



SR 306 Road Widening
Project STP-012-1(81), Forsyth County, P.I. No. 122015
SR 306 from SR 400 to East of SR 369 and
Bridge at Baldrige Creek

Value Engineering Study Report
Preliminary Design Phase

October 2007

Design Consultant
Florence & Hutcheson, Inc.



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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November 7, 2007

Ms. Lisa L. Myers
Design Review Engineer Manager
Georgia Department of Transportation
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334

re: Project STP-012-1(81), P.I. No. 122015
SR 306 from SR 400 to East of SR 369 and Bridge at Baldrige Creek, Forsyth County, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. (LZA) is pleased to submit four hard copies and one CD of the referenced value engineering (VE) study report which documents the results of the VE study conducted October 9-12, 2007 with members of HNTB Corporation and Delon Hampton & Associates. This project has a current combined probable construction cost estimate of \$12.1 million and \$31.5 million in right-of-way and utilities.

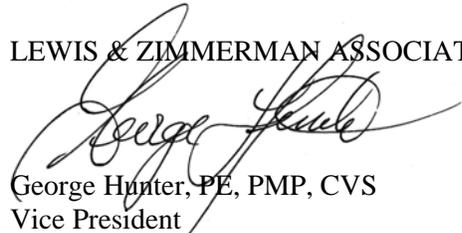
The VE team developed 13 alternatives and two design suggestions that recommend improvements to the typical section, bridges, geometry and contract packaging categories.

The VE alternatives have the potential to generate \$7.0 million in capital savings for this project. Two alternatives requiring a \$4.9 million increase in additional capital investment could be implemented to improve level of service of the facility. One alternative recommends that \$0.9 million of work be transferred from the adjacent SR 369 widening project, immediately south of this project.

We thank you and other GDOT employees and the design team for assisting the VE team in completing this assignment. Please do not hesitate to call upon LZA for assistance in implementing the alternatives presented.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



George Hunter, PE, PMP, CVS
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction	2
Project Description	2
Concerns and Objectives	3
Results	3
Summary of Potential Cost Savings	6

STUDY RESULTS

Introduction	8
Key Issues	9
Results of the Study	9
Evaluation of Alternatives and Design Suggestions	11
Value Engineering Alternatives	13

PROJECT DESCRIPTION

Introduction	81
Project Description	81

VALUE ANALYSIS & CONCLUSIONS

Introduction	86
Preparation Effort	86
Value Engineering Workshop Effort	88
Post-Study Procedures	91
Value Engineering Workshop Agenda	92
Value Engineering Workshop Participants	95
Cost Model	97
Function Analysis	100
Creative Idea Listing and Judgment of Ideas	102

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 Project STP-012-1(81), Forsyth County, P.I. No. 122015, SR 306 from SR 400 to East of SR 369 & Bridge at Baldrige Creek. The project is being designed by Florence & Hutcheson, Inc. The plans were at the preliminary plan development stage (30% complete). The slope right-of-way easements have not yet been identified.

The VE Workshop was conducted October 23-26, 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
- Creative Idea Generation
- Evaluation of Creative Ideas
- Development of Alternatives
- Presentation of Results

PROJECT DESCRIPTION

The SR 306 widening project will reduce congestion and improve safety within a segment of SR 306 experiencing rapid growth in Forsyth County. The widening and reconstruction of SR 306 will be bound between SR 400 northbound ramps to a point just east of SR 369/Browns Bridge (conforming to the existing two-lane section at Martin Road) - a total project length of 1.40 miles. The roadway will be reclassified within the project limits from a rural arterial with a 55 mph design speed to an urban arterial with a reduced 45 mph design speed. The proposed typical section for this project will consist of two 12-ft. lanes in each direction with a 24-ft. raised median. The shoulder section will be a 16-ft. urban shoulder with a 5-ft. sidewalk.

This project also includes 0.80 miles of improvements to SR 369, north and south of SR 306. On the south side, SR 369 will be widened to a four-lane section south of SR 306 to Holtzclaw Road, matching the typical section of the widening project to the south. North of SR 306 the roadbed will conform approximately 2,000 ft. away from the SR 306/SR 369 intersection to the existing two-lane section.

The safety improvements will consist of improving the turn lanes at the major intersections, Freedom Parkway and SR 369. A double left-turn lane will be provided for the northbound SR 369 to westbound SR 306 move, and double right-turn lanes will be provided for the eastbound SR 306 to southbound SR 369 move.

The project is to be let January 2011. The current project cost estimate (2007 dollars) is as follows:

Construction Costs	\$ 12,067,285
Right-of-way	\$ 30,958,000
Reimbursable Utilities	<u>\$ 534,100</u>
Total Project Costs	\$ 43,559,385

CONCERNS AND OBJECTIVES

The following issues and objectives were noted by the VE team:

- The project was reclassified from a rural arterial to an urban arterial.
- The design speed was reduced from 55 mph to 45 mph when the roadway was reclassified.
- The existing project's profile did not achieve 55 mph, including an especially deficient sag vertical curve near the Baldbridge Creek double 9-ft. x 9-ft. concrete box culvert.
- The widening from two to four lanes will be done by widening to the north on SR 306 and to the west on SR 369.
- The widening to the west on SR 369 impacts four properties, two of which are on the east side.
- Right-of-way costs are \$31 million. The right-of-way is set at the hinge point. Easements will be negotiated for the embankment and cut slopes from the adjacent land owners.
- The concept report identifies that in the design year 2032, SR 306, within the project limits, will operate at a Level of Service (LOS) F.
- The SR 306/SR 369 intersection will operate at a LOS F in the design year.
- The Freedom Parkway LOS was not identified, but the VE team estimated that the turn lanes from SR 306 into Freedom Parkway may operate poorly with only a single left-turn lane.
- Three closely-spaced driveways will be retained at the west end of the project that may impact the operations of SR 306.
- The widening of SR 369 to the south will tie in with the subsequent, near-term SR 369 widening project.
- Storm drainage design retains and reuses the small portions of SR 306 that are currently collected into the city street system.

The objective of the VE study was to identify potential cost savings, particularly in right-of-way.

RESULTS

Thirteen alternatives and two design suggestions were developed by the VE team to address the concerns and issues described above. The key alternatives and design suggestions are described below.

Typical Section (TS)

Seven alternatives and one design suggestion recommend improvements to the project's typical sections.

Alt. TS-3 converts the north side SR 306 concrete sidewalk to a 10-ft. asphalt concrete multi-use path. This would reduce the capital investment and work in tandem with the County's long-term goal to add bicycle paths along SR 306 east of SR 369.

Alts. TS-8, TS-11, TS-13 and TS-14 all recommend reducing the footprint to reduce the related right-of-way. Alt. TS-8 reduces the urban shoulder green strip by 4 ft.; Alt. TS-11 reduces the width of the raised median by 4 ft.; and Alts. TS-13 and TS-14 reduce the slope easement by reducing the fill section slopes by using a 1:1 reinforced slope or placing a gravity wall at the back of the sidewalk. The potential right-of-way savings associated with implementing Alts. TS-8, TS-11 and TS-14 are in the \$3 million range.

Alt. TS-9/10 addresses the poor level of service within the SR 306 project limits for the design year. It projects \$5 million of additional investment in construction and right-of-way costs to provide a six-lane facility in lieu of the current design's four lanes to increase the level of service to a more acceptable level for the basic highway segments. This proposal also recommends that if the mainline lanes be widened, the critical turn movements at SR 306/SR 369 be increased to three lanes. Related to Alt. TS-9/10 is Alt. G-8 which increases the turn lanes on SR 306 to SR-360 from one to two lanes.

Geometry (G)

Four alternatives and one design suggestion were developed in this category.

- Alt. G-2 recommends that the three driveways along westbound SR 306 that service the supermarket, McDonalds' and the Waffle House parking lot be consolidated into a single signalized driveway opposite Freedom Parkway. The elimination of the other two driveways would improve operations and safety at the west end of the project. The additional traffic volumes related to the westbound egress traffic funneled into the single driveway would be mitigated with the provision of an acceleration lane that could be extended and joined with the SR 400 entrance ramp deceleration lane. A subset to Alt. G-2 is Alt. D-1, which recommends eliminating the easternmost of the driveways and eliminating 13 linear feet of the extension of the DBL 9-ft. x 9-ft. concrete box culvert while increasing the deceleration lane length preceding the remaining, signalized driveway
- Alt. G-3 shifts the proposed SR 369 roadbed by approximately 50 feet. This modification would trade off two displacements on the east side of the roadbed for two on the west side and, in the estimation of the VE team, generate approximately \$3 million in savings.
- Alt. G-4 recommends that the southern project limit at SR 369 be built to the full section requirements, including curb and gutter and sidewalk. This would essentially transfer approximately \$900,000 in construction costs from the adjacent, southern project to this project and end the project at the logical terminus at Holtzclaw Road.
- Alt. G-7, a design suggestion, would line up the through lanes for those exiting the parking lot headed south on Freedom Parkway southbound lanes.

Drainage (D)

Three alternatives and one design suggestion were developed in this category. The key alternative in this category is Alt. D-3 which would eliminate the extension of the double 9-ft. x 9-ft. concrete box culvert by raising the existing headwall and wingwalls.

The potential cost impacts of the VE study findings could generate approximately \$7 million in savings which could offset \$5 million in scope/cost increases. In addition, there is a suggestion to transfer \$0.9 million in project transfers. The details of this analysis are summarized below:

COST SAVINGS POTENTIAL

TS-6	Delay construction of sidewalks	\$ 587,715
TS-8	Reduce 6-ft.-wide grassed strip to 2 ft. wide	\$ 1,360,307
TS-11	Reduce median from a 24-ft. to a 20-ft. raised median	\$ 489,164
TS-13	Use reinforced slope embankments to reduce required easements	\$ 1,166,865
G-2	Consolidate SR 306 west end driveways	\$ 105,496
G-3	Shift alignment of SR 369 by approximately 50 ft. west	\$ 3,276,000
D-3	Eliminate southerly extension of double 9 ft. x 9 ft. culvert at Baldbridge Creek	\$ <u>40,586</u>
	Total Savings Potential:	\$ 7,026,133

Scope Improvements/Cost Additions

TS-9/TS-10	Widen SR 306 to six lanes	(\$ 4,699,293)
G-8	Add additional turn lane at Freedom Parkway	(\$ <u>218,714</u>)
	Total Project Scope Increase Potential:	(\$ 4,918,007)

Project Cost Transfer

G-4	Full widening to south project limit of SR 369	(\$ <u>912,774</u>)
	Total Project Transfer:	(\$ 912,774)

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



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: WIDENING SR 306 (SR 400 TO EAST OF SR 369)

Forsyth County, Georgia

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-3	Urban shoulder with multi-use path on one side	\$ 645,269	\$ 461,800	\$ 183,469		\$ 183,469
TS-6	Delay construction of sidewalks	\$ 645,269	\$ 57,554	\$ 587,715		\$ 587,715
TS-8	Reduce 6-ft. wide grassed strip to 2 ft. wide	\$ 1,360,307	-	\$ 1,360,307		\$ 1,360,307
TS-9/10	Widen SR 306 to six lanes	-	\$ 4,699,293	\$ (4,699,293)		\$ (4,699,293)
TS-11	Reduce median from 24 ft. to 20 ft. raised median	\$ 489,164	-	\$ 489,164		\$ 489,164
TS-13	Use reinforced slope embankments to reduce required easements	\$ 1,166,865	\$ 331,344	\$ 835,521		\$ 835,521
TS-14	Use walls to reduce required easements	\$ 2,619,184	\$ 2,026,812	\$ 592,372		\$ 592,372
GEOMETRY (G)						
G-2	Consolidate SR 306 west end driveways	\$ 126,883	\$ 21,387	\$ 105,496		\$ 105,496
G-3	Shift alignment of SR 369 by approximately 50 ft. west	\$ 4,576,000	\$ 1,300,000	\$ 3,276,000		\$ 3,276,000
G-4	Full widening to south project limit of SR 369	\$ -	\$ (912,774)	\$ 912,774		\$ 912,774
G-7	Line up driveway lanes across SR 306 at Freedom Parkway		DESIGN SUGGESTION			
G-8	Add additional turn lane at Freedom Parkway	\$ -	\$ 219,407	\$ (219,407)		\$ (219,407)
DRAINAGE (D)						
D-1	Eliminate driveway at Station 124+10	\$ 60,729	-	\$ 60,729		\$ 60,729
D-2	Straighten double 9-ft. x 9-ft. concrete box culvert extension at Baldridge Creek		DESIGN SUGGESTION			
D-3	Eliminate southerly extension of double 9-ft. x 9-ft. culvert at Baldridge Creek	\$ 61,642	\$ 21,056	\$ 40,586		\$ 40,586

STUDY RESULTS

INTRODUCTION

The results are the major feature of the value engineering study conducted on the SR 306 widening 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 study, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that comprise the project. These are in the form of VE alternatives (accompanied by cost estimates) or design suggestions (typically without cost estimates). For each alternative developed, the following information is provided:

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

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner data bases 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.

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

Design Category	Prefix	No. of Ideas
Typical Section	TS	14
Geometry	G	9
Drainage	D	4
	Subtotal:	27

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 Potential Cost Savings tables.

KEY ISSUES

- The project was reclassified from a rural arterial to an urban arterial.
- The design speed was reduced from 55 mph to 45 mph when the roadway was reclassified.
- The existing project’s profile did not achieve 55 mph, including an especially deficient sag vertical curve near the Baldbridge Creek double 9-ft. x 9-ft. concrete box culvert.
- The widening from two to four lanes will be done by widening to the north on SR 306 and to the west on SR 369.
- The widening to the west on SR 369 impacts four properties, two of which are on the east side.
- Right-of-way costs are \$31 million. The right-of-way is set at the hinge point. Easements will be negotiated for the embankment and cut slopes from the adjacent land owners.
- The concept report identifies that in the design year 2032, SR 306, within the project limits, will operate at a Level of Service (LOS) F.
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- Three closely-spaced driveways will be retained at the west end of the project that may impact the operations of SR 306.
- The widening of SR 369 to the south will tie in with the subsequent, near-term SR 369 widening project.
- Storm drainage design retains and reuses the small portions of SR 306 that are currently collected into the city street system.

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 13 alternatives and two design suggestions.

Typical Section (TS)

Seven alternatives and one design suggestion recommend improvements to the project's typical sections.

Alt. TS-3 converts the north side SR 306 concrete sidewalk to a 10-ft. asphalt concrete multi-use path. This would reduce the capital investment and work in tandem with the County's long-term goal to add bicycle paths along SR 306 east of SR 369.

Alts. TS-8, TS-11, TS-13 and TS-14 all recommend reducing the footprint to reduce the related right-of-way. Alt. TS-8 reduces the urban shoulder green strip by 4 ft.; Alt. TS-11 reduces the width of the raised median by 4 ft.; and Alts. TS-13 and TS-14 reduce the slope easement by reducing the fill section slopes by using a 1:1 reinforced slope or placing a gravity wall at the back of the sidewalk. The potential right-of-way savings associated with implementing Alts. TS-8, TS-11 and TS-14 are in the \$3 million range.

Alt. TS-9/10 addresses the poor level of service within the SR 306 project limits for the design year. It projects \$5 million of additional investment in construction and right-of-way costs to provide a six-lane facility in lieu of the current design's four lanes to increase the level of service to a more acceptable level for the basic highway segments. This proposal also recommends that if the mainline lanes be widened, the critical turn movements at SR 306/SR 369 be increased to three lanes. Related to Alt. TS-9/10 is Alt. G-8 which increases the turn lanes on SR 306 to SR-360 from one to two lanes.

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- Alt. G-3 shifts the proposed SR 369 roadbed by approximately 50 feet. This modification would trade off two displacements on the east side of the roadbed for two on the west side, and in the estimation of the VE team generate approximately \$3 million in savings.
- Alt. G-4 recommends that the southern project limit at SR 369 be built to the full section requirements, including curb and gutter and sidewalk. This would essentially transfer approximately \$900,000 in construction costs from the adjacent, southern project to this project and end the project at the logical terminus at Holtzclaw Road.
- Alt. G-7, a design suggestion, would line up the through lanes for those exiting the parking lot headed south on Freedom Parkway southbound lanes.

Drainage (D)

Three alternatives and one design suggestion were developed in this category. The key alternative in this category is Alt. D-3 which would eliminate the extension of the double 9-ft. x 9-ft. concrete box culvert by raising the existing headwall and wingwalls.

The potential cost impacts of the VE study findings could generate approximately \$7 million in savings which could offset \$5 million in scope/cost increases. In addition, there is a suggestion to transfer \$0.9 million in project transfers. The details of this analysis are summarized below:

COST SAVINGS POTENTIAL

TS-6	Delay construction of sidewalks	\$ 587,715
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TS-13	Use reinforced slope embankments to reduce required easements	\$ 1,166,865
G-2	Consolidate SR 306 west end driveways	\$ 105,496
G-3	Shift alignment of SR 369 by approximately 50 ft. west	\$ 3,276,000
D-3	Eliminate southerly extension of DBL 9 ft. x 9 ft. culvert at Baldbridge Creek	<u>\$ 40,586</u>
Total Savings Potential:		\$ 7,026,133

Scope Improvements/Cost Additions

TS-9/TS-10	Widen SR 306 to six lanes	(\$ 4,699,293)
G-8	Add additional turn lane at Freedom Parkway	<u>(\$ 218,714)</u>
Total Project Scope Increase Potential:		(\$ 4,918,007)

Project Cost Transfer

G-4	Full widening to south project limit of SR 369	<u>(\$ 912,774)</u>
Total Project Transfer:		(\$ 912,774)

Note: The Potential Cost Savings indicated above take 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 POTENTIAL COST SAVINGS

PROJECT: **WIDENING SR 306 (SR 400 TO EAST OF SR 369)**

Forsyth County, Georgia

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-3	Urban shoulder with multi-use path on one side	\$ 645,269	\$ 461,800	\$ 183,469		\$ 183,469
TS-6	Delay construction of sidewalks	\$ 645,269	\$ 57,554	\$ 587,715		\$ 587,715
TS-8	Reduce 6-ft. wide grassed strip to 2 ft. wide	\$ 1,360,307	-	\$ 1,360,307		\$ 1,360,307
TS-9/10	Widen SR 306 to six lanes	\$ -	\$ 4,699,293	\$ (4,699,293)		\$ (4,699,293)
TS-11	Reduce median from 24 ft. to a 20 ft. raised median	\$ 489,164	-	\$ 489,164		\$ 489,164
TS-13	Use reinforced slope embankments to reduce required easements	\$ 1,166,865	\$ 331,344	\$ 835,521		\$ 835,521
TS-14	Use walls to reduce required easements	\$ 2,619,184	\$ 2,026,812	\$ 592,372		\$ 592,372
GEOMETRY (G)						
G-2	Consolidate SR 306 west end driveways	\$ 126,883	\$ 21,387	\$ 105,496		\$ 105,496
G-3	Shift alignment of SR 369 by approximately 50 ft. west	\$ 4,576,000	\$ 1,300,000	\$ 3,276,000		\$ 3,276,000
G-4	Full widening to south project limit of SR 369	\$ -	\$ (912,774)	\$ 912,774		\$ 912,774
G-7	Line up driveway lanes across SR 306 at Freedom Parkway		DESIGN SUGGESTION			
G-8	Add additional turn lane at Freedom Parkway	\$ -	\$ 219,407	\$ (219,407)		\$ (219,407)
DRAINAGE (D)						
D-1	Eliminate driveway at Station 124+10	\$ 60,729	-	\$ 60,729		\$ 60,729
D-2	Straighten double 9-ft. x 9-ft. concrete box culvert extension at Baldridge Creek		DESIGN SUGGESTION			
D-3	Eliminate southerly extension of double 9-ft. x 9-ft. culvert at Baldridge Creek	\$ 61,642	\$ 21,056	\$ 40,586		\$ 40,586

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)** ALTERNATIVE NO.: **TS-3**
Forsyth County, Georgia

DESCRIPTION: **INSTALL A MULTI-USE PATH ON ONE SIDE OF ROAD** SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design is for a 16-ft. shoulder, eleven feet of which is from the back of the curve to the back of the sidewalk.

ALTERNATIVE: (Sketch attached)

Install a 10-ft. multi-use path 1 ft. from the back of the curb to the edge of the path. Alternatively, delete green space.

