Value Engineering Study Report
Project –IM-75-3(189)
Gordon County

Redbud Road, P.I. #610750

Preserve Roadway - Integrity – Serviceability – Safety

Value Management Team:

PBS&J

Design Team:

The LAI Engineering

April 4, 2007

April 4, 2007

Ms. Lisa Myers
Design Review Engineer Manager
Georgia Department of Transportation
#2 Capitol Square, Room 266
Atlanta, GA 30334

RE: Submittal of the final Value Engineering Report
IM-75-3(189) Redbud Road
PI No.: 610750 Gordon County
PBS&J Project Task Order No. 6

Dear Ms. Myers:

Please find enclosed four (4) hard copies and a CD of our final Value Engineering Report for the S.R. 156 Redbud Road/ I-75 Interchange Improvements, Gordon County, as referenced above.

This Value Engineering Study, which was performed during the period March 12 through March 15, 2007, identified ***15 Alternative Ideas*** of which ***8*** **are recommended for implementation**. The VE Team also identified ***3 Design Suggestion Ideas*** which are recommended for the Engineer to consider in his final design. We believe that the **8 Alternative Ideas** recommended may have a significant positive affect on the project.

We trust that you will find this report to be in proper order. It should be noted that the results of this workshop are volatile in that they can be overcome by the events that accompany the expeditious continuance of the design process. Accordingly, we encourage an equally expeditious implementation meeting to design the disposition of the contents of this report.

On behalf of our VE Team, we thank you very much for this opportunity to work with you and the hard working staff of the Georgia Department of Transportation.

Yours truly,
PBS&J

Les M. Thomas

Les M. Thomas, P.E., CVS-Life
VE Team Leader

Value Engineering Study Report

IM-75-3(189) – Redbud Road
Gordon County, Georgia

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Executive Summary

Executive Summary

INTRODUCTION

This report summarizes the analysis and conclusions by the PBS&J Value Engineering workshop team as they performed a VE Study during the period of March 12 through 15, 2007 in Atlanta, Georgia for the Georgia Department of Transportation. The subject of the Value Engineering study was **IM-75-3(189) – Redbud Road**. The design is being performed by The LAI Engineering

PROJECT DESCRIPTION

This project consists of reconstruction of the I-75/SR 156 interchange and also includes widening reconstruction of SR 156/Redbud Road to provide a five-lane section through the interchange from Curtis Parkway/Warriors Path to Newtown Church Road/Harmony Church Road. The project also includes the replacement of the I-75 bridge over SR 156.

More information about this project may be found in the tabbed section of this report entitled ***Project Description***.

VALUE ENGINEERING PROCESS

The Value Engineering Team followed the Seven Step Value Engineering job plan as promulgated by Georgia Department of Transportation. This Seven Step Job Plan includes the following:

- Investigation
- Analysis
- Speculation
- Evaluation
- Development
- Recommendation
- Presentation

This report is a component of the Presentation Phase. As part of the VE workshop in Atlanta, the team made an informal presentation of their results on the last morning of the workshop. This report is intended to formalize the workshop results and set the stage for a formal implementation meeting in which alternatives and design suggestions will typically be accepted, accepted with modifications, or rejected for cause. The worksheet that follows, along with the formally developed alternatives and design suggestions can be used as a "score sheet" for the implementation meeting. It is also included in this report to identify, on a summary basis, the results of the workshop. The reader is encouraged to visit the third tabbed section of this report entitled ***Study Results*** for a review of the details of the developed alternatives. The tabbed section

Project Description includes information about the project itself and the tabbed section ***Value Engineering Process*** presents the detail process of the Value Engineering Study.

THE STUDY RESULTS

During the speculation phase the VE Team identified ***15 Alternative Ideas*** that appeared to hold potential for reducing the construction cost, improving the end product and/or reducing the difficulty and time of project construction.

After the evaluation phase was completed, **8** ***Alternative Ideas*** and **3 Design Suggestions** remained for further consideration. These Alternative Ideas and Design Suggestions may be found, in their documented form, in the section of this report entitled ***Study Results***. The following ***Summary of Alternatives and Design Suggestions*** coupled with the documentation of the developed alternatives should provide the reader with the information required to fully evaluate the merits of each of the alternatives.

SUMMARY OF ALTERNATIVES & DESIGN SUGGESTIONS

April 4, 2007

Georgia Department of Transportation

IM-75-3(189) Redbud Road

P.I. Number: 610750 Gordon County

Alternative Number	Description of Alternative	Initial Cost Savings	Implemented Cost Savings/Disposition	FINAL DISPOSITION
	(B) Bridge Work			
B-1	Remove end spans and use wall abutments	$1,301,353.00		
B-2	Build entire right side and shift traffic and then build balance of bridge	$347,153.00		
	(P) Paving			
P-2	Use GDOT separation of 100' limited access	$4,263,212*		
P-3	For future growth condition use minimum 11' lane widths	$618,165.00		
P-5	Delete right turn lane Sta8+00 to12+00 East bound 156	DS		
P-6	Eliminate concrete paving on ramps	$645,878.00		
P-7	Use keystone wall in lieu of pour in place retaining wall	$112,117.00		
P-8	Eliminate all construction west of Curtis Drive	DS		
P-9	Provide additional left turn storage for north movement. on 156	DS		
P-11 and P-12 combined	Move South bound on/off to the east and the North bound on/off ramps to the west (moving ramps closer together)	$4,000,000*		

* These estimated initial cost savings reflect the VE Team's estimate of $4,000,000 for four (4) service station right-of-way acquisitions which could be realized.

Study Results

Study Results

Introduction

This section includes the study results presented in the form of fully developed value engineering alternatives that include descriptions of the original design, description of the alternative design configurations, comments on the technical justifications, opportunities and risks associated with the alternatives, sketches, calculations and technical justification for these alternatives. For the most part, these fully developed alternatives represent an array of choices that clearly could have an impact on the eventual cost and performance of the finished project.

The documented alternatives also include Design Suggestions. As their name implies, these are short write-ups making note of VE perspectives on technical issues and sharing some thoughts for consideration as the design moves forward.

This introductory sheet is followed by a *Summary of Alternatives & Design Suggestions* table. It should be noted that the alternatives that are included, which have cost estimates attached are not necessarily representative of the final cost outcome for each alternative. Some of these alternatives have components that are mutually exclusive so they may not be added together.

The users of this report are asked to consider these alternatives and design suggestions as a smorgasbord of choices for selection and use as the project moves forward. The following *Summary of Alternatives & Design Suggestions* may also be used as a "score sheet" within the bounds of an implementation meeting.

Cost Calculations

The cost calculations are intended only as a guide to the approximate results that might be expected from implementation of the alternatives. They should be helpful in making clear choices as to the pursuit of individual alternatives.

A composite mark-up of 10% for the construction cost comparisons was derived from the cost estimate for the project. This estimate can be found in the section of this report entitled ***Project Description.***

SUMMARY OF ALTERNATIVES & DESIGN SUGGESTIONS

April 4, 2007

Georgia Department of Transportation

IM-75-3(189) Redbud Road

P.I. Number: 610750 Gordon County

Alternative Number	Description of Alternative	Initial Cost Savings	Implemented Cost Savings/Disposition	FINAL DISPOSITION
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* These estimated initial cost savings reflect the VE Team's estimate of $4,000,000 for four (4) service station right-of-way acquisitions which could be realized.

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: **B-1**
Proj. No. IM-75-3(189) – Gordon County - P.I. Number: 610750

DESCRIPTION: **ELIMINATE END SPANS AND USE WALLED ABUTMENTS** SHEET NO.: 1 of 6

Original Design:

The original 3-span bridge is 226'-8" long with 50' and 41' end spans and a 135'-8" intermediate span. The bridge is on a vertical curve. The original design replaces the existing bridge across Redbud Road. End spans 1 and 3 consist of eighteen Type II PSC beams with BT-72 PSC Fascia beams spaced. Span 2 consist of twenty four BT-72 PSC beams. The out-to-out width of the bridge is 155'-3". The bridge accommodates an intermediate barrier, 20' inside shoulder, and three 12' travel lanes, a 20' outside shoulder and barrier rails in each direction. The bents are made up of concrete caps and columns. The intermediate bents are founded on Steel H Piles with pile caps and the end bents are founded directly on Steel H piles.

Alternative:

The proposed alternative eliminates the 50' and 41' end spans and reduces the bridge length to 135'-8". This can be accomplished by providing a walled abutment at the current Bent 2 and Bent 3 locations.

The alternative maintains a 16'-11" minimum vertical clearance to Redbud Road and other current geometry.

- **Opportunities:**

- Cost savings by reducing bridge length
- Cost savings on slope paving
- Reduced construction time

- **Risks:**

- This configuration is typically used in Urban areas with limited availability of Right-Of-Way.
- Will require bridge redesign effort.

Technical Discussion:

Special design for MSE walls will be required. The same beam depth and configuration as in the original design can be used for the alternate.
Should the lane widths along Redbud Road also be reduced to 11', this will reduce the bridge span considerably and permit the use of a shallower beam which in turn lowers the revised profile of I-75 resulting in considerable additional savings.

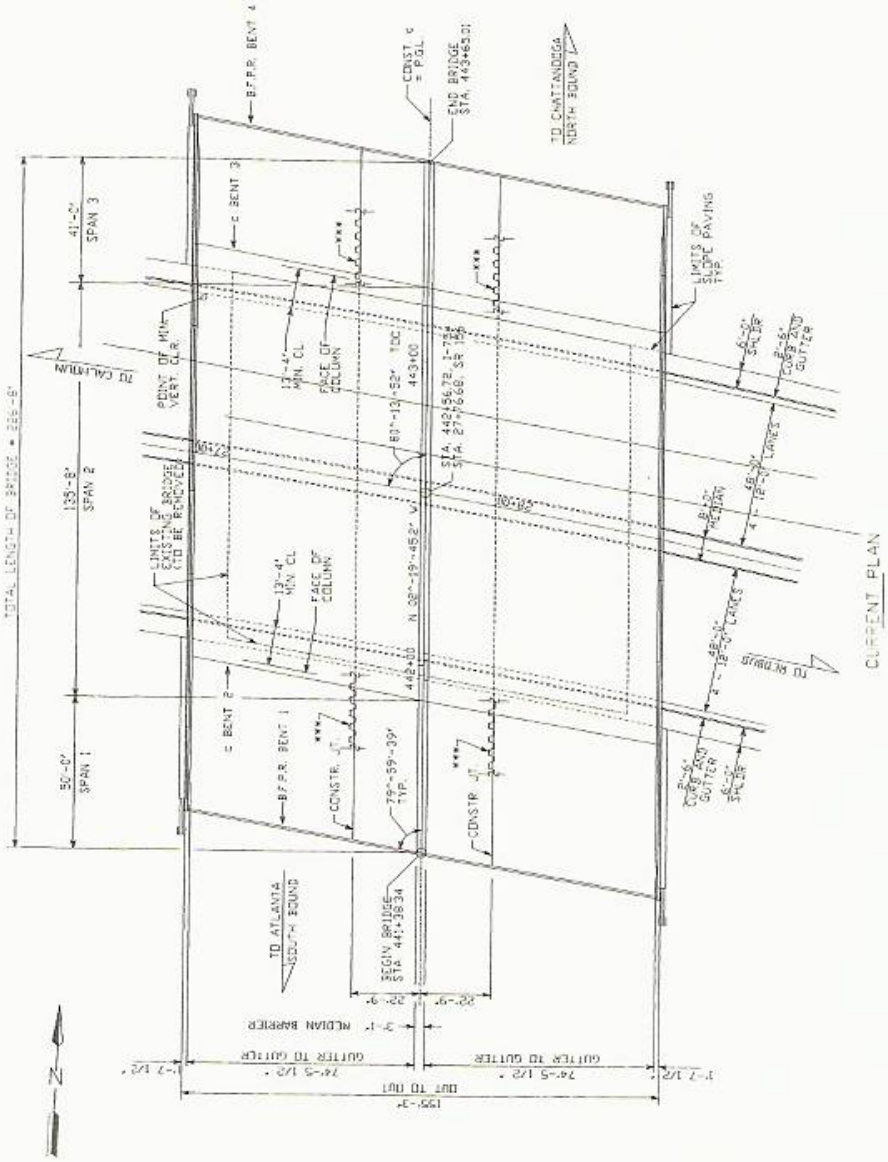
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 3,417,660	$	$ 3,417,660
ALTERNATIVE	$ 2,116,307	$	$ 2,116,307
SAVINGS	$ 1,301,353	$	$ 1,301,353

