



Windsor Spring Road Widening

Richmond County

Phase IV: CR 65/Windsor Spring Road from Willis Foreman to Tobacco Road
P.I. No. 250610, 250615/STP-7007(6), BRSLB-7007(7)

Phase V: CR 65/Windsor Spring Road from State Route 88 to Willis Foreman
P.I numbers: 245320, 245325/STP-1105(4), BHLB-1105(5)

Value Engineering Study Report

Preliminary Field Plan Review

October 2007

Design Consultant



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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October 25, 2007

Ms. Lisa L. Myers
Design Review Engineering Manager
State of Georgia Department of Transportation
No. 2 Capital Square, Room 266
Atlanta, Georgia 30334-1002

re: Phase IV: CR 65/Windsor Spring Road from Willis Foreman to Tobacco Road
P.I. No. 250610, 250615/STP-7007(6), BRSLB-7007(7)
Phase V: CR 65/Windsor Spring Road from State Route 88 to Willis Foreman
P.I numbers: 245320, 245325/STP-1105(4), BHLB-1105(5)
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Dear Ms. Myers:

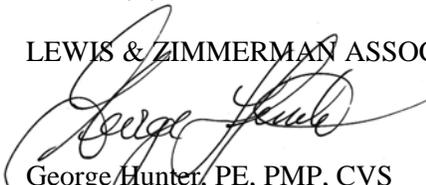
Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced value engineering study report. The VE team developed numerous alternatives and design suggestions that recommend improvements to the typical section, bridges, geometry and contract packaging categories.

The VE alternatives have the potential to generate \$6.5 million in capital savings for this project. Three alternatives requiring \$.3 million increase in additional capital investment could be implemented to improve the crossroad, driveway connections and intersections.

We appreciate the excellent participation of GDOT staff and Jordan, Jones & Goulding design team members throughout the study. Please call us if you have any questions as you review this report and determine implementation.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



George Hunter, PE, PMP, CVS
Vice President

Attachments

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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., (LZA) for the Georgia Department of Transportation (GDOT). The subject of the study was the Windsor Spring Road Widening from State Route 88 to Willis Foreman and Willis Foreman to Tobacco Road (Phases IV & V) (P.I Nos.: 245320, 245325 and 250610, 250615). The project is being designed by Jordan, Jones & Goulding and associated firms. Both phases are at the Preliminary Field Plan Review (PFPR) Phase, with right-of-way identified but not completed.

The VE Workshop was conducted October 9-12, 2007 in the Atlanta offices of GDOT using a multidisciplinary team comprised of highway design, structures and construction professionals. The team followed the six-phase VE Job Plan to guide its deliberations:

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

PROJECT DESCRIPTION

This project converts a two-lane conventional highway to a divided four-lane facility with a 20-ft. raised median serving the southwest community of Augusta, Richmond County. The purpose is to address existing deficiencies and to improve the existing north-south connectivity between the City of Hephzibah and the commercial and industrial resources of the greater Augusta area.

The need for these improvements is supported by high crash rates, projected poor levels of service due to the increasing traffic demand, unsatisfactory bike and pedestrian accommodations, and projected expectations associated with the proposed ARTS Pedestrian and Bicycle plan. The crash rate for this section of Windsor Spring Road is two to three times higher than the statewide average for this type of facility. With no improvements, the projected LOS for the 2025 design year is F.

The southern terminus of the project (and Phase V) begins at SR 88 and the northern terminus (and Phase V) ends at Tobacco Road. The intermediate limit between Phases IV and V lies at a point south of Willis Foreman Road, where Phase IV, 3.22 miles in length, costs \$43.4 million, broken down as \$17.8 million for construction, \$13.6 million for right-of-way and \$1.7 million for reimbursable utilities. Phase V, 2.09 miles in length, costs \$43.4 million, broken down as \$17.8 million for construction, \$12.9 million for right-of-way and \$1.1 million for reimbursable utilities. The total project (Phases IV and V) requires a \$75.1 million capital investment.

The Phase V contract is scheduled to advertise first, followed by Phase IV. The proposed award date (letting) is Feb 2010 for Phase V and July 2010 for Phase IV. The bridge projects will be let along with their respective road projects. No construction schedules have yet been identified.

The environmental document is an EA/FONSI, with the FONSI signed by the FHWA on September 5, 2007.

CONCERNS AND OBJECTIVES

Key project issues and objectives include:

- The mainline passes through a dense development between SR 88 and Railroad Avenue (Phase V) and from Willis Foreman Road to Tobacco Road (Phase IV).
- A key access point is the Creekside Road because it feeds two schools – an elementary and a middle school.
- The mainline and the reconstructed bridge over the Norfolk – Southern Railroad is constrained by the vertical and horizontal clearance, drainage and construction window requirements.
- Spirit Creek Bridge is being raised to accommodate the current flood stage requirements.
- The tie-in of Ebenezer Drive (north) is very close to the Norfolk-Southern Railroad bridge abutment and railing. It may pose a safety hazard from an intersection sight distance.
- The widening from two lanes to four lanes (with a 20-ft. raised median) is not all symmetrical, particularly between Willis Foreman Road to Plantation Road and from Diamond Lakes Road to Patrick Avenue where the roadbed is being widened to the left (west).
- There is one curve correction within the vicinity of Spirit Creek on a new location alignment that is not necessary from a 45 mph design speed requirement.
- On Phase IV three cross roads intersections are being modified to line up on opposite ends of the mainline: Diamond Lakes/Turkey Trail Road, South Fieldcrest Drive/Patrick Avenue and Inverness Drive/Boykin Road.
- A new eastside extension along Spirit Creek Road is being proposed from Windsor Spring Road to Kingsgate Drive that will require the displacement of 15 properties.
- Between Lincolnton Parkway to Tobacco Road, and between SR 88 to Railroad Avenue, there are numerous closely-spaced driveways. It appears that the right-turn lanes are being used to provide a speed change lane.

The objective of the VE study was to identify opportunities to reduce cost and improve the level of service in the corridor.

RESULTS

The VE team explored more than 30 ideas that could enhance the value of the project and address the project issues identified. Evaluation and research of the ideas yielded 19 technically feasible alternatives with definable cost implications and five design suggestions that would 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 VE Alternatives table. Note that the alternatives were developed independently of each other. Thus, the total potential cost savings achievable is dependent upon the combination of alternatives selected for implementation.

Some of the key alternatives and design suggestions that address the key issues are highlight below.

Typical Section (TS)

Nine alternatives and one design suggestion deal with the typical sections.

Alternative Numbers (Alt. Nos.) TS-1, TS-2, TS-3 and TS-4 are modifications to the current design's treatment of the 5-ft. sidewalk (within the urban shoulder) and the 4-ft. bike lane (within the paved roadbed). The key one, in the opinion of the VE team, is Alt. No. TS-4 which provides an 8-ft. multi-use trail on both sides of the roadway in lieu of the separate sidewalks and bike lanes. By doing so, bicyclists would be removed from the roadway and savings could be generated, especially in right-of-way and pavement.

Alt. Nos. TS-5 and TS-9 revisit the features of the current design's urban shoulder as follows:

- Alt. No. TS-5 reduces the green space between the sidewalk and the top of the curb from 6 ft. to 2 ft. for a 12-ft. total urban shoulder. The 16-ft. urban shoulder is a recent policy that should be reviewed in light of the expensive right-of-way required on this project.
- Alt. No. TS-9 recommends that a rural section be employed where Windsor Spring Road traverses through undeveloped areas, i.e., between Carroll Drive to the northern project limits of Phase V.

Alt. No. TS-11 suggests that the designer review the drainage system with a single storm drain line on one side of the roadbed with catch basins with laterals on the opposite side.

A cost estimate error in the current estimate's sidewalk concrete quantities indicates the cost estimate is approximately \$1.8 million too low.

Bridges (B)

Two alternatives and one design suggestion were developed in this category. Alt. No. B-1 suggests that the two outer spans of the current three-span configuration for the bridge over the Norfolk Southern Railway be replaced with MSE walls. Alt. No. B-2 lowers the profile grade line to the minimum freeboard requirements at the bridge over Spirit Creek.

Geometry (G)

Eight alternatives and two design suggestions were developed in this category. The following summarizes the key alternatives:

- Alt. No. G-1 suggests flattening the curve of the new location in the vicinity of Spirit Creek/Plantation Road connection for a \$150,000 savings in right-of-way. If the new location

- curve is kept per the current design, then Alt. No. G-10 recommends using the abandoned mainline as a frontage road and the number of driveway connections to Windsor Spring Road.
- Alt. No. G-2 modifies the mainline alignment in the vicinity of Turkey Trail Road so that the northbound right-turn lane is placed at the existing edge of the pavement, thereby reducing six property relocations to two property relocations.
 - Alt. No. G-3 provides a 90° skew angle at the Diamond Lakes Way and Turkey Trail Road intersection in lieu of the current design's 79°.
 - Alt. No. G-6 eliminates the Ebenezer Drive (north and south) connections to Windsor Spring by building a new roadway connection between Railroad Avenue and Ebenezer Drive (south).
 - Alt. No. G-7 recommends that the Spirit Creek Road extension be removed from the project scope or, alternatively, Alt. No. G-14 suggests that if this extension is retained, the Travis Road connection to Windsor Springs Road be removed. The VE team was concerned with the project delay risk associated with the Spirit Creek Road extension, especially its impact on the currently approved environmental document.
 - Alt. No. G-9 removes three driveways along the northbound right-turn lane at Tobacco Road by providing an access road to those properties.
 - Alt. No. G-11 recommends that the designer review the current design's profile grade line placed to accommodate pavement overlays over the existing roadbed. It should be noted that only where there is symmetrical widening and a 20-ft. median, no overlays are possible.
 - Alt. No. G-14 recommends that the signal warrants at Plantation Road and Boykin Road be investigated per the suggestion of the GDOT area engineer.

Contract Packaging and Staging (CPS)

Alt. No. CPS-1 suggests that GDOT let the Phase IV and Phase V construction contracts as a single contract, and Alt. No. CPS-2 recommends that if the Springs Creek Road extension is pursued, that it be segregated into a separate project and environmental document.

The following Summary of VE Alternatives indicates a cost savings potential of \$6.5 million, while three alternatives propose approximately \$.3 million in cost increases to improve the design, for a net project cost impact potential of \$6.2 million.

ALT. NO.	DESCRIPTION	INITIAL COST SAVINGS
TS-4	Construct multi-use trails in lieu of bike lanes and sidewalks on both sides of the road.	\$2,171,621
TS-6	Use 11-ft. travel lanes in lieu of 12-ft. travel lanes.	\$864,238
TS-7	Reduce median width on Winsdor Spring Road to 18 ft.	\$147,180
TS-8	Use 8 in. x 24 in. Type 2 curb and gutter in lieu of 8 in. x 30 in Type 2 curb and gutter.	\$286,010
B-1	Omit end spans on the bridge over the Norfolk Southern Railway and replace with MSE walls.	\$434,134
B-2	Lower profile grade line at the Spirit Creek Bridge by 2 ft.±.	\$87,100
G-1	Flatten mainline curve correction in the vicinity of Spirit Creek.	\$149,575
G-2	Reduce mainline curve and widen to the left in the vicinity of Turkey Trail Road.	\$408,000
G-7	Eliminate Spirit Creek Road extension.	\$1,995,303
Potential Costs Saving available from VE alternatives:		\$6,543,161
G-3	Realign Diamond Lakes Way and Turkey Trail Road to improve the skew angle of intersection to 90°.	(\$39,450)
G-6	Connect Ebenezer Dr. (north and south) to Railroad Avenue and eliminate the Windsor Spring Road to Ebenezer Drive (north and south) connections.	(\$20,830)
G-9	Consider alternatives to driveway access to Winsdor Spring Road near Tobacco Road.	(\$197,119)
Value-added costs increases in VE alternatives:		(\$257,399)

Note: The Potential Cost Savings indicated above takes into account the interrelations of the alternatives.



SUMMARY OF VE ALTERNATIVES

(Submitted as Draft Summary of Potential Cost Savings at VE Presentation)

PROJECT: WINDSOR SPRING ROAD WIDENING <i>Fulton County, Georgia</i>		PRESENT WORTH OF COST SAVINGS				
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
TYPICAL SECTION (TS)						
TS-1	Eliminate sidewalk on both sides of roadway in undeveloped areas	\$ 2,056,032	\$ 1,501,698	\$ 554,334		\$ 554,334
TS-2	Eliminate bike lanes on both sides of roadway	\$ 9,764,399	\$ 8,139,244	\$ 1,625,155		\$ 1,625,155
TS-3	Construct multi-use trail on the left side of road and sidewalk on the right	\$ 11,820,448	\$ 9,922,052	\$ 1,898,396		\$ 1,898,396
TS-4	Construct multi-use trails in lieu of bike lanes and sidewalks on both sides of the road	\$ 11,820,448	\$ 9,648,827	\$ 2,171,621		\$ 2,171,621
TS-5	Reduce the 16-ft. urban shoulder to a 12-ft. urban shoulder	\$ 885,233	\$ -	\$ 885,233		\$ 885,233
TS-6	Use 11-ft. travel lanes in lieu of 12-ft. travel lanes	\$ 864,238	\$ -	\$ 864,238		\$ 864,238
TS-7	Reduce median width on Windsor Spring Road to 18 ft.	\$ 147,180	\$ -	\$ 147,180		\$ 147,180
TS-8	Use 8 in. x 24 in. Type 2 curb and gutter instead of 8 in. x 30 in. Type 2 curb and gutter	\$ 1,160,446	\$ 874,436	\$ 286,010		\$ 286,010
TS-9	Use rural shoulders from STA 154+60 to STA 214+10	\$ 1,167,580	\$ 388,270	\$ 779,310		\$ 779,310
TS-11	Modify drainage to a single longitudinal storm drain with laterals				Design Suggestion	
BRIDGES (B)						
B-1	Omit end spans on the bridge over the Norfolk Southern Railroad and replace with MSE Walls	\$ 1,894,376	\$ 1,460,242	\$ 434,134		\$ 434,134
B-2	Lower profile grade line at the Spirit Creek Bridge by 2 ft. ±	\$ 87,100	\$ -	\$ 87,100		\$ 87,100
B-3	Eliminate 90° corners on slope paving at the bridge over Norfolk Southern Railway				Design Suggestion	
GEOMETRY (G)						
G-1	Flatten mainline curve correction in the vicinity of Spirit Creek	\$ 149,575	\$ -	\$ 149,575		\$ 149,575
G-2	Reduce mainline curve and widen to the left in the vicinity of Turkey Trail Road	\$ 408,000	\$ -	\$ 408,000		\$ 408,000
G-3	Provide a 90° skew angle at the Diamond Lakes Way and Turkey Trail Road intersection	\$ -	\$ 39,450	\$ (39,450)		\$ (39,450)
G-6	Connect Ebenezer Drive (north and south) to Railroad Avenue and eliminate the Windsor Spring Road to Ebenezer Road (north and south) connections	\$ 51,850	\$ 72,680	\$ (20,830)		\$ (20,830)

STUDY RESULTS

INTRODUCTION

The results are the major feature of this value engineering study conducted on the Windsor Spring Road project since they portray the benefits that can be realized by GDOT and the designers. 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 study, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that comprise the project. These are in the form of VE alternatives (accompanied by cost estimates) or design suggestions (without cost estimates). For each alternative developed, the following information is provided:

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

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means company, or team member or owner databases, were consulted. 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 that no cost information is usually included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved facility operation, ease of maintenance, ease of construction, safer working conditions, reduction in project risk, etc. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 19 alternatives and five design suggestions for consideration.

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 VE Alternatives table. The Alt. No. includes a prefix that refers to a major project design category listed below:

Design Category	Prefix	No. of Ideas
Typical Section	TS	11
Bridges	B	3
Geometry	G	14
Contract Packaging/ Staging	CPS	2
Pavement	P	1
Spelling	S	2
	Subtotal:	33

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

The VE team explored more than 30 ideas that could enhance the value of the project and address the project issues identified. Evaluation and research of the ideas yielded 19 technically feasible alternatives with definable cost implications and five design suggestions that would improve the project in areas other than cost such as operations, safety, constructability, reliability, etc., or produce non-quantifiable cost reductions.

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- Alt. No. G-3 provides a 90° skew angle at the Diamond Lakes Way and Turkey Trail Road intersection in lieu of the current design's 79°.
- Alt. No. G-6 eliminates the Ebenezer Drive (north and south) connections to Windsor Spring by building a new roadway connection between Railroad Avenue and Ebenezer Drive (south).
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Potential Costs Saving available from VE alternatives:		\$6,543,161
G-3	Realign Diamond Lakes Way and Turkey Trail Road to improve the skew angle of intersection to 90°.	(\$39,450)
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Value-added costs increases in VE alternatives:		(\$257,399)

Note: The Potential Cost Savings indicated above takes into account the interrelations of the alternatives.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

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

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

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



SUMMARY OF VE ALTERNATIVES

(Submitted as Draft Summary of Potential Cost Savings at VE Presentation)

PROJECT: WINDSOR SPRING ROAD WIDENING <i>Fulton County, Georgia</i>		PRESENT WORTH OF COST SAVINGS				
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TS-2	Eliminate bike lanes on both sides of roadway	\$ 9,764,399	\$ 8,139,244	\$ 1,625,155		\$ 1,625,155
TS-3	Construct multi-use trail on the left side of road and sidewalk on the right	\$ 11,820,448	\$ 9,922,052	\$ 1,898,396		\$ 1,898,396
TS-4	Construct multi-use trails in lieu of bike lanes and sidewalks on both sides of the road	\$ 11,820,448	\$ 9,648,827	\$ 2,171,621		\$ 2,171,621
TS-5	Reduce the 16-ft. urban shoulder to a 12-ft. urban shoulder	\$ 885,233	\$ -	\$ 885,233		\$ 885,233
TS-6	Use 11-ft. travel lanes in lieu of 12-ft. travel lanes	\$ 864,238	\$ -	\$ 864,238		\$ 864,238
TS-7	Reduce median width on Windsor Spring Road to 18 ft.	\$ 147,180	\$ -	\$ 147,180		\$ 147,180
TS-8	Use 8 in. x 24 in. Type 2 curb and gutter instead of 8 in. x 30 in. Type 2 curb and gutter	\$ 1,160,446	\$ 874,436	\$ 286,010		\$ 286,010
TS-9	Use rural shoulders from STA 154+60 to STA 214+10	\$ 1,167,580	\$ 388,270	\$ 779,310		\$ 779,310
TS-11	Modify drainage to a single longitudinal storm drain with laterals				Design Suggestion	
BRIDGES (B)						
B-1	Omit end spans on the bridge over the Norfolk Southern Railroad and replace with MSE Walls	\$ 1,894,376	\$ 1,460,242	\$ 434,134		\$ 434,134
B-2	Lower profile grade line at the Spirit Creek Bridge by 2 ft. ±	\$ 87,100	\$ -	\$ 87,100		\$ 87,100
B-3	Eliminate 90° corners on slope paving at the bridge over Norfolk Southern Railway				Design Suggestion	
GEOMETRY (G)						
G-1	Flatten mainline curve correction in the vicinity of Spirit Creek	\$ 149,575	\$ -	\$ 149,575		\$ 149,575
G-2	Reduce mainline curve and widen to the left in the vicinity of Turkey Trail Road	\$ 408,000	\$ -	\$ 408,000		\$ 408,000
G-3	Provide a 90° skew angle at the Diamond Lakes Way and Turkey Trail Road intersection	\$ -	\$ 39,450	\$ (39,450)		\$ (39,450)
G-6	Connect Ebenezer Drive (north and south) to Railroad Avenue and eliminate the Windsor Spring Road to Ebenezer Road (north and south) connections	\$ 51,850	\$ 72,680	\$ (20,830)		\$ (20,830)

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-1**

DESCRIPTION: **ELIMINATE SIDEWALK ON BOTH SIDES OF ROADWAY
 IN DEVELOPMENT AREAS**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The original design includes sidewalks on both sides of the alignment, down the improved sections of side roads, and along the improved sections of Tobacco Road.

ALTERNATIVE:

Construct the sidewalk only from the beginning of the project to Railroad Avenue (STA 105+22 to 134+80) and from Willis Foreman Road to the end of the project.

ADVANTAGES:

- Reduces cost
- Constructs sidewalks only in areas where significant developments exist
- Reduces construction schedule
- 16-ft. shoulders will allow for construction of sidewalks in the future by developers

DISADVANTAGES:

- Eliminates continuity of sidewalks throughout the project

DISCUSSION:

It should be noted that the quantities for sidewalks on this project are in error. The estimate shows 3,751 SY, however, with 5.31 miles of project length, the estimate should be closer to 31,152 SY.*

This alternative constructs sidewalks only in areas where it appears that they will be used consistently under current land usage. The city, county or developers could construct sidewalks later within the existing right-of-way, as development occurs.

* The error in quantities translates into a cost estimate error of \$1.8 million (with mark-ups).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,056,032	—	\$ 2,056,032
ALTERNATIVE	\$ 1,501,698	—	\$ 1,501,698
SAVINGS (Original minus Alternative)	\$ 554,334	—	\$ 554,334

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: TS-1

Georgia Department of Transportation

SHEET NO.:

2 of 3

Length of Sidewalk for Alternative:

2 • 105+22 to 133+20 (Mainline)	:	5596 ft
133+20 to 134+60 (Rt) (Mainline)	:	140 ft
160 ft down Railroad (East)	:	160 ft
100 ft down " (West)	:	100 ft
1502+00 to 1512+40 (Lt, Willis Foreman)	:	1040 ft
1515+00 to 1524+00 (Lt, Willis Foreman)	:	900 ft
2 • 237+00 to 272+00 (Mainline)	:	7,000 ft
2 • 273+70 to 380+50 (Mainline)	:	21,360 ft
2 • 1601+00 to 1605+51 (Creekside Ct)	:	902 ft
2 • 1806+00 to 1801+71 (Diamond Lakes)	:	858 ft
2 • 2500+00 to 2504+50 (Spirit Creek)	:	900 ft
2 • 2791+00 to 2714+00 (Tobacco Rd - East)	:	1000 ft
2 • 2701+00 to 2706+00 (Tobacco Rd - West)	:	1000 ft
		<u>40,956 ft</u>

$$\text{Area of Sidewalk} = 40,956 \text{ ft} \cdot 5 \text{ ft} \cdot \frac{1 \text{ SY}}{9 \text{ ft}^2}$$

$$= 22,753 \text{ SY}$$

Original Sidewalk Quantity:

$$2451 \text{ SY} + 1300 \text{ SY} = 3,751 \text{ SY}$$

$$3751 \text{ SY} \cdot \frac{9 \text{ ft}^2}{1 \text{ SY}} = 33,759 \text{ ft}^2$$

$$\text{Project Length} = 5.31 \text{ mi}$$

$$= 28,037 \text{ ft}$$

$$\text{Area} = 33,759 \text{ ft}^2$$

$$= 5 \text{ ft} \cdot L$$

$$A = 2 \cdot 28,037 \text{ ft} \cdot 5 \text{ ft} \cdot \frac{1 \text{ SY}}{9 \text{ ft}^2}$$

$$= \underline{31,152 \text{ SY}}$$

$$L = 6752 \text{ ft}$$

Incorrect

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-2**

DESCRIPTION: **ELIMINATE BIKE LANES ON BOTH SIDES OF ROADWAY**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design includes 4 ft. of bike lane on each side of the roadway.

ALTERNATIVE: (Sketch attached)

Eliminate the 4 ft. of pavement for the bike lane, decreasing the pavement and right-of-way requirements on both sides.

ADVANTAGES:

- Reduces cost
- Reduces construction time

DISADVANTAGES:

- Eliminates bike lanes for residents

DISCUSSION:

Eliminating the 4 ft. of bike lane decreases the cost of the project by \$1.6M, without having a major effect on the functional qualities of the widening.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 9,764,399	—	\$ 9,764,399
ALTERNATIVE	\$ 8,139,244	—	\$ 8,139,244
SAVINGS (Original minus Alternative)	\$ 1,625,155	—	\$ 1,625,155

PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

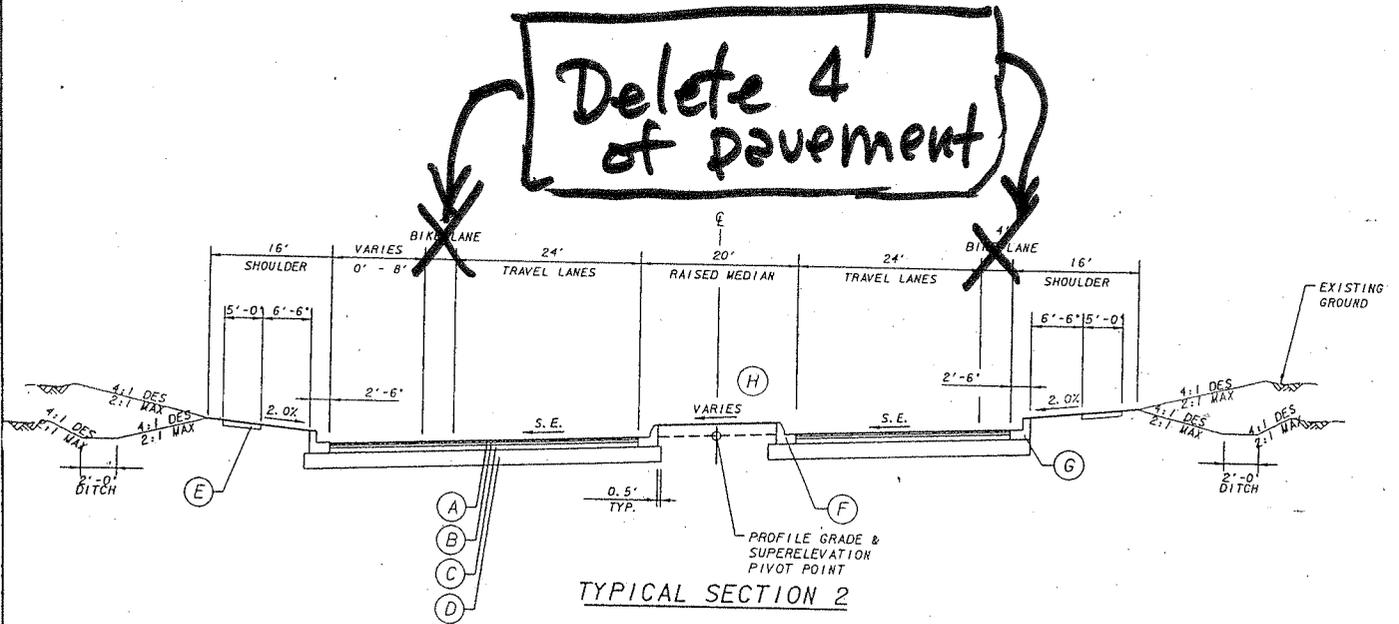
ALTERNATIVE NO.: **TS-2**

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

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



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: TS-2

SHEET NO.: 3 of 4

Quantity of 4' Bike Lane (SY):

$$\text{Sta } 104+67 \text{ to } 272+00, 16,733 \text{ ft} \cdot 4 \text{ ft} \cdot 2 = 133,864$$

$$\text{Sta } 273+70 \text{ to } 380+50, 10,680 \text{ ft} \cdot 4 \text{ ft} \cdot 2 = 85,440$$

$$A = 219,304 \text{ ft}^2$$

$$= \underline{24,367 \text{ SY}}$$

Original Pavement Quantity (SY):

$$L = 16,733 \text{ ft} + 10,680 \text{ ft} = 27,413 \text{ ft}$$

$$\text{Width} = 48 \text{ ft}$$

$$\text{Area} = 27,413 \text{ ft} \cdot 48 \text{ ft} \cdot \frac{1 \text{ SY}}{9 \text{ ft}^2}$$

$$\text{Orig} = \underline{146,203 \text{ SY}}$$

$$\text{Alt} = 146,203 \text{ SY} - 24,367 \text{ SY} = \underline{121,836 \text{ SY}}$$

Right of Way Quantity:

$$\text{Land}_{(\text{Alternate})} = 121,836 \text{ SY} \cdot \frac{9 \text{ ft}^2}{1 \text{ SY}} \cdot \frac{1 \text{ Acre}}{43,560 \text{ ft}^2} = 25.2 \text{ Acre}$$

$$\text{Land}_{(\text{Original})} = 146,203 \text{ SY} \cdot \frac{9 \text{ ft}^2}{1 \text{ SY}} \cdot \frac{1 \text{ Acre}}{43,560 \text{ ft}^2} = 30.2 \text{ Acre}$$

No displacements are eliminated by eliminating the Bike Lane.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-3**

DESCRIPTION: **CONSTRUCT MULTI-USE TRAIL ON LEFT OF ROADWAY AND SIDEWALK ON THE RIGHT**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design constructs 5-ft. sidewalks within the 16-ft. urban shoulder and 4-ft. bike lanes within the paved roadbed section on each side of the roadway.

