



Georgia Department of Transportation

McRae Bypass

EDS-441(12) (13), BR-0001-00(220) Telfair/Wheeler Counties
P.I. Nos. 531100, 561470, 0001220

Value Engineering Study Report
60% Design Stage

May 2007

Design Consultant



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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June 7, 2007

Ms. Lisa L. Myers
Design Review Engineer Manager/VE Coordinator
State of Georgia Department of Transportation, General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: McRae Bypass Project, Telfair/Wheeler Counties - 441(12) (13), BR-0001-00(220),
P.I. Nos. 531100, 561470, 0001220
Value Engineering Study Report

Dear Ms. Myers:

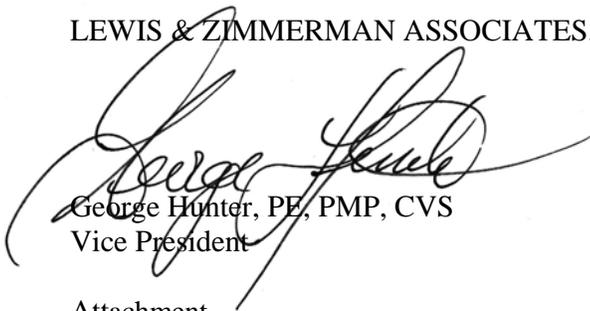
Lewis & Zimmerman Associates, Inc. (LZA) is pleased to submit four hard copies and one electronic copy of the referenced report. This report documents the results of the VE study conducted May 21-24, 2007 on the referenced project.

The McRae Bypass project has a current combined probable cost estimate of \$55 million that may be reduced by implementing a selection of alternatives contained in this report, including reconsidering the need to four-lane the bypass. In the absence of major scope changes, this report provides alternatives that can easily be integrated into the final design phase for the project.

We thank you, the design team and others who assisted the VE team in completing its assignment. Please do not hesitate to call upon LZA for assistance in implementing the alternatives presented.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



George Hunter, PE, PMP, CVS
Vice President

Attachment

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PROJECT DESCRIPTION

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EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. for the Georgia Department of Transportation (GDOT). The subject of the study was the McRae Bypass project being designed by O'Brien & Gere and associated firms. The project was at the 60% design phase at the time of the study.

The VE study was conducted May 21-24, 2007 at GDOT Headquarters in Atlanta using a multidisciplinary team comprised of design, structures and construction professionals. The team followed the six-phase VE Job Plan to guide its deliberations:

- Information Gathering
- Function Identification and Analysis
- Creative Idea Generation
- Evaluation of Creative Ideas
- Development of Alternatives
- Presentation of Results

PROJECT DESCRIPTION

US-441, within the project limits, is a two-lane rural principal arterial that passes through the town of McRae in Telfair and Wheeler counties. This project involves the realignment of US-441 around and east of McRae with a new four-lane roadway between CR-149 and CR-133. The existing US-441 will be retained as Business-441. The new alignment will intersect with various highways and county roads, and two railroads (Norfolk-Southern and Heart of Georgia Railroad), and will pass over two major water courses, Sugar Creek and Little Ocmulgee River. The new alignment will also pass by a prison near the middle of the stretch, a state park, and a county airport at the north end of the bypass. The average daily traffic for the bypass is estimated to be 2,025 vehicles for design year 2025 with 10% truck traffic. The design speed for the new facility will be 65 mph.

A concept report was approved February 5, 1994. The preliminary layouts for the CSX Railroad, Little Ocmulgee, and US 280/SR-30 bridges were completed in February 2001. The preliminary layouts for Sugar Creek and Norfolk Southern Railroad are currently being revised due to an alignment shift to avoid a snake habitat.

The project will be built in two contracts: the South McRae Bypass (EDS-441(12)) and the North McRae Bypass (EDS-441(13) and BR-0001-00(220)). These contracts are expected to have a two-year construction duration and will be simultaneously let in FY 2009. The current project cost for construction and right-of-way is \$ 55,433,218. The project qualifies for federal aid reimbursement.

CONCERNS AND OBJECTIVES

During the designer briefing, representatives from O'Brien & Gere and GDOT highlighted the following project issues:

- Project traffic projections are extremely low (2,025 vehicles in the design year).
- Access points are provided to CR-152, SR-149, Business-441, CR-236 (east and west), the prison access road, US-341, US-280, CR-232 and CR-233.
- The highway is relocated to avoid the Gopher Tortoise/Indigo Snake habitat just north of the prison and south of US-341. This alignment shift caused a longer Sugar Creek bridge.
- The US-441 bypass and CR-280 will be grade-separated, and access is being maintained by a connecting roadway (ramp). The US-280 ramp is a by-product of the new Heart of Georgia grade separation which appears to impact nine to 10 parcels.
- The grade separations on the north bypass project are driving the earthwork, structures and right-of-way costs.
- CR-133 provides direct access to the local airport at the north end of the project.
- The south end tie-in (US-441/Business-441) is near the confluence of Business-441/SR-149/CR-152.
- The north end tie-in involves the horizontal tie of US-280/US-441 and the vertical conform at CR-132.
- The airway-highway clearance requirements need to be verified.

The VE study objectives determined at the designer briefing were as follows:

- Reduce capital costs
- Protect the environment
 - River habitat and wetlands
 - Endangered species habitat
- Improve the project's performance by concentrating on the following design elements:
 - Traffic Level of Service
 - Access control (quality of the access and number of points)
 - Safety of opposing traffic, i.e., the reason for the divided median
 - Safety at intersections of the roadways and railroads with the US-441 bypass

RESULTS

The VE team explored 59 ideas that could enhance the value of the project and address GDOT's concerns. Evaluation and research of the ideas yielded 15 technically feasible alternatives with definable cost implications and six design suggestions that could improve the project in areas other than cost such as operations, safety, constructability, reliability, etc., or produce non-quantifiable cost reductions. Each of the alternatives and design suggestions are summarized on the Summary of Potential Cost Savings table. Note that the alternatives were developed independently of one another so the total potential cost savings achievable is dependent on the combination of alternatives selected for implementation.

A discussion of some of the alternatives and design suggestions developed by the VE team follows.

Alignment

Three design suggestions, Alternative Numbers (Alt. Nos.) A-1, A-2 and A-4, recommend relocating the horizontal position of the proposed bypass. There was no history or information offered during the briefing on the selection of the current alignment of the McRae Bypass, therefore, the team investigated three other alignments in a cursory manner, all of which would require a re-design and an environmental evaluation.

The remaining three alternatives, Alt. Nos. A-7, A-9 and A-12, deal with modifications to the vertical profile at Sugar Creek Bridge, Spring Avenue, and the Norfolk Southern Railway Bridge. Alt. Nos. A-7 and A-12 reduce the amount of vertical clearance to match the minimum requirements.

Maintain Access

This category deals with the numerous access points that the new bypass incorporates. A key access point is where the new US-441, Business-441 and CR-152 and SR-149 intersect near the south end of the project. The current design “teed” into CR-152 into SR-149 to form a single tie-in with US-441. Alt. No. MA-2 takes this a step further and lines up the combined CR-152/SR-149 opposite Business-441 to form a single intersection in lieu of two intersections. The additional cost for this alternative is approximately \$700,000. This modification will provide better access between CR-152 and SR-149 and McRae.

Alt. No. MA-12 proposes a single median opening by lining up the Little Ocmulgee State Park entrance opposite CR-133.

Typical Section

Numerous proposals could reduce the lane and shoulder widths on both the mainline and side streets. A key alternative is Alt. No. TS-2, which suggests building the bypass with a two-lane section in lieu of the proposed four lanes. The project objective to provide a four-lane facility north of McRae would be maintained. The traffic volumes do not require four lanes in the current or design year. The VE team understood that McRae is a major destination point along this stretch of US-441; therefore, a two-lane Business-441 with a two-lane US-441 could be a logical way to terminate the four-laning of this stretch of US-441.

Structures

The Little Ocmulgee River and the Sugar Creek bridge span arrangements could be shortened, as suggested in Alt. Nos. S-1 and S-4, to allow lighter, more economical Type III beams and prestressed concrete pile intermediate bents. An expected \$1.5 million savings could be achieved. Alt. No. S-3 suggests that if the Little Ocmulgee River Bridge’s current span arrangements are kept, Bents 2, 3 and 4 can be modified to have prestressed concrete pile bents in lieu of the concrete bents shown in the current plans.

Constructability

Alt. Nos. C-1 and C-6 suggest that the profile at the north and south tie-ins be modified to follow the existing profile grade to reduce the amount of full-depth pavement reconstruction and simplify the staging and traffic control.

Summary of Potential Cost Savings

The VE team reviewed all of the alternatives and assembled a group that can be easily implemented into the final design of the project and favorably address the requirements of the project. It should be noted that although there is a net savings associated with these alternatives, some of those listed below add cost to the project:

ALT. NO.	DESCRIPTION	INITIAL COST SAVINGS
ALIGNMENT		
A-7	Lower the mainline profile at Sugar Creek Bridge (Station 221+45 to 250+50)	\$ 355,325
A-9	Lower the mainline profile in the vicinity of Spring Avenue (Station 311+75 to 338+00)	\$ 240,792
A-12	Lower the mainline profile over Norfolk Southern Railway (Station 275+00 to 303+00)	\$ 1,497,522
MAINTAIN ACCESS		
MA-2	Relocate CR-152/SR-149 opposite the US-441/Business-441 intersection	\$ (708,720)
MA-12	Line up the State Park entrance with CR-133	Design Suggestion
STRUCTURES		
S-1	Use shorter spans for Little Ocmulgee River Bridge and prestressed concrete pile intermediate bents	\$ 961,552
S-2	Relocate the drainage pipe at Station 346+00 to avoid the bridge end bent	Design Suggestion
S-4	Use shorter spans and pile intermediate bents in lieu of concrete intermediate bents at the Sugar Creek Bridge	\$ 587,207
CONSTRUCTIBILITY		
C-1	Retain the existing profile grade at the south project tie-in	\$ 65,693
C-2	Reduce the right-of-way mitre at Station 145+00	\$ 21,001
C-6	Reduce the profile grade north of the Heart of Georgia Railroad and reduce the amount of full depth reconstruction at the north end tie-in (Station 382+00 to Station 413+00)	\$ <u>171,992</u>
Net Potential Cost Savings		\$ 3,192,364

Note: The net potential cost savings take into account the interrelations of the alternatives.



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **McRAE BYPASS**

Georgia Department of Transportation

PRESENT WORTH OF COST SAVINGS

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
ALIGNMENT						
A-1	Relocate alignment approximately 2,200 ft. west at the intersection with US-341			Design Suggestion		
A-2	Shift alignment east at the Little Ocmulgee River Crossing			Design Suggestion		
A-4	Shift alignment beginning at the south end to follow Willow Creek Lane, tying back near Spring Avenue			Design Suggestion		
A-7	Lower mainline profile at Sugar Creek Bridge (Station 221+45 to 250+50)	\$ 355,325		\$ 355,325		\$ 355,325
A-9	Lower the mainline profile in the vicinity of Spring Avenue (Station 311+75 to 338+00)	\$ 240,792		\$ 240,792		\$ 240,792
A-12	Lower mainline profile over Norfolk Southern Railway (Station 275+00 to 303+00)	\$ 1,497,522		\$ 1,497,522		\$ 1,497,522
MAINTAIN ACCESS						
MA-2	Relocate CR-152/SR-149 opposite the US-441/Business-441 intersection	\$ 319,871	\$ 1,028,591	\$ (708,720)		\$ (708,720)
MA-4	Shift mainline east and retain CR-236 between Station 160+00 to 195+00 and delete CR-236(W) connection			Design Suggestion		
MA-12	Line up state park entrance and CR-133			Design Suggestion		
TYPICAL SECTION						
TS-2	Construct 2-lane bypass with right-of-way for 4 lanes	\$ 42,742,522	\$ 24,511,308	\$ 18,231,214		\$ 18,231,214
TS-3	Use 11-ft. lanes on all mainline sections	\$ 675,072		\$ 675,072		\$ 675,072
TS-5	Reduce median width to 20 ft.	\$ 11,973,271	\$ 10,836,415	\$ 1,136,856		\$ 1,136,856
TS-8	Reduce lane width on side streets	\$ 103,783		\$ 103,783		\$ 103,783
TS-10	Use 4:1 median slopes where possible	\$ 142,432		\$ 142,432		\$ 142,432



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **McRAE BYPASS**

Georgia Department of Transportation

PRESENT WORTH OF COST SAVINGS

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
STRUCTURES						
S-1	Use shorter spans for Little Ocmulgee River bridge and prestressed concrete pile intermediate bents	\$ 4,388,996	\$ 3,427,444	\$ 961,552		\$ 961,552
S-2	Relocate drainage pipe at Station 346+00 to avoid bridge end bent				Design Suggestion	
S-3	Use pile intermediate bents at bents 2, 3 and 4 at the Little Ocmulgee Bridge using current span arrangements	\$ 340,522	\$ 157,047	\$ 183,475		\$ 183,475
S-4	Use shorter spans and pile intermediate bents in lieu of concrete intermediate bents at the Sugar Creek Bridge	\$ 2,615,836	\$ 2,028,629	\$ 587,207		\$ 587,207
CONSTRUCTABILITY						
C-1	Retain existing profile grade at south project tie-in	\$ 71,864	\$ 6,171	\$ 65,693		\$ 65,693
C-2	Reduce the right-of-way mitre at Station 145+00	\$ 882,400	\$ 861,399	\$ 21,001		\$ 21,001
C-6	Reduce the profile grade north of the Heart of Georgia Railroad and the amount of full depth reconstruction at the north end tie-in (Station 382+00 to Station 413+00)	\$ 206,312	\$ 34,320	\$ 171,992		\$ 171,992
PLAN CHECK ITEMS						
P-1	Check the airway-highway clearance requirements at the north end of the North McRae Bypass					
P-2	Profiles at the intersection of the north/south project meet at a PVC (algebraic difference of 3.14%) without a vertical curve					
P-3	Profile elevation information are in error on the Plan Sheets from Station 360+00 to 375+00					
P-4	Reconcile payment for in-place embankment on the North and South McRae projects					
P-5	The North McRae project's asphalt leveling quantities appear to be missing					

STUDY RESULTS

INTRODUCTION

The results are the major feature of the value engineering study conducted on the McRae Bypass project since they portray the benefits that can be realized by GDOT, the users and O'Brien & Gere, the designer. The results will directly affect the project's design and will require coordination between the owner and the design team to determine the disposition of each alternative.

During the VE Workshop, 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);
- An evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and 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 or its subconsultant, 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. Direct quotes from vendors for equipment items were also obtained. A composite markup of 10%, as described in the Value Analysis and Conclusions section of the report, was used to generate an all-inclusive project cost for the construction items being compared.

Each design suggestion contains the same information as the VE alternatives except for cost information. 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 could not 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 between 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 design discipline or project element listed below:

Design Discipline or Project Element	Prefix	No. of Ideas Generated
Maintain Access	MA	16
Alignment	A	21
Typical Section	TS	10
Structures	S	3
Drainage	D	2
Constructability	C	7

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

KEY ISSUES

During the designer briefing representatives from O’Brien & Gere and GDOT highlighted the following project issues:

- Project traffic projections are extremely low (2,025 vehicles in the design year).
- Access points are provided to CR-152, SR-149, Business-441, CR-236 (east and west), the prison access road, US-341, US-280, CR-232 and CR-233.
- The highway is relocated to avoid the Gopher Tortoise/Indigo Snake habitat just north of the prison and south of US-341. This alignment shift caused a longer Sugar Creek bridge.
- The US-441 bypass and CR-280 will be grade-separated, and access is being maintained by a connecting roadway (ramp). The US-280 ramp is a by-product of the new Heart of Georgia grade separation which appears to impact nine to ten parcels.
- The grade separations in the north bypass project drive the earthwork, structures and right-of-way costs.
- CR-133 provides direct access to the local airport at the north end of the project.
- The south end tie-in (US-441/Business-441) is near the confluence of Business-441/SR-149/CR-152.
- The north end tie-in involves the horizontal tie of US-280/US-441 and the vertical conform at CR-132.
- The airway-highway clearance requirements need to be verified.

STUDY OBJECTIVES

The VE study objectives discussed at the designer briefing were as follows:

- Reduce project capital costs
- Protect the environment
 - river habitat and wetlands
 - Endangered species habitat
- Improve the project's performance by concentrating on the following design elements:
 - Traffic level of service
 - Access control (quality of the access and number of points)
 - Safety of opposing traffic, i.e., the reason for the divided median
 - Safety at intersections of roadways and railroads with the US-441 bypass

RESULTS OF THE STUDY

Research of the 59 ideas identified as having potential for enhancing the value of the project resulted in the development of 16 alternatives and six design suggestions for consideration by GDOT and the designer. These alternatives and design suggestions address the key issues described above. Furthermore, there are four plan check items indicated on the Summary of Potential of Cost Savings that the VE team recommends the designers review.

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 GDOT or the 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 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.



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: McRAE BYPASS <i>Georgia Department of Transportation</i>		PRESENT WORTH OF COST SAVINGS				
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
ALIGNMENT						
A-1	Relocate alignment approximately 2,200 ft. west at the intersection with US-341			Design Suggestion		
A-2	Shift alignment east at the Little Ocmulgee River Crossing			Design Suggestion		
A-4	Shift alignment beginning at the south end to follow Willow Creek Lane, tying back near Spring Avenue			Design Suggestion		
A-7	Lower mainline profile at Sugar Creek Bridge (Station 221+45 to 250+50)	\$ 355,325		\$ 355,325		\$ 355,325
A-9	Lower the mainline profile in the vicinity of Spring Avenue (Station 311+75 to 338+00)	\$ 240,792		\$ 240,792		\$ 240,792
A-12	Lower mainline profile over Norfolk Southern Railway (Station 275+00 to 303+00)	\$ 1,497,522		\$ 1,497,522		\$ 1,497,522
MAINTAIN ACCESS						
MA-2	Relocate CR-152/SR-149 opposite the US-441/Business-441 intersection	\$ 319,871	\$ 1,028,591	\$ (708,720)		\$ (708,720)
MA-4	Shift mainline east and retain CR-236 between Station 160+00 to 195+00 and delete CR-236(W) connection			Design Suggestion		
MA-12	Line up state park entrance and CR-133			Design Suggestion		
TYPICAL SECTION						
TS-2	Construct 2-lane bypass with right-of-way for 4 lanes	\$ 42,742,522	\$ 24,511,308	\$ 18,231,214		\$ 18,231,214
TS-3	Use 11-ft. lanes on all mainline sections	\$ 675,072		\$ 675,072		\$ 675,072
TS-5	Reduce median width to 20 ft.	\$ 11,973,271	\$ 10,836,415	\$ 1,136,856		\$ 1,136,856
TS-8	Reduce lane width on side streets	\$ 103,783		\$ 103,783		\$ 103,783
TS-10	Use 4:1 median slopes where possible	\$ 142,432		\$ 142,432		\$ 142,432

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **A-1**

DESCRIPTION: **RELOCATE THE ALIGNMENT APPROXIMATELY
2,200 FT. WEST AT THE INTERSECTION WITH US-341**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The alignment for the proposed bypass was set at the time of the design concept report in 2004. The alignment passes south of a large building in the vicinity of US-341.

ALTERNATIVE: (Sketch attached)

Shift the mainline alignment to intersect US-341 approximately 2,200 ft. west of the original design intersection, and pass north of the above referenced building.

ADVANTAGES:

- Shortens alignment by approximately 2,500 ft.
- Provides a more direct route with fewer curves
- Increases distance from endangered species habitat

DISADVANTAGES:

- Requires major redesign of south McRae Bypass
- Potential commercial displacement at US-341
- Environmental document re-evaluation

DISCUSSION:

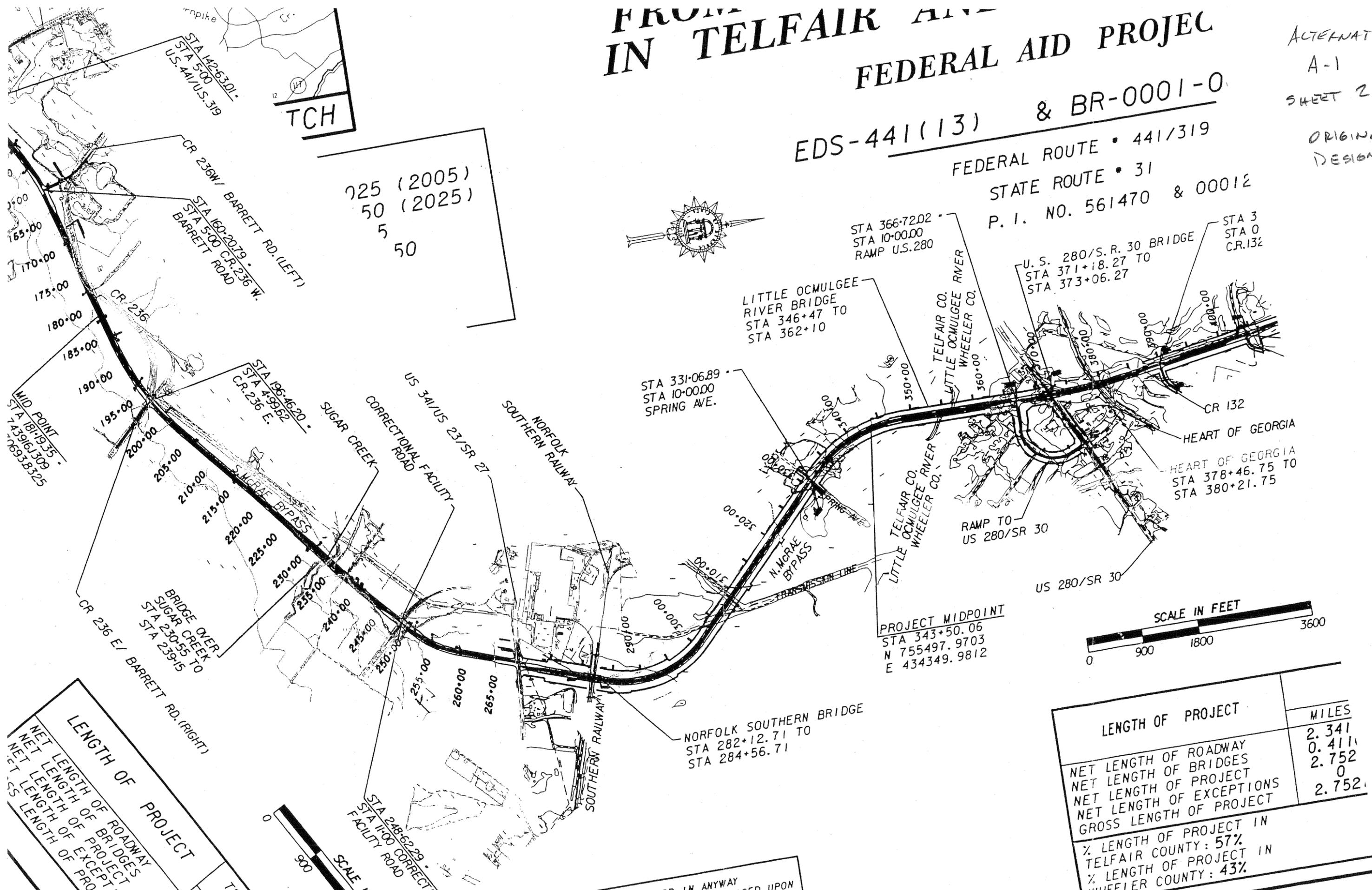
This alternative provides a smoother horizontal alignment while shortening the project length by approximately 15%. The VE team was not briefed on the environmental analysis and commitments. This alternative, if not already evaluated, may be worth considering.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	DESIGN SUGGESTION		
ALTERNATIVE			
SAVINGS (Original minus Alternative)			

FROM TELFAIR AND IN TELFAIR AND FEDERAL AID PROJECT

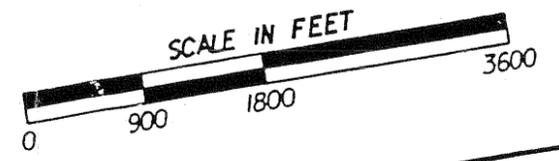
EDS-441(13) & BR-0001-0
FEDERAL ROUTE • 441/319
STATE ROUTE • 31
P. I. NO. 561470 & 00012

ALTERNATIVE
A-1
SHEET 2 OF 3
ORIGINAL
DESIGN



725 (2005)
50 (2025)
50

PROJECT MIDPOINT
STA 343+50.06
N 755497.9703
E 434349.9812



LENGTH OF PROJECT	
NET LENGTH OF ROADWAY	2.341
NET LENGTH OF BRIDGES	0.411
NET LENGTH OF PROJECT	2.752
NET LENGTH OF EXCEPTIONS	0
NET LENGTH OF PROJECT	2.752

LENGTH OF PROJECT	
NET LENGTH OF ROADWAY	2.341
NET LENGTH OF BRIDGES	0.411
NET LENGTH OF PROJECT	2.752
NET LENGTH OF EXCEPTIONS	0
NET LENGTH OF PROJECT	2.752
% LENGTH OF PROJECT IN TELFAIR COUNTY	57%
% LENGTH OF PROJECT IN WHEELER COUNTY	43%

SHOWN ON THESE PLANS OR IN ANYWAY
NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON
NATIVE OF ACTUAL CONDITIONS. HOWEVER,
AND DO NOT BIND THE



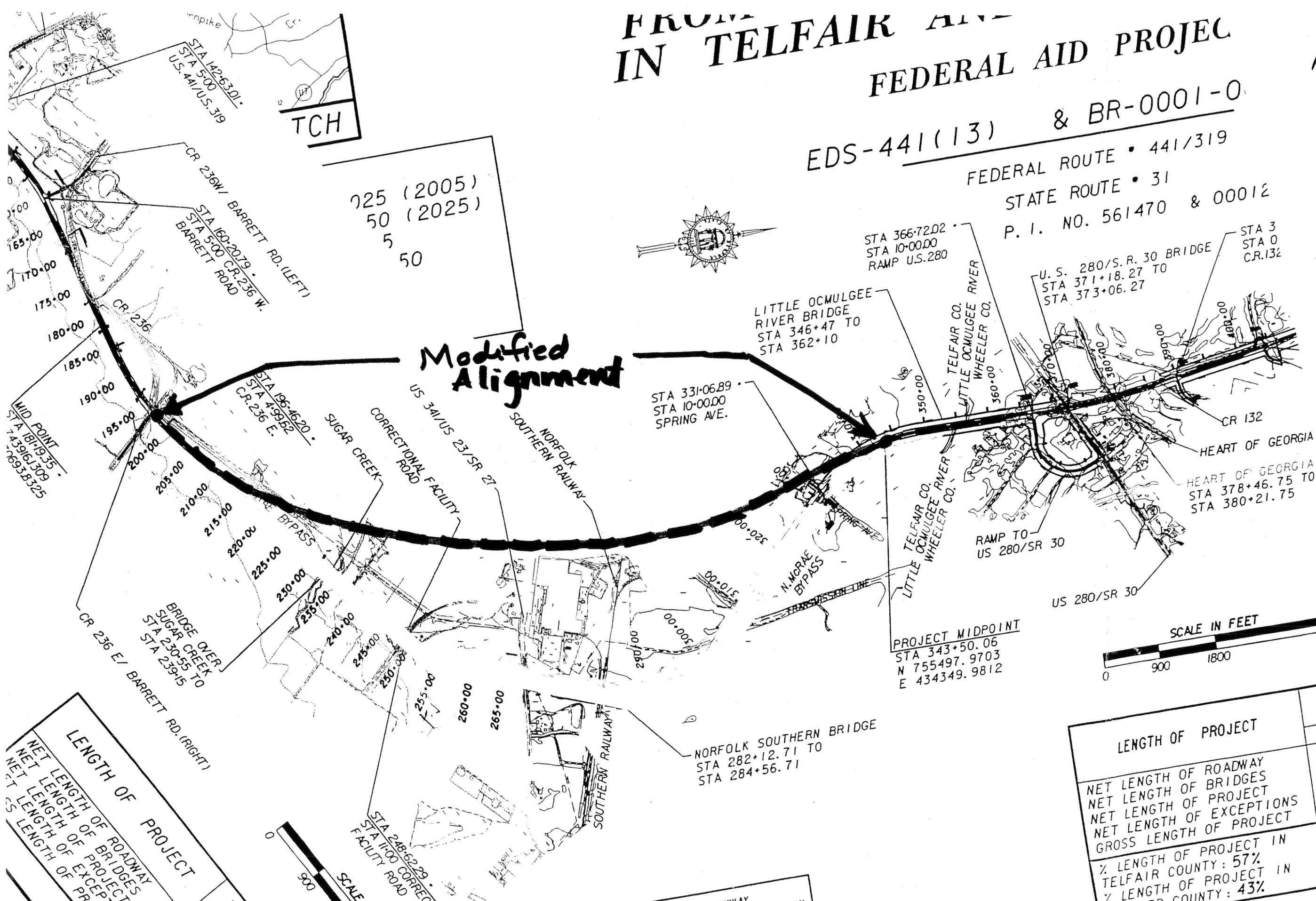
3.1 MILE
TELFAIR COUNTY

FRONT IN TELFAIR AND FEDERAL AID PROJECT

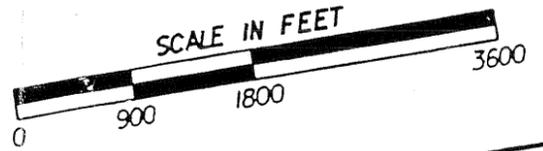
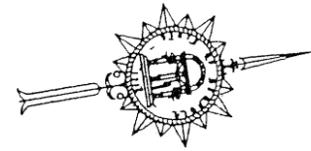
EDS-441(13) & BR-0001-0

ALTERNATIVE
A-1
ALTERNATIVE
DESIGN
SHEET 3 OF 3

FEDERAL ROUTE • 441/319
STATE ROUTE • 31
P. I. NO. 561470 & 00012



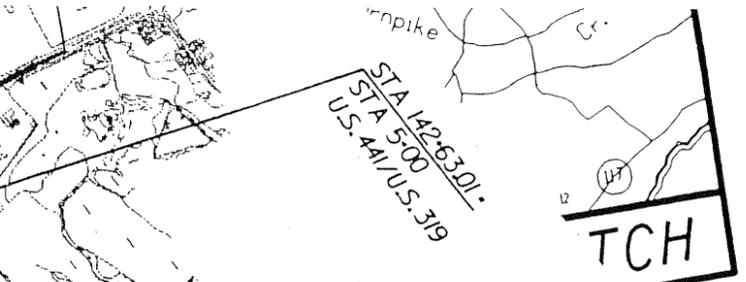
**Modified
Alignment**



LENGTH OF PROJECT	
NET LENGTH OF ROADWAY	2.341
NET LENGTH OF BRIDGES	0.411
NET LENGTH OF PROJECT	2.752
NET LENGTH OF EXCEPTIONS	0
GROSS LENGTH OF PROJECT	2.752

LENGTH OF PROJECT	
NET LENGTH OF ROADWAY	2.341
NET LENGTH OF BRIDGES	0.411
NET LENGTH OF PROJECT	2.752
NET LENGTH OF EXCEPTIONS	0
GROSS LENGTH OF PROJECT	2.752
% LENGTH OF PROJECT IN TELFAIR COUNTY	57%
% LENGTH OF PROJECT IN WHEELER COUNTY	43%

SHOWN ON THESE PLANS OR IN ANYWAY
OR IN ANY OTHER MANNER, ARE BASED UPON
ACTUAL CONDITIONS. HOWEVER,
NOT BIND THE



725 (2005)
50 (2025)
5
50

PROJECT MIDPOINT
STA 343+50.06
N 755497.9703
E 434349.9812

STA 331+06.89
STA 10+00.00
SPRING AVE.

