



WIDENING, RECONSTRUCTION, AND
RELOCATION OF SR 347/FRIENDSHIP ROAD
FROM I-985 TO SR 211

Project No. STP - 2884 (1)
Hall County, Georgia

Value Engineering Study Report
Preliminary Design Submittal

October 2007

Designer

Kisinger Campo Associates



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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October 18, 2007

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

re: SR 347/Friendship Road from I-985 to SR 211, Project No. STP-2984-(1), Hall County
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the value engineering study report on the referenced project. We hope that these VE alternatives provide opportunities to enhance the true value and constructability of the Friendship Road Project.

The key cost driver on the project is the \$33M in new right-of-way, so decisions made on the alignment and typical section have significant implications on the total project cost. However, much of the right-of-way has already been approved, limiting potential alignment change opportunities. Other key issues are the 500,000CY of excess soil on the project that will need to be exported. The VE team considered options to raise the profile, keeping more of the soil on site.

We appreciate the excellent participation of GDOT staff and Kisinger Campo Associates design team members throughout the study. Please call us if you have any questions as you review this report and determine implementation.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

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

Enclosures

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EXECUTIVE SUMMARY

INTRODUCTION

This report summarizes the events and results of the value engineering (VE) study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the Georgia Department of Transportation (GDOT). The subject of the study was the Preliminary Design Submittal on the SR 347/Friendship Road Reconstruction from I-985 to SR 211 located in Hall County east of Lake Lanier. This 7.9-mile-long, four- and six-lane corridor is in need of major improvements to increase the Level of Service in this rapidly developing corridor. The project is being designed by Kisinger Campo Associates (KCA).

The study was held October 1 - 4, 2007 at the GDOT Central Office in Atlanta, and was conducted under the value engineering guidelines of GDOT, FHWA, and SAVE International. VE team members consisted of a Certified Value Specialist and design and construction professionals from local engineering firms.

Decision Making

Value engineering studies by their nature identify alternate design schemes, construction methods, and project delivery options, which if accepted by the owner and design team, may impact the final scope, design documents, budget, schedule, functionality, and appearance of the SR347/Friendship Road Reconstruction Project. The task of the VE team is to identify possible solutions, whereas the task of the GDOT and KCA design team is to choose the most favorable of the VE alternatives for incorporation into the project.

Decisions are needed on each of the alternatives presented in this report. Personnel from GDOT and the design team will accept, reject, or modify these alternatives. Value engineering searches for new, unique, and different methods to provide for the needed project functions at the lowest total life cycle (30-yr.) cost. The blending of these new and sometimes challenging ideas with established procedures, norms, and protocol is the responsibility of user representatives. The project team should accept alternatives that support their construction program and similarly reject alternatives that do not optimize their goals for the Friendship Road Reconstruction Project.

PURPOSE AND NEED

This project will improve the Level of Service (LOS) throughout the SR 347/Friendship Road corridor by widening the existing facilities to four and six lanes, respectively, providing protected left-turn facilities, increasing lane width to 12 ft., modifying the geometry at several intersections, installing traffic signals, limiting access of secondary roads, improving sight distance, adding bike lanes and sidewalks, and increasing the radius of vertical and horizontal curves. These improvements

will improve the LOS and upgrade the aesthetics of the neighborhood, while streamlining transportation between I-985 and I-85. The construction cost for the project is estimated at \$62.4M, plus right-of-way requirements of approximately \$33.3M.

TOTAL PROJECT LENGTH: 7.9 miles

TOTAL PROJECT COST: \$96M (Including markups and right-of-way cost)

PROJECT DESCRIPTION

This project involves the widening, reconstruction, and relocation of SR 347/Friendship Road/Thompson Mill Road. The project begins just east of Milepost 4.076 within the City of Buford, goes through the City of Flowery Branch and the City of Braselton, and ends on SR 211 at Milepost 11.991 for a total length of 7.915 miles. The present roadway serves as an east-west connector between I-985 and I-85. This corridor has recently experienced rapid residential, commercial, industrial, and manufacturing development, and was identified for improvement in the 1987 Gainesville-Hall Transportation Study (GHTS). It was also included in the 1997 GHTS update as a Stage I (1994-2000) transportation need. This project is now in the approved 2006–2011 Transportation Improvement Program (TIP) and Mobility 2030 Regional Transportation Plan. The proposed project is presently in right-of-way acquisition for FY 2007 and construction is scheduled in FY 2009.

SR 347 is a two-lane rural roadway with a posted speed limit of 45 mph. According to 2003 traffic counts, the Average Annual Daily Traffic (AADT) along SR 347 for the length of the project proposed for widening to six lanes was approximately 25,800, yielding a roadway LOS of F. Traffic figures for the same year along the length of the project proposed for widening to four lanes included an AADT of approximately 17,900 at a LOS of E. Assuming completion of the proposed project, level of service in 2009 is projected to be LOS B for both portions of the roadway. In the year 2029, however, level of service along the six-lane portion is projected to LOS C with an AADT of 57,000, while the level of service along the four-lane portion is projected to be LOS D, with an AADT of 44,500. The proposed six-lane widening from I-985 to Williams Road is recommended to achieve and maintain an acceptable level of service on the facility for a significant period of time. The proposed design speed is 45 mph.

The proposed construction will widen SR 347 to six lanes from I-985 heading east to Williams Road where it will transition to a four-lane roadway to SR 211 on the eastern project termini. Both sections will be separated by a raised median which varies from 20 to 44 feet, with 16-ft. shoulders and an urban section with bike lanes and sidewalks. This is a change from the Concept Report which called for six lanes from I-985 to Friendship Circle. This change is due to the traffic capacity analysis of the updated traffic projections. Access will be partially limited on new locations and controlled by permit on existing alignments. Traffic will be maintained during the 24–30 months required for construction of the improvements.

CONCERNS AND CONSTRAINTS

Concerns

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

- The right-of-way (ROW) has already been estimated and approved.
- The ROW cost is over \$33M.
- The median width of 30 ft. and addition of bike lanes exacerbates the ROW cost.
- The large cut and embankment portions of the alignment require additional ROW or slope easements.
- There is approximately 500,000CY of export soil material on the job.
- Rock excavation is expected in several locations along the alignment per the Soil Survey Summary Report dated January 30, 2007.
- Some boulders, outcrops and/or rock layers may also be encountered.
- Groundwater is anticipated at grade in several locations.

Constraints

Discussions held during the VE study evolved around several key constraints that must be incorporated in the design:

- The proposed alignment is generally fixed since most of the ROW has been approved.
- There are a number of side streets which tend to fix the roadway profile in a number of locations.

RESULTS

To address the concerns noted above, the VE team conducted a brainstorming session and identified ways to improve the value and constructability of the structure.

A summary of the key recommendations includes:

Profile (P)

- Raise the road profile in areas of possible rock, i.e., STA 391, STA 402, and STA 170 to reduce the volume of unclassified excavation by more than 75,000CY and significantly reduce the potential for high cost excavation.
- Raise the sag vertical curves to create more area for fill in areas such as STA 415 and reduce the volume of unclassified excavation and export by 40,000CY.

- Raise the profile and reduce the amount of earthwork in the vicinity of STA 137+00 and STA 275+00. The new profile as drawn by the VE team reduces the amount of unclassified excavation by 19,000CY and export soil by 257,000CY. This higher profile may require more ROW and retaining wall; allowances have been included in the cost estimate for these items.

Typical Section (S)

- Traffic projections show a steady increase over the next 25 years and a full six lanes will eventually be required near the end of the planning period. A phased approach to these improvements may suggest that the road be designed for six lanes, but defer the final two lanes until traffic counts warrant from STA 100+00 to STA 205+00. Build the road section from the outside in, placing the sidewalks and curbs/gutters in their final location for the six-lane section. The median could initially be grassed instead of concrete. This phased approach could defer nearly \$3M in improvements.
- As noted, the cost of ROW is substantial for this project and methods to conserve land should be investigated. One possibility is to use a 10-ft.-wide multi-use path on each side of the road instead of the 5-ft. sidewalk and 4-ft. bike lane. This arrangement saves 4 ft. of ROW on each side of the road, resulting in a net savings exceeding \$6M.
- The pavement on the median is another area when several options could reduce capital cost. It may be possible to use a grassed median in lieu of the 7 ½-in.-thick concrete median. Apply 4-in.-thick concrete median only in areas directly adjacent to the turn lanes for added protection and improved visibility. This change would result in a \$3M reduction in capital cost. Another option would be to use a 4-in.-thick concrete median in lieu of 7 ½-in. concrete. This alone would save nearly \$1.6M.

Drainage (D)

- To reduce the more than 700 catch basins, several options are suggested. Increasing the gutter spread from 8 ft. to 10 ft. is allowed by GDOT criteria. This 25% increase in gutter spread could result in a net 10% savings in catch basins and pipe.

Construction Management (CM)

- Bidding the job in smaller segments has some advantages, but it should be recognized that the western half of the project is primarily a net fill project, whereas the eastern half of the project is a net cut segment. Splitting the job into two contracts would negate the opportunity to balance some of the project and would result in inefficient soil operations. Therefore, it is strongly recommended that the job be bid as one large piece of work with the goal of balancing as much of the excavation quantity as possible.

In summary, the key goal for the next phase of design is to raise the profile as much as possible to reduce the risk of rock excavation and keep as much of the 500,000CY of export material on site. Many options exist for this project, and value improvement is possible through the acceptance of these ideas. These and many more VE alternatives are presented in this report and include the joint recommendations of the VE team members.



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: SR 347/FRIENDSHIP ROAD FROM I-985 TO SR 211 Project No. STP-2984-(1) - Hall County, Georgia		PRESENT WORTH OF COST SAVINGS				
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
PROFILE (P)						
P-1	Raise the profile in areas of rock at STA 391, STA 402, and STA 170 to reduce the volume of unclassified excavation by more than 75,000CY and significantly reduce the risk of rock excavation.	\$ 525,830	\$ -	\$ 525,830	\$ -	\$ 525,830
P-2	Raise the sag vertical curves to create more area for fill at STA 415 to reduce the volume of unclassified excavation and export by 40,000CY.	\$ 260,320	\$ -	\$ 260,320	\$ -	\$ 260,320
P-3	Raise the profile in the vicinity of STA 137+00 and STA 275+00 to reduce the amount of unclassified excavation by 19,000CY and export soil by 257,000CY.	\$ 383,440	\$ 488,210	\$ (104,770)	\$ -	\$ (104,770)
TYPICAL SECTION (S)						
S-1	Design for six lanes, but defer the final two lanes until traffic counts warrant from STA 100+00 to STA 205+00. Build the section from the outside in, placing the sidewalks and curbs/gutters in their final location for the six-lane section. The median would initially be grassed.	\$ 2,810,423	\$ -	\$ 2,810,423	\$ -	\$ 2,810,423
S-2	Use a 10-ft.-wide multi-use path on each side of the road instead of the 5-ft. sidewalk and the 4-ft. bike lane to save 4 ft. of right-of-way on each side of the road.	\$ 7,104,132	\$ 858,462	\$ 6,245,670	\$ -	\$ 6,245,670
S-3	Reduce the width of the outside lanes from 12 ft. to 11 ft. on both sides of the road. The 2-ft. gutter and 4-ft.-wide bike lanes would not be affected. All other lanes would remain 12 ft.	\$ 1,994,845	\$ -	\$ 1,994,845	\$ -	\$ 1,994,845
S-4	Use a 24-in.-wide curb/gutter in lieu of 30 in. to save 6 in. of right-of-way along each side of the road.	\$ 4,091,422	\$ 2,160,355	\$ 1,931,067	\$ -	\$ 1,931,067



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: SR 347/FRIENDSHIP ROAD FROM I-985 TO SR 211 Project No. STP-2984-(1) - Hall County, Georgia		PRESENT WORTH OF COST SAVINGS				
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TYPICAL SECTION (S) (continued)						
S-9	Use a grassed median in lieu of a 7 1/2-in.-thick concrete median. Apply 4-in.-thick concrete median only in areas directly adjacent to the turn lanes for added protection and improved visibility.	\$ 4,163,125	\$ 1,161,824	\$ 3,001,301	\$ (452,778)	\$ 2,548,523
S-10	Use a 4-in.-thick concrete median in lieu of 7 1/2 in. concrete.	\$ 4,163,125	\$ 2,556,893	\$ 1,606,232	\$ -	\$ 1,606,232
DRAINAGE (D)						
D-1	Use precast sedimentation vaults in lieu of purchased right-of-way for ponds.	DESIGN SUGGESTION				
D-2	Reduce the number of catch basins by increasing the gutter spread from 8 ft. to 10 ft. as allowed by GDOT criteria. This 25% increase in gutter spread could result in a net 10% savings in catch basins and pipe.	\$ 8,945,200	\$ 8,050,680	\$ 894,520	\$ -	\$ 894,520
CONSTRUCTION MANAGEMENT (CM)						
CM-1	Bid the project as one large job in lieu of two smaller pieces. The west half of the project is a net import job, while the east half is a net export. To reduce the extra cost from excessive import and export, combine the project into a single contract.	DESIGN SUGGESTION				
RIGHT-OF-WAY (RW)						
RW-1	Generally, reduce the cut and fill areas in the profile to minimize extensive slopes and right-of-way takes.	DESIGN SUGGESTION				

STUDY RESULTS

INTRODUCTION

The results are the major feature of a VE study since they represent the benefits that can be realized on the project by GDOT, local patrons that use the SR 347/Friendship Road corridor, and the KCA design team.

The recommended engineering and construction management suggestions in this report are presented as individual alternatives for specific change. These are in the form of VE alternatives with cost savings or design suggestions without associated cost. Individual comments on the current design are presented with a summary of the original design, a description of the proposed enhancements to the chosen improvement scheme, and if appropriate, a descriptive evaluation of the advantages and disadvantages. Suggested alternatives on the current project are accompanied by a brief narrative to compare the original design and the proposed modifications. Sketches, where appropriate, are also presented.

Examples of improved value include improved constructability, ease of maintenance, minimization of risk, and less disruption upon roadway operations during construction. 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.

The summaries of the more favorable improvements to the interchanges follow this narrative on the Summary of Potential Cost Savings table. The table is divided into major project elements convenience of the reviewer and is used to divide the results section. The complete documentation of the developed VE alternatives follows the Summary of Potential Cost Savings.

RESULTS OF THE STUDY

The value engineering team brainstormed 19 creative ideas that could enhance the value of the project in the areas noted by GDOT as being desirable, such as cost control, safety, durability, ease of operation, expected life, constructability, and traffic improvement. Evaluation of those ideas considered the full range of project value objectives and resulted in the development of a number of recommendations.

The alternatives are presented with the following designations to aid in organization and review.

CATEGORY	PREFIX
Alignment	AL
Typical Section	S
Profile	P
Drainage	D
Construction Management	CM
Right-of-Way	RW

EVALUATION OF ALTERNATIVES

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 concern about one part of it. Each area within an alternative that is acceptable should be considered for use in the final design, even if the entire alternative is not implemented. Design variations of these alternatives are encouraged.

Cost is a primary basis of comparison for alternative designs, but other project criteria must be considered also when selecting alternatives for further analysis. Negative impacts upon existing traffic is extremely critical and design modifications that impact traffic, right-of-way, safety, or environment elements should be selected carefully following detailed review.

The various alternatives are “mutually exclusive,” so acceptance of one may preclude the acceptance of another. Multiple solutions to a single function were sought. All alternatives or design suggestions were developed independently of each other. However, some of the alternatives are interrelated so acceptance of one element may also be included in other alternatives. The reader should evaluate those alternatives carefully in order to select the combination of ideas with the greatest beneficial impact on the project.



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: SR 347/FRIENDSHIP ROAD FROM I-985 TO SR 211		PRESENT WORTH OF COST SAVINGS				
Project No. STP-2984-(1) - Hall County, Georgia						
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
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TYPICAL SECTION (S)						
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S-3	Reduce the width of the outside lanes from 12 ft. to 11 ft. on both sides of the road. The 2-ft. gutter and 4-ft.-wide bike lanes would not be affected. All other lanes would remain 12 ft.	\$ 1,994,845	\$ -	\$ 1,994,845	\$ -	\$ 1,994,845
S-4	Use a 24-in.-wide curb/gutter in lieu of 30 in. to save 6 in. of right-of-way along each side of the road.	\$ 4,091,422	\$ 2,160,355	\$ 1,931,067	\$ -	\$ 1,931,067

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **P-1**

DESCRIPTION: **RAISE THE PROFILE IN AREAS OF ROCK**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

The current design indicates excavation in a number of areas where rock is predicted per the geotechnical report.

ALTERNATIVE: (Sketch attached)

Raise the profile of the mainline SR 347 in areas known to have rock.

ADVANTAGES:

- Reduces construction cost and eliminates rock excavation
- Facilitates construction
- Reduces waste earthwork
- May reduce right-of-way in certain areas

DISADVANTAGES:

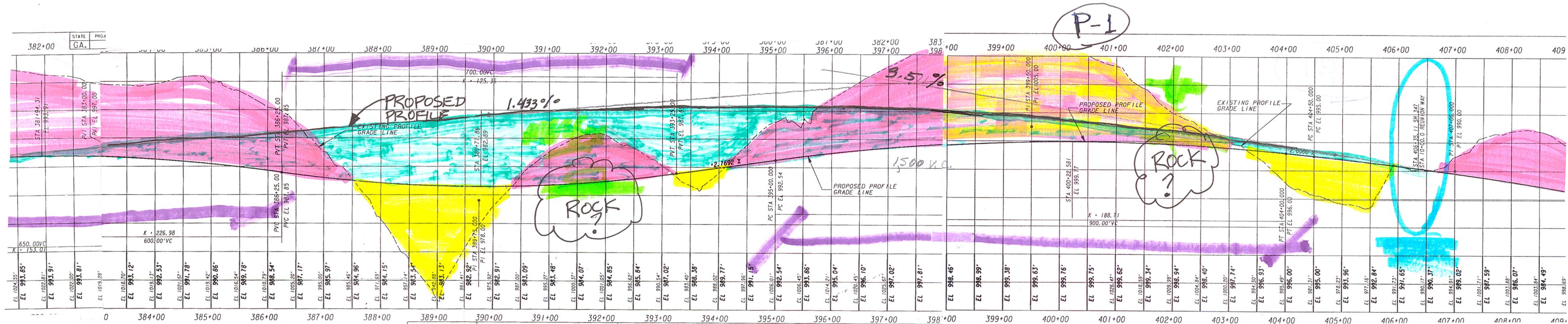
- May require additional right-of-way in certain areas due to higher fill heights

DISCUSSION:

This project as presently designed has an earthwork surplus (waste) of approximately 500,000CY. Also, there is rock that may require excavation depending on the profile grade. This alternative raises the grade at locations of rock to reduce the potential for costly rock excavation and to reduce the earthwork surplus and waste. Review the possibility of raising the profile grade at STA 170+00 and STA 391+00; STA 402+00.

The VE study computation did not change the profile grade in the area of STA 170+00 since this is in the vicinity of the drives for Georgia Marble Rock Quarry. It appears that the profile grade at STA 391+00 can be raised enough to avoid the rock in this area. The profile can also be raised at STA 402+00 but not nearly enough to avoid all the rock, since the mainline profile must accommodate the tie-in at Reunion Way. The right-of-way increases in the embankment/fill areas; however the required right-of-way can be reduced in the areas with less unclassified excavation. Therefore, the right-of-way cost will remain approximately the same.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 525,830	—	\$ 525,830
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 525,830	—	\$ 525,830



SCALE: 1"=50' HORIZONTAL
1"=10' VERTICAL



STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE OF DESIGN

MAINLINE ROADWAY PROFILE

Iendsh1prdw\roadway\162430\egh\162430p01.dgn

CALCULATIONS



PROJECT: SR 347/FRIENDSHIP ROAD/I-985 TO SR 211
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.: P-1

SHEET NO.: 5 of 6

Earthwork change from profile change
in the area of STATIONS 391+00 & 402+00
(see attachments).

Decrease in Unclassified Excavation (Cut) \approx
-14,080 c.y. (STA 384+50 to STA 387+50)
-23,340 c.y. (STA 390+50 to STA 393+50)
-39,350 c.y. (STA 394+00 to STA 406+00)

-76,770 c.y. Less unclass EXCAV.

~~increase~~ Fill (Required Embankment)
(STA 386+50 to STA 396+00)
+108,600 more Fill Required
Less Embankment saves waste.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **P-2**

DESCRIPTION: **RAISE THE SAG VERTICAL CURVES AND CREATE
 MORE FILL AREAS AT STA 415+00**

SHEET NO.: **1 of 7**

ORIGINAL DESIGN: (Sketch attached)

There are several deep sags in the vertical profile grade for SR 347.

ALTERNATIVE: (Sketch attached)

Raise the profile to create more fill areas and minimize the more than 500,000CY of export material.

ADVANTAGES:

- Reduces construction cost to haul earthwork waste off the project
- Increases the “K” for stopping sight distance

DISADVANTAGES:

- Requires more right-of-way or retaining walls in lieu of right-of-way
- Requires detailed balancing of export, right-of-way, and retaining walls

DISCUSSION:

This project as presently designed has an earthwork export of more than 500,000CY. Raising the vertical sag curves will create more fill areas to reduce the amount of export material. After a review of the vertical sags curves, it was determined that the profile could be raised without creating severe impacts to side roads and properties in the vicinity of STA 415+00.

Even though the alternative appears to add cost, the concept is sound, and a more detailed investigation may reveal additional savings. The side road grades at Gogan Road/CR617 and Jones Drive/CR616 have been adjusted to meet the proposed mainline profile change.

Note: The cumulative change by accepting Alternatives P-1, P-2, and P-3 shows an overall reduction in excavation of approximately 135,870CY (soil & rock), and a reduction of over 400,000CY of the possible 500,000CY of soil export. The aggregate impact of accepting these three alternatives is quite positive.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 260,320	—	\$ 260,320
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 260,320	—	\$ 260,320

SHEET NO. 11
 PROJECT NUMBER STP-2984 (1)
 STATE GA.