ALTERNATIVE: (Sketch attached)

Construct an 8-ft. multi-use trail on the left and retain the current design's 5-ft. sidewalk on the right side of the roadway. Eliminate the 4-ft. bike lanes in the paved roadbed.

ADVANTAGES:

- Reduces cost
- Reduces bicycle/vehicle conflicts
- Enhances recreational value
- Reduces right-of-way

DISADVANTAGES:

- Bike lane on only one side of roadway

DISCUSSION:

Constructing an 8-ft. multi-use trail (within the 16 ft. of shoulder) along with the elimination of the 4-ft. bike lane in the roadway, decreases costs significantly.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 11,820,448	—	\$ 11,820,448
ALTERNATIVE	\$ 9,922,052	—	\$ 9,922,052
SAVINGS (Original minus Alternative)	\$ 1,898,396	—	\$ 1,898,396



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.:

TS-3

Georgia Department of Transportation

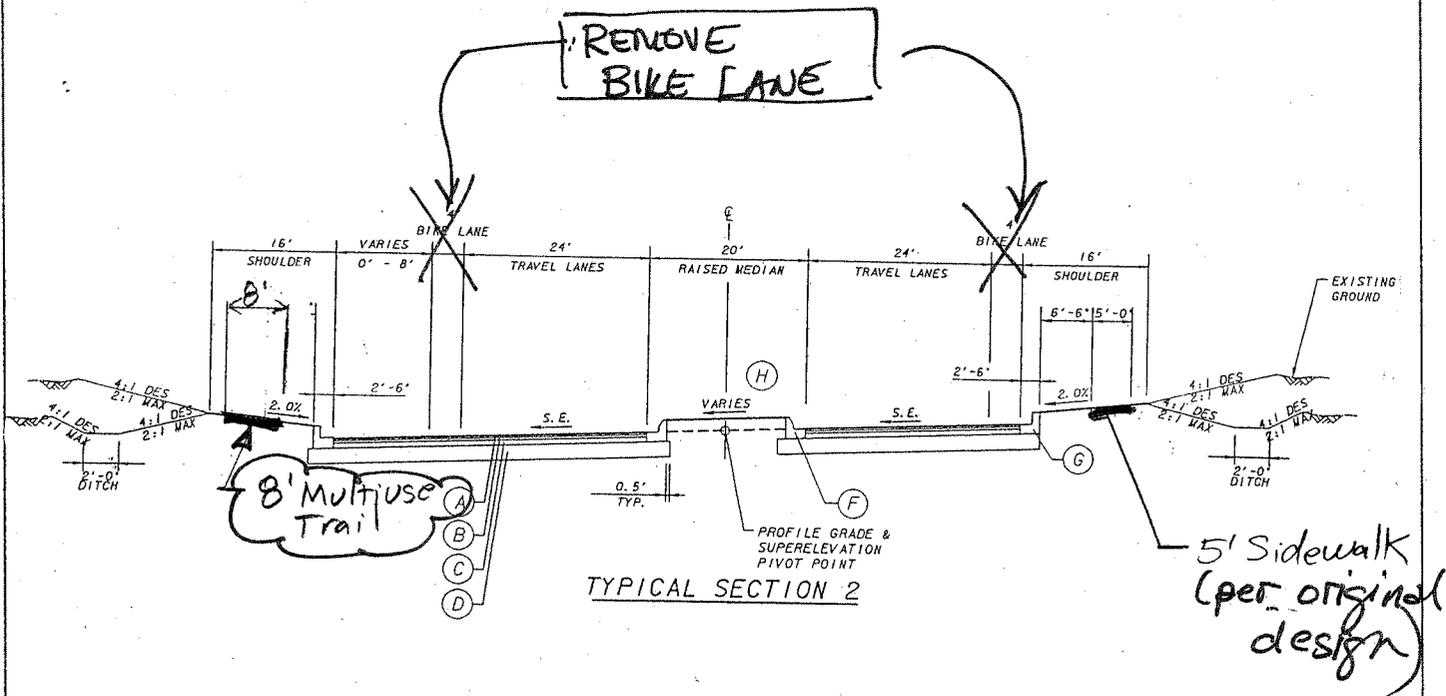
ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.:

2 of 4



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.:

TS-3

Georgia Department of Transportation

SHEET NO.:

3 of 4

Multiuse Trail Quantity:

Asphalt (4in)

$$110 \text{ lb/sy/in} \cdot 4 \text{ in} \cdot \frac{1 \text{ TN}}{2000 \text{ lb}} = \underline{0.22 \frac{\text{TN}}{\text{SY}}}$$

GAB (8in)

$$110 \text{ lb/sy/in} \cdot 8 \text{ in} \cdot \frac{1 \text{ TN}}{2000 \text{ lb}} = \underline{0.44 \frac{\text{TN}}{\text{SY}}}$$

$$\begin{aligned} \underline{\text{Total Cost/sy}} &= 0.22 \frac{\text{TN}}{\text{SY}} \cdot \$80/\text{TN} + 0.44 \frac{\text{TN}}{\text{SY}} \cdot \$24/\text{TN} \\ &= \underline{\$28.16/\text{SY}} \end{aligned}$$

Area of Multiuse Trail:

$$\begin{aligned} \underline{A} &= 27,413 \text{ ft} \cdot 8 \text{ ft} \cdot \frac{1 \text{ SY}}{9 \text{ ft}^2} \\ &= \underline{24,367 \text{ SY}} \end{aligned}$$

Total Original Sidewalk = 31,152 SY

Asphalt Pavement

~~Bikeline~~ Quantity

Original Design = 146,203 SY

Alt. Design = 121,836 SY

Right of Way

Land Original = 30.2 Acre

Land Alt. = 25.2 Acre

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-3

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
Conc. Sidewalk 4in	SY	31,152	\$60	\$1,869,120	15,576	\$60	\$934,560
Multibase Trail 8fe	SY	0	\$28.16	0	24,367	\$28.16	\$686,175
Asphalt Pavement	SY	146,203	\$48.20	\$7,046,985	121,836	\$48.20	\$5,872,495
				\$8,916,105			\$7,493,230
Right of Way	Acrc	30.2	\$26,136	\$789,307	25.2	\$26,136	\$658,627
Subtotal				\$9,705,412	\$8,151,857		
Markup (%) at 10%/155%				\$891,610	\$749,823		
				\$1,223,426	\$1,020,872		
TOTAL				\$11,820,448	\$9,922,052		

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-4**

DESCRIPTION: **CONSTRUCT MULTI-USE TRAILS INSTEAD OF
SIDEWALK ON BOTH SIDES OF ROADWAY**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The original design constructs 5-ft. sidewalks within the 16-ft. urban shoulders on both sides of the roadway and 4-ft. bike lanes within the paved roadbed section on each side of the roadway.

ALTERNATIVE: (Sketch attached)

Eliminate the 4-ft. bike lanes from the paved roadbed section and replace them with 8-ft. multi-use trails on each side of the roadbed.

ADVANTAGES:

- Reduces cost
- Reduces right-of-way
- Maintains bike and pedestrian access

DISADVANTAGES:

- Multi-use trail will not match other existing sidewalks

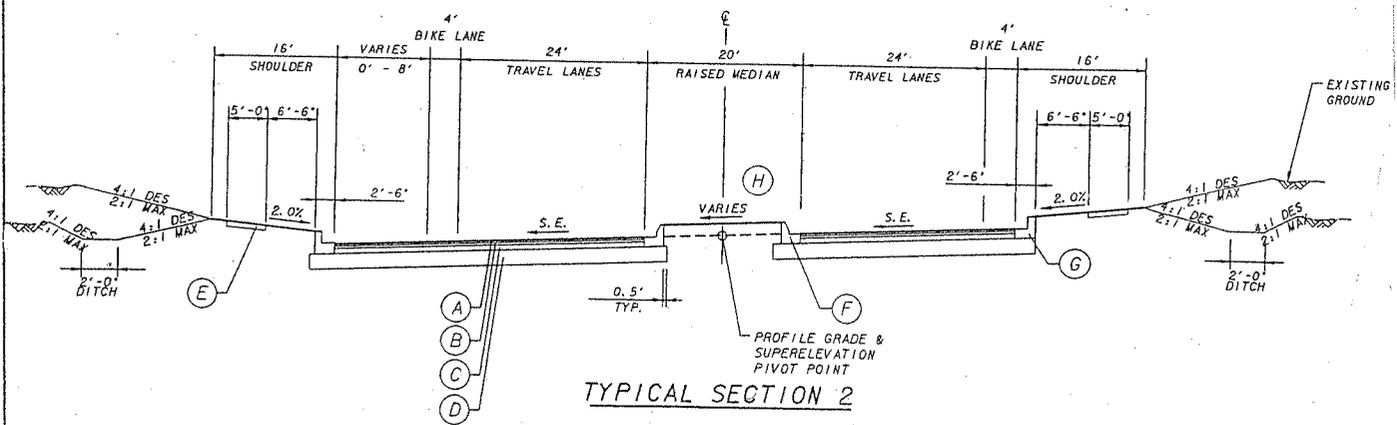
DISCUSSION:

Construction of multi-use trails as opposed to concrete sidewalks decreases the cost of the project by over \$2M. Pedestrian and bike access will be maintained, with 8 ft. of right-of-way eliminated.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 11,820,448	—	\$ 11,820,448
ALTERNATIVE	\$ 9,648,827	—	\$ 9,648,827
SAVINGS (Original minus Alternative)	\$ 2,171,621	—	\$ 2,171,621

PROJECT: **WINDSOR SPRING RD WIDENING** ALTERNATIVE NO.: **TS-4**
Georgia Department of Transportation

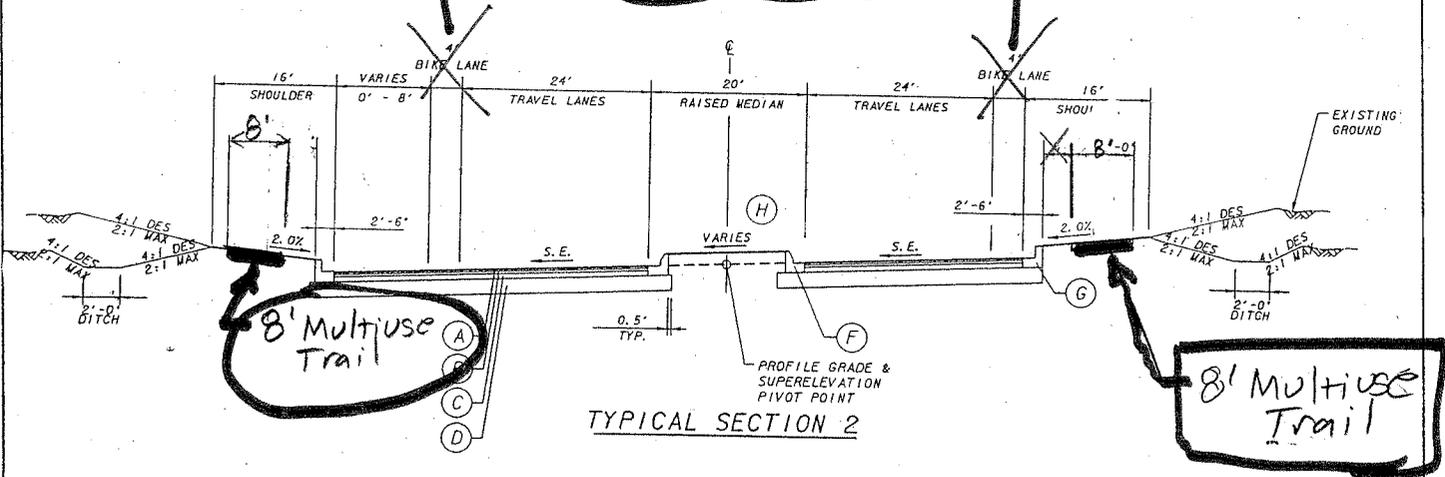
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH SHEET NO.: **2 of 5**



PROJECT: **WINDSOR SPRING RD WIDENING** ALTERNATIVE NO.: **TS-4**
Georgia Department of Transportation

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH SHEET NO.: **3 of 5**

Delete
Pavement



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: TS-4

SHEET NO.: 4 of 5

$$\begin{aligned} \text{Original Design Sidewalk Quantity} \\ = 31,152 \text{ SY} \end{aligned}$$

$$\begin{aligned} \text{Area of Multiuse Trail Proposed} \\ = 2 \cdot 27,413 \text{ ft} \cdot 8 \text{ ft} \cdot \frac{1 \text{ SY}}{9 \text{ ft}^2} \\ = 48,734 \text{ SY} \end{aligned}$$

$$\text{Asphalt with bikelane} = 146,203 \text{ SY}$$

$$\text{Asphalt without bikelane} = 121,836 \text{ SY}$$

$$\text{Right of Way, Original Design} = 30.2 \text{ Acre}$$

$$\text{Right of Way, Alternate Design} = 25.2 \text{ Acre}$$

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-4**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
Sidewalk	SY	31,152	\$60	\$1,869,120	Ø	\$60	Ø
Multibase Trail	SY	Ø	\$28.16	Ø	48,734	\$28.16	\$1,372,349
Asphalt Pavement	SY	146,203	\$48.20	\$7,046,985	121,836	\$48.20	\$5,872,495
				\$8,916,105			\$7,244,844
	10%			\$891,611			\$724,485
Right of Way	Acre	30.2	\$26,136	\$789,307	25.2	\$26,136	\$658,627
	1.55			\$1,223,425			\$1,020,871
Subtotal				\$11,820,448			\$9,648,827
Markup (%) at N/A				Ø			Ø
TOTAL				\$11,820,448			\$9,648,827

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-5**

DESCRIPTION: **REDUCE THE 16-FT. URBAN SHOULDER TO A 12-FT. URBAN SHOULDER**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The present design uses a 16-ft.-wide urban shoulder for sidewalk placement.

ALTERNATIVE: (Sketch attached)

The alternative design calls for 12-ft.-wide urban shoulder as has been commonly used in the recent past.

ADVANTAGES:

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

DISADVANTAGES:

- The sidewalk would have to “jog” around driveway “dust pans” to meet ADA
- Where there are 2:1 fill slopes, these will have to be flattened to meet clear zone or use guardrail to mitigated clear zone

DISCUSSION:

The 12-ft. shoulder would save 8 ft. of right-of-way and x-drains, excavation, and clearing shrubbing.

The 12-ft. shoulder would require the sidewalk to “jog” around driveway “dust pans,” but would still meet ADA.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 885,233	—	\$ 885,233
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 885,233	—	\$ 885,233

SKETCH



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: **TS-5**

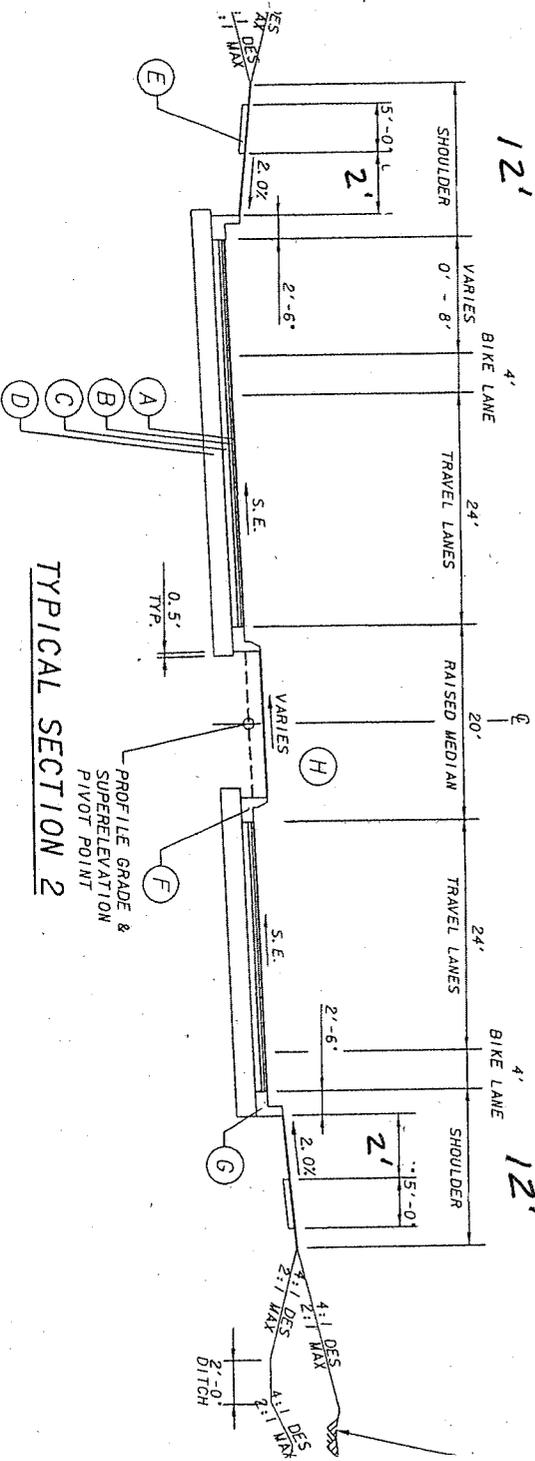
Georgia Department of Transportation

ORIGINAL DESIGN

ALTERNATIVE DESIGN

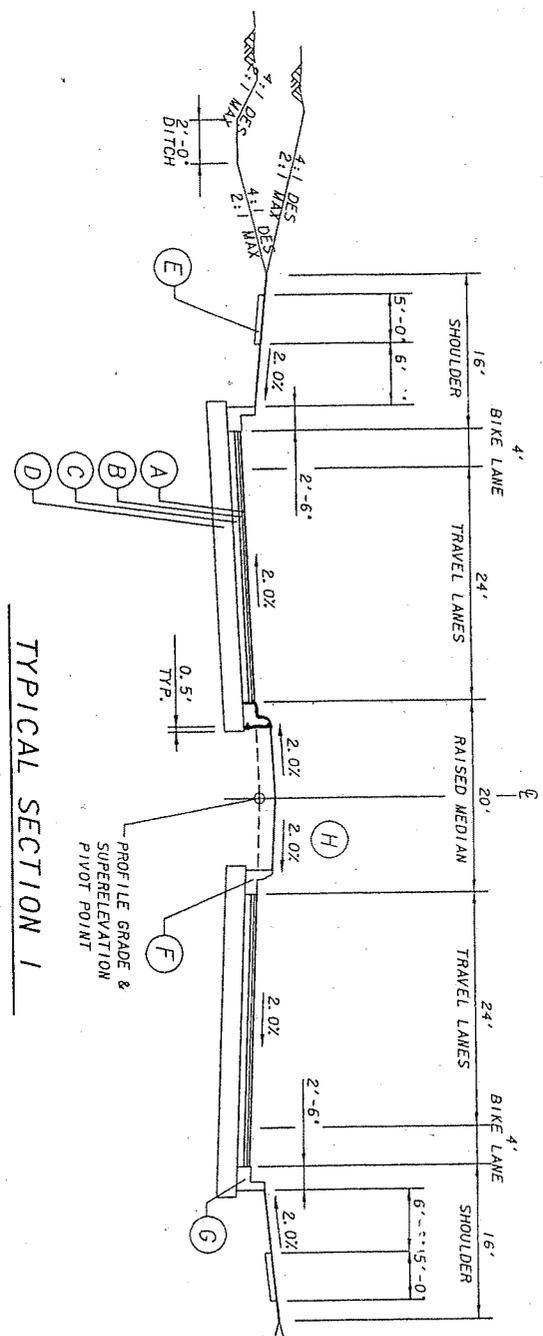
BOTH

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



(Alternate Shoulder)

TYPICAL SECTION 2



TYPICAL SECTION 1
NORMAL CROWN
WITH RAISED MEDIAN
N.T.S.
WINDSOR SPRING ROAD

Original (Shoulder)

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.:

TS-5

Georgia Department of Transportation

SHEET NO.:

3 of 4

(Original) Additional 8' of RLW for 16' side
 $8' \times 5.31 \text{ miles} \times 5,280' = 224,295' \text{ S.F.}$

(Original) additional construction cost for
 8' of roadway width, x-drains, earthwork,
 and clearing & grubbing

$\frac{8' \text{ width}}{100' \text{ total width}} = 8\% \text{ of } \cancel{\text{x-drains, earthwork}} \text{ \& Clearing \& grubbing.}$

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-5**

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

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
R/W for 8'	SF	224,295	0.76	\$170,470			
<u>Add'l construction costs for 8' width</u>						N/A	
- Clearing & Grubbing	LS	3,700,000	8%	\$296,000			
- Unclass Exc.	LS	1,419,765	8%	\$113,596			
SUBTOTAL				409,576			
CONSTRUCTION MARK-UP		10%		\$40,958			
CONSTRUCTION TOTAL				\$450,534			
RIGHT OF WAY				170,470			
R/W MARK-UP		155%		264,229			
R/W TOTAL				434,699			
Subtotal				\$885,233			0
Markup (%) at				N/A			0
TOTAL				\$885,233			0

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-6**

DESCRIPTION: **USE 11-FT. TRAVEL LANES IN LIEU OF 12-FT. TRAVEL LANES**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

Mainline lanes are 12 ft. wide in the current design.

ALTERNATIVE: (Sketch attached)

Use 11-ft. mainline lanes while keeping turn lanes at 12 ft.

ADVANTAGES:

- Reduces construction cost
- Reduces right-of-way cost
- Minimal (2%) truck traffic

DISADVANTAGES:

- Somewhat less safe

DISCUSSION:

Reducing the travel lane width will reduce the right-of-way and construction costs. Since the design speed is 45 mph, the reduced lane width would have a minimal effect on safety and is permitted by ASSHTO Green Book 2004. This should be acceptable also, because of the low percentage of trucks (2%).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 864,238	—	\$ 864,238
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 864,238	—	\$ 864,238



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

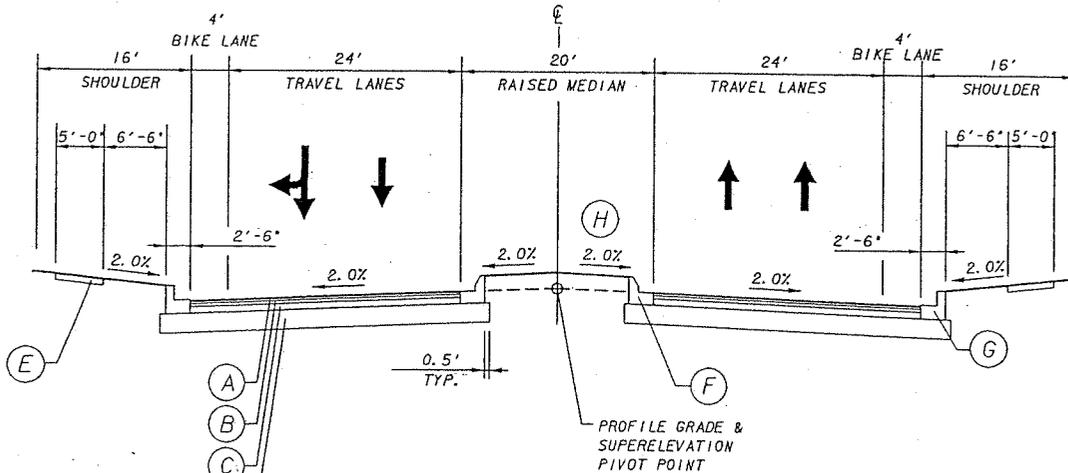
ALTERNATIVE NO.: TS-6

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

SHEET NO.: 2 of 5

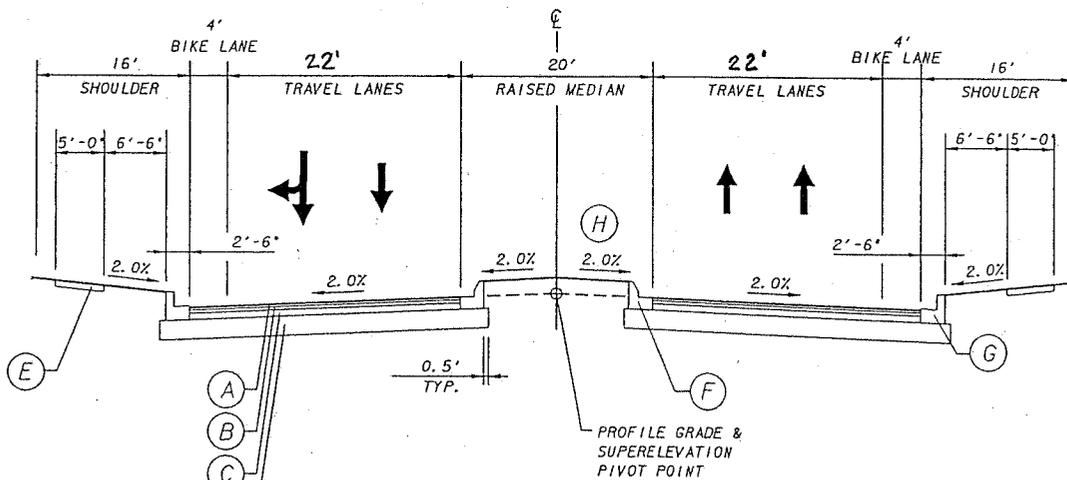


TYPICAL SECTION 3 (ORIGINAL DESIGN)
WINDSOR SPRING ROAD

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



TYPICAL SECTION 3 (ALTERNATIVE DESIGN)
WINDSOR SPRING ROAD



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-6**

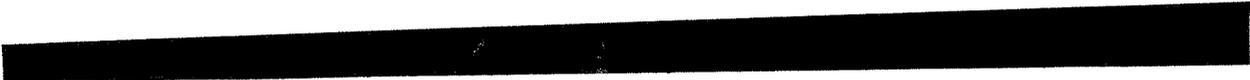
SHEET NO.: **3 of 5**

AASHTO GREEN BOOK (2004)

Lane Widths URBAN ARTERIAL

Lane widths may vary from 3.0 to 3.6 m [10 to 12 ft]. Lane widths of 3.0 m [10 ft] may be used in highly restricted areas having little or no truck traffic. Lane widths of 3.3 m [11 ft] are used quite extensively for urban arterial street designs. The 3.6-m [12-ft] lane widths are most desirable and should be used, where practical, on higher speed, free-flowing, principal arterials.