LITTLE OCMULGEE
RIVER BRIDGE
STA 346+47 TO
STA 362+10

STA 366+72.02
STA 10+00.00
RAMP U.S. 280

U. S. 280/S. R. 30 BRIDGE
STA 371+18.27 TO
STA 373+06.27

STA 3
STA 0
C.R. 132

HEART OF GEORGIA
STA 378+46.75 TO
STA 380+21.75

NORFOLK SOUTHERN BRIDGE
STA 282+12.71 TO
STA 284+56.71



VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)** ALTERNATIVE NO.: **A-2**
Georgia DOT

DESCRIPTION: **SHIFT THE ALIGNMENT EAST AT THE CROSSING OF** SHEET NO.: **1 of 3**
LITTLE OCMULGEE RIVER

ORIGINAL DESIGN: (Sketch attached)

The alignment crosses the river and its associated wetlands at a skew of approximately 60° at a moderately wide part of the floodplain.

ALTERNATIVE: (Sketch attached)

Shift the alignment approximately 800 ft. to the east. The skew of the crossing is similar to the original design, but the floodplain is narrower, allowing for a shorter bridge.

ADVANTAGES:

- Reduces alignment by approximately 500 ft.
- Reduces bridge by approximately 500 ft.
- More economical

DISADVANTAGES:

- Increases the skew at the crossing of the transmission line
- Requires environmental document reevaluation

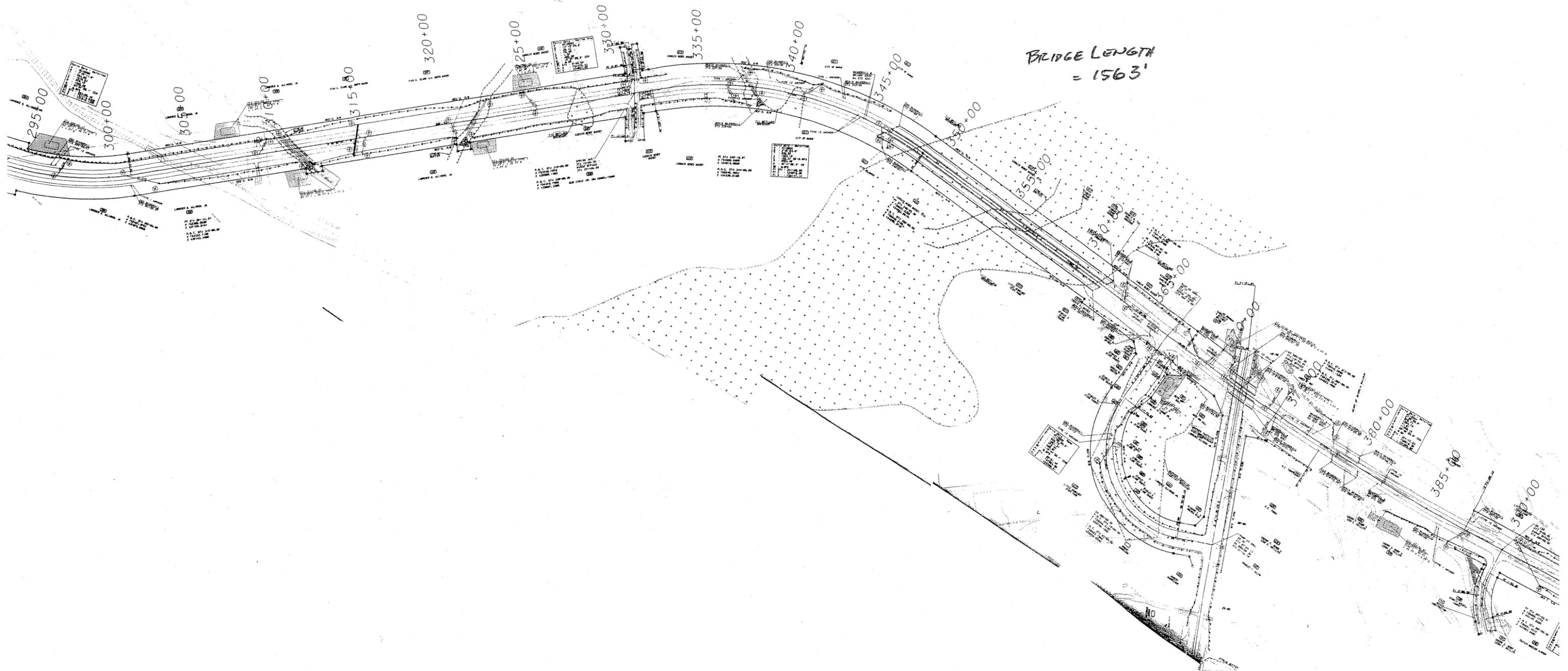
DISCUSSION:

The proposed alternative alignment flattens the curve on the south approach to the bridge. Since both the bridge and the alignment are shorter, the alternative alignment should be less expensive.

The VE team was not briefed on the environmental analysis and commitments and therefore evaluated alternative alignments and footprints.

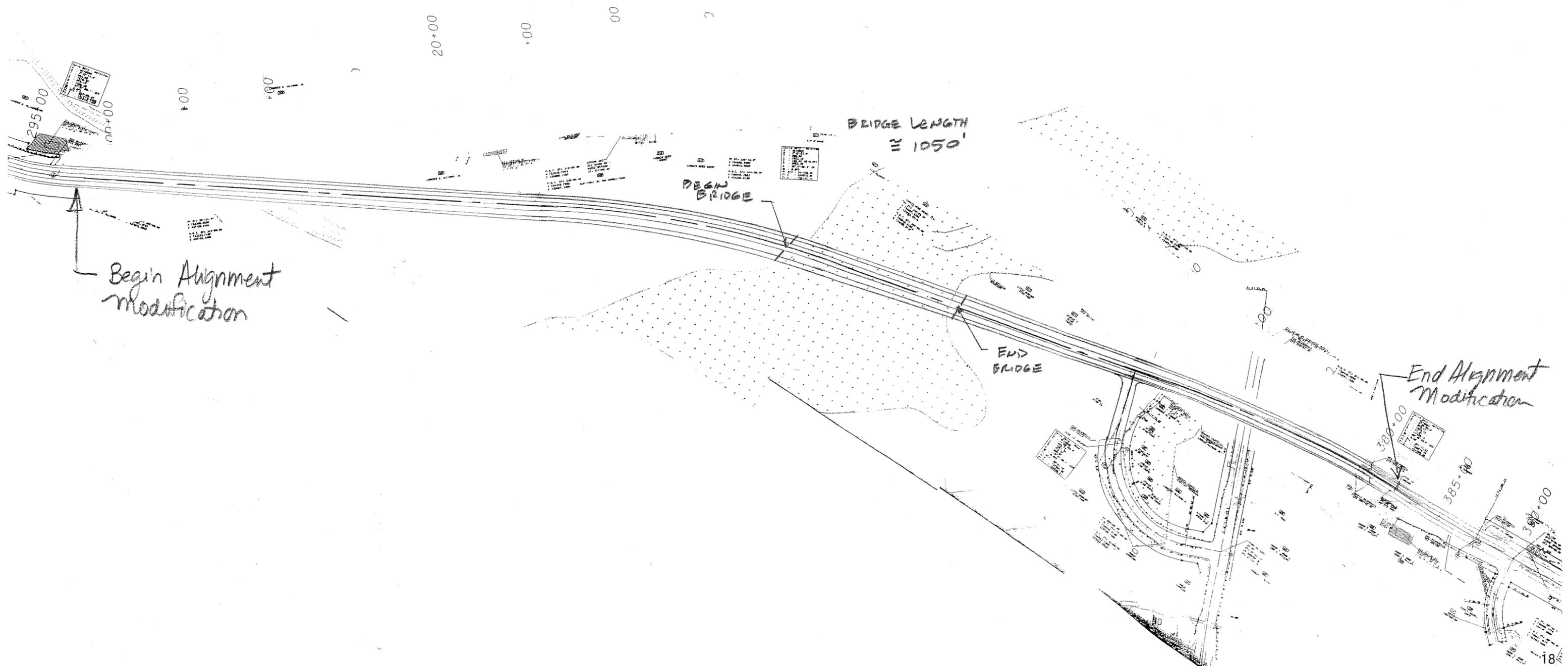
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS (Original minus Alternative)			

ALTERNATIVE No.
A-2
ORIGINAL
DESIGN
SHEET 2 OF 3



BRIDGE LENGTH
= 1563'

ALTERNATIVE No.
A-2
ALTERNATIVE DESIGN
SHEET 3 OF 3



VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)** ALTERNATIVE NO.: **A-4**
Georgia DOT

DESCRIPTION: **SHIFT THE ALIGNMENT BEGINNING AT SOUTH END TO FOLLOW WILLOW CREEK LANE, TYING BACK NEAR SPRING AVENUE** SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

The alignment for the proposed bypass was set at the time of the design concept report in 2004. The alignment is offset from the edge of the major development by up to 3000 ft.

ALTERNATIVE: (Sketch attached)

Pull alignment in towards McRae development. Set eastern boundary along Willow Creek Lane.

ADVANTAGES:

- Alignment is shortened 500 ft.
- Further away from endangered species habitat
- Horizontal geometry is much smoother

DISADVANTAGES:

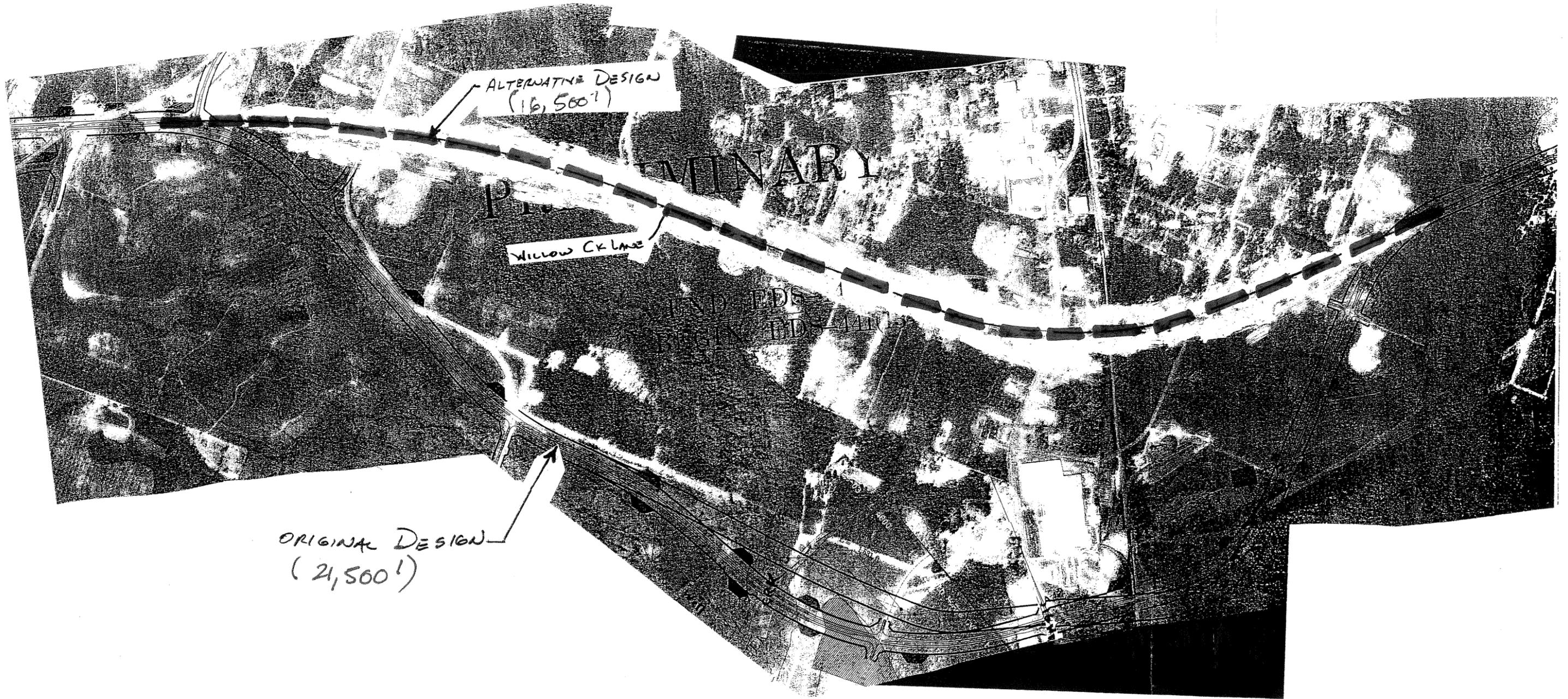
- More street connections requires major revision to environmental report
- Closer to town
- More property impacts

DISCUSSION:

The proposed alternative follows Willow Creek Lane, an existing road. It ties back in the original design alignment between Spring Avenue and Little Ocmulgee River Bridge.

The VE team was not briefed on the environmental analysis and commitments, and therefore we investigated bypass alignment options.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	
SAVINGS (Original minus Alternative)			



VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **A-7**

DESCRIPTION: **LOWER THE MAINLINE PROFILE AT SUGAR CREEK
BRIDGE (STATION 221+45 TO 250+50)**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

From PVC Station (STA) 221+45 to STA 250+50 is approximately 12 ft. above the original ground at STA 233+50.

ALTERNATIVE: (Sketch attached)

Lower the profile at Sugar Creek Bridge by approximately six ft. over the original design between STA 221+45 and STA 250+50.

ADVANTAGES:

- Reduces earthwork quantity
- Reduces bridge costs
- Reduces earthwork costs
- Reduces settlement periods (if any)
- Reduces construction duration for the embankment

DISADVANTAGES:

- Requires redesign

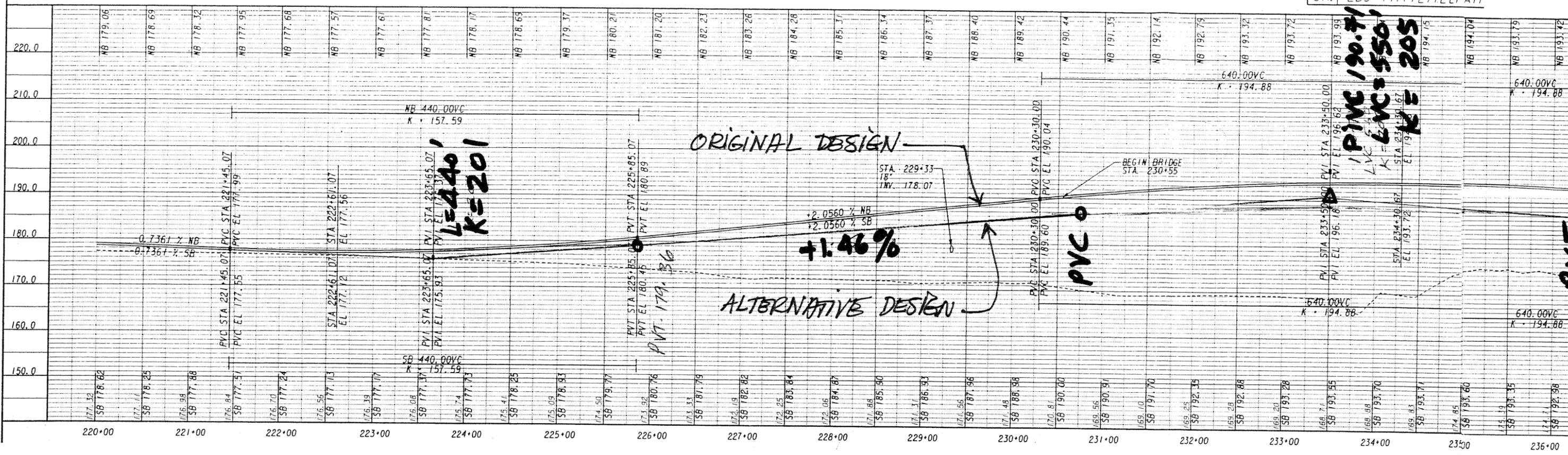
DISCUSSION:

According to the bridge plans and the 50- and 100-year flood elevations, the minimum bottom of the beam elevation for the proposed Sugar Creek Bridge should not be lower than 175.82. The alternative design is laid out to keep the bridge above this elevation and lowering the profile by approximately six ft. This design will keep low points out of the bridge and also will help reduce the cost of construction by reducing the earthwork quantity.

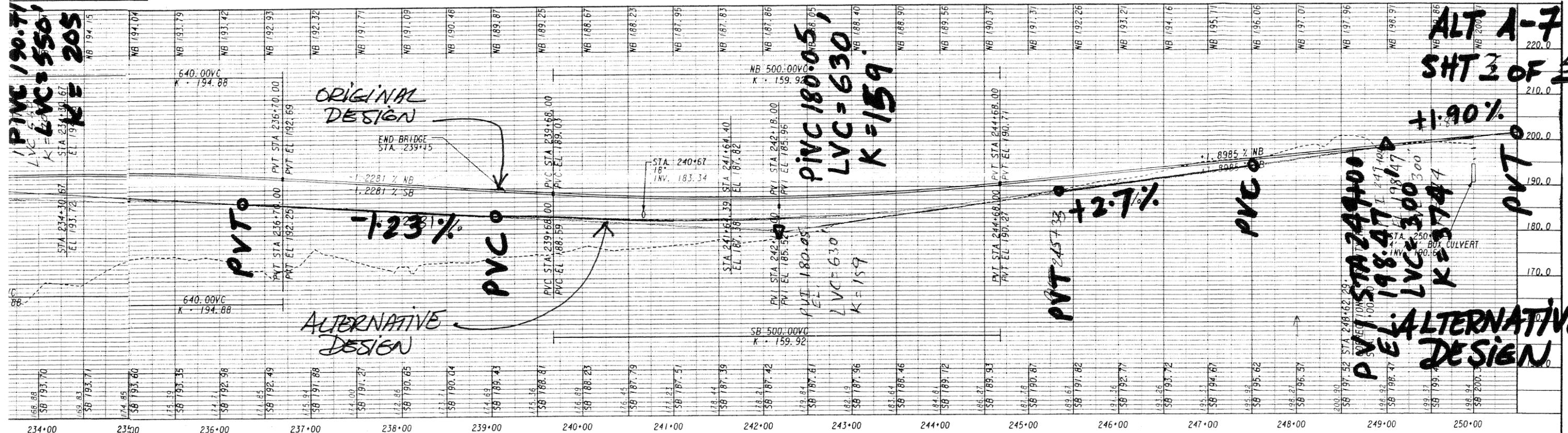
The lowering of the profile grade as proposed in this alternative would reduce the embankment requirements by approximately 31,700 ft.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 355,325	—	\$ 355,325
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 355,325	—	\$ 355,325

STATE	PROJECT NUMBER
GA.	EDS-441(12)TELFAIF



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 ENGINEERING AND PROJECT DELIVERY
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 Marietta, GA 30066
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 Fax: (770) 548-4697

SCALE
 HOR: 1" = 50'
 VER: 1" = 10'

DATE	REVISIONS	DATE	REVISIONS

GEORGIA
 DEPARTMENT OF TRANSPORTATION
 MAINLINE PROFILE
 STA 220+00 TO STA 250+00
 PROJ. EDS-441(12)TELFAIR
 DATE: _____ DWG NO. 15-6

Lower profile @ SugarCreek Bridge

CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.: A-7

SHEET NO.: 4 of 5

(1) STA. 223+00 to STA 230+55
diff in profile 0 to 5'
width of cross section approx 180 ft

$$\text{Volume 1} = 755 \text{ LF} \times 2.5' \times 180 \text{ LF} \\ = 339,750 \text{ CF}$$

(2) STA. 239+15 to 243+50
diff in profile 5' to 6'

$$\text{Volume 2} = 435 \text{ LF} \times 5.5' \times 180 \text{ LF} \\ = 430,650 \text{ CF}$$

(3) STA 243+50 to STA 247+00
diff in profile 5' to 0'

$$\text{Volume 3} = 350 \text{ LF} \times 2.5' \times 180 \text{ LF} \\ = 157,500 \text{ CF}$$

$$\text{Total Embankment} = \text{Volume 1} + \text{Volume 2} + \text{Volume 3} \\ = 339,750 + 430,650 + 157,500 \\ = 927,900 \text{ CF} \\ = 34,367 \text{ CY}$$

(4) Excavation from STA 245+00 to 249+00
 $\sqrt{4} = 400 \text{ LF} \times 1 \text{ FT} \times 180 \text{ LF} = 72,000 \text{ CF} = 2,667 \text{ CY}$

Net borrow material = Total Embankment - Excav. = 31,700 CY.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **A-9**

DESCRIPTION: **LOWER THE MAINLINE PROFILE IN THE VICINITY OF
SPRING AVENUE (STA 311+75 TO 338+00)**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The mainline profile between STA 311+75 to 338+00 undulates between a sag at the south end and a crest at the north end.

ALTERNATIVE: (Sketch attached)

Modify the profile to reduce the amount of embankment associated with the previously mentioned crest curve at the north end.

ADVANTAGES:

- Reduces embankment
- Culvert at STA 314+75 can be raised (drains better) by one to two feet
- Improves sight distance at the crest curve near Spring Avenue

DISADVANTAGES:

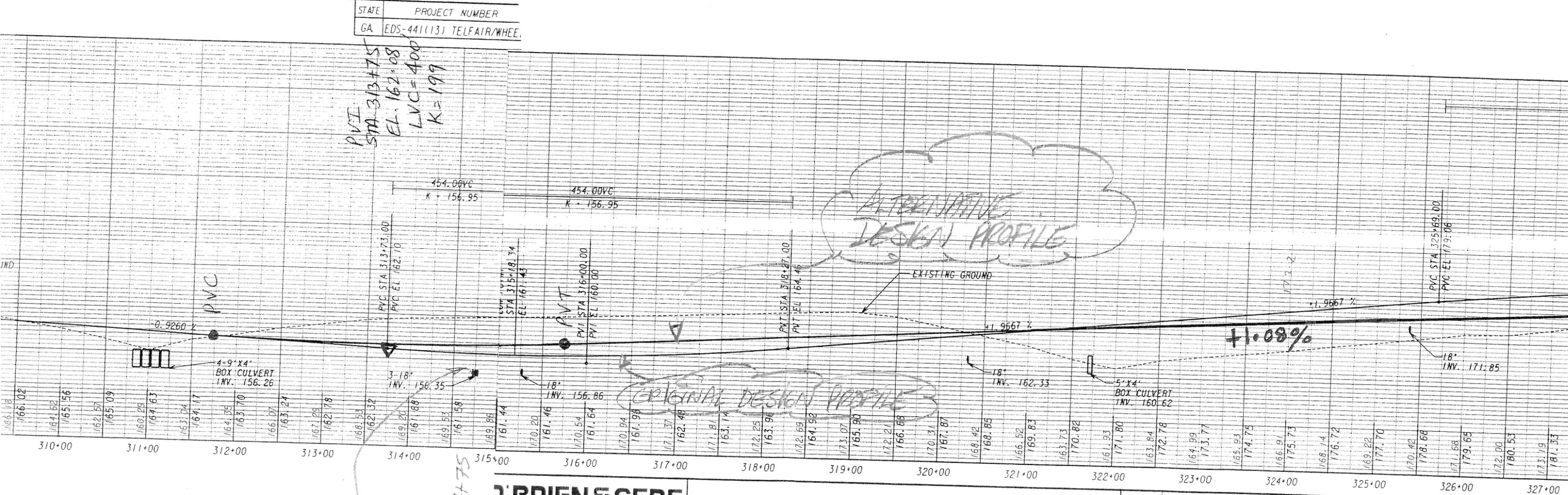
- None apparent

DISCUSSION:

The original design shifts a natural low point at STA 311+00 (wetlands) further north. The alternative profile will reduce the project's embankment and move the low point closer to the wetlands at STA 311+00. Between STA 311+00 to STA 338+00, the alternate design has reduced the amount of borrow material by lowering the profile at Spring Avenue. The Spring Avenue driveway conform should easily match the modified profile grade.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 240,792	—	\$ 240,792
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 240,792	—	\$ 240,792

STATE	PROJECT NUMBER
GA	EDS-441(13) TELFAIR/WHEE.



Raise box culvert

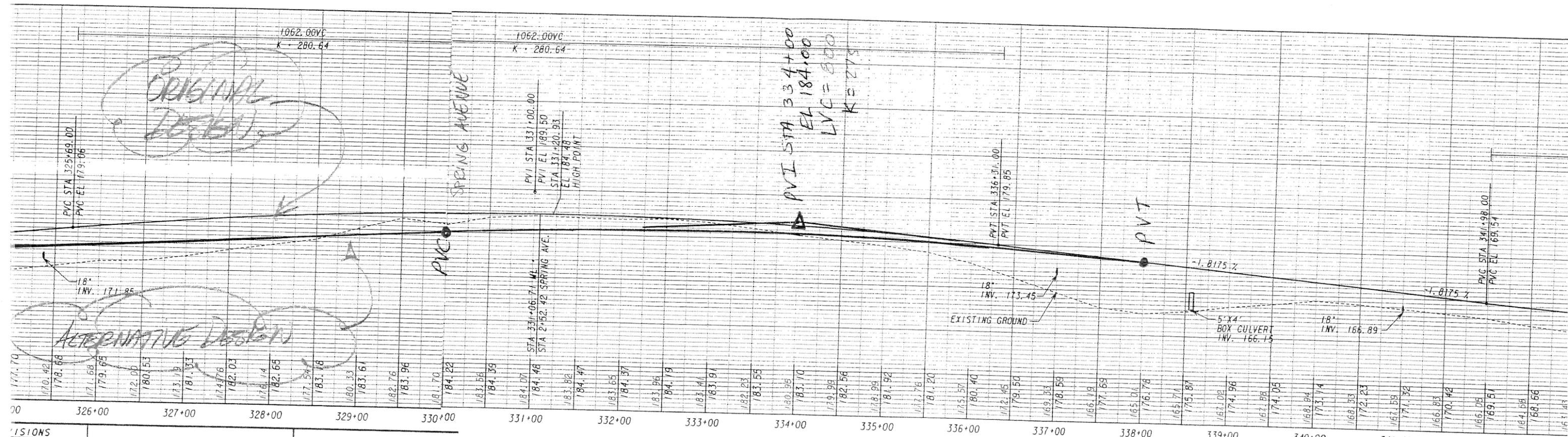
314+75

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SCALE
HOR: 1" = 50'
VER: 1" = 10'

DATE	REVISIONS	DATE	REVISIONS

137663-NMcRoe0204\DCN-CAICE\DCM\56147OPR01.dgn



STATION	ELEVATION
326+00	177.70
326+00	170.42
326+00	178.68
326+00	171.68
326+00	179.65
327+00	172.00
327+00	180.53
327+00	173.19
327+00	181.33
328+00	174.76
328+00	182.03
328+00	176.14
328+00	182.65
329+00	177.54
329+00	183.18
329+00	180.33
329+00	183.6
329+00	182.76
329+00	183.96
330+00	181.70
330+00	184.22
330+00	183.56
330+00	184.39
331+00	184.07
331+00	184.48
331+00	183.82
331+00	184.47
332+00	183.65
332+00	184.37
333+00	183.96
333+00	184.19
333+00	183.11
333+00	183.91
334+00	182.23
334+00	183.55
334+00	180.96
334+00	183.10
335+00	179.98
335+00	182.56
335+00	178.99
335+00	181.92
336+00	177.76
336+00	181.20
336+00	175.57
336+00	180.40
337+00	172.45
337+00	179.50
337+00	169.33
337+00	178.59
338+00	166.19
338+00	177.69
338+00	165.01
338+00	176.78
339+00	165.71
339+00	175.87
339+00	167.02
339+00	174.96
340+00	167.88
340+00	174.05
340+00	168.94
340+00	173.74
341+00	168.33
341+00	172.83
341+00	167.59
341+00	171.32
342+00	166.83
342+00	170.42
342+00	166.05
342+00	169.51
343+00	164.58
343+00	168.66

GEORGIA
DEPARTMENT OF TRANSF
MAINLINE PROJ
STA 300+00 TO STA
PROJ. EDS-441(13) TELFAI
DATE DWG 1

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **A9**

SHEET NO.: **4 of 5**

Volume of Embankment:

(1) STA. 321+00 to STA 326+50, av. depth 2.5', section width 160'

$$\begin{aligned} \text{Volume 1} &= 550' \times 2.5' \times 160' \\ &= 220,000' \text{ CF} \end{aligned}$$

(2) STA. 326+50 to 329+00, av. depth 5', section width 160'

$$\begin{aligned} \text{Volume 2} &= 250' \times 5' \times 160' \\ &= 200,000' \text{ CF} \end{aligned}$$

(3) STA 329+00 to 338+00, av. depth 1.5', section width 160'

$$\begin{aligned} \text{Volume 3} &= 900' \times 1.5' \times 160' \\ &= 216,000' \text{ CF} \end{aligned}$$

$$\begin{aligned} \text{Total Embankment} &= 220,000 + 200,000 + 216,000 \\ &= 636,000' \text{ CF} \\ &= 23,556' \text{ CY} \end{aligned}$$

Volume of Excavation:

Reduction in Excv.
STA 311+75 to STA 321+00.

$$\text{Volume 4} = 925' \times 2' \times 160' = 296,000' \text{ CF} = 10,963' \text{ CY}$$

Added in Excv. STA. 328+00 to STA. 334+00

$$\text{Volume 5} = 600' \times 2.5' \times 160' = 240,000' \text{ CF} = 8,889' \text{ CY}$$

$$\text{Resulting Excavation} = \text{Volume 5} - \text{Volume 4} = -2,074' \text{ CY}$$

$$\text{Net Borrow material} = 23,556' \text{ CY} - 2,074' \text{ CY} = 21,482' \text{ CY}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)** ALTERNATIVE NO.: **A-12**
Georgia DOT

DESCRIPTION: **LOWER THE MAINLINE PROFILE OVER THE NORFOLK SOUTHERN RAILROAD (STA 275+00 TO 303+00)** SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The mainline profile alignment from STA 275+00 to STA 303+00 is set with approximately 32 ft. of vertical clearance over the Norfolk Southern Railroad tracks.