P-2
 Sht. 2 of 7

GEORGIA
 DEPARTMENT OF TRANSPORTATION
 CONSTRUCTION PLAN
 PROJECT STP-2984 (1)
 COUNTY HALL

KCS
 KISINGER CAMPO &
 ASSOCIATES CORP.
 1720 PEACHTREE ST., N.W., SUITE 1048
 ATLANTA, GA 30309

DATE	REVISIONS	DATE	REVISIONS

SCALE 1" = 50'
 SCALE IN FEET

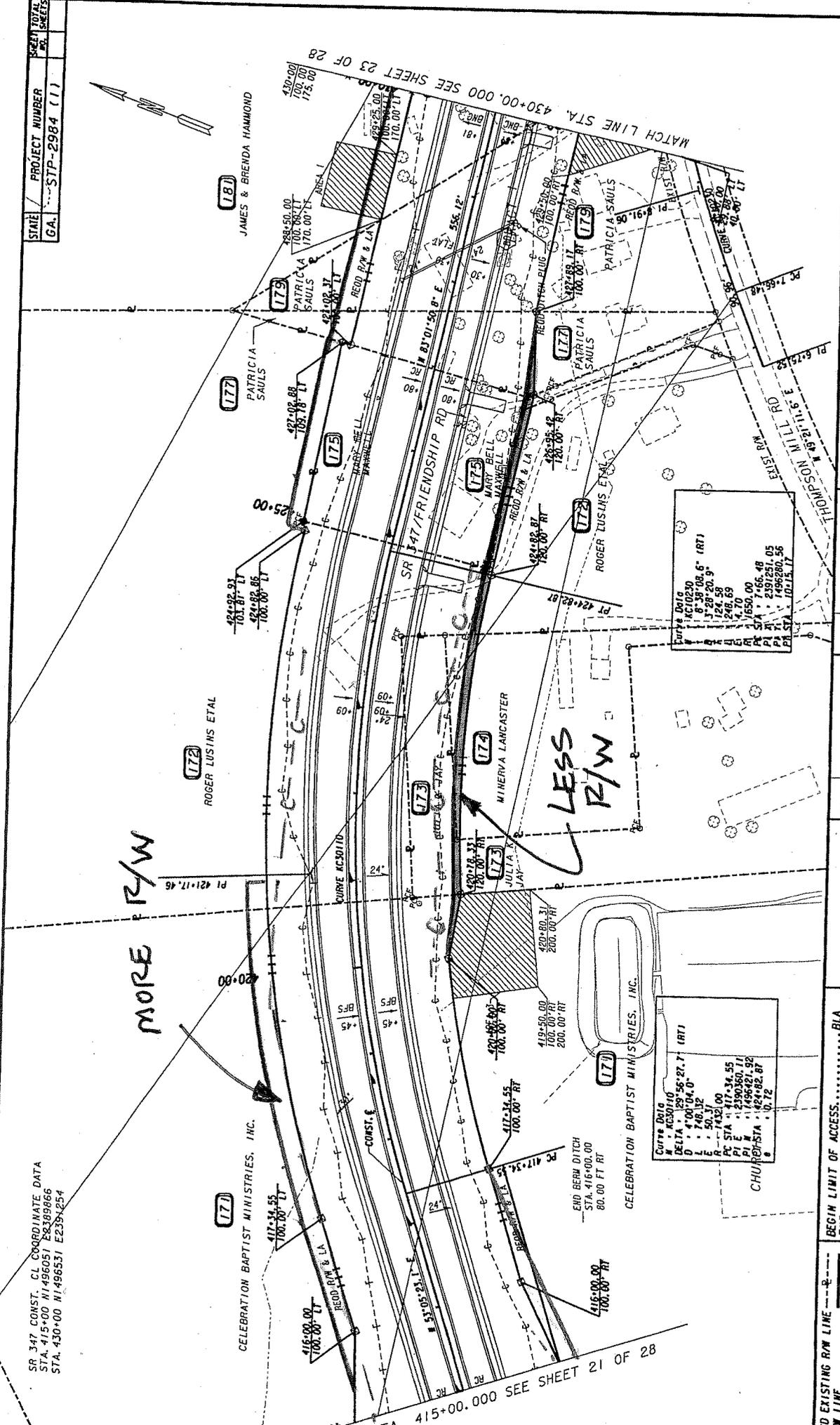
BEGIN LIMIT OF ACCESS.....BLA
 END LIMIT OF ACCESS.....ELA
 LIMIT OF ACCESS
 R/W AND LIMIT OF ACCESS

END EXISTING R/W LINE
 R/W LINE
 ON LIMITS
 FOR CONSTRUCTION
 R/W AND LIMIT OF ACCESS
 OR CONSTR. OF SLOPES
 OR CONSTR. OF DITCHES

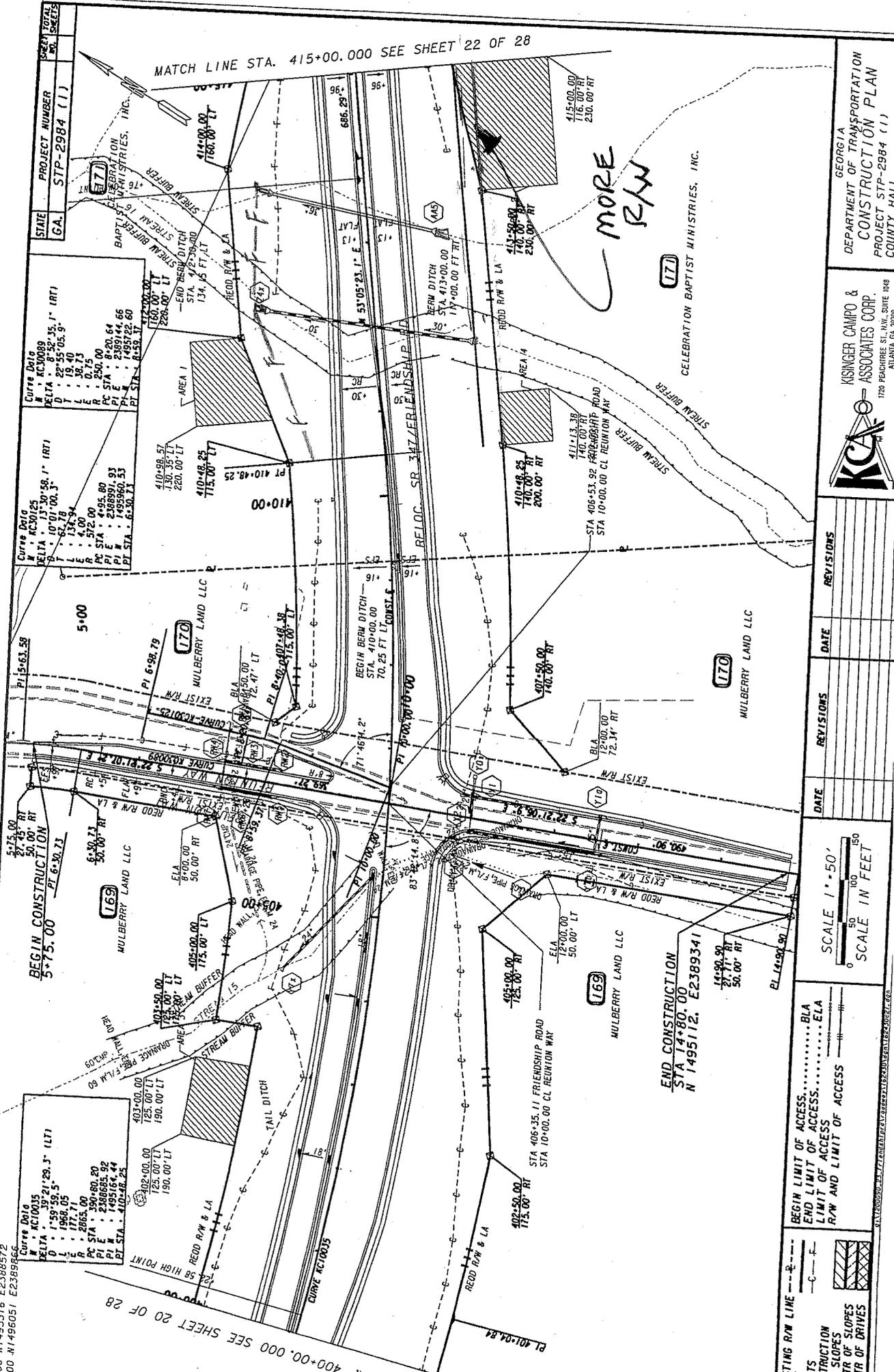
SR 347 CONST. CL. COORDINATE DATA
 STA. 415+00.00 N1496051 E2339866
 STA. 430+00.00 N1496531 E23394254

MORE R/W

LESS R/W



P-2
Sht. 3 of 7



STATE PROJECT NUMBER
GA. STP-2984 (1)

Curve Data
M . AC30089
DELTA . 32° 35.1' (RT)
D . 27.50
L . 19.40
E . 38.73
R . 0.75
PC STA . 8+20.64
PT STA . 239144.66
PI E . 425722.60
PT STA . 41048.25

Curve Data
M . AC30125
DELTA . 17° 30.58.1' (RT)
D . 1071.00
L . 72.78
E . 14.00
R . 572.00
PC STA . 4+95.80
PT STA . 238697.93
PI E . 1495960.53
PT STA . 6230.73

Curve Data
M . AC10015
DELTA . 39° 21' 29.3" (LT)
D . 1' 59.59.5"
L . 1968.05
E . 177.71
R . 2305.30
PC STA . 238695.22
PT STA . 1495164.42
PT STA . 41048.25

Curve Data
M . AC10015
DELTA . 39° 21' 29.3" (LT)
D . 1' 59.59.5"
L . 1968.05
E . 177.71
R . 2305.30
PC STA . 238695.22
PT STA . 1495164.42
PT STA . 41048.25

Curve Data
M . AC10015
DELTA . 39° 21' 29.3" (LT)
D . 1' 59.59.5"
L . 1968.05
E . 177.71
R . 2305.30
PC STA . 238695.22
PT STA . 1495164.42
PT STA . 41048.25

GEORGIA
DEPARTMENT OF TRANSPORTATION
CONSTRUCTION PLAN
PROJECT STP-2984 (1)
COUNTY HALL

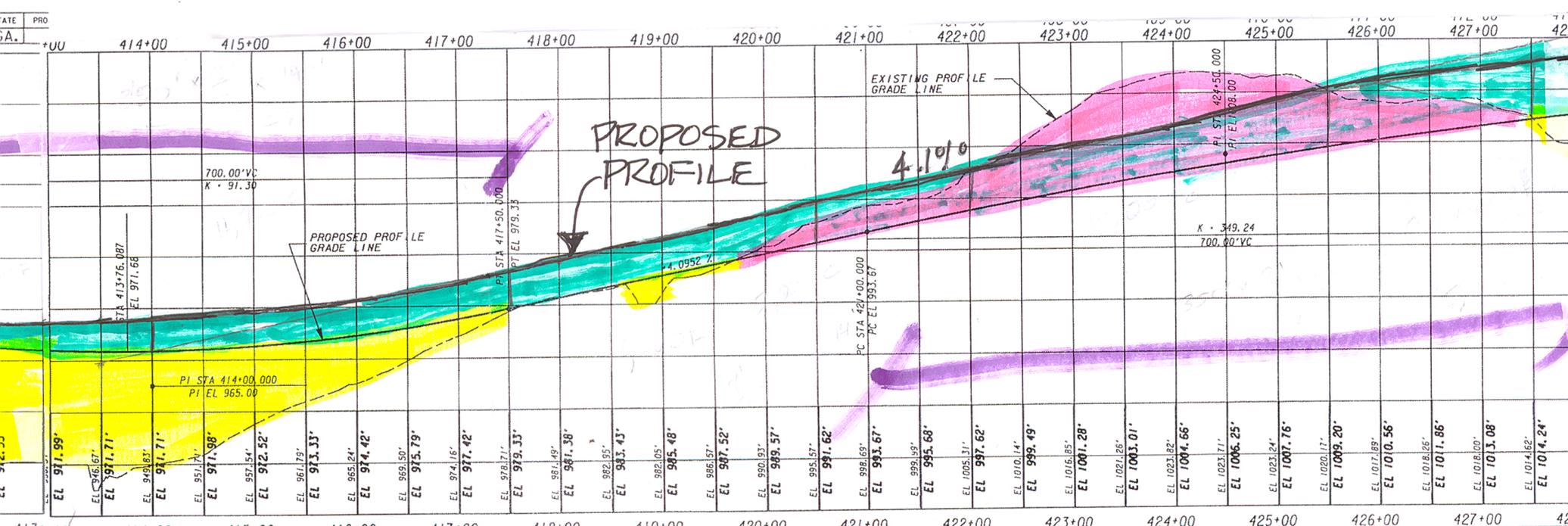
KISINGER CAMPO & ASSOCIATES CORP.
1720 PEACHTREE ST., N.W., SUITE 1008
ATLANTA, GA 30309

DATE	REVISIONS	DATE	REVISIONS

SCALE 1" = 50'
SCALE IN FEET

EXISTING R/W LINE
LIMITS
CONSTRUCTION
E.O.P. OF SLOPES
CONSTR. OF DRIVES

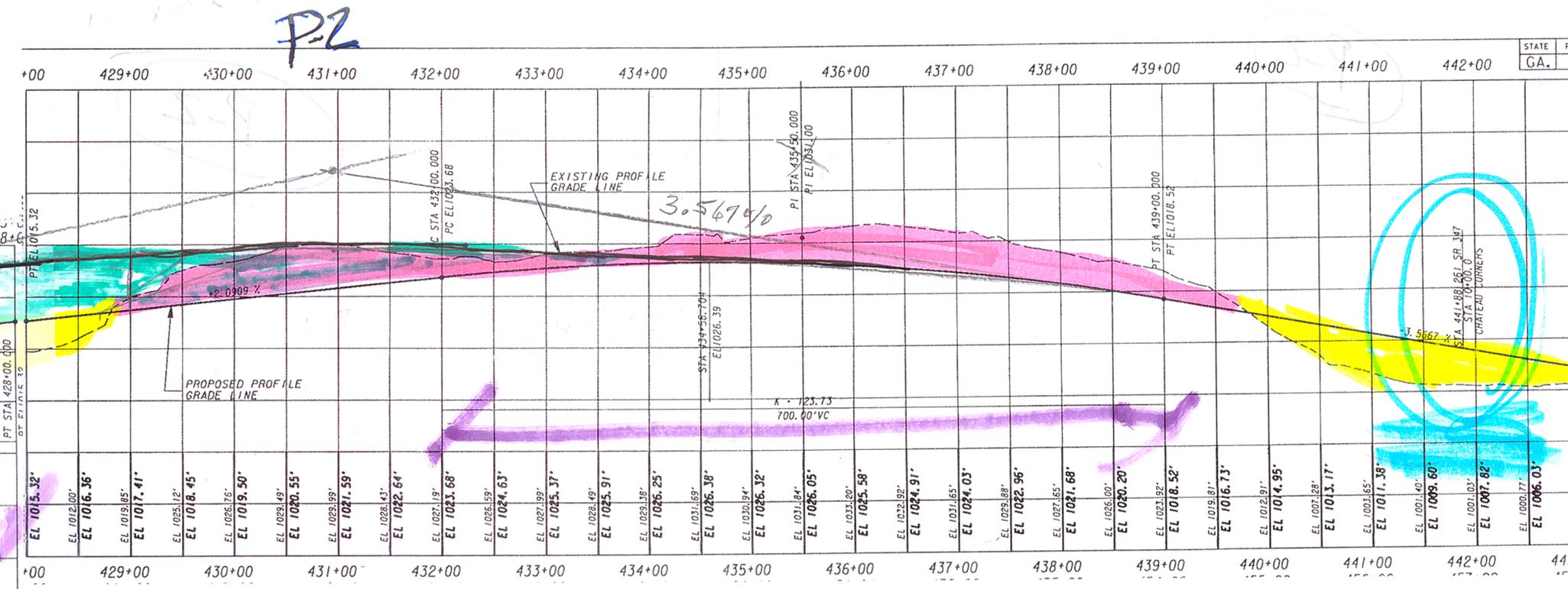
BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS.....ELA
R/W AND LIMIT OF ACCESS



SCALE: 1"=50' HORIZONTAL
1"=10' VERTICAL

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE OF DESIGN

MAINLINE ROADWAY PROFILE



P2

STATE PRO
GA.

CALCULATIONS



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.: **P-2**

SHEET NO.: **6 of 7**

Less unclass excau. by RAISING the
mainline profile grade from STA 420+00 to
40,800 C.Y. (Less excau.) STA. 435+00

INCREASE in Fill AREAS (Required Embankment)

40,000 C.Y. (more fill) STA. 41+00 to STA 43+00

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **P-3**

DESCRIPTION: **RAISE THE PROFILE IN THE VICINITY OF STA 137+00**
AND STA 275+00

SHEET NO.: **1 of 10**

ORIGINAL DESIGN: (Sketch attached)

The proposed profile on SR 347/Friendship Road results in a net export of material of approximately 500,000CY.

ALTERNATIVE: (Sketch attached)

Raise the profile of mainline SR 347 in the vicinity of STA 137+00 and STA 275+00 to reduce the amount of earthwork export.

ADVANTAGES:

- Reduces construction cost
- Streamlines construction
- Reduces truck hauling off-site
- Reduces waste
- May reduce right-of-way in certain areas

DISADVANTAGES:

- May require additional right-of-way in certain areas

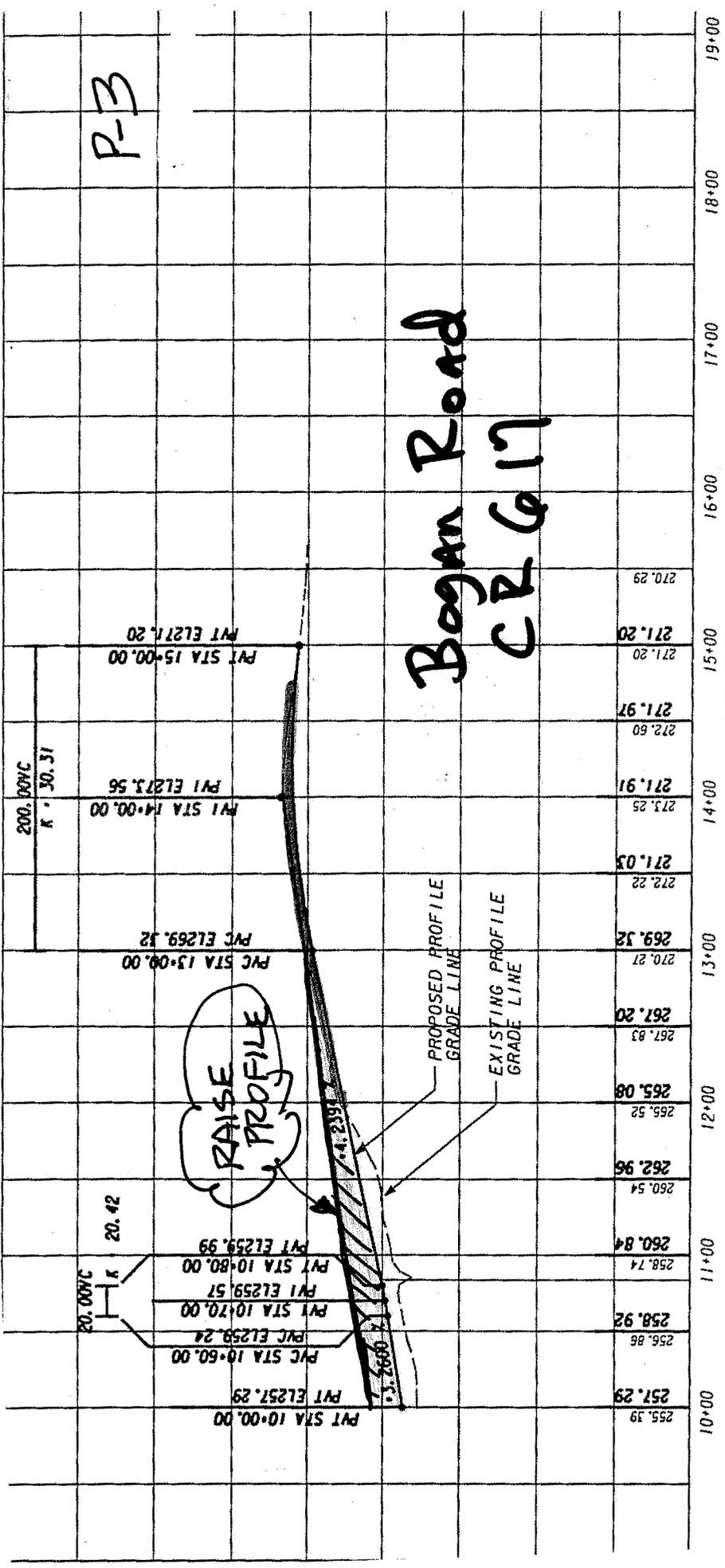
DISCUSSION:

This alternative, along with Alternatives P-1 and P-2, would substantially reduce the amount of export by raising the grade and increasing the fill areas to use earthwork embankment and waste.