472



Rural and Urban Arterials (Urban)

Under interrupted-flow operating conditions at low speeds (70 km/h [45 mph] or less), narrower lane widths are normally adequate and have some advantages. For example, reduced lane widths allow more lanes to be provided in areas with restricted right-of-way and allow shorter pedestrian crossing times because of reduced crossing distances. Arterials with reduced lane widths are also more economical to construct. A 3.3-m [11-ft] lane width is adequate for through lanes, continuous two-way left-turn lanes, and lanes adjacent to a painted median. Left-turn and combination lanes used for parking during off-peak hours and for traffic during peak hours may be 3.0 m [10 ft] in width. If provision for bicyclists is to be made, see the AASHTO *Guide for the Development of Bicycle Facilities* (6).

If substantial truck traffic is anticipated, additional lane width may be desirable. The widths needed for all lanes and intersection design controls should be evaluated collectively. For instance, a wider right-hand lane that provides for right turns without encroachment on adjacent lanes may be attained by providing a narrower left-turn lane. Local practice and experience regarding lane widths should also be evaluated.

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: TS-6

SHEET NO.: 4 of 5

$$\begin{aligned} \text{PROJECT LENGTH IS } & 3.22 + 2.09 = 5.31 \text{ MILES} \\ & = 28037 \text{ FT} \end{aligned}$$

$$\begin{aligned} \text{AREA REDUCTION FOR PAVEMENT AND R/W} \\ = 28037(4) = 112,148 \text{ FE}^2/9 = 12461 \text{ SY} \end{aligned}$$

$$\begin{aligned} \text{COMMERCIAL HW IS } & 77\% \text{ OF PROJECT} \\ \text{COMM. A} = & 107(112148) = 7848 \text{ FE}^2 \end{aligned}$$

$$\text{RESIDENTIAL A} = 104266 \text{ FE}^2$$

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-6

SHEET NO.:

5 of 5

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
PAVEMENT	SY	12461	48.20	609,620	0	-	0
MARKUP @ 10%				<u>60062</u>			<u>0</u>
TOTAL				660,682			0
RIGHT OF WAY							
COMMERCIAL	SF	7848	2.20	17,266	0	-	0
RESIDENTIAL	SF	104266	0.60	<u>62,560</u>	0	-	<u>0</u>
SUBTOTAL				79,826			0
MARKUP @ 15%				<u>123,730</u>			<u>0</u>
TOTAL				203,556			0
Subtotal				864,238			0
Markup (%) at 0				0			0
TOTAL				864,238			0

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-7**

DESCRIPTION: **REDUCE MEDIAN WIDTH ON WINDSOR SPRING ROAD TO 18 FT.**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes a 20-ft. raised median on Windsor Spring Road.

ALTERNATIVE: (Sketch attached)

Use an 18-ft. raised median.

ADVANTAGES:

- Reduces right-of-way costs
- Reduces constructions, e.g., shorter x-drains, etc.

DISADVANTAGES:

- Narrow median could possibly affect traffic operations

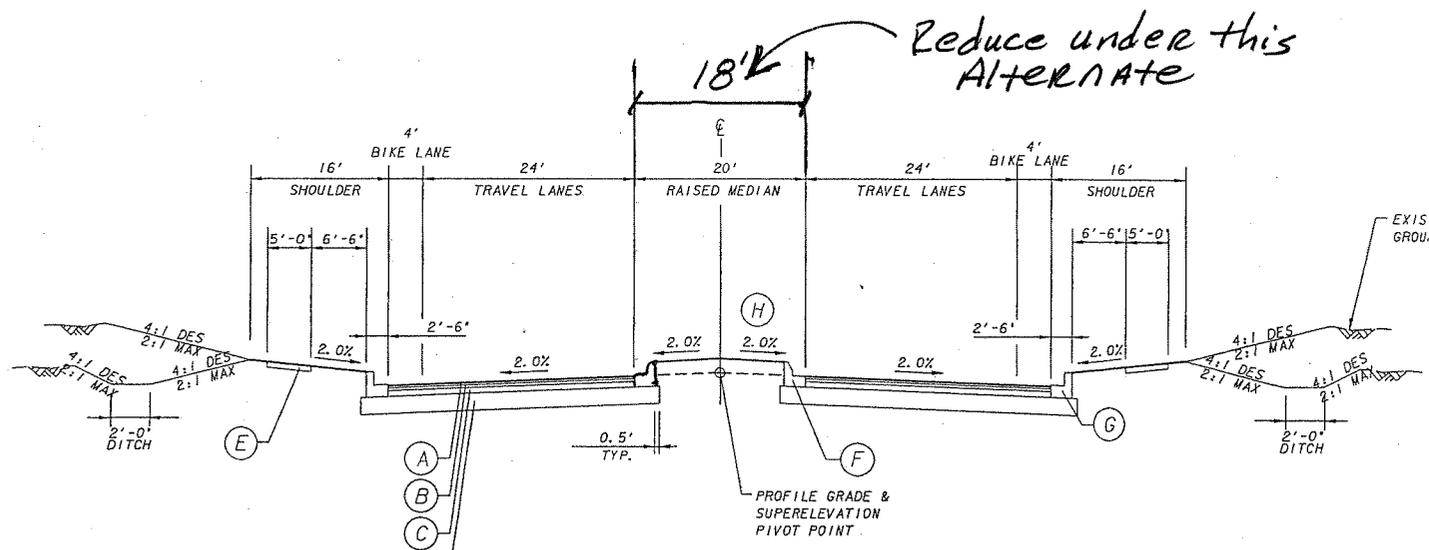
DISCUSSION:

This alternative proposes to use an 18-ft. median to reduce the width of the right-of-way. Saving 2 ft. of right-of-way might seem minimal, but right-of-way cost is a large part of the expense for this project.

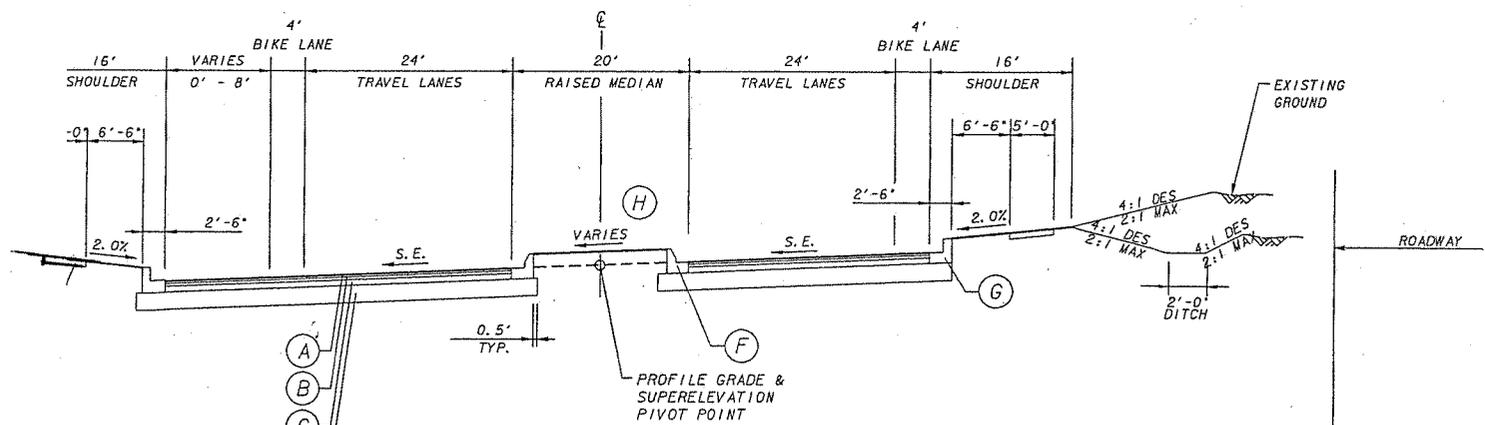
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 147,180	—	\$ 147,180
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 147,180	—	\$ 147,180

PROJECT: **WINDSOR SPRING RD WIDENING** ALTERNATIVE NO.: **TS-7**
Georgia Department of Transportation

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH SHEET NO.: **2** of **4**



TYPICAL SECTION 1
 NORMAL CROWN
 WITH RAISED MEDIAN
 N. T. S.
 WINDSOR SPRING ROAD
 STA. 214+10.00 TO 227+89.00
 STA. 240+08.00 TO 259+68.00
 STA. 306+45.00 TO 307+18.00
 STA. 317+44.00 TO 367+91.00
 STA. 377+26.00 TO 380+50.00



TYPICAL SECTION 2
 SUPERELEVATION
 WITH RAISED MEDIAN
 N. T. S.
 WINDSOR SPRING ROAD
 STA. 227+89.00 TO 240+08.00
 STA. 259+68.00 TO 306+45.00
 STA. 307+18.00 TO 317+44.00
 STA. 367+91.00 TO 377+26.00

TURN LANES
 CONSTRUCTION
 SUPERELEVATION

AUX

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: TS-7

SHEET NO.: 3 of 4

R/W cost for 2' under the "Original" design.

$$2' \times (5,280' \times 5.31 \text{ miles}) = 56,074 \text{ S.F.}$$

weighted R/W unit cost for "Land" = $(.9 \times \frac{\$0.60}{\text{SF}}) + (.1 \times \frac{\$2.2}{\text{SF}})$

↑ 90% residential ↑ 10% commercial

Wt. R/W = $\$0.76/\text{SF}$

Incidental Construction Cost

Savings = $\$35,000$ short x-drain structures.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-8**

DESCRIPTION: **USE AN 8 IN. X 24 IN. TYPE 2 CURB AND GUTTER IN LIEU OF 8 IN. X 30 IN.**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Curb and gutter is 8 in. x 30 in. Type 2.

ALTERNATIVE: (Sketch attached)

Use an 8 in. x 24 in. Type 2 curb and gutter.

ADVANTAGES:

- Reduces width of typical section
- Reduces required right-of-way
- Reduces cost

DISADVANTAGES:

- Reduces area for gutter spread

DISCUSSION:

Reducing the gutter width from 2 ft. to 1 ft.-6 in. reduces the cost of the curb and gutter due to the reduced concrete volume. Since there are four curb and gutter sections across the typical section, there is the potential to reduce the right-of-way width by 2 ft. Also, the bicycle lane provides an additional 4 ft. of gutter spread on each side, keeping water out of the travel lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,160,446	—	\$ 1,160,446
ALTERNATIVE	\$ 874,436	—	\$ 874,436
SAVINGS (Original minus Alternative)	\$ 286,010	—	\$ 286,010



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: TS-8

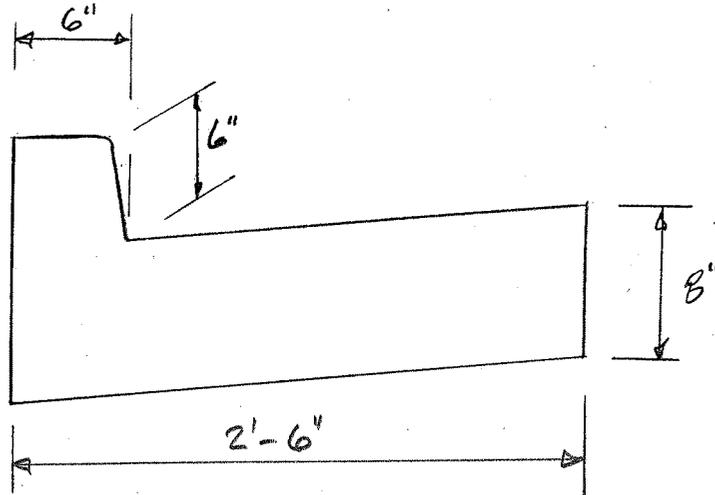
Georgia Department of Transportation

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

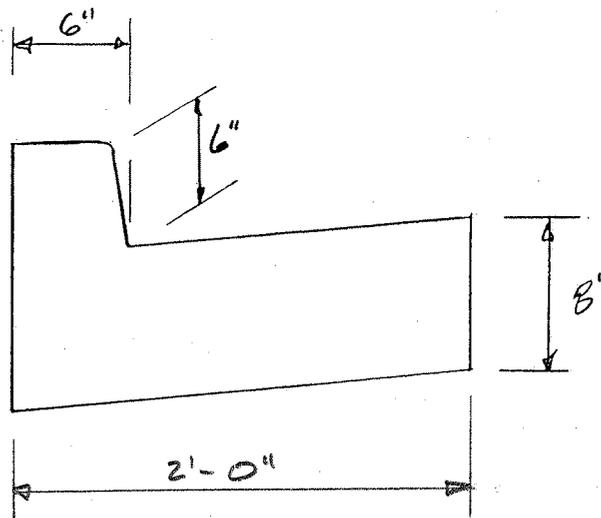
SHEET NO.: 2 of 4



ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.:

TS-8

Georgia Department of Transportation

SHEET NO.: 3

of 4

CONCRETE VOLUME REDUCTION:

$$\text{ORIGINAL VOLUME} = 8(30) + 6(6) = 276 \text{ IN}^2$$

$$\text{ALTERNATIVE VOLUME} = 8(24) + 6(6) = 228 \text{ IN}^2$$

$$\text{RATIO} = 228/276 = 82.6\%$$

$$\text{ORIGINAL COST} = \$15/\text{LF}$$

$$\text{ALTERNATIVE COST} = 15(1826) = \$12.39/\text{LF}$$

$$\text{LIFT C\&G} = 4330 + 22830 = 64,160 \text{ LF}$$

RIGHT-OF-WAY COST

PHASE IV 170023 SF COMMERCIAL R/W

1976010 SF RESIDENTIAL

PHASE V 63400 SF COMMERCIAL

1143341 SF RESIDENTIAL

$$\text{TOTAL COMMERCIAL} = 233423 \text{ SF} \quad \text{TOTAL RESIDENTIAL} = 3,119,351 \text{ SF}$$

$$\text{SO COMMERCIAL IS } 7.0\%$$

$$\text{PROJECT LENGTH} = 5.31 \text{ MILES} = 28037$$

$$\text{REDUCTION IN GUTTER SAVES } 2'/\text{LF}$$

$$\begin{aligned} \text{R/W AREA SAVINGS} &= 28037(2) \\ &= 56074 \text{ SF} \end{aligned}$$

$$\text{COMMERCIAL} = .07(56074) = 3925 \text{ SF}$$

$$\text{RESIDENTIAL} = .93(56074) = 52149 \text{ SF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-9**

DESCRIPTION: **USE RURAL SHOULDERS FROM STA 154+60 TO
STA 214+10**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design uses an urban shoulder (curb and gutter) throughout both projects.

ALTERNATIVE: (Sketch attached)

Use a rural shoulder between STA 154+60 to STA 214+10 (Carroll Drive to Phase V northern project units).

ADVANTAGES:

- Reduces cost
- Easier to achieve clear zone
- The additional unclass excavation will reduce the requirement for borrow

DISADVANTAGES:

- Could require more unclass excavation in “cut” sections for ditches
- Increases right-of-way

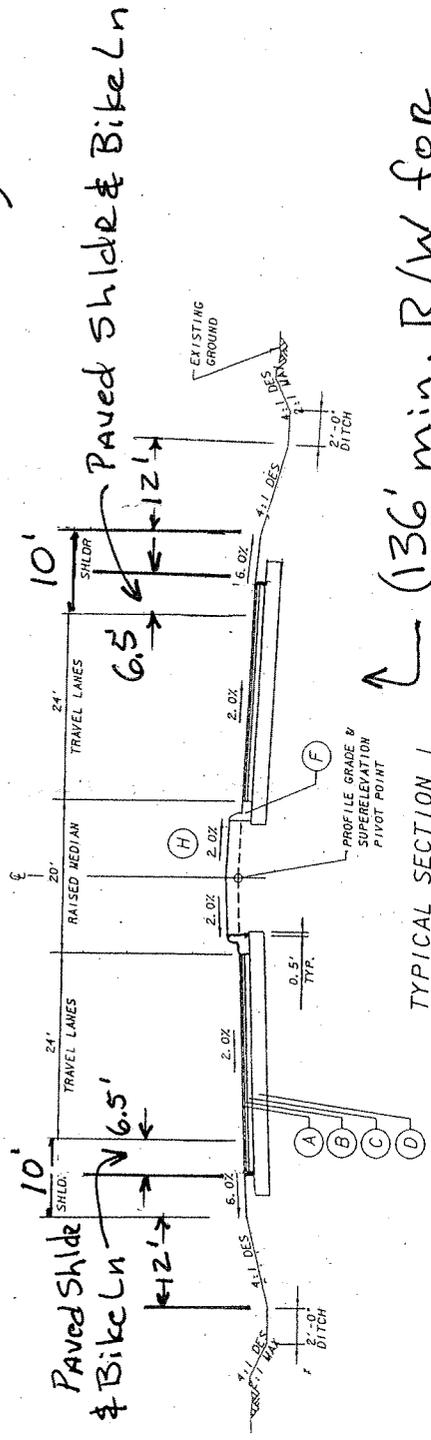
DISCUSSION:

In undeveloped areas (non-commercial) that may remain that way for awhile, a rural shoulder could be used. When this section of roadway is developed, the local government could require the developer to install the curb and gutter and drainage to change the rural shoulder to an urban shoulder. Rural shoulders would start at Carroll Drive (STA 154+60) to STA 214+10.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,167,580	—	\$ 1,167,580
ALTERNATIVE	\$ 388,270	—	\$ 388,270
SAVINGS (Original minus Alternative)	\$ 779,310	—	\$ 779,310

ALT TS-9
SHT 2 OF 4

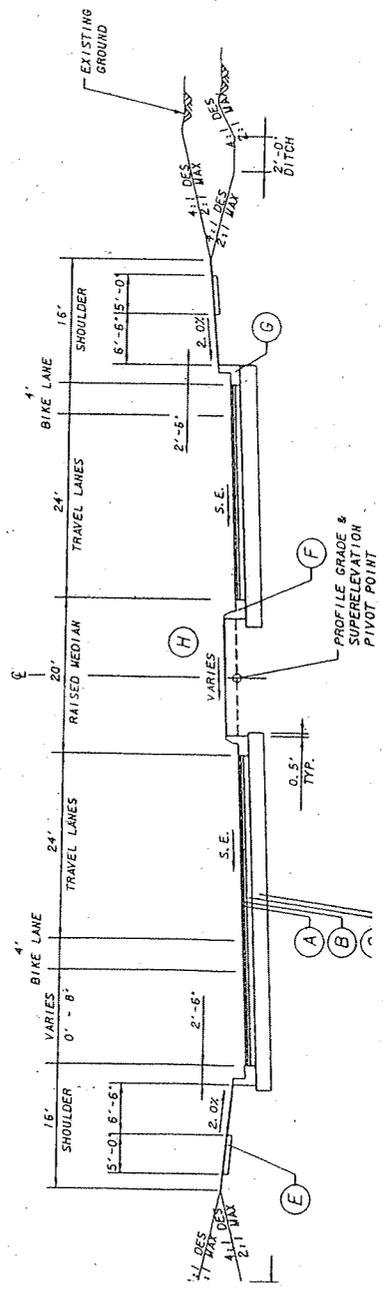
Alternate (Rural Shoulders)



(136' min. R/W for "Cut" (ditch) section)

TYPICAL SECTION 1
NORMAL CROWN
WITH RAISED MEDIAN
N. T. S.
WINDSOR SPRING ROAD

Original (Urban Shoulders)





PROJECT

Georgia Department of Transportation

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: 75-9

SHEET NO.: 3 of 4

Length of At. proposed Rural shoulder
 STA 154+60 to STA 214+10 = 5950'
 Urban Curb and Gutter items: 1' or (1.127 mi)

- curb & gutter:
 $2 \text{ sides} \times 5,950 = 11,900 \text{ L.F.}$
- Catch basins: 45 EA.
- Longitudinal pipe: 5,980 L.F.

• sidewalk: $(5' \times 2 \text{ sides} \times 5,950) / 9 = 6,610 \text{ s.y.}$

Rural shoulder more cost for two 6.5 full depth
 Pavement shoulders ^{Construction} versus 4' Bike Lane
 $(5,950' \times 2 \text{ sides} \times (6.5' - 4')) = 3,310 \text{ s.y.}$

More R/W for Rural Section

for Urban shoulder, Avg. R/W = 20'

for Rural shoulder, Avg. R/W = 34'

add'l 14" in "cut"
 No extra R/W in Fill sections

(^{sides avg.} $2 \times 14' \times 5,950'$) $\times .5 (50\%) = 83,300 \text{ s.y.}$

50% Fill (No extra R/W) 50% Cut (2x14' extra R/W)

Original

At.

COST WORKSHEET



PROJECT: Windsor Spring Road Widening ALTERNATIVE NO.: TS-9
 Georgia Department of Transportation SHEET NO.: 4 of 4

PROJECT ITEM		ORIGINAL ESTIMATE			Alt. PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
curb & gutter	L.F.	11,900	\$15	\$178,500			
catch basins	EA	45	\$3100	\$139,500			
St. DR Pipe Avg. size	L.F.	5,980	\$58	\$346,840			
4" side walk (s')	S.Y.	6,610	\$60	\$396,600			
				\$1,061,440			
Alt. shldr Paved shoulder	S.Y.				3,310	\$48.20	\$159,540
Alt. Rural shldr add' R/W over Urban Shldr	S.F.				83,440	0.70	83,440
R/W Mark-up (155%)							129,330
R/W SUBTOTAL							212,880
Construction Subtotal				\$1,061,440			\$159,540
Const. Markup (10%)				\$106,140			\$15,960
Subtotal							
Markup (%) at							
CONSTR + R/W TOTAL				\$1,167,580			\$388,270

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **TS-11**

DESCRIPTION: **MODIFY DRAINAGE TO A SINGLE LONGITUDINAL STORM DRAIN WITH LATERALS**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The present design uses two longitudinal pipe systems, on each outside, throughout most of the project.

ALTERNATIVE:

Review drainage design that consists of a single longitudinal storm drain with laterals tying in from the opposite roadway.

ADVANTAGES:

- Potential reduction in construction costs

DISADVANTAGES:

- Some pipe size could possibly increase slightly

DISCUSSION:

This alternative recommends reducing the amount of longitudinal drainage pipe by using x-drains between catch basins in lieu of two outside longitudinal pipe systems.

An x-drain between catch basins could be approximately 70 ft. versus the longitudinal distance between catch basins which averages over 130 ft. The reduction in the amount of storm drain pipe could result in substantial savings.

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: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **B-1**

DESCRIPTION: **OMIT END SPANS ON THE BRIDGE OVER THE
NORFOLK SOUTHERN RAILWAY AND REPLACE WITH
MSE WALLS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

End spans of 69 ft. and 59 ft. are shown. Span 2 is 64 ft. long.

ALTERNATIVE: (Sketch attached)

Omit Spans 1 and 3, lengthen Span 2 to 75 ft. to provide the same horizontal clearance as the original design with 6 ft. from face of wall to back face paving rest, and construct retaining walls parallel to the railroad at each end.

ADVANTAGES:

- Reduces cost
- Quicker bridge construction

DISADVANTAGES:

- Difficulty of building bridge end bent with wall
- Potential maintenance problems with walls

DISCUSSION:

Repairing portions of the bridge with walls will reduce costs since the bridge area is more expensive than the wall area. Making the walls parallel to the railroad makes them easier to construct than if they turn back along the roadway.

Future maintenance could be an issue with the walls.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,894,376	—	\$ 1,894,376
ALTERNATIVE	\$ 1,460,242	—	\$ 1,460,242
SAVINGS (Original minus Alternative)	\$ 434,134	—	\$ 434,134

PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: **B-1**

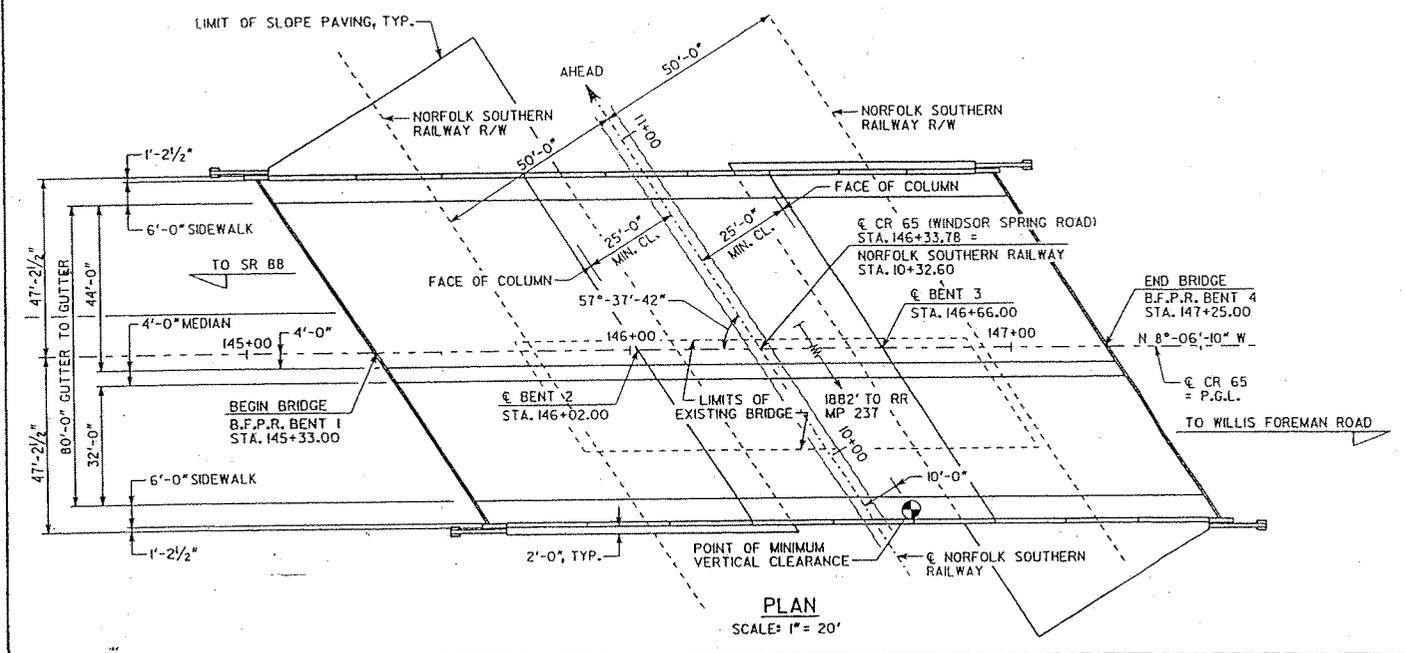
Georgia Department of Transportation

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

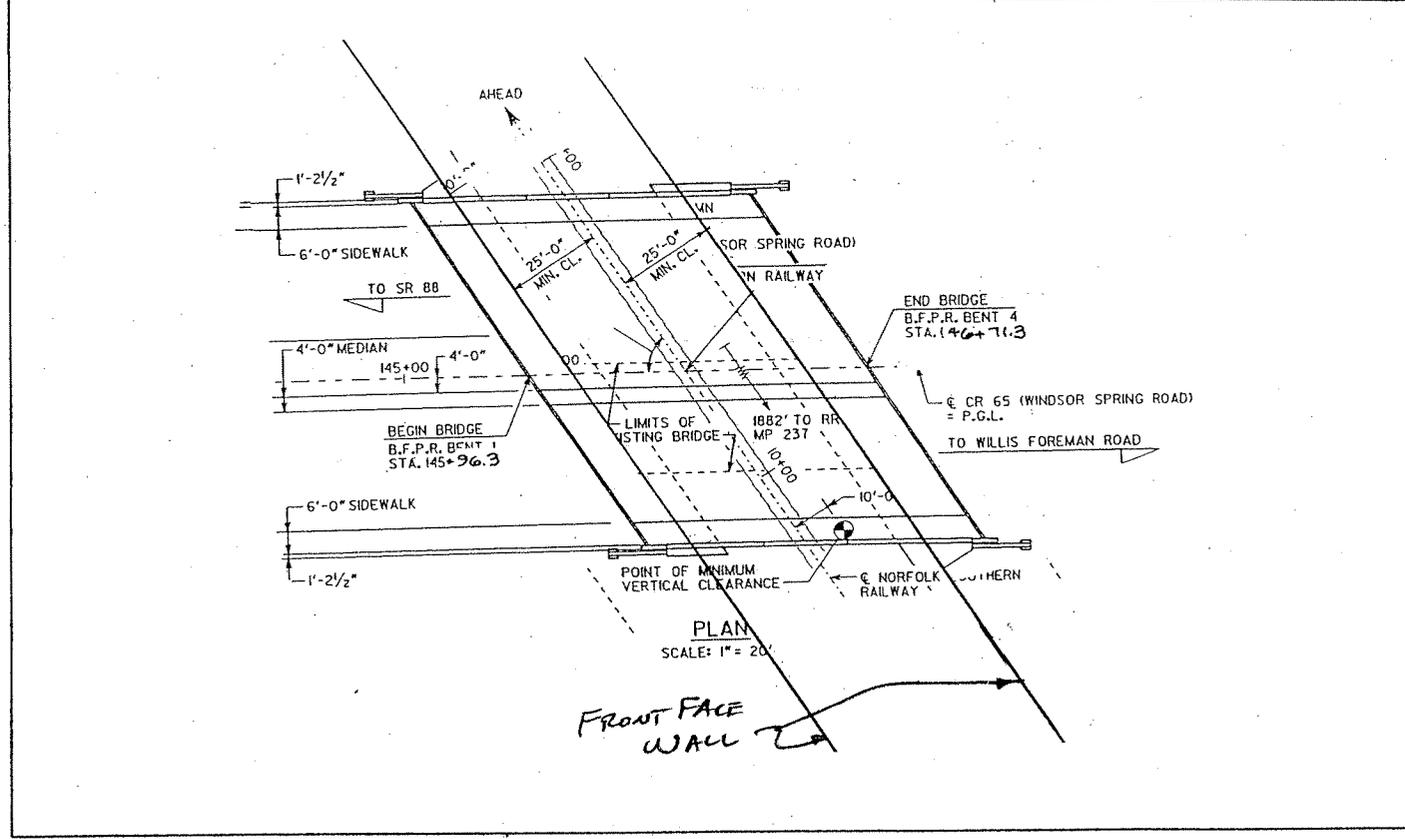
SHEET NO.: **2 of 4**



ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: B-1

SHEET NO.: 3 of 4

ORIGINAL DESIGN 94'-5" OUT-TO-OUT

$$\text{BRIDGE AREA} = 192(94.4167) = 18128 \text{ SF}$$

PROPOSED DESIGN 94'-5" OUT-TO-OUT

BRIDGE LENGTH: INCREASE SPAN 2 TO PROVIDE 6'