ALTERNATIVE: (Sketch attached)

Lower the mainline profile grade and provide the minimum 23-ft. clearance required over the Norfolk Southern Railroad.

ADVANTAGES:

- Reduces settlement periods (if any)
- Reduces embankment (133,600 ft.)
- Reduces costs
- Reduces truck speed loss (\pm 1,700 ft. at 3.5% vs. 4.2%)
- Reduces construction duration

DISADVANTAGES:

- Requires redesign

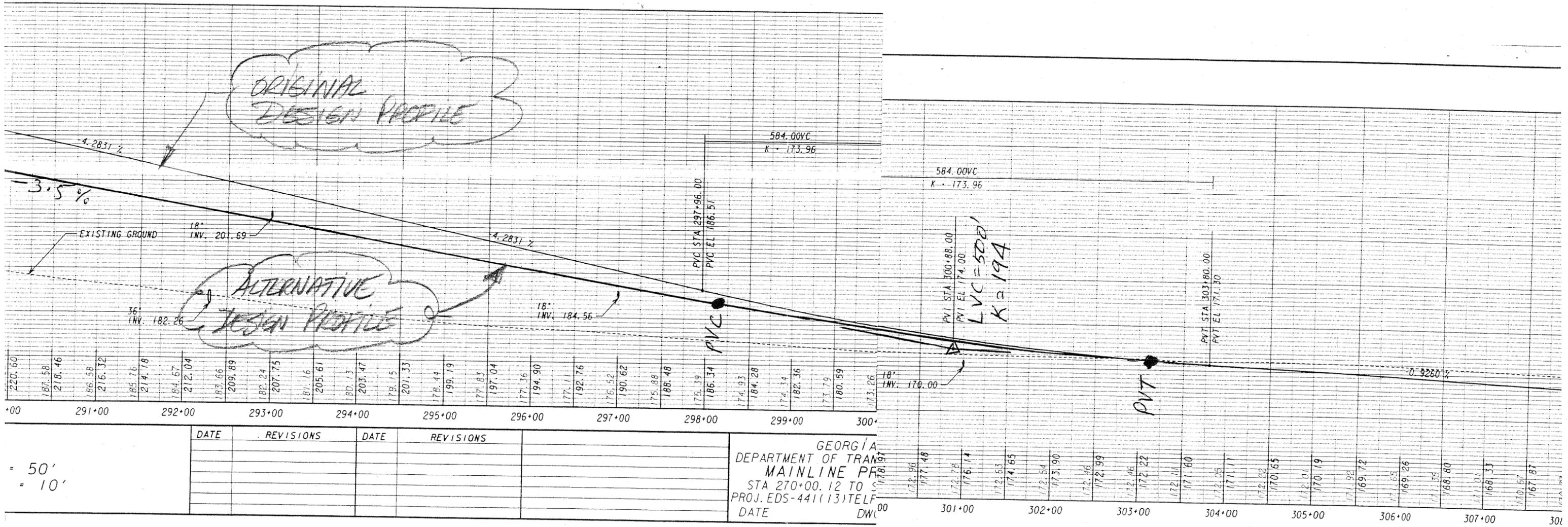
DISCUSSION:

In order to achieve the required profile at the bridge over Norfolk Southern Railroad, the tangents and PVI's on the original profile may be revised to lower the profile to the minimum vertical clearance requirements of 23 ft. over the railroad from STA 275+ to STA 303+00. This alternative will reduce fill and truck speed loss and improve constructability.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,497,522	—	\$ 1,497,522
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 1,497,522	—	\$ 1,497,522

ALT. A-12
SHT. 3 of 5

Lower Profile @ Norfolk Southern R/R



CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: A-12

SHEET NO.: 4 of 5

① STA. 275+00 to 280+52, depth 0' to 9', section width 260'

$$\begin{aligned} \text{Volume 1} &= 552' \times 4.5' \times 260' \\ &= 645,840 \text{ CF} \end{aligned}$$

② STA. 282+96 to 291+00, depth 9', section width 260'

$$\begin{aligned} \text{Volume 2} &= 804' \times 9' \times 260' \\ &= 1,881,360 \text{ CF} \end{aligned}$$

③ STA. 291+00 to 303+00, 4.5', section width 200'

$$\begin{aligned} \text{Volume 3} &= 1200' \times 4.5' \times 200' \\ &= 1,080,000 \text{ CF} \end{aligned}$$

$$\begin{aligned} \text{Total Volume (earthwork)} &= \text{Volumes (1 + 2 + 3)} \\ &= 645,840 + 1,881,360 + 1,080,000 \\ &= 3,607,200 \text{ CF} \\ &= 133,600 \text{ CY.} \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT:	McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20) <i>Georgia DOT</i>	ALTERNATIVE NO.:	MA-2
DESCRIPTION:	RELOCATE CR-152/SR-149 OPPOSITE THE US-441/ BUSINESS-441 INTERSECTION	SHEET NO.:	1 of 4

ORIGINAL DESIGN: (Sketch attached)

The original design shifts SR-149 approximately 320 ft. south to provide a 90° tie-in with the proposed US-441/McRae Bypass. US-441/SR-31/US-319 will shift approximately 1,275 ft. to the north for a safer tie-in with the proposed US-441/McRae Bypass.

CR-152 will relocate 500 ft. east of its current location and form a “T” intersection with SR-149.

ALTERNATIVE: (Sketch attached)

Eliminate the SR-149 tie-in with US-441/McRae Bypass and form a “T” intersection with CR-152. The joint CR-152/SR-149 roadway will relocate and tie into the proposed Business-441 intersection at STA 142+63.01. The proposed extension of CR-152 is approximately 1,600 ft. on new location.

ADVANTAGES:

- Improves intersection for both CR-152 and SR-149
- Improves operations of US-441
- Improves intersection safety
- Improves quality of access to McRae Bypass

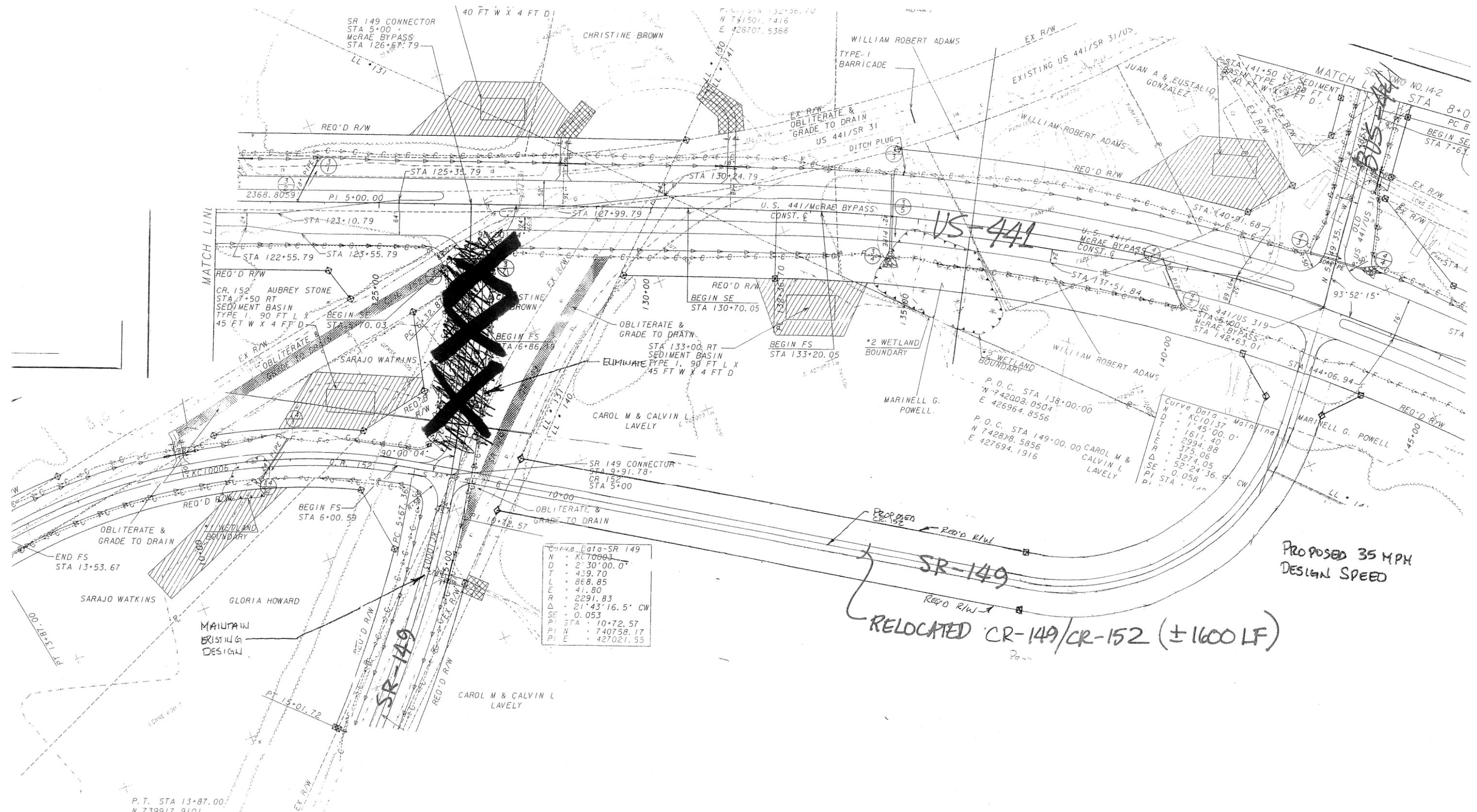
DISADVANTAGES:

- Additional roadway and right-of-way costs due to new location of CR-152
- May generate additional displacements for required right-of-way

DISCUSSION:

The extension of CR-152/SR-149 will provide a safer movement for local traffic and have the immediate benefit of an improved intersection relocation. The cost for the required right-of-way will increase over the current proposed needs for CR-152 and SR-149. Increases for the roadway will be adjusted due to the new location.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 319,871	—	\$ 319,871
ALTERNATIVE	\$ 1,028,591	—	\$ 1,028,591
SAVINGS (Original minus Alternative)	\$ (708,720)	—	\$ (708,720)



Curve Data - SR 149

N	• KC70003
D	• 2'30'00.0"
T	• 439.70
L	• 868.85
E	• 41.80
R	• 2291.83
Δ	• 21'43'16.5" CW
SE	• 0.053
PI	• STA 10+72.57
PI N	• 740758.17
PI E	• 427021.55

Curve Data - Main Line

N	• KC10137
D	• 1'45'00.0"
T	• 1611.40
L	• 2994.88
E	• 375.06
R	• 3274.05
Δ	• 52'24'36.9" CW
SE	• 0.058
PI	• STA 149

SR-149
RELOCATED CR-149/CR-152 (±1600 LF)

PROPOSED 35 MPH
DESIGN SPEED

P.T. STA 13+87.00
N 739917 9101

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: ~~22L~~
MA-2

REALIGNMENT OF CR. 149, CR. 152 AND OLD US 441/US 319

SHEET NO.: 3 of 4

NEW LOCATION COST

ROW COST.

$$1575 \text{ LF} \times 100' = \frac{157,500.00 \text{ SF}}{43,560}$$

$$= 3.616 \text{ ACS}$$

$$\$6,500 \times 3.616 \text{ ACS} = \underline{\$23,502.07} \quad \text{R.O.W. INCREASE} = \$23,502.07$$

C.R. 152 EXTENSION

CONSTRUCTION COST

CR 152 EXTENSION

AVG COST OF CONSTRUCTION PER MILE $\$3,066,164.09$
FOR 2 LANE ROADWAY

$$1575.00 \text{ LF} \div 5280 = 0.298 \text{ MILES}$$

COST FOR CR 152 EXTENSION

$$\$3,066,164.09 (0.298) = \underline{\$913,716.878} \quad \text{COST INCREASE}$$

ELIMINATE ROAD PORTION BETWEEN STA. 5+00 - STA. 9+91.78 - SR. 149

$$\$3,066,164.09 (0.093) = \underline{\$285,582.981} \quad \text{COST REDUCTION (RDWY CONSTRUCTION)}$$

$$\frac{320' \times 120'}{43,560} = 0.882 \text{ AC} \quad (\text{RIGHT OF WAY})$$

COST WORKSHEET

PROJECT: **McRae Bypass EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **MA-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
Req'd R.O.W.	AC	0.882	6500	5,730.02	3.416	6500	23,502.07
CONSTR. COST				285,582.98			913,716.88
R.O.W. CONSTR.							
* NOTE: CONSTRUCTION COST WILL RECEIVE A 10% MARK UP FOR MAT'L'S. R.O.W HAS NO ASSOCIATED MARK-UP							
Subtotal				285,582.98			913,716.88
Markup (%) at 10%				28,558.30			91,371.49
TOTAL *				314,141.28			1,005,088.57
R.O.W.				5,730.02			23,502.07
GRAND TOTAL				319,871.30			1,028,590.64

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)** ALTERNATIVE NO.: **MA-4**
Georgia DOT

DESCRIPTION: **SHIFT THE MAINLINE EAST AND RETAIN CR-236** SHEET NO.: **1 of 2**
BETWEEN STATIONS 160+00 TO 195+00 AND DELETE CR-236 WEST CONNECTION

ORIGINAL DESIGN:

Currently, CR-236 and SR-441 alignments are coincidental between STA 160+00 to STA 193+00. CR-236 is abandoned at the referenced stations, requiring two connections: CR-236 west and CR-236 east.

ALTERNATIVE: (Sketch attached)

Shift the mainline approximately 30 ft. east and retain CR-236 in its current configuration. Retain only the CR-236 east connection at 193+00±.

ADVANTAGES:

- Removes one intersecting roadway
- Retains CR-236 continuity
- Provides a frontage-road like system between STA 160 to 195

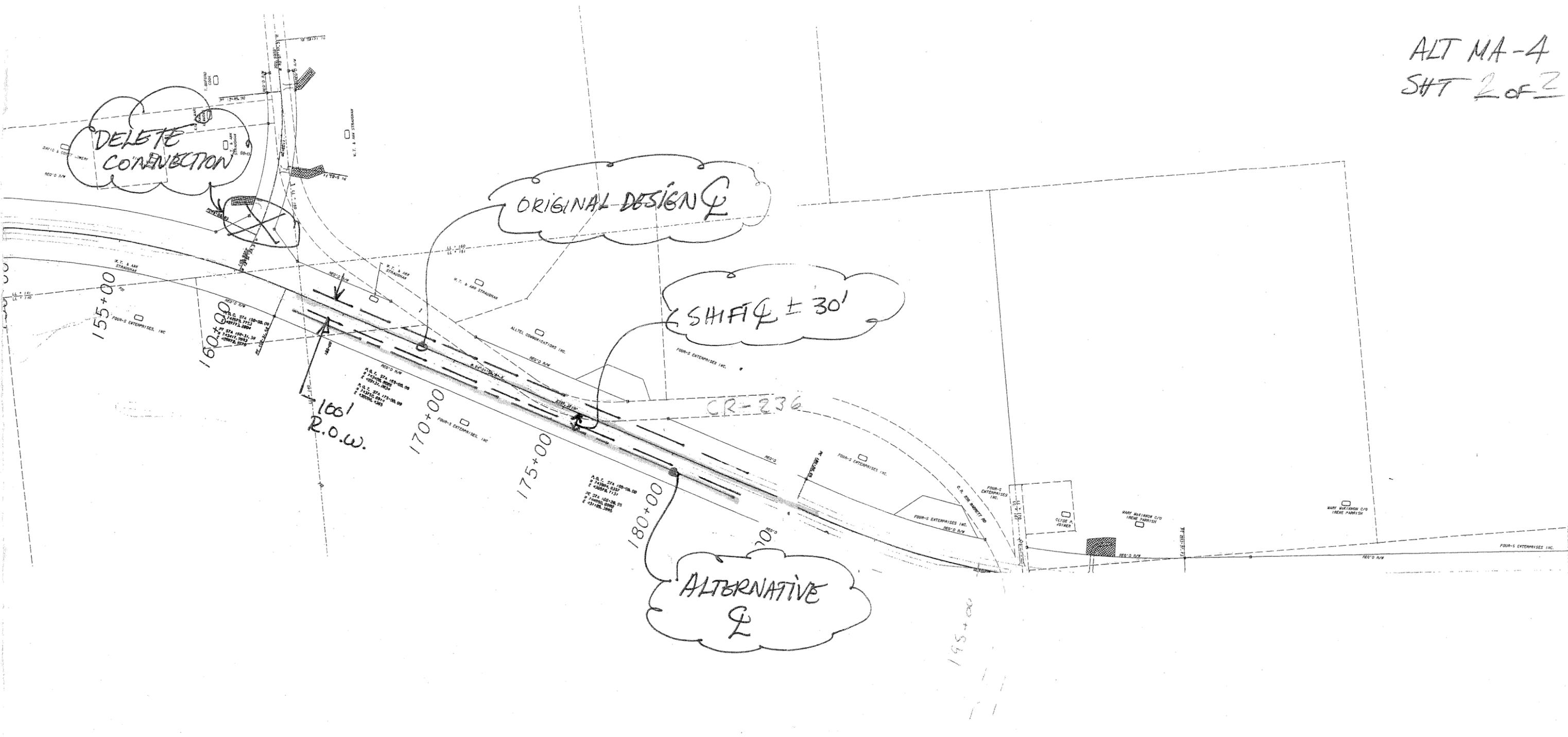
DISADVANTAGES:

- Unknown commitments
- Possible right-of-way impacts
- Possible environment re-evaluation

DISCUSSION:

The VE team was not briefed on alternative analyses or environmental evaluations. The shift in the mainline, if acceptable from an environmental and right-of-way impact could remove one connection from the mainline and retain CR-236 as a "frontage-road" to service the McRae development.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS (Original minus Alternative)			



DELETE CONNECTION

ORIGINAL DESIGN

SHIFT ± 30'

ALTERNATIVE

155+00

160+00

170+00

175+00

180+00

195+00

100' R.O.W.

CR-236

DAVID & CO. LUMBER

S.T. & AM STRAUBER

S.T. & AM STRAUBER

A.S. & S. STA 155+00.00
E 145° 15' 15" W
D 149.75
S.T. & AM STRAUBER

A.S. & S. STA 156+34.28
E 145° 15' 15" W
D 149.75
S.T. & AM STRAUBER

A.S. & S. STA 160+00.00
E 145° 15' 15" W
D 149.75
S.T. & AM STRAUBER

A.S. & S. STA 161+34.28
E 145° 15' 15" W
D 149.75
S.T. & AM STRAUBER

S.T. & AM STRAUBER

S.T. & AM STRAUBER

ALTEL COMMUNICATIONS INC.

REG'D B/M

FOUR-S ENTERPRISES INC.

FOUR-S ENTERPRISES INC.

FOUR-S ENTERPRISES INC.

FOUR-S ENTERPRISES INC.

HARY WATSON C/O TERRY PARRISH

REG'D B/M

HARY WATSON C/O TERRY PARRISH

FOUR-S ENTERPRISES INC.

REG'D B/M

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)** ALTERNATIVE NO.: **MA-12**
Georgia DOT

DESCRIPTION: **LINE UP THE STATE PARK ENTRANCE WITH CR-133** SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The plans show separate entrance and exit driveways to the state park at the north end of the project.

ALTERNATIVE: (Sketch attached)

Combine the entrance and exit driveways into one driveway and align it with CR-133.

ADVANTAGES:

- Reduces the number of potential accident locations
- Allows left turns out of the state park to US-441 north

DISADVANTAGES:

- May increase costs

DISCUSSION:

As detailed, the entrance to the state park is right-in, right-out from US-441 southbound. Northbound US-441 traffic is permitted to turn left into the state park. This alternative would reduce conflict points while allowing traffic exiting the state park to turn left onto US-441 north.

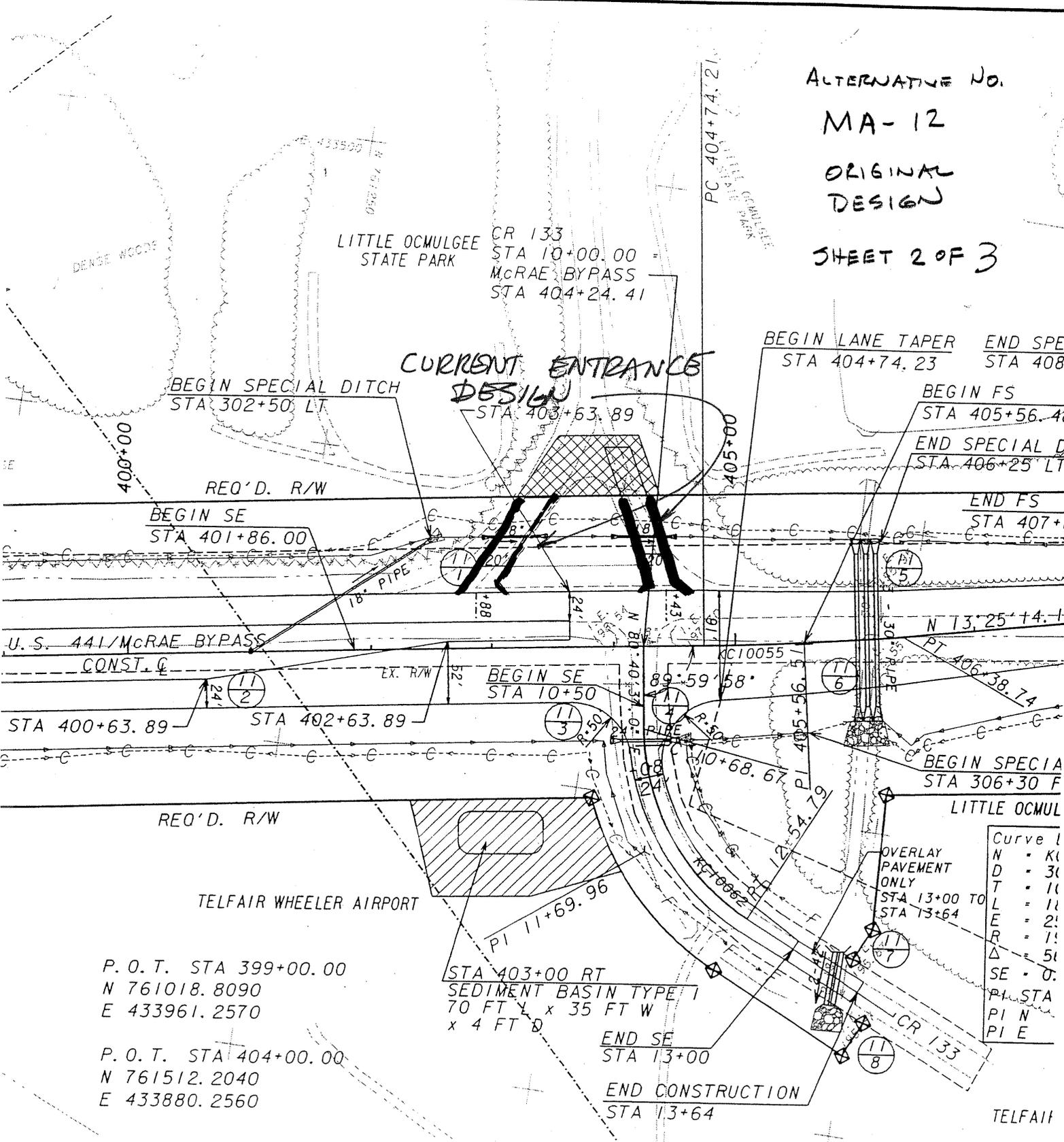
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE			
SAVINGS (Original minus Alternative)			
	DESIGN SUGGESTION		

ALTERNATIVE NO.

MA-12

ORIGINAL DESIGN

SHEET 2 OF 3



P. O. T. STA 399+00.00
 N 761018.8090
 E 433961.2570

P. O. T. STA 404+00.00
 N 761512.2040
 E 433880.2560

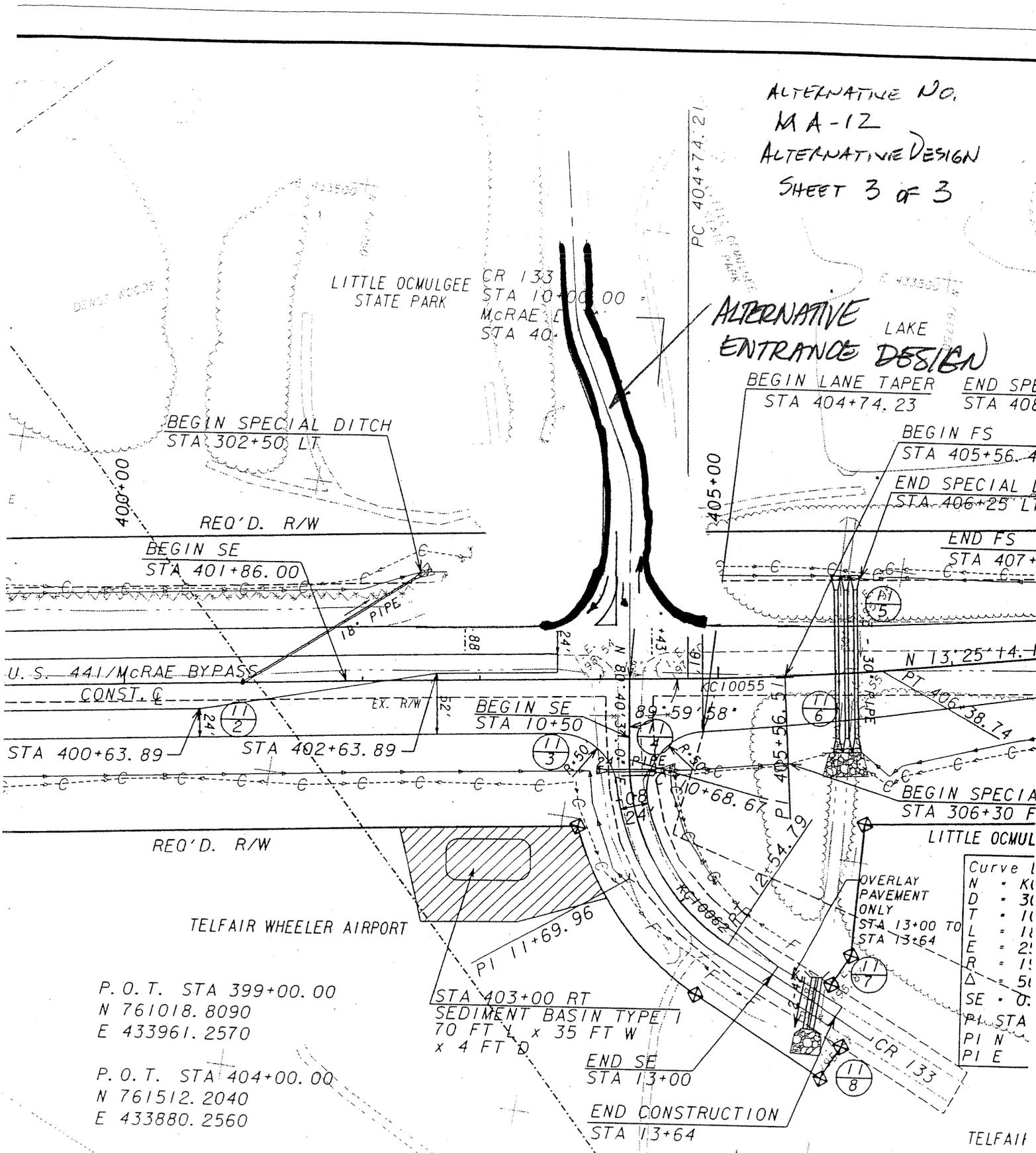
Curve 1
N = K
D = 30
T = 10
L = 11
E = 2
R = 1
Δ = 5
SE = 0
PI = STA
PI N
PI E

PROPERTY AND EXISTING R/W LINE	---
REQUIRED R/W LINE	---
CONSTRUCTION LIMITS	---G---F---
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	[Hatched Box]
EASEMENT FOR CONSTR OF SLOPES	[Diagonal Lines Box]
EASEMENT FOR CONSTR OF DRIVES	[Cross-hatched Box]



DATE	REVISIONS	DATE	REVISIONS

ALTERNATIVE NO.
MA-12
ALTERNATIVE DESIGN
SHEET 3 OF 3



Curve I	
N	- K0
D	- 30
T	- 10
L	- 11
E	- 21
R	- 11
Δ	- 50
SE	- 0
PI	STA
PI N	
PI E	

P. O. T. STA 399+00.00
N 761018.8090
E 433961.2570

P. O. T. STA 404+00.00
N 761512.2040
E 433880.2560

PROPERTY AND EXISTING R/W LINE	---
REQUIRED R/W LINE	---
CONSTRUCTION LIMITS	---
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	▨
EASEMENT FOR CONSTR OF SLOPES	▩
EASEMENT FOR CONSTR OF DRIVES	▧



DATE	REVISIONS	DATE	REVISIONS

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-2**

DESCRIPTION: **CONSTRUCT A TWO-LANE BYPASS FACILITY WITH A
RIGHT-OF-WAY FOR FOUR LANES**

SHEET NO.: **1 of 7**

ORIGINAL DESIGN: (Sketch attached)

Four lanes 12 ft. each are proposed on a bypass alignment with a 44-ft. median. The outside shoulders are 10 ft. (6 ft.-6 in. paved) and inside shoulders are 6 ft. (2 ft-0 in. paved).