These profile adjustments require further adjustments, but the concept of keeping the soil on site is valid, and substantial costs can be saved by balancing the excavation, export, retaining walls, and right-of-way.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 383,440	—	\$ 383,440
ALTERNATIVE	\$ 488,210	—	\$ 488,210
SAVINGS (Original minus Alternative)	\$ (104,770)	—	\$ (104,770)

ALT P-E
sheet
2 of 10



STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE OF DESIGN

KESNER CAMPO & ASSOCIATES CORP.
INCORPORATED IN FLORIDA

SCALE: 1" = 50' HORIZONTAL
1" = 10' VERTICAL

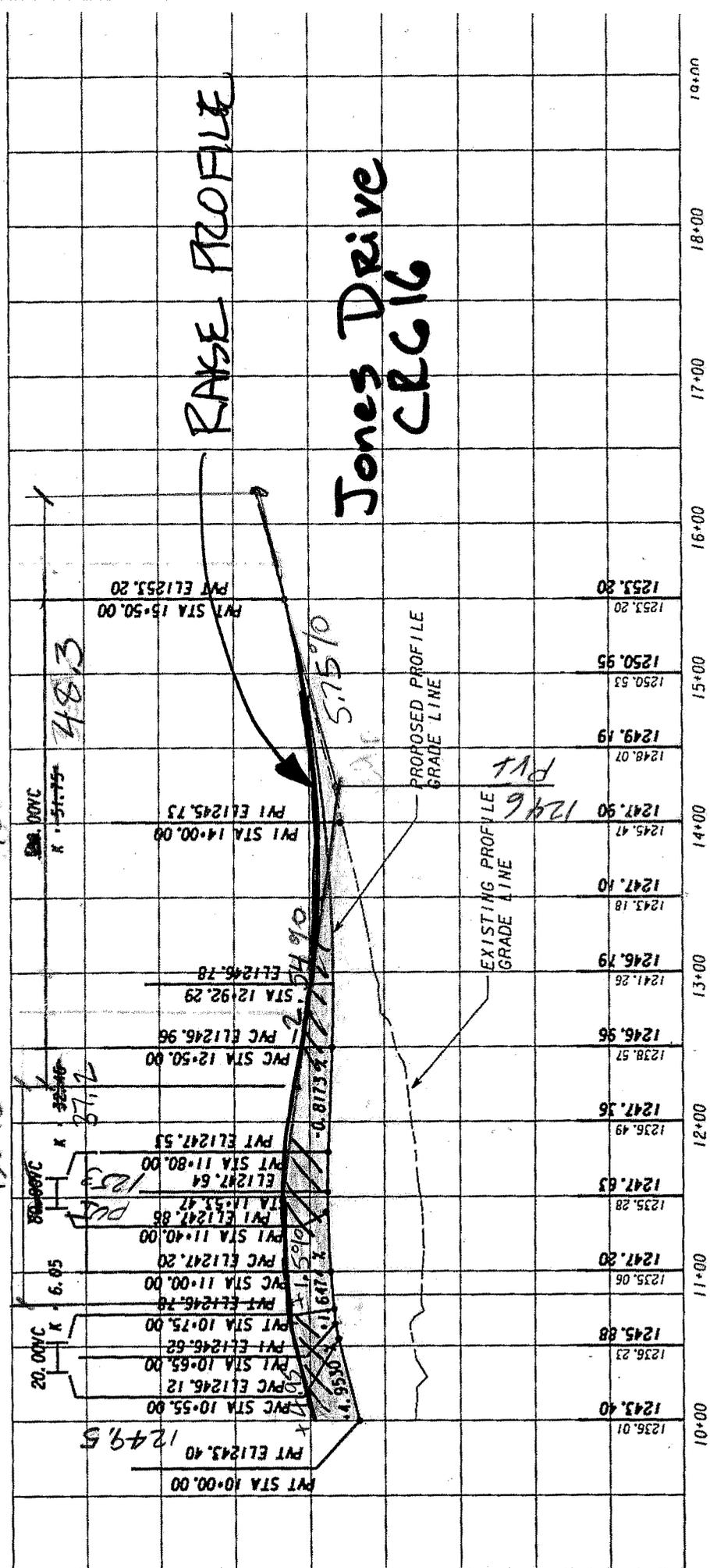
\\sagehpc\proj\arcadw\proj\62230\dgn\1563450.dwg

P-3

ALTP-3
Sheet
3 of 10

400

50' VC



48.3

K = 51.75

K = 32.50

K = 6.85

K = 10.75

K = 10.65

K = 10.50

K = 10.50

K = 10.50

1249.5

1249.5

1249.5

1249.5

1249.5

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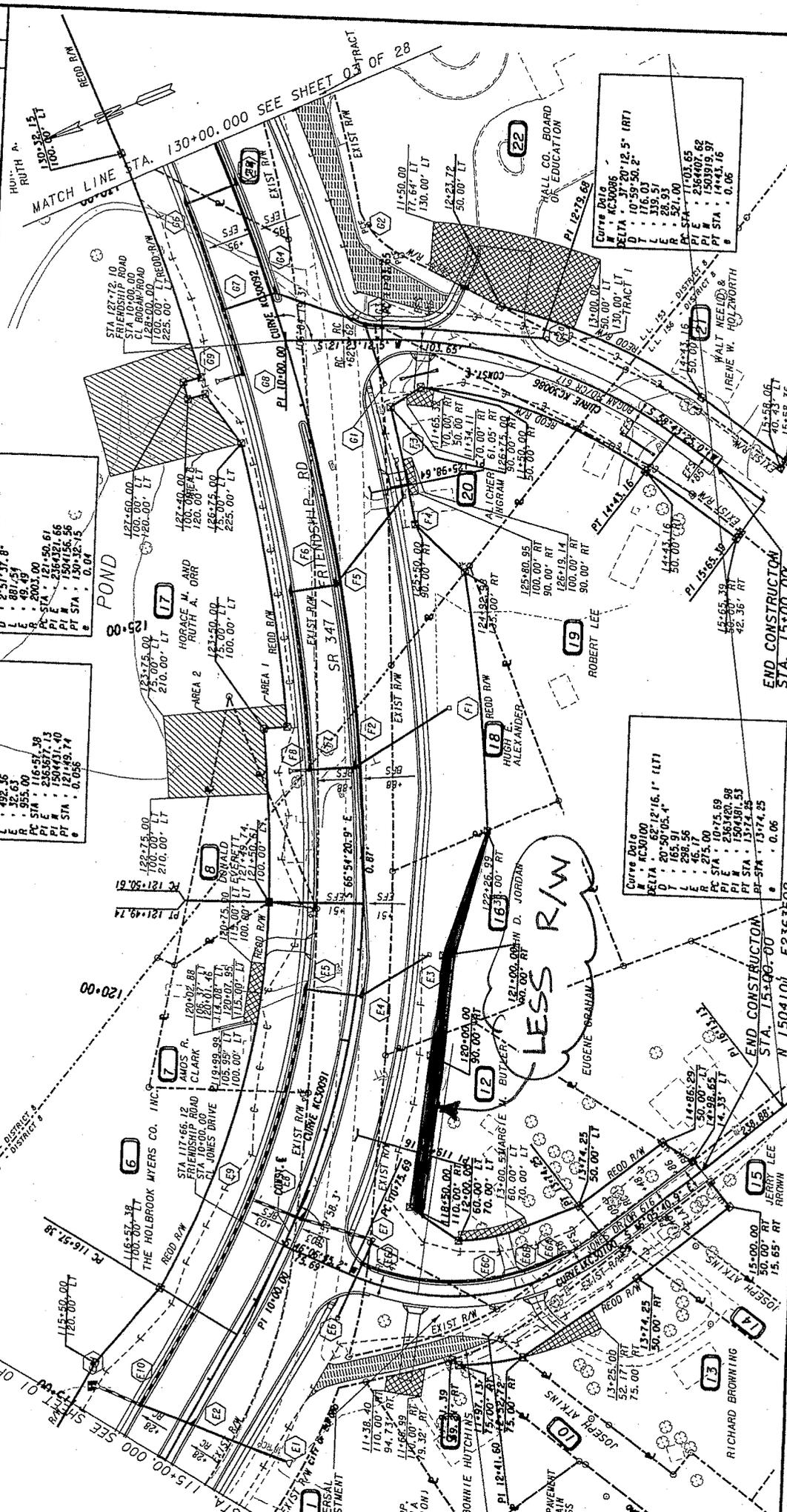
1249.5

1249.5

1249.5

STATE	PROJECT NUMBER	SHEET TOTAL
GA.	STP-2984 (1)	NO. SHEETS

347 CONST. CL COORDINATE DATA
 A. 115+00 N1504757 E2363429
 A. 130+00 N1504172 E2364737



Curve Data
 K: KC0092
 D: 5°59'48.4"
 L: 492.36
 E: 32.63
 R: 955.00
 PC STA: 116+57.38
 PT STA: 236567.13
 PI STA: 150443.40
 PF STA: 0.06

Curve Data
 K: KC0091
 D: 5°59'48.4"
 L: 492.36
 E: 32.63
 R: 955.00
 PC STA: 116+57.38
 PT STA: 236567.13
 PI STA: 150443.40
 PF STA: 0.06

Curve Data
 K: KC0096
 D: 37°20'12.5" (RT)
 L: 1629.30.2
 E: 319.51
 R: 28.93
 PC STA: 11+03.65
 PT STA: 236407.62
 PI STA: 150319.97
 PF STA: 14+43.16
 PF STA: 0.06

Curve Data
 K: KC0100
 D: 62°12'16.1" (LT)
 L: 2050.05.4
 E: 298.56
 R: 46.17
 PC STA: 236574.68
 PT STA: 150431.53
 PI STA: 13174.25
 PF STA: 0.06

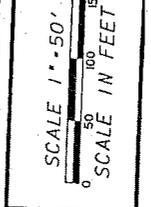
GEORGIA
 DEPARTMENT OF TRANSPORTATION
 CONSTRUCTION PLAN
 PROJECT STP-2984 (1)
 COUNTY HALL



KISINGER CAMPO &
 ASSOCIATES CORP.
 1720 PEACHTREE ST., N.W., SUITE 1048
 ATLANTA, GA 30309

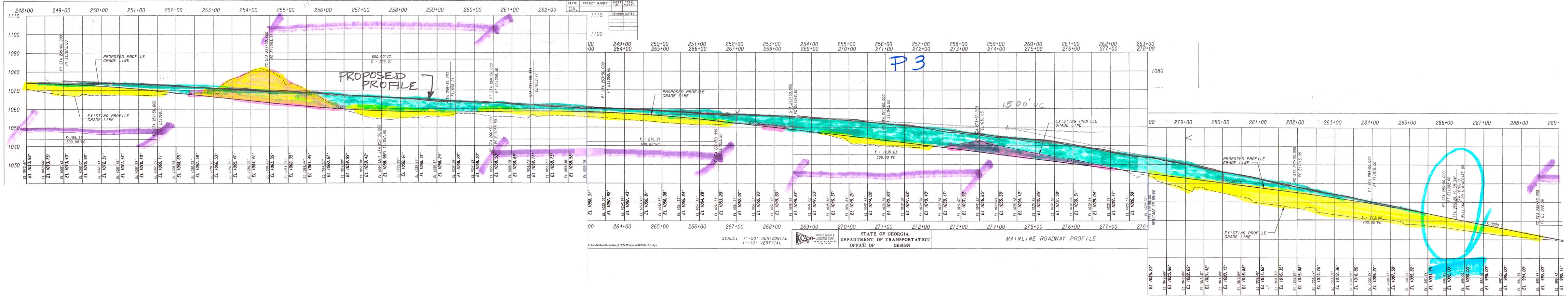
DATE	REVISIONS

DATE	REVISIONS



BEGIN LIMIT OF ACCESS.....BLA
 END LIMIT OF ACCESS.....ELA
 LIMIT OF ACCESS.....ELA
 R/W AND LIMIT OF ACCESS
 R CONSTR OF SLOPES
 C CONSTR OF DRIVES

P-3
 SH. 40810



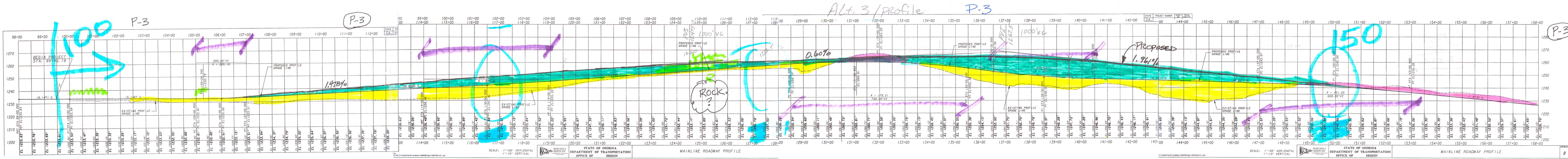
STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.	1110	1110	1110

STATION	ELEVATION
249+00	1110
250+00	1110
251+00	1110
252+00	1110
253+00	1110
254+00	1110
255+00	1110
256+00	1110
257+00	1110
258+00	1110
259+00	1110
260+00	1110
261+00	1110
262+00	1110
263+00	1110

STATION	ELEVATION
264+00	1038.31
264+00	1035.03
264+00	1037.92
265+00	1034.24
265+00	1037.43
265+00	1035.81
265+00	1039.08
266+00	1035.24
266+00	1034.12
266+00	1034.28
267+00	1035.13
267+00	1033.20
267+00	1035.81
267+00	1032.07
268+00	1035.51
268+00	1030.91
268+00	1031.7
268+00	1049.80
269+00	1048.69
269+00	1047.02
269+00	1047.53
270+00	1045.52
270+00	1045.37
270+00	1044.64
270+00	1045.21
271+00	1044.02
271+00	1039.79
271+00	1042.83
272+00	1039.20
272+00	1041.62
272+00	1040.40
273+00	1039.78
273+00	1039.17
273+00	1041.07
273+00	1037.32
274+00	1042.25
274+00	1036.65
274+00	1040.05
274+00	1035.38
275+00	1038.12
275+00	1035.95
275+00	1032.85
276+00	1034.39
276+00	1031.58
276+00	1030.31
277+00	1029.54
277+00	1029.04
277+00	1028.39
277+00	1027.77
278+00	1025.51
278+00	1026.50

STATION	ELEVATION
279+00	1025.23
279+00	1019.65
279+00	1023.95
280+00	1016.85
280+00	1022.69
280+00	1021.37
280+00	1021.42
281+00	1014.80
281+00	1020.15
281+00	1012.84
281+00	1018.88
282+00	1009.16
282+00	1017.62
282+00	1016.35
282+00	1005.87
282+00	1015.08
283+00	1009.14
283+00	1013.76
283+00	1003.88
283+00	1012.36
284+00	1002.07
284+00	1010.85
284+00	1000.84
284+00	1009.27
284+00	1000.47
284+00	1007.59
284+00	998.09
284+00	1005.82
284+00	997.14
284+00	1003.95
284+00	996.15
284+00	1002.07
284+00	995.07
284+00	1000.00
284+00	993.53
284+00	998.00
284+00	991.89
284+00	994.00
284+00	990.44
284+00	992.00
284+00	989.03
284+00	990.11

STATION	ELEVATION
285+00	1026.00
285+00	1022.00
285+00	1020.00
285+00	1018.00
285+00	1016.00
285+00	1014.00
285+00	1012.00
285+00	1010.00
285+00	1008.00
285+00	1006.00
285+00	1004.00
285+00	1002.00
285+00	1000.00
285+00	998.00
285+00	996.00
285+00	994.00
285+00	992.00
285+00	990.00
285+00	988.00
285+00	986.00
285+00	984.00
285+00	982.00
285+00	980.00
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285+00	974.00
285+00	972.00
285+00	970.00
285+00	968.00
285+00	966.00
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285+00	420.00
285+00	418.00
285+00	416.00
285+00	414.00
285+00	412.00
285+00	410.00
285+00	



SCALE: 1" = 50' HORIZONTAL
 1" = 10' VERTICAL

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE OF DESIGN

MAINLINE ROADWAY PROFILE

SCALE: 1" = 50' HORIZONTAL
 1" = 10' VERTICAL

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE OF DESIGN

MAINLINE ROADWAY PROFILE

CALCULATIONS



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
 Project No. STP-2984(1), Hall County, Georgia
 Preliminary Submittal

ALTERNATIVE NO.: **P-3**

SHEET NO.: **8** of 10

A. Earthwork changes in Areas of
 Raising the mainline profile from STA.
 106+00 to STA. 153+00
 Less unclass. Excavation =
 - 6,000 c.y.

A. increase Fill (embankment Required)
 159,000 more Fill (embankment Required.)
 STA. 106 to STA 153+00

B. Earthwork changes in Areas of
 Raising mainline grade from STA. 249+00
 to STA. 286+00.
 Less unclass EXCAV.
 - 11,500 c.y.
 - 6,800 c.y.
 - 18,300 c.y. ← TOTAL SAVINGS unclass

B. increase Fill (embankment)
 98,000 c.y. Fill
 159,000 c.y. Fill
 257,000 c.y. Total Fill (additional Embankment Required)
 STA 249+00 to 286+00
 STA 106+00 to 153+00

CALCULATIONS



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.: **P-3**

SHEET NO.: **9 of 10**

Retaining Wall to Hold Fill
off Historic Property
 $470' \times 15' = 7050 \text{ S.F.}$

Additional R/W Required
 $29,800 \text{ S.F.} = (\text{No displacements})$
 $= 0.684 \text{ ac}$

COST WORKSHEET

PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211** ALTERNATIVE NO.: **P-3**
Project No. STP-2984(1), Hall County, Georgia

DESCRIPTION: SHEET NO.: **10 of 10**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
Uncl. EXCAV.	C.Y.	19,000	\$4.82	\$91,580			
LESS SOIL EXPORT	C.Y.	257,000	\$1.00	\$257,000			
Retain wall		SF			7050	\$40	\$282,000
					CONSTR. Markup 10%		\$ 28,200
					CONSTR. TOTAL		\$ 310,200
→ Add'l R/W Residential					.684	75,000	51,300
	AC				R/W markup 247%		126,710
					TOTAL R/W =		\$ 178,010
Subtotal				\$348,580	CONSTR.		\$ 310,200
Markup (%) at 10%				34,860	R/W		\$ 178,010
TOTAL				\$383,440			\$ 488,210

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **S-1**

DESCRIPTION: **DESIGN FOR SIX LANES, BUT BUILD ONLY FOUR LANES – STA 100+00 TO STA 205+00**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Three 12-ft. lanes are designed on both sides of the median, along with a 4-ft. bike lane from STA 100+00 to STA 205+00.

ALTERNATIVE: (Sketch attached)

From STA 100+00 to STA 205+00, provide two 12-ft.-wide lanes on both sides of the median along with a 4-ft. bike lane. Widen the median from 20 ft. to 44 ft. in width. Defer the final lane and construction of the median curb and gutter for the future.

ADVANTAGES:

- Reduces construction time
- Reduces cost

DISADVANTAGES:

- May increase future costs
- Creates an inconvenience to travelers during future construction period

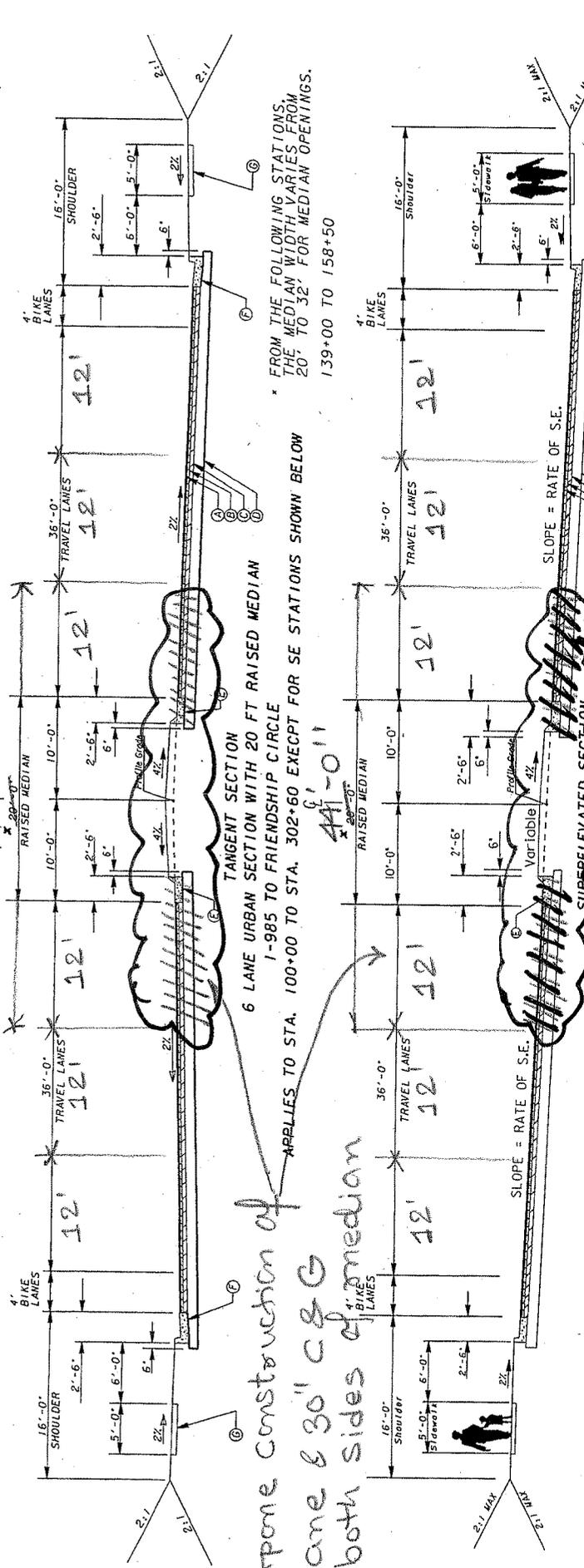
DISCUSSION:

The current and near-term traffic projections do not warrant construction of all six lanes. Money and time can be saved by constructing additional two lanes in the future.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,810,423	—	\$ 2,810,423
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 2,810,423	—	\$ 2,810,423

Alt. S-1 Sheet 2 of 4

STATE	PROJECT NUMBER
GA.	STP-2984 (1)



Postpone construction of 12' lane & 30" C & G on both sides of median

DEFER TILL NEEDED

- Ⓐ ASPH CONC. 12.5 mm SUPERPAVE, POLYMER MODIFIED, 165 LB/ST
- Ⓑ ASPH CONC. 15 mm SUPERPAVE 220 LB/ST
- Ⓒ ASPH CONC. 25 mm SUPERPAVE 170 LB/ST
- Ⓓ GRADED AGGREGATE BASE, 4 IN X 30 MM, TYPE 7
- Ⓔ CONC CURB & GUTTER, 6 IN X 30 IN, TYPE 2
- Ⓕ CONC CURB & GUTTER, 6 IN X 30 IN, TYPE 2
- Ⓖ CONC SIDEWALK, 4 IN

SLOPE CONTROLS	
SLOPE	CUT/FILL
4:1	0'-6"
3:1	0'-6"
2:1	OVER 6' OVER 6'

NOTE: FOR TYPICAL SE SECTIONS REFERENCE AASHTO'S "A" POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS, CURRENT EDITION (THE GREEN BOOK) AND THE GEORGIA DETAIL STANDARD SUBEC FOR SE TABLES AND MAX RATES.

* FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32', FOR MEDIAN OPENINGS. 139+00 TO 158+50

* FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32', FOR MEDIAN OPENINGS. 139+00 TO 158+50

DATE	REVISIONS	DATE	REVISIONS

H. T. S.

KCS&A
KISINGER CAMPO & ASSOCIATES CORP.
1720 PEACHTREE ST., N.W., SUITE 1048
COUNTY, GA.

