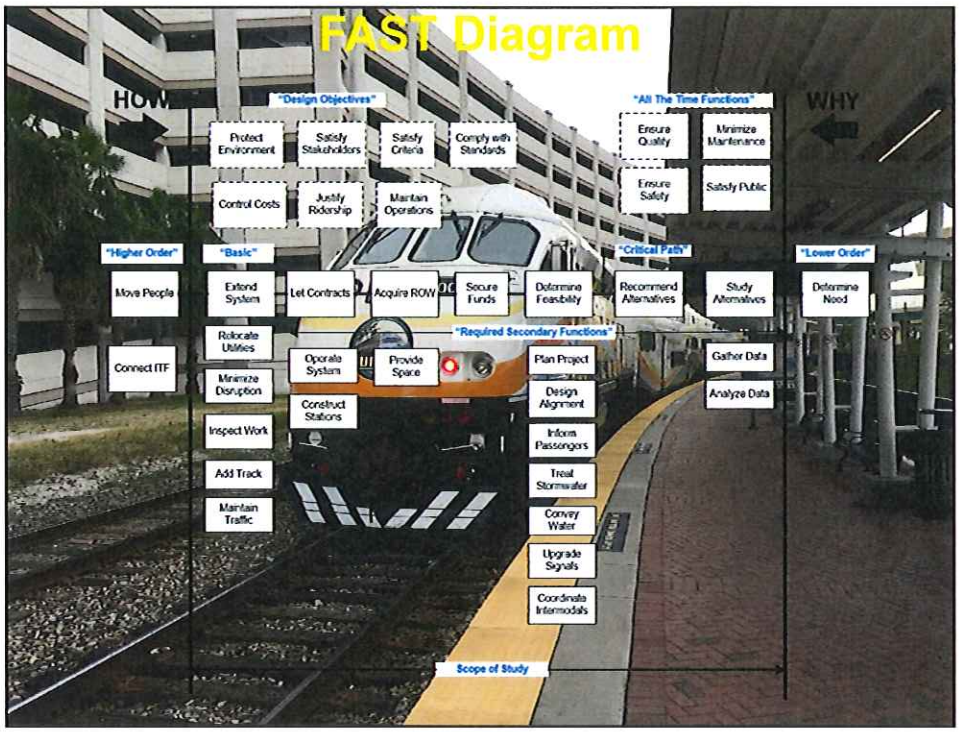
Construction: $222.78M
Right of Way: $ 37.98M

Constraints

- Must connect at the second level of the Intermodal Transit Facility
- Cannot eliminate the Bus connection at the Transfer Station

Function Analysis

- Move People
- Extend System
- Let Contracts
- Acquire Right of Way
- Secure Funds
- Determine Feasibility
- Recommend Alternatives
- Study Alternatives
- Determine Need



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- Generated Ideas in Major Disciplines and for Each Function
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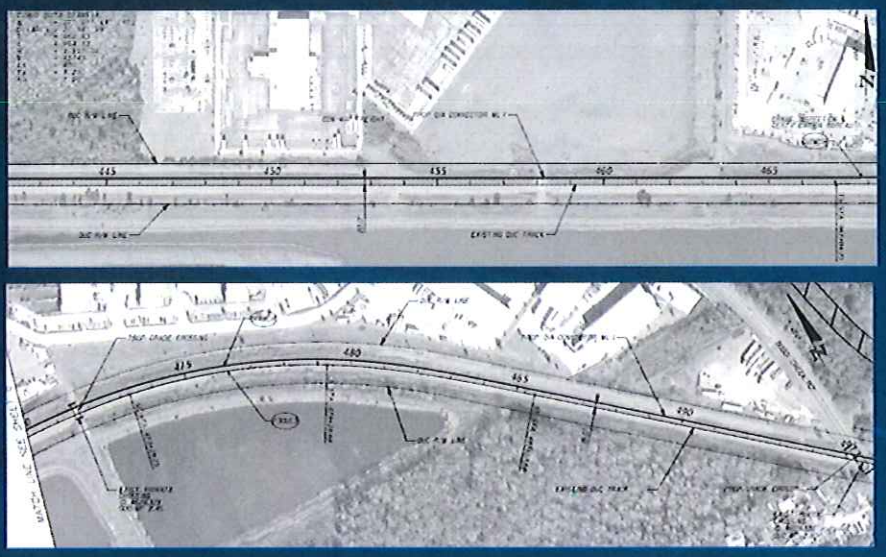
Use the existing track

- **PD&E Alternative:** The PD&E Documents show constructing a new track to the north of the existing OUC (Stanton Spur) track between station 440+00 and 500+00.

Use the existing track

- **VE Alternative No. 1:** The VE team recommends constructing sharing the existing OUC (Stanton Spur) track between station 440+00 and 500+00. Upgrade OUC track to meet Class 4 standards.

Use the existing track



Use the existing track

- **Advantages:**
  - Reduction in cost
  - Reduction in construction time
- **Disadvantages:**
  - Potential for conflicts with freight trains due to shared track
  - Additional maintenance due to added turnout
- **Potential Cost Savings: $1,407,000**

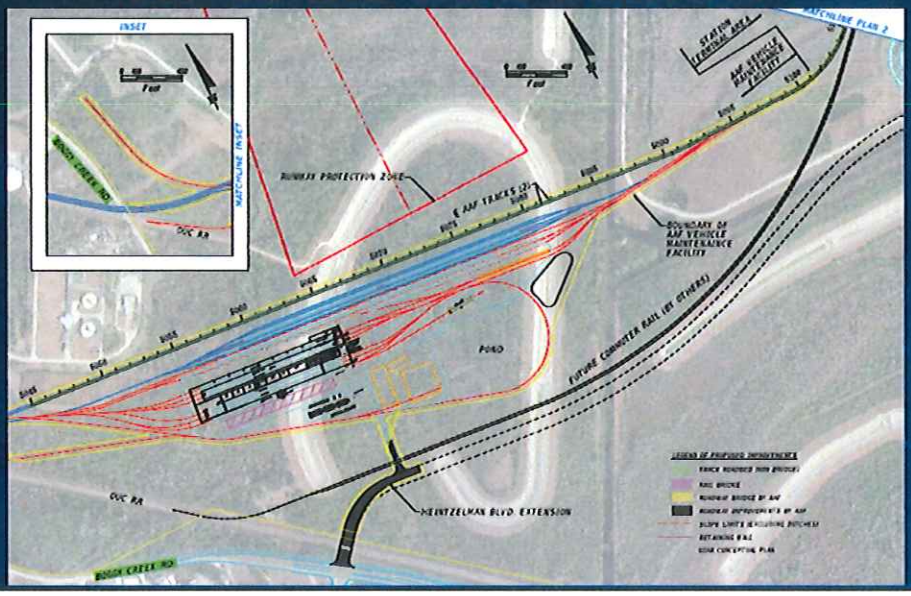
Share Brightline track from the ITF to the OUC corridor

- **PD&E Alternative:** The PD&E Documents show new corridor for SunRail between Orlando International Airport ITF and the OUC (Stanton Spur) track corridor just north of E Wetherbee Rd.

Share Brightline track from the ITF to the OUC corridor

- **VE Alternative No. 2:** The VE team recommends constructing sharing the AAF/Brightline tracks from SunRail Sta. 495+00 at Boggy Creek Rd to Sta. 575+00 on GOAA property at bottom of station approach ramps. Assume that AAF/Brightline carries cost for their facilities and SunRail is incremental increase.

Share Brightline track from the ITF to the OUC corridor



Share Brightline track from the ITF to the OUC corridor

- **Advantages:**
  - Less right of way
  - Less construction cost
  - Less maintenance
  - Eliminates two at-grade crossings
- **Disadvantages:**
  - Potential conflicts with AAF
  - Usage fee and agreement with AAF
- **Potential Cost Savings: $38,872,000**

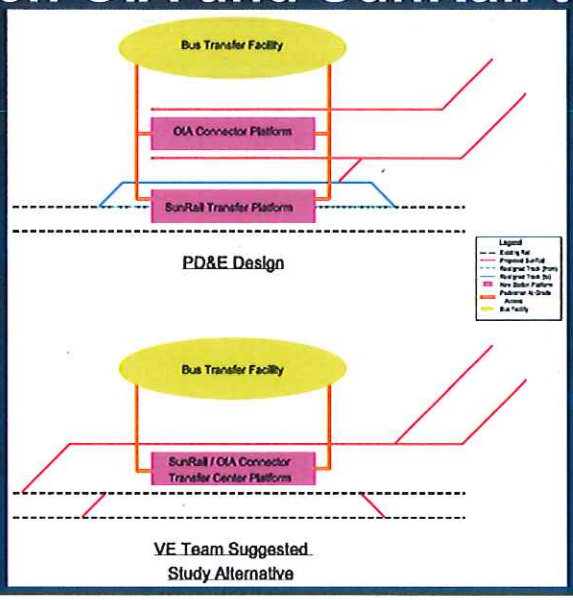
Build a single center platform between OIA and SunRail tracks

- **PD&E Alternative:** The PD&E Documents show realigning the SunRail\CSX eastern mainline track to accommodate a center platform. OIA Connector would come in on the east with two tracks and a center platform. Pedestrian grade crossing of eastern CSX track. Bus facility is east of OIA Connector tracks.

Build a single center platform between OIA and SunRail tracks

- **VE Alternative No. 3:** The VE team recommends eliminating realignment of SunRail/CSX mainline track, provide only a single platform to the east of the SunRail/CSX mainline. Provide single OIA Connector track east of the platform with tail track for connection to CSX Mainline (non-revenue service movement). Maintain placement of bus facility to east of OIA Connector track.