ADVANTAGES:

- Allows better use of sidewalk/bicycle paths

DISADVANTAGES:

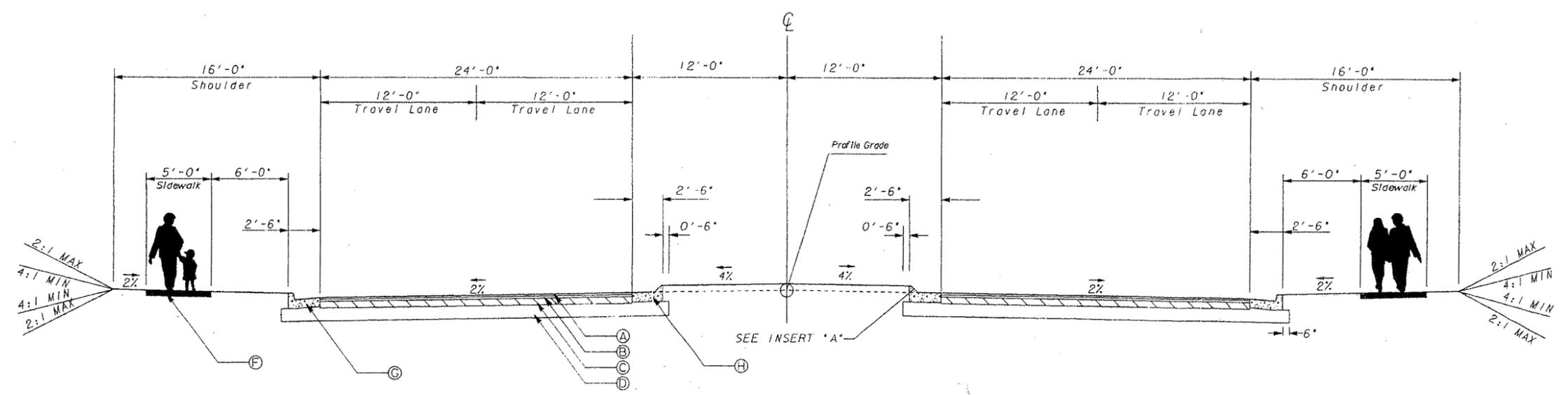
- Move paving/costs

DISCUSSION:

A long-range plan was mentioned at the designer's briefing to provide a bicycle path along SR 306, east of SR 369. Providing a multi-use path within the currently proposed SR 306 widening project limits would compliment the future path. The cost savings is caused by the customary use of asphalt concrete.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 645,269	—	\$ 645,269
ALTERNATIVE	\$ 461,800	—	\$ 461,800
SAVINGS	\$ 183,469	—	\$ 183,469

ALT TS-3
 SH 2 of 4

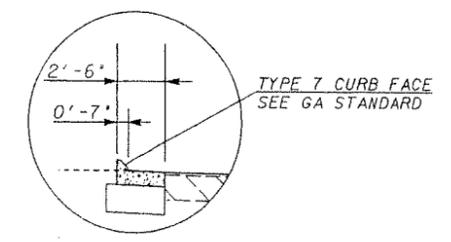


ORIGINAL DESIGN

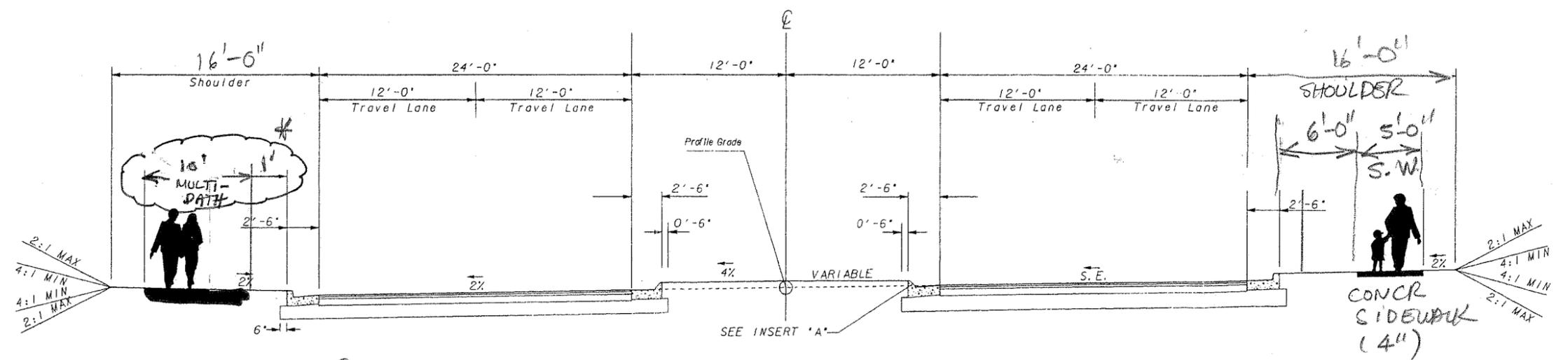
- REQUIRED PAVEMENT
- (A) ASPHALTIC CONCRETE 12.5 mm SMA, 165 LBS./SQ. YD.
 - (B) ASPHALTIC CONCRETE 19.0 mm SUPERPAVE, 220 LBS./SQ. YD.
 - (C) ASPHALTIC CONCRETE 25.0 mm SUPERPAVE, 660 LBS./SQ. YD.
 - (D) GRADED AGGREGATE BASE, 12"
 - (E) ASPHALTIC CONCRETE LEVELING, AS REQ'D
 - (F) CONC. SIDEWALK, 4" THICK
 - (G) 8"X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 2
 - (H) 8"X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 7

SLOPE CONTROLS - FEET		
SLOPE	CUT	FILL
4:1	0-5'	0-5'
2:1	OVER 5'	OVER 5'

2:1 FILL SLOPES
 REQUIRE GUARDRAIL



INSERT "A"
 NOT TO SCALE



* OPTION: ELIMINATE
 GREEN
 SPACE

ALTERNATIVE DESIGN

PLANS PREPARED BY:



REVISION DATES

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CONSULTANT DESIGN
 TYPICAL SECTIONS

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO. 122015)
Georgia Department of Transportation

ALTERNATIVE NO.: TS-3

NORTH Side (ALT DESIGN)

SHEET NO.: 3 of 4

MAINLINE

STA 181+13 TO STA 111+00 — 7,013 LF
SR 369
STA 316+60 TO STA 337+10 — 2,050 LF
9,063 LF

GAB

$$10' \times .5 \times 9,063' = 45,315 \text{ cf} \div 27 = 964.15 \text{ yd}^3 \times \frac{2.03 \text{ TN}}{\text{cy}} = 1957.22 \text{ TN}$$

19mm AC

$$10' \times 9,063 = 90,630 \text{ ft}^2 \div 9 = 10,070 \text{ yd}^2 \times \frac{220 \#}{\text{yd}^2} \times \frac{1 \text{ TN}}{20,000 \text{ TN}} = 1107.7 \text{ TN}$$

GRASSING

$$1' \times 9,063 = 9,063 \text{ ft}^2 \times \frac{1 \text{ AC}}{43,560 \text{ ft}^2} = 0.21 \text{ AC}$$

SOUTH SIDE (ALT DESIGN) — CONCR Sidewalk

Assume $\frac{1}{2}$ total applies to new design
 $= \frac{1}{2} (586,608) = 293,304$

ORIGINAL DESIGN (CONCR SIDEWALK — NORTH & SOUTH)

LS = \$ 586,608

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **TS-6**

DESCRIPTION: **DELAY CONSTRUCTION OF SIDEWALKS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design has 5-ft. sidewalks on both sides of the roadway for the entire length of the project.

ALTERNATIVE: (Sketch attached)

Require developers to install sidewalks as a condition of development of the property. Only those portions currently developed would be part of this project.

ADVANTAGES:

- Eliminates installation of sidewalks that will not be used until development

DISADVANTAGES:

- May eliminate continuity of sidewalk

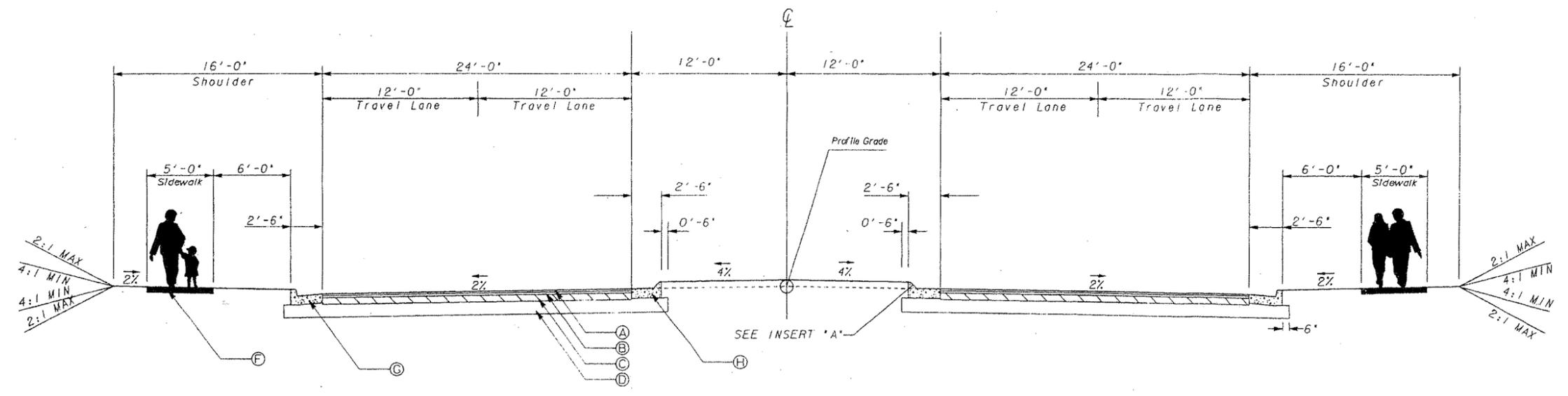
DISCUSSION:

The original design has a sidewalk on both sides of the roadway. However, at this time, there is very little development, and the need for a sidewalk is questionable because pedestrian traffic is probably low.

Having the developers install a sidewalk as they develop along the project route would allow them to absorb the impact of the material and labor costs, while providing sidewalks as the need arises.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 645,269	—	\$ 645,269
ALTERNATIVE	\$ 57,554	—	\$ 57,554
SAVINGS	\$ 587,715	—	\$ 587,715

ALT T-6
 SH 2 of 4

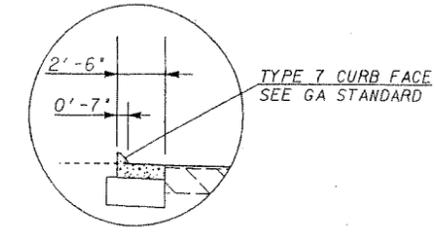


ORIGINAL DESIGN

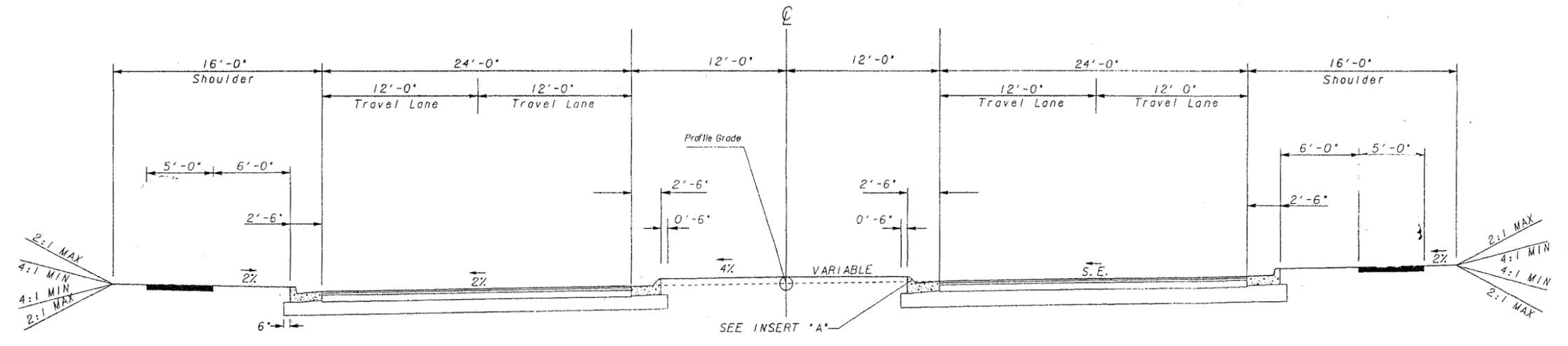
- REQUIRED PAVEMENT
- (A) ASPHALTIC CONCRETE 12.5 mm SMA, 165 LBS./SQ. YD.
 - (B) ASPHALTIC CONCRETE 19.0 mm SUPERPAVE, 220 LBS./SQ. YD.
 - (C) ASPHALTIC CONCRETE 25.0 mm SUPERPAVE, 660 LBS./SQ. YD.
 - (D) GRADED AGGREGATE BASE, 12"
 - (E) ASPHALTIC CONCRETE LEVELING, AS REQ'D
 - (F) CONC. SIDEWALK, 4" THICK
 - (G) 8"X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 2
 - (H) 8"X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 7

SLOPE CONTROLS - FEET		
SLOPE	CUT	FILL
4:1	0-5'	0-5'
2:1	OVER 5'	OVER 5'

2:1 FILL SLOPES
 REQUIRE GUARDRAIL



INSERT "A"
 NOT TO SCALE



ALTERNATE

ALT T-6

PLANS PREPARED BY:



REVISION DATES

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CONSULTANT DESIGN
 TYPICAL SECTIONS 19

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: T6

SHEET NO.: 3 of 4

S/W TO BE INSTALLED
SOUTH SIDE

STA 110+49.68 TO STA 129+00	1850.32
STA 133+00 TO STA 139+00	600
STA 143+50 TO STA 149+00	550
STA 158+50 TO STA 165+19.58	670
STA 328+04.28 TO STA 325+00 — BROWNS BRIDGE RD.	304.28
STA 166+50 TO STA 174+11	761
	<hr/>
	4735.18

NORTH SIDE

STA 111+00 TO STA 131+00	2000
STA 140+00 TO STA 151+50	1150
STA 162+50 TO STA 164+00	150
STA 329+00 TO STA 331+50 BROWNS BRIDGE RD	250
	<hr/>
	3550

$$4735.18 + 3550 = 8285.18 \div 9 = 920.58 \text{ sy}$$

GRASSING

$$8285.18 \text{ LF} \times 5 \text{ FT} = 41,425.90 \text{ sf} \times \frac{1 \text{ AC}}{43560} = .95 \text{ AC}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **TS-8**

DESCRIPTION: **REDUCE 6-FT.-WIDE GRASSED STRIP TO 2 FT. WIDE**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design has a 6-ft.-wide grassed strip.

ALTERNATIVE: (Sketch attached)

Install a 2-ft.-wide grassed strip and reduce 4 ft. of right-of-way on each side of the roadway.

ADVANTAGES:

- Reduces 8 ft. of right-of-way strip for the entire length of the project
- Reduces right-of-way take required
- Reduces earthwork

DISADVANTAGES:

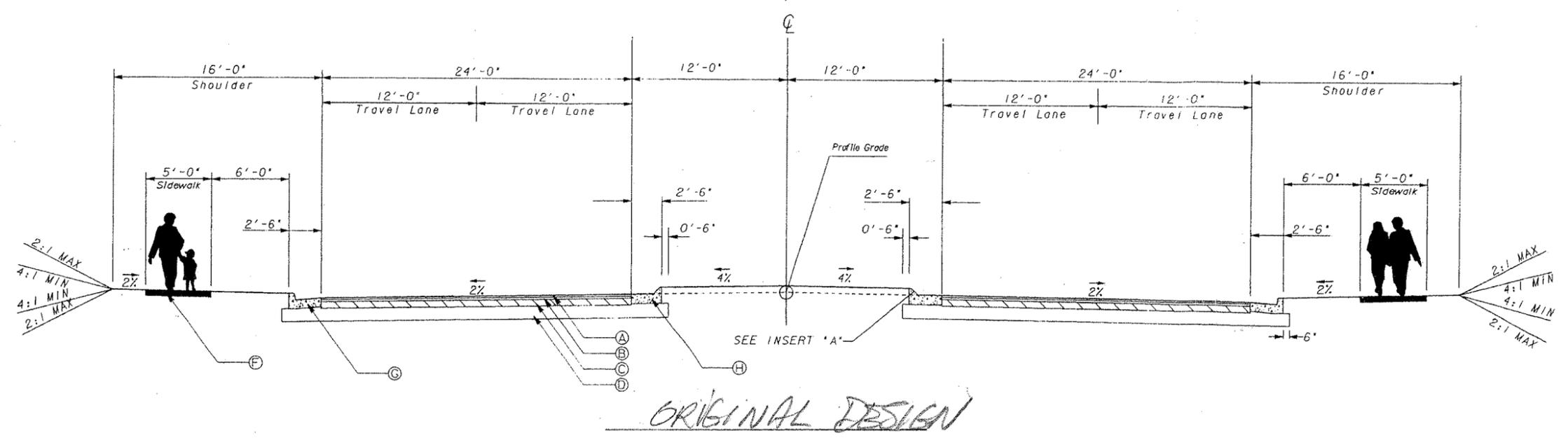
- Sidewalk layout at driveway locations

DISCUSSION:

Reducing the grassed strip from 6 ft. to 2 ft. eliminates one acre of right-of-way, which is the largest cost of the project.

The sidewalk may need to be tapered out at driveway crossings to provide ADA compliant cross-slopes.

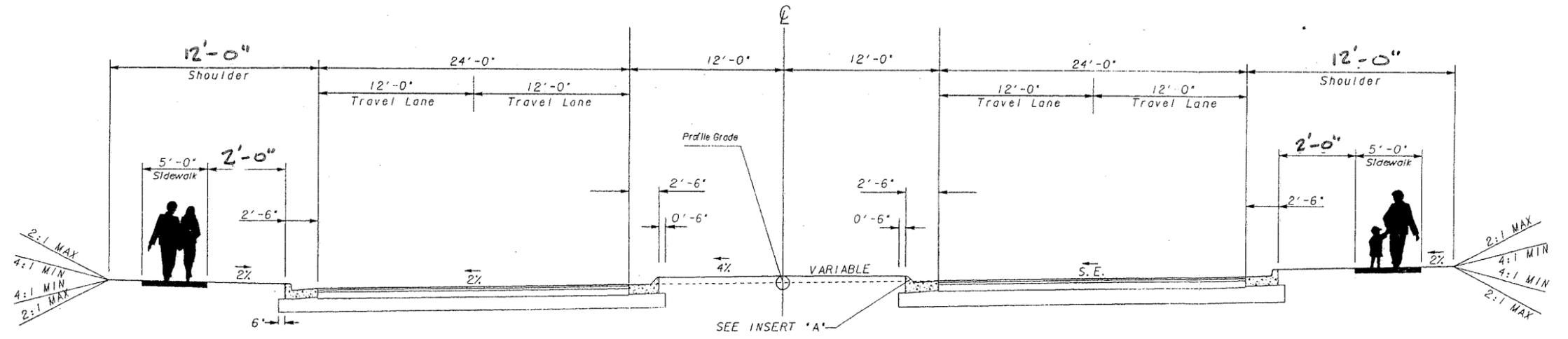
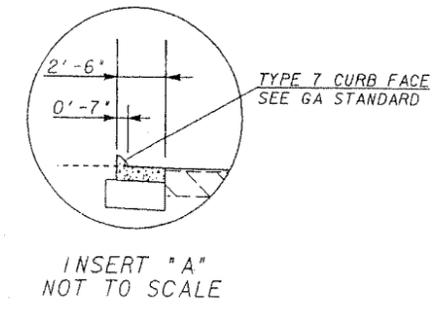
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,360,307	—	\$ 1,360,307
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 1,360,307	—	\$ 1,360,307



- REQUIRED PAVEMENT**
- (A) ASPHALTIC CONCRETE 12.5 mm SMA, 165 LBS./SQ. YD.
 - (B) ASPHALTIC CONCRETE 19.0 mm SUPERPAVE, 220 LBS./SQ. YD.
 - (C) ASPHALTIC CONCRETE 25.0 mm SUPERPAVE, 660 LBS./SQ. YD.
 - (D) GRADED AGGREGATE BASE, 12"
 - (E) ASPHALTIC CONCRETE LEVELING, AS REQ'D
 - (F) CONC. SIDEWALK, 4" THICK
 - (G) 8" X 30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 2
 - (H) 8" X 30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 7

SLOPE CONTROLS - FEET		
SLOPE	CUT	FILL
4:1	0-5'	0-5'
2:1	OVER 5'	OVER 5'

2:1 FILL SLOPES
REQUIRE GUARDRAIL



TYPICAL SECTION *4
S. R. 306 SUPERELEVATION FULL DEPTH SECTION
APPLIES TO
152+00 TO 159+00

ALTERNATIVE DESIGN

CALCULATIONS



PROJECT: **SR 306 WIDENING (P.I. NO.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-8**

SHEET NO.: **3 of 4**

GRASSING

STA 107+10 TO 181+13 7403 LF

STA 305+00 TO 347+50 4250 LF

11653 LF

$$11653 \times 4' = 46612 \text{ sf} \times \frac{1 \text{ AC}}{43560 \text{ sf}} = 1.07 \text{ AC}$$

R.O.W. Unit Cost

Use \$ 365,753/AC. (Ave \$400K ^{DEVELOPED LAND} & \$300K ^{UNDEVELOPED LAND}/AC)

Embankment

-5 cy

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **TS-9**

DESCRIPTION: **WIDEN SR 306 TO SIX LANES**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

A four-lane urban section along SR 306 is currently proposed.