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: B-1

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156

DESCRIPTION: ELIMINATE END SPANS AND USE WALLED ABUTMENTS SHEET NO.: 2 of 6

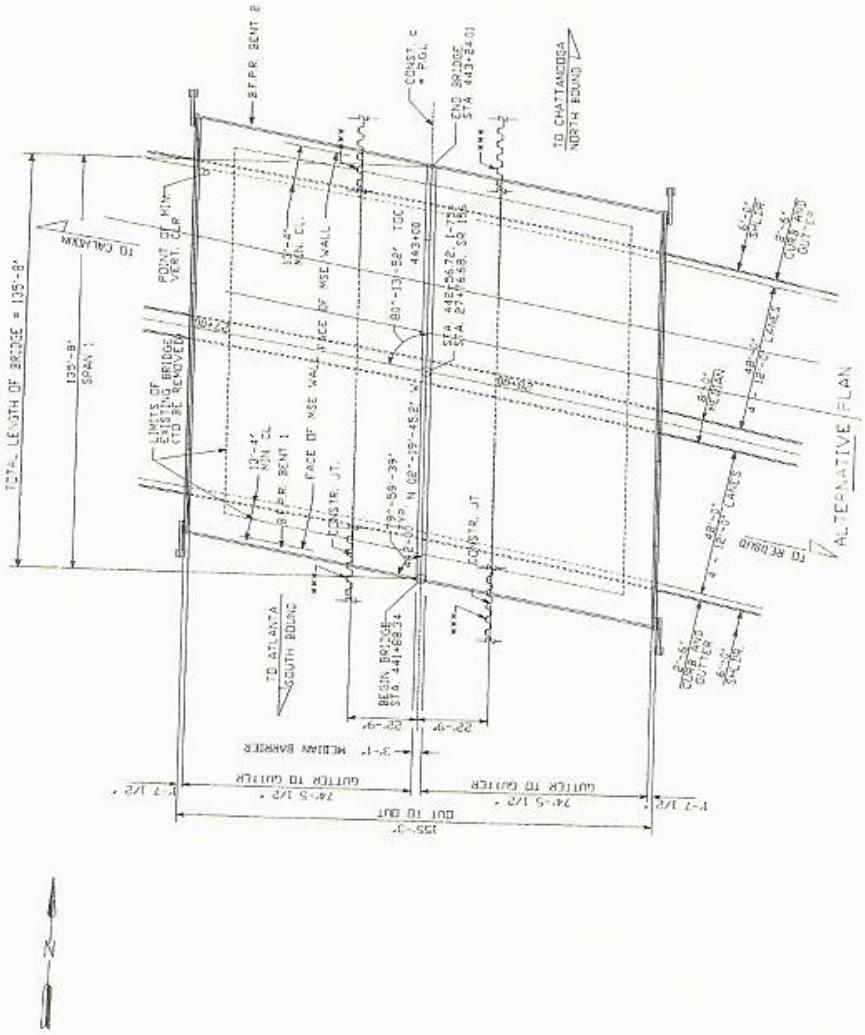


PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: B-1

DESCRIPTION: ELIMINATE END SPANS AND USE WALLED ABUTMENTS

SHEET NO.: 3 of 6

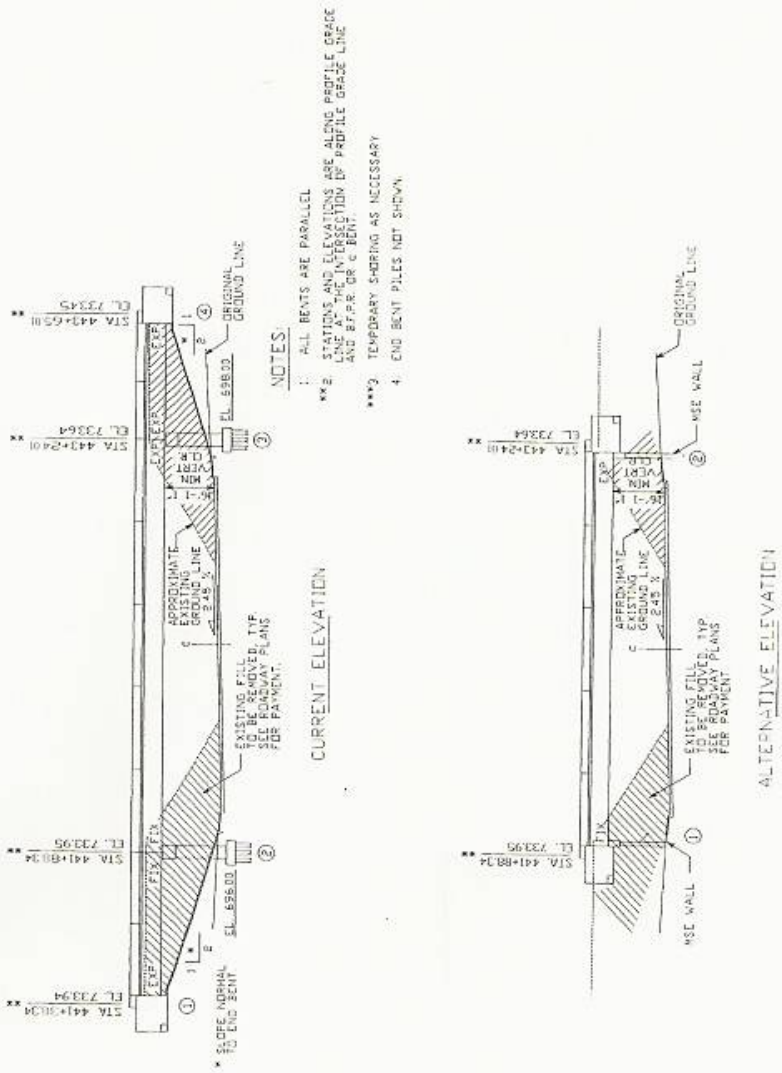


PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: B-1

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156

DESCRIPTION: ELIMINATE END SPANS AND USE WALLED ABUTMENTS SHEET NO.: 4 of 6



Current Design (3 Span – 226'-8" Long)

Superstructure:
Deck Area = 226.67' * 155.25' (avg.) = 35,190.5 SF

Volume of 7 1/2" thick Class AA Superstructure Deck concrete = [35190.5*(7.5/12)]/27= 814.60 CY

Area of Grooved concrete (approx.) = 141'*226.67'/9 = 3551.16 SY

Total length of Type II PPC Girders (approx.) = (50*18) + (41*18') = 1,638 LF

Total length of BT-72 PPC Girders (approx.) = (2*50 + 2*41) + (135.67'*24)' = 3,437.08'

Total length of Barrier Rail = 2*226.67 = 453.34'

Total length of Median Barrier = 2*226.67 = 453.34'

Area of Sloped Paving (approx.) = {[(14^2 + 55.75^2)^0.5 + (14^2 + 46.75^2)^0.5)]*159.25 + 2*2*159.25 + 2*1.5*159.25}/9 = 2004.5 SY

Substructure:
Volume of Class AA concrete (average dimensions of Caps, Columns & Pile Caps, Columns @ 19'):

Intermediate Bents: 2*{[(46+53.67+53.67)*(4*4.5 + 2.083'*3.15') + (6*4'*4'*19') + (6'*8.5'*8.5'*3')]}/27= 510.43 CY

End Bents: 2*{[158.75'*3'*3'] + [2*17'*10.4'*1']}/27 = 132.00 CY

Total Volume of Class AA concrete = 879.86 CY

Length of Steel HP 10X42 Piles (End Bents – 30 ft piles) = 2*22*30' = 1,320 LF

Length of Steel HP 14X73 Piles (Intermediate Bents – 30 ft piles) = 2*(2*8*30 + 4*7*30') = 2,640 LF

PROJECT:	GEORGIA DEPARTMENT OF TRANSPORTATION	ALTERNATIVE NO.:	B-1

Project No.: IM-75-3(189) -- Gordon County, P.I. No. 610750

DESCRIPTION:	*Eliminate End Spans & Used Walled Abutments*	SHEET NO.:	6 of 6

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Type II PSC Beams	LF	1638	$ 126.13	$206,600.94	0	$ 126.13	$0.00
BT-72 PSC Beam	LF	3437.1	$ 227.53	$782,038.81	3256.08	$ 227.53	$740,855.88
Class "AA" Concrete (Sup)	CY	814.6	$ 1,122.40	$914,307.04	487.56	$ 1,122.40	$547,237.34
Class "AA" Concrete (Sub)	CY	879.86	$ 692.53	$609,329.45	132	$ 692.53	$91,413.96
Concrete Deck Grooving	SY	3551.2	$ 4.17	$14,808.34	2125.5	$ 4.17	$8,863.34
Concrete Side Barrier	LF	453.34	$ 239.24	$108,457.06	271.34	$ 239.24	$64,915.38
Concrete Median Barrier	LF	453.34	$ 340.00	$154,135.60	271.34	$ 340.00	$92,255.60
MSE Walls	SF	0	$ 52.00	$0.00	6160	$ 52.00	$320,320.00
Steel H, HP 14X73	LF	2640	$ 58.18	$153,595.20	0	$ 58.18	$0.00
Steel H, HP 10X42	LF	1320	$ 43.98	$58,054	1320	$ 43.98	$58,053.60
Sloped Paving	SY	2004.5	$ 52.70	$105,637	0	$ 52.70	$0.00
Sub-total				$3,106,963			$1,923,915
Mark-up at 10.00%				$310,696			$192,392
TOTAL				**$3,417,660**			**$2,116,307**

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Proj. No. IM-75-3(189) – Gordon County –
P.I. Number: 610750

ALTERNATIVE NO.: **B-2**

DESCRIPTION: **USE A THREE STAGE CONSTRUCTION SEQUENCE IN LIEU OF A FOUR STAGE CONSTRUCTION SEQUENCE**

Original Design:

The original 3-span bridge is 226'-8" long with 50' and 41' end spans and a 135'-8" intermediate span. The original construction sequence calls for 4 Stages. 1) Shoring at two locations of the existing bridge (and roadway). Shifting traffic to the left and right of the middle and removing the middle portion. 2) Rebuild the middle portion and shift Northbound traffic on to newly constructed portion. 3) Rebuild right side of the bridge and tie into middle portion rebuilt in Stage 2. 4) Shift all traffic (Northbound and Southbound) to the right and rebuild the left side of the bridge to complete construction

Alternative:

The proposed alternative eliminates one stage of construction by following a 3 Stage construction sequence. The proposed construction sequence involves: 1) Shoring at one location of the existing bridge (and roadway). Shifting Southbound traffic to the right and removing the left portion of the bridge. 2) Rebuild the left portion and shift Southbound and Northbound traffic on to the newly constructed portion. 3) Rebuild right side of the bridge and tie into left portion rebuilt in Stage 2 to complete construction.

The alternative maintains a 16'-11" minimum vertical clearance to Redbud Road and other current geometry

- **Opportunities:**

- Cost savings by reducing construction time
- Cost savings by reducing shoring requirement of bridge and roadway
- Reduced user inconvenience
- Minimal redesign effort required

- **Risks:**

- The bridge may have to be made approximately 5' wider than the current design to facilitate a 3 Stage construction sequence

Technical Discussion:

The same bridge design and configuration as in the original design can be used for the alternate.
The cost savings are realized primarily from reduced construction time. Cost analysis is based on an assumption that contractor overheads (mobilization, etc) are approximately 50% of the total construction cost.

See sheet 2 for the calculation of the savings noted below. Cost savings from reduction of shoring on one side and traffic control requirements is not considered. These are an additional benefit of the Alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 3,471,587	$	$ 3,471,587
ALTERNATIVE	$ 3,124,433	$	$ 3,124,433
SAVINGS	$ 347,153	$	$ 347,153

Calculations

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Proj. No. IM-75-3(189) – Gordon County - P.I. Number: 610750

ALTERNATIVE NO.: **B-2**

DESCRIPTION: **USE A THREE STAGE CONSTRUCTION SEQUENCE IN LIEU OF A FOUR STAGE CONSTRUCTION SEQUENCE**

Current Design (3 Span – 135'-8" Long, 4 Stage Construction Sequence)

Current estimate of Construction of Bridge Complete = $ 3,471,587.00

Assumptions:

1) Assume the cost includes shoring, traffic control, removal of existing bridge and all incidental costs.
2) Assume the cost includes contractor mobilization.
3) Assume the contractor overheads are 50% of total construction cost.
4) Assume the duration of construction is 15 months.