ALT S-1
Sheet 2 of 4

CALCULATIONS



PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
 Project No. STP-2984(1), Hall County, Georgia
 Preliminary Submittal

ALTERNATIVE NO.:

S-1

SHEET NO.: 3 of 4

STA. 100+00 to STA 205+00 $\Rightarrow 10,500'$

Per foot width of pavement $\Rightarrow 10,500$ sq ft or $1,166.6$ SY
 Total Pavement area = $1,166.6 \times 24 = 28,000$ SY

12.5 mm A.C. weighs 165 lbs/SY

Cost is \$75/ton $\Rightarrow 75 \times 165 / 2000 = \$6.2/SY$

19 mm A.C. weighs 220 lbs/SY $\Rightarrow \frac{75 \times 220}{2000} = \$8.25/SY$

25 mm A.C. weighs 270 lbs/SY $\Rightarrow \frac{75 \times 270}{2000} = \$28.9/SY$

12" G.A.B weighs 150 lbs/cf or $\frac{150 \times 27}{2000} = 2$ tons/cy.

Since G.A.B is \$18.23/ton,

its cost per cy is \$36.43

Bituminous Tack Coat : 0.07 Gal/SY & costs \$2.08/Gal

$\Rightarrow 2.08 \times 0.07 = \$0.15/SY$

Total length of curb & gutter : $2 \times 10,500 = 21,000'$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: S-2

DESCRIPTION: **USE A 10-FT. MULTI-USE PATH ON BOTH SIDES OF THE ROAD IN PLACE OF BIKE LANES AND SIDEWALKS**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

Four-ft.-wide bike lanes on full depth pavement are provided along with 5-ft.-wide concrete sidewalk on both sides of the road.

ALTERNATIVE: (Sketch attached)

Eliminate the 4-ft.-wide bike lanes and 5-ft.-wide concrete sidewalks from both sides of the road. Replace with a 16-ft.-wide shoulder and construct a 10-ft.-wide multi-use path.

ADVANTAGES:

- Reduces construction time
- Reduces 8 ft. of right-of-way
- Reduces cost
- Reduces fatal accidents

DISADVANTAGES:

- Eliminates dedicated bike lanes
- Requires pedestrians to share space with bicyclists, increasing the chance of minor accidents
- Reduces landscaped area between the road and pedestrians

DISCUSSION:

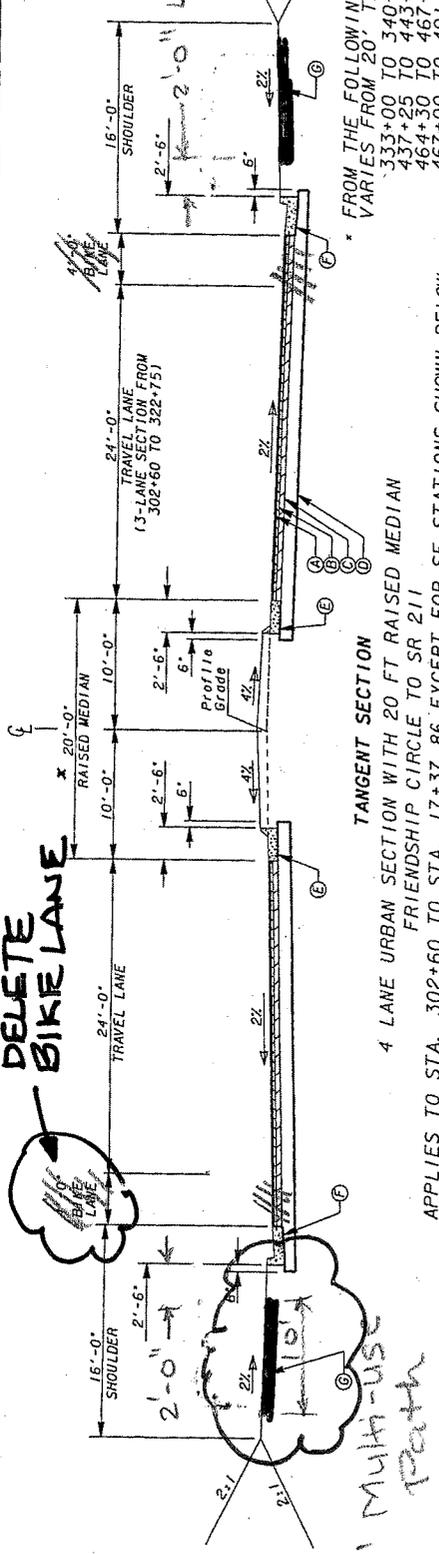
It does not make much sense to lay down full-depth pavement for a small number of bicycles. The same objective can be achieved through the use of multi-use paths.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 7,104,132	—	\$ 7,104,132
ALTERNATIVE	\$ 858,462	—	\$ 858,462
SAVINGS (Original minus Alternative)	\$ 6,245,670	—	\$ 6,245,670

Alt. S-2 sht. 2 of 5

STATE	PROJECT NUMBER	SHEET TOTAL
GA.	STP-2984 (1)	25

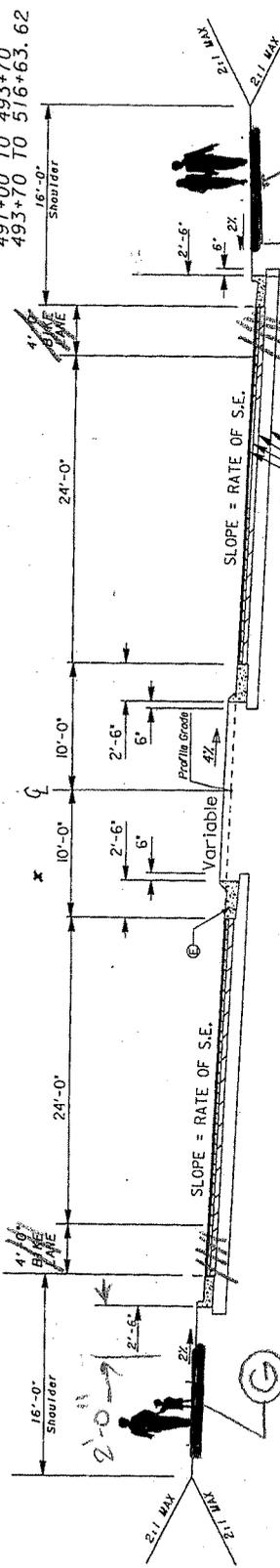
DATE	REVISIONS



FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32' FOR MEDIAN OPENINGS.

20', TO 28',
333+00 TO 340+00
347+25 TO 443+00
464+30 TO 467+00
481+00 TO 491+00
493+70 TO 493+70
516+63.62

TANGENT SECTION
4 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
FRIENDSHIP CIRCLE TO SR 211
APPLIES TO STA. 302+60 TO STA. 17+37.86 EXCEPT FOR SE STATIONS SHOWN BELOW



SUPERELEVATED SECTION
4 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
FRIENDSHIP CIRCLE TO SR 211
APPLIES TO THE FOLLOWING STATIONS:

- 305+34.664 TO 309+84.622
- 317+78.906 TO 323+81.705
- 330+67.048 TO 334+35.603
- 345+31.976 TO 347+23.677
- 378+24.519 TO 386+72.714
- 391+89.343 TO 409+15.646
- 419+45.078 TO 423+09.059
- 443+87.923 TO 446+92.621
- 454+82.058 TO 462+81.954

4-LANE SECTION

62 OR RATE OF S.E. WHICHEVER IS GREATER
S.FOLLOWS:
1. CONC 12.5 mm SUPERPAVE, POLYMER MODIFIED, 165 LB/SY
2. CONC 19 mm SUPERPAVE 220 LB/SY
3. CONC 25 mm SUPERPAVE 770 LB/SY
4. UNDESIGNED AGGREGATE BASE, 12 IN
5. CURB & GUTTER, 8 IN X 30 IN, TYPE 7

TYPICAL SE SECTIONS REFERENCE AASHTO'S 'A' POLICY (C DESIGN OF HIGHWAYS AND STREETS, CURRENT EDITION) AND THE GEORGIA DETAIL STANDARD (SEE TABLES AND MAX RATES.

SLOPE CONTROLS	
SLOPE	CUT
4:1	0-6'
3:1	0-6'
2:1	OVER 6'

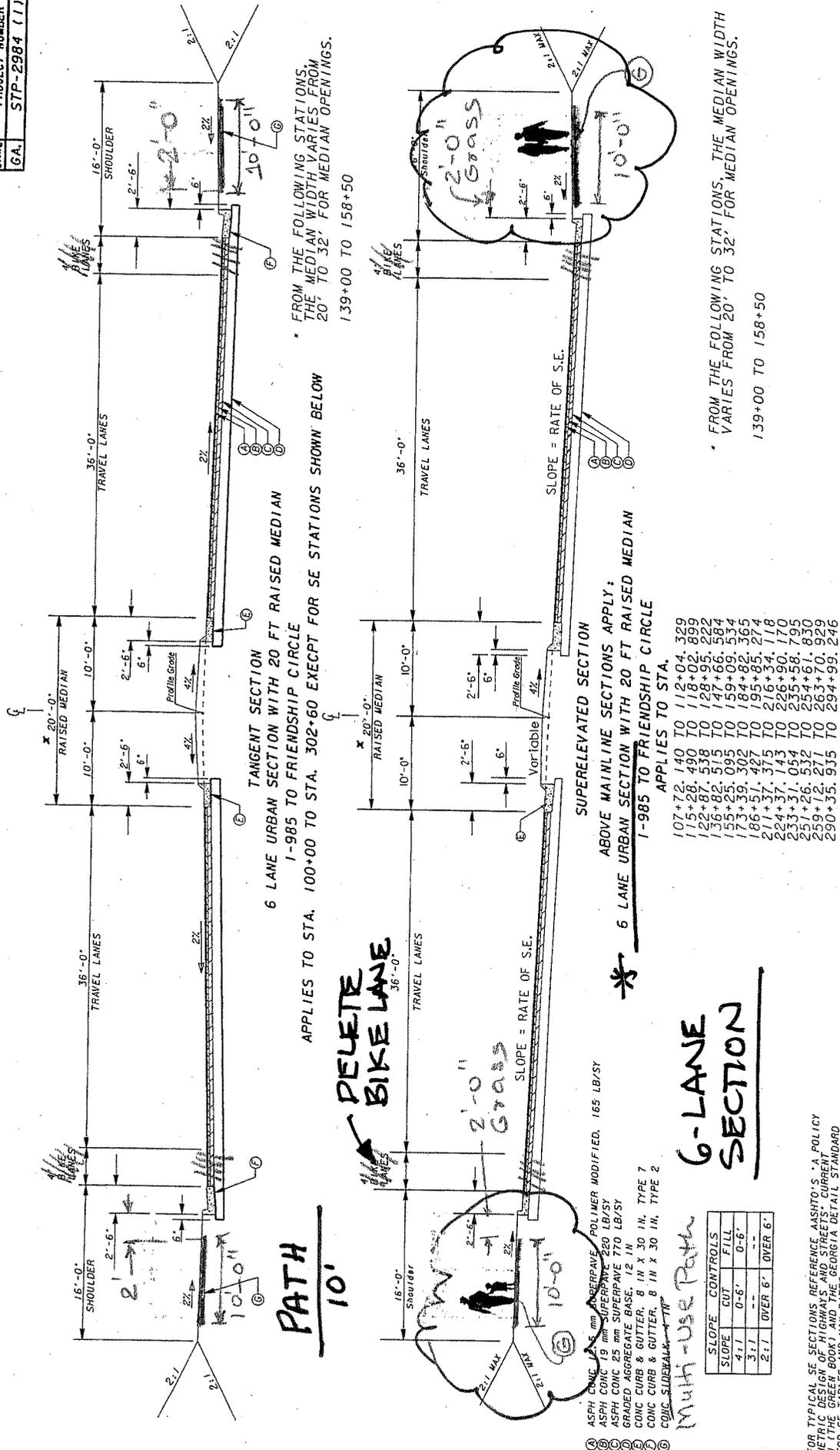
Multi-Use Path Section

GEORGIA DEPARTMENT OF TRANSPORTATION

S-2
Sheet
2 of 5

Alt. S-2 Stat. 3 of 5

STATE	PROJECT NUMBER
GA.	STP-2984 (11)



DATE	REVISIONS	DATE	REVISIONS



N. T. S.

GEORGIA
 DEPARTMENT OF TRANSPORTATION
 TYPICAL SECTION
 PROJECT STP-2984 (11)
 COUNTY HALL

KINSINGER CAMPO &
 ASSOCIATES CORP.
 1129 PEACHTREE ST., N.W., SUITE 1048

S-2
 sheet
 3 of 5

CALCULATIONS



PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
 Project No. STP-2984(1), Hall County, Georgia
 Preliminary Submittal

ALTERNATIVE NO.:

S-2

SHEET NO.:

4 of 5

Bike lanes & sidewalks are proposed throughout the project from STA. 100+00 to 517+00 for a total length of 41700 feet.

Keep 4" thick 5' wide concrete sidewalk on the side roads. Their total length: 5000' and total SY = $5000 \times 5/9 =$

Eliminate bike lanes & sidewalks everywhere else.

Total road area saved = $41,700 \times 8/9 = 37066.6$ SY

Total area of multi-use path to be installed = $41,700 \times 10/9 = 46333.3$ SY.

R/W saved: $\frac{41,700 \times 8}{43560} = 7.65$ acres out of which 20% is commercial and 80% is residential.

\Rightarrow 1.53 acres is commercial & 6.13 acres is residential

Also assume 10% of savings in not having to do improvements, relocations & damages.

$0.10 (1,128,000 + 245,000 + 1,227,000) = \$260,000$ lump sum

See S-1 Calculations for other cost data

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **S-3**

DESCRIPTION: **REDUCE OUTSIDE LANES FROM 12 FT. TO 11 FT. WIDE**
ON BOTH SIDES OF THE ROAD

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

Throughout the project, 12-ft.-wide outside lanes adjoin the 4-ft.-wide bike lanes.

ALTERNATIVE: (Sketch attached)

Reduce the width of the outside lanes from 12 ft. to 11 ft. The right-of-way requirement will be reduced by one foot on both sides of the road.

ADVANTAGES:

- Reduces construction time
- Reduces cost
- Reduces right-of-way requirements

DISADVANTAGES:

- Does not conform to normal standards
- Perceived as a reduction in safety

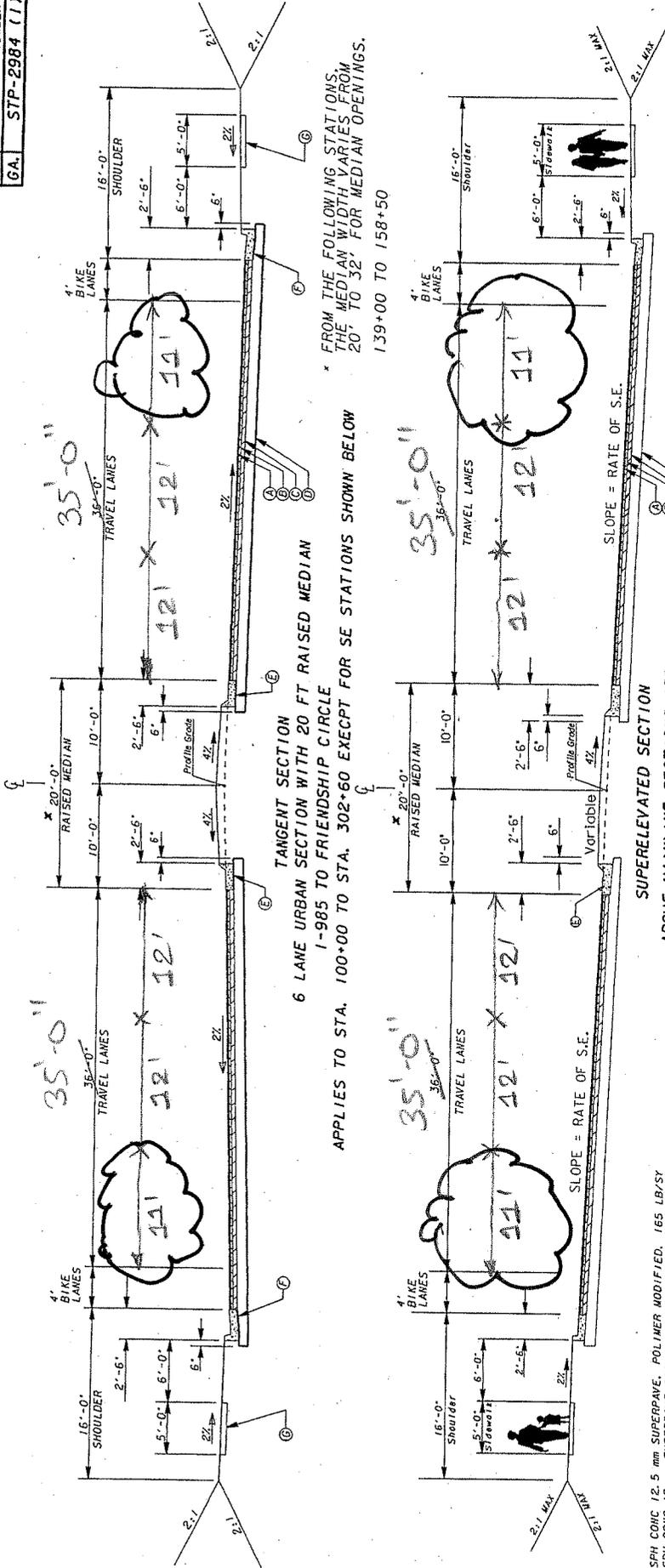
DISCUSSION:

Inside the perimeter of I-285, all freeways in Atlanta have 11-ft.-wide lanes. Four-ft.-wide bike lanes next to 11-ft.-wide lanes will likely eliminate a perceived reduction in safety.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,994,845	—	\$ 1,994,845
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 1,994,845	—	\$ 1,994,845

Alt. S-3 SHC. 2 of 5

STATE	PROJECT NUMBER
GA.	STP-2984 (1)



FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32', FOR MEDIAN OPENINGS. 139+00 TO 158+50

FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32', FOR MEDIAN OPENINGS. 139+00 TO 158+50

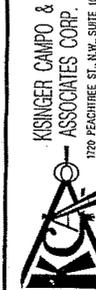
- ① ASPH CONC 12.5 mm SUPERPAVE, POLYMER MODIFIED, 165 LB/ST
- ② ASPH CONC 19 mm SUPERPAVE 220 LB/ST
- ③ ASPH CONC 25 mm SUPERPAVE 770 LB/ST
- ④ GRADED AGGREGATE BASE, 12 IN
- ⑤ CONC CURB & GUTTER, 8 IN X 30 IN, TYPE 7
- ⑥ CONC CURB & GUTTER, 8 IN X 30 IN, TYPE 2
- ⑦ CONC SIDEWALK, 4 IN

SLOPE CONTROLS	
SLOPE	FILL
4:1	0'-6"
3:1	--
2:1	OVER 6' OVER 6'

NOTE: FOR TYPICAL SE SECTIONS REFERENCE AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS", CURRENT EDITION (THE GREEN BOOK) AND THE GEORGIA DETAIL STANDARD 9028C FOR SE TABLES AND MAX RATES.

DATE	REVISIONS	DATE	REVISIONS

N. T. S.

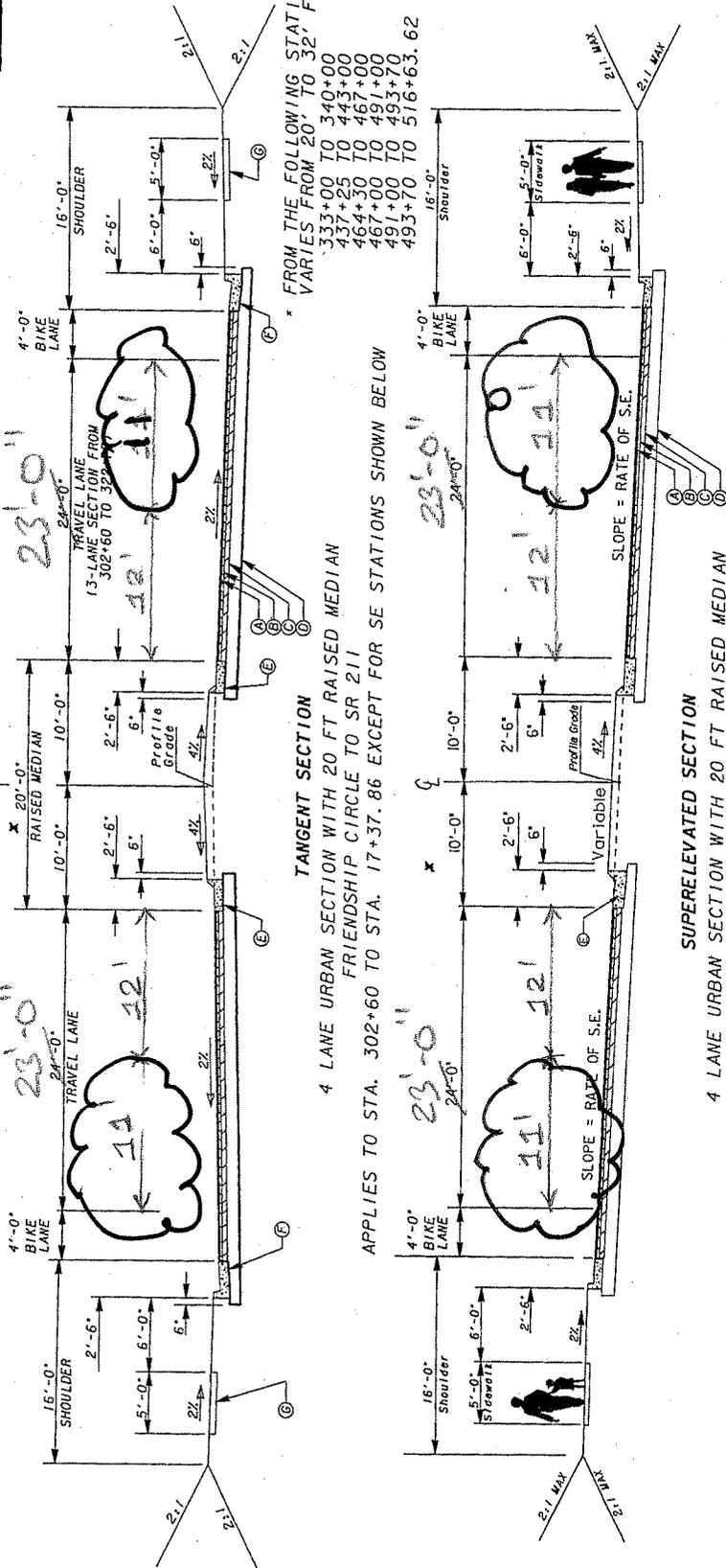


GEORGIA DEPARTMENT OF TRANSPORTATION
TYPICAL SECTION
PROJECT STP-2984 (1)
COUNTY HALL

S-3
Sheet
2 of 5

Alt. S-3 Sht. 3 of 5

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA.	STP-2984 (1)		



FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32' FOR MEDIAN OPENINGS.