ALTERNATIVE: (Sketch attached)

Design a 6-lane urban section along SR 306 from the beginning of the project to SR 369.

ADVANTAGES:

- Increases capacity
- Provides a better level of service (LOS)

DISADVANTAGES:

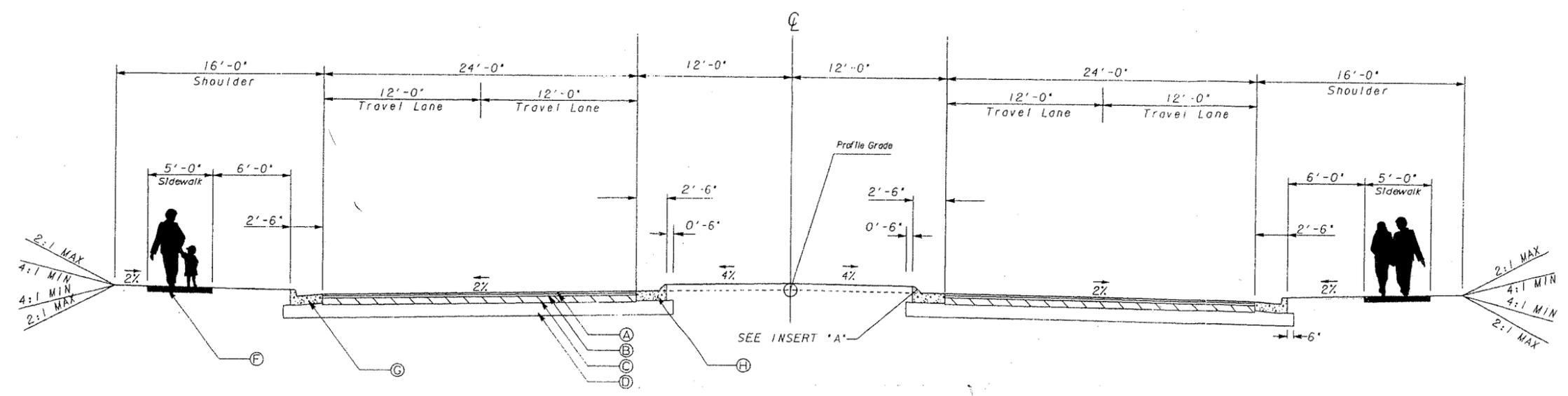
- Requires revised concept and design
- Increases right-of-way impacts

DISCUSSION:

In the opening year (2012), the LOS for proposed conditions for SR 306 is C and in the design year (2032) the LOS is E. The project area is currently being developed and traffic is expected to increase. The 6-lane section will increase capacity along the corridor. Widening now would also not require the additional widening and right-of-way purchase when costs are higher.

Also, consider adding a third turn lane from 306 EB to 369 SB and 369 NB to 306 WB to improve LOS and operations.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 4,699,293	—	\$ 4,699,293
SAVINGS	\$ (4,699,293)	—	\$ (4,699,293)

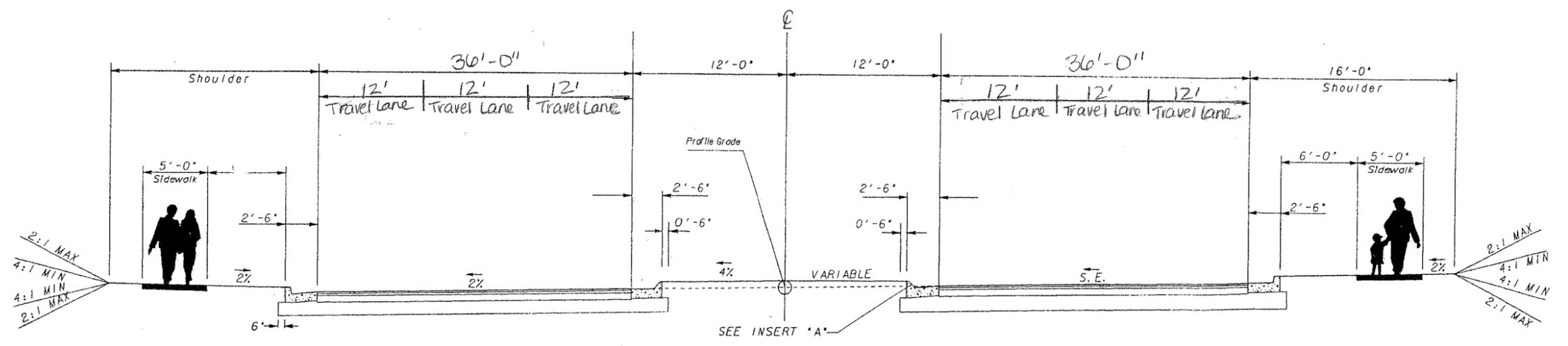
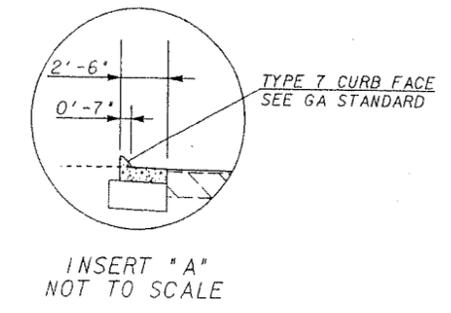


ORIGINAL

- REQUIRED PAVEMENT
- (A) ASPHALTIC CONCRETE 12.5 mm SMA, 165 LBS./SQ. YD.
 - (B) ASPHALTIC CONCRETE 19.0 mm SUPERPAVE, 220 LBS./SQ. YD.
 - (C) ASPHALTIC CONCRETE 25.0 mm SUPERPAVE, 660 LBS./SQ. YD.
 - (D) GRADED AGGREGATE BASE, 12"
 - (E) ASPHALTIC CONCRETE LEVELING, AS REQ'D
 - (F) CONC. SIDEWALK, 4" THICK
 - (G) 8" X 30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 2
 - (H) 8" X 30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 7

SLOPE CONTROLS - FEET		
SLOPE	CUT	FILL
4:1	0-5'	0-5'
2:1	OVER 5'	OVER 5'

2:1 FILL SLOPES
 REQUIRE GUARDRAIL



ALTERNATIVE

PLANS PREPARED BY:



REVISION DATES

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CONSULTANT DESIGN
 TYPICAL SECTIONS 27

CALCULATIONS



PROJECT: **SR 306 WIDENING (P.I. NO.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: TS-9

SHEET NO.: 3 of 4

24' additional pavement
Station 110+50 - 165+00 = 5450'

$$15450 \times 24 = 130800 \text{ SF} = 14534 \text{ sy}$$

12.5 mm SMA - 165 lb/sy
 $14534 \text{ sy} \times 165 = 2398110 \text{ lb} = 1199 \text{ ton}$

19.0 mm Superpave - 220 lb/sy
 $14534 \text{ sy} \times 220 = 3197480 \text{ lb} = 1599 \text{ ton}$

25.0 mm Superpave - 660 lbs/sy
 $14534 \text{ sy} \times 660 = 9592440 \text{ lb} = 4797 \text{ ton}$

GAB - 12"
 $5450' \times 24' \times 1' = 130800 \text{ cf} = 4845 \text{ cy}$
 $\frac{2.03 \text{ tons}}{\text{cy}} \times 4845 = 9836 \text{ ton}$

ROW
 $24 \times 5450 = 130800 \text{ SF} \times \frac{1 \text{ acre}}{43560 \text{ SF}} = 3.00 \text{ acre}$

In Place Embankment
negligible difference

COST WORKSHEET



PROJECT: **SR 306 Widening (P.I. No.122015)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **TS-9**

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
12.5mm SMA	TN				1199	90.00	107,910
19.0mm Superpave	TN				1599	80.00	127,920
25.0mm Superpave	TN				4797	80.00	383,760
Gr. Aggr. Base	TN				9836	19.23	189,146.28
Construction (E & C)						10%	80,873.63
Subtotal							889,609.90
ROW	AC				3.00	365,753	1,097,259
ROW MU						247.2%	2,712,424.25
Subtotal							3,809,683.25
Subtotal							(4,699,293.15)
Markup (%) at							
TOTAL							(4,699,293.15)

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)** ALTERNATIVE NO.: **TS-11**
Forsyth County, Georgia

DESCRIPTION: **USE A 20-FT. RAISED CONCRETE MEDIAN IN LIEU OF** SHEET NO.: **1 of 4**
A 24 FT. RAISED CONCRETE MEDIAN

ORIGINAL DESIGN: (Sketch attached)

Original design is a 24-ft. raised concrete median.

ALTERNATIVE: (Sketch attached)

Use a 20-ft. raised concrete median symmetric about the roadway centerline. GDOT guidelines allow for a median 20-24 ft. (16-20 ft. raised portion).

ADVANTAGES:

- Reduces right-of-way

DISADVANTAGES:

- Provides a narrower curb-to-curb distance along left-turn lane

DISCUSSION:

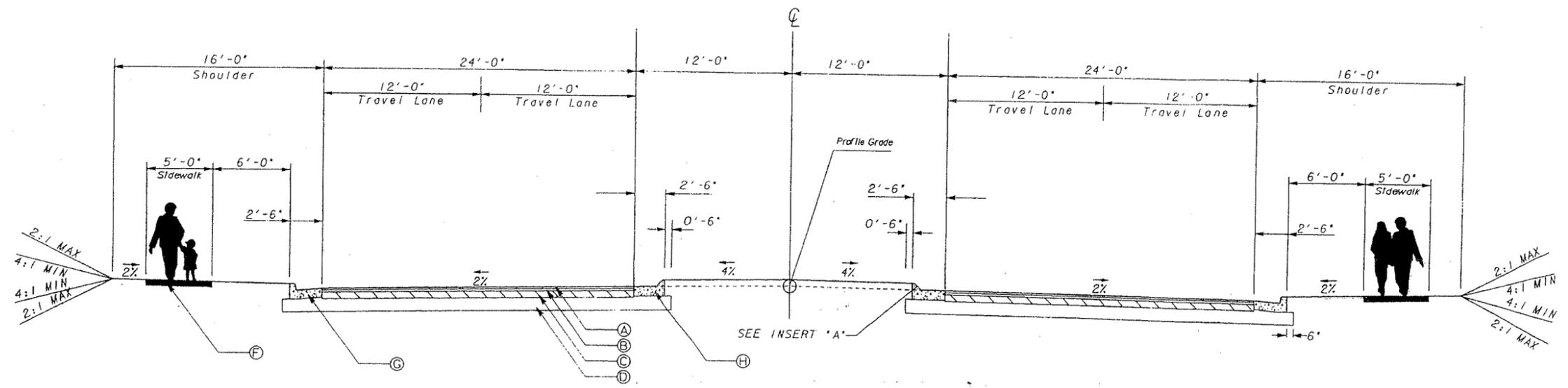
A 20-ft. raised median reduces the amount of right-of-way and concrete required. The median along the turn lane (curb-to-curb) would be reduced from 8 ft. to 4 ft.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 489,164	—	\$ 489,164
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 489,164	—	\$ 489,164

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I:\122015\GDM\1220151Y02.dgn 3, 45, 49, 51, 53, 55

STATE	PROJECT NUMBER	SHEET NO.	TOTAL
GA	STP-012-1(61)		

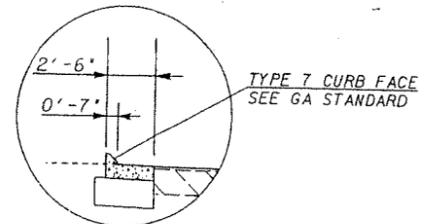


REQUIRED PAVEMENT

- (A) ASPHALTIC CONCRETE 12.5 mm SMA, 165 LBS./SQ. YD.
- (B) ASPHALTIC CONCRETE 19.0 mm SUPERPAVE, 220 LBS./SQ. YD.
- (C) ASPHALTIC CONCRETE 25.0 mm SUPERPAVE, 660 LBS./SQ. YD.
- (D) GRADED AGGREGATE BASE, 12"
- (E) ASPHALTIC CONCRETE LEVELING, AS REQ'D
- (F) CONC. SIDEWALK, 4" THICK
- (G) 8" X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 2
- (H) 8" X30" CONC. CURB & GUTTER, GA. STD. 9032b, TYPE 7

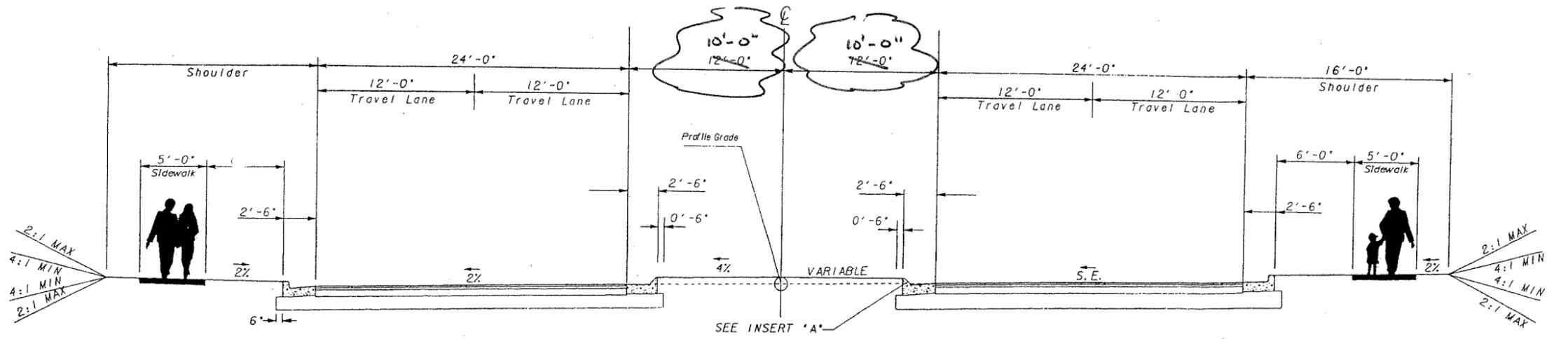
SLOPE CONTROLS - FEET		
SLOPE	CUT	FILL
4:1	0-5'	0-5'
2:1	OVER 5'	OVER 5'

2:1 FILL SLOPES
REQUIRE GUARDRAIL



TYPE 7 CURB FACE
SEE GA STANDARD

INSERT "A"
NOT TO SCALE



PLANS PREPARED BY:

Florence & Hutcheson, Inc.

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CONSULTANT DESIGN

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: TS-11

SHEET NO.: 3 of 4

EXISTING 24' MEDIAN

STA 125+50 TO STA 158+00 — 3250 LF

STA 172+00 TO STA 174+00 — 200 LF

3450 LF

4' REDUCTION OF CONCRETE MEDIAN

$$3,450 \times 4' = 13800 \text{ sf} \div 9 = 1533.3 \text{ CY}$$

EXCAVATION

negligible difference

ROW

4' STRIP FOR 3,450 LF

$$3450 \times 4 = 13800 \text{ ft}^2 \times \frac{1 \text{ AC}}{43560 \text{ ft}^2} = 0.32 \text{ AC}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)** ALTERNATIVE NO.: **TS-13**
Forsyth County, Georgia

DESCRIPTION: **USE FABRIC REINFORCEMENT WITH STEEP SLOPES** SHEET NO.: **1 of 4**
TO REDUCE EASEMENT

ORIGINAL DESIGN: (Sketch attached)

From the hinge point (25 ft. past sidewalk) the fill slope is 2:1 maximum.

ALTERNATIVE: (Sketch attached)

Reinforce backfill to stabilize slope at 1:1 using geogrid reinforcements.

ADVANTAGES:

- Reduces easement take

DISADVANTAGES:

- Growth of weeds on sharp slope is difficult to deal with

DISCUSSION:

The big cost of easement is more than enough to offset the cost of geogrid reinforcement. The savings can be used for treatment of the slope such as shrubs or other plants to stabilize surface due to erosion.

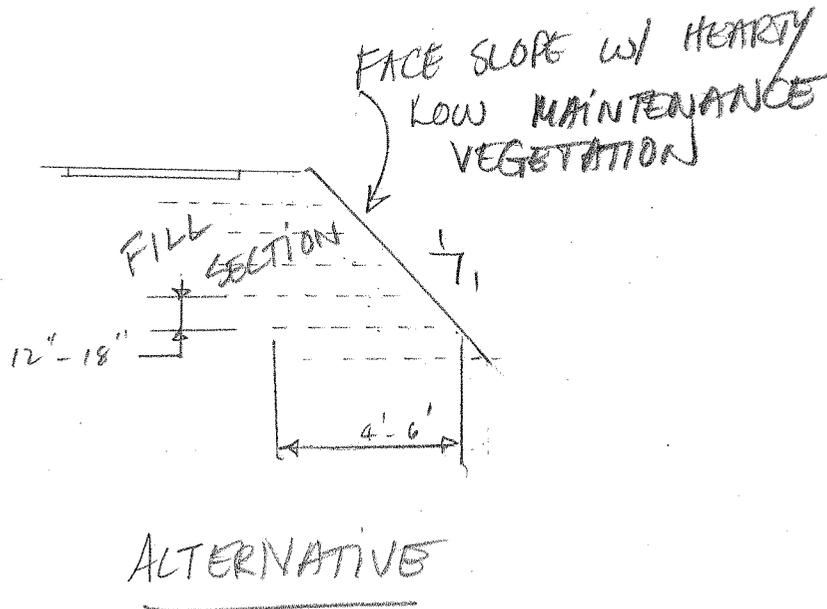
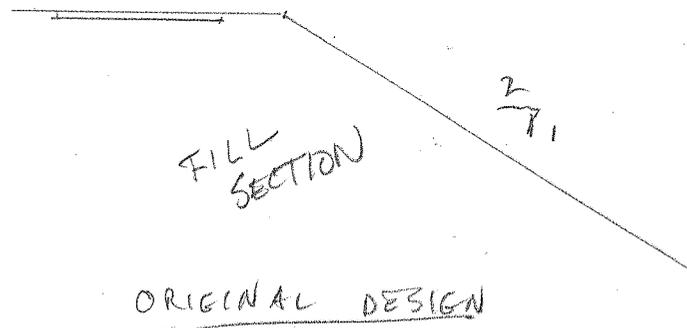
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,166,865	—	\$ 1,166,865
ALTERNATIVE	\$ 331,344	—	\$ 331,344
SAVINGS	\$ 835,521	—	\$ 835,521

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: TS-13

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 4



CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO. 122015)
Georgia Department of Transportation

ALTERNATIVE NO.: TS-13

SHEET NO.: 3 of 4

$$\text{COST OF EASEMENT} = \$365,753 / \text{ACRE} = \$365,753 / 43,560 \text{ SF} = \$8.40 / \text{SF}$$

GEGRID REINFORCEMENT - USE ONLY FOR 2' 6" HIGH SLOPES.

