Georgia Department of Transportation

Georgia Department of Transportation

SR 36 Passing Lanes and Flint River Bridge Replacement

Project No. STP00-0000-00(929) and BRST0-0157-01(009)

P.I. Nos. 0000929/333210

Talbot/Upson Counties, Georgia

Value Engineering Study Report

Preliminary Engineering Submittal

April 2009

Designer

GDOT

Value Engineering Consultant

an ARCADIS company

an ARCADIS company

Lewis & Zimmerman Associates
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Tacoma, Washington 98422
Tel: 253.229.7703
www.lza.com

Ms. Lisa L. Myers
Design Review Engineering Manager/VE Coordinator
GA DOT - Engineering Services
One Georgia Center – 5th Floor
Atlanta, Georgia 30308

re: **SR 36 Passing Lanes and Flint River Bridge Replacement**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia
Value Engineering Study Report

Date:
April 13, 2009

Contact:
Dave Hamilton

Phone:
253.229.7703

Email:
dhamilton@lza.com

Our ref:
LZ083344.0000

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. (LZA) is pleased to present two hard copies and one CD of the value engineering study report on the referenced project. We appreciate your assistance in the conduct of this study, and hope that these VE recommendations will provide a variety of improvements that will enhance the true value and constructability of the SR 36 Passing Lane Project. Some of the more interesting alternatives concern optimizations to the roadway alignment, section, and the Flint River Bridge. These alternatives provide comparable performance at a lower total cost to the project.

We appreciate the excellent participation of the GDOT staff and the District 3 design team throughout the conduct of this study. Please feel free to contact David Hamilton at 253.229.7703 if you have any questions as you review this report.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

David A. Hamilton, P.E., CVS, CCE, LEED® AP
Vice President/VE Team Leader
Certified Value Specialist No. 910506 - Life

Attachment

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EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA), for the Georgia Department of Transportation (GDOT). The subject of the study was the Preliminary Engineering Submittal on the SR 36 Passing Lanes and Flint River Bridge Replacement, STP00-0000-00(929) and BRST0-0157-01(009), P.I. No. 0000929 and No. 333210, respectively, located in Talbot/Upson County, Georgia. The project is being designed by GDOT District 3.

The VE study was conducted March 23 - 26, 2009 at the GDOT Central Office, located in Atlanta, Georgia and was conducted under the value engineering guidelines of GDOT, FHWA, AND SAVE International (The Value Society). VE team members consisted of a Certified Value Specialist from LZA and design and construction professionals from local highway engineering consultants.

Decision Making

Value engineering studies by their nature identify alternate design schemes, construction methods, and project delivery options, which if accepted by the project users and design team, may impact the final scope, design documents, budget, schedule, functionality, and appearance of the SR 36 Passing Lane and Flint River Bridge Replacement Project. The task of the VE team is to identify possible solutions, whereas the task of GDOT project staff is to choose the most favorable of the VE alternatives for incorporation into the project.

Decisions are needed on each of the alternatives presented in this report and personnel from GDOT are totally empowered to accept, reject, or modify these alternatives. Value engineering by its nature searches for new, unique, and different methods to provide for the needed project functions at the lowest total life cycle cost. The blending of these new and sometimes challenging ideas with established procedures, norms, and protocol is the responsibility of the project team. The project team should feel free to accept alternatives which support its construction program and similarly reject alternatives which do not optimize its goals for the SR 36 corridor.

PROJECT DESCRIPTION

This project will provide passing lanes along State Route 36 and replace the aging bridge crossing the Flint River. Two separate sites are involved with this project. Site 1 is located in Talbot County with a westbound passing lane being added between mile 20.40 and mile 22.75. Site 2 is located in Upson County and with a new eastbound passing lane being added between mile 0.05 and mile 1.79. The total project cost of the passing lane project for Sites 1 & 2 is estimated at $17.0 including right of way, reimbursable utilities, and engineering. The Flint Bridge replacement project, including roadway approaches, is estimated at $2.1M.

Existing Roadway Characteristics

SR 36 is functionally classified as a rural minor collector within the project area. This route is used by school buses and is not part of the National Highway System. SR 36 is an east-west access route in Talbot and Upson Counties. This route begins at SR 20B in Waverly Hall, Harris County and runs northeasterly through Harris, Talbot, Upson, and Lamar Counties to I-85 in Butts County. SR 36 continues northerly through Butts County to SR 81 in Covington, Newton County, where it ends. SR 36 is a two-lane roadway with truck traffic ranging from 10 to 15 percent in the project area. The lack of passing opportunities along this route causes vehicle delays resulting from platoons or vehicles queuing behind slower-moving cars or trucks. This project will ensure that adequate passing opportunities are optimally available along the route.

Proposed Schedule

The 3.9 mile long segment will be realigned in several locations to eliminate design variances and speed constraints due to substandard horizontal and vertical curves. The typical roadway section will include two 12-ft-wide travel lanes with 2 ft of paved shoulder and 8 ft of gravel shoulder. The new passing lanes will be 12 ft wide. The right-of-way for the new improvements is planned to be between 150 and 200 ft wide to accommodate cut/fill slopes in this rolling terrain. Construction is expected to take 24 months and will be staged so that two-way traffic is maintained at all times. A total of 600,000 CY of material will be cut/filled along the alignment to accommodate the new horizontal and vertical alignment.

The new Flint River Bridge will be a three-span concrete structure with 110 ft long prestressed, concrete girders and two intermediate drilled caisson piers in the river. The existing Flint River bridge, built in 1958, has a Bridge Sufficiency Rating of 29 and will be demolished.

CONCERNS AND OBJECTIVES

During the presentation by the representatives from the GDOT District 3 design team on the first day of the VE study, several areas of concern in the development of the project were noted. These items were identified as areas of opportunity to improve value, meet design requirements, satisfy goals, and reduce project risk on the SR 36 project.

- SR 36 has a projected average daily traffic (ADT) in the design year of 3,000, which is quite modest. Complications from the design deficiencies, mainly horizontal curve issues and grades in the range of 6 to 7% appear to be causing some platooning of vehicles.
- The solution to the deficiencies may not actually require both alignment and passing lane improvements, but rather a choice of only one solution. Several fatalities and truck roll-overs have occurred on the worst curves and should have the highest priority for capital investment.
- Due to the rolling terrain, fills along the alignment are substantial, with several locations showing nearly 30 ft of fill. Similarly, substantial cuts are required along the profile.
- Overall impression of the cost estimate is that several items on the bridge could increase the project's cost. Unit price extensions on the superstructure concrete and reinforcing steel need to be adjusted.

- A total of nearly 600,000 CY of material is required to be cut/filled on the project. This cut/fill amount appears to be balanced.
- One of the side roads has a grade of 15% and may need additional investigation.

Project Constraints

Discussions held during the VE study evolved around several key constraints that must be incorporated in the design. Specific items that are considered fixed are as follows:

- Two wetlands are noted along the alignment and variations to the design in this region should be avoided.
- A total of five streams are present and environmental work thus far has established a planned approach for these crossings, the most notable is the Reeves Creek crossing. GDOT has applied for environmental permits through the U.S. Army Corps of Engineers.
- Several cemeteries are in the area and must be avoided.
- A design speed of 55 mph must be incorporated into all design solutions.

RESULTS

The VE team explored 22 ideas that could enhance the value of the project and address the concerns of GDOT. Evaluation and research of the ideas yielded 18 technically feasible alternatives with definable cost implications. Each of the alternatives and design suggestions are summarized on the table entitled Summary of Potential Cost Savings. Note that the alternatives were developed independent of each other and thus the total potential cost savings achievable is dependent on the combination of alternatives selected for implementation. A discussion of some of the more salient alternatives developed by the VE team follows.

The VE team searched for ways to optimize the design from a traffic perspective and looked for schemes to reduce capital cost and right-of-way expenditures. Since the basic function of the project is to improve safety, much of this can be done by either providing passing lanes, or by modifying the roadway alignment and improving curve geometry. The relatively low ADT on SR 36 makes it questionable to provide both alignment and passing lane improvements to meet the safety goals for the project. Thus, the most significant finding of the study was the identification of two alternatives which would provide for a dual level of improvement to SR 36. The first alternative provides for limited passing lane improvements using the existing alignment and the second provides a new alignment with improved geometry, but without any passing lanes. These two concepts provide a basis for conceptualizing the project solution and should be considered before the project moves further into the design process. They can meet the basic function of the project for as little as $5M compared to the current cost of $17M. Various hybrids of this concept are presented in both Talbot (Site 1) and Upson (Site 2) Counties, but the concept of providing either passing lanes or roadway realignment, but not both, can adequately solve the safety and design deficiency issues on SR 36 at a substantially lower capital construction cost.

Two completely new alignments with significantly longer curve radii were also explored by the VE team to meet the functional requirements. These alignments would offer markedly improved line of site, speed potential, and safety, but require two bridges each to cross over the Flint River due to the

divided channel in this location. These alternatives are agreeably interesting, but considerably more expensive than the base design.

The Flint River Bridge also offers possibilities for value improvements through the incorporation of several structural modifications. The width of the bridge could be reduced by changing the width of one of the shoulders from 8 ft to 2 ft and increasing the beam spacing from 7 ft 3 in to 9 ft. This increased beam spacing and shoulder width adjustment will save over $200,000.

The Study Results section of the report provides additional backup support describing each alternative

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE REPLACEMENT**

Project No. STP00-0000-00(929) and BRST0-0157-01(009) Talbot/Upson County, Georgia

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
ALIGNMENT - SITE #1 (TALBOT CO.) & #2 (UPSON CO.) (A)						
A-1	Realign the route from Road 28 to the City of Roland through the north end of Seven Islands and lengthen the horizontal curve radius. Total length is 26,000 LF.	$19,394,479	$24,850,340	($5,455,861)		($5,455,861)
A-2	Realign the route from Road 28 to the City of Roland through the south end of Seven Islands. Total length is 26,000 LF.	$19,394,479	$24,850,340	($5,455,861)		($5,455,861)
A-3	Shorten the alignment length by increasing the radius of curvature in the Talbot County portion of SR 36. Total length of this segment is 12,000 LF.	$10,408,584	$10,334,520	$74,064		$74,064
A-4	Retain the existing SR 36 alignment, do not make horizontal improvements, but add a single 4,000 ft long, 12ft wide passing lane on Site 1 (Talbot County).	$10,564,700	$1,525,889	$9,038,811		$9,038,811
A-5	Provide a total of 6,000 LF of passing lanes in lieu of 16,652 LF.	$4,780,290	$1,722,420	$3,057,870		$3,057,870
A-7	Eliminate the passing lanes in total, but construct two 12ft lanes on the improved As-Designed alignment.	$4,780,290	0	$4,780,290		$4,780,290
A-8	Make the outside lanes 11ft wide in lieu of 12 ft wide, but keep the passing lanes at 12 ft.	$398,316	0	$398,316		$398,316
A-9	Keep the existing SR 36 alignment, but add a single 4,000ft long passing lane on Site #2 (Upson County).	$6,740,298	$1,524,889	$5,215,409		$5,215,409
A-10	Combine Alt. Nos. A-4 and A-9 and do not realign SR 36, but add two 4,000 ft long, 12-ft-wide passing lanes.	$17,305,000	$3,050,000	$14,255,000		$14,255,000
A-11	Realign only a portion of SR 36 Site 1, Talbot County.	$10,564,700	$2,487,883	$8,076,817		$8,076,817

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE REPLACEMENT**

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ALIGNMENT - SITE #1 (TALBOT CO.) & #2 (UPSON CO.) (A) (continued)						
A-12	Add a single12ft wide passing lane to SR 36 in Site #2 (Upson County) and correct the alignment for a portion of the road only.	$6,740,300	$24,878,836	($18,138,536)		($18,138,536)
A-13	This is a combination of A-11 and A-12. Add two passing lanes, one in Talbot County and one in Upson County, and realign only a portion of the alignment.	$17,305,000	$4,975,766	$12,329,234		$12,329,234

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE REPLACEMENT**

Project No. STP00-0000-00(929) and BRST0-0157-01(009) Talbot/Upson County, Georgia

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
PROFILE (P)						
P-1	Adjust the profile of the mainline to reduce cut/fill quantities. Increase some grades up to 8%, shorten the radius of the vertical curves, but retain the proposed alignment and passing	$427,350	0	$427,350		$427,350
BRIDGE (B)						
B-1	Reduce the width of the shoulder on one side of the bridge from 8 ft wide to 2 ft wide. Remaining shoulder to be 8 ft.	$1,102,644	$937,475	$165,169		$165,169
B-2	Increase the beam spacing on the bridge from 7 ft 3 in to 9 ft and use five prestressed concrete beams in lieu of six.	$451,715	$409,750	$41,965		$41,965
B-5a	Use Conspan type of structure for the triple box culvert in lieu of the conventional cast-in-place IP concrete box with base slab.	$403,241	$385,800	$17,441		$17,441
B-5b	Use Conspan type of structure for the triple box culvert in lieu of the conventional CIP box, but eliminate the invert base slab. Use the natural stream bed.	$403,240	$253,226	$150,014		$150,014
B-8	Change the project delivery method from design/bid/build to design/build, reduce the schedule by 6 mo. and reduce the impact of cost escalation. This could reduce the total project cost by approximately $485,000 for 6 months worth of escalation.	DESIGN SUGGESTION				

STUDY RESULTS

GENERAL

The results of this value engineering study conducted on the SR 36 Passing Lane and Flint River Bridge Replacement, STP00-0000-00(929) and BRST0-0157-01(009), P.I. Nos. 0000929 and 333210, respectively, represent the benefits that can be realized by the project and the patrons that use the SR 36 corridor in Talbot and Upson Counties, Georgia.

During the study, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that comprise the project. These are in the form of VE alternatives (accompanied by cost estimates) or design suggestions (typically without cost estimates). For each alternative developed, the following information is provided:

- A summary of the original design;
- A description of the proposed change to the project;
- Sketches and design calculations, if appropriate;
- A capital cost comparison and life cycle discounted present worth cost comparison of the alternative and original design (where appropriate);
- A descriptive evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted. Capital cost calculations, as described in the Value Analysis and Conclusions section of the report, were assumed to include all unit prices markups for contractor overhead, profit, contingencies, and escalation.

Each design suggestion contains the same information as the VE alternatives, except that no cost information is usually included. The design suggestions are presented as a series of narratives following the alternatives. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved facility operation, ease of maintenance, ease of construction, safer working conditions, reduction in project risk, etc. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) to track through the value analysis process and thus facilitate referencing among the Creative Idea Listing and Evaluation worksheets, the alternatives, and the Summary of Potential Cost Savings table. The Alt. No. includes a prefix that refers to a major project element listed below:

PROJECT ELEMENT	PREFIX
Alignment – Site #1 and Site #2	A
Profile	P
Bridge	B

Summaries of the alternatives and design suggestions are provided on the Summary of Potential Cost Savings tables. The tables are divided into project elements and are used to divide the results section. The complete documentation of the developed alternatives and design suggestions follows each of the Summary of Potential Cost Savings tables.

KEY ISSUES

During the design presentation several issues arose as being key drivers in the project' design, including right-of-way constraints, alignment, historical accident rates, and safety issues. The key issue that developed during the VE study was the identification of specific project functions which clarified and divided the requirements of the project into manageable solutions. The desire to "Improve Safety" appears to be driven more by horizontal alignment and curve radii rather than a need to add passing lanes. The passing lane issue appears to be more of a convenience item since the ADTs at the design year are only in the range of 3,000. Improvements to the horizontal and vertical alignment will create more opportunities for drivers to pass, thus reducing the potential for delays along the corridor. The need for the passing lanes appears to be lessened if horizontal and vertical modifications are made to SR 36. Functionally dividing the project needs into safety and convenience, or basic and secondary, allows for a clearer evaluation of the project needs and may lead to a significantly reduced project scope.

STUDY OBJECTIVES

The key objectives of the project as described by the design team are to improve the level of service to drivers in the SR 36 corridor, maximize safety along the roadway, reduce truck turnovers, protect numerous historical properties, and control the amount of right of way required. The challenge to the VE team then was to optimize the roadway design, construction management plan, cost estimate, and procurement approach while managing project risk, reducing traffic delays, and improving highway safety. Eliminating design deficiencies was the primary scope item as envisioned by the VE team for the success of the project, with improved passing capabilities seen as secondary.

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 18 alternatives for consideration by GDOT. These alternatives address the key issues described above, specifically the overall capital cost of the project, amount of project right-of-way, and safety.

The following are select highlights from the VE study.

Alignment – Site #1 and Site #2 (A)

- To improve the alignment, several concepts were investigated by the team, including a totally new alignment with large sweeping radii and excellent line of sight, a partial scheme with improvements to specific problem areas only, and several schemes with limited passing lane improvements. The new alignment options moved the roadway further north and crossed the Flint River near Seven Islands. This more direct alignment provides excellent geometry, but requires two new bridges over the Flint River, increases the cost of right-of-way, since it is located in a totally new corridor, and results in a total project length of 24,000 ft. The added cost for this new alignment is approximately $5M, but it would provide excellent safety characteristics and optimal passing opportunities.
- Another approach explored by the VE team was to provide limited passing lanes of 4,000 LF each in both Talbot and Upson Counties in lieu of the 16,000 LF currently included in the project. This concept would reuse the existing roadway alignment without any improvements to the horizontal or vertical curves. Providing only passing lane improvements could be accomplished for a modest investment of only $3M instead of the $10M currently being planned. The 4,000 LF passing lanes meet the GDOT Design Criteria for minimum length and provides for the passing function desired in the project scope of work. The $7M in potential project savings can be realized if the highest priority for the project is placed on adding passing lanes rather than passing lanes plus geometry improvements.
- Decreasing the investment in the project to $5M would allow for 4,000 LF passing lanes in both counties plus geometric improvements to the most critical alignment deficiencies. In light of the relatively modest ADT projection of 3,000 vehicles in the design year, this reduced project scope may be warranted and highly justified.
- The roadway section can be improved by reducing the outside lane width in the area of the passing lanes from 12 ft wide to 11 ft wide. This one foot wide strip is worth nearly $400,000 and provides needed cost control for the project.

Profile (P)

- To optimize the profile and potentially reduce the more than 600,000 CY of cut/fill on the project, the team identified incremental grade adjustments along the corridor. Some grades were increased up to 8% to reduce some of the major cuts, while other areas were modified to reduce the 30 ft high fill areas. The accumulated changes to the profile resulted in a net reduction of nearly 70,000 CY of cut/fill and a cost savings of more than $400,000.

Bridge (B)

- The Flint River Bridge replacement appears well designed, but some optimization is possible to the section and structural geometry. The section can be optimized by reducing one of the shoulders from 8 ft wide to 2 ft wide to reduce the total area of bridge decking. This reduction in bridge deck results in a project cost savings of approximately $165,000. The beam spacing can also be optimized by increasing the spacing from 7 ft 3 in to 9 ft, thus saving one beam at a cost of $43,000.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

When reviewing the study results, the reader should consider each part of an alternative or design suggestion on its own merit. There may be a tendency to disregard an alternative because of a concern about one part of it. Each area within an alternative or design suggestion that is acceptable should be considered for use in the final design, even if the entire alternative or design suggestion is not implemented. Variations of these alternatives and design suggestions by the owner or designer are encouraged.

All alternatives and design suggestions were developed independently of each other to provide a broad range of options to consider for implementation. Therefore, some of them are mutually exclusive, so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative. Design suggestions could also be interrelated thus precluding a part of one or more suggestions from being implemented if another design suggestion is also implemented.

The reader should evaluate all alternatives carefully in order to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution.

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A-5	Provide a total of 6,000 LF of passing lanes in lieu of 16,652 LF.	$4,780,290	$1,722,420	$3,057,870		$3,057,870
A-7	Eliminate the passing lanes in total, but construct two 12ft lanes on the improved As-Designed alignment.	$4,780,290	0	$4,780,290		$4,780,290
A-8	Make the outside lanes 11ft wide in lieu of 12 ft wide, but keep the passing lanes at 12 ft.	$398,316	0	$398,316		$398,316
A-9	Keep the existing SR 36 alignment, but add a single 4,000ft long passing lane on Site #2 (Upson County).	$6,740,298	$1,524,889	$5,215,409		$5,215,409
A-10	Combine Alt. Nos. A-4 and A-9 and do not realign SR 36, but add two 4,000 ft long, 12-ft-wide passing lanes.	$17,305,000	$3,050,000	$14,255,000		$14,255,000
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A-13	This is a combination of A-11 and A-12. Add two passing lanes, one in Talbot County and one in Upson County, and realign only a portion of the alignment.	$17,305,000	$4,975,766	$12,329,234		$12,329,234

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-1**

DESCRIPTION: **REALIGN THE ROUTE FROM ROAD 28 TO THE CITY OF ROLAND THROUGH THE NORTH END OF SEVEN ISLANDS AND LENGTHEN THE HORIZONTAL CURVE RADIUS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The original design constructs Route 36 over and next to existing Route 36. The total length of the roadway is 20,990 LF.

ALTERNATIVE: (sketch attached)

Create a completely new alignment from Road 28 to the City of Roland as shown on the sketch. Keep the existing route as it is for local businesses to access the new route. The total length of the new route would be 26,000 LF.