ALTERNATIVE: (Sketch attached)

Construct two lanes only with 10-ft. shoulders (6 ft-6 in. paved) on each side of the same bypass alignment.

ADVANTAGES:

- Reduces operations and maintenance (O&M) costs
- More economical
- Shorter construction time
- Very low traffic volumes do not warrant four lanes at the present

DISADVANTAGES:

- Future construction required to reach final section
- Impacts safety of opposing lanes

DISCUSSION:

Both present and design year traffic volumes are low. Constructing two lanes now would save a lot of money. Two additional lanes could be built in the future if traffic volumes warrant it. Also, since the existing route through McRae would still be available, some traffic could use that.

GDOT could further elevate this with a cost benefit analysis; weigh the reduction in capital investment against travel time and vehicle operation losses (if any) and safety losses.

In order to provide the desired four-lane access, US-441 could be constructed as four lanes wide from US-280 north to I-16 and from the south end of the McRae Bypass south to Douglas, thus satisfying the need and purpose for this corridor.

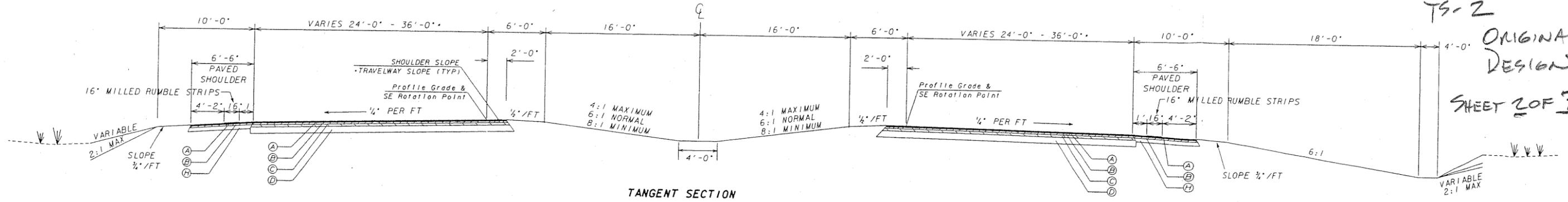
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 42,742,522	—	\$ 42,742,522
ALTERNATIVE	\$ 24,511,308	—	\$ 24,511,308
SAVINGS (Original minus Alternative)	\$ 18,231,214	—	\$ 18,231,214

TS - 1

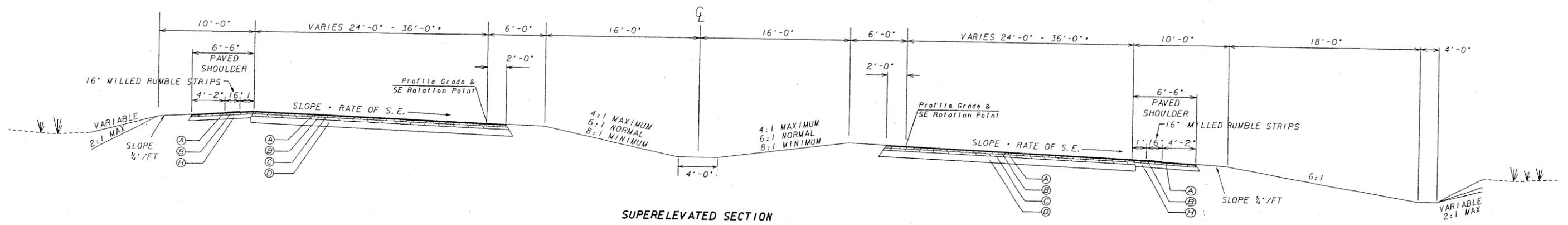
APPLIES TO STA. 270+00.12 TO STA. 404+74.23

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELFAIR-WHEELER		

ALTERNATIVE No.
TS-2
ORIGINAL DESIGN
SHEET 2 OF 7



TANGENT SECTION

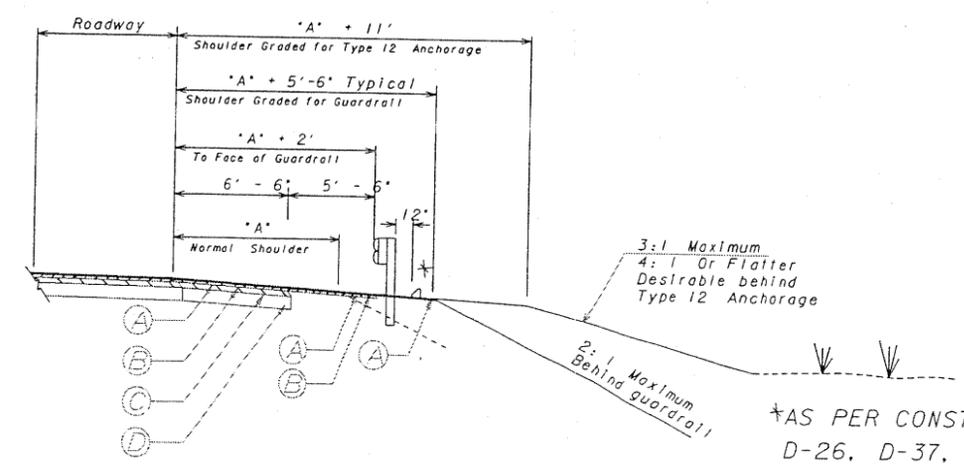


SUPERELEVATED SECTION

- REQUIRED PAVEMENT - MAINLINE & SHOULDER.**
- (A) RECYCLED ASPH. CONCRETE, 12.5 MM SUPERPAVE, 165 LB/YD²
 - (B) RECYCLED ASPH. CONCRETE 19.0 MM SUPERPAVE, 220 LB/YD²
 - (C) RECYCLED ASPH. CONCRETE 25.0 MM SUPERPAVE, 550 LB/YD²
 - (D) GRADED AGGREGATE BASE, 10"
 - (E) GRADED AGGREGATE BASE, 6"
- REQUIRED PAVEMENT - TEMPORARY PAVEMENT WHERE REQUIRED FOR CONSTRUCTION STAGING**
- (B) RECYCLED ASPH. CONCRETE, 19.0 MM SUPERPAVE, 220 LB/YD²
 - (C) RECYCLED ASPH. CONCRETE 25.0 MM SUPERPAVE, 550 LB/YD²
 - (D) GRADED AGGREGATE BASE, 8"
- * SEE PLANS FOR LOCATION LEVELING AS DIRECTED BY THE ENGINEER.

SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0-6'	0-10'
2:1		6-10'
2:1	6' & OVER*	10' & OVER*

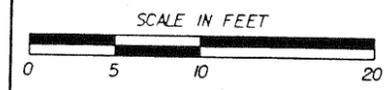
*REQUIRES GUARDRAIL



TYPICAL SHOULDER DETAIL FOR GUARDRAIL (OUTSIDE SHOULDER)

*AS PER CONSTRUCTION DETAIL D-26, D-37, & S-4, 6" ASPHALTIC CURB AND SLOPE DRAINS ARE TO BE INSTALLED AT THE FOLLOWING LOCATIONS:

O'BRIEN & GERE
ENGINEERING AND PROJECT DELIVERY
2500 Atlanta Hwy., Suite 510
Athens, GA 30606
(706) 548-4881
Fax: (706) 548-4697



DATE	REVISIONS	DATE	REVISIONS

GEORGIA
DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS - MAINLINE
PROJ. EDS-441(13)TELFAIR/WHEELER
DATE _____
DWG NO. 5-1

SKETCH



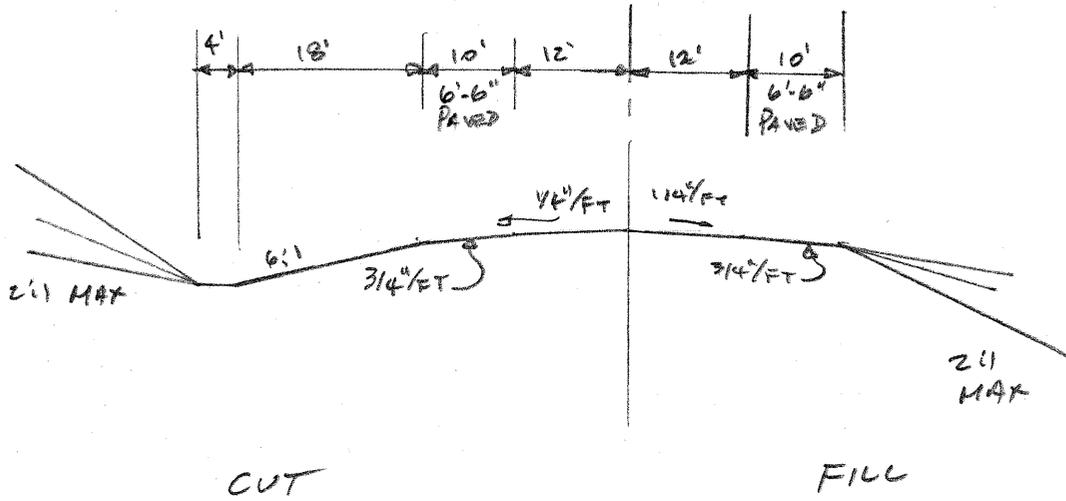
PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

TS-2

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 3 of 7

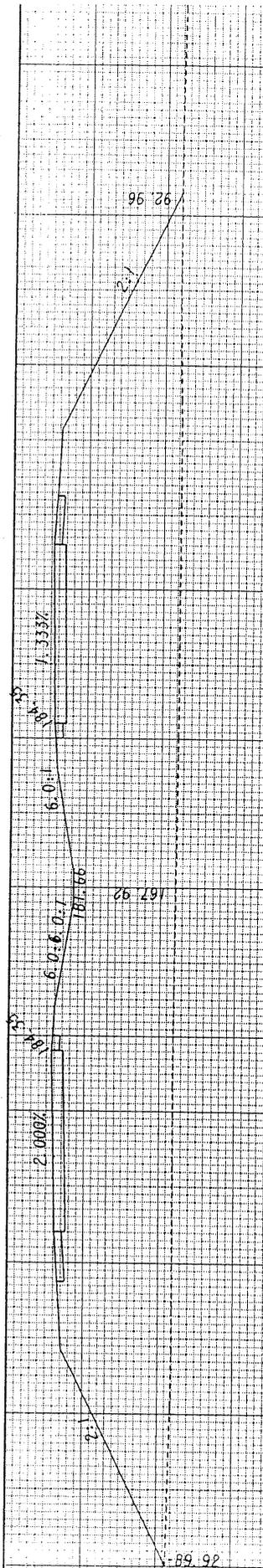


ALTERNATIVE NO.

TS- 2

ORIGINAL DESIGN

SHEET 4 OF 7



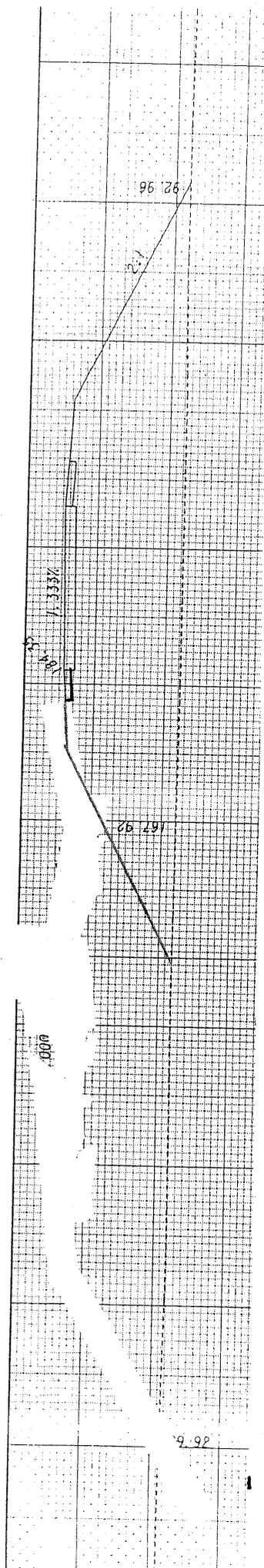
ORIGINAL DESIGN

$$\text{Fill Volume} = 15(30)(7) + 15(112) + 17(70)(1.5) - 16(7)$$

$$= 2082 \text{ SF}$$

ALTERNATIVE No.
TS-2

ALTERNATIVE DESIGN
SHEET 5 OF 7



ALTERNATIVE DESIGN

$$\text{Fill Volume} = 15(30 \times 1.5) + 44(1.5) + 15(30 \times 1.5) \\ = 1110$$

CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.:

75-2

SHEET NO.: 6 of 7

ORIGINAL DESIGN

$$\text{TOTAL PAVEMENT WIDTH} = 2(2+24+6.5) = 65'$$

ALTERNATIVE DESIGN

$$\text{TOTAL PAVEMENT WIDTH} = 2(12+6.5) = 37'$$

SO ALTERNATIVE PAVEMENT IS 57%
OF ORIGINAL DESIGN

FROM A TYPICAL CROSS-SECTION,

EARTHWORK FOR 2-LANE SECTION

IS APPROXIMATELY 1110/2082

= 53% OF 4 LANE

SECTION

$$\text{2-LANE BRIDGE WIDTH WOULD BE} \\ 2(12+10) = 44' + 11.625(2) = 47.25'$$

$$\text{ORIGINAL DESIGN BRIDGE WIDTH} \\ \text{IS } 2(41.25) = 82.50$$

ALTERNATIVE IS 57% OF
ORIGINAL DESIGN

COST WORKSHEET



PROJECT: **McRae Bypass EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

TS-2

SHEET NO.:

7 of 7

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
<i>ORIGINAL DESIGN</i>							
PAVEMENT (12)	LUMP	1	7063796	7063796	0.57	7063796	4026364
(13)	LUMP	1	4004212	4004212	0.57	4004212	2282401
<i>ORIGINAL DESIGN</i>							
EARTHWORK (12)	LUMP	1	2529005	2529005	0.53	2529005	1340373
(13)	LUMP	1	8955787	8955787	0.53	8955787	4428567
<i>ORIGINAL DESIGN</i>							
BRIDGES (12)	LUMP	1	5130000	5130000	0.57	5130000	2924100
(13)	LUMP	1	12774038	12774038	0.57	12774038	7281202
Subtotal				39,056,838			22,289,007
Markup (%) at 10%				3,885,684			2,228,301
TOTAL				42,742,522			24,511,308

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-3**

DESCRIPTION: **USE 11-FT. LANES ON ALL MAINLINE SECTIONS**

SHEET NO.: **1 of 8**

ORIGINAL DESIGN: (Sketch attached)

Twelve-ft. lanes are used in the original design of the mainline sections.

ALTERNATIVE: (Sketch attached)

Use 11-ft. lanes on all mainline sections.

ADVANTAGES:

- Reduces paving cost
- Reduces earthwork cost

DISADVANTAGES:

- Future construction and standards may be required to reach final section width
- Safety issues for large vehicles
- Requires justification for design exception

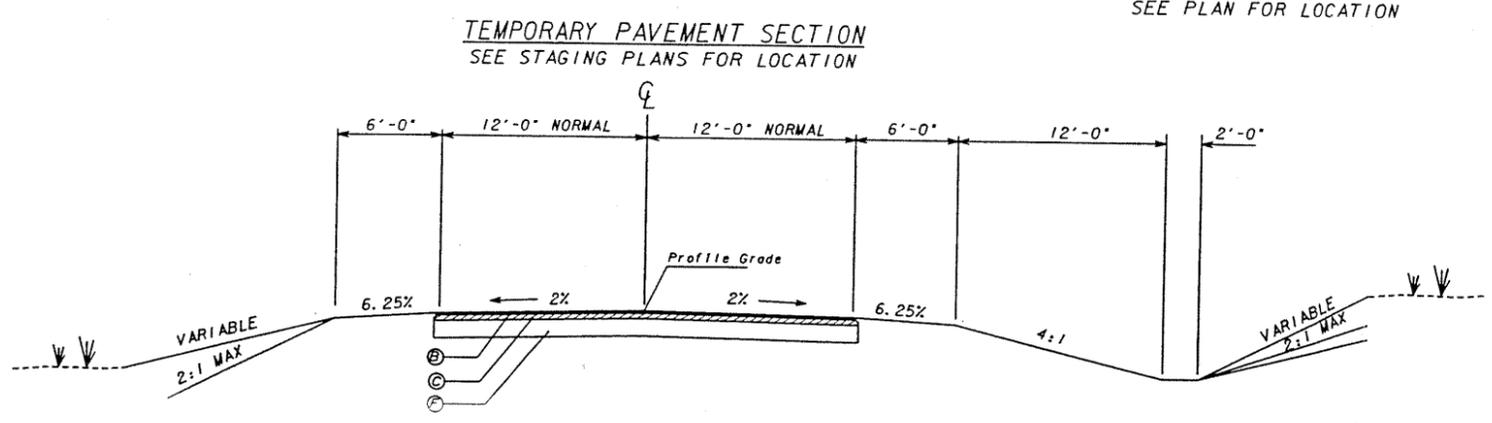
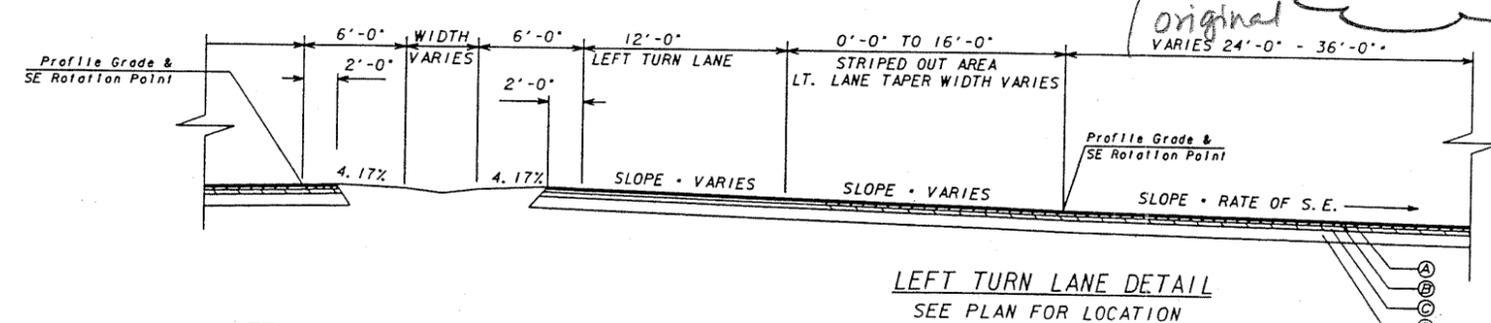
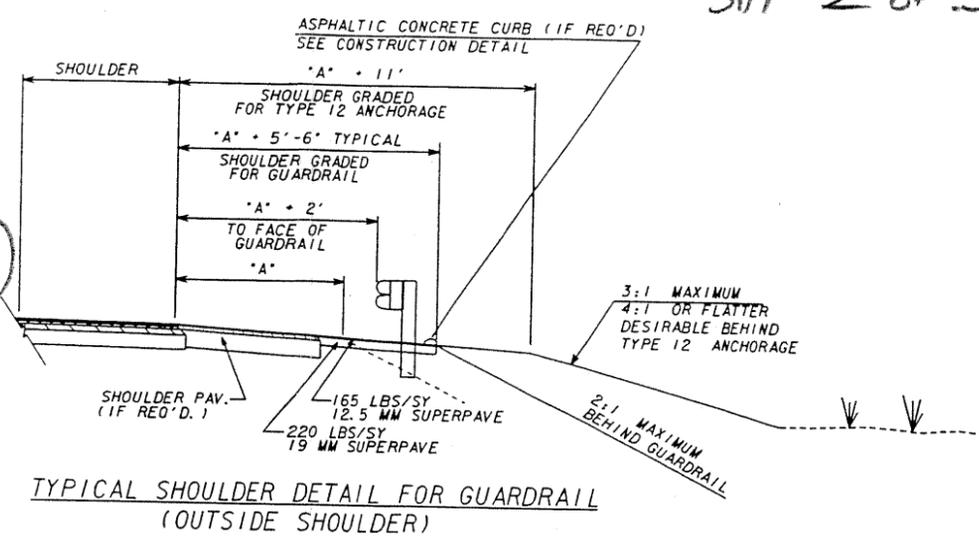
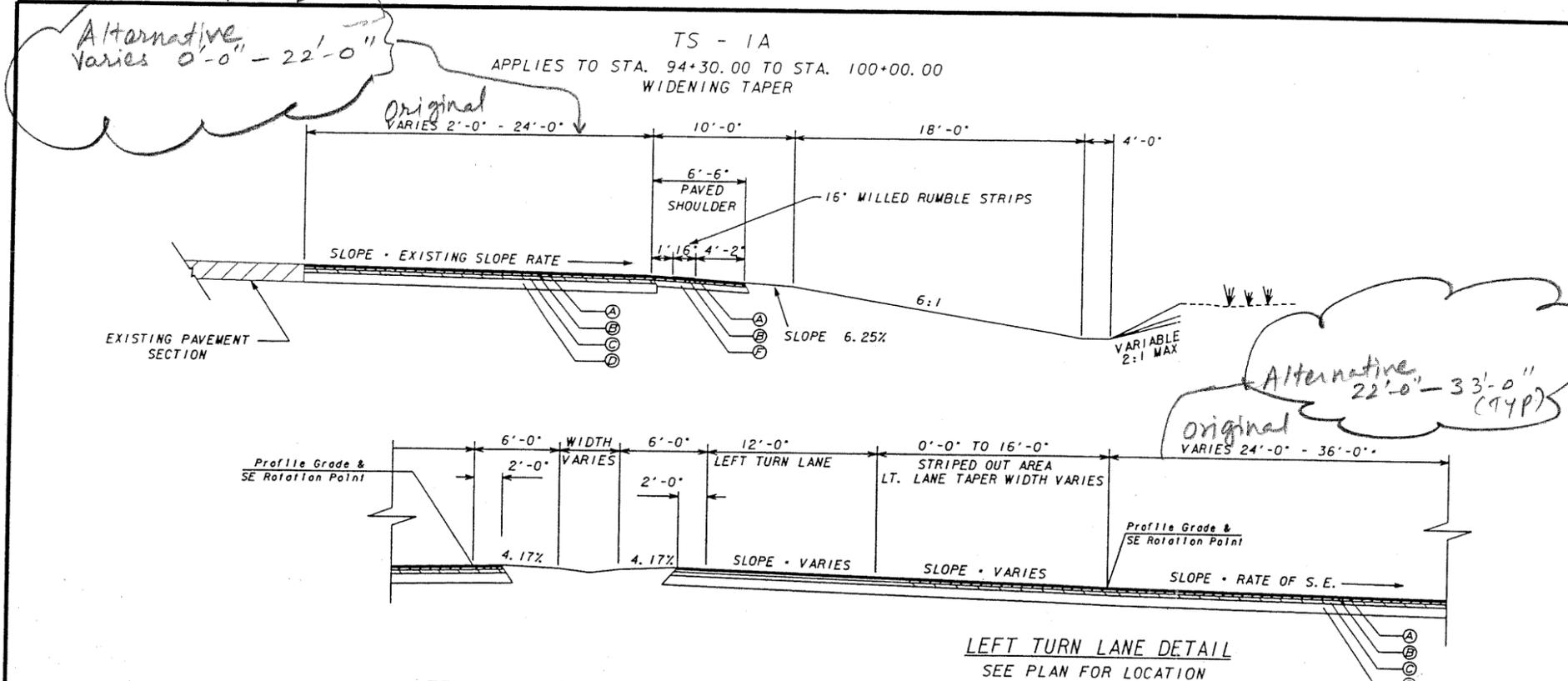
DISCUSSION:

Reducing all mainline travel lanes from 12-ft. to 11-ft. lanes results in the reduction of four feet of pavement on four-lane divided sections. At the same time, the earthwork is reduced throughout the length of the project. The low traffic volumes including the low percentage of trucks for these projects can help justify this alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 675,072	—	\$ 675,072
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 675,072	—	\$ 675,072

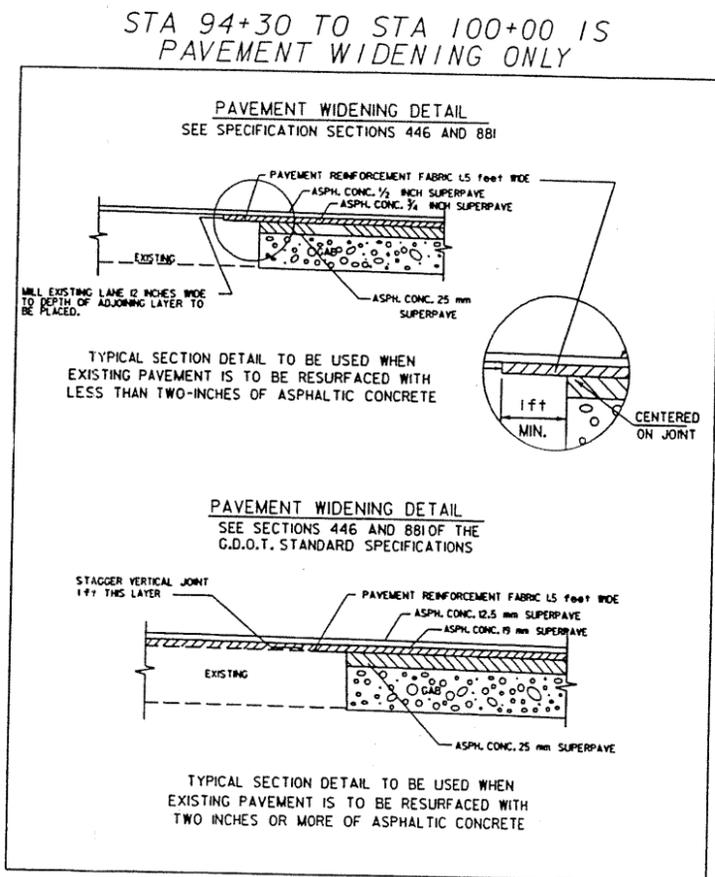
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.	EDS-441(12)TELFAIR		

SHT 3 OF 4

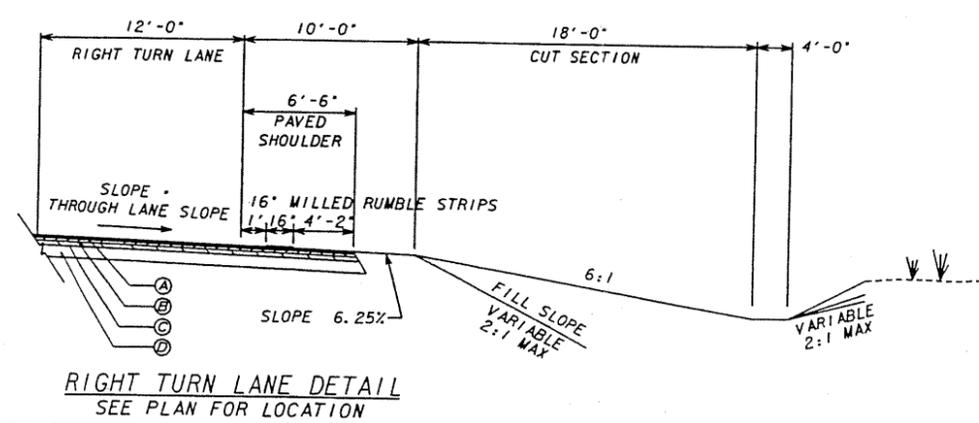


SLOPE	CUT	FILL
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2:1	6' & OVER	10' & OVER

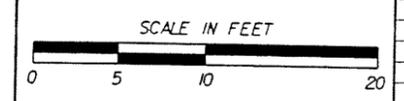
*REQUIRES GUARDRAIL



- REQUIRED PAVEMENT - MAINLINE & SHOULDER
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 - (C) RECYCLED ASPH. CONCRETE 25.0 MM SUPERPAVE .550 LB/YD²
 - (D) GRADED AGGREGATE BASE, 10"
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DATE	REVISIONS	DATE	REVISIONS

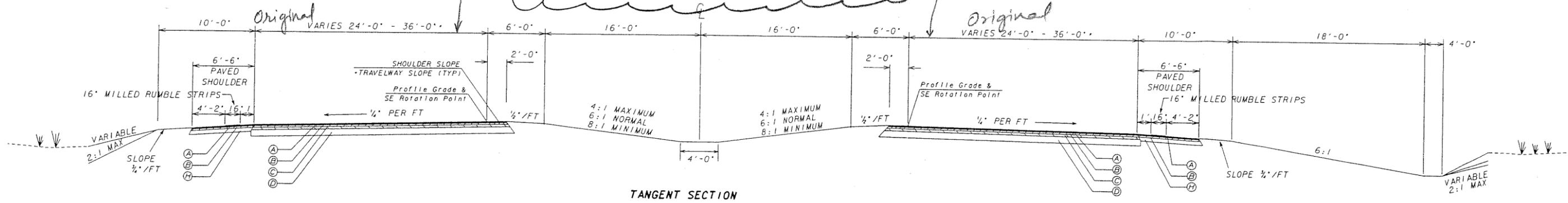
GEORGIA
DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS
MAINLINE
PROJ. EDS-441(12)TELFAIR
DATE
DWG NO. 5-2

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELFAIR-WHEELER		

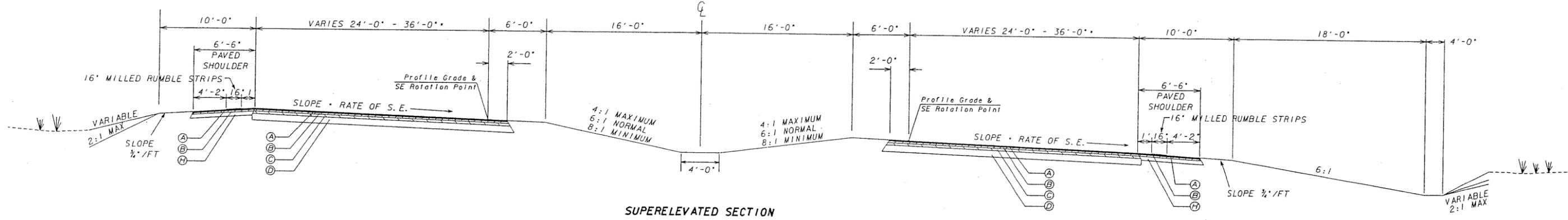
SHT 4 OF 5

TS - 1

APPLIES TO STA. 270+00 TO STA. 404+74.23
Alternative, varies 22'-0" - 33'-0" (Typ.)