FROM FRONT FACE WALL TO BACK FACE PAVING REST

$$\text{NEW } L = 64 + 2[6 - 1.5] / \sin \alpha = 74.65'$$

USE 75'

$$\text{BRIDGE AREA} = 75(94.4167) = 7081 \text{ SF}$$

WALL AREA @ SOUTH END:

$$H_{\text{MAX}} = 23 + 3 + 4 = 30'$$

$$L = (94.4167 + 2 \times 30 \times 2) / \sin \alpha = 254'$$

$$A = 30(94.4167 / \sin \alpha) + \left(\frac{30+4}{2}\right)(254 - 94.4167 / \sin \alpha)$$

$$= 3354 + 2418 = 5772 \text{ SF}$$

WALL @ NORTH END

$$H_{\text{MAX}} = 23 + 4 = 27$$

$$L = 254'$$

$$A = 27(94.4167 / \sin \alpha) + \left(\frac{27+4}{2}\right)(142.21) = 3018 + 2204 = 5222$$

$$\text{WALL AREA} = 5772 + 5222 = 10994 \text{ SF}$$

$$\text{ADDITIONAL PAVEMENT} = 80(192 - 75) / 9 = 1040 \text{ SY}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **B-2**

DESCRIPTION: **LOWER PROFILE GRADE LINE AT SPIRIT CREEK
BRIDGE BY 2 FT.±**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

The original design sets the profile over the Spirit Creek bridge 2 ft.± higher than required by the freeboard elevation. The entire modified alignment is on borrowed fill. Any reduction in PGL elevation is a cost savings.

ALTERNATIVE: (Sketch attached)

Lower the profile over the bridge by roughly 1 ft.-8 in. (max.). More detailed studies can be performed to lower this further.

ADVANTAGES:

- Reduces required fill
- Lowers bridge
- Reduces right-of-way requirements

DISADVANTAGES:

- Reduces longitudinal grade to minimum allowed
- Reduces additional freeboard

DISCUSSION:

The original design PGL is set to allow for the required freeboard, possibly based on the assumed superstructure depth. This should now be adjusted to the minimum required PGL elevation to minimize required fill and reduce right-of-way due to slope length reduction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 87,100	—	\$ 87,100
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 87,100	—	\$ 87,100

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: B-2

Georgia Department of Transportation

Lowrise PGL @ SPIRIT CREEK BRIDGE BY Z'±

SHEET NO.: 2 of 6

@ 45 MPH DESIGN SPEED $K_{MIN} = 79.0$ SAG CURVES.

$$\frac{2'}{0.0313} = 63.90'$$

$$\left[\text{STA } 281+00 \right] - 50$$

$$\underline{\underline{\text{STA } 280+50}}$$

$$\frac{2'}{0.0116} = 172.41' \quad \left[\text{STA } 270+00 \right] - 150 = \underline{\underline{\text{STA } 268+50}}$$

@ STA 280+50 ELEVATION = $202.06 - (50' \times 0.0313)$

$$= \underline{\underline{200.50'}}$$

@ STA 268+50 ELEVATION = $208.99 - (150 \times 0.0116)$

$$= \underline{\underline{207.25}}$$

New Slope = $\frac{200.50 - 207.25}{28050 - 26850} = -0.563\%$

> 0.5%
OK

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: B-2

Georgia Department of Transportation

Lower PGL @ Spirit Creek Bridges Pgs 2' ±

SHEET NO.: 3 of 6

MAINTAIN 400' VC } 600' VC.

$$K_1 = \frac{400'}{1.160 - 0.563} = \underline{670.0} > 79.0 \text{ MIN OK}$$

$$K_2 = \frac{600'}{0.563 + 3.130} = \underline{162.0} > 79.0 \text{ MIN OK}$$

CURVE 1: PC = 266+50
PT = 270+50

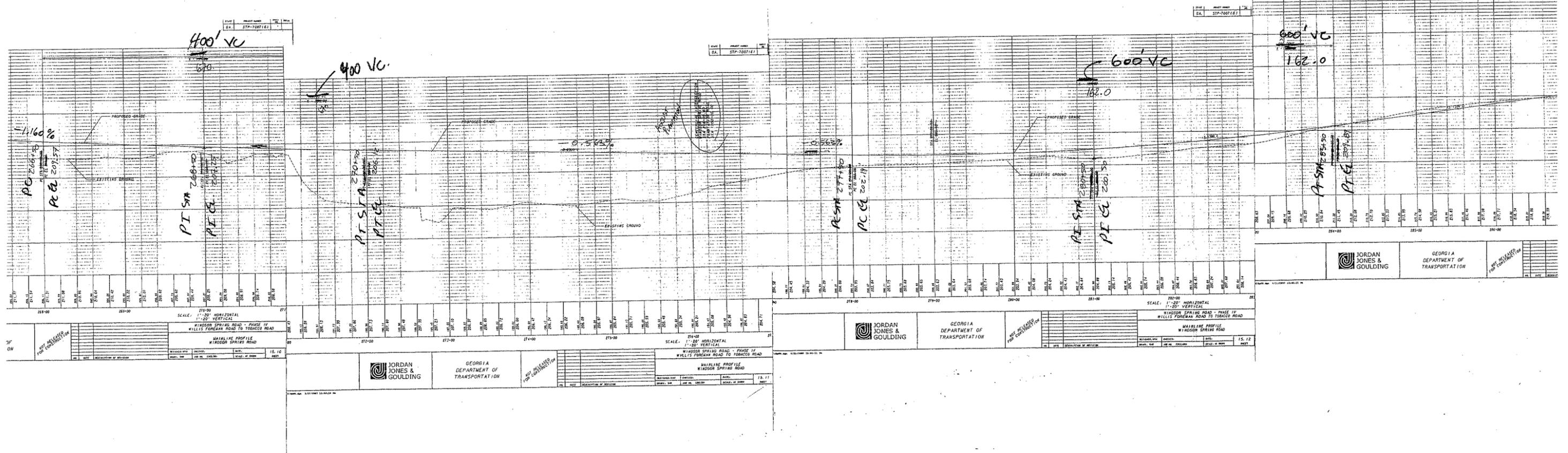
$$\text{Elev}_1 = 207.25 + (0.0116 * 200') = 209.57'$$

$$\text{Elev}_2 = 207.25 - (0.00563 * 200') = 206.12'$$

CURVE 2: PC = 277+50
PT = 283+50

$$\text{Elev}_1 = 200.50 + (0.00563 * 300') = 202.19'$$

$$\text{Elev}_2 = 200.50 + (0.0313 * 300') = 209.89'$$



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: B-2

Georgia Department of Transportation

Lower PGL @ SPIRIT CREEK BRIDGE By 2'±

SHEET NO.: 5 of 6

COST:

$$\text{AVERAGE DEPTH SAVINGS (FILL/CUT)} = 1'-8''$$

$$\begin{aligned} \text{ROADWAY WIDTH AVERAGE} &= 20' + 24' + 24' + 4' + 4' + 2.5' + 2.5' + 16' + 16' \\ &= 113' \end{aligned}$$

$$\text{LENGTH OF CHANGE AVERAGE} = 1400'$$

$$\text{VOLUME} = \frac{(1.67')(113')(1400')}{27} = \underline{\underline{9785 \text{ CY}}}$$

$$\text{R/W} = (4' \text{ EA SIDE})(2)(1400') = \underline{\underline{11,200 \text{ SF}}}$$

No Displacements Saved.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **B-3**

DESCRIPTION: **ELIMINATE 90° CORNERS ON SLOPE PAVING AT THE
BRIDGE OVER NORFOLK SOUTHERN RAILROAD**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN: (Sketch attached)

On one side of the bridge at each end, the slope paving edge is normal to the railroad, making a right angle at the toe of the slope.

ALTERNATIVE: (Sketch attached)

Make edges of slope paving parallel to and 2 ft. outside of the edge of the bridge deck.

ADVANTAGES:

- Reduces cost
- Reduces excavation

DISADVANTAGES:

- Potential erosion problem

DISCUSSION:

The original design PGL is set to allow for the required freeboard, possibly based on the assumed superstructure depth. This should now be adjusted to the minimum required PGL elevation to minimize required fill and reduce right-of-way due to slope length reduction.

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

PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: **B-3**

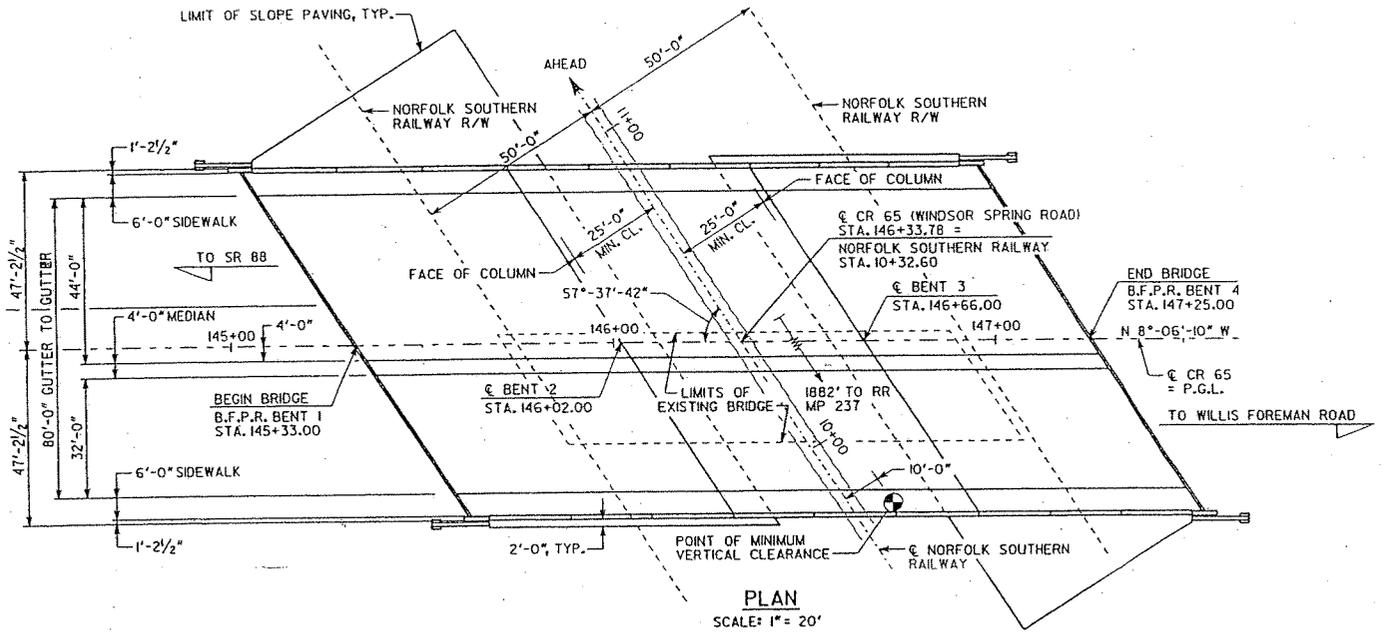
Georgia Department of Transportation

ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH

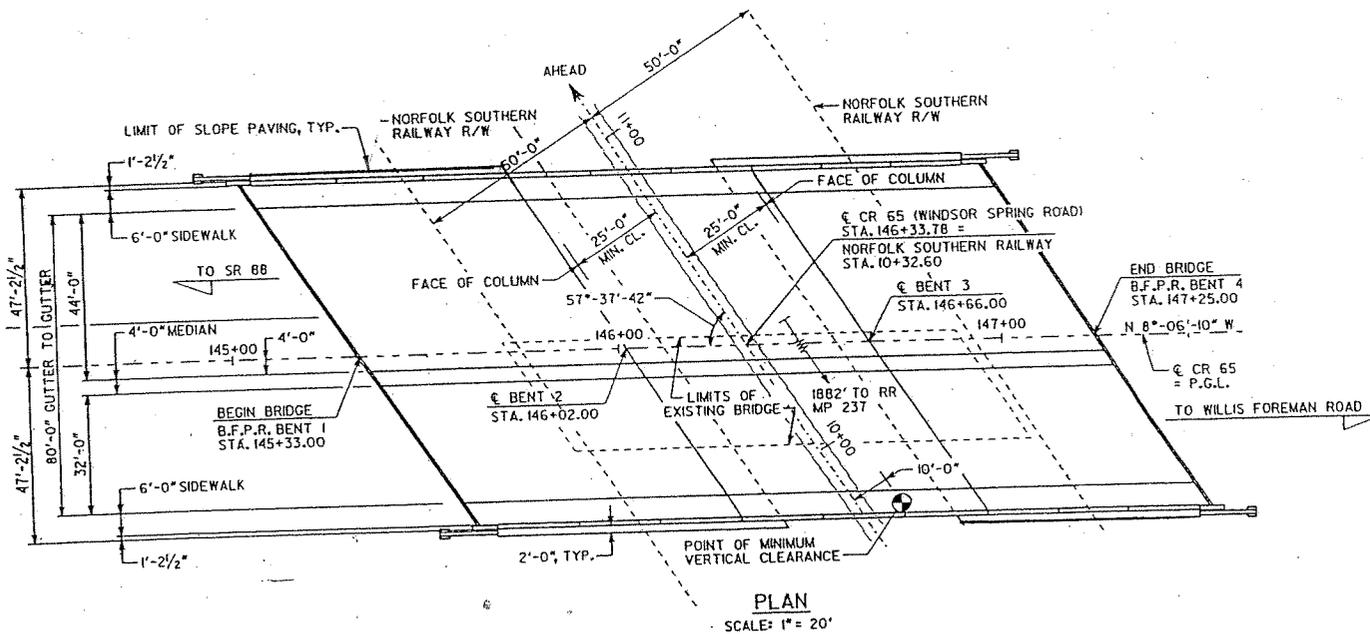
SHEET NO.: **2 of 2**



ORIGINAL DESIGN

ALTERNATIVE DESIGN

BOTH



VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-1**

DESCRIPTION: **FLATTEN CURVE CORRECTION IN THE VICINITY OF SPIRIT CREEK**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

In order to reconstruct the Spirit Creek bridge at a higher elevation, the current design provides for a new location curve (#10008) with a 1,910-ft. centerline radius in the vicinity of Spirit Creek. The offset from the existing to new alignment is approximately 150 ft. at the midpoint of the curve (approximately at the location of Plantation Road connection).

ALTERNATIVE: (Sketch attached)

Place the new location alignment (50 ft.±) closer to the existing centerline.

ADVANTAGES:

- Reduces right-of-way
- Reduces Plantation Road driveway conform
- Reduces cost

DISADVANTAGES:

- Requires redesign

DISCUSSION:

The attached Table 4.9 GDOT manual specifies an e_{max} of 4%. AASHTO e_{max} indicates a 711-ft. minimum radius for e_{max} of 4% for a 45 mph design speed. Reducing the maximum offset from 150 ft. to 50 ft. seems feasible and should still allow the construction of the new bridge offline, which appears to be a control for the new location curve. This modification should not require a re-evaluation of the environmental document as the footprint is reduced.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 149,575	—	\$ 149,575
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 149,575	—	\$ 149,575

The maximum rates of superelevation used on highways are controlled by four factors:

- Climatic conditions (i.e., frequency and amount of snow and ice)
- Terrain conditions (i.e., flat, rolling, or mountainous)
- Type of area (i.e., rural or urban)
- Frequency of very slow-moving vehicles whose operation might be affected by high superelevation rates

Superelevation requirements for maximum superelevation rates (0.04 to 0.12-ft./ft) for various design speeds (15 mph to 80 mph) are provided in the AASHTO *Green Book* Chapter 3, Elements of Design – Superelevation Tables. GDOT has designated the values in **Table 4.9.** as the maximum values (e_{max}) for use on Georgia roadways.

It is important for designers to realize that the minimum curve radii and maximum superelevation rates depicted in the AASHTO *Green Book* are extremes and should be avoided wherever possible.

The e_{max} values presented in **Table 4.9.** requires the use of the more moderate design value ranges for curvature and superelevation. In certain situations, such as those described below, the e_{max} values in **Table 4.9.** may require further reduction:

- Wherever practical, consideration should be given to maximizing curve radii and minimizing superelevation rates on curves which include bridges. This is due to the increased potential for icing. Where constraints do not exist, an e_{max} of 4% should be utilized.
- Wherever possible, the maximum superelevation rates on roadways within an intersection should be limited to 4% (2% for urban areas with crosswalks). Wherever possible and when applicable in intersections, superelevation cross slopes of one roadway should be coordinated with the mainline profile grade of the intersecting roadway.
- Where traffic congestion or extensive development acts to restrict top speeds on a rural roadway, a maximum rate of superelevation of 6% should be used.

Table 4.9. Maximum Superelevation Rates

Setting	Maximum Superelevation Rates (e_{max}) ⁽¹⁾
Urban (Curb and Gutter) Roads (DS ≤ 45mph)	4% *
Suburban / Developing Areas	6%
Rural (Non Curb and Gutter)	
Paved Roads	6%
Unpaved Roads	Reverse Crown
Interstates, Expressways, L/A Facilities	
Rural	8%
Urban	6%
System-to-System Ramps	
Rural	8%
Urban	6%
Exit-Entrance Ramps	8%
Free Flowing Loop Ramps	10%
Long Ramps with STOP	8%

(1) The maximum allowed values (e_{max}) for usage on Georgia roadways, as designated by GDOT. In general, GDOT does not require superelevation on low-speed urban roadways or roadways with a design speed of 25 mph or less

METRIC

e (%)	V _d = 20 km/h		V _d = 30 km/h		V _d = 40 km/h		V _d = 50 km/h		V _d = 60 km/h		V _d = 70 km/h		V _d = 80 km/h		V _d = 90 km/h		V _d = 100 km/h	
	R (m)	R (ft)	R (m)	R (ft)														
1.5	163	371	371	819	441	970	511	1123	632	1393	749	1650	865	1900	1110	2430	1390	3060
2.0	102	227	237	523	283	626	310	686	332	732	366	811	400	885	443	979	482	1068
2.2	75	165	187	414	213	468	236	521	260	575	282	620	310	686	332	732	366	811
2.4	51	113	132	293	157	347	170	373	187	414	213	468	236	521	260	575	282	620
2.6	38	84	99	217	114	253	125	277	138	302	150	331	165	366	200	443	213	468
2.8	30	66	79	173	86	190	96	213	114	253	125	277	138	302	150	331	165	366
3.0	24	53	64	141	70	155	77	170	96	213	114	253	125	277	138	302	150	331
3.2	20	44	54	119	58	129	64	141	70	155	77	170	96	213	114	253	125	277
3.4	17	37	45	100	50	111	55	121	61	134	81	179	86	188	103	228	101	223
3.6	14	31	38	84	42	93	46	101	50	111	55	121	61	134	81	179	86	188
3.8	12	26	31	69	35	77	38	84	42	93	46	101	50	111	55	121	61	134
4.0	8	18	22	47	24	53	26	57	30	66	34	74	38	84	42	93	46	101

Note: Use of e_{max} = 4% should be limited to urban conditions.

Exhibit 3-25. Minimum Radii for Design Superelevation Rates, Design Speeds, and e_{max} = 4%

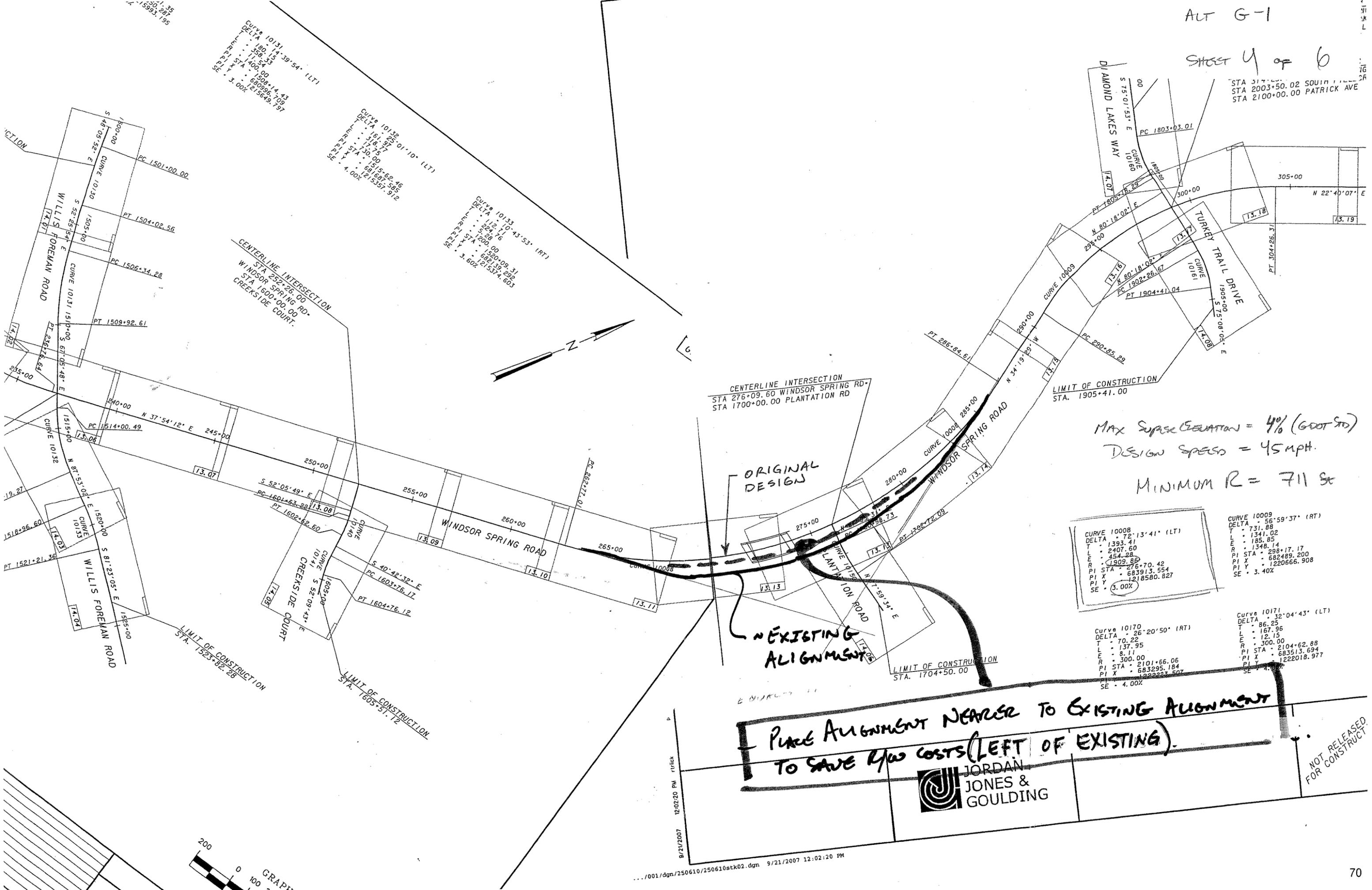
US CUSTOMARY

e (%)	V _d = 15 mph		V _d = 20 mph		V _d = 25 mph		V _d = 30 mph		V _d = 35 mph		V _d = 40 mph		V _d = 45 mph		V _d = 50 mph		V _d = 55 mph		V _d = 60 mph	
	R (ft)	R (m)																		
1.5	296	1410	402	1840	506	2300	606	2770	706	3200	806	3680	906	4150	1006	4630	1106	5100	1206	5580
2.0	196	902	273	1250	340	1540	406	1840	476	2160	546	2480	616	2800	686	3120	756	3440	826	3760
2.2	146	665	203	925	253	1150	303	1380	353	1600	403	1830	453	2060	503	2290	553	2520	603	2750
2.4	106	485	147	670	177	800	210	950	243	1100	276	1250	309	1400	342	1550	375	1700	408	1850
2.6	81	373	111	508	138	626	165	753	192	880	219	1000	246	1120	273	1240	300	1360	327	1480
2.8	66	308	96	438	117	534	140	637	163	743	186	846	209	949	232	1052	255	1155	278	1258
3.0	56	259	81	373	99	453	117	534	135	614	153	695	171	776	189	857	207	938	225	1019
3.2	48	223	69	317	84	386	100	458	117	534	135	614	153	695	171	776	189	857	207	938
3.4	41	188	58	267	70	317	84	386	100	458	117	534	135	614	153	695	171	776	189	857
3.6	35	160	49	226	60	276	70	317	84	386	100	458	117	534	135	614	153	695	171	776
3.8	30	137	42	192	50	226	70	317	84	386	100	458	117	534	135	614	153	695	171	776
4.0	22	101	31	142	38	173	42	192	50	226	70	317	84	386	100	458	117	534	135	614

Note: Use of e_{max} = 4% should be limited to urban conditions.