Based on the above assumptions, the contractor overhead cost = 0.5* $3471587 = $ 1,735,793.50

Overhead cost per month = 1735793.50/15 = $115,720.00

Material cost = overhead cost = $1,735,793.50

Alternative (3 Span – 135'-8" Long, 3 Stage Construction Sequence)

Assumptions:

1) Assume the duration of construction is 12 months (reduction of 3 months).
2) **Note:** Cost savings from reduction of shoring requirement on one side is not considered. This is an additional benefit of the Alternative.
3) **Note:** Cost savings from reduction of traffic control requirement is not considered. This is an additional benefit of the Alternative.

Based on the above assumptions, the contractor overhead cost = 12*115,720.00 = $ 1,388,640.00

Material cost = $ 1,735,793.50

Total Bridge Cost = 1388640.00 + 1735793.50 = **$ 3,124,433.50**

Savings = 3471587 - 3,124,433.50 = **$ 347,153.00**

Illustrations

PBSJ

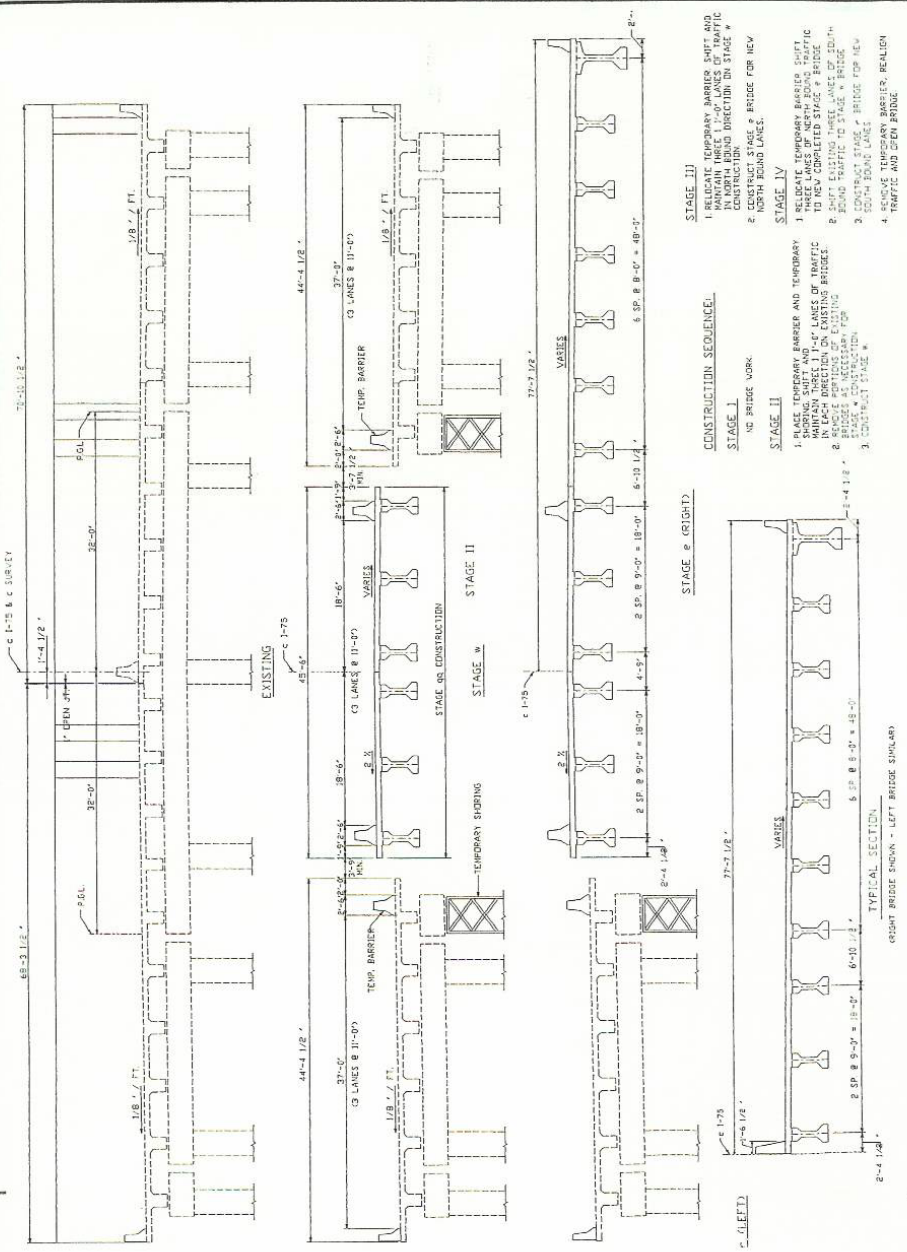
PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156

ALTERNATIVE NO.: B-2

DESCRIPTION: USE A THREE STAGE CONSTRUCTION SEQUENCE IN LIEU OF A FOUR STAGE CONSTRUCTION SEQUENCE

SHEET NO.: 3 of 4



Current Design

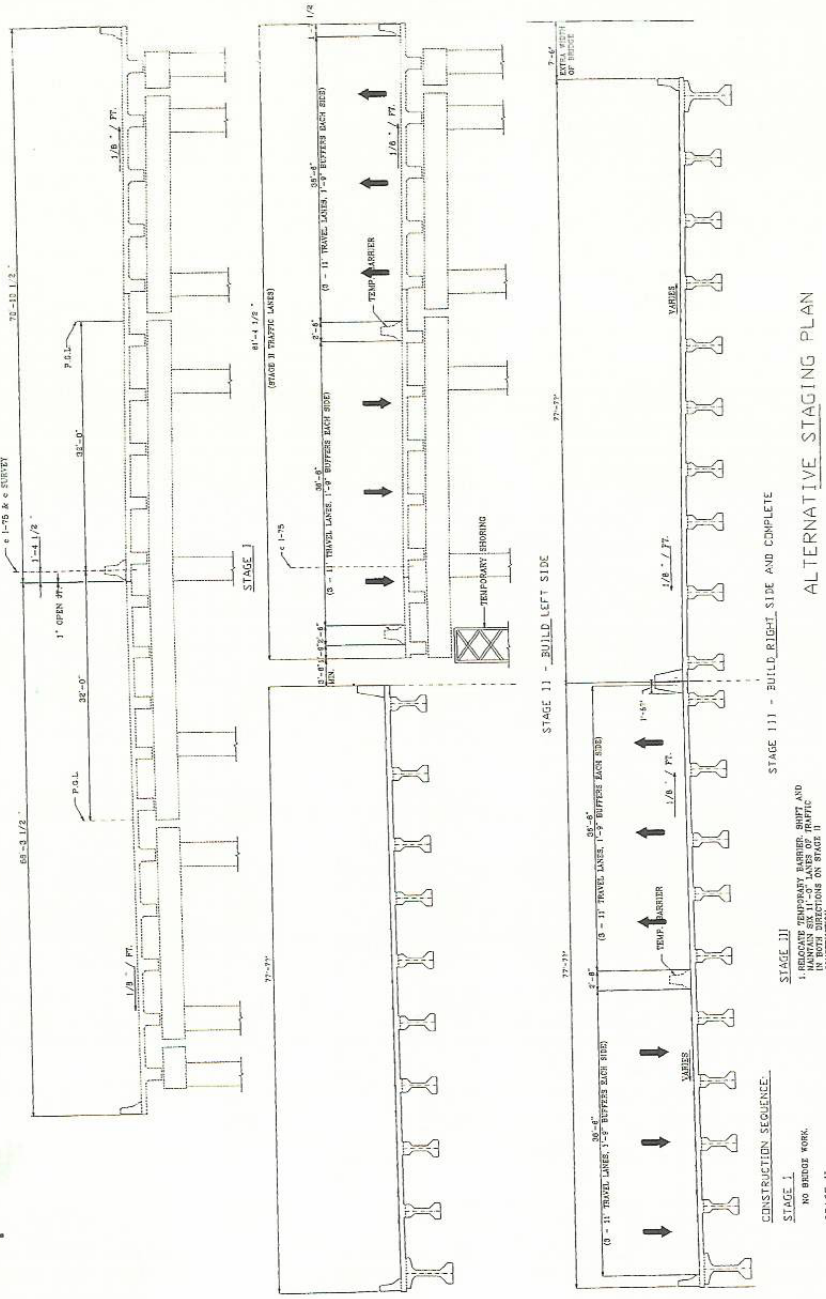
Illustrations

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: B-2

DESCRIPTION: USE A THREE STAGE CONSTRUCTION SEQUENCE IN-LIEU OF A FOUR STAGE CONSTRUCTION SEQUENCE.

SHEET NO.: 4 of 4



Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-2

DESCRIPTION: **USE GDOT SEPARATION OF 100' LIMITED ACCESS**

SHEET NO.: 1 of 6

Original Design:

The original design calls for the construction of a raised concrete median from STA 30+88 to STA 33+72.97, SR 156, Redbud Road. The median would prevent left hand turns from eastbound CR 156 to the existing Adventist Drive. Access to Adventist Church Building would be via Harmony Church Road and the proposed Adventist Drive Extension.

Alternative:

This alternative design suggests elimination of the concrete median. Access could then be provided to the existing Adventist Drive thereby eliminating the need for the Adventist Drive Extension. Closure of one drive at each service station may still be required, but total acquisition may not be necessary.

Opportunities:

- Reduce project construction time
- Reduce project costs
- Reduce motorists delays
- Extend the life of the pavement
- Increase SAFETY

Risks:

- Will require minor project redesign
- May delay project start for redesign time.

Technical Discussion: The concept validation report discussed the GDOT concept of a limited access of 100 feet from the ramps. A site visit indicated no problems with the current configuration which has one lane in each direction with no median.

*The VE TEAM estimates that the service station Right-of-Way Costs could exceed $1,000,000 each for a total value of $4,000,000.

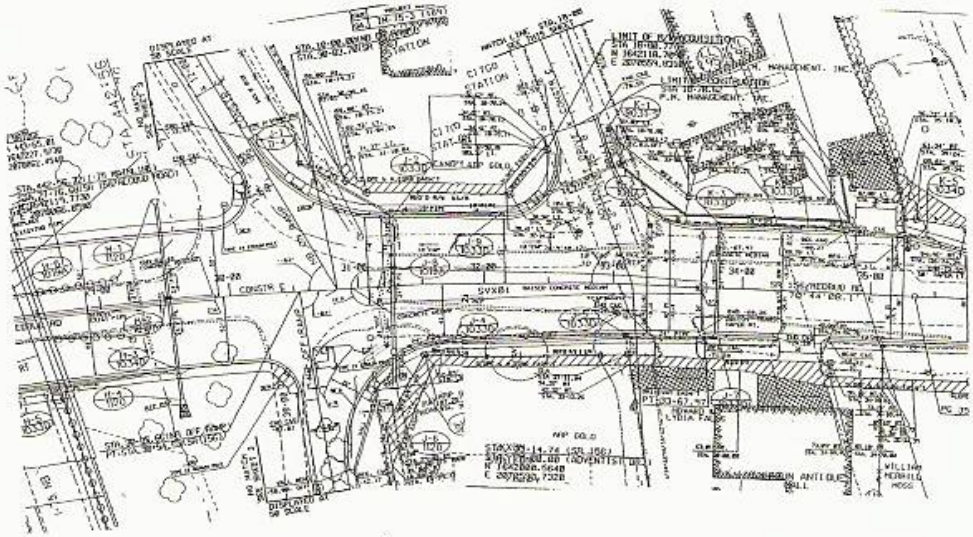
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 9,661,493	$ 0	$ 9,661,493
ORIGINAL RIGHT OF WAY COSTS	$ 4,000,000*	$ 0	$ 4,000,000*
ALTERNATIVE DESIGN	$ 9,398,281	$ 0	$ 9,398,281
ALTERNATIVE RIGHT OF WAY COSTS	$ 0	$ 0	$ 0
SAVINGS	$ 4,263,212*	$ 0	$ 4,263,212*