ADVANTAGES:

- Improves safety
- Reduces travel time
- Negligible impact on traffic
- Eliminates curves all the way to Road 28

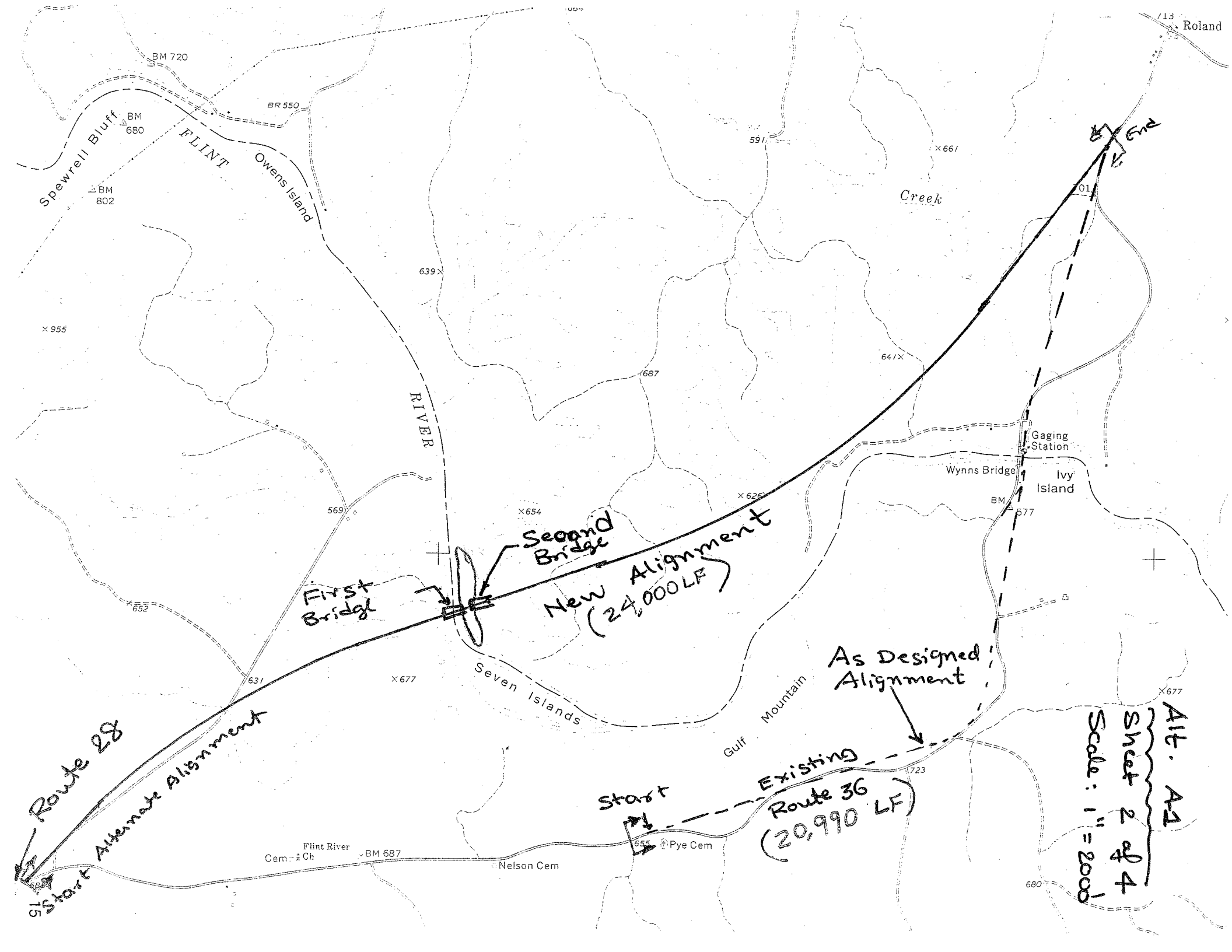
DISADVANTAGES:

- Costs increase
- More construction time required
- May require environmental review

DISCUSSION:

It is to be noted that the as-designed alignment stops at Pye Cemetery, which is 12,000 ft from the Route 36 intersection with Road 28. This alternative removes the curve on Route 36 at the Road 28 intersection.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 19,394,479	—	$ 19,394,479
ALTERNATIVE	$ 24,850,340	—	$ 24,850,340
SAVINGS (Original minus Alternative)	$ (5,455,861)	—	$ (5,455,861)


Roland
BM 720
BR 550
Spewrell Bluff
BM 680
BM 802
FLINT
Owens Island
RIVER
Creek
End
Gaging Station
Wynns Bridge
Ivy Island
BM 677
Second Bridge
First Bridge
New Alignment
(24,000 LF)
As Designed Alignment
Existing
Route 36
(20,990 LF)
Start
Alternate Alignment
Route 28
Start
Seven Islands
Gulf Mountain
Flint River Cem
Ch
BM 687
Nelson Cem
Pye Cem
Alt. A1
Sheet 2 of 4
Scale: 1" = 2000'
639
955
687
641
661
591
569
654
626
652
631
677
723
655
660
15

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-1

SHEET NO.: 3 of 4

Cost of Bridge including the approach road, drainage etc. is given to be : $2,089,299.85

The total length is : 1,035' out of which the bridge itself is 350' costing $911,715. Excluding the approach road, drainage etc. is 685' costing $1,177,584.

The complete cost of Bridge is $\frac{2,089,299.85}{1,035} = \$2,018.65/ft$

The bridges proposed under this alternative are likely to be less than 350' long. However for simplicity, assume that both bridges match the as-designed bridge. Including the approach roads on both ends of both bridges, the total length is two thousand feet from beginning of 1st bridge to ending the 2nd bridge approach road.

The total length of the roadway alignment as proposed under this alternative is : 24,000 feet

The total length of as designed roadway only is 19,955'
The total cost of as designed roadway is : $17,305,233
∴ Cost per foot of roadway only will be : $\frac{17,305,233}{19,955} = \$867.21$
(including P/w)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-1**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge	FT	1,035	2,018.65	2,089,303	2,000	2,018.65	4,037,300
Roadway	FT	19,955	867.21	17,305,176	24,000	867.21	20,813,040
Subtotal				19,394,479			24,850,340
Markup (%) at							
TOTAL				19,394,479			24,850,340

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-2**

DESCRIPTION: **REALIGN THE ROUTE FROM ROAD 28 TO THE CITY OF ROLAND THROUGH THE SOUTH END OF SEVEN ISLANDS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The original design constructs Route 36 over and next to existing Route 36. The total length of the roadway is 20,990 LF. It requires one new bridge over the Flint River.

ALTERNATIVE: (sketch attached)

Create a completely new alignment from Road 28 to the City of Roland as shown on the sketch. Keep the existing route as it is for local businesses to access the new route. The total length of the route would be 26,000 LF, including two required bridges over the Flint River.

ADVANTAGES:

- Improves safety
- Reduces travel time
- Negligible impact on traffic
- Eliminates curve all the way to Road 28

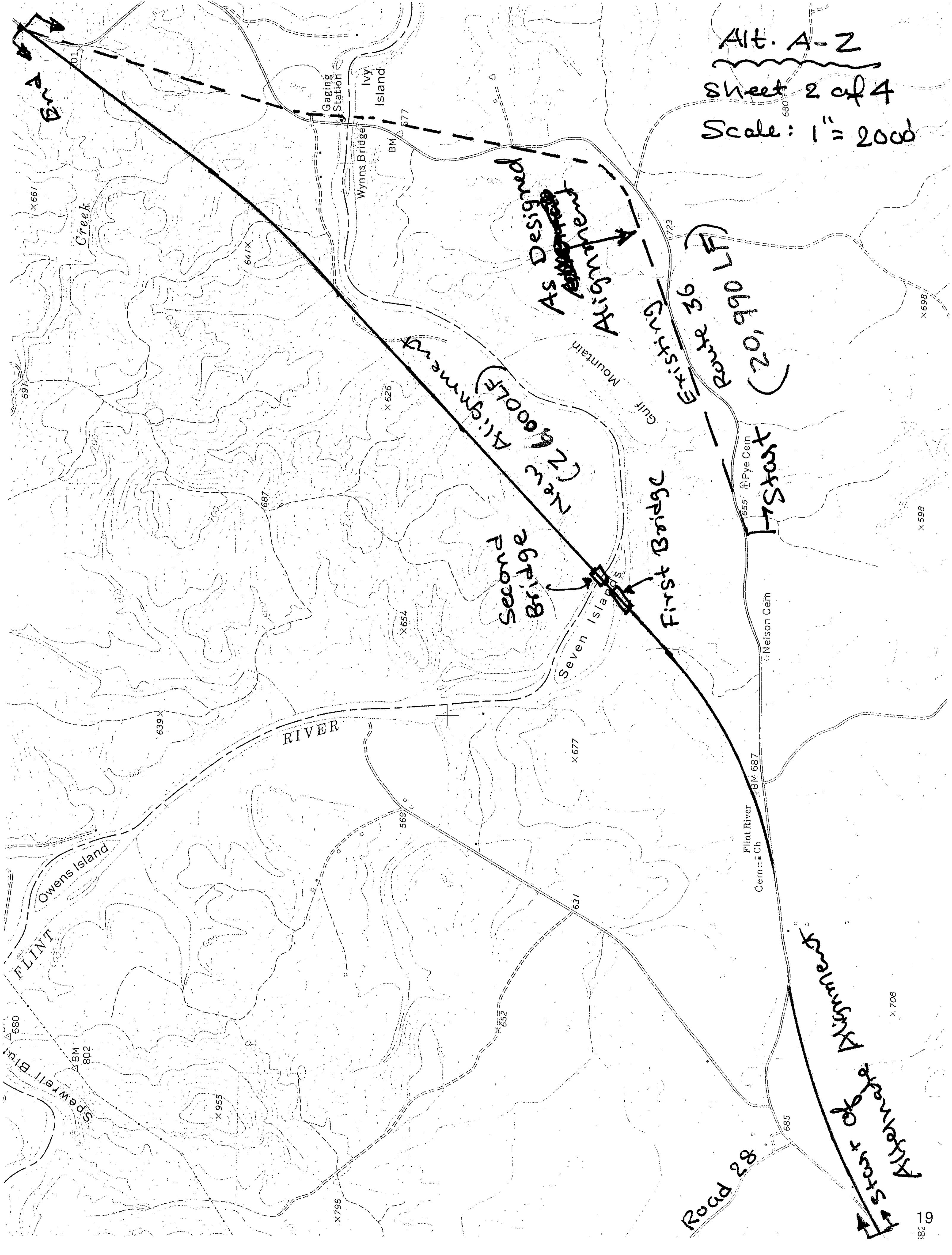
DISADVANTAGES:

- Costs increase
- More construction time required
- May require environmental review

DISCUSSION:

It is to be noted that the as-designed alignment stops at Pye Cemetery, which is 12,000 ft away from the Route 36 intersection with Road 28. This alternative removes the curves on Route 36 at the Road 28 intersection.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 19,394,479	—	$ 19,394,479
ALTERNATIVE	$ 24,850,340	—	$ 24,850,340
SAVINGS (Original minus Alternative)	$ (5,455,861)	—	$ (5,455,861)


Alt. A-Z
Sheet 2 of 4
Scale: 1" = 2000
End
As Designed Alignment
Existing Route 36 (20,990 LF)
Start
New Alignment (26000 LF)
First Bridge
Second Bridge
Start of Alternate Alignment
Road 28
Gaging Station
Ivy Island
Wynns Bridge
Creek
Gulf Mountain
Pye Cem
Nelson Cem
Seven Islands
RIVER
FLINT
Owens Island
Flint River Cem Ch
Sperwell Bluff
BM 687
BM 802
BM 677

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-2

SHEET NO.: 3 of 4

Cost of Bridge including the approach road drainage etc. is given to be : $2,089,299.85

The total length is : 1,035' out of which the bridge itself is 350' costing $911,715. Whereas the approach road, drainage etc. is 685' costing $1,177,585.

The complete cost of Bridge is : $\frac{2,089,299.85}{1,035} = \$2,018.65/ft$

The bridges proposed under this alternative are likely to be less than 350' long. However for simplicity assume that both bridges match the as-designed bridge. Including the approach roads on both ends of both bridges, the total length is two thousand feet from beginning of 1st bridge to end of the 2nd bridge approach road.

The total length of the roadway alignment as proposed under this alternate is : 24,000 feet

The total length of as designed roadway only is 19,955

The total cost of as designed roadway is : $17,305,233

∴ Cost per foot of roadway only will be : $\frac{17,305,233}{19,955} = \$867.21$
(incl. Cost P/w road)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-2**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge	FT	1,035	2,018.65	2,089,303	2,000	2,018.65	4,037,300
Roadway	FT	19,955	867.21	17,305,176	24,000	867.21	20,813,040
Subtotal				19,394,479			24,850,340
Markup (%) at							
TOTAL				19,394,479			24,850,340

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-3**

DESCRIPTION: **SHORTEN THE ALIGNMENT BY INCREASING THE RADIUS OF THE CURVATURE AT THE SITE 1 (TALBOT COUNTY) PORTION OF ROUTE 36**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (sketch attached)

The alignment hugs the existing SR 36 producing a sharper horizontal curve. The total length of the alignment is 12,086 LF.

ALTERNATIVE: (sketch attached)

Begin about 2,000 ft further away at Nelson Cemetery to eliminate one more existing road curve and end at the same point (end of Site 1) as in the designed alignment. The total length would be 12,000 LF.

ADVANTAGES:

- Saves costs
- Increases safety

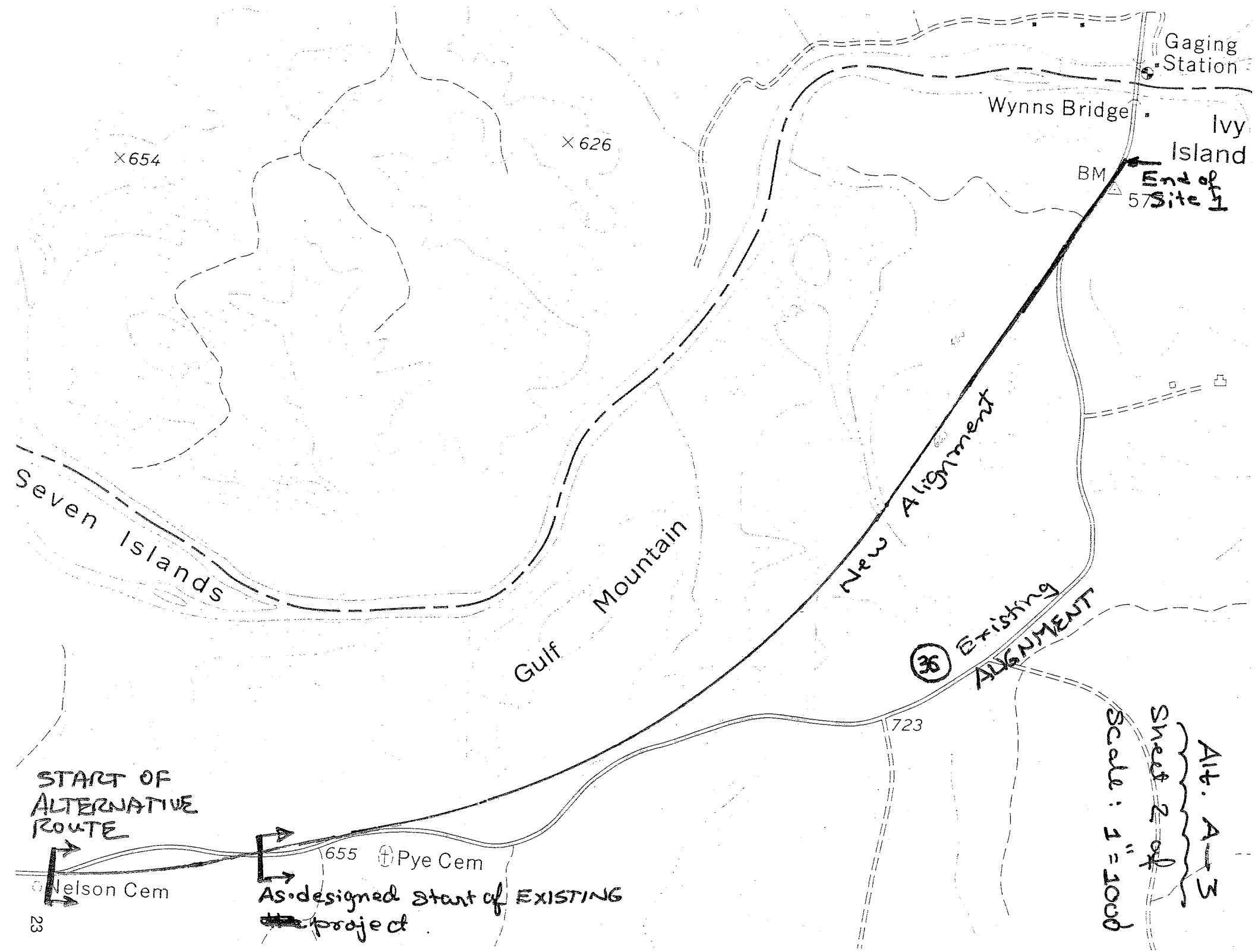
DISADVANTAGES:

- Possible increase in construction
- Increases design time due to completely new alignment

DISCUSSION:

The as-designed length of Route 36 from the start of the project to the end of Site 1 is 12,085.93 ft. The proposed alternate alignment to the end of Site 1 is 12,000 ft, saving about 86 ft of pavement.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 10,408,584	—	$ 10,408,584
ALTERNATIVE	$ 10,334,520	—	$ 10,334,520
SAVINGS (Original minus Alternative)	$ 74,064	—	$ 74,064


Gaging Station
Wynns Bridge
Ivy Island
BM 57
End of Site 1
×654
×626
Seven Islands
Gulf Mountain
New Alignment
36
Existing ALIGNMENT
723
START OF ALTERNATIVE ROUTE
655
Pye Cem
Nelson Cem
As-designed start of EXISTING project
Alt. A-3
Sheet 2 of
Scale: 1" = 1000'

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-3**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Roadway	LF	12,086	861.21	10,408,584	12,000	861.21	10,334,520
(See A-1 for unit cost)							
Subtotal				10,408,584			10,334,520
Markup (%) at							
TOTAL				10,408,584			10,334,520

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-4**

DESCRIPTION: **KEEP THE EXISTING SR 36 ALIGNMENT BUT ADD A 12 FT PASSING LANE AT SITE 1 (TALBOT COUNTY)**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN:

The current design realigns SR 36 (both horizontally and vertically) along the entire length of Site 1.

ALTERNATIVE: (sketch attached)

Retain the existing SR 36 alignment and widen 12 ft for a new passing lane.

ADVANTAGES:

- Less construction cost
- Less right-of-way cost

DISADVANTAGES:

- Alternative does not upgrade the existing SR 36 to present-day desirable design standards

DISCUSSION:

The current project upgrades the design of existing SR 36 since it is substandard. However, the intent of this project is to add a passing lane since it is unsafe to pass due to the substandard horizontal and vertical alignments of SR 36. By adding a passing lane to the existing alignment, it will allow faster moving vehicles to pass safely. It is important to mention the low volumes of traffic for a state route, estimated at 2,000 vpd in the year 2013 and 3,100 vpd in the year 2033.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 10,564,700	—	$ 10,564,700
ALTERNATIVE	$ 1,525,889	—	$ 1,525,889
SAVINGS (Original minus Alternative)	$ 9,038,811	—	$ 9,038,811

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 2 of 5

Passing lanes are also used to improve safety on two-lane highways. Safety evaluations have shown that passing lanes and short four-lane sections reduce accident rates below the levels found on conventional two-lane highways. Installation of passing lanes can reduce accident rates by up to 25 percent.

To maximize the traffic operational efficiency of a passing lane in level or rolling terrain, it's length can vary from a minimum of 0.5 mi. to a maximum of 2.0 mi. depending on the directional flow rate, as shown in the following table:

Length of Passing Lanes	
Directional flow rate (pc/h)	**Passing lane length (mi)**
100	≤0.50
200 279	>0.50-0.75
400	>0.75-1.00
≥700	>1.00-2.00
Source: Transportation Research Board, Highway Capacity Manual, 2000	

∴ USE 0.75mi PASSING LANE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-4

Full Depth Pavement:

1½" (12.5mm Superpave):

$$1.5\,in \times 110\,\frac{Lbs}{SY\text{-}in} \times \frac{T}{2000\,Lbs} \times \$100/T = \$8.25/SY$$

2" (19mm Superpave):

$$2\,in \times 110\,\frac{Lbs}{SY\text{-}in} \times \frac{T}{2000\,Lbs} \times \$100/T = \$11.00/SY$$

4" (25mm Superpave):

$$4\,in \times 110\,\frac{Lbs}{SY\text{-}in} \times \frac{T}{2000\,Lbs} \times \$100/T = \$22.00/SY$$

(12") GAB: $\left(\frac{9\,SF}{SY} \times 1'\right) \times \frac{.076\,T}{CF} \times \$25/T = \$17.10/SY$

Total = $\$58.35/SY$

Recommend Adding Site 1 (Alt. 1-4) Passing Lane from Sta. 180+00 → Sta 220+00 Along exist. SR 36. This would be in Lieu of the proposed site 1

Present Cost of Site 1:

Site 1 (100+10 → 220+86) = 2.287 mi (proposed)

Total Roadway Length of Cost Estimate (Site 1 & Site 2) = 3.746 mi

Site 1 total Cost (incl. constr., R/W & mkup of 35.1%)

Site 1 (%) of total Rdwy or R/W = $\frac{2.287\,mi}{3.746\,mi}$ = 61.05% or (.6105)

CALCULATIONS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A4

SHEET NO.: 4 of 5

The Length of Passing Lane to be used i (Alt. design) 4000' See attached chart for Length of Passing Lane for 279 veh./hr.

$(3100 upd) \times \frac{.09}{2K} = 279 \text{ veh/hr.}$

use 4,000' ± for Passing Chart, or .75 mi

$\frac{(4{,}000' \times 12')}{9 sf/sy} = 5{,}333 \text{ s.y. (of full depth pavement)}$

(Add'l R/W for 12' widening) : $\frac{(25' \times 4{,}000') + (1400' \times 80')}{43{,}560 sf/AC} = 4.9 AC$ use 5 AC.

Earthwork estimate (Alternate)

$\frac{(12' + 10' + 20') \times 4{,}000' \times 13')}{27 cf/cy} = 89900 \text{ c.y.}$

use $200,000/mi for Passing Lane only Erosion Control.
use $100,000/mi for Passing Lane Drainage.
use $ 20,000/mi for Passing Lane Signing & Striping
use $ 7,050/AC - from GDOT R/W cost Estimate

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-4**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 1 Cost	%	17,305,000	0.6105	10,564,703			
Cost for Alt. Site 1							
Overlay existing lanes	SY				10,666	8.25	87,995
Full depth pavement	SY				5,333	58.35	311,181
Earthwork	CY				80,900	3.00	242,700
Traffic control	LS				LS	LS	50,000
Guard rail	LF				2,500	18.00	45,000
Type 12 anchor	EA				4	2,000.00	8,000
Type 1 anchor.	EA				4	500.00	2,000
Drainage (12 ft lane)	MI				1	100,000.00	75,000
Erosion control (12 ft lane)	MI				1	200,000.00	150,000
Signing/Striping	MI				1	20,000.00	15,000
Subtotal							986,876
Alternate Right-of-Way	AC				7	7,050.00	49,350
Proximity Damages	LS				LS	LS	6,000
Right-of-Way Subtotal				included			55,350
Right-of-Way Mark-up (2.48)				included			137,270
Construction Subtotal				10,564,703			986,876
Markup (%) at 35.1%				included			346,393
TOTAL				10,564,703			1,525,889

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-5**

DESCRIPTION: **PROVIDE A TOTAL OF 6,000 LF OF PASSING LANES IN LIEU OF 16,652 LF**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current design provides 16,652 ft of passing lanes throughout the project.