Exhibit 3-25. Minimum Radii for Design Superelevation Rates, Design Speeds, and e_{max} = 4%

STA 2100+00.00 PATRICK AVE
STA 2003+50.02 SOUTH
STA 217+00.00



MAX SUPERELEVATION = 4% (GOOD STD)
 DESIGN SPEED = 45 MPH.
 MINIMUM R = 711 ft

CURVE 10008
 DELTA . 72°13'41" (LT)
 T . 1393.41
 L . 2407.60
 E . 454.28
 R . 1909.86
 PI STA . 276+70.42
 PI X . 683913.554
 PI Y . 1218580.827
 SE . 3.00%

CURVE 10009
 DELTA . 56°59'37" (RT)
 T . 731.88
 L . 1341.02
 E . 185.85
 R . 1348.14
 PI STA . 298+17.17
 PI X . 682489.200
 PI Y . 1220666.908
 SE . 3.40%

Curve 10170
 DELTA . 26°20'50" (RT)
 T . 70.22
 L . 137.95
 E . 8.11
 R . 300.00
 PI STA . 2101+66.06
 PI X . 683295.184
 PI Y . 122223.507
 SE . 4.00%

Curve 10171
 DELTA . 32°04'43" (LT)
 T . 86.25
 L . 167.96
 E . 12.15
 R . 300.00
 PI STA . 2104+62.88
 PI X . 683513.694
 PI Y . 1222018.977
 SE . 4.00%

Place Alignment NEARER TO EXISTING ALIGNMENT
 TO SAVE R/W COSTS (LEFT OF EXISTING).



NOT RELEASED
 FOR CONSTRUCTION



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: G-1

Georgia Department of Transportation

REDUCE PROPOSED RADIUS CORRECTION AT SPIRIT CREEK

SHEET NO.: 5 of 6

$$\text{RESIDENTIAL} = \$0.60 \text{ SF}$$

$$\text{MARK-UP} = 1.55$$

$$\text{SF} = (1700' \times 50') = 85,000$$

$$\text{COST} = (85,000)(\$0.60)(1+1.55) = \underline{\underline{\$130,050}}$$

PLANTATION ROAD

$$\text{PAVEMENT} = \left(\$48 \frac{20}{9} \right) \left(\frac{24' \times 100'}{9} \right) = \underline{\underline{\$12,850}}$$

DRIVEWAY PAVEMENT

$$\begin{aligned} \text{DRIVEWAYS} &= (10' \times (55' + 75' + 65' + 60' + 40' + 55')) \times 4 \\ &= 367 \text{ SY} \end{aligned}$$

$$\text{COST SAVINGS} = (367)(\$13.35) = \underline{\underline{\$4900}}$$

* Assumes R/W line can be pulled in by 50'

COST WORKSHEET



PROJECT: **Windsor Spring Road Widening** ALTERNATIVE NO.: **G-1**
 Georgia Department of Transportation
 REMOVE PROPOSED RADIUS CORRECTION ASPIRIT CREEK SHEET NO.: **6 of 6**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
PAVEMENT	SY	266.7	\$48.00	\$12,850		N/A	
DRIVEWAY	SY	367	\$13.35	\$4,900.00			
SUBTOTAL 1				\$17,750			
10%				\$1,775			
SUBTOTAL 2				\$19,525		N/A	
R/W DIFFERENCE	SF	85,000	\$0.60	\$51,000		N/A	
MARK UP (1.55)				\$79,050			
SUBTOTAL 3				\$130,050			
Subtotal				\$149,575			0
Markup (%) at N/A				0			0
TOTAL				\$149,575			0

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-2**

DESCRIPTION: **REDUCE MAINLINE CURVE AND WIDEN THE LEFT IN
THE VICINITY OF TURKEY TRAIL ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design uses a 1,348-ft. curve with symmetrical widening that requires the relocation of six properties.

ALTERNATIVE: (Sketch attached)

Place the edge of the right-turn lane at the current edge of the pavement location and widen to the left. The curve radius is reduced to 1,200 ft.±.

ADVANTAGES:

- Reduces number of relocations from six to two
- Tight curve provides a traffic calming effect for northbound approach to the denser residential portions of Windsor Spring Road
- Takes undeveloped right-of-way on the west side

DISADVANTAGES:

- Tighter curve (but still above the minimum 45 mph design speed)

DISCUSSION:

The current design appears to have been based on a widening to the left but did not account for the northbound right-turn lane. Reducing the radius and providing a genuine widening will reduce the relocations from six to two properties.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 408,000	—	\$ 408,000
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 408,000	—	\$ 408,000

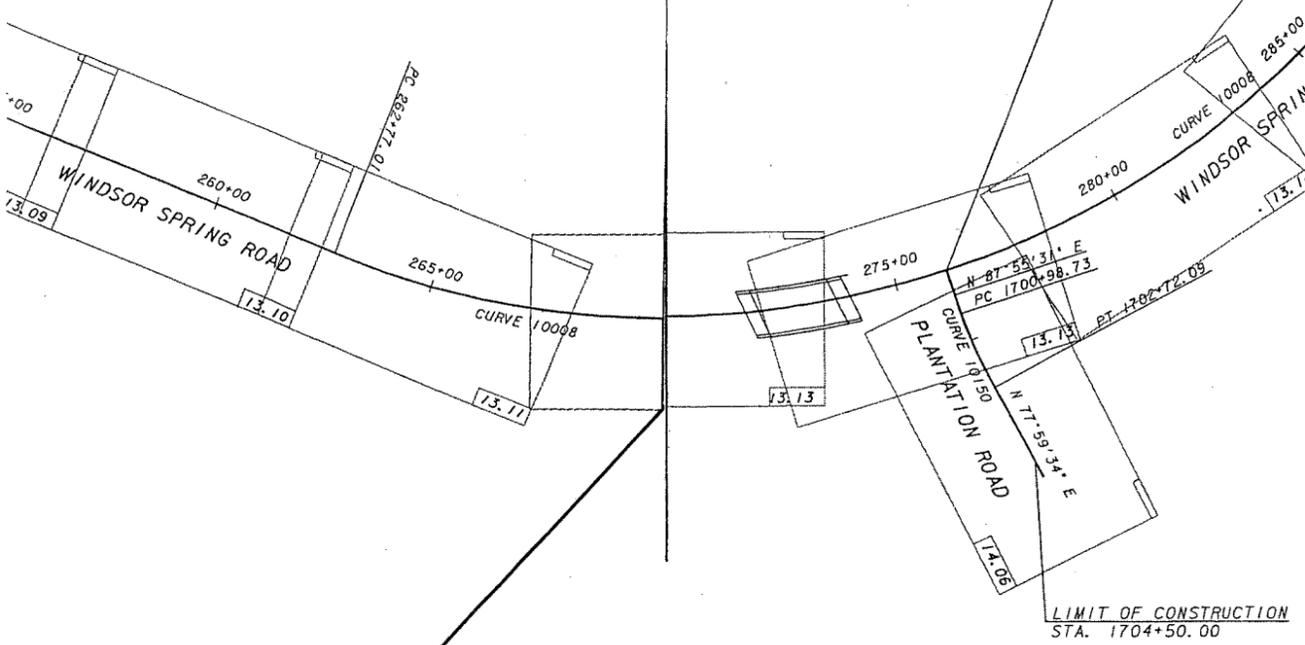
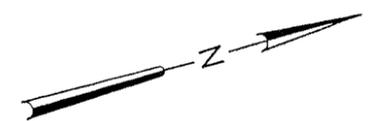
$$R = \frac{E}{\left[\frac{1}{\cos\left(\frac{\Delta}{2}\right)} - 1 \right]}$$

$$= \frac{(185-20)}{\left[\frac{1}{\cos\left(\frac{56.99}{2}\right)} - 1 \right]} = 1197 \pm$$

PROPOSED:
USE 1200' RADIUS.

For 10009

Curve 10133
DELTA - 121°10'
T - 222.16
L - 522.56
E - 1200.00
R - 3.60%



LIMIT OF CONSTRUCTION
STA. 1905+41.00

LIMIT OF CONSTRUCTION
STA. 1801+71.07

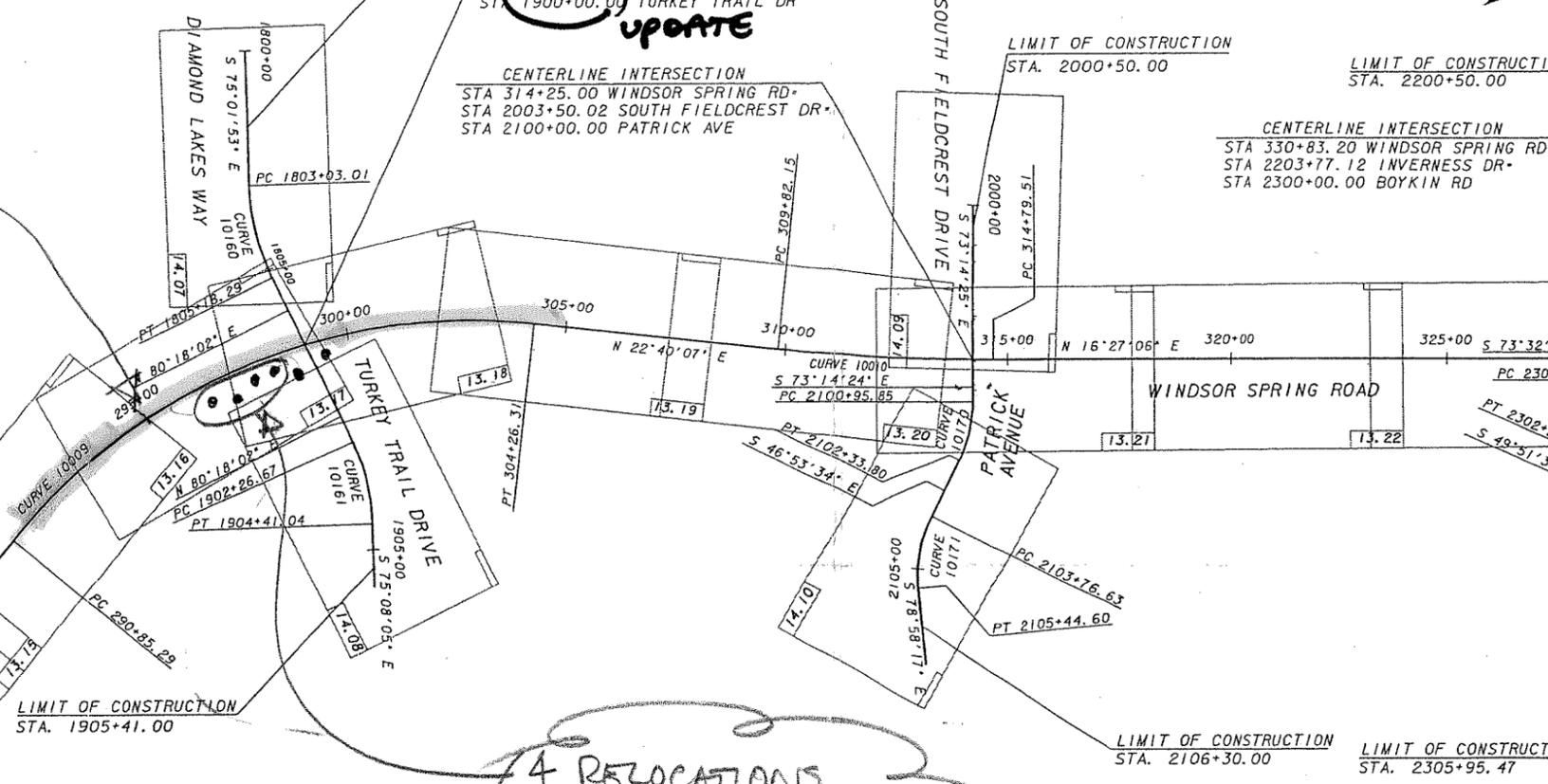
CENTERLINE INTERSECTION
STA. 299+00.00 WINDSOR SPRING RD.
STA. 1806+89.10 3 DIAMOND LAKES WAY
STA. 1900+00.00 TURKEY TRAIL DR
UPDATE

CENTERLINE INTERSECTION
STA. 314+25.00 WINDSOR SPRING RD.
STA. 2003+50.02 SOUTH FIELDCREST DR.
STA. 2100+00.00 PATRICK AVE

LIMIT OF CONSTRUCTION
STA. 2000+50.00

LIMIT OF CONSTRUCTION
STA. 2200+50.00

CENTERLINE INTERSECTION
STA. 330+83.20 WINDSOR SPRING RD.
STA. 2203+77.12 INVERNESS DR.
STA. 2300+00.00 BOYKIN RD



4 RELOCATIONS
AVOIDED W/ VE ALT

CURRENT DESIGN

CURVE 10009
DELTA - 56°58'37" (RT)
T - 731.88
L - 1341.02
E - 185.85
R - 1348.14
PI STA - 298+17.17
PI X - 682489.200
PI Y - 1220666.908
SE - 3.40%

R=1348

CURVE 10008
DELTA - 72°13'41" (LT)
T - 1393.41
L - 2407.60
E - 454.28
R - 1909.86
PI STA - 276+70.42
PI X - 683913.554
PI Y - 1218580.827
SE - 3.00%

CURVE 10010
DELTA - 6°13'01" (LT)
T - 248.92
L - 497.36
E - 6.75
R - 4583.66
PI STA - 312+31.08
PI X - 683081.425
PI Y - 1222084.846
SE - 2.20%

Curve 10150
DELTA - 9°55'57" (LT)
T - 86.90
L - 173.35
E - 3.77
R - 1000.00
PI STA - 1701+85.63
PI X - 683644.681
PI Y - 1218730.497
SE - 3.80%

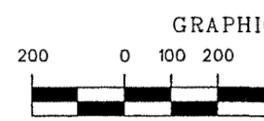
Curve 10160
DELTA - 24°40'05" (LT)
T - 109.33
L - 215.27
E - 11.81
R - 500.00
PI STA - 1804+12.34
PI X - 682390.999
PI Y - 1220782.550
SE - 4.00%

Curve 10170
DELTA - 26°20'50" (RT)
T - 70.22
L - 137.95
E - 8.11
R - 300.00
PI STA - 2101+66.06
PI X - 683295.184
PI Y - 1222223.507
SE - 4.00%

Curve 10171
DELTA - 32°04'43" (LT)
T - 86.25
L - 167.96
E - 12.15
R - 300.00
PI STA - 2104+62.88
PI X - 683513.694
PI Y - 1222018.977
SE - 4.00%

Curve 10180
DELTA - 23°41'15" (RT)
T - 88.08
L - 173.64
E - 9.14
R - 420.00
PI STA - 2301+37.00
PI X - 683737.491
PI Y - 1223822.817
SE - 4.00%

Curve 10181
DELTA - 23°44'15" (LT)
T - 118.74
L - 234.08
E - 12.34
R - 565.00
PI STA - 2304+32.75
PI X - 683966.170
PI Y - 1223629.983
SE - 4.00%



(IN F)
1"=2'

9/21/2007 12:02:20 PM rtrick



NOT RELEASED
FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

DESIGNED: WVM		CHECKED:
DRAWN: SKS		JOB NO. 2302-001

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: 6-2

Georgia Department of Transportation

SHIFT MAINLINE HORIZ CURVE @ TURKEY TRAIL TO THE LT. SHEET NO.:

3 of 4

→ NO CHANGE IN PAVEMENT, CURBS & GUTTER, FUR/CUT,
DRAINAGE, ETC.

→ NO R/W ACQUISITIONS CHANGE
ONLY CHANGE IS RELOCATION

4 HOUSES SAVED.

$$4 \times \$40,000 \times 2.55 = \underline{\underline{\$ 408,000}}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-3**

DESCRIPTION: **PROVIDE A 90° SKEW ANGLE AT THE DIAMOND LAKES WAY AND TURKEY TRAIL ROAD INTERSECTION**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The present design realigns the new intersection of Diamond Lakes Way and Turkey Trail Drive at 79°.

ALTERNATIVE: (Sketch attached)

Realign Diamond Lake Way and Turkey Trail Drive to 90°.

ADVANTAGES:

- Most desirable angle of intersection (90°)
- Better alignment to facilitate turning movements
- Uses purchased parcels at the SE corner of the intersection for the newly proposed crossroad alignment east of Windsor Spring Road

DISADVANTAGES:

- Increases right-of-way cost
- Increases construction cost to extend culvert

DISCUSSION:

The most desirable angle of an intersection is 90°. The realignment lengths with roadway for the “original” design and the proposed alternative are virtually the same lengths.

There would be more right-of-way required to realign Turkey Trail Drive and more construction cost to extend the culvert 60 ft.

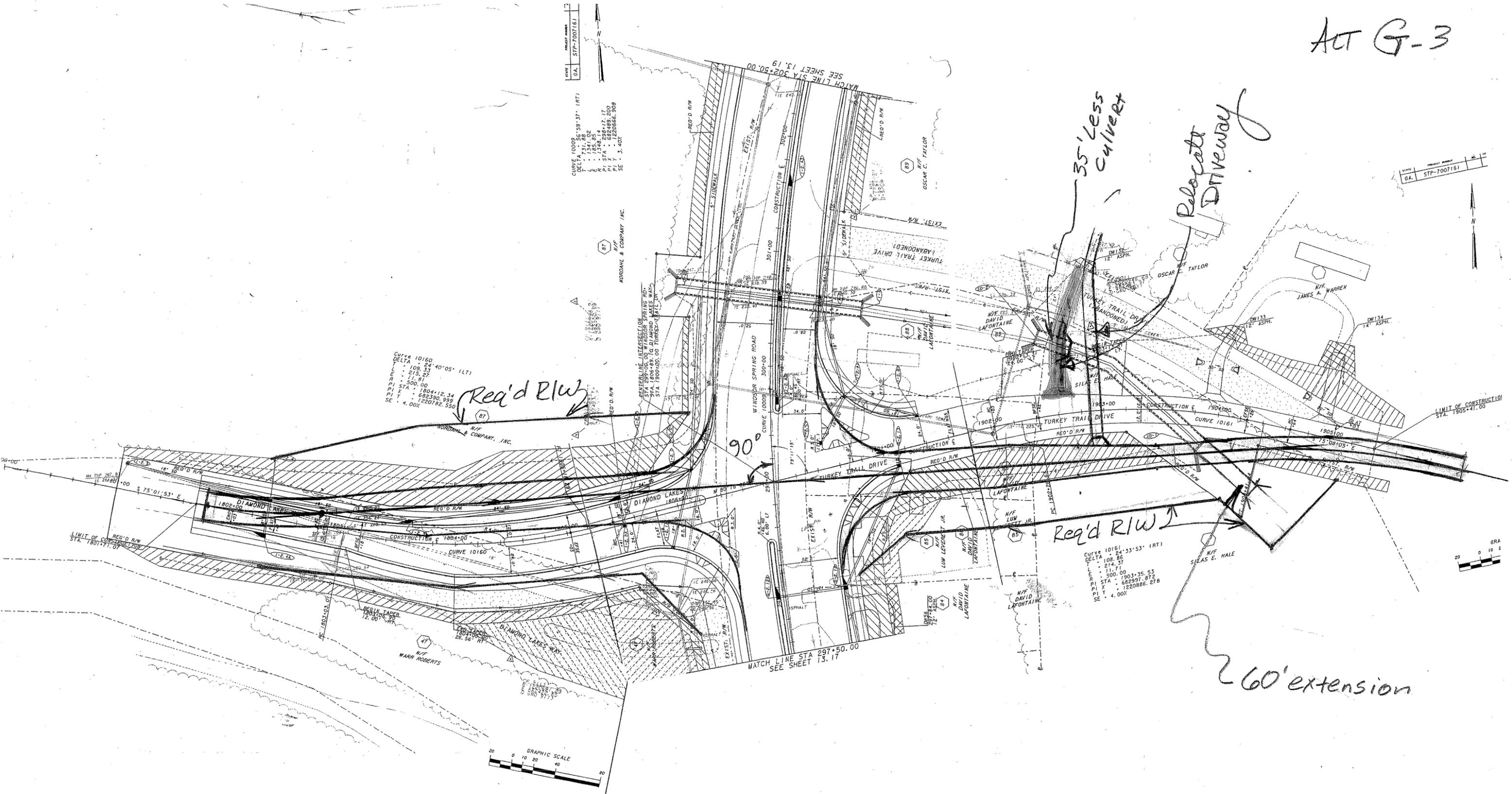
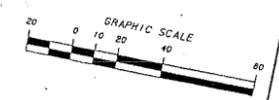
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 39,450	—	\$ 39,450
SAVINGS (Original minus Alternative)	\$ (39,450)	—	\$ (39,450)

STATE PROJECT NUMBER
GA. STP-7007(16)

CURVE 10009 - 56°59'37" (RT)
DELTA 71.1
L 1341.02
E 154.05
P.I. STA. 298+17.17
P.T. STA. 292066.908
S.E. 3.40%

Curve 10160
DELTA 24°40'05" (LT)
L 109.33
E 215.27
P.I. STA. 1804+12.34
P.T. STA. 182390.999
S.E. 4.00%

CURVE 10161 - 24°33'53" (RT)
DELTA 108.86
L 214.37
E 11.71
P.I. STA. 1903+35.53
P.T. STA. 182086.278
S.E. 4.00%



ALTERNATIVE
DESIGN
sh 2/4
G-3

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: G-3

SHEET NO.: 3 of 4

Alt. Additional costs over Original¹
(constr.) extend double 6' x 6' culvert 60ft. (ASSUMED)
more R/W = $(250 \times 40') + (40' \times 80') = 13,200 \text{ SF}$

culvert extension = 60'
save culvert length = 35'

25' net increase of
culvert length.

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.:

G-3

SHEET NO.:

4 of 4

PROJECT ITEM		ORIGINAL ESTIMATE			A.H. PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
R/W	S.F.				13,200	0.60	\$7,920
net length of culvert Extension		L.F.			25	\$700/l.f.	\$17,500
							\$7,920
R/W Subtotal							\$12,280
R/W markup 1.55							\$17,500
Subtotal							\$1,750
Markup (%) at 10%							\$39,450
TOTAL							\$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-6**

DESCRIPTION: **BUILD CONNECTOR ROAD BETWEEN EBENEZER DRIVE (NORTH AND SOUTH) TO RAILROAD AVENUE AND ELIMINATE PROPOSED CONNECTIONS TO WINDSOR SPRING ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The proposed design realigns Ebenezer Drive south (S) to Windsor Spring Road and reconnects Ebenezer Drive north (N) within close proximity of the abutment and barrier of the bridge over the Norfolk Southern Railroad.

ALTERNATIVE: (Sketch attached)

Eliminate the Ebenezer Drive (N&S) connections to Windsor Spring Road by building a “connecting road” from Railroad Avenue.

ADVANTAGES:

- Eliminates poor intersection sight distance at Ebenezer Drive (N)
- Eliminates closely spaced median openings [Railroad Avenue to Ebenezer Drive (N)]
- Consolidates three access points to a single access point with full access (median opening)
- Eliminates a right-in/right-out access to Ebenezer Dr. (S)
- Less construction in this area could reduce the size of the sediment basin

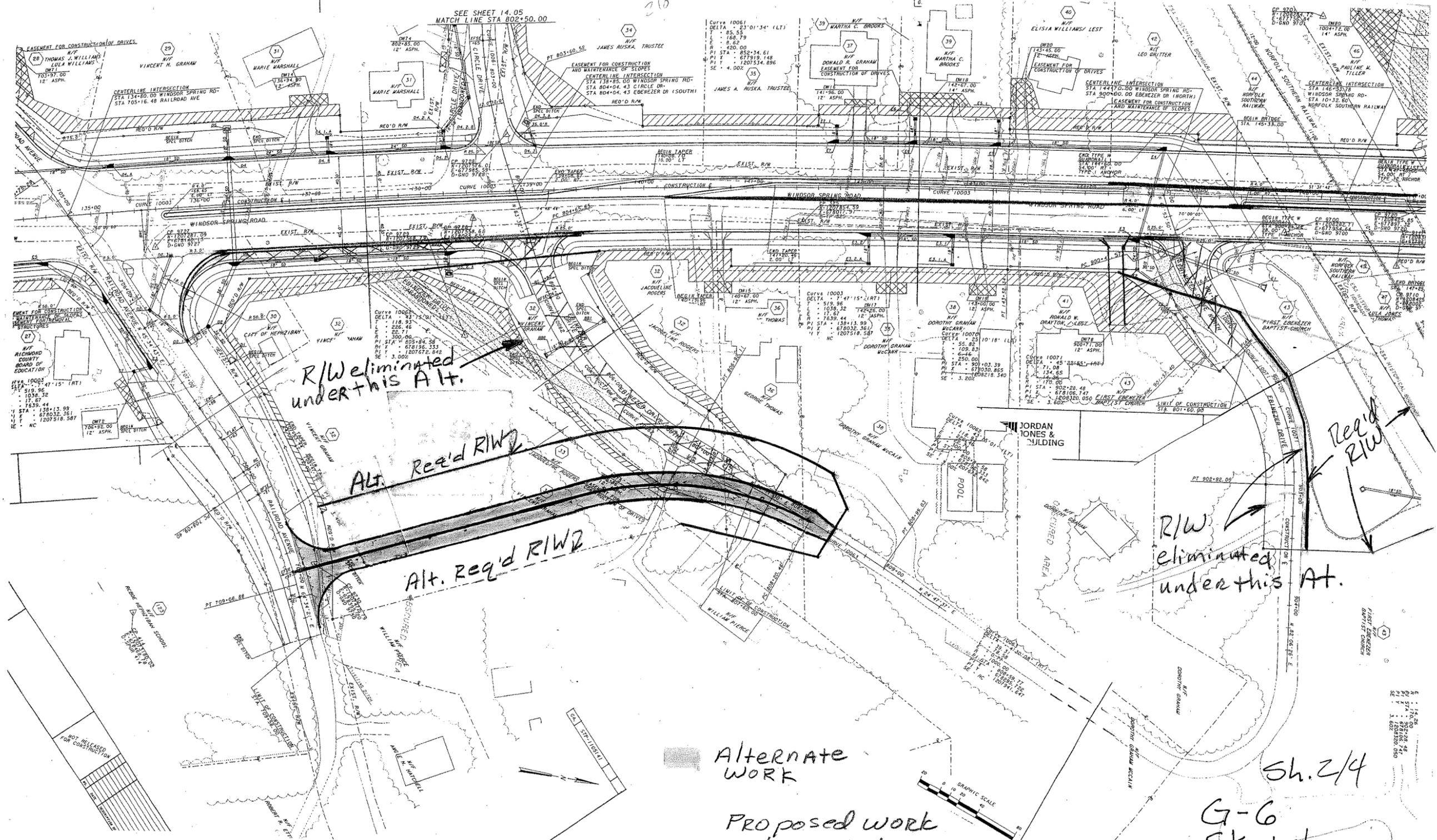
DISADVANTAGES:

- Slight out of direction for motorists bound to Ebenezer Dr. (N)

DISCUSSION:

The elimination of the connections of both Ebenezer (N and S) with Windsor Spring Road by using the “connecting road” from Ebenezer Dr. (S) to Railroad Avenue will reduce accidents and improve the quality of access to Ebenezer Drive (S) with a slight, insignificant out of direction travel for Ebenezer (N) travel. A key benefit of the recommendation is the elimination of accident potential associated with the proximity of the Ebenezer Drive (N) to the end of the bridge barrier and the associated sight distance obstruction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 51,850	—	\$ 51,850
ALTERNATIVE	\$ 72,680	—	\$ 72,680
SAVINGS (Original minus Alternative)	\$ (20,830)	—	\$ (20,830)



■ ALTERNATE WORK
 Proposed work eliminated

Sh. 2/4
 G-6
 Sketch

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.:

G-6

SHEET NO.:

3

of 4

(Realigned Ebenezer Dr. South)
Pink Rd = 520' (Alternative)

Original Realignment construction eliminated = 540' -
For all practical purposes it can be said that
The construction cost are equal.

