**United States Department of the Interior**
**NATIONAL PARK SERVICE**

**Everglades and Dry Tortugas National Parks**
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**Homestead, Florida 33034**

In Reply Refer to:
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MAY 08 2014

Memorandum

To: Files

Through: Park Interdisciplinary Team and Denver Service Center

From: Acting Superintendent, Everglades and Dry Tortugas National Parks

Subject: Tamiami Trail Modifications: Next Steps Project — Adequacy of National Environmental Policy Act Documentation

## Project Information

**Park Name:** Everglades National Park
**Project Title:** Confirmation of Previous Analysis Documented in the *Tamiami Trail Modifications: Next Steps* Final Environmental Impact Statement for Addressing the Modifications to the Authorized Plan Based on the Recommendations of the Value Analysis Workshop, December 9-13, 2013
**Project Location:** Miami-Dade County, Florida
**Project Leaders:** Lydia Creager (DSC) and David Sikkema (ENP)

## Project Description

The Confirmation of Previous Analysis (attached) to the Tamiami Trail Modifications: Next Steps Project (Next Steps Project) specifically addresses whether the modifications recommended by the Value Analysis (VA) Workshop held on December 9-13, 2013 are consistent with the impacts and benefits analyzed and documented in the Final Environmental Impact Statement (2010 FEIS) for the 2.6-mile bridge component of the project's authorized plan, Alternative 6e. The National Park Service (NPS) completed the FEIS and signed the Record of Decision (ROD) for the Next Steps Project authorized plan on April 26, 2011.

## Background

The 2009 Omnibus Appropriations Act (March 10, 2009) directed the NPS to evaluate bridging alternatives to the Tamiami Trail (US Highway 41) roadway (10.7-mile eastern section), beyond what was authorized by the 2008 Limited Reevaluation Report (LRR, Modified Water Deliveries Project), in order to "restore more natural water flow to Everglades National Park (ENP) and Florida Bay and for the purpose of restoring habitat within the Park and the ecological connectivity between the Park and the Water Conservation Areas." The 2009 Omnibus Act also directed the US Army Corps of Engineers to immediately construct the 2008 LRR plan—a 1-mile bridge and the remaining road elevated to allow

stages in the L-29 Canal to be raised to as much as 8.5 feet. Passage of the 2009 Omnibus Act was an acknowledgement that construction of the LRR modifications was only the first step, albeit an important one, to restoration of flows and ecological conditions in ENP.

A FEIS was completed in 2010 by ENP for the Next Steps Project. The Notice of Availability for the FEIS was published in the Federal Register on December 20, 2010. The Record of Decision was subsequently published in the Federal Register on April 26, 2011. The key finding in the FEIS/ROD was that an additional 5.5 miles of bridging and raising the balance of the 10.7-mile highway corridor (Alternative 6e in the FEIS) are necessary to achieve the 2009 Omnibus Appropriations Act's restoration objectives.

On December 23, 2011, Congress passed the Consolidated Appropriations Act of 2012 (Public Law 112-74) which authorized construction of Alternative 6e of the Next Steps Project. In October 2012, NPS Director Jonathan Jarvis directed the staff of the Denver Service Center (DSC) and ENP to focus on the western 2.6-mile bridge as the first increment towards implementation of Alternative 6e.

In August 2013, Florida Governor Rick Scott committed the State of Florida to contribute one-half of the construction costs of the 2.6-mile bridge, amounting to approximately $90 million. This decision allowed the NPS/DSC project team to partner formally with the Florida Department of Transportation (FDOT) and for the eventual identification of the design-build approach to project implementation.

## Description of Compliance Documentation

The US Army Corps of Engineers completed a LRR and Environmental Assessment in October 2008 for the Tamiami Trail component of the Modified Water Deliveries (MWD) Project. The selected plan includes the construction of a 1-mile bridge within the 10.7 mile highway corridor and the raising of the remainder of the highway to allow water levels within the adjacent L-29 Canal to increase from the current 7.5 feet to levels consistent with the new design high water of 8.5 feet. The report also acknowledged that other alternatives would provide higher levels of benefit but at costs beyond the capability of the MWD Project.

Passage of the 2009 Omnibus Act was an acknowledgement that construction of the LRR features would be insufficient to meet the long-term restoration objectives of ENP and it directed the NPS to complete a report to Congress in 2010 that identified additional modifications to the Tamiami Trail (e.g., bridging and road-raising) required to restore the ecological conditions in Northeast Shark River Slough and establish the foundation for future restoration efforts in the Everglades. Based on provisions in the 2009 Act, the NPS completed the Next Steps Project and FEIS. The Next Steps Project would modify the road to allow for water levels in the adjacent marshes associated with the broader restoration objectives of the Comprehensive Everglades Restoration Plan (CERP). The Next Steps Project FEIS evaluated six Alternatives including a No-action alternative.

Subsequent to the publication of the Next Steps Project FEIS and authorization of the plan, the ENP completed a Memo to File and Supplemental Assessment for Radio Towers to address the compatibility of the two radio towers currently operating within the area immediately south of the Tamiami Trail. While the ENP determined that the radio towers were incompatible with the long-term restoration plans for the area, the park also determined that acquisition of the facilities, while preferred, is not necessary to attain incremental restoration benefits to the park in a manner consistent with the implementation of planned restoration projects. Acknowledgement of this continued use was documented in the 1991 Land

Protection Plan and Environmental Assessment. In addition, allowing the owners to remain on site at both the Everglades Safari and the Lincoln Financial Media sites was discussed in the ENP General Management Plan FEIS (*Draft General Management Plan / East Everglades Wilderness Study / Environmental Impact Statement for Everglades National Park, February 2013)* and included in the recommendations associated with the General Management Plan.

## Conclusion

The general conclusion from this Memorandum to the File and the associated Confirmation of Previous Analysis is that the Modified Alternative, recommended by the VA Workshop, contains the elements analyzed in detail under Alternative 5 in the FEIS. While these elements were part of the FEIS analysis the inclusion of the elements into the Modified Alternative will result in improvements to natural resources of ENP when compared to the original design of the 2.6-mile bridge included in the 2010 FEIS (Original Plan) for this feature of the Next Steps Project. The interdisciplinary team determined the following specific benefits and impacts associated with the Modified Alternative when compared to the Original Plan:

A. Fewer acres of permanent wetlands impacted (14.07 acres for the Modified Alternative compared to 16.41 acres impacted by the Original Plan for a reduction of 2.34 acres)
B. Fewer acres of temporary wetlands impacted (0 acres for the Modified Alternative compared to 16.97 acres impacted by the Original Plan for a reduction of 16.97 acres)
C. The Modified Alternative still results in the project remaining self-mitigating (UMAM analysis of wetland impacts resulted in the determination that the amount of roadway removed more than compensates for the wetland losses associated with the Modified Alternative)
D. Slightly less potential marsh connectivity (2.32 miles of potential connectivity for the Modified Alternative compared to 2.38 miles for the Original Plan)
E. Reduction in wildlife mortality is not as great as compared to the Original Plan (606 deaths per year avoided estimated for the Modified Alternative compared to 679 deaths per year avoided for the Original Plan)
F. Improved water quality treatment (Provided 4 additional Runoff Treatment Units (RTUs) and added 2 dry retention ponds in the Modified Alternative compared to the Original Plan)

Additionally, the interdisciplinary team considered and updated information on species which have had their status changed since the completion of the FEIS/ROD and while some new information on species has been evaluated, the impacts to listed species and critical habitat from the Modified Alternative is not substantively different than those described in the FEIS. It is recommended that the park re-engage in section 7 consultations at the appropriate level with US Fish and Wildlife Service to conserve those newly listed Threatened and Endangered species in the park.

Therefore, the interdisciplinary team concludes that the Modified Alternative, as described in the attached Confirmation of Previous Analysis, is consistent with the alternatives analyzed in the 2010 FEIS. Furthermore, the interdisciplinary team also concludes that the impacts and benefits described for the Modified Alternative are consistent with the impacts and benefits described in the FEIS for the

portion of the project associated with the 2.6-mile western bridge of Alternative 6e of the 2011 authorized plan.

**Acting Superintendent:** _____ **Date:** 5.2.14

Shawn T. Benge

# Confirmation of Previous Analysis the *Tamiami Trail Modifications: Next Steps* Final Environmental Impact Statement for Addressing the Modifications to the Authorized Plan Based on the Recommendations of the Value Analysis Workshop, December 9-13, 2013

National Park Service
South Florida Natural Resources Center
Everglades and Dry Tortugas National Parks

and the

Denver Service Center
Denver, CO

May 8, 2014

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## 1. Purpose and Need for Confirmation of Previous Analysis

This Confirmation of Previous Analysis for the original 2010 Final Environmental Impact Statement (FEIS) for the Tamiami Trail Modifications: Next Steps Project (Next Steps Project) examines several modifications to Alternative 6e, focusing on the design of the western 2.6-mile bridge, now determined to be the first phase in the implementation of the plan authorized in 2011. These modifications were recommended as a result of a National Park Service (NPS) mandated Value Analysis (VA) of a segment of the originally authorized plan that was the culmination of a workshop held in 2013. Modifications made to this segment of the roadway included the changes to the access to the Everglades Safari commercial airboat facility that resulted in separating the original 2.6-mile bridge span into two separate bridges, the inclusion of an access road to the Lincoln Financial Media radio tower facility on the west end of the project area, and the inclusion of additional facilities to improve water quality treatment throughout the reduced project area. For purposes of comparison, the original design of the 2.6-mile bridge included in the 2010 FEIS is referred to as the Original Plan and the modifications associated with the 2013 VA are referred to as the Modified Alternative. This analysis is needed to verify that the VA recommended modifications are consistent with the FEIS analysis of the Original Plan prior to proceeding with the implementation.

## 2. Background

***Tamiami Trail Modifications: Next Steps Project***

The 2009 Omnibus Appropriations Act (March 10, 2009) directed the NPS to evaluate bridging alternatives to the Tamiami Trail (US Highway 41) roadway (10.7-mile eastern section), beyond what was authorized by the 2008 Limited Reevaluation Report (LRR, Modified Water Deliveries Project), in order to "restore more natural water flow to Everglades National Park (ENP) and Florida Bay and for the purpose of restoring habitat within the Park and the ecological connectivity between the Park and the Water Conservation Areas." The 2009 Omnibus Act also directed the US Army Corps of Engineers to immediately construct the 2008 LRR plan—a 1-mile bridge and the remaining road elevated to allow stages in the L-29 Canal to be raised to levels consistent with the revised design high water of 8.5 feet. Passage of the 2009 Omnibus Act was an acknowledgement that construction of the 1-mile bridge and roadway improvements was only the first step, albeit an important one, to restoration of flows and ecological conditions in ENP.

A FEIS was completed in 2010 by ENP for the Next Steps Project. The Notice of Availability was published in the Federal Register on December 20, 2010. The Record of Decision (ROD) was subsequently published in the Federal Register on April 26, 2011. The key finding in the FEIS/ROD was that an additional 5.5 miles of bridging and raising the balance of the 10.7-mile highway corridor (Alternative 6e in the FEIS) are necessary to achieve the 2009 Omnibus Appropriations Act's restoration objectives (Figure 1).

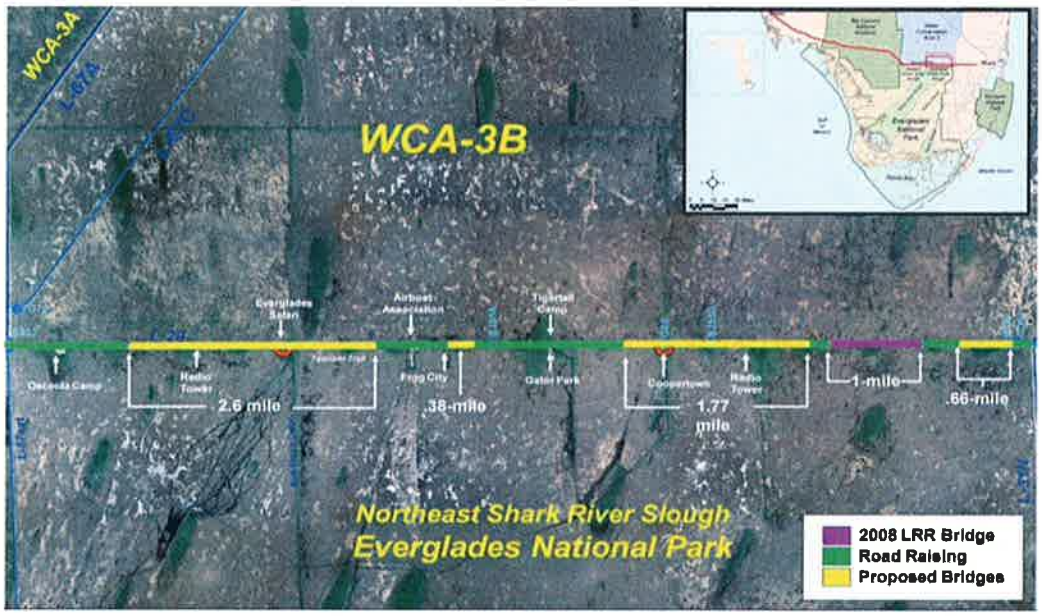


Figure 1: The Next Steps Project Alternative 6e as identified in the 2010 Final Environmental Impact statement consists of four additional bridges and the raising of the remainder of the of the 10.7 mile section of the Tamiami Trail.

On December 23, 2011, Congress passed the Consolidated Appropriations Act of 2012 (Public Law 112-74) which authorized construction of Alternative 6e of the Next Steps Project. In October 2012, NPS Director Jonathan Jarvis directed the staff of the Denver Service Center (DSC) and ENP to focus on the western 2.6-mile bridge as the first increment towards implementation of Alternative 6e (Figure 2).

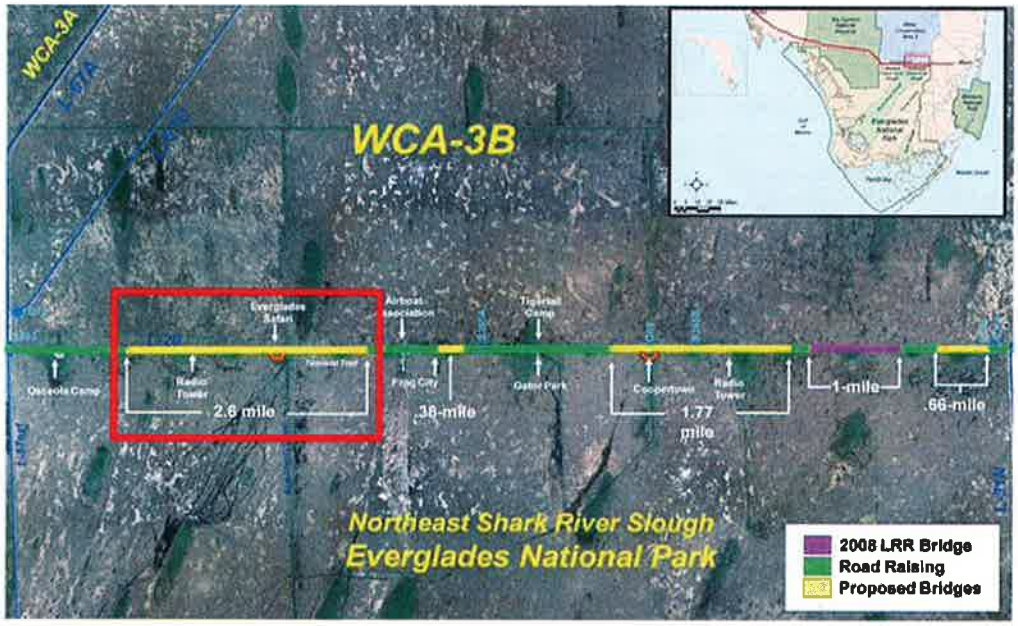


Figure 2: Phase 1 of the Next Steps Project specifies the planning and construction of the western 2.6-mile bridge.

In August 2013, Florida Governor Rick Scott committed the State of Florida to contribute one-half of the construction costs of the 2.6-mile bridge, amounting to approximately $90 million. This decision allowed the NPS/DSC project team to partner formally with the Florida Department of Transportation (FDOT) and for the eventual identification of the design-build approach to project implementation.

***Land Acquisition and Relationship to Next Steps Project***

The 1989 ENP Protection and Expansion Act, in addition to authorizing the Modified Water Deliveries Project, also authorized the acquisition of 109,000 acres of lands within the east Everglades, including commercial airboat and AM radio facilities. Six parcels remain to be acquired in the ENP expansion area: three commercial airboat facilities, including Everglades Safari Park, two commercial radio towers, including the Lincoln Financial Media site, and a Florida Power and Light Company parcel. The 1989 Act also stated that the commercial airboat facilities, such as Everglades Safari, could remain operational and at their current locations. Since the Everglades Safari Park and Lincoln Financial Media parcels are within the area affected by the 2.6-mile bridge component of the Next Steps Project, structural features for continued access to these two facilities will be addressed in this Confirmation of Previous Analysis (Figure 3).

Figure 3: 2.6-mile project area depicting location of the Everglades Safari commercial airboat facility and the Lincoln Financial Media radio tower facility.

Subsequent to the publication of the Next Steps Project FEIS and authorization of the plan, ENP completed an analysis of the compatibility of the two radio towers currently operating within the area immediately south of the Tamiami Trail. While the ENP determined that the radio towers were incompatible with the long-term restoration plans for the area, the park also determined that acquisition of the facilities, while preferred, is not necessary to attain incremental restoration benefits to the park in

a manner consistent with the implementation of planned restoration projects. Acknowledgement of this continued use was documented in the 1991 Land Protection Plan and Environmental Assessment. Specifically, the 1991 Land Protections Plan acknowledges the following:

> *"Restoration and enhancement of the ecosystem and hydrologic conditions will not occur immediately. Based on past projects, sufficient funds for acquiring the land base to accomplish this goal will take a minimum of five years. Management of the resources on currently undisturbed areas will involve significant funding, both for the gathering of scientific data to prescribe the methods and to accomplish the task. Thus, for areas that are disturbed, current uses may continue that have been described as incompatible with the purposes of the addition until the lands are acquired or long-term restoration plans can be developed."*

While additional funding for land acquisition was provided by the 2012 Consolidated Appropriations Act (Public Law 112-74, December 23, 2011), two potential paths are emerging for the acquisition of the required real estate for implementation of the current and planned restoration projects. The 1989 ENP Expansion and Protection Act provided the authority for the fee acquisition of these properties. A more expeditious and potentially more cost-effective path could be the purchase of flowage easements in lieu of fee acquisition. This path would allow the owners to retain access to the property and continue to operate and therefore avoid potentially high costs for relocation and demolition of the facility. In addition, allowing the owners to remain on site at both the Everglades Safari and the Lincoln Financial Media sites was discussed in the ENP General Management Plan FEIS (*Draft General Management Plan / East Everglades Wilderness Study / Environmental Impact Statement for Everglades National Park, February 2013)* and included in the recommendations associated with the final General Management Plan.

The NPS now recognizes that many of the benefits of the Next Steps project will not be realized until the Central Everglades Planning Project (CEPP) is implemented. A FEIS for CEPP has been completed but this project is still without authorization and appropriations. One of the primary benefits that will be derived from the construction of the CEPP features is the elimination of the L-29 Levee immediately north of the 2.6-mile bridge and structural changes that will provide increased water deliveries to Northeast Shark River Slough. Removal of this levee is required for realizing many of the benefits of the Next Steps Project, primarily the connectivity and conveyance benefits. The most recent estimate for when these CEPP features will be implemented is near the end of the next decade or 2025-2030. Therefore, the NPS believes that a more prudent approach to the acquisition of the Lincoln Financial Media property would be to allow the facility to remain operational until there is more certainty in the implementation of the CEPP features (elimination of the L-29 Levee). This also may correspond to the lifespan of the radio tower facility, which currently only transmits AM radio signals. This could be accomplished through fee acquisition or flowage easement coupled with a Use and Occupancy Agreement of defined duration consistent with the timelines for CEPP implementation. However, continued access to the Lincoln Financial Media radio tower requires modifications to the plan identified in the 2010 FEIS in order to provide continued access to the access road currently located south of Tamiami Trail approximately one mile east of the Osceola Camp. Given this reality, the NPS elected to evaluate different access corridors for the Lincoln Financial Media radio tower facility as part of the VA Workshop. A detailed explanation of the alternatives evaluated and the results of the NPS mandated Choosing By Advantages analysis of these alternatives is found in *Value Analysis Final Report for 2.6-Mile Tamiami Trail Bridge (EVER196127), National Park Service (December 2013)* and included as Appendix A to this document.

***Modifications to the Original Plan for the Tamiami Trail Next Steps Project Based Upon Recommendations from the Value Analysis Workshop***

As part of the DSC planning process for the Next Steps Project, a VA workshop was held in December 2013. Staff from the DSC, ENP, and FDOT, including consultants assisting the participating agencies attended. The purpose of this workshop was to identify areas of project design improvement and potential savings. The workshop reviewed five structural components of the Original Plan: bridge structural systems, bridge drainage and collection systems, bridge water quality treatment, Everglades Safari down ramp, and Lincoln Financial Media radio tower access road. The results of the VA workshop were finalized in the report cited above and included in Appendix A. Since the modifications associated with bridge structural system and the drainage collection were focused primarily on improving the design for cost savings and have little to no effect on the environmental impacts and benefits, these two aspects of the VA report will not be addressed in this Confirmation of Previous Analysis and the reader is referred to the final VA report for the basis of the selection of the alternatives for each of these components. However, the Everglades Safari down ramp, the water quality treatment of the bridge runoff, and the Lincoln Financial Media Access all have the potential to alter the benefits and the impacts of the project when compared to the Original Plan. Therefore, the focus of this Confirmation of Previous Analysis will be confined to these three structural components. The Modified Alternative selected from the VA workshop for these features includes the following changes to the original 2.6-mile bridge described in the 2010 FEIS:

A. Everglades Safari down ramp: Replace the authorized down-ramp south of the Tamiami Trail with a within-corridor down ramp immediately north of the Everglades Safari facility (Figure 4). This change results in replacing the single 2.6-mile bridge span identified in the Original Plan with two separate smaller bridges, east and west of the facility. The section of the highway immediately north of the Everglades Safari facility would remain unbridged and necessitates the raising of this section of highway to conform to the project design high water specification of 9.7 feet.

**(a) Everglades Safari Park: FEIS Original Plan**

**(b) Everglades Safari Park: VA Modified Plan**

Figure 4: Original Plan (a) and Modified Alternative (b) for the Everglades Safari. The Original Plan consisted of a continuous bridge over the facility with down ramp access; the Modified Alternative eliminates the need for a down ramp through the construction of two separate bridges, east and west of the facility.

B. Temporary Lincoln Financial Media access road: Retain a 0.8 mile section of the existing Tamiami Trail originating at the west end of the project area and extending eastward until the intersection of the existing north-south aligned Lincoln Financial Media access road (Figure 5). This road is deemed temporary as the access will only be provided up to the time when either (a) access to the facility is no longer needed, or (b) other planned restoration projects are implemented and require the removal of the access road. The Original Plan specified removal of this portion of the highway as part of the assumed acquisition of this facility.

Figure 5: Modified Alternative for the Lincoln Financial Media radio tower access. The Original Plan specified the removal of this section of the existing roadway.

C. Water quality treatment facilities: Increase the number of Runoff Treatment Units (RTUs) specified in the Original Plan and augment the treatment provided by the RTUs with dry retention ponds on the west (Figure 6a) and east (Figure 6b) ends of the project area. No dry retention facilities were included in the Original Plan; these features were added at the request of the Florida Department of Environmental Protection to provide a higher degree of water quality treatment.

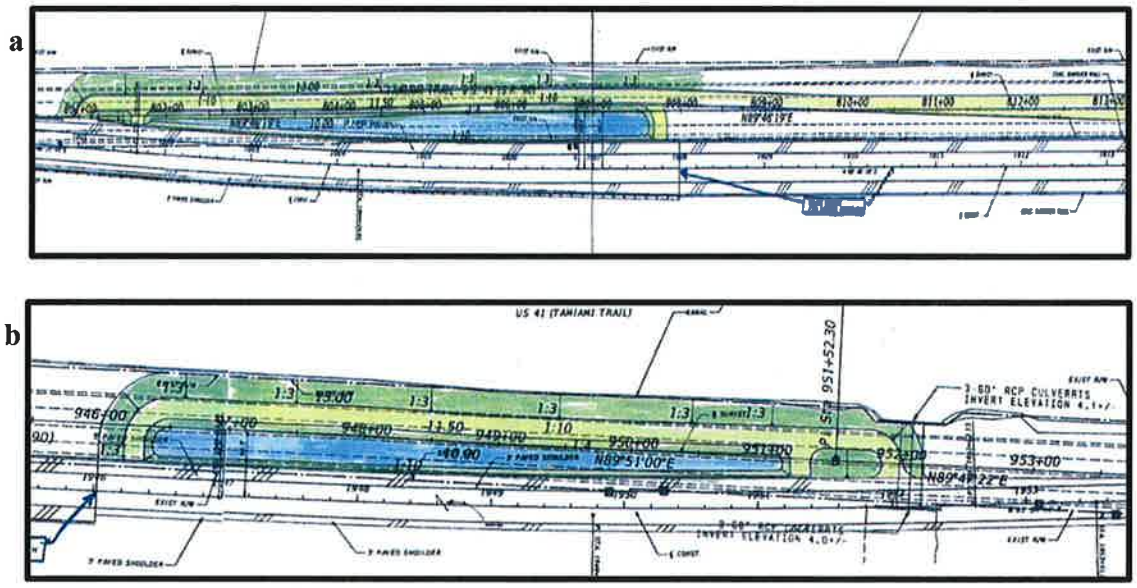


Figure 6: Dry retention water quality treatment ponds added to the west approach (a) and east approach (b) of the Next Steps Project.

## 3. Documents and Legislation Pertinent to Confirmation of Previous Analysis

- *1989 Everglades National Park Protection and Expansion Act (Public Law 101-229)*
- *Land Protection Plan Environmental Assessment, East Everglades Addition, Everglades National Park (1991)*
- *2009 Omnibus Appropriations Act (March 10, 2009)*
- *Tamiami Trail Modifications: Next Steps Project: Final Environmental Impact Statement (2010)*
- *2012 Consolidated Appropriations Act (Public Law 112-74)*
- *Memo to File and Supplemental Assessment for Lincoln Financial Media and Salem Communications Radio Tower Facilities Located in the East Everglades Expansion Area of Everglades National Park (June 2012)*
- *Draft General Management Plan / East Everglades Wilderness Study / Environmental Impact Statement for Everglades National Park (February 2013)*
- *Value Analysis Final Report for 2.6-Mile Tamiami Trail Bridge (EVER196127), National Park Service (December 2013)*

## 4. Value Analysis Recommended Modifications and Consistency with Alternatives Evaluated in 2010 FEIS

The 2010 FEIS for the Next Steps Project presented an environmental analysis of six alternatives that the NPS considered in accordance with the National Environmental Policy Act (NEPA) of 1969:

1. No-Action Alternative – A 1-mile eastern bridge and elevation of the remaining roadway to allow for 8.5 foot stage in the L-29 Canal (recently completed by the US Army Corps of Engineers)
2. Alternative 1 – 2.2 miles of total bridging and the remaining highway raised to an elevation of 13.13 feet
3. Alternative 2a – 3.3 miles of total bridging and the remaining highway raised to an elevation of 13.13 feet
4. Alternative 4 – 1.0 mile of total bridging and the remaining highway raised to an elevation of 13.13 feet
5. Alternative 5 – 1.5 miles of total bridging and the remaining highway raised to an elevation of 13.13 feet
6. Alternative 6e – 5.5 miles of total bridging and the remaining highway raised to an elevation of 13.13 feet

The total bridging for each of the action alternatives described above was made possible through combining smaller bridge spans (2010 FEIS, pp. 2-37 thru 2-41). As an example, Alternative 5 (Figure 7) had approximately 1.5 miles of total bridging due to the inclusion of three separate bridges as follows:

A. 0.56 mile bridge located between the Osceola Camp and the Lincoln Financial Media Radio Tower
B. 0.45 mile bridge located between the Lincoln Financial Media Radio Tower and Everglades Safari Park, and
C. 0.51 mile bridge located between Everglades Safari Park and the Airboat Association

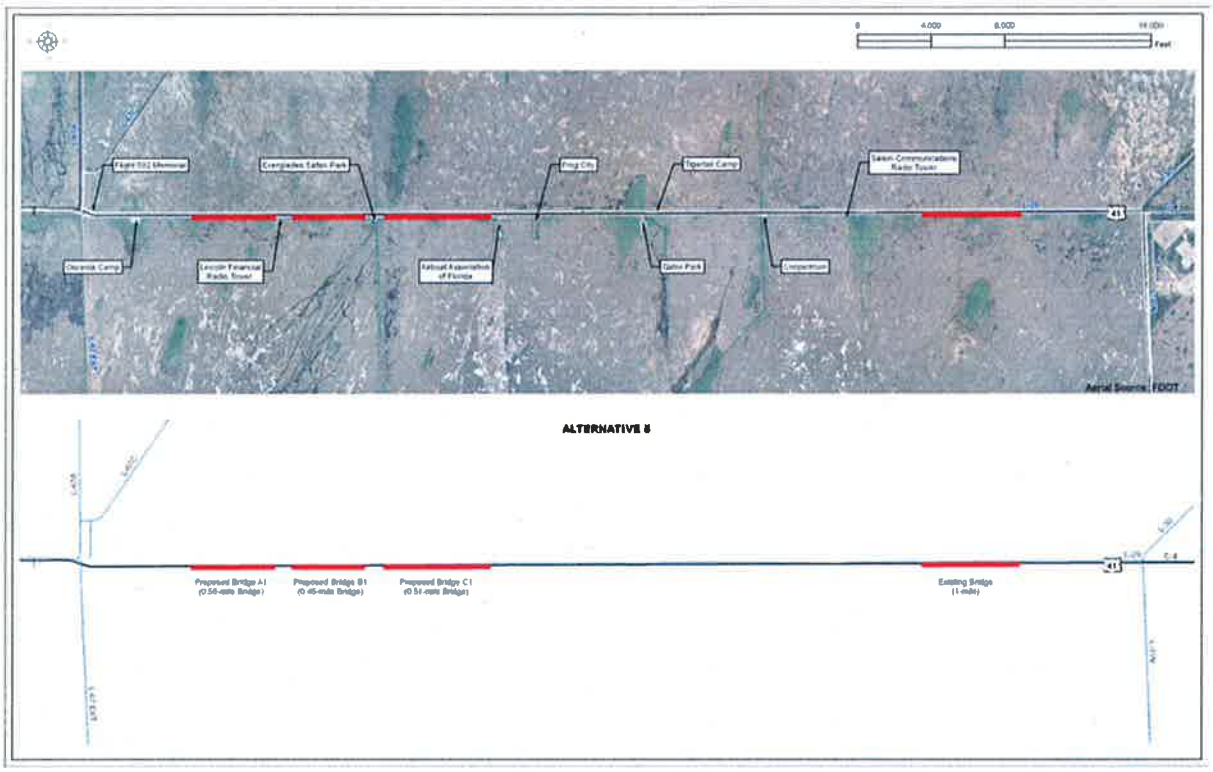


Figure 7. Alternative 5 from the 2010 FEIS for the Next Steps project.

Combining bridges A and B above into a single span bridge is the same as the western bridge of the Modified Alternative and bridge C above is very similar to the eastern bridge in the Modified Alternative. The western 2.6-mile bridge of Alternative 6e was created in a similar manner through the combining of bridges A, B, and C, above, and the addition of the down-ramp to Everglades Safari. Therefore, the original FEIS considered alternatives that provided similar levels of bridging and access to both the Everglades Safari and Lincoln Financial Media sites as are now described in the Modified Alternative.

## 5. Impacts and Benefits Evaluated in Confirmation of Previous Analysis

Since the benefits of the projects summarized in the 2010 FEIS were based on the implementation of all four bridges included in the authorized plan, including the 2.6-mile bridge that is the focus of this Confirmation of Previous Analysis, it is necessary for the evaluations included in this document to isolate the impacts and benefits of the 2.6-mile bridge from the impacts and benefits associated with the other project features in order to assess the changes in impacts and benefits that may result from the

implementation of the Modified Alternative. Staff at ENP considered the following impacts and benefits as those most affected by the changes resulting from the Modified Alternative:

1. Soil and Wetland Impacts
2. Potential Marsh Connectivity
3. Reduction in Wildlife Mortality
4. Water Quality

In addition to the above impacts and benefits evaluations, the changes in the design of the project features associated with the Modified Alternative will also require re-initiation of Section 7 consultation with the US Fish and Wildlife Service (USFWS) to ensure protection of federally listed species, including the Florida bonneted bat (*Eumops floridanus*) that were added to the list of endangered species since the release of the 2010 FEIS.

***Assessment of Changes in Impacts and Benefits***

**Soil and Wetland Impacts**

This section describes soil and wetland impacts of the Modified Alternative in comparison to the impacts identified in the Original Plan in the FEIS and provides a wetland mitigation assessment for the Modified Alternative. We geo-referenced the AutoCAD® engineering design files to create GIS shapefile layers that we then intersected with the modified Florida Land Use, Cover, and Forms Classification System (FLUCCS) Level 3 shapefile layer (South Florida Water Management District 2011) to estimate the quantity and type of wetland vegetation community impacted with each of the plans. Wetland impacts associated with the Original Plan described in the FEIS were corrected to reflect the change in designation of the wetland impacts associated with the footprint of the down-ramp to Everglades Safari from temporary to permanent. The FLUCCS GIS shapefile layer was also updated since the release of the FEIS; therefore, we used the most recent GIS shapefile layer (South Florida Water Management District 2011) in our analysis.

The Modified Alternative will result in an estimated 2.34 acres fewer permanent and 16.97 acres fewer temporary wetland impacts than the Original Plan because the down-ramp to the Everglades Safari property and the temporary construction easement south of the project was eliminated from the engineering design and the bridge approach footprint was reduced. Table 1 provides the estimated permanent and temporary wetland impacts of the Original Plan as compared to wetland impacts with the Modified Alternative based on the FLUCCS analysis.

Table 1. Estimated soil and wetland impacts of the Original Plan and the Modified Alternative based on the Florida Land Use, Cover, and Forms Classification System analysis.

| Project Design | Estimated Permanent Impact (acres) | Estimated Temporary Impact (acres) |
|---|---|---|
| Original Plan (2010) | 16.41 | 16.97 |
| Modified Alternative (2014) | 14.07 | 0 |

Results of the FLUCCS analysis are provided in Figure 8. While overall soil and wetland impact quantities are reduced with the Modified Alternative relative to the Original Plan, the changes do not result in a modification to the NEPA impact intensities in the FEIS.

The NPS conducted a tabletop Uniform Mitigation Assessment Method (UMAM) to estimate the wetland relative functional gain from removal of the Tamiami Trail US Highway 41 roadway in relation to the permanent wetland functional loss resulting from construction and implementation of the Modified Alternative. UMAM scores for location and landscape support, water environment, and community structure were based on lessons learned from previous UMAM impact assessments within the project area, our knowledge of the wetland values and functions in this region of ENP, and the Florida Administrative Code Chapter 62-345.

Results of the UMAM are summarized in Table 2. We estimated soil and wetland impact quantities, using Microstation software, from the AutoCAD® engineering design file. The estimated wetland impact quantities from the Microstation analysis differ slightly than those estimated with the FLUCCS analysis because of the lower resolution of the FLUCCS shapefile layer. The Microstation analysis is the most accurate and conservative representation of wetland impact quantities and was therefore used in the UMAM tabletop analysis. Wetland impact assessment areas included in the analysis were 1) the eastern and western bridge approaches that will be permanently filled and 2) wetland sites beneath the bridges that will have permanent shading (Figure 8). Our mitigation roadway removal sites were 1) the areas east of the Lincoln Financial Media property and 2) the roadway removal sites at Lincoln Financial Media Property and west of the Lincoln Financial Media property (Figure 8). We assessed the mitigation sites separately to incorporate different expected time lags in recovery of wetland function. The time lag for restoration east of the Lincoln Financial Media property is estimated to be five years. The estimated time lag at and west of the Lincoln Financial Media property is an estimated 19 years due to the expected 14 years until this section of road is removed, with an additional 5 years for wetland function to be restored after road removal.

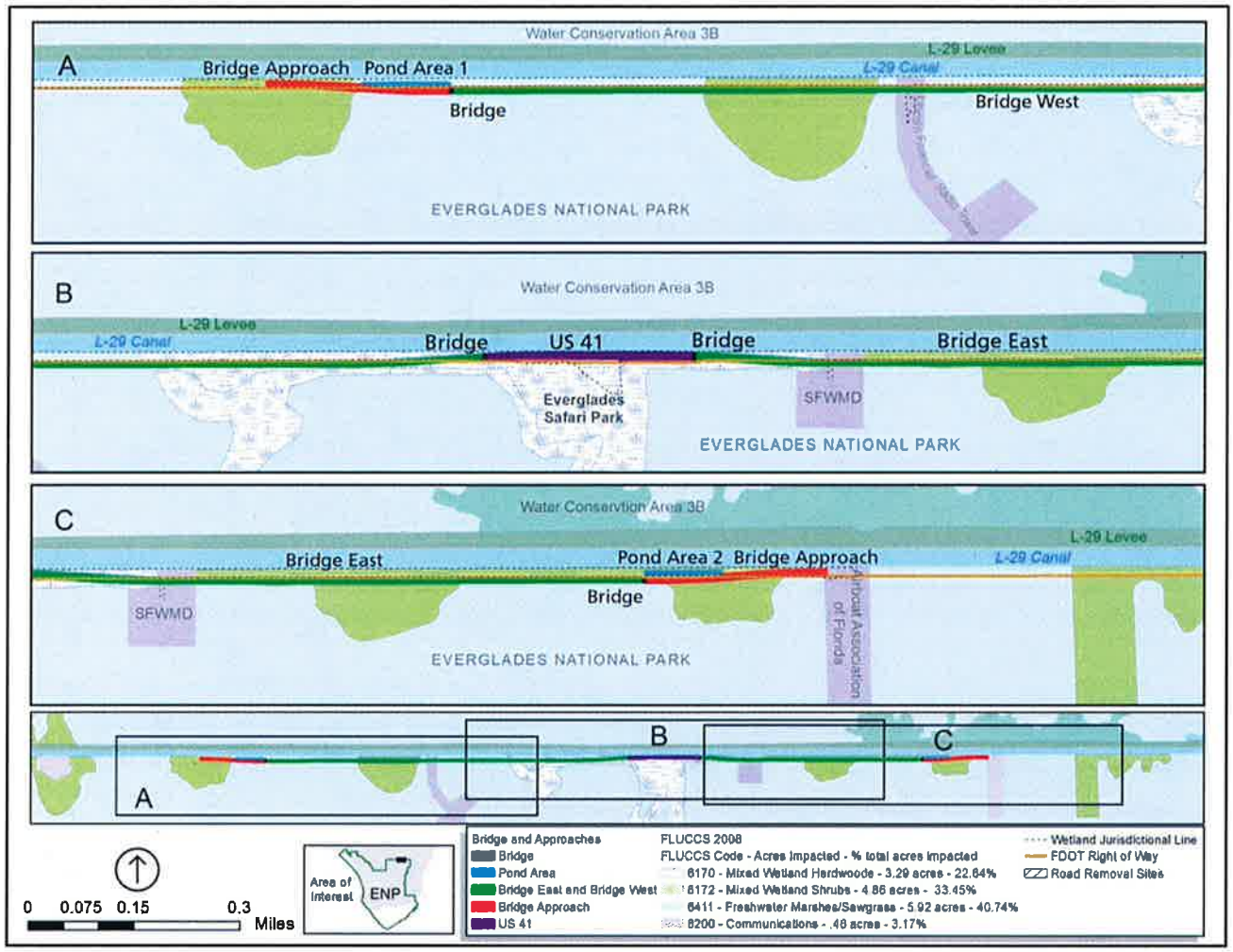


Figure 8. Types of wetland communities impacted and estimated soil and wetland impacts of the Modified Alternative.