GRID AREA PER LINEAR FOOT OF SLOPE

$$5 \text{ LAYERS} \times 6' = 30 \text{ FT. / LF.}$$

$$\text{LENGTH OF SR 306} = 17400 - 11000 = 6400 \text{ FT.}$$

(CONSIDER NORTH SIDE ONLY SINCE SOUTH SIDE IS BEING CONSTRUCTED ON EXISTING GRADE)

$$30' \times 6400' \div 96 = 21,333 \text{ SQ. YDS.}$$

$$\text{EASEMENT} = 6' \times 6400 = 38400 \text{ SF}$$

$$\text{FILL} = 0.5(6' \times 6') \times 6400 \div 27 = 4267 \text{ CYOS.}$$

COST WORKSHEET



PROJECT: **SR 306 Widening (P.I. No.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-13**

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
ORIGINAL DESIGN							
ERSEMENT	SF	38,400	8.40	322,560			
MARK UP 247.2%				797,368			
BACK FILL							
MARK UP 10%	CY	4267	10.00	42,670			
				4,267			
PROPOSED ALTERNATE							
GEORID REINF	SY				21,333	14.12	301,222
TYPE 2							30,122
MARK UP 10%							
Subtotal				1,166,865			331,344
Markup (%) at							
TOTAL							

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **TS-14**

DESCRIPTION: **CONSTRUCT WALLS TO REDUCE REQUIRED EASEMENTS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

From the hinge point (25 ft. past sidewalk) the fill slope is 2:1 maximum.

ALTERNATIVE: (Sketch attached)

Construct gravity wall (maximum exposed height of 6.25 ft.) to retain earth and limit easement take.

ADVANTAGES:

- Reduces cost

DISADVANTAGES:

- Limits future expansion

DISCUSSION:

There are savings in constructing walls in lieu of extending fill. The wall is to be the fill section only.

Additional savings can be obtained by using less expensive wall systems. Possibly an MSE wall system could generate added savings.

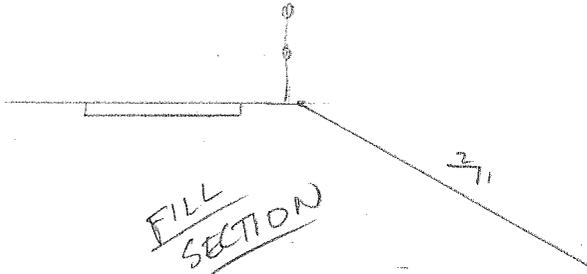
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,619,184	—	\$ 2,619,184
ALTERNATIVE	\$ 2,026,812	—	\$ 2,026,812
SAVINGS	\$ 592,372	—	\$ 592,372

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
Georgia Department of Transportation

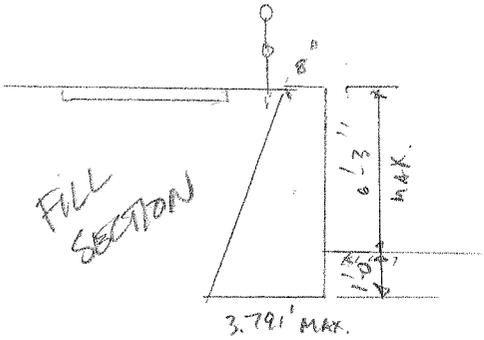
ALTERNATIVE NO.: TS-14

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 4



ORIGINAL DESIGN



ALTERNATE DESIGN

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: TS-14

SHEET NO.: 3 of 4

$$\text{COST OF EASEMENT: } \$365,753 / \text{ACRE} = \$365,753 / 43,560 \text{ SF} = \$8.40 / \text{SF}$$

$$\text{GRAVITY WALL: (STD. 9031-L) MAX. HT. FOR FLAT SLOPE} = 7.25' - 1' \text{ EMBED} = 6.25'$$

$$\text{WALL AREA: } 7.25' (0.5 \times [0.6667 \times 3.7919]) = 16.16 \text{ SF.}$$

$$16.16 \text{ SF} \times 1' \div 27 \times \$461.02 / \text{CY} = \$287.88 / \text{LF} \times 1.10 \text{ (w/ MARK UP)} = \$316.67$$

$$\text{EASEMENT } \$8.40 \times 2 \times 6.25' \times 3.672 \text{ (w/ MARK UP)} = \$364.56 \text{ (6.25' HIGH)}$$

$$\frac{364.56 - 316.67}{364.56} \approx 13\% \text{ SAVINGS. (APPLIES ALSO TO SIMILAR WALLS)}$$

$$\text{LENGTH OF SR 306: } 17400' - 11000.00' = 6400 \text{ FT. (CONSIDER NORTH SIDE ONLY SINCE SOUTH SIDE IS BEING BUILT ON EXISTING GRADE.)}$$

$$\text{USE MAXIMUM HT. OF WALL} = 7.25'$$

$$\text{EASEMENT} = 2 \times 6.25' \times 6400' = 80,000 \text{ SF TOTAL.}$$

$$\text{CONCRETE} = 16.16 \text{ SF} \times 6400' \div 27 = 3830 \text{ CY.}$$

$$\text{FILL} = 0.5 (16.25' \times 13.5') \times 6400 \div 27 = 24,000 \rightarrow 10,000$$

COST WORKSHEET



PROJECT: **SR 306 Widening (P.I. No.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **TS-14**

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
ORIGINAL DESIGN							
EASEMENT	SF	80,000	8.40	672,000			
MARK UP				247.2%			1,661,184
BACK FILL							
	CY	26,200	10.60	260,000			
MARK UP				10%			26,000
PROPOSED ALTERNATE							
GRAVITY WALL	CY				3830	481.02	1,842,556
MARK UP							10%
							184,256
							2,026,812
Subtotal				2,019,184			2,026,812
Markup (%) at							
TOTAL							

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **G-2**

DESCRIPTION: **CONSOLIDATE SR 306 WEST END DRIVEWAYS**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

On the north side of the roadway at the west end of the project there are three driveways between STA 116+00 and STA 123+00 that all give egress into the same shopping area. The westernmost driveway ingress is immediately upstream of the deceleration lane to the I 400 entrance ramp.

ALTERNATIVE: (Sketch attached)

Eliminate two of the three driveways and have motorists enter and exist the shopping area at the signalized intersection.

Add an acceleration lane at the downstream end of the driveway.

ADVANTAGES:

- Channelizes all traffic into shopping area to signalized intersection
- Improves operations (SR 306)
- Reduces fill material
- Reduces collisions

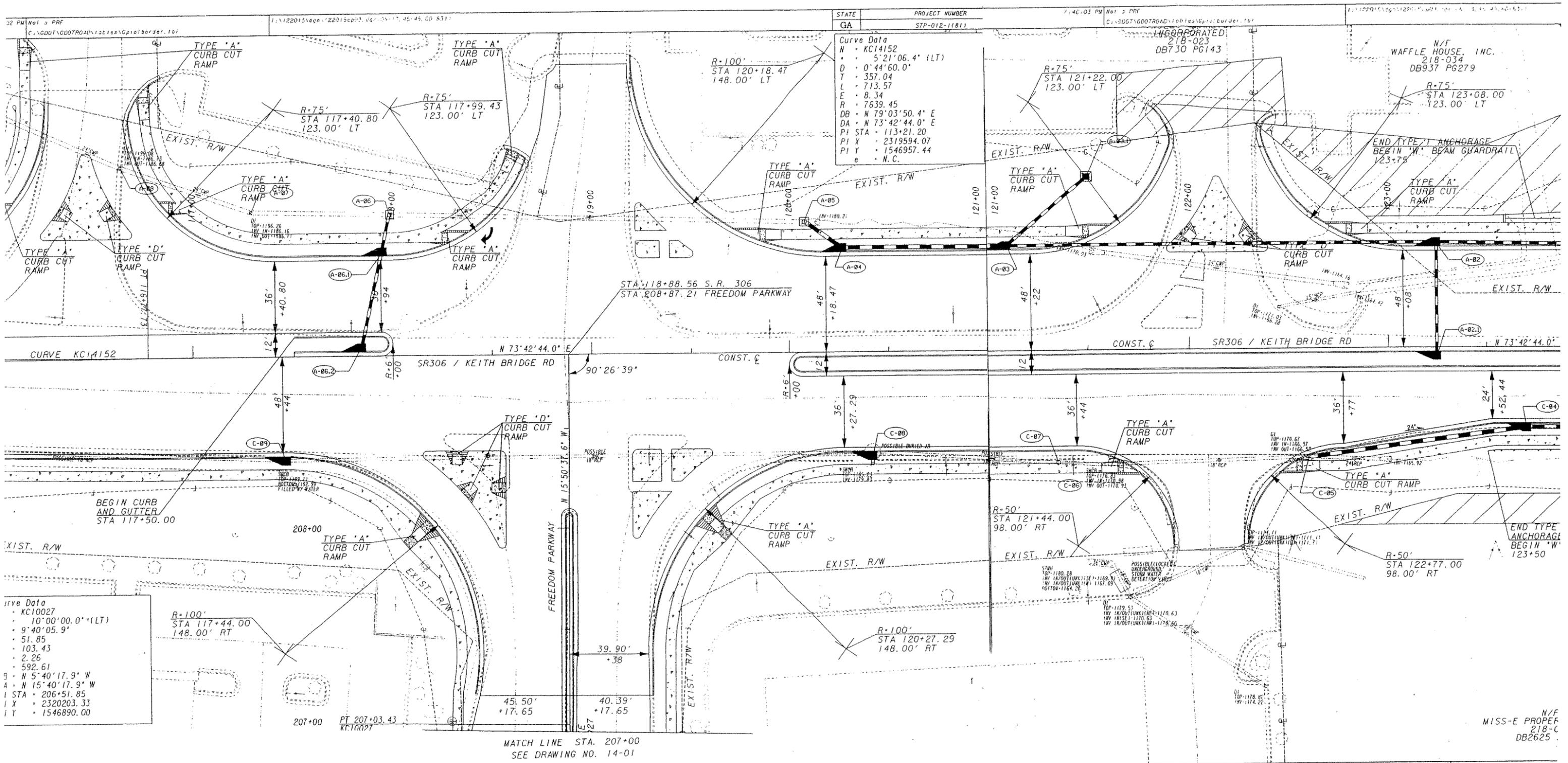
DISADVANTAGES:

- May require compensation of businesses that lose dedicated drive/common easement

DISCUSSION:

Eliminating the driveways on the north side of the roadway would channelize traffic in and out of the shopping center through one signalized intersection, reducing conflict points and collision potential.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 126,883	—	\$ 126,883
ALTERNATIVE	\$ 21,387	—	\$ 21,387
SAVINGS	\$ 105,496	—	\$ 105,496



Curve Data

N	KC14152
D	5°21'06.4" (LT)
L	148.00'
T	357.04
E	713.57
R	7639.45
DB	N 79°03'50.4" E
DA	N 73°42'44.0" E
PI	STA 113+21.20
PI X	2319594.07
PI Y	1546957.44
e	N.C.

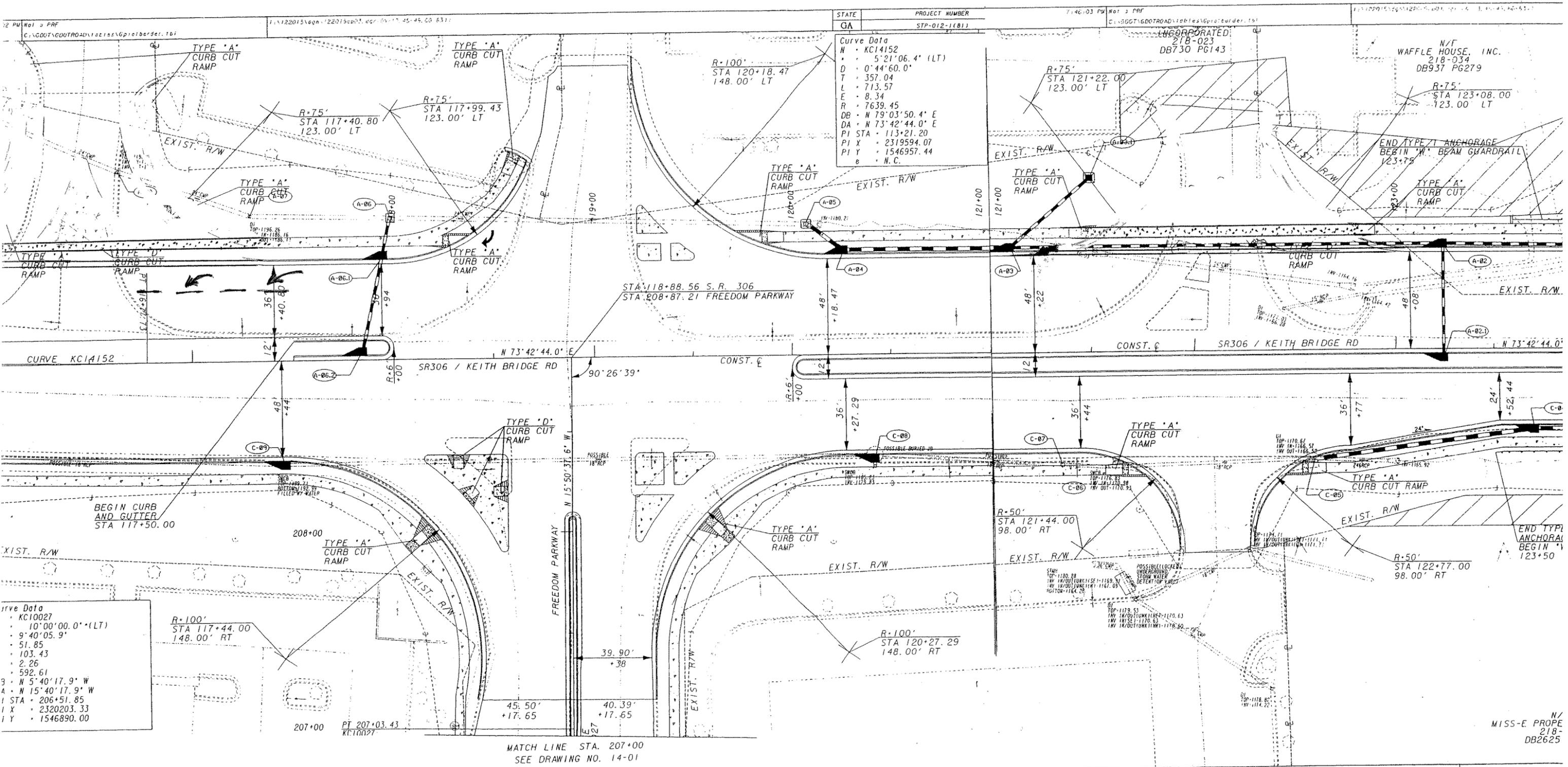
Curve Data

N	KC10027
D	10°00'00.0" (LT)
L	9°40'05.9"
T	51.85
E	103.43
R	2.26
DB	N 5°40'17.9" W
DA	N 15°40'17.9" W
PI	STA 206+51.85
PI X	2320203.33
PI Y	1546890.00

NG R/W LINE	BEGIN LIMIT OF ACCESS.....BLA	REVISION DATES	STATE DEPARTMENT OF HIGHWAYS AND EXISTING R/W LINE	BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA	END LIMIT OF ACCESS.....ELA		REQUIRED R/W LINE	END LIMIT OF ACCESS.....ELA
			INSTRUCTION LIMITS	LIMIT OF ACCESS
				REQUIRED R/W AND LIMIT

PLANS PREPARED BY
F Florence & CONSULTING

ORIGINAL DESIGN



NG R/W LINE	BEGIN LIMIT OF ACCESS.....BLA	REVISION DATES	STATE DEPARTMENT OF	PROPERTY AND EXISTING R/W LINE	BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA			OFFICE CONSULTANT	REQUIRED R/W LINE	END LIMIT OF ACCESS.....ELA
				INSTRUCTION LIMITS	LIMIT OF ACCESS
					REQUIRED R/W AND LIMIT

PLANS PREPARED BY
Florence
CONSULTANTS

ALTERNATE DESIGN

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO. 122015)
Georgia Department of Transportation

ALTERNATIVE NO.: G-2

SHEET NO.: 4 of 5

CURBS AND GUTTER

STA 116+00 TO STA 117+50 — 150 LF

STA 121+00 TO STA 123+00 — 200 LF

350 LF

TOTAL C & G
REMOVED
170 LF

REMOVED CURB AND GUTTER

$140 + 140 + 120 + 120 = 520 \text{ LF}$

ADD'L SIDEWALK

350 LF

CONC MEDIAN

$1968 \text{ ft}^2 \div 9 = 218.7 \text{ sy}$

PVMT

$80 \text{ LF} \times 4 \text{ LANES} = 320 \text{ LF}$

EXCAVATION

$50 \text{ sy} \times 150' = 7500 \text{ cy}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **G-3**

DESCRIPTION: **SHIFT ALIGNMENT OF SR 369 APPROXIMATELY
 50 FT. WEST**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

SR 369 is being widened to accommodate four through-lanes and turning lanes in the proximity of SR 306. Widening is mainly to the west.

ALTERNATIVE: (Sketch attached)

Shift proposed east edge of pavement along SR 369 approximately 50 feet to the west and avoid displacement of commercial building owned by Barbara J. Hendrix at the northwest quadrant of the SR 306/SR 369 intersection and another owned by Roger D. Hammond.

ADVANTAGES:

- Avoids two displacements on east side of SR 369

DISADVANTAGES:

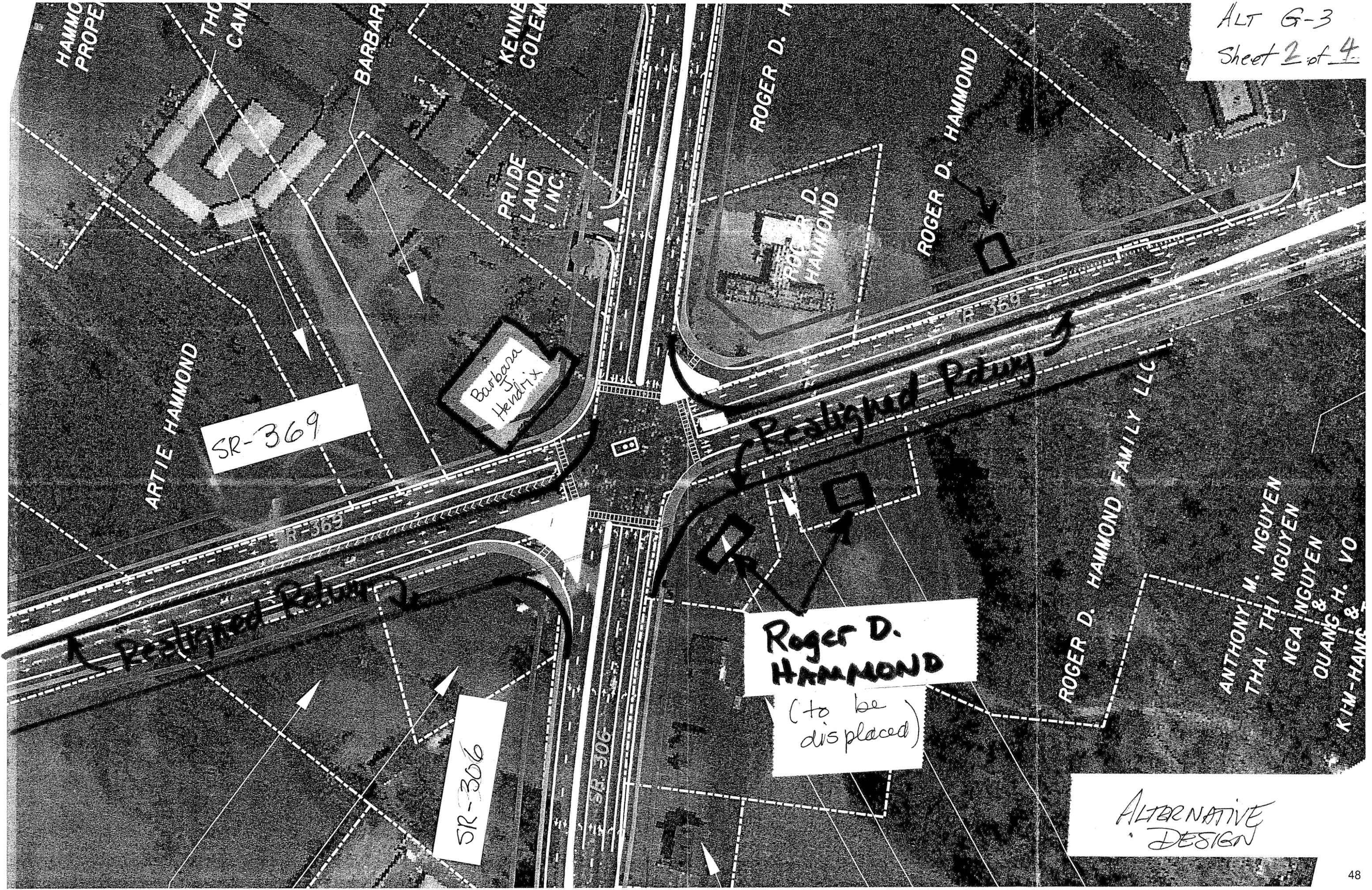
- Displaces two smaller buildings on SR 369 west
- Requires redesign

DISCUSSION:

The current widening along SR 369 is primarily widened west; however, it would still create two displacements along the east side of SR 369.