ALTERNATIVE: (sketch attached)

Decrease the aggregate passing lane length from 16,652 LF to 3,000 ft in each direction for a total of 6,000 ft. Going northeast to Rowland, the passing lane will be from Sta. 245+47 to Sta. 275+47. Going southwest to Pleasant Hill, the passing lane will be from Sta. 184+26 to Sta. 26.

ADVANTAGES:

- Significant cost savings
- Shorter construction time

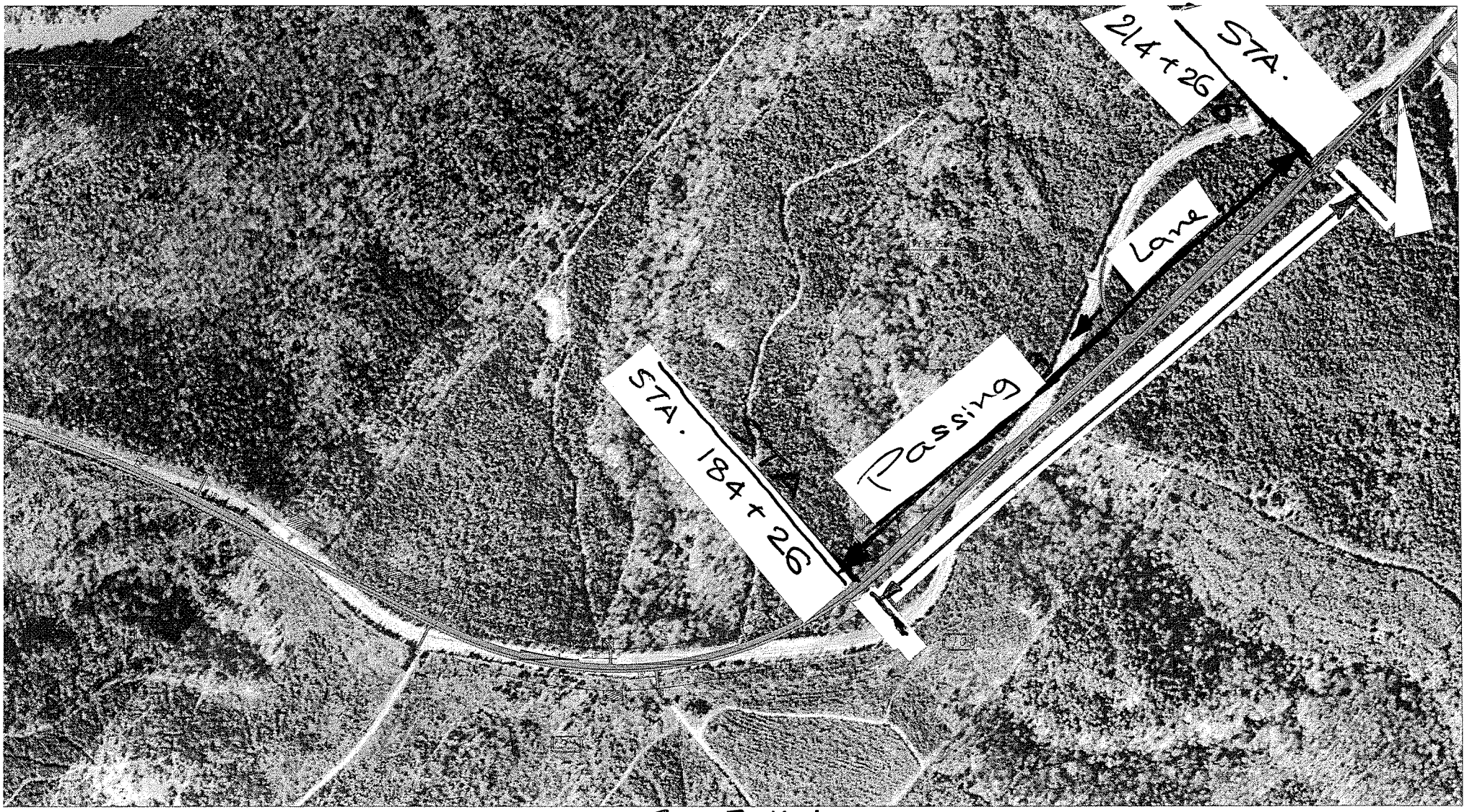
DISADVANTAGES:

- Slight decrease in safety due to only two lane roads

DISCUSSION:

For the design year 2024, the ADT volume is only 2,250. For this little traffic, it is unnecessary to provide passing lanes for the total length of the project. The stations where the new passing lanes are suggested are straight alignments and have 6 to 7 percent vertical grades.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 4,780,290	—	$ 4,780,290
ALTERNATIVE	$ 1,722,420	—	$ 1,722,420
SAVINGS (Original minus Alternative)	$ 3,057,870	—	$ 3,057,870

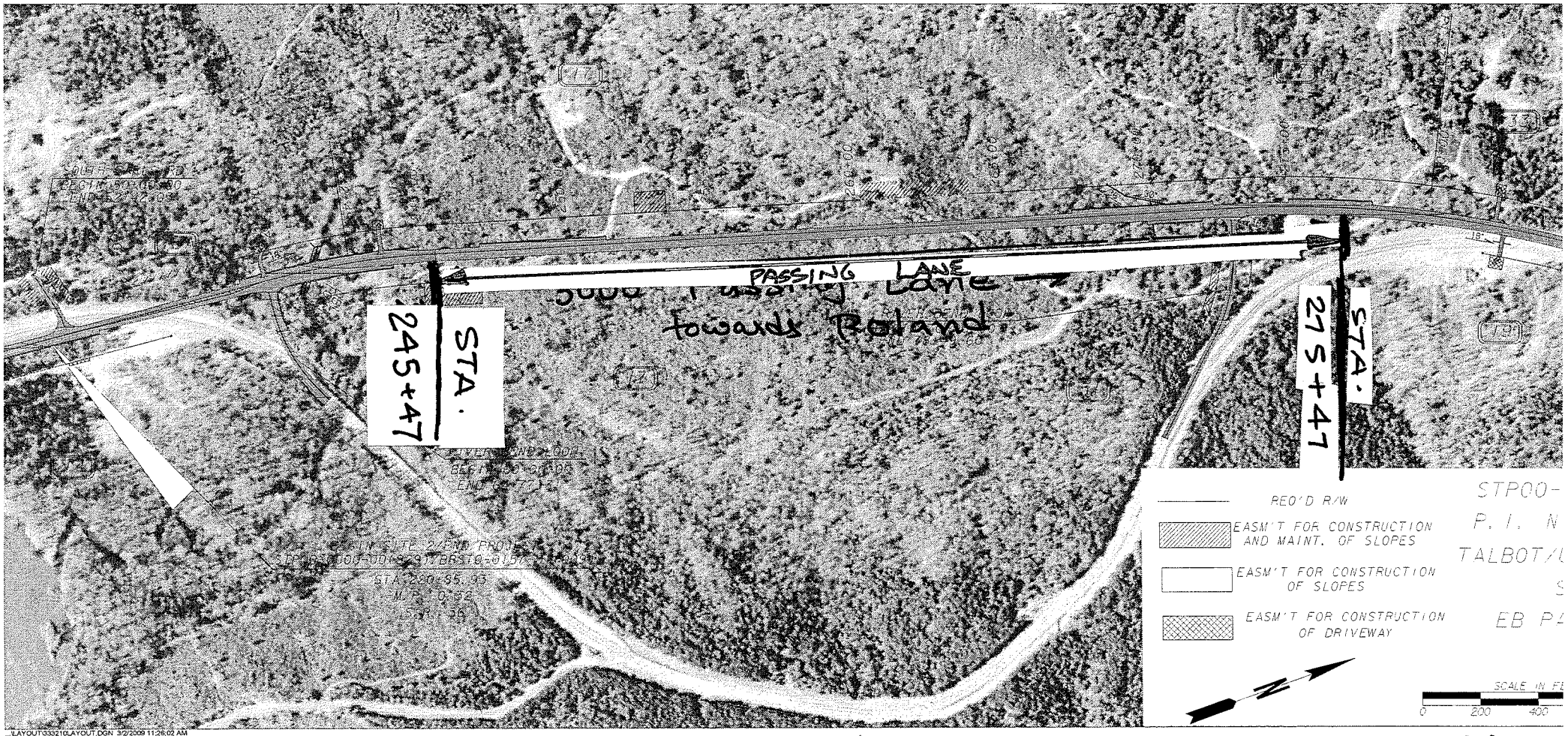


SITE #1

12' wide → 3000' Passing lane towards Pleasantville from STA. 184+26 to STA. 214+26

ALTERNATIVE

ALT. A+S
Sheet 2 of 4



SITE #2

12' wide → 3000' Passing Lane towards Roland

from STA. 245+47 to STA. 275+47

ALTERNATIVE

ALT. A-5

Sheet 3 of 4

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-5**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Passing Lane	LF	16,652	287.07	4,780,290	6,000	287.07	1,722,420
(For unit cost, see Alt. No. A2-1)							
Subtotal				4,780,290			1,722,420
Markup (%) at							
TOTAL				4,780,290			1,722,420

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-7**

DESCRIPTION: **ELIMINATE THE PASSING LANE AND CONSTRUCT ONLY TWO 12-FT-WIDE TRAVEL LANES ON THE NEW AS-DESIGNED ALIGNMENT**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

Construct a 12-ft-wide passing lane from Sta. 107+10 to Sta. 214+86 (10,776 LF) and from Sta. 238+10 to Sta. 296+86 (5,876 LF) for a total of 16,652 LF.

ALTERNATIVE:

Completely eliminate the 12-ft-wide passing lane. Construct only two 12-ft-wide travel lanes on the as-designed alignment.

ADVANTAGES:

- Significant cost savings

DISADVANTAGES:

- Slight decrease in safety, but the new alignment solves the grade and radius constraints

DISCUSSION:

For the design year 2024, the ADT volume is only 2,250. For this little traffic, there is no reason to provide a passing lane, especially when the various sharp curves are eliminated and long tangents are provided both horizontally and vertically.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 4,780,290	—	$ 4,780,290
ALTERNATIVE	$ 0	—	$ 0
SAVINGS (Original minus Alternative)	$ 4,780,290	—	$ 4,780,290

CALCULATIONS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-7

SHEET NO.: 2 of 3

The total length of as designed roadway only is 19,995 ft.
Including R/W, total cost of this roadway is $17,305,233
∴ Cost/ft of roadway only is: $\frac{17,305,233}{19,955} = \$861.21$
(for all 3 lanes)

Cost of roadway for, last per lane is:
861.21 / 3 = $287.07

The total length of roadway on which the passing lane has been proposed is 16,652'.
This alternative eliminates this round-length of pavement & other costs including the R/W cost associated with it.
Since each lane is 12' wide,
The cost per square foot will be: $\frac{287.07}{12} = \$23.92$

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-7**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Roadway	LF	16,652	287.07	4,780,290			
Subtotal				4,780,290			
Markup (%) at							
TOTAL				4,780,290			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-8**

DESCRIPTION: **MAKE OUTSIDE LANES 11 FT WIDE IN LIEU OF 12 FT WIDE, BUT KEEP PASSING LANES 12 FT WIDE**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (sketch attached)

Make through and passing lanes 12 ft wide. Passing lanes are from Sta. 107+10 to Sta. 214+86 and from Sta. 238+10 to Sta. 296+80 for a total of 16,652 LF.

ALTERNATIVE: (sketch attached)

Where the passing lane exists, make the outside lane 11 ft wide. Thus, the pavement will shrink by one ft for a length of 16,652 ft.

ADVANTAGES:

- Significant cost savings
- Shorter construction time

DISADVANTAGES:

- Slightly narrower outside lane, but ATDs are relatively low

DISCUSSION:

In an area where ADT volume for the design year 2024 is only 2,250, decreasing one ft of pavement from the outside lane will not cause any safety issues since 2 ft of paved shoulder will still be provided. 11 ft lanes exist on many Atlanta freeways.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 398,316	—	$ 398,316
ALTERNATIVE	$ 0	—	$ 0
SAVINGS (Original minus Alternative)	$ 398,316	—	$ 398,316

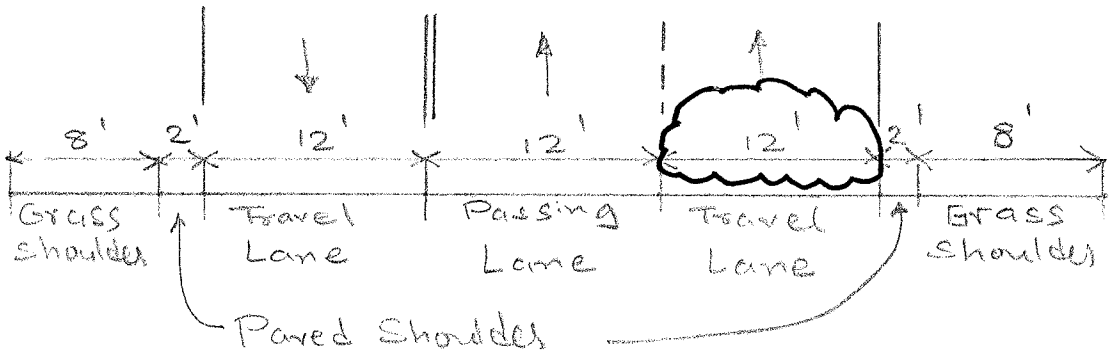
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

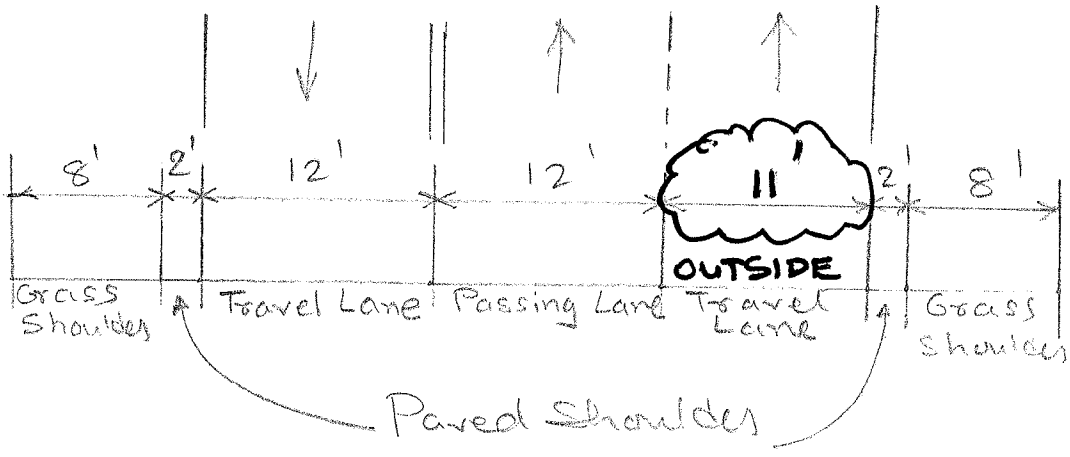
ALTERNATIVE NO.: A-8

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 2 of 3



As-Designed



Alternate

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-8**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Roadway	LF	16,652	23.92	398,316			
(For unit cost, See A-7)							
Subtotal				398,316			
Markup (%) at							
TOTAL				398,316			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-9**

DESCRIPTION: **KEEP THE EXISTING SR 36 ALIGNMENT AND ADD A 12-FT-WIDE PASSING LANE IN SITE 2 (UPSON COUNTY)**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

Realign SR 36 (both horizontally and vertically) along the entire length of Site 2 (Upson County).

ALTERNATIVE:

Retain the existing SR 36 alignment, but widen 12 ft for a new passing lane.

ADVANTAGES:

- Less construction cost
- Less right-of-way cost

DISADVANTAGES:

- The alternate design does not upgrade the existing SR 36 to present day design criteria

DISCUSSION:

The current design proposes to upgrade the design criteria (geometrics) of existing SR 36 since it is substandard. However the intent of the project is to add a passing lane since it is unsafe to pass due to the substandard horizontal and vertical alignments of SR 36. By adding a passing lane to the existing SR 36 alignment, it will allow faster moving vehicles to pass slow traffic safely. It is important to mention the low volumes of traffic for a state route are estimated at 2,000 vpd in 2013 and 3,100 vpd in 2033.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 6,740,298	—	$ 6,740,298
ALTERNATIVE	$ 1,524,889	—	$ 1,524,889
SAVINGS (Original minus Alternative)	$ 5,215,409	—	$ 5,215,409

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
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ALTERNATIVE NO.: A-9

SHEET NO.: 2 of 3

Refer to Alternate A1-4 for determination of passing Lane Length (4,000 ft; 0.75 mi)

Also for Full depth Pavement Cost ($58.30/S.Y.) based on GDOT project cost estimate.

The R/W cost of $7,050/Ac. is from the GDOT R/W cost estimate.

- Recommend adding site 2 (Alt. 2-3) Passing Lane from STA. 240+00 → 280+00 along exist. SR 36.

This widening would be in lieu of the proposed Site 2.

Present Cost of Site 2:

Site 2 (231+71 → 308+76) = 1.459 mi.

$$\frac{\text{Site 2 Total Length (Proposed now)}}{\text{Total Roadway Length of Cost Est.}} = \frac{1.459 \text{ mi}}{3.746 \text{ mi}} = 38.95\% \text{ or } (.3895)$$

(includes Constr.; R/W; & mkups)

Quantities for Alternate Passing Lane Site 2
See Alt. A1-4 Calculations:
5,333 S.Y. of Full depth Pavement
overlay existing 24' SR 36 for Restriping: 10,666 S.Y.

Earthwork = 80,900 C.Y.
Use $100,000/mi Passing Lane Drainage
Use $200,000/mi Passing Lane Erosion Control
Use $ 20,000/mi Passing Lane Signing & Striping
use $ 7,050/AC - from GDOT cost estimate

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-9**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 2 Cost	%	17,305,000	0.3895	6,740,298			
Cost for Alt. Site 2							
Overlay existing lanes	SY				10,666	8.25	87,995
Widening pavement	SY				5,333	58.35	311,181
Earthwork	CY				80,900	3.00	242,700
Traffic control	LS				LS	LS	50,000
Guard rail	LF				2,500	18.00	45,000
Type 12 anchor	EA				4	2,000.00	8,000
Type 1 anchor	EA				4	500.00	2,000
Drainage (12 ft lane)	MI				1	100,000.00	75,000
Erosion control (12 ft lane)	MI				1	200,000.00	150,000
Signing/Striping	MI				1	20,000.00	15,000
Subtotal							986,876
Alternate Right-of-Way	AC				7	7,050.00	49,350
Proximity Damages	LS				LS	LS	6,000
Right-of-Way Subtotal				included			55,350
Right-of-Way Mark-up (2.48)				included			137,270
Construction Subtotal				6,740,298			986,876
Markup (%) at 35.1%				included			346,393
TOTAL				6,740,298			1,525,889

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-10**

DESCRIPTION: **ADD 12 FT PASSING LANES ON THE EXISTING SR 36 ALIGNMENT**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

Realign SR 36 in Talbot and Upson counties to upgrade the geometric alignments to desirable standards. Add two passing lane sites (one westbound and one eastbound) in Talbot County (Site 1) and Upson County (Site 2).

ALTERNATIVE:

Eliminate the current design realignments and construct two 4,000 ft long (12 ft wide) passing lanes with one in Talbot County (Site 1 westbound) and one in Upson County (Site 2 eastbound).

ADVANTAGES:

- Less construction cost
- Less right-of-way cost

DISADVANTAGES:

- The alternate design does not upgrade the existing SR 36 to present day desirable design criteria

DISCUSSION:

This alternative combines Alt. Nos A-4 and A-9 and reverts back to the original intention of this project, which is to provide two passing lane sites (one westbound and one eastbound) along existing SR 36. The traffic volumes are low for a state route, estimated at 2,000 vpd in 2013 and 3,100 in 2033, thus providing only passing lanes should be considered.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 17,305,000	—	$ 17,305,000
ALTERNATIVE (A4 + A9)	$ 3,050,000	—	$ 3,050,000
SAVINGS (Original minus Alternative)	$ 14,255,000	—	$ 14,255,000

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-10**
Site 1 **A-4 cost**
SHEET NO.: **2 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 1 Cost	%	17,305,000	0.6105	10,564,703			
Cost for Alt. Site 1							
Overlay existing lanes	SY				10,666	8.25	87,995
Full depth pavement	SY				5,333	58.35	311,181
Earthwork	CY				80,900	3.00	242,700
Traffic control	LS				LS	LS	50,000
Guard rail	LF				2,500	18.00	45,000
Type 12 anchor	EA				4	2,000.00	8,000
Type 1 anchor.	EA				4	500.00	2,000
Drainage (12 ft lane)	MI				1	100,000.00	75,000
Erosion control (12 ft lane)	MI				1	200,000.00	150,000
Signing/Striping	MI				1	20,000.00	15,000
Subtotal							986,876
Alternate Right-of-Way	AC				7	7,050.00	49,350
Proximity Damages	LS				LS	LS	6,000
Right-of-Way Subtotal				included			55,350
Right-of-Way Mark-up (2.48)				included			137,270
Construction Subtotal				10,564,703			986,876
Markup (%) at 35.1%				included			346,393
TOTAL				10,564,703			1,525,889

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-10**
Site 2 **A-9 cost**
SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 1 Cost	%	17,305,000	0.6105	10,564,703			
Cost for Alt. Site 1							
Overlay existing lanes	SY				10,666	8.25	87,995
Full depth pavement	SY				5,333	58.35	311,181
Earthwork	CY				80,900	3.00	242,700
Traffic control	LS				LS	LS	50,000
Guard rail	LF				2,500	18.00	45,000
Type 12 anchor	EA				4	2,000.00	8,000
Type 1 anchor.	EA				4	500.00	2,000
Drainage (12 ft lane)	MI				1	100,000.00	75,000
Erosion control (12 ft lane)	MI				1	200,000.00	150,000
Signing/Striping	MI				1	20,000.00	15,000
Subtotal							986,876
Alternate Right-of-Way	AC				7	7,050.00	49,350
Proximity Damages	LS				LS	LS	6,000
Right-of-Way Subtotal				included			55,350
Right-of-Way Mark-up (2.48)				included			137,270
Construction Subtotal				10,564,703			986,876
Markup (%) at 35.1%				included			346,393
TOTAL				10,564,703			1,525,889

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-11**

DESCRIPTION: **REALIGN ONLY A PORTION OF SR 36 SITE 1, TALBOT COUNTY**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN:

Realign SR 36 (both horizontally and vertically) along the entire length of Site 1 (Talbot County).