Table 2. Tabletop Uniform Mitigation Assessment Method Summary for the Modified Alternative completed by the National Park Service.

| | Impact Assessment - Bridge Approaches ( Permanent Impact) | | Impact Assessment - Bridge (Permanent Impact) | | Roadway Removal (East of Lincoln Financial) Mitigation Assessment[3] | | Roadway Removal – (West of Lincoln Financial) Mitigation Assessment[3] | |
|---|---|---|---|---|---|---|---|---|
| | Current[1] | With Project[2] | Current | With Project | Current | Restored[4] | Current | Restored |
| Location & Landscape Support | 7 | 0 | 7 | 7 | 0 | 5 | 0 | 5 |
| Water Environment | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 |
| Community structure | 6 | 0 | 6 | 1 | 0 | 2 | 0 | 2 |
| SCORE[5] | 0.60 | 0.00 | 0.60 | 0.43 | 0.00 | 0.40 | 0.00 | 0.40 |
| Delta = [with-current] | | -0.60 | | -0.17 | | 0.40 | | 0.40 |
| Acres Impacted[6] | | 2.97 | | 12.51 | | | | |
| Functional Loss (FL)[7] | | -1.78 | | -2.09 | | 3.44 | | 0.42 |
| Time Lag[8] | | | | | | 1.14 | | 1.68 |
| Risk Factor[9] | | | | | | 1.25 | | 1.25 |
| Relative Functional Gain (RFG)[10] | | | | | | 0.28 | | 0.19 |
| Acres of Mitigation Needed[11] | | | | | | 12.27 | | 2.22 |

NOTES

[1]Current wetland value and function scores at the impact or mitigation site.

[2] Future wetland value and function scores following implementation of the Modified Alternative.

[3] The proposed mitigation is the roadway removal of the Tamiami Trail (US. 41) that is part of the Modified Alternative.

[4]Future wetland value and function scores following mitigation.

[5] Score = sum of above scores/30.

[6]Acres impacted based on Microstation analysis.

[7] FL = impact delta X impact acres.

[8] Period of time between when the functions are lost at an impact site and when the mitigation site has achieved the projected outcome.

[9] Mitigation risk shall be evaluated to account for the degree of uncertainty that the proposed conditions will be achieved.

[10] RFG = delta/(time factor x risk).

[11] Acres of Mitigation = FL/RFG.

The estimated wetland impacts and UMAM results are our best estimate at this time and are subject to modification resulting from final engineering designs and comments from state, federal and local agencies and tribal Governments.

Jurisdictional wetland delineations were determined by a field assessment conducted by HDR Engineering, Inc. June 17-18, 2013 and are depicted in Figure 8. For the UMAM assessment, only wetlands defined in the jurisdictional delineation were included. The "with project" UMAM scores for the wetland fill impacts associated with the bridge approaches were 0/30 = 0 because these areas will be converted from wetlands to uplands with no wetland values and functions. The "with project" UMAM score for the bridge areas was given a substantially reduced community structure score (reduced to a score of 1) as there will be shading beneath the bridge and only limited opportunity for vegetation

recolonization. The mitigation restoration values for location and landscape support, water environment, and community structure were based on the Tamiami Trail roadway removal mitigation values previously used in the UMAM for the Tamiami Trail LRR 1-Mile Bridge. The UMAM mitigation analysis summary is provided in Table 2. The Tamiami Trail roadway removal mitigation results in more wetland mitigation than is required to offset the wetland functional loss per the tabletop UMAM. The total amount of estimated mitigation required for the Modified Alternative is 14.49 acres while a total of 17.23 acres of wetlands will be restored from Tamiami Trail roadway removal (Table 3). Based on the UMAM results and also the requirements of the NPS Director's Order #77-1 that establish the NPS implementation of Executive Order 11990, Protection of Wetlands, our results indicate that the Modified Alternative is a self-mitigating project based on the roadway removal mitigation provided by the plan.

Table 3. Tabletop Uniform Mitigation Assessment Method mitigation summary results for the Modified Alternative.

| Impact Site | Wetland Functional Loss (FL) = impact delta X impact acres | Wetland Relative Functional Gain (RFG) = mitigation delta/(t-factor X risk) | FL/RFG=Acres Mitigation Needed | Mitigation Acres Available | Mitigation Site |
|---|---|---|---|---|---|
| Bridge Approaches, Bridge | 3.44 | 0.28 | 12.27 | 12.27 | TTM: Next Steps Roadway Removal |
| Bridge | 0.42 | 0.19 | 2.22 | 4.96 | Lincoln Financial Area of TTM: Next Steps Roadway Removal |
| | | **Total** | **14.49** | **17.23** | |

In summary, the UMAM results show that the Modified Alternative roadway removal activities fully mitigate for the project impacts to wetland function and values and that State of Florida and federal wetland mitigation requirements have been met. Therefore, no additional mitigation beyond the roadway removal activities with the Modified Alternative will be needed to offset the wetland impacts due to project implementation. It should also be noted that with implementation of future Comprehensive Everglades Restoration Plan projects, such as the CEPP, our long-term restoration benefits to wetlands are anticipated to substantially outweigh the current project's impacts to wetland functions and values. The NPS finds that the Modified Alternative is consistent with the service-wide no net loss of wetland policy and Executive Order 11990 for the protection of wetlands.

**Potential Marsh Connectivity**

This section compares potential ecological connectivity benefits of the Modified Alternative relative to the Original Plan. In the FEIS, potential ecological connectivity was estimated as miles of bridging that would be provided by the project alternative as a percent of total project length. In this document, we refined the calculation by excluding artificial barriers (e.g., parking lots, boat ramp, and permanent structures) on the Everglades Safari Property from our benefit calculations and simplified the calculation by just reporting the miles of potential ecological connectivity provided by the project. The refined

connectivity estimate reduced the miles of potential ecological connectivity of the Original Plan from the 2.6 miles provided in the FEIS, to 2.38 miles.

Table 4 provides estimates of the potential ecological connectivity of the Modified Alternative and the Original Plan, with and without the updated metric (2014). Based on the refined analysis, the Modified Alternative will result in a negligible 2.56% loss of ecological connectivity benefits (total of 0.06 mile loss of potential benefits) compared to the Original Plan (Table 4).

Table 4. Estimated potential ecological connectivity benefits of the Original Plan and the Modified Alternative.

| Project Design | Potential Ecological Connectivity (miles) |
|---|---|
| Original Plan (2010) – Original Metric | 2.60 |
| Original Plan (2010) – Updated Metric | 2.38 |
| Modified Alternative (2014) – Updated Metric | 2.32 |

## Reduction in Wildlife Mortality

This section quantifies wildlife mortality avoided from vehicular collisions with the Original Plan as compared to the Modified Alternative. The methodology used to estimate the average annual number of wildlife deaths avoided is described in the FEIS and results of our analysis are summarized in Table 5. The expected reduction in wildlife mortality is not as great under the Modified Alternative as compared to the Original Plan, an estimated 11% difference. This difference does not result in a change in impact levels identified in the FEIS.

Table 5. Estimated reduction in wildlife mortality from vehicular collisions for the Original Plan and the Modified Alternative.

| Project Design | Reduction in Wildlife Mortality (average deaths/year avoided) |
|---|---|
| Original Plan – 2.60 miles of bridging (2010) | 679 |
| Modified Alternative – 2.32 miles of bridging (2014) | 606 |

## Water Quality Treatment

Florida Administration Code (Part IV, Chapter 373, Management and Storage of Surface Waters, ERP/CERP) requires that implementation of the Modified Alternative would cause no harmful impacts to the water resources, be in compliance with state water-quality standards, and be clearly in the public

interest. The last requirement is an added condition because runoff from the bridge may discharge into ENP, which has a designation of an Outstanding Florida Water.

To ensure compliance with the requirement stated above, the design of the Modified Alternative received special consideration; in particular, the design features addressing deck runoff stormwater collection and treatment systems, which must meet state water-quality standards. The design objective for the treatment system was set not only to meet but to exceed the requirements established by law.

A comparison of the Modified Alternative and the Original Plan show that that there are some noticeable differences in bridge design. A comparative analysis of these two alternatives shows that water-quality benefits would improve under the Modified Alternative. The Original Plan assessed that the adverse water-quality effects resulting from construction and maintenance of the continuous 2.6-mile bridge would be local, minor, and of short-term duration. This same assessment still applies to the Modified Alternative.

Bridge deck runoff is treated to protect the receiving waters, in this case, waters within the park. Water quality treatment is accomplished by a combination of runoff treatment units (RTUs) and dry detentions ponds (DDPs). The use of these two systems in series provides added benefits over those derived from using either system separately.

Runoff Treatment Units (RTUs). The RTUs are based on a patented water-quality technology. Typically, the RTU consists of a pre-fabricated, underground, cylindrical chamber divided into a separation chamber and a return/bypass chamber. The commercial names for these units are Stormceptor and Continuous Deflection Separation (CDS), among others. The RTUs screen, separate, and trap debris, sediment, and oil and greases from stormwater runoff. Some RTUs have a separation screen that traps floatables and solids. During rainfall events that exceed the capacity of the RTU, excess stormwater flows bypass the separation chamber and enter directly into the return/bypass chamber.

Dry Detention Ponds (DDP). The DDPs are basins whose outlets have been designed to detain stormwater runoff for some minimum time to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool of water. The DDPs may provide limited flood control and flow attenuation by including additional flood detention storage. The DDPs in this system are a modification of conventional dry ponds, which may be as wide as they are long. The proposed DDPs may be narrower but longer than conventional DDPs because of limited space available within the foot print of the project.

The following qualitative water-quality benefits analysis focuses on two aspects of the bridge design: (a) water-quality treatment quality and capacity; and (b) bridge deck runoff.

### a. Water-Quality Treatment Quality and Capacity

The Modified Alternative implements bridge stormwater controls to collect runoff through a series of deck drains and parallel collection lines located at each side and below deck. The runoff is then directed to three centralized locations (two bridge approaches and two middle areas), avoiding direct release into the nearby marsh or canal. At three centralized locations (see below), the runoff is routed through RTUs to separate oil and greases and retain suspended solids. The treated runoff is then discharged into DDPs to remove additional pollutants by settling and bioremediation. After circulating through the dry ponds,

the effluent is directed into nearby surface waters of the L29 Canal. Added benefits provided by the collection and treatment system are extended detention times and flow attenuation.

The Modified Alternative provides additional water-quality benefits over the Original Plan because of two significant design changes in the runoff collection and treatment systems:

- Inclusion of 0.62 ac-ft of DDPs to provide additional treatment, and
- Exceedence of the minimum required treatment capacity.

The Modified Alternative includes 0.62 ac-ft of DDPs to provide additional water quality treatment in excess of that offered by the RTUs (6.32 ac-ft). By contrast the Original Plan relies only on the RTUs to meet the required water quality treatment capacity. It is important to emphasize that the Modified Alternative meets all of the required treatment capacity with RTUs and the extra treatment capacity offered by the DDPs is provided purposely to exceed the requirements. The addition of DDPs represents a 10% increase in treatment capacity which in combination with RTUs offers a total of 6.94 ac-ft. The DDPs provide water quality benefits, mainly in the form of additional treatment, extended detention times, and flow attenuation.

Taking advantage of the revised bridge configuration, the Modified Alternative increased the number of RTUs to eight from four in the Original Plan. Increasing the number of RTUs will substantially increase the water-quality benefits. Furthermore, as the Modified Alternative is refined and finalized, it may include more DDP features to provide extra treatment capacity. This option depends on securing additional land surface area within the footprint of the project suitable to be converted into DDP.

**b. Bridge Deck Runoff**

Water-quality benefits are also expected from a 10% decrease in the Modified Alternative bridge deck surface area, which represents a proportional decrease in the deck runoff volume. The Modified Alternative divides the deck surface area into three basins for the purpose of collection and treatment: (1) Basin 1, which is the western most deck area; (2) Basin 2, which includes the two central deck areas (2A and 2B); and (3) Basin 3, which is the eastern most deck area. Basins 1 and 3 have two RTUs each and Basin 3 has four RTUs for of total of eight RTUs. These eight RTUs will provide a treatment capacity of 6.32 ac-ft. By comparison, the Original Plan had only four RTUs—no treatment capacity was provided in FEIS.

***Endangered Species***

This section describes the threatened and endangered species impact assessment of the Modified Alternative in comparison with the Original Plan, and incorporates newly listed species and associated information. Soil and wetland impacts are reduced with the Modified Alternative, leading to fewer impacts to wood stork (*Mycteria americana*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and Florida panther (*Puma concolor coryi*) habitat; however, the reduction in impacts does not alter impact assessments for threatened and endangered species described in the Original Plan FEIS. Since the release of the FEIS, the US Fish and Wildlife Service listed four species that occur in ENP. The Florida bonneted bat and the Cape Sable thoroughwort *(Chromolaena frustrata)* have been listed as endangered and the Bartram's scrub-hairstreak butterfly (*Strymon acis bartrami*) and the Florida leafwing butterfly (*Anaea troglodyta floridalis*) are proposed to be listed as endangered. Since the release of the FEIS, the US Fish and Wildlife Service also designated critical habitat for the Cape Sable

thoroughwort and proposed critical habitat for the Bartram's scrub-hairstreak butterfly and the Florida leafwing butterfly. Within this document, we are only addressing updated information on impacts within the Modified Alternative project area, and are not updating the analysis of the entire plan in the FEIS. Any future projects conducted under the plan as analyzed in the FEIS the Park will need to re-engage in Section 7 Consultation to update threatened and endangered species determinations during project design.

**Florida bonneted bat**

The Florida bonneted bat is the largest bat occurring in Florida and is named for its large ears that extend beyond its eyes, forming the appearance of a bonnet (US Fish and Wildlife Service 2013 (a)). This bat species feeds on insects and is known to inhabit forests, wetlands, other types of natural habitats, and suburban and urban areas (US Fish and Wildlife Service 2013 (a)). Roosting sites within south Florida generally occur within manmade structures and trees. The range of the Florida bonneted bat is largely restricted to south and southwest Florida and has been detected within Charlotte, Lee, Collier, Monroe, Miami-Dade Counties, Polk, and Okeechobee counties (US Fish and Wildlife Service 2013(a)).

The NPS performed acoustic monitoring along the L-31 North Levee (L-31N), east of the Modified Alternative project area, in 2012 and has detected the Florida bonneted bat (email communication between Skip Snow and Paula Halupa, US Fish and Wildlife Service 2012). Based on the NPS survey data, the Florida bonneted bat has the potential to occur within the project area of the Modified Alternative due to the project site proximity to the NPS monitoring site on the L-31N, but it has not been documented in the project area. It is uncertain if the Florida bonneted bat roosts within trees or tree cavities within Northeast Shark River Slough, ENP or artificial structures bordering Northeast Shark River Slough, as no roosting surveys have been conducted in these areas. However, due to the limited mature woody vegetation and lack of other suitable roost substrates, it is unlikely that Florida bonneted bats roost in the project area. It is possible that the Florida bonneted bats forage for insects within the Northeast Shark River Slough of ENP because they are known to forage over wetlands and range widely across the landscape. For the purpose of our analysis, we assumed the bat is foraging but not roosting in the project area. We do not anticipate that implementation of the Modified Alternative will significantly impact potential foraging because the loss of wetlands is small compared to the availability of similar habitats adjacent to the project, and bonneted bats are not known to preferentially forage in wetlands. Beneficial effects to bat foraging habitat are also anticipated to result from the removal of the Tamiami Trail roadway, providing an overall net increase in foraging habitat as compared to current conditions. The expansive habitat south of the project area in ENP would provide suitable foraging during the limited time of project construction and foraging bats (if present) would likely move away from the bridge and construction as a result of any disturbance.

The estimated 12 foot distance between bridge support beams in the Modified Alternative will likely be too wide to provide Florida bonneted bat day roosting sites (Kelly and Tuttle 1999) should the bats occur in this area. It is uncertain if the height and design of the bridging structure would provide suitable conditions for night roosting for the Florida bonneted bat. To date, there are no documented reports of Florida bonneted bats using bridging structures as roosting sites. However, other bat species are known to night roost in similar bridging designs between beam structures (Kelly and Tuttle 1999). Open locations on the underside of the bridges between the bridge beam structures may provide night roosting sites if the bat occurs in this area. Therefore, there may be increased night roosting sites available for the Florida bonneted bat resulting from implementation of the Modified Alternative if this species occurs in

the project area. However, sustainability of potential night-time roosting benefits would be contingent on implementation of bridge maintenance and repair protocols that minimize disturbance to roosting bats.

General mitigation measures for threatened and endangered species will be followed under the Modified Alternative as described in the FEIS and includes the following:

- Pre-construction surveys would be conducted to identify any federal- and state-listed species occurring in the project area. Should any individuals or active breeding sites be identified, additional protective measures would be taken to avoid impacts (e.g., providing additional information to contractors about the species) and Florida Fish and Wildlife Conservation Commission (FFWCC) and the US Fish and Wildlife Service would be notified of the presence of these species in the project area.
- During the environmental training, construction contractors would receive training on federally- and state-listed species and how to recognize and avoid impacts to these species.

In summary, it is uncertain whether the Florida bonneted bat occurs in the project area, although this is possible due to the detection of this species at the nearby L-31N monitoring site and the suitable foraging wetlands that occur in the project area. Presence of roosting bats would be evaluated during the threatened and endangered species survey. Should the Florida bonneted bat or evidence of recent roosting activity be detected during the survey and show potential for bats to be affected by the project, consultation with the U.S. Fish and Wildlife Service would be reinitiated. Short-term, minor effects are expected to be limited to temporary disturbance during construction, and potentially reduced foraging habitat in the immediate vicinity of the bridge. In response, if bats are present in the project area, they are expected to move to adjacent foraging areas. These effects are anticipated to be insignificant and discountable. Due to the small but permanent impacts to potential Florida bonneted bat foraging habitat, long-term, minor, localized impacts to the Florida bonneted bat would be anticipated with implementation of the Modified Alternative.

**Bartram's scrub-hairstreak butterfly**

The Bartram's scrub-hairstreak butterfly was proposed for listing as endangered in August 2013 (US Fish and Wildlife Service (a) 2014). Survey data indicate the range of the Bartram's scrub-hairstreak butterfly is restricted to the pine rockland habitat of Miami-Dade and Monroe counties in Florida (US Fish and Wildlife Service (a) 2014). The distribution of the Bartram's scrub-hairstreak is thought to be restricted to pine rockland habitat that contains its only known larval host plant, the pineland croton (US Fish and Wildlife Service (a) 2014). Proposed critical habitat for the Bartram's scrub-hairstreak occurs within the Long Pine Key region of ENP and also outside of ENP at the Navy Wells Pineland Preserve, Camp Owaissa Bauer, Big Pine Key, No Name Key, and Little Pine Key (US Fish and Wildlife Service (b) 2013).

Pine rockland habitat and pineland croton does not occur within the Modified Alternative project area, and the project does not occur in proposed critical habitat of the Bartram's scrub-hairstreak butterfly.

**Florida leafwing butterfly**

The Florida leafwing butterfly was also proposed for listing as endangered in August 2013 (US Fish and Wildlife Service (c) 2014). Survey data indicate the range of the Florida leafwing butterfly is currently restricted to ENP, and its historic range was limited to Miami-Dade and Monroe counties in Florida (US Fish and Wildlife Service (c) 2014). The distribution of the Florida leafwing is thought to be restricted to pine rockland habitat that contains its only known larval host plant, the pineland croton (US Fish and Wildlife Service (c) 2014). Proposed critical habitat for the Florida leafwing butterfly occurs within the Long Pine Key region of ENP and also outside of ENP at the Navy Wells Pineland Preserve, the Richmond Pine Rocklands, and Big Pine Key (US Fish and Wildlife Service (b) 2013).

There are no records of Florida leafwing in the project area, and pine rockland habitat and pineland croton does not occur within the Modified Alternative project area. No proposed critical habitat for the Florida leafwing butterfly occurs within the project area.

**Cape Sable thoroughwort**

The endangered Cape Sable thoroughwort is restricted to southern Florida and occurs within coastal berm, coastal rock barrens, coastal hardwood hammocks, rockland hammock, and buttonwood forest habitats located from the Coastal Prairie Trail in ENP near the southern tip of Cape Sable to Madeira Bay, and in the Florida Keys (US Fish and Wildlife Service (b) 2014). This species has been extirpated from approximately half of its historical distribution in the Florida Keys but still occupies its historical habitat range in ENP. Critical habitat for this species has been designated within ENP along the southern coast of Florida from Cape Sable to Trout Cove, and within the Florida Keys (US Fish and Wildlife Service (b) 2014). This species and its critical habitat do not occur within Modified Alternative project area.

## 6. Conclusion

The general conclusion from this Confirmation of Previous Analysis is that the Modified Alternative will result in improvements to natural resources of Everglades National Park when compared to the Original Plan for this feature of the Tamiami Trail Modifications: Next Steps Project. The interdisciplinary team determined the following specific benefits and impacts associated with the Modified Alternative when compared to the Original Plan:

A. Fewer acres of permanent wetlands impacted (14.07 acres for the Modified Alternative compared to 16.41 acres impacted by the Original Plan for a reduction of 2.34 acres)
B. Fewer acres of temporary wetlands impacted (0 acres for the Modified Alternative compared to 16.97 acres impacted by the Original Plan for a reduction of 16.97 acres)
C. The Modified Alternative still results in the project remaining self-mitigating (UMAM analysis of wetland impacts resulted in the determination that the amount of roadway removed more than compensates for the wetland losses associated with the Modified Alternative)
D. Slightly less potential marsh connectivity (2.32 miles of potential connectivity for the Modified Alternative compared to 2.38 miles for the Original Plan)

E. Reduction in wildlife mortality is not as great as compared to the Original Plan (606 deaths per year avoided estimated for the Modified Alternative compared to 679 deaths per year avoided for the Original Plan)
F. Improved water quality treatment (Provided 4 additional Runoff Treatment Units (RTUs) and added 2 dry retention ponds in the Modified Alternative compared to the Original Plan)

Finally, the interdisciplinary team also updated information regarding species which have either been listed, proposed, or had critical habitat designated since the completion of the FEIS and signing of the rerecord of Decision. It is recommended that the park re-engage in Section 7 consultations at the appropriate level with USFWS to conserve those newly listed Threatened and Endangered species in the park.

## 7. References


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## 8. Appendix A. Value Analysis Final Report for 2.6-Mile Tamiami Trail Bridge, National Park Service (December 2013)

National Park Service

National Park Service
U.S. Department of the Interior

**Value Analysis Study**
**December 9 - 13, 2013**

National Park Service
**Everglades National Park, Florida**

# Construct 2.60-Mile Tamiami Trail Bridge (EVER 196127)

# Value Analysis Final Report

**January 30, 2013**

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# Value Analysis Study
# Construct 2.60-Mile Tamiami Trail Bridge

Everglades National Park
Florida

December 9 - 13, 2013

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**Value Analysis Study**
**Construct 2.60-Mile Tamiami Trail Bridge**

Everglades National Park
Florida

December 9 – 13, 2013

# FORWARD

This report includes recommendations for Tamiami Trail Modification – Next Steps: Phase I at Everglades National Park, Florida. They stem from a Value Analysis (VA) workshop initiated by the National Park Service. The VA workshop was held at the HDR Office located at 15450 New Barn Road, Miami, FL 33014, December 9 – 13, 2013.

Coordination of this VA was done by Daniel D. Ford, project manager, HDR. Stephen Kirk and Stephen Garrett, both certified value specialists of Kirk Value Planners (Kirk Associates, LLC), led the team's deliberations during the workshop. The list of attendees is contained at the end of Section B.

**Value Analysis Study**
**Construct 2.60-Mile Tamiami Trail Bridge**

Everglades National Park
Florida

December 9 - 13, 2013

# SECTION A: EXECUTIVE SUMMARY

*"He has the right to criticize who has the heart to help," A. Lincoln*

## Summary Description of Project:

Construct a 2.60-mile bridge to replace an at-grade section of U.S. Route 41 (also designated State Road 90, SW 8th Street, and "Tamiami Trail") in Miami-Dade County, Florida. This bridge will span from a half mile east of the Osceola Camp to a half mile west of the Airboat Association. This project represents Phase 1 of the Tamiami Trail Modifications: Next Steps (TTM:NS) project authorized by Congress in 2012. The bridge will be constructed approximately 50 feet south of the centerline of the existing roadway to maintain motor vehicle traffic during bridge construction.

Following bridge construction, the section of existing highway and embankment will be removed. A down ramp is included to maintain access to Everglades Safari Park (a private business authorized to remain operational in current location) as well as a temporary access road to a privately held radio tower (the Lincoln Financial facility). Initial design work for this bridge is being accomplished under package EVER 196127. See site plan, **Figure 1**, below.

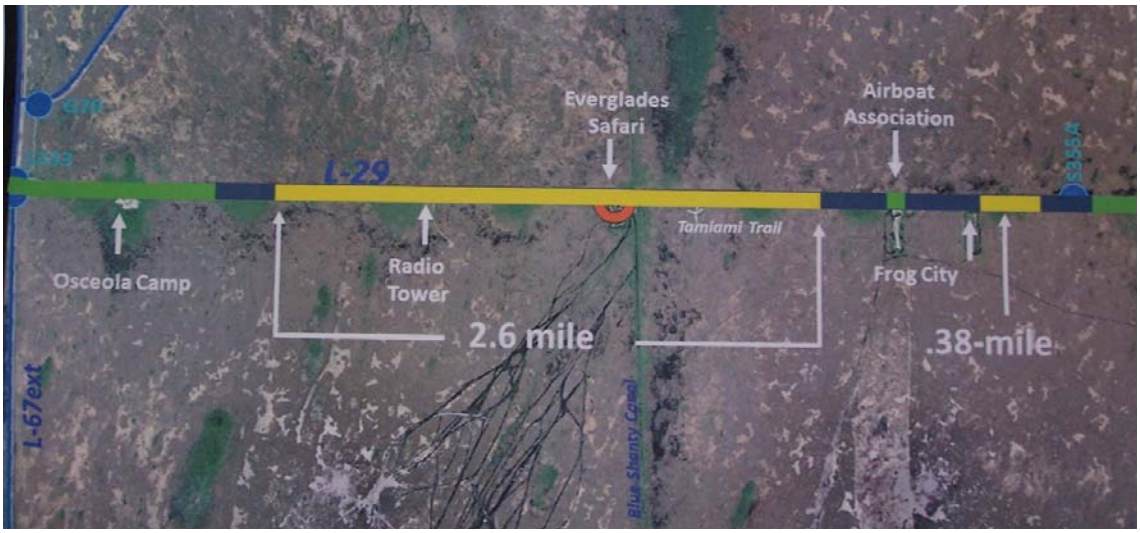



Figure 1: Site Plan

## Project Collaboration

This project is a collaboration between the Federal Government (National Park Service) and the State of Florida (Florida Department of Transportation). The Governor of Florida has made a commitment of $90 million for the project. For this reason it was extremely important to the success of the VA that the FDOT be an equal partner in the workshop.

## Project Budget

The net construction budget for the project has not yet been established. Based on the VA workshop a net construction budget of $145 - $150 million appears feasible.

## Value Analysis Objectives

This VA workshop focused on:

- Selecting preferred alternatives using Choosing By Advantages (CBA) and Life Cycle Costing (LCC) for a variety of decisions
- Determining the project budget (Class B-)
- Identifying ideas to add value to the project
- Risk identification and mitigation strategies
- Consistency with EIS
- Timely project schedule
- Constructability
- FDOT standards and maintainability
- Environmental sensitivity during construction
- Maintenance of traffic (MOT) for visitors, community, tribes, private businesses

## Subject Areas, Alternatives Considered & Preferred Alternatives

The design team identified five subject areas for decision making. Each subject area had four to five alternatives. The value analysis team reviewed the design alternatives. These alternatives were evaluated using Choosing By Advantages (CBA) and Life Cycle Costing (LCC) techniques, as appropriate, to assist in the discussion and help select the preferred alternatives. The five decisions are as follows:

1. Bridge Structural System
2A. Bridge Drainage Collection & Discharge
2B. Bridge Drainage Water Treatment
3. Everglades Safari Down Ramp
4. West End Radio Tower Access

## Summary of Recommended Alternatives

**Figure 2A** is a summary of the five value analysis decisions, including a listing of alternatives, costs, benefits/ advantages and the preferred alternatives.

## Summary of Value Analysis Recommendations

Figure 2A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge**
**Location:** **Everglades National Park, Florida**

***Preferred Alternatives: Indicated in Bold Type Below, Note costs are not additive.***

| ORIGINAL FEIS | Description | Cost | LCC | Total Importance Points | Total Importance Sensitivity Analysis | Safety | Natural Resources | Cultural Resources | Visitor Experience | Maintainability | Sustainability | Constructability | De-constructability | Business Access | Permitting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benefits (Advantages) | | | | | | | | | |
| **Decision 01** | **FEIS 2.6-Mile Tamiami Trail Bridge** | | | | | | | | | | | | | | |
| Alternative 1 | Florida I-Beam, 3 @ 12' spacing, 130' span | Not Estimated | | | | | | | | | | | | | |
| | *Dismissed, similar to Alternative 2* | | | | | | | | | | | | | | |
| **Alternative 2** | **Florida Concrete I-Beam, 4 @ 9' spacing, 140' span** | **$134,789,300** | **$138,219,000** | **340** | | ● | ● | | | ● | ● | ● | | | |
| Alternative 3 | Florida Concrete U-Beam, 2 @ 16' spacing, 100' span | $181,965,600 | $186,595,700 | 283 | | | | | | | | | | | |
| Alternative 4 | Florida Spliced Concrete U-Beam, 2 @ 16' spacing, 200' span | Not Estimated | | | | | | | | | | | | | |
| | *Dismissed, Alternative 6 (steel box beam) is better and similar in cost* | | | | | | | | | | | | | | |
| Alternative 5 | Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span | $208,923,400 | $214,239,400 | 150 | | | | | | | | | | | |
| Alternative 6 | Florida Steel Box Beam, 3 @ 8' spacing, 173' average span | $202,184,000 | $207,328,500 | 268 | | | | | | | | | | | |
| **Decision 02A** | **Bridge Drainage Collection & Discharge** | | | | | | | | | | | | | | |
| Alternative 1 | 2 Drainage Areas, Piping on 1 Side | $4,992,600 | $5,222,400 | 155 | | | | | | | | | | | |
| Alternative 2 | 3 Drainage Areas, Piping on 1 Side | $4,967,600 | $5,197,400 | 240 | | | | | | | | | | | |
| Alternative 3 | 2 Drainage Areas, Piping on 2 Sides | $4,942,700 | $5,287,400 | 220 | | | | | | | | | | | |
| **Alternative 4** | **3 Drainage Areas, Piping on 2 Sides** | **$4,917,700** | **$5,453,900** | **295** | | ● | ● | | ● | | ● | ● | | | |
| Alternative 5 | 4 Drainage Areas, Piping on 2 Sides | $4,892,700 | $5,237,400 | 285 | | | | | | | | | | | |

## Summary of Value Analysis Recommendations

Figure 2A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge**
**Location:** **Everglades National Park, Florida**

***Preferred Alternatives: Indicated in Bold Type Below, Note costs are not additive.***

| ORIGINAL FEIS | Description | Cost | LCC | Total Importance Points | Total Importance Sensitivity Analysis Points | Safety | Natural Resources | Cultural Resources | Visitor Experience | Maintainability | Sustainability | Constructability | De-constructability | Business Access | Permitting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benefits (Advantages) | | | | | | | | | |
| **Decision 02B** | **Bridge Drainage Water Treatment** | | | | | | | | | | | | | | |
| Alternative 1 | 100% Minimum Treatment, 8 CDS Units, No Ponds | | | | | | | | | | | | | | |
| | *Dismissed, due to DEP requirement for some pond retention* | | | | | | | | | | | | | | |
| Alternative 2 | 100% Treatment, Using Existing Roadbed | | | | | | | | | | | | | | |
| | *Dismissed, due to loss of some connectivity, unacceptable to NPS* | | | | | | | | | | | | | | |
| Alternative 3 | 100% of Minimum Req'mt, 7 CDS Units and Ponds | | | | | | | | | | | | | | |
| **Alternative 4** | **Maximum Treatment (113%) Using 100% CDS + Maximum Pond Space Available** | Costs Incorporated into Section 02A | | | | | ● | | | | | | | | ● |
| **Decision 03** | **Everglades Safari Down Ramp** | | | | | | | | | | | | | | |
| Alternatives 1-4 | Previous Study, Alternative 4 was selected | | | | | | | | | | | | | | |
| Alternative 4 | South Down Ramp | $16,512,000 | $17,140,000 | 293 | 188 | | | | | | | | | | |
| Alternative 5 | Right In, Right Out | $25,253,000 | $26,214,000 | 89 | 59 | | | | | | | | | | |
| Alternative 6 | Tight Diamond | $33,994,000 | $35,287,000 | 134 | 134 | | | | | | | | | | |
| Alternative 7 | Left Lane Down Ramp | Not Estimated | | | | | | | | | | | | | |
| | *Dismissed, due to safety concerns* | | | | | | | | | | | | | | |
| **Alternative 8** | **Down Ramp Incorporated Into Bridge (with warning lights and added left turn lane)** | **$6,782,000** | **$7,040,000** | **507** | **282** | ● | | ● | ● | ● | ● | | | ● | ● |
| **Decision 04** | **West End Radio Tower Connector Access** | | | | | | | | | | | | | | |
| Alternative 1 | Down Ramp T Configuration on Fill | $2,939,000 | $3,218,600 | 295 | 210 | | | | | | | | | | |
| Alternative 2 | Down Ramp T Configuration on Structure | $4,050,000 | $4,436,800 | 305 | 220 | | | | | | | | | | |
| **Alternative 3** | **Use Existing Tamiami Trail + Culverts** | **$300,000** | **$414,900** | **355** | **240** | | | | ● | | ● | ● | ● | ● | ● |
| Alternative 4 | Use Levy to Cross Canal (via boat, bridge) | $4,050,000 | $4,436,800 | 210 | 160 | | | | | | | | | | |
| Alternative 5 | Create Overlook with Parking and Stair | $2,528,000 | $3,297,500 | 230 | 230 | | | | | | | | | | |

## Summary of Value Analysis Savings

Based on the Class C cost estimate prepared prior to the workshop and the Class B- cost estimate prepared after the VA workshop, a cost savings of approximately $17.4 million was identified. In addition, the preferred alternative from the VA resulted in significant performance improvements to safety, protection of natural & cultural resources, improved visitor experience, enhanced maintainability & sustainability, improved constructability & de-constructability, greater business access, and achievement of permitting requirements. No loss of project benefits resulted from the workshop recommendations. See **Figure 2B** for a summary of the cost savings.

The VA study details are contained in **Section B** of this report which follows.

## Summary of Value Analysis Savings

Figure 2B

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge**
**Location:** **Everglades National Park, Florida**

| ORIGINAL FEIS ALTERNATIVE | Net Construction Cost |
|---|---|
| **FEIS 2.6-Mile Tamiami Trail Bridge** | **$162,293,500** |
| **Total EIS ORIGINAL DESIGN** | **$162,293,500** |

| VALUE ANALYSIS PREFERRED ALTERNATIVE | Net Construction Cost |
|---|---|
| **Bridge Span & Structural System** | |
| **Florida Concrete I-Beam, 4 @ 9' spacing, 140' span** | **$134,789,300** |
| **Bridge Drainage Collection & Discharge** | |
| **3 Drainage Areas, Piping on 2 Sides** | **$4,917,700** |
| **Bridge Drainage Water Treatment** | |
| **Maximum Treatment (113%) Using 100% CDS + Maximum Pond Space Available** | Costs Incorporated in Bridge Drainage Collection & Discharge Above |
| **Everglades Safari Down Ramp** | |
| **Down Ramp Incorporated Into Bridge (with warning lights and added left turn lane)** | **$6,782,000** |
| **West End Radio Tower Connector Access** | |
| **Use Existing Tamiami Trail + Culverts** | **$300,000** |
| **TOTAL VA PREFFERED ALTERNATIVE** | **$144,910,746** |

| VALUE ANALYSIS SAVINGS | Net Construction Cost |
|---|---|
| **TOTAL VALUE ANALYSIS SAVINGS** | **$17,382,754** |

**Value Analysis Study**
**Construct 2.60-Mile Tamiami Trail Bridge**

Everglades National Park
Florida

December 9 - 13, 2013

# SECTION B: VALUE ANALYSIS STUDY

## Phase I - Information
***Study Specifics***

### Project Background

The 2009 Omnibus Appropriations Act (March 10, 2009) directed the National Park Service (NPS) to evaluate bridging alternatives to the Tamiami Trail (10.7-mile eastern section), beyond what was authorized by the 2008 Limited Reevaluation Report (LRR), in order to "restore more natural water flow to Everglades National Park (ENP) and Florida Bay and for the purpose of restoring habitat within the Park and the ecological connectivity between the Park and the Water Conservation Areas." In response to this Congressional directive, the NPS completed an Environmental Impact Statement (EIS) for the Tamiami Trail Modifications: Next Steps (TTM:NS) project (Notice of Availability published in the Federal Register on December 20, 2010). The Record of Decision (ROD) for this EIS was published in the Federal Register on April 26, 2011. On December 23, 2011, Congress passed the Consolidated Appropriations Act of 2012 (Public Law 112-74) which authorized construction of the EIS selected plan, Alternative 6e. The first priority of TTM:NS Alternative 6e is the 2.60-mile bridge located between the Osceola Camp and the Airboat Association.

### Measurable Results

Construction of the 2.60-mile bridge will allow for the restoration of more natural water flow to Everglades National Park and Florida Bay and allow for restoration of habitat within the Park and the ecological connectivity between the Park and the Water Conservation Area.

### *Reference Documents*

The design team of HDR Engineering, Inc. provided the VA team with the following reference documents:

- Structures Design Guidelines, FDOT Structures Manual Volume 1, January 2013
- PMIS 202746 Construct 2.60-Mile Tamiami Trail Bridge, July 17, 2013
- Span Length Optimization, HDR, November 2013
- Pre-Design Project Program, HDR, November 2013
- Pre-Design Exhibits for VA Workshop, HDR, November 2013
- Class C estimate (provided by Kirk Value Planners), December 2013

## Phase II - Function Analysis

### *Stakeholders, Primary Interests and Concerns*

The following table, **Figure 3**, reflects the project's primary stakeholders, their interest and the concerns reflected over the 2.60-mile Tamiami Trail Bridge project.