Build a single center platform between OIA and SunRail tracks



Build a single center platform between OIA and SunRail tracks

- Advantages:
  - Reduced cost
  - Cross platform transfer at station
  - No pedestrian crossing of SunRail/CSX mainline
  - Reduction of construction schedule
- Disadvantages:
  - Reduced flexibility in operations at station
- Potential Cost Savings: $213,000

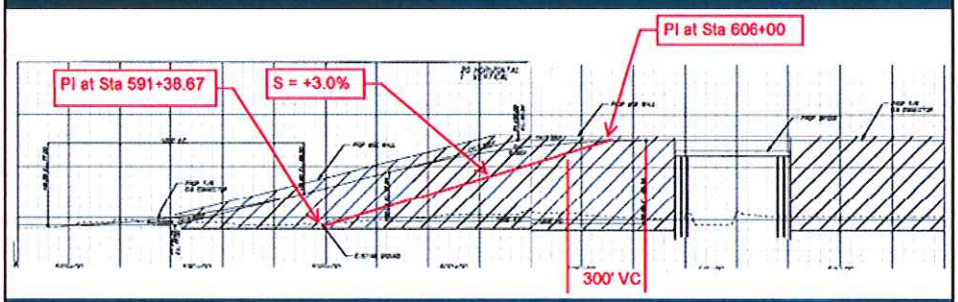
Increase the approach grade for the ITF from 2.5% to 3%

- **PD&E Alternative:** The PD&E Documents show a profile grade of 2.5% to attain the level grade of 0.00% at elevation 110.34 for connection to the ITF. The track alignment incline starts at approximately Station 589+00 and the guideway is on retained fill with MSE walls and a proposed 450 ft. long bridge spanning the access road and pond off of Jeff Fuqua Road.

Increase the approach grade for the ITF from 2.5% to 3%

- **VE Alternative No. 6:** The VE team recommends reducing the amount of retained earth fill within MSE walls by: 1) reducing the vertical curve from 1,000 ft. to 300 ft., and 2) increasing the alignment grade to 3.0%.

Increase the approach grade for the ITF from 2.5% to 3%



Increase the approach grade for the ITF from 2.5% to 3%

- Advantages:
  - Less cost
- Disadvantages:
  - Will require design variation
- Potential Cost Savings: $2,584,000

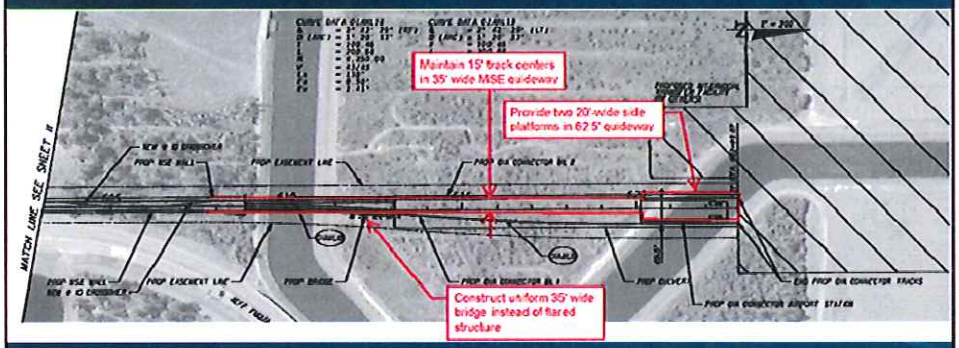
Maintain track centers at the ITF and provide side platforms

- **PD&E Alternative:** The PD&E Documents show the tracks diverging from 15-ft. centers at approximately Station 607+00 to 69.5-ft. centers at the ITF to accommodate a 59.3-ft. wide center platform.

Maintain track centers at the ITF and provide side platforms

- **VE Alternative No. 7:** The VE team recommends maintaining the tracks at 15-ft. centers into the ITF and providing two 20-ft. wide side platforms. The proposed reconfiguration of the tracks and platforms reduces the overall guideway section from 89.5 ft. to 65.2 ft. and greatly simplifies the construction of the 450-ft. long two-track track bridge over the access road and pond.

Maintain track centers at the ITF and provide side platforms



Maintain track centers at the ITF and provide side platforms

- **Advantages:**
  - Less cost
  - Meets Design Criteria preference
  - Simplified construction of 450-ft. bridge
- **Disadvantages:**
  - Slightly increased schedule to construct separate platforms
- **Potential Cost Savings: $10,242,000**

Construct BRT service through the corridor to the ITF

- **PD&E Alternative:** The PD&E Documents show use Heavy Rail CRT (3 diesels, 3 cab cars and 3 coaches).

Construct BRT service through the corridor to the ITF

- **VE Alternative No. 8:** The VE team recommends using the Meadow Woods Station to transfer and constructing a BRT system (3 articulated buses) connecting to the ITF by using the median on Wetherbee Road. Maintained by Lynx.

Construct BRT service through the corridor to the ITF

Construct BRT service through the corridor to the ITF

Construct BRT service through the corridor to the ITF

- **Advantages:**
  - Vehicle costs are considerably less
  - Less construction cost
  - Less O&M
  - Flexibility – future systems
- **Disadvantages:**
  - Need turnarounds at each terminal
  - Manually operated
- **Potential Cost Savings: $77,917,000**

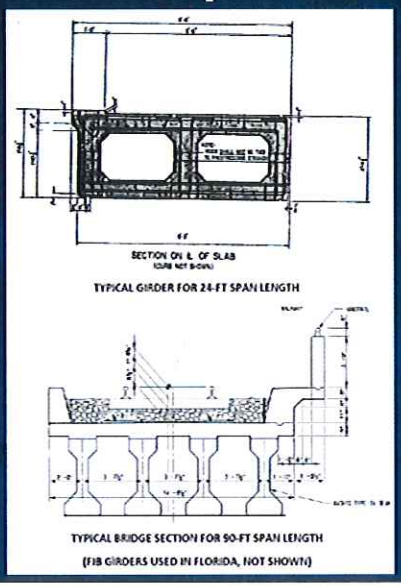
Use 50-90 ft. spans instead of 24-ft. spans

- **PD&E Alternative:** The PD&E Documents show the new bridges with 24-ft spans. The bridge at station 545+50 is 900-ft long with 38 spans. The bridge at station 560+00 is 200-ft long with 9 spans. The bridge at station 610+85 is 450-ft long. The PD&E does not identify the substructure elements for the 450-ft. bridge and therefore it is excluded from this analysis.

Use 50-90 ft. spans instead of 24-ft. spans

- **VE Alternative No. 11:** Use 50-ft. spans instead of 24-ft. spans with a more robust girder also can span longer spans. The girders cost more per foot, but by using this type of girder a more robust service life can be achieved with the elimination of half of the substructure, or pile bents.

Use 50-90 ft. spans instead of 24-ft. spans



Use 50-90 ft. spans instead of 24-ft. spans

- **Advantages:**
  - Eliminate 50% of substructure
  - Enhance canal conveyance
  - Decreases construction schedule
  - Avoids the voided slab design
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings:** $6,528,000

Extend the GOAA APM system to the SunRail Transfer Station

- **PD&E Alternative:** The PD&E Documents show Heavy Rail Commuter Rail Transit.

Extend the GOAA APM system to the SunRail Transfer Station

- **VE Alternative No. 16:** The VE team recommends extending the GOAA Automated People Mover system and cars along the corridor to the SunRail Transfer station.

Extend the GOAA APM system to the SunRail Transfer Station

Extend the GOAA APM system to the SunRail Transfer Station

- Advantages:
  - Potentially less right of way
  - Less O&M
  - Automated train operation
- Disadvantages:
  - Adds cost
  - Less seating
  - Longer run time
- Potential Value Added: ($386M)

Purchase only two sets of cars

- PD&E Alternative: The PD&E Documents show a new car procurement of 3 train sets (consist made up of a diesel locomotive, coach car and cab car). Two train sets are used for daily operation, one is a spare for to allow preventive maintenance.

Purchase only two sets of cars

- **VE Alternative No. 17:** The VE team recommends procuring only 2 train sets and using the pool of mainline spares to provide one spare when required.

Purchase only two sets of cars

- **Advantages:**
  - Less cost
  - Less maintenance
- **Disadvantages:**
  - Lower spare ratio
  - Higher risk to make full service
- **Potential Cost Savings: $10,522,000**

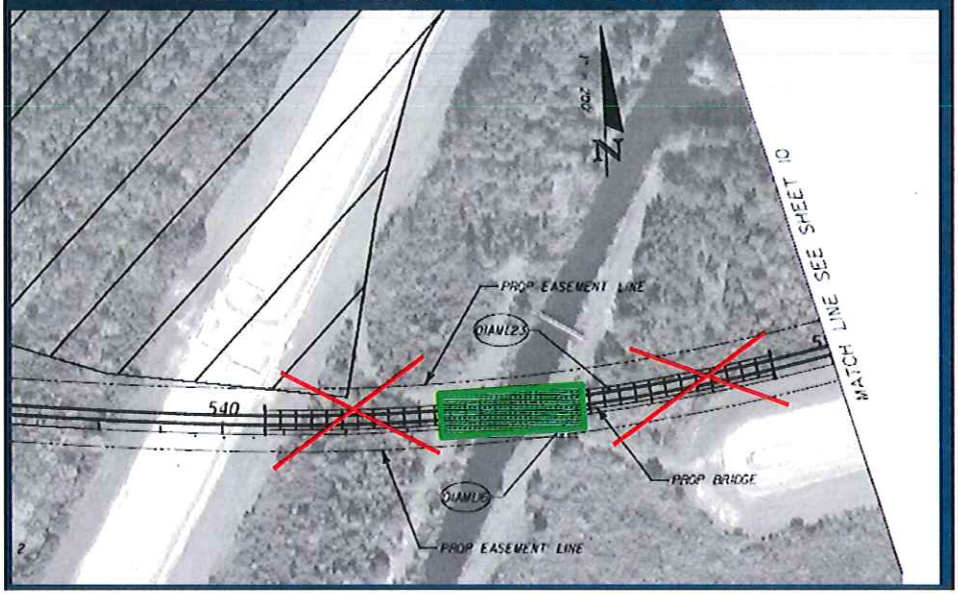
Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **PD&E Alternative:** The PD&E Documents show a proposed bridge (850 ft.) spanning the current regulated floodway area at station 560+35 (approx.).

Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **VE Alternative No. 18:** GOAA is in the process of modifying the floodplain map in the area and anticipate that the floodway boundary shall be contained within the banks of the existing stream. In light of these efforts, the VE team recommends constructing a bridge that spans the existing stream channel.

Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.



Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **Advantages:**
  - Less cost
  - Less Maintenance costs
  - Reduced Construction Schedule
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings: $16,588,000**

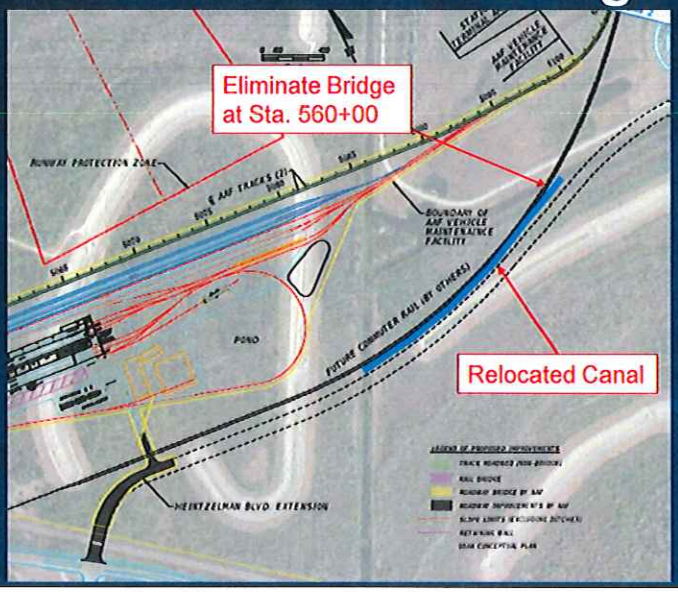
Realign Heintzelman Canal to eliminate the RR Bridge

- **PD&E Alternative:** The PD&E Documents show a proposed bridge (200 ft.) spanning the Heintzelman canal at station 560+00.

Realign Heintzelman Canal to eliminate the RR Bridge

- **VE Alternative No. 25:** GOAA is conceptually planning to build a maintenance facility within the project limits, which includes a connection between Canal Road and Wetherbee Road. Consequently, a realignment of the Heintzelman canal is anticipated to maintain existing hydraulic patterns. As a result the bridge at station 545+50 can be eliminated.

Realign Heintzelman Canal to eliminate the RR Bridge



Realign Heintzelman Canal to eliminate the RR Bridge

- **Advantages:**
  - Less cost
  - Less Maintenance costs
  - Reduced Construction Schedule
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings: $4,739,000**

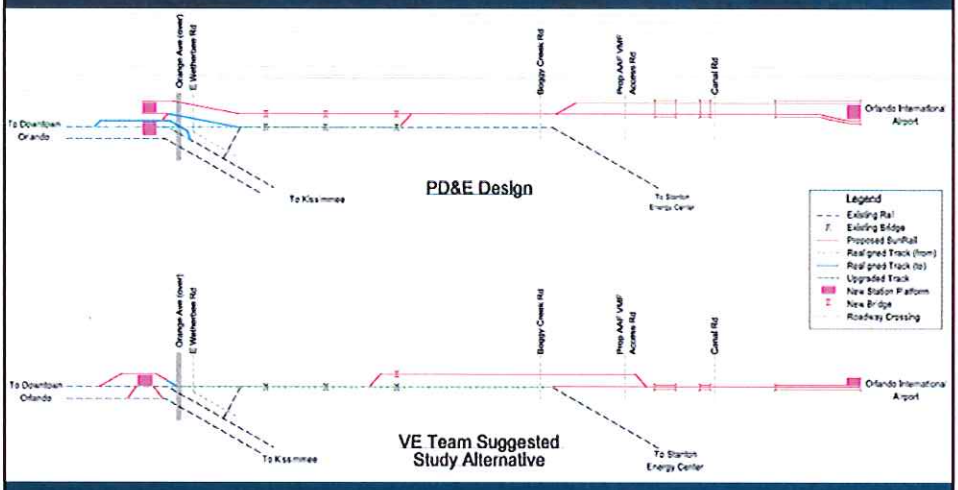
Revisit the RTC model

- **PD&E Alternative:** The PD&E Documents show the RTC Runs indicate need for double tracking at the east and west ends of the alignment (at the stations) resulting in 4.25 miles of the 5.35 mile corridor being double tracked.

Revisit the RTC model

- **VE Alternative No. 26:** The VE team recommends revisiting RTC Run and modify schedules so the meet is in the middle of the alignment. With <10 minute run time and 5 minute turn time on a 15 minute schedule, there is no need for 2 station tracks at each end of the alignment.

Revisit the RTC model



Revisit the RTC model

- **Advantages:**
  - Reduced costs
  - Single track stations
  - Reduced double track
  - Reduction of construction schedule
- **Disadvantages:**
  - Potential for rolling delays if one train is delayed
  - SunRail trains have to utilize crossovers
  - **Potential Cost Savings: $43,203,000**

Design Suggestions

- Use no-fines/cellular concrete where muck is encountered

- Preferred options are the CRT and BRT

Savings Summary

Recommendation	Savings	Maximum Savings
Use the existing track	$1,407,000	
Share Brightline track from the ITF to the OUC corridor	$38,872,000	
Build a single center platform between OIA and SunRail tracks	$213,000	
Increase the approach grade for the ITF from 2.5% to 3%	$2,584,000	$1,033,600
Maintain track centers at the ITF and provide side platforms	$10,242,000	
Construct BRT service down the median of Weatherbee Road*	$77,917,000	
Use 50-ft. spans instead of 24-ft. spans	$6,528,000	$1,187,000
Extend the GOAA APM system to the SunRail Transfer Station	($385,675,000)	
Purchase only two train sets of cars	$10,522,000	$10,522,000
Shorten the bridge at Sta. 545+00 from 850 ft. to 200 ft.	$16,588,000	$8,294,000
Realign Heintzelman Canal to eliminate the RR Bridge	$4,739,000	$2,370,000
Revisit the RTC model	$43,203,000	$43,203,000
		$66,609,600

Action Plan

- Receive Draft VE Report 11/25/16
- Draft Report Routed for Comments
- Resolution Meeting
- Receive and Incorporate D5 Comments and Revisions 12/16/16
- Issue Final VE Report 12/30/16


SunRail Phase III
VE Study Recommendations
Conducted November 7 – 10, 2016
108
SunRail

SunRail Phase III

Team Members:

- Chris Ray, PE, Structures
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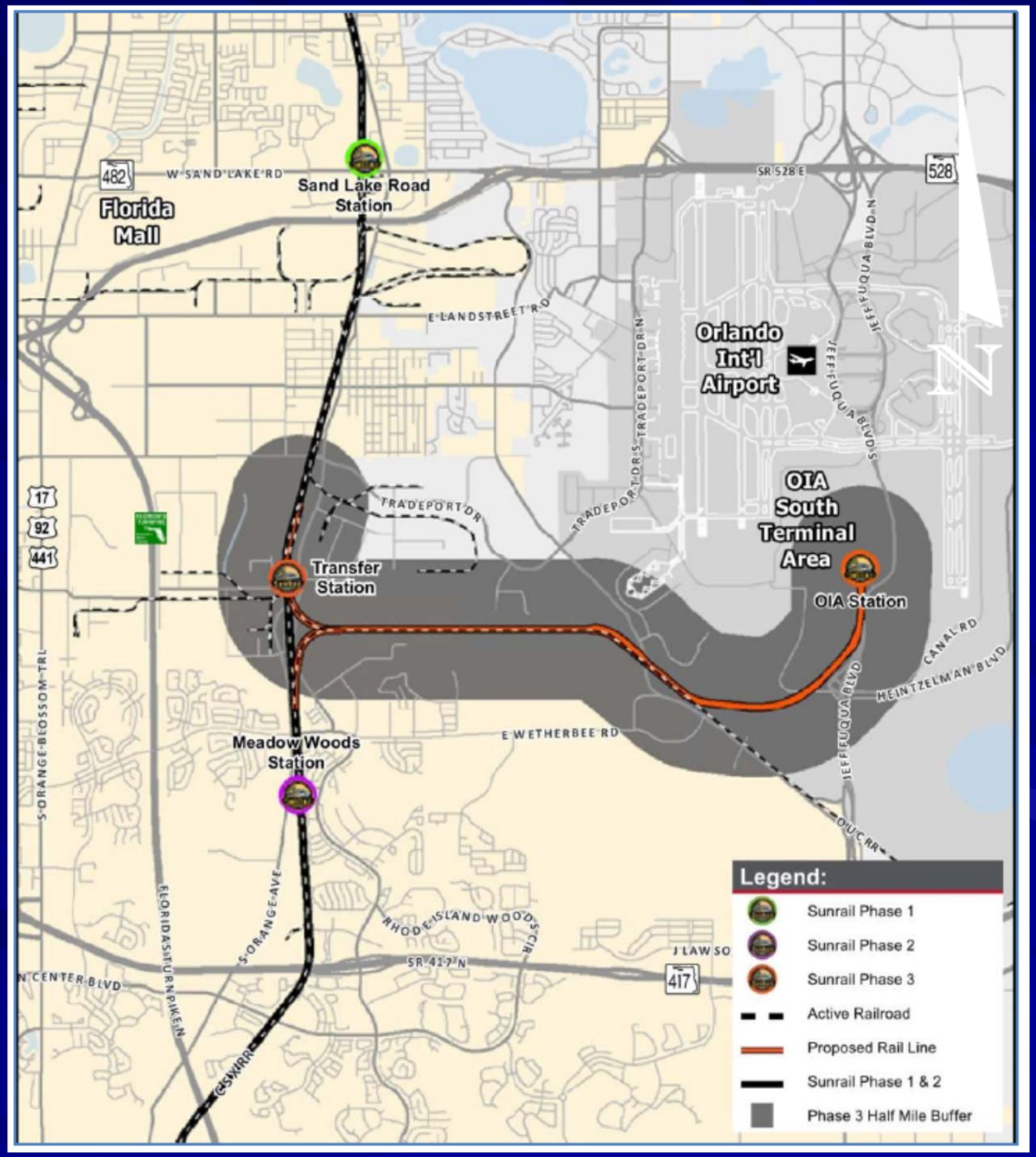