ALTERNATIVE: (sketch attached)

For Site 1 (Talbot County), realign the portion of SR 36 with substandard horizontal curves to upgrade it to desirable design standards.

ADVANTAGES:

- Reduces construction cost
- Reduces right-of-way cost

DISADVANTAGES:

- The alternate design does not upgrade all of the existing SR 36 to present day desirable design criteria

DISCUSSION:

This alternative realigns the horizontal curve from Sta. 17+00 to 216+00 on the passing lane (Site 1) to correct reverse (substandard) curves on SR 36.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 10,564,700	—	$ 10,564,700
ALTERNATIVE	$ 2,487,883	—	$ 2,487,883
SAVINGS (Original minus Alternative)	$ 8,076,817	—	$ 8,076,817

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-11

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 2 of 5

Passing lanes are also used to improve safety on two-lane highways. Safety evaluations have shown that passing lanes and short four-lane sections reduce accident rates below the levels found on conventional two-lane highways. Installation of passing lanes can reduce accident rates by up to 25 percent.

To maximize the traffic operational efficiency of a passing lane in level or rolling terrain, it's length can vary from a minimum of 0.5 mi. to a maximum of 2.0 mi. depending on the directional flow rate, as shown in the following table:

Length of Passing Lanes	
Directional flow rate (pc/h)	**Passing lane length (mi)**
100	≤0.50
200 270	>0.50-0.75
400	>0.75-1.00
≥700	>1.00-2.00
Source: Transportation Research Board, Highway Capacity Manual, 2000	

Use 0.75 mi. PASSING LANE

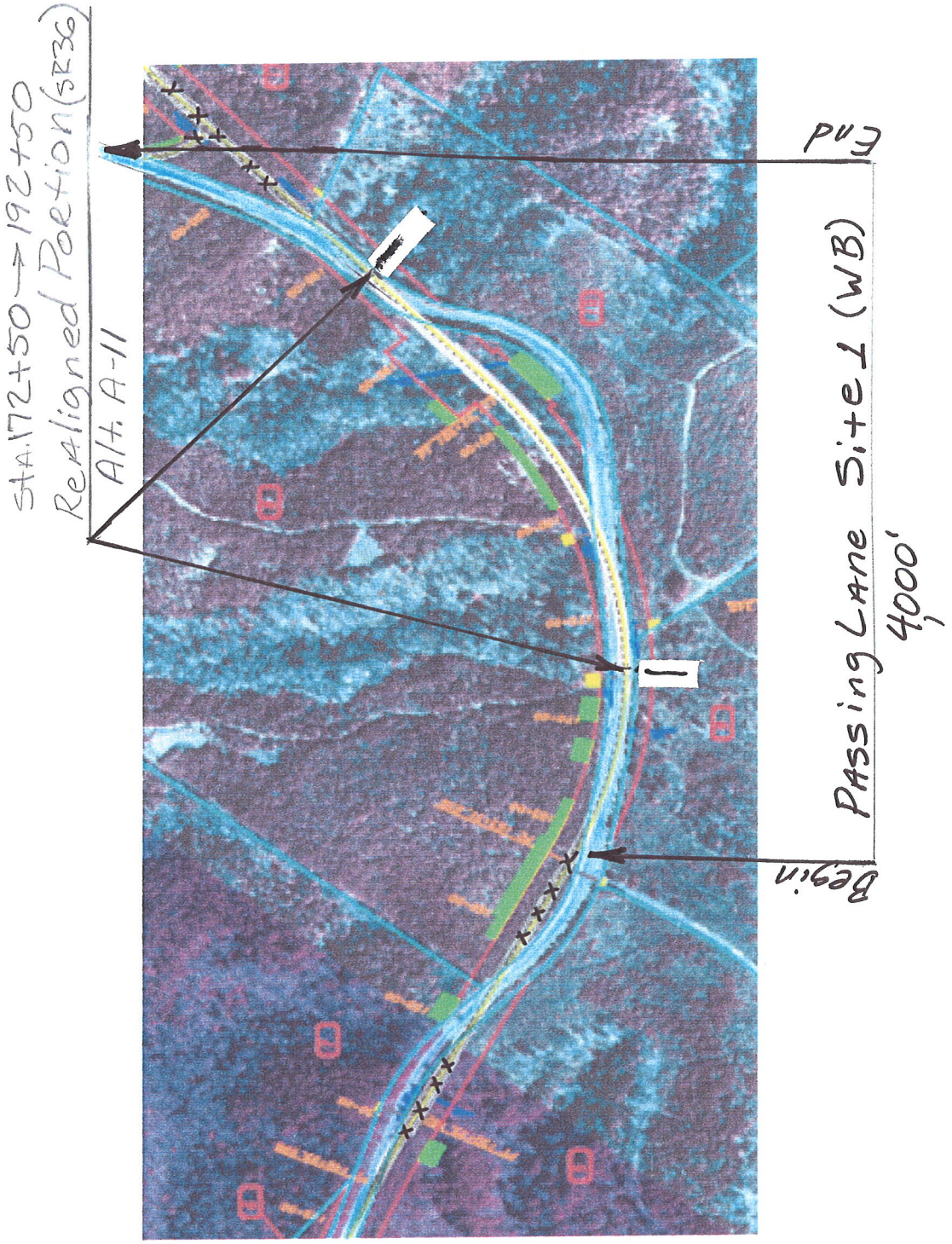
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-11**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 3 of 5



CALCULATIONS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-11

SHEET NO.: 4 of 5

Length of SR 36 Alignment to Correct is from STA 172+50 to 192+50 (2,000') (Site 1)

$\frac{2000'}{5,280'} = 0.3788$ mi. (Alt.)

$\frac{\$17,320,000}{3.8\text{mi}} \approx \$4,550,000/\text{mi}$ (incl. Constr, R/W & All markups)

Passing Lane = 4000' (2000' Along exist. SR36 & 2000' realigned)

.3788mi (of 12' widening) & .3788mi of Realigned

$\frac{\$1,524,330}{0.7576\text{mi}} \approx \$2,012,800/\text{mi}$ (incl. Constr., R/W & All mkups)

2 4000' pass. Lanes

$4,550,000/mi (for on new alignment/location)

$2,012,800/mi (for on 12' of widening on exist. Route)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-11**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 1 (A-4)				10,564,700			
Alt. Site 1 cost							
Along existing SR 36	MI				0.3788	4,555,000.00	1,725,434
SR 36 realignment	MI				0.3788	2,012,800.00	762,449
Subtotal				10,564,700			2,487,883
Markup (%) at							
TOTAL				10,564,700			2,487,883

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-12**

DESCRIPTION: **ADD A NEW 12-FT-WIDE PASSING LANE TO SR 36 (SITE 2) UPSON COUNTY AND CORRECT ALIGNMENT FOR A PORTION OF SR 36**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

Realign SR 36 (both horizontally and vertically) along the entire length of Site 2 (Upson County).

ALTERNATIVE: (sketch attached)

Realign a portion of SR 36 with substandard horizontal curves to upgrade to desirable design standards for Site 2 (Upson County).

ADVANTAGES:

- Reduces construction cost
- Reduces right-of-way cost

DISADVANTAGES:

- The alternate design does not upgrade the entire existing SR 36 to present day desirable design criteria

DISCUSSION:

This alternative realigns the horizontal curves for 2,000 ft on SR 36 in Upson County with a passing lane. The correction of substandard curves occurs where trucks have historically had problems.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 6,740,300	—	$ 6,740,300
ALTERNATIVE	$ 2,487,883	—	$ 2,487,883
SAVINGS (Original minus Alternative)	$ 4,252,417	—	$ 4,252,417

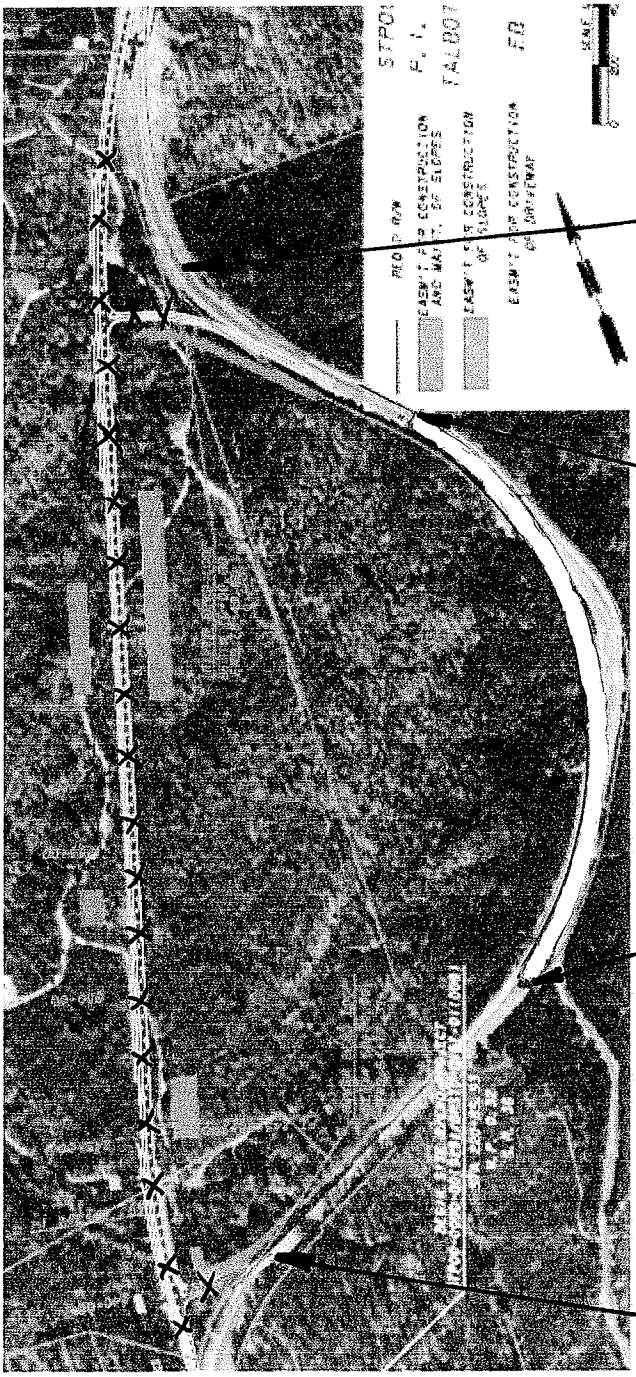
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-12

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: A-12

SHEET NO.: 3 of 4

Length of SR 36 Alignment to Correct is from (see Attached Sketch) (2,000') (Site 2)

$\frac{2,000'}{5,280'} = 0.3788$ mi. (Alt.)

$\frac{\$17,300,000}{3.8\text{mi}} = \$4,550,000/\text{mi}$ (incl. Constr, R/W & All markups)

Passing Lane = 4000' (2000' Along exist. SR 36 & 2000' realigned)
.3788mi (of 12' widening) & .3788 mi of realigned

$\frac{\$1,524,380}{0.7576\text{mi}} = \$2,012,800/\text{mi}$ (incl. Constr, R/W & all markups)
2 4000' pass. Lane

$4,550,000/mi (for on new alignment/Location)

$2,012,800/mi (for on 12' of wideing on exist. Route)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-12**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 2 (A-9)				6,740,300			
Alt. Site 2 cost							
Along existing SR 36	MI				0.3788	4,555,000.00	1,725,434
SR 36 realignment	MI				0.3788	2,012,800.00	762,449
Subtotal				6,740,300			2,487,883
Markup (%) at							
TOTAL				6,740,300			2,487,883

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **A-13**

DESCRIPTION: **COMBINE ALT. NOS. A-11 AND A-12 TO PROVIDE TWO PASSING LANES WITH ONLY SELECTED PORTIONS OF SR 36 REALIGNED**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

Realign SR 36 (both horizontally and vertically) along the entire length of the project.

ALTERNATIVE:

Construct 4,000 ft of new road for Sites 1 and 2. Realign a portion of each passing lane to upgrade a portion of substandard horizontal curve alignment.

ADVANTAGES:

- Reduces construction cost
- Reduces right-of-way cost

DISADVANTAGES:

- The alternate design does not fully upgrade existing SR 36 to present day desirable design criteria

DISCUSSION:

This alternative realigns a portion of the horizontal alignments for both Sites 1 and 2. It would realign approximately 2,000 LF of each site. Approximately one-half of both passing lane sites where the traveling vehicles have problems will have substandard horizontal curves corrected.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 17,305,000	—	$ 17,305,000
ALTERNATIVE	$ 4,972,000	—	$ 4,972,000
SAVINGS (Original minus Alternative)	$ 12,333,000	—	$ 12,333,000

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **A-13**

SHEET NO.: **2 of 2**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Site 1 (A-4)				10,564,700			
Alt. Site 1 cost							
Along existing SR 36	MI				0.3788	4,555,000	1,725,434
SR 36 realignment	MI				0.3788	2,012,800	762,449
Site 2 (A-9)				6,740,300			
Alt. Site 1 cost							
Along existing SR 36	MI				0.3788	4,555,000	1,725,434
SR 36 realignment	MI				0.3788	2,012,800	762,449
Subtotal				17,305,000			4,975,766
Markup (%) at							
TOTAL				17,305,000			4,975,766

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE REPLACEMENT**

Project No. STP00-0000-00(929) and BRST0-0157-01(009) Talbot/Upson County, Georgia

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
PROFILE (P)						
P-1	Adjust the profile of the mainline to reduce cut/fill quantities. Increase some grades up to 8%, shorten the radius of the vertical curves, but retain the proposed alignment and passing	$427,350	0	$427,350		$427,350
BRIDGE (B)						
B-1	Reduce the width of the shoulder on one side of the bridge from 8 ft wide to 2 ft wide. Remaining shoulder to be 8 ft.	$1,102,644	$937,475	$165,169		$165,169
B-2	Increase the beam spacing on the bridge from 7 ft 3 in to 9 ft and use five prestressed concrete beams in lieu of six.	$451,715	$409,750	$41,965		$41,965
B-5a	Use Conspan type of structure for the triple box culvert in lieu of the conventional cast-in-place IP concrete box with base slab.	$403,241	$385,800	$17,441		$17,441
B-5b	Use Conspan type of structure for the triple box culvert in lieu of the conventional CIP box, but eliminate the invert base slab. Use the natural stream bed.	$403,240	$253,226	$150,014		$150,014
B-8	Change the project delivery method from design/bid/build to design/build, reduce the schedule by 6 mo. and reduce the impact of cost escalation. This could reduce the total project cost by approximately $485,000 for 6 months worth of escalation.	DESIGN SUGGESTION				

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **P-1**

DESCRIPTION: **INCREASE/ADJUST PROFILE GRADE TO MINIMIZE CUT/FILL VOLUMES**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

600,000 cubic yards (CY) of cut and fill are required for the project.

ALTERNATIVE:

Adjust (increase, if necessary) the mainline profile grade to reduce the cut and fill earthwork volumes by approximately 70,000 CY.

ADVANTAGES:

- Reduces construction cost
- Reduces construction time

DISADVANTAGES:

- Could result in steeper grades

DISCUSSION:

The current design has over 600,000 CY of combined unclassified cut and fill embankment volume requirements. Adjusting the profile grade to lessen both the cut volumes and fill embankment volumes would reduce the project construction cost. Presently, the cut and fill volumes are practically equal (balanced). Any adjustment to the profile grade would need to keep the earthwork balanced. Since this profile change would narrow the limit of construction, there would also be a right-of-way savings of approximately 2 acres.

AASHTO Greenbook Exhibit 6-4 allows the use of 8% grades for rural collectors. This roadway terrain would be classified between "rolling" (7%) and "mountainous" (9%). It is important to mention that the "Greenbook" states that "grades on low-volume rural collectors may be up to 2% steeper than the grades shown in Exhibit 6-4."

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 427,350	—	$ 427,350
ALTERNATIVE	$ 0	—	$ 0
SAVINGS (Original minus Alternative)	$ 427,350	—	$ 427,350

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: P-1

SHEET NO.: 2 of 3

The Adjusted Alternat Profil P-1 will save uncl. excav. and Fill embankment which will be a project cost + Savings.
Presently the Earthwork Total is 54,700 c.y of waste!

Uncl/Ass. Excav. Saved

- 134+00 → 139+50: $\frac{(500' \times 90' \times 3')}{27 cf/cy} = -6,000$ c.y.
- 157+50 → 165+50 $\frac{(800' \times 90' \times 6')}{27 cf/cy} = -16,000$ c.y.
- 173+50 → 182+50 $\frac{(900' \times 90 \times 3')}{27 cf/cy} = -9,000$ c.y.
- 254+50 → 267+00 $\frac{(1250' \times 90' \times 7')}{27 cf/cy} = -29,000$ c.y.
- 278+50 → 284+50 $\frac{(600' \times 90' \times 5')}{27 cf/cy} = -10,000$ c.y.

Total Less Unclass Excav. = − 70,000 c.y.

Fill Embankment Saved:

- 124+50 → 130+50 $(600' \times 120' \times 2')/27 = -5,300$ c.y.
- 149+50 → 154+50 $(500' \times 120' \times 1.5')/27 = -3,300$ c.y.
- 184+50 → 190+00 $(550' \times 120' \times 5')/27 = -12,200$ c.y.
- 202+50 → 214+00 $(1150' \times 120' \times 6')/27 = -30,600$ c.y.
- 238+00 → 250+00 $(1200' \times 120' \times 5')/27 = -26,600$ c.y.

Total Less Fill Embankment Req'd: − 66,400 c.y.
(Needed to save to keep balance)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **P-1**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Original saved:							
Less uncl. Excavation	CY	70,000	4.00	280,000			
(because of high fills)							
Save right-of-way	AC	2	7,050.00	14,100			
Right-of-Way Total				14,100			
Right-of-Way Markup 2.48%				34,968			
Construction Subtotal				280,000			
Markup (%) at 35.1%				98,280			
TOTAL				427,350			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **B-1**

DESCRIPTION: **REDUCE SHOULDER ON ONE SIDE OF THE BRIDGE FROM 8 FT TO 2 FT**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The current bridge section is 40 ft gutter to gutter with an 8 ft shoulder, two 12 ft lanes, and an 8 ft shoulder.

ALTERNATIVE: (sketch attached)

Reduce the bridge section by 6 ft from 40 ft wide to 34 ft, gutter to gutter including an 8 ft shoulder, two 12 ft lanes and a 2 ft shoulder.

ADVANTAGES:

- Reduces bridge width/cost
- Eliminates one beam

DISADVANTAGES:

- No full refuge area on one side

DISCUSSION:

The reduced cost and refuge width can be justified by the low traffic counts, short span of the bridge and good visibility.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,102,644	—	$ 1,102,644
ALTERNATIVE	$ 937,475	—	$ 937,475
SAVINGS (Original minus Alternative)	$ 165,169	—	$ 165,169

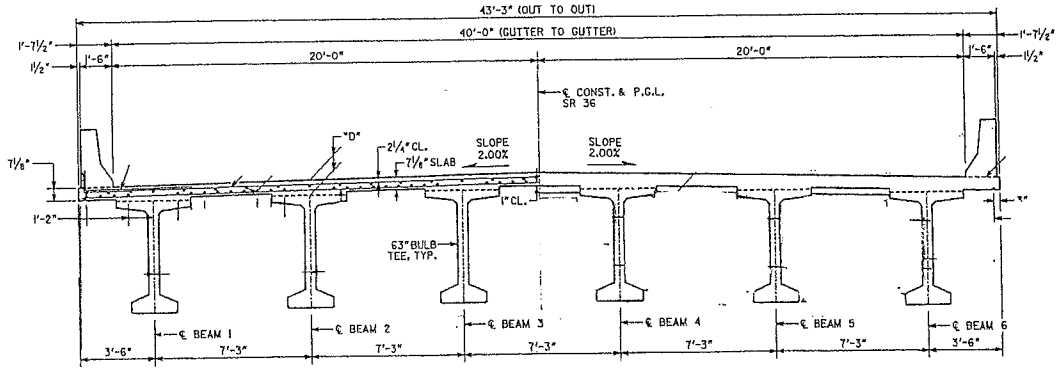
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-1

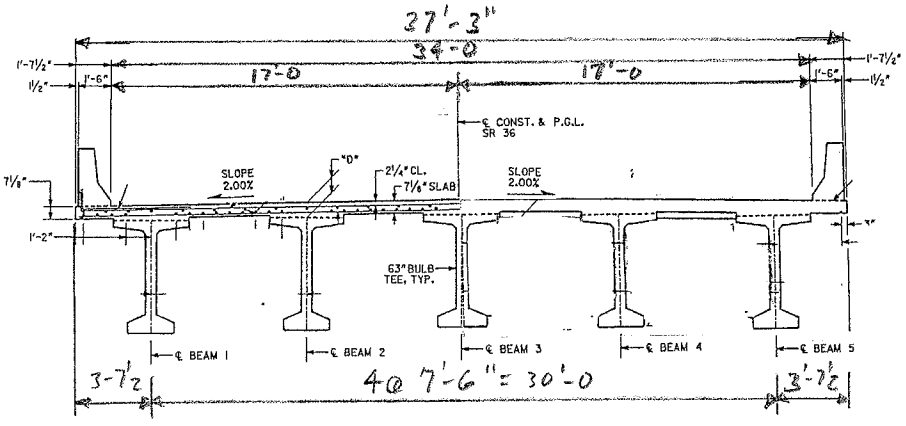
ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 2 of 4



DECK SECTION
SR 36 OVER FLINT RIVER

ORIGINAL



DECK SECTION
SR 36 OVER FLINT RIVER

ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-1

SHEET NO.: 3 of 4

REVISED BEAM SPACING => 37.25 ÷ 5 = 7.45 SAY 7.5' w/ 3'-7½" OVERHANGS

SLAB DESIGN => EFF SPAN = 7.5 - 1.75 = 5.75' ∴ USE 7.125" SLAB THICKNESS
[GDOT B.R. DES. MAN. 3-75]
(SAME AS ORIGINAL)

63" BULB TEE LENGTH => ORIGINAL = 349 × 6 = 2073' (ORIG)
(115.67 × 5 × 2) (1&3) + (114.17 × 5) (2) = 1727' ALT

DECK AREA => 349' × 43.25' (1/9) = 1677 SY (ORIG)
349 × 37.25' (1/9) = 1444 SY (ALT.)
RATIO = 0.86

SUPER STR. CONC. = 448 CY (ORIG) × 0.86 = 385 CY (ALT)

GROOVING = 1474 SY (ORIG.) 1370 SY (ALT.)