## Stakeholders, Primary Interests and Concerns

Figure 3

Project: **Construct 2.6 Mile Tamiami Trail Bridge**
Location: **Everglades National Park, Florida**
Date: **December 9 - 13, 2013**

| | **Stakeholders:** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stakeholder Interests & Concerns:** | Florida DOT | NPS | Businesses | Native Tribes | Florida DEP | South Florida WMD | US F&W | Florida FWCC | Non Government Organizations | Corps of Engineers | Congressional delegates | Utility Company | Miami-Dade (WASAD) |
| Water quality | X | X | | X | X | X | X | | X | X | | | |
| Maintenance / Life Cycle Costs | X | X | | | X | | | | | | | | |
| Safety and related standards | X | X | | | | | | | X | | | | |
| Engineering standards / codes | X | X | | | | | | | | | | | |
| Schedule (design and construction) | X | X | X | | | | | | X | | | | |
| Maintenance of Traffic (MOT) | X | X | X | X | | | | | X | | | | |
| Environmental mitigation | X | X | | | X | | | | X | | | | |
| Buy-in / Partnerships | X | X | | | | | | | | | | | |
| Natural resource protection | | X | | X | X | X | X | X | X | X | X | | |
| Aesthetics | X | X | X | X | X | | | | X | | | | |
| Cultural resource protection | | X | | X | | | | | X | X | X | | |
| Restoration of natural resources | | X | X | X | X | X | X | X | X | X | X | | |
| Visitor experience | | X | X | X | | | | X | X | | | | |
| Impacts to private businesses | | X | X | | | | | | X | | | | |
| Clearance of bridge | X | X | X | | | | | | | | | | |
| Cost - initial budget | X | X | | | | | | | X | | X | | |
| Environmental monitoring / compliance | X | X | | X | X | X | X | X | X | X | X | | |
| Threatened & endangered species | | X | | | | | X | X | X | X | X | | |
| Recreation / sport fishing / income | | X | | X | | | | X | | | | | |
| View scape | | X | X | | | | | X | X | | X | | |
| Wetlands | | X | | X | | X | X | X | X | X | X | | |
| Municipal water supply | | X | | | | X | | | | X | | | X |
| Real estate | | X | X | | | | | | | | X | X | |
| Utility Locations | | X | | | | | | | | | | X | |

### *Function Logic Diagram*

Function analysis is core to any value analysis study. For this project, the VA team prepared a function logic diagram (**Figure 4**) to help understand the overall purposes of the project to “restore more natural water flow” to Everglades National Park and Florida Bay and for the purpose of “restoring habitat” within the Park and “restore the ecological connectivity” between the Park and the Water Conservation Areas. Functions are described using an abridged description with an active verb and a measurable noun. Reading to the right of the diagram answers “how” the mission is to be achieved with this project. Functions include:

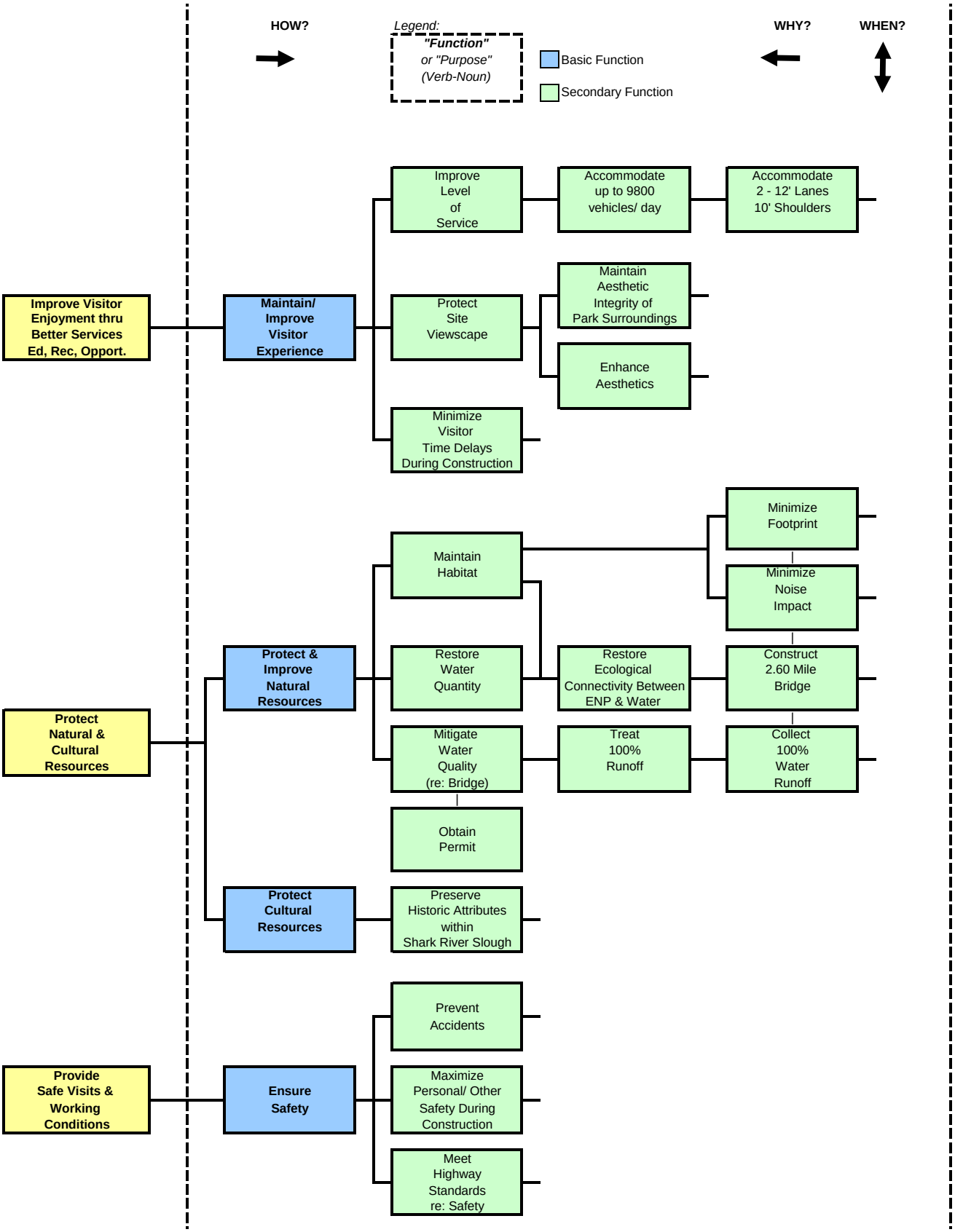
- Provide for visitor enjoyment
- Prevent loss, maintain, and improve the condition of the resources
- Protect public and employee health, safety and welfare
- Improve operational efficiency and sustainability
- Strengthen partnership and community relationships

Reading even further to the right answers “how” each of these functions are to be met with this project. Reading from right to left on the diagram answers “why” the specific functions of the project are to be done.

This function logic diagram was later used by the VA team to identify factors to evaluate the alternatives using the Choosing By Advantages (CBA) decision making approach. The functions used as factors are identified on the diagram. Those functions that are equally met by each alternative (no advantages to one alternative over another) did not need to be included as evaluation factors in the CBA.

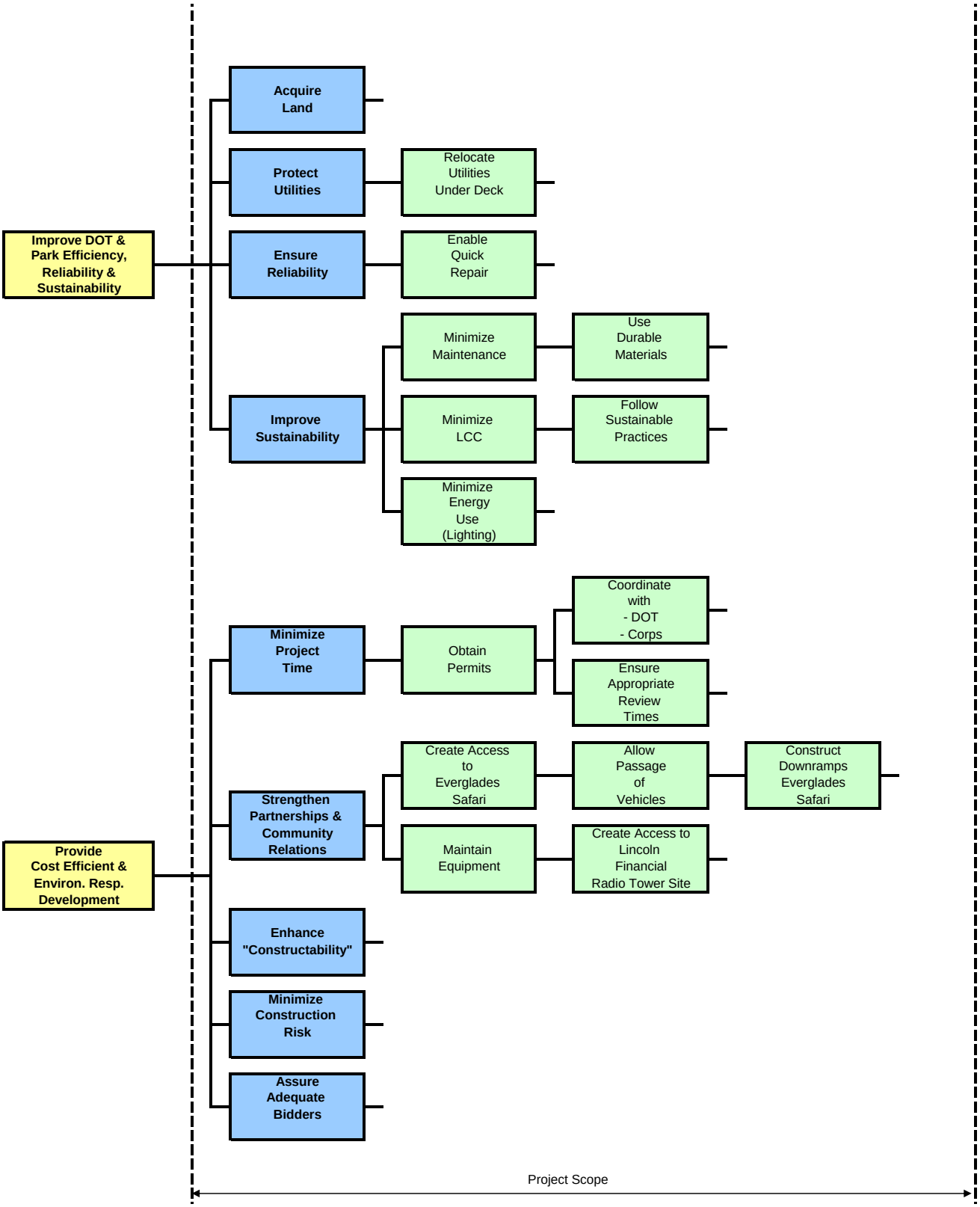
# Construct 2.6 Mile Tamiami Trail Bridge
## Function Logic Diagram

Figure 4



## Construct 2.6 Mile Tamiami Trail Bridge
### Function Logic Diagram

Figure 4



### *Pareto Cost Model*

The following Pareto Cost Model, **Figure 5**, illustrates the net construction cost breakdown for the bridge superstructure and the substructure. The costs are ordered from largest to smallest. Although the concrete bridge deck was the highest cost item, FDOT will only allow an 8.5" deck on the bridge where ½" is for milling, therefore the current design provides a structural deck slab of 8". The deck width for the bridge is constant and the length of the bridge is also a constant fixed value. Therefore the deck volume will not change with the various alternatives. Reducing the deck thickness is not an option with FDOT since the FDOT code mandates an 8.5" deck slab unless it is a widening. Other options, such as lightweight concrete, can be considered but typically are only allowed if there is a load capacity issue with the beams or the foundations. This is not the case for this bridge. Lightweight concrete will need approval by FDOT Central Office.

Precast panels for the deck slab are another consideration that could be evaluated but will tend to be more costly due to the fabrication off-site and transportation and erection of the units. FDOT has not utilized this construction previously. It is typically considered where accelerating the construction time is a goal and where casting on site is hindered by the ability to get concrete within the mixing time frame to the job site. This does not seem to be an issue at this location. The volume of concrete is the same as the cast-in-place deck, so the quantity remains constant.

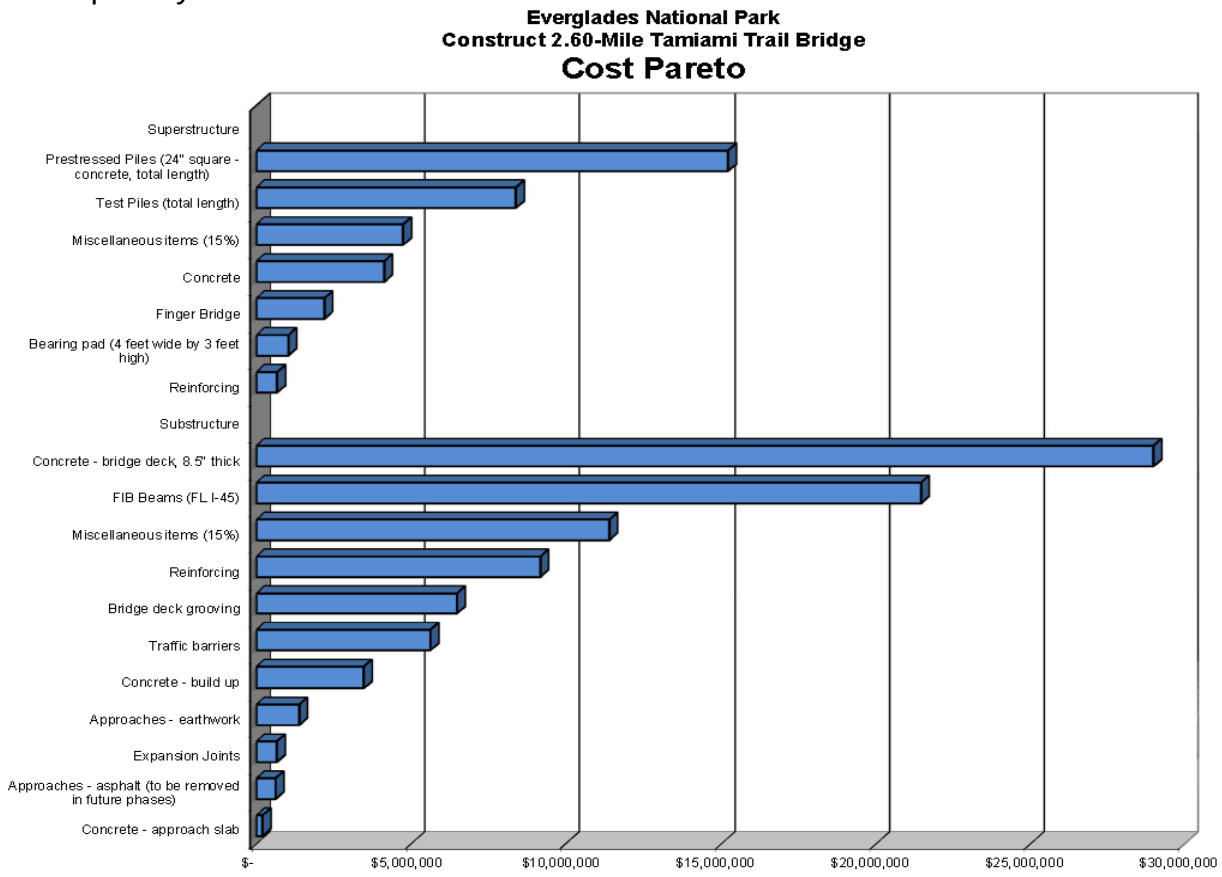



**Figure 5 Pareto Cost Model**

***Risk Model***

The VA team identified the following risks associated with the project. Mitigation measures are also listed.

| Risks: | Mitigation Measures: |
|---|---|
| **Project Controls** | |
| • **Permitting*** | Communication Early |
| • Budget Source | Collaboration, Cost Sharing |
| • **Public & Political Perspectives*** | Public Involvement (Meetings, Press Releases, Web Site, Public Information Officer) |
| **Technical Issues** | |
| • Environmental Restrictions | Innovative Design |
| • Site Restraints | Laydown area across canal<br>Temporary transportation for visitors |
| • Geotechnical/ Foundation | See Lessons Learned from One Mile Bridge<br>Gather more geotechnical Information |
| **Implementation** | |
| • Field Changes | Contractor to Provide Unit Prices in Bid<br>Partnering with Contractor<br>Innovative Design<br>Use of DOT Specifications with Combination of DOT/ NPS for General Conditions |
| • Utility Connections | Early Coordination with Utility Companies |
| **Construction Activities** | |
| • Wildlife Protection | Monitoring & Communication<br>Contractor Education |
| • Water Quality Protection | Monitoring & Communication<br>Contractor Education |
| • MOT | Partnering |
| • Claims | Innovative Design |
| • **Soil Contamination*** | Identify Disposal Areas by Partnering with Local Authorities including tribes |
| • Weather Impact on Time | Partnering |

**** Team identified risks of most concern***

## *Force Field Analysis*

In generating ideas for improvement, the VA team used this tool to identify "best features and features of concern" regarding the project. The best features were those felt by the team to be important to retain in the design. The features of concern were identified so they could be addressed in a refinement to the design. The result of this analysis is as follows:

### Best Features – entire project

- Length of bridge, for connectivity
- Span length - lay lightly on the land
- Minimal infrastructure
- Small project footprint
- Site location for flexibility in designing bridge
- Ecological restoration
- Strengthening partnerships between NPS and FDOT (both heavily involved early in design)
- Creates vista to Everglades
- Creates momentum for ultimate goal
- Ease of maintaining traffic flow during construction
- Safety of design section
- Aesthetics
- Keeps businesses in operation
- Considers lessons learned from 1 mile bridge (like better geotechnical information, enhanced team communication, improved constructability issues, etc.)

### Features of Concern – entire project

- Political issues (uncertainties, funding, policies, commitment, etc.)
- Very compressed project schedule
- Lincoln Financial access (high cost for low benefit)
- Maintenance of bridge, drainage, site
- Minimal opportunity to collect / treat water runoff
- Design Bid Build requires very complete technical documentation due to compressed schedule
- Construction methods (pile drilling) impact on water turbidity
- Not complete geotechnical information
- View from bridge, may become people stop / safety issue
- Access to Safari (high cost)
- Fishing off bridge may occur (safety issue)
- Technical difficulty of collecting water on the bridge
- Water quality during construction
- Potential impact to resources during construction
- Securing permits
- Aesthetics of bridge (opportunity to enhance visitor experiences)
- Safety during construction

- Construction staging
- Impact of construction to wildlife
- Maintaining of natural water flow under access road

## Phase III - Creativity

### *Creative Ideas*

Some seventy (70) creative ideas were generated during the “brainstorming” portion of the VA workshop. Since time was not available to develop all the favorable ideas into recommendations, the design team is encouraged to consider them as the design develops. Ideas in Bold are recommended for further consideration.

Following is a listing of ideas:

*Coding: B = Bridge, F = Foundation, A = Access, D = Drainage, G = General*

1. Consider investigating taper piles, FDOT (B, F)
2. **Treat first flush of water runoff from bridge, improve water quality (B, D)**
3. Options for clear height of bridge versus DOT standard (B, D)
4. **Blend bridge aesthetics to environment, light on land (B)**
5. Add culverts to access road (G)
6. **Increase span length to reduce footprint (B)**
7. **Establish partnership team to immediately solve problems during construction and avoid delays (G)**
8. Use precast columns (B)
9. **Use aesthetic vehicle barrier design (B)**
10. **Combine innovate procurement process, VE alternatives by contractor and alternate bids by designer (G)**
11. **Consider alternate foundation types, steel H or pipe (B, F)**
12. Less quantity of piles but larger size (B, F)
13. **Create overlook (G)**
14. Create viewpoint at Lincoln Financial, part of deceleration lane (A)
15. Use alternate superstructure components such as steel, see bridge alternative 5 (B)
16. **Use precast pile caps (B)**
17. **Increase frequency of dynamic pile testing, reduces impact to habitat, less cost, improved constructability (B, F)**
18. Use cable stay bridge, too high in cost (B)
19. Use splice U beam, see bridge alternative 4 (B)
20. Identify options for Lincoln Financial (A)
    a. Purchase rights, real estate issue
    b. Provide access other ways
    c. Create agreement for NPS to transport equipment to site
21. **Consider deck slab options such as precast (B)**
22. **Consider nighttime & weekend construction to minimize vehicle delays, DOT allows (G)**

23. Consider U beams to convey water, not allowed by DOT, too time consuming (B, D)
24. Use U beams for temporary storage of water, too time consuming (B, D)
25. Include utilities duct bank within walls of structural concrete beam (B)
26. Consider mix of I beams and U beams, and use U beams to convey water an needed, concern for aesthetics and constructability (B)
27. **Consider light weight concrete, DOT may not approve (B)**
28. Use barge to extend crane area to complete lifts (B)
29. Use column piers at high points (B)
30. **Investigate suitable fill material for finger piers (B)**
31. Longer spans (B)

**Bridge Drainage Collection & Discharge and Treatment**

32. **Use fiber reinforced pipe (D)**
33. **Use HDPE, less cost, lighter, needs DOT approval (D)**
34. **Use PVC, less cost, lighter, needs DOT approval (D)**
35. **Add more discharge points to reduce natural resources impact (D)**
36. **Consider pipe hanger options such as stainless steel for improved durability (D)**
37. **Use sheet piling for pond design D)**
38. **Explore additional locations for ponds, for example:**
    a. **Wetlands adjacent to Everglades Safari Park (D)**
    b. **Parking at Everglades Safari Park (D)**
39. Alternative sites to meet treatment requirement, not desirable and generally not available with ponds (D)
40. **Retrofit One-Mile Bridge (D)**
41. Add storm water vaults for runoff under bridge, maintenance issue (D)
42. **Treat Everglades Safari Park parking lot runoff, consider agreement with business to perform maintenance (D)**

**Everglades Safari Down Ramp**

43. Parking under bridge. Note: DOT Agreement for Everglades Safari Park use of land under bridge for parking (A)
44. Improve exiting to accommodate busses for improved safety and avoid crossing lane (A)
45. Minimize height of bridge to reduce length of down ramp (A)
46. Create vista with down ramp (A)
47. Public/Private Partnership for development vista, parking entry, etc. (A)
48. Use two bridges in lieu of single bridge, see alternative 8, document with NEPA notes to file (B, A)
49. **Add vista level below bridge and above parking – could be wood bridge/ramp (A)**
50. Agreement with Everglades Safari Park vista for water/pond retaining basin (D)
51. Use temporary bridge for MOT during construction with traffic on north side of canal
52. **Add sheet piling along canal for MOT during construction (A)**

53. **Have temporary parking for Everglades Safari Park and shuttle visitors to allow use of parking area for construction to improve MOT (A)**
54. Shift Alternative 4 further West (A)
55. **Use solar powered flashing signal for Alternative 8 (A)**
56. **Retain sheet piling permanently to provide left turn lane (A)**
57. Construct temporary parking at wetland to improve MOT (A)
58. **Temporarily use area near business for MOT and parking (A)**

**<u>West End Connector Access</u>**

59. **Add gate entry (A)**
60. Solar flashing light – traffic control (A)
61. **Add culverts for connectivity, Alternative 3 (A)**
62. New road over existing disturbed area (A)
63. Add bridge over canal and use levee road, remove in future (A)
64. Relocate Tower to 8 ½ square mile (A)
65. Add drawbridge – 12’ wide x 100’ long (A)
66. Add new canal control structure, use for access (A)
67. **Agreement to:**
    a. **Use 1 lane of Tamiami Trail**
    b. **Add culverts**
    c. **Maintain until water flow from North is improved by removing levee (L-29)**
    d. **A portion of the access road will be removed if/ when the tower is relocated**
68. Add overlook to provide added benefit with access down ramp (A)
69. **Use access road as part of berm maintenance road (A)**
70. **Add recreational opportunities (A, G)**

## Phase IV - Evaluation (Part 1 – Factors & Definitions)

As the first task of the evaluation phase the team developed and discussed the CBA factors which would be used to evaluate the alternatives within each decision topic (goal). The study team then defined variables and sub factors to tailor the evaluation factors to the needs for each topic. The following is a table of the evaluation factors and definitions used.

***CBA Topics***

| | |
|---|---|
| **NPS OBJECTIVE: Provide for Visitor Enjoyment** | |
| Factor 1: Improve Visitor Services, Educational and Recreational Opportunities | |
| **NPS OBJECTIVE: Protect Cultural and Natural Resources** | |
| Factor 2: Prevent Loss, Maintain & Improve Resources | |
| **NPS OBJECTIVE: Protect Public and Employee Health, Safety & Welfare** | |
| Factor 3: Protect Public and Employee Health, Safety & Welfare | |
| **NPS OBJECTIVE: Improve Efficiency of Park Operations** | |
| Factor 4: Improve Operational Efficiency, Reliability and Sustainability | |
| **NPS OBJECTIVE: Other Considerations** | |
| Factor 5: Provide Other Advantages to NPS | |
| **SPECIAL FACTOR: COST** | |
| Sub-factor | Definition/Variables |
| Initial Cost (Short-term) | • Capital Costs |
| Life Cycle Cost (Long-term) | • Maintenance Costs<br>• Operating Costs<br>• Staffing Costs |

## Phase IV - Evaluation (Part 2 – Choosing by Advantages)

Alternatives within each decision topic were evaluated using a process called Choosing by Advantages, where decisions are based on the importance of advantages between alternatives. The value based decision making technique has been used by the NPS for many years to help identify the preferred alternative for further design development. The evaluation involves the identification of the attributes or characteristics of each alternative relative to the evaluation criteria, a determination of the advantages for each alternative within each evaluation factor, and then the weighing of importance of each advantage.

The highest importance advantage is identified in each factor. The paramount advantage, across factors, was determined and assigned a weight determined by the team. Remaining advantages were rated on the same scale. Construction and life cycle costs were developed for each alternative, as appropriate. Recommendations are based on a balance of cost and importance.

The evaluation sheets form the basis for presenting the alternatives and design sketches and cost estimates. The evaluation tables present many types of information. Attributes of an alternative are shown above the dotted line in the CBA table. Advantages between alternatives are shown below the dotted line. An anchor statement summarizes those advantages. The advantage with the highest importance within a factor is indicated by a highlight around the advantage cell.

The study team evaluated the benefit or “importance of advantage” to be realized from the Alternatives (see CBA Matrix for each decision topic). Relative initial cost estimates for the alternatives were developed by the VA team. Results were graphed with importance or benefit on the vertical scale and initial cost on the horizontal scale, as appropriate. The positive slope of the increment reflects good value and the highest benefit to cost ratio. Similarly, when the life cycle costs are considered, certain alternatives offer the best value and the highest benefit to cost ratio to the NPS and were selected as the preferred alternative.

Upon reconsideration, the VA team suggested the design team explore ways to add additional benefits and lower initial and life cycle costs to each of the preferred alternatives.

## Phase V - Development

The development phase of the VA job plan includes preparing a variety of items to verify each creative idea truly adds value to the project. The results are then used to prepare a presentation.

For each of the five decisions, the following pages contain the following, as appropriate:

A. Value Analysis Recommendation
   - Original Design Alternatives
   - Preferred Alternative
   - Discussion
   - Life Cycle Cost Analysis
B. Reconsideration (Additional ideas as part of the preferred alternative)
C. Sketches of Alternatives Considered
D. Choosing By Advantages Matrix
E. Life Cycle Cost Analysis
F. Total Importance Allocation to Advantages Scale
G. CBA Importance to Initial Cost Graph
H. CBA Importance to Life Cycle Cost
I. Sensitivity Analysis, CBA Importance to Initial Cost Graph
J. Sensitivity Analysis, CBA Importance to Life Cycle Cost

Following is the CBA for each of the following value analysis decisions:

1. Bridge Span & Structural System (**Figure 6**)

2A. Bridge Drainage Collection & Discharge (**Figure 7**)

2B. Bridge Drainage Water Treatment (**Figure 8**)

3. Everglades Safari Down Ramp (**Figure 9**)

4. West End Radio Tower Connector Access (**Figure 10**)

# Value Analysis Recommendation-Choosing By Advantages

Figure 6A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** **VA No.**
**Item:** **Bridge Span & Structural System** **CBA-1**

## Original Design

The VA team reviewed the original CBA alternatives for the project. Other options were discussed in the VA but ultimately the following alternatives were evaluated in the Choosing By Advantages:

• Alternative 1: Florida Concrete I-Beam, 3 @ 12' spacing, 130' span *(dismissed, similar to alternative 2)* ;

• Alternative 2: Florida Concrete I-Beam, 4 @ 9' spacing, 140' span;

• Alternative 3: Florida Concrete U-Beam, 2 @ 16' spacing, 100' span;

• Alternative 4: Florida Spliced Concrete U-Beam, 2 @ 16' spacing, 200' average span *(dismissed, alternative 6 is better and similar in cost);*

• Alternative 5: Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span;

• Alternative 6: Florida Steel Box Beam, 3 @ 8' spacing, 173' average span

## Preferred Alternative

Based on the CBA analysis, the VA team identified the Alternative 2 as the preferred alternative. See following page for reconsideration additional ideas.

**Advantages of Preferred Alternative:**

- Minimally better at protecting / improving natural resources
- Slightly better at supporting sustainable practices
- Slightly better at minimizing time during construction
- Moderately better at minimizing maintenance needs
- Moderately better at minimizing constructability and risk issues during construction
- Lowest initial and life cycle cost

## Life Cycle Cost Summary

| | Initial Cost | Life Cycle Cost |
|---|---|---|
| **Proposed Design (Preferred Alternative 2)** | **134,789,300** | **138,219,000** |

# Reconsideration

Figure 6B

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** **VA No.**

**Item: Bridge Span & Structural System** **CBA-1**

☐ **Original Design** ■ **Proposed Design**

Reconsideration Alternative 2

Consider the following ideas as part of the preferred alternative. Numbers refer to idea listing.

*Coding: B = Bridge, F = Foundation, D = Drainage*

2. Treat first flush of water runoff from bridge, improve water quality (B, D)
4. Blend bridge aesthetics to environment, light on land (B)
6. Increase span length to reduce footprint (B)
9. Use aesthetic vehicle barrier design (B)
11. Consider alternate foundation types, steel H or pipe (B, F)
16. Use precast pile caps (B)
17. Increase frequency of dynamic pile testing, reduces impact to habitat, less cost, improved constructability (B, F)
21. Consider deck slab options such as precast (B)
27. Consider light weight concrete, DOT may not approve (B)
30. Investigate suitable fill material for finger piers (B)

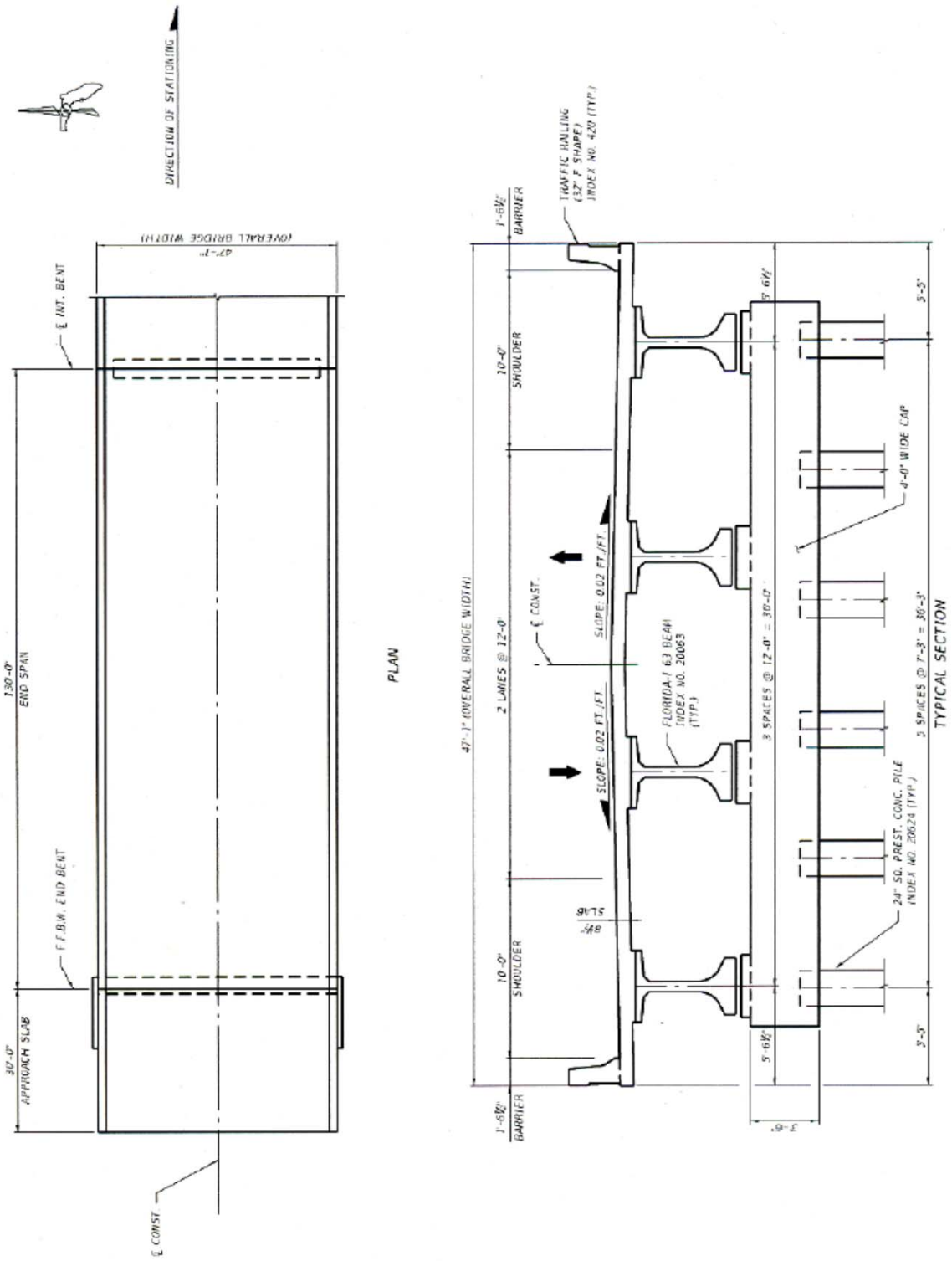
# Sketch Worksheet

Figure 6C

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** — **VA No.**

**Item: Bridge Span & Structural System** — **CBA-1**

| **Original Design** | **Proposed Design** |
|---|---|
| ALTERNATIVE 2 | Florida Concrete I-Beam, 4 @ 9' spacing, 140' span |



# Sketch Worksheet

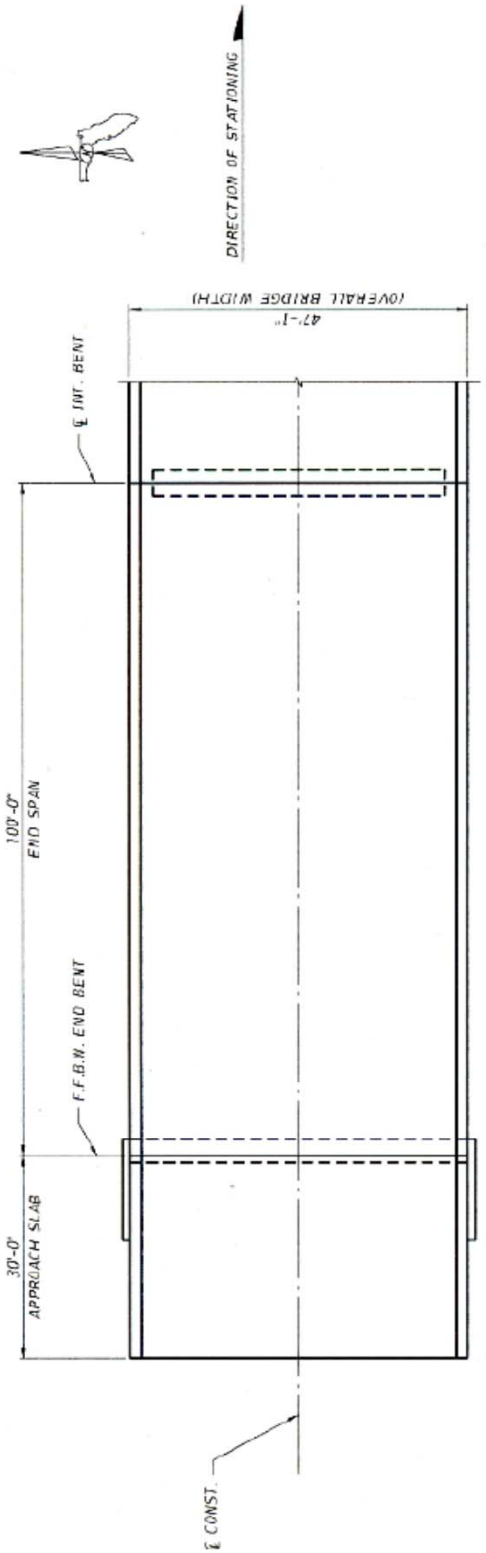
Figure 6C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** — **VA No.**

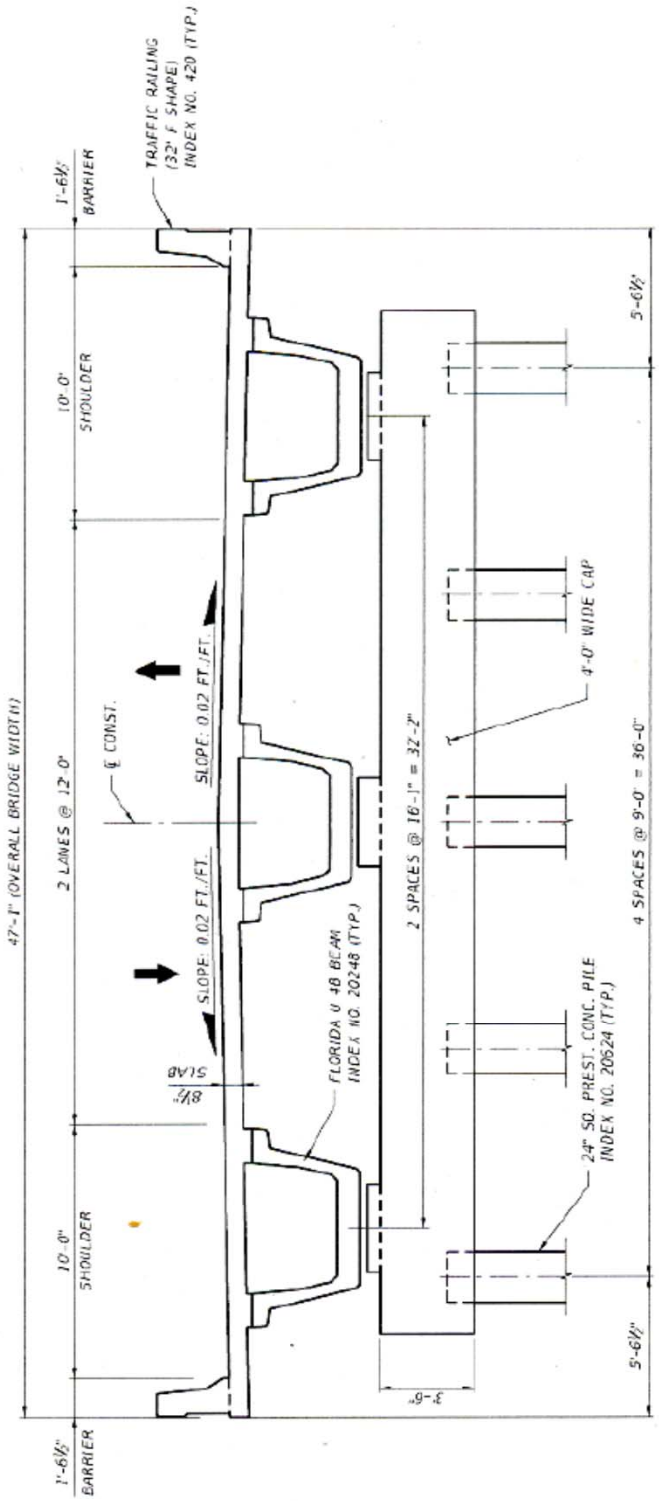
**Item:** **Bridge Span & Structural System** — **CBA-1**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 3 Florida Concrete U-Beam, 2 @ 16' spacing, 100' span




PLAN




TYPICAL SECTION

## Sketch Worksheet

Figure 6C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** — **VA No.**

**Item:** **Bridge Span & Structural System** — **CBA-1**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 5 Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span

HDR | ONE COMPANY *Many Solutions*

| | | | | | |
|---|---|---|---|---|---|
| Project: | Tamiami Trail | Computed: | RF | Date: | 12/13 |
| Subject: | Spliced U72 Beam | Checked: | | Date: | |
| Task: | alternative | Page: | | of: | |
| Job #: | | No: | | | |