By shifting the proposed edge of pavement line 50 ft. west, two properties on the east side could be “traded” for two displacements at the southwest quadrant of the SR 306/SR 369 intersection. The square footage difference between the two alternative displacements should cost much less.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,576,000	—	\$ 4,576,000
ALTERNATIVE	\$ 1,300,000	—	\$ 1,300,000
SAVINGS	\$ 3,276,000	—	\$ 3,276,000



SR-369

SR-306

Roger D.
HAMMOND
(to be displaced)

ALTERNATIVE
DESIGN

HAMMO
PROPE

THO
CANAL

BARBARA

KENNA
COLEM

PRIDE
LAND
INC.

ROGER D. H

ROGER D.
HAMMOND

ROGER D. HAMMOND

ARTIE HAMMOND

Barbara
J.
Hendrix

ROGER D. HAMMOND FAMILY LLC

ANTHONY M. NGUYEN
THAI THI NGUYEN

NGA NGUYEN
QUANG H. VO
KIM-HANG &

CALCULATIONS



PROJECT: **SR 306 WIDENING (P.I. NO.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: *G-3*

SHEET NO.: *3* of *4*

NE quadrant $120 \times 100 = 12000 \text{ sf}$ > 14080
SR 369 E - $40 \times 52 = 2080 \text{ sf}$

SR 369 W , $40 \times 30 = 1200 \text{ sf}$
SW quadrant $70 \times 40 = 2800 \text{ sf}$ > 4000

COST WORKSHEET

PROJECT: **SR 306 Widening (P.I. No.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **G-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
Original ROW	SF	14080	325	4,576,000			
Proposed ROW	SF				4000	325	1,300,000
Subtotal							
Markup (%) at							
TOTAL				4,576,000			1,300,000

VALUE ENGINEERING ALTERNATIVE



PROJECT:	WIDENING SR 306 (SR400 TO EAST OF SR 369) <i>Forsyth County, Georgia</i>	ALTERNATIVE NO.:	G-4
DESCRIPTION:	FULL WIDENING OF SOUTH PROJECT PUTS LIMITS ON SR 369	SHEET NO.:	1 of 9

ORIGINAL DESIGN: (Sketch attached)

Current design begins to taper to a two-lane section at STA 337+00± to the end of the project (STA 348+91) at the south project limit of SR 369.

ALTERNATIVE: (Sketch attached)

Combine a 4-lane-section with 24-ft. raised concrete median to the end of the project in preparation of a continuation project along SR 369. Install temporary striping to reduce travel lanes to one lane.

ADVANTAGES:

- Reduces disruption to new pavement when next project begins
- Locates curb and gutter at final location

DISADVANTAGES:

- Increases cost
- Requires more length to 8 ft. x 7 ft. box culvert

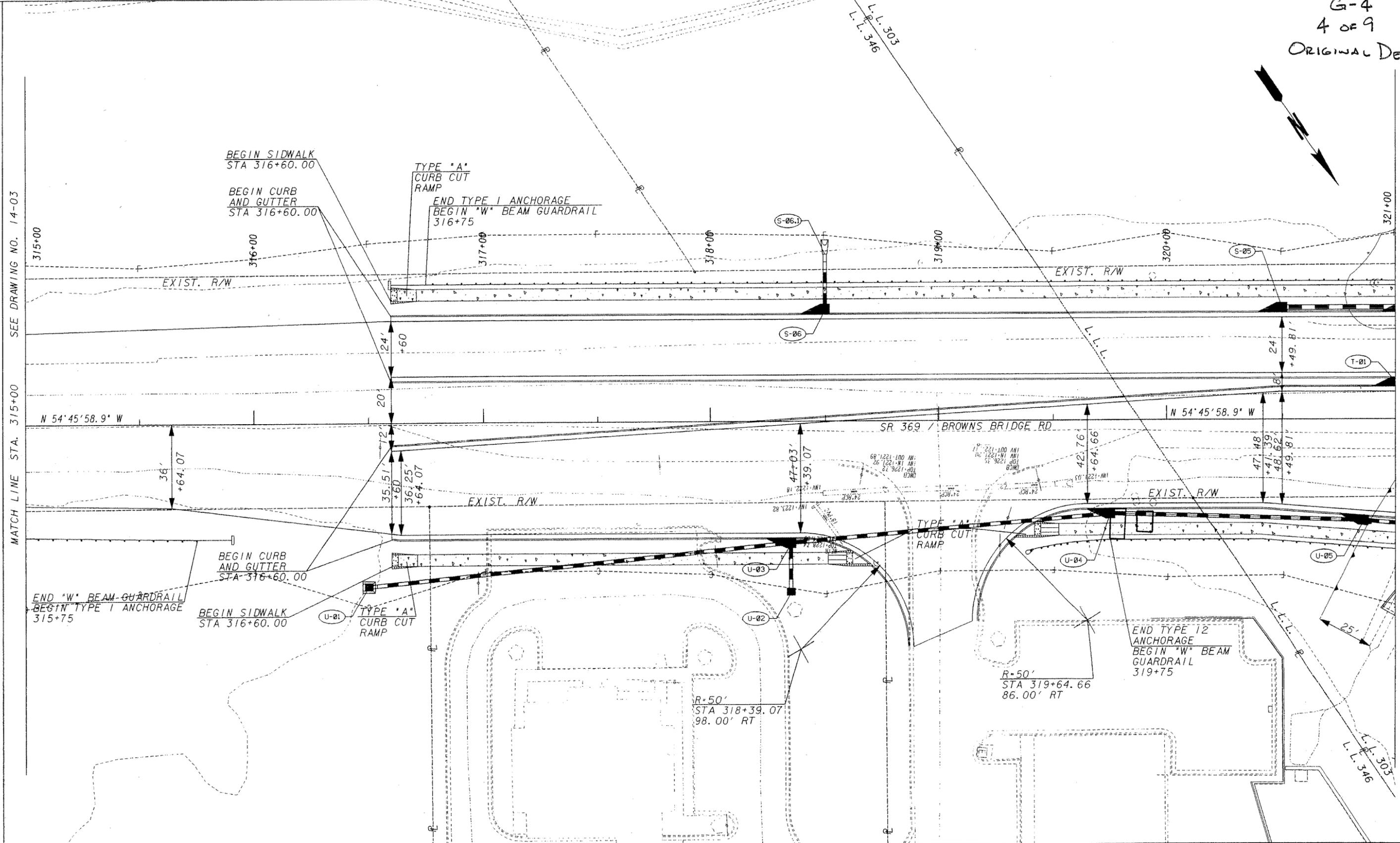
DISCUSSION:

This proposed alternative will allow the future SR 369 widening to conform to a full section without any disruption to traffic or widening.

The right-of-way lines as drawn on the current plans appear to accommodate a full, ultimate section.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 912,774	—	\$ 912,774
SAVINGS	\$ (912,774)	—	\$ (912,774)

G-4
4 of 9
ORIGINAL DESIGN



MATCH LINE STA. 315+00 SEE DRAWING NO. 14-03

MATCH LINE STA. 321+00 SEE DRAWING NO. 14-05

1. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 2. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 3. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 4. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 5. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 6. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 7. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 8. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 9. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM
 10. 11/20/07 10:00 AM 11/20/07 10:00 AM 11/20/07 10:00 AM

PROPERTY AND EXISTING R/W LINE	---	BEGIN LIMIT OF ACCESS.....BLA
REQUIRED R/W LINE	---	END LIMIT OF ACCESS.....ELA
CONSTRUCTION LIMITS	---	LIMIT OF ACCESS
EASEMENT FOR CONSTR	---	REQUIRED R/W AND LIMIT
& MAINTENANCE OF SLOPES	---	OF ACCESS
EASEMENT FOR CONSTR. OF SLOPES	---	

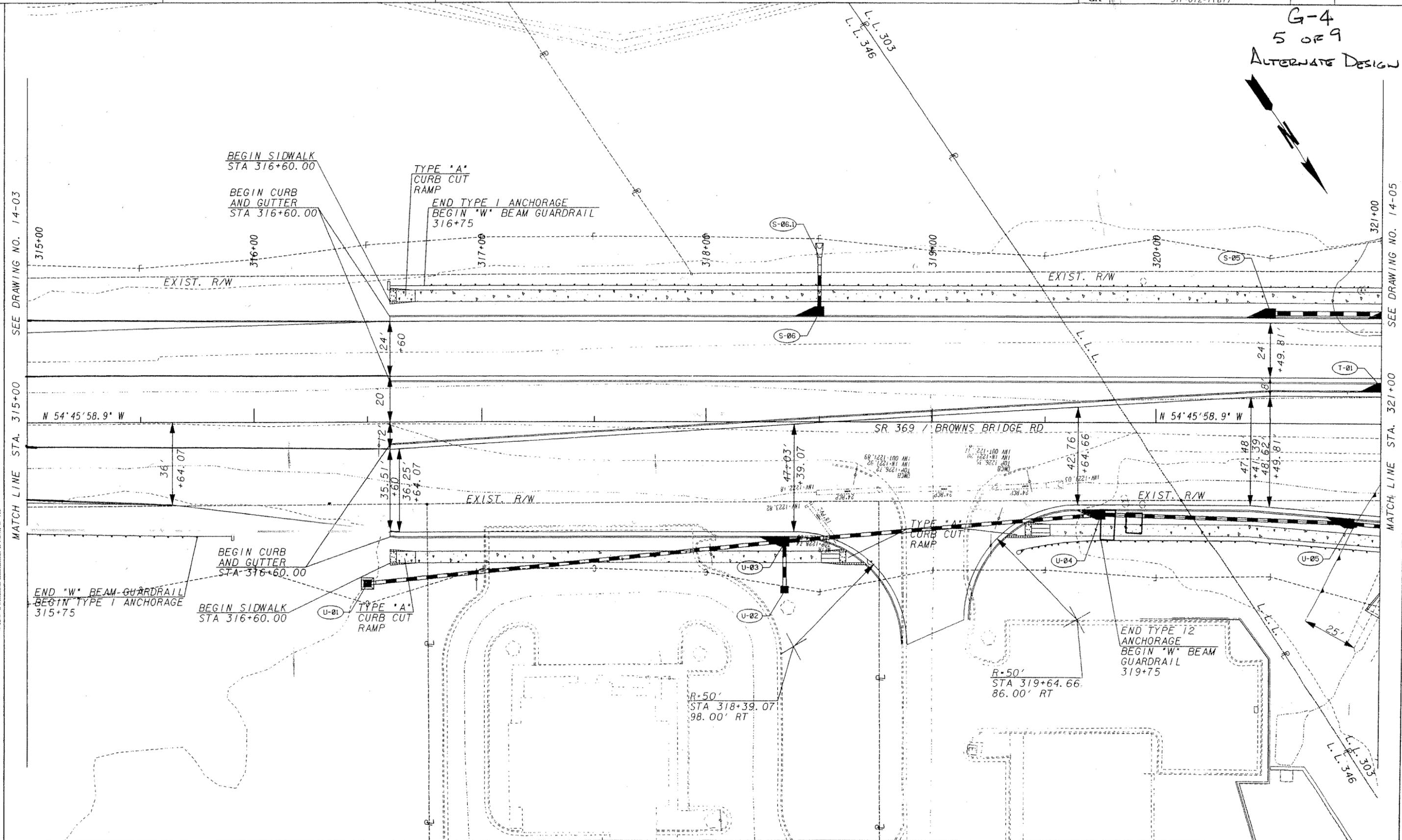
PLANS PREPARED BY:
 Florence & Hutcheson, Inc.
 CONSULTING ENGINEERS

SCALE IN FEET

REVISION DATES

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CONSULTANT DESIGN
CROSSROAD PLAN
 S. R. 369

G-4
5 OF 9
ALTERNATE DESIGN



PROPERTY AND EXISTING R/W LINE	---	BEGIN LIMIT OF ACCESS.....BLA	---
REQUIRED R/W LINE	---	END LIMIT OF ACCESS.....ELA	---
CONSTRUCTION LIMITS	---	LIMIT OF ACCESS	---
EASEMENT FOR CONSTR	---	REQUIRED R/W AND LIMIT	---
& MAINTENANCE OF SLOPES	---	OF ACCESS	---
EASEMENT FOR CONSTR OF SLOPES	---		

PLANS PREPARED BY:

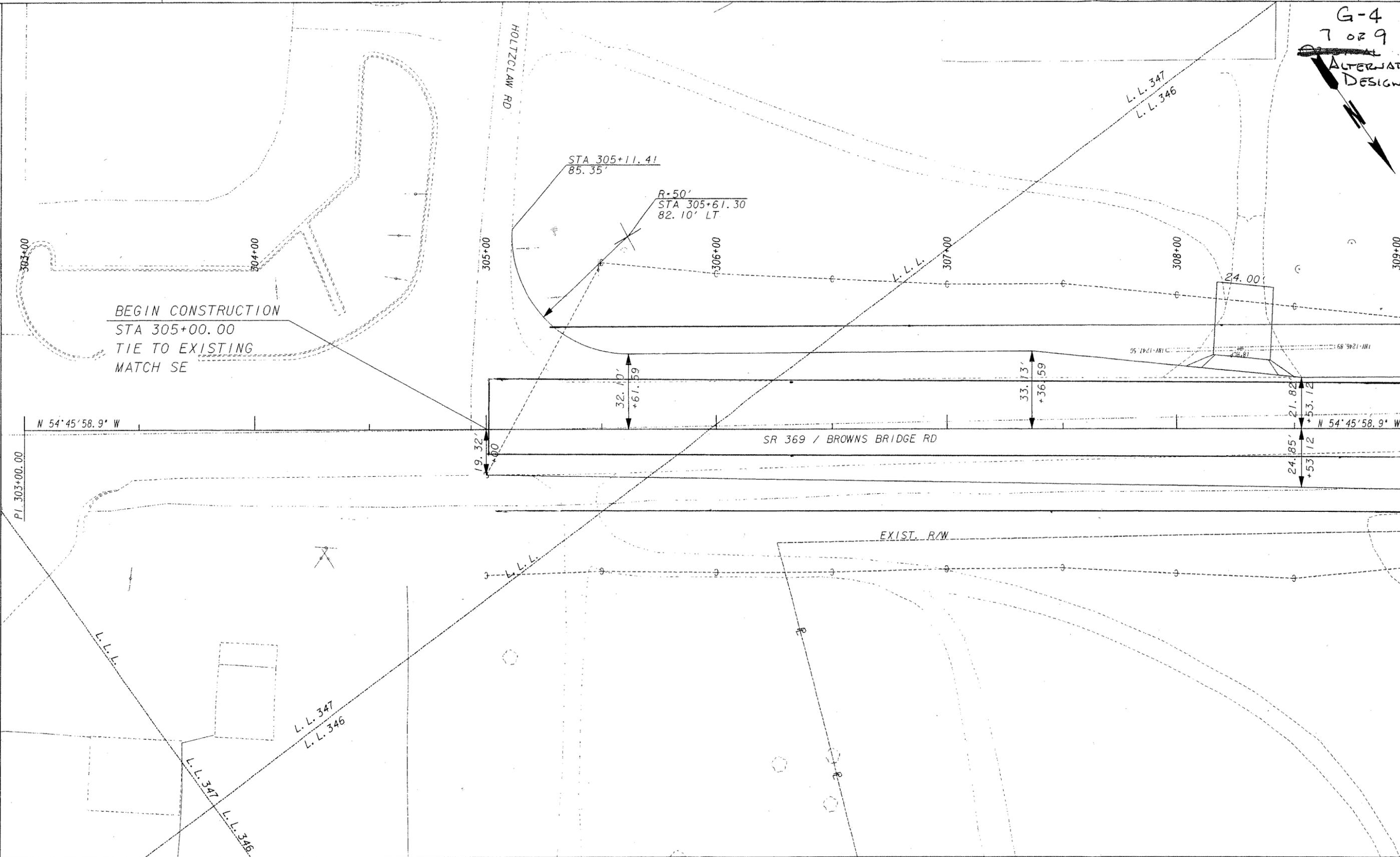
Florence & Hutcheson, Inc.
CONSULTING ENGINEERS

SCALE IN FEET

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CONSULTANT DESIGN
CROSSROAD PLAN
S. R. 369

G-4
 7 of 9
 ALTERNATE
 DESIGN



BEGIN CONSTRUCTION
 STA 305+00.00
 TIE TO EXISTING
 MATCH SE

SR 369 / BROWNS BRIDGE RD

EXIST. R/W

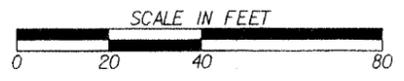
PROPERTY AND EXISTING R/W LINE	---
REQUIRED R/W LINE	---
CONSTRUCTION LIMITS	---
& MAINTENANCE OF SLOPES	---
EASEMENT FOR CONSTR OF SLOPES	---
EASEMENT FOR CONSTR OF DRIVES	---

BEGIN LIMIT OF ACCESS.....BLA	---
END LIMIT OF ACCESS.....ELA	---
LIMIT OF ACCESS	---
REQUIRED R/W AND LIMIT OF ACCESS	---

PLANS PREPARED BY:



Florence & Hutcheson, Inc.
 CONSULTING ENGINEERS
 1200 Ridgeway Blvd, Suite 200 • Kennesaw, GA 30143



REVISION DATES	

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: CONSULTANT DESIGN

CROSSROAD PLAN

S. R. 369
 FORSYTH COUNTY
 STA 303+00 TO 309+00

DRAWING No.
14-02

MATCH LINE STA. 309+00 SEE DRAWING NO. 14-03

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: G-4

SHEET NO.: 8 of 9

- ADD TRAVEL LANE STA 305+00 TO 314+00 ON NORTH
900 LF

- ADD TRAVEL LANE STA 305+00 TO 310+00 ON SOUTH
500 LF

TOTAL LENGTH OF LANES
 $900 + 500 = 1400$ LF

EXCAVATION

AVG EXCAVATION 5'

$$5 \times 24 \times 900 \div 27 = 4000 \text{ cy}$$

ROW

PURCHASE ROW AT END OF PROJECT AT TURNER PROPERTY

$$50' \times 400' = 20000 \text{ ft}^2 \times \frac{1 \Delta e}{43560 \text{ ft}^2} = 0.46$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **G-7**

DESCRIPTION: **LINE UP DRIVING LANES ACROSS SR 306 AT
 FREEDOM PARKWAY**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The straight-through lane from the driveway to Freedom Parkway south of SR 306 does not align because of the 8-ft. median separating the northbound and southbound lanes.

ALTERNATIVE: (Sketch attached)

Add the same 8-ft. median at the driveway to shift the existing lanes 8 ft. over, thus aligning the straight-through lane right.

ADVANTAGES:

- Aligns the straight-through lanes

DISADVANTAGES:

- Increases costs

DISCUSSION:

Aligning the lane eliminates the danger of swerving 8 ft. over to enter the lane on the other side of SR 306.