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

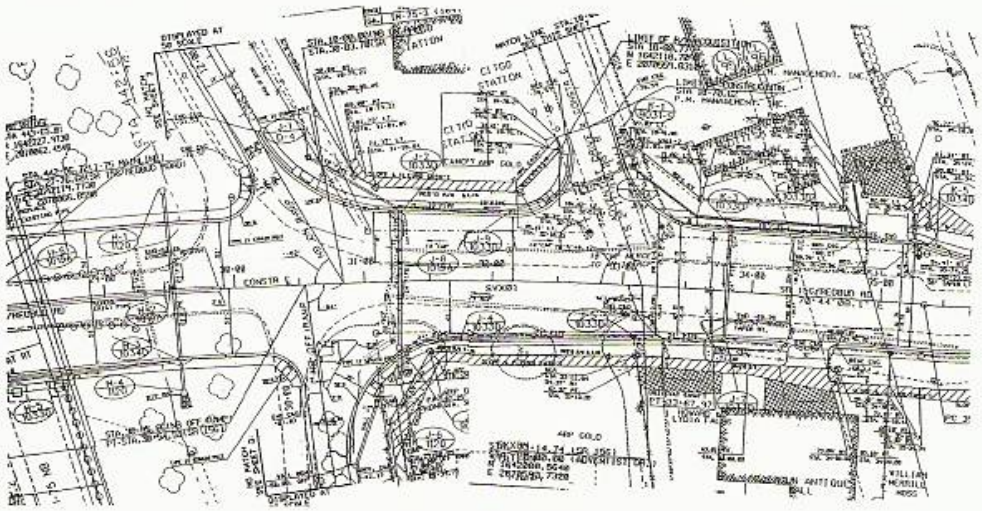
ALTERNATIVE NO.: P-2

DESCRIPTION: USE GDOT SUPERPARATION OF 100' LIMITED ACCESS

SHEET NO.: 2 of 6



ORIGINAL-DESIGN - RAISED CONCRETE MEDIAN



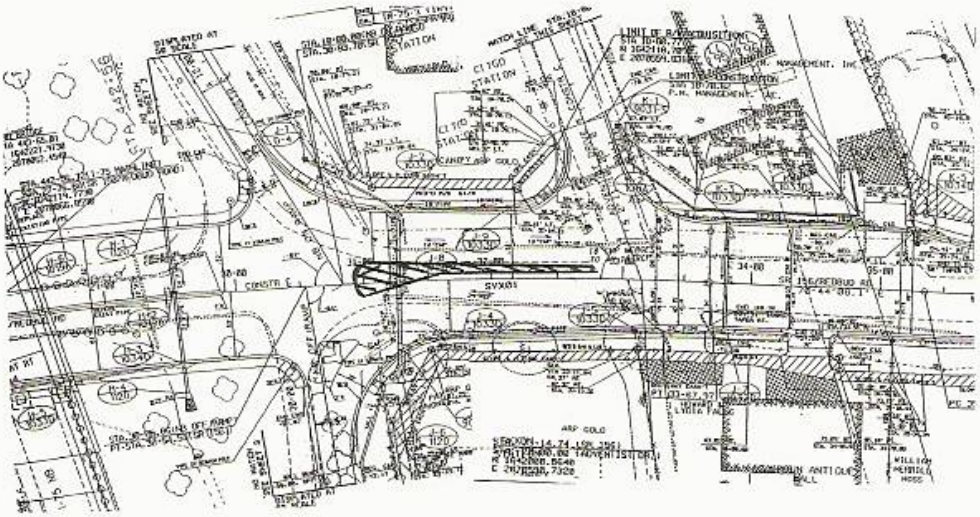
ALTERNATIVE DESIGN - DELETE CONCRETE MEDIAN
100' LIMITED ACCESS

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-2

DESCRIPTION: USE GDOT SEPARATION OF 100' LIMITED ACCESS

SHEET NO.: 3 of 6



ALTERNATIVE DESIGN - DELETE CONCRETE MEDIAN
THERMOPLASTIC TRAFFIC STRIPING FOR
DEVELOPMENT OF LEFT TURN LANE

COST WORKSHEET

PBSJ

PROJECT:	IM-75-3(189) Gordon County	ALTERNATIVE NO.:	P-2
P.I. Number: 610750		SHEET NO.:	4 of 6
DESCRIPTION:	USE GOOT SEPARATION OF 100' LIMITED ACCESS		

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
205-0001 UNCLASS EXCAV	CY	202000	5.61	1133220	175438	5.61	984207
208-0100 IN-PLACE EMBANKMENT	CY	156500	10.19	1594735	156244	10.19	1592126
310-1101 GR AGGR BASE CRS	TN	129302	17.17	2220115	128175	17.17	2200764
402-3112 RECYCLED ASPH CONC 19mm	TN	27819	85.00	2364615	27590	85.00	2345150
402-3113 RECYCLED ASPH CONC 12.5mm	TN	12974	85.00	1102790	12803	85.00	1088255
441-6222 CONC CURB & GUTTER TP 2	LF	6535	17.08	116617	6377	17.08	108919
441-6140 CONC MEDIAN 4IN	SY	1873	30.26	56676	1272	30.26	38490
550-1180 STORM DRAIN PIPE 18IN	LF	2305	41.02	94551	2215	41.02	90859
550-1240 STORM DRAIN PIPE 24IN	LF	1607	53.78	86424	1577	53.78	84811
550-4218 FLARED END SECTION 18IN	EA	12	678.07	8136	10	678.07	6780
550-4224 FLARED END SECTION 24IN	EA	6	882.93	5297	4	882.93	3531
			Sub-total	8783176			8543892
			Mark-up at	878317			854389
			TOTAL	9661493			9398281

Calculations

PBSJ

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-2

DESCRIPTION: USE GDOT SEPARATION OF 100' LIMITED ACCESS

SHEET NO.: 5 of 6

ADVENTIST DRIVE EXTENSION
STA 11+00 – STA 18+80.92

ROADWAY AREA

780.92 x 24 = 18742 sf = 2082 SY

TYPICAL SECTION

GRAD AGGR BASE = 10"
19 mm SUPERPAVE = 220 #/yd²
12.5mm SUPERPAVE = 165 #/yd²

GAB 18742 ft² x 0.83 ft x 145 #/ft³ ÷ 2000 = 1121 TN
19mm SUPERPAVE 2082 yd² x 220 #/yd² ÷ 2000 = 229 TN
12.5mm SUPERPAVE 2082 yd² x 165 #/yd² ÷ 2000 = 171 TN

CURB & GUTTER

STA 18+70.62 – STA 19+50
TP 2 C&G 79 lf x 2 = 158 l.f.

PIPE - 18" - STR P-1 to P-2
18" STORM DRAIN = 90 lf
18" FES = 2 EA
PIPE - 24" - STR D-1 to D-2
24" STORM DRAIN = 30 lf
24" FES = 2 EA

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-2

DESCRIPTION: USE 600' SEPARATION OF 100' LIMITED ACCESS

SHEET NO.: 6 of 6

ADVENTIST DRIVE EXTENSION

EARTHWORK

	WIDTH	DEPTH			
STA 10+00	0	0		0	
+50	0	0		0	
11+00	0	0		59 yd³ - F	
+50	32	2	(F)	151 yd³ - F	
12+00	50	2	(F)	46 yd³ - F	175 yd³ - C
+50	72 x 40	3	(C)	1288 yd³ C	
13+00	97 x 44	8	(C)	1783 yd³ - C	
+50	130 x 50	16	(C)	3021 yd³ C	
14+00	141 x 52	19	(C)	3729 yd³ C	
+50	148 x 52	22	(C)	4694 yd³ C	
15+00	150 x 52	22	(C)	3898 yd³ C	
+50	147 x 52	20	(C)	3263 yd³ C	
16+00	130 x 52	17	(C)	2315 yd³ C	
+50	111 x 52	12	(C)	1407 yd³ C	
17+00	105 x 52	7	(C)	905 yd³ C	
+50	92 x 52	6	(C)	581 yd³ C	
18+00	83 x 52	3	(C)	103 yd³ C	
+50	44	1	(C)		

FILL = 256 yd³ COT = 26562 yd³

RED BUD ROAD

CONCRETE MEDIAN

MEDIAN REMOVAL

STA 30+88 - STA 33+72.97

28' WIDTH x 10' WIDTH

$284.97 \times \frac{28+10}{2} \div 9$ = 601 SY

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: **P-3**

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156

DESCRIPTION: **USE 11 FT LANE WIDTHS ALONG SR 156** SHEET NO.: 1 of 6

Original Design:

The original design calls for the construction of 68' of pavement along SR 156 (Redbud Rd) to accommodate four (4) - 12 ft. travel lanes and a future 20 ft. raised median. The pavement will be marked as four (4) - 12ft. travel lanes with a 14 ft. flush median and 3 ft. buffers on the outside travel lanes until traffic volumes warrant the installation of the 20 ft. raised median.

Alternative:

This alternative design suggests to construct 61' of pavement along SR 156 (Redbud Rd.) to accommodate four (4) – 11 ft. travel lanes and a future 17 ft. raised median, which will allow for an 11 ft. Turn lane and a 6 ft. median separator. The pavement can be marked as four (4) – 11 Ft. travel lanes with a 17 ft. flush median until traffic volumes warrant the installation of the raised median.

Opportunities:

- Reduce project construction time
- Reduce project costs

Risks:

- Will require minor project redesign
- May delay project start for redesign time
- Design variance will be required by GDOT for lane width and median width reductions

Technical Discussion:

The alternative accomplishes the same function as the original at a reduced cost. The AASHTO Manual for the Geometric Design of Highways and Streets (2004) states that narrower lanes are normally adequate and have some advantages for urban arterials with speeds of 45 MPH or less. 11 ft. lane width allow the same number of lanes to be constructed with less right-of-way and allow shorter pedestrian crossing times because of reduced crossing distances.

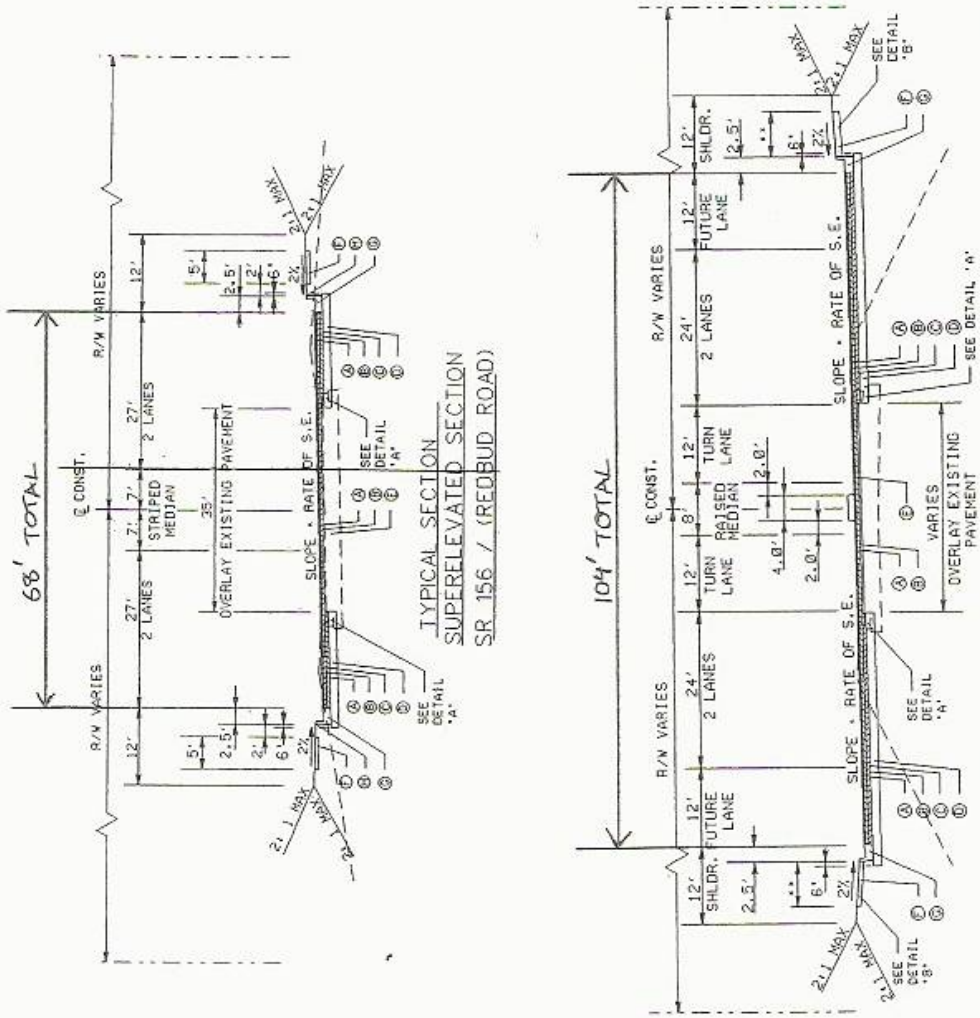
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 39,763,770	$ 0	$ 39,763,770
ALTERNATIVE	$ 36,951,325	$ 0	$ 36,951,325
SAVINGS	$ 2,812,445	$ 0	$ 2,812,445