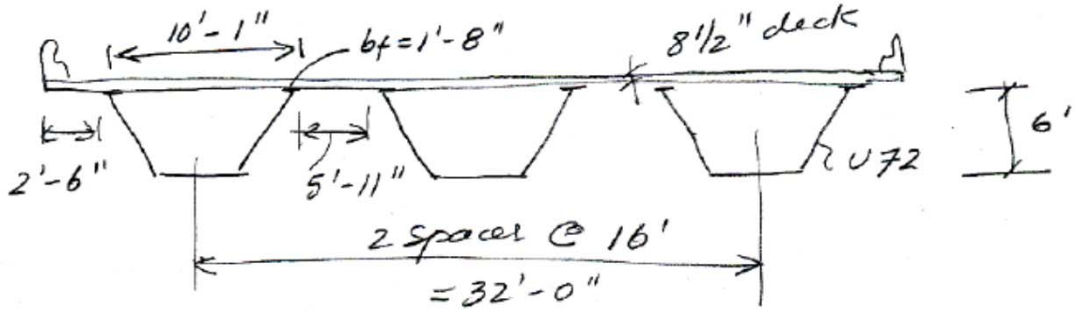
Using U72-3 Lmax = 185' by standard

adjustments due to straight girder & spacing btw beams

Lmax = 200'

span arrangement 80%L - L - 80%L

160' - 200' - 160' = 520'




Weight = 2.117 K/ft

A = 2.117/0.15 = 14.113 ft²

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 5 Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span

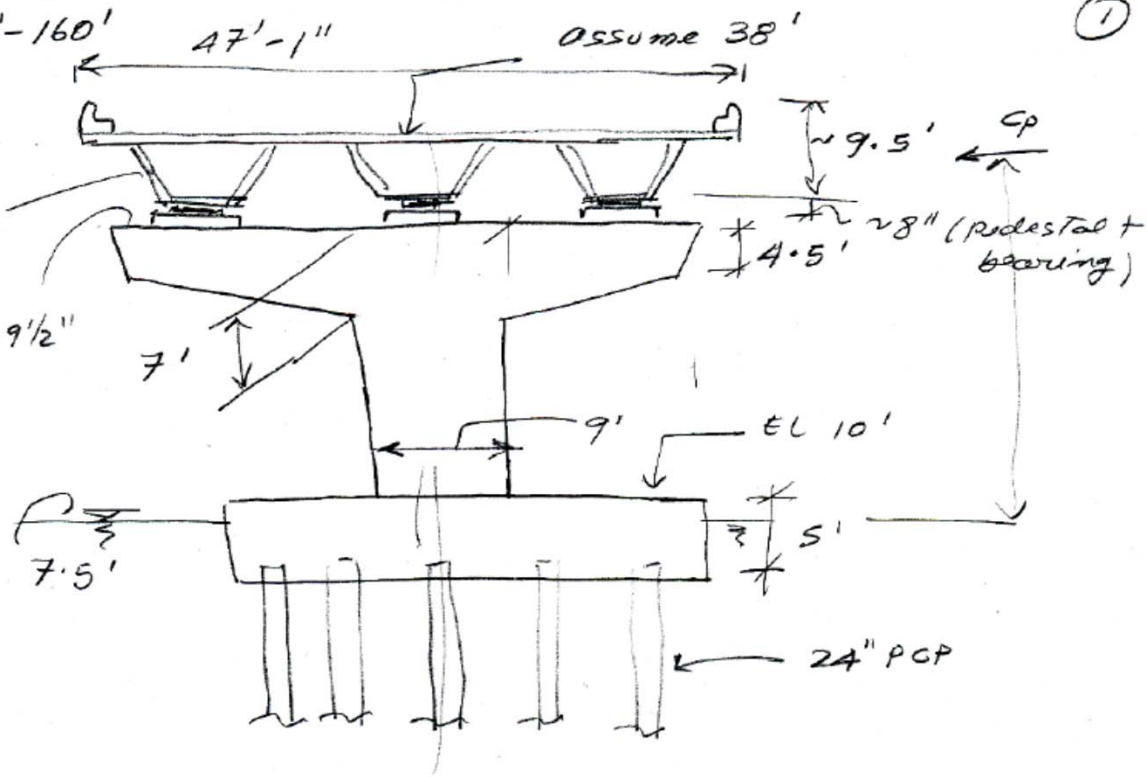
HDR | ONE COMPANY Many Solutions

| | | | |
|---|---|---|---|
| Project: Tamiami Trail | Computed: RF | Date: 12/10/2013 | |
| Subject: Foundation for | Checked: | Date: | |
| Task: Spliced U72 beam | Page: 1 | of: | |
| Job #: alternative | No: | | |

span arrangement

160'-200'-160'

(1)




Foundation controlling loading Strength I
1.25DL + 1.75(LL)

Nominal pile bearing capacity = 350 Ton
(≈ 80% maximum driving resistance)

use $\phi = 0.65$

$\Rightarrow \phi P_n = 0.65 \times 2 \times 350 = 455^k$

$\therefore$ Maximum pile load $< \phi P_n = 455^k$

## Sketch Worksheet

Figure 6C

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** — **VA No.**

**Item: Bridge Span & Structural System** — **CBA-1**

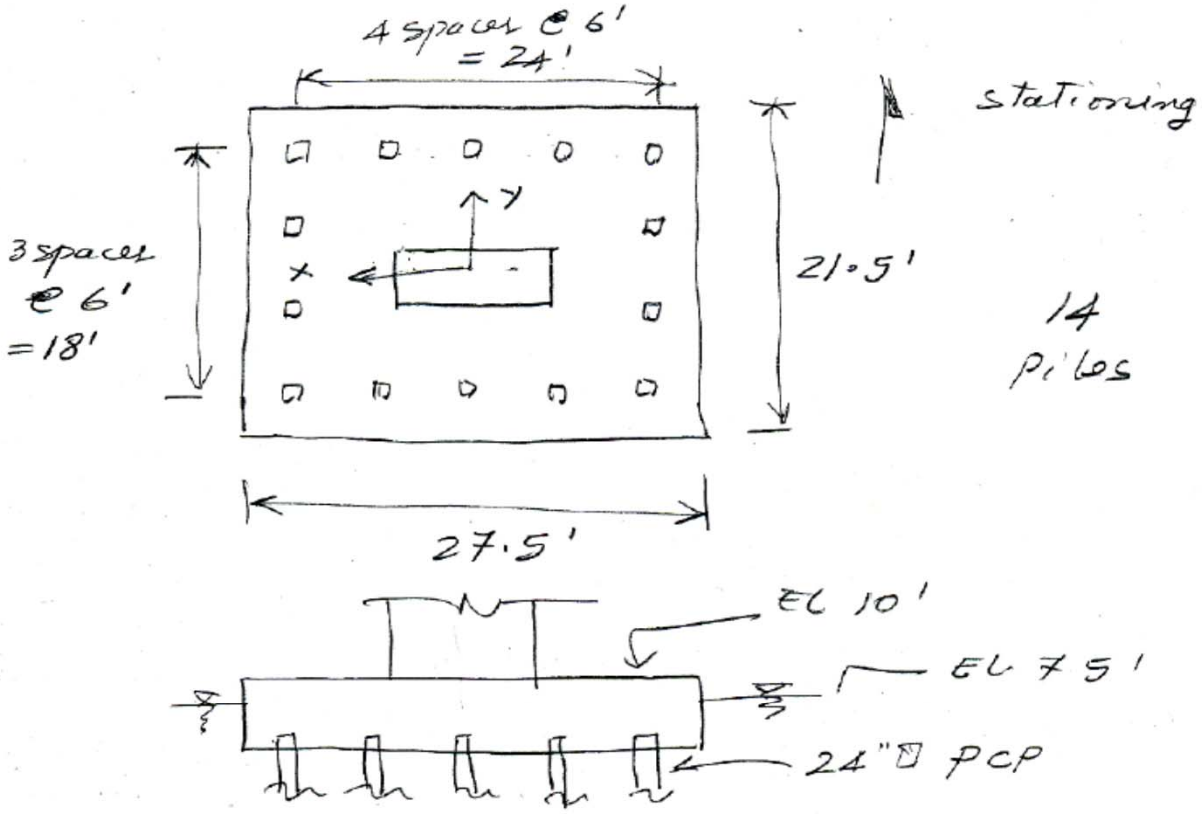
■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 5 Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span

HDR | ONE COMPANY *Many Solutions*

| | | | | | |
|---|---|---|---|---|---|
| Project: | Tamiami Trail | | Computed: RF | | Date: |
| Subject: | Spliced U Beam | | Checked: | | Date: |
| Task: | | alternative | Page: | 2 | of: |
| Job #: | | | No: | | |

Piling Configuration (Interior Pier)




Controlling loading case

$P = 5169^k$

$M_y = 7608$ k-ft

$M_x = 549$ k-ft

$P_{pile\ max} = 445^k$

no uplift

## Sketch Worksheet

Figure 6C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** — **VA No.**

**Item:** **Bridge Span & Structural System** — **CBA-1**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 6 Florida Steel Box Beam, 3 @ 8' spacing, 173' average span

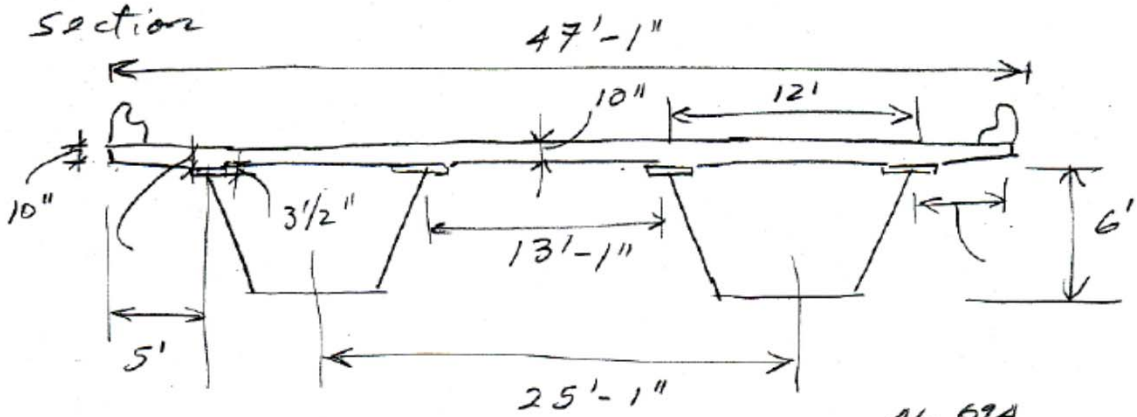
HDR | ONE COMPANY *Many Solutions*

| | | | | | |
|---|---|---|---|---|---|
| Project: | Tamiami Trail | Computed: | RF | Date: | 10/ |
| Subject: | Steel Box | Checked: | | Date: | |
| Task: | Alternative | Page: | | of: | |
| Job #: | | No: | | | |

average Thickness of bottom flange = 1.5"

Consider 30% weight for X-frames, splices, bolts etc.

Section




41.694

Concrete deck $= \left[47.083 \times \frac{10}{12} + 18 \times 4 \times 2/144 + 2 \times 5 \times \frac{3.5}{2} \times \frac{1}{12}\right] \times 0.15 = 6.25^{k}/ft$

Steel box $= 2 \times \frac{272.55}{144} \times 0.49 = 0.927^{k}/ft$

+ 35% due to other components = .325

7.50 k/ft

SIP → 32.583' × 20 PSF = 0.65 k/ft

+ Barriers 0.84 k/ft

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 6 Florida Steel Box Beam, 3 @ 8' spacing, 173' average span

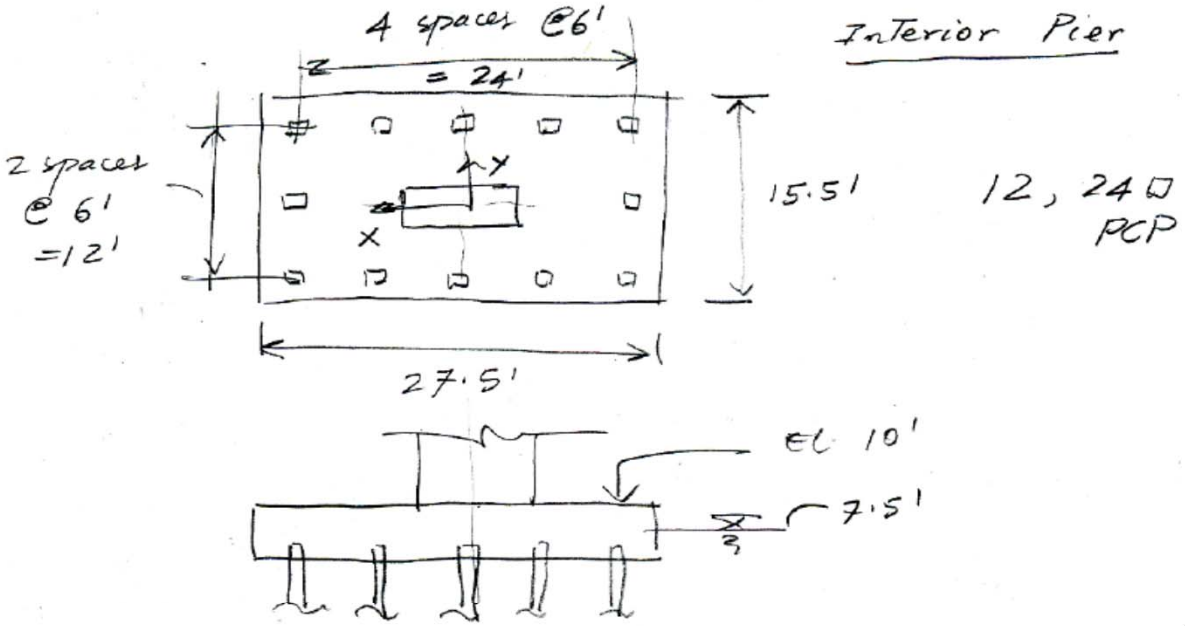
HDR | ONE COMPANY *Many Solutions*

| | | | |
|---|---|---|---|
| Project: Tamiami Trail | | Computed: | Date: |
| Subject: Foundation - Steel | | Checked: | Date: |
| Task: Box alternative | | Page: | of: |
| Job #: | | No: | |

Steel Box alternative

Span arrangement

160' - 200' - 160'




Controlling loading case: Strength I

2 lanes of Traffic

1.25DL + 1.75 LL + 1.75 BR

P = 3845^k

My = 7780 k-ft

Mx = 549 k-ft

Pmax = 422^k

No uplift.

**Choosing By Advantages** **Matrix** Figure 6D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**

**Component:** **Bridge Span & Structural System**

**Functions:** **Restore Water Flow, Create Access**

| Factors: | Alternative 2<br>Florida Concrete I-Beam, 4 @ 9' spacing, 140' span | | Alternative 3<br>Florida Concrete U-Beam, 2 @ 16' spacing, 100' span | | Alternative 5<br>Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span | | Alternative 6<br>Florida Steel Box Beam, 3 @ 8' spacing, 173' average span | |
|---|---|---|---|---|---|---|---|---|
| **Improving Visitor Services, Educational & Recreational Opportunities** | | | | | | | | |
| **Sub Factor: Improve Visitor Experience** | | | | | | | | |
| **Criterion:**<br>**- Aesthetics (long term issue)** | Attribute:<br>These components appear on many types of simple construction (low aesthetic appeal) | | Attribute:<br>Will use concrete U beams that help hide some utilities and are less typical (more aesthetic appeal) | | Attribute:<br>Will use concrete U beams that help hide some utilities and are less typical (more aesthetic appeal) | | Attribute:<br>Will use self weathering steel and it will appear more natural (high aesthetic appeal) | |
| **Criterion:**<br>**- Time delay to complete construction (temporary issue)** | Attribute:<br>Anticipate that this requires more time to complete construction | | Attribute:<br>Anticipate that this requires less time to complete construction | | Attribute:<br>Anticipate that this requires the much more time to complete construction | | Attribute:<br>Anticipate that this requires even more time to complete construction | |
| **Advantages:** | **No Advantage** | **0** | **Minimally better at improve visitor experience** | **50** | **No Advantage** | **0** | **Slightly better at improve visitor experience** | **90** |
| **Prevent loss of resources, Maintain / Improve Condition of Resources** | | | | | | | | |
| **Sub Factor: Protect / Improve Natural Resources** | | | | | | | | |
| **Criterion:**<br>**- Footprint created (long term issue)** | Attribute:<br>Uses more quantity of piers (97) | | Attribute:<br>Uses much more quantity of piers (136) | | Attribute:<br>Uses less quantity of piers (78) | | Attribute:<br>Uses less quantity of piers (78) | |
| **Criterion:**<br>**- Noise created when installing piles (temporary issue)** | Attribute:<br>Uses less quantity of piles (693) | | Attribute:<br>Uses less quantity of piles (690) | | Attribute:<br>Uses much more quantity of piles (1,106) | | Attribute:<br>Uses more quantity of piles (948) | |
| **Criterion:**<br>**- Turbidity created when installing piles (temporary issue)** | Attribute:<br>Uses more quantity of piers (97) | | Attribute:<br>Uses much more quantity of piers (136) | | Attribute:<br>Uses less quantity of piers (78) | | Attribute:<br>Uses less quantity of piers (78) | |
| **Advantages:** | **Minimally better at protecting / improving natural resources** | **100** | **No Advantage** | **0** | **Minimally better at protecting / improving natural resources** | **100** | **Minimally better at protecting / improving natural resources** | **100** |
| **Sub Factor: Limit Impacts to Cultural Resources** | | | | | | | | |
| **Criterion:**<br>**- No difference anticipated** | Attribute:<br>There was no anticipated difference between the alternatives so No Advantage | | | | | | | |
| **Sub Factor: Support Sustainable Practices** | | | | | | | | |
| **Criterion:**<br>**- Type of resource used** | Attribute:<br>Low amount of resources required | | Attribute:<br>Some amount of resources required | | Attribute:<br>High amount of resources required | | Attribute:<br>Some amount of resources required | |
| **Criterion:**<br>**- Amount of recycled content** | Attribute:<br>Low amount of recycled content | | Attribute:<br>Low amount of recycled content | | Attribute:<br>Low amount of recycled content | | Attribute:<br>Very high amount of recycled content | |
| **Criterion:**<br>**- Distance from resource (500 mi)** | Attribute:<br>Would come from within the 500 mile radius | | Attribute:<br>Would come from within the 500 mile radius | | Attribute:<br>Would come from within the 500 mile radius | | Attribute:<br>Would come from far outside 500 mile radius | |
| **Criterion:**<br>**- Storm water treatment (same amongst alternatives)** | Attribute:<br>There was no anticipated difference between the alternatives so No Advantage | | | | | | | |
| **Advantages:** | **Slightly better at supporting sustainable practices** | **15** | **Minimally better at supporting sustainable practices** | **8** | **No Advantage** | **0** | **Minimally better at supporting sustainable practices** | **8** |

**Choosing By Advantages** **Matrix** Figure 6D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**

**Component:** **Bridge Span & Structural System**

**Functions:** **Restore Water Flow, Create Access**

| Factors: | Alternative 2<br>Florida Concrete I-Beam, 4 @ 9' spacing, 140' span | | Alternative 3<br>Florida Concrete U-Beam, 2 @ 16' spacing, 100' span | | Alternative 5<br>Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span | | Alternative 6<br>Florida Steel Box Beam, 3 @ 8' spacing, 173' average span | |
|---|---|---|---|---|---|---|---|---|
| **Protect Public and Employee Health, Safety, Welfare** | | | | | | | | |
| **Sub Factor: Limit time during construction** | | | | | | | | |
| **Criterion:**<br>**- Risks to visitors and workers (during time of construction)** | Attribute:<br>Anticipate that this requires more time to complete construction | | Attribute:<br>Anticipate that this requires less time to complete construction | | Attribute:<br>Anticipate that this requires the much more time to complete construction | | Attribute:<br>Anticipate that this requires even more time to complete construction | |
| **Criterion:**<br>**- Amount of substructure required (most completed in water)** | Attribute:<br>Anticipate that this requires more piles to complete construction | | Attribute:<br>Anticipate that this requires less piles to complete construction | | Attribute:<br>Anticipate that this requires the much more amount of piles to complete | | Attribute:<br>Anticipate that this requires even more piles to complete construction | |
| **Criterion:**<br>**- Type of construction erection required for the superstructure** | Attribute:<br>Creates a less stable system in erecting the superstructure (requires bracing for l | | Attribute:<br>Creates a stable system in erecting the superstructure | | Attribute:<br>Creates a stable system in erecting the superstructure | | Attribute:<br>Creates a stable system in erecting the superstructure | |
| **Advantages:** | **Slightly better at minimizing time during construction** | **55** | **Slightly better at minimizing time during construction** | **55** | **No Advantage** | **0** | **Minimally better at minimizing time during construction** | **30** |
| **Improve Operational Efficiency, Reliability & Sustainability** | | | | | | | | |
| **Sub Factor: Minimize Operational Needs - Maintenance by FDOT** | | | | | | | | |
| **Criterion:**<br>**- Maintenance needs (performed by FDOT)** | Attribute:<br>Requires little maintenance | | Attribute:<br>Requires some maintenance | | Attribute:<br>Requires more maintenance | | Attribute:<br>Requires much more maintenance | |
| **Advantages:** | **Moderately better at minimizing maintenance needs** | **95** | **Moderately better at minimizing maintenance needs** | **95** | **Slightly better at minimizing maintenance needs** | **50** | **No Advantage** | **0** |
| **Provide Cost Effective, Environmentally Responsible & Beneficial Development to NPS** | | | | | | | | |
| **Sub Factor: Minimize Constructability and Risks** | | | | | | | | |
| **Criterion:**<br>**- Constructability needs** | Attribute:<br>Creates less difficult constructability issues | | Attribute:<br>Creates less difficult constructability issues | | Attribute:<br>Creates much more difficult constructability issues | | Attribute:<br>Creates more difficult constructability issues | |
| **Criterion:**<br>**- Risks issues** | Attribute:<br>Creates less risks associated with the construction of the bridge | | Attribute:<br>Creates less risks associated with the construction of the bridge | | Attribute:<br>Creates much more risks associated with the construction of the bridge | | Attribute:<br>Creates more risks associated with the construction of the bridge | |
| **Advantages:** | **Moderately better at minimizing constructability and risk issues during construction** | **75** | **Moderately better at minimizing constructability and risk issues during construction** | **75** | **No Advantage** | **0** | **Slightly better at minimizing constructability and risk issues during construction** | **40** |
| **Total Importance of Advantages** | | **340** | | **283** | | **150** | | **268** |
| **Initial Cost** | $134,789,300 | | $181,965,600 | | $208,923,400 | | $202,184,000 | |
| **Life Cycle Cost** | $138,219,000 | | $186,595,700 | | $214,239,400 | | $207,328,500 | |

## LIFE CYCLE COST ANALYSIS (LCCA)

Figure 6E

Project/Location: **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**
Subject: **Bridge Span & Structural System**
Description: **Restore Water Flow, Create Access**

Project Life Cycle = **75 Years**
Discount Rate = **1.1%**

| | | | | | Alternative 2 Florida Concrete I-Beam, 4 @ 9' spacing, 140' span | | Alternative 3 Florida Concrete U-Beam, 2 @ 16' spacing, 100' span | | Alternative 5 Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span | | Alternative 6 Florida Steel Box Beam, 3 @ 8' spacing, 173' average span | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **INITIAL COSTS** | | **Quantity** | **UM** | **Cost / SF** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** |
| Alternative 2 | Florida Concrete I-Beam, 4 @ 9' spacing, 140' span | 598,224 | Sq Ft | $225.32 | 134,789,300 | 134,789,300 | | | | | | |
| Alternative 3 | Florida Concrete U-Beam, 2 @ 16' spacing, 100' span | 598,224 | Sq Ft | $304.18 | | | 181,965,600 | 181,965,600 | | | | |
| Alternative 5 | Florida Spliced Concrete U-Beam, 3 @ 8' spacing, 173' average span | 598,224 | Sq Ft | $349.24 | | | 0 | 0 | 208,923,400 | 208,923,400 | | |
| Alternative 6 | Florida Steel Box Beam, 3 @ 8' spacing, 173' average span | 598,224 | Sq Ft | $337.97 | | | | | | | 202,184,000 | 202,184,000 |
| **Total Initial Cost** | | | | | | **134,789,300** | | **181,965,600** | | **208,923,400** | | **202,184,000** |
| **REPLACEMENT COST/ SALVAGE VALUE** | | | | | | | | | | | | |
| **Description** | | | **Year** | **PW Factor** | | | | | | | | |
| Replace steel components | Not Anticipated | | 50 | 0.5787 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Replace concrete components | Not Anticipated | | 50 | 0.5787 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Replace substructure components | Not Anticipated | | 50 | 0.5787 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Replacement/Salvage Costs** | | | | | | **0** | | **0** | | **0** | | **0** |
| **ANNUAL COSTS** | | | **Diff.** | | | | | | | | | |
| **Description** | | **Cost** | **Escl. %** | **PWA** | | | | | | | | |
| Annual maintenance | | | 0.00% | 50.890 | 67,395 | 3,429,692 | 90,983 | 4,630,086 | 104,462 | 5,316,023 | 101,092 | 5,144,540 |
| **Total Annual Costs (Present Worth)** | | | | | | **3,429,700** | | **4,630,100** | | **5,316,000** | | **5,144,500** |
| **Total Life Cycle Costs (Present Worth)** | | | | | | **138,219,000** | | **186,595,700** | | **214,239,400** | | **207,328,500** |
| **Total Life Cycle Costs (Annualized)** | | | **PP Factor** | **0.0197** | **2,716,051** | **Per Year** | **3,666,670** | **Per Year** | **4,209,879** | **Per Year** | **4,074,077** | **Per Year** |

## Choosing By Advantages

Figure 6F

**Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**

Bridge Span & Structural System

**Total Importance Allocation to Advantages Scale**

| | |
|---|---|
| | **Paramount Advantage** |
| **100** | Minimally better at protecting / improving natural resources |
| **95** | Moderately better at minimizing maintenance needs |
| **90** | Slightly better at improve visitor experience |
| **85** | |
| **80** | |
| **75** | Moderately better at minimizing constructability and risk issues during construction |
| **70** | |
| **65** | |
| **60** | |
| **55** | Slightly better at minimizing time during construction |
| **50** | |
| **45** | |
| **40** | |
| **35** | |
| **30** | |
| **25** | |
| **20** | |
| **15** | Slightly better at supporting sustainable practices |
| **10** | |
| **5** | |
| **0** | No Advantage |

Figure 6G

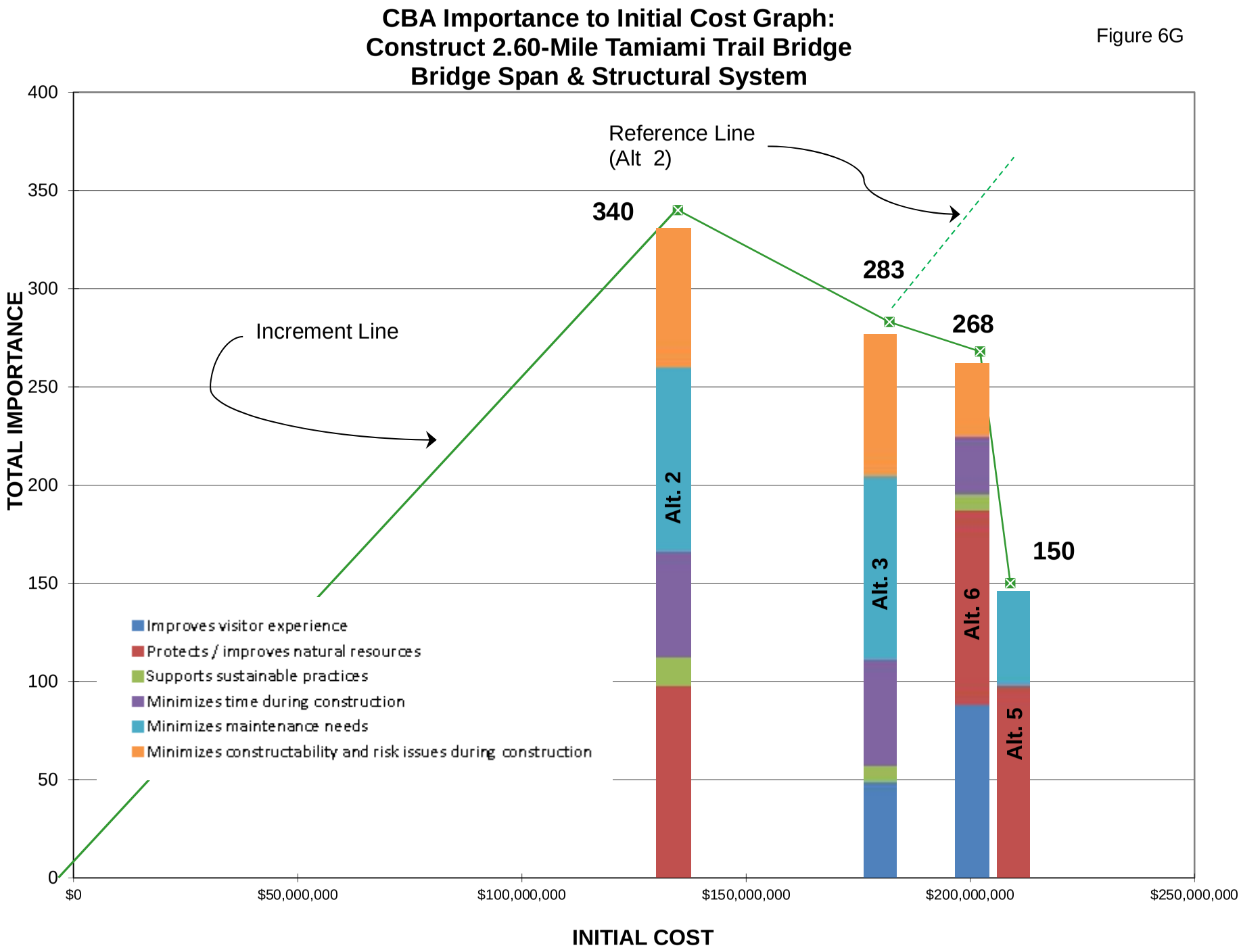
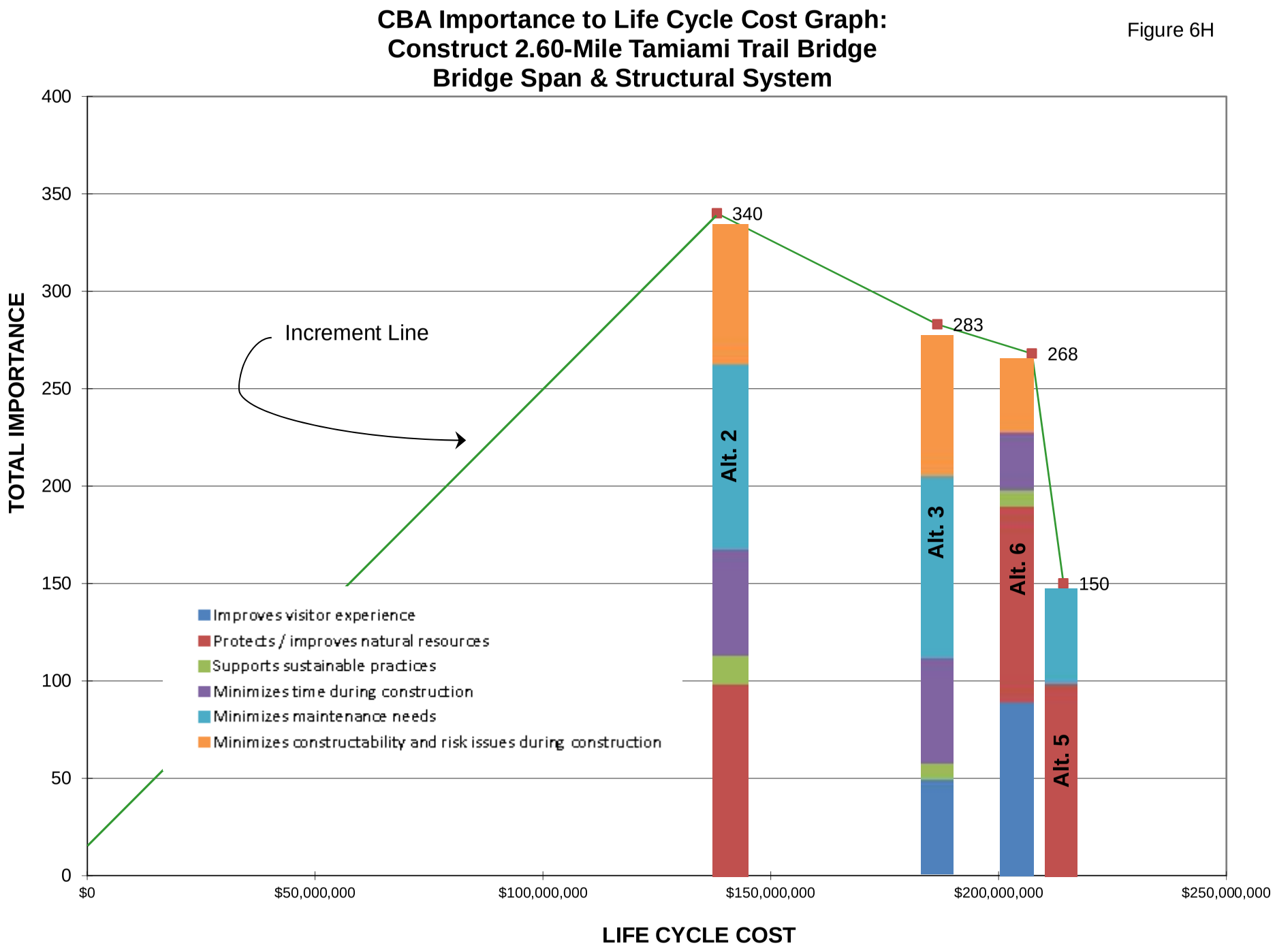

CBA Importance to Initial Cost Graph:
Construct 2.60-Mile Tamiami Trail Bridge
Bridge Span & Structural System
TOTAL IMPORTANCE
INITIAL COST
400
350
300
250
200
150
100
50
0
$0
$50,000,000
$100,000,000
$150,000,000
$200,000,000
$250,000,000
Reference Line
(Alt 2)
Increment Line
340
283
268
150
Alt. 2
Alt. 3
Alt. 6
Alt. 5
Improves visitor experience
Protects / improves natural resources
Supports sustainable practices
Minimizes time during construction
Minimizes maintenance needs
Minimizes constructability and risk issues during construction

Figure 6H


CBA Importance to Life Cycle Cost Graph:
Construct 2.60-Mile Tamiami Trail Bridge
Bridge Span & Structural System
TOTAL IMPORTANCE
LIFE CYCLE COST
400
350
300
250
200
150
100
50
0
$0
$50,000,000
$100,000,000
$150,000,000
$200,000,000
$250,000,000
Increment Line
340
283
268
150
Alt. 2
Alt. 3
Alt. 6
Alt. 5
Improves visitor experience
Protects / improves natural resources
Supports sustainable practices
Minimizes time during construction
Minimizes maintenance needs
Minimizes constructability and risk issues during construction

# Value Analysis Recommendation-Choosing By Advantages

Figure 7A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades** **VA No.**
**Item:** **Drainage Collection & Discharge** **CBA-2A**

## Original Design

The VA team reviewed the following alternatives for the project. They were then evaluated using Choosing By Advantages:

• Alternative 1: 2 Drainage Areas, Piping on 1 Side;

• Alternative 2: 3 Drainage Areas, Piping on 1 Side;

• Alternative 3: 2 Drainage Areas, Piping on 2 Sides;

• Alternative 4: 3 Drainage Areas, Piping on 2 Sides; and,

• Alternative 5: 4 Drainage Areas, Piping on 2 Sides.

## Preferred Alternative

Based on the CBA analysis, the VA team identified the Alternative 4 as the preferred alternative. See following page for reconsideration ideas.