333+00 TO 340+00	20' TO 28'
437+25 TO 443+00	20' TO 32'
464+50 TO 467+00	32' TO 44'
467+00 TO 491+00	44' TO 32'
491+00 TO 493+70	32' TO 32'
493+70 TO 516+63.62	32' TO 32'

* FROM THE FOLLOWING STATIONS, THE MEDIAN WIDTH VARIES FROM 20' TO 32' FOR MEDIAN OPENINGS.

399+00 TO 410+48	20' TO 32'
443+00 TO 464+30	32' TO 32'

SLOPE	CUT	FILL
4:1	0-6"	0-6"
3:1	--	--
2:1	OVER 6"	OVER 6"

TANGENT SECTION
4 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
FRIENDSHIP CIRCLE TO SR 211
APPLIES TO STA. 302+60 TO STA. 17+37.86 EXCEPT FOR SE STATIONS SHOWN BELOW

SUPERELEVATED SECTION
4 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
FRIENDSHIP CIRCLE TO SR 211
APPLIES TO THE FOLLOWING STATIONS:

- 305+34.664 TO 309+84.622
- 317+78.906 TO 323+81.705
- 330+67.048 TO 334+35.605
- 345+37.916 TO 347+23.677
- 378+24.517 TO 386+72.714
- 391+89.343 TO 409+15.646
- 419+45.078 TO 423+09.059
- 443+87.923 TO 446+92.621
- 454+82.058 TO 462+81.954

CONC 12.5 mm SUPERPAVE, POLYMER MODIFIED, 165 LB/5Y
CONC 19 mm SUPERPAVE 220 LB/5Y
CONC 25 mm SUPERPAVE 770 LB/5Y
CURB & GUTTER, 8 IN X 30 IN, TYPE 7

6X OR RATE OF S.E. WHICHEVER IS GREATER
FOLLOWS:
E OF 2%, USE 6X
E OF 3%, USE 5X
E OF 4%, USE 4X
E OF 5%, USE 3X
E OF 6%, USE 2X
E OF 8%, USE 1X
E OF 10% OR GREATER, USE 1X
DIFFERENCE IN PAVING AND SHOULDER TO EXCEED 6X.

TYPICAL SE SECTIONS REFERENCE AASHTO'S 'A' POLICY
DESIGN OF HIGHWAYS AND STREETS, CURRENT
(GREEN BOOK) AND THE GEORGIA DETAIL STANDARD
E TABLES AND MAX RATES.

DATE	REVISIONS	DATE	REVISIONS

MINIFER CAMPBELL &
GEORGIA
DEPARTMENT OF TRANSPORTATION

S-3
Sheet
3 of 5

CALCULATIONS



PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.:

S-3

SHEET NO.: 4 of 5

Total project roadway length: $517 + w - 100 + w = 41,700'$
Reducing a foot on both sides $\Rightarrow 93,400'$ in savings
 $\Rightarrow 10,378$ SY.

$$\underline{R/w \text{ saved}} = \frac{41,700 \times 2}{43,560} = 1.915 \text{ acres}$$

Assume

20% (0.383 ac) to be commercial and

80% (1.532 ac) to be residential

Reducing a foot on either side of the road will probably save about 5% of money expected to be spent for improvements, relocations & damages.

$$0.05 (1,128,000 + 245,000 + 1,227,000) = \$130,000$$

lump sum

See S-1 for other cost data

COST WORKSHEET



PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia

ALTERNATIVE NO.:
3-3

DESCRIPTION:

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
12.5 mm AC.	SY	10,378	6.20	64,348.6			
19 mm AC.	SY	11	8.25	85,618.5			
25 mm AC.	SY	11	28.90	299,924.2			
12" G.A.B.	CY	11	36.43	378,070.5			
Tack Coat	SY	11	0.15	1,556.7			
				829,513.5			
10% Const. Markup				82,951.4			
				912,465			
<u>Right of Way</u>							
Commercial	AC.	0.383	175,000	67,025			
Residential	AC.	1.532	75,000	114,900			
Improvements etc.	LS			130,000			
				311,925			
247' R/W TA cost up				770,455			
				1,082,380			
Subtotal							
Markup (%) at							
TOTAL							1,994,845



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: SR 347/FRIENDSHIP ROAD FROM I-985 TO SR 211 Project No. STP-2984-(1) - Hall 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 (S) (continued)						
S-9	Use a grassed median in lieu of a 7 1/2-in.-thick concrete median. Apply 4-in.-thick concrete median only in areas directly adjacent to the turn lanes for added protection and improved visibility.	\$ 4,163,125	\$ 1,161,824	\$ 3,001,301	\$ (452,778)	\$ 2,548,523
S-10	Use a 4-in.-thick concrete median in lieu of 7 1/2 in. concrete.	\$ 4,163,125	\$ 2,556,893	\$ 1,606,232	\$ -	\$ 1,606,232
DRAINAGE (D)						
D-1	Use precast sedimentation vaults in lieu of purchased right-of-way for ponds.	DESIGN SUGGESTION				
D-2	Reduce the number of catch basins by increasing the gutter spread from 8 ft. to 10 ft. as allowed by GDOT criteria. This 25% increase in gutter spread could result in a net 10% savings in catch basins and pipe.	\$ 8,945,200	\$ 8,050,680	\$ 894,520	\$ -	\$ 894,520
CONSTRUCTION MANAGEMENT (CM)						
CM-1	Bid the project as one large job in lieu of two smaller pieces. The west half of the project is a net import job, while the east half is a net export. To reduce the extra cost from excessive import and export, combine the project into a single contract.	DESIGN SUGGESTION				
RIGHT-OF-WAY (RW)						
RW-1	Generally, reduce the cut and fill areas in the profile to minimize extensive slopes and right-of-way takes.	DESIGN SUGGESTION				

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **S-4**

DESCRIPTION: **USE 24-IN. CURB AND GUTTER IN LIEU OF 30-IN. CURB
 AND GUTTER**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

Eight in. x 30 in. Type 2 curb and gutter will be constructed on both sides of the road, and 8 in. x 30 in. Type 7 curb and gutter will be constructed on both sides of the median

ALTERNATIVE:

Construct 8-in. x 24-in. Type 2 curb and gutter on both sides of the road, and 8-in. x 24-in. Type 7 curb and gutter on both sides of the median.

ADVANTAGES:

- Reduces 2 ft. of right-of-way
- Reduces construction cost
- Reduces right-of-way requirements

DISADVANTAGES:

- Requires wider gutter spread

DISCUSSION:

Many streets around the country have 24-in. curb and gutters, and some Canadian freeways have 18-in. curb and gutters. If the gutter spread is within limits, a 24-in. curb and gutter should be used in place of 30-in. curb and gutters.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,091,422	—	\$ 4,091,422
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 4,091,422	—	\$ 4,091,422

CALCULATIONS



PROJECT: SR 346/FRIENDSHIP ROAD/I-985 TO SR 211
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.:

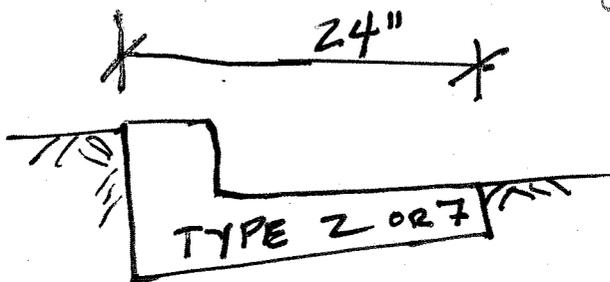
S-4

SHEET NO.:

2 of 3

Proposing 24" C&G in lieu of 30" C&G, will result in savings of 6" on both sides of the road in both directions. Thus, the total savings in R/w = 6" + 6" + 6" + 6" = 24" or 2'
(left side) (Rt. side)

See S-3 for further analysis on savings resulting from 2' of R/w.



VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **S-6**

DESCRIPTION: **USE A GRASS MEDIAN IN LIEU OF 7½-IN.-THICK CONCRETE**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

The median is constructed of 7½ in. of concrete.

ALTERNATIVE: (Sketch attached)

Use a grass median everywhere except near the turn lanes, then lay 4-in.-thick concrete in the median adjoining the turn lanes.

ADVANTAGES:

- Reduces construction time
- Reduces cost
- Aesthetically pleasing

DISADVANTAGES:

- Recurring costs to maintain the grassed median

DISCUSSION:

Seven and one-half-in. of concrete seems excessive for a median. Four-in.-thick concrete would suffice. Also, laying concrete everywhere in the median will cause higher storm water runoff. Thus, it is advisable to put concrete only around turn lanes where maintenance is more difficult.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,163,125	\$ 0	\$ 4,163,125
ALTERNATIVE	\$ 1,161,824	\$ 452,778	\$ 1,614,602
SAVINGS (Original minus Alternative)	\$ 3,001,301	\$ (452,778)	\$ 2,548,523



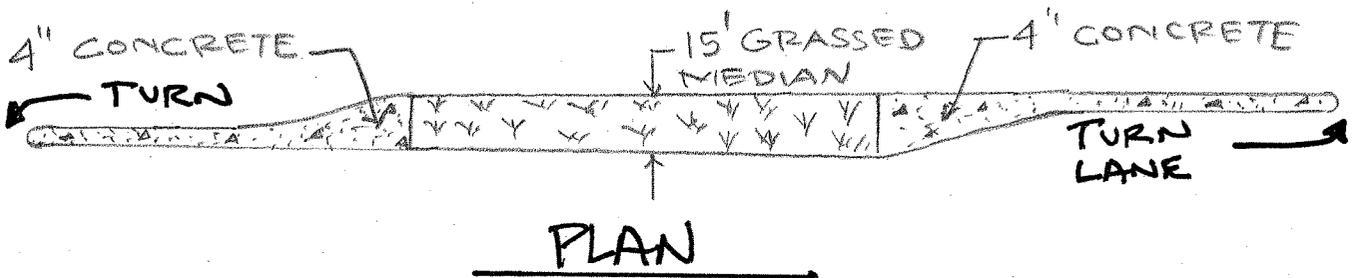
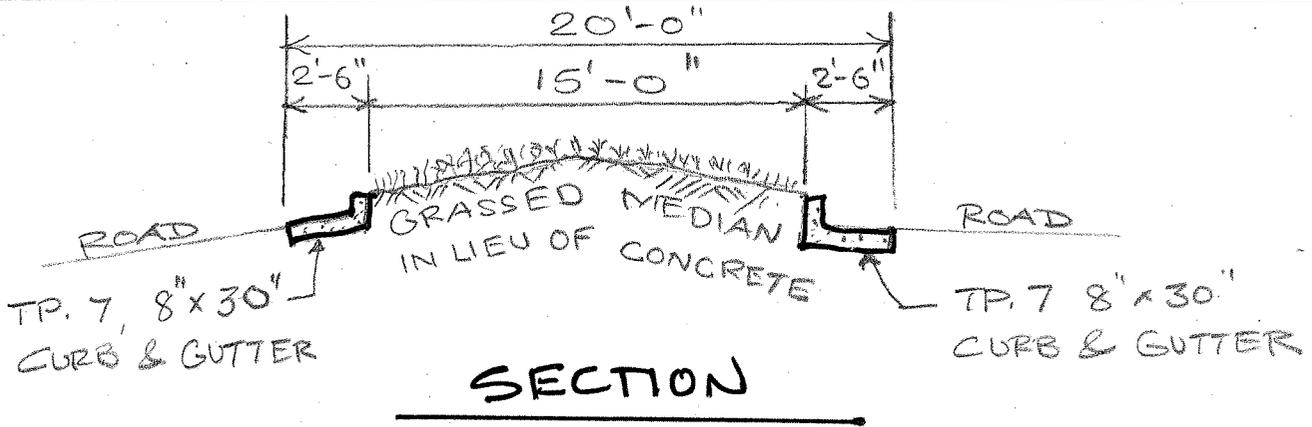
PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. *STP-2984(1), Hall County, Georgia*
Preliminary Submittal

ALTERNATIVE NO.:

S-9

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 6



TYPICAL PROPOSED MEDIAN
ALTERNATE S-9

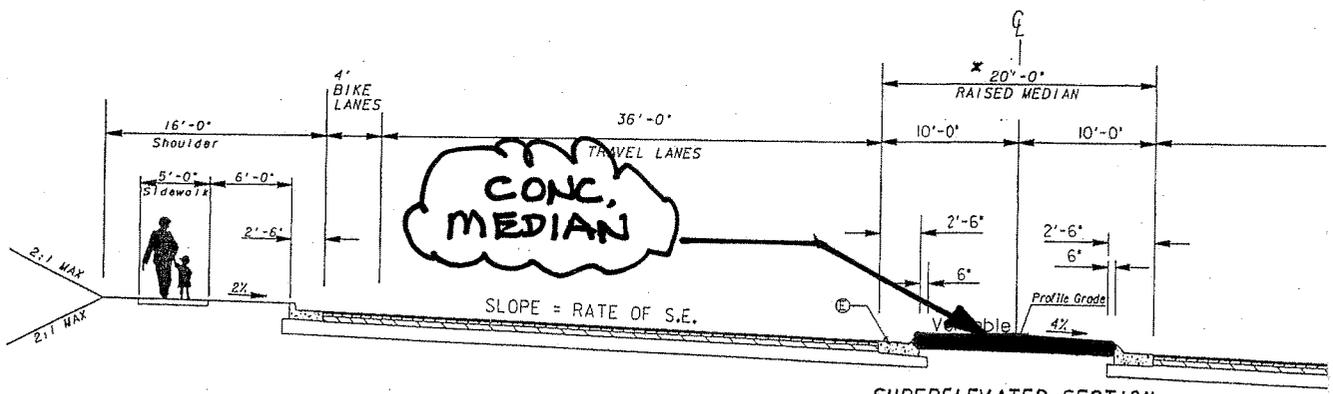
PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
 Project No. STP-2984(1), Hall County, Georgia
 Preliminary Submittal

ALTERNATIVE NO.:

S-9

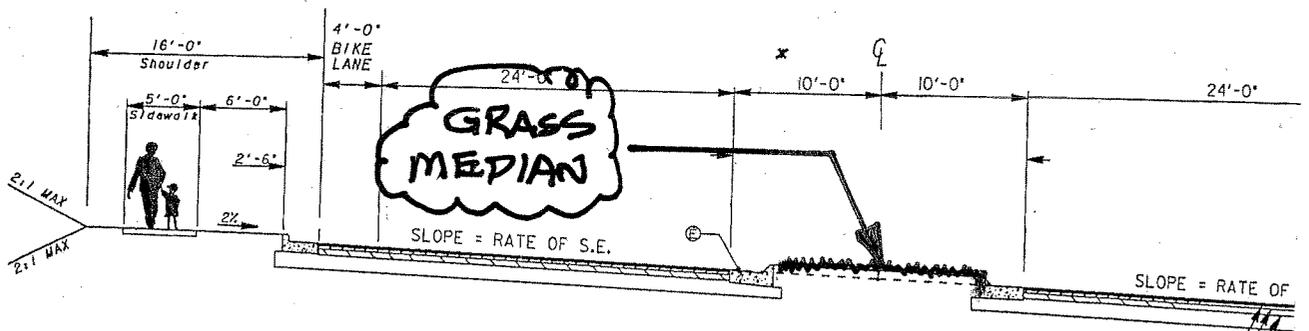
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **3 of 6**



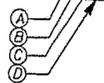
SUPERELEVATED SECTION
 ABOVE MAINLINE SECTIONS APPLY:
 * 6 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
 I-985 TO FRIENDSHIP CIRCLE

ORIGINAL DESIGN →



* 4 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
 FRIENDSHIP CIRCLE TO SR 211
 APPLIES TO THE FOLLOWING STATIONS:

ALTERNATIVE



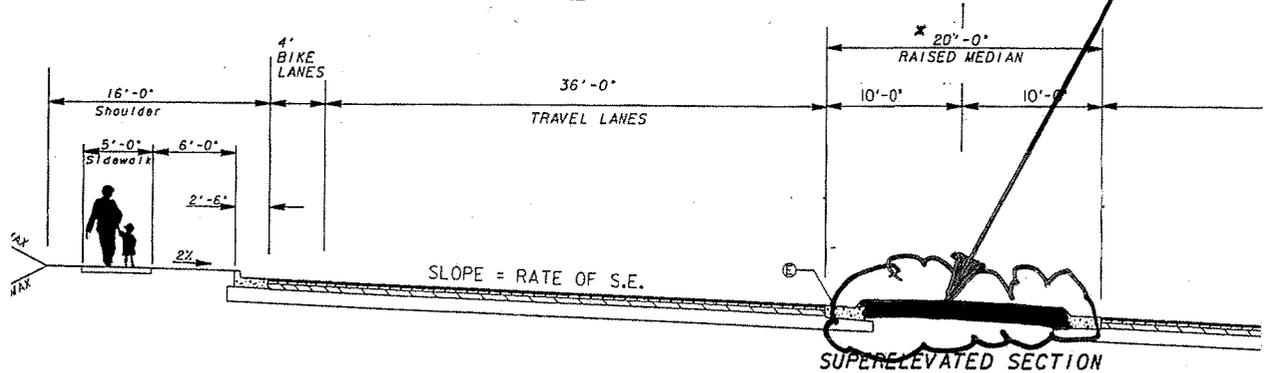
PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

ALTERNATIVE NO.:
S-9

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **4 of 6**

**USE 4" CONC. MEDIAN
 IN LIEU OF 7 1/2"**



* ABOVE MAINLINE SECTIONS APPLY:
6 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
 I-985 TO FRIENDSHIP CIRCLE

COST WORKSHEET



PROJECT: **SR 346/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia

ALTERNATIVE NO.:

S-9

DESCRIPTION:

SHEET NO.:

5 of 6

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
7.5" CONC. MEDIAN	SY	74,311	50.93	3,784,659			
10% Const. Markup				378,466			
Total →				4,163,125			
4" CONC. MEDIAN	SY				39,500	31.28	1,047,880
PERM. GRASSING	AC				8.432	987.28	8,324
							1,056,204
10% Const. Markup							105,620
Total →							1,161,824
Subtotal							
Markup (%) at							
TOTAL				4,163,125			1,161,824

LIFE CYCLE COST WORKSHEET



PROJECT: SR 347/FRIENDSHIP ROAD/I-985 TO SR 211 <i>Project No. STP-2984(1), Hall County, Georgia</i>					ALTERNATIVE NO.: S-9	
					SHEET NO.: 6 of 6	
LIFE CYCLE PERIOD: <u>30</u> years					ORIGINAL	PROPOSED
INTEREST RATE: <u>3.10%</u> ESCALATION RATE:						
A. INITIAL COST					4,163,125	1,161,824
Useful Life (Years)						
INITIAL COST SAVINGS						3,001,301
B. RECURRENT COSTS (Annual Expenditures)						
1. Mow grass every 2-weeks = 26times/yr x 15ac x 1ac/hr x \$60/hr = \$23,400/yr						23,400
2. Operating						
3. Energy						
4.						
5. test						
6.						
Total Annual Costs					-	23,400
Present Worth Factor					19.3495	19.3495
Present Worth of RECURRENT COSTS					-	452,778
C. SINGLE EXPENDITURES			Year	Amount	PW factor	Present Worth
ORIG	PROP	< Put "x" in appropriate box (original design or proposed design)				
		1.			1.0000	-
		2.			1.0000	-
		3.			1.0000	-
		4.			1.0000	-
		5.			1.0000	-
		6.			1.0000	-
		7.			1.0000	-
		8.			1.0000	-
D. SALVAGE VALUE			Year	Amount	PW factor	Present Worth
		1.			(1.0000)	-
		2.			(1.0000)	-
Present Worth of SINGLE EXPENDITURES					-	-
E. Total Recurrent Costs & Single Expenditures (B + C + D)					-	452,778
RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS						(452,778)
TOTAL PRESENT WORTH COST (A + E)					4,163,125	1,614,602
TOTAL LIFE CYCLE SAVINGS						2,548,523

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **S-10**

DESCRIPTION: **USE A 4-IN.-THICK CONCRETE MEDIAN IN LIEU OF**
7½-IN.-THICK CONCRETE

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The design uses a 7 ½-in.-thick concrete median throughout the length of the corridor.

ALTERNATIVE:

Use a 4-in.-thick concrete median instead of 7½-in.-thick everywhere.

ADVANTAGES:

- Reduces concrete required
- Reduces material cost

DISADVANTAGES:

- Reduces bearing capacity

DISCUSSION:

Seven and one-half-in. concrete seems excessive for a median. 4-in.-thick concrete would suffice the purpose. Also, laying concrete everywhere in the median will cause higher storm water runoff. Thus, it is advisable to put concrete only around turn lanes where maintenance is more difficult.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,163,125	—	\$ 4,163,125
ALTERNATIVE	\$ 2,556,893	—	\$ 2,556,893
SAVINGS (Original minus Alternative)	\$ 1,606,232	—	\$ 1,606,232

PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Hall County, Georgia
Preliminary Submittal

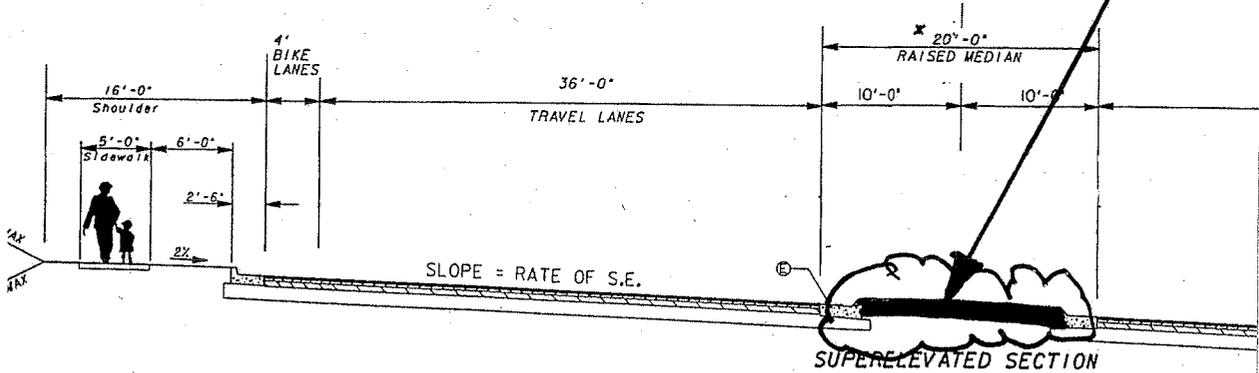
ALTERNATIVE NO.:

S-10

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2 of 3**

**USE 4" CONC. MEDIAN
 IN LIEU OF 7 1/2"**



* ABOVE MAINLINE SECTIONS APPLY:
6 LANE URBAN SECTION WITH 20 FT RAISED MEDIAN
 I-985 TO FRIENDSHIP CIRCLE

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1), Preliminary Submittal
Hall County, Georgia

ALTERNATIVE NO.: **D-2**

DESCRIPTION: **REDUCE THE NUMBER OF CATCH BASINS BY
 INCREASING THE GUTTER SPREAD FROM
 8 FT. TO 10 FT.**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

Storm water will be collected in 783 catch basins with a maximum 8-ft. gutter spread. A network of pipes and headwalls will carry and discharge the storm water.