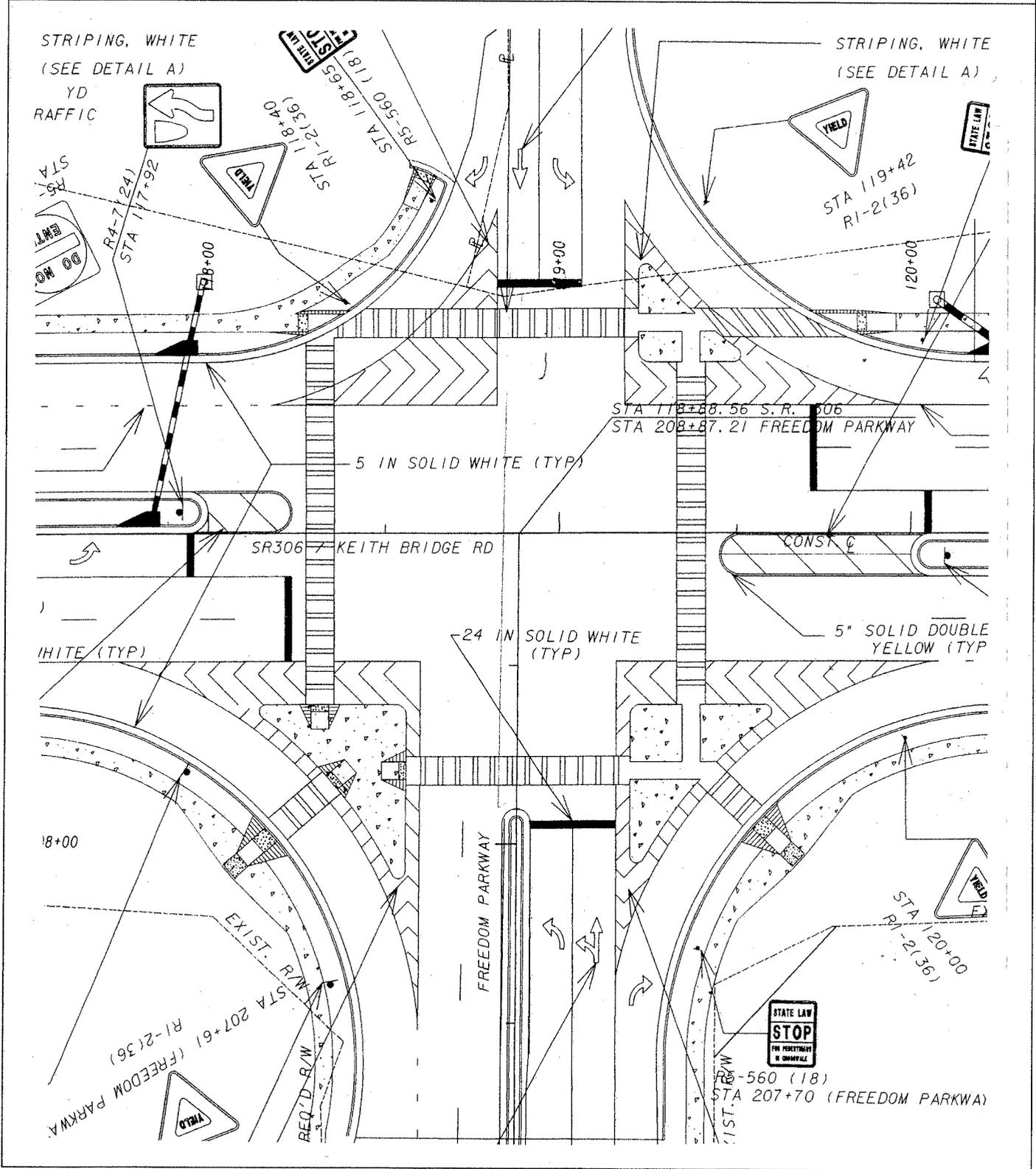
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS			

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **G-7**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2** of **3**

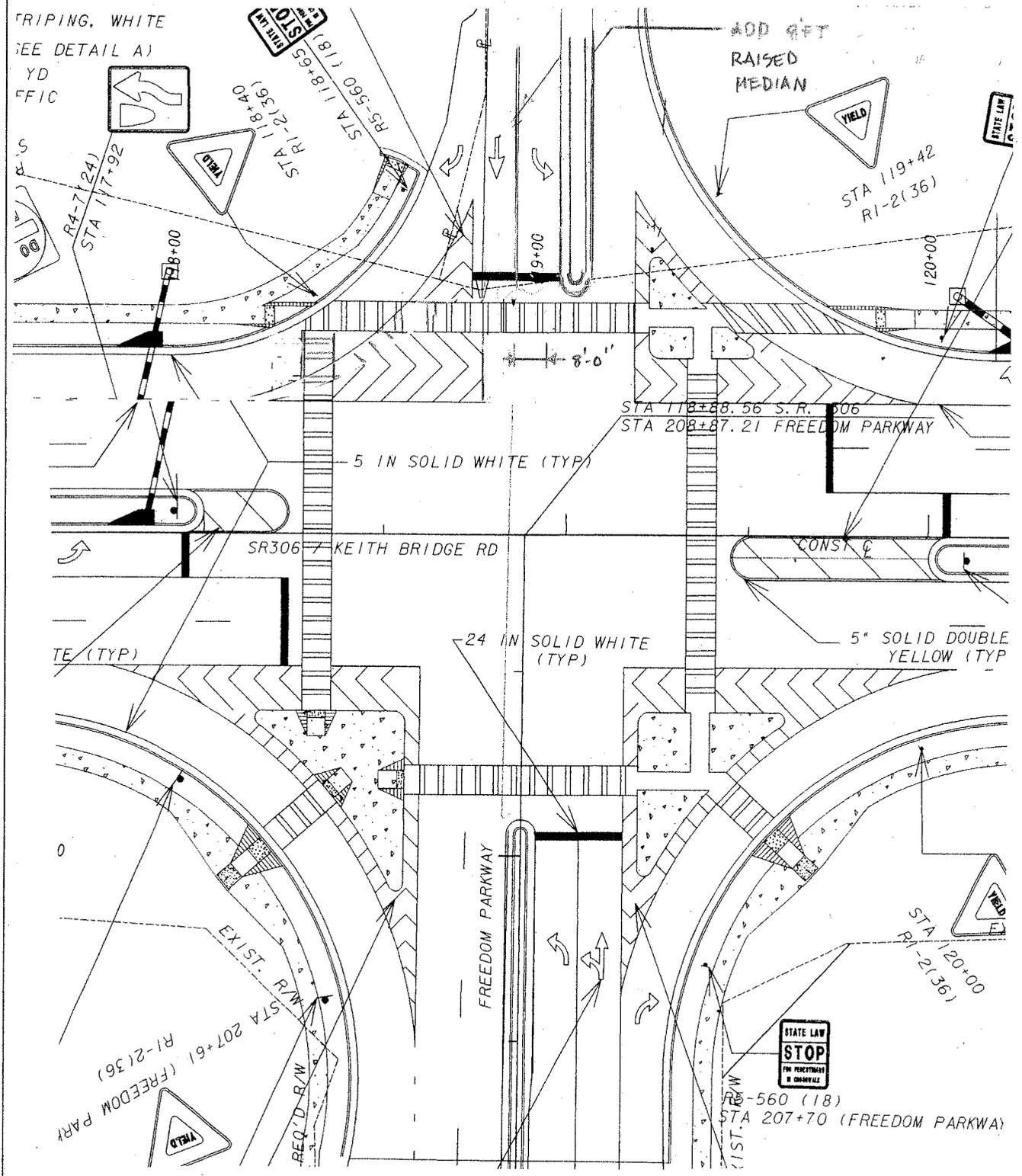


PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **G-7**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

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



VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **G-8**

DESCRIPTION: **ADD ADDITIONAL TURN LANE AT FREEDOM PARKWAY**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design shows one left-turn lane from SR 306 WB to Freedom Parkway.

ALTERNATIVE: (Sketch attached)

Consider two left-turn lanes from SR 306 WB to Freedom Parkway.

ADVANTAGES:

- Increases capacity
- Increases storage

DISADVANTAGES:

- Requires redesign
- May require additional right-of-way

DISCUSSION:

Both SR 306 and Freedom Parkway are currently being developed. Adding the extra turn lane will increase both storage and capacity along SR 306 at the intersection.

Based on traffic projections, GDOT may also want to add additional turn lanes to Freedom Parkway.

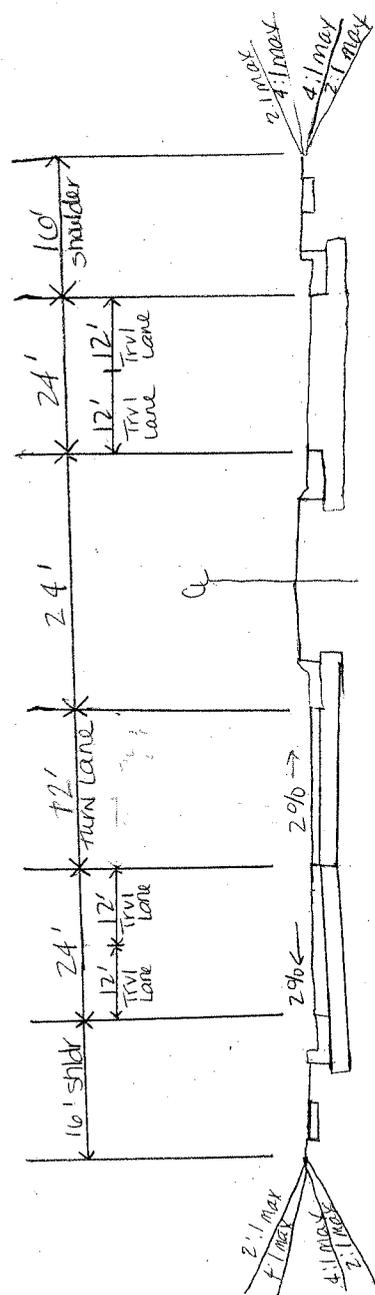
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 219,407	—	\$ 219,407
SAVINGS	\$ (219,407)	—	\$ (219,407)

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **G-8**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2** of **5**



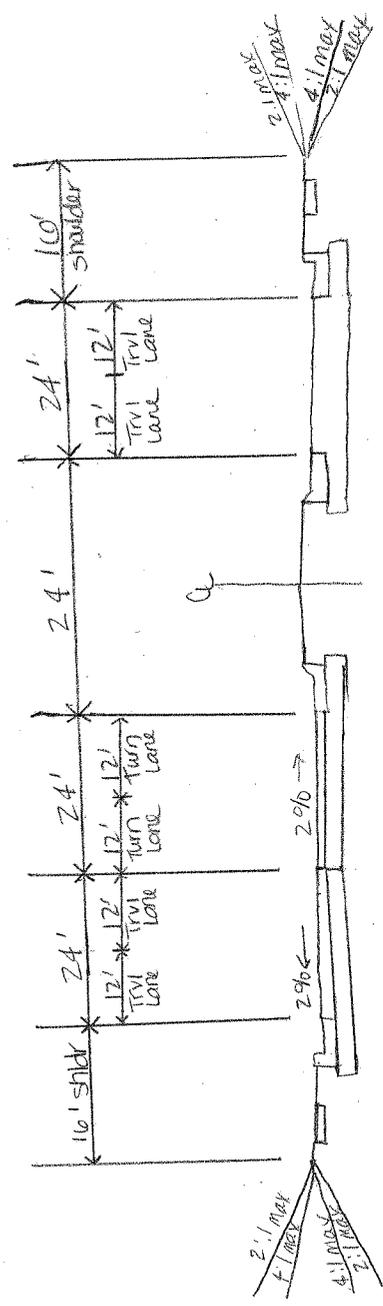
1.2

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **G-8**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

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



CALCULATIONS



PROJECT: **SR 306 WIDENING (P.I. NO.122015)**
 Georgia Department of Transportation

ALTERNATIVE NO.: G-8

SHEET NO.: 4 of 5

Additional Lane - 500'
 12' width

$$(500)(12) = 6000 \text{ sf} = 667 \text{ sy}$$

12.5 mm - 165 lb/sy

$$(165)(667) = 110055 \text{ lb} = 55 \text{ ton}$$

19 mm - 220 lb/sy

$$(220)(667) = 146740 \text{ lb} = 74 \text{ ton}$$

25 mm - 660 lb/sy

$$(660)(667) = 440220 \text{ lb} = 220 \text{ ton}$$

GAP = 2.03 ton/cy

$$(500)(12)(1) = 6000 \text{ cf} = 222 \text{ cy}$$

$$(222)(2.03) = 451 \text{ ton}$$

ROW

$$(500)(12) = 6000 \text{ sf} = .14 \text{ acre}$$

COST WORKSHEET



PROJECT: **SR 306 Widening (P.I. No.122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **G-8**

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
12.5mm SMA	TN				55	90.00	4950
19mm Superpave	TN				74	80.00	5920
25mm Superpave	TN				220	80.00	17600
Gr. Aggr. Base Crs	TN				451	19.23	8672.73
Solid Traffic Stripe, 5in, white	LF				500	.77	385
Pmt Marking, Arrow, TP2	EA				4	77.53	310.12
							37837.85
Construction (E+O)						10%	3783.79
subtotal							41621.64
ROW	AC				.14	365753	51205.42
ROW M/U						247.2%	126579.80
subtotal							177785.22
Total							219406.86
Subtotal							
Markup (%) at							
TOTAL							219406.86

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **D-1**

DESCRIPTION: **ELIMINATE DRIVEWAY AT STATION (STA) 124+10**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

Plans call for a deceleration lane that turns right into the Waffle House restaurant.

ALTERNATIVE: (Sketch attached)

Eliminate the driveway access at STA 124+10±.

ADVANTAGES:

- Increases deceleration lane length
- Shortens double 9-ft. x 9-ft. box culvert
- Consolidates three successive driveways into two

DISADVANTAGES:

- Limits access to the commercial area to the main driveway across Freedom Parkway and the next driveway to the west
- Retains the driveway and SR 400 entrance ramp weave

DISCUSSION:

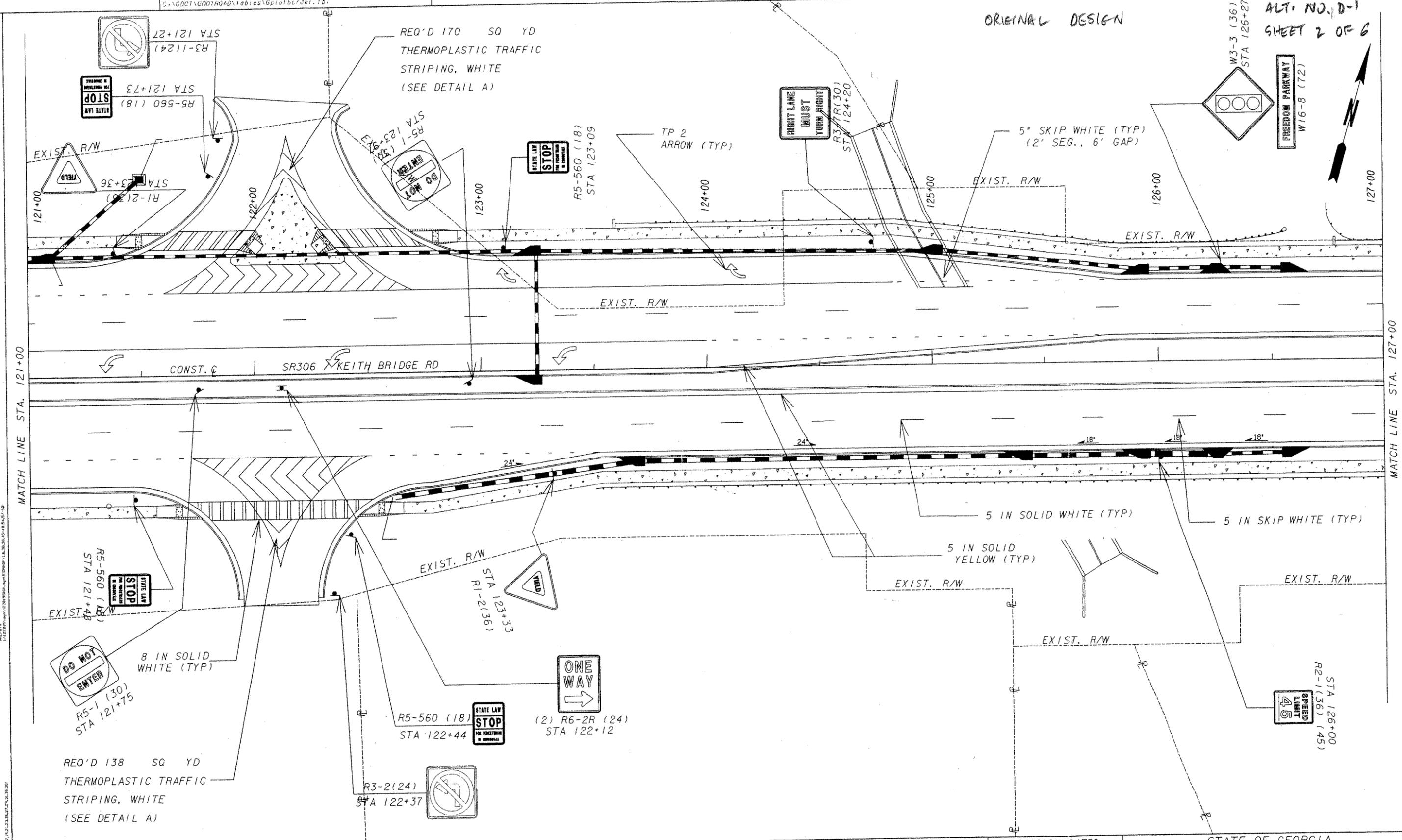
Dropping the right-turn lane of the WB SR 306 after the Baldrige Creek and partially consolidating the three entrances will result in a smoother controlled traffic in the area and help save construction costs.

This alternative is not as beneficial in SR 306 operations as Alt. No. G-2, but does provide some operational benefits by consolidating access points. However, it retains the ingress to SR 306 adjacent to the SR 400 entrance ramp deceleration lane.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 60,729	—	\$ 60,729
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 60,729	—	\$ 60,729

ORIGINAL DESIGN

ALT. NO. D-1
SHEET 2 OF 6



MATCH LINE STA. 121+00

MATCH LINE STA. 127+00

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

BEGIN LIMIT OF ACCESS.....BLA	---
END LIMIT OF ACCESS.....ELA	---
LIMIT OF ACCESS	---
REQUIRED R/W AND LIMIT OF ACCESS	---

PLANS PREPARED BY:

FH Florence & Hutcheson, Inc.
CONSULTING ENGINEERS
1200 Ridgewood Blvd., Suite 500 • Kennesaw, GA 30144

SCALE IN FEET

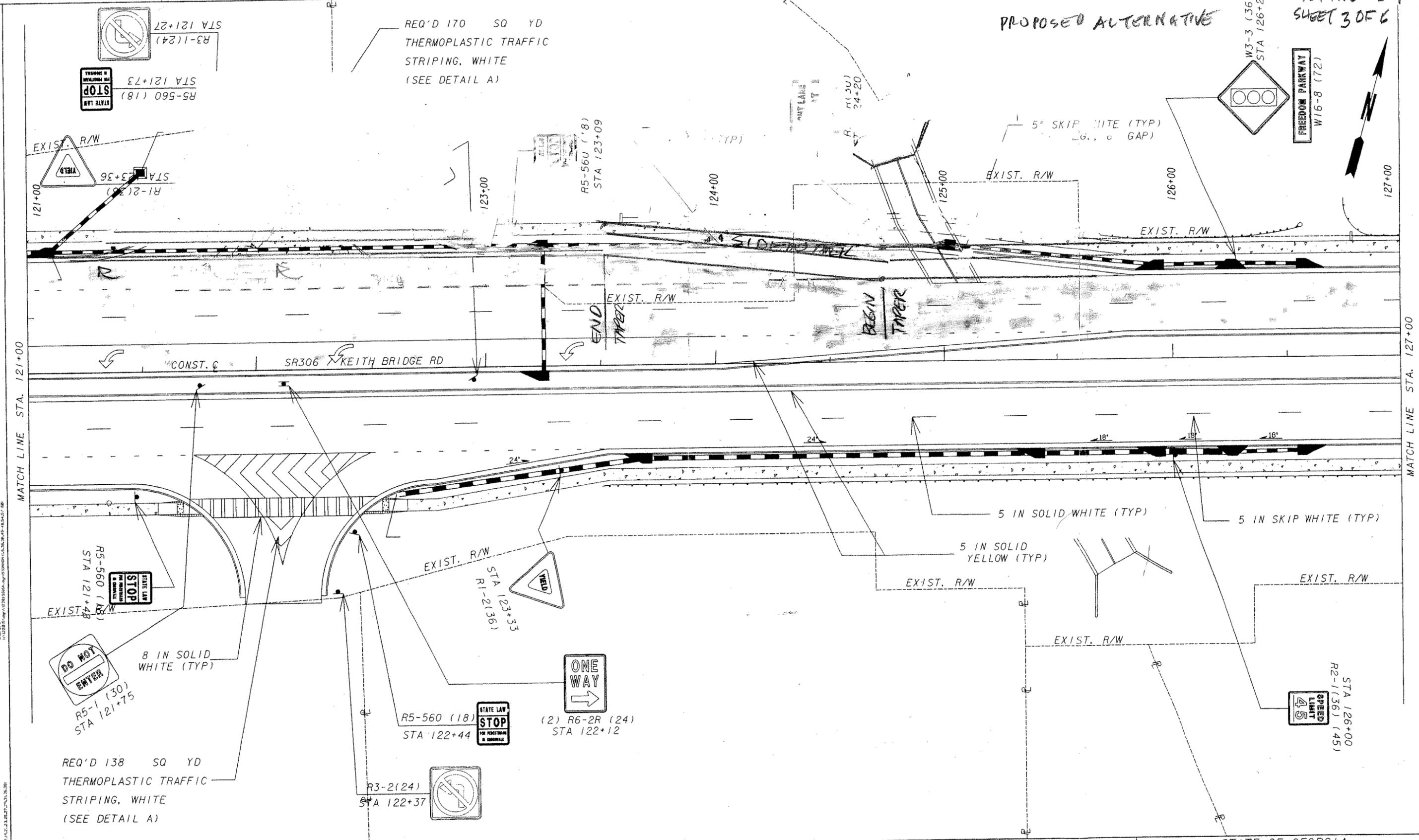
REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CONSULTANT DESIGN
SIGNING AND MARKING PLANS