**Advantages of Preferred Alternative 4:**

- Moderately better at improving aesthetics (CDS below grade)
- Slightly better at protecting / improving natural resources via discharge points
- Moderately better at limiting vehicle passengers by removing surface water
- Minimally better at minimizing maintenance needs / accessibility
- Slightly better at improving sustainable practices
- Much better at improving constructability (pipe and location)

## Life Cycle Cost Summary

| | Initial Cost | Life Cycle Cost |
|---|---|---|
| **Proposed Design (Preferred Alternative 4)** | **4,917,700** | **5,453,900** |

# Reconsideration

Figure 7B

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades**
**Item: Drainage Collection & Discharge**

**VA No.**
**CBA-2A**

☐ **Original Design** ■ **Proposed Design**

Reconsideration Alternative 4

Consider the following ideas as part of the preferred alternative :
*Numbers refer to idea number.*

32. Use fiber reinforced pipe
33. Use HDPE, less cost, lighter, needs DOT approval
34. Use PVC, less cost, lighter, needs DOT approval
35. Add more discharge points to reduce natural resources impact
36. Consider pipe hanger options such as stainless steel for improved durability

# Sketch Worksheet

Figure 7C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

**VA No.**

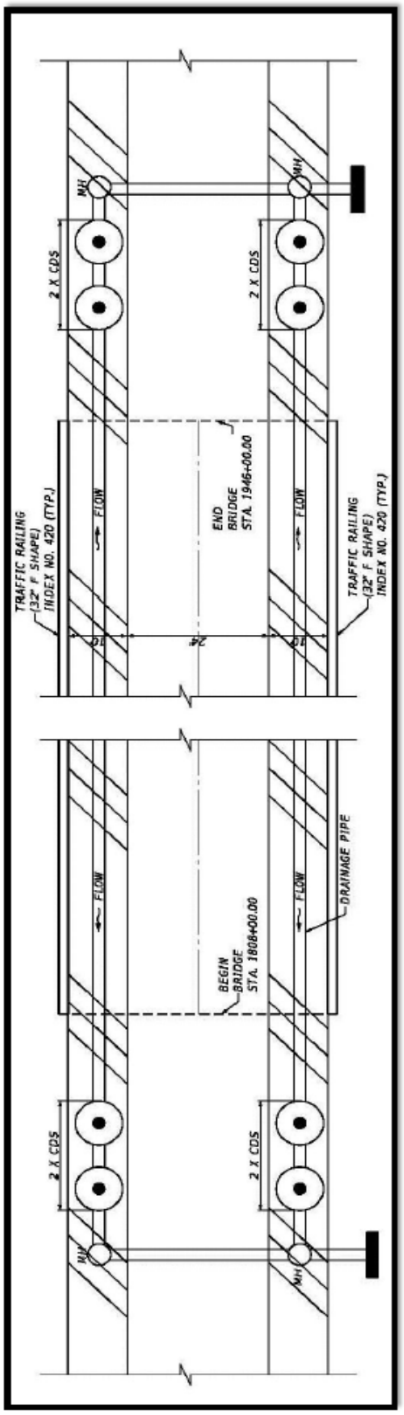
**Item:** **Drainage Collection & Discharge**

**CBA-2A**

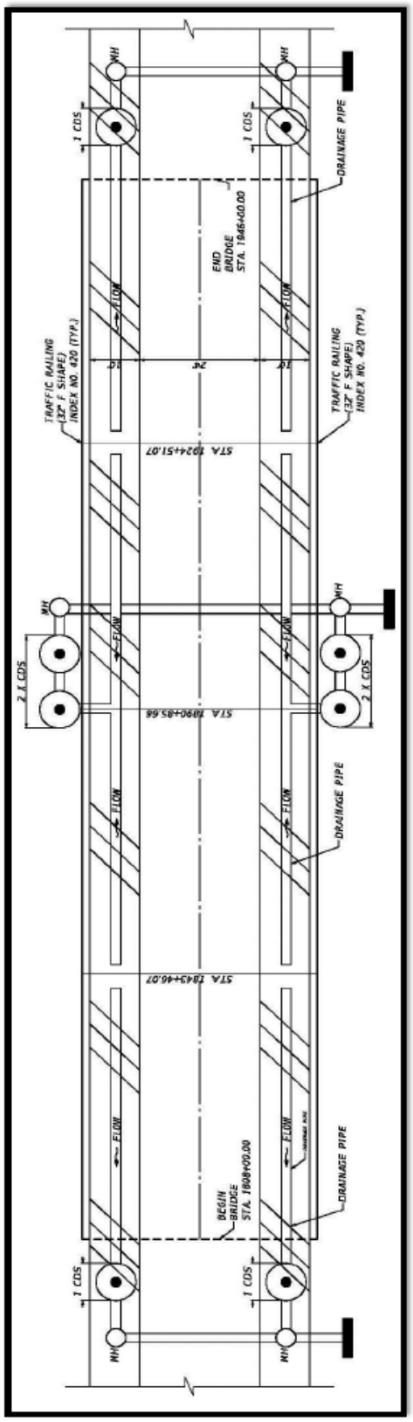
■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES

**Section 1 Pre-Design Drainage Alternatives**




**OPTION 1 INSIDE PIPE SHOWN & NORMAL CROWN TYPICAL SECTION**




**OPTION 2 INSIDE PIPE SHOWN & NORMAL CROWN TYPICAL SECTION**

# Sketch Worksheet

Figure 7C

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

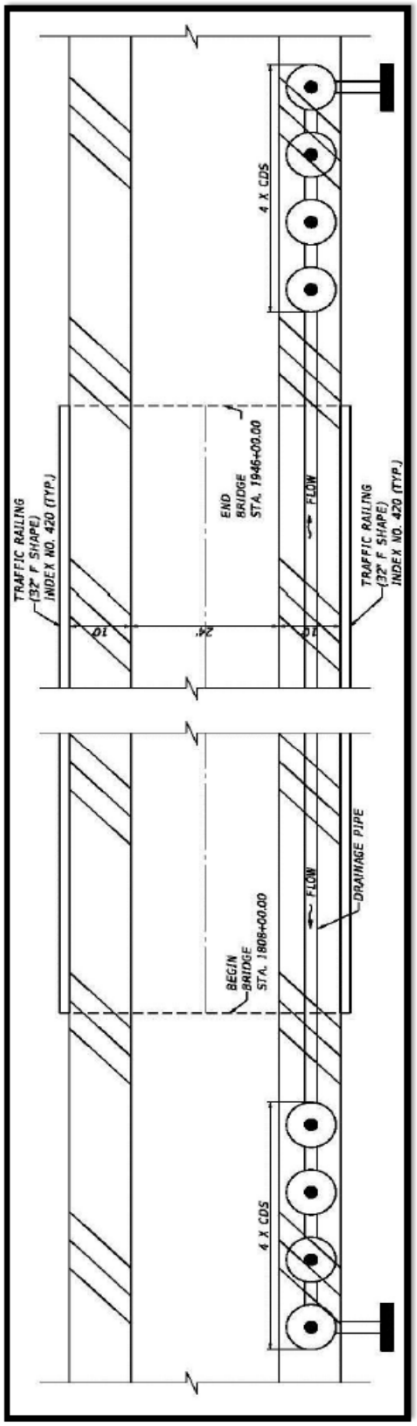
**VA No.**

**Item: Drainage Collection & Discharge**

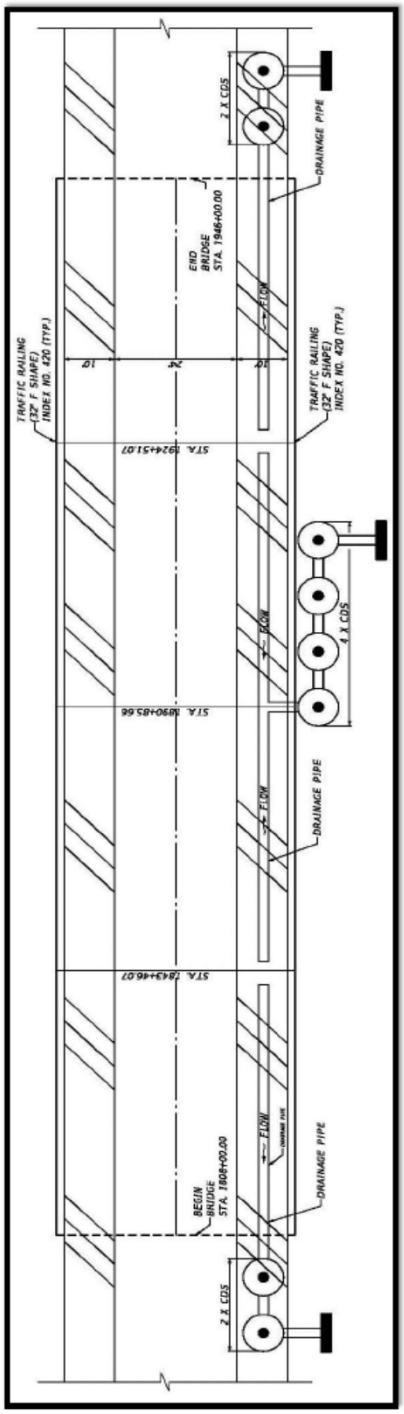
**CBA-2A**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES




1.3 OPTION 3 INSIDE PIPE SHOWN & REVERSE CROWN TYPICAL SECTION




1.4 OPTION 4 INSIDE PIPE SHOWN & REVERSE CROWN TYPICAL SECTION

# Sketch Worksheet

Figure 7C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

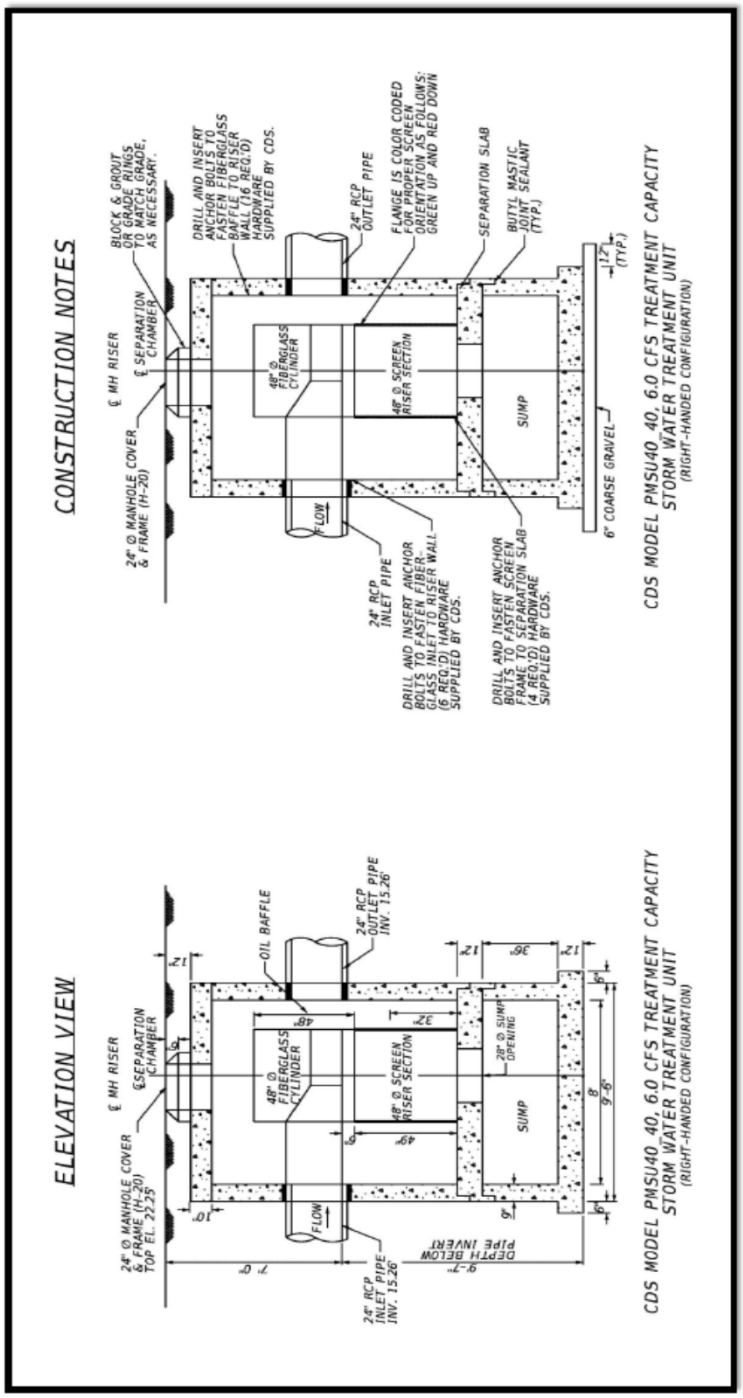
**VA No.**

**Item:** **Drainage Collection & Discharge**

**CBA-2A**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES




15 STORM WATER TREATMENT UNIT

# Sketch Worksheet

Figure 7C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

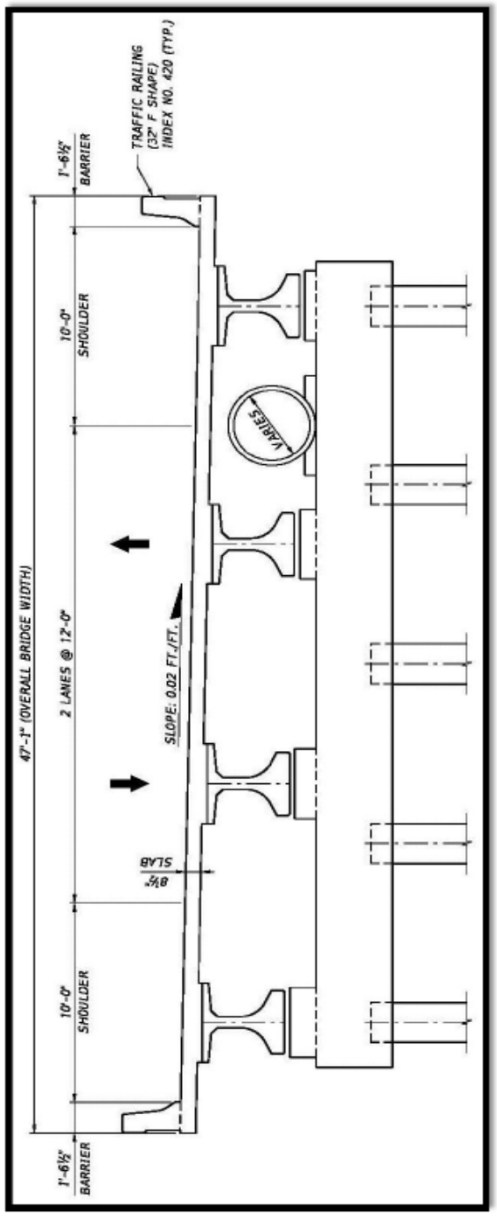
**VA No.**

**Item:** **Drainage Collection & Discharge**

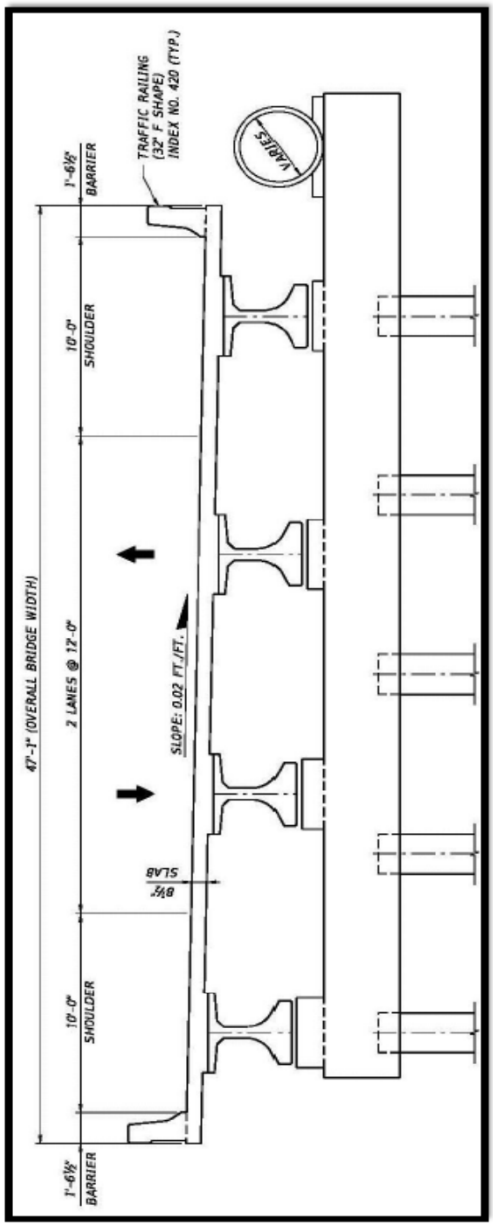
**CBA-2A**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES




1.6 TYPICAL SECTION – FRC DRAINAGE PIPE INSIDE




1.7 TYPICAL SECTION – FRC DRAINAGE PIPE OUTSIDE

# Sketch Worksheet

Figure 7C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

**VA No.**

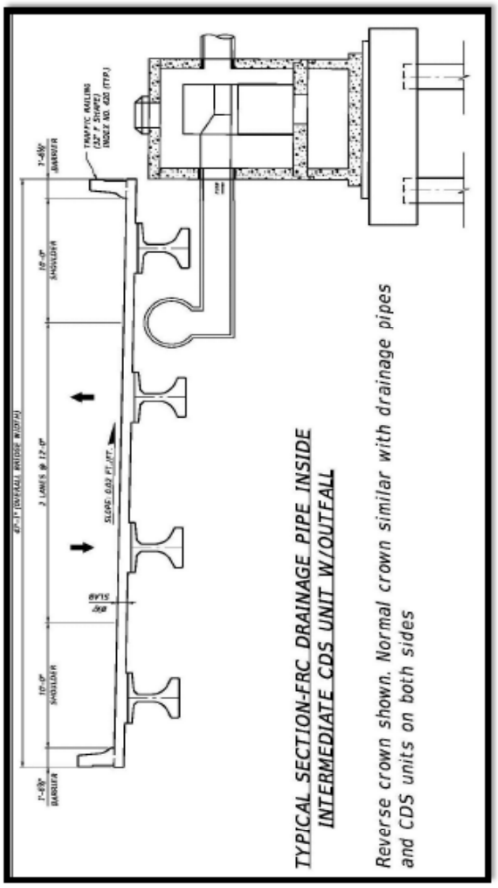
**Item:** **Drainage Collection & Discharge**

**CBA-2A**

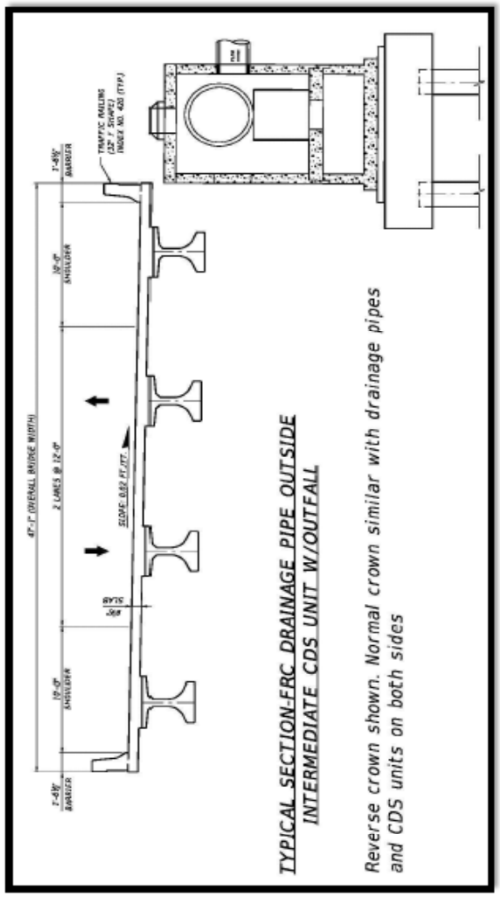
■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES

1.8 TYPICAL SECTION – FRC DRAINAGE PIPE INSIDE INTERMEDIATE CDS UNIT W/OUTFALL (APPLICABLE FOR OPTION 2 DUAL HIGH POINT WITH MID-STRUCTURE LOW POINT)




1.9 TYPICAL SECTION – FRC DRAINAGE PIPE OUTSIDE INTERMEDIATE CDS UNIT W/OUTFALL (APPLICABLE FOR OPTION 2 DUAL HIGH POINT WITH MID-STRUCTURE LOW POINT)



## Choosing By Advantage Matrix

Figure 7D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades

**Component:** Drainage Collection & Discharge

**Functions:** Restore Water Flow, Collect Water, Discharge Water

| Factors: | Alternative 1<br>2 Drainage Areas, Piping on 1 Side | | Alternative 2<br>3 Drainage Areas, Piping on 1 Side | | Alternative 3<br>2 Drainage Areas, Piping on 2 Sides | | Alternative 4<br>3 Drainage Areas, Piping on 2 Sides | | Alternative 5<br>4 Drainage Areas, Piping on 2 Sides | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Improving Visitor Services, Educational & Recreational Opportunities** | | | | | | | | | | |
| **Sub Factor: Improve Visitor Experience** | | | | | | | | | | |
| **Criterion:**<br>**- Aesthetics of visible drainage components** | Attribute:<br>Good aesthetics - CDS units will be located below grade | | Attribute:<br>Good aesthetics - CDS units will be located below grade | | Attribute:<br>Good aesthetics - CDS units will be located below grade | | Attribute:<br>Good aesthetics - CDS units will be located below grade | | Attribute:<br>Poor aesthetics - CDS units will be located above grade | |
| **Advantages:** | **Moderately better at improving aesthetics (CDS below grade)** | **75** | **Moderately better at improving aesthetics (CDS below grade)** | **75** | **Moderately better at improving aesthetics (CDS below grade)** | **75** | **Moderately better at improving aesthetics (CDS below grade)** | **75** | **No Advantage** | **0** |
| **Prevent Loss of Resources, Maintain / Improve Condition of Resources** | | | | | | | | | | |
| **Sub Factor: Protect / Improve Natural Resources** | | | | | | | | | | |
| **Criterion:**<br>**- Number of discharge points created (distributes impact)** | Attribute:<br>Creates 2 discharge points (1 at each end of the bridge) | | Attribute:<br>Creates 3 discharge points (1 at each end of the bridge and 1 at middle) | | Attribute:<br>Creates 2 discharge points (1 at each end of the bridge) | | Attribute:<br>Creates 3 discharge points (1 at each end of the bridge and 1 at middle) | | Attribute:<br>Creates 4 discharge points (1 at each end of the bridge and 2 at each central span) | |
| **Advantages:** | **No Advantage** | **0** | **Slightly better at protecting / improving natural resources via discharge points** | **50** | **No Advantage** | **0** | **Slightly better at protecting / improving natural resources via discharge points** | **50** | **Moderately better at protecting / improving natural resources via discharge points** | **100** |
| **Sub Factor: Limit Impacts to Cultural Resources** | | | | | | | | | | |
| **Criterion:**<br>**- No impact anticipated** | Attribute: | | Attribute: | | Attribute: | | Attribute: | | Attribute: | |
| **Protect Public and Employee Health, Safety, Welfare** | | | | | | | | | | |
| **Sub Factor: Limit impacts to vehicle passengers** | | | | | | | | | | |
| **Criterion:**<br>**- Ability to remove surface water** | Attribute:<br>Slopes drainage on deck to single side | | Attribute:<br>Slopes drainage on deck to single side | | Attribute:<br>Slopes drainage on deck to both sides | | Attribute:<br>Slopes drainage on deck to both sides | | Attribute:<br>Slopes drainage on deck to both sides | |
| **Advantages:** | **No Advantage** | **0** | **No Advantage** | **0** | **Moderately better at limiting vehicle passengers by removing surface water** | **95** | **Moderately better at limiting vehicle passengers by removing surface water** | **95** | **Moderately better at limiting vehicle passengers by removing surface water** | **95** |

## Choosing By Advantage Matrix

Figure 7D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades

**Component:** Drainage Collection & Discharge

**Functions:** Restore Water Flow, Collect Water, Discharge Water

| Factors: | Alternative 1<br>2 Drainage Areas, Piping on 1 Side | | Alternative 2<br>3 Drainage Areas, Piping on 1 Side | | Alternative 3<br>2 Drainage Areas, Piping on 2 Sides | | Alternative 4<br>3 Drainage Areas, Piping on 2 Sides | | Alternative 5<br>4 Drainage Areas, Piping on 2 Sides | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Improve Operational Efficiency, Reliability & Sustainability** | | | | | | | | | | |
| **Sub Factor: Minimize Operational Needs - Maintenance** | | | | | | | | | | |
| **Criterion:**<br>**- Quantity of components / access required to maintain system** | Attribute:<br>Good maintenance - creates less overall pipe length to maintain, CDS units on one side | | Attribute:<br>Good maintenance - creates less overall pipe length to maintain, CDS units on one side | | Attribute:<br>Fair maintenance - creates more overall pipe length to maintain, CDS units on two sides | | Attribute:<br>Fair maintenance - creates a little more overall pipe length to maintain, CDS units on two sides | | Attribute:<br>Fair maintenance - creates high overall pipe length to maintain, CDS units on two sides | |
| **Advantages:** | **Moderately better at minimizing maintenance needs / accessibility** | **80** | **Moderately better at minimizing maintenance needs / accessibility** | **80** | **Slightly better at minimizing maintenance needs / accessibility** | **20** | **Minimally better at minimizing maintenance needs / accessibility** | **10** | **No Advantage** | **0** |
| **Sub Factor: Support Sustainability** | | | | | | | | | | |
| **Criterion:**<br>**- Amount of materials (concrete and steel)** | Attribute:<br>Limits the opportunity for using sustainable materials | | Attribute:<br>Does create some opportunity for using sustainable materials | | Attribute:<br>Limits the opportunity for using sustainable materials | | Attribute:<br>Does create some opportunity for using sustainable materials | | Attribute:<br>Does create more opportunity for using sustainable materials | |
| **Advantages:** | **No Advantage** | **0** | **Slightly better at improving sustainable practices** | **20** | **No Advantage** | **0** | **Slightly better at improving sustainable practices** | **20** | **Moderately better at improving sustainable practices** | **35** |
| **Provide Cost Effective, Environmentally Responsible & Beneficial Development to NPS** | | | | | | | | | | |
| **Sub Factor: Improve Constructability** | | | | | | | | | | |
| **Criterion:**<br>**- Amount of large pipe and location to be installed** | Attribute:<br>Creates very high difficulty - very large pipe but single location | | Attribute:<br>Creates high difficulty - very large pipe in short length but single location | | Attribute:<br>Creates more difficulty - Uses smaller pipe in short length but double location | | Attribute:<br>Creates some difficulty - Uses smaller pipe in long length but double location | | Attribute:<br>Creates limited difficulty - Uses very smaller pipe in long length but double location | |
| **Advantages:** | **No Advantage** | **0** | **Slightly better at improving constructability (pipe and location)** | **15** | **Moderately better at improving constructability (pipe and location)** | **30** | **Much better at improving constructability (pipe and location)** | **45** | **Significantly better at improving constructability (pipe and location)** | **55** |
| **Total Importance of Advantages** | | **155** | | **240** | | **220** | | **295** | | **285** |
| **Initial Cost** | $4,992,600 | | $4,967,600 | | $4,942,700 | | $4,917,700 | | $4,892,700 | |
| **Life Cycle Cost** | $5,222,400 | | $5,197,400 | | $5,287,400 | | $5,453,900 | | $5,237,400 | |

## LIFE CYCLE COST ANALYSIS (LCCA)

Figure 7E

Project/Location: **Construct 2.60-Mile Tamiami Trail Bridge, Everglades**
Subject: **Drainage Collection & Discharge**
Description: **Restore Water Flow, Collect Water, Discharge Water**

Project Life Cycle = **50 Years**
Discount Rate = **1.1%**

| | | | | | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | | Alternative 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2 Drainage Areas, Piping on 1 Side | | 3 Drainage Areas, Piping on 1 Side | | 2 Drainage Areas, Piping on 2 Sides | | 3 Drainage Areas, Piping on 2 Sides | | 4 Drainage Areas, Piping on 2 Sides | |
| **INITIAL COSTS** | | **Quantity** | **UM** | **Cost / SF** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** |
| Alternative 1 | 2 Drainage Areas, Piping on 1 Side | 598,224 | Sq Ft | $8.35 | 4,992,600 | 4,992,600 | | | | | | | | |
| Alternative 2 | 3 Drainage Areas, Piping on 1 Side | 598,224 | Sq Ft | $8.30 | | | 4,967,600 | 4,967,600 | | | | | | |
| Alternative 3 | 2 Drainage Areas, Piping on 2 Sides | 598,224 | Sq Ft | $8.26 | | | | | 4,942,700 | 4,942,700 | | | | |
| Alternative 4 | 3 Drainage Areas, Piping on 2 Sides | 598,224 | Sq Ft | $8.22 | | | | | | | 4,917,700 | 4,917,700 | | |
| Alternative 5 | 4 Drainage Areas, Piping on 2 Sides | 598,224 | Sq Ft | $8.18 | | | | | | | | | 4,892,700 | 4,892,700 |
| **Total Initial Cost** | | | | | | **4,992,600** | | **4,967,600** | | **4,942,700** | | **4,917,700** | | **4,892,700** |
| **REPLACEMENT COST/ SALVAGE VALUE** | | | | | | | | | | | | | | |
| **Description** | | | **Year** | **PW Factor** | | | | | | | | | | |
| Replace pipe | Not Anticipated | | 0 | 1.0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Replacement/Salvage Costs** | | | | | | **0** | | **0** | | **0** | | **0** | | **0** |
| **ANNUAL COSTS** | | | **Diff.** | | | | | | | | | | | |
| **Description** | | **Cost** | **Escl. %** | **PWA** | | | | | | | | | | |
| Cleaning | | (contracted) | 0.00% | 38.301 | 6,000 | 229,808 | 6,000 | 229,808 | 9,000 | 344,712 | 9,000 | 344,712 | 9,000 | 344,712 |
| Operations & Maintenance | | | 0.00% | 38.301 | 0 | 0 | 0 | 0 | 0 | 0 | 5,000 | 191,506 | 0 | 0 |
| **Total Annual Costs (Present Worth)** | | | | | | **229,800** | | **229,800** | | **344,700** | | **536,200** | | **344,700** |
| **Total Life Cycle Costs (Present Worth)** | | | | | | **5,222,400** | | **5,197,400** | | **5,287,400** | | **5,453,900** | | **5,237,400** |
| **Total Life Cycle Costs (Annualized)** | | | **PP Factor** | **0.0261** | **136,350** | **Per Year** | **135,698** | **Per Year** | **138,047** | **Per Year** | **142,394** | **Per Year** | **136,742** | **Per Year** |

# Choosing By Advantages

Figure 7F

**Construct 2.60-Mile Tamiami Trail Bridge, Everglades**

Drainage Collection & Discharge

## Total Importance Allocation to Advantages Scale

| | |
|---|---|
| | **Paramount Advantage** |
| **100** | Moderately better at protecting / improving natural resources via discharge points |
| **95** | Moderately better at limiting vehicle passengers by removing surface water |
| **90** | |
| **85** | |
| **80** | Moderately better at minimizing maintenance needs / accessibility |
| **75** | Moderately better at improving aesthetics (CDS below grade) |
| **70** | |
| **65** | |
| **60** | |
| **55** | Significantly better at improving constructability (pipe and location) |
| **50** | |
| **50** | |
| **40** | |
| **45** | |
| **35** | Moderately better at improving sustainable practices |
| **30** | |
| **20** | |
| **15** | |
| **10** | |
| **5** | |
| **0** | No Advantage |

Figure 7G

# CBA Importance to Initial Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, Drainage Collection & Discharge

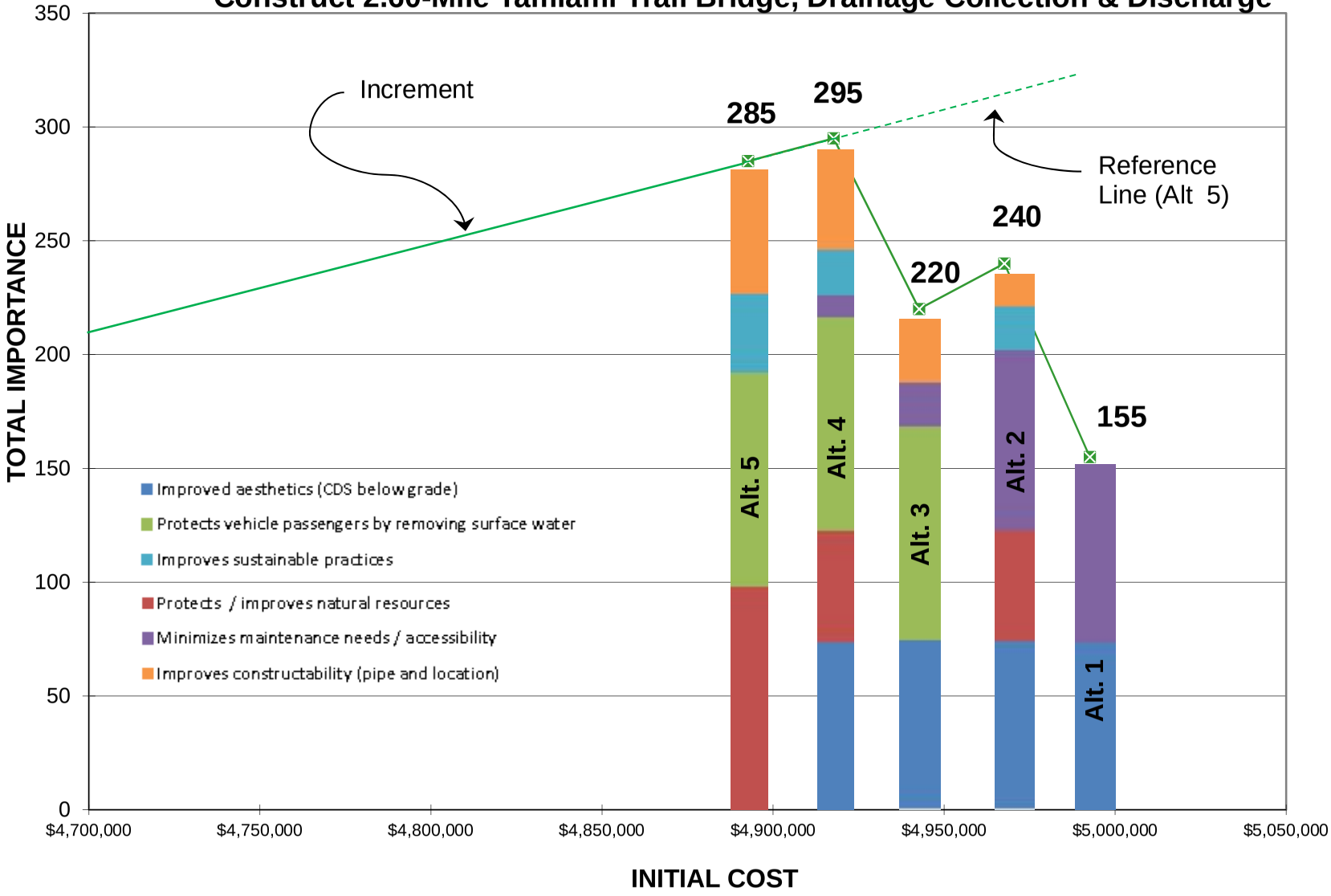
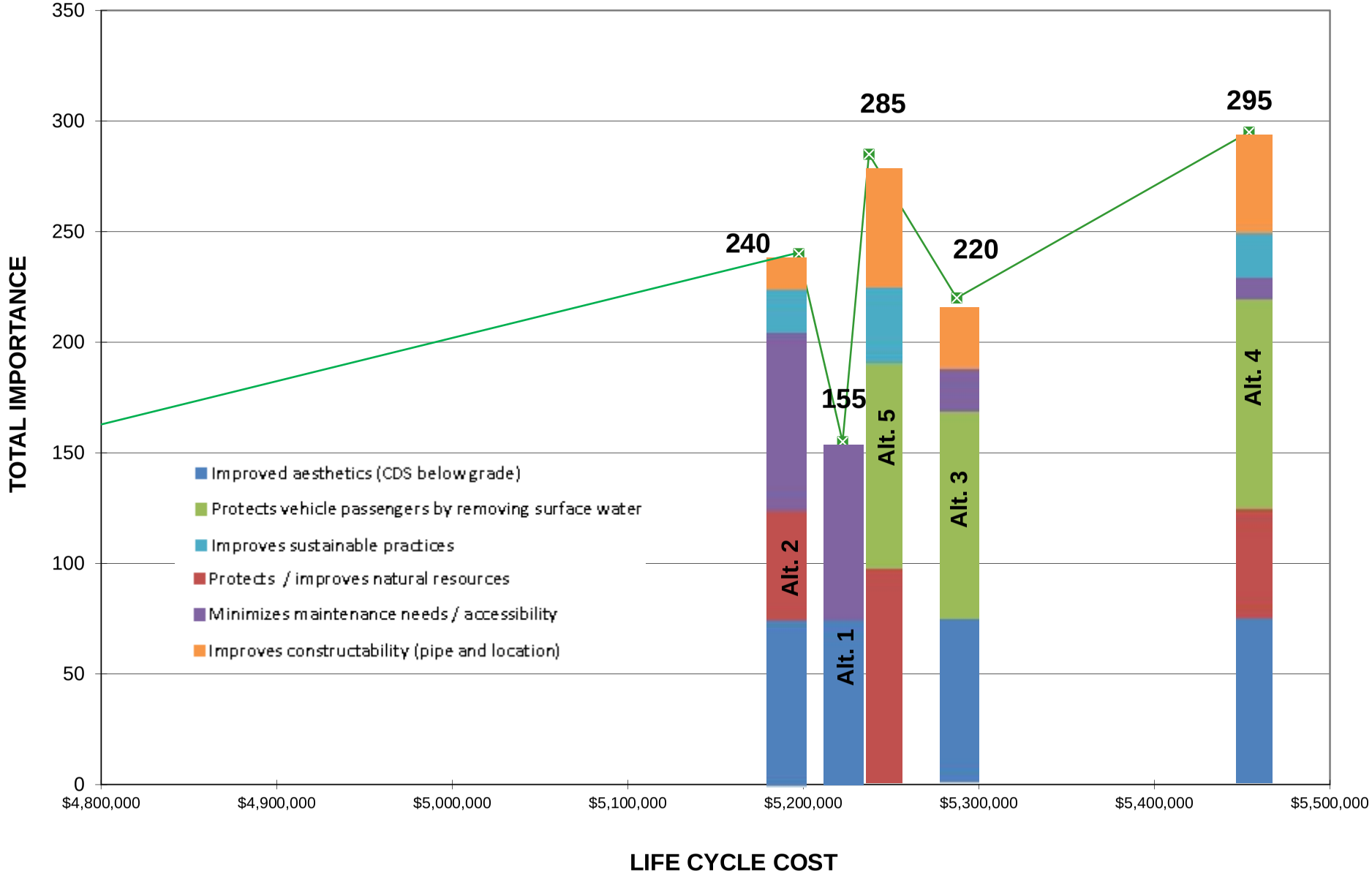


Figure 7H

# CBA Importance to Life Cycle Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, Drainage Collection & Discharge



# Value Analysis Recommendation-Choosing By Advantages

Figure 8A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park** **VA No.**
**Item:** **Bridge Drainage Water Treatment** **CBA 2B**

## Original Design

The VA team reviewed alternatives developed by the design team as follows:

• Alternative 1: 100% Minimum Treatment, 8 CDS Units, No Ponds;

• Alternative 2: 100% Treatment, Using Existing Roadbed;

• Alternative 3: 100% of Minimum Req'mt, 7 CDS Units and Ponds Treatment; and,

• Alternative 4: Maximum Treatment (113%) Using 100% CDS + Maximum Pond Space Available

## Preferred Alternative

The VA team selected alternative 4 as the preferred based on the significance of protecting the environment and number of advantages listed. See the following page for reconsideration ideas.

**Advantages of Alternative 4:**

- Much better at protecting the environment
- Much better connectivity
- Much better opportunity for DEP permit approval

## Life Cycle Cost Summary

| | Initial Cost | Life Cycle Cost |
|---|---|---|
| **Proposed Design (Preferred Alternative 4)** | **Not Estimated** | **Not Estimated** |

☐ **Original Design** ■ **Proposed Design**

Alternative 4

Consider the following ideas as part of the preferred alternative 4:
*Numbers refer to idea number.*

**37. Use sheet piling for pond design D)**

**38. Explore additional locations for ponds, for example:**

- **a. Wetlands adjacent to Everglades Safari Park (D)**
- **b. Parking at Everglades Safari Park (D)**

**41. Retrofit One-Mile Bridge (D)**

**42. Treat Safari parking lot runoff, consider agreement for Safari to perform maintenance (D)**

## Sketch Worksheet

Figure 8C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**

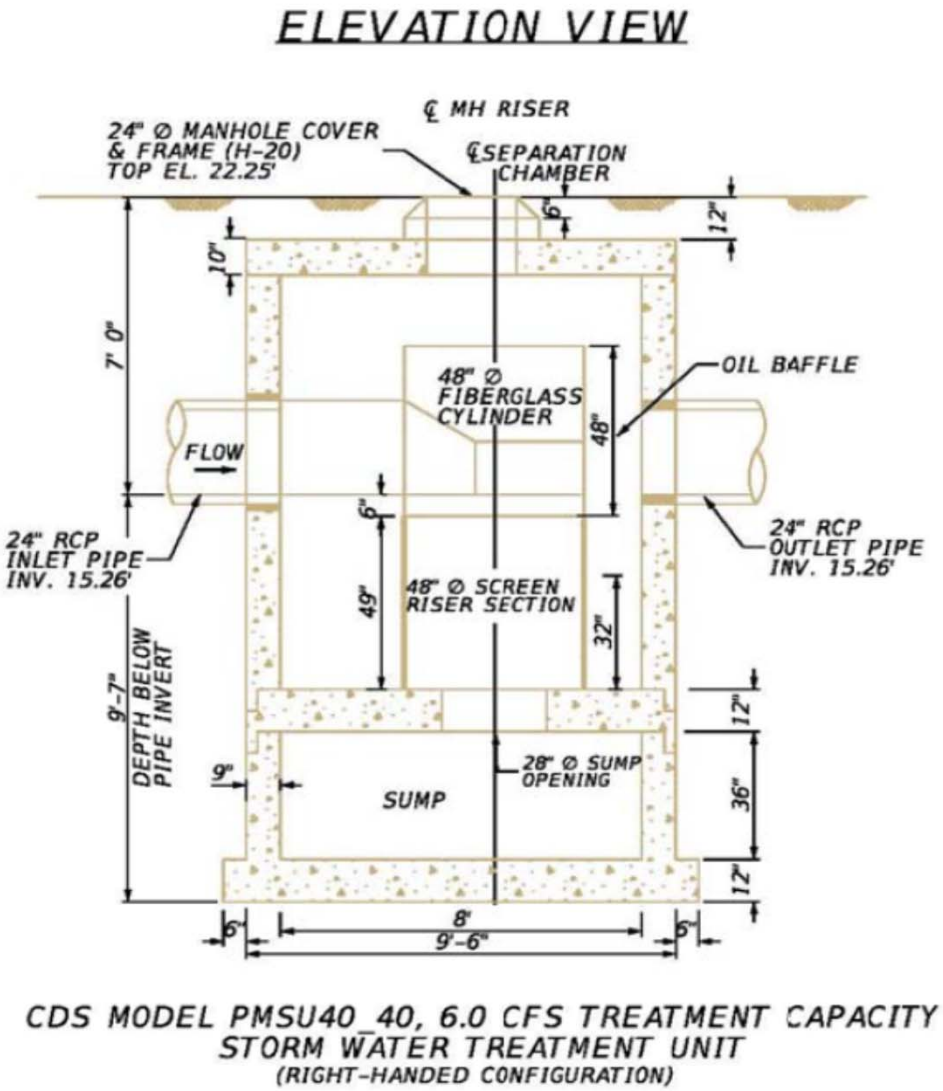
**VA No.**

**Item:** **Bridge Drainage Water Treatment**

**CBA 2B**

■ **Original Design** ☐ **Proposed Design**

Alternative 1



## Choosing By Advantages Matrix

Figure 8D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades National Park**

**Component:** **Bridge Drainage Water Treatment**
**Function:** **Restore Water Flow, Treat Water**

Preferred Alternative

| Factors: | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| | **100% Minimum Treatment, 8 CDS Units, No Ponds** | **100% Treatment, Using Existing Roadbed** | **100%of Minimum Req'mt, 7 CDS Units and Ponds Treatment** | **Maximum Treatment (113%) Using 100% CDS + Maximum Pond Space Available** |
| **Protect Natural & Cultural Resources** | | | | |
| **Sub Factor: Protection of the Environment** | | | | |
| ***Attributes:*** | 100% Minimum Treatment | 100% Minimum Treatment | 100% Minimum Treatment | 113% Maximum Treatment |
| ***Advantages:*** | **------** | **------** | **------** | **Much better at protecting the environment** |
| **Sub Factor: Degree of Connectivity** | | | | |
| ***Attributes:*** | Good Connectivity | Moderate Connectivity | Good Connectivity | Good Connectivity |
| ***Advantages:*** | **Much better connectivity** | **------** | **Much better connectivity** | **Much better connectivity** |
| **Improve The Efficiency, Reliability & Sustainability of Park Operations** | | | | |
| **Sub Factor: Maintainability/ Sustainability** | | | | |
| ***Attributes:*** | Moderately easy to maintain | Moderately easy to maintain | Moderate to maintain | Moderate to maintain |
| ***Advantages:*** | **Slightly easier to maintain** | **Slightly easier to maintain** | **------** | **------** |
| **Provide Cost Effective, Environmentally Responsible & Beneficial Development to NPS** | | | | |
| **Sub Factor: DEP Permit Approval** | | | | |
| ***Attributes:*** | DEP Permit Not Approved | DEP Permit May Not Be Approved | DEP Permit May Not Be Approved | DEP Permit Potentially Approved |
| ***Advantages:*** | **------** | **Moderately better opportunity for DEP permit approval** | **Moderately better opportunity for DEP permit approval** | **Much better opportunity for DEP permit approval** |
| | Dismissed, due to DEP requirement for some pond retention | Dismissed, due to loss of some connectivity, unacceptable to NPS | | |
| **Initial Cost** | Not Estimated | Not Estimated | Not Estimated | Not Estimated |

The VA team selected alternative 4 as the preferred based on the significance of protecting the environment and number of advantages listed.