R/W & easement saved or eliminated from "original" design.

$$\text{Ebenezer Dr. South} = (120' \times 80') + \left[\frac{80' + 50'}{2} \right] \times 70' + \left(\frac{80' \times 44'}{2} \right) = 15,910 \text{ S.F.}$$

$$\text{E. Dr. S. (easement)} = (250' \times 5') + (250' \times 10') = 3,750 \text{ S.F.}$$

$$\text{E. Dr. S.} = 15,910 \text{ S.F.} + 3,750 \text{ S.F.} = 19,660 \text{ S.F.}$$

Ebenezer Dr. North R/W & easement eliminated

$$\text{E. DR. N. R/W} = (190' \times 40') + (60' \times 40') + \left(\frac{60' \times 16'}{2} \right) = 10,480 \text{ S.F.}$$

$$\text{R/W \& easement eliminated} = 3,750 + 19,660 + 10,480 = 33,890$$

$$\text{R/W required for "Pink" Road (Alt. / Ebenezer Dr. South Connector)} \\ (100' \times 350') + (130' \times 85') + \left(22' \times \left(\frac{80' + 50'}{2} \right) \right) = 47,500 \text{ S.F.}$$

(Alt.)

47,500 S.F. v.s. 33,890 S.F. (eliminated or saved)

(Original)

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-7**

DESCRIPTION: **ELIMINATE SPIRIT CREEK ROAD EXTENSION**

SHEET NO.: **1 of 8**

ORIGINAL DESIGN: (Sketch attached)

The current plans indicate an extension that extends Spirit Creek Road from Windsor Spring Road to Kings Gate Drive.

ALTERNATIVE: (Sketch attached)

Eliminate this extension. It was not included in the original concept and further documents to date.

ADVANTAGES:

- Reduces displacements
- Reduces right-of-way
- Reduces materials
- Keeps project on schedule
- Removes additional NCCPA hurdles
- Reduces cost

DISADVANTAGES:

- None apparent

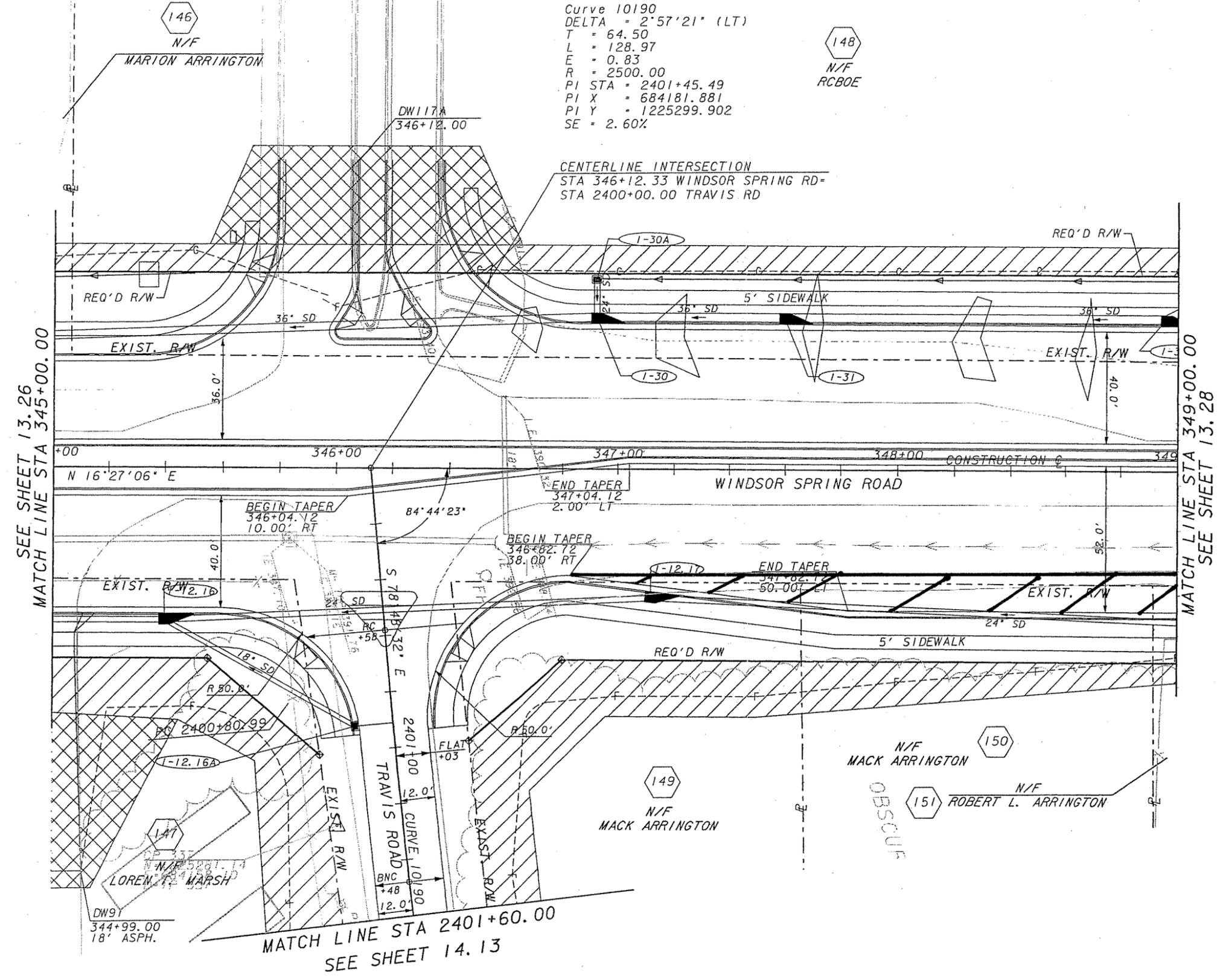
DISCUSSION:

There is no traffic data corroborating this extension. The approved environmental documents do not show this extension as part of the project. The number of displacements seems excessive without any discernible traffic benefits.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,995,303	—	\$ 1,995,303
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 1,995,303	—	\$ 1,995,303

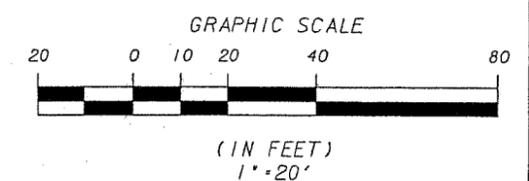
Curve 10190
 DELTA = 2°57'21" (LT)
 T = 64.50
 L = 128.97
 E = 0.83
 R = 2500.00
 PI STA = 2401+45.49
 PI X = 684181.881
 PI Y = 1225299.902
 SE = 2.60%

148
 N/F
 RCBOE



- NO RIGHT TURN LANE
- NO ROAD EXTENSION
- NO R/W.
- NO DISPLACEMENTS
- REDUCED DRAINAGE

VE ALTERNATIVE



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REQUIRED R/W LINE	—
PROPERTY AND EXISTING R/W LINE	- - -
CONSTRUCTION LIMITS	- - - F
EASEMENT FOR CONST OF SLOPES	[Hatched pattern]
EASEMENT FOR CONST OF DRIVES	[Cross-hatched pattern]
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	[Stippled pattern]
OVERLAY PAVEMENT	[Diagonal hatched pattern]



NOT RELEASED FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: W/M	CHECKED:	DATE:	13.27
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET 13.27
			REV

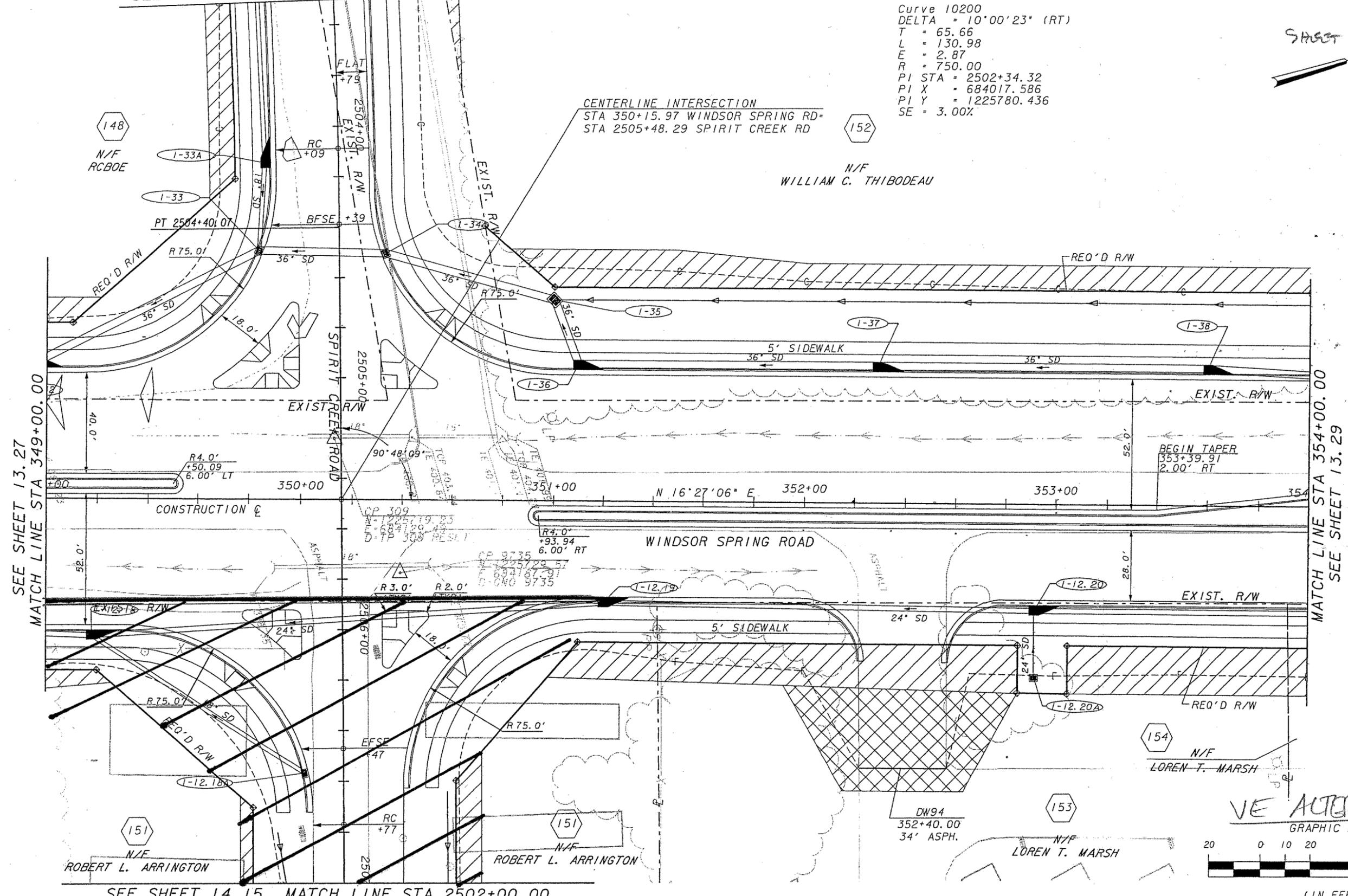
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SEE SHEET 14.14 MATCH LINE STA 2502+00.00

ALT. G-7

SHEET 3 OF 8

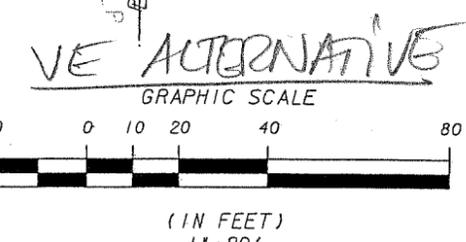
Curve 10200
 DELTA = 10°00'23" (RT)
 T = 65.66
 L = 130.98
 E = 2.87
 R = 750.00
 PI STA = 2502+34.32
 PI X = 684017.586
 PI Y = 1225780.436
 SE = 3.00%



SEE SHEET 13.27
 MATCH LINE STA 349+00.00

MATCH LINE STA 354+00.00
 SEE SHEET 13.29

SEE SHEET 14.15 MATCH LINE STA 2502+00.00



9/21/2007 12:04:43 PM r1/rick p:\02\02302\001\dgn\250610\250610c28.dgn

REQUIRED R/W LINE	—
PROPERTY AND EXISTING R/W LINE	- - -
CONSTRUCTION LIMITS	C - F
EASEMENT FOR CONST OF SLOPES	[Hatched pattern]
EASEMENT FOR CONST OF DRIVES	[Cross-hatched pattern]
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	[Stippled pattern]
OVERLAY PAVEMENT	[Diagonal hatched pattern]



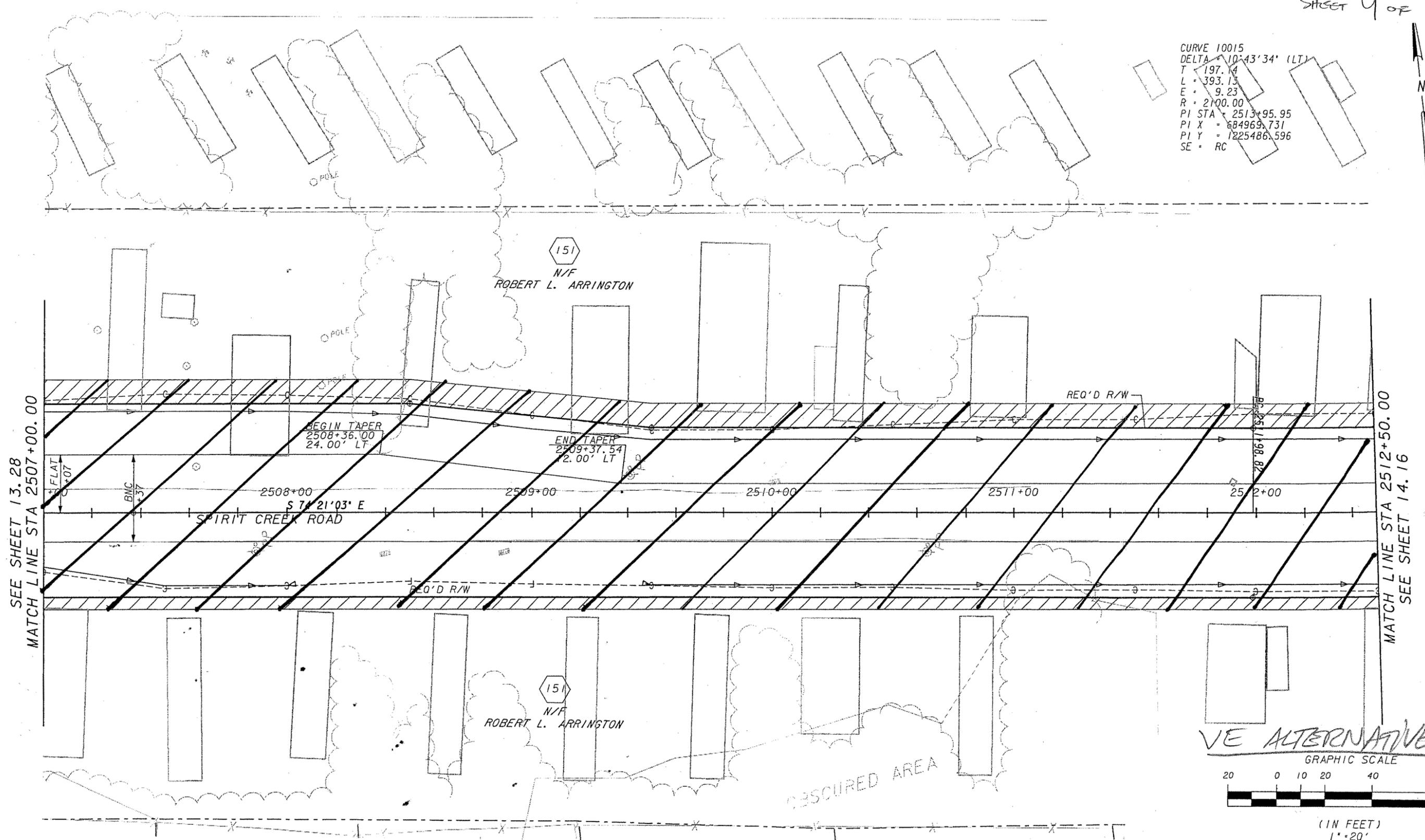
NOT RELEASED FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: MWM	CHECKED:	DATE:	13.28
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET 13.28
			REV

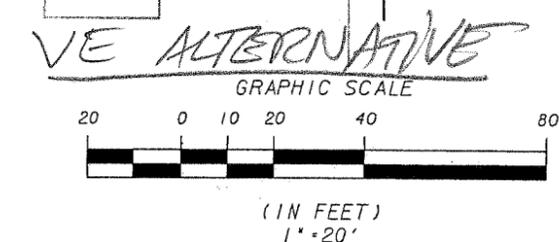
9/21/2007 12:04:43 PM 87/LES

CURVE 10015
 DELTA = 10°43'34" (LT)
 T = 197.14
 L = 393.13
 E = 9.23
 R = 2100.00
 PI STA = 2513+95.95
 PI X = 684969.731
 PI Y = 1225486.596
 SE = RC



SEE SHEET 13.28
 MATCH LINE STA 2507+00.00

MATCH LINE STA 2512+50.00
 SEE SHEET 14.16



9/21/2007 12:05:54 PM r11ick p:\02\02302\001\dgn\250610\250610c49.dgn

REQUIRED R/W LINE	
PROPERTY AND EXISTING R/W LINE	
CONSTRUCTION LIMITS	
EASEMENT FOR CONST OF SLOPES	
EASEMENT FOR CONST OF DRIVES	
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	
OVERLAY PAVEMENT	



NOT RELEASED
 FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

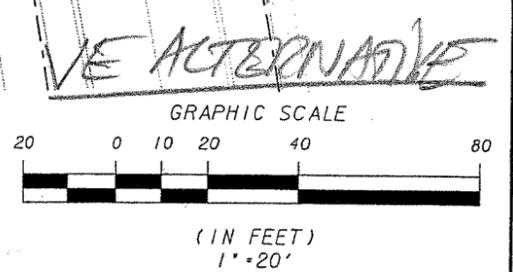
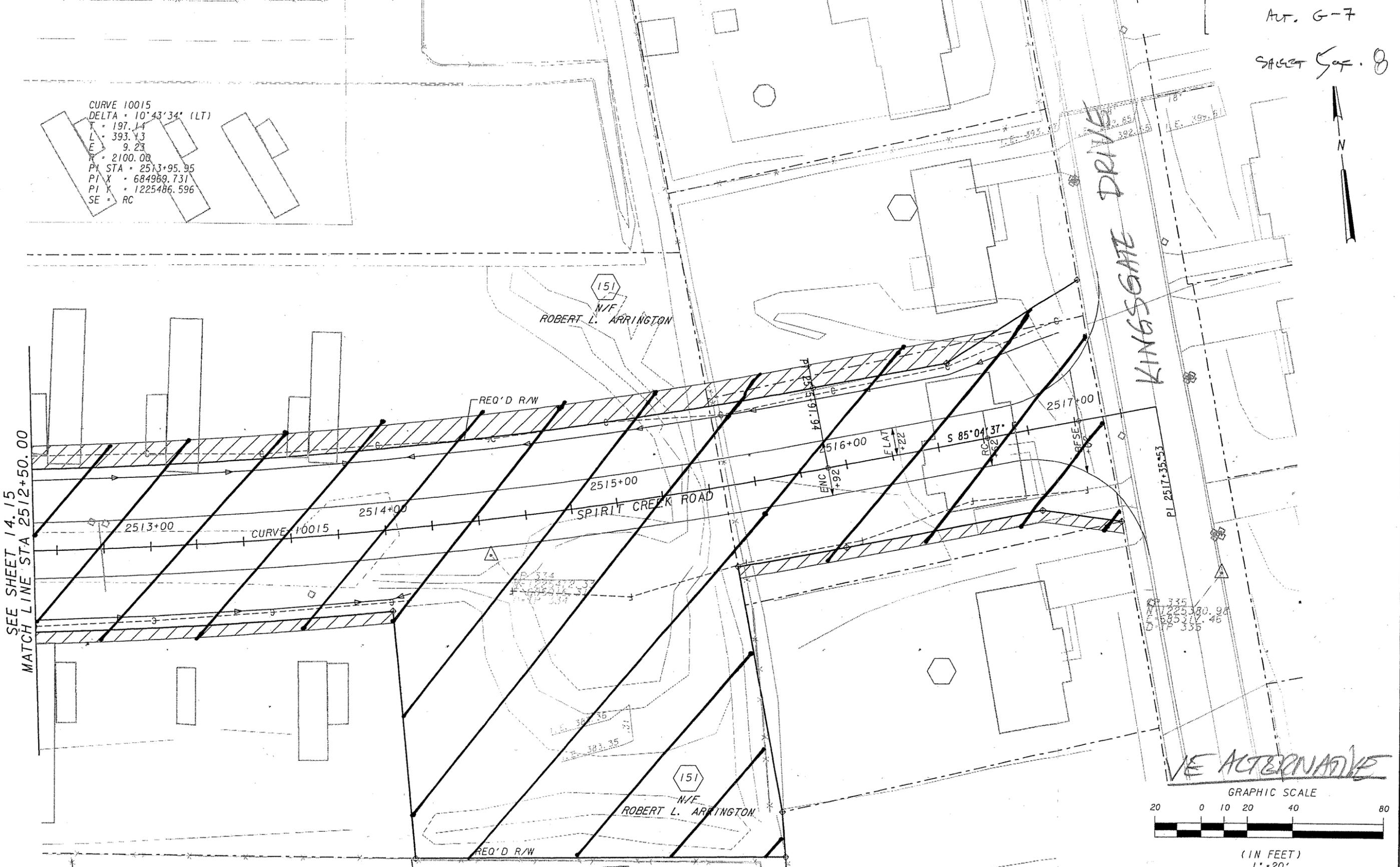
WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: MVM	CHECKED:	DATE:	14.15
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET
			REV

9/21/2007 12:05:54 PM #71E5



CURVE 10015
 DELTA = 10°43'34" (LT)
 T = 197.14
 L = 393.43
 E = 9.23
 R = 2100.00
 PI STA = 2513+95.95
 PI X = 684969.731
 PI Y = 1225486.596
 SE = RC

SEE SHEET 14.15
 MATCH LINE STA 2512+50.00



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 p:\02\02302\001\dgn\250610\250610c50.dgn

REQUIRED R/W LINE	
PROPERTY AND EXISTING R/W LINE	
CONSTRUCTION LIMITS	
EASEMENT FOR CONST OF SLOPES	
EASEMENT FOR CONST OF DRIVES	
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	
OVERLAY PAVEMENT	



NOT RELEASED
 FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: MVM	CHECKED:	DATE:	14.16
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET
			REV

9/21/2007 12:05:57 PM r11ck
 p:\02\02302\001\dgn\250610\250610c50.dgn

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: G-7.

Georgia Department of Transportation

ELIMINATE SPIRIT CREEK RD EXTENSIONS

SHEET NO.: 6 of 8

ON WINDSOR SPRING RD:

12' PAVEMENT @ 350' (RIGHT TURN LANE)

12' R/W @ 350' (RIGHT TURN LANE)

$$\text{PAVEMENT} = \frac{(12)(350)}{9} (\$48.20/\text{SY}) = \underline{\underline{\$ 22,494}}$$

$$\text{R/W BREAKDOWN} = 4200 \text{ SF}$$

$$\text{DISPLACEMENTS} = \emptyset \text{ TOTAL}$$

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING

ALTERNATIVE NO.: G-7

Georgia Department of Transportation

ELIMINATE SPIRIT CREEK RD EXTENSIONS.

SHEET NO.: 7 of 8

ON SPIRIT CREEK NEW ALIGNMENT:

36' LANES @ 300' PAVEMENT

24' LANES @ 800' PAVEMENT

$$\begin{aligned} \text{PAVEMENT} &= \frac{1}{4} [(36)(300) + (24)(800)] (\$48.20/\text{sy}) \\ &= \underline{\underline{\$ 160,667}} \end{aligned}$$

CURB & GUTTER = NO CHANGE

SIDEWALK = NO CHANGE

ISLAND & ACCESS RAMPS \approx \\$10,000

DRAINAGE = 18" @ 100' = (100') @ 47⁰⁰ = \\$4700

RLW = 300' @ 90' & 800' @ 80' = 91,000 SF

DISPLACEMENT = 16 TOTAL.

COST WORKSHEET



PROJECT: **Windsor Spring Road Widening** ALTERNATIVE NO.: **6-7.**
 Georgia Department of Transportation
 ELIMINATE SPIRIT CREEK RD EXTENSIONS 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
PAVEMENT	SY	466	\$48 ²⁰	\$22,494		N/A	
PAVEMENT	SY	3333	\$48 ²⁰	\$160,667		N/A	
DRAINAGE	LF	100	\$47 ⁰⁰	\$4700		N/A	
ISLAND & ACCESS RAMPS	LS	1	\$10,000	\$10,000		N/A	
SUBTOTAL ₁				\$197,861			
MARK UP 10%				\$19,786			
SUBTOTAL ₂				\$217,647			
R/W	SF	4200	\$0.60	\$2,520			
R/W	SF	91,000	\$0.60	\$54,600			
DISPLACEMENTS	EA	16	\$40,000	\$640,000			
MARK UP (1.55)				\$1,080,536			
SUBTOTAL ₃				\$1,777,656			
Subtotal				\$1,995,303			∅
Markup (%) at				∅			∅
TOTAL				\$1,995,303			∅

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-9**

DESCRIPTION: **IN LIEU OF DRIVEWAYS, PROVIDE ACCESS ROAD TO
COMMERCIAL PROPERTIES NEAR TOBACCO ROAD
AND THE WINDSOR SPRING INTERSECTION**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

Access is provided to six driveways in approximately 800 ft. with the northern most only 200 ft. from Tobacco Road.

ALTERNATIVE: (Sketch attached)

Provide an access road to commercial buildings and eliminate 3 to 5 driveway connections to Windsor Spring Road.