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-3

DESCRIPTION: USE 11-FT. LANE WIDTHS ALONG SR 156

SHEET NO.: 2 of 6



TYPICAL SECTION
SUPERELEVATED SECTION
SR 156 / (REDBUD ROAD)

TYPICAL SECTION
SUPERELEVATED SECTION
SR 156 / REDBUD ROAD
STA. 25+21.67 TO STA. 30+83.70

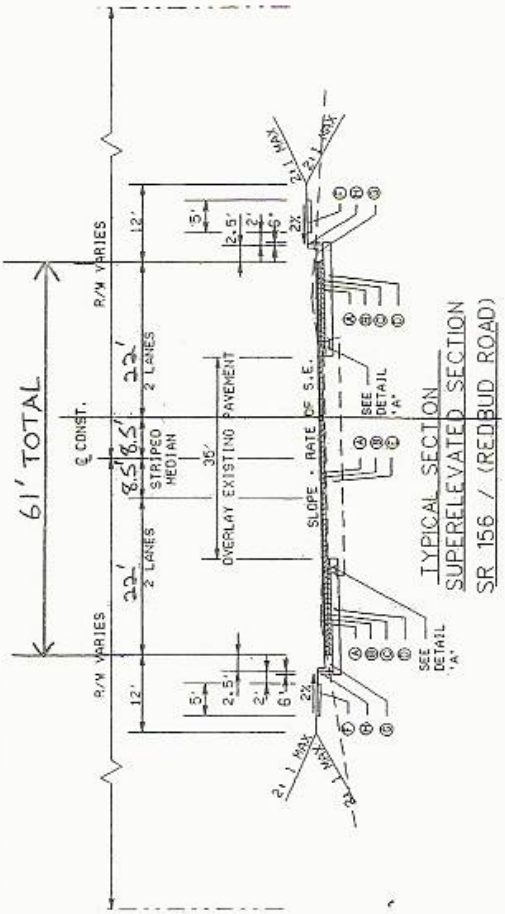
ORIGINAL DESIGN

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

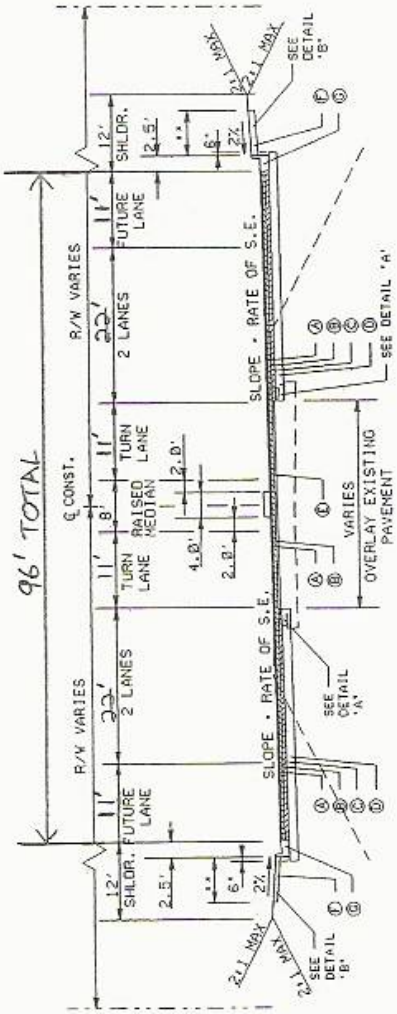
ALTERNATIVE NO.: P-3

DESCRIPTION: USE 11 FOOT LANES ALONG SR 156

SHEET NO.: 3 of 6



TYPICAL SECTION
SUPERELEVATED SECTION
SR 156 / (REDBUD ROAD)



TYPICAL SECTION
SUPERELEVATED SECTION
SR 156 / REDBUD ROAD
STA. 25+21.67 TO STA. 30+83.70

ALTERNATIVE

Calculations

PROJECT: GEORGIA DEPARTMENT OF TRANSPORTATION
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-3

DESCRIPTION: USE 11-FT. LANE WIDTHS ALONG SR 156

SHEET NO.: 4 of 6

* SR 156 (REDBUD RD)

STA. 6+81.24 TO STA. 25+21.67 PAVEMENT IS REDUCED FROM 68' TO 61'
STA 25+21.67 TO STA. 30+83.70 PAVEMENT IS REDUCED FROM 104' TO 96'
STA. 30+83.70 TO STA 41+36.80 PAVEMENT IS REDUCED FROM 68' TO 61'

1840.43' x 7' = 12883.01 SF
562.03' x 8' = 4496.24 SF
1053.10' x 7' = 7371.70 SF
TOTAL = 24750.95 SF → SAY 25,000 SF

GRADED AGGREGATE BASE COURSE, 12" THICK

25,000 SF x 1' = 25,000 CF x 145 LB/CF x 1 TN/2000 LB = 1812.5 TN

129,302 TN − 1813 TN = **127,489 TN**

RECYCLED ASPH. CONC. BASE 25 MM SUPERPAVE

25000 SF x 1 SY/9 SF x 440 LB/SY x 1 TN/2000 LB = 611 TN

46,317 TN − 611 TN = **45,706 TN**

RECYCLED ASPH. CONC. 19 MM SUPERPAVE

25000 SF x 1 SY/9 SF x 220 LB/SY x 1 TN/2000 LB = 306 TN

27,819 TN − 306 TN = **27,513 TN**

RECYCLED ASPH. CONC. 12.5 MM SUPERPAVE

25000 SF x 1 SY/9 SF x 165 LB/SY x 1 TN/2000 LB = 230 TN

12,974 TN − 230 TN = **12,744 TN**

Calculations

PBSJ

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-3

DESCRIPTION: USE 11-FT. LANE WIDTHS ALON SR 156

SHEET NO.: 5 of 6

STORM DRAIN PIPE

18 IN. PIPE → 7'+7'+7'+8' = 29 LF → SAY 30 LF

2305' − 30' = **2275 LF**

24 IN. PIPE → 7'+8'+7'+7' = 29 LF → SAY 30 LF

1607' − 30' = **1577 LF**

30 IN. PIPE → 7'+7' = 14 LF → SAY 15 LF

841' − 15' = **826 LF**

CONSTRUCTION OF BRIDGE

* BRIDGE LENGTH CAN BE REDUCED BY 8-FT.

ORIGINAL BRIDGE LENGTH = 443+65.01 − 441+38.34 = 226.67 FT.
ORIGINAL BRIDGE WIDTH = 155'-3" = 155.25 -FT
ORIGINAL BRIDGE AREA = L × W = 226.67' × 155.25'
= 35,191 SF

ORIGINAL COST TO CONSTRUCT BRIDGE → $3,471,587 / 35,191 SF = $98.65/SF

LUMP SUM COST TO BUILD REDUCED BRIDGE
226.67 − 8' = 218.67'
218.67' × 155.25' = 33,948.52 SF × $98.65/SF = **$3,349,021**

RIGHT OF WAY

* REQUIRED RIGHT OF WAY WILL BE REDUCED BY REDUCING THE PAVEMENT WIDTH OF SR 156 (REDBUD RD). ASSUME RIGHT OF WAY COSTS WILL BE REDUCED BY 10%.

23,048,000 − 10% = **20,743,200**

COST WORKSHEET

PBSJ

PROJECT:	IM-75-3(189) Gordon County	ALTERNATIVE NO.:	P-3
P.I. Number: 610750 Redbud Road		SHEET NO.:	6 of 6
DESCRIPTION:	USE 11-FT. LANE WIDTHS ALONG SR 156		

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
GRADED AGGREGATE BASE COURSE	TN	129,302	17.17	2,220,115	127,489	17.17	2,188,986
RECYC. ASPH. CONC. 25 MM SUPERPAVE	TN	46,317	80.00	3,705,360	45,706	80.00	3,656,480
RECYC. ASPH. CONC. 19 MM SUPERPAVE	TN	27,819	85.00	2,364,615	27,513	85.00	2,338,605
RECYC. ASPH. CONC. 12.5 MM SUPERPAVE	TN	12,974	85.00	1,102,790	12,744	85.00	1,083,240
STORM DRAIN PIPE, 18 IN.	LF	2305	41.02	94,551	2275	41.02	93,321
STORM DRAIN PIPE, 24 IN	LF	1607	53.78	86,425	1577	53.78	84,811
STORM DRAIN PIPE, 30 IN	LF	841	65.92	55,439	826	65.92	54,450
CONSTRUCTION OF BRIDGE	LS	1	3,471,587	3,471,587	1	3,349,021	3,349,021
RIGHT OF WAY	LS	1	23,048,000	23,048,000	1	20,743,200	20,743,200
			Sub-total	36,148,882			33,592,114
			Mark-up at	10 %			10%
			TOTAL	39,763,770			36,951,325

Value Analysis Design Suggestion

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: **P-5**

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

DESCRIPTION: **DELETE RIGHT TURN LANE ALONG EASTBOUND SR 156 (STA. 10+00 TO STA. 12+00)** SHEET NO.: 1 of 1

Original Design:

The original design calls for the construction of a right turn lane along eastbound SR 156 at the intersection with Curtis Parkway/Warrior Path.

Alternative Design:

The alternative design suggests to delete the right turn lane along eastbound SR 156 (Sta. 10+00 to Sta. 12+00).

Opportunities:

- Improved safety for vehicles turning out of adjacent property
- Reduce impact to existing properties
- Reduce project cost

Risks:

- Requires minimal redesign
- May reduce capacity of intersection

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County–P.I. Number: 610750

I-75 & SR 156

ALTERNATIVE NO.: **P-6**

DESCRIPTION: **ELIMINATE CONCRETE PAVING ON RAMPS**

SHEET NO.: 1 of 6

Original Design:

The original design calls for the construction of new exit and entrance from I-75 to CR 156, Redbud Road, to be constructed of concrete paving. It includes the mainline ramps and a 6 foot shoulder on the left and a 10 foot shoulder on the right.

Alternative Design:

This alternative design suggests to construct the ramps of recycled asphalt concrete. The ramp and shoulder widths would remain the same and the pavement typical section would match the I-75 pavement section.

Opportunities:

- Reduce project construction time
- Reduce project costs
- Reduce motorists delays
- Extend the life of the pavement
- Increase SAFETY

Risks:

- Will require minor project redesign
- May delay project start for redesign time.

Technical Discussion:

The new I-75 mainline and the widening of Redbud Road would be constructed of recycled asphaltic concrete. Construction of the ramps with asphaltic concrete would provide uniformity of all construction. Field inspections of the existing ramps indicate existing asphalt ramps in good condition.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 13,828,056	$ 0	$ 13,828,056
ALTERNATIVE	$ 13,182,178	$ 0	$ 13,182,178
SAVINGS	$ 645,878	$ 0	$ 645,878

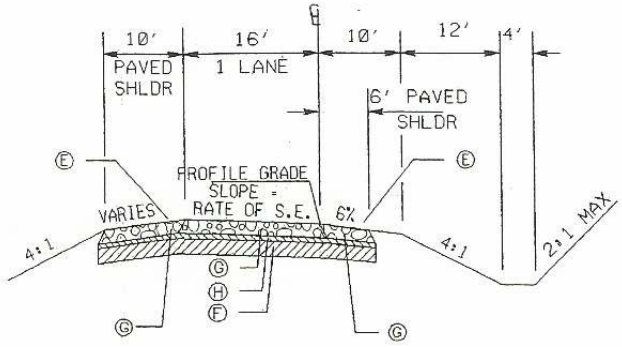
PBSJ

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-6

DESCRIPTION: ELIMINATE CONCRETE PAVING ON RAMPS

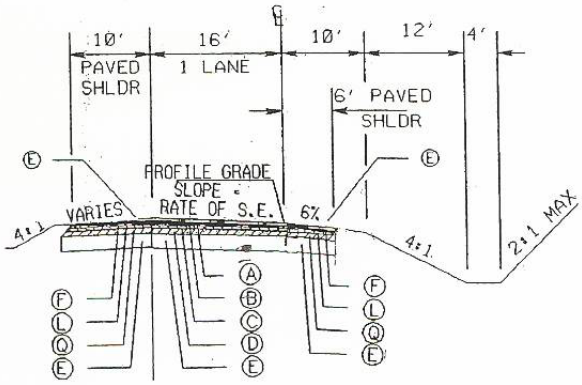
SHEET NO.: 2 of 6



ORIGINAL DESIGN

REQUIRED PAVEMENT

Ⓐ RECYC.ASPH.CONCRETE 12.5MM SUPERPAVE, GP 2 ONLY, INCL. BITUM MATL & H.LIME (165 LB/YD²)
Ⓑ RECYC.ASPH.CONCRETE 19MM SUPERPAVE, GP 1 OR 2 , INCL. BITUM MATL & H.LIME (220 LB/YD²)
Ⓒ RECYC.ASPH.CONCRETE BASE 25MM SUPERPAVE, GP 1 OR 2 , INCL. BITUM MATL & H.LIME (770 LB/YD²)
Ⓓ GRADED AGGREGATE BASE, 10"
Ⓔ GROUND IN PLACE RUMBLE STRIPS - 16" WIDE.
Ⓕ GRADED AGGREGATE BASE, 12"
Ⓖ PLAIN PORTLAND CEMENT CONCRETE PAVEMENT, 12"
Ⓗ 19 MM SUPERPAVE ASPHALT CONC. BASE (330 LB/YD·2) SUPERPAVE