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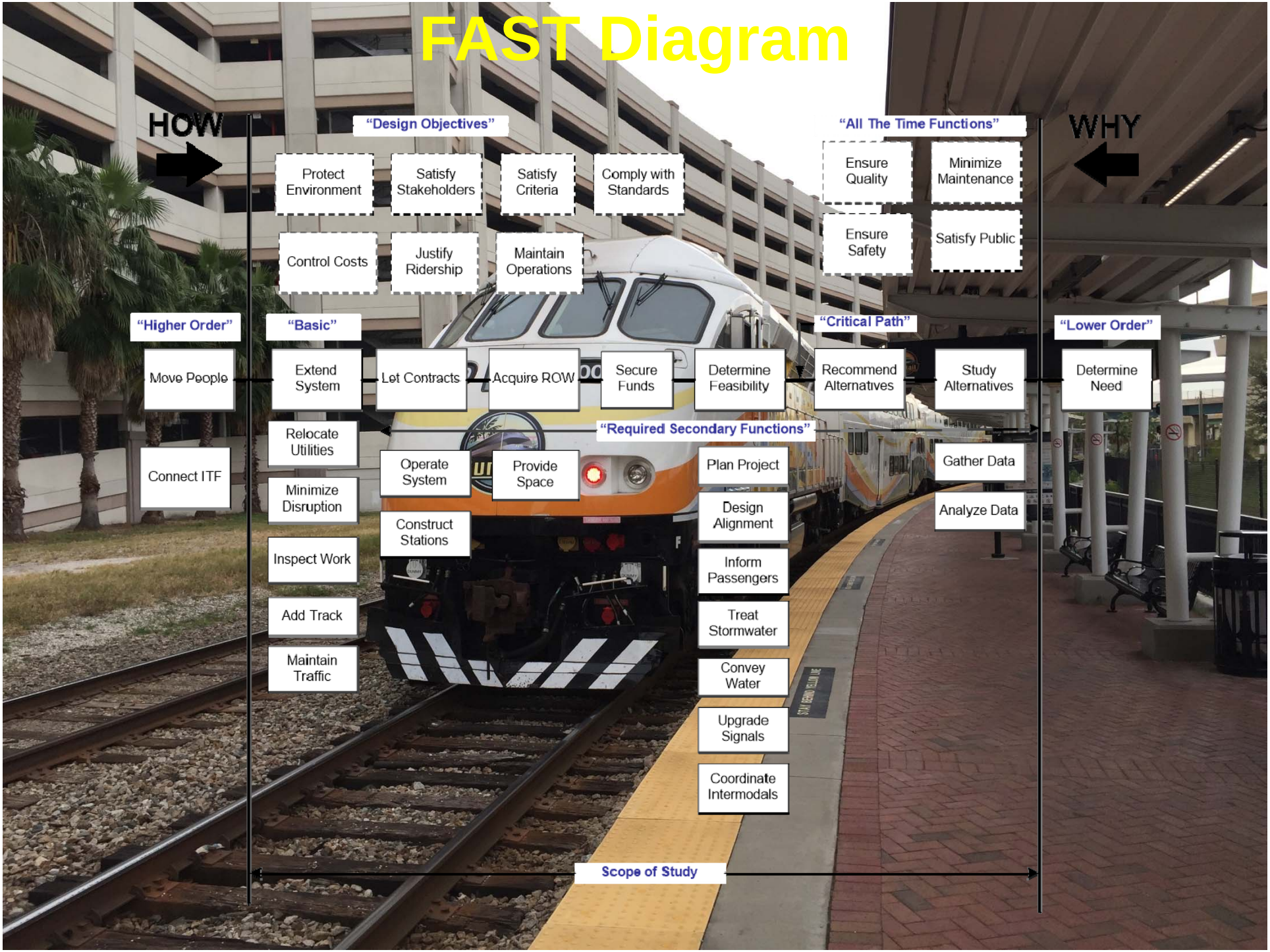
FAST Diagram



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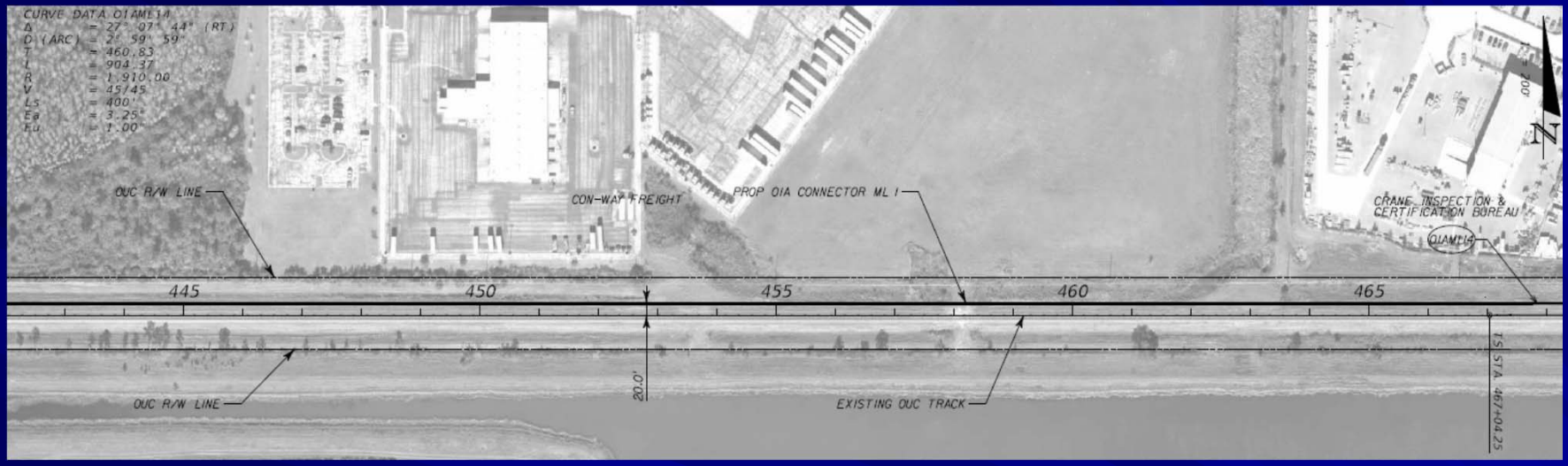
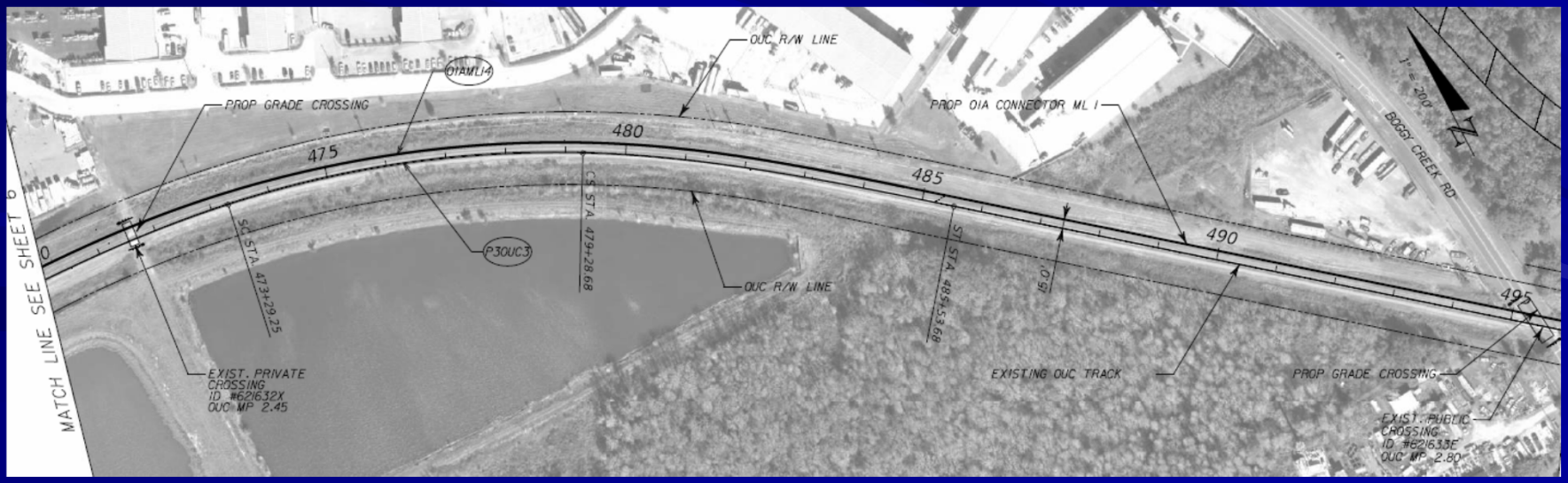
Use the existing track