ALTERNATIVE:

Increase the gutter spread to 10 ft. since the 4 -ft. bike lanes will likely not be used during rain. Reduce the number of catch basins, pipes and headwalls.

ADVANTAGES:

- Reduces construction time
- Reduces cost

DISADVANTAGES:

- Results in accumulation of rain water in the bike lane

DISCUSSION:

Hydrological calculations show the design gutter spread to be 8 ft. However, when bike lanes are present, GDOT allows gutter spread to be 10 ft. This 25% increase in allowable width of gutter spread can result in approximately 10% reduction in drainage network consisting of catch basins, pipes, headwalls, etc.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 8,945,200	—	\$ 8,945,200
ALTERNATIVE	\$ 8,050,680	—	\$ 8,050,680
SAVINGS (Original minus Alternative)	\$ 894,520	—	\$ 894,520

to be met for the 50-year event. Low points where water can overtop the curb and escape do not warrant being designed for the 50-year event.

- A 100-year event should be used to assess the effects of a larger runoff event on the pavement drainage design. One lane of traffic should be open to traffic for the check storm event⁽²⁾ with a reasonable depth of water on the pavement (0.5 feet).

Table 6.3. Allowable Spread for 10-Year Storm.

Gutter Spread	Speed Design	Design Applications
Confined within 10 ft max shoulder	> 45 mph	All roads other than interstates
½ lane width + gutter width max	≤ 45 mph	All roads other than interstates
Confined within 10 ft max shoulder	N/A	Interstate highways

Note: Even in the case of a bicycle lane, maximum gutter spread will be 10 ft from face of curb.

6.2.2 Spread Requirements

Gutter spread is defined as the perpendicular distance from the curb face or barrier to the furthest extent of the water on the roadway during the design storm (Figures 6.1 and 6.2).

Limiting the gutter-spread width is a very important design criterion and will vary depending on the type of highway and speed of traffic. Gutter spread shall be limited to the widths as shown in Table 6.3.

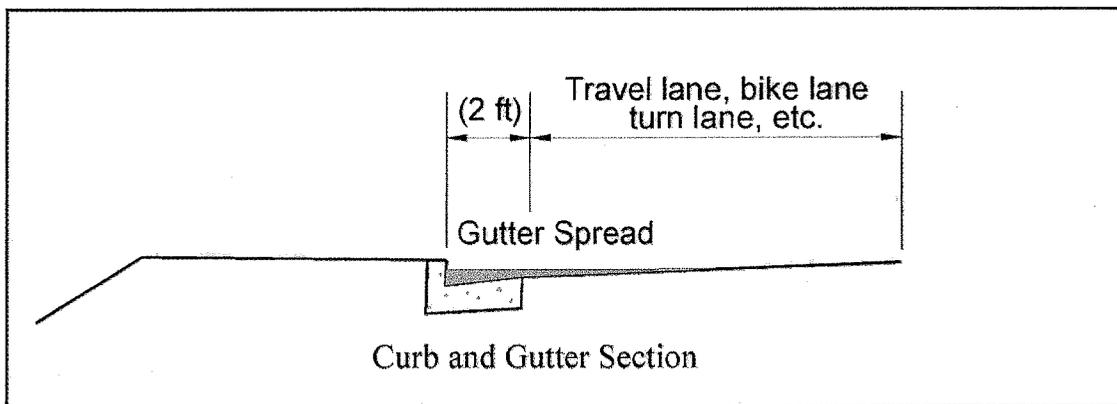


Figure 6.1. Gutter Spread.

6.3 Gutter Flow

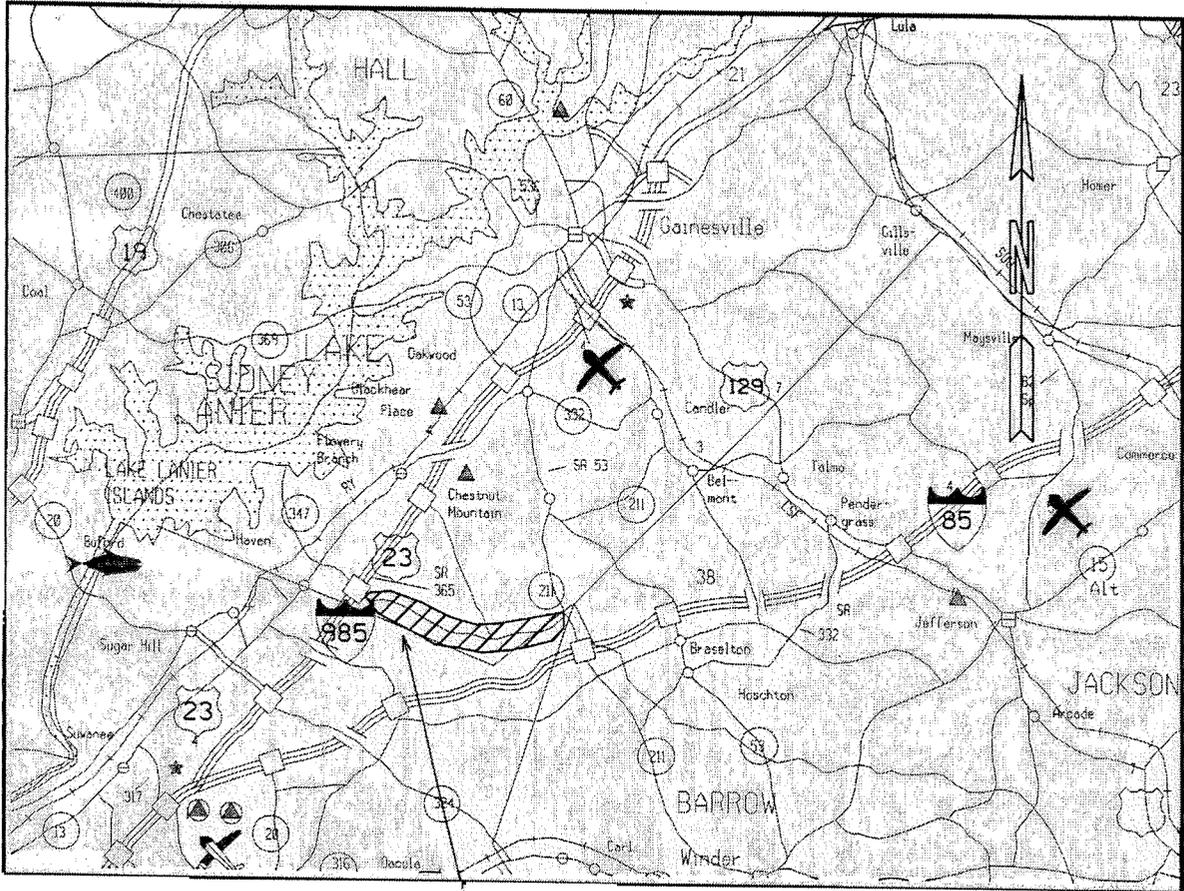
Gutter flow calculations are necessary to relate the quantity of flow (Q) in the curbed channel to the spread of water on the shoulder, parking lane or pavement section. Two main components that influence the gutter flow are the longitudinal (gutter grade) and transverse (cross) slopes.

PROJECT DESCRIPTION

This project involves the widening, reconstruction, and relocation of SR 347/Friendship Road/Thompson Mill Road. The project begins just east of Milepost 4.076 within the City of Buford, goes through the City of Flowery Branch and the City of Braselton, and ends on SR 211 at Milepost 11.991 for a total length of 7.915 miles. The present roadway serves as an east-west connector between I-985 and I-85. This corridor has recently experienced rapid residential, commercial, industrial, and manufacturing development, and was identified for improvement in the 1987 Gainesville-Hall Transportation Study (GHTS). It was also included in the 1997 GHTS update as a Stage I (1994-2000) transportation need. This project is now in the approved 2006–2011 Transportation Improvement Program (TIP) and Mobility 2030 Regional Transportation Plan. The proposed project is presently in right-of-way acquisition for FY 2007 and construction is scheduled in FY 2009.

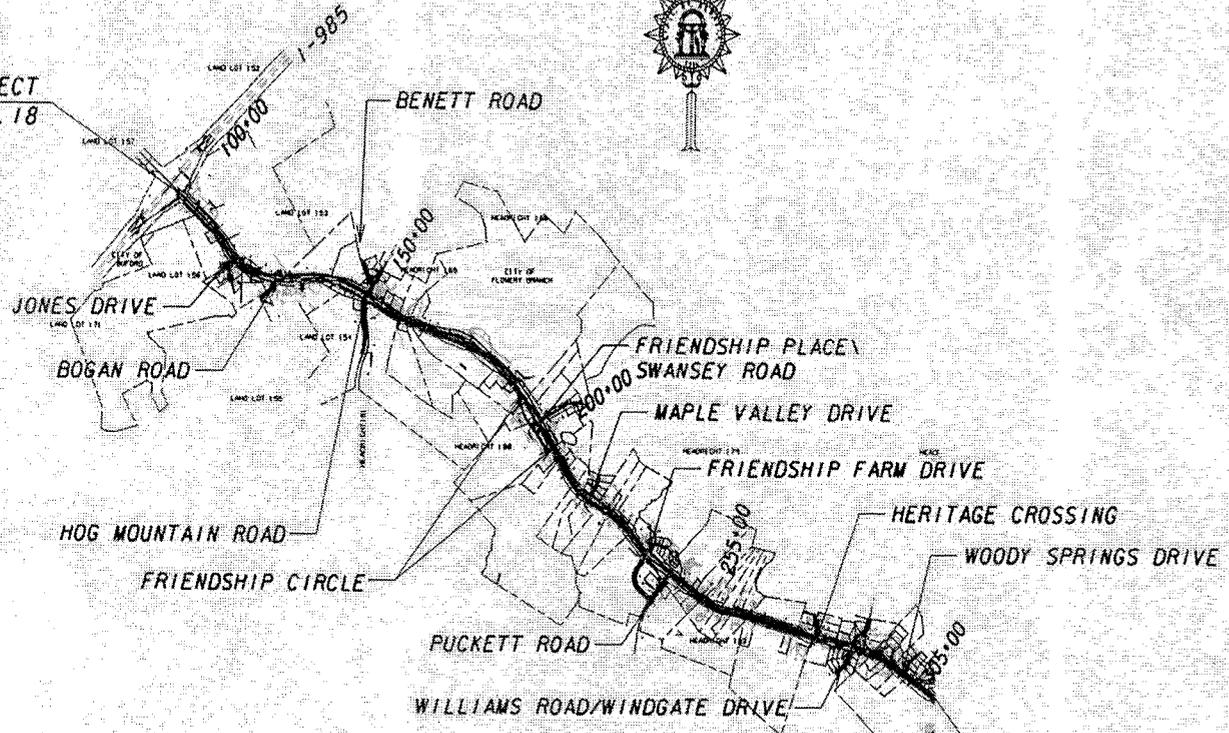
SR 347 is a two-lane rural roadway with a posted speed limit of 45 mph. According to 2003 traffic counts, the Average Annual Daily Traffic (AADT) along SR 347 for the length of the project proposed for widening to six lanes was approximately 25,800, yielding a roadway LOS of F. Traffic figures for the same year along the length of the project proposed for widening to four lanes included an AADT of approximately 17,900 at a LOS of E. Assuming completion of the proposed project, level of service in 2009 is projected to be LOS B for both portions of the roadway. In the year 2029, however, level of service along the six-lane portion is projected to LOS C with an AADT of 57,000, while the level of service along the four-lane portion is projected to be LOS D, with an AADT of 44,500. The proposed six-lane widening from I-985 to Williams Road is recommended to achieve and maintain an acceptable level of service on the facility for a significant period of time. The proposed design speed is 45 mph.

The proposed construction will widen SR 347 to six lanes from I-985 heading east to Williams Road where it will transition to a four-lane roadway to SR 211 on the eastern project termini. Both sections will be separated by a raised median, which varies from 20 to 44 feet, with 16-ft. shoulders and an urban section with bike lanes and sidewalks. This is a change from the Concept Report, which called for six lanes from I-985 to Friendship Circle. This change is due to the traffic capacity analysis of the updated traffic projections. Access will be partially limited on new locations and controlled by permit on existing alignments. Traffic will be maintained during the 24–30 months required for construction of the improvements.



PROJECT STP-2984(1)

BEGIN PROJECT
STA. 99+46.18
MP * 4.076



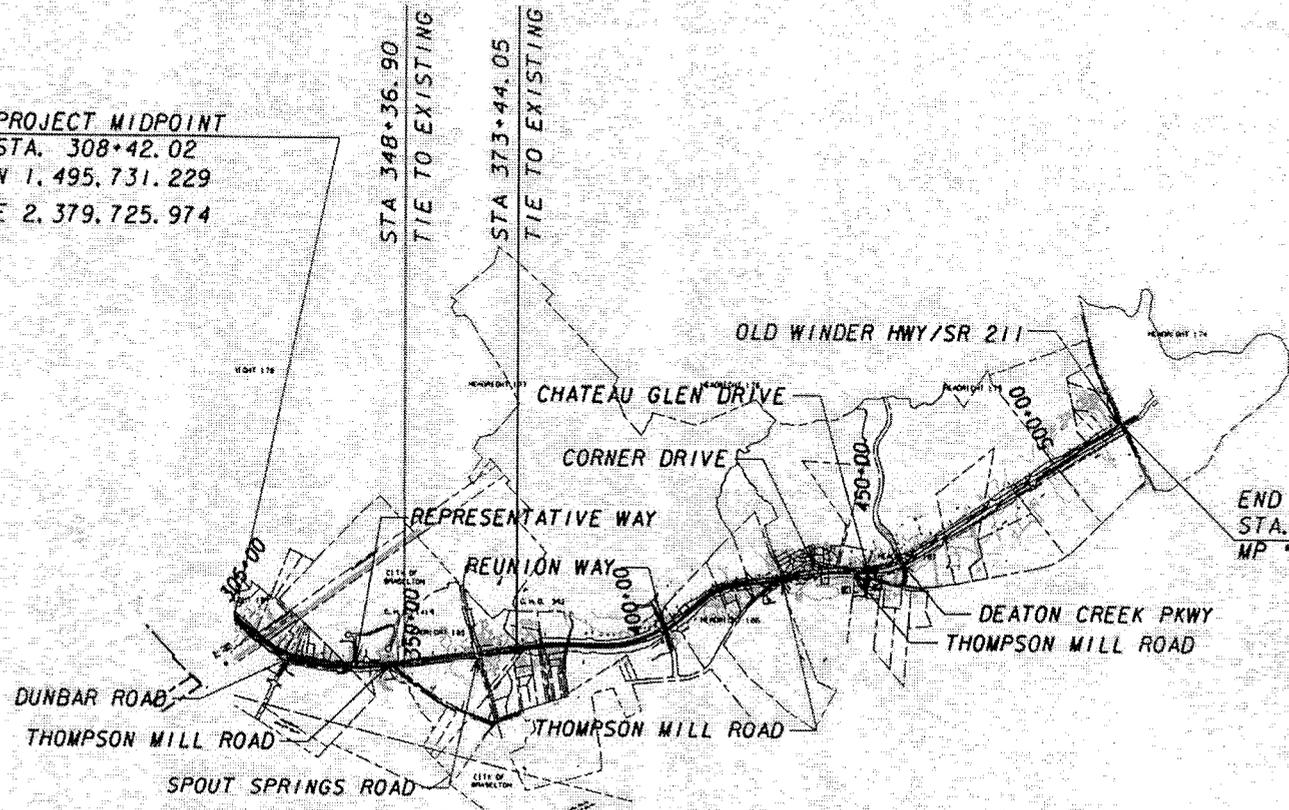
PROJECT MIDPOINT
STA. 308+42.02
N 1,495,731.229
E 2,379,725.974

PROJECT MIDPOINT
STA. 308+42.02
N 1,495,731.229
E 2,379,725.974

STA 348+36.90
TIE TO EXISTING

STA 373+44.05
TIE TO EXISTING

END PROJECT
STA. 517+37.86
MP = 11.991



VALUE ANALYSIS AND CONCLUSIONS

INTRODUCTION

This section describes the value analysis procedures used during the value engineering study on the SR 347/Friendship Road Reconstruction Project. It is followed by separate narratives and conclusions concerning:

- Value Engineering Study Agenda
- Value Engineering Workshop Participants
- Economic Data
- Function Analysis (Project Purpose and Need)
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) pre-study, 2) VE orientation meeting and workshop, and 3) post-study. A Task Flow Diagram, which outlines each of the procedures included in the VE study, is attached for reference.

PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks and gathering necessary project documents from the KCA design team. Information relating to alternative analysis and phasing is also very important, as it tends to drive the construction methods. Information relating to the preliminary cost estimate prepared by KCA was used as the basis for the comparison/analysis during the VE study.

VALUE ENGINEERING WORKSHOP EFFORT

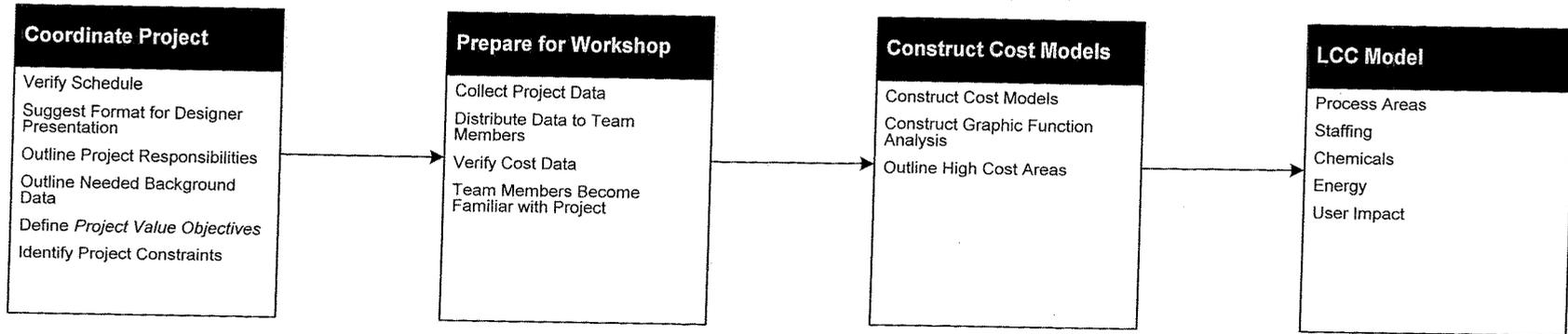
The VE workshop effort consisted of a 30-hour workshop beginning with an orientation meeting on October 1, 2007 and the final VE Presentation on October 4, 2007. During the workshop, the VE job plan was followed in compliance with FHWA and GDOT guidelines for VE studies. The job plan guided the search for alternatives to mitigate or eliminate high cost drivers and potential risk elements. It includes six phases:

- Information Phase
- Function Identification and Analysis
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase
- Implementation Phase

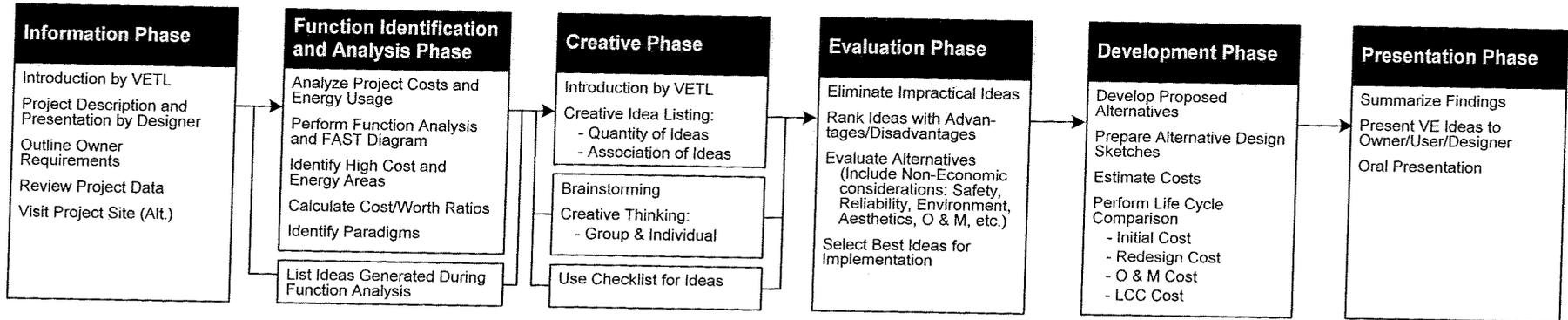


Value Engineering Study Task Flow Diagram

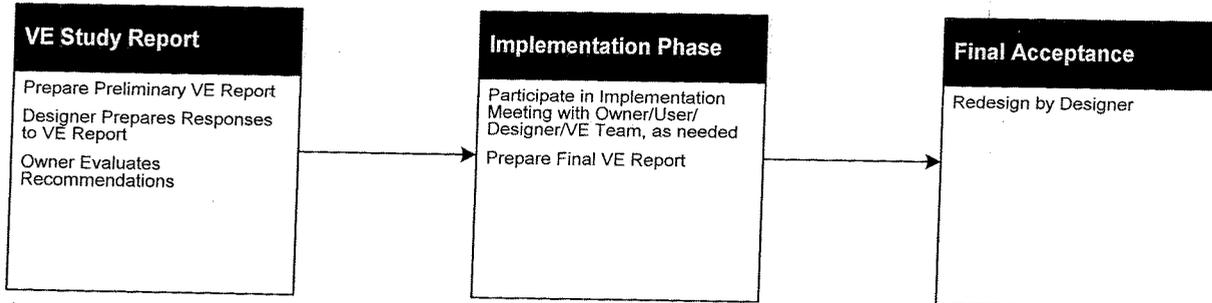
Preparation Effort



Workshop Effort



Post-Workshop Effort



Information Phase

At the beginning of the study, the decisions that have influenced the project design and proposed construction methods had to be reviewed and understood. For this reason, the KCA design team presented information about the project to the VE team on the first day of the VE workshop. Following the presentation meeting, the VE team spent the remainder of the first day reviewing the project documents, discussing the project purpose and need, and identifying the key elements of the project. Throughout the study, the following documents were used to establish guidelines for action and for determining cost implications for the various alternatives:

- Preliminary Design Submittal - Plan and Profile of the Widening, Reconstruction, and Relocation of Friendship Road from I-985 to SR 211, dated September 2007, prepared by KCA.
- Draft Revised Project Concept Report, prepared by KCA.
- Concept Report, prepared by GDOT, dated November 8, 2007.
- Traffic Projections – Friendship Road/Thompson Mill Road, dated September 2004, prepared by GDOT.
- Approved Notice of Location and Design, dated May 31, 2007, prepared by GDOT.
- Flexible Pavement Design Analysis, dated September 5, 2007, prepared by GDOT.
- Preliminary Right-of-Way Cost Estimate, dated June 19, 2006, prepared by GDOT
- Project Cost Estimate Report, dated September 6, 2007, prepared by KCA.
- Soil Survey Summary, dated January 30, 2007, prepared by PSI for KCA.