SUPERSTR. REINF STEEL = 106405# (ORIG) × 0.86 = 91,508 (ALT.)

CLASS AA = 130 CY (ORIG) × .86 = 112 CY (ALT)
BAR REINF = 17,086# (ORIG.) × .86 = 14,694# (ALT)

PILING => 400 LF (ORIG.) - 26.5 (1) - 18. (4) = 355 LF (ALT)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE** ALTERNATIVE NO.: **B-1**
Talbot/Upson County, Georgia - Preliminary Engineering

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
63 in bulb tee	LF	2,073	185.45	384,438	1,727	185.45	320,272
Super str. concrete Class AA	CY	448	762.56	341,627	385	762.56	293,586
Grooved concrete	SY	1,474	4.67	6,884	1,370	4.67	6,398
Super str. reinforced steel	LB	106,405	0.92	97,893	91,508	0.92	84,187
Class AA	CY	130	488.45	63,499	112	488.45	54,706
Bar reinforced steel	LB	17,086	0.89	15,207	14,694	0.89	13,078
Piling - HP 14 x 73	LF	400	72.18	28,872	355	72.18	25,624
Subtotal				938,420			797,851
Markup (%) at 17.5%				164,224			139,624
TOTAL				1,102,644			937,475

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **B-2**

DESCRIPTION: **INCREASE BEAM SPACING FROM 7 FT 3 IN TO 9 FT AND SAVE ONE BEAM**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The typical bridge section is 43 ft 3 in out-to-out with six beams spaced at 7 ft 3 in and 3 ft 6 in overhangs.

ALTERNATIVE: (sketch attached)

Revise the beam spacing using five beams at 9 ft and 3 ft 7 in overhangs.

ADVANTAGES:

- Reduces beam cost
- Reduces construction time

DISADVANTAGES:

- Additional slab costs

DISCUSSION:

The increased beam spacing will maximize the design capabilities of the beam. The construction time will be reduced with one less set of beams to be cast, transported and placed.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 451,715	—	$ 451,715
ALTERNATIVE	$ 409,750	—	$ 409,750
SAVINGS (Original minus Alternative)	$ 41,965	—	$ 41,965

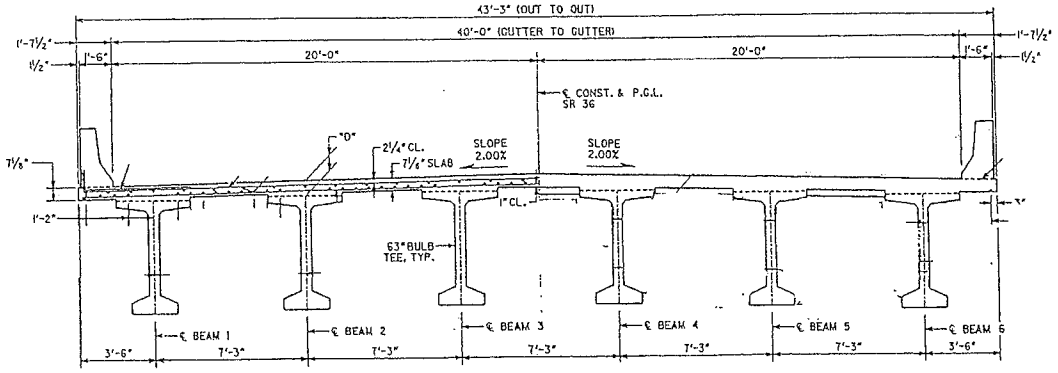
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-2

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

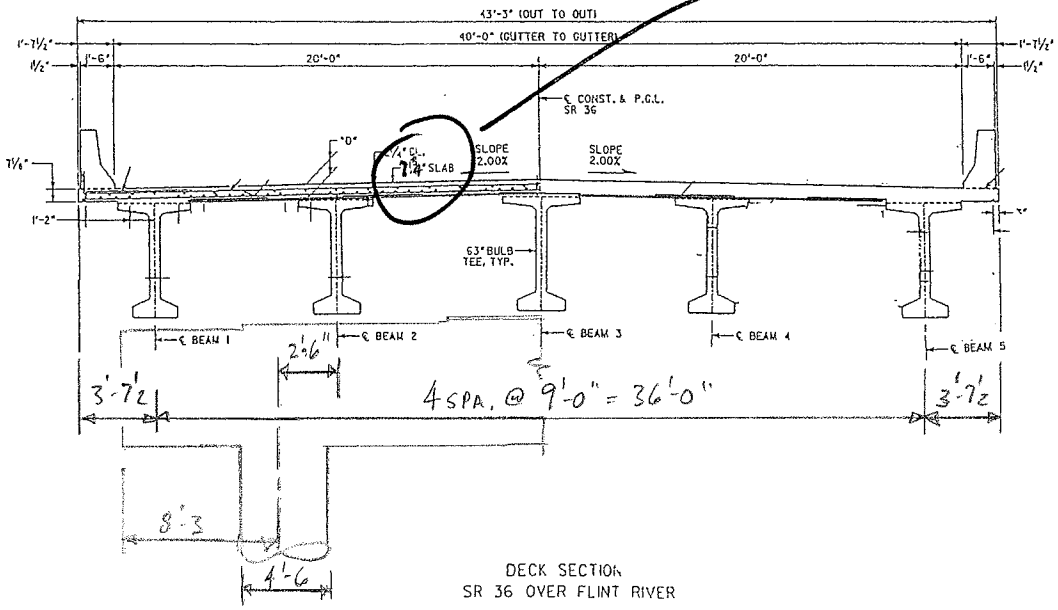
SHEET NO.: 2 of 4



DECK SECTION
SR 36 OVER FLINT RIVER

ORIGINAL

7 3/4" SLAB



DECK SECTION
SR 36 OVER FLINT RIVER

ALTERNATIVE

CALCULATIONS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-2

SHEET NO.: 3 of 4

REVISED BEAM SPACING => 43.25 ÷ 5 = 8.65' USE 9' TO REDUCE OVERHANGS

SLAB DESIGN => EFF. SPAN = 9' - 1.75' = 7.25' ∴ USE 7 3/4" SLAB THICKNESS * [GDOT BR DES MAN. 3-76]

63" BULB TEE LENGTH => 349 x 6 = 2073' ORIG
(115.67' x 5 x 2) + (114.17 x 5) = 1187' ALT
1 @ 3 2

SUPER STR. CONC => 349' x 43.75' x (9" - 7.75"/12) (1 CY/27) = 29 CY ADD'L

ORIG = 995

SUPER STR. ADD'L STEEL => ORIG. PORTION 10690 LB / 995 CY = 23.251 LB/CY

29 CY x 23.251 = 674 LB ADD'L

NOTES:
1) NO CAP DESIGN CHANGES ANTICIPATED.
2) 117' SPAN BEAM REQUIRES 10KSI STRENGTH.
- 72" BULB TEE CANNOT BE USED @ COST w/ 8.5 K ADD'L CAP (117.6 K REDUCTION)

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE** ALTERNATIVE NO.: **B-2**
Talbot/Upson County, Georgia - Preliminary Engineering

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
63 in bulb tee	LF	2,073	185.45	384,438	1,727	185.45	320,272
Super str. concrete Class AA	CY				29	762.56	22,114
Super str. reinforced steel	LB				6,888	0.92	6,337
Subtotal				384,438			348,723
Markup (%) at 17.5%				67,277			61,027
TOTAL				451,715			409,750

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **B-5A**

DESCRIPTION: **USE CONSPAN TYPE STRUCTURE FOR THE TRIPLE BOX CULVERT**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

A triple 9 ft cast-in-place concrete box culvert, 136 ft long, is used at Reeves Creek, Sta. 241+00.

ALTERNATIVE: (sketch attached)

Use a single-span, precast concrete structure that is 120 ft long with a 30 ft span and cast-in-place concrete base slab. The arch has a higher profile so the length can be shortened. Use precast concrete for the wing walls too.

ADVANTAGES:

- Better hydraulic flow
- Less debris congestion
- Shorter construction time
- Reduces cost
- No additional engineering costs

DISADVANTAGES:

- None apparent

DISCUSSION:

The Reeves Creek area is a fill location with approximately 20 ft of fill on the structure. The single span will reduce debris collection and increase stream flow. Pre-casting off-site will reduce on-site construction time. Further cost savings can be realized if the environmental and hydraulic reports show that the cast-in-place concrete base slab is not required.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 403,241	—	$ 403,241
ALTERNATIVE	$ 385,800	—	$ 385,800
SAVINGS (Original minus Alternative)	$ 17,441	—	$ 17,441

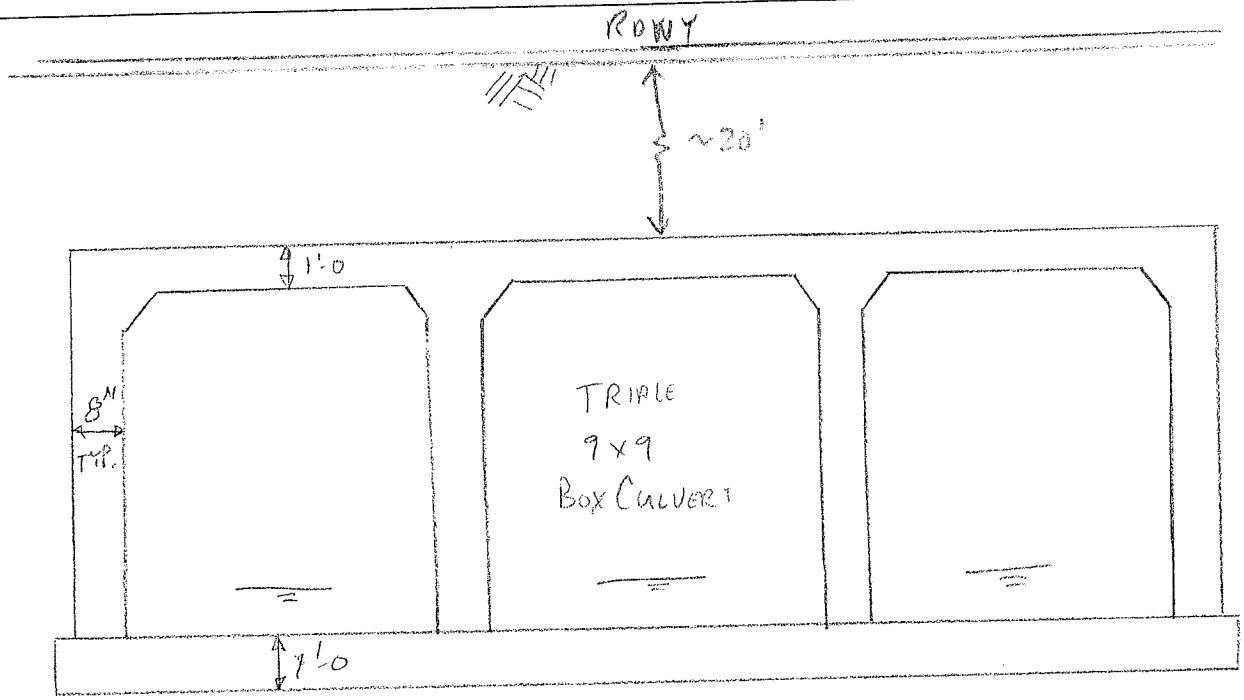
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

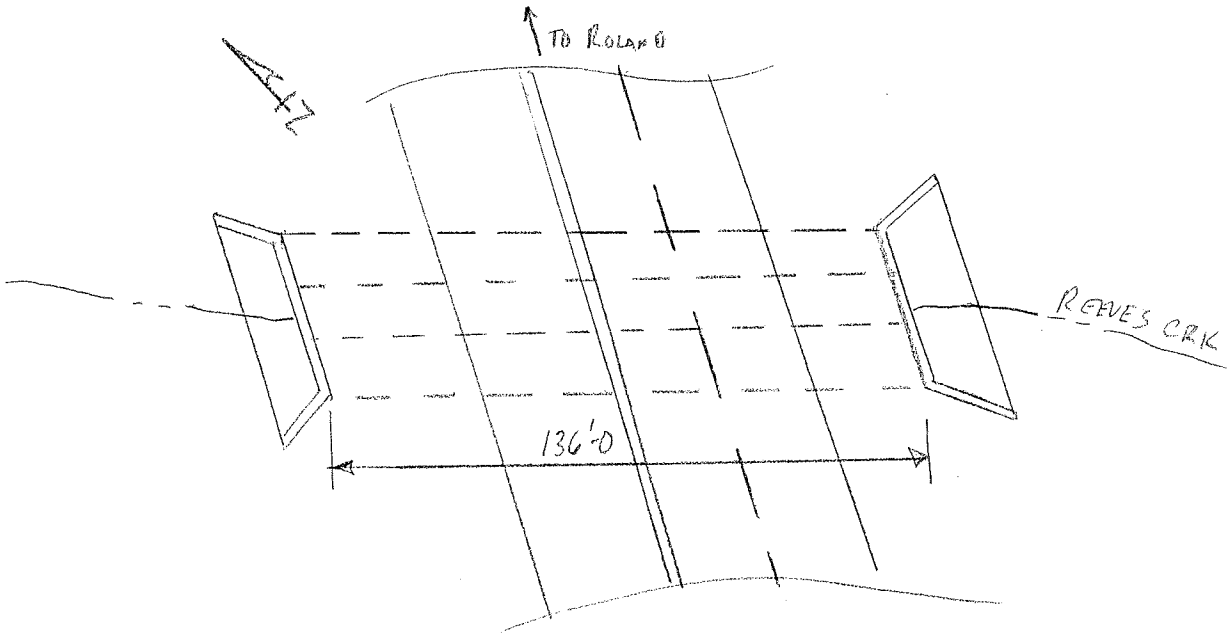
ALTERNATIVE NO.: B-5A

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐

SHEET NO.: 2 of 5



TYPICAL SECTION



PLAN

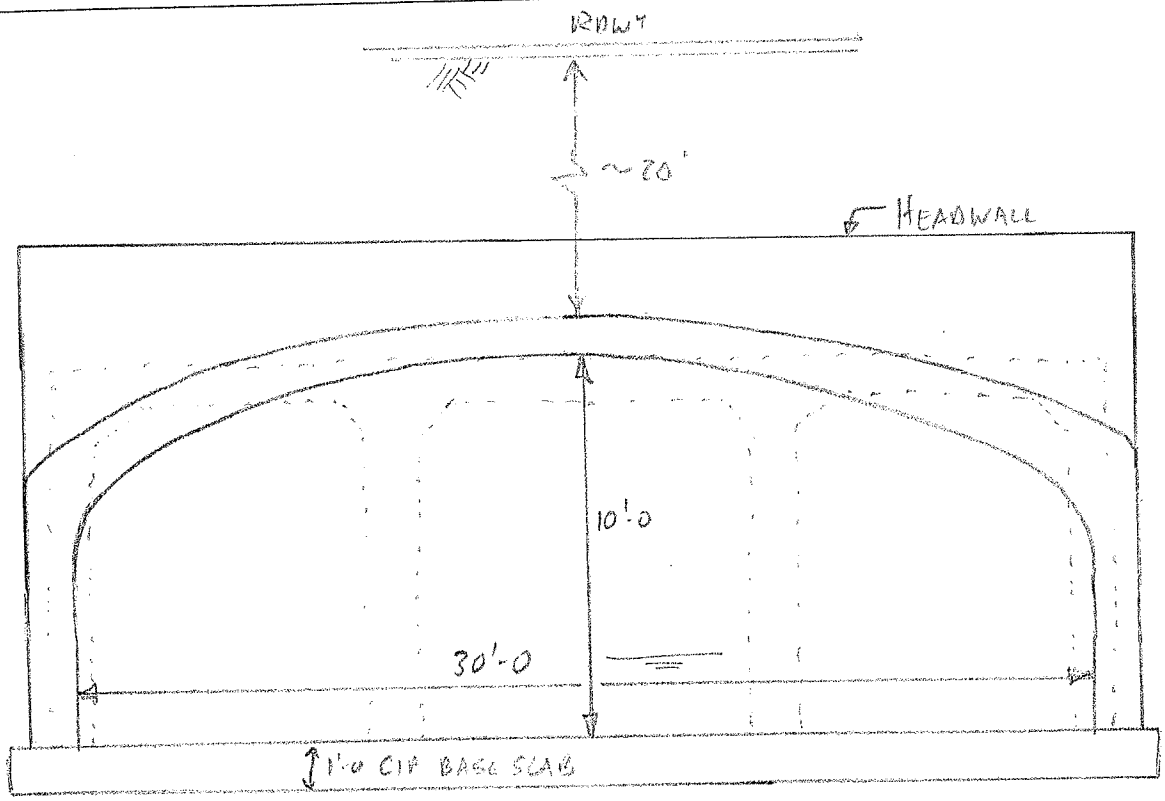
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-5A

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 3 of 5



TYPICAL SECTION - SINGLE SPAN PRE-CAST

(PLAN IS SIMILAR)

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-5A

SHEET NO.: 4 of 5

EXISTING CULVERT

$[(0.67' \times 9' \times 4) + (31' \times 1') + (32' \times 1')] \times 136' \ (1/27) = 438$ CY
(WALLS, TOP, BOTTOM)

$[(2' \times 1' \times 32') + (35' \times 10' \times 1' \times 2) + (12' \times 10' \times 2)] (1/27) = 37$ CY
(HEADWALL, SPILLWAY, WING WALLS)

475 CY *

PRECAST, SINGLE SPAN

CIP $[(32' \times 1 \times 120') + (35' \times 10' \times 1' \times 2)] (1/27) = 168$ CY *
(SLAB, SPILLWAY)

CONSPAN, 30' SPAN x 120 L (WITH HEADWALL & WINGWALLS) = $180,000

· CUT & FILL ARE SIMILAR, THEREFORE NEGATE EACH OTHER.

NOTE: IF THE ENVIRONMENTAL AND HYDRAULIC REPORTS SHOW THAT THE BASE SLAB IS NOT REQUIRED AND THE NATURAL STREAM BED IS MAINTAINED, THEN AN ADDITIONAL SAVINGS OF APPROXIMATELY $92,000 IS POSSIBLE. [SEE ALT. NO. 5B]

* FOR CONSISTENCY, USE ITEM 500-3800 CLASS A CONC., INCL REINF STL

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **B-5A**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Triple 9 x 9 box culvert							
Class A concrete incl. reinforcement	CY	475	628.37	298,476	168	628.37	105,566
Precast single span							
Concrete arch	EA				1	180,000.00	180,000
Subtotal				298,476			285,566
Markup (%) at 35.1%				104,765			100,234
TOTAL				403,241			385,800

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **B-5B**

DESCRIPTION: **USE CONSPAN TYPE STRUCTURE FOR THE TRIPLE BOX CULVERT IN LIEU OF CAST-IN-PLACE (NATURAL STREAM BED)**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

A triple 9 ft cast-in-place concrete box culvert, 136 ft long, is used at Reeves Creek, Sta. 241+00.

ALTERNATIVE: (sketch attached)

Use a single-span, precast concrete structure 120 ft long with a 30 ft span. The arch has a higher profile so the length can be shortened. Use a natural stream bed with only the footings being cast-in-place concrete. Use precast concrete for the wing walls too.