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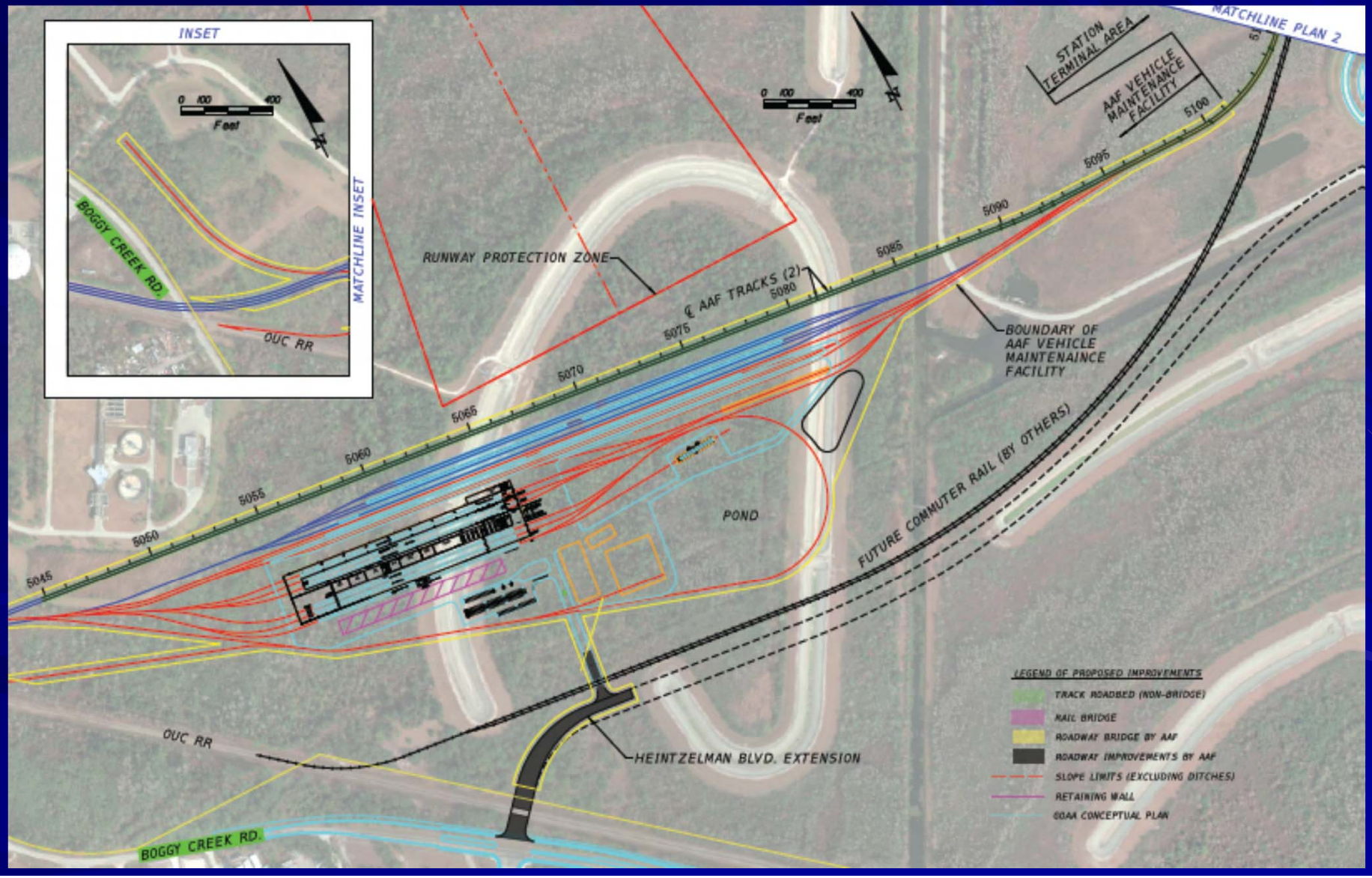

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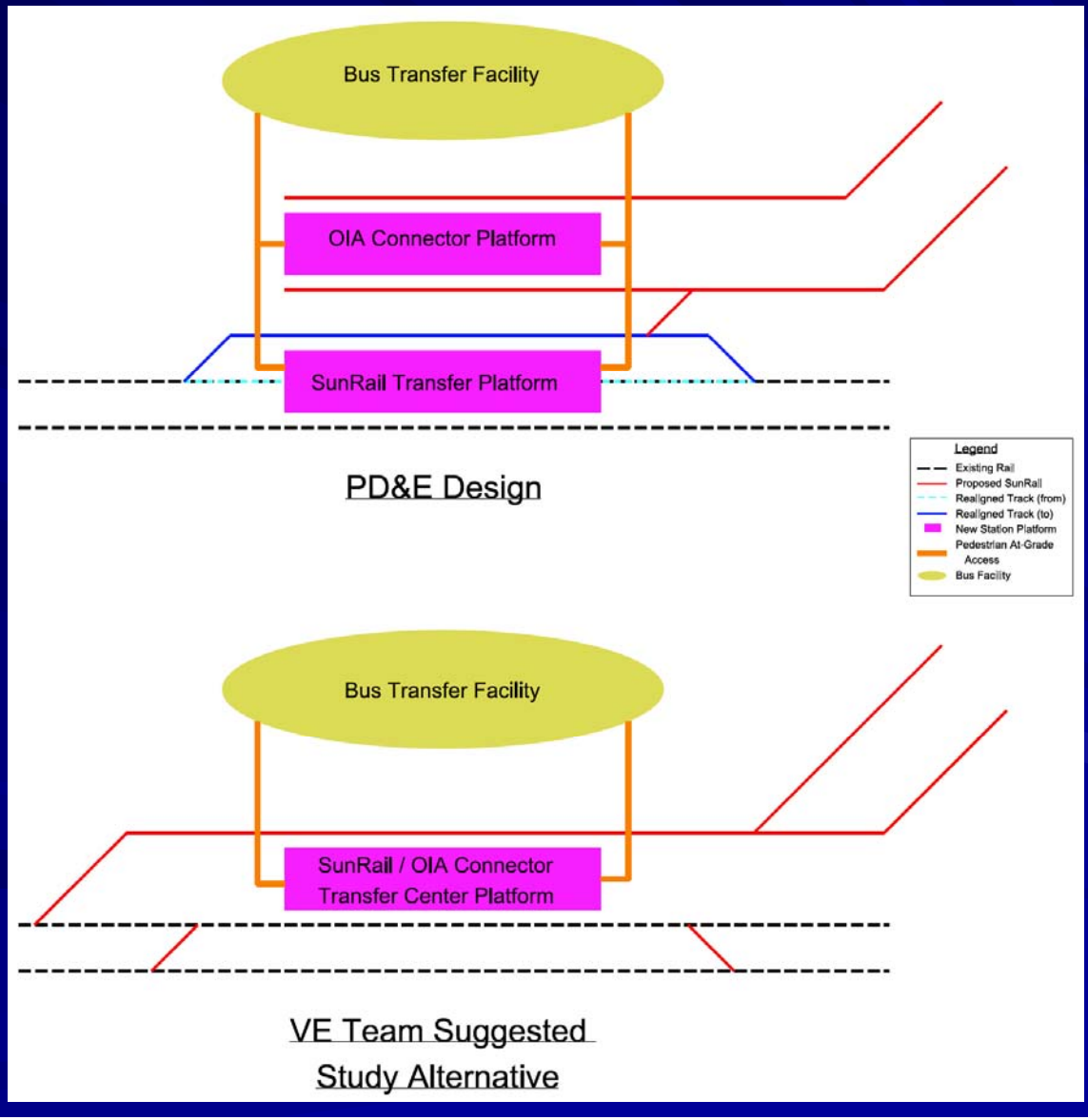
Build a single center platform between OIA and SunRail tracks

- **PD&E Alternative:** The PD&E Documents show realigning the SunRail\CSX eastern mainline track to accommodate a center platform. OIA Connector would come in on the east with two tracks and a center platform. Pedestrian grade crossing of eastern CSX track. Bus facility is east of OIA Connector tracks.

Build a single center platform between OIA and SunRail tracks

- **VE Alternative No. 3: The VE team recommends eliminating realignment of SunRail/CSX mainline track, provide only a single platform to the east of the SunRail/CSX mainline. Provide single OIA Connector track east of the platform with tail track for connection to CSX Mainline (non-revenue service movement). Maintain placement of bus facility to east of OIA Connector track.**

Build a single center platform between OIA and SunRail tracks



Build a single center platform between OIA and SunRail tracks

- **Advantages:**
  - Reduced cost
  - Cross platform transfer at station
  - No pedestrian crossing of SunRail/CSX mainline
  - Reduction of construction schedule
- **Disadvantages:**
  - Reduced flexibility in operations at station
- **Potential Cost Savings: $213,000**

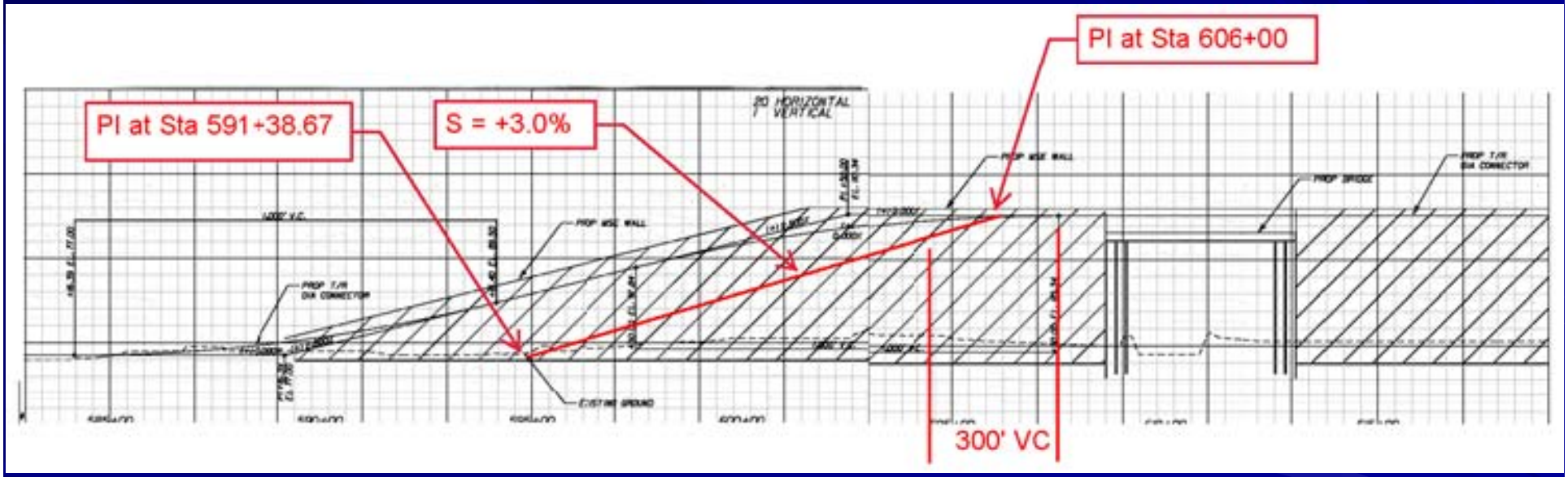
Increase the approach grade for the ITF from 2.5% to 3%

- **PD&E Alternative:** The PD&E Documents show a profile grade of 2.5% to attain the level grade of 0.00% at elevation 110.34 for connection to the ITF. The track alignment incline starts at approximately Station 589+00 and the guideway is on retained fill with MSE walls and a proposed 450 ft. long bridge spanning the access road and pond off of Jeff Fuqua Road.