# Value Analysis Recommendation-Choosing By Advantages

Figure 9A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP** **VA No.**
**Item:** **Everglades Safari Down Ramp** **CBA-3**

## Original Design

The VA team reviewed the original alternatives 1-4 studied prior to this analysis. This value analysis started with the selected alternative 4 and added the following:

• Alternative 4: South Down Ramp;

• Alternative 5: Right In, Right Out;

• Alternative 6: Tight Diamond;

• Alternative 7: Left Lane Down Ramp (Dismissed due to safety concerns); and

• Alternative 8: Down Ramp Incorporated Into Bridge (with warning lights and added left turn lane).

## Preferred Alternative

Based on the CBA analysis, the VA team identified the Alternative 8 as the preferred alternative. See the following page for reconsideration ideas.
A **sensitivity analysis** was performed by lowering the protection of natural resources advantage to 0 points, reducing the maintenance advantage by half to 40 points, and reducing the business access advantage from 100 to 0 points. Alternative 8 remained the preferred alternative.

**Advantages of Preferred Alternative:**

- Significantly better at improving visitor experience
- Significantly better at protecting / improving Natural Resources
- Moderately better at limiting impacts to Cultural Resources
- Significantly better at support sustainable practices
- Moderately better at limiting safety risks to vehicle passengers
- Much better at minimizing maintenance needs
- Much better at limiting degree risks to change EIS
- Significantly better at limiting time need to obtain FDOT and COE / SFWMD permits
- Slightly better at improving constructability needs (easy, staging, business access)
- Significantly better at maintaining access to business

## Life Cycle Cost Summary

| | Initial Cost | Life Cycle Cost |
|---|---|---|
| **Proposed Design (Preferred Alternative 8)** | **6,782,000** | **7,040,000** |

# Sketch Worksheet

Figure 9B

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP** **VA No.**

**Item: Everglades Safari Down Ramp** **CBA-3**

☐ **Original Design** ■ **Proposed Design**

Reconsideration Alternative

Consider the following ideas as part of the prferred alternative 8:
Numbers refer to the creativity listing.

49. Add vista level below bridge and above parking – could be wood bridge/ramp
52. Add sheet piling along canal for MOT during construction
53. Have temporary parking for Safari and shuttle visitors to allow use of parking area for construction to improve MOT
55. Use solar powered flashing signal
56. Retain sheet piling permanently to provide left turn lane
58. Temporarily use area near business for MOT and parking

## Sketch Worksheet

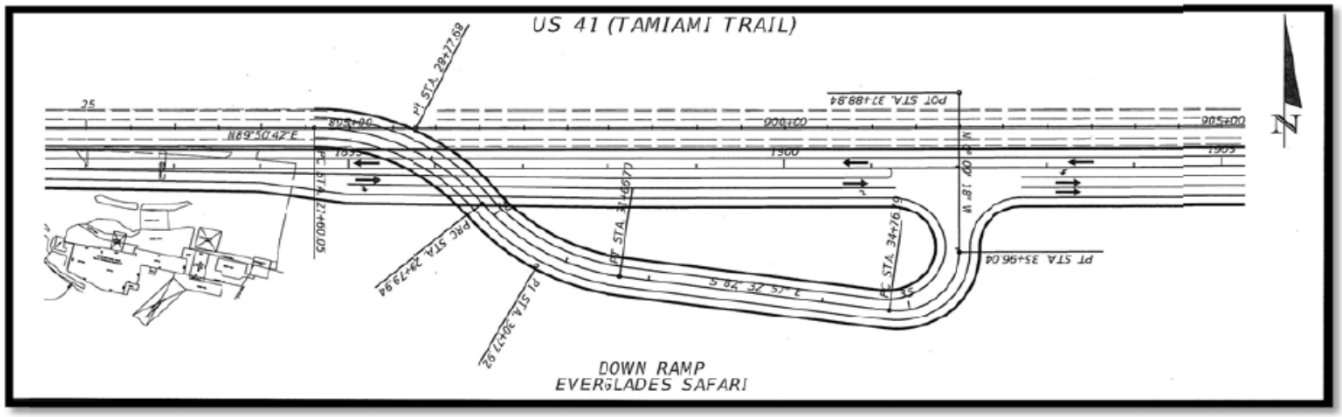
Figure 9C

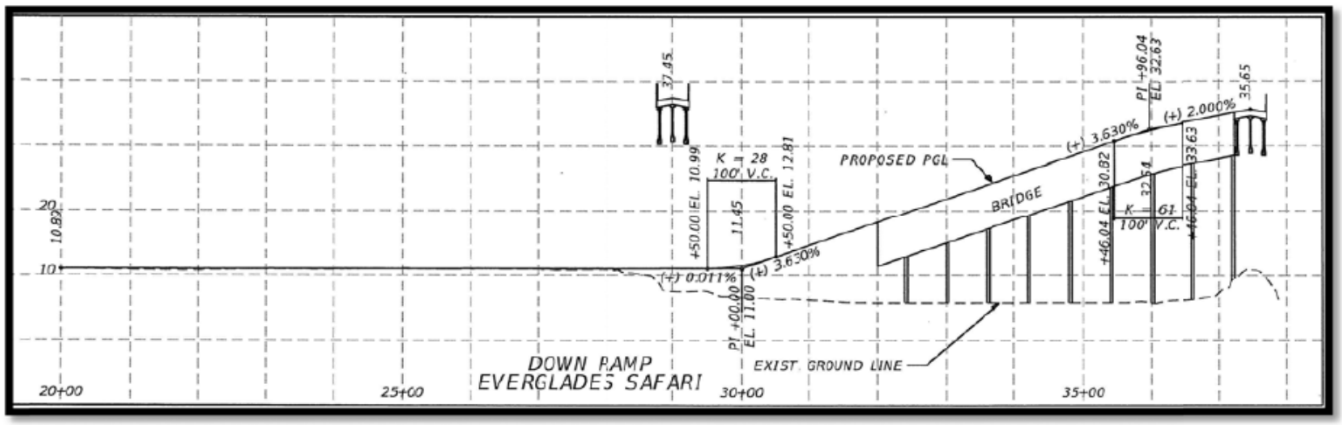
**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP** **VA No.**

**Item: Everglades Safari Down Ramp** **CBA-3**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 4



## Sketch Worksheet

Figure 9C

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

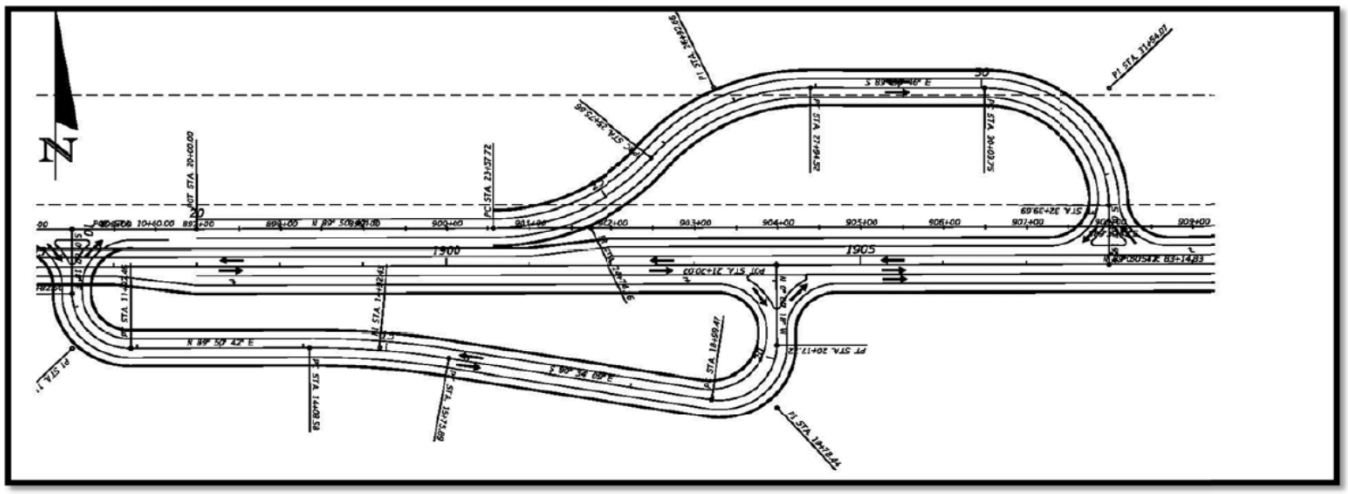
**VA No.**

**Item: Everglades Safari Down Ramp**

**CBA-3**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 5



## Sketch Worksheet

Figure 6D

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

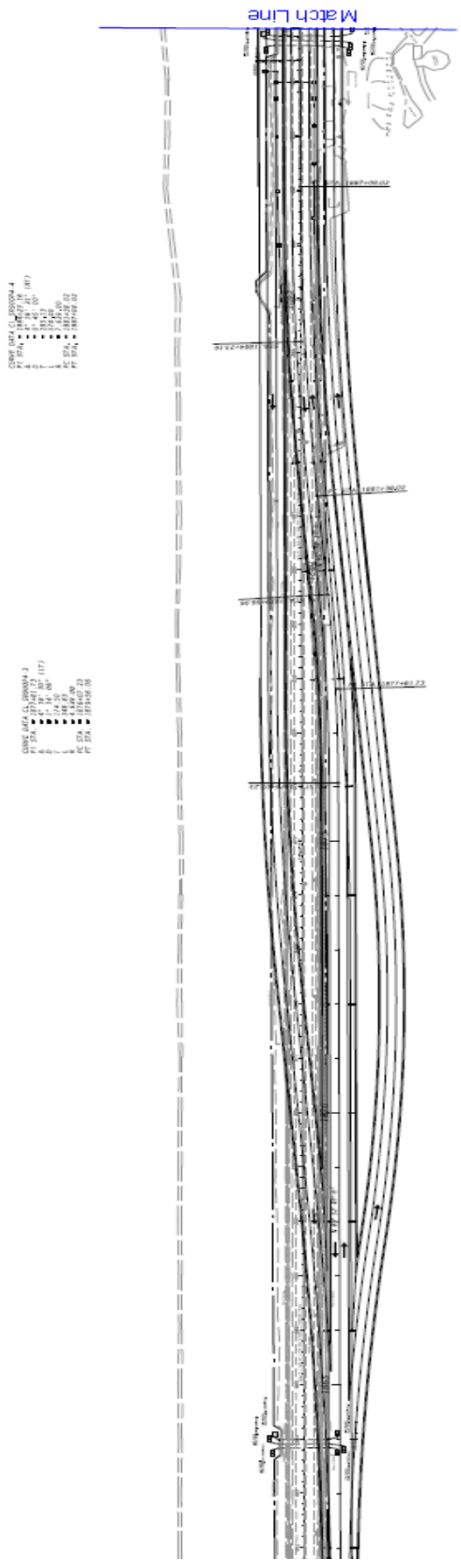
**VA No.**

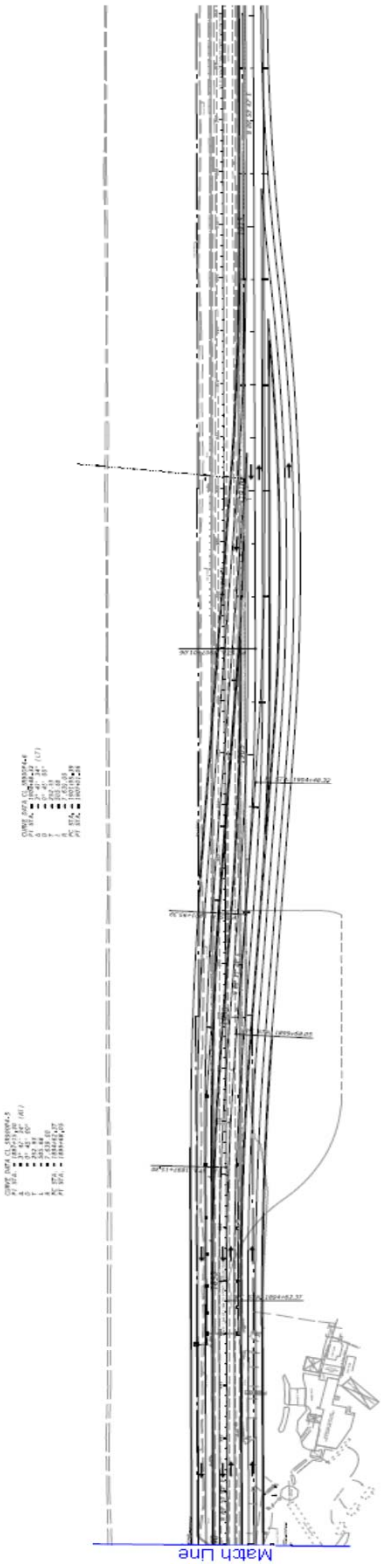
**Item: Everglades Safari Down Ramp**

**CBA-3**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVES 6 & 7 (Only Profile Changes)



## Sketch Worksheet

Figure 9C

**Project: Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

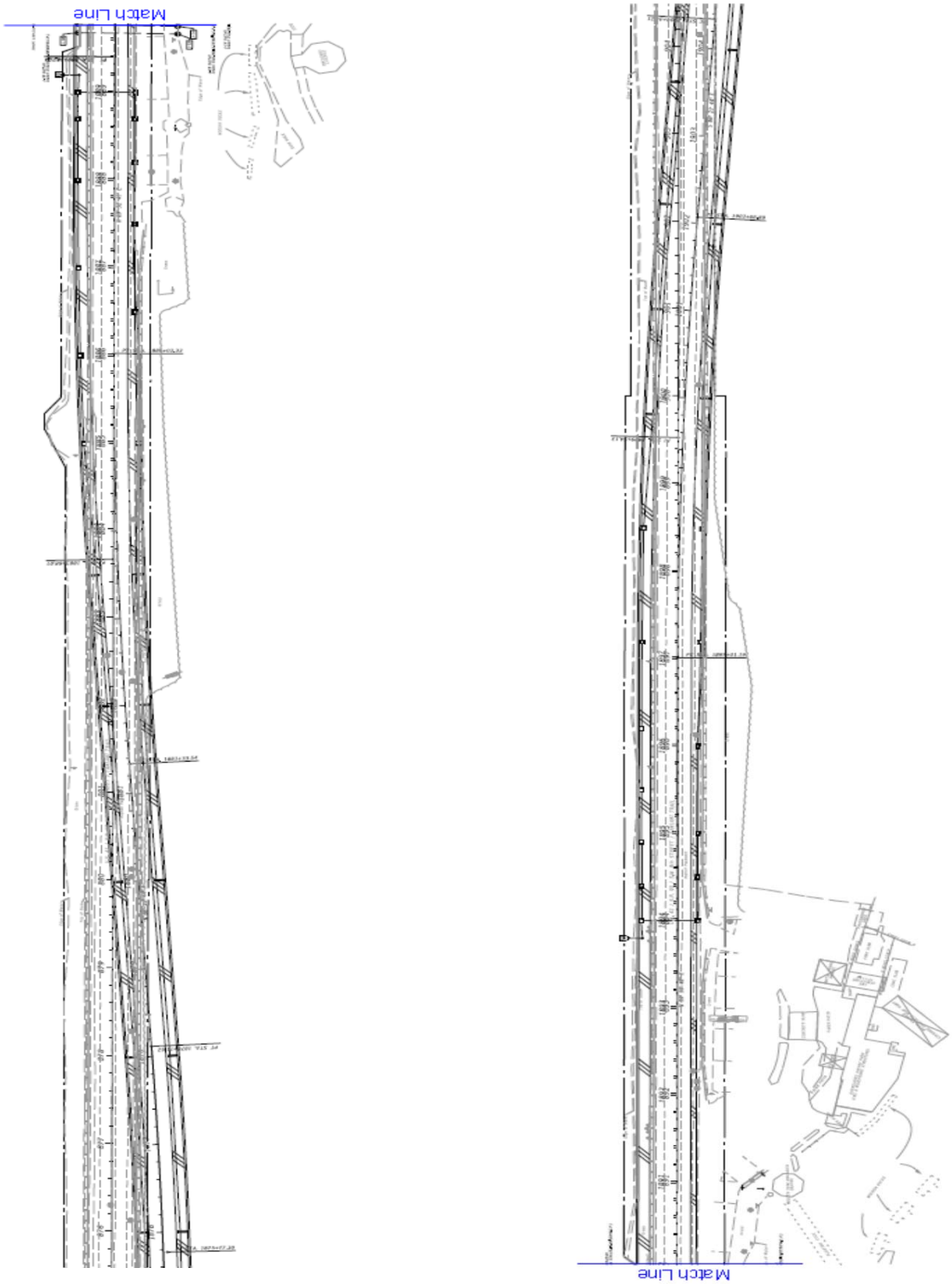
**VA No.**

**Item: Everglades Safari Down Ramp**

**CBA-3**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 8



**Choosing By Advantages** **Matrix** Figure 9D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

**Component:** **Everglades Safari Down Ramp**

**Functions:** **Restore Water Flow, Create Access**

| Factors: | Alternative 4<br>South Down Ramp | | Alternative 5<br>Right In, Right Out | | Alternative 6<br>Tight Diamond | | Alternative 8<br>Down Ramp Incorporated Into Bridge (with warning lights and added left | |
|---|---|---|---|---|---|---|---|---|
| **Improving Visitor Services, Educational & Recreational Opportunities** | | | | | | | | |
| **Sub Factor: Improve Visitor Experience** | | | | | | | | |
| **Criterion:**<br>**- Aesthetics / Fit within the environment** | Attribute:<br>Creates more amount of elevated surface (one ramps and one bridge) | | Attribute:<br>Creates a lot more amount of elevated surface (two ramps and one bridge) | | Attribute:<br>Creates the most amount of elevated surface (four ramps and one bridge) | | Attribute:<br>Creates no elevated surface (no ramps or bridge at this area) | |
| **Criterion:**<br>**- Vista created** | Attribute:<br>Creates a surface at 33' elevation (highest point) for vistas | | Attribute:<br>Creates a surface at 33' elevation (highest point) for vistas | | Attribute:<br>Creates a surface at 33' elevation (highest point) for vistas | | Attribute:<br>Creates two surfaces at 23' elevation (highest point) for vistas | |
| **Advantages:** | **Moderately better at improving visitor experience** | **30** | **Slightly better at improving visitor experience** | **15** | **No advantage** | **0** | **Significantly better at improving visitor experience** | **55** |
| **Prevent loss of resources, Maintain / Improve Condition of Resources** | | | | | | | | |
| **Sub Factor: Protect / Improve Natural Resources** | | | | | | | | |
| **Criterion:**<br>**- Amount (acres) of Vegetation / Wetland Impact (biology)** | Attribute:<br>Creates some impact on vegetation / wetland impact (one down ramps) | | Attribute:<br>Creates most impact on vegetation / wetland impact (two down ramps) | | Attribute:<br>Creates more impact on vegetation / wetland impact (long speed transition distances) | | Attribute:<br>Creates little impact on vegetation / wetland impact (no down ramps, extension of the existing everglades) | |
| **Criterion:**<br>**- Ecological connectivity from north to south (linear feet of bridged area)** | Attribute:<br>Creates almost no loss of connectivity (bridge is allowing free movement of water except at one down ramp) | | Attribute:<br>Creates very little loss of connectivity (bridge is allowing free movement of water except at two down ramps) | | Attribute:<br>Creates less connectivity (maintains more of the existing roadway for long approach lanes outside the Everglades Safari limits) | | Attribute:<br>Creates a little less connectivity (maintains some of the existing roadway outside the Everglades Safari limits) | |
| **Criterion:**<br>**- Wildlife mortality rate** | Attribute:<br>Creates almost no change to wildlife mortality rate (bridge is allowing free movement of water except at one down ramp) | | Attribute:<br>Creates very little change to wildlife mortality rate (bridge is allowing free movement of water except at two down ramps) | | Attribute:<br>Creates more change to wildlife mortality rate (maintains more of the existing roadway for long approach lanes outside the Everglades Safari limits) | | Attribute:<br>Creates some change to wildlife mortality rate (maintains some of the existing roadway outside the Everglades Safari limits) | |
| **Criterion:**<br>**- Storm drainage (conveyance and treatment)** | Attribute:<br>Offers very little conveyance opportunities (single bridge) and almost no area for treatment | | Attribute:<br>Offers very little conveyance opportunities (single bridge) and almost no area for treatment | | Attribute:<br>Offers limited conveyance opportunities (single bridge) and allows some area for treatment | | Attribute:<br>Offers very good conveyance opportunities (two bridges) and allows some area for treatment | |
| **Criterion:**<br>**- Hydrology changes** | Attribute:<br>The differences between the alternatives will be so minor that it will have no measurable impact on the hydrology; thus no advantage between alternatives | | | | | | | |
| **Advantages:** | **Significantly better at protecting / improving Natural Resources** | **85** | **Slightly better at protecting / improving Natural Resources** | **20** | **No advantage** | **0** | **Significantly better at protecting / improving Natural Resources** | **85** |
| **Sub Factor: Limit Impacts to Cultural Resources** | | | | | | | | |
| **Criterion:**<br>**- Amount of Tamiami Trail impacted (linear feet)** | Attribute:<br>Impacts some of the Tamiami Trail | | Attribute:<br>Impacts a little more of the Tamiami Trail | | Attribute:<br>Impacts more of the Tamiami Trail | | Attribute:<br>Impacts less of the Tamiami Trail | |
| **Advantages:** | **Slightly better at limiting impacts to Cultural Resources** | **10** | **Slightly better at limiting impacts to Cultural Resources** | **10** | **No advantage** | **0** | **Moderately better at limiting impacts to Cultural Resources** | **30** |

**Choosing By Advantages** **Matrix** Figure 9D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

**Component:** **Everglades Safari Down Ramp**

**Functions:** **Restore Water Flow, Create Access**

| Factors: | Alternative 4<br>South Down Ramp | | Alternative 5<br>Right In, Right Out | | Alternative 6<br>Tight Diamond | | Alternative 8<br>Down Ramp Incorporated Into Bridge (with warning lights and added left | |
|---|---|---|---|---|---|---|---|---|
| **Sub Factor: Support Sustainability** | | | | | | | | |
| **Criterion:**<br>**- Amount of materials (concrete and steel)** | Attribute:<br>Uses a much more material | | Attribute:<br>Uses a high amount of material | | Attribute:<br>Uses a very high amount of material | | Attribute:<br>Uses a very low amount of material | |
| **Criterion:**<br>**- Amount of recycled content used** | Attribute:<br>Allows limited use of recycled content | | Attribute:<br>Allows limited use of recycled content | | Attribute:<br>Allows limited use of recycled content | | Attribute:<br>Allows high use of recycled content (concrete can be used a road base) | |
| **Criterion:**<br>**- Transpiration distance** | Attribute:<br>There is recognized difference between the alternatives; thus no advantage between alternatives | | | | | | | |
| **Advantages:** | **Moderately better at support sustainable practices** | **8** | **Slightly better at support sustainable practices** | **4** | **No advantage** | **0** | **Significantly better at support sustainable practices** | **15** |
| **Protect Public and Employee Health, Safety, Welfare** | | | | | | | | |
| **Sub Factor: Limit impacts to vehicle passengers** | | | | | | | | |
| **Criterion:**<br>**- Sight distance** | Attribute:<br>Short sight distance | | Attribute:<br>Short sight distance | | Attribute:<br>Long sight distance | | Attribute:<br>Long sight distance | |
| **Criterion:**<br>**- Cross traffic** | Attribute:<br>Does have cross traffic at bridge | | Attribute:<br>Does not have cross traffic at bridge | | Attribute:<br>Does not have cross traffic at bridge | | Attribute:<br>Does have cross traffic at grade | |
| **Criterion:**<br>**- Curve needed** | Attribute:<br>Creates tight curve | | Attribute:<br>Creates tight curve | | Attribute:<br>Creates no curve | | Attribute:<br>Creates no curve | |
| **Advantages:** | **No advantage** | **0** | **Slightly better at limiting safety risks to vehicle passengers** | **20** | **Much better at limiting safety risks to vehicle passengers** | **65** | **Moderately better at limiting safety risks to vehicle passengers** | **50** |
| **Improve Operational Efficiency, Reliability & Sustainability** | | | | | | | | |
| **Sub Factor: Minimize Operational Needs - Maintenance** | | | | | | | | |
| **Criterion:**<br>**- Maintenance needs (down ramps)** | Attribute:<br>Has 1 ramp need to maintain | | Attribute:<br>Has 2 ramps need to maintain | | Attribute:<br>Has 4 ramps need to maintain | | Attribute:<br>Does not have down ramps need to maintain | |
| **Criterion:**<br>**- Maintenance needs (drainage issues)** | Attribute:<br>Drainage treatment is up at the bridge, needs added work | | Attribute:<br>Drainage treatment is up at the bridge, needs added work | | Attribute:<br>Creates drainage opportunities at grade | | Attribute:<br>Creates drainage opportunities at grade | |
| **Advantages:** | **Moderately better at minimizing maintenance needs** | **40** | **Slightly better at minimizing maintenance needs** | **20** | **No advantage** | **0** | **Much better at minimizing maintenance needs** | **80** |
| **Provide Cost Effective, Environmentally Responsible & Beneficial Development to NPS** | | | | | | | | |
| **Sub Factor: Limiting Potential Impacts to Project Schedule** | | | | | | | | |
| **Criterion:**<br>**- Limit changes to EIS Model (degree of complexity to change)** | Attribute:<br>Very low degree of risk for changes | | Attribute:<br>High degree of risk for changes (may require modifications) | | Attribute:<br>Some degree of risk for changes | | Attribute:<br>Low degree of risk for changes | |
| **Advantages:** | **Significantly better at limiting degree risks to change EIS** | **20** | **No Advantage** | **0** | **Slightly better at limiting degree risks to change EIS** | **4** | **Much better at limiting degree risks to change EIS** | **12** |

**Choosing By Advantages** **Matrix** Figure 9D

**Project/Location:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

**Component:** **Everglades Safari Down Ramp**

**Functions:** **Restore Water Flow, Create Access**

| Factors: | Alternative 4<br>South Down Ramp | | Alternative 5<br>Right In, Right Out | | Alternative 6<br>Tight Diamond | | Alternative 8<br>Down Ramp Incorporated Into Bridge (with warning lights and added left | |
|---|---|---|---|---|---|---|---|---|
| **Sub Factor: Type of Permits - Time Required** | | | | | | | | |
| **Criterion:**<br>**- Florida DOT (time required)** | Attribute:<br>Should require more time to obtain FDOT permit | | Attribute:<br>Should require more time to obtain FDOT permit | | Attribute:<br>Should require more time to obtain FDOT permit | | Attribute:<br>Should require less time to obtain FDOT permit | |
| **Criterion:**<br>**- Corps of Engineers / South Florida Water Management District** | Attribute:<br>Anticipate this alternative to require short time to obtain permit (fairly easy) | | Attribute:<br>Anticipate this alternative to require very long time to obtain permit (very difficult) | | Attribute:<br>Anticipate this alternative to require short time to obtain permit (fairly easy) | | Attribute:<br>Anticipate this alternative to require some time to obtain permit (limited difficulties) | |
| **Advantages:** | **Much better at limiting time need to obtain FDOT and COE / SFWMD permits** | **55** | **No Advantage** | **0** | **Much better at limiting time need to obtain FDOT and COE / SFWMD permits** | **55** | **Significantly better at limiting time need to obtain FDOT and COE / SFWMD permits** | **70** |
| **Sub Factor: Improve Constructability** | | | | | | | | |
| **Criterion:**<br>**- Ease of construction** | Attribute:<br>Creates some difficulty of construction needed (some quantity and elevated location) | | Attribute:<br>Creates more difficulty of construction needed (more quantity and elevated location) | | Attribute:<br>Creates high difficulty of construction needed (high quantity and elevated location) | | Attribute:<br>Easier construction needed (limited quantity and limited elevation location) | |
| **Criterion:**<br>**- Staging required (materials, location)** | Attribute:<br>Creates some difficulty in staging needed (some materials and elevated location) | | Attribute:<br>Creates more difficulty in staging needed (more materials and elevated location) | | Attribute:<br>Creates high difficulty in staging needed (high materials and elevated location) | | Attribute:<br>Easier construction needed (limited materials and limited elevation location) | |
| **Criterion:**<br>**- Maintenance of Traffic - MOT - needed to maintain business access** | Attribute:<br>Allows very good opportunity to maintain access to business (limited MOT needed) | | Attribute:<br>Allows some difficult opportunity to maintain access to business (very high MOT needed) | | Attribute:<br>Allows some difficult opportunity to maintain access to business (very high MOT needed) | | Attribute:<br>Allows very difficult opportunity to maintain access to business (very high MOT needed) | |
| **Advantages:** | **Much better at improving constructability needs (easy, staging, business access)** | **45** | **No Advantage** | **0** | **Slightly better at improving constructability needs (easy, staging, business access)** | **10** | **Slightly better at improving constructability needs (easy, staging, business access)** | **10** |
| **Sub Factor: Ability to Maintain Business Access** | | | | | | | | |
| **Criterion:**<br>**- Number of parking spaces** | Attribute:<br>Allows for potential added parking spaces (approximately 10% or 6 spaces) | | Attribute:<br>Allows for potential added parking spaces (approximately 10% or 6 spaces) | | Attribute:<br>Allows for potential added parking spaces (approximately 10% or 6 spaces) | | Attribute:<br>Does not allow for potential added parking spaces | |
| **Criterion:**<br>**- Partner relationship** | Attribute:<br>Does not maintain direct access to business (does create potential flyby of business) | | Attribute:<br>Does not maintain direct access to business (does create potential flyby of business) | | Attribute:<br>Does not maintain direct access to business (does create potential flyby of business) | | Attribute:<br>Maintains direct access to business (no flyby of business) | |
| ***Advantages:*** | **No Advantage** | **0** | **No Advantage** | **0** | **No Advantage** | **0** | **Significantly better at maintaining access to business** | **100** |
| **Total Importance of Advantages** | | **293** | | **89** | | **134** | | **507** |
| **Initial Cost** | $16,512,000 | | $25,253,000 | | $33,994,000 | | $6,782,000 | |
| **Life Cycle Cost** | $17,140,000 | | $26,214,000 | | $35,287,000 | | $7,040,000 | |

## LIFE CYCLE COST ANALYSIS (LCCA)

Figure 9E

Project/Location: **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**
Subject: **Everglades Safari Down Ramp**
Description: **Restore Water Flow, Create Access**

Project Life Cycle = **50 Years**

Discount Rate = **1.1%**

| | | | | | Alternative 4 South Down Ramp | | Alternative 5 Right In, Right Out | | Alternative 6 Tight Diamond | | Alternative 8 Down Ramp Incorporated Into Bridge (with warning lights and added left turn lane) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **INITIAL COSTS** | | **Quantity** | **UM** | **Cost / SF** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** |
| Alternative 4 | South Down Ramp | 32,150 | Sq Ft | $271.88 | 8,741,000 | 8,741,000 | | | | | | |
| | 1,200 Lin Ft of Bridge | 56,400 | Sq Ft | $137.79 | 7,771,000 | 7,771,000 | | | | | | |
| Alternative 5 | Right In, Right Out | 64,300 | Sq Ft | $271.88 | 0 | 0 | 17,482,000 | 17,482,000 | | | | |
| | 1,200 Lin Ft of Bridge | 56,400 | Sq Ft | $137.79 | | | 7,771,000 | 7,771,000 | | | | |
| Alternative 6 | Tight Diamond | 96,450 | Sq Ft | $271.88 | | | | | 26,223,000 | 26,223,000 | | |
| | 1,200 Lin Ft of Bridge | 56,400 | Sq Ft | $137.79 | | | | | 7,771,000 | 7,771,000 | | |
| Alternative 8 | Down Ramp Incorporated Into Bridge | - | Sq Ft | $0.00 | | | | | | | | |
| | 1,200 Lin Ft of Bridge (approaches) | 16,920 | Sq Ft | $137.79 | | | | | | | 2,331,000 | 2,331,000 |
| | Raise existing roadway | 32,150 | Sq Ft | $47.00 | | | | | | | 1,511,000 | 1,511,000 |
| | Add left turn lane | 11,253 | Sq Ft | $47.00 | | | | | | | 529,000 | 529,000 |
| | MOT Premium | 32,150 | Sq Ft | $75.00 | | | | | | | 2,411,000 | 2,411,000 |
| **Total Initial Cost** | | | | | | **16,512,000** | | **25,253,000** | | **33,994,000** | | **6,782,000** |
| **REPLACEMENT COST/ SALVAGE VALUE** | | | | | | | | | | | | |
| **Description** | | | **Year** | **PW Factor** | | | | | | | | |
| Replace ramp components | Not Anticipated | | 50 | 0.5702 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Replacement/Salvage Costs** | | | | | | **0** | | **0** | | **0** | | **0** |
| **ANNUAL COSTS** | | | **Diff.** | | | | | | | | | |
| **Description** | | **Cost** | **Escl. %** | **PWA** | | | | | | | | |
| Annual maintenance | | | 0.00% | 38.039 | 16,512 | 628,000 | 25,253 | 961,000 | 33,994 | 1,293,000 | 6,782 | 258,000 |
| **Total Annual Costs (Present Worth)** | | | | | | **628,000** | | **961,000** | | **1,293,000** | | **258,000** |
| **Total Life Cycle Costs (Present Worth)** | | | | | | **17,140,000** | | **26,214,000** | | **35,287,000** | | **7,040,000** |
| **Total Life Cycle Costs (Annualized)** | | | **PP Factor** | **0.0263** | **450,595** | **Per Year** | **689,142** | **Per Year** | **927,663** | **Per Year** | **185,075** | **Per Year** |

# Choosing By Advantages

Figure 9F

**Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

Everglades Safari Down Ramp

**Total Importance Allocation to Advantages Scale**

| | |
|---|---|
| | **Paramount Advantage** |
| **100** | Significantly better at maintaining access to business |
| **95** | |
| **90** | |
| **85** | Significantly better at protecting / improving Natural Resources |
| **80** | Much better at minimizing maintenance needs |
| **75** | |
| **70** | Significantly better at limiting time need to obtain FDOT and COE / SFWMD permits |
| **65** | Much better at limiting safety risks to vehicle passengers |
| **60** | |
| **55** | Significantly better at improving visitor experience |
| **50** | |
| **45** | Much better at improving constructability needs (easy, staging, business access) |
| **40** | |
| **35** | |
| **30** | Moderately better at limiting impacts to Cultural Resources |
| **25** | |
| **20** | Significantly better at limiting degree risks to change EIS |
| **15** | Significantly better at support sustainable practices |
| **10** | |
| **5** | |
| **0** | No Advantage |