TANGENT SECTION



SUPERELEVATED SECTION

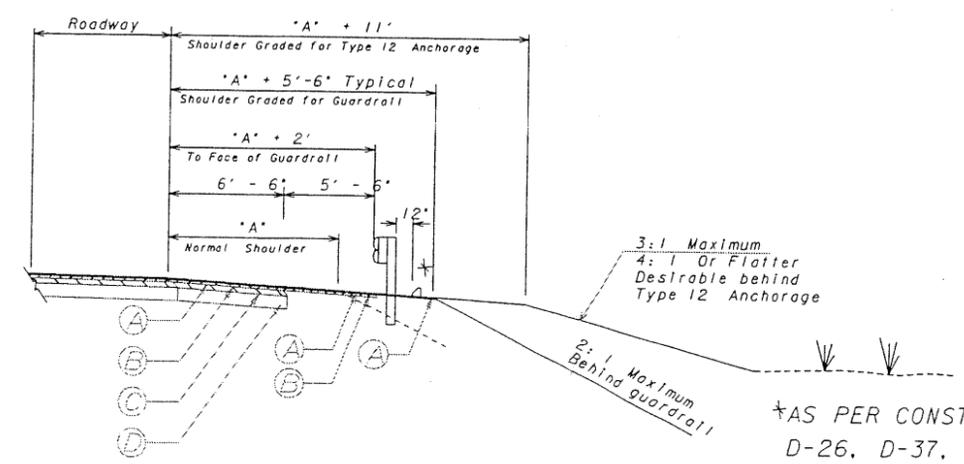
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SLOPE CONTROLS		
SLOPE	CUT	FILL
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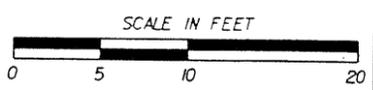
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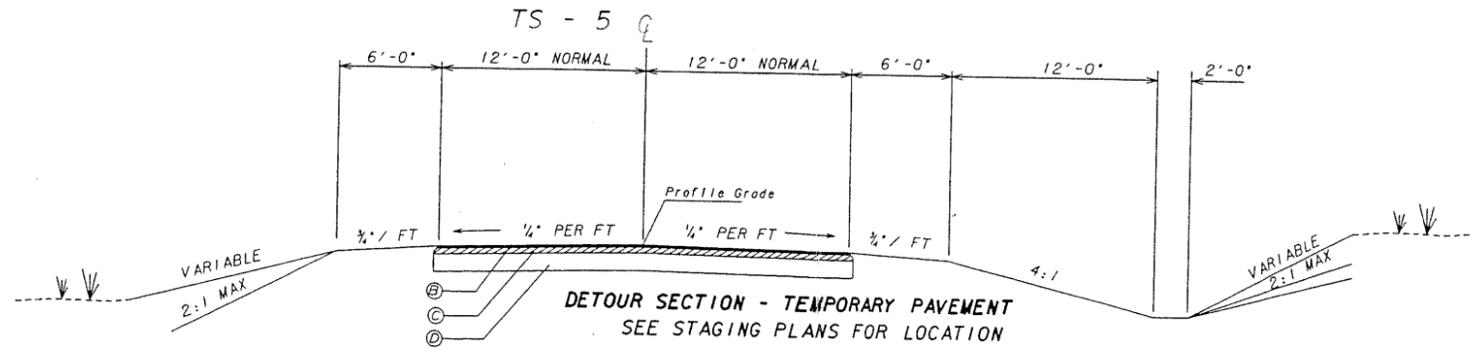
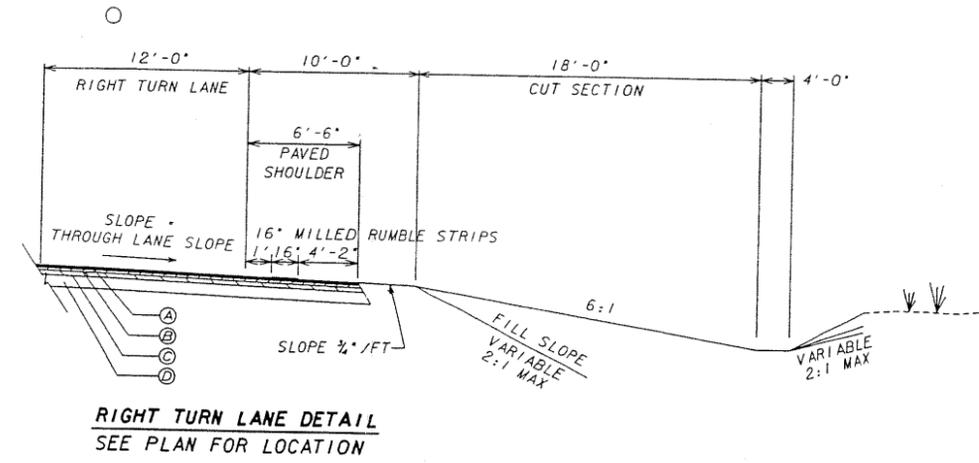
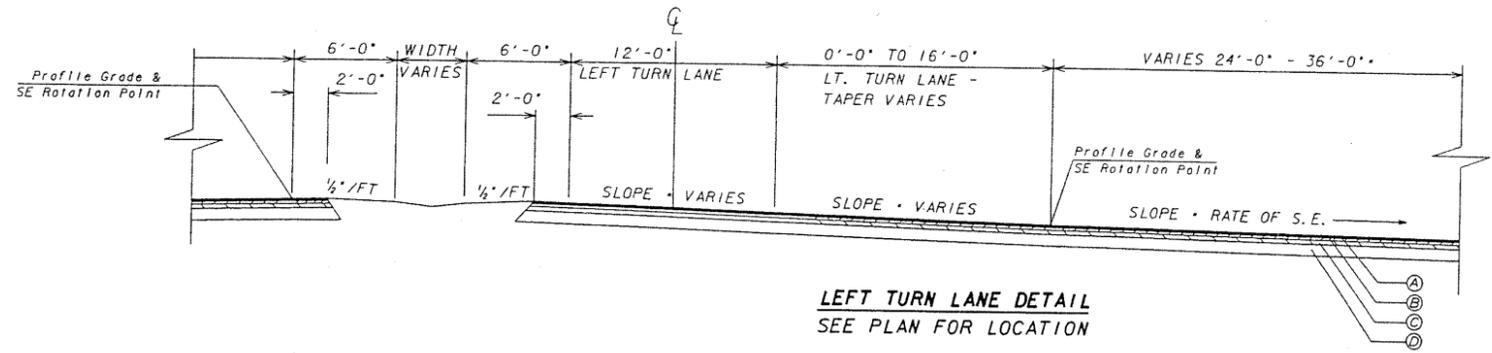
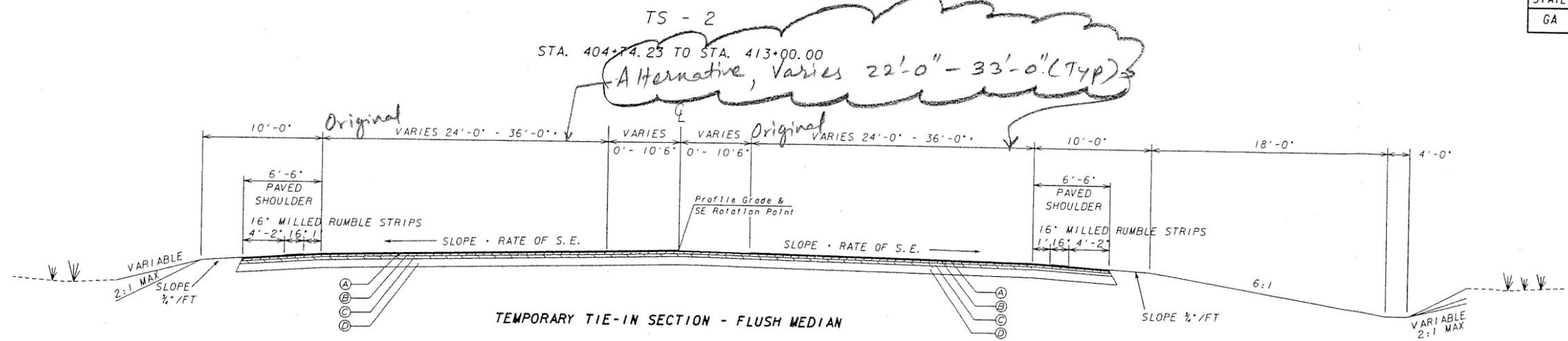


DATE	REVISIONS	DATE	REVISIONS

GEORGIA DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS - MAINLINE
PROJ. EDS-441(13)TELFAIR/WHEELER
DATE _____ DWG NO. 5-1

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELFAIR-WHEELER		

SHT 5 OF 5



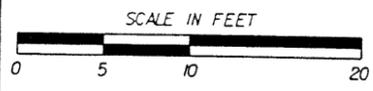
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SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0-6'	0-10'
2:1		6-10'
2:1	6' & OVER	10' & OVER

*REQUIRES GUARDRAIL

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DATE	REVISIONS	DATE	REVISIONS

GEORGIA
DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS - MAINLINE
PROJ. EDS-441(13)TELFAIR/WHEELER
DATE _____ DWG NO. 5-2

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-3**

SHEET NO.: **6 of 8**

EDS - 441(13)

$$\text{STA. } 270+00 \text{ to } 280+52 = 1052 \text{ LF}$$

$$282+96 \text{ to } 346+45 = 6349 \text{ LF}$$

$$362+10 \text{ to } 371+18 = 908 \text{ LF}$$

$$373+06 \text{ to } 378+46 = 540 \text{ LF}$$

$$380+21 \text{ to } 412+55 = 3234 \text{ LF}$$

$$\text{Total Length} = \underline{12083 \text{ LF}}$$

$$\text{Pavement section, } 12083 \text{ LF} \times 4' \text{ width} = 48,332 \text{ SF} = 5370.5 \text{ Y}$$

Recycled Asph. Conc.	12.5 mm super pave	165 lbs/sy = 886,050 lbs. = 443 TN
"	" 19.0 mm "	220 lbs/sy = 1,181,400 lbs. = 591 TN
"	" 25 mm "	550 lbs/sy = 2,953,500 lbs. = 1477 TN
		Total (2) = 2511 TN

$$\text{GAB, } 10'' = 1492' \text{ C.Y.}$$

$$\text{@ } 110 \text{ lb/cy, GAB} = 164120 \text{ lbs.} = 82 \text{ TN.}$$

$$\text{Embankment at avg. } 8 \text{ ft. depth, } \frac{48332 \text{ SF} \times 8'}{2} = 193328 \text{ CF} = 7160 \text{ CY}$$

$$\text{Excr. at avg. } 2 \text{ ft. depth, } \frac{48332 \text{ SF} \times 2'}{2} = 48332 \text{ CF} = 1790 \text{ CY}$$

CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.: TS-3

SHEET NO.: 7 of 8

EDS-441(12)

STA. 100+00 to 229+85 = 12985 LF

STA. 237+90 to 268+09 = 3019 LF

Total MainLine length for Pavement = 16004 LF

Pavement section, 16004 LF * 4' width = 64016 SF = 7113 SF

Recycled Asph. conc.	12.5 mm	superpave	165 lbs/sy.	= 1,173,645 lbs = 587 TN
"	"	"	220 lbs/sy.	= 1,564,860 lbs = 782 TN
"	"	"	550 lbs/sy.	= 3,912,150 lbs = 1956 TN
				Total(1)Asph. conc. = <u>3325 TN</u>

GAB, 10" = 1976 CY.

@ 110 lb/cy, GAB = 217360 lbs. = 109 TN.

Assumption: Embankment 1/2 of project length & Exc. 1/2 of proj length

Embankment at avg. 4 ft depth, $\frac{64016}{2} \text{ SF} \times 4 = 128032 \text{ CF}$

Exc. at avg. 6 ft depth, $\frac{64016}{2} \times 6 = 192048 \text{ CF}$
= 4742 CY

= 7113 CY.

COST WORKSHEET



PROJECT: **McRae Bypass EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-3**

SHEET NO.: **8 of 8**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	\$ COST/UNIT	\$ TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
<p>(Total of EDS-441 (12) and ESD-441 (13))</p>							
1) Recycled Asphalt conc. super pave	TON	5836	75	437,700			
2) Graded Aggr. Base	TON	191	25.0	4,775			
3) Borrow mat'l	CY	11902	10.19	121,281			
4) Excavation	CY	8903	5.61	49,946			
<p>(THE ABOVE FOUR ITEMS INCLUDE ADDITIONAL 4-FT. WIDTH COSTS.)</p>							
Subtotal				613,702			
Markup (%) at 10%				61,370			
TOTAL				675,072			

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-5**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH TO 20 FEET**

SHEET NO.: **1 of 7**

ORIGINAL DESIGN: (Sketch attached)

A 44-ft. median is used throughout the project.

ALTERNATIVE: (Sketch attached)

Reduce the median width to 20 ft. and place a cable barrier.

ADVANTAGES:

- Reduces cost
- Reduces construction time
- Reduces earthwork

DISADVANTAGES:

- Requires a cable median barrier
- Increases frequency of collisions
- Non-standard for divided highway

DISCUSSION:

Since this is a borrow project, reducing the footprint will reduce the cost of the project. The safety benefit should be analyzed in light of increased collisions associated with a narrower median with cable barrier. There is established software such as RSAP (Roadway Safety Analysis Program) available that can evaluate on a user benefit basis. The low volume of this facility may justify the narrower median.

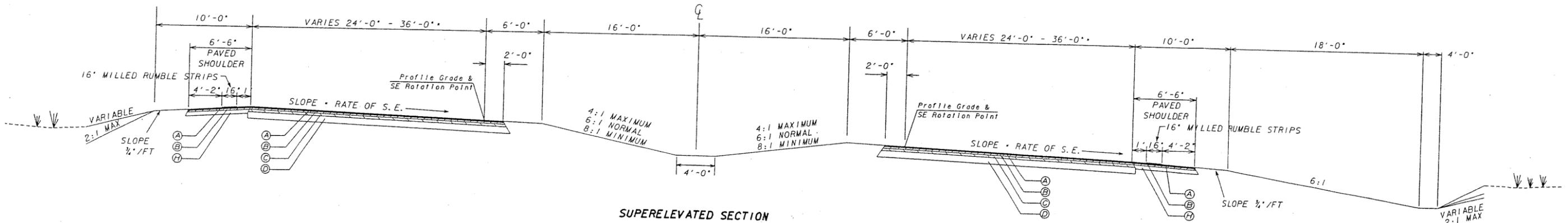
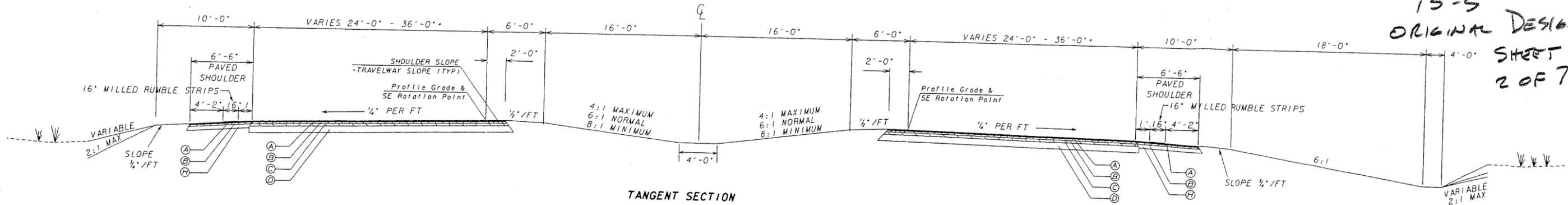
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 11,973,271	—	\$ 11,973,271
ALTERNATIVE	\$ 10,836,415	—	\$ 10,836,415
SAVINGS (Original minus Alternative)	\$ 1,136,856	—	\$ 1,136,856

TS - 1

APPLIES TO STA. 270+00.12 TO STA. 404+74.23

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELFAR-WHEELER		

ALTERNATIVE NO.
TS-5
ORIGINAL DESIGN
SHEET
2 OF 7



REQUIRED PAVEMENT - MAINLINE & SHOULDER.

- (A) RECYCLED ASPH. CONCRETE, 12.5 MM SUPERPAVE, 165 LB/YD²
- (B) RECYCLED ASPH. CONCRETE 19.0 MM SUPERPAVE, 220 LB/YD²
- (C) RECYCLED ASPH. CONCRETE 25.0 MM SUPERPAVE, 550 LB/YD²
- (D) GRADED AGGREGATE BASE, 10"
- (E) GRADED AGGREGATE BASE, 6"

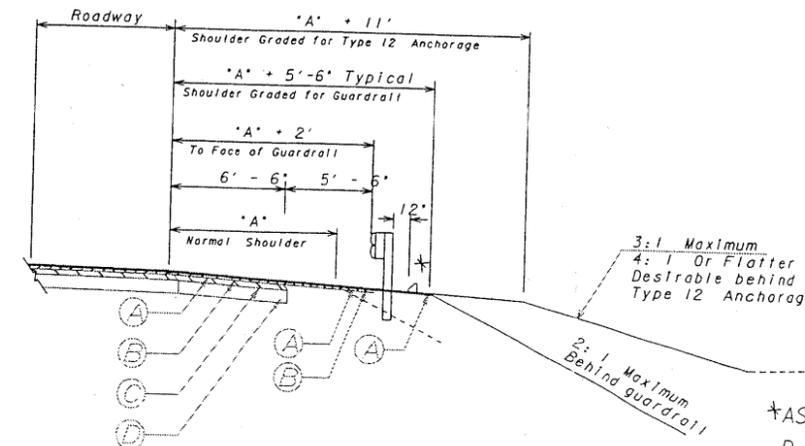
REQUIRED PAVEMENT - TEMPORARY PAVEMENT WHERE REQUIRED FOR CONSTRUCTION STAGING

- (B) RECYCLED ASPH. CONCRETE, 19.0 MM SUPERPAVE, 220 LB/YD²
- (C) RECYCLED ASPH. CONCRETE 25.0 MM SUPERPAVE, 550 LB/YD²
- (D) GRADED AGGREGATE BASE, 8"

* SEE PLANS FOR LOCATION LEVELING AS DIRECTED BY THE ENGINEER.

SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0-6'	0-10'
2:1		6-10'
2:1	6' & OVER*	10' & OVER*

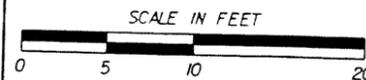
*REQUIRES GUARDRAIL



TYPICAL SHOULDER DETAIL FOR GUARDRAIL (OUTSIDE SHOULDER)

*AS PER CONSTRUCTION DETAIL D-26, D-37, & S-4, 6" ASPHALTIC CURB AND SLOPE DRAINS ARE TO BE INSTALLED AT THE FOLLOWING LOCATIONS:

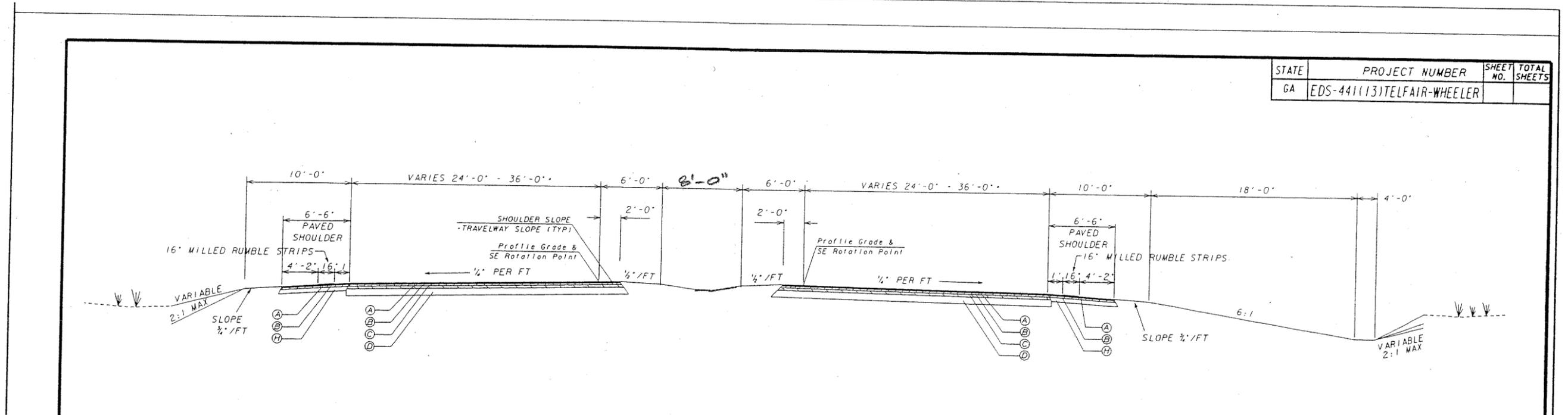
O'BRIEN & GERE
ENGINEERING AND PROJECT DELIVERY
2500 Atlanta Hwy., Suite 510
Athens, GA, 30606
(706) 548-4881
Fax: (706) 548-4697



DATE	REVISIONS	DATE	REVISIONS

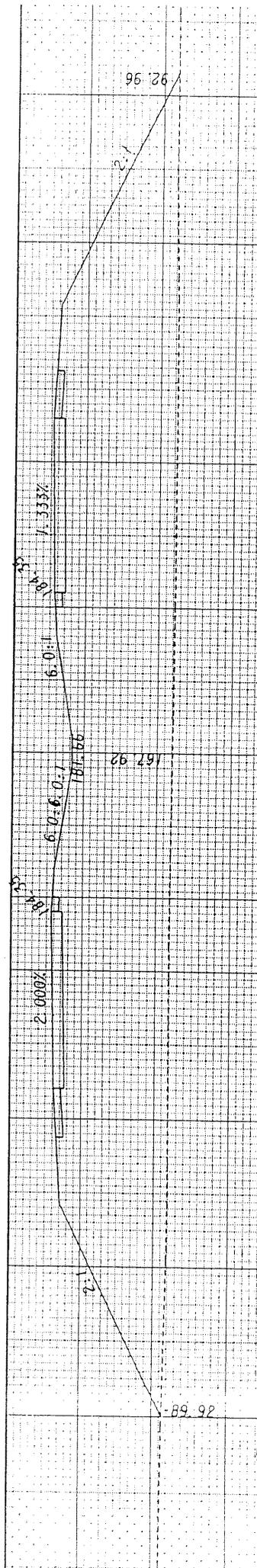
GEORGIA
DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS - MAINLINE
PROJ. EDS-441(13)TELFAR/WHEELER
DATE
DWG NO. 5-1

ALTERNATIVE NO.
 TS-5
 ALTERNATIVE DESIGN
 SHEET 3 OF 7



STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELF AIR-WHEELER		

ALTERNATIVE NO.
 TS-5
 ORIGINAL DESIGN
 SHEET 4 OF 7



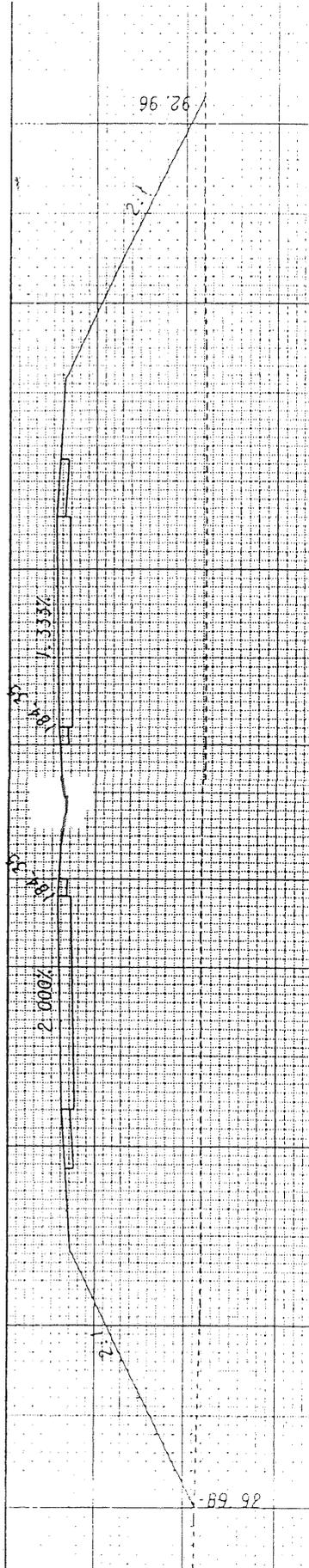
$$\text{Volume} = 5(5)(30)(2) + 112(15) - 16(3)$$

$$= 2002 \text{ ft}^3/\text{ft}$$

ALTERNATIVE NO.
TS-5

ALTERNATIVE DESIGN
SHEET 5 OF 7

20'
MEDIAN



$$\text{VOLUME} = 15(15 \times 30 \times 2) + 92(15) \\ = 1830$$

$$\text{PERCENT OF ORIGINAL} \\ = 1830/2082 = 87.87\%$$

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

TS-5

SHEET NO.: 6 of 7

LENGTH OF CABLE BARRIER REQUIRED
= PROJECT LENGTH - BRIDGE LENGTH

$$(12) \quad (3.2915 - .1629)(5280) = 16,519 \text{ LF}$$

$$(13) \quad (2.7521 - .4110)(5280) = 12,361 \text{ LF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-8**

DESCRIPTION: **REDUCE THE WIDTH OF LANES ON SIDE STREET CONNECTIONS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original plan typical sections for side roads call for a 12-ft. pavement width for all side street connections.

ALTERNATIVE: (Sketch attached)

Reduce the lanes to 11 ft.

ADVANTAGES:

- Reduces overall project cost
- Matches existing lane conditions

DISADVANTAGES:

- None apparent

DISCUSSION:

This effort will reduce project cost and right-of-way impacts to adjacent property owners. As existing roads are already at this width and common practice is to conform into existing conditions, this approach seems reasonable.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 103,783	—	\$ 103,783
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 103,783	—	\$ 103,783

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-8**

LANE WIDTH REDUCTION FOR SIDE STREETS

SHEET NO.: **2** of **4**

C.R. 152 STA. 5+67.36 - STA. 14+81.20

* UNIT (12) REDUCTION

$$\begin{aligned} \text{LENGTH} &= 913.84' \times 2' = 1827.68 \text{ SF/9} \\ &= \underline{203.076 \text{ SY}} \end{aligned}$$

SR. 149 STA. 5+70.03 - STA. 15+50

$$\begin{aligned} \text{LENGTH} &= 979.97 \times 2' = 1959.94 \text{ SF/9} \\ &= \underline{217.77 \text{ SY}} \end{aligned}$$

US 441/US. 319/SR 31 - STA. 6+00 - STA. 20+45.32

$$\begin{aligned} \text{LENGTH} &= 1,445.32 \times 2' = 2,890.64 \text{ SF/9} \\ &= \underline{321.18 \text{ SY}} \end{aligned}$$

C.R. 236

BARRETT ROAD STA. 5+00 - STA. 13+56.8

$$\begin{aligned} \text{LENGTH} &= 856.80' \times 2' = 1,713.60 \text{ SF/9} \\ &= \underline{190.40 \text{ SY}} \end{aligned}$$

CR. 236 EAST : STA. 7+00 - STA. 14+00

$$\begin{aligned} \text{LENGTH} &= 700.00' \times 2' = 1400 \text{ SF/9} \\ &= \underline{155.55 \text{ SY}} \end{aligned}$$

CORR. FACILITY ROAD STA. 5+25.00 - STA. 14+50

$$\begin{aligned} \text{LENGTH} &= 925' \times 2' = 1850.00 \text{ SF/9} \\ &= \underline{205.55 \text{ SY}} \end{aligned}$$

TOTAL SQUARE YARDS

$$\underline{1,293.54}$$

$$1\frac{1}{2}'' = 165 \frac{10^3}{40^2} (12.50 \text{ MM}) = 1293.54 \text{ SY} \times \frac{165 \frac{10^3}{40^2}}{2000} = 106.71 \text{ TNS} \times 75.00 = 8,003.25$$

$$2'' = 220 \frac{10^3}{40^2} (19.00 \text{ MM}) = \quad \quad \quad \frac{220 \frac{10^3}{40^2}}{2000} = 142.29 \text{ TNS} \times 75.00 = 10,671.75$$

$$4\frac{1}{8}'' = 550 \frac{10^3}{40^2} (25.00 \text{ MM}) = \quad \quad \quad \frac{550 \frac{10^3}{40^2}}{2000} = 355.72 \text{ TNS} \times 75.00 = 26,679.00$$

$$10'' - \text{G.A.B.} (110 \frac{10^3}{40^2}) = \underline{9,662.74 \text{ FT}^3} (110 \frac{10^3}{40^2}) \div 2000 = 531.45 \text{ TNS} \times 25.00 = 13,286.25$$

$$5820.93 \text{ LF} \times 2' \times .85' = 9,662.74 \text{ FT}^3$$

$$= 9,662.74 (110 \frac{10^3}{40^2}) \div 2000 = 531.45 \text{ TNS}$$

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: TS-8

SHEET NO.: 3 of 4

SPRING AVE STA. 7+17.10 - STA. 12+68.90

$$\begin{aligned} \text{LENGTH } 551.80 \times 2' &= 1103.60 \text{ SF/9} \\ &= \underline{122.62 \text{ SY}} \end{aligned}$$

RAMP US 280/SR. 30 STA. 11+00 - STA. 26+70

$$\begin{aligned} \text{LENGTH } 1570.00 \times 2' &= 3,140.00 \text{ SF/9} \\ &= \underline{348.88 \text{ SY}} \end{aligned}$$

C.R. 132 STA. 0+50 - STA. 5+06.05

$$\begin{aligned} \text{LENGTH } 456.05 \times 2' &= 912.10 \text{ SF/9} \\ &= \underline{101.34 \text{ SY}} \end{aligned}$$

CR. 133 STA. 10+50 - STA. 13+64

$$\begin{aligned} \text{LENGTH } 314.00 \times 2' &= 628.00 \text{ SF/9} \\ &= \underline{69.77 \text{ SY}} \end{aligned}$$

TOTAL SQUARE YARDS = 642.61

$$1\frac{1}{2}'' = 165 \text{ lbs/YDS} \quad 642.61 \text{ SY} \quad (165) \div 2000 = 53.02 \text{ TNS} \times 75.00 = 3,976.50 \checkmark$$

$$2'' = 220 \text{ lbs/YDS} \quad 642.61 \text{ SY} \quad (220) \div 2000 = 70.68 \text{ TNS} \times 75.00 = 5,301.00 \checkmark$$

$$4\frac{1}{5}'' = 550 \text{ lbs/YDS} \quad 642.61 \text{ SY} \quad (550 \text{ lbs/YDS}) \div 2000 = 176.72 \text{ TNS} \times 75.00 = 13,254.00 \checkmark$$

$$\text{GAB} = 110 \text{ lbs/FT}^3$$

$$A = 2,891.74 \text{ LF} \times .83 \times 2' = 4800.28 \text{ FT}^3 \quad (110 \text{ lbs/FT}^3) \div 2000 = 264.01 \text{ TNS} \times 25.00 = \underline{6600.39}$$

EARTHWORK

281.14

$$8712.78 \text{ LF} \times 2' \times 1/27 = 645.39 \text{ CY} \cdot \$10.19 = \$6,576.54 \text{ EMBANKMENT}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-10**

DESCRIPTION: **USE 4:1 MEDIAN SLOPES WHEREVER POSSIBLE**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current plans indicate that 4:1 slopes in the median are allowed, 6:1 slopes are normal, and the slopes can be as flat as 8:1 (minimum).