ALTERNATIVE DESIGN

Ⓐ ASPHALTIC CONCRETE 12.5mm PEM INCL. POLYMER-MODIFIED BITUM MATL & H LIME, 135 LBS/SQ YD, LEVEL "D"
Ⓑ ASPHALTIC CONCRETE 12.5mm SMA INCL. POLYMER-MODIFIED BITUM MATL & H LIME, 165 LBS/SQ YD, LEVEL "D"
Ⓒ ASPHALTIC CONCRETE 19mm SUPERPAVE, INCL BITUM MATL & H LIME, 440 LBS/SQ YD, LEVEL "D"
Ⓓ ASPHALTIC CONCRETE 25mm SUPERPAVE, INCL BITUM MATL & H LIME, 880 LBS/SQ YD, LEVEL "C"
Ⓔ 16" GRADED AGGREGATE BASE COURSE, INCL MATL
Ⓕ ASPHALTIC CONCRETE 12.5mm SUPERPAVE INCLUDING BITUM MATL & H LIME,165 LBS/SQ YD,LEVEL "A"
Ⓖ ASPHALTIC CONCRETE LEVELING, VARIABLE DEPTH AS REQUIRED
Ⓗ MILL ASPHALTIC CONCRETE PAVEMENT, 1½" DEPTH
Ⓙ SEE DETAIL "A" FOR REINFORCING FABRIC DETAIL
Ⓛ ASPHALTIC CONCRETE 19mm SUPERPAVE, INCL BITUM MATL & H LIME, 220 LBS/SQ YD, LEVEL "A"
Ⓠ ASPHALTIC CONCRETE 25mm SUPERPAVE, INCL BITUM MATL & H LIME, 660 LBS/SQ YD, LEVEL "A"

PROJECT: GEORGIA DEPARTMENT OF TRANSPORTATION
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P. 6

DESCRIPTION: ELIMINATE CONCRETE PAVING ON RAMPS

SHEET NO.: 3 of 6

INCREASED ASPHALT QUANTITY TO BE USED IN LIEU OF CONCRETE - MAINLINE

12.5 mm	8001 yd² x 165 #/yd² ÷ 2000 =	660 TN
19 mm	8001 yd² x 110 #/yd² ÷ 2000 =	440 TN
25 mm	8001 yd² x 880 #/yd² ÷ 2000 =	3520 TN
GAB	8001 yd² x 9 x 145 #/ft³ x 0.33 ÷ 2000 =	1722 TN

I-75 RAMPS - SHOULDERS

WIDTHS - RIGHT 10' LEFT 6'

NB OFF			
STA 18+84 - STA 29+45	WIDTH 16'	1886 SY
NB ON			
STA 11+34 - STA 20+57	WIDTH 16'	1640 SY
SB OFF			
STA 11+60 - STA 23+68	WIDTH 16'	2147 SY
SB ON			
STA 27+75 - STA 37+13	WIDTH 16'	1720 SY
		7393 SY

PROPOSED ASPHALT SECTION - SHOULDER

12.5 mm SUPERPAVE 165 #/yd²
19 mm SUPERPAVE 220 #/yd² (DECREASE 110 #/yd²)
25 mm SUPERPAVE 660 #/yd²
GAB 16" (INCREASE OF 4")

PROJECT: GEORGIA DEPARTMENT OF TRANSPORTATION
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-6

DESCRIPTION: ELIMINATE CONCRETE PAVING ON RAMPS

SHEET NO.: 4 of 6

I-75 RAMPS - MAINLINE

AREA FROM END OF C&G (RADIUS) TO PHYSICAL GORE @ I-75

NB - OFF		
STA 18+84 - STA 24+60	WIDTH - 16'	1024 SY
STA 24+60 - STA 26+60	WIDTH - 16'-24'	444 SY
STA 26+60 - STA 29+45	WIDTH - 24'	760 SY
NB ON		
STA 11+34 - STA 20+57	WIDTH - 16'	1640 SY
SB OFF		
STA 15+35 - STA 23+68	WIDTH - 16'	1480 SY
STA 13+85 - STA 15+35	WIDTH - 16'-24'	333 SY
STA 11+60 - STA 13+85	WIDTH - 24'	600 SY
SB ON		
STA 27+45 - STA 37+13	WIDTH - 16'	1720 SY
	TOTAL	8001 SY

PROPOSED ASPHALT SECTION - MAINLINE

12.5 mm SUPERPAVE 165 #/yd²
19 mm SUPERPAVE 440 #/yd² (INCREASE OF 110 #/yd²)
25 mm SUPERPAVE 880 #/yd²
GMB 16" (INCREASE OF 4")

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P-6

DESCRIPTION: ELIMINATE CONCRETE PAVING ON RAMPS

SHEET NO.: 5 of 6

INCREASED / DECREASED ASPHALT QUANTITY
TO BE USED IN LIEU OF CONCRETE - SHOULDERS

12.5 mm	7393 yd² x 165#/yd² ÷ 2000 =	609 TN
19 mm	7393 yd² x 110#/yd² ÷ 2000 =	406 TN
25 mm	7393 yd² x 660#/yd² ÷ 2000 =	DECREASE 2439 TN
GAB	7393 yd² x 9 x 145#/ft³ x 0.33 ÷ 2000 =	1591 TN

QUANTITY CHANGE

12" CONC PAVEMENT	15394 yd²
12.5 mm SUPERPAVE	1269 TN
19 mm SUPERPAVE	34 TN
25 mm SUPERPAVE	5959 TN
GAB	3313 TN

COST WORKSHEET

PBSJ

PROJECT:	IM-75-3(189) Gordon County	ALTERNATIVE NO.:	P-L
P.I. Number: 610750 Redbud Road		SHEET NO.:	6 of 6
DESCRIPTION:	ELIMINATE CONCRETE PAVING ON RAMPS		

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
310-1101 GR AGGR BASE	TN	129302	17.17	2220115	132615	17.17	2276999
402-3112 RECYCLED ASPH CONC 19mm	TN	27819	85.00	2364615	27853	85.00	2367505
402-3113 RECYCLED ASPH CONC 12.5mm	TN	12974	85.00	1102790	14243	85.00	1210655
402-3121 RECYCLED ASPH CONC 25mm	TN	46317	80.00	3705360	52276	80.00	4182080
439-0026 PLAIN PC CONC PAVT CL3	SY	39726	80.00	3178080	24332	80.00	1946560
			Sub-total	12570960			11983799
			Mark-up at	1257096			1198379
			TOTAL	13828056			13182178

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Proj. No. IM-75-3(189) – Gordon County - P.I. Number: 610750
I-75 and SR-156

ALTERNATIVE NO.: **P -7**

DESCRIPTION: **CHANGE CAST-IN-PLACE RETAINING WALL TYPE TO MODULAR BLOCK WALLS**

SHEET NO.: **1** of 3

Original Design:

The original design calls for cast-in-place concrete retaining walls to the right side of the Northbound Off Ramp from station 26+11.20 (offset 55') to 30+09 (offset 45') and to the right of the intersection between SR 156 and the Northbound On Ramp from station 33+02.83 (offset 92.67') to 34+75 (offset 89.63').

Alternative:

The alternative proposes the use of MODULAR BLOCK walls in lieu of the cast-in-place concrete retaining walls.

The alternative maintains the original design geometry.

- **Opportunities:**
- Cost savings
- Reduced construction time
- Manufacturer designs and installs the system
- Improved aesthetics

- **Risks:**
- Minimal or no redesign effort and cost

Technical Discussion:

MODULAR BLOCK walls have demonstrated acceptable performance. Performance warranties are provided by the manufacturer.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 301,970	$	$ 301,970
ALTERNATIVE	$ 189,853	$	$ 189,853
SAVINGS	$ 112,117	$	$ 112,117

Calculations

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Proj. No. IM-75-3(189) – Gordon County - P.I. Number: 610750

ALTERNATIVE NO.: **P-7**

DESCRIPTION: **CHANGE CAST-IN-PLACE RETAINING WALL TYPE TO MODULAR BLOCK WALLS**

Current Design - Cast-in-Place Concrete Retaining Walls – Special Design

Retaining Wall No. 1:
Station 26+11.20 (offset 55') to Station 26+58 (average height = 12.40') = 60 LF
Station 26+58 to Station 29+60 (average height = 15.90') = 302 LF
Station 29+60 to Station 30+09 (offset 45') (average height = 4.47) = 55' LF

{Assume 12" thick wall, 12" thick footing, 8' wide for wall height greater than 12' and 5' wide for wall height less than 6'}

Volume of Class A Retaining Wall 1 Concrete = {60'*[12.40'*1' + 8'*1'] + 302'*[15.90'*1' + 8'*1'] + 55'*[4.47*1' + 5'*1']}/27 = 332 CY

Retaining Wall No. 2:
Station 33+02.83 (offset 92.67') to Station 33+54 (offset 56.80') (average height = 9.50) = 61.75 LF
Station 33+54 (offset 56.80') to Station 34+82 (offset 56.64') (average height = 9.30) = 129.75 LF
Station 34+82 (offset 56.64') to Station 34+75 (offset 89.63') (average height = 6.00) = 35.75 LF

Volume of Class A Retaining 2 Wall Concrete = {61.75'*[9.50'*1' + 8'*1'] + 129.75'*[9.30'*1' + 8'*1'] + 33.75'*[6.00*1' + 5'*1']}/27 = 137 CY

Total volume of Class A Retaining Wall Concrete = 469 CY

Alternate – MODULAR BLOCK Walls with Coping

Length of Coping = 60 + 302 + 55 + 61.75 + 129.75 + 35.75 = 644.25 LF

Wall area = 60*12.40 + 302*15.90 + 55*4.47 + 61.75*9.50 + 129.75*9.30 + 35.75*6.00 = 7825 SF

COST WORKSHEET

PBSJ

PROJECT:	GEORGIA DEPARTMENT OF TRANSPORTATION	ALTERNATIVE NO.:	P-7

Project No.: IM-75-3(189) -- Gordon County, P.I. No. 610750

DESCRIPTION:	Change Cast-in-place Retaining Wall To MODULAR BLOCK Walls	SHEET NO.:	3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Class A Rtg Wall Concrete	CY	469	$ 467.59	$219,299.71	0	$ 467.59	$0.00
Modular Block Walls	SF	0	$ 15.00	$0.00	7825	$ 15.00	$117,375.00
Coping	LF	644.25	$ 85.71	$55,218.67	644.25	$ 85.71	$55,218.67
Sub-total				$274,518			$172,594
Mark-up at 10.00%				$27,452			$17,259
TOTAL				**$301,970**			**$189,853**

Value Analysis Design Suggestion

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: **P-8**

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

DESCRIPTION: **ELIMINATE ALL CONSTRUCTION WEST OF CURTIS PARKWAY/WARRIOR PATH** SHEET NO.: 1 of 1

Original Design: The original design calls for the limits of the project along SR 156 to extend 500 feet west of Curtis Parkway/Warrior Path to provide for an eastbound left turn lane and adequate lane reduction taper from the proposed 5-lane to existing 4-lane.

Alternative: The alternative suggests to eliminate all construction along SR 156 west of Curtis Parkway/Warrior Path and to taper from the proposed 5-lane section to the existing 4-lane section to the east of the intersection. The existing intersection currently provides a left-turn for eastbound traffic.

Opportunities:

- Existing intersection operates acceptably
- Reduce impact to existing properties
- Reduce project cost

Risks:

- Requires minimal redesign
- May reduce future capacity of intersection

Value Analysis Design Suggestion

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: **P-9**

DESCRIPTION: **PROVIDE ADDITIONAL LEFT TURN STORAGE ON SR156 FOR NORTH MOVEMENT ONTO I-75**

SHEET NO.: 1 of 1

Original Design:

The original design calls for the construction of limited left turn storage from SR 156 onto I-75 northbound.