ADVANTAGES:

- Improves safety by eliminating driveways close to major intersection

DISADVANTAGES:

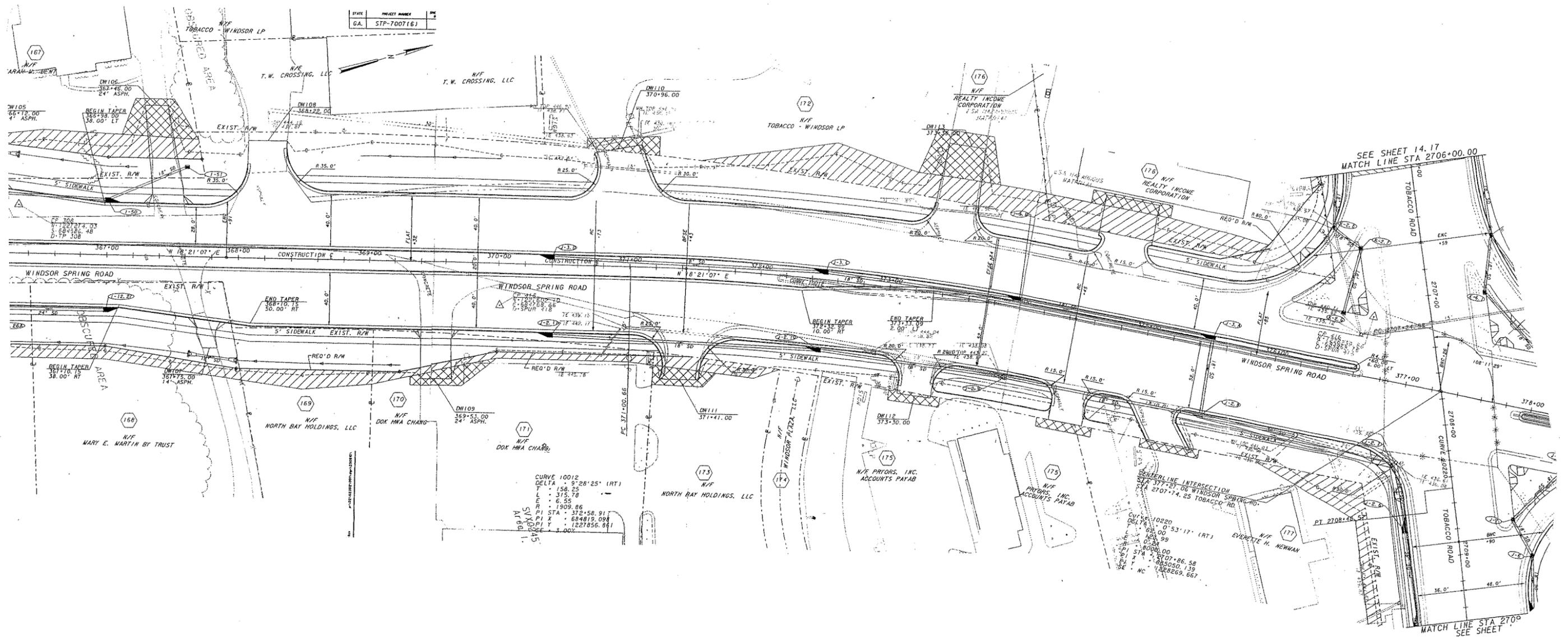
- Requires additional right-of-way and construction costs
- Quality of "direct" access to three commercial properties

DISCUSSION:

Need and purpose of this project discusses excessive rear-end collisions. The number of driveways provided in this right-turn lane will exacerbate the high accident issues on the existing roadway. The loss of quality access could be assuaged by the strategic placement of directional signing.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 197,119	—	\$ 197,119
SAVINGS (Original minus Alternative)	\$ (197,119)	—	\$ (197,119)

ALTERNATIVE
G-9
ORIGINAL
DESIGN
SHEET 2 OF 5



CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: G-9

SHEET NO.: 4 of 5

RIGHT-OF-WAY: PURCHASE 50' PLUS FOR
ACCESS ROAD APPROX. 550' LONG

$$A = 50(550) = 27,500 \text{ SF}$$

PAVEMENT (COMMERCIAL ASPHALT DRIVEWAY SECTION)

$$A = 24(550) = 13,200 / 9 = 1467 \text{ SY}$$

COST WORKSHEET



PROJECT: Windsor Spring Road Widening
 Georgia Department of Transportation

ALTERNATIVE NO.: G-9

SHEET NO.: 5 of 5

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
Comm. DANCEWAY PAV'T	SY	0	26.55	0	1467	26.55	38,949
MARKUP @ 10%				0			3,895
PAYMENT TOTAL							\$ 42,844
RIGHT-OF-WAY	SF	0	2.20	0	27,500	2.20	60,500
MARKUP @ 155%							93,775
R/W TOTAL							154,275
Subtotal				0			197,119
Markup (%) at				0			0
TOTAL				0			197,119

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-10**

DESCRIPTION: **USE ABANDONED WINDSOR SPRING ROAD AT
PLANTATION ROAD AS A FRONTAGE ROAD**

SHEET NO.: **1 of 7**

ORIGINAL DESIGN: (Sketch attached)

Windsor Spring Road is being relocated to the west to flatten the curve. The existing road is being abandoned and driveways are being extended to meet the new road.

ALTERNATIVE: (Sketch attached)

Retain the existing road as a frontage road to provide access to five driveways. Access to the five driveways could be provided via the frontage road.

ADVANTAGES:

- Improves safety on Windsor Spring Road
- Improves highway operations
- Maintains driveway access
- Reduces costs

DISADVANTAGES:

- Requires access on Plantation Road near Windsor Spring Road

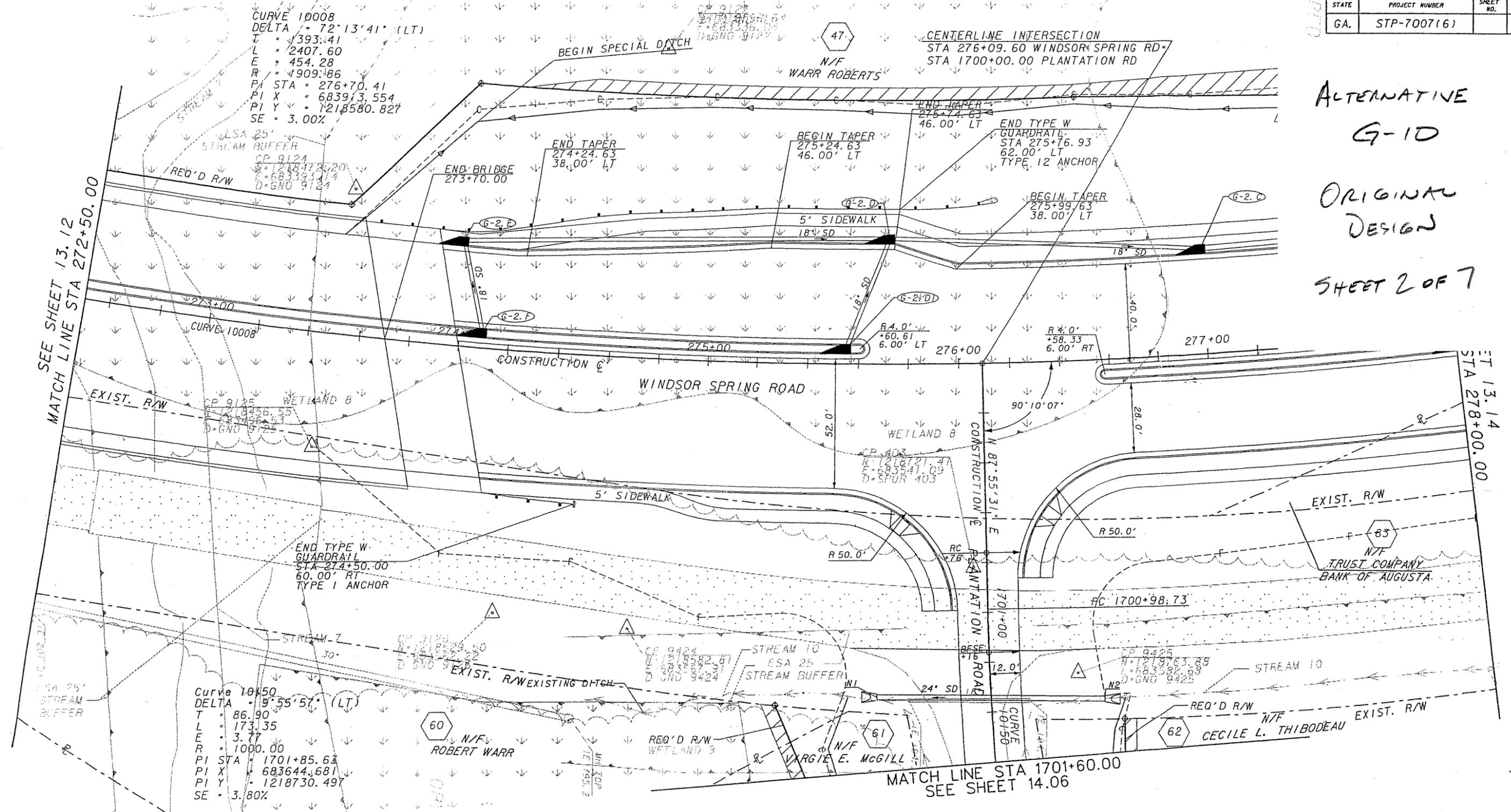
DISCUSSION:

This alternative maintains the existing pavement on the east side of relocated Windsor Spring Road to provide access to five driveways. Eliminating these driveway connections to Windsor Spring road will improve safety. While a cul-de-sac will be required at the end of the access road, a substantial amount of driveway pavement can be omitted.

The aforementioned five driveways would have access to one driveway off Plantation Road.

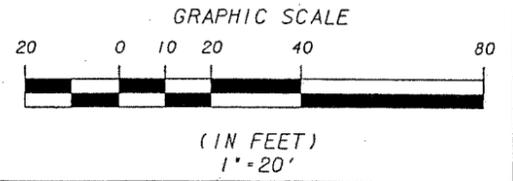
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 6,769	—	\$ 6,769
ALTERNATIVE	\$ 4,026	—	\$ 4,026
SAVINGS (Original minus Alternative)	\$ 2,743	—	\$ 2,743

ALTERNATIVE
G-10
ORIGINAL
DESIGN
SHEET 2 OF 7



CURVE 10008
DELTA = 72°13'41" (LT)
T = 393.41
L = 2407.60
E = 454.28
R = 1909.86
PI STA = 276+70.41
PI X = 683913.554
PI Y = 1218580.827
SE = 3.00%

Curve 10150
DELTA = 9°55'57" (LT)
T = 86.90
L = 173.35
E = 3.77
R = 1000.00
PI STA = 1701+85.63
PI X = 683644.681
PI Y = 1218730.497
SE = 3.80%



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REQUIRED R/W LINE	
PROPERTY AND EXISTING R/W LINE	
CONSTRUCTION LIMITS	
EASEMENT FOR CONST OF SLOPES	
EASEMENT FOR CONST OF DRIVES	
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	
OVERLAY PAVEMENT	



NOT RELEASED
FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: MVM	CHECKED:	DATE:	13.13
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET 13.13
			REV

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CURVE 10008
 DELTA = 72°13'41" (LT)
 T = 1393.41
 L = 2407.60
 E = 454.28
 R = 1909.86
 PI STA = 276+70.42
 PI X = 683913.554
 PI Y = 1218580.827
 SE = 3.00%

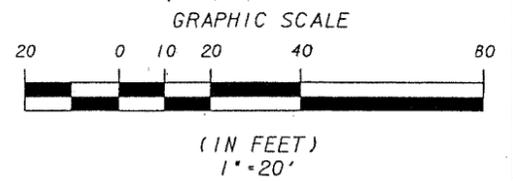
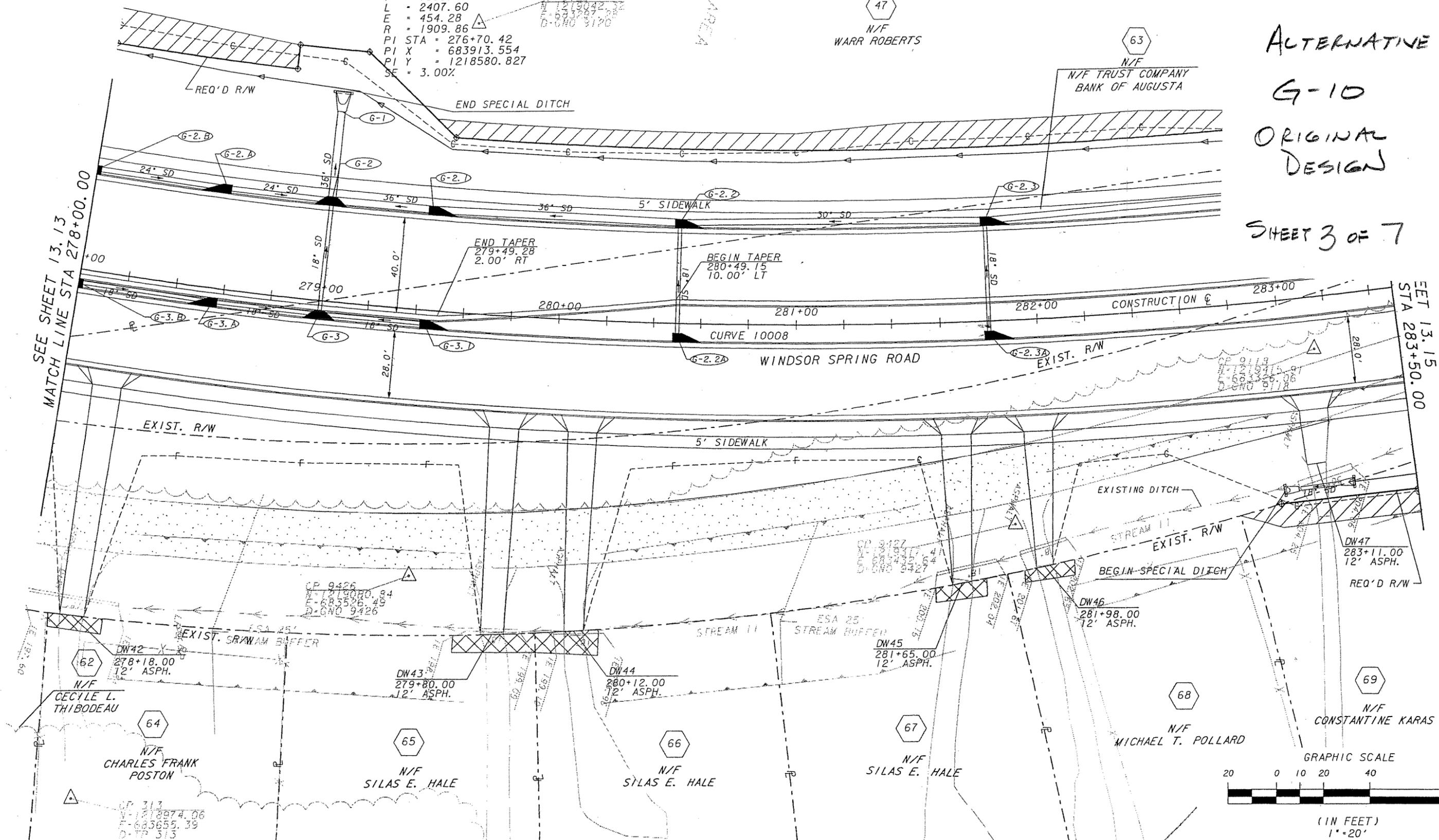
47
 N/F
 WARR ROBERTS

63
 N/F
 N/F TRUST COMPANY
 BANK OF AUGUSTA

ALTERNATIVE
 G-10
 ORIGINAL
 DESIGN
 SHEET 3 OF 7

SEE SHEET 13.13
 MATCH LINE STA 278+00.00

EET 13.15
 STA 283+50.00



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REQUIRED R/W LINE	---
PROPERTY AND EXISTING R/W LINE	- - -
CONSTRUCTION LIMITS	- - - -
EASEMENT FOR CONST OF SLOPES	▨
EASEMENT FOR CONST OF DRIVES	▩
OBITERLATE PAVEMENT GRASS & GRADE TO DRAIN	▧
OVERLAY PAVEMENT	▨



NOT RELEASED
 FOR CONSTRUCTION

NO.	DATE	DESCRIPTION OF REVISION

WINDSOR SPRING ROAD - PHASE IV WILLIS FOREMAN ROAD TO TOBACCO ROAD			
CONSTRUCTION PLAN			
DESIGNED: MVM	CHECKED:	DATE:	13.14
DRAWN: SKS	JOB NO. 2302-001	SCALE: AS SHOWN	SHEET
			REV

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CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: G-10

SHEET NO.: 6 of 7

ADDITIONAL CURB-AND-GUTTER REQUIRED AT THE
INTERSECTION OF PLANTATION ROAD AND THE
PROPOSED FRONTAGE ROAD = 50 LF

ADDITIONAL PAVEMENT FOR CUL-DE-SAC
 $A = \pi (25^2) / 9 = 218 \text{ SY}$

DRIVEWAY PAVEMENT OMITTED

$$A = 10 (105 + 90 + 90 + 70 + 60) / 9 = 461 \text{ SY}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-11**

DESCRIPTION: **ELIMINATE DESIGN CARRYOVER, ASSOCIATED WITH AN OVERLAY FOR THE PROPOSED ELEVATIONS FOR THE PGL**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

PGL is set to allow for the possibility of an overlay.

ALTERNATIVE:

Remove PGL constraints set to allow for overlay.

ADVANTAGES:

- Reduces constrained design
- Option to correct geometric deficiencies
- Reduces right-of-way
- Reduces earthwork
- Reduces cost

DISADVANTAGES:

- Requires major redesign at this stage

DISCUSSION:

For an overlay to be truly effective, the existing pavement must be under the proposed pavement. The majority of the project places the existing pavement directly under the grass median, defeating the whole purpose of the overlay. Trying to meet an overlay PGL constraint reduces design possibilities that could yield substantial cost savings.

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: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **G-13**

DESCRIPTION: **EVALUATE SIGNAL WARRANTS AT PLANTATION ROAD AND BOYKIN ROAD**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

Neither the Plantation Road nor the Boykin Road intersections are signalized.

ALTERNATIVE:

Consider signalizing this intersection based on GDOT signal warrant procedures.

ADVANTAGES:

- Improves safety at intersection
- Improves access to U.S. 25

DISADVANTAGES:

- Increases cost
- Adds a signalized intersection

DISCUSSION:

Both Plantation Road and Boykin Road provide access from Windsor Spring Road to U.S. 25 (Peach Orchard Road). Providing signals at these intersections will improve traffic flow from Windsor Spring Road to these crossroads. Also, signals would facilitate left turns from these crossroads to Windsor Spring Road southbound. The decision should be based on a signal warrant evaluation.

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: **WINDSOR SPRING ROAD WIDENING**
Georgia Department of Transportation

ALTERNATIVE NO.: **G-14**

DESCRIPTION: **RETAIN THE PROPOSED SPIRIT CREEK ROAD
 EXTENSION AND CUL-DE-SAC TRAVIS ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes to add a new connection between Windsor Spring Road and Kingsgate Drive along Spirit Creek Road (easterly extension) with a median opening while the adjacent Travis Road would have access to Windsor Spring Road as a right-in/right-out only.

ALTERNATIVE: (Sketch attached)

Retain the proposed Spirit Creek Road but close off Windsor Spring/Travis Road access by providing a cul-de-sac at Travis Road.

ADVANTAGES:

- Improves traffic operations along Windsor Spring Road
- Improves right-turn and left-turn lanes to Spirit Creek Road (extension) due to elimination of the Travis Road connection
- Reduces construction costs
- Reduces right-of-way costs
- Eliminates accidents at the Windsor Spring Road/Travis Road intersection

DISADVANTAGES:

- Results in a slight out of direction travel for motorists headed to and from Travis Road to Windsor Spring Road

DISCUSSION:

The current design proposes right-in/right-out Windsor Spring to Travis Road access and full access (median opening) at the Windsor Spring/proposed Spirit Creek Road intersection. The location of Travis Road is within 400 ft. of Spirit Creek Road. With the implementation of this VE alternative, Spirit Creek Road extension would now provide access to the cul-de-sac Travis Road via Kingsgate Drive without excessive out of direction travel. The removal of the Travis Road connection would improve the safety and highway operations of Windsor Spring Road, such as lengthening the right-turn lane (decel lane) to Spirit Creek Road extension and eliminating the current design's short weave from the Travis Road to the median opening at Spirit Road. It is important to note that the Spirit Creek extension does provide access for Travis Road to a median opening. This proposed alternative would provide a safer design by removing the weave caused by Travis Road motorists headed to the left-turn lane at Spirit Creek Road and by removing them from the right-turn lane (decel lane) to Spirit Creek Road. Windsor Spring Road's accident rate is an important "driver" on this project; therefore, the proposed design changes support the reduction in accidents being achieved by the project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 81,570	—	\$ 81,570
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 81,570	—	\$ 81,570

CALCULATIONS



PROJECT:

WINDSOR SPRING RD WIDENING
Georgia Department of Transportation

ALTERNATIVE NO.: G-14

SHEET NO.: 3 of 4

Original Design proposes to upgrade / Reconstruct TRAVIS ROAD (see typical sections No. 6 and No. 7 in plans). This Alternate recommends to cul-de-sac TRAVIS Rd and leave it as it is, and not upgrade / Reconstruct it since it is not tying into Windsor Spring. 400' Length

$$\left(\frac{400' \times 24'}{9}\right) = 1066.67 \text{ s.y.}$$

Project unit price \$48.20/s.y.

RIW cost for Original upgrade of TRAVIS Rd not required under Alternate G-1

$$RIW = (300' \times 10' \text{ Aug}) + (200' \times 17' \text{ Aug}) = 6,400 \text{ S.F.}$$

$$\begin{aligned} \text{Easement} &= (200' \times 4') + (200' \times 24') + (200' \times 6') + (100' \times 20') = \\ &= 8,800 \text{ S.F.} \end{aligned}$$

COST WORKSHEET



PROJECT:

Windsor Spring Road Widening
Georgia Department of Transportation

ALTERNATIVE NO.:

G-14

SHEET NO.:

4 of 7

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
upgrade of TRAVIS ROAD	S.Y.	1100	48.20	\$53,020			
RW & Easement Required for upgrade of TRAVIS Rd							
R/W	S.F.	6,400	0.60	\$3,840			
Easement	S.F.	8,800	0.60	\$5,280			
		R/W subtotal		\$9,120			
CONSTR. Subtotal				\$53,020			
CONSTR. Markup (10%)				5,300			
				\$58,320			
RW Subtotal				\$9,120			
Markup (%) at 1.55				\$14,130			
TOTAL				\$81,570			

R/W

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **CPS-1**

DESCRIPTION: **RELEASE PHASE IV AND PHASE V AS ONE CONSTRUCTION CONTRACT**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The current concept is to release Phases IV and V as two separate construction contracts.

ALTERNATIVE:

Combine Phase IV and V contracts into one significant contract.

ADVANTAGES:

- Reduces construction administration costs
- Provides a single contract point of contact
- Simplifies staging
- Eliminates multiple contractors with conflicting schedules
- Reduces cost

DISADVANTAGES:

- Increases upfront cost
- Eliminates use of smaller local contractors
- May preclude some smaller contracts

DISCUSSION:

Depending on the staging of each contract, multiple contractors may need to be in the same location. Combining the contractors provides one single point of authority and scheduling.

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: **WINDSOR SPRING ROAD WIDENING**
Richmond County, Georgia

ALTERNATIVE NO.: **CPS-2**

DESCRIPTION: **SEPARATE SPIRIT CREEK ROAD EXTENSION INTO A
 SEPARATE PROJECT**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The current design calls for an extension of Spirit Creek Road that appears to be a recent modification that could require a reevaluation of the environmental document.

ALTERNATIVE:

Segregate the Spirit Creek Road extension from the Phase IV contract and prepare a separate environmental document.

ADVANTAGES:

- Eliminates environmental re-evaluation
- Allows Phase IV contract to progress without delays
- Avoids additional public input/meetings

DISADVANTAGES:

- None apparent

DISCUSSION:

The extension of Spirit Creek does not appear to match the purpose and need of the project and may complicate the environmental re-evaluation. The potential delay to the project could impact the STP funding cycle. The inclusion of the extension is very risky to the timely progression and completion of the rest of the project.

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

PROJECT DESCRIPTION

INTRODUCTION

The Windsor Spring Road from State Route 88 to Willis Foreman and Willis Foreman to Tobacco Road (Phases IV and V) (P.I Nos.: 245320, 245325 and 250610, 250615) project provides multi-lane access to areas not served by the interstate system. This project proposes to convert a two-lane conventional highway to a divided four-lane facility with a 20-ft. raised median serving the southwest community of Augusta, Richmond County.

The purpose of this is to address existing deficiencies and improve the existing north-south connectivity between the City of Hephzibah and the commercial and industrial resources of the greater Augusta area.

The need for these improvements is supported by high crash rates, projected poor levels of service due to the increasing traffic demand, unsatisfactory bike and pedestrian accommodations, and projected expectations associated with the proposed ARTS Pedestrian and Bicycle plan. The crash rate for this section of Windsor Spring Road is two to three times higher than the statewide average for this type of facility. With no improvements, the projected LOS for the 2025 design year is F.

The southern terminus of the project (and Phase V) begins at SR 88 and the northern terminus (and Phase V) ends at Tobacco Road. The intermediate limit between Phases IV and V lies at a point south of Willis Foreman Road (where Phase IV, 3.22 miles in length, costs a total of \$43.4 million broken down as \$17.8 million for construction, \$13.6 million for right-of-way and \$1.7 million for reimbursable utilities). Phase V, 2.09 miles in length, costs a total of \$43.4 million broken down as \$17.8 million for construction, \$12.9 million for right-of-way and \$1.1 million for reimbursable utilities. The total project (Phases IV and V) requires a \$75.1 million capital investment.

The Phase V contract is scheduled to advertise first, followed by Phase IV. The proposed award date (letting) is Feb 2010 for Phase V and July 2010 for Phase IV. The bridge projects will be let along with their respective road projects. No construction schedules have yet been identified.

The environmental document is an EA/FONSI, with the FONSI signed by the FHWA on September 5, 2007.

PROJECT DESCRIPTION

Phase IV Project

Project STP-7007(6) and BRSLB-7007(7), Richmond County

P.I. Numbers 250610 and 250615

Windsor Spring Road/CR 65 from Willis Forman Road to Tobacco Road

Project History

Project STP-7007(6) consists of improvements to Windsor Spring Road/CR 65 from Willis Foreman Road (Milepost 7.40) to Tobacco Road (Milepost 4.71) in Richmond County, Georgia. Windsor Spring Road/CR 65 is functionally classified as an Urban Minor Arterial. Project BRSLB-7007(7) consists of replacing the existing bridge over Spirit Creek.

The project corridor is primarily rural and suburban residential with commercial areas at the northern end. There are two schools located just north of Willis Foreman Road, and Diamond Lakes Regional Park is located just north of Spirit Creek.

Projects STP-7007(6) and BRSLB-7007(7) are included in the Fiscal Year (FY) 2004-2006 Transportation Improvement Program (TIP) as TIP project numbers STP-16 and BRM-6, respectively. Also, bike lanes and sidewalks for Windsor Spring Road are included in the Augusta Regional Transportation Study's (ARTS) Bicycle and Pedestrian Plan.

The current transportation network in the project area presents multiple deficiencies, including:

- insufficient capacity for future traffic volumes,
- deteriorating levels of service,
- high crash rates,
- pedestrian and bicycle hazards, and
- bridge deficiencies.

Travel Demand

The travel demand on the Windsor Spring Road corridor has been steadily increasing in traffic due to development in the area such as the Diamond Lakes Regional Park which has been constructed within the project limits. In addition, Windsor Spring Road provides a direct route from the City of Hephzibah to I-520, which leads to the commercial and business areas of the City of Augusta.

Traffic Counts and Historical Growth

Several traffic counts were collected on Windsor Spring Road in September 2001. In September 2001, the daily traffic on Windsor Spring Road ranged from 6,800 vehicles per day (vpd) north of Willis Foreman Road to 18,000 vpd south of Tobacco Road. The GDOT traffic count station for this section of road, TC 256, is generally collected south of Patrick Avenue and has shown a historical growth rate of 2.1 percent per year over the past five years (1997-2001). Traffic north of Tobacco Road has increased by 8.8 percent per year over the last five years, according to GDOT traffic count station TC 258. Additionally, the ARTS Travel Demand Model has a 1999 base year volume of 7,000 vpd and a 2025 demand volume of 15,000 vpd at the TC256 count station. This is a growth rate of 3 percent per year at this location.