Function Identification and Analysis Phase

This VE study phase involves the analysis of the project's functions and the creation and listing of ideas. Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function. This creates a high cost-to-worth ratio and the VE team targets these areas for value improvement. A GDOT design criterion was compared to the as designed drawings for general conformance of the typical section.

Creative Phase

The VE team generated as many ideas as possible to provide the necessary functions within the highway project at a lower total life cycle cost, or to improve the quality of the project. Methods to improve on the maintenance of traffic plan were also discussed. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and free association of ideas. Creative idea worksheets were organized by project elements.

Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the Creative Phase in comparison to project objectives established by GDOT. The team evaluated each of the VE ideas for feasibility and incorporation into the project. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those which represented the greatest potential for cost savings or improvement to the project were then developed further to be presented during the presentation phase.

To assist the team in ranking the creative ideas, each of the criteria were discussed, and the following criteria definitions were developed in the project purpose and need.

- Construction Cost – The initial cost of the material is important and should be considered.
- Safety – Safety is very important and must control all decision making.
- Level of Service – The projected LOS must be achieved to meet the purpose and need.
- Impact Upon Trucks – There is a relatively high percentage of trucks in the area.
- Life Cycle Costs – The costs of operating and maintaining the highway are extremely important. These costs would include labor and materials over the next 30 years.
- Right-of-Way Cost – It is important to minimize right-of-way purchase if possible.

The VE team would have liked to develop all the ideas that were generated, but time constraints limited the number of ideas that could be developed. Therefore, each idea was compared with the present design concept in terms of how well it met the design criteria. Advantages and disadvantages were discussed and the ideas were rated on a scale of 1 to 5, with the best ideas rated 5. Ideas rated 4 or 5 were generally developed into written VE alternatives.

Development Phase

Each highly-rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. Analysis also compared each new alternative with others presented in the design report. The VE alternatives and comparisons are included in the Study Results section entitled.

Presentation Phase

The last phase of the VE team's workshop was to present the recommendations. The presentation was held on October 4, 2007 and included personnel from GDOT and the KCA design team. During the meeting, a handout was distributed that included a summary listing of the VE study Alternatives and Design Suggestions. These documents were presented to give the attendees an executive summary of the proposals and the key findings of the VE team.

POST STUDY PROCEDURES

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT and the design team will analyze each alternative and prepare a short response, recommending either incorporating 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.

Implementation Phase

Following distribution of the VE report and collection of written comments from all parties, a VE implementation phase meeting is typically scheduled. At this time, each VE alternative will be considered discussed, and a final disposition made. During this process, a VE alternative may be accepted as written, rejected for cause, modified to improve the idea, or in some cases, the idea may need further study to establish its' merits.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will facilitate a 30-hour value engineering (VE) study on the Preliminary Design Submittal of the SR 347/Friendship Road from I-985 to SR 211, Hall County, Georgia. The Georgia Department of Transportation (GDOT) project management staff and the Kisinger Campo & Associates (KCA) design team will be available to formally present the project at the beginning of the workshop; attend a presentation of the VE alternatives at the conclusion of the VE study; and be available to answer questions during the VE study effort.

The VE study will follow the outline described below and be conducted October 1 - 4, 2007 at the offices of:

GDOT
2 Capital Square, SW
Atlanta, Georgia 30334-9003
Conference Room 264

The point-of-contact is Ms. Lisa Meyers, GDOT Value Engineering Coordinator, who may be reached at 404-651-7468.

VE STUDY AGENDA

Monday, October 1, 2007

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

9:00 am – 12:00 noon **Owner's/Designer's Presentation**

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

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

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

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost models will be refined, as necessary. The VE team will define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost/worth or value index ratios will be calculated, and high cost/low worth areas for study identified. In addition, the VE team will continue defining the function of each element/system to gain a thorough understanding of the projects' Purpose and Need.

Monday, October 1, 2007 (continued)

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

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

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

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

Tuesday, October 2, 2007

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

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

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

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

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

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

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

Wednesday, October 3, 2007

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

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

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

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

Thursday, October 4, 2007

8:00 am - 9:00 am

Development Phase and Preparation for Presentation

9:00 am – 12:00 noon

Presentation Phase

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

Noon - Adjourn

POST-STUDY PHASE

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

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

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

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE Team was organized by GDOT and Lewis & Zimmerman Associates, Inc. to provide specific expertise on the unique project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of highway design, construction, environmental permitting, and VE procedures. Members of the team consisted of the following professionals:

VE Team

David Hamilton, PE, CVS, CCE, LEED® AP	VE Team Leader/Civil	Lewis & Zimmerman Assoc.
Joe Leoni, PE	Highway Design Engineer	ARCADIS
Paresh Parikh, PE	Construction Engineer	Delon Hampton

Project Designer

Michael Reynolds, PE	Project Manager	KCA
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GDOT

Lisa Myers	VE Coordinator	GDOT
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DESIGNER'S PRESENTATION

An overview of the project was presented on Monday, October 1, 2007, by the KCA design team. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE Team "up-to-speed" regarding the overall project specifics including traffic projections, accident history, drainage elements, construction phasing, local permitting issues, and estimated project cost. Additionally, the meeting afforded the design staff the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted on Thursday, October 4, 2007 to review the VE alternatives with the GDOT project management and design staff. The attendees received a copy of the Presentation Outline and Summary of Potential Cost Savings. An attendance list for the meeting is attached.

VE PRESENTATION



PROJECT: **SR 347/Friendship Road From I-985 to SR 211**
 Project No. STP-2984(1), Hall County, Georgia
 Preliminary Submittal - Value Engineering Study

DATE: **04 OCTOBER 2007**

NAME & E-MAIL (please print)	ORGANIZATION/TITLE	PHONE/FAX
David Hamilton, PE, CVS, CCE, LEED ^{AP} em dahamilton@lza.com	Lewis & Zimmerman Associates, Inc. VE Team Leader/Civil	ph 253-925-8741 mob 253-229-7703 fx 253-925-8791
Lisa Myers em lisa.myers@dot.state.ga.us	GDOT - Engineering Services Design Review Engineering Manager	ph 404-651-7468 mob fx 404-463-6131
Jayaram Kottapally em jkottapally@kisingercamp.com		ph mob fx
Rick Reasans em rick.reasans@dot.state.ga.us	OCD PM	ph mob fx
Fred Enloe em fenloe@kisingercamp.com	KCA DESIGN	ph (404) 607-1676 mob fx
Parash J. Parikh em pparikh@delonhampton.com	DHA	ph (404) 419-8434 mob fx
Brian Sumner em brian.sumner@dot.state.ga.us	ES	ph mob fx
JOE LEONI em JOE.LEONI@ARCADIS-US.COM	ARCADIS	ph 770-431-8666 mob fx
em		ph mob fx
em		ph mob fx

VE STUDY SIGN-IN SHEET

Project No.: STP-2984(1)

County: Hall

PI No.: 162430

Date: 10/1-4/07

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
Lisa L. Myers	00244168	Engineering Services	404-651-7468	lisa.myers@dot.state.ga.us
James Magnus Rick Reardon		OCD	404-463-3832	rick.reardon@dot.state.ga.us
Funmi Adesesan	86922496	DEL	404-699-6866	ofunmilayo.adesesan@dot.state.ga.us
Joe Leoni		ARCADIS	770-431-8666	Joe.Leoni@ARCADIS-UG.com
DAVE HAMILTON		LZA	253-925-8741	DAHAMILTON@LZA.COM
Jerry MILLIGAN		GDOT R/U	770-986-1541	jerry.milligan@dot
BRIAN SUMMERS	00208175	GDOT ES	---	brian.summers@dot.state.ga.us
Jayaram Kottapally		KCA	404-607-1676	jkottapally@kisingercampo.com
Paresh J. Parikh		DHA	404-419-8434	pparikh@delconhampton.com
Mike Reynolds		MCR	607-1676	mreynolds@kisingercampo.com
Ken Werho		GDOT TO-DES REV.	404-635-8144	Ken.WERHO@
NIRAL PATEL	00327662	DOT D-1	770-536-5759	niral.patel@dot.state.ga.us

ECONOMIC DATA

Economic criteria used for evaluation were developed by the VE team with information gathered from the Federal Office of Management & Budget. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for the planning project period and interest rates are based on the following parameters:

Year of Analysis:	2007
Construction Dollars Based Upon:	2007
Economic Planning Life:	30 years starting in 2008
Bond (Discount) Rate:	3.1%
Inflation/Escalation Rate:	0.0% (Constant dollar method)
Net Discount Rate:	3.1%
Uniform Present Worth (UPW) Factor:	19.3495
Cost of Power/Electricity (Average without Demand Charge)	\$0.10/kwh
Cost of Labor (\$/hr)	\$60/hr

Schedule Work

The project is planned to begin construction in the summer of 2009 and be completed by late fall of 2011. The project should be completed within a 24- to 30-month construction duration depending upon award date, shop drawing approval, and material availability.

Total Present Worth

Discussions during the VE study included impacts of 30-year present worth cost for major elements.

VE Alternatives Mark-up

Cost estimates were prepared for each of the VE alternatives using unit prices contained in the project cost estimate prepared by the design team. The unit prices contained in the estimate are considered to include all contractor mark-ups, mobilization, overhead, and profit. A markup of 10% was added to account for engineering and construction services.

COST MODEL

The SR 347/Friendship Road Reconstruction Project will greatly improve safety and capacity along the alignment in this area north of Atlanta while reducing accidents caused by deficiencies in the corridor. To achieve these benefits, a considerable investment in the infrastructure is required, including construction of six- and four-lane sections, signalized intersections, addition of sidewalks and bike lanes, and acquisition of the needed right-of-way. The total construction cost of the project is estimated at approximately \$62.4M, plus right-of-way in the amount of \$33.3M.

Project Cost

The data used to analyze costs by design element are presented on the attached Cost Histogram table. To gain an overview of the total project cost, Pareto Analysis was prepared. This table presents total project costs by roadway element.

From the cost models, the following areas showed potential for further discussion and value improvement.

Roadway Section

- Minimize right-of-way if possible
- Consider multi-use path
- Eliminate bike lanes

Profile

- Raise, reduce soil export requirements
- Raise above rock elevations

Drainage

- Review temp. sedimentation basins

Construction Management

- Bid job as one large contract
- Add cost for escalation

Preliminary Right-of-Way Cost Estimate

Date: April 18, 2006
Project: STP-2984 (1) **P.I. Number:** 162430
Existing/Required R/W: Varies/Varies **No. Parcels:** 210
Project Termini: Friendship Rd. from I-985 to SR 211
Project Description: Widening, Reconstruction, and Relocation of Friendship Rd.

Land:

Commercial	20% of 73.65 ac. @ \$ 175,000/ac	=	\$ 2,577,750
Residential	80% of 73.65 ac. @ \$ 75,000/ac	=	<u>\$ 4,419,000</u>
			\$ 6,996,750

Improvements:

1 businesses, 15 houses, 2 mobile homes, curbing, paving, signs, fencing and site improvements
 \$ 1,128,000

Relocation:

1 Commercial @ \$ 25,000 / parcel	=	\$ 25,000	
17 Residential @ \$ 20,000 / parcel	=	<u>\$ 220,000</u>	
			\$ 245,000

Damages:

Proximity - 15 Parcels	\$ 1,227,000		
			<u>\$ 1,227,000</u>
			\$ 9,596,750

Net Cost		\$	9,596,750
Scheduling Contingency 55 %		\$	5,278,212
Adm/Court Cost 60 %		\$	8,924,977
Inflation Factor 40 %		\$	<u>9,519,976</u>
		\$	33,319,916

Total Cost \$ **33,320,000**

Prepared By : _____
 GDOT R/W

Approved : _____

Estimate Report for file "162430_07_09_06"

Section ROADWAY					
Item Number	Quantity	Units	Unit Price	Item Description	Cost
150-1000	1	LS	3166000.00	TRAFFIC CONTROL -	3166000.00
153-1300	1	EA	76829.70	FIELD ENGINEERS OFFICE TP 3	76829.70
201-1500	1	LS	680000.00	CLEARING & GRUBBING -	680000.00
205-0001	1410000	CY	4.82	UNCLASS EXCAV	6796200.00
310-1101	240174	TN	19.98	GR AGGR BASE CRS, INCL MATL	4798676.52
402-3121	140101	TN	75.00	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	10507575.00
402-3130	30021	TN	75.00	RECYCLED ASPH CONC 12.5 MM SUPERPAVE, GP 2 ONLY, INCL BITUM MATL & H LIME	2251575.00
402-3190	40029	TN	75.00	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	3002175.00
413-1000	436680	GL	2.00	BITUM TACK COAT	873360.00
441-0104	46444	SY	33.67	CONC SIDEWALK, 4 IN	1563769.48
441-0754	74311	SY	54.31	CONCRETE MEDIAN, 7 1/2 IN	4035830.41
441-6222	85000	LF	19.04	CONC CURB & GUTTER, 8 IN X 30 IN, TP 2	1618400.00
441-6740	83600	LF	15.02	CONC CURB & GUTTER, 8 IN X 30 IN, TP 7	1255672.00
500-3101	2500	CY	600.77	CLASS A CONCRETE	1501925.00
511-1000	305000	LB	0.94	BAR REINF STEEL	286700.00
550-1150	5856	LF	44.00	STORM DRAIN PIPE, 15 IN, H 1-10	257664.00
550-1180	66704	LF	45.96	STORM DRAIN PIPE, 18 IN, H 1-10	3065715.84
550-1240	16984	LF	54.17	STORM DRAIN PIPE, 24 IN, H 1-10	920023.28
550-1300	5620	LF	70.50	STORM DRAIN PIPE, 30 IN, H 1-10	396210.00
550-1360	6804	LF	86.79	STORM DRAIN PIPE, 36 IN, H 1-10	590519.16
550-1480	808	LF	127.33	STORM DRAIN PIPE, 48 IN, H 1-10	102882.64
550-1600	440	LF	181.88	STORM DRAIN PIPE, 60 IN, H 1-10	80027.20
550-4118	88	EA	275.65	FLARED END SECTION 18 IN, SIDE DRAIN	24257.20
550-4218	12	EA	672.20	FLARED END SECTION 18 IN, STORM DRAIN	8066.40
550-4224	12	EA	781.26	FLARED END SECTION 24 IN, STORM DRAIN	9375.12
550-4230	4	EA	951.12	FLARED END SECTION 30 IN, STORM DRAIN	3804.48
550-4236	12	EA	1252.70	FLARED END SECTION 36 IN, STORM DRAIN	15032.40
550-4242	8	EA	1656.57	FLARED END SECTION 42 IN, STORM DRAIN	13252.56
611-8055	20	EA	1733.33	ADJUST MINOR STRUCTURE TO GRADE	34666.60
668-1100	700	EA	2784.43	CATCH BASIN, GP 1	1949101.00
668-1110	1740	LF	285.46	CATCH BASIN, GP 1, ADDL DEPTH	496700.40
668-1200	32	EA	4010.77	CATCH BASIN, GP 2	128344.64
668-1210	260	LF	346.09	CATCH BASIN, GP 2, ADDL DEPTH	89983.40
668-2100	132	EA	3987.53	DROP INLET, GP 1	526353.96
668-2110	28	LF	353.03	DROP INLET, GP 1, ADDL DEPTH	9884.84
668-2200	4	EA	4918.88	DROP INLET, GP 2	19675.52
668-2210	4	LF	360.51	DROP INLET, GP 2, ADDL DEPTH	1442.04
Section Sub Total:					\$51,157,670.79

Section EROSION CONTROL					
Item Number	Quantity	Units	Unit Price	Item Description	Cost
163-0232	48	AC	679.69	TEMPORARY GRASSING	32625.12
163-0240	1600	TN	161.07	MULCH	257712.00
163-0300	120	EA	1655.76	CONSTRUCTION EXIT	198691.20
163-0501	12	EA	764.08	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 1	9168.96
163-0503	220	EA	529.93	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	116584.60
163-0520	20560	LF	17.42	CONSTRUCT AND REMOVE TEMPORARY PIPE SLOPE DRAIN	358155.20
163-0530	10280	LF	4.20	CONSTRUCT AND REMOVE BALED STRAW EROSION CHECK	43176.00
163-0550	1192	EA	282.90	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	337216.80
165-0010	174840	LF	0.78	MAINTENANCE OF TEMPORARY SILT FENCE, TP A	136375.20

165-0085	12	EA	170.84	MAINTENANCE OF SILT CONTROL GATE, TP 1	2050.08
165-0087	220	EA	169.84	MAINTENANCE OF SILT CONTROL GATE, TP 3	37364.80
165-0101	120	EA	607.78	MAINTENANCE OF CONSTRUCTION EXIT	72933.60
165-0105	1192	EA	96.97	MAINTENANCE OF INLET SEDIMENT TRAP	115588.24
167-1000	2	EA	1278.47	WATER QUALITY MONITORING AND SAMPLING	2556.94
167-1500	48	MO	944.75	WATER QUALITY INSPECTIONS	45348.00
171-0010	174840	LF	1.63	TEMPORARY SILT FENCE, TYPE A	284989.20
171-0030	51420	LF	3.83	TEMPORARY SILT FENCE, TYPE C	196938.60
441-0204	5600	SY	34.02	PLAIN CONC DITCH PAVING, 4 IN	190512.00
603-2182	8000	SY	61.02	STN DUMPED RIP RAP, TP 3, 24 IN	488160.00
603-7000	8000	SY	4.71	PLASTIC FILTER FABRIC	37680.00
700-6910	480	AC	1023.43	PERMANENT GRASSING	491246.40
700-7000	3600	TN	59.64	AGRICULTURAL LIME	214704.00
700-7010	1200	GL	22.32	LIQUID LIME	26784.00
700-8000	1056	TN	292.83	FERTILIZER MIXED GRADE	309228.48
700-8100	24000	LB	2.31	FERTILIZER NITROGEN CONTENT	55440.00
710-9000	8000	SY	4.38	PERMANENT SOIL REINFORCING MAT	35040.00
716-2000	226000	SY	1.20	EROSION CONTROL MATS, SLOPES	271200.00
Section Sub Total:					\$4,470,919.02

Section TRAFFIC SIGNS & MARKING

Item Number	Quantity	Units	Unit Price	Item Description	Cost
632-0003	15	EA	16286.19	CHANGEABLE MESSAGE SIGN, PORTABLE, TYPE 3	244292.85
636-1020	1500	SF	15.19	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	22785.00
636-1031	3375	SF	19.00	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING TP 6	64125.00
636-1032	150	SF	20.80	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING TP 6	3120.00
636-2070	7125	LF	8.27	GALV STEEL POSTS, TP 7	58923.75
636-2080	300	LF	10.87	GALV STEEL POSTS, TP 8	3261.00
636-3010	15	EA	538.23	GROUND-MOUNTED BREAKAWAY SIGN SUPPORT	8073.45
639-2002	450	LF	3.30	STEEL WIRE STRAND CABLE, 3/8 IN	1485.00
639-3003	30	EA	8120.35	STEEL STRAIN POLE, TP III	243610.50
653-0120	375	EA	73.54	THERMOPLASTIC PVMT MARKING, ARROW, TP 2	27577.50
653-0170	300	EA	84.44	THERMOPLASTIC PVMT MARKING, ARROW, TP 7	25332.00
653-0210	112	EA	117.24	THERMOPLASTIC PVMT MARKING, WORD, TP 1	13189.50
653-1501	225000	LF	0.68	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	153000.00
653-1502	150000	LF	0.62	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	93000.00
653-1704	3375	LF	4.53	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	15288.75
653-1804	26250	LF	2.08	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	54600.00
653-3501	150000	GLF	0.51	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	76500.00
654-1001	750	EA	3.14	RAISED PVMT MARKERS TP 1	2355.00
654-1003	5625	EA	3.68	RAISED PVMT MARKERS TP 3	20700.00
654-1010	150	EA	37.81	RAISED PVMT MARKERS TP 10	5671.50
Section Sub Total:					\$1,136,890.80