Alternative:

This alternative design suggests to create additional left turn storage by going west on SR 156 and creating additional left turn storage for turns onto I-75.

Opportunities:

- Reduce motorists delays
- Increase SAFETY

Risks:

- Will require minor project redesign

Technical Discussion:

Typical traffic loads may require more left turn storage for northbound I-75 traffic. If the recommended relocation of the on-off ramps contained herein are accepted, this will most likely be necessary.

Value Analysis Design Alternative

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: **P-11 AND12**

DESCRIPTION: **MOVE SOUTHBOUND ON/OFF TO THE EAST; MOVE NORTHBOUND ON/OFF TO THE WEST**

SHEET NO.: 1 OF 3

Original Design:

The original design calls for the construction of new ramps for the I-75 and SR 156, Redbud Road. The new ramps were moved outward from the I-75 centerline. The relocation and limited access requirements required the closing of driveway access to the four gas/convenience stores located in each quadrant.

Alternative:

This alternative design suggests to relocate the ramps as close as possible to the shoulder slopes of I-75. Relocation of the ramps 100 feet toward the centerline would be possible and therefore allow, with the GDOT 100' rule, all four service stations to remain with one or two driveways.

Opportunities:

- Reduce project construction time
- Reduce project costs
- Reduce motorists delays
- Extend the life of the pavement
- Increase SAFETY

Risks:

- Will require minor project redesign
- May delay project start for redesign time.

Technical Discussion:

Each ramp could be relocated inward 100 feet and still maintain the 300' minimum distance between ramps per GDOT policy. No significant construction issues should be encountered as the relocated ramps would be in close proximity to the existing ramps. The right-of-way acquisition costs do not indicate the estimated cost to acquire the existing 4 service stations.

*We believe that the right-of-way cost for the four stations could reasonably be $1,000,000 for each service station saved. For this alternative, we suggest using $4,000,000 as a reasonable Right-of-way cost savings.

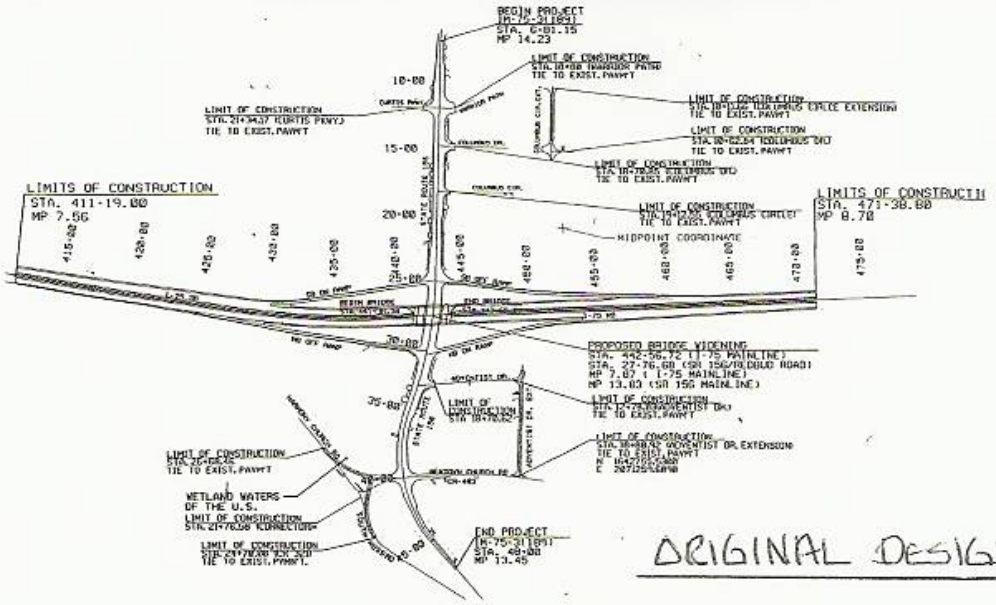
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 4,000,000*	$ 0	$ 4,000,000*
ALTERNATIVE	$ 0	$ 0	$ 0
SAVINGS*	$ 4,000,000*	$ 0	$ 4,000,000*

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** ALTERNATIVE NO.: P-11&8-12

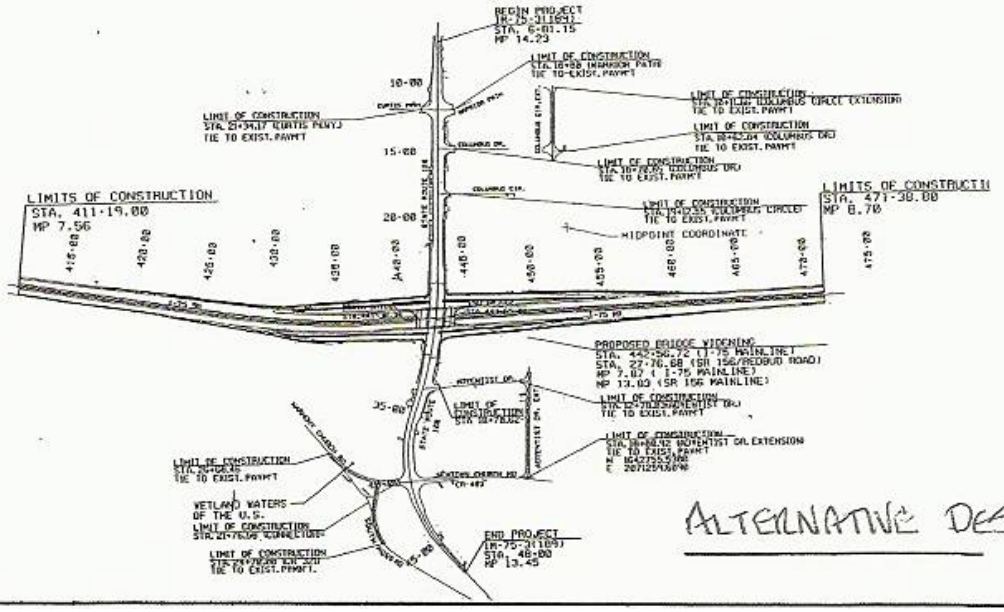
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156

DESCRIPTION: MOVE SOUTHBOUND ON/OFF TO THE EAST
MOVE NORTHBOUND ON/OFF TO THE WEST SHEET NO.: 2 of 3



ORIGINAL DESIGN



ALTERNATIVE DESIGN

PROJECT: GEORGIA DEPARTMENT OF TRANSPORTATION
Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750
I-75 & SR 156

ALTERNATIVE NO.: P11 & P12

DESCRIPTION: MOVE SOUTHBOUND ON/OFF TO THE EAST
MOVE NORTHBOUND ON/OFF TO THE WEST

SHEET NO.: 3 of 3

RAMP CONSTRUCTION COSTS WOULD NOT CHANGE AS THE RAMP QUANTITIES WOULD REMAIN THE SAME. COST SAVINGS FOR THE ELIMINATION OR REDUCTION OF RETAINING WALL #1 WOULD BE OFFSET BY THE REQUIRED STAGING OF THE RAMP CONSTRUCTION AS THE NEW RAMP WOULD CROSS THE EXISTING RAMP AND UTILIZING EXISTING PROFILE GRADE INFORMATION WOULD REQUIRE TEMPORARY PAVING OR CLOSING THE RAMP FOR A SHORT DURATION.

RELOCATION OF THE RAMPS PLUS UTILIZATION OF THE GDOT CONCEPT OF 100' LIMITED ACCESS WOULD ALLOW RETENTION OF ONE DRIVEWAY PER SERVICE STATION.

COST SAVINGS POTENTIAL WOULD RESULT FROM NOT PURCHASING THE FOUR BUSINESSES IN EACH QUADRANT. UNTIL THE COST OF THE BUSINESSES, COST OF ACCESS RIGHTS AND REDESIGN OF THE RAMPS IS REVIEWED, NO COST SAVINGS CAN BE DETERMINED

Project Description

Project Description

INTRODUCTION

This project consists of reconstruction of the I-75/SR 156 interchange and also includes widening reconstruction of SR 156/Redbud Road to provide a five-lane section through the interchange from Curtis Parkway/Warriors Path to Newtown Church Road/Harmony Church Road. The project also includes the replacement of the I-75 bridge over SR 156.

At the time of this study, the estimated cost of this construction (attached), not including right-of-way purchase, was approximately $24,611,350 dollars. The estimated cost of Right-of-way acquisition was estimated at $3,100,000 dollars. Subsequent to the study, the GDOT revised the estimates to $37,901,000 for construction and $23,048,000 for ROW.

Please see the following enclosed documents:

- GDOT Cost Estimate
- Concept Plan of the Proposed IM-75-3(189)-Redbud Road, Gordon County, Georgia; PI No.: 610750

The VE Team utilized the supplied project materials noted above, along with the design products from THE LAI ENGINEERING, and the current standard drawings, details and specifications during the conduct of their work in the VE Study effort.

Estimate Report for file "610750"

Section CLEARING & GRUBBING

Item Number	Quantity	Units	Unit Price	Item Description	Cost
202-1000	60	AC	4000.00	CLEARING & GRUBBING	240000.00
				Section Sub Total:	**$240,000.00**

Section EARTHWORK

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	100	CY	15.00	DRAINAGE MATERIAL	1500.00
205-0001	202000	CY	5.61	UNCLASS EXCAV	1133220.00
205-0210	1000	CY	15.00	EXCAVATION - ROCK	15000.00
206-0002	20000	CY	6.31	BORROW EXCAV, INCL MATL	126200.00
208-0100	156500	CY	10.19	IN PLACE EMBANKMENT	1594735.00
573-2006	1500	LF	17.71	UNDDR PIPE INCL DRAINAGE AGGR, 6 IN	26565.00
603-7000	1000	SY	4.83	PLASTIC FILTER FABRIC	4830.00
				Section Sub Total:	**$2,902,050.00**

Section BASE & PAVING

Item Number	Quantity	Units	Unit Price	Item Description	Cost
310-1101	129302	TN	17.17	GR AGGR BASE CRS, INCL MATL	2220115.34
402-1811	3000	TN	90.00	RECYCLED ASPH CONC LEVELING, INCL BITUM MATL	270000.00
402-3110	250	TN	90.00	RECYCLED ASPH CONC 9.5 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	22500.00
402-3112	27819	TN	85.00	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	2364615.00
402-3113	12974	TN	85.00	RECYCLED ASPH CONC 12.5 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	1102790.00
402-3121	46317	TN	80.00	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME	3705360.00
413-1000	57000	GL	1.84	BITUM TACK COAT	104880.00
432-0205	61000	SY	1.89	MILL ASPH CONC PVMT, 1 1/4 IN DEPTH	115290.00
439-0026	39726	SY	80.00	PLAIN PC CONC PVMT, CL 3 CONC, 12 INCH THK	3178080.00
446-3500	23000	LF	5.18	HIGH STRENGTH PVMT REINF FABRIC -	119140.00
				Section Sub Total:	**$13,202,770.34**

Section DRAINAGE

Item Number	Quantity	Units	Unit Price	Item Description	Cost
550-1150	140	LF	41.50	STORM DRAIN PIPE, 15 IN, H 1-10	5810.00
550-1180	2305	LF	41.02	STORM DRAIN PIPE, 18 IN, H 1-10	94551.10
550-1240	1607	LF	53.78	STORM DRAIN PIPE, 24 IN, H 1-10	86424.46
550-1300	841	LF	65.92	STORM DRAIN PIPE, 30 IN, H 1-10	55438.72
550-1360	220	LF	77.97	STORM DRAIN PIPE, 36 IN, H 1-10	17153.40
550-4215	3	EA	700.74	FLARED END SECTION 15 IN, STORM DRAIN	2102.22
550-4218	12	EA	678.07	FLARED END SECTION 18 IN, STORM DRAIN	8136.84
550-4224	6	EA	882.93	FLARED END SECTION 24 IN, STORM DRAIN	5297.58
550-4230	6	EA	909.32	FLARED END SECTION 30 IN, STORM DRAIN	5455.92
576-1018	60	LF	26.13	SLOPE DRAIN PIPE, 18 IN	1567.80
668-1100	36	EA	2277.92	CATCH BASIN, GP 1	82005.12
668-2100	19	EA	4470.97	DROP INLET, GP 1	84948.43
668-4300	1	EA	2213.53	STORM SEWER MANHOLE, TP 1	2213.53
668-8011	100	SF	44.29	SAFETY GRATE, TP 1	4429.00
				Section Sub Total:	**$455,534.12**