C D 306

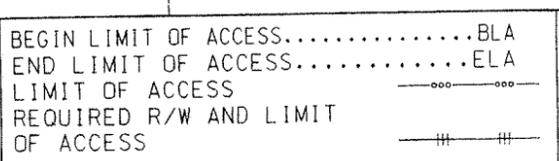
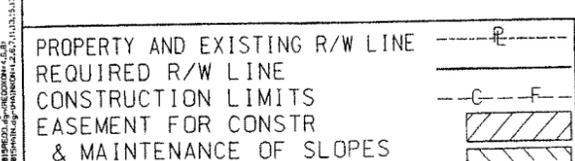
ALT. NO. D-1
SHEET 3 OF 6

PROPOSED ALTERNATIVE

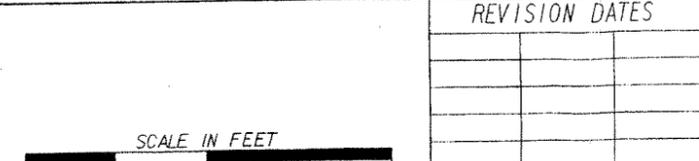


MATCH LINE STA. 121+00

MATCH LINE STA. 127+00



PLANS PREPARED BY:
FH Florence & Hutchison, Inc.
CONSULTING ENGINEERS
1300 Ridgewood Blvd, Suite 500 • Kennesaw, GA 30145



REVISION DATES	

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: CONSULTANT DESIGN
SIGNING AND MARKING PLANS

C D 306

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: D-1

SHEET NO.: 4 of 6

COST PER LINEAL FOOT OF DBL 9'x9' BOX CULVERT = \$ 371,506/895 = \$4151

LENGTH OF DECEL. LANE = 325 FT.

WIDTH = 12'

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: D-1

SHEET NO.: 5 of 6

12' TRAVEL LANE UNIT COST

12mm $12' \times 1' = 12 \text{ ft}^2 \div 9 = 1.33 \text{ yd}^2 \times \frac{165 \text{ lb}}{\text{yd}^2} = 220.0 \text{ lb}$

$$220 \text{ lb} \times \frac{1 \text{ TN}}{2000 \text{ lb}} \times \$90/\text{TN} = \$9.90/\text{ft}$$

19mm

$$12' \times 1' = 12 \text{ ft}^2 \div 9 = 1.33 \text{ yd}^2 \times \frac{220 \text{ lb}}{\text{yd}^2} = 292.6 \times \frac{1 \text{ TN}}{2000 \text{ lb}} \times \$80/\text{TN} = \$11.70$$

25mm

$$12' \times 1' = 12 \text{ ft}^2 \div 9 = 1.33 \text{ yd}^2 \times \frac{660 \text{ lb}}{\text{yd}^2} = 877.8 \text{ lb} \times \frac{1 \text{ TN}}{2000 \text{ lb}} \times \$80/\text{TN} = \$35.11$$

GAB

$$12' \times 1' \times 1' = 12 \text{ ft}^3 \div 27 = 0.44 \text{ yd}^3 \times \frac{2.03 \text{ TN}}{\text{yd}^3} \times \frac{\$19.23}{\text{TN}} = \$17.35$$

TOTAL

$$9.90 + 11.70 + 35.11 + 17.35 = \$74.06$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)** ALTERNATIVE NO.: **D-2**
Forsyth County, Georgia

DESCRIPTION: **STRAIGHTEN DOUBLE 9-FT. X 9-FT. CONCRETE BOX** SHEET NO.: **1 of 2**
CULVERT EXTENSION AT BALDRIDGE CREEK

ORIGINAL DESIGN: (Sketch attached)

Half of the length of extension follows the existing alignment, and then kinks back towards the creek.

ALTERNATIVE: (Sketch attached)

Extend the box culvert along the same bearing as the existing culvert.

ADVANTAGES:

- Easier to form
- Better angle of deviation for the hydraulic flow

DISADVANTAGES:

- None apparent

DISCUSSION:

Orienting the whole length of the extension allows one straight wall on the left for easier forming and construction.

There is still a need to bisect the angle of deviation to allow redirection of the middle and right walls.

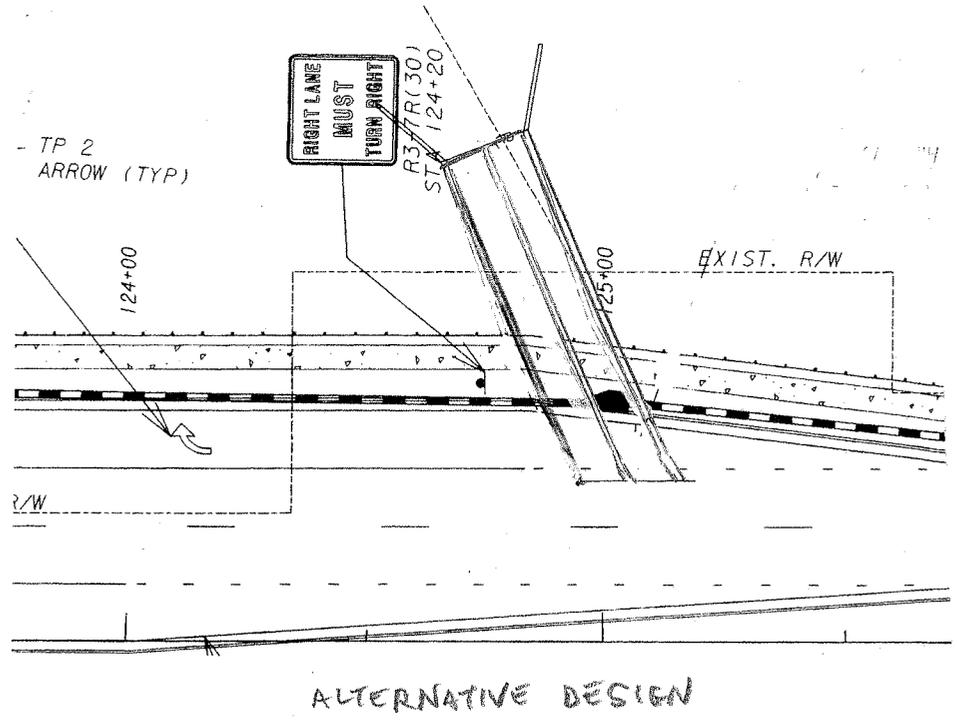
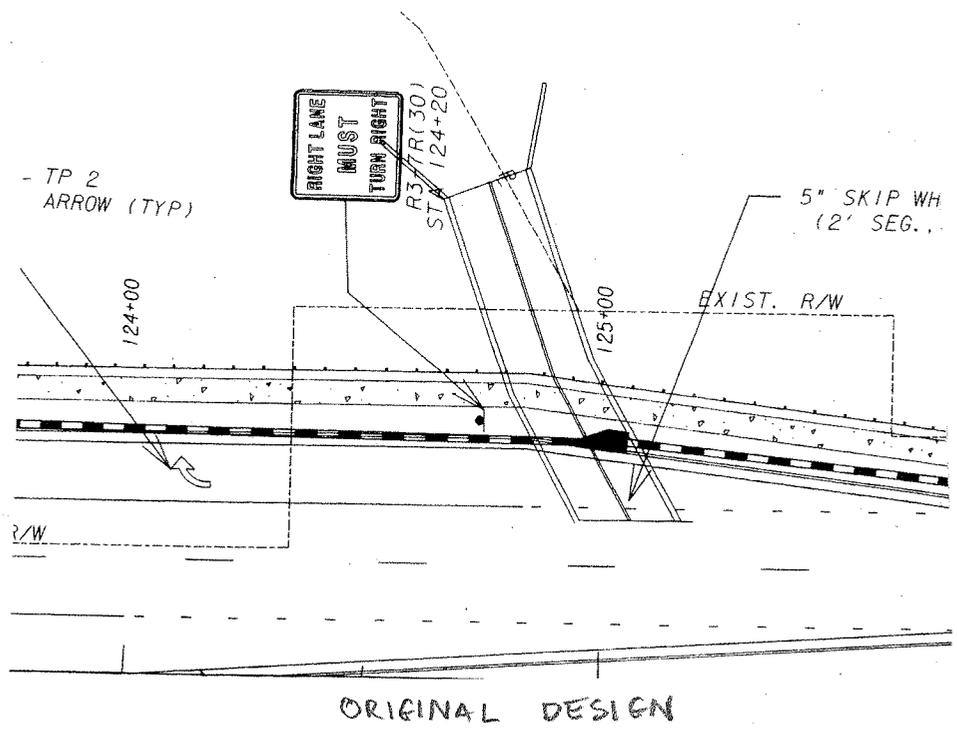
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS			

PROJECT: **SR 306 WIDENING (P.I. NO. 122015)**
Georgia Department of Transportation

ALTERNATIVE NO.: **D-2**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

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



VALUE ENGINEERING ALTERNATIVE



PROJECT: **WIDENING SR 306 (SR400 TO EAST OF SR 369)**
Forsyth County, Georgia

ALTERNATIVE NO.: **D-3**

DESCRIPTION: **ELIMINATE SOUTH EXTENSION OF DOUBLE 9 FT. X
 9 FT. CULVERT AT BALDRIDGE CREEK**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The double 9-ft. x 9-ft. culvert is extended approximately 13.5 in. at the south part.

ALTERNATIVE: (Sketch attached)

Extend parapet height and wingwall and avoid lengthening the culvert. Headwall would remain 50 ft. offset from edge of pavement.

ADVANTAGES:

- Retains existing parapet
- Easier to form
- Reduces cost
- Accelerates construction

DISADVANTAGES:

- Requires special design to retain dirt

DISCUSSION:

The plan shows the footprint of the extension with the right wingwall being replaced with almost exactly the same configuration. Better to just increase the parapet height with the left wingwall extended.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 61,642	—	\$ 61,642
ALTERNATIVE	\$ 21,056	—	\$ 21,056
SAVINGS	\$ 40,586	—	\$ 40,586

CALCULATIONS



PROJECT: SR 306 WIDENING (P.I. NO.122015)
Georgia Department of Transportation

ALTERNATIVE NO.: D-3

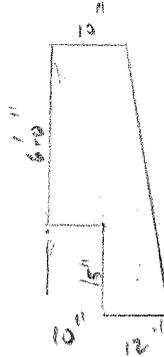
SHEET NO.: 3 of 4

$$\text{COST OF DBL. 9'x9' CULVERT} = \$371,506 / 89.5' = \$4151 / \text{LIN. FT.}$$

RAISE HEADWALL 6 FT AND EXTEND LEFT WINGWALL 12'.

$$\text{TOTAL LENGTH} = 17.5' + 31.5' + 17.5' + 12' = 78.5'$$

AREA OF ADDL. HEIGHT:



$$0.5(0.8333 + 1.8333)(7.25') - 0.8333 \times 1.25' = 8.625 \text{ SF.}$$

$$\text{VOL.} = 78.5' \times 8.625' \div 27 = 25.1 \text{ CYDS.}$$

$$\text{REINFORCEMENT} = 25.1 \times 200 = 5,015 \text{ LBS.}$$

PROJECTION DESCRIPTION

The following information was taken from the Project Need and Purpose and Design Concept Reports.

Georgia Department of Transportation
Project STP-012-1(81), Forsyth County, P.I. No. 122015
SR 306 from SR 400 to East of SR 369 & Bridge at Baldrige Creek

INTRODUCTION

The SR 306 widening project will reduce congestion and improve safety within a segment of SR 306 experiencing rapid growth in Forsyth County. The widening and reconstructing of SR 306 will be bounded between SR 400 northbound ramps to a point just east of SR 369/Browns Bridge (conforming to the existing two-lane section at Martin Road) - a total project length of 1.40 miles. The roadway will be reclassified, within the project limits, from a rural arterial with a 55 mph design speed to an urban arterial with a reduced 45 mph design speed. The proposed typical section for this project will consist of two 12-ft. lanes in each direction with a 24-ft. raised median. The shoulder section will be a 16-ft. urban shoulder with a 5-ft. sidewalk.

This project also includes 0.80 miles of improvements of SR 369, north and south of SR 306. On the south side, SR 369 will be widened to a four-lane section south of SR 306 to Holtzclaw Road matching the typical of the widening project to the south. North of SR 306 the roadbed will conform approximately 2,000 ft. away from the SR 306/SR 369 intersection to the existing two-lane section.

The safety improvements will consist of improving the turn lanes at the major intersections, Freedom Parkway and SR 369. A double left-turn lane will be provided for the northbound SR 369 to westbound SR 306 move and double right-turn lanes will be provided for the eastbound SR 306 to southbound SR 369 move.

The project is to be let January 2011. The current project cost estimate (2007 dollars) is as follows:

Construction Costs	\$ 12,067,285
Right of Way	\$ 30,958,000
Reimbursable Utilities	\$ <u>534,100</u>
Total Project Costs	\$ 43,559,385

PROJECT DESCRIPTION

The purpose of the project is to improve the efficiency and safety of SR 306 by increasing the capacity of the roadway, which will improve traffic flow and reduce vehicular conflicts. The proposed project is located along SR 306 from SR 400 to the Martin Road intersection, just east of SR 369, in the northern section of Forsyth County, Georgia. This area of Forsyth County is experiencing rapid suburbanization, and SR 306 is classified as a rural minor arterial, but serves as a major arterial route from SR 400 to the rapidly growing northeast corner of the County. The

widening of SR 306 from a two-lane section to a four-lane section was originally approved in 1997 as part of the reconstruction of the SR 400/SR 306 interchange. The original concept began at CR 148 (State Barn Road) and extended to just east of SR 369. Since the approval of the original concept, the SR 400/SR 306 interchange has been reconstructed, which included the widening of SR 306 from CR 148 to just east of SR 400.

The roadway will be operating above capacity at the scheduled time of construction, year 2012. The 2012 projected AADT is 33,940 vpd, and the 2032 projected AADT is 54,030 vpd. A traffic analysis was conducted along the project area to determine the impacts of the projected traffic volumes on the operating conditions of the roadway, and is summarized in Table 1. The findings of the traffic analysis conclude that the peak AM westbound and peak PM eastbound traffic along this segment of SR 306 will be operating at a LOS E and F, respectively, by the year 2012. In addition, the intersection of SR 306/SR 369 is currently operating at an LOS E during peak AM hours, and is projected to be operating at an LOS F during peak AM and PM hours by 2012. The failure of this intersection is largely due to the left turning movement from SR 369 to SR 306 and the volume of through traffic along each direction of SR 369.

The proposed project is also needed to improve the safety of the existing roadway, as approximately 303 accidents were reported between milepost 5.15 and 6.33 from January 2000 through December 2004. A review of the statewide accident data provided by the Georgia Department of Transportation concludes that there were 72,178 accidents reported between 2001 and 2004 along rural minor arterial routes. This results in approximately 210 accidents per 100 million vehicular miles. In comparison, between 2000 and 2004, the project area included 85 million vehicular miles and 303 accidents, which results in an accident rate of 356 vehicles per 100 million vehicular miles. Therefore, the accident rate along the project area is 41% greater than the statewide accident rate for rural minor arterials. In addition, the majority of the reported accidents were rear-end (56%) or angle (32%) collisions, which indicates traffic congestion and unsafe turning conditions.

Table 1
Summary of the LOS along SR 306 and at the intersection with SR 369

	Year	Traffic Volumes (vph)	LOS for Existing Conditions	LOS for Proposed Conditions
SR 306 – AM WB	2006	990	C	NA
SR 306 – PM EB	2006	751	C	NA
SR 306/SR 369				
AM	2006	2836	E	NA
AM NW Lt.	2006	511	E	NA
PM	2006	2711	D	NA
PM EB Rt.	2006	287	B	NA
SR 306 – AM WB	2012	1035	E	B
SR 306 – PM EB	2012	939	F	C
SR 306/SR 369	2012			
AM	2012	4072	F	C
AM NW Lt.	2012	626	F	C
PM	2012	4068	F	C
PM EB Rt.	2012	777	F	A
SR 306 – AM WB	2032	2082	F	E
SR 306 – PM EB	2032	2082	F	E
SR 306/SR 369	2032			
AM	2032	6888	F	F
AM NW Lt.	2032	1112	F	F
PM	2032	6889	F	F
PM EB Rt.	2032	1237	F	F

The project termini are logical as the western terminus will begin at the existing four-lane section of SR 306 near the SR 400 interchange, and continue through, and improve, the SR 306/SR 369 intersection. The traffic analysis demonstrates that the majority of the traffic along this segment of SR 306 is generated from SR 369. The 2006 hourly volumes along SR 306 increase by as much as 56% between the eastern terminus and the western terminus. Therefore, it is logical that the proposed improvements would continue eastward through the intersection and terminate as traffic volumes no longer warrant immediate improvements.

There are two other GDOT projects located in the vicinity of the proposed project. STP-012-1(106), PI No. 122014 includes the widening/reconstruction of SR 369 from SR 306 to the Hall County line. STP-0001-00(037), PI No. 0001037, includes the widening/reconstruction of SR 369 from SR 9 to SR 306, including the interchange at SR 400. To achieve the maximum benefit of reconstructing SR 306, it is recommended that all four legs of the SR 306/SR 369 intersection be reconstructed under STP-012-1(81).

Description of Revised Project Features

The original project concept began at CR 148/State Barn Road west of the SR 400 interchange and widened to four lanes to just east of SR 369. Since the original concept approval in 1997, the SR 400 interchange with SR 306 has been reconstructed, with the roadway and the bridge widened to accommodate the extra lanes and median from CR 148 west of SR 400 to the shopping center driveways east of SR 400. The revised project begins at the SR 400 northbound ramps and extends to east of SR 369/Browns Bridge Road for a total project length of 1.40 miles.

The current posted speed limit for SR 306 is 55 mph, with the proposed design speed in the approved concept report being 55 mph. This design speed does not match the type of development that is increasingly attracted to this area. This area is building up with residential development and all of the supporting businesses including grocery and fast food establishments. In addition to the development, pedestrian traffic is on the increase along the corridor. With a 45 mph design speed it would be possible to use curb and gutter on the outside shoulder as well as a continuous sidewalk throughout the corridor. Also at 45 mph, it would be possible to retain more existing pavement and reduce the number of displacements on the corridor.

The typical section for SR 306 that is proposed in the approved concept report is a four-lane roadway divided by a 20-ft. raised median with rural shoulders. Due to the urban nature of this project, and the development, both residential and commercial, in the area, it is proposed that the typical section be revised to be a four-lane roadway divided by a 24-ft. raised median with 16-ft. urban shoulders that include a five ft. sidewalk. This urban typical section is made possible by the reduction of the design speed to 45 mph.

The proposed typical section for SR 369 in the approved concept report includes a 4-lane roadway divided by a 44 ft. depressed median with rural shoulders. Due to the urban nature of this project and the development, both residential and commercial, in the area, it is proposed that the typical section be revised to be a 4-lane roadway divided by a 24-ft. raised median with 16-ft. urban shoulders that include a 5 foot sidewalk in the area near SR 306.