Population Growth

In order to help confirm the anticipated growth in the area, census population data for 1990 and 2000 for the City of Hephzibah was analyzed. According to the census data, the City of Hephzibah has had a population growth rate of 4.6 percent for each of the last ten years. The 1990 population was 2,466 and the 2000 population was 3,880.

Traffic Projections and Level of Service (LOS)

Table 1 provides opening year and design year projections and LOS for the project corridor.

**Table 1
Traffic Projections for Windsor Spring Road**

YEAR	2005			2025		
	LOCATION	VPD	LOS	VPD	LOS	
			No-Build		No-Build	With Widening
	North of Willis Foreman Road	10,030	C	20,620	F	C
	North of Lincolnton Parkway	22,290	F	36,560	F	C

Using the growth data previously identified, the opening year (2005) traffic on Windsor Spring Road will range from 10,030 vpd just north of Willis Foreman Road to 22,290 vpd north of Lincolnton Parkway. According to the 2005 projected traffic, Windsor Spring Road will operate at LOS C south of Lincolnton Parkway and LOS F north of Lincolnton Parkway if the road is not widened.

The projected design year (2025) traffic ranges from 20,620 vpd north of Willis Foreman Road to 36,560 vpd north of Lincolnton Parkway based on the increase in population and forecasted travel demand. The arterial will operate at LOS F as a two-lane roadway. However, with the proposed widening of Windsor Spring Road to four lanes with a median, the facility will operate at LOS C.

Crash Data

Table 2 provides crash data for the years 1995, 1996, 1997, and 2001 for the project corridor from Willis Foreman Road to Tobacco Road (Mile Post 7.39-4.71).

**Table 2
Crash History for Windsor Spring Road**

YEAR	CRASH RATE		INJURY RATE		FATALITY RATE	
	Windsor Spring Rd.	Statewide Average	Windsor Spring Rd.	Statewide Average	Windsor Spring Rd.	Statewide Average
1995	1259	549	437	263	0	1.39
1996	1211	525	874	246	0	1.56
1997	1520	549	582	249	0	1.41
2001	1408	564	805	218	14	1.35

Note: All rates are per 100 million vehicle miles of travel.

The crash rate for the project corridor was more than double the statewide average in 1995, 1996, 1997, and 2001. The injury rate for the project corridor was over three times higher than the statewide average in 1996 and 2001. According to the 2001 data, there was a fatality just south of the intersection of Windsor Spring Road and Tobacco Road causing the fatality rate to be ten times higher than the statewide average.

The most common type of crashes were rear-end collisions, which can generally be attributed to insufficient through capacity, non-existent or insufficient turning lanes for storage, and poor traffic progression. The next most common types of crashes were angle collisions and sideswipe collisions, and these are likely attributed to side street intersections that do not align properly and insufficient stopping sight distance due to poor horizontal and vertical curvature.

Pedestrian and Bicycle Needs

The project corridor, being primarily residential with the schools and the park, has the potential for a significant amount of pedestrian traffic. Pedestrians are currently forced to walk or ride bikes along the shoulder of the road and sometimes in the travel way which is particularly hazardous for pedestrians, except in a few areas where there are existing sidewalks.

In addition, Windsor Spring Road from SR 88 (south of the project) to SR 56 (north of the project) is slated for bike lanes and sidewalks in the ARTS Bicycle and Pedestrian Plan. Inclusion of pedestrian and bicycle improvements in this project would be consistent with the ARTS plan.

Bridge Deficiencies

Project BRSLB-7007(7) is a bridge replacement over Spirit Creek. The existing two-lane bridge has a sufficiency rating of 42.7 and is hydraulically insufficient to handle the volume of water in Spirit Creek during a 100-year storm event.

Other Programmed Projects and Logical Termini

Other projects in the area include Project STP-1105(4), the widening of Windsor Spring Road from SR 88 to Willis Foreman Road; and its companion project, BHLB-1105(5), the replacement of the existing bridge over the Norfolk Southern Railroad.

The southern terminus of Project STP-7007(6) is project STP-1105(4), the previously mentioned widening of Windsor Spring Road from SR 88 to Willis Foreman Road.

The northern terminus of project STP-7007(6) is the intersection of Windsor Spring Road and Tobacco Road. Windsor Spring Road has already been widened to 4 lanes with a raised median north of Tobacco Road leading to the commercial and business centers in Augusta.

Phase V Project

Project STP-1105(4) and BHLB-1105(5), Richmond County
P.I. Numbers 245320 and 245325
Windsor Spring Road/CR 65 From SR 88 to Willis Forman Road

Project History

Project STP-1105(4) consists of improvements to Windsor Spring Road/CR 65 from just south of State Route 88 (Milepost 9.64) to Willis Foreman Road (Milepost 7.40) in Richmond County, Georgia. Windsor Spring Road is currently functionally classified as a Rural Major Collector. Project BHLB-1105(5) consists of replacing the existing bridge over the Norfolk Southern Railroad.

The project corridor is primarily rural and suburban residential with commercial areas at the southern end in the City of Hephzibah.

Projects STP1105(4) and BHLB-1105(5) are included in the Fiscal Year (FY) 2004-2006 Transportation Improvement Program (TIP) as TIP project numbers STP-17 and BRM-1, respectively. Also, bike lanes and sidewalks for Windsor Spring Road are included in the Augusta Regional Transportation Study's (ARTS) Bicycle and Pedestrian Plan.

Deficiencies in the System

The current transportation network in the project area presents multiple deficiencies, including:

- insufficient capacity for future traffic volumes,
- deteriorating levels of service,
- high crash rates,
- pedestrian and bicycle hazards, and
- bridge deficiencies.

Travel Demand

The travel demand on Windsor Spring Road has been steadily increasing in traffic due to development in the area such as the Diamond Lakes Regional Park which has been constructed on Windsor Spring Road north of Willis Foreman Road. In addition, Windsor Spring Road provides a direct route from the City of Hephzibah and SR 88 to I-520.

Traffic Counts and Historical Growth

Several traffic counts were collected on Windsor Spring Road in September 2001. In 2001 the existing daily traffic on Windsor Spring Road ranged from 6,400 vehicles per day (vpd) north of SR 88 to 7,200 vpd south of Willis Foreman Road. The GDOT traffic count station for this section of road, TC 252, is generally collected in the vicinity of Patterson Bridge Road and has shown a historical growth rate of 2.4 percent per year over the last five years (1997 to 2001). Additionally, the ARTS Travel Demand Model has a 1999 base year volume of 7,000 vpd and 2025 demand volume of 15,000 vpd on Windsor Spring Road north of Willis Foreman Road. This is a growth rate of 3 percent per year.

Population Growth

In order to help confirm the anticipated growth in the area, census population data for 1990 and 2000 for the City of Hephzibah was analyzed. According to the census data, the City of Hephzibah has had a population growth rate of 4.6 percent for each of the last ten years. The 1990 population was 2,466 and the 2000 population was 3,880.

Traffic Projections and Level of Service (LOS)

Table 3 provides opening year and design year projections and LOS for the project corridor.

**Table 3
Traffic Projections for Windsor Spring Road**

YEAR LOCATION	2005		2025		
	VPD	LOS	VPD	LOS	
		No-Build		No-Build	With Widening
North of SR 88	7,420	C	16,310	E	C or better
South of Willis Foreman Road	9,020	C	19,080	E	C or better

Using the growth data previously identified, the opening year traffic (2005) on Windsor Springs Road was projected to range from 7,420 vpd just north of SR 88 to 9,020 vpd south of Willis Foreman Road. With the 2005 projected traffic the arterial will operate at LOS C or better without improvements. However, in the projected design year (2025) traffic ranges from 16,310 vpd north of SR 88 to 19,080 vpd south of Willis Foreman Road based on the increase in population and forecasted travel demand. The arterial will operate at LOS E under a no-build condition. However with the widening of the roadway to a four-lane facility, it will operate at LOS C or better.

Crash Data

Table 4 provides crash data for the years 1995, 1996, 1997, and 2001 for the project corridor from SR 88 to Willis Foreman Road (Mile Post 9.64-7.40).

**Table 4
Crash History for Windsor Spring Road**

YEAR	CRASH RATE		INJURY RATE		FATALITY RATE	
	Windsor Spring Rd.	Statewide Average	Windsor Spring Rd.	Statewide Average	Windsor Spring Rd.	Statewide Average
1995	1259	549	437	263	0	1.39
1996	1211	525	874	246	0	1.56
1997	1520	549	582	249	0	1.41
2001	1408	564	805	218	14	1.35

Note: All rates are per 100 million vehicle miles of travel.

The crash rate between SR 88 and Willis Foreman Road has consistently been two to three times higher than the statewide average. The injury rate for the project corridor has fluctuated from being close to the statewide average in 1996 and 2001 to being four to five times higher than the statewide average in 1995 and 1997.

The most common types of crashes were rear-end collisions, which can generally be attributed to insufficient through capacity, non-existent or insufficient turning lanes for storage, and poor traffic progression. The next most common types of crashes were angle collisions and sideswipe collisions and these are likely attributed to side street intersections that do not align properly and insufficient stopping sight distance due to poor horizontal and vertical curvature.

Pedestrian and Bicycle Needs

The project corridor, being primarily residential, has the potential for a significant amount of pedestrian traffic. Pedestrians are currently forced to walk or ride bikes along the shoulder of the road and sometimes in the travel way which is particularly hazardous for the pedestrian. The construction of sidewalks and bike lanes will separate the modes of transportation and bring continuity and connectivity to the Windsor Spring Road corridor to increase pedestrian access and safety.

In addition, Windsor Spring Road from SR 88 to SR 56 (north of the project) is slated for bike lanes and sidewalks in the ARTS Bicycle and Pedestrian Plan. Inclusion of pedestrian and bicycle improvements in this project would be consistent with the ARTS plan.

Bridge Deficiencies

Project BHLB-1105(5) is a bridge replacement over the Norfolk Southern Railroad. The existing bridge has a sufficiency rating of 26.5, and it now requires load limit posting as a caution.

Other Programmed Projects and Logical Termini

Other projects in the area include STP-7007(6), the widening of Windsor Spring Road from Willis Foreman Road to Tobacco Road, and its companion project, BRSLB-7007(7), a replacement bridge over Spirit Creek.

The southern terminus of Project STP-1105(4) is in the City of Hephzibah at SR 88, a four lane state route that provides access to US 25 to the east and US 1 to the west. The travel lanes on Windsor Spring Road south of SR 88 will taper back to a two-lane facility approximately 1,500 feet south of SR 88.

The northern terminus of Project STP-1105(4) is the above mentioned Project STP-7007(6), the widening of Windsor Spring Road from Willis Foreman Road to Tobacco Road.

VALUE ANALYSIS AND CONCLUSION

INTRODUCTION

This section describes the procedures used during the value engineering study on Windsor Spring Road.

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/kickoff 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 VE procedures, separate narratives and supporting documentation identify the following:

- Value Engineering Workshop Participants
- 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.

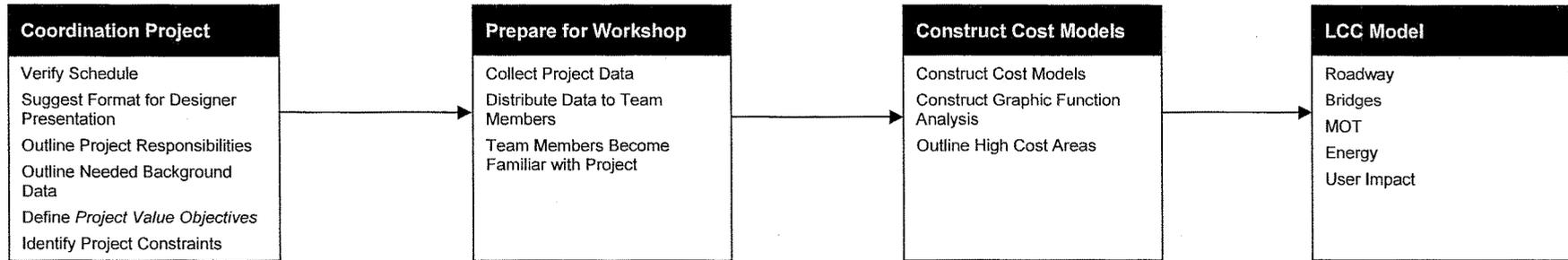
- A Preliminary Field Plan Review (PFPR) set plans, half size prints, for Phase IV and Phase V, not dated, prepared by Jordan, Jones and Goulding.
- Approved Concept Report for Phase IV, approved on July 13, 2004, prepared by Jordan, Jones and Goulding.
- Approved Concept Report for Phase IV, approved on June 28, 2004, prepared by Jordan, Jones and Goulding.
- Construction Cost Estimate, not dated, prepared by Georgia Department of Transportation.
- Phase IV and V right-of-way estimates, dated December 8, 2006, prepared by Georgia Department of Transportation.

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.

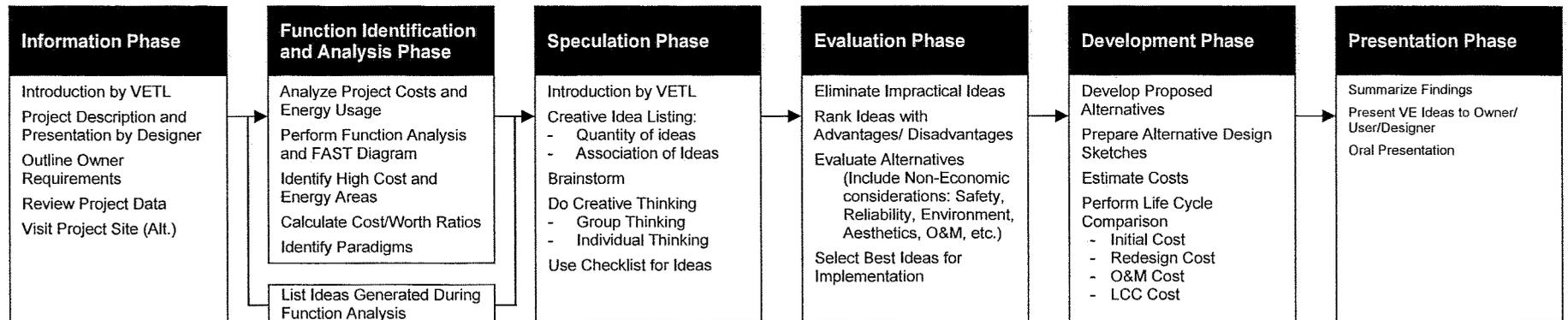


Value Engineering Study Task Flow Diagram

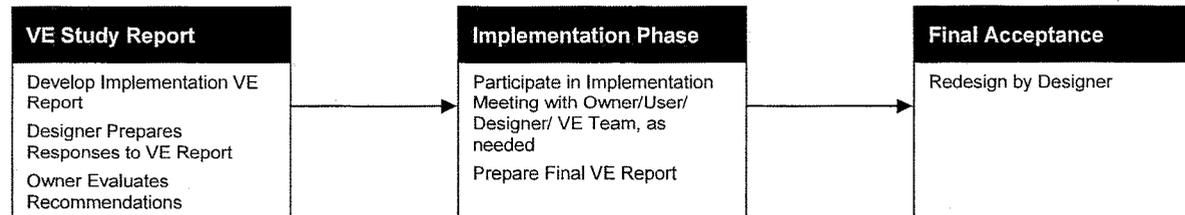
Preparation Effort



Workshop Effort



Post-Workshop Effort



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 prepared by the designers to develop cost models for the project. 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/kickoff meeting October 9, 2007 and concluding with the final VE Presentation on October 12, 2007. During the workshop, the VE Job Plan was followed in compliance with FHWA and SAVE International guidelines for VE studies. 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 includes six phases:

- Information Gathering Phase (without site visit)
- 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 VE 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 VA 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). Then 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:

<u>Abbreviation</u>	<u>Type of Function</u>	<u>Definition</u>
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 assigned 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.

Speculation Phase

This VE study phase involved the creation and listing of ideas. Starting with the functions or project elements with high cost/worth ratios, a high absolute cost compared to other elements in the project, and secondary functions providing little or no value, 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 team but can be further evaluated for potential use in the design.

Evaluation/Judgment Phase

Since the goal of the Speculation 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 Speculation Phase based on the project value objectives identified through conversations at the Designer's Briefing.

Based on the team's understanding of the owner's value objectives, each idea was compared with the present design concept and the advantages and disadvantages of each idea were discussed. How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of 1 to 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 value improvement and 1 indicating an idea with a major technical flaw that does not respond to project requirements. Generally, ideas rated 2 or 3 are continued in the next phase and presented 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 constructibility, 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 consisted of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and 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 report's 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 report's 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 Saving worksheets to hand out at the presentation and to present the key Value Engineering Alternatives and design suggestions to GDOT and the design team. The purpose of the presentation 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 the owner and design team 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, the owner and designer will meet and, by consensus, select those Value Engineering 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 Windsor Spring Road project. Team members consisted of a multidisciplinary group with professional highway design, structures 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>
Joe Leoni, PE	Highway Design	ARCADIS U.S., Inc.
Dan Hood, PE	Highway Design	HNTB Corporation
Jeffery Dingle, PE	Constructability	Delon Hampton & Associates
John Tiernan, PE	Structures	ARCADIS U.S., Inc.
George Hunter, PE, PMP, CVS	VE Team Leader	Lewis & Zimmerman Associates

DESIGNER'S PRESENTATION

An overview of the project was presented on October 19, 2007 by representatives from GDOT and Jordan, Jones & Goulding. 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 the owner and design staff the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted on October 12, 2007 at GDOT's offices in Atlanta to review the VE recommendations. Copies of the Draft Summary of Potential Cost Savings were provided to the attendees. Attendees of the meeting are noted on the attached attendance list.

VE STUDY SIGN-IN SHEET

Project No.: STP-1105(4) BHLB-1105(5)
STP-7007(6) BRSLB-7007(7)

County: Richmond

PI No.: 245320 245325
250610 250615

Date: 10/9-12/07

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
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Ken Werho		GDOT TRIP DES. REV.	404-635-8144	Ken.Werho@
Ryan Triick		JTG	678-333-0628	rtriick@jtg.com
Michael Keene	00319214	GDOT AUGUSTA AREA ENGR	706-855-3466	mike.keene@dot---
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Joe Leoni		ARCADIS	" " "	Joe.Leoni@Arcadis-US.com
Jerry Milligan		GDOT NW	770 986 1544	jerry.milligan@dot
Jan C. Hilliard	00248650	GDOT URBAN DESIGN	404-638-5441	jan.hilliard@dot.state.ga.us
George Hunter		LEWIS & ZIMMERMAN	916-224-9812	ghunter@lza.com
Lisa Myers		GDOT		

(X) = Attendance - Friday, Oct 12.

COST MODEL

The VE Team Leader prepared a Pareto Chart, or cost histogram, for the two projects that follows this page. This cost histogram displays the major construction elements identified in the cost estimate prepared by the designer in descending order of magnitude and thus identifies the high cost areas in the project and provides the VE team with a focus for its work during the study. For this project, approximately 20% of the construction items represent about 80% of the project costs. They are, by contract:

Phase IV, 5 of 25 items (81% of costs):

- Pavement
- Storm Drainage
- Clearing and Grubbing
- Bridge and Approaches
- Concrete Curb and Gutter

Phase V, 4 of 25 items (79% of costs):

- Pavement
- Storm Drainage
- Bridge and Approaches
- Clearing and Grubbing

The breakdown of the major project components are allocated as follows:

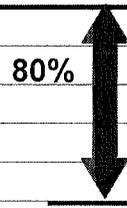
• Phase IV Construction Costs (with mark-ups)	\$ 28,050,784	37.36% of Total Project
• Phase V Construction Costs (with mark-ups)	\$ 17,803,210	61.07% of Total Project
• Phase IV Right-of-Way Costs	\$ 13,600,000	79.18% of Total Project
• Phase V Right-of-Way Costs	\$ 12,850,000	96.30% of Total Project
• Reimbursable Utilities	<u>\$ 2,780,000</u>	100.00% of Total Project
Project total:	\$ 75,083,994	

COST HISTOGRAM



WINDSOR SPRING ROAD WIDENING - Phase IV

PROJECT ELEMENT	COST	PERCENT	CUM. PERCENT
Pavement, Pvmt Reinf Strips	\$11,610,780	45.53%	45.53%
Storm Drainage & Side Drain Pipes	\$3,279,380	12.86%	58.39%
Clearing and Grubbing	\$2,200,000	8.63%	67.02%
Bridge & Approaches	\$1,833,095	7.19%	74.21%
Concrete Curb and Gutter	\$1,753,699	6.88%	81.08%
Unclassified Excavation	\$859,299	3.37%	84.45%
Temporary Erosion Control	\$689,818	2.71%	87.16%
Signals	\$645,000	2.53%	89.69%
Traffic Control	\$600,000	2.35%	92.04%
Signing & Markings	\$550,000	2.16%	94.20%
Borrow Excavation, Incl. Material	\$259,317	1.02%	95.21%
Class A Concrete & Reinf Steel	\$245,565	0.96%	96.18%
Foundation Backfill Materials	\$244,000	0.96%	97.13%
Concrete Median, Concrete	\$178,960	0.70%	97.84%
Erosion Control	\$147,302	0.58%	98.41%
Sidewalks, Concrete	\$147,060	0.58%	98.99%
Field Engineer's Office	\$75,000	0.29%	99.28%
Underdrain Pipe	\$60,000	0.24%	99.52%
Right of Way Markers	\$36,480	0.14%	99.66%
Storm Sewer Manholes	\$31,580	0.12%	99.79%
Mill Asphalt Concrete Pavement	\$28,948	0.11%	99.90%
Guardrail and appurtenances	\$23,630	0.09%	99.99%
Driveways, Concrete	\$1,800	0.01%	100.00%
Precast Concrete Barrier, M-3	\$0	0.00%	100.00%
Misc. Roadway Items (missing)	\$0	0.00%	100.00%
Subtotal	\$25,500,713	100.00%	
E&C 10.00%	\$ 2,550,071		
Inflation 0.00%	\$ -		
SUBTOTAL CONSTRUCTION	\$ 28,050,784	Comp Mark-up:	10%
Right of Way	\$13,600,000		
Reimbursable Utilities	\$ 1,700,000		
TOTAL PROJECT COSTS	\$ 43,350,784		



COST HISTOGRAM



WINDSOR SPRING ROAD WIDENING - Phase V

PROJECT ELEMENT		COST	PERCENT	CUM. PERCENT
Pavement, Pvmt Reinf Strips	80% 	\$6,409,010	39.60%	39.60%
Storm Drain & Side Drain Pipes		\$1,982,033	12.25%	51.85%
Bridge & Approaches		\$1,828,910	11.30%	63.15%
Clearing and Grubbing		\$1,500,000	9.27%	72.41%
Concrete Curb and Gutter		\$1,010,300	6.24%	78.66%
Erosion Control		\$570,747	3.53%	82.18%
Unclassified Excavation		\$560,406	3.46%	85.64%
Traffic Control		\$500,000	3.09%	88.73%
Signals		\$375,000	2.32%	91.05%
Class A Concrete & Reinf Steel		\$352,640	2.18%	93.23%
Signing & Markings		\$330,000	2.04%	95.27%
Precase Concrete Barrier, M-3		\$160,000	0.99%	96.26%
Borrow Excavation, Incl Material		\$124,150	0.77%	97.02%
Foundation Bkfill Matl		\$123,500	0.76%	97.79%
Concrete Median, Concrete		\$79,000	0.49%	98.28%
Sidewalks, Concrete		\$78,000	0.48%	98.76%
Field Engineer's Office		\$75,000	0.46%	99.22%
Underdrain Pipe		\$60,000	0.37%	99.59%
Guardrail and appurtenances		\$55,010	0.34%	99.93%
Right of Way Markers		\$25,560	0.16%	100.09%
Storm Sewer Manholes		\$23,310	0.14%	100.23%
Mill Asphalt Concrete Pavement		\$19,560	0.12%	100.35%
Driveways, Concrete		\$1,800	0.01%	100.37%
Temporary Erosion Control		\$0	0.00%	100.37%
Misc Rdwy Items (fixup no)		-\$59,200	-0.37%	100.00%
Subtotal		\$16,184,736	100.00%	
E&C	10.00%	\$ 1,618,474		
Inflation	0.00%	\$ -		
SUBTOTAL CONSTRUCTION		\$ 17,803,210	Comp Mark-up:	10%
Right of Way		\$12,850,000		
Reimbursable Utilities		\$ 1,080,000		
TOTAL PROJECT COSTS		\$ 31,733,210		

FUNCTION ANALYSIS

Function Analysis of the 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 worksheet completed by the team for the project in its entirety and the various elements follows.

The result of the function analysis exercise identified that the basic function to “Add Lanes” is supported by the key required secondary functions of “Increase Load Capacity,” “Increase Flood Capacity,” “Store Left Turning Vehicles” and “Transition Vehicle Speed Change.” The high order function of reducing accidents and relieving congestion are supported as carried out by the project scope and as defined by the basic, required secondary and secondary project functions.

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Speculation Phase, numerous ideas were generated for this 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 categories and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the design categories:

Design Category	Prefix	No. of Ideas
Typical Section	TS	11
Bridges	B	3
Geometry	G	14
Contract Packaging/ Staging	CPS	2
Pavement	P	1
Spelling	S	2
	Subtotal:	33

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 GDOT's value objectives for the project. The following are the top value objectives for this project:

- Reduce Capital Costs
- Enhance Highway Operations
- Increase Highway User Safety
- Conforms/Crossings of Side Roads

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 5 ideas to develop as Design Suggestions to be included in the Study Results section of the report. When this was 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 worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING



PROJECT: WINDSOR SPRING ROAD WIDENING <i>Richmond County, Georgia</i>	SHEET NO.:	1 of 2
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NO.	IDEA DESCRIPTION	RATING
TYPICAL SECTION (TS)		
TS-1	Eliminate sidewalks	3
TS-2	Eliminate bike lanes	3
TS-3	Multi-use trail on one side of road/sidewalk on the opposite side	3
TS-4	Multi-use trail on both sides of road	3
TS-5	Use 12-ft. shoulder in lieu of 16-ft. and use guardrail where needed	2
TS-6	Use 11-ft. through lanes with 12-ft. turn lanes	3
TS-7	Use 18-ft. raised median	2
TS-8	Use 8 in. x 24 in. Type 2 curb and gutter, reduce roadway width by 2 ft.	3
TS-9	Use rural shoulder where applicable	2
TS-10	Use curb opening in lieu of storm drains	1
TS-11	Consider a single longitudinal storm drain with laterals in lieu of two longitudinal storm drains	1
BRIDGES (B)		
B-1	Eliminate end span of 3-spanner over north-south railroad with retaining walls	3
B-2	Lower Spirit Creek Bridge PGL by 2 ft.± (check)	3
B-3	Eliminate corners of slope paving on north-south railroad bridge	DS
GEOMETRY (G)		
G-1	“Unflatten” Spirit Creek Road curve correction	3
G-2	At M/L curve at Turkey Trail, widen west (left) from exist E.S.	3
G-3	Decrease skew further at Turkey Trail/Diamond Lakes	2
G-4	Review alignment at Patrick/Fieldcrest intersection	1
G-5	Review alignment at Boykin/Inverness	1
G-6	Connect Ebenezer(S) to Railroad Avenue (east side); eliminate Ebenezer (N and S) to Windsor Spring Road	3
G-7	Eliminate Spirit Creek Road extension	3
G-8	Segregate Spirit Creek Road extension into separate project	See CPS-2
G-9	Revisit proximity of driveways near Tobacco Road	DS
G-10	Use abandoned Windsor Spring Road as frontage road in lieu of driveways at the Spirit Creek curve correction	DS

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