Increase the approach grade for the ITF from 2.5% to 3%

- **VE Alternative No. 6: The VE team recommends reducing the amount of retained earth fill within MSE walls by: 1) reducing the vertical curve from 1,000 ft. to 300 ft., and 2) increasing the alignment grade to 3.0%.**

Increase the approach grade for the ITF from 2.5% to 3%



Increase the approach grade for the ITF from 2.5% to 3%

- **Advantages:**
  - Less cost
- **Disadvantages:**
  - Will require design variation
- **Potential Cost Savings: $2,584,000**

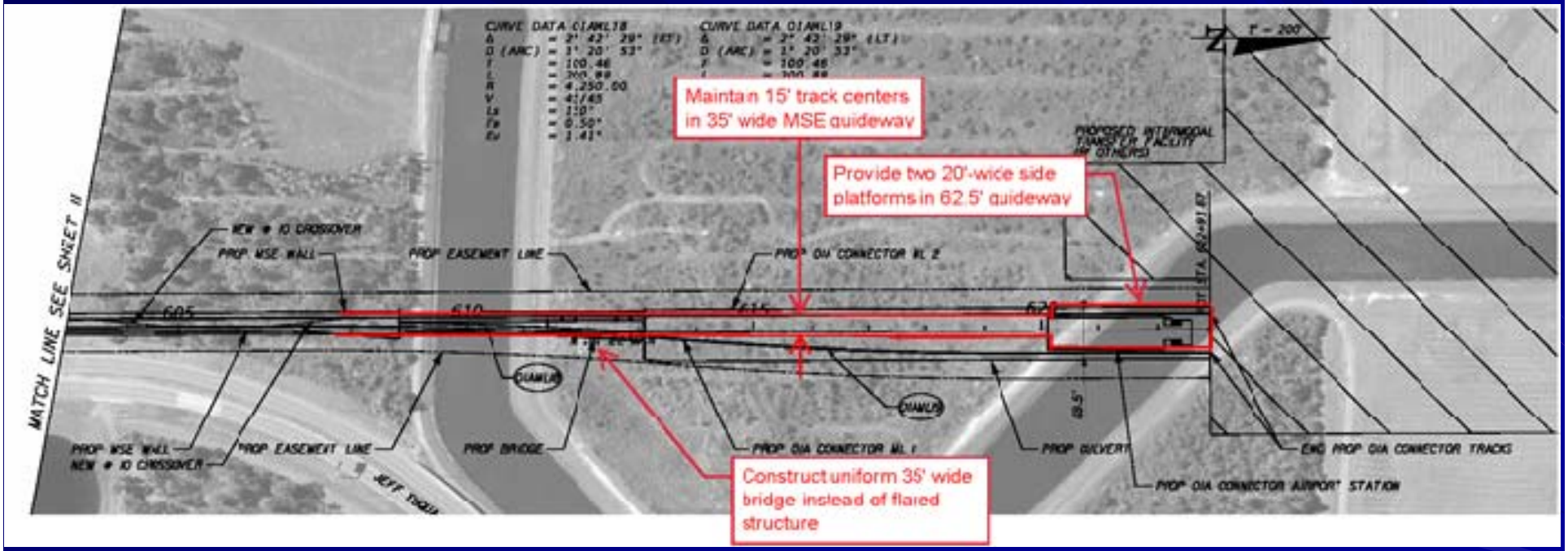
Maintain track centers at the ITF and provide side platforms

- **PD&E Alternative:** The PD&E Documents show the tracks diverging from 15-ft. centers at approximately Station 607+00 to 69.5-ft. centers at the ITF to accommodate a 59.3-ft. wide center platform.

Maintain track centers at the ITF and provide side platforms

- **VE Alternative No. 7:** The VE team recommends maintaining the tracks at 15-ft. centers into the ITF and providing two 20-ft. wide side platforms. The proposed reconfiguration of the tracks and platforms reduces the overall guideway section from 89.5 ft. to 65.2 ft. and greatly simplifies the construction of the 450-ft. long two-track track bridge over the access road and pond.

Maintain track centers at the ITF and provide side platforms



Maintain track centers at the ITF and provide side platforms

- **Advantages:**
  - Less cost
  - Meets Design Criteria preference
  - Simplified construction of 450-ft. bridge
- **Disadvantages:**
  - Slightly increased schedule to construct separate platforms
- **Potential Cost Savings: $10,242,000**

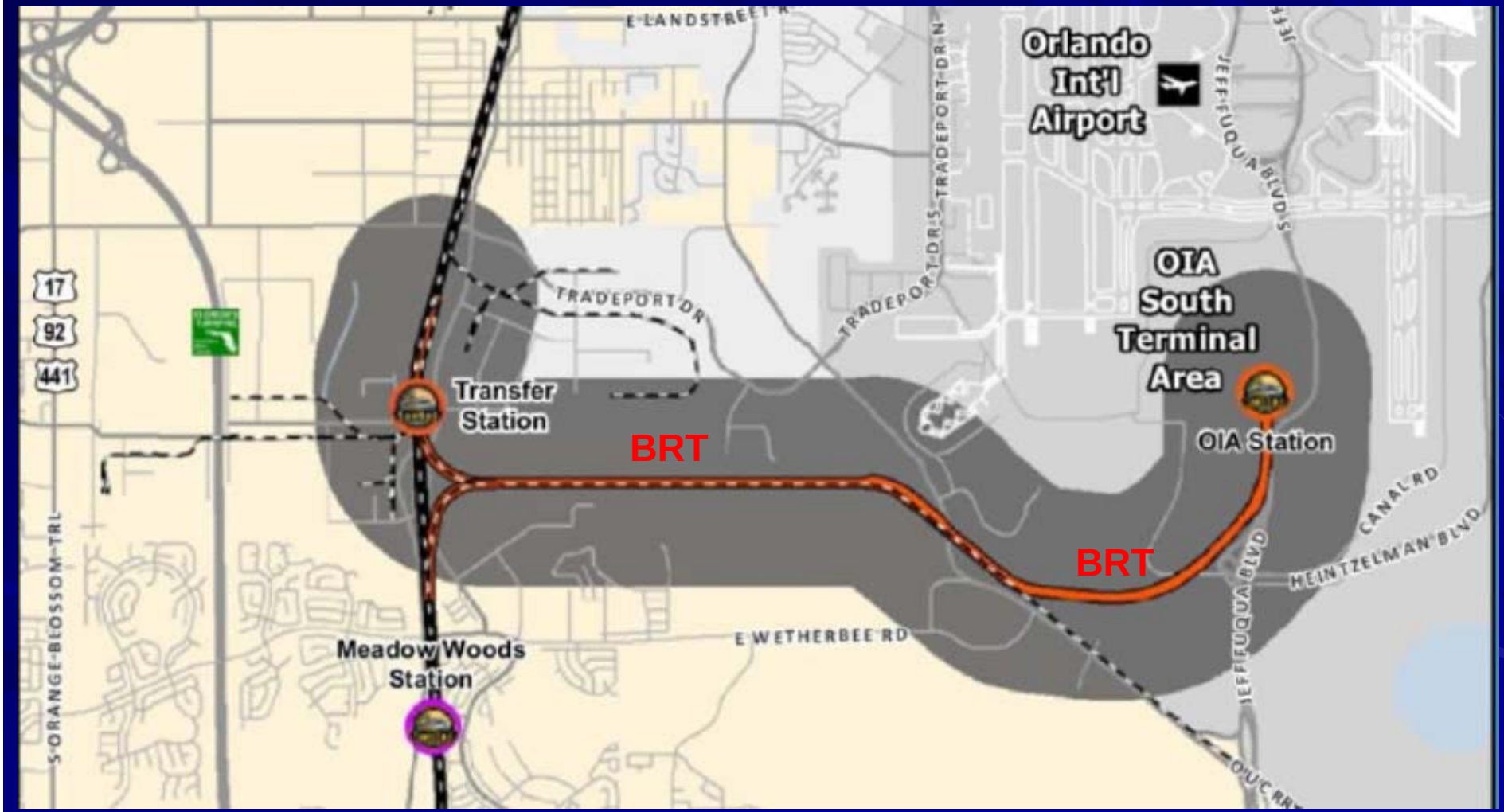
Construct BRT service through the corridor to the ITF

- **PD&E Alternative:** The PD&E Documents show use Heavy Rail CRT (3 diesels, 3 cab cars and 3 coaches).