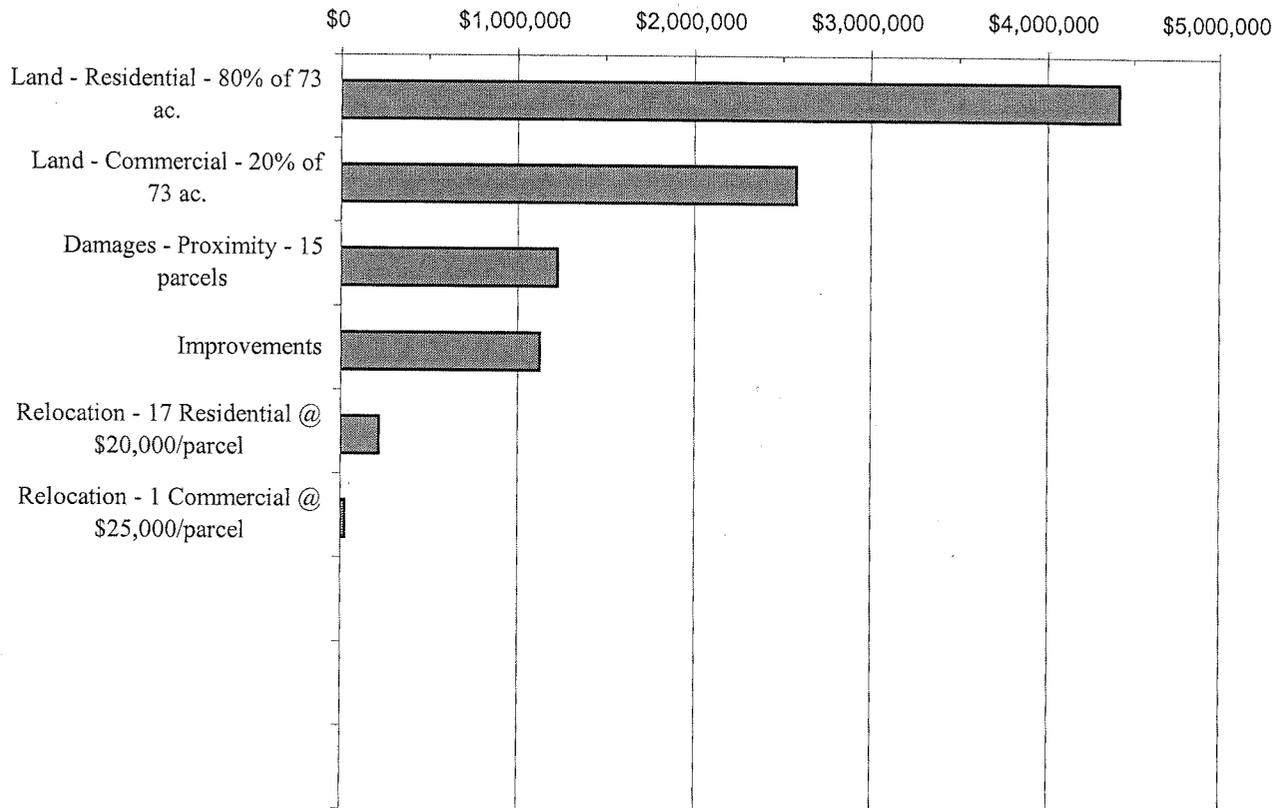
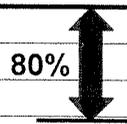
Total Estimated Cost: \$56,765,480.61

COST HISTOGRAM



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1) - Hall County, Georgia

RIGHT-OF-WAY ONLY	COST	PERCENT	CUM. PERCENT
Land - Residential - 80% of 73 ac.	4,419,000	46.05%	46.05%
Land - Commercial - 20% of 73 ac.	2,577,750	26.86%	72.91%
Damages - Proximity - 15 parcels	1,227,000	12.79%	85.69%
Improvements	1,128,000	11.75%	97.45%
Relocation - 17 Residential @ \$20,000/parcel	220,000	2.29%	99.74%
Relocation - 1 Commercial @ \$25,000/parcel	25,000	0.26%	100.00%
Right-of-Way Subtotal			
Scheduling Contingency 55.00%	5,278,213	100.00%	
Admin/Court Costs 60.00%	8,924,978		
Inflation Factor 40.00%	9,519,976		
TOTAL CONSTRUCTION & RIGHT-OF-WAY \$	\$ 33,319,916	Comp Markup:	



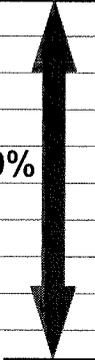
COST HISTOGRAM

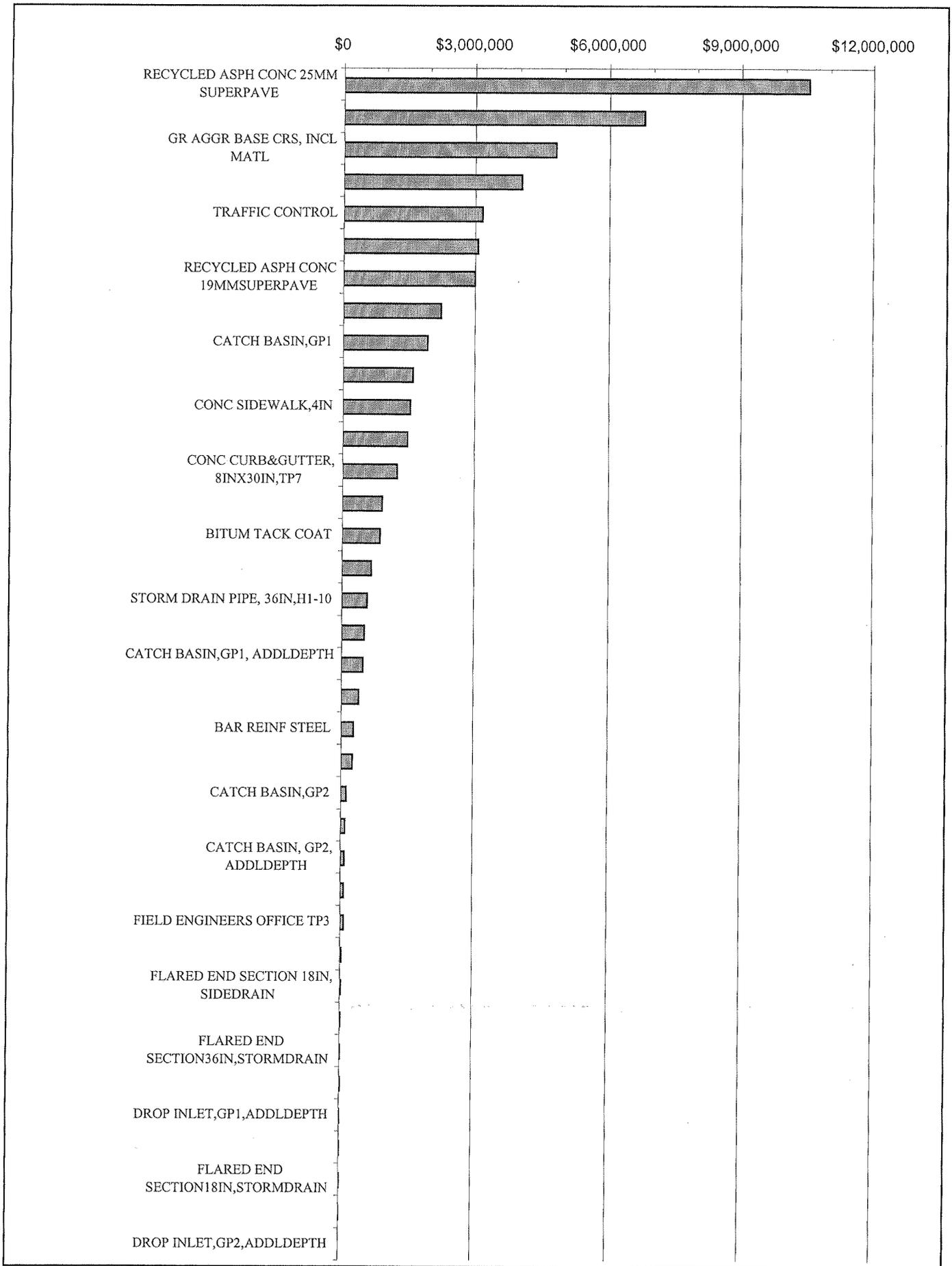


PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1) - Hall County, Georgia

ROADWAY ITEMS ONLY	COST	PERCENT	CUM. PERCENT
RECYCLED ASPH CONC 25MM SUPERPAVE	\$10,507,575	20.54%	20.54%
UNCLASS EXCAVATION	\$6,796,200	13.28%	33.82%
GR AGGR BASE CRS, INCL MATL	\$4,798,677	9.38%	43.20%
CONCRETE MEDIAN, 71/2 IN	\$4,035,830	7.89%	51.09%
TRAFFIC CONTROL	\$3,166,000	6.19%	57.28%
STORM DRAIN PIPE, 18IN, H1-10	\$3,065,716	5.99%	63.27%
RECYCLED ASPH CONC 19MMSUPERPAVE	\$3,002,175	5.87%	69.14%
RECYCLED ASPH CONC 12.5MMSUPERPAVE	\$2,251,575	4.40%	73.54%
CATCH BASIN, GP1	\$1,949,101	3.81%	77.35%
CONC CURB & GUTTER, 8INX30IN, TP2	\$1,618,400	3.16%	80.52%
CONC SIDEWALK, 4IN	\$1,563,769	3.06%	83.57%
CLASS A CONCRETE	\$1,501,925	2.94%	86.51%
CONC CURB&GUTTER, 8INX30IN, TP7	\$1,255,672	2.45%	88.97%
STORMDRAIN PIPE, 24IN, H1-10	\$920,023	1.80%	90.76%
BITUM TACK COAT	\$873,360	1.71%	92.47%
CLEARING & GRUBBING-	\$680,000	1.33%	93.80%
STORM DRAIN PIPE, 36IN, H1-10	\$590,519	1.15%	94.95%
DROP INLET, GP1	\$526,354	1.03%	95.98%
CATCH BASIN, GP1, ADDLDEPTH	\$496,700	0.97%	96.95%
STORM DRAIN PIPE, 30IN, H1-10	\$396,210	0.77%	97.73%
BAR REINF STEEL	\$286,700	0.56%	98.29%
STORM DRAIN PIPE, 15IN, H1-10	\$257,664	0.50%	98.79%
CATCH BASIN, GP2	\$128,345	0.25%	99.04%
STORM DRAIN PIPE, 48IN, H1-10	\$102,883	0.20%	99.24%
CATCH BASIN, GP2, ADDLDEPTH	\$89,983	0.18%	99.42%
STORMDRAIN PIPE, 60IN, H1-10	\$80,027	0.16%	99.58%
FIELD ENGINEERS OFFICE TP3	\$76,830	0.15%	99.73%
ADJUST MINOR STRUCTURE TO GRADE	\$34,667	0.07%	99.80%
FLARED END SECTION 18IN, SIDEDRAIN	\$24,257	0.05%	99.84%
DROP INLET, GP2	\$19,676	0.04%	99.88%
FLARED END SECTION 36IN, STORMDRAIN	\$15,032	0.03%	99.91%
FLARED END SECTION 42IN, STORMDRAIN	\$13,253	0.03%	99.94%
DROP INLET, GP1, ADDLDEPTH	\$9,885	0.02%	99.96%
FLARED END SECTION 24IN, STORMDRAIN	\$9,375	0.02%	99.97%
FLARED END SECTION 18IN, STORMDRAIN	\$8,066	0.02%	99.99%
FLARED END SECTION 30IN, STORMDRAIN	\$3,804	0.01%	100.00%
DROP INLET, GP2, ADDLDEPTH	\$1,442	0.00%	100.00%
Construction and Right-of-Way Subtotal	51,157,670	100.00%	
E&C Rate (Applied to construction cost only)	10.00%	5,115,767	
TOTAL CONSTRUCTION & RIGHT-OF-WAY	\$ 56,273,437	Comp Markup:	

80%





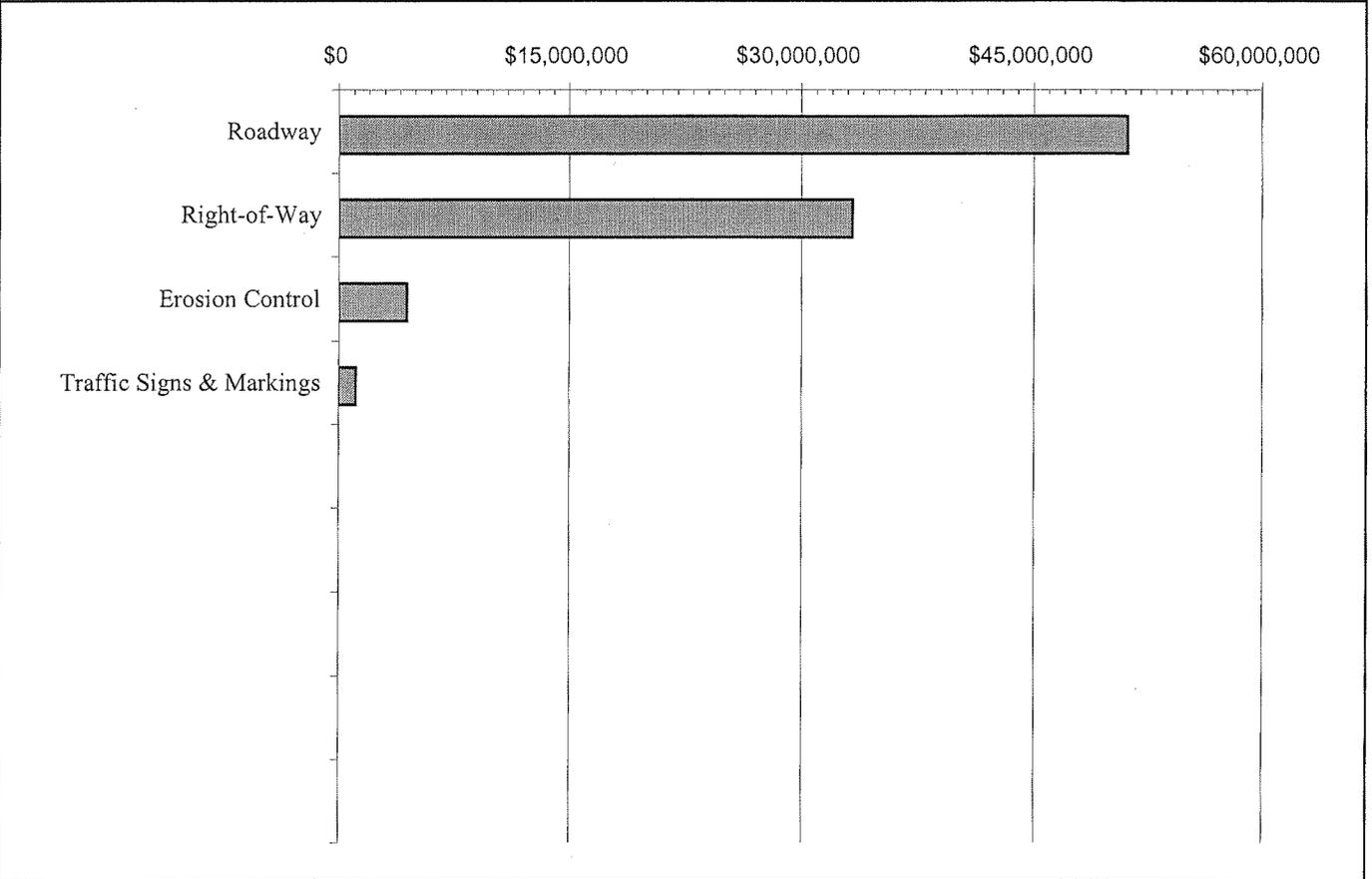
COST HISTOGRAM



PROJECT: **SR 347/FRIENDSHIP ROAD/I-985 TO SR 211**
Project No. STP-2984(1) - Hall County, Georgia

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
Roadway	51,157,670	56.79%	56.79%
Right-of-Way	33,320,000	36.99%	93.78%
Erosion Control	4,470,919	4.96%	98.74%
Traffic Signs & Markings	1,136,890	1.26%	100.00%
<i>Construction and Right-of-Way Subtotal</i>			
	<i>90,085,479</i>	<i>100.00%</i>	
E&C Rate (Applied to construction cost only)	10.00%	5,676,548	
TOTAL CONSTRUCTION & RIGHT-OF-WAY		\$ 95,762,027	Comp Markup:

80% ↑↓



FUNCTION ANALYSIS

Function Analysis of the SR 347/Friendship Road Reconstruction Project was performed to understand the project purpose and need, define the requirements for each project element, ensure a complete and thorough understanding by the VE team of the basic function(s), and identify other public goals through the corridor. A Random Function Analysis Worksheet for the project elements is attached.

Function Analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These support elements add cost to the final product, but may have a relatively low worth to the basic function. This creates a high cost-to-worth ratio.

The Random Function Analysis worksheet includes verb and noun function definition of each project element, and the VE team's identification of basic or secondary functions. This exercise stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

The key issues that evolved from the Function Analysis session were the concurrence of the project needs and purpose. The basic function of the project is to "Increase Capacity." Adding turn lanes, redesigning the intersections, and improving the sight stopping distance will greatly improve safety, reduce delays in the corridor, and help to meet other required project goals. Limiting access to the road by terminating several of the side streets will be a great help in reducing the several uncontrolled left turns. Interestingly enough though, the current accident rate in the corridor is nearly half of the state average.

The goals as established for the project appear consistent with the functions identified by the VE team. Therefore, the function analysis justifies the project need and purpose and will greatly improve driving conditions along this corridor. This project will be a marked improvement in the aesthetics of the corridor and provide added functionality for pedestrians and bicyclists in the area.

RANDOM FUNCTION ANALYSIS



PROJECT: **FRIENDSHIP ROAD FROM I-985 TO SR 211**
Project No. STP-2984 (1) - Hall County, Georgia

SHEET NO.: 1 of 1

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
Total Project Purpose and Need	<i>Improve</i>	<i>LOS</i>	<i>B</i>
	Accommodate	Growth	G
	Move	Cars	HO
	Reduce	Accidents	G
	<i>Increase</i>	<i>Capacity</i>	<i>B</i>
	Allow	Movements	RS
	Meet	Standards	G
	Improve	Intersections	RS
	Control	Traffic	RS
	Improve	Geometrics	RS
	Relocate	Utilities	RS
	Control	Budget	G
	Meet	Schedule	G
	Protect	Environment	RS
	Minimize	Right-of-Way Takes	G
	Manage	Drainage	RS
	Satisfy	Stakeholders	G
	Control	Traffic	RS
	Maximize	Safety	G
	Accommodate	Bikes/Pedestrians	RS
	Balance	Cut/Fill	G
	Improve	Corridor	G
	Protect	Historical Properties	G
	Eliminate	Exceptions	RS
	Cross	Streams	RS
	Connect	Corridors	G

Function defined as:	Action Verb	Kind:	B = Basic	HO = Higher Order
	Measurable Noun		S = Secondary	LO = Lower Order
			RS = Required Secondary	G = Goal

CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the Creative Phase, numerous ideas, alternative proposals and/or recommendations were generated for the SR 347/Friendship Road Project using conventional brainstorming techniques as recorded on the following pages.

The creative session yielded a total of 19 ideas for further consideration by the team. These ideas were grouped into the following categories with letter prefixes to identify the area of study.

CATEGORY	PREFIX
Alignment	AL
Typical Section	S
Profile	P
Drainage	D
Construction Management	CM
Right-of-Way	RW

These ideas were discussed between the VE team members to identify the advantages/disadvantages of each. The VE Team compared each of the ideas with the as-designed solution determining whether it improved value, was equal in value, or lessened the value of the presented solution in terms of capital cost, schedule, functionality/safety, maintainability, durability and life cycle costs.

To assist the team in ranking the creative ideas, each of the criteria were discussed, and the following criteria definitions were developed from the statement of project need as presented by GDOT on the first day of the VE study:

- Construction Cost – The initial cost of the material is important and should be considered.
- Safety – Safety is very important and must control all decision making.
- Level of Service – The projected LOS must be achieved to meet the purpose and need.
- Impact Upon Trucks – There is a reasonably high percentage of trucks in the area.
- Life Cycle Costs – The costs of operating and maintaining the highway is extremely important. These costs would include labor and materials over the next 30 years.
- Right-of-Way Cost – It is important to minimize right-of-way purchase if possible.

Creative Idea Ranking

The ideas were ranked on a qualitative scale of 1 (poor) to 5 (excellent) on how well the VE team believed the idea met the project purpose and need criteria shown above. The higher rated ideas, with scores of 4 or 5, were then developed into formal alternatives and included in the Study Report. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved safety, accident reduction, constructability or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestion. This designation is also used when an idea increases cost resulting from improving the functionality of the project or system, and is deemed by the VE team to be of significant value to the owner or designer.

Typically, all ideas rated 4 or 5 are developed by the VE team and included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research, which indicated the concept as not being cost-effective or technically feasible. All readers are encouraged to review the attached Creative Idea Listing worksheet since it may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING



PROJECT: SR 347/FRIENDSHIP ROAD FROM I-985 TO SR 211 Project No. STP-2984 (1) - Hall County, Georgia	SHEET NO.:	1 of 1
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NO.	IDEA DESCRIPTION	RATING
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PROFILE (P)		
P-1	Raise the profile in areas of rock, i.e., STA 391, STA 402, and STA 170.	5
P-2	Raise the sag curves to create more area for fill at STA 415.	5
P-3	Raise the profile at STA 275.	5
TYPICAL SECTION (S)		
S-1	Design for 6 lanes, but only construct 4 lanes now; move sidewalks to outside permanent location instead of relocating in the future.	4
S-2	Use multi-use path in lieu of bike lanes.	4
S-3	Reduce the outside lane from 12 ft. to 11 ft.	4
S-4	Use 24-in. curb/gutter in lieu of 30-in.	4
S-5	Use permeable asphalt pavement to reduce runoff.	Drop
S-6	Use narrower median.	2
S-7	Add MSE walls in fill areas to reduce the amount of right-of-way.	3
S-8	Use a rural section in lieu of an urban section.	Drop
S-9	Use grassed median in lieu of paved median.	4
S-10	Use 4-in. concrete in median in lieu of 7 ½-in.	4
ALIGNMENT (A)		
A-1	Make the project 6 lanes everywhere, now.	DS
DRAINAGE (D)		
D-1	Use precast sedimentation vaults in lieu of purchased right-of-way for ponds.	Drop
D-2	Reduce the number of catch basins.	DS
CONSTRUCTION MANAGEMENT (CM)		
CM-1	Bid the project as one large job to maintain options for cut/fill balancing.	DS
CM-2	Look for home for 500,000 CY of soil.	See P-1
RIGHT-OF-WAY (RW)		
RW-1	Minimize cut/fill areas to reduce right-of-way requirements.	See P-1/P-2

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