ADVANTAGES:

- Better hydraulic flow
- Less debris congestion
- Shorter construction time
- Reduces cost
- No additional engineering costs

DISADVANTAGES:

- Different concept

DISCUSSION:

The site is a fill section with new alignment over Reeves Creek. A single span arch will open the channel flow and reduce debris congestion. The precast concrete components will decrease on-site construction time for additional cost savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 403,241	—	$ 403,241
ALTERNATIVE	$ 260.158	—	$ 260.158
SAVINGS (Original minus Alternative)	$ 143,083	—	$ 143,083

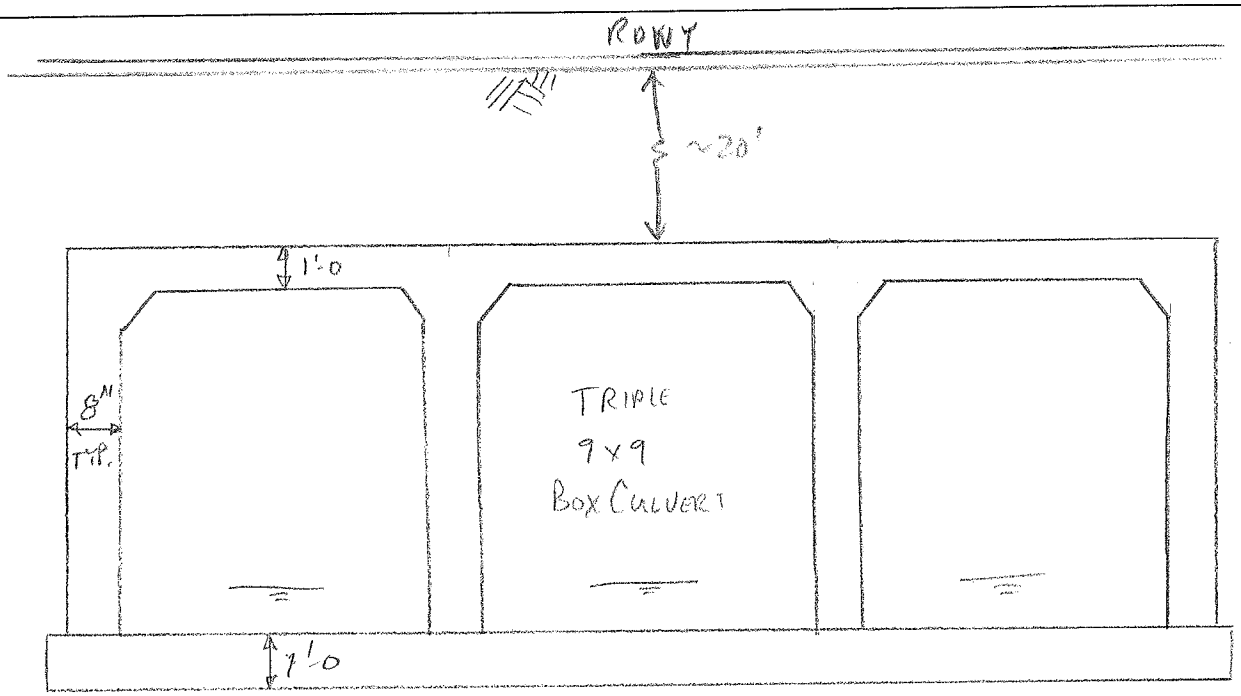
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

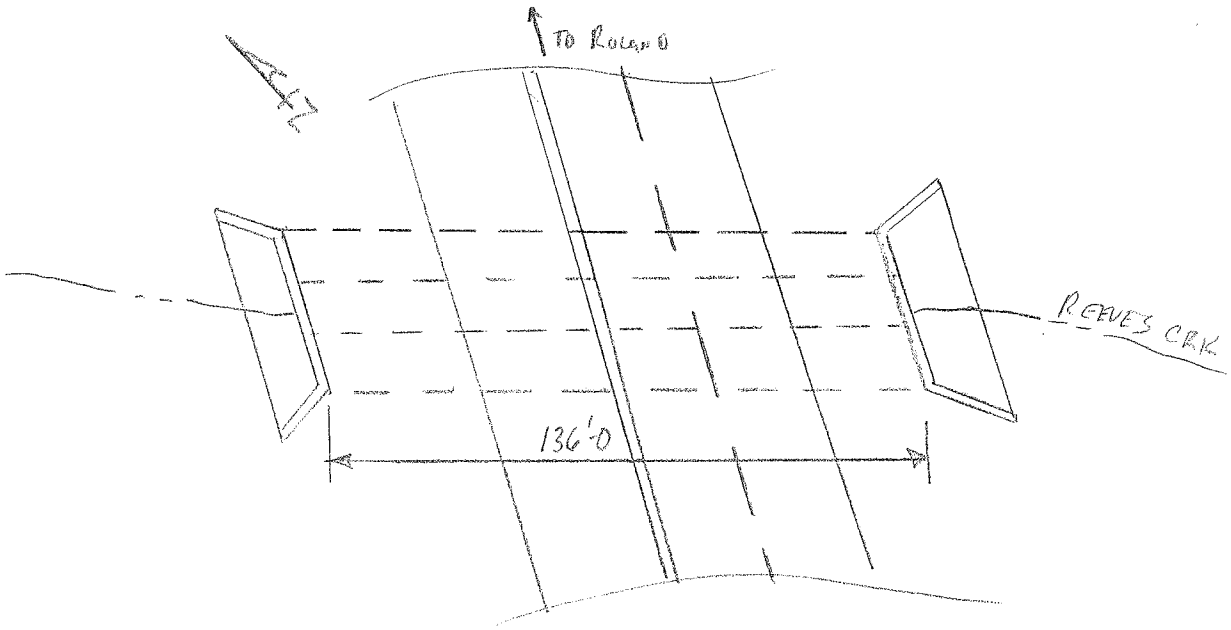
ALTERNATIVE NO.: B-5B

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐

SHEET NO.: 2 of 5



TYPICAL SECTION



PLAN

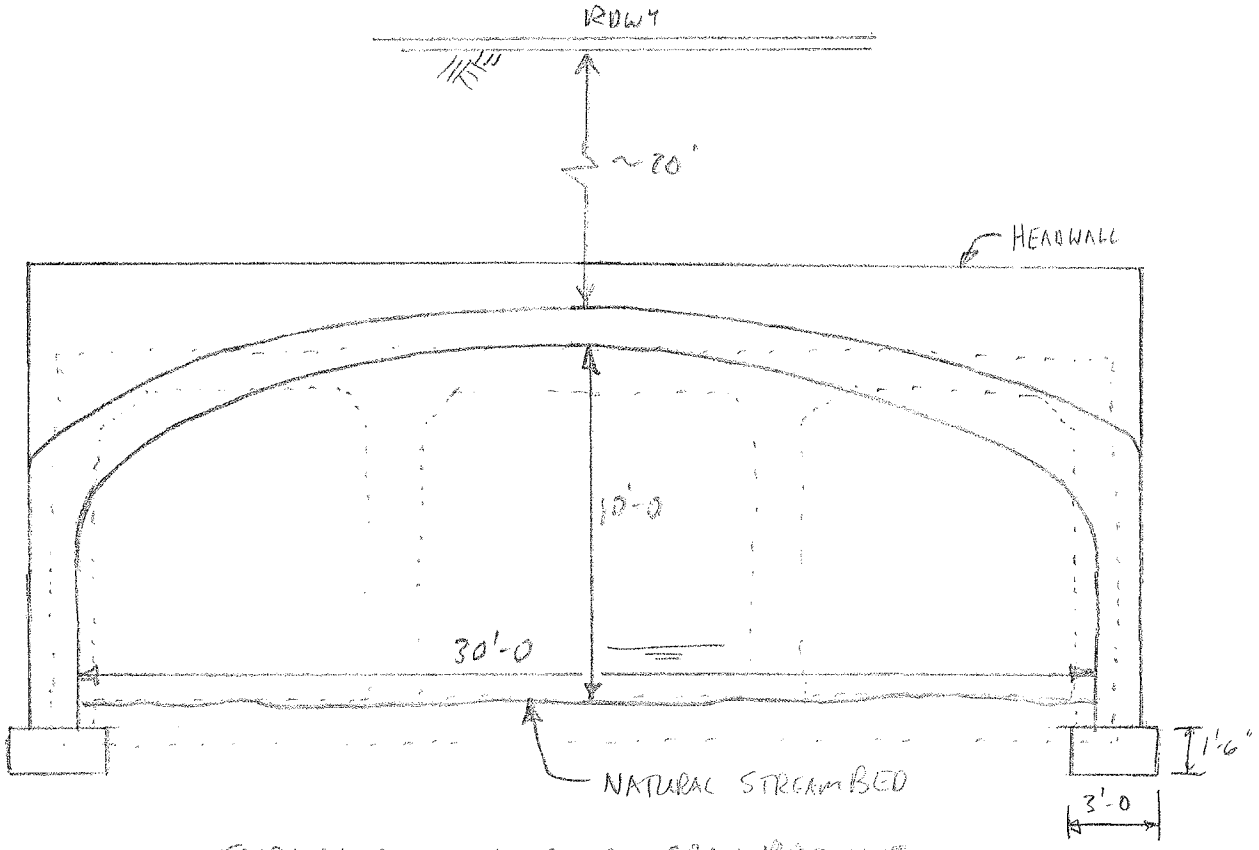
SKETCH

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-5B

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 3 of 5



TYPICAL SECTION - SINGLE SPAN PRE-CAST

(PLAN IS SIMILAR)

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: B-5B

SHEET NO.: 4 of 5

EXISTING C.I.P. CULVERT:

[(0.167' x 9' x 4') + (31' x 1') + (32' x 1')] x 136' (1/27) = 438 CY
WALLS TOP BTM

[(2' x 1' x 32') + (30' x 10' x 1' x 2) + (12' x 10' x 2)] 1/27 = 378 CY
HEADER CUTWATER WING

438 CY + 378 CY = 816 CY *

PRECAST SINGLE-SPAN ARCH:

CIP FOOTINGS = (3' x 1.5' x 120') (1/27) = 20 CY *

CONSPAN = 30' SPAN x 120' L (W/ HEADWALLS AND WINGWALLS) = $180,000

CUT/FILL AND RIP-RAP AREA WASH

* FOR CONSISTENCY, USE ITEM 500-3800 CLASS CONCRETE, INCL. REINF STEEL.

COST WORKSHEET

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Talbot/Upson County, Georgia - Preliminary Engineering

ALTERNATIVE NO.: **B-5B**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Triple 9 x 9 box culvert							
Class A concrete incl. reinforcement	CY	475	628.37	298,476	20	628.37	12,567
Precast single span							
Concrete arch	EA				1	180,000.00	180,000
Subtotal				298,476			192,567
Markup (%) at 35.1%				104,765			67,591
TOTAL				403,241			260,158

VALUE ENGINEERING ALTERNATIVE

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE**
Project Nos. STP00-0000-00(929) and BRST0-0157-01(009)
Talbot/Upson County, Georgia

ALTERNATIVE NO.: **B-8**

DESCRIPTION: **CHANGE THE PROJECT DELIVERY FROM DESIGN/BID/BUILD TO DESIGN/BUILD**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The standard design/bid/build process has been complicated by consultant issues which require redesign by the Department.

ALTERNATIVE:

With minimal effort, the project could be advertised this year via a design/build RFQ/RFP process.

ADVANTAGES:

- Reduces build schedule
- Reduces inflation costs due to shortened schedule
- Reduces liability on DOT
- Reduces possible accidents due to shortened schedule to complete the work

DISADVANTAGES:

- Possible increase in project costs due to risks for design/build contractor

DISCUSSION:

The design/build process will allow an early start to portions of the contract (clearing and grubbing), which could reduce the overall construction time by six months. With a construction cost escalation rate of 5%, cost savings for the project are approximately $970,000 per year or $485,000 for six months.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 485,000	—	$ 485,000
ALTERNATIVE	$ 0	—	$ 0
SAVINGS (Original minus Alternative)	$ 485,000	—	$ 485,000

PROJECT DESCRIPTION

PURPOSE AND NEED

This project will provide passing lanes along State Route 36 and replace the aging bridge crossing the Flint River. Two separate sites are involved with this project. Site 1 is located in Talbot County where a westbound passing lane will be added between mile 20.40 and mile 22.75. Site 2 is located in Upson County where a new eastbound passing lane will be added between mile 0.05 and mile 1.79. The total project cost of the passing lane project for Sites 1 & 2 is estimated at $17M, including right-of-way and engineering. The Flint Bridge replacement project, including roadway approaches, is estimated at $2.1M.

The need for this project is being driven by safety issues as opposed to capacity or level of service constraints; however, the new passing lanes should greatly improve travel times through this segment of SR 36 by providing needed passing opportunities.

Updated traffic data, average annual daily traffic (AADT), is presented below.

CURRENT			PROJECTED	
SITE	YEAR	AADT	YEAR	AADT
1 (old Site 4)	2004	1450	2024	2100
2 (old Site 5)	2004	1700	2024	2250

Project STP00-0000-00(929) widens State Route (SR 36) by providing 12-ft-wide passing lanes at two locations (labeled as Sites 1 and 2) between milepost 204 (near Pie Road) in Talbot County and mile 1.8 (Roland Road) in Upson County. The project will add a passing lane (Site 1) on the westbound roadway and the passing lane (Site 2) on the eastbound roadway of SR 36. This project is needed to provide optimal passing opportunities for vehicles. The terrain along SR 36 within the project area is mostly rolling with reduced sight distances and limited passing opportunities for vehicles. Slower moving vehicles cause traffic to stack up and delays are common because of slow moving trucks.

Community Issues

SR 36 provides access to tourist attractions in surrounding areas. SR 36 also provides access to the Big Lazer Creek Wildlife Management Area, Sprewell State Park, Pine Mountain Animal Park, Franklin Roosevelt State Park, and the Little Whitehouse via SR 85 Alt, SR 116, and SR 190. The Franklin Roosevelt (FDR) State Park is a 10,000-acre park and includes two lakes, hiking and backpacking trails, FDR Museum and warm springs that are famous for their curative powers. The

Little Whitehouse is a historic cottage home of FDR, built while he was governor of New York. SR 36 provides access to the Fall Line Freeway (via SR 90) to the south, the City of Manchester to the north, the City of Thomaston to the east and the City of Columbus to the Southwest.

Existing Roadway Characteristics

SR 36 is functionally classified as a rural main arterial within the project area. This route is used by school buses and is not part of the National Highway System. SR 36 is an east-west access route in Talbot and Upson Counties. This route begins at SR 20B in Waverly Hall, Harris County and runs northeasterly through Harris, Talbot, Upson, and Lamar Counties to I-85 in Butts County. SR 36 continues northerly through Butts County to SR 81 in Covington, Newton County, where it ends. SR 36 is a two-lane roadway with truck traffic ranging from 10 to 15 percent in the project area.

Bicycle and Pedestrian Statewide Network

Existing land use along the programmed project is primarily agricultural with limited residential parcels. The percent of "no passing" zones along this route ranges from 94 percent in Talbot County to 74 percent in Upson County. The lack of passing opportunities along this route causes vehicle delays resulting from platoons or vehicles queuing behind slower-moving cars or trucks. This project will ensure that adequate passing opportunities are optimally available along the route.

Accident Data

The available accident data (1995-1997) along this segment (Upson County MP0,00-4.7) of SR 36 were retrieved from the Department's accident database. The data showed that the prevailing types of accidents that have occurred along this route were "struck object" or "rear-end" accidents. These types of accidents are commonly associated with poor or limited sight distances and vehicles attempting to merge into lanes to avoid oncoming vehicles. Lack of passing opportunities, limited stopping distance or limited recovery shoulder can also be factors.

Highway Design Issues

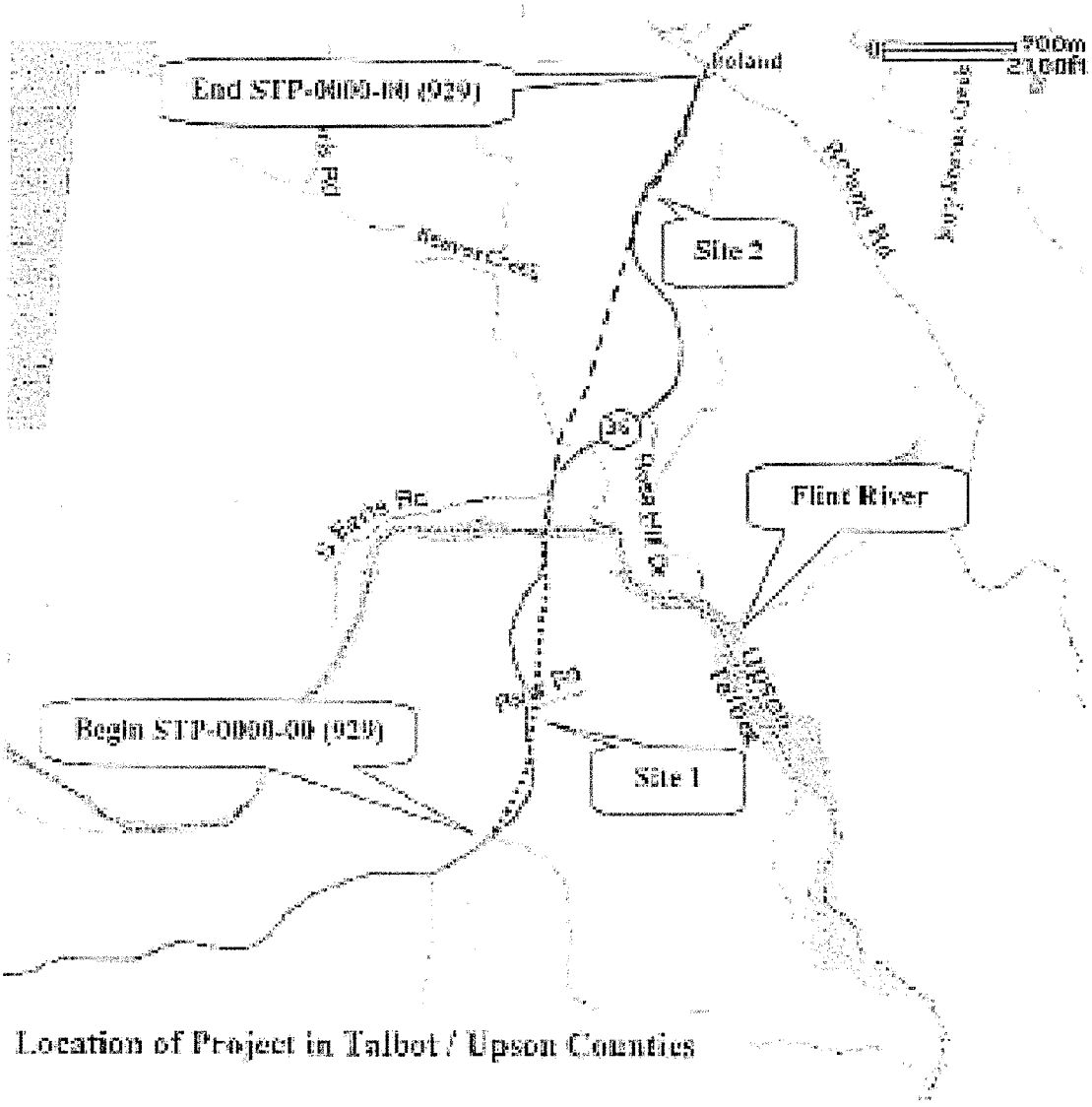
The 3.9 mile long segment will be realigned in several locations to eliminate design variances and speed constraints due to substandard horizontal and vertical curves. The typical roadway section will include two 12-ft-wide travel lanes with 2 ft of paved shoulder and 8 ft of gravel shoulder. The new passing lanes will be 12 ft wide. The right-of-way for the new improvements is planned to be between 150 and 200 ft wide to accommodate cut/fill slopes in this rolling terrain. Construction is expected to take an estimated 24 months and will be staged so that two-way traffic is maintained at all times. A total of 600,000 CY of material will be cut/filled along the alignment.

Flint River Bridge

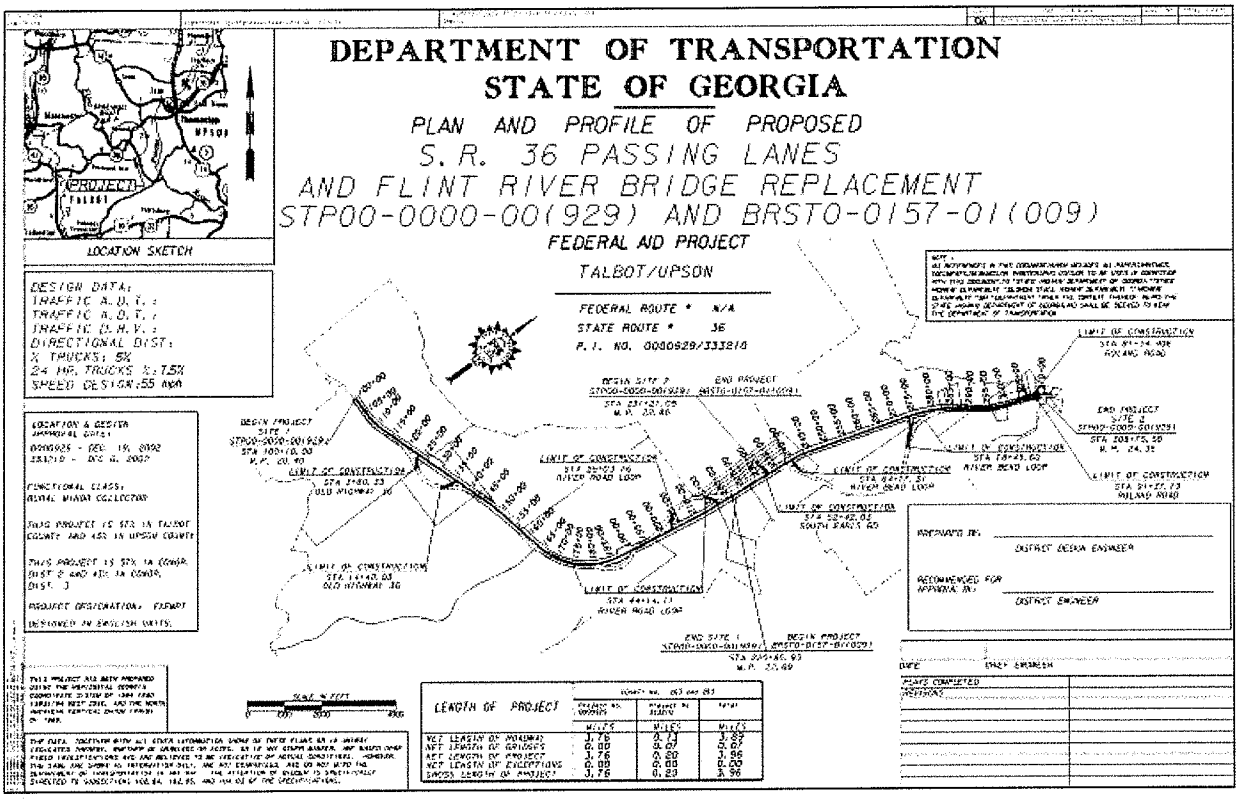
The new Flint River Bridge is a three-span concrete structure with 110 ft long, precast, prestressed concrete girders and two intermediate drilled caisson piers in the river.

DRAWINGS

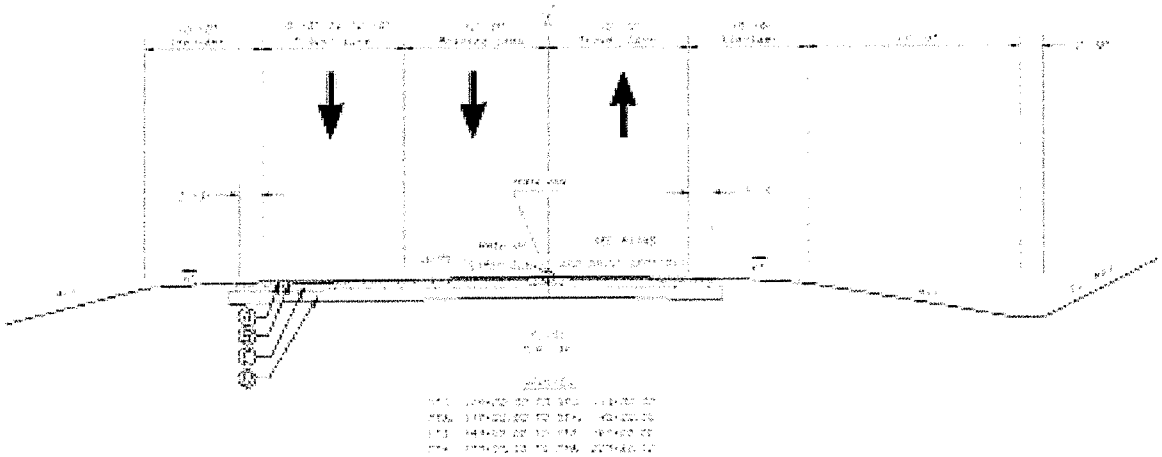
Location maps, typical roadway section, and bridge concept drawings follow.