ALTERNATIVE: (Sketch attached)

Use 4:1 slopes where the superelevation rates permit.

ADVANTAGES:

- Reduces the amount of fill required in median
- Reduces cost

DISADVANTAGES:

- Vehicle recovery reduced and overturning potential increased

DISCUSSION:

Since this is a borrow project, any reduction in the amount of fill materials is desirable. Consider a roadside safety cost benefit analysis to determine the viability of this alternative.

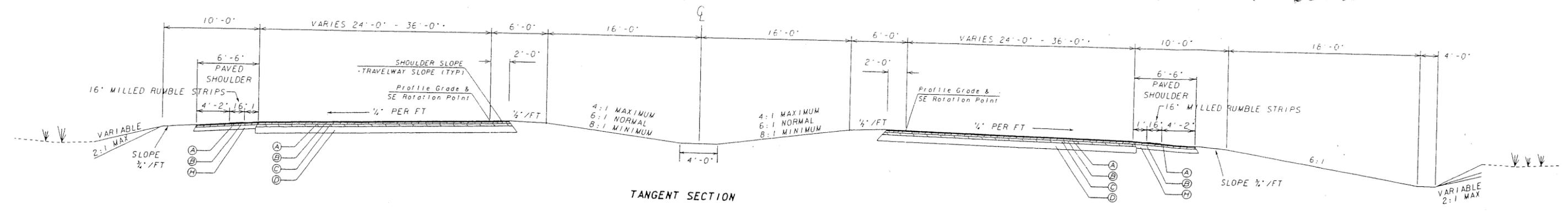
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 142,432	—	\$ 142,432
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 142,432	—	\$ 142,432

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELF AIR-WHEELER		

TS - 1

APPLIES TO STA. 270+00.12 TO STA. 404+74.23

ORIGINAL DESIGN



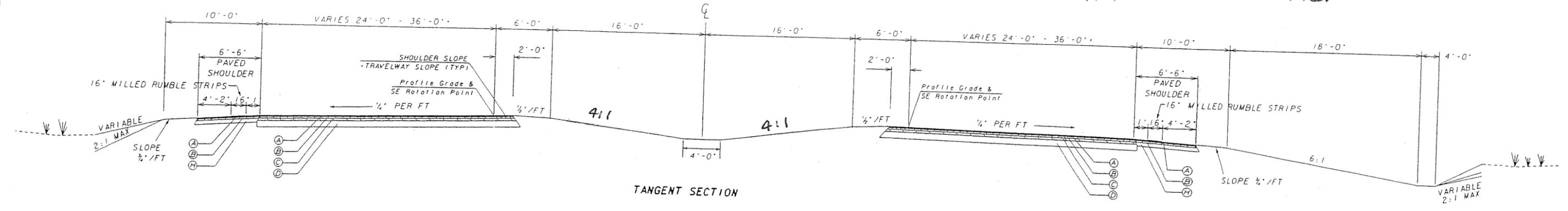
TANGENT SECTION

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13)TELF AIR-WHEELER		

TS - 1

APPLIES TO STA. 270+00.12 TO STA. 404+74.23

ALTERNATIVE DESIGN



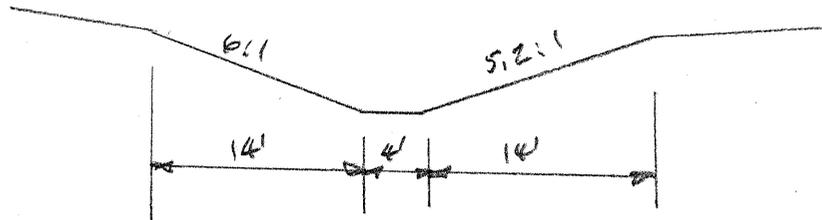
TANGENT SECTION

PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **TS-18**

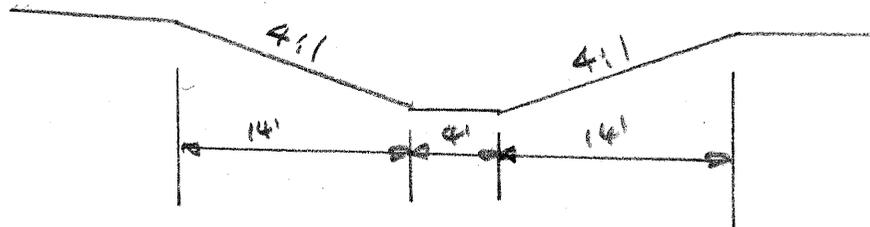
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **3** of **5**



TYPICAL MEDIAN

ALTERNATIVE DESIGN



CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.:

TS-10

SHEET NO.: 4 of 5

Typical Median Volume

$$= .5(14)(2.7) + 4(1.27) + .37(14) + .5(14)(2.33)$$

$$= 51.2 \text{ ft}^3/\text{ft}$$

With 4:1 Slopes

$$\text{Median Volume} = 2(.5)(3.5)(14) + 3.5(4)$$

$$= 63.0$$

$$\text{Reduction is } (63 - 51.2) / 27$$

$$= 0.44 \text{ CY/FT}$$

Project Length - Bridges

$$(12) = 3.2915 - .1629 = 3.1286 \text{ mi} = 16519'$$

$$\text{Reduction} = 7268 \text{ CY}$$

$$(13) = 2.7521 - .4110 = 2.3411 \text{ mi} = 12361'$$

$$\text{Reduction} = 5439 \text{ CY}$$



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **McRAE BYPASS**

Georgia Department of Transportation

PRESENT WORTH OF COST SAVINGS

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
STRUCTURES						
S-1	Use shorter spans for Little Ocmulgee River bridge and prestressed concrete pile intermediate bents	\$ 4,388,996	\$ 3,427,444	\$ 961,552		\$ 961,552
S-2	Relocate drainage pipe at Station 346+00 to avoid bridge end bent				Design Suggestion	
S-3	Use pile intermediate bents at bents 2, 3 and 4 at the Little Ocmulgee Bridge using current span arrangements	\$ 340,522	\$ 157,047	\$ 183,475		\$ 183,475
S-4	Use shorter spans and pile intermediate bents in lieu of concrete intermediate bents at the Sugar Creek Bridge	\$ 2,615,836	\$ 2,028,629	\$ 587,207		\$ 587,207
CONSTRUCTABILITY						
C-1	Retain existing profile grade at south project tie-in	\$ 71,864	\$ 6,171	\$ 65,693		\$ 65,693
C-2	Reduce the right-of-way mitre at Station 145+00	\$ 882,400	\$ 861,399	\$ 21,001		\$ 21,001
C-6	Reduce the profile grade north of the Heart of Georgia Railroad and the amount of full depth reconstruction at the north end tie-in (Station 382+00 to Station 413+00)	\$ 206,312	\$ 34,320	\$ 171,992		\$ 171,992
PLAN CHECK ITEMS						
P-1	Check the airway-highway clearance requirements at the north end of the North McRae Bypass					
P-2	Profiles at the intersection of the north/south project meet at a PVIC (algebraic difference of 3.14%) without a vertical curve					
P-3	Profile elevation information are in error on the Plan Sheets from Station 360+00 to 375+00					
P-4	Reconcile payment for in-place embankment on the North and South McRae projects					
P-5	The North McRae project's asphalt leveling quantities appear to be missing					

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **S-1**

DESCRIPTION: **USE SHORTER SPANS FOR THE LITTLE OCMULGEE RIVER
 BRIDGE AND PRE-STRESSED CONCRETE PILE
 INTERMEDIATE BENTS**

SHEET NO.: **1 of 7**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the following spans lengths:

- One at 140 ft.;
- Ten at 110 ft.;
- One at 75 ft.; and
- Four at 62 ft.

Concrete intermediate bents are required with these span lengths.

ALTERNATIVE:

Use 12 spans at 67 ft. and 11 spans at 69 ft. (same total bridge length) with Type III beams and prestressed concrete pile intermediate bents.

ADVANTAGES:

- More economical
- Lighter beams to set
- No footing excavation in wetlands
- Fewer piles to drive

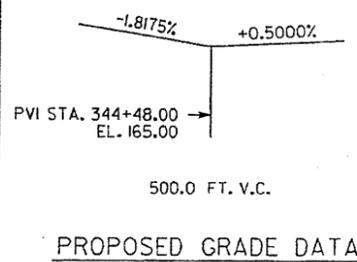
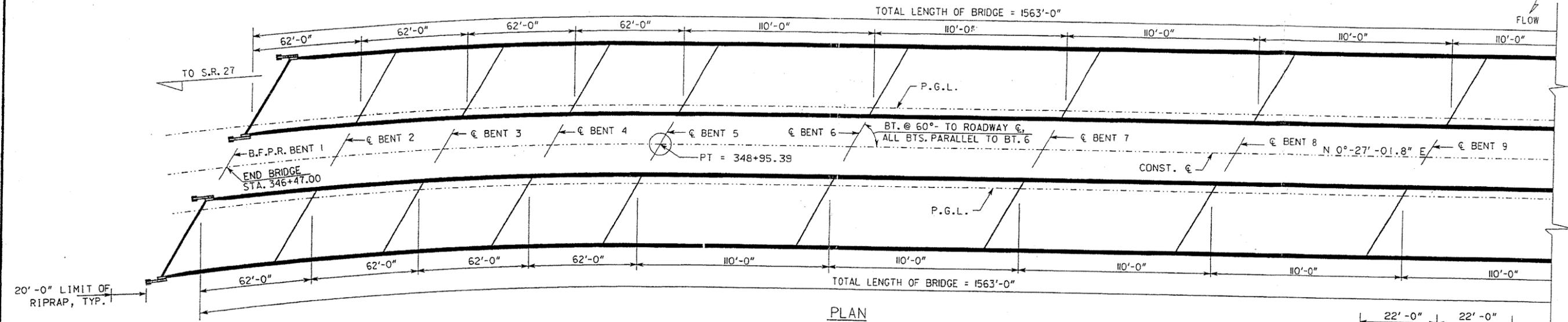
DISADVANTAGES:

- More beams to set

DISCUSSION:

Constructing the bridge with shorter spans will reduce the cost of construction and simplify construction since no concrete bents or footings will be required.

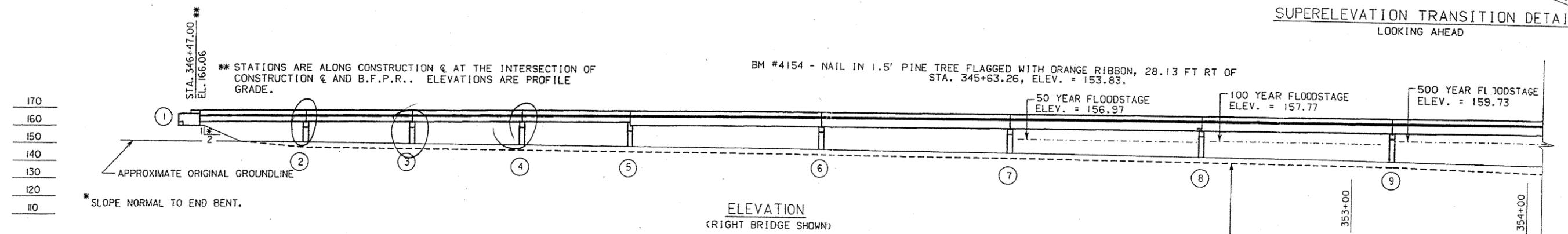
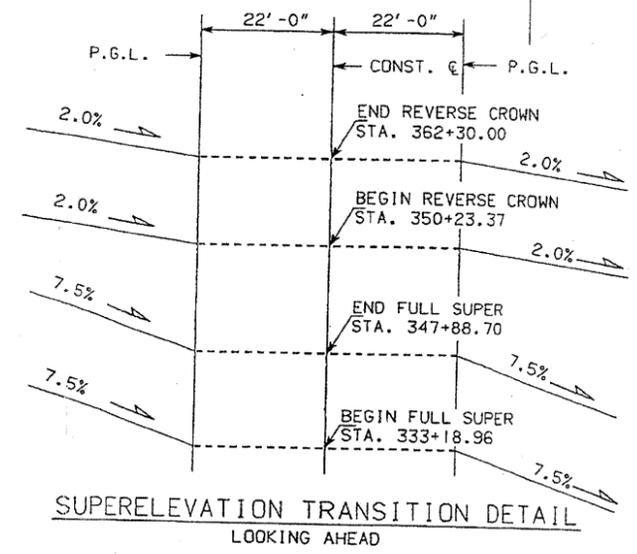
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,388,996	—	\$ 4,388,996
ALTERNATIVE	\$ 3,427,444	—	\$ 3,427,444
SAVINGS (Original minus Alternative)	\$ 961,552	—	\$ 961,552



-----HORIZONTAL CURVE DATA-----
 PI STA = 341+02.80
 PC STA = 332+12.27
 PT STA = 348+95.39
 D = 2°45'00.0"
 DELTA = 48°17'08.5" RT
 T = 890.52
 L = 1683.12
 R = 2083.48

- EACH BRIDGE CONSISTS OF-----
- 1 - 140'-0" BULB TEE, 72 IN, PSC BEAM SPAN ----- SPECIAL DESIGN
 - 10 - 110'-0" BULB TEE, 54 IN, PSC BEAM SPANS ----- SPECIAL DESIGN
 - 1 - 75'-0" TYPE III PSC BEAM SPAN ----- SPECIAL DESIGN
 - 4 - 62'-0" TYPE II PSC BEAM SPANS ----- SPECIAL DESIGN
 - 15 - CONCRETE INTERMEDIATE BENTS ----- SPECIAL DESIGN
 - 2 - PILE END BENTS ----- SPECIAL DESIGN
- 24" TYPE I RIPRAP

NOTES: - THE PROPOSED BRIDGE DECKS ARE TO BE BUILT ON SUPERELEVATION TRANSITION. SEE SUPERELEVATION TRANSITION DETAIL.
 - MINIMUM BOTTOM OF BEAM ELEVATION FOR PROPOSED BRIDGE SHALL NO LOWER THAN ELEVATION 158.97.



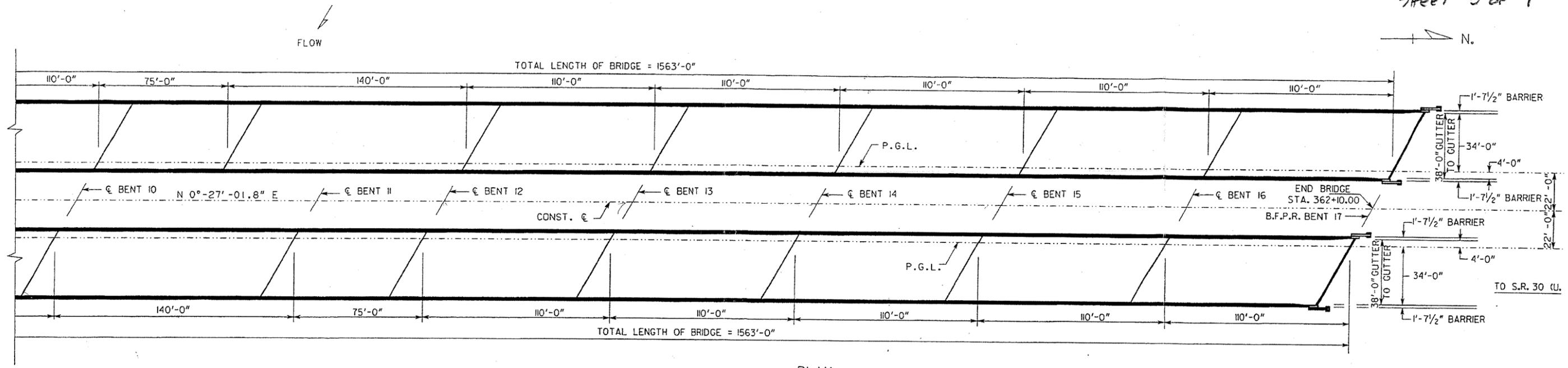
THEORETICAL SCOUR DEPTHS (FT)						
LEFT BRIDGE						
BENT LOCATION	100 YEAR STORM			500 YEAR STORM		
	GENERAL	LOCAL	TOTAL	GENERAL	LOCAL	TOTAL
BENTS 2 - 10	0.0	2.8	2.8	0.0	3.0	3.0
BENTS 11 & 12	0.0	4.6	4.6	0.0	5.2	5.2
BENTS 13 - 16	0.0	2.7	2.7	0.0	3.1	3.1

THEORETICAL SCOUR DEPTHS (FT)						
RIGHT BRIDGE						
BENT LOCATION	100 YEAR STORM			500 YEAR STORM		
	GENERAL	LOCAL	TOTAL	GENERAL	LOCAL	TOTAL
BENTS 2 - 9	0.0	2.8	2.8	0.0	3.0	3.0
BENTS 10 & 11	0.0	4.6	4.6	0.0	5.2	5.2
BENTS 12 - 16	0.0	2.7	2.7	0.0	3.1	3.1

ORIGINAL DESIGN

BRIDGE NO. 2 LT. & RT.
 EXISTING BRIDGE SERIAL NO. N/A
 EXISTING BRIDGE I.D. NO. N/A
 P.I. NO. 561470
 PRELIMINARY LAYOUT
 PROJECT : EDS-441(13)
 NAME: NORTH MCRAE BYPASS OVER
 LITTLE OCMULGEE RIVER
 TELFAIR-WHEELER COS.
 DRAWN BY : ELS
 DATE : FEBRUARY 14, 2007
 SCALE : 1" = 30'-0"
 SHEET 1 OF 2
 PREPARED BY

345+50 | 346+00 | 347+00 | 348+00 | 349+00 | 350+00 | 351+00 | 352+00



PLAN

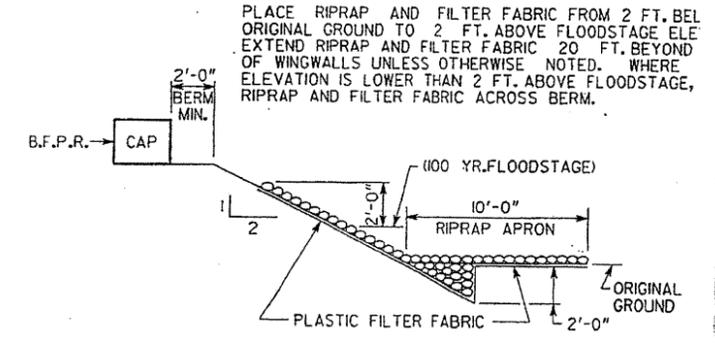
-----TRAFFIC DATA-----

TRAFFIC	ADT = 2025 (2005)
	ADT = 2950 (2025)
TRAFFIC DHV	385
DIRECTIONAL DIST	50%
24 HR TRUCKS	20%
TRUCKS	10%
SPEED DESIGN	65 MPH

-----DRAINAGE DATA-----

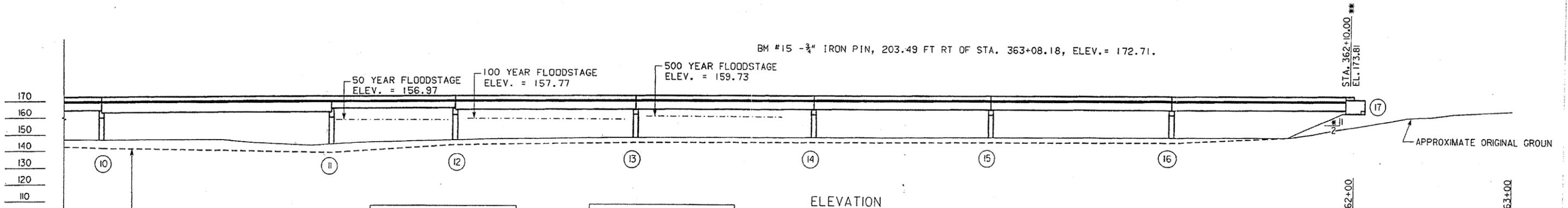
DRAINAGE AREA		300.90 SQ MI	
FLOOD FREQUENCY	TOTAL DISCHARGE	AREA OF OPENING BELOW FLOODSTAGE	MEAN VELOCITY
50 YEAR	9104 CFS	12248 SQ FT	0.74 FPS
100 YEAR	10936 CFS	13462 SQ FT	0.81 FPS
500 YEAR	16006 CFS	16399 SQ FT	0.98 FPS

FLOOD OF RECORD = 162.0 (1925) BY L.C. MOON



RIPRAP DETAIL
NO SCALE

-----DESIGN DATA-----
TYPICAL HS20-44 AND/OR MILITARY LOADING ----- IMPACT ALLOWED
SPECIFICATIONS ----- AASHTO 17th EDITION, 2002



ELEVATION
(RIGHT BRIDGE SHOWN)

BERM ELEVATIONS	
LEFT BRIDGE	
END BENT	ELEVATIONS
I LT	162.59
I RT	159.63
17 LT	166.98
17 RT	166.11

NOTE: FOR BRIDGE ENDROLL STAKING PURPOSES ONLY.

BERM ELEVATIONS	
RIGHT BRIDGE	
END BENT	ELEVATIONS
I LT	160.15
I RT	157.27
17 LT	166.17
17 RT	165.30

NOTE: FOR BRIDGE ENDROLL STAKING PURPOSES ONLY.

ORIGINAL DESIGN

BRIDGE NO. 2 LT. & RT.

EXISTING BRIDGE SERIAL NO. N/A
EXISTING BRIDGE I.D. NO. N/A
P.I. NO. 561470

PRELIMINARY LAYOUT
PROJECT : EDS-441(13)
NAME : NORTH MCRAE BYPASS OVI
LITTLE OCMULGEE RIVER
TELFAR-WHEELER COS.

DRAWN BY : ELS
DATE : FEBRUARY 14, 2007
SCALE : 1" = 30'-0"
PREPARED I

CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.:

5-1

SHEET NO.: 4 of 7

ORIGINAL DESIGN - EACH BRIDGE

BEAM QUANTITIES - 5 BEAMS PER SPAN @ 9'-6"

TYPE II $(61 + 3 + 61.6667)(5) = 1230$

TYPE III $74.6667(5) = 373$

54" BULB-T $(109 + 9 + 109.6667)(5) = 5480$

72" BULB-T $5(139.6667) = 698$

DECK DESIGN

BM TYPE	SLAB t	MAIN STEEL	DIST. STEEL
TYPE II	7 3/4"	#5 @ 6"	8 @ 4 - #4
TYPE III	7 5/8"	#5 @ 6 1/8"	8 @ 4 - #4
BULB-T	7 1/2"	#5 @ 6 1/4"	7 @ 4 - #4

NEGLECT DIFFERENCE IN DISTRIBUTION STEEL

CALCULATE DECK QUANTITY FOR THICKNESS > 7 1/2"

$$4(62)(41.25)(.25/12) + 75(41.25)(.125/12)$$

$$= 245 / 27 = 9.1 \text{ CY}$$

MAIN SLAB PANS:

62' SPANS	2(4)(125)	= 1000
75' SPAN	2(1)(148)	= 296
110' SPANS	2(10)(214)	= 4280
140' SPAN	2(1)(270)	= 540

TOTAL = 6116

WT = 1.043(44')(6116) = 280675 #

CALCULATIONS



PROJECT: MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)
Georgia DOT

ALTERNATIVE NO.:

S-1

SHEET NO.: 5 of 7

SUBSTRUCTURE: ASSUME CAP IS 45' X 4' DEEP X 3'-6"
COLUMNS 3'-0" SQUARE X 11' HIGH
FOOTINGS 6' X 6' X 3'-6", 5-14" PSC PILES EA

$$\text{CONC: } 15 [45 \times 4 \times 3.5 + 2 \times 3^2 \times 11 + 2 \times 3.5 \times 6^2] / 27 = 600 \text{ CY}$$

$$\text{REBAR @ } 125 \# / \text{CY} = 75000 \#$$

PILING: ASSUME 35' BOTTOM OF FINE TO TIP

$$L = (1 + 35)(2)(15)(5) = 5400 \text{ LF}$$

$$\text{EXCAVATION } 15(2)(9^2)(6) / 27 = 540 \text{ CY}$$

PROPOSED ALTERNATIVE

$$\text{TYPE III BEAMS } 5(66 + 11 \times 66.6667 + 10 \times 68.6667 + 68) \\ = 7770 \text{ LF}$$

$$\text{DECK: } 1563(4.25)(.125/12) / 27 = 24.9 \text{ CY}$$

MAIN SPAN BARS:

$$67' \text{ SPANS } 12(2)(133) = 3192$$

$$69' \text{ SPANS } 11(2)(137) = 3014$$

$$\text{TOTAL} = 6206$$

$$\text{WT} = 1.043(44)(6206) = 284806 \#$$

SUBSTRUCTURE: ASSUME CAP IS 45' X 3'-6" X 2'-0" DEEP

$$\text{CONC. QUANTITY} = 22(45)(3.5)(2) / 27 = 256.7 \text{ CY}$$

$$\text{REBAR @ } 110 \# / \text{CY} = 28,233 \#$$

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

5-1

SHEET NO.: 6 of 7

PIPING: 1 - 18" PSC PIPE @ EA Pm

40' PENETRATIONS, 14' ABOVE GROUND
L=54'

$$L = 22(5)(54) = 5940 \text{ LF}$$

NOTE: QUANTITIES ON CALCULATION
SHEETS ARE PER BRIDGE

DOUBLE QUANTITIES TO CALCULATE
COSTS

UNIT COSTS ARE FROM GEORGIA DOT
ITEM MEAN SUMMARY 01/2006 + 12/2006

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **S-2**

DESCRIPTION: **RELOCATE THE DRAINAGE PIPE AT STA 346+00 TO AVOID
 THE BRIDGE END BENT**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN: (Sketch attached)

The 18-in. storm drain pipe goes from a median inlet to an outlet at the toe of the bridge endroll slope. This pipe passes directly beneath the bridge end bent.

ALTERNATIVE: (Sketch attached)

Relocate the inlet, outlet or both ends to avoid passing beneath the bridge end bent.

ADVANTAGES:

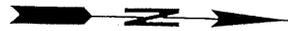
- Avoids trying to space bridge end bent piles to miss pipe
- Avoids driving a pile through the pipe

DISADVANTAGES:

- None apparent

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	DESIGN SUGGESTION		
ALTERNATIVE			
SAVINGS (Original minus Alternative)			

CITY OF McRAE



SENSE WOODS

E 454000

070299.7

*12 WETLAND BOUNDARY

END BERM DITCH
STA 346+25 LT

END GUARDRAIL
STA 346+88

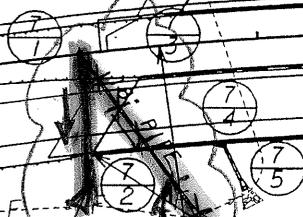
MATCH LINE STA. 345+00

350+00

REQ'D. R/W

E 404250

U. S. CO



END FS
STA 347+88.70

348+95.39

END GUARDRAIL
STA 346+01

REQ'D.

BEGIN BRIDGE
STA 346+45

SENSE WOODS

CITY OF McRAE

CITY OF McRAE

CAROLYN RENEE MASSEY, ETAL

PT STA 348+95.39

N 756037.6356

E 434283.2617

P. O. T. STA 358+00.00

N 756942.2185

E 434290.3742

Alternative Design
Original Design

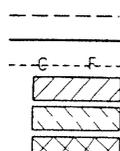


O'BRIEN & GERE

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Fax (706) 548-4697

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES



VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **S-3**

DESCRIPTION: **USE PILE INTERMEDIATE BENTS AT BENTS 2, 3, AND 4 AT
THE LITTLE OCMULGEE RIVER BRIDGE USING CURRENT
SPAN ARRANGMENTS**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The preliminary layout shows concrete intermediate bents used at all intermediate bent locations.

ALTERNATIVE:

Since this site will almost certainly use prestressed concrete (PSC) pile foundations, use PSC pile intermediate bents at bents 2, 3 and 4 which have shorter spans.

ADVANTAGES:

- More economical
- Reduces excavation in wetlands
- Fewer piles to drive
- Avoids possibility of cofferdams

DISADVANTAGES:

- None apparent

DISCUSSION:

GDOT bridge policy allows PSC pile bents for spans not longer than 70 feet. Spans 1, 2, 3 and 4 of this bridge are 62 ft. long, thus pile bents are permissible.