Figure 9G

# CBA Importance to Initial Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, Everglades Safari Down Ramp

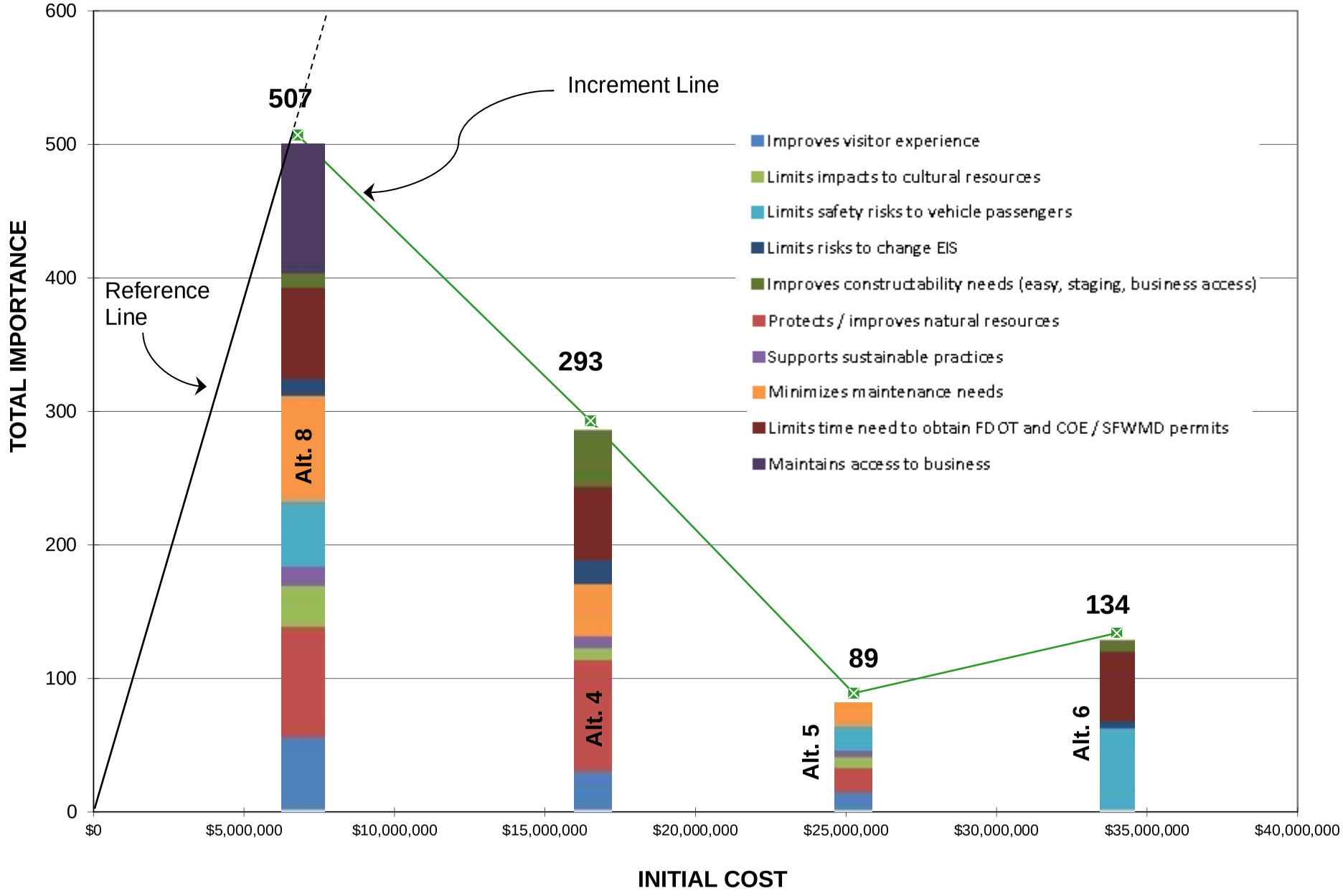


Figure 9H

# CBA Importance to Life Cycle Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, Everglades Safari Down Ramp

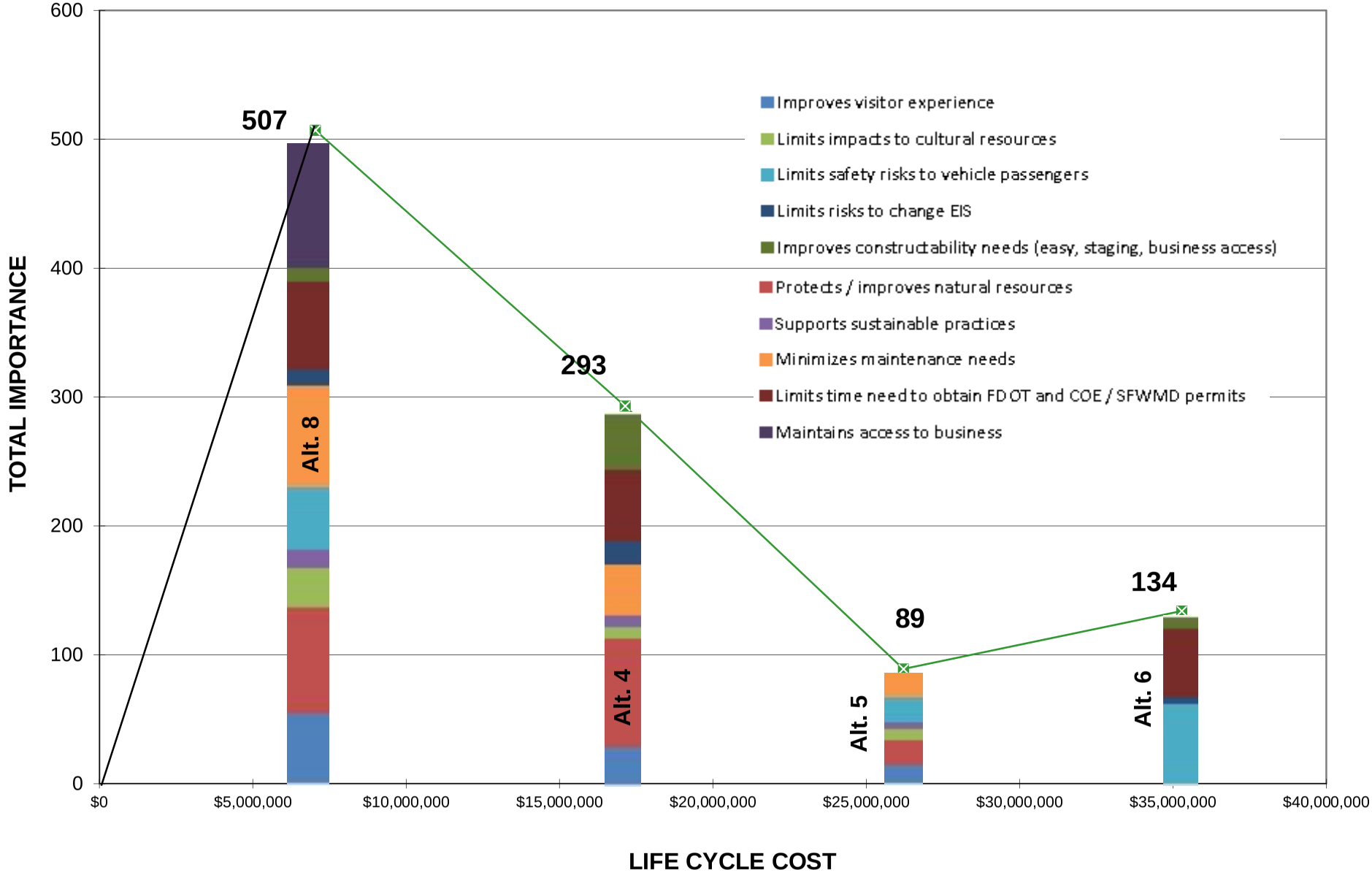


Figure 9I
Sensitivity Analysis

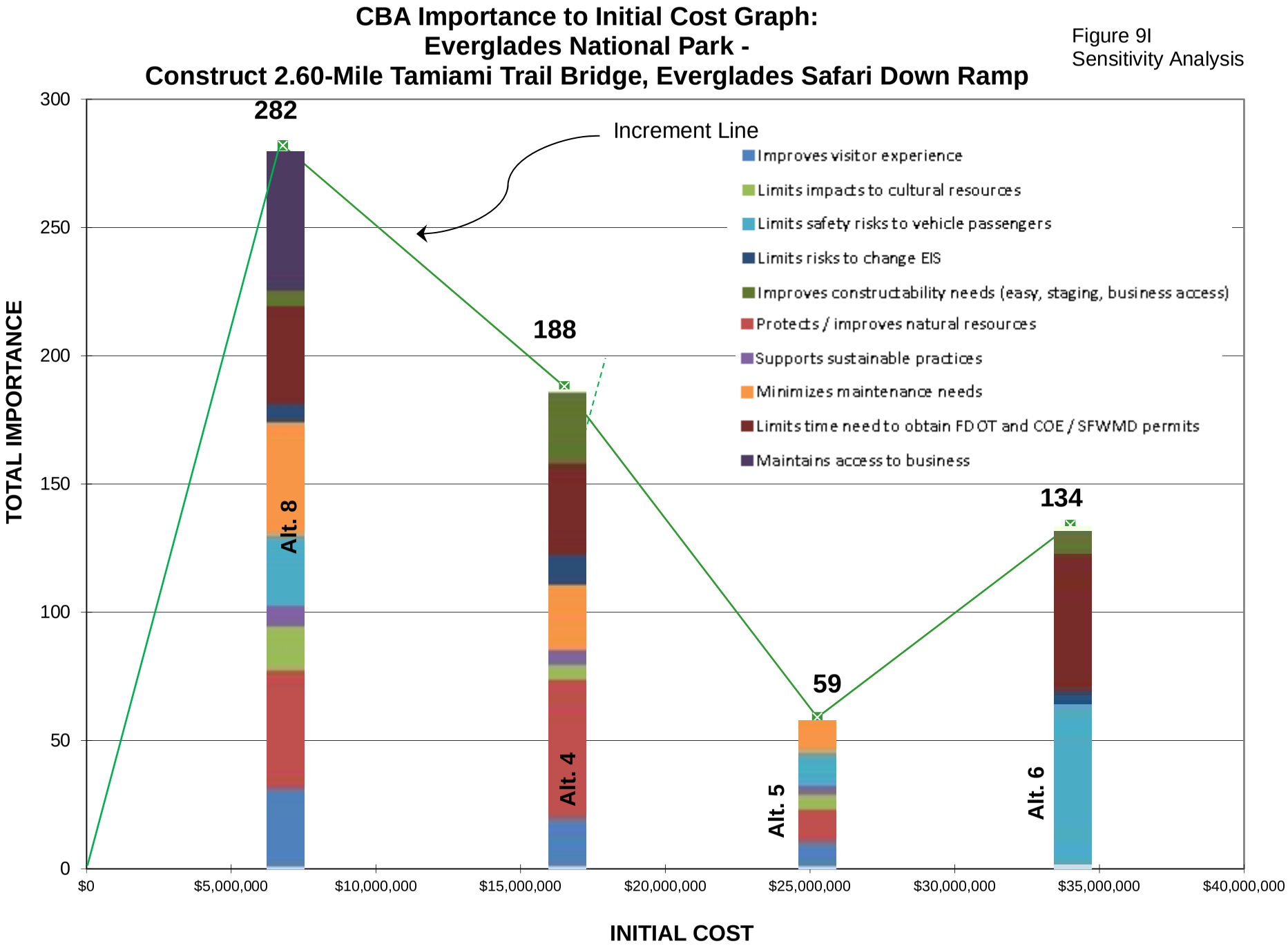
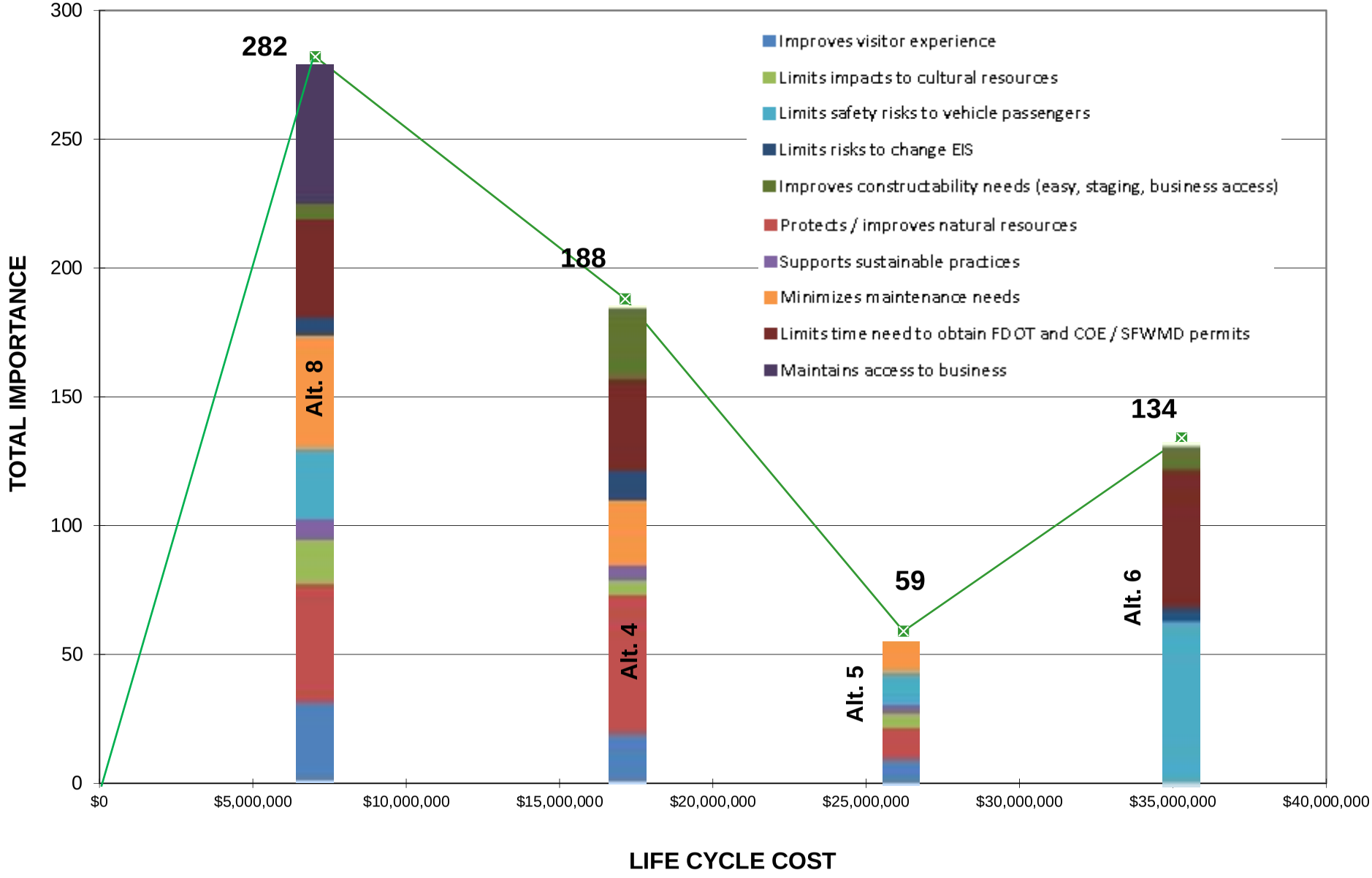


Figure 9J
Sensitivity Analysis

# CBA Importance to Life Cycle Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, Everglades Safari Down Ramp



# Value Analysis Recommendation-Choosing By Advantages

Figure 10A

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP** **VA No.**
**Item:** **West End Radio Tower Connector Access** **CBA-4**

## Original Design

The VA team reviewed the following alternatives. They were then evaluated based on Choosing By Advantages:

• Alternative 1: Down Ramp T Configuration on Fill;

• Alternative 2: Down Ramp T Configuration on Structure;

• Alternative 3: Use Existing Tamiami Trail, Add Culverts;

• Alternative 4: Use Levy to Cross Canal (via boat, bridge); and,

• Alternative 5: Create Overlook with Parking and Stair.

## Preferred Alternative

Based on the CBA analysis, the VA team identified the Alternative 3 as the preferred alternative. See following page for reconsideration recommendations.
A **sensitivity analysis** was performed by lowering the deconstruction advantage by 15 points and reducing the business access advantage from 100 to 0 points. Alternative 3 remained the preferred alternative.

**Advantages of Preferred Alternative:**

- Moderately better at improving visitor experience (views, aesthetics, delays, recreation)
- Slightly better at improving sustainable practices
- Much better at improving constructability / project risk
- Much better at ability to remove material in the future
- Significantly better at maintaining access to business
- Moderately better at limiting time required to obtain FDOT and COE / SFWMD permits
- Lowest initial and life cycle cost

## Life Cycle Cost Summary

| | Initial Cost | Life Cycle Cost |
|---|---|---|
| **Proposed Design (Preferred Alternative 3)** | **300,000** | **414,900** |

# Reconsideration

Figure 10B

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

**Item:** **West End Radio Tower Connector Access**

**VA No.**
**CBA-4**

☐ **Original Design** ■ **Proposed Design**

Reconsideration Alternative 3

Consider the following as part of the preferred alternative 3:
Numbers refer to creative idea listing

59. Add gate entry
61. Add culverts for connectivity, Alternative 3
67. Agreement to:
    a. Use 1 lane of Tamiami Trail
    b. Add culverts
    c. Maintain until water flow from North is improved by removing levee (L-29)
    d. A portion of the access road will be removed if/ when the tower is relocated

## Sketch Worksheet

Figure 10C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

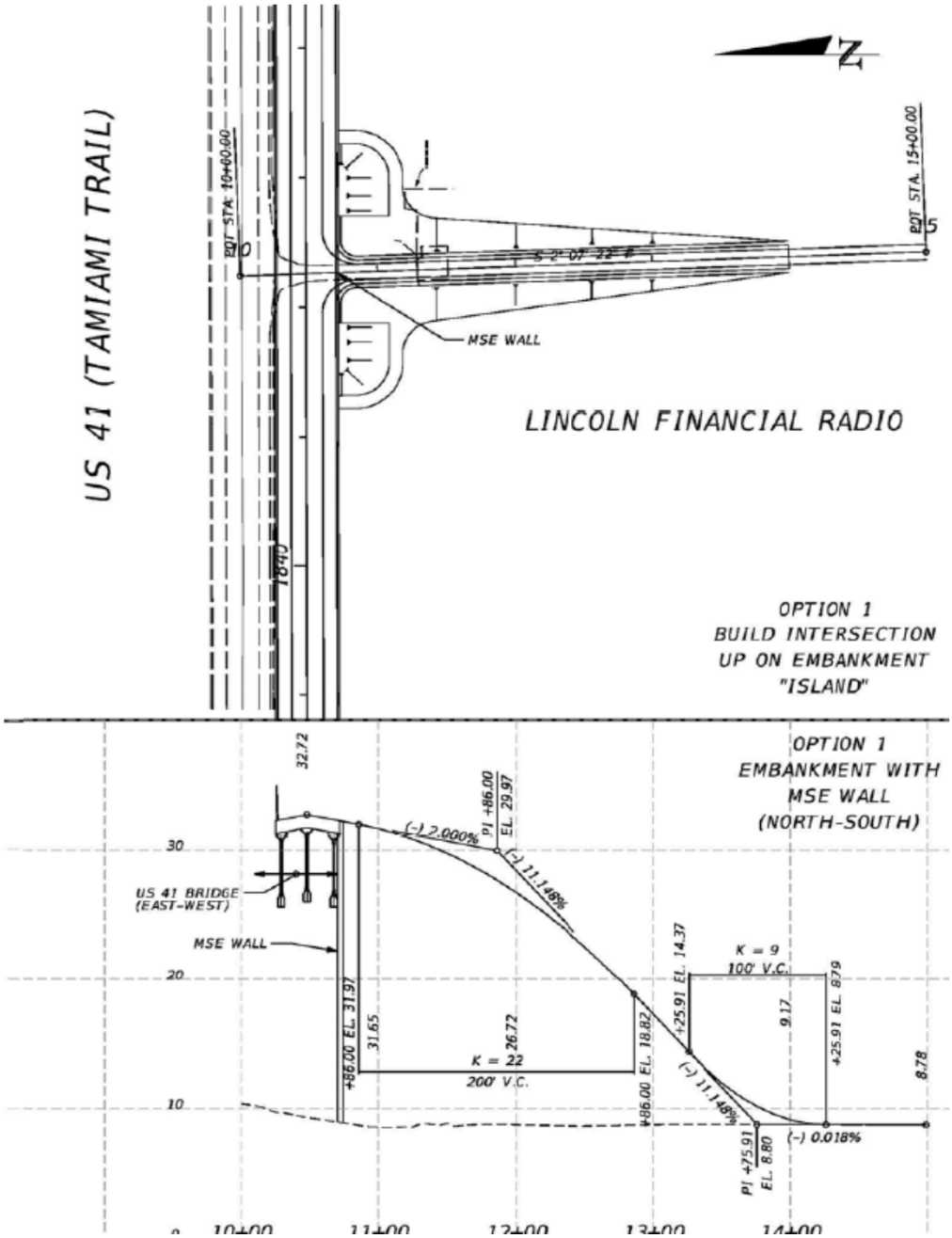
**VA No.**

**Item:** **West End Radio Tower Connector Access**

**CBA-4**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 1



## Sketch Worksheet

Figure 10C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

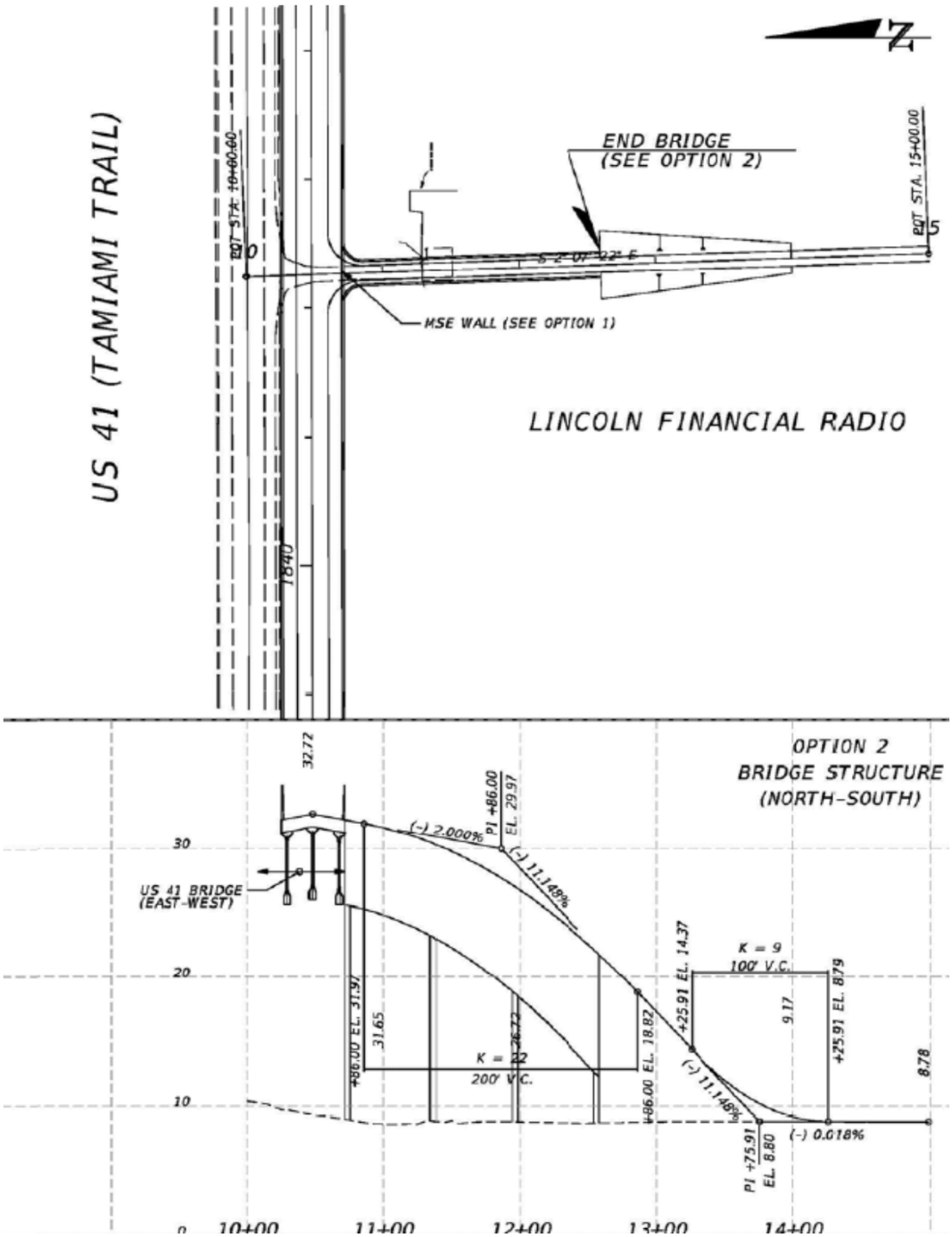
**VA No.**

**Item:** **West End Radio Tower Connector Access**

**CBA-4**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 2



## Sketch Worksheet

Figure 10C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

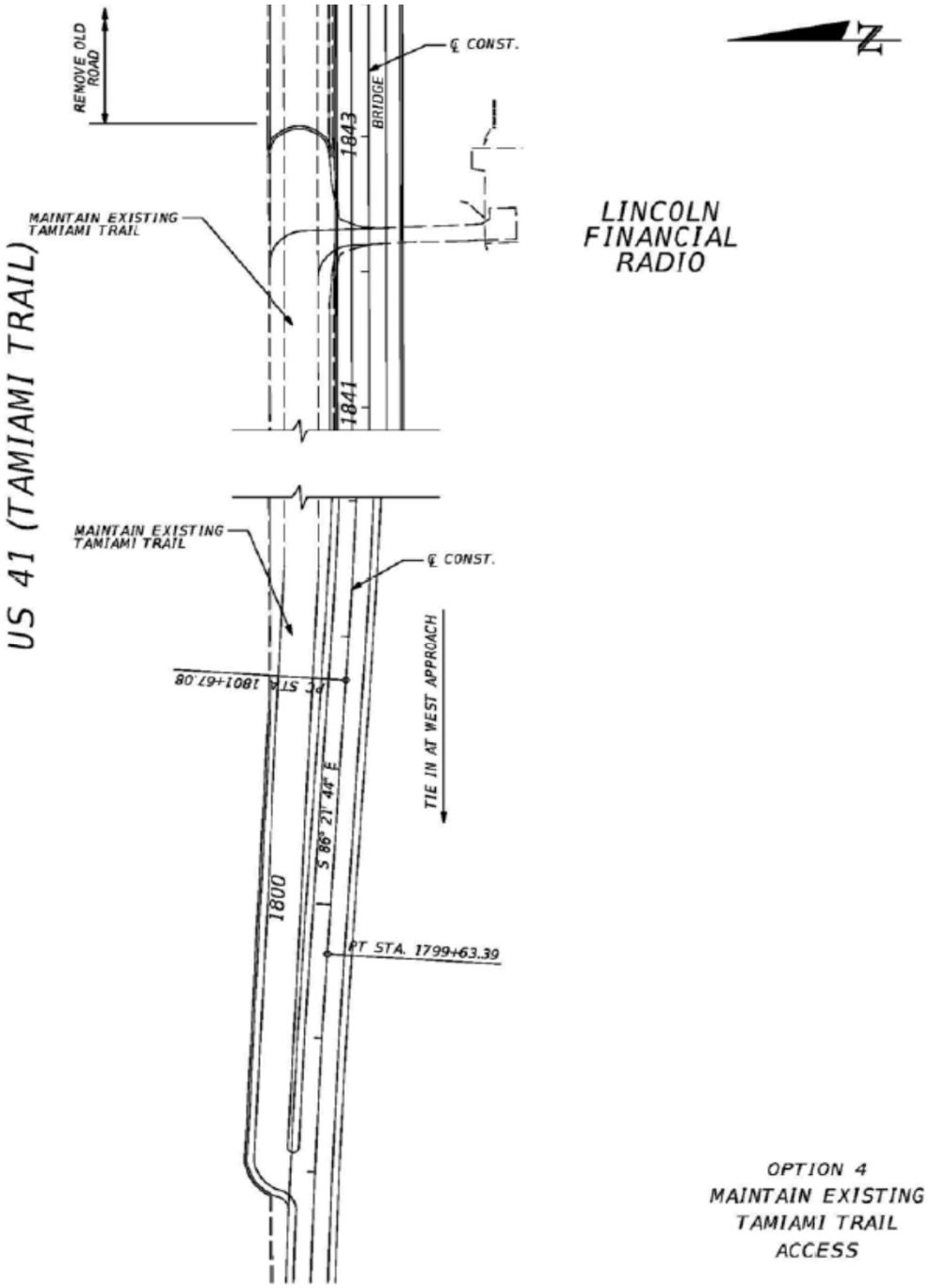
**VA No.**

**Item:** **West End Radio Tower Connector Access**

**CBA-4**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 3



## Sketch Worksheet

Figure 10C

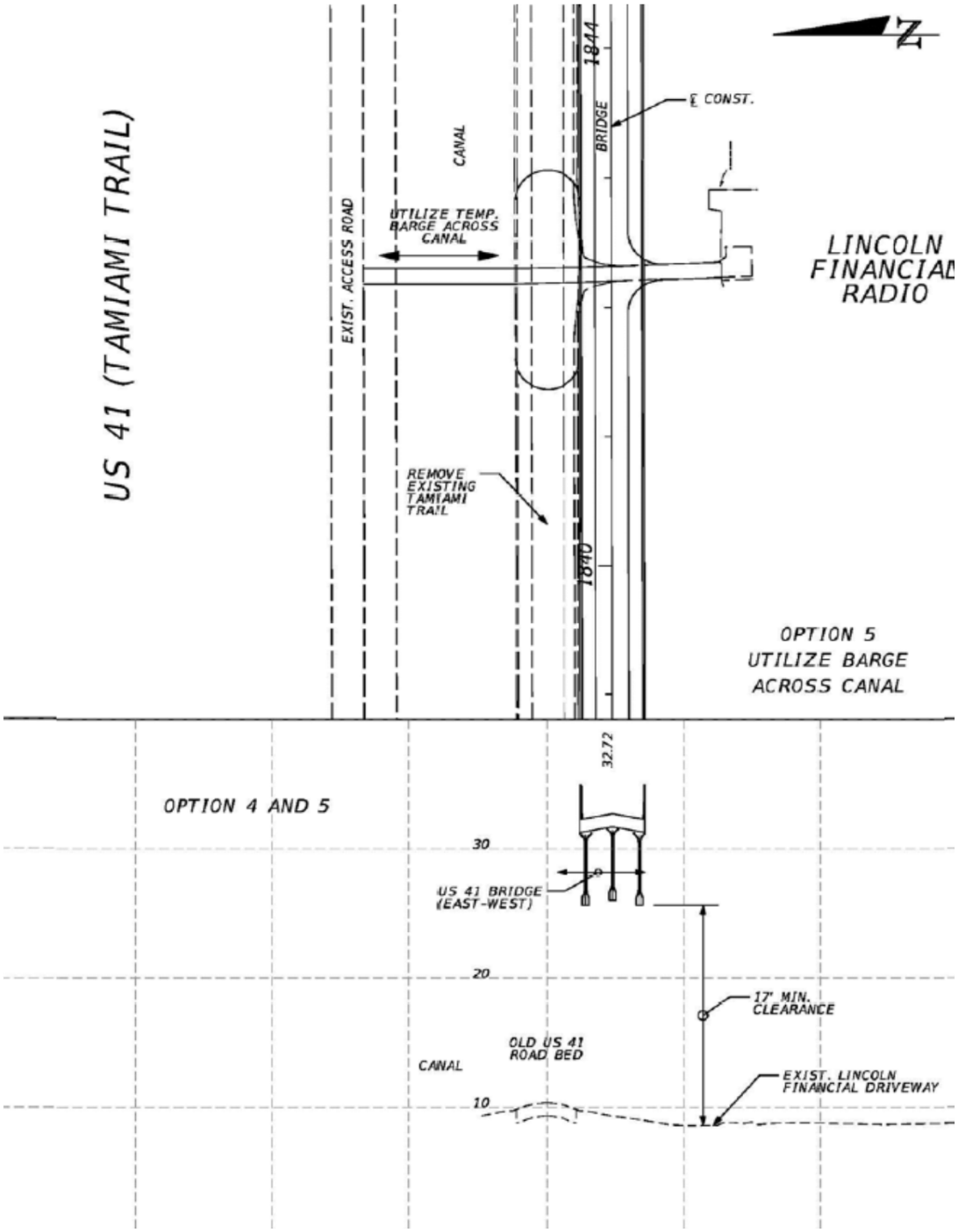
**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

**VA No.** **CBA-4**

**Item:** **West End Radio Tower Connector Access**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 4



## Sketch Worksheet

Figure 10C

**Project:** **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

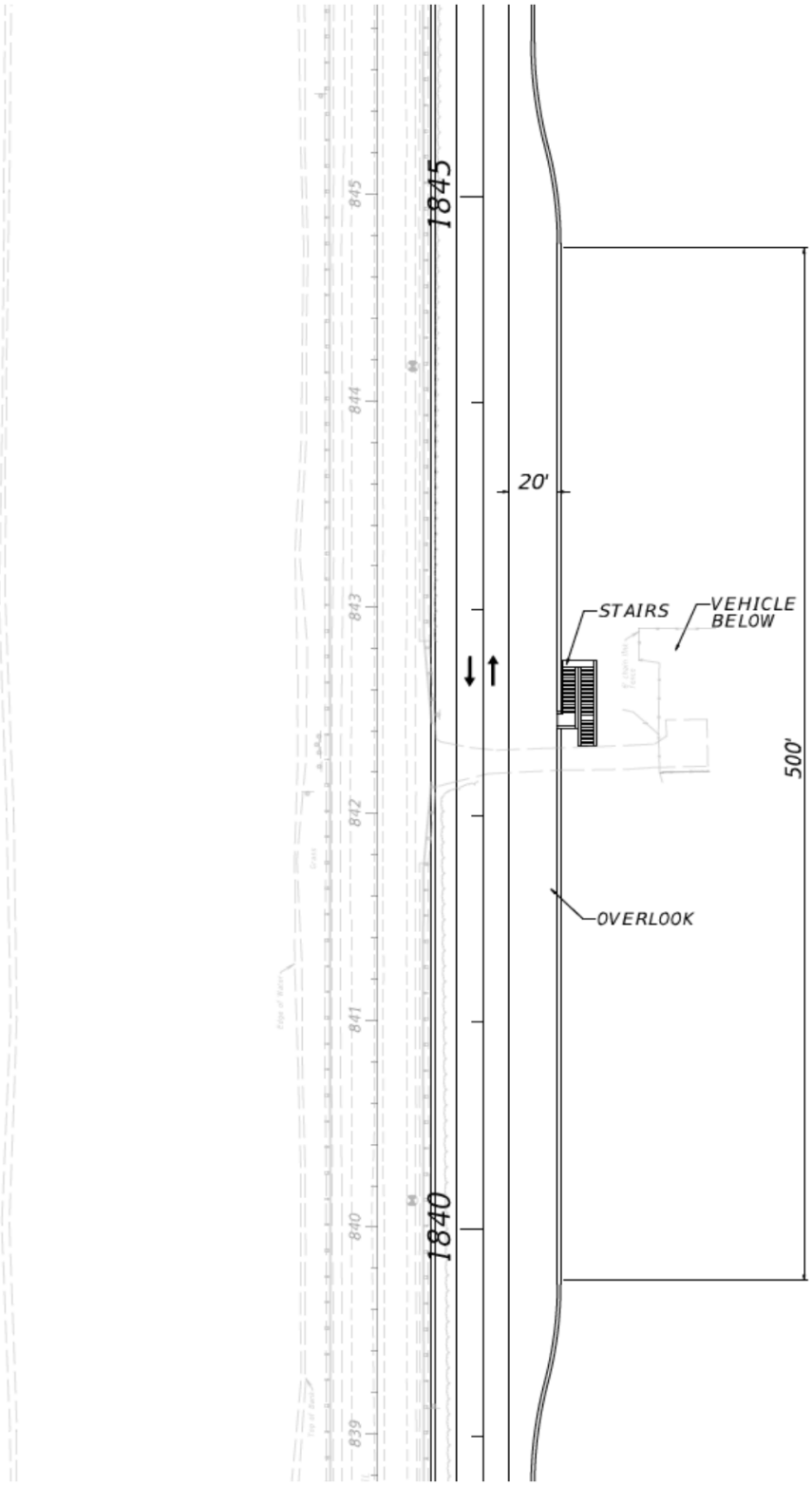
**VA No.**

**Item:** **West End Radio Tower Connector Access**

**CBA-4**

■ **Original Design** ☐ **Proposed Design**

ALTERNATIVE 5



## Choosing By Advantages Matrix

Figure 10D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP

**Component:** West End Radio Tower Connector Access

**Functions:** Restore Water Flow, Create Access

| Factors: | Alternative 1<br>Down Ramp T Configuration on Fill | | Alternative 2<br>Down Ramp T Configuration on Structure | | Alternative 3<br>Use Existing Tamiami Trail, Add Culverts | | Alternative 4<br>Use Levy to Cross Canal (via boat, bridge) | | Alternative 5<br>Create Overlook with Parking and Stair | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Improving Visitor Services, Educ. & Rec. Opportunities** | | | | | | | | | | |
| **Sub Factor: Improve Visitor Experience** | | | | | | | | | | |
| **Criterion:**<br>**- Impacts to view** | Attribute:<br>Does not elevate surface so no high viewpoint vistas | | Attribute:<br>Does not elevate surface so no high viewpoint vistas | | Attribute:<br>Does not elevate surface so no high viewpoint vistas | | Attribute:<br>Does not elevate surface so no high viewpoint vistas | | Attribute:<br>Elevates surface to create high viewpoint vistas | |
| **Criterion:**<br>**- Aesthetics of visible components** | Attribute:<br>Creates some aesthetic opportunities | | Attribute:<br>Creates some aesthetic opportunities | | Attribute:<br>Creates high aesthetic opportunities | | Attribute:<br>Creates high aesthetic opportunities | | Attribute:<br>Creates high aesthetic opportunities | |
| **Criterion:**<br>**- Construction delay created** | Attribute:<br>Creates more construction delays | | Attribute:<br>Creates more construction delays | | Attribute:<br>Creates some construction delays | | Attribute:<br>Creates some construction delays | | Attribute:<br>Creates some construction delays | |
| **Criterion:**<br>**- Changes to recreation** | Attribute:<br>Creates high change in recreation | | Attribute:<br>Creates high change in recreation | | Attribute:<br>Creates some change in recreation | | Attribute:<br>Creates some change in recreation | | Attribute:<br>Creates some change in recreation | |
| **Advantages:** | **No Advantage** | **0** | **No Advantage** | **0** | **Moderately better at improving visitor experience (views, aesthetics, delays, recreation)** | **30** | **Moderately better at improving visitor experience (views, aesthetics, delays, recreation)** | **30** | **Much better at improving visitor experience (views, aesthetics, delays, recreation)** | **45** |
| **Prevent Loss of Resources, Maintain / Improve Condition of Resources** | | | | | | | | | | |
| **Sub Factor: Protect / Improve Natural Resources** | | | | | | | | | | |
| **Criterion:**<br>**- Ecological connectivity from north to south (linear feet of bridged area)** | Attribute:<br>Creates some loss of connectivity | | Attribute:<br>Creates little loss of connectivity | | Attribute:<br>Creates more loss of connectivity | | Attribute:<br>Creates little loss of connectivity | | Attribute:<br>Creates very little loss of connectivity | |
| **Criterion:**<br>**- Wildlife mortality rate** | Attribute:<br>Creates some change to wildlife mortality rate | | Attribute:<br>Creates little change to wildlife mortality rate | | Attribute:<br>Creates more change to wildlife mortality rate | | Attribute:<br>Creates little change to wildlife mortality rate | | Attribute:<br>Creates very little change to wildlife mortality rate | |
| **Criterion:**<br>**- Change to the wetland area** | Attribute:<br>Creates some change to the wetland area | | Attribute:<br>Creates little change to the wetland area | | Attribute:<br>Creates more change to the wetland area | | Attribute:<br>Creates little change to the wetland area | | Attribute:<br>Creates very little change to the wetland area | |
| **Advantages:** | **Slightly better at protecting / improving natural resources (ecology, wildlife, wetland)** | **25** | **Much better at protecting / improving natural resources (ecology, wildlife, wetland)** | **50** | **No Advantage** | **0** | **Much better at protecting / improving natural resources (ecology, wildlife, wetland)** | **50** | **Significantly better at protecting / improving natural resources (ecology, wildlife, wetland)** | **60** |