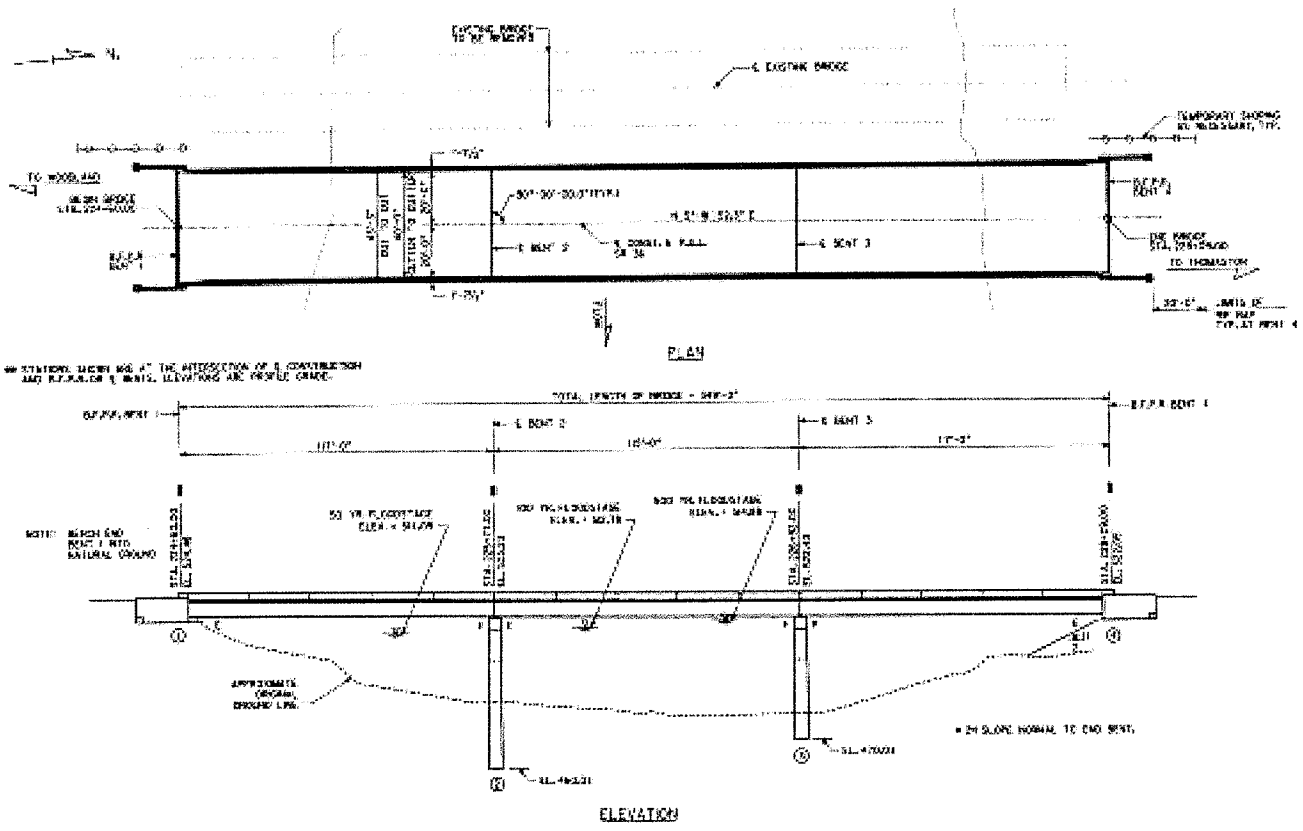
Location of Project in Talbot / Upson Counties



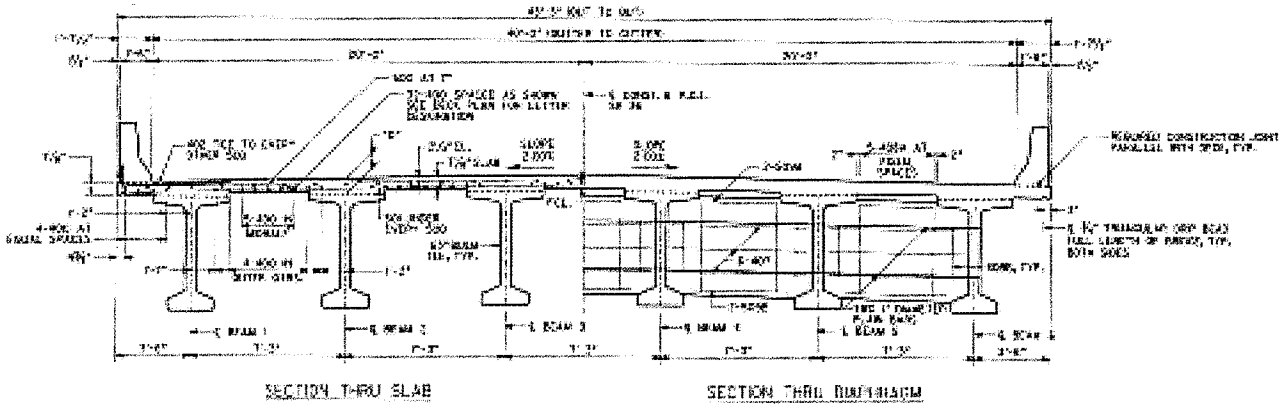
PLAN AND LOCATION



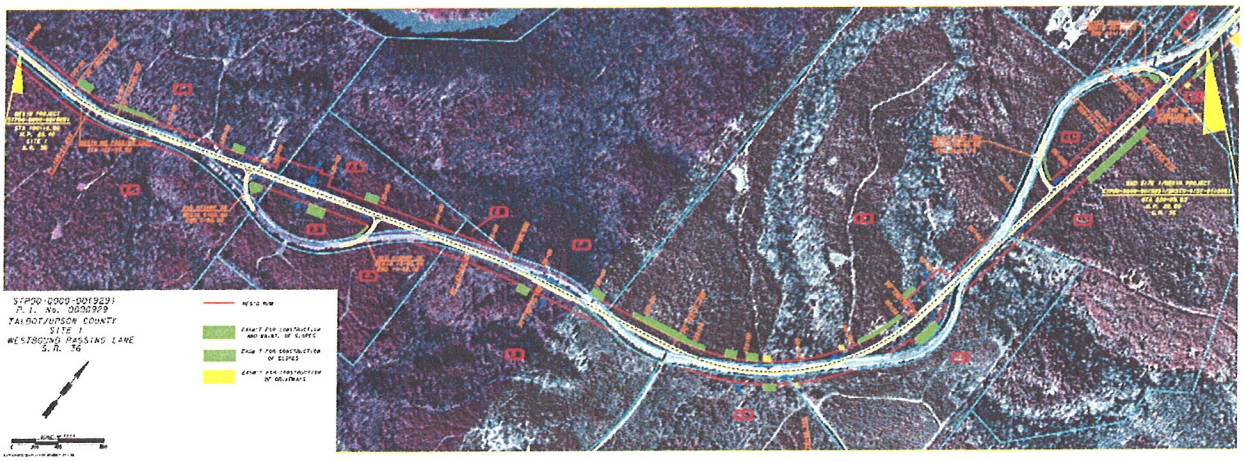
TYPICAL SECTION



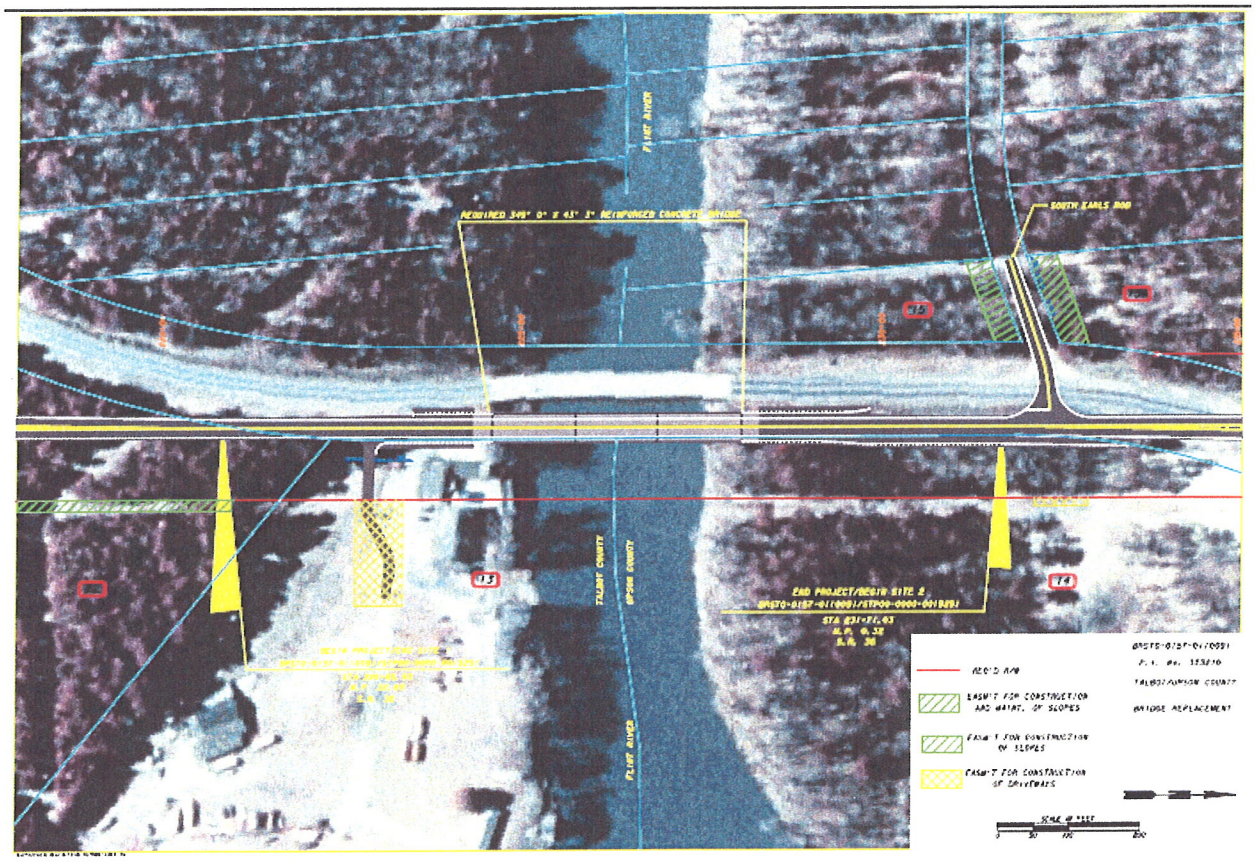
BRIDGE



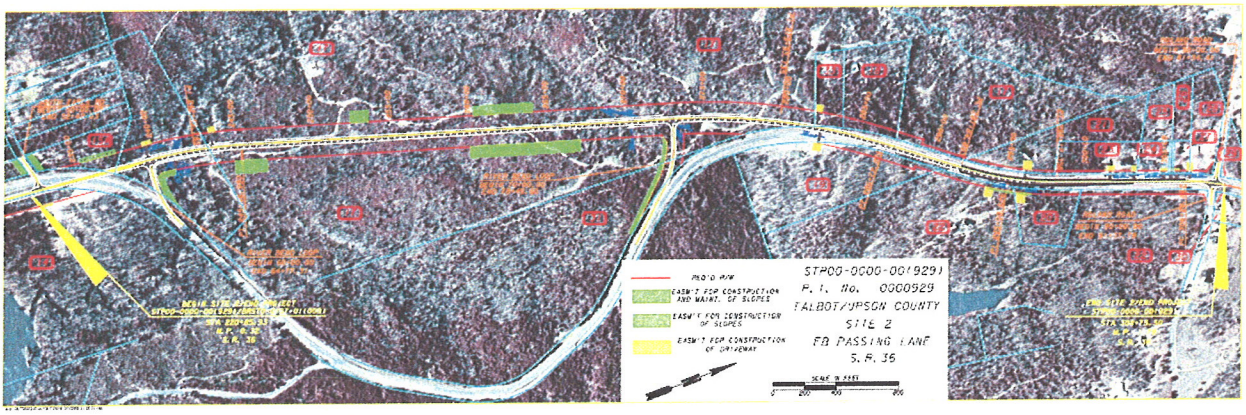
BRIDGE SECTION



SITE #1 ALIGNMENT



BRIDGE PLAN



SITE #2 ALIGNMENT

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis (VA) procedure used during the VE study conducted for the SR 36 Passing Lanes and Flint River Bridge Replacement Project by Lewis & Zimmerman Associates, Inc. The workshop was performed March 23 - 26, 2009 at the preliminary engineering stage of completion. The GDOT management and the District 3 design team provided information for the VE team to use as the basis of this study.

A systematic approach was used in the VE study, which was divided into three parts: (1) Preparation Effort, (2) Workshop Effort, and (3) Post-Workshop Effort. A task flow diagram outlining each of the procedures included in the VE study is attached for reference.

Following this description of the VA procedure, separate narratives and supporting documentation identify the following:

- VE workshop participants
- Economic data
- Cost model
- Function analysis
- Creative ideas and evaluations

PREPARATION EFFORT

Preparation for the workshop consisted of scheduling workshop participants and tasks and gathering necessary project documents for team members to review before attending the workshop. Documents such as those listed below were used as the basis for generating VE alternatives and for determining the cost implications of the selected VE alternatives:

- STP-0000-00(929) Revised Project Concept Report – SR 36 Passing Lanes, dated December 31, 2003, prepared by GDOT District 3.
- BRST0-0157-01(009) Revised Project Concept Report – Flint River Bridge Replacement, dated December 18, 2002, prepared by GDOT District 3.
- Plan and Profiles Drawings, SR 36 Passing Lanes and Flint River Bridge Replacement, dated March 3, 2009, prepared by District 3
- STP00-0000-00(929) Project Cost Estimate – SR 36 Passing Lanes, dated March 2, 2009, prepared by GDOT District 3.
- BRST0-0157-01(009) Project Cost Estimate – Flint River Bridge Replacement, dated January 13, 2009, prepared by GDOT District 3.

Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project
- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Define *Project Value Objectives*
- Identify Project Constraints

→

Prepare for Workshop
- Collect Project Data
- Distribute Data to Team Members
- Verify Cost Data
- Team Members Become Familiar with Project

→

Construct Cost Models
- Construct Cost Models
- Construct Graphic Function Analysis
- Outline High Cost Areas

→

LCC Model
- Process Areas
- Staffing
- Chemicals
- Energy
- User Impact

Workshop Effort

Information Phase
- Introduction by VETL
- Project Description and Presentation by Designer
- Outline Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)

→

Function Identification and Analysis Phase
- Analyze Project Costs and Energy Usage
- Perform Function Analysis and FAST Diagram
- Identify High Cost and Energy Areas
- Calculate Cost/Worth Ratios
- Identify Paradigms

List Ideas Generated During Function Analysis

→

Creative Phase
- Introduction by VETL
- Creative Idea Listing:
  - Quantity of Ideas
  - Association of Ideas

Brainstorming

Creative Thinking:
- Group & Individual

Use Checklist for Ideas

→

Evaluation Phase
- Eliminate Impractical Ideas
- Rank Ideas with Advantages/Disadvantages
- Evaluate Alternatives (Include Non-Economic considerations: Safety, Reliability, Environment, Aesthetics, O & M, etc.)
- Select Best Ideas for Implementation

→

Development Phase
- Develop Proposed Alternatives
- Prepare Alternative Design Sketches
- Estimate Costs
- Perform Life Cycle Comparison
  - Initial Cost
  - Redesign Cost
  - O & M Cost
  - LCC Cost

→

Presentation Phase
- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Oral Presentation

Post-Workshop Effort

VE Study Report
- Prepare Preliminary VE Report
- Designer Prepares Responses to VE Report
- Owner Evaluates Recommendations

→

Implementation Phase
- Participate in Implementation Meeting with Owner/User/Designer/VE Team, as needed
- Prepare Final VE Report

→

Final Acceptance
- Redesign by Designer

Information relating to the project's purpose and need, owner concerns, project stakeholder concerns, design criteria, project constraints, funding sources and availability, regulatory agency approval requirements, and the project's schedule and costs is very important as it provides the VE team with insight about how the project has progressed to its current state.

Project cost information provided by the designers is used by the VE team as the basis for a comparative analysis with similar projects. To prepare for this exercise, the VE team leader used the cost estimate prepared by District 3 to develop cost models for the project. The models were used to distribute the total project cost among the various elements or functions of the project. The VE team used this model to identify the high-cost elements or functions that drive the project and the elements or functions providing little or no value so that the team could focus on reducing or eliminating their impact.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a 3½-day effort beginning with an orientation/kickoff meeting on Monday March 23, 2009 and concluding with the final VE Presentation on Thursday March 26, 2009. During the workshop, the VE Job Plan was followed in compliance with GDOT and FHWA guidelines for conducting a VE study. The Job Plan guided the search for alternatives to mitigate or eliminate high-cost drivers, secondary functions providing little or no value, and potential project risks. Alternatives to specifically address the owner's project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructability, and providing missing functions were also considered. The Job Plan includes six phases:

- Information Phase
- Function Analysis Phase
- Creative/Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Information Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods have to be reviewed and understood. For this reason, the workshop began with a presentation of the project by the GDOT management and District 3 teams. The presentation highlighted the information provided in the documentation reviewed by the VE team before the workshop and expanded on it to include a history of the project's development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarification about the information provided. Following the presentation, the VE team reviewed the project documents to become familiar with site conditions and traffic considerations in order to enhance their understanding of the project.

Function Analysis Phase

Having gained some information on the project, the VE team proceeded to define the functions provided by the project, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project or if there are disproportionate amounts of money spent on support functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function.

Function is defined as the intended use of a physical or process element. The team attempted to identify functions in the simplest manner using measurable noun/verb word combinations. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions, which were recorded on Random Function Analysis Worksheets (provided in the Function Identification and Analysis section). Then the individual function(s) of the major components of the project depicted on the cost model(s) were identified.

After identifying the functions, the team classified the functions according to the following:

Abbreviation	Type of Function	Definition
HO	Higher Order	The primary reason the project is being considered or project goal.
B	Basic	A function that must occur for the project to meet its higher order functions.
S	Secondary	A function that occurs because of the concept or process selected and may or may not be necessary.
R/S	Required Secondary	A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed.
G	Goal	Secondary goal of the project.
O	Objective	Criteria to be met
LO	Lower Order	A function that serves as a project input.

Higher order and basic functions provide value, while secondary functions tend to reduce value. The goal of the next job phase is to reduce the impact of secondary functions and thereby enhance project value.

To further clarify the impact of the various functions, the team may assign costs to provide the functions or group of functions indicated by a specific project element using the cost estimate and cost model(s). Where possible, they seek to find the lowest cost, or worth, to perform the function. This is accomplished using published data from other sources or team knowledge obtained from working on other similar projects to establish cost goals and then comparing them to the current costs. By identifying the cost and worth of a function or group of functions, cost/worth ratios can be calculated. Cost/worth ratios greater than one indicated that less than optimum value was being provided. Those project functions or elements with high cost/worth ratios became prime targets for value improvement.

Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

Creative/Speculation Phase

This VE study phase involved the creation and listing of ideas. Starting with the functions or project elements with high cost/worth ratios, a high absolute cost compared to other elements in the project, and secondary functions providing little or no value and using the classic brainstorming technique, the VE team began to generate as many ideas as possible to provide the necessary functions at a lower total life cycle cost, or to improve the quality of the project. Ideas for improving operation and maintenance, reducing project risk, and simplifying constructability were also encouraged. At this stage of the process, the VE team was looking for a large quantity of ideas and free association of ideas. A Creative Idea Listing worksheet was generated and organized by the function or project element being addressed.

The GDOT design team may wish to review these creative lists since they may contain ideas that were not pursued by the VE team but can be further evaluated for potential use in the design.

Evaluation Phase

Since the goal of the Creative/Speculation Phase was to conceive as many ideas as possible without regard for technical merit or applicability to the project goals, the Evaluation Phase focused on identifying those ideas that do respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of the VE team evaluating the ideas originated during the Creative/Speculation Phase based on the GDOT value objectives identified through conversations during the design presentation. Based on the team's understanding of the owner's value objectives, each idea was compared with the present design concept, and the advantages and disadvantages of each idea were discussed.

How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of 1 to 5, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond to project requirements. Generally, ideas rated 4 and 5 are pursued in the next phase and presented to the owner during the Presentation Phase.

The team also used the designation "DS" to indicate a design suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, ease maintenance, reduce schedule time, or enhance project value in other ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. These are also developed in the next phase of the VE process.

Development Phase

In this phase, each highly rated idea was expanded into a workable solution designated as a VE alternative. The development consisted of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and writing a brief narrative to compare the original design to the

proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the Study Results section of this report. Design suggestions include the same information as the alternatives except that no cost analysis is performed. They too are included in the Study Results section.

Presentation Phase

The goals of the last phase of the workshop were to summarize the results of the study, to prepare draft Summary of Potential Cost Saving worksheets to hand out at the presentation, and to present the key VE alternatives and design suggestions to the District 3 design team and Central Office staff. The presentation was held on March 26, 2009 at the GDOT Central Office. The purpose of the meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed, and arrangements were made for the reviewers of the VE report to contact the VE team in order to obtain further clarifications, if necessary.

POST-WORKSHOP EFFORT

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Personnel from the GDOT management and the District 3 design team will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives. Please do not hesitate to call us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, GDOT management and District 3 design team will meet to select by consensus the VE alternatives to incorporate into the project.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will facilitate a 30-hour value engineering (VE) study on the Preliminary Engineering Submittal for the **SR 36 Passing Lanes and Flint River Bridge Replacement,** Project No. STP00-0000-00(929) and BRST0-0157-01(009), P.I. No. 0000929/333210, Talbot/Upson Counties, Georgia. The Georgia Department of Transportation (GDOT) project management and District 3 design team will be available to formally present the project at the beginning of the workshop; attend a presentation of the VE alternatives at the conclusion of the VE study; and be available to answer questions during the VE study effort.

The VE study will follow the outline described below and be conducted March 23 - 26, 2009 at the offices of:

GDOT
600 West Peachtree Street, 5th Floor
Atlanta, Georgia 30308
Conference Room 5CR1L2

The point-of-contact is Ms. Lisa Myers, GDOT Value Engineering Coordinator, who may be reached at 404-631-1770.

VE STUDY AGENDA

Monday, March 23, 2009

8:00 am - 9:00 am **VE Team Members Arrive and Review Documents**

9:00 am – 11:00 am **Owner's/Designer's Presentation**

GDOT District 3 design team will present information concerning the project including, but not limited to: the Purpose and Need for the project, rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:00 am – 12:00 noon **VE Team Reviews Project Documents**

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 2:00 pm **Information Phase**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost models will be refined, as necessary. The VE team will define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost/worth or value index ratios will be calculated, and

high cost/low worth areas for study identified. In addition, the VE team will continue defining the function of each element/system to gain a thorough understanding of the projects' Purpose and Need.