This alternative is mutually exclusive with Alt. No. S-1.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 340,522	—	\$ 340,522
ALTERNATIVE	\$ 157,047	—	\$ 157,047
SAVINGS (Original minus Alternative)	\$ 183,475	—	\$ 183,475

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

5-3

SHEET NO.: 2 of 3

ORIGINAL DESIGN: PER BRIDGE

CAP 45' X 4' DEEP X 3'-6"

COLUMNS 3'-0" SQUARE X 11' HIGH

FOOTINGS 6' X 6' X 3'-6"; 5- 14" PSC PILES EA.

$$\text{CONCRETE } 3[45(4)(3.5) + 2(3^2)(11) + 2(6^2)(3.5)]/27 = 120 \text{ CY CLASS 'A'}$$

$$\text{REBAR @ } 125 \#/\text{CY} = 15000 \text{ LB}$$

PILING: ASSUME 35' BOTTOM OF FTNG TO TIP

$$L = (1 + 35)(2)(5)(3) = 1080 \text{ LF } 14" \text{ PSC}$$

$$\text{EXCAVATION} = 2(3)(92)(6)/27 = 108 \text{ CY}$$

ALTERNATIVE DESIGN: PER BRIDGE

CAP 14 45' X 3'-6" X 2'-0" DEEP

$$\text{CONCRETE } 3[45(2)(3.5)]/27 = 35.0 \text{ CY CLASS 'A'}$$

$$\text{REBAR @ } 110 \#/\text{CY} = 3850 \text{ LB}$$

PILING: 1- 18" PSC AT EX. END, 40' PENETRATION,
14' ABOVE GROUND

$$L = 3(5)(57) = 810 \text{ LF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: S-4

DESCRIPTION: **USE SHORTER SPANS AND PILE INTERMEDIATE BENTS IN LIEU OF CONCRETE INTERMEDIATE BENTS AT THE SUGAR CREEK BRIDGE**

SHEET NO.: 1 of 4

ORIGINAL DESIGN:

The current preliminary bridge layout shows seven spans at 115 ft. with concrete intermediate bents. Beams are 63-in. Bulb-T beams.

ALTERNATIVE:

Use 13 spans at 62 ft. with PSC pile intermediate bents. Beams are Type II PSC beams.

ADVANTAGES:

- More economical
- Smaller beams to set
- Fewer piles to drive
- No excavation in wetlands
- Avoids possibility of cofferdams

DISADVANTAGES:

- More beams to set

DISCUSSION:

GDOT bridge policy permits PSC pile bents for spans not longer than 70 feet.

Note: The preliminary layout for this site has not been completed. This proposal is based on a "preliminary" preliminary layout.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,615,836	—	\$ 2,615,836
ALTERNATIVE	\$ 2,028,629	—	\$ 2,028,629
SAVINGS (Original minus Alternative)	\$ 587,207	—	\$ 587,207

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:
5-4

SHEET NO.: 2 of 4

ORIGINAL DESIGN: SLAB THICKNESS = 7 1/2"
PER BRIDGE MAIN SLAB STEEL IS #5 @ 6' 14"
BEAMS ARE 63" BULB-T

CONCRETE: 0 CY

$$\text{MAIN SLAB STEEL} = 2(2)(222)(1.043)(43) = 139,391 \#$$

63" BULB-T BEAMS: 5 PER SPAN

$$L = 5 [114 * 2 + 5 * 114.6667] = 4007 \text{ LF}$$

INT ABUTTS: CAP 33' LONG x 4' DEEP x 3'-6"

COLS 3'-0" SQUARE x 12' HIGH

FOOTINGS 6'-0" SQUARE x 3'-6", 5-14" PSC PILES EACH

$$\text{CL HA CONCRETE } 6 [33(4)(3.5) + 2(3^2)(12) + 2(6^2)(3.5)] / 27 = 222.2$$

$$\text{REINF @ } 125 \# / \text{CY} = 27,778 \#$$

PILES: ASSUME 35' PENETRATION BELOW FOOTING

$$L = 6(2)(5)(1 + 35) = 2160 \text{ LF } 14" \text{ PSC}$$

$$\text{EXCAV} = 6(2)(9^2)(6) / 27 = 216 \text{ CY}$$

PROPOSED DESIGN

PER BRIDGE

SLAB THICKNESS 7 3/4"

MAIN SLAB STEEL #5 @ 6"

BEAMS ARE TYPE II PSC

$$\text{CONCRETE } 13(62)(4.25)(.25/12) / 27 = 25.7 \text{ CY}$$

$$\text{MAIN SLAB STEEL } 13(2)(125)(1.043)(43) = 145,759 \#$$

TYPE II BEAMS: 5 PER SPAN

$$L = 5 [61 * 2 + 11 * 61.6667] = 4002 \text{ LF}$$

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.:

5-4

SHEET NO.:

3

of 4

INT BEAMS: CAP 35 X 3'-6" X 2'-0" DEEP

PILE S: 40' PENETRATION, 10' ABOVE GROUND
18" PSC, 1 @ EA. BEAM

CL' CONCRETE $12(35)(3.5)(2)/27 = 108.9$ CY

REINF @ 110#/CY = 11978 #

PILES: $12(5)(50) = 3000$ LF

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **C-1**

DESCRIPTION: **RETAIN THE EXISTING PROFILE GRADE AT THE SOUTH PROJECT**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The original design indicates full depth reconstruction to the existing pavement caused by a profile grade that is higher than existing grades beginning at STA 103+00±.

ALTERNATIVE: (Sketch attached)

Retain the existing profile grade with overlay from STA 100+00 to STA 113+-00. Widen where needed off the existing pavement edge.

ADVANTAGES:

- Uses existing pavement where new/old alignment are coincidental
- Reduces propose embankment
- Allows better tie-in with existing pavement for staging
- Reduces project costs and schedule
- Uses existing pavement and maintain existing traffic
- Less traffic control

DISADVANTAGES:

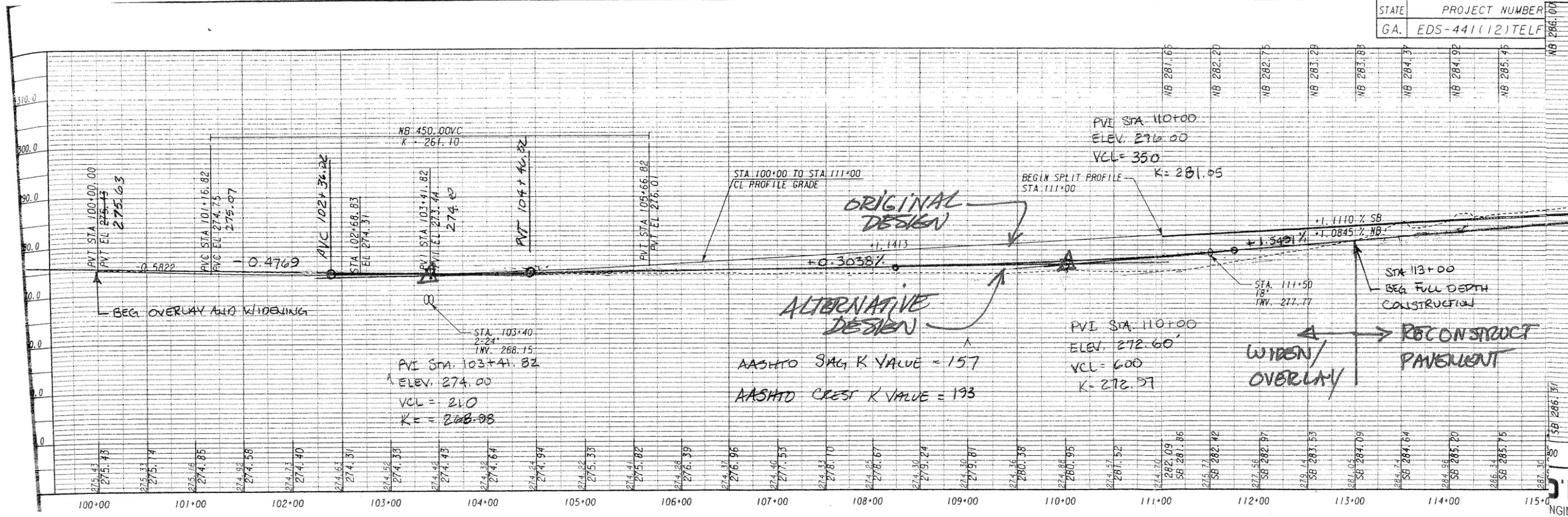
- None apparent

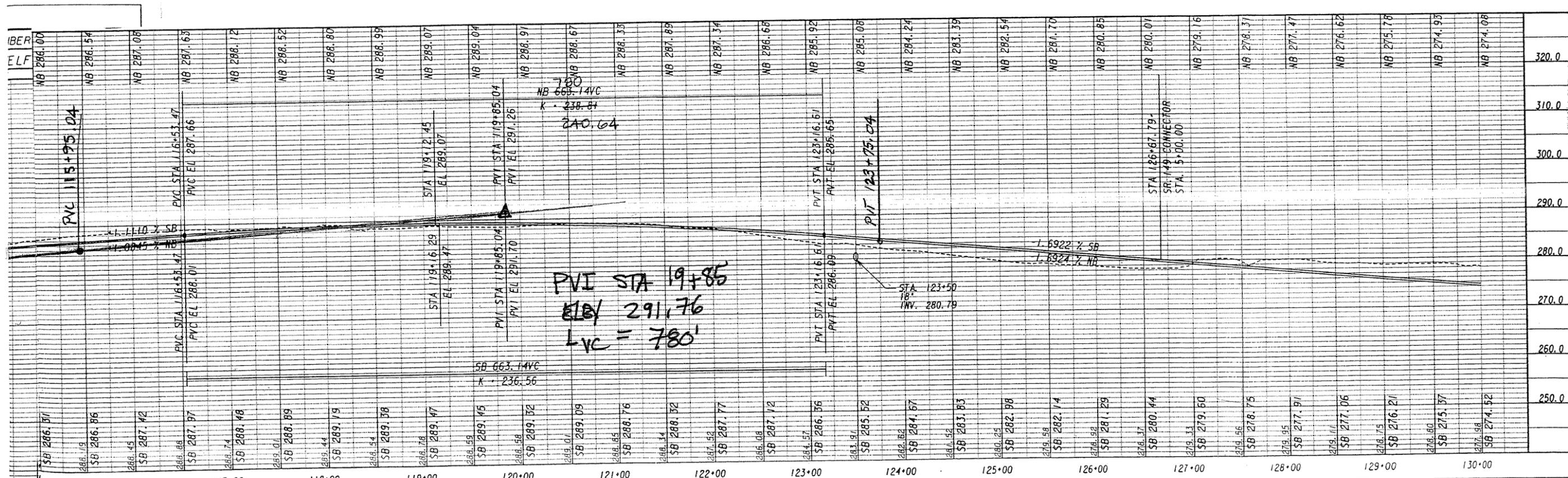
DISCUSSION:

This alternative will greatly reduce full depth reconstruction at the beginning of the project, allowing for savings in materials for GAB and asphalt construction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 71,864	—	\$ 71,864
ALTERNATIVE	\$ 6,171	—	\$ 6,171
SAVINGS (Original minus Alternative)	\$ 65,693	—	\$ 65,693

STATE	PROJECT NUMBER
GA.	EDS-441(12)TEL





PVI STA 119+85
ELEV 291.76
LVC = 780'

STA 123+50
INVT. 280.79

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Athens, GA. 30606
(706) 548-4881
FAX (706) 548-4697

SCALE
HOR: 1" = 50'
VER: 1" = 10'

DATE	REVISIONS	DATE	REVISIONS

GEORGIA
DEPARTMENT OF TRANSPORTATION
MAINLINE PROFILE
STA 100+00 TO STA 130+00
PROJ. EDS-441(12) TELFAIR
DATE _____ DWG NO. 15-2

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: C-1

REVISE PROPOSED GRADE AT BEGINNING OF PROJECT

SHEET NO.: 4 of 5

LEVELING QUANTITIES

STA. 100+00 - STA. 110+00

$$1000 \text{ LF} \times 24' \div 9 = 2666.67 \text{ SY} \left(1" \cdot 165 \frac{\text{lb}}{\text{SY}} \right) \div 2000$$

= 220 TNS OF LEVELING AT 1 INCH DEPTH.

STA. 110+00 - STA. 113+00

$$300 \text{ LF} \times 24' \div 9 \times \left(165 \frac{\text{lb}}{\text{SY}} \right) \div 2000 = \underline{66 \text{ TNS}} \text{ OF LEVELING AT 2 INCH DEPTH.}$$

EMBANKMENT REDUCTION

STA. 104+50 - STA. 118+00

1350 LF

STA. 104+50 - STA. 111+25 + STA. 111+25 - STA. 118+00

$$\begin{aligned} A &= \frac{1}{2} b \cdot h \\ &= .5(23)(675) \\ &= 843.75 \text{ SF} \end{aligned}$$

$$\begin{aligned} A &= \frac{1}{2} (b)(h) \\ &= .5(23)(675) \\ &= 843.75 \text{ SF} \end{aligned}$$

$$A = \frac{1687.5 \text{ SF} \cdot 75' (\text{AVG WIDTH})}{27}$$

$$= \underline{4687.5 \text{ CY}} \text{ REDUCTION OF FILL}$$

G.A.B REDUCTION

STA. 100+00 - STA. 113+00

$$1300' \times 24' = 31,200 \text{ SF} / 9$$

$$= \underline{3466.67 \text{ SY}} \text{ REDUCTION}$$

$$3466.67(9) = 31200 \text{ SF} \times (10/12) (110 \text{ lb}/\text{CF}) / 2000$$

$$= 1430 \text{ TN}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: **C-2**

DESCRIPTION: **REDUCE THE RIGHT-OF-WAY MITRE AT STATION 145+00**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The right-of-way mitre impacts the existing structure to achieve the maximum amount of right-of-way to be acquired.

ALTERNATIVE: (Sketch attached)

Reduce the proposed mitre that may result in a displacement, thus reducing right-of-way project costs.

ADVANTAGES:

- Reduces overall right-of-way costs

DISADVANTAGES:

- None apparent

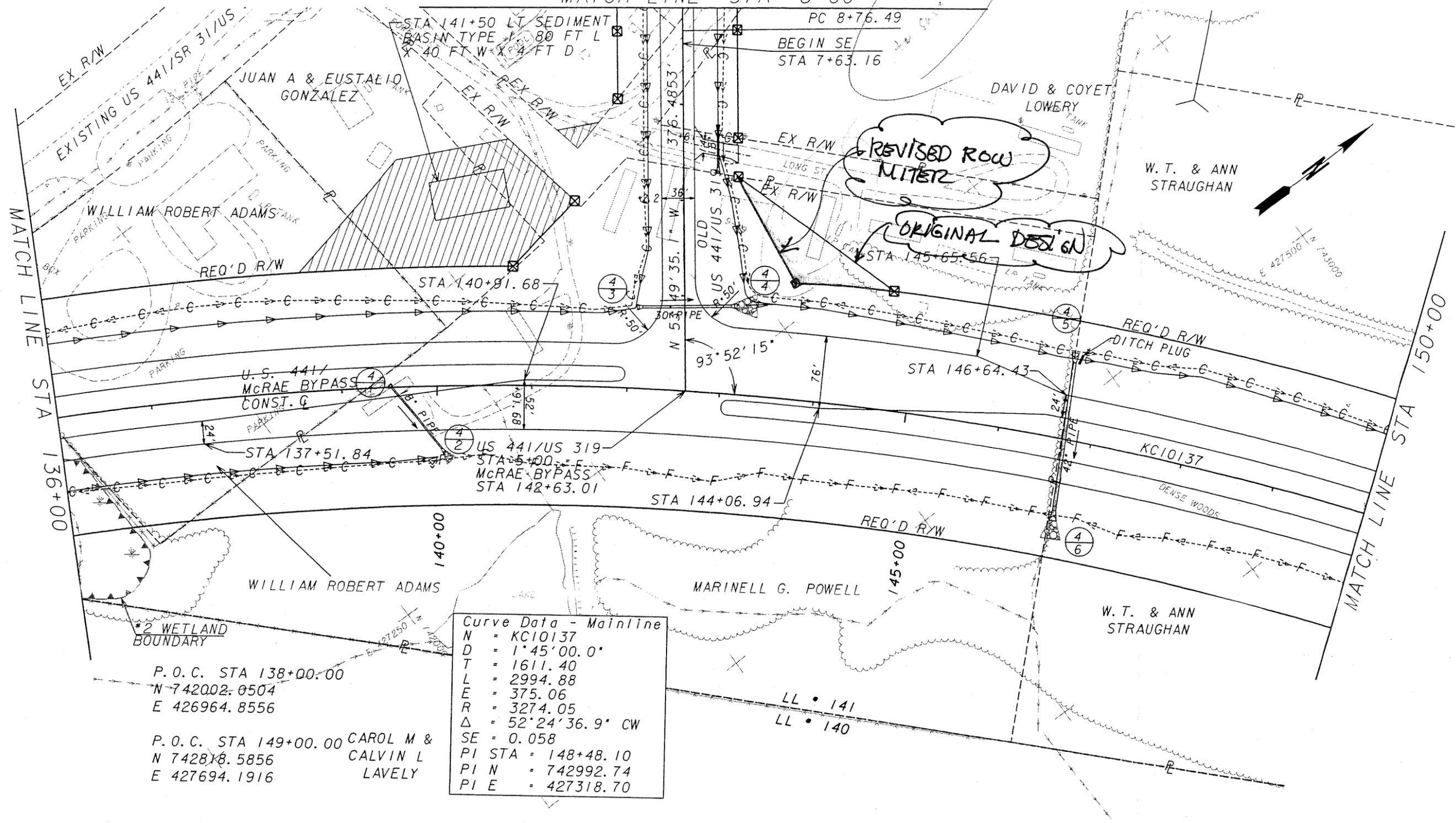
DISCUSSION:

Reducing the right-of-way at this location will save residences and the cost of relocating owners.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 882,400	—	\$ 882,400
ALTERNATIVE	\$ 861,399	—	\$ 861,399
SAVINGS (Original minus Alternative)	\$ 21,001	—	\$ 21,001

STATE	PROJECT NUMBER
GA.	EDS-441(12)TELFAIR

SEE DWG NO. 14-2
MATCH LINE STA 8+00



Curve Data - Mainline

N	=	KC10137
D	=	1°45'00.0"
T	=	1611.40
L	=	2994.88
E	=	375.06
R	=	3274.05
Δ	=	52°24'36.9" CW
SE	=	0.058
PI STA	=	148+48.10
PI N	=	742992.74
PI E	=	427318.70

P. O. C. STA 138+00.00
N 742002.0504
E 426964.8556

P. O. C. STA 149+00.00 CAROL M & CALVIN L LAVELY
N 742818.5856
E 427694.1916

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Athens, GA 30606
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Fax: (706) 548-4697

PROPERTY AND EXISTING R/W LINE	---
REQUIRED R/W LINE	---
CONSTRUCTION LIMITS	---
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	---G---F---
EASEMENT FOR CONSTR OF SLOPES	---G---
EASEMENT FOR CONSTR OF DRIVES	---G---



DATE	REVISIONS	DATE	REVISIONS

LAND DISTRICT 10TH LL NOS. 140, 141
--

GEORGIA
DEPARTMENT OF TRANSPORTATION
CONSTRUCTION PLAN
STA 136+00 TO STA 150+00
PROJ. EDS-441(12)TELFAIR
DATE _____ DWG NO. 13-4

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CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: C-2

SHEET NO.: 3 of 3

R.O.W REDUCTION STA. 143+00 - STA. 144+80 1/2 - LT

$$\begin{aligned} A &= 105'(.50) \cdot 128' \\ &= 6720 \text{ SF} / 43560 \text{ SF/AC} \\ &= \underline{0.154 \text{ AC}} \end{aligned}$$

$$\text{AC} = 0.154(6500) = \underline{\$1,001.00} \text{ R.O.W REDUCTION}$$

RELOCATION COST \$20,000 REDUCTION

TOTAL SAVINGS 21,001.00

VALUE ENGINEERING ALTERNATIVE



PROJECT:	McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20) <i>Georgia DOT</i>	ALTERNATIVE NO.:	C-6
DESCRIPTION:	REDUCE THE PROFILE GRADE ELEVATION NORTH OF THE HEART OF GEORGIA RAILROAD AND REDUCE THE AMOUNT OF FULL DEPTH RECONSTRUCTION AT THE NORTH END TIE-IN (STATION 382+00 TO 413+00)	SHEET NO.:	1 of 6

ORIGINAL DESIGN: (Sketch attached)

The original design indicates full depth reconstruction between Heart of Georgia Railroad to the end of the project. Reconstruction of pavement will begin at STA 413+00.

ALTERNATIVE: (Sketch attached)

Lower the PVI at STA 389+18.09 to help side road tie-ins and reduce embankment material to the end of the project. Reconstruction of pavement will begin at STA 397+00.

ADVANTAGES:

- Reduces construction costs and duration for in-place embankment
- Easier tie-ins with CR.132 and CR.133
- Reduces amount of pavement reconstruction
- Decreases impact to motorists during construction
- Less traffic control/easier stopping

DISADVANTAGES:

- None apparent

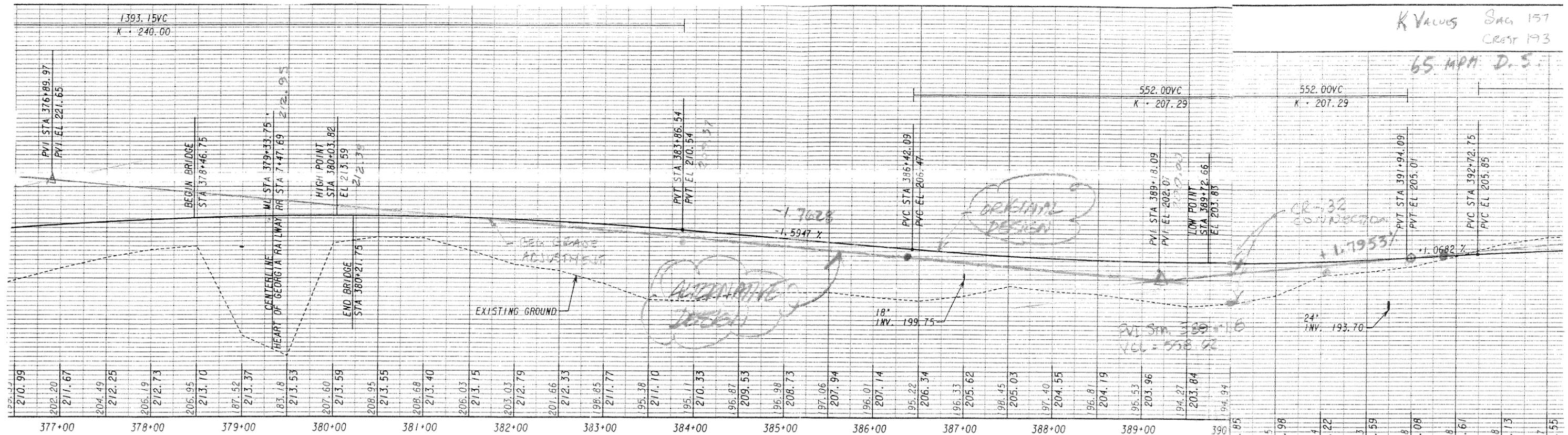
DISCUSSION:

This grade adjustment will reduce in-place embankment costs and allow easier tie-ins for C-132 and C-133 at the airport.

GDOT should verify the airway-highway clearance requirements at this location.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 206,312	—	\$ 206,312
ALTERNATIVE	\$ 34,320	—	\$ 34,320
SAVINGS (Original minus Alternative)	\$ 171,992	—	\$ 171,992

ALT C-6
SHT 2 of 6



K Values Sag 157
Crest 193
65 MPH D.S.

DATE	REVISIONS	DATE	REVISIONS

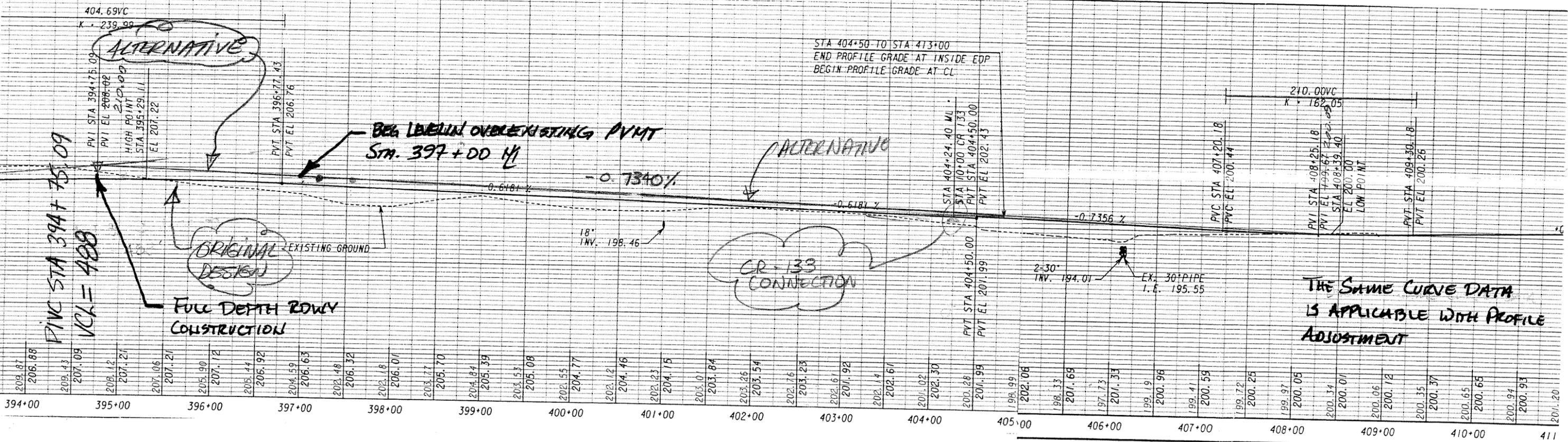
3ERE
T DELIVERY

SCALE
HOR: 1" = 50'
VER: 1" = 10'

GEORGIA
DEPARTMENT OF TRANSPORTATION
MAINLINE PROJECT
STA 360+00 TO STA 390+00
PROJ. EDS-441(13) TELFAIR/WHEELER
DATE _____ DWG NO. 15-4

L.Y.A

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	EDS-441(13) TELFAIR/WHEELER		



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Jonesboro, GA 30606
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Fax (706) 548-4697

SCALE
HOR: 1" = 50'
VER: 1" = 10'

37663-NWcRo0204\0GN-CA\CE\0GN\561470PR01.dgn

CALCULATIONS



PROJECT: **MCRAE BYPASS EDS-441 (12) & (13), BR-0001-00 (20)**
Georgia DOT

ALTERNATIVE NO.: C-6

GRADE REDUCTION FROM H.O.G. RR TO PROJECT END

SHEET NO.: 5 of 6

STA. 381+70 - STA. 390+50

IN PLACE EMBANKMENT REDUCTION

$$A = 880 \text{ LF} \cdot \left(\frac{242 + 169}{2} \right) \cdot 2' / 27 = \underline{13,396.00 \text{ CY}}$$

$$13,396.00 \cdot (.10) = 1339.60 + 13396.00$$

$$= \underline{14,735.60 \text{ CY}} \cdot 10.19$$

$$\text{TOTAL} = \underline{\underline{\$150,155.75}}$$

G. A. B REDUCTION

STA. 397+00 - STA. 415+00

$$A = 1800 \text{ LF} \times 24 \times .83 \div 27 = 1333.33 \text{ CY}$$

$$= 1333.33 \text{ CY} (0.10) = 133.33$$

$$+ 133.33$$

$$\text{TOTAL } 1466.66 \text{ CY} \times 27 \times 110 / 2000 = \underline{\underline{2178 \text{ TMS}}}$$

LEVELING NOT SHOWN IN PAY ITEMS FOR BID.

STA. 397+00 - 415+00

$$A = \frac{1800 \text{ LF} \times 24' \left(\frac{165 \text{ }^{100}}{34} \right)}{2000}$$

$$= 396 \text{ TMS} \times 0.05 = 19.8 \text{ TMS}$$

$$= \underline{19.8 \text{ TMS}}$$

$$\text{TOTAL } 416 \text{ TMS}$$

PROJECT DESCRIPTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. for the Georgia Department of Transportation (GDOT). The subject of the study was the McRae Bypass project being designed by O'Brien & Gere and associated firms. The project was at the 60% design phase at the time of the study.

The VE study was conducted May 21-24, 2007 at GDOT Headquarters in Atlanta using a multidisciplinary team comprised of design, structures and construction professionals. The team followed the six-phase VE Job Plan to guide its deliberations:

- Information Gathering
- Function Identification and Analysis
- Creative Idea Generation
- Evaluation of Creative Ideas
- Development of Alternatives
- Presentation of Results

South McRae Bypass

Project EDS-441(12) in Telfair County consists of construction of the South McRae Bypass beginning at US-441/US-319/SR-31 approximately 0.56 miles south of the SR-149 connector. The bypass goes onto a new location at the intersection of US-441/US-319/SR-31 and SR-149 and continues north and northeasterly to the intersection with US-341/US-23/SR-27 where the North McRae Bypass begins. The project length is approximately 3.36 miles. The proposed typical section consists of two 12-ft. lanes in each direction with a 44-ft. depressed-grassed median. The project includes new parallel bridges over Sugar Creek. Access is provided at the following roadways:

- CR-149
- CR-236 (W)
- CR-236 (E)
- US-341

CR-152 will realign and “teed” into CR-149 so that only one connection, CR-149, is made to US-441. The alignment of the bypass was recently moved north to avoid the Gopher Tortoise/Indigo Snake habitat north of the prison.

The South McRae Bypass current engineer’s estimate is \$18,338,492 for construction and \$767,000 for right-of-way.

North McRae Bypass

Project EDS-441(13) in Telfair and Wheeler Counties consists of construction of the North McRae Bypass beginning at US-341/US-23/SR-27 where the project ties to the South McRae Bypass. The

Bypass continues north for 2.8 miles before tying back to the existing US-441/US-319/SR-31 and US-280/SR-30. The proposed typical section consists of two 12-ft. lanes in each direction with a 44-ft. depressed-grassed median. The project includes new parallel bridges over Norfolk Southern Railroad, Little Ocmulgee River, US-280/SR-30, and US-441/US-280. The existing bridge over the CSX Railroad will be replaced under twin project BR-0001-00(220), and a new parallel bridge will be constructed under EDS-441(13). Spring Avenue will be provided a connection with the new US-441 approximately halfway through the North McRae Bypass. The intersection of the new US-441 and the existing US-280 roadways will be grade separated US-441 flying overhead. The connection between US-441/US-280 will be provided via a two-way ramp in the southeast quadrant. Near the north conform, CR-132 and CR-133 connections will be maintained.