## Choosing By Advantages Matrix

Figure 10D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP

**Component:** West End Radio Tower Connector Access

**Functions:** Restore Water Flow, Create Access

| Factors: | Alternative 1<br>Down Ramp T Configuration on Fill | | Alternative 2<br>Down Ramp T Configuration on Structure | | Alternative 3<br>Use Existing Tamiami Trail, Add Culverts | | Alternative 4<br>Use Levy to Cross Canal (via boat, bridge) | | Alternative 5<br>Create Overlook with Parking and Stair | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Protect Public and Employee Health, Safety, Welfare** | | | | | | | | | | |
| **Sub Factor: Limit impacts to vehicle passengers** | | | | | | | | | | |
| **Criterion:**<br>**- Impact to vehicular passengers** | Attribute:<br>No elevated surface | | Attribute:<br>No elevated surface | | Attribute:<br>No elevated surface | | Attribute:<br>No elevated surface | | Creates elevated surface | |
| **Advantages:** | **No Advantage** | **0** | **No Advantage** | **0** | **No Advantage** | **0** | **No Advantage** | **0** | **Slightly better at limiting impacts to vehicular passengers** | **10** |
| **Improve Operational Efficiency, Reliability & Sustainability** | | | | | | | | | | |
| **Sub Factor: Minimize Operational Needs - Maintenance** | | | | | | | | | | |
| **Criterion:**<br>**- Quantity of components / access required to maintain system** | Attribute:<br>Use very limited components that require maintenance | | Attribute:<br>Creates little components that require maintenance (structure) | | Attribute:<br>Creates some components that require maintenance (culverts) | | Attribute:<br>Use very limited components that require maintenance | | Attribute:<br>Creates little components that require maintenance (stairs, gates) | |
| **Advantages:** | **Slightly better at minimizing maintenance needs** | **40** | **Minimally better at minimizing maintenance needs** | **20** | **No Advantage** | **0** | **Slightly better at minimizing maintenance needs** | **40** | **Minimally better at minimizing maintenance needs** | **20** |
| **Sub Factor: Support Sustainability** | | | | | | | | | | |
| **Criterion:**<br>**- Amount of materials (concrete and steel)** | Attribute:<br>Very limited opportunities for sustainable materials | | Attribute:<br>Limited opportunities for sustainable materials | | Attribute:<br>Some opportunities for sustainable materials | | Attribute:<br>Limited opportunities for sustainable materials | | Attribute:<br>Limited opportunities for sustainable materials | |
| **Advantages:** | **No Advantage** | **0** | **Minimally better at improving sustainable practices** | **10** | **Slightly better at improving sustainable practices** | **20** | **Minimally better at improving sustainable practices** | **10** | **Minimally better at improving sustainable practices** | **10** |

## Choosing By Advantages Matrix

Figure 10D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP

**Component:** West End Radio Tower Connector Access

**Functions:** Restore Water Flow, Create Access

| Factors: | Alternative 1<br>Down Ramp T Configuration on Fill | | Alternative 2<br>Down Ramp T Configuration on Structure | | Alternative 3<br>Use Existing Tamiami Trail, Add Culverts | | Alternative 4<br>Use Levy to Cross Canal (via boat, bridge) | | Alternative 5<br>Create Overlook with Parking and Stair | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Provide Cost Effective, Environmentally Responsible & Beneficial Development to NPS** | | | | | | | | | | |
| **Sub Factor: Improve Constructability / Reduce Risk** | | | | | | | | | | |
| **Criterion:**<br>**- Degree of constructability / risk required to complete scope** | Attribute:<br>Creates some potential for difficulties with constructability and risk | | Attribute:<br>Creates more potential for difficulties with constructability and risk | | Attribute:<br>Creates low potential for difficulties with constructability and risk | | Attribute:<br>Creates more potential for difficulties with constructability and risk | | Attribute:<br>Creates some potential for difficulties with constructability and risk | |
| **Advantages:** | **Slightly better at improving constructability / project risk** | **20** | **No Advantage** | **0** | **Much better at improving constructability / project risk** | **55** | **No Advantage** | **0** | **Slightly better at improving constructability / project risk** | **20** |
| **Sub Factor: Allow Ability to Remove Material in Future (deconstruction)** | | | | | | | | | | |
| **Criterion:**<br>**- Degree of deconstruction required (including radio tower)** | Attribute:<br>Creates some difficulty to remove material in the future | | Attribute:<br>Creates some difficulty to remove material in the future | | Attribute:<br>Creates limited difficulty to remove material in the future | | Attribute:<br>Creates more difficulty to remove material in the future | | Attribute:<br>Creates much more difficult approach to remove material in the future (radio tower) | |
| **Advantages:** | **Moderately better at ability to remove material in the future** | **70** | **Moderately better at ability to remove material in the future** | **70** | **Much better at ability to remove material in the future** | **85** | **Slightly better at ability to remove material in the future** | **30** | **No Advantage** | **0** |
| **Sub Factor: Ability to Maintain Business Access** | | | | | | | | | | |
| **Criterion:**<br>**- Ability to maintain access to local business** | Attribute:<br>Allows for limited interruption to business access | | Attribute:<br>Allows for limited interruption to business access | | Attribute:<br>Allows for very limited interruption to business access | | Attribute:<br>Allows for limited interruption to business access | | Attribute:<br>Allows for more interruption to business access | |
| ***Advantages:*** | **Much better at maintaining access to business** | **75** | **Much better at maintaining access to business** | **75** | **Significantly better at maintaining access to business** | **100** | **Moderately better at maintaining access to business** | **50** | **No Advantage** | **0** |

## Choosing By Advantages Matrix

Figure 10D

**Project/Location:** Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP

**Component:** West End Radio Tower Connector Access

**Functions:** Restore Water Flow, Create Access

| Factors: | Alternative 1<br>Down Ramp T Configuration on Fill | | Alternative 2<br>Down Ramp T Configuration on Structure | | Alternative 3<br>Use Existing Tamiami Trail, Add Culverts | | Alternative 4<br>Use Levy to Cross Canal (via boat, bridge) | | Alternative 5<br>Create Overlook with Parking and Stair | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sub Factor: Type of Permits - Time Required** | | | | | | | | | | |
| **Criterion:**<br>**- Flirida DOT (time required)** | Attribute:<br>Should require less time to obtain FDOT permit | | Attribute:<br>Should require less time to obtain FDOT permit | | Attribute:<br>Should require less time to obtain FDOT permit | | Attribute:<br>Should require less time to obtain FDOT permit | | Attribute:<br>Should require more time to obtain FDOT permit | |
| **Criterion:**<br>**- Corps of Engineers (time required)** | Attribute:<br>Anticipate this alternative to require more time to obtain permit (404 review) | | Attribute:<br>Anticipate this alternative to require less time to obtain permit (no 404 review) | | Attribute:<br>Anticipate this alternative to require less time to obtain permit (no 404 review) | | Attribute:<br>Anticipate this alternative to require more time to obtain permit (404 review) | | Attribute:<br>Anticipate this alternative to require less time to obtain permit (no 404 review) | |
| **Criterion:**<br>**- South Florida Water Management District (time required)** | Attribute:<br>Anticipate this alternative to require short time to obtain permit (fairly easy) | | Attribute:<br>Anticipate this alternative to require short time to obtain permit (fairly easy) | | Attribute:<br>Anticipate this alternative to require more time to obtain permit (into the ROW) | | Attribute:<br>Anticipate this alternative to require more time to obtain permit (into the ROW) | | Attribute:<br>Anticipate this alternative to require short time to obtain permit (fairly easy) | |
| **Advantages:** | **Moderately better at limiting time required to obtain FDOT and COE / SFWMD permits** | **65** | **Much better at limiting time required to obtain FDOT and COE / SFWMD permits** | **80** | **Moderately better at limiting time required to obtain FDOT and COE / SFWMD permits** | **65** | **No Advantage** | **0** | **Moderately better at limiting time required to obtain FDOT and COE / SFWMD permits** | **65** |
| **Total Importance of Advantages** | | **295** | | **305** | | **355** | | **210** | | **230** |
| **Initial Cost** | $2,939,000 | | $4,050,000 | | $300,000 | | $4,050,000 | | $2,528,000 | |
| **Life Cycle Cost** | $3,218,600 | | $4,436,800 | | $414,900 | | $4,436,800 | | $3,297,500 | |

## LIFE CYCLE COST ANALYSIS (LCCA)

Figure 10E

Project/Location: **Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**
Subject: **West End Radio Tower Connector Access**
Description: **Restore Water Flow, Create Access**

Project Life Cycle = **50 Years**
Discount Rate = **1.1%**

| | | | | | Alternative 1 Down Ramp T Configuration on Fill | | Alternative 2 Down Ramp T Configuration on Structure | | Alternative 3 Use Existing Tamiami Trail, Add Culverts | | Alternative 4 Use Levy to Cross Canal (via boat, bridge) | | Alternative 5 Create Overlook with Parking and Stair | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **INITIAL COSTS** | | **Quantity** | **UM** | **Cost / SF** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** | **Est.** | **PW** |
| Alternative 1 | Down Ramp T Configuration on Fill | 598,224 | Sq Ft | $4.91 | 2,939,000 | 2,939,000 | | | | | | | | |
| Alternative 2 | Down Ramp T Configuration on Structure | 598,224 | Sq Ft | $6.77 | | | 4,050,000 | 4,050,000 | | | | | | |
| Alternative 3 | Use Existing Tamiami Trail, Add Culverts | 598,224 | Sq Ft | $0.50 | | | | | 300,000 | 300,000 | | | | |
| Alternative 4 | Use Levy to Cross Canal (via boat, bridge) | 598,224 | Sq Ft | $6.77 | | | | | | | 4,050,000 | 4,050,000 | | |
| Alternative 5 | Create Overlook with Parking and Stair | 598,224 | Sq Ft | $4.23 | | | | | | | | | 2,528,000 | 2,528,000 |
| **Total Initial Cost** | | | | | | **2,939,000** | | **4,050,000** | | **300,000** | | **4,050,000** | | **2,528,000** |
| **REPLACEMENT COST/ SALVAGE VALUE** | | | | | | | | | | | | | | |
| **Description** | | | **Year** | **PW Factor** | | | | | | | | | | |
| Remove stair in future | | | 25 | 0.7607 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 300,000 | 228,214 |
| **Total Replacement/Salvage Costs** | | | | | | **0** | | **0** | | **0** | | **0** | | **528,200** |
| **ANNUAL COSTS** | | | **Diff.** | | | | | | | | | | | |
| **Description** | | **Cost** | **Escl. %** | **PWA** | | | | | | | | | | |
| Cleaning | | (contracted) | 0.00% | 38.301 | 7,300 | 279,600 | 10,100 | 386,844 | 3,000 | 114,904 | 10,100 | 386,844 | 6,300 | 241,299 |
| **Total Annual Costs (Present Worth)** | | | | | | **279,600** | | **386,800** | | **114,900** | | **386,800** | | **241,300** |
| **Total Life Cycle Costs (Present Worth)** | | | | | | **3,218,600** | | **4,436,800** | | **414,900** | | **4,436,800** | | **3,297,500** |
| **Total Life Cycle Costs (Annualized)** | | | **PP Factor** | **0.0261** | **84,034** | **Per Year** | **115,839** | **Per Year** | **10,833** | **Per Year** | **115,839** | **Per Year** | **86,094** | **Per Year** |

## Choosing By Advantages

Figure 10F

**Construct 2.60-Mile Tamiami Trail Bridge, Everglades NP**

West End Radio Tower Connector Access

### Total Importance Allocation to Advantages Scale

| | |
|---|---|
| | **Paramount Advantage** |
| **100** | Significantly better at maintaining access to business |
| **95** | |
| **90** | |
| **85** | Much better at ability to remove material in the future |
| **80** | Much better at limiting time required to obtain FDOT and COE / SFWMD permits |
| **75** | |
| **70** | |
| **65** | |
| **60** | Significantly better at protecting / improving natural resources (ecology, wildlife, wetland) |
| **55** | Much better at ability to remove material in the future |
| **50** | |
| **50** | |
| **45** | Much better at improving visitor experience (views, aesthetics, delays, recreation) |
| **40** | Slightly better at minimizing maintenance needs |
| **35** | |
| **30** | |
| **20** | Slightly better at improving sustainable practices |
| **15** | |
| **10** | Slightly better at limiting impacts to vehicular passengers |
| **5** | |
| **0** | No Advantage |

# CBA Importance to Initial Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, West End Connector

Figure 10G

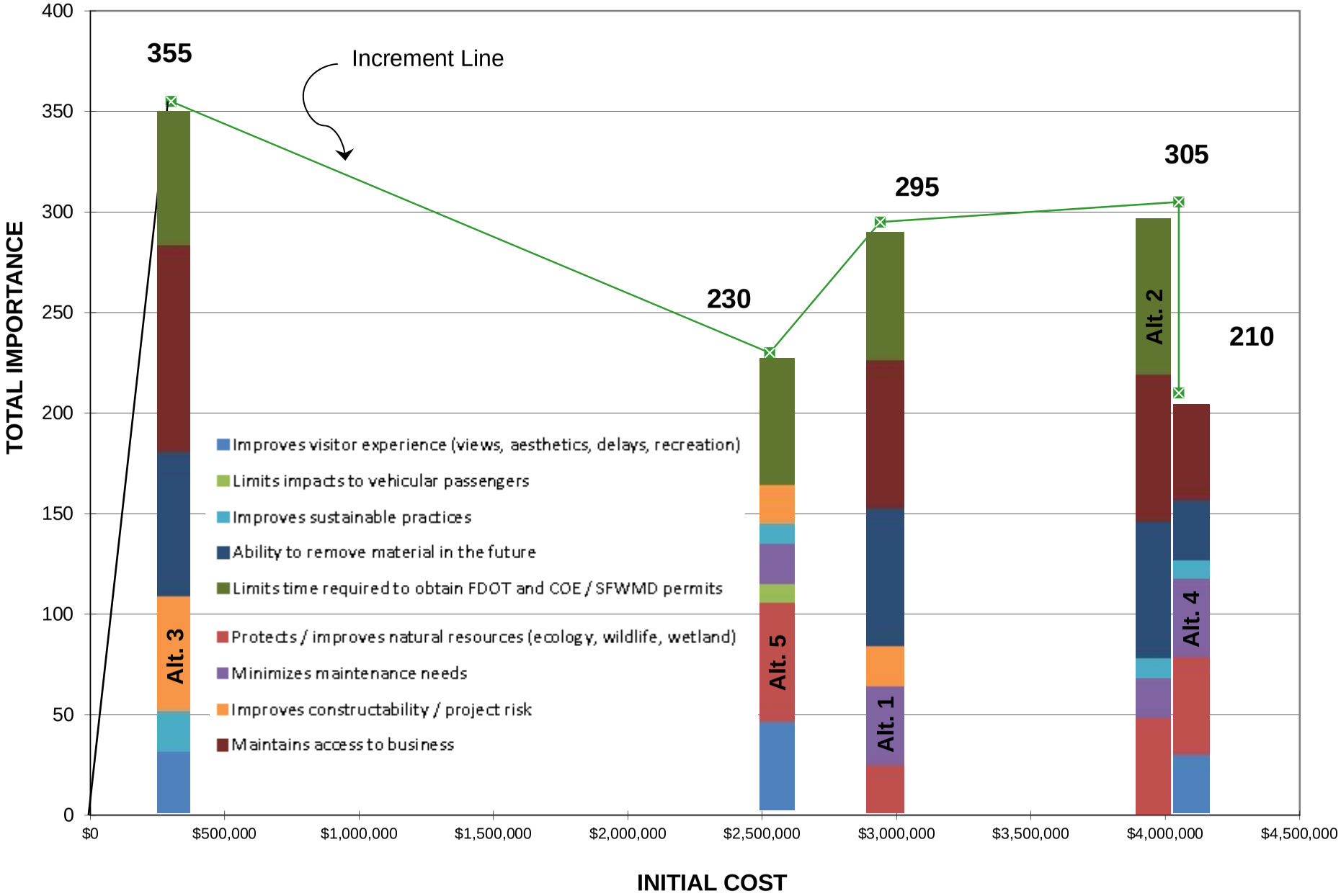


Figure 10H

# CBA Importance to Life Cycle Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, West End Connector

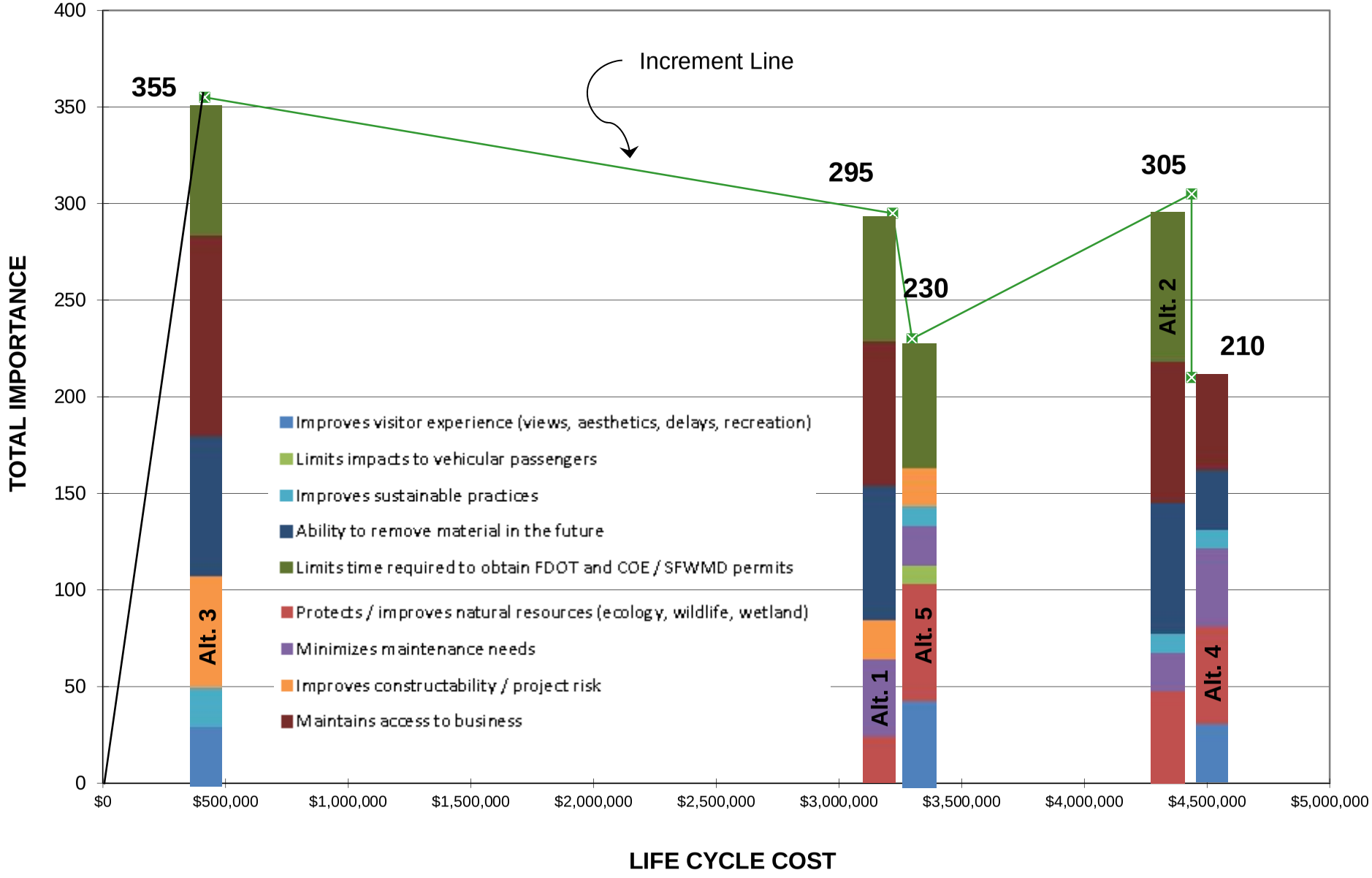
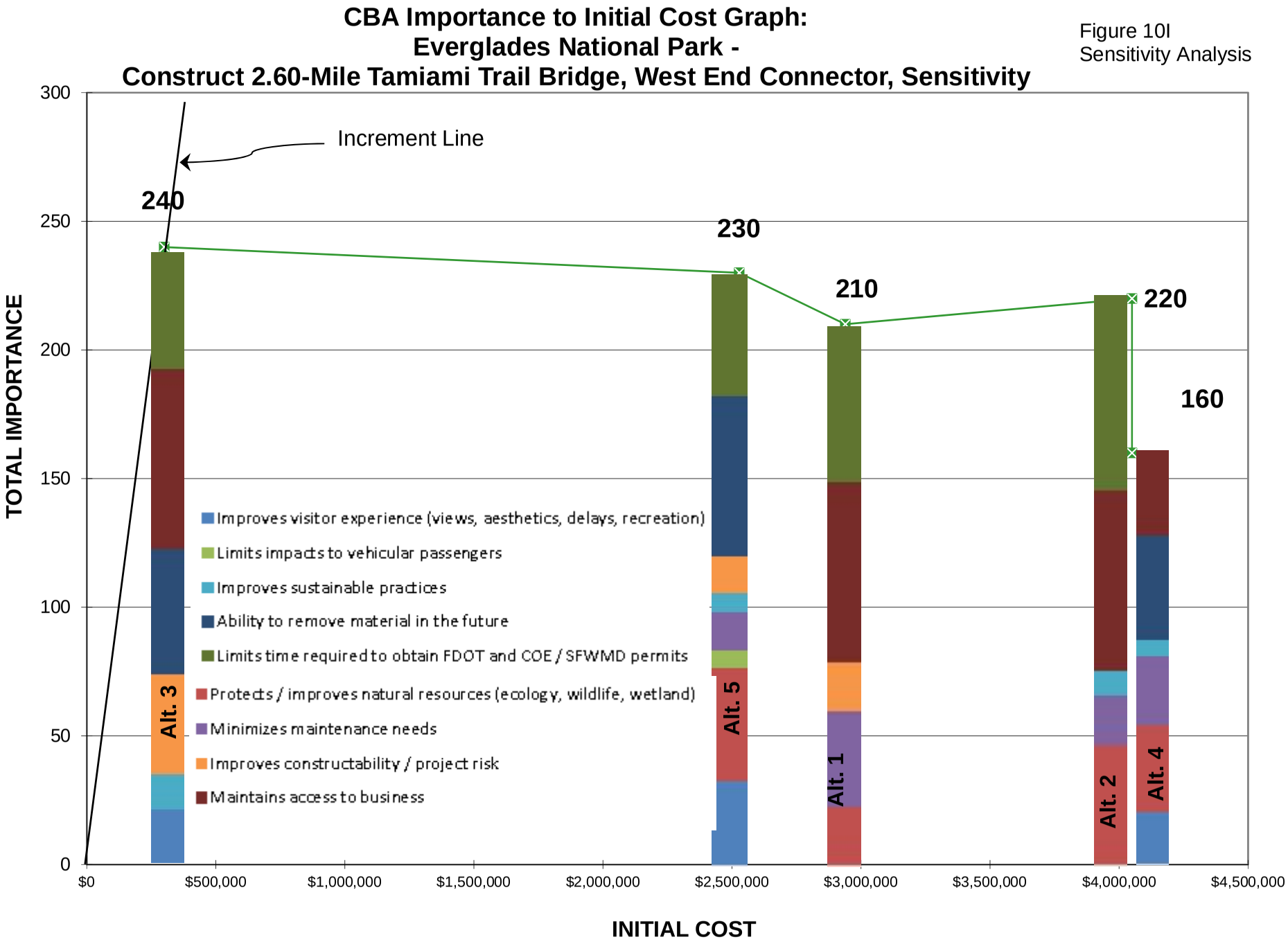
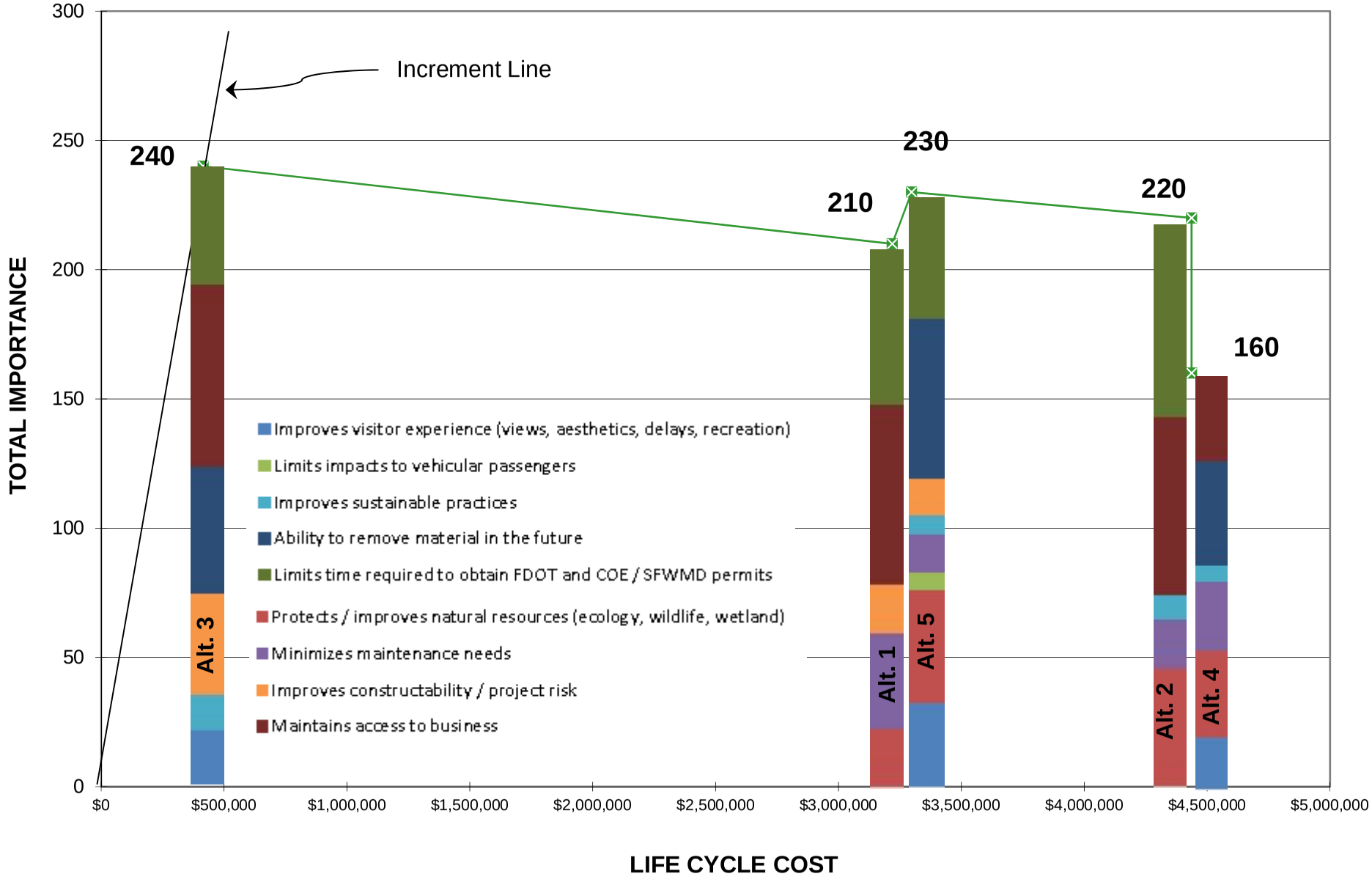


Figure 10I
Sensitivity Analysis



# CBA Importance to Life Cycle Cost Graph: Everglades National Park - Construct 2.60-Mile Tamiami Trail Bridge, West End Connector, Sensitivity

Figure 10J
Sensitivity Analysis



## Phase VI - Recommendation

The final day of the VA workshop, the VA team summarized the workshop and the decisions reached.

The NPS project manager discussed next steps to maintain the design schedule. Following are important upcoming events:

| | |
|---|---|
| VA Report | |
| Submit Draft VA Report | January 3, 2014 |
| Review / Comment | 2-3 weeks |
| Finalize VA Report | 1-2 weeks |
| Class B Cost Estimate | |
| Class B- Estimate | December 17, 2013 |
| Design Documents | |
| 100% Schematic Design, Class B Estimate | Early January 2014 |
| DAB Submittal | January 29, 2014 |
| DAB Presentation/ Approval | March 5, 2014 |
| Bridge Development Report | June/ July 2014 |

## VA Team

The study team was composed of a mix of professional disciplines and varied design, operations and maintenance experience. Members of the park staff grounded the team with knowledge of the intricacies of managing and working on this site.

Stephen Kirk and Stephen Garrett, both certified value specialists of Kirk Associates, led the team's deliberations during the workshop. A list of VA team participants is contained on **Figure 11** that follows.

# ATTENDANCE LIST

Figure 11

***Value Analysis Study***

Project: **Construct 2.6 Mile Tamiami Trail Bridge**

Location: **Everglades National Park, Florida**

Date: **December 9 - 13, 2013**

## PARTICIPANTS:

| Name/ Title: | Job Function: | Phone: | Email: |
|---|---|---|---|
| **Everglades National Park** | | | |
| Joffre Castro | Civil Eng / Water Quality | 305-224-4247 | joffre_castro@nps.gov |
| Tylan Dean | Biological / Wetland Resources | 305-224-4239 | tylan_dean@nps.gov |
| David Sikkema | Chief, Project Mgmt Branch | 305-224-4214 | dave_sikkema@nps.gov |
| Alicia Logalbo | Biologist | 305-224-4243 | alicia_logalbo@nps.gov |
| **NPS - Denver Service Center, Transporation Division** | | | |
| Charles Borders | Branch Chief | 202-619-7455 | charles_borders@nsp.gov |
| Seth Greenwall | Technical Support & Review | 303-898-5046c | seth_greenwell@nsp.gov |
| **NPS - Denver Service Center, Design & Construction Division** | | | |
| Lydia Creager | Program Manager | 303-987-6855 | lydia_creager@nps.gov |
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| **Florida Department of Transporation** | | | |
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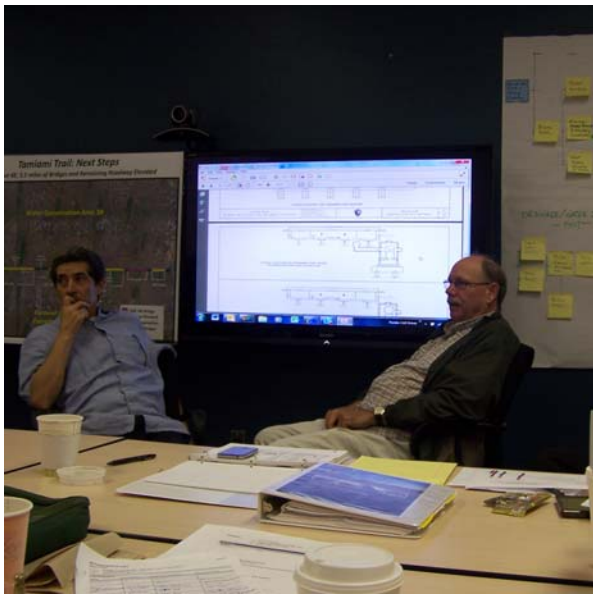
## VA Team Photos



## Acknowledgements

It would be a serious oversight in documenting this study without acknowledging the significant contributions made by the well-informed, spirited and cooperative staff of the VA team members. Their hard work and input from their specific expertise made this VA Study a success.

**Value Analysis Study**
**Construct 2.60-Mile Tamiami Trail Bridge**

Everglades National Park
Florida

December 9 - 13, 2013

# SECTION C: APPENDIX

## VALUE ANALYSIS PROCESS

### INTRODUCTION

Value Analysis (VA) is an organized, creative process, which focuses attention on the requirements of a project for the purpose of achieving essential functions and attendant benefits at the lowest, total costs for materials, equipment, staffing, energy usage, facilities, professional services, maintenance, etc. over the life of the project. In other words, value engineering is a systematic approach to obtain optimum ***value*** for each dollar spent. As a result of thorough investigation, using experienced, multi-disciplined teams, value and economy are improved by the study of alternate systems, concepts, materials, methods and procedures.

A Certified Value Specialist (CVS) guides a Value Analysis Study. Experience has shown that project studies performed by a person or team with little or no value engineering leadership will tend to steer in the direction of a superficial review and concentrate on errors made by others. A Value Analysis Study, on the other hand, focuses on both reducing the total cost of ownership and improving overall performance. Application of the VA methodology and coordination of the activities before and after the study also significantly increase the probability the recommendations will be implemented.

This approach has been successfully applied to projects of all types and magnitudes and allows value analysis teams to be responsive to clients by producing practical results. The VA approach also encourages participation of the clients in the study in order to take advantage of their experience and knowledge. Multi-disciplined teams, using a value analysis job plan, analyze the functions of the buildings, products or processes under study, identify high cost areas, ascertain the benefits sought and propose alternatives to those planned or currently being used.

A value analysis job plan is organized into three distinct parts: (1) Pre-Study Preparation, (2) Study Workshop, and (3) Post-Study Implementation.

## PRE-STUDY PREPARATION

The success of a Value Analysis Study is largely dependent on proper preparation and coordination. Information and documents are furnished by the client and distributed to the team to enable them to prepare for their role in the study. All participants are briefed on the project and their responsibility prior to the study. The pre-study activities include the following tasks:

- Identification of context of the Value Analysis Study.
- Review of project documentation and distribution of information to team members. The VA team relies on the client for the completeness and organization of the material to be used.
- Finalization of team and team assignments.
- Preparation of analytic models, as appropriate.
- Finalization of arrangements for workshop.

Each VA study is designed in response to the goals of the client. The analytic models developed prior to the workshop are consistent with these goals and are based on the information provided to the study team. While not every model is used for every study, it is important the team have sufficient data to develop at least a few of the analytic models to ensure a measure of thoroughness and perspective.

## STUDY WORKSHOP

During the workshop portion of a Value Analysis Study, a Study Plan is followed which usually includes specific phases to ensure a thoughtful, professional analysis.

### *Phase I - Information Phase*

At the beginning of a Value Analysis Study, it is important to understand the background and decisions that have influenced the development of the client's goals. For this reason, the client normally describes the history and scope of the project.

### *Phase II - Function Phase*

The functions of the project are the controlling elements in the overall value engineering approach. Explicitly identifying the functions that drive the project is essential to the team because it forces the participants to think in terms of the purposes for the project and the desired results and costs associated with those functions.

### *Phase III - Creativity Phase*

This step in a Value Analysis Study involves the listing of creative ideas. During this portion of a workshop, the value analysis team thinks of as many ways as possible to provide the necessary functions, keeping in mind the benefits important to the client and, at the same time, the need to reduce costs in a responsible manner. During this creative session, judgement about the ideas is not permitted.

### *Phase IV - Evaluation Phase*

All of the information created up to this point must undergo careful consideration. The value analysis team assesses the ideas stemming from the creativity session to test, first,

whether the creativity session addressed the problem areas, opportunities and functions identified earlier and, second, whether the specific strategies generated during the creativity session can be, at least in a preliminary fashion, linked with them. The value based decision-making technique of Choosing by Advantages is used to help select the preferred alternative(s). Other techniques such as life cycle costing are also used as appropriate to help the VA team discuss and evaluate alternatives.

***Phase V - Development Phase***

The development phase includes preparing sketches, engineering calculations, cost estimates and life cycle cost analyses to verify the idea adds value to the project. The results of this effort are then used to prepare a presentation.

***Phase VI - Recommendation Phase***

The last phase of the Value Analysis Study involves the presentation of recommendations. The team carefully reviews the recommendations before they are formally presented, generally on the last day of the workshop. The recommendations, the rationale that went into the development of each proposal and a summary of the cost savings are presented at this time so that the client can begin an evaluation of the value analysis recommendations prior to the receipt of the report itself.

## POST-STUDY PROCEDURES

The post-study portion of a Value Analysis Study includes the preparation of a report describing the activities undertaken during the study and incorporating the recommendations stemming from the workshop. This post-study effort may require follow-up to resolve questions remaining from the study. Either the value analysis team leader or an appropriate team member may work directly with the client to further implementation strategies.

**CONSTRUCT 2.60-MILE TAMIAMI TRAIL BRIDGE**
**PMIS 196127**

**Everglades National Park, Florida**

**VALUE ANALYSIS (VA) WORKSHOP**
**December 9 - 13, 2013**

**FIVE DAY AGENDA**

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**Day 1:**

8:00 a.m. **INTRODUCTION TO WORKSHOP/ INFORMATION PHASE**

Welcome & Opening Remarks
Team Member Introductions
Objectives of Workshop
Workshop Organization & Agenda

8:15 **VALUE ANALYSIS BRIEFING**

8:30 **PROJECT DESIGN PRESENTATION** (By Design Team)

Status (Current Stage of Design Process)
Project Goals (by Park/ Region, as desired)
Alternatives Considered (Subject Areas)
- Bridge Span Alternatives (Optimization Report)
- Everglades Center Down Ramp Alternatives
- Drainage/ Water Quality Alternatives
- West End Radio Tower Access Alternatives

Project Budget & Schedule

10:30 **FUNCTION & VALUE MODELS**

Stakeholders/ Interests
Function Logic Diagram (Function Analysis)
Function Cost Model (Pareto)
Risk Model (final day)
Force Field Analysis (as time permits)

12:00 **LUNCH**

1:00 p.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Bridge Span Alternatives)**

Alternatives Considered/ Brainstorm Additional Alternatives
(Identify Opportunities to Achieve Best Balance of Life Cycle Cost, Performance, Sustainability, and Durability, while meeting Required Functions)
Choosing by Advantages* as appropriate
Sketches of Alternatives
Cost Estimate of Alternatives
Estimates of Maintenance, Energy, Replacements
Life Cycle Cost Calculations
Preferred Alternative/ Written Proposal (Present, Proposed, Discussion)

5:00 **ADJOURN**

**Day 2:**

8:00 a.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Bridge Span Continued)**

12:00 **LUNCH**

1:00 p.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Down Ramp Alternatives)**

Alternatives Considered/ Brainstorm Additional Alternatives
(Identify Opportunities to Achieve Best Balance of Life Cycle Cost, Performance, Sustainability, and Durability, while meeting Required Functions)
Choosing by Advantages* as appropriate
Sketches of Alternatives
Cost Estimate of Alternatives
Life Cycle Cost Calculations
Preferred Alternative/ Written Proposal (Present, Proposed, Discussion)

5:00 **ADJOURN**

**Day 3:**

8:00 a.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Down Ramp Continued)**

12:00 **LUNCH**

1:00 p.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Drainage/ Water Quality)**

Alternatives Considered/ Brainstorm Additional Alternatives
(Identify Opportunities to Achieve Best Balance of Life Cycle Cost, Performance, Sustainability, and Durability, while meeting Required Functions)
Choosing by Advantages* as appropriate
Sketches of Alternatives
Cost Estimate of Alternatives
Life Cycle Cost Calculations
Preferred Alternative/ Written Proposal (Present, Proposed, Discussion)

5:00 **ADJOURN**

**Day 4:**

8:00 a.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (Drainage/ Water Continued)**

12:00 **LUNCH**

1:00 p.m. **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (West End Access)**

Alternatives Considered/ Brainstorm Additional Alternatives
(Identify Opportunities to Achieve Best Balance of Life Cycle Cost, Performance, Sustainability, and Durability, while meeting Required Functions)
Choosing by Advantages* as appropriate
Sketches of Alternatives
Cost Estimate of Alternatives
Life Cycle Cost Calculations
Preferred Alternative/ Written Proposal (Present, Proposed, Discussion)

5:00 **ADJOURN**

**Day 5:**

| | |
|---|---|
| 7:30 a.m. | **CREATIVITY, EVALUATION, DEVELOPMENT PHASE (West End Access, Continued)** |
| 11:00 | **PERMITTING DISCUSSION** |
| 12:00 | **LUNCH** |
| 12:30 p.m. | **RISK ANALYSIS / 90% & 75% ALTERNATIVES** |
| | Risk Model<br>Alternatives Considered/ Brainstorm Additional Alternatives<br>Cost Estimate of Alternatives |
| 1:30 | **PRESENTATION PHASE** |
| | VA Preferred Alternatives & Advantages<br>Next Steps (VA Implementation Plan) |
| 2:30 | **ADJOURN/ CELEBRATION!** |

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*** CHOOSING BY ADVANTAGES (CBA)**

**Alternatives & Importance**
Define CBA Alternatives (including sketches)
Define Evaluation Factors
Identify Attributes & Advantages
Score Importance of Advantages
Determine Total Importance of Each Alternative
**Life Cycle Cost Analysis**
Estimate Construction Costs
Estimate O & M Costs & Revenue Potential
Determine Life Cycle Cost of Each Alternative
**Importance to LCC Graphs/ Reconsideration**
Importance to Cost Graphs
Reconsideration, Other Alternatives
CBA/ LCC/ Importance to Cost Graph Updates
Consensus of Preferred Alternative