2:00 pm – 3:00 pm **Function Analysis**

The team will identify all project functions required to meet the established purpose and need. Functions will be identified as to basic, required secondary, secondary, or project goals.

3:00 pm - 5:00 pm **Speculation Phase**

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment.

Tuesday, March 24, 2009

8:00 am - 10:00 am **Speculation Phase (cont.)**

The VE team will continue the brainstorming exercise to capture ideas to improve the project in terms of initial and life cycle cost, technical aspects, schedule, and constructibility issues.

10:00 am – 12:00 noon **Analysis Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas for further development.

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Development Phase**

VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations and written substantiation.

Wednesday, March 25, 2009

8:00 am – 12:00 noon **Development Phase (cont.)**

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Development Phase (cont.)**

Upon completion of the Development Phase, the VE team leader will prepare the summary worksheets based on the alternatives developed by the VE team. The summary worksheets form the basis of the informal oral presentation to be made to GDOT, local representatives, and the District 3 design team representatives. The team will review all documentation and prepare for the presentation.

Thursday, March 26, 2009

8:00 am - 9:00 am **Development Phase and Preparation for Presentation**

9:00 am – 12:00 noon **Presentation Phase**

Upon completion of the Development Phase, the VE team leader will prepare the summary worksheets based on the alternatives developed by the VE team. The summary worksheets form the basis of the informal oral presentation to be made to GDOT, local representatives, and the District 3 design team representatives. The team will review all documentation and prepare for the presentation.

Noon - Adjourn

POST-STUDY PHASE

Upon completion of the value engineering study, the VE team leader will prepare the Value Engineering Study Report and submit it to GDOT. The report will include the following material:

- Project description and design concept of project
- Cost models and graphic function analysis worksheets
- Value engineering alternatives: original design and proposed alternatives, including sketches, design calculations and initial and life cycle estimates
- Potential contract savings (capital construction and life cycle costs)

The GDOT design team will independently review the VE alternatives and classify them as accepted, accepted with modifications, needs further study, or rejected—accompanied by the reasons for rejection. A meeting with all stakeholders will then be convened to decide which VE alternatives to implement.

VE TEAM MEMBERS

David Hamilton, PE, CVS, CCE, LEED ^{AP}	VE Team Leader/Civil	Lewis & Zimmerman Assoc.
Joe Leoni, PE	Highway Design Engineer	ARCADIS
Larry Prescott, PE	Structural Engineer	HNTB
Parish Parikh, PE	Construction Engineer	Delon Hampton

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the SR 36 Passing Lanes and Flint River Bridge Replacement Project. The following multidisciplinary team comprised professionals with highway and bridge design experience and a working knowledge of VE procedures:

Participant	Specialization	Affiliation
David Hamilton, PE, CVS, CCE, LEED ®	VE Team Leader/Civil	Lewis & Zimmerman Assoc.
Joe Leoni, PE	Highway Design Engineer	ARCADIS
Larry Prescott, PE	Bridge Engineer	HNTB
Paresh Parikh, PE	Construction Engineer	Delon Hampton

DESIGNER'S PRESENTATION

An overview of the project was presented on Monday, March 23rd by representatives from GDOT management and the District 3 design team. The purpose of this meeting, in addition to being an integral part of the Information Phase of the VE study, was to bring the VE team up-to-speed regarding the overall project specifics. Additionally, the meeting afforded the owner and design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted by the VE team on Thursday March 26, 2009 at the GDOT Central Office to review VE alternatives with GDOT management and the District 3 design team. Copies of the Draft Summary of Potential Cost Savings worksheet were provided to the attendees. An attendance list for the meeting is attached.

VE STUDY SIGN-IN SHEET

Project No.: STP00-0157-01(008)(009) County: Upson PI No.: 332900/333210/0000929 Date: March 23-26, 2009
STP00-0000-00(929)

3-26-09

	NAME 3-23-09	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
LM	Lisa L. Myers	00244168	Engineering Services	404-631-1770	lmyers@dot.ga.gov
NO	James K. Magnus	00208161	Construction	404-631-1971	jmagnus@dot.ga.gov
—	~~Kan Werho~~	~~00258268~~	Traffic Operations	404-635-8144	kwerho@dot.ga.gov
DF	Douglas Fadool	00928931	Engineering Services	404-631-1764	dfadool@dot.ga.gov
NO	Ron Wishon	00208180	Engineering Services	404-631-1753	rwishon@dot.ga.gov
JL	JoeLeoni		ARCADIS	770-431-8666	joe.leoni@arcadis.com
LP	LARRY PRESCOTT		HNTB	404-946-5743	LPRESCOTT@HNTB.com
post	Paresh J. Parikh		DHA	404-524-8030	pparikh@delonhampton.com
DH	DAVE HAMILTON		LZA	253.229.7703	DAHAMILTON@LZA.com
LE	Lyn Clements	00313424	Bridge	404-631-1849	lclements@dot.ga.gov
NO	Nabil Raad	00729514	Traffic Op.	404-635-8126	nraad@dot.ga.gov
	Via Video with D-3	3-23-09			
	Via Telephone with D3	3-26-09			
BR	Bill Rountree	00251237	District Design Engineer	706-646-6990	brountree@dot.ga.gov
DM	David Millen	00248693	District Preconstruction Engineer	706-646-6987	dmillen@dot.ga.gov
DP	Debra Pruitt	00232983	District Environmentalist	706-646-6984	dpruitt@dot.ga.gov
	Lamar M. Pruitt Jr.	00229230	Asst. District Engineer	404-274-9199	lpruitt@dot.ga.gov
	Kevin Van Houten	00322471	Asst. Area Eng. Constr.	706-741-3469	kvanhouten@dot.ga.gov
JS	Jeff Swiderski	00347110	Design Engineer 2	706-646-6997	jswiderski@dot.ga.gov

TC Tom Cleveland — tcleveland@dot.ga.gov
JM Jason Mobley — jmobley@dot.ga.gov

ECONOMIC DATA

The comparisons of life cycle costs between the VE alternatives and the current design solutions were performed on the basis of discounted present worth. To accomplish this, the VE team developed economic criteria to use in its calculations based on information gathered from GDOT management and the District 3 design team. The following parameters were used when calculating discounted present worth:

Year of Analysis:	2009
Construction Start Date:	2010
Construction Completion Date:	2012
Planning Period (n):	30 years starting in 2009
Net Discount Rate (i):	5%
Escalation Rate (e):	0%

When computing capital costs, direct material, labor and equipment costs are marked up using a composite markup of 17.5% on the Flint River Bridge Replacement and 35.1% on the SR 36 Passing Lanes Project. These markups include factors for the following elements.

- Construction Administration & Engineering
- Construction Contingency
- Total Fuel Adjustment
- Total Liquid AC Adjustment
- Reimbursable Utilities
- Utility Contingency

COST MODEL

The SR 36 Passing Lanes and Flint River Bridge Replacement Project will greatly improve safety and the Level of Service along the alignment in this area of Talbot/Upson County by reducing accidents caused by slow moving traffic. To achieve these benefits, a considerable investment in the infrastructure is required, including construction of new alignments, signage, structures, and acquisition of the needed right-of-way. The total construction cost of the Passing Lanes and Flint River Bridge Replacement is estimated at approximately $10.3M and $2.0M, respectively, plus right-of-way, and utilities. Since the right-of-way cost is a substantial portion of the cost of the required construction, the total width of the section, profile, and alignment must be reviewed carefully to ensure proper investments are made.

Project Cost

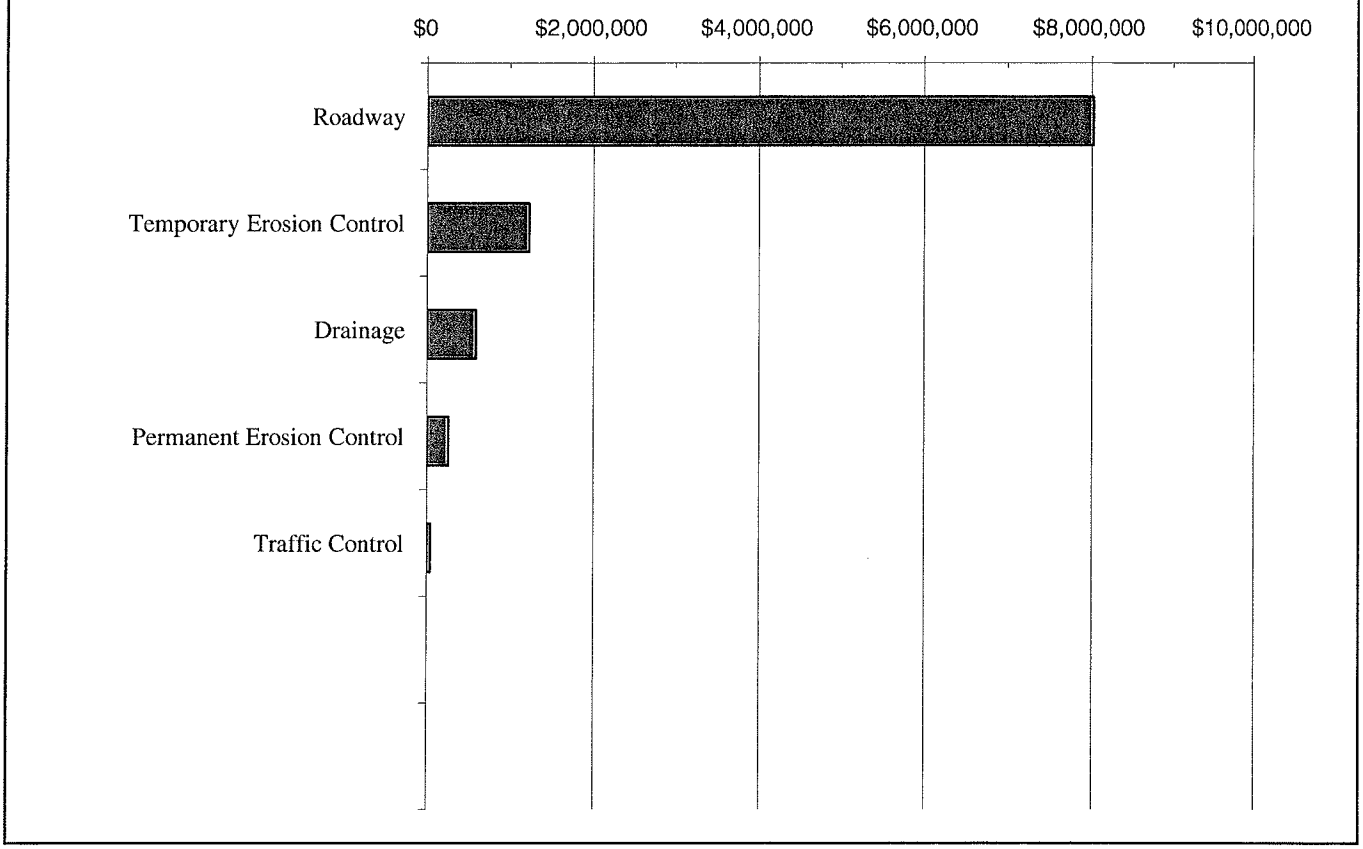
The VE team prepared a Pareto Chart, or Cost Histogram, for the two parts of the project that follows this page. This Cost Histogram displays the major construction elements identified in the cost estimate prepared by the designer in descending order of magnitude and thus identifies the high cost areas in the project. The high cost elements provide the VE team with one focus for its work during the study.

From this analysis, it can be seen that the right-of-way impacts are a major component of the overall project cost and appears to be driven by the section width of the road. Other cost components such as base, paving, and embankment appear prudent for a road widening project, but optimization measures can be applied.

COST HISTOGRAM

PROJECT: **SR 36 BRIDGE REPLACEMENT AND SR 36 PASSING LANES**
Project No. STP00-0000-00(929), Talbot/Upson County, Georgia

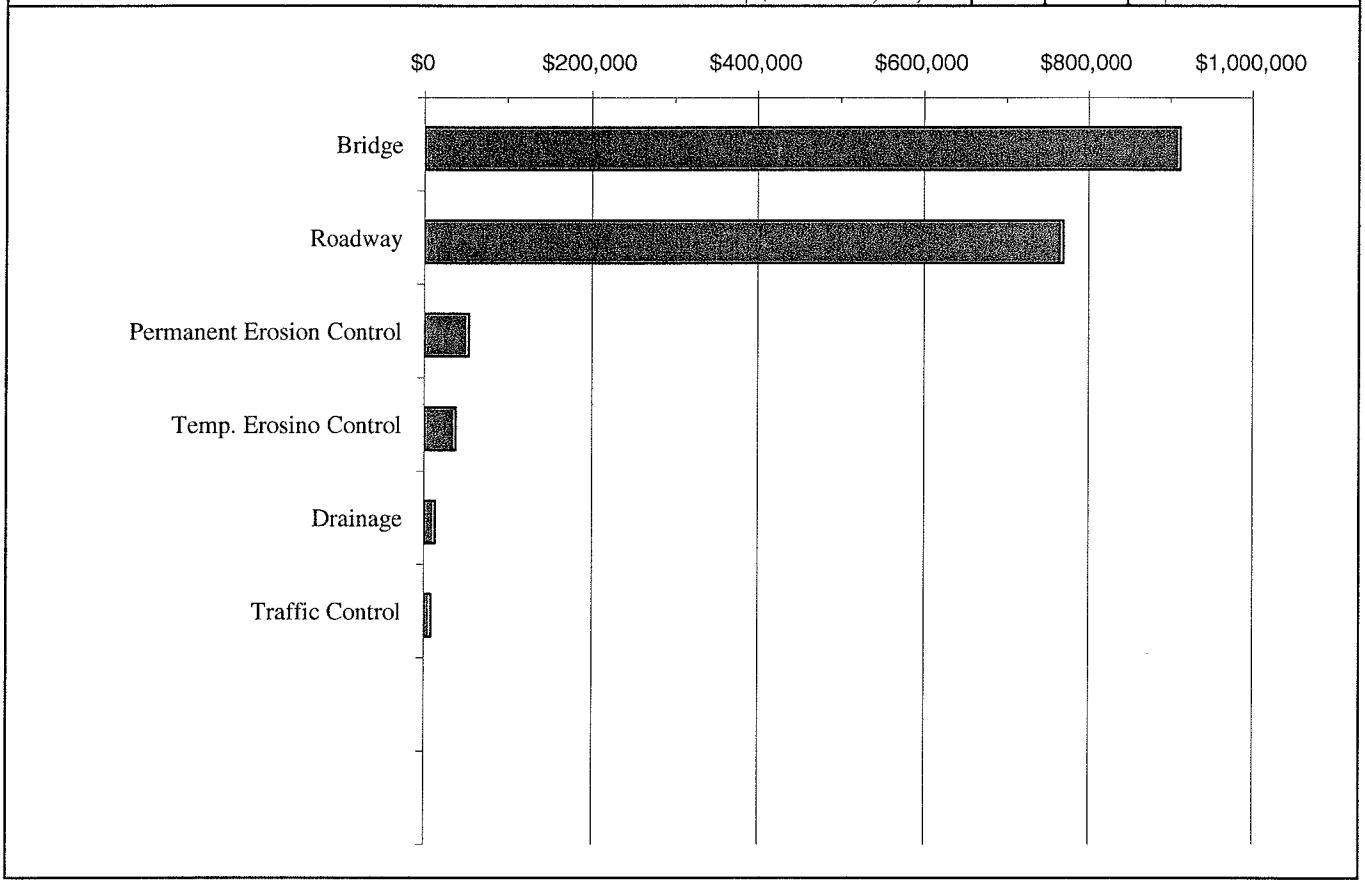
PASSING LANES		COST	PERCENT	CUM. PERCENT
Roadway		8,012,279	79.07%	79.07%
Temporary Erosion Control		1,230,092	12.14%	91.21%
Drainage		588,240	5.81%	97.01%
Permanent Erosion Control		258,493	2.55%	99.57%
Traffic Control		44,069	0.43%	100.00%
Construction Subtotal		***$ 10,133,173***	100.00%	
Engineering and Construction Inspection	5.00%	506,659		
Construction Contingency		303,995		
Total Fuel Adjustment		1,143,366		
Total Liquid AC Adjustsment		1,572,336		
Right of Way		3,614,265		
Reimbursable Utilities		24,875		
Utility Contingency		6,563		
TOTAL CONSTRUCTION & RIGHT OF WAY		**$ 17,305,232**	Comp Markup:	35.11%



COST HISTOGRAM

PROJECT: **SR 36 BRIDGE REPLACEMENT AND SR 36 PASSING LANES**
Project No. BRST0-0157-01(009) Talbot/Upson County, Georgia

BRIDGE	COST	PERCENT	CUM. PERCENT
Bridge	911,714	50.76%	50.76%
Roadway	769,240	42.83%	93.59%
Permanent Erosion Control	54,095	3.01%	96.61%
Temp. Erosino Control	38,548	2.15%	98.75%
Drainage	13,400	0.75%	99.50%
Traffic Control	9,021	0.50%	100.00%
Construction Subtotal	***1,796,018***	100.00%	
Engineering and Construction Inspection 5.00%	89,801		
Construction Contingency	71,841		
Total Fuel Adjustment	33,321		
Total Liquid AC Adjustment	20,377		
Right of Way	0		
Reimburseable Utilities	76,755		
Utility Contingency	23,027		
TOTAL CONSTRUCTION & RIGHT OF WAY	**$ 2,111,140**	Comp Markup:	17.55%



FUNCTION ANALYSIS

A function analysis was performed to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain the given project purpose and need, (4) identify other public goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow.

The key issues that evolved from the function analysis session were the concurrence of the project needs and purpose. The basic function of the project is to "Improve Safety" and "Reduce Accidents." However, "Improve LOS" and "Improve Capacity" are key required project goals that must be included in the project. Because of the nature of the construction, the functions of "Control Budget" and "Protect Environment" are client driven goals.

The results of the function analysis are as follows:

- The project need and purpose are justified, and
- Accidents must be reduced in this segment through the addition of the passing lanes, proposed alignment/profile changes, and replacement of the Flint River Bridge.

RANDOM FUNCTION ANALYSIS

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE** SHEET NO.: **1 of 1**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
Total Project Purpose and Need	***Improve***	***Safety***	***B***
	Replace	Bridge	B
	Reduce	***Accidents***	***B***
	Use	Stimulus Funds	G
	Eliminate	Variances	RS
	Improve	Maintainability	S
	Improve	Design	RS
	Improve	Ridability	G
	Reduce	Time	S
	Stimulate	Growth	G
	Shorten	Route	RS
	Renew	Infrastructure	RS
	Reduce	Delays	G
	Minimize	Impacts	G
	Route	Drainage	RS
	Protect	Environment	RS
	Meet	Expectations	G
	Meet	Goals	G
	Improve	LOS	RS

Function defined as: Action Verb
Measurable Noun

Kind: B = Basic
S = Secondary
RS = Required Secondary
HO = Higher Order
LO = Lower Order
G = Goal

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Creative/Speculation Phase, numerous ideas were generated for the SR 36 using conventional brainstorming techniques. These ideas were recorded and are shown with their corresponding ranking on the attached Creative Idea Listing Worksheets. For the convenience of tracking an idea through the VE process, the ideas were grouped into the following categories and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the categories.

PROJECT ELEMENT	PREFIX
Alignment – Site 1	A1
Alignment – Site 2	A2
Section	S
Profile	P
Bridge	B

The ideas were ranked on a qualitative scale of 1 to 5 on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea compared to the existing design solution were discussed based on the owner's value objectives for the project. The following are the top value objectives for this project:

- Minimize accidents in the corridor
- Level of Service should be acceptable at the design year
- Right-of-way cost should be optimized to fit the roadway section
- Life cycle cost should optimized through durable design features

After discussing each idea, the team evaluated the ideas by consensus. This produced 18 ideas rated 4 or 5 to research and develop into formal VE alternatives and 1 idea to develop as design suggestions to be included in the Study Results section of the report. Highly rated ideas that were not developed further may have been combined with another related idea or discarded as a result of additional research indicating the concept as not being cost effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheet since it may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **SR 36 PASSING LANES AND FLINT RIVER BRIDGE** SHEET NO.: **1 of 1**
Project No. STP00-0000-00(929) and BRST0-0157-01(009)

NO.	IDEA DESCRIPTION	RATING
ALIGNMENT – SITES #1 & #2 (A)		
A-1	Realign SR 36 from Road #28 to City of Roland for a totally new alignment through the top of 7 Islands.	3
A-2	Realign SR 36 from Road #28 to City of Roland for a partially new alignment at the bottom of 7 Islands.	3
A-3	Shorten alignment by increasing radius of curvature in Talbot County portion of project.	4
A-4	Keep the existing alignment, but add new 12ft wide passing lane in Talbot County.	4
A-5	Shorten the length of the passing lanes to use standard minimums.	5
A-6	Four-lane the total alignment in lieu of 3-lane.	Drop
A-7	Eliminate the passing lane in total, use two 12ft wide lanes only on the new alignment.	5
A-8	Make the outside lane 11ft wide in lieu of 12ft wide.	5
A-9	Keep the existing alignment but add a new 12ft wide passing lane in Upson County.	4
A-10	Combine Alternatives A-4 and A-5.	4
A-11	Realign only a portion of the alignment instead of building all of the realignments.	4
SECTION (S)		
S-1	Use retaining walls in lieu of exposed slide slopes and reduce temporary erosion control.	2
PROFILE (P)		
P-1	Increase the profile grade along the alignment to minimize cut/fill.	4
P-2	Dig a tunnel under the Flint river in lieu of using a bridge.	Drop
BRIDGE (B)		
B-1	Reduce the shoulder width on one side of the road from 8ft to 2ft; keep the 12ft lanes.	5
B-2	Increase the beam spacing from 7'-3" to 9'-0" and save one beam.	4
B-3	Use 74-inch deep girders and increase the span from 117ft to approximately 140ft.	3
B-4	Use 74-inch deep post tensioned spliced girders with 175ft spans and one center pier.	4
B-5	Use Conspan type structure for the two double box culverts in lieu of conventional CIP.	4
B-6	Eliminate the vertical curve on the bridge to improve constructability.	4
B-7	Review the construction cost estimate and revise several line items upwards.	DS
B-8	Procure the total project under a design/build contract and save 6 – 12 months in escalation	DS

Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed
DS = Design suggestion ABD = Already being done