The North McRae Bypass current engineer's estimate is \$31,382,186 for construction and \$4,350,000 for right of way.

VALUE ANALYSIS AND CONCLUSIONS

INTRODUCTION

This section describes the value analysis procedures used during the value engineering study on the McRae Bypass project.

A systematic approach was used in the VE study. The key steps taken were organized into three distinct parts: 1) pre-study preparation; 2) VE orientation/kick-off meeting and workshop; and 3) post-study reporting and implementation. A Task Flow Diagram, which outlines each of the procedures included in the VE study, is attached for reference.

In the sections following the value analysis procedures, separate narratives and supporting documentation identify the following:

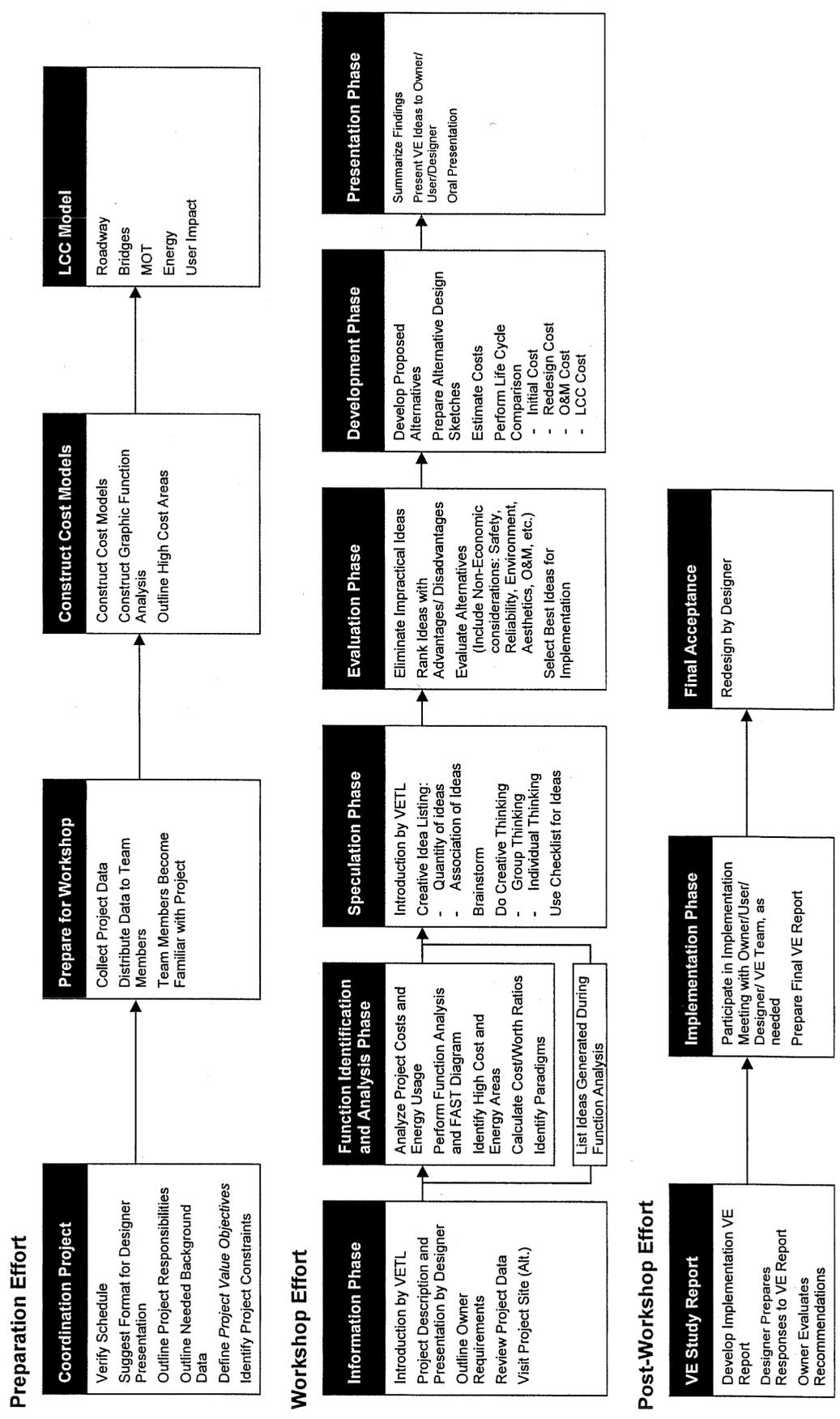
- Value Engineering Workshop Participants
- Economic Data used in the workshop
- Cost Model(s) developed for use in the workshop
- Function Analysis performed by the team
- Creative Ideas and Evaluation of the ideas performed by the team

PREPARATION EFFORT

A workshop format was used to conduct the study. Pre-study preparation for the workshop consisted of scheduling study participants and tasks and gathering necessary project documents to distribute to team members for review prior to attending the workshop. Throughout the study, the following documents were used as the basis for generating alternative approaches for achieving project functions and for determining the cost implications of the alternatives that have potential for enhancing the value of the project:

- Project plans, including cross-sections, for the North and South Bypass contracts, dated 1/10/2007, prepared by O'Brien & Gere
- "Traffic Capacity Analysis" (South & North Bypass), dated August 2004, prepared by Chasman & Associates, L.L.C.
- "Detail Estimate: Cost Estimate Report" (Engineer's Estimate), dated 2/8/2007, of unknown origin (from the GDOT database)
- Revised Project Concept Report- South McRae Bypass, dated February 25, 2004, prepared by GDOT
- Revised Project Concept Report- North McRae Bypass, dated February 25, 2004 prepared by GDOT
- "EDS-441(12) Telfair County South McRae Bypass Over Sugar Creek (P.I. No. 53110) Revised Hydraulic and Hydrology Study" dated March 8, 2007 prepared by GDOT.

Value Engineering Study Task Flow Diagram



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 are very important as they provide the VE team with insight as to how the project has progressed to its current state.

Project cost data provided by the designers was used by the VE team as the basis for a comparative analysis with other similar projects. To prepare for this exercise, the VE Team Leader used the cost estimate provided by GDOT to develop a cost model for the North and South McCrea Bypass projects. The models (described in the Cost Model section of this report) were used to distribute the total project cost among the various elements or functions comprising the project. The VE team used this data 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 effectively use its time and focus on reducing or eliminating the impact of those elements.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop effort consisted of a 4-day workshop beginning with an orientation/kick-off meeting May 21, 2007 and concluding with the final VE presentation on May 24, 2007. During the workshop, the VE Job Plan was followed in compliance with FHWA guidelines. The job plan guided the search for alternatives to mitigate or eliminate high cost drivers, support functions providing little or no value, and potential project risk elements. Alternatives to specifically address the owner's project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructibility, and providing missing or less than optimum functionality were also entertained. The Job Plan included six phases:

- Information Gathering Phase
- Function Identification and Analysis Phase
- Creative Idea Generation Phase
- Evaluation of Creative Ideas Phase
- Alternative Development Phase
- Presentation Phase

Information Gathering Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods had to be reviewed and understood. For this reason, GDOT and the design team sent information (described above) to the VE team prior to the study and, following a short orientation session, the workshop was kicked off with a presentation of the project to the team. The presentation highlighted the information provided in the written documentation and expanded on that information 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 clarifications of the information provided.

Function Identification and Analysis Phase

Having gained some information on the project, the VE team proceeded to further enhance its project knowledge by defining the functions provided, 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 determine if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. The elements performing support functions add cost to the final product, but have a relatively low worth to the basic function.

Function is defined as the “intended use” of a physical or process element. In the value analysis process, the team attempted to identify functions in the simplest manner using active verb/measurable noun word combinations. Sometimes modifying adjectives were used with the noun to clarify the definition. 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). The individual function(s) were identified for the major components of the project depicted on the cost model(s).

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 the 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 meet
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. Thus, the team works in future phases to reduce the impact of secondary functions and thus enhance project value.

To further clarify the impact of the various functions, the team analyzed the costs to provide the functions or group of functions provided by a specific project element using the cost estimate and cost model(s). Where possible, they seek to benchmark the costs for providing functions, i.e., finding the lowest cost, or worth, to perform the function, 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 were calculated. Cost/worth ratios greater than 1 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.

As well as looking at areas with high cost/worth ratios, the team used the cost model(s) to seek out the areas where most of the project funds are being applied. Because of the absolute magnitude of these high cost elements or functions, they too became initial targets for value enhancement.

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 Idea Generation 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, the VE team generated 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 constructibility 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. Creative Idea Listing worksheets were generated and organized by the function or project element being addressed.

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

Evaluation/Judgment Phase

Since the goal of the Creative Idea Generation phase was to conceive as many creative ideas as possible without regard for technical merit or applicability to respond to the project goals, this phase of the workshop focused on identifying those ideas that 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 evaluating the ideas originated during the Creative Idea Generation phase based on the owner's value objectives identified through conversations and questions during the designer's briefing.

Based on the team's understanding of GDOT'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 3, with 3 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project; 2 indicating an idea that provides moderate project value improvement; and 1 indicating an idea with a major technical flaw or does not respond to project requirements. Generally, ideas rated 3 and 2 are continued to be pursued in the next phase and presented to GDOT 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 VA process.

Development Phase

In this phase, each highly-rated idea was expanded into a workable solution designated as a value engineering alternative. The development consists 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 a 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 value engineering alternatives are included in the Study Results section.

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 last phase of the workshop was to summarize the results of the study and prepare draft Summary of Potential Cost Savings worksheets to hand out at the presentation and to present the key VE alternatives and design suggestions to GDOT and the design team. The purpose of the presentation 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. Draft copies of the Summary of Potential Cost Savings worksheets were given to facilitate a timely review and speedy implementation of the selected ideas.

POST-STUDY PROCEDURES

The post-study portion of the VE study consisted of the preparation of this Value Engineering Study Report. Personnel from GDOT and the 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 on us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, GDOT and the designer will meet and, by consensus, select those VE alternatives and design suggestions that provide good value to incorporate into the project.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the McRae Bypass Project. Team members consisted of a multidisciplinary group with professional planning, design and construction experience and a working knowledge of VE procedures. The VE team included the following:

<u>Participant</u>	<u>Specialization</u>	<u>Affiliation</u>
John Tiernan, PE	Structures	ARCADIS
Harley Griffin, PE	Highway Design/ Constructability	Delon Hampton & Associates
Geeta Bhatt, PE	Highway Design	HNTB
George Hunter, PE, PMP, CVS	VE Team Leader	Lewis & Zimmerman Associates

DESIGNER BRIEFING

An overview of the project was presented on May 21, 2007 by representatives from GDOT and the design team. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team “up-to-speed” regarding the overall project specifics. Additionally, the meeting afforded GDOT and design staff the opportunity to highlight in greater detail those areas of the project requiring additional or special attention.

VALUE ENGINEERING TEAM PRESENTATION

A presentation was conducted on May 24, 2007 at GDOT Headquarters to review VE alternatives with GDOT and representatives from the design team. Copies of the Summary of Potential Cost Savings and Value Engineering Alternatives and Design Suggestions were provided to the attendees. An attendance list for the meeting is attached.

VE STUDY SIGN-IN SHEET

Project No.: EDS-441(12)(13) & BR-0001-00(220) County: Telfair Wheeler PI No.: 531100, 561470 & 0001220 Date: 5/21-24/07

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
Lisa L. Myers	00244168	Engineering Services	404-651-7468	lisa.myers@dot.state.ga.us
Ron Wishon	00208180	ENGINEERING SERVICES	404-651-7470	ron.wishon@dot.state.ga.us
George Hunter		LZA	916-224-9812	ghunter@lza.com
Maureen Obrien			706-548-4881	obrienmk@obg.com
JAMES MAGNUS		DOT		
Brian Summers	00208175	RS		brian.summers@dot.state.ga.us
John P. Tierwan		ARCADIS	770-431-8666	john.tierwan@arcadis-us.com
Greta Bhatt		HNTB	404-946-5728	gbhatt@hntb.com
Karyn Matthews	00820668	OCD	404-656-5404	Karyn.Matthews@dot.state.ga.us
DAVID NORWOOD	00337661	OCD	404-463-3829	david.norwood@dot
Nabil Road		OT&D	404-633-8126	n.nabil@dot
Philip P. Alimia	00910548	OEL (env)	41699-4448	philip.alimia@dot
Jack Muirhead	00237324	Bridge Design	41656-5197	jack.muirhead@dot.state.ga.us
HARLEY G. GRIFFIN		DATA	4-524-8030	hgriffin@delonhampton.com

X = 5/24/2007 Attendance

COST MODEL

The attached 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 and provides the VE team with a focus for its work during the study.

For the South Bypass project, 19% of the construction items represent about 82% of the project costs. They are:

- Paving
- Sugar Creek Bridge
- Unclassified excavation

For the North Bypass project, 26% of the construction items represent about 80% of the project costs. They are:

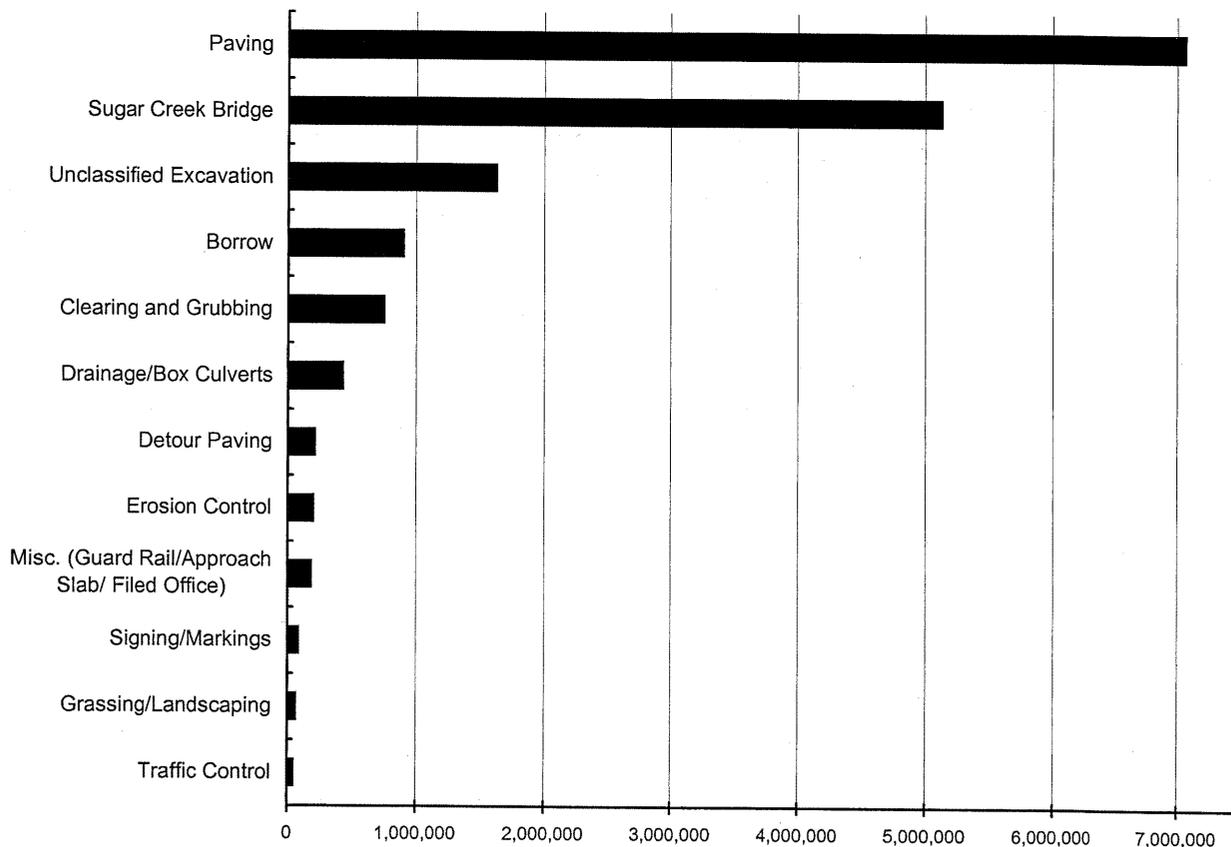
- Little Ocmulgee River Bridge
- Borrow
- Paving
- Norfolk-Southern Railroad Bridge

COST HISTOGRAM



PROJECT: South Bypass EDS-441 (12)

PROJECT ELEMENT	COST	PERCENT	CUM. PERCENT
Paving	7,063,796	42.37%	42.37%
Sugar Creek Bridge	5,130,000	30.77%	73.14%
Unclassified Excavation	1,629,463	9.77%	82.92%
Borrow	899,540	5.40%	88.31%
Clearing and Grubbing	750,000	4.50%	92.81%
Drainage/Box Culverts	421,338	2.53%	95.34%
Detour Paving	208,200	1.25%	96.59%
Erosion Control	198,000	1.19%	97.77%
Misc. (Guard Rail/Approach Slab/ Filed Office)	180,731	1.08%	98.86%
Signing/Markings	81,801	0.49%	99.35%
Grassing/Landscaping	63,483	0.38%	99.73%
Traffic Control	45,000	0.27%	100.00%
Subtotal	\$ 16,671,352	100.00%	
Escalation @ 10.00%	\$ 1,667,135		
SUB-TOTAL	\$ 18,338,487	Comp Mark-up: 10%	
Right of Way SUB-TOTAL	\$ 767,000		
	\$ 19,105,487		



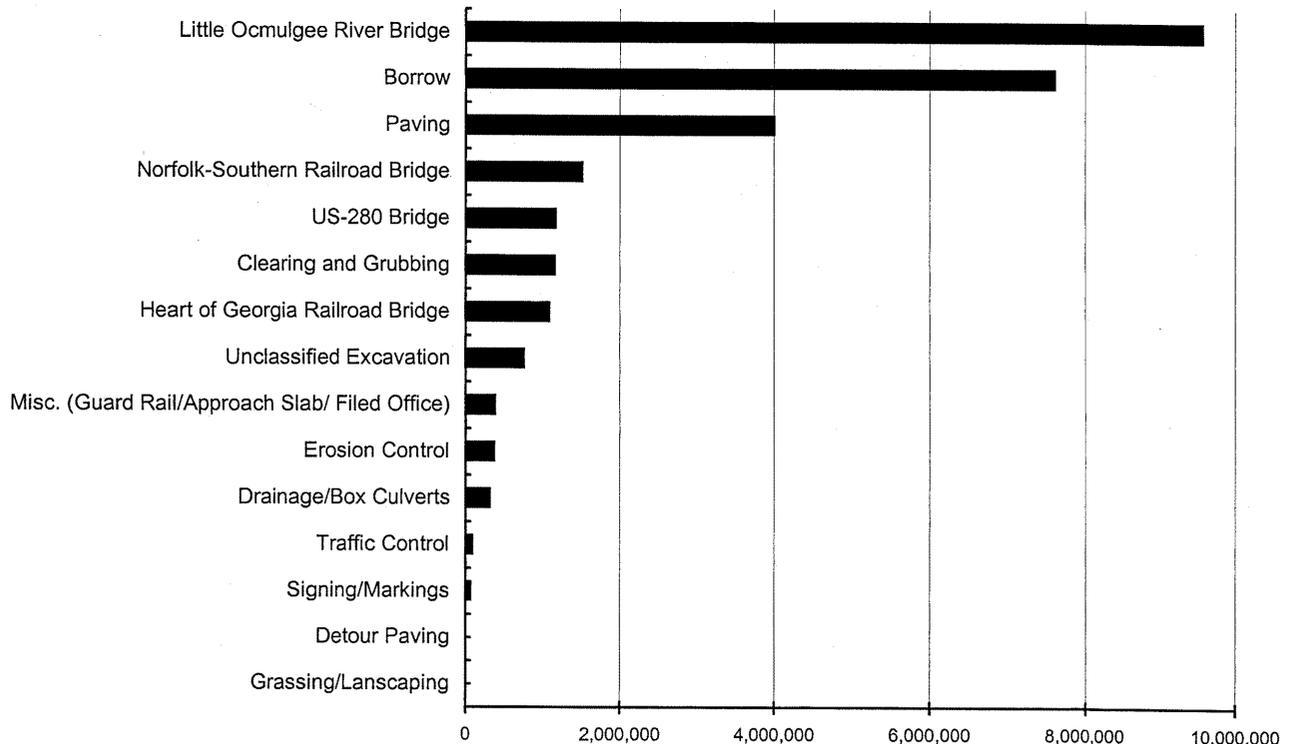
Costs in graph are not marked-up.

COST HISTOGRAM



PROJECT: North Bypass EDS-441 (13) and BR-0001-00 (20)

PROJECT ELEMENT	COST	PERCENT	CUM. PERCENT
Little Ocmulgee River Bridge	9,559,688	34.08%	34.08%
Borrow	7,602,212	27.10%	61.19%
Paving	4,004,212	14.28%	75.46%
Norfolk-Southern Railroad Bridge	1,509,750	5.38%	80.85%
US-280 Bridge	1,163,200	4.15%	84.99%
Clearing and Grubbing	1,150,000	4.10%	89.09%
Heart of Georgia Railroad Bridge	1,082,800	3.86%	92.95%
Unclassified Excavation	753,575	2.69%	95.64%
Misc. (Guard Rail/Approach Slab/ Filed Office)	382,930	1.37%	97.01%
Erosion Control	368,767	1.31%	98.32%
Drainage/Box Culverts	313,640	1.12%	99.44%
Traffic Control	90,000	0.32%	99.76%
Signing/Markings	67,375	0.24%	100.00%
Detour Paving	0	0.00%	100.00%
Grassing/Lanscaping	0	0.00%	100.00%
Subtotal	\$ 28,048,149	100.00%	
Escalation @ 10.00%	\$ 2,804,815		
SUB-TOTAL	\$ 30,852,964	Comp Mark-up:	10%
Right of Way SUB-TOTAL	\$ 4,350,000		
	\$ 35,202,964		



Costs in graph are not marked-up.

FUNCTION ANALYSIS

Function Analysis of the McRae Bypass project 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 worksheets completed by the team for the project in its entirety and the various elements follow.

The overall corridor objective is to increase the economic development for the region. In support of this objective, the McRae Bypass project must “Increase Traffic Capacity” and “Separate Highway/Town” as the basic functions of the project. In support of the basic functions, the required secondary functions include, “Connect US-441/Local Roads,” “Flyover Waterbodies” and “Separate Opposing Lanes,” “Add Lanes.” In the opinion of the VE team, all remaining functions are secondary in that they support the basic functions but the project did not necessarily have to carry them out to achieve the basic function. The secondary functions include: “Eliminate Railroad Crossing” and “Separate Highway/Railroad Grades.”

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the creative phase, numerous ideas were generated for the project using conventional brainstorming techniques as recorded on the following pages. For the convenience of tracking an idea through the VA process, the ideas were grouped into the following design disciplines or project elements and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the design disciplines and project elements:

Design Discipline or Project Element	Prefix	No. of Ideas Generated
Maintain Access	MA	16
Alignment	A	21
Typical Section	TS	10
Structures	S	3
Drainage	D	2
Constructability	C	7

Creative Idea Evaluation

The ideas were ranked on a qualitative scale of 1 to 3 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 responses of GDOT through questions posed at the designer briefing that identified the following as its top value objectives:

- Reduce project capital costs
- Protect the environment:
 - River habitat and wetlands
 - Endangered species habitat
- Improve the project's performance by concentrating on the following design elements:
 - Traffic level of service
 - Access control (quality of the access and number of points)
 - Safety of opposing traffic, i.e., the reason for the divided median
 - Safety at intersections of roadways and railroads with US-441 bypass

After discussing each idea, the team evaluated the ideas by consensus. This produced 19 ideas evaluated as 2 or 3 to carry forward and research and develop into formal value engineering alternatives and seven ideas to develop as design suggestions to be included in the Study Results section of the report. When this is not the case, an idea may have been combined with another related idea or discarded, as a result of the additional research that indicated the concept as not being cost-effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING



PROJECT: McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20) <i>Georgia DOT</i>	SHEET NO.: 1 of 4
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NO.	IDEA DESCRIPTION	RATING
MAINTAIN ACCESS (MA)		
MA-1	Cul-de-Sac CR-152/CR-149 and tie back to CR-236 (E)	1
MA-2	Line-up CR-149/CR-152 and Business-441	D.S.
MA-3	Cul-de-Sac CR-236 (W)	1
MA-4	Keep Route 236 as frontage road (pull mainline (M/L) alignment east) → One access point	D.S.
MA-5	Eliminate access to prison via US-441; access via US-341	1
MA-6	Eliminate US-441/prison access, provide via CR-236	1
MA-7	Cul-de-Sac Business-441/rely on US-341 as access point to town	1
MA-8	Cul-de-Sac Spring Avenue	1
MA-9	Combine US-280 and Heart of Georgia grade separate, relocate US-280 north	1
MA-10	Place "Oblong" 280 ramp on the north side (in lieu of south side)	1
MA-11	Impinge on wetlands: place ramp at southwest quad	1
MA-12	Line-up park entrance/CR-133 and use standard driveway design	D.S.
MA-13	Cul-de-Sac CR-132, connect CR-132 into CR-133, maintain only CR-133 connection	1
MA-14	At-grade railroad intersection at Norfolk/Southern Railroad	1
MA-15	At-grade railroad – intersection at Heart of Georgia Railroad	1
MA-16	Delay this project	1
ALIGNMENT (A)		
A-1	Move M/L 2,200 ft.± at US-341 location	D.S.
A-2	Move M/L east to cross narrow part of Little Ocmulgee River	D.S.
A-3	Build 2-lane facility/defer 4-lane divided	3
A-4	Realign M/L at south end to follow Willow Creek Lane – tie back to current alignment near Spring Avenue	D.S.
A-5	Move M/L east at Spring Avenue – reduce embankment	1
<i>Profile Modifications</i>		
A-6	Lower profile from PVI STA 119+85 to PVI STA 147+82 to PVI STA 187+65	1

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	

CREATIVE IDEA LISTING



PROJECT:	McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20) <i>Georgia DOT</i>	SHEET NO.:	2 of 4
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NO.	IDEA DESCRIPTION	RATING
ALIGNMENT (A) (Continued)		
	<i>Profile Modifications</i>	
A-7	Lower profile at Sugar Creek Bridge (need H ₂ O levels and span arrangements)	2
A-8	Lower profile at Norfolk/Southern Railroad bridge approximately nine ft.	3 (Combine with A-12 and C-5)
A-9	Lower profile PVI STA 300+88 to PVI STA 316+00 to PVI STA 331+00 to generate spoils and reduce borrow and review culverts	2
A-10	Lower profile at Little Ocmulgee River Bridge	2
A-11	Lower profile at US-280 and Heart of Georgia Railroad	1
A-12	Norfolk/Southern Railroad location – lower profile 9 ft. from STA 275+00 to STA 300+00 – will bring flatter downgrade	3
A-13	To keep minimum 2 ft. above 50-year flood level – lower profile from STA 345+00 (0 ft.) to STA 362+00 (6 ft.)	2
A-14	Lowering profile at STA 362+00 will continue until next PVI STA 366+00 to keep bridge over US-280	2
A-15	From STA 362+00 continue lower profile to eliminate bridging over US-280 – (at-grade US-280 intersection)	2
A-16	Eliminate bridging over Heart of Georgia Railroad along with Alt. No. A-15	1
A-17	Lower ±12 ft. at US-280 to +20 ft. at railroad – overall lower profile from US-280 to end of project CR-133	1
A-18	Alt. No. A-15 will eliminate ramp at US-280 - reduction of construction and tie-in costs with existing ramp at US-280	2
A-19	Profile from STA 300+00 to STA 309+00 – adjust grades to shift low point near culvert at STA 311+00	2
A-20	Bring grades up by ± 7 ft. from STA 311 to STA 321+00 to reduce cut	1
A-21	Lower PVI STA 331+00	2
TYPICAL SECTION (TS)		
TS-1	Two-lane in lieu of four-lane (divided)	1
TS-2	Defer 4-lane highway, build now only a two-lane (undivided) and retain right-of-way	3

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
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CREATIVE IDEA LISTING



PROJECT: McRAE BYPASS EDS-411 (12) AND (13), BR-0001-00 (20) <i>Georgia DOT</i>	SHEET NO.: 3 of 4
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NO.	IDEA DESCRIPTION	RATING
TYPICAL SECTION (TS) (Continued)		
TS-3	11-foot lanes M/L (low volumes)	2
TS-4	3.6M lanes	1
TS-5	Narrow (20 ft.) median/leave right-of-way width at 250 ft.	3
TS-6	Four-lane undivided/buy right-of-way for future six-lane divided	1
TS-7	Two-lane with T.W.L.T.L.	1
TS-8	11-ft. lanes at crossroads	2
TS-9	4-ft. crossroad shoulders	2
TS-10	Use 4.1 slopes in median everywhere possible	2
STRUCTURES (S)		
S-1	Use 68 ft. and 69 ft. spans in lieu of longer spans on Little Ocmulgee River Bridge (pile bents)	2
S-2	Relocate pipe at STA 346+50 to avoid bridge end bent	D.S.
S-3	Use pile bents for bents 2, 3, and 4 at Little Ocmulgee River Bridge	2
S-4	Use shorter spans for the Sugar Creek Bridge, also use pile intermediate bents	2
DRAINAGE (D)		
D-1	Omit pipe 7/4 \longrightarrow 7/3	D.S.
D-2	Drainage culvert and #3, use existing pipe to median	D.S.
CONSTRUCTION (C)		
<i>EDS-441 (12)</i>		
C-1	Consider lowering grade between STA 103+50 to STA 109+00 M/L to use existing pavement for staging and finishing grade construction	2
C-2	Reduce right-of-way mitre on old US-441/US-319 LT. STA 143+20 to STA 144+70 LT; There is enough room to construct the back slope; save trailer	2

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
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