Construct BRT service through the corridor to the ITF

- **VE Alternative No. 8: The VE team recommends using the Meadow Woods Station to transfer and constructing a BRT system (3 articulated buses) connecting to the ITF by using the median on Wetherbee Road. Maintained by Lynx.**

Construct BRT service through the corridor to the ITF



Construct BRT service through the corridor to the ITF

Construct BRT service through the corridor to the ITF

- **Advantages:**
  - Vehicle costs are considerably less
  - Less construction cost
  - Less O&M
  - Flexibility – future systems
- **Disadvantages:**
  - Need turnarounds at each terminal
  - Manually operated
- **Potential Cost Savings: $77,917,000**

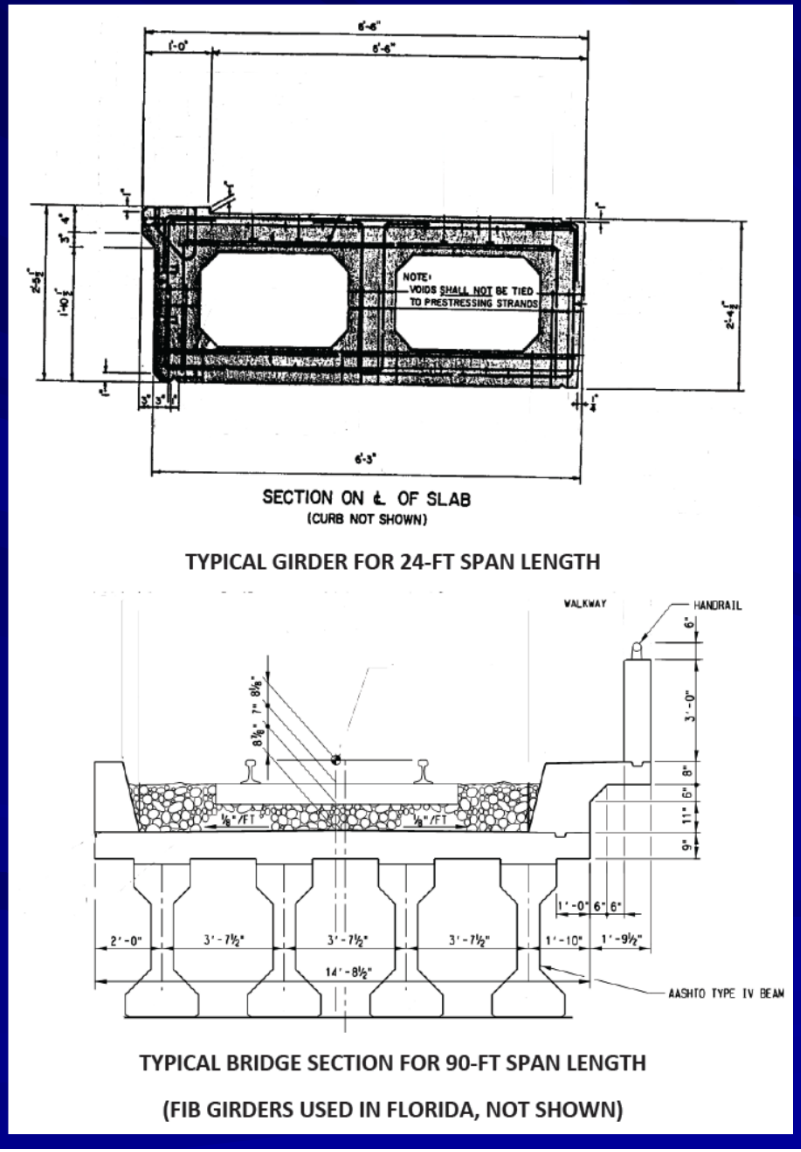
Use 50-90 ft. spans instead of 24-ft. spans

- **PD&E Alternative:** The PD&E Documents show the new bridges with 24-ft spans. The bridge at station 545+50 is 900-ft long with 38 spans. The bridge at station 560+00 is 200-ft long with 9 spans. The bridge at station 610+85 is 450-ft long. The PD&E does not identify the substructure elements for the 450-ft. bridge and therefore it is excluded from this analysis.

Use 50-90 ft. spans instead of 24-ft. spans

- **VE Alternative No. 11: Use 50-ft. spans instead of 24-ft. spans with a more robust girder also can span longer spans. The girders cost more per foot, but by using this type of girder a more robust service life can be achieved with the elimination of half of the substructure, or pile bents.**

Use 50-90 ft. spans instead of 24-ft. spans



Use 50-90 ft. spans instead of 24-ft. spans

- **Advantages:**
  - Eliminate 50% of substructure
  - Enhance canal conveyance
  - Decreases construction schedule
  - Avoids the voided slab design
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings: $6,528,000**

Extend the GOAA APM system to the SunRail Transfer Station

- **PD&E Alternative: The PD&E Documents show Heavy Rail Commuter Rail Transit.**

Extend the GOAA APM system to the SunRail Transfer Station

- **VE Alternative No. 16: The VE team recommends extending the GOAA Automated People Mover system and cars along the corridor to the SunRail Transfer station.**

Extend the GOAA APM system to the SunRail Transfer Station

Extend the GOAA APM system to the SunRail Transfer Station

- **Advantages:**
  - Potentially less right of way
  - Less O&M
  - Automated train operation
- **Disadvantages:**
  - Adds cost
  - Less seating
  - Longer run time
- **Potential Value Added: ($386M)**

Purchase only two sets of cars

- **PD&E Alternative: The PD&E Documents show a new car procurement of 3 train sets (consist made up of a diesel locomotive, coach car and cab car). Two train sets are used for daily operation, one is a spare for to allow preventive maintenance.**

Purchase only two sets of cars

- **VE Alternative No. 17: The VE team recommends procuring only 2 train sets and using the pool of mainline spares to provide one spare when required.**

Purchase only two sets of cars

- **Advantages:**
  - Less cost
  - Less maintenance
- **Disadvantages:**
  - Lower spare ratio
  - Higher risk to make full service
- **Potential Cost Savings: $10,522,000**

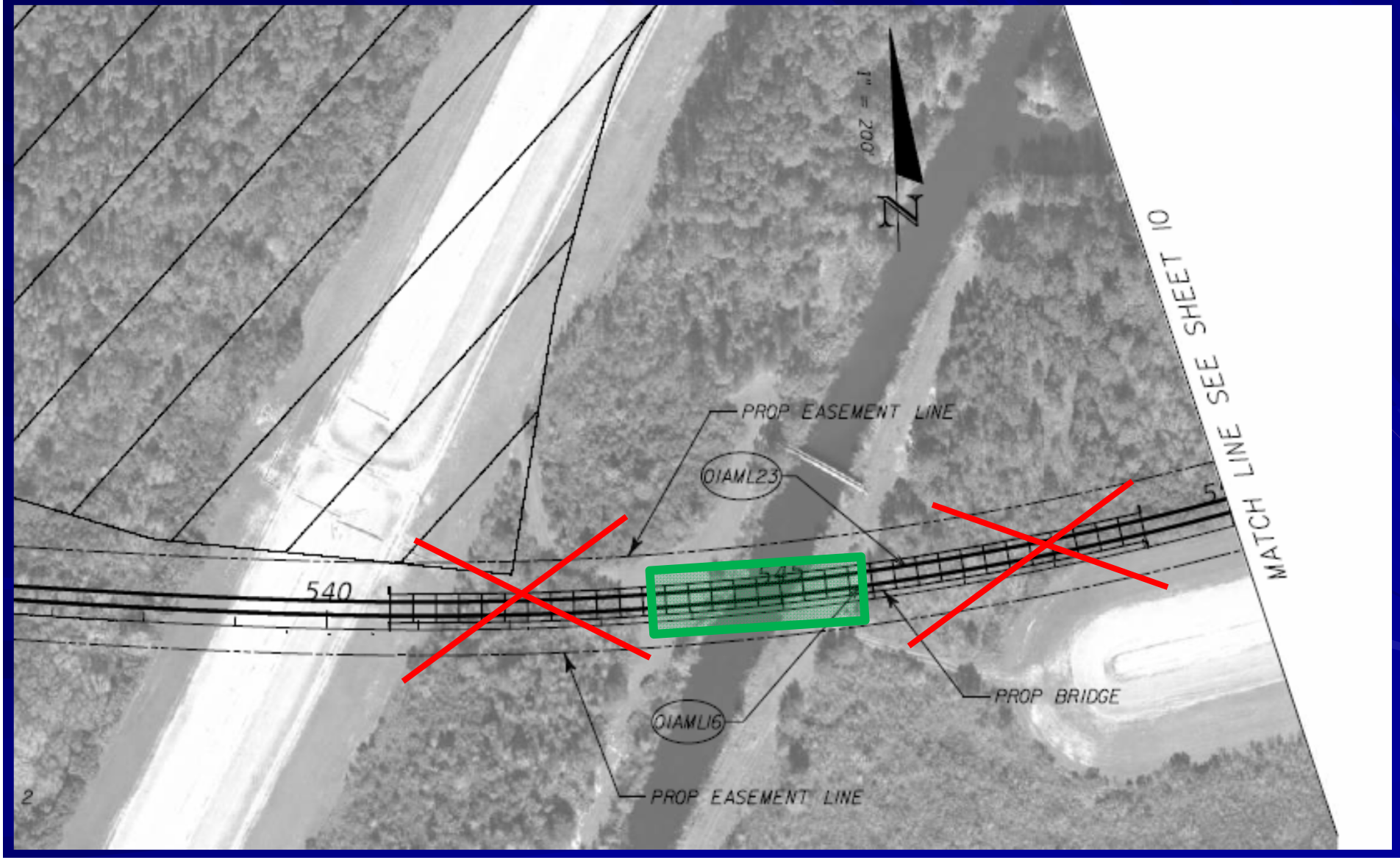
Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **PD&E Alternative:** The PD&E Documents show a proposed bridge (850 ft.) spanning the current regulated floodway area at station 560+35 (approx.).

Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **VE Alternative No. 18:** GOAA is in the process of modifying the floodplain map in the area and anticipate that the floodway boundary shall be contained within the banks of the existing stream. In light of these efforts, the VE team recommends constructing a bridge that spans the existing stream channel.

Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.



Shorten the bridge at Sta. 545+00 from 900 ft. to 200 ft.