Project STP-012-1(106) is the widening and reconstruction of SR 369 that includes the reconstruction of the SR 306/SR 369 intersection. In order to achieve the maximum benefit of reconstructing SR 306, it is recommended that all four legs of the SR 306/SR 369 intersection be reconstructed under project STP-012-1(81).

The change in typical section and design speed would affect the right-of-way limits by reducing the footprint of the project. These changes would also allow the Baldrige Creek culvert to remain in place instead of replacing sparing the Department the cost of replacing a culvert that is in good condition.

VALUE ANALYSIS AND CONCLUSIONS

INTRODUCTION

This section describes the procedures used during the value engineering (VE) study on the SR 306 Road Widening (P.I. 122015) project.

A systematic approach was used in the VE study. The key steps taken were organized into three distinct parts: 1) pre-study preparation; 2) VE orientation/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 VA procedures, separate narratives and supporting documentation identify the following:

- Value Engineering Workshop Agenda
- 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 set of preliminary set plans (layouts, drainage, cross-sections, pavement delineation and signing and stage construction), half size prints, dated September 26, 2007 prepared by Florence & Hutcheson
- Original Concept Report, approved on October 1, 1997, prepared by the Georgia Department of Transportation.
- Revised Project Concept Report, approved on March 21, 2007, prepared by the Georgia Department of Transportation.
- Updated Construction Cost estimate, dated September 24, 2007, prepared by Florence & Hutcheson
- Right of way estimates, dated December 11, 2006, prepared by the Georgia Department of Transportation.



Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project

- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Establish Performance and Acceptance Requirements
- Conduct Coordination Meeting
- Identify Project Constraints

Prepare for Workshop

- Collect Project Data
- Distribute Data to Team Members
- Team Members Become Familiar with Project
- Visit Project Site

Construct Cost, LCC, Energy Models

- Construct Models
- Identify High Cost and Consumption Areas

Workshop Effort

Information Phase

- VETL Opens Workshop
- Designer Gives Project Description/Presentation
- Discuss Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)
- Finalize Cost, LCC, Energy Models

Function Identification and Analysis Phase

- Perform Function Analysis
- Calculate Cost/Worth Ratios
- List Ideas Generated During Function Analysis

Creative Phase

- VETL Introduces Creative Thinking
- Prepare Creative Idea Listing. Seek:
 - Quantity of Ideas
 - Association of Ideas
- Brainstorm
- Do Creative Thinking
 - Group Thinking
 - Individual Thinking

Evaluation Phase

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

Development Phase

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

Presentation Phase

- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Prepare VE Report

Post-Workshop Effort

Implementation Phase

- Develop Implementation Plan
- Designer Prepares Responses to VE Report
- Participate in Implementation Meeting with Owner/User/Designer/VE Team, as needed
- Owner Evaluates and Selects Preferred Alternatives

Final Acceptance

- Redesign by Designer

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

Project cost data provided by the designers was used by the VE team as the basis for a comparative analysis with other similar projects. To prepare for this exercise, the VE Team Leader used the cost estimate 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 four-day workshop beginning with an orientation/kickoff meeting October 23, 2007 and concluding with the final VE Presentation on October 26, 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 the Georgia Department of Transportation and the design teams sent information (described above) to the VE team prior to the study and, following a short orientation session, the workshop was kicked off with a presentation of the project to the team. The presentation highlighted the information provided in the written documentation and expanded on that information to include a history of the project's development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarifications of the information provided.

Function Identification and Analysis Phase

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

Function is defined as the “intended use” of a physical or process element. In the 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 that must occur for the project to meet its higher order functions
S	Secondary	A function that occurs because of the concept or process selected and may or may not be necessary
R/S	Required Secondary	A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed
G	Goal	Secondary goal of the project
O	Objective	Criteria to be 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.

Creative Idea Generation Phase

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

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

Evaluation/Judgment Phase

Since the goal of the Creative Idea Generation phase was to conceive as many creative ideas as possible without regard for technical merit or applicability to respond to the project goals, this phase of the workshop focused on identifying those ideas that respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of evaluating the ideas originated during the Creative Idea Generation phase based on the 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 consists of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and a writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The Value Engineering Alternatives are included in the report section entitled, Study Results. Design suggestions include the same information as the alternatives except that no cost analysis is performed. They too are included in the report section entitled Study Results.

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 handout at the presentation and to present the key Value Engineering Alternatives and design suggestions to the Georgia Department of Transportation and the design teams. The purpose of the presentation meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study, and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed and arrangements were made for the reviewers of the VE report to contact the VE Team in order to obtain further clarifications, if necessary. Draft copies of the Summary of Potential Cost Savings worksheets were given 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 Georgia Department of Transportation 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 AGENDA

Lewis & Zimmerman Associates, Inc. will conduct a four-day value engineering (VE) workshop on the SR-306 project for the Georgia Department of Transportation from October 23-26, 2007.

The study, including the Designer's Briefing will be conducted at:

Room 264
No. 2 Capitol Square
Atlanta, Georgia 30334

The Designers will present the design at the beginning of the VE workshop and will be available to answer questions during the study effort. A suggested outline for the Designer's presentation follows the agenda. Georgia Department of Transportation (GDOT) staffs are encouraged to attend.

The VE team is comprised of the following:

George Hunter	VE Team Leader/Civil	Lewis & Zimmerman Associates
Laurie Reed	Highway Design Engineer	HNTB
Alex Pascual	Structural Engineer	HNTB
Dion Moten	Construction Engineer	Delon Hampton & Associates

Tuesday, October 23, 2007

8:00 am-9:00 am **Convene VE Team** **(VE Team)**

VE team gathers to review project documents and prepare for VE study

9:00 am- 9:15 am **Welcome, Introduction and Objectives** **(All Participants)**

Welcome; Opening Remarks and Introduction of Participants: Owner, Designer, VE Team members

History and Background of the project and available project funds

Overview of the VE Process, Workshop Organization and Agenda

Review VE Workshop Objectives and Goals

9:15 am – 10:30 am **Design Team Detailed Presentation (All Participants)**

Overview, Scope, and Project Requirements

Key Design Issues for all Disciplines

Construction Phasing and most recent Project Cost Estimate

Design Team fields VE Team questions

Tuesday, October 23, 2007 (continued)

10:30 am – 11:00 pm **Cost Model** **(VE Team)**

VE team develops cost histogram from the project estimate.

12:30 pm - 1:00 pm **Lunch**

1:00 pm – 2:00 pm **Function Analysis** **(VE Team)**

Identify basic and secondary functions
Analyze cost model(s) and worth assignments

2:00 pm – 3:00 pm **Identification of Major Project Risks,
Project Constraints and Key Issues**

3:00 pm – 5:00 pm **Creative Phase** **(VE Team)**

Brainstorm to generate ideas through free association. Defer judgment.

5:00 pm **Daily Wrap-up Session** **(VE Team)**

Wednesday, October 24, 2007

8:00 am – 10:00 am **Creative Phase (cont.)** **(VE Team)**

10:00 am – 11:00 am **Evaluation Phase** **(VE Team)**

Establish the criteria for evaluation and rate each idea on a scale of 1 to 5, identifying the “best” ideas for development.

11:00 am - noon **Development Phase** **(VE Team)**

The VE team develops creative ideas into value engineering alternatives with sketches, calculations and written justifications. Initial and life-cycle cost estimates comparing baseline and proposed designs will be prepared.

12:00 pm – 1:00 pm **Lunch**

1:00 pm – 5:00 pm **Development Phase (Cont.)** **(VE Team)**

Thursday, October 25, 2007

8:00 am – 5:00 pm **Development Phase (continued)** **(VE Team)**

Friday, October 26, 2007

8:00 am – 9:00 am

Development Phase (continued)

(VE Team)

9:00 pm – 10:00 am

Presentation Phase

(All Participants)

The VE team presents the value engineering alternatives to the Designers and GDOT representatives. A draft copy of the *Summary of Potential Cost Savings* will be distributed.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the SR 306 Road Widening (P.I. 122015) 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>
Laurie Reed, P.E.	Highway Design	HNTB Corporation
Alex Pascual, P.E.	Structures	HNTB Corporation
Dion Moten, P.E.	Constructability	Delon Hampton & Associates
George Hunter, PE, PMP, CVS	VE Team Leader	Lewis & Zimmerman Associates

DESIGNER'S PRESENTATION

An overview of the project was presented on October 23, 2007 by representatives from the owner and the design teams. 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 entitled Designer's Presentation Meeting Participants is attached.

Site Visit

No site visit was done on this VE study.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted on October 26, 2007 at the Georgia Department of Transportation Headquarters offices in Atlanta, Georgia to review VE alternatives with the owner and representatives from the design team. Copies of the Draft Summary of Potential Cost Savings were provided to the attendees.

VE STUDY SIGN-IN SHEET

Project No.: STP-012-1(81) County: Forsyth PI No.: 122015 Date: Oct. 23-26, 2007

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
Lisa L. Myers	00244168	Engineering Services	404-651-7468	lisa.myers@dot.state.ga.us
JAY SIMONIE	—	FLORENCE HUGHESON	7 ARS 0157	JSIMONIE@FLOHUT.COM
JOHN BAXTER	—	"	"	JBAXTER@FLOHUT.COM
Laurie Reed		HNTB	404-946-5722	lreed@hntb.com
JASON DYKES	00768669	Dist 1 Construction	770-535-5759	JASON.DYKES@DOT.STATE.GA.US
VALESHA PEREZ-LAM	00684767	GOODLOCH	404-463-2888	VALESHA.PEREZ@DOT.STATE.GA.US
ALEX PASQUAL		HNTB CORP.	404-946-5736	apascual@hntb.com
George Hunter		Lewis & Zimmerman	916-224-9812	ghunter@lzm.com
Ken Werho	00258268	GOOD TRAP DES REV.	404-635-8144	Ken.Werho@
James Magwis				
Stanley Hill	00232993	OCCO	404-656-6609	Stanley.Hill@dot.state.ga.us
Brian Summers	00208175	FES		brian.summers@dot.state.ga.us
Dion Moten		DELOW HAMPTON	404-524-8030	dionmoten@delonhampton.com

✓ FRIDAY, OCT 26 VE PRESENTATION ATTENDANCE

COST MODEL

The VE Team Leader prepared a Pareto Chart, or cost histogram, for the project that follows this page. This cost histogram displays the major construction elements identified in the cost estimate prepared by the designer in descending order of magnitude and thus identifies the high cost areas in the project and provides the VE team with a focus for its work during the study. For this project, the top five project elements constituting approximately 25% of the total number of construction items represent about 88% of the project costs. They are as follows:

5 of 25 items (88% of costs):

1. Right-of-Way (\$31 Million)
2. Pavement
3. Clearing & Grubbing
4. Guard Railing
5. Concrete Median

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

1. Construction with markups)	\$ 12,067,285	28% of Total Project
2. Right-of-Way	\$ 30,958,000	71% of Total Project
3. Reimbursable Utilities	<u>\$ 534,100</u>	<u>1% of Total Project</u>
Project total:	\$ 43,559,385	100% of Total Project

When computing capital costs, direct material, labor and equipment costs are marked up using a composite markup of 10 % that includes:

E & C 10 % Rate

Although the project will be let in January 2011, it is not customary for the project managers to escalate the cost and the VE team followed suit.

A 247% markup, based on the items indicated below, was applied to all right-of-way estimates:

Scheduling Contingency	55 % Rate
Adm/Court Cost	60 % Rate
Inflation Factor	40 % Rate

COST HISTOGRAM

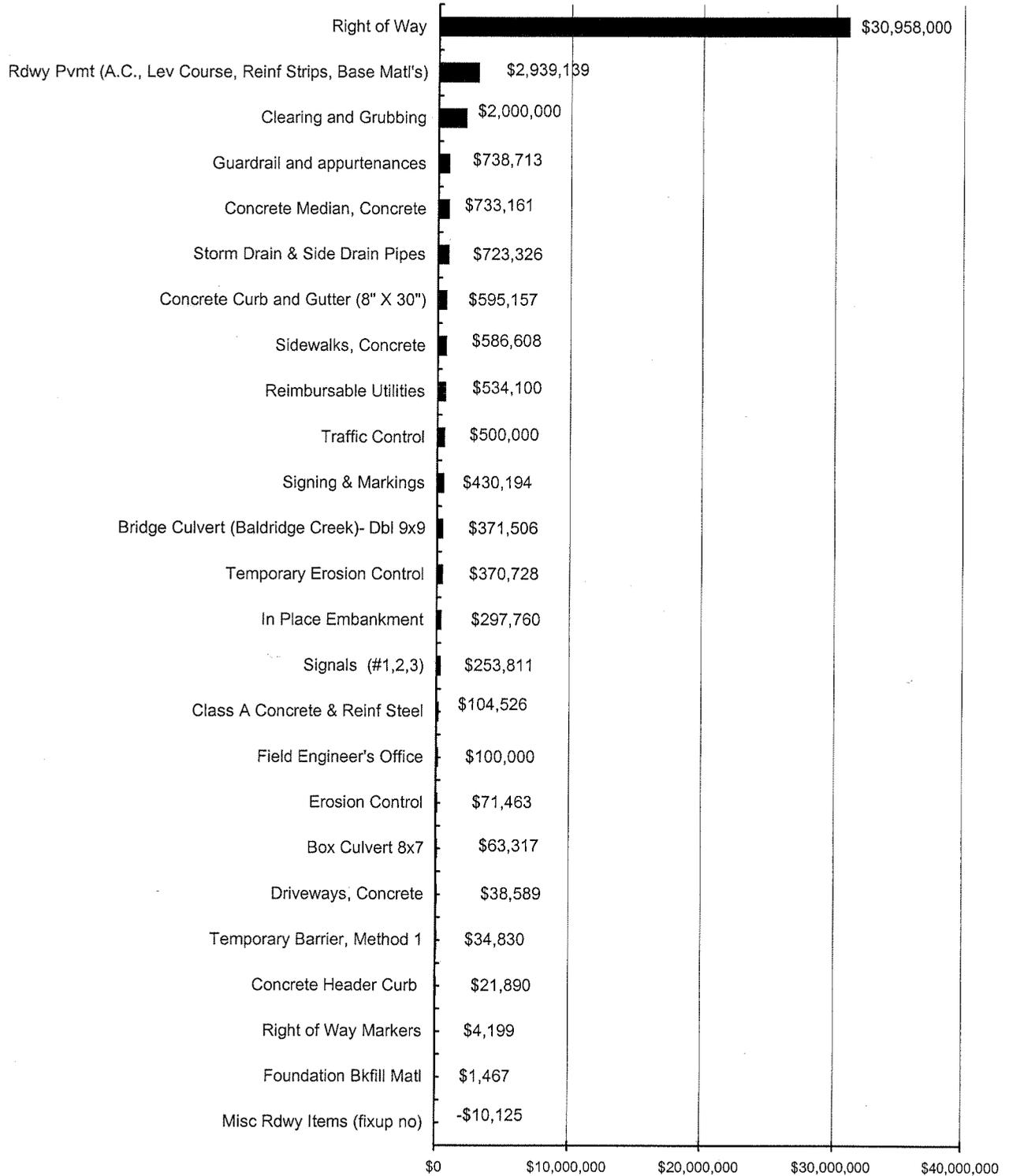


PROJECT: S.R. 306 Widening (SR 400 to east of SR 369) (P.I. No.122015)				
PROJECT ELEMENT		COST	PERCENT	CUM. PERCENT
Right of Way		\$30,958,000	72.91%	72.91%
Rdwy Pvmt (A.C., Lev Course, Reinf Strips, Base Mat's)	80% ↑	\$2,939,139	6.92%	79.83%
Clearing and Grubbing		\$2,000,000	4.71%	84.54%
Guardrail and appurtenances		\$738,713	1.74%	86.28%
Concrete Median, Concrete		\$733,161	1.73%	88.01%
Storm Drain & Side Drain Pipes		\$723,326	1.70%	89.71%
Concrete Curb and Gutter (8" X 30")		\$595,157	1.40%	91.11%
Sidewalks, Concrete		\$586,608	1.38%	92.49%
Reimbursable Utilities		\$534,100	1.26%	93.75%
Traffic Control		\$500,000	1.18%	94.93%
Signing & Markings		\$430,194	1.01%	95.94%
Bridge Culvert (Baldridge Creek)- Dbl 9x9		\$371,506	0.87%	96.81%
Temporary Erosion Control		\$370,728	0.87%	97.69%
In Place Embankment		\$297,760	0.70%	98.39%
Signals (#1,2,3)		\$253,811	0.60%	98.99%
Class A Concrete & Reinf Steel		\$104,526	0.25%	99.23%
Field Engineer's Office		\$100,000	0.24%	99.47%
Erosion Control		\$71,463	0.17%	99.64%
Box Culvert 8x7		\$63,317	0.15%	99.79%
Driveways, Concrete		\$38,589	0.09%	99.88%
Temporary Barrier, Method 1		\$34,830	0.08%	99.96%
Concrete Header Curb		\$21,890	0.05%	100.01%
Right of Way Markers		\$4,199	0.01%	100.02%
Foundation Bkfill Matl		\$1,467	0.00%	100.02%
Misc Rdwy Items (fixup no)		-\$10,125	-0.02%	100.00%
Subtotal		\$ 42,462,359	100.00%	
E & C 10.00%		\$ 4,246,236		
G.C. OH & Profit @ 0.00%		\$ -		
Design Contingency @ 0.00%		\$ -		
Escalation @ 0.00%		\$ -		
Construction Phasing @ 0.00%		\$ -		
TOTAL		\$ 46,708,595	Comp Mark-up:	10%

COST HISTOGRAM



PROJECT: S.R. 306 Widening (SR 400 to east of SR 369) (P.I. No.122015)



Costs in graph are not marked-up.

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 worksheets completed by the team for the project in its entirety and the various elements follow.

The result of the function analysis exercise identified that the basic function to “Add Mainline Lanes” project is supported by the key required secondary functions of “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 creative 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 VE 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	14
Geometry	G	9
Drainage	D	4
	Subtotal:	27

The ideas were ranked on a qualitative scale of 1-3 on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea compared to the existing design solution were discussed based on the responses of the owner during the project briefings identified the following as below:

- Capital Costs
- Highway Operations
- Highway User Safety
- Conforms/Crossings of cross roads and driveways

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

CREATIVE IDEA LISTING



PROJECT: **WIDENING SR 306 (SR 400 TO EAST OF SR 369)**
Forsyth County, Georgia

SHEET NO.: **1 of 2**

NO.	IDEA DESCRIPTION	RATING
TYPICAL SECTION (TS)		
TS-1	Rural shoulder (55 mph D.S.)	3
TS-2	11 lanes (ALL) (ML + turn lanes)	1
TS-3	Urban shoulder with multi-use path on one side of roadway	2
TS-4	Urban shoulder with multi-use path on both sides of roadway	1
TS-5	Eliminate sidewalk on one side of roadway	1
TS-6	Sidewalks only where developed	2
TS-7	8 in. x 24 in. curb	1
TS-8	2 ft. grass strip versus 6 ft. in plan (12 ft. urban shoulder)	2
TS-9	6-lane section	3
TS-10	Build 4-lane with right-of-way for 6-lane section	3
TS-11	20 ft. raised median (includes gutter)	2
TS-12	16 ft. raised median	1
TS-13	Reinforce backfill to stabilize slope using geogrid reinforcements	2
TS-14	Use gravity wall to retain earth and limit easement take	2
GEOMETRY (G)		
G-1	55 mph D.S. address vertical alignment at Baldrige Creek	Combine w/TS-1
G-2	Consolidate driveways at west end of SR 306	2
G-3	Widen SR 369 west (but match edge pavement at east side)	2
G-4	Full widening to south project limit (SR 369) in lieu of taper	2
G-5	Use 3 turn lanes at SR 306/SR 369 intersection	1
G-6	Add 3 rd lane/free exit ramp (NB 400/SR 306), merge past Freedom Parkway	ABD
G-7	Line up driveway lanes opposite Freedom Parkway Lanes	DS
G-8	Add additional turn lanes at Freedom parkway	3
G-9	Shorten distance of 24 ft. median on north limit of SR 369 (void 8 ft. x 7 ft. culvert extension)	1

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