- **Advantages:**
  - Less cost
  - Less Maintenance costs
  - Reduced Construction Schedule
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings: $16,588,000**

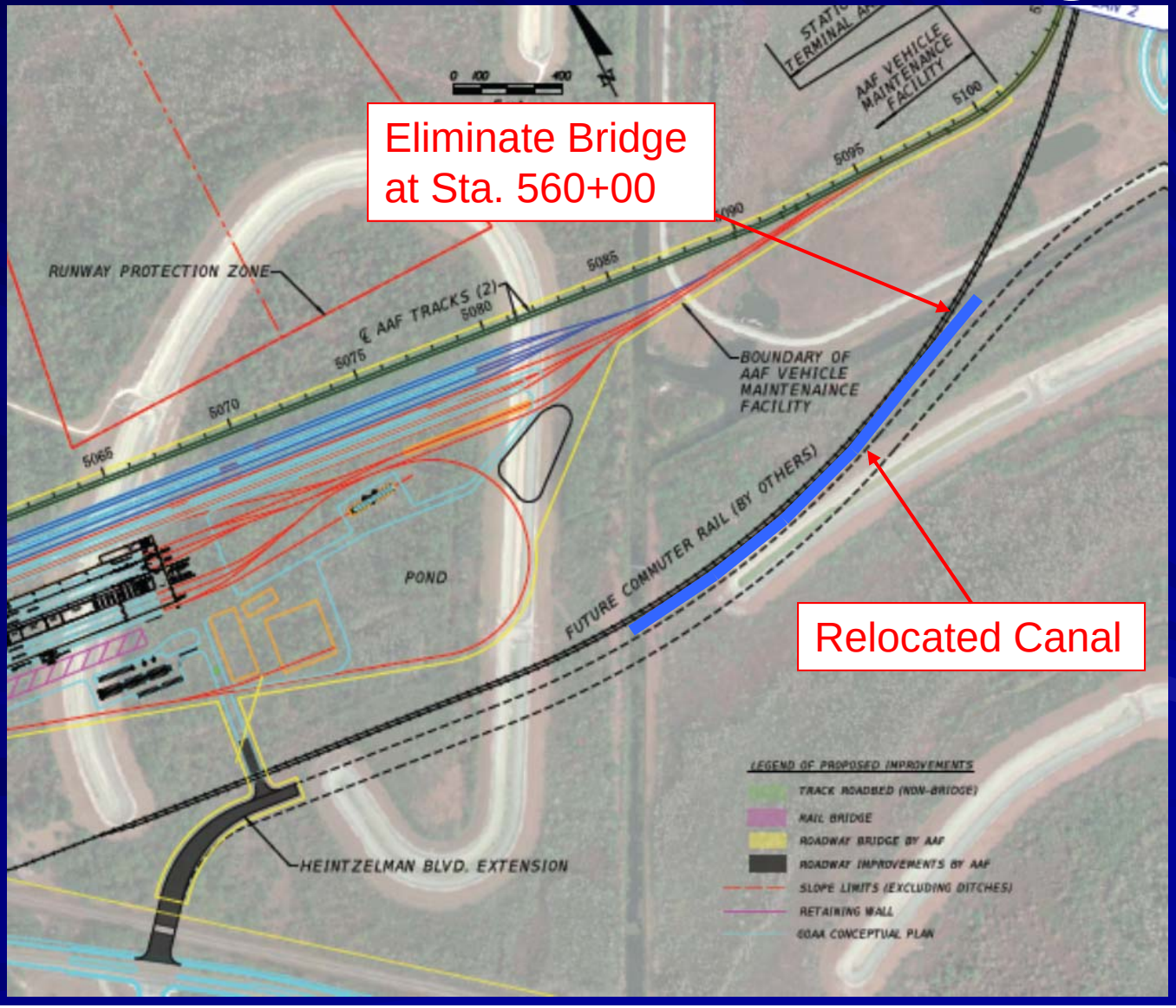
Realign Heintzelman Canal to eliminate the RR Bridge

- **PD&E Alternative:** The PD&E Documents show a proposed bridge (200 ft.) spanning the Heintzelman canal at station 560+00.

Realign Heintzelman Canal to eliminate the RR Bridge

- **VE Alternative No. 25: GOAA is conceptually planning to build a maintenance facility within the project limits, which includes a connection between Canal Road and Wetherbee Road. Consequently, a realignment of the Heintzelman canal is anticipated to maintain existing hydraulic patterns. As a result the bridge at station 545+50 can be eliminated.**

Realign Heintzelman Canal to eliminate the RR Bridge



Realign Heintzelman Canal to eliminate the RR Bridge

- **Advantages:**
  - Less cost
  - Less Maintenance costs
  - Reduced Construction Schedule
- **Disadvantages:**
  - None apparent
- **Potential Cost Savings: $4,739,000**

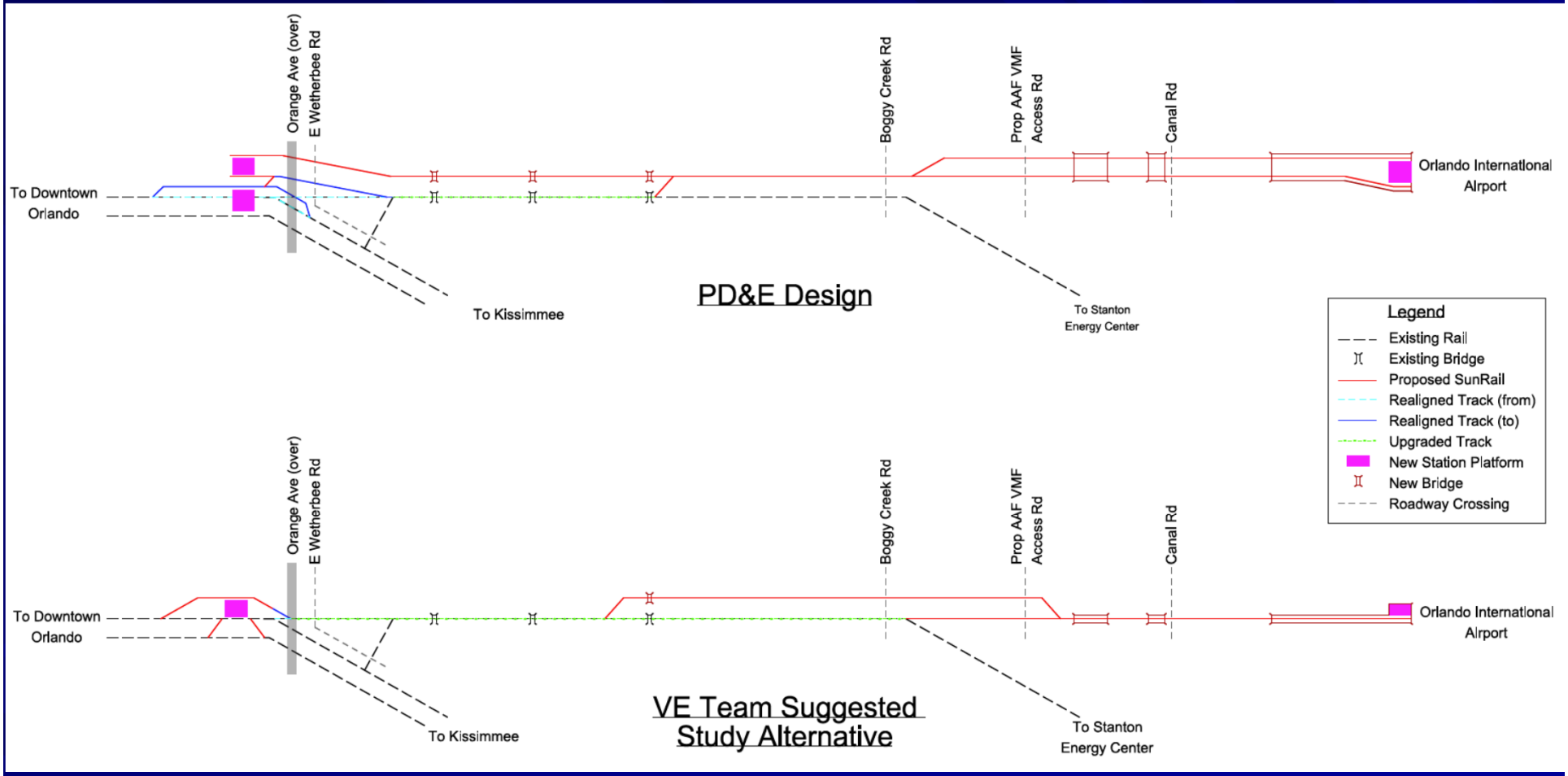
Revisit the RTC model

- **PD&E Alternative: The PD&E Documents show the RTC Runs indicate need for double tracking at the east and west ends of the alignment (at the stations) resulting in 4.25 miles of the 5.35 mile corridor being double tracked.**

Revisit the RTC model

- **VE Alternative No. 26: The VE team recommends revisiting RTC Run and modify schedules so the meet is in the middle of the alignment. With <10 minute run time and 5 minute turn time on a 15 minute schedule, there is no need for 2 station tracks at each end of the alignment.**

Revisit the RTC model



Revisit the RTC model

- **Advantages:**
  - Reduced costs
  - Single track stations
  - Reduced double track
  - Reduction of construction schedule
- **Disadvantages:**
  - Potential for rolling delays if one train is delayed
  - SunRail trains have to utilize crossovers
  - **Potential Cost Savings: $43,203,000**

Design Suggestions

- Use no-fines/cellular concrete where muck is encountered

- Preferred options are the CRT and BRT

Savings Summary

Recommendation	Savings	Maximum Savings
Use the existing track	$1,407,000	
Share Brightline track from the ITF to the OUC corridor	$38,872,000	
Build a single center platform between OIA and SunRail tracks	$213,000	
Increase the approach grade for the ITF from 2.5% to 3%	$2,584,000	$1,033,600
Maintain track centers at the ITF and provide side platforms	$10,242,000	
Construct BRT service down the median of Weatherbee Road*	$77,917,000	
Use 50-ft. spans instead of 24-ft. spans	$6,528,000	$1,187,000
Extend the GOAA APM system to the SunRail Transfer Station	($385,675,000)	
Purchase only two train sets of cars	$10,522,000	$10,522,000
Shorten the bridge at Sta. 545+00 from 850 ft. to 200 ft.	$16,588,000	$8,294,000
Realign Heintzelman Canal to eliminate the RR Bridge	$4,739,000	$2,370,000
Revisit the RTC model	$43,203,000	$43,203,000
		$66,609,600

Action Plan

- Receive Draft VE Report 11/25/16
- Draft Report Routed for Comments
- Resolution Meeting
- Receive and Incorporate D5 Comments and Revisions 12/16/16
- Issue Final VE Report 12/30/16


Questions
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SunRail