Section CONCRETE WORK

Item Number	Quantity	Units	Unit Price	Item Description	Cost
433-1000	1020	SY	135.15	REINF CONC APPROACH SLAB	137853.00
441-0104	3328	SY	37.12	CONC SIDEWALK, 4 IN	123535.36
441-0204	500	SY	33.76	PLAIN CONC DITCH PAVING, 4 IN	16880.00
441-0740	1873	SY	30.26	CONCRETE MEDIAN, 4 IN	56676.98
441-4030	500	SY	45.27	CONC VALLEY GUTTER, 8 IN	22635.00
441-5002	1800	LF	16.02	CONCRETE HEADER CURB, 6 IN, TP 2	28836.00
441-6222	6535	LF	17.08	CONC CURB & GUTTER, 8 IN X 30 IN, TP 2	111617.80

622-1033	14000	LF	40.00	PRECAST CONCRETE MEDIAN BARRIER, METHOD 3	560000.00
				Section Sub Total:	**$1,058,034.14**

Section TRAFFIC CONTROL

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	1	Lump Sum	425000.00	TRAFFIC CONTROL	425000.00
				Section Sub Total:	**$425,000.00**

Section EROSION CONTROL (TEMP)

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	180	LB	50.00	TEMPORARY GRASSING	9000.00
000-0000	60	LB	50.00	ADDITIONAL GRASSING	3000.00
163-0240	93	TN	183.84	MULCH	17097.12
163-0503	9	EA	549.25	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	4943.25
163-0520	68	LF	16.16	CONSTRUCT AND REMOVE TEMPORARY PIPE SLOPE DRAIN	1098.88
163-0550	66	EA	308.76	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	20378.16
165-0020	94100	LF	2.36	MAINTENANCE OF TEMPORARY SILT FENCE, TP B	222076.00
165-0030	31100	LF	1.83	MAINTENANCE OF TEMPORARY SILT FENCE, TP C	56913.00
165-0087	9	EA	178.48	MAINTENANCE OF SILT CONTROL GATE, TP 3	1606.32
165-0105	66	EA	110.84	MAINTENANCE OF INLET SEDIMENT TRAP	7315.44
171-0020	94100	LF	4.01	TEMPORARY SILT FENCE, TYPE B	377341.00
171-0030	31100	LF	3.84	TEMPORARY SILT FENCE, TYPE C	119424.00
				Section Sub Total:	**$840,193.17**

Section EROSION CONTROL (PERM)

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	200	LB	50.00	PERMANENT GRASSING	10000.00
000-0000	50	LB	50.00	ADDITIONAL GRASSING	2500.00
455-1000	150	SY	3.91	FILTER FABRIC FOR EMBANKMENT STABILIZATION	586.50
603-2012	120	SY	45.00	STN DUMPED RIP RAP, TP 1, 12 IN	5400.00
700-7000	110	TN	58.05	AGRICULTURAL LIME	6385.50
700-8000	27	TN	348.14	FERTILIZER MIXED GRADE	9399.78
700-8100	1200	LB	2.04	FERTILIZER NITROGEN CONTENT	2448.00
710-9000	50000	SY	3.65	PERMANENT SOIL REINFORCING MAT	182500.00
				Section Sub Total:	**$219,219.78**

Section GUARDRAIL

Item Number	Quantity	Units	Unit Price	Item Description	Cost
641-1100	100	LF	51.47	GUARDRAIL, TP T	5147.00
641-1200	7000	LF	18.54	GUARDRAIL, TP W	129780.00
641-2200	5800	LF	23.54	DBL FACED GUARDRAIL, TP W	136532.00
641-5001	8	EA	617.35	GUARDRAIL ANCHORAGE, TP 1	4938.80
641-5012	8	EA	1871.80	GUARDRAIL ANCHORAGE, TP 12	14974.40
650-1100	11	EA	22841.01	IMPACT ATTENUATOR UNIT (CRASH COMPRESSION CUSHION) TYPE P-	251251.11
				Section Sub Total:	**$542,623.31**

Section SIGNS, STRIPING, SIGNALS, LIGHTING

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	4	EA	100000.00	TRAFFIC SIGNAL INSTALLATION, PERMANENT	400000.00
000-0000	65	EA	100.00	ARROWS & WORDS	6500.00
636-1020	500	SF	15.31	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	7655.00
636-1029	170	SF	18.64	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING, TP 3	3168.80
636-2070	1100	LF	8.75	GALV STEEL POSTS, TP 7	9625.00
636-2080	150	LF	11.30	GALV STEEL POSTS, TP 8	1695.00
653-1501	35500	LF	0.63	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	22365.00
653-1502	34600	LF	0.69	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	23874.00
653-1704	710	LF	5.02	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	3564.20
653-1804	5600	LF	1.99	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	11144.00
653-1810	6400	LF	1.16	THERMOPLASTIC SOLID TRAF STRIPE, 10 IN, WHITE	7424.00

653-3501	31000	GLF	0.48	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	14880.00
653-3502	1560	GLF	0.36	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, YELLOW	561.60
653-6004	1170	SY	2.79	THERMOPLASTIC TRAF STRIPING, WHITE	3264.30
653-6006	880	SY	3.21	THERMOPLASTIC TRAF STRIPING, YELLOW	2824.80
654-1001	478	EA	3.64	RAISED PVMT MARKERS TP 1	1739.92
				Section Sub Total:	**$520,285.62**

Section GRASSING/LANDSCAPING

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	1	Lump Sum	15000.00	GRASSING/LANDSCAPING	15000.00
				Section Sub Total:	**$15,000.00**

Section MISCELLANEOUS

Item Number	Quantity	Units	Unit Price	Item Description	Cost
153-1300	1	EA	75272.56	FIELD ENGINEERS OFFICE TP 3	75272.56
634-1200	100	EA	104.82	RIGHT OF WAY MARKERS	10482.00
643-2162	6000	LF	22.00	CH LK FENCE W/EXT ARMS & BARBED WIRE, ZC COAT, 8 FT, 9 GA	132000.00
				Section Sub Total:	**$217,754.56**

Section MAJOR STRUCTURES

Item Number	Quantity	Units	Unit Price	Item Description	Cost
000-0000	113	CY	800.00	CONCRETE FOR BOX CULVERT	90400.00
511-1000	10400	LB	0.95	BAR REINF STEEL	9880.00
543-9000	1	Lump Sum	3471587.00	CONSTRUCTION OF BRIDGE COMPLETE	3471587.00
617-0510	1	LS	401018.00	RETAINING WALLS	401018.00
				Section Sub Total:	**$3,972,885.00**

Total Estimated Cost: $24,611,350.04

Georgia Department of Transportation

Concept Validation Report
and
Traffic Concept Validation Report

S.R. 156 / I-75 Interchange Improvements

GDOT Project No. IM-75-3 (189)
P.I. No. 610750
Gordon County

LOWE & ASSOCIATES, INC.

CIVIL & TRANSPORTATION ENGINEERS

Concept Validation Report
and
Traffic Concept Validation Report
SR 156/I-75 Interchange Improvements
GDOT Project No. IM-75-3 (189)
PI No. 610750
Gordon County

January 7, 2002

Lowe & Associates Project: T-273.1

Prepared for:
Georgia Department of Transportation

LOWE & ASSOCIATES, INC.

CIVIL & TRANSPORTATION ENGINEERS

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B Traffic Signal Warrant Analyses

C Arterial Level of Service Report
Arterial Bandwidth Time-Space Diagram

I-75/SR 156 INTERCHANGE IMPROVEMENT CONCEPT VALIDATION REPORT

Introduction

Project IM-75-3 (189), Gordon County, P.I. No. 610750, is the proposed widening of S.R. 156 and reconstruction of the I-75/SR 156 interchange. This project will include the reconstruction of S.R. 156 (Redbud Road), beginning on the west side of I-75 at the intersection of Curtis Parkway/Warrior Path and extending 0.56 mile, east crossing under I-75 to the intersection of Newtown Church Road/Harmony Church Road. The project is designed to improve capacity of the proposed roadway and improve safety by increasing sight distances to reduce potential accidents between the bridge ramps.

Purpose

The purpose of this Concept Validation Report is to evaluate the Department's November 10, 1999 Project Concept and document the proposed design standards and guidelines for the Design Data Book and other information gathered in this phase.

Approach to Concept Validation

The Georgia Department of Transportation (GDOT) provided the approved Conceptual Plan dated February 8, 2000 and Project Conceptual Report dated February 8, 2000 with traffic volumes and project background information to Lowe & Associates for validation of the approved Project Concept.

The approach to validating the concept is as follows:

- A detailed review of the Georgia Department of Transportation's Project Concept Report dated November 10, 1999
- Review of the Georgia Department of Transportation's Concept Plan for the Project
- Field visit to the Project area
- Traffic Analysis for noted project intersections, and
- Analysis for bridge requirements for the Project

Project Concept Evaluation

Review of Traffic Data

After review of the Project Concept Report, Concept Plan and field visit, traffic analyses of the following intersections were conducted:

- Redbud Road at Curtis Parkway/Warrior Path (signalized)
- Redbud Road at I-75 southbound ramps (stop sign controlled)

- Redbud Road at I-75 northbound ramps (stop sign controlled)
- Redbud Road at Newtown Church Road/Harmony Church Road (stop sign controlled)

Review of Bridge Data

The following design issues were reviewed in regard to the new bridge construction and limits of the interstate re-construction:

- Main span length required over Redbud Road
- Length of interstate reconstruction required
- Staging requirements of both I-75 and Redbud Road due to new bridge construction
- Tie in ramp alignments
- Project Cost

Review of Roadway Data

The analyses of the concept drawings and report in regards to the widening and reconstruction of Redbud Road and the construction of the connector streets were validated in the following way:

- Clear Zone Requirements
- Drainage Criteria
- Environmental Concerns
- Driveway Design Parameters
- Preliminary Surface Typical Sections
- Project Design Schedule
- Known Utilities
- Information Needed for GDOT
- Sample Plan Formats

The Project Concept Report approved by GDOT on February 8, 2000 is included.

Results of the Traffic, Roadway and Bridge Analyses are indexed in the Design Data Book.

Recommended Revisions to the Improvements

1. Extend 500 feet west of Curtis Parkway to provide for eastbound left turn into Warrior Path and adequate lane reduction taper from proposed 5-lane to existing 4-lane.

   As a result of reviewing the concept plans and report and a site visit, it was recommended that the limits of the project be extended westward to maintain two through lanes of traffic for eastbound traffic at the intersection of Curtis Parkway/Warrior Path. As shown in Figure 1, the introduction of a westbound left-turn lane will reduce both the eastbound and westbound through lanes from two lanes to one lane. The concept plan should be revised to continue the two through lanes in each direction beyond the intersection so as to improve operations.

2. Our analysis of Newtown Church Road/Harmony Church Road at SR 156 and the I-75 south and north bound ramps at SR 156 predicts an unacceptable level of service (LOS) as a two-lane stop controlled intersection. Therefore, a traffic signal warrant study and signal capacity

analysis was performed. It was determined that the intersections will operate at an acceptable level of service as signalized intersections. The traffic signal warrants study also indicated that both intersections are warranted for signalization.

A signal capacity analysis was performed at the existing signalized intersection on Redbud Road at Curtis Parkway/Warrior Path. The analysis was to determine the intersection's LOS under projected volumes. The results of the analysis revealed that the intersection would operate at an acceptable level of service under the projected traffic volumes. No geometric revisions are recommended outside of the initial concept validation report and plan at the intersection of Redbud Road and Curtis Parkway/Warrior Path. See the Traffic Concept Validation Report Section 2 page 6 for more detailed information.

3. The realignment of Harmony Church Road and County Road 321 would provide improved sight distance and transition at the design speed of 40 mph. The plan was submitted to the GDOT's Office of Environmental and Location to review for any concerns that the new alignment may raise.

   Although the revised environmental studies are not completed, Melanie Brooks with the Office of Environmental and Location does not anticipate any problems. According to the ecologist, there may be a stream in the area that may raise some question as to whether GDOT would have a longitudinal encroachment. If this were the case this would cause a small shift in alignment. In any event, we were given the go-ahead to proceed with getting approval for the revised concept.

   Left turn lanes are recommended on all approaches at the intersection of SR 156 and Newtown Church Road/Harmony Church Road.

4. Realignment of the new connector road between Warrior Path and Columbus Drive is recommended to eliminate the offset at the intersection into Columbus Circle.

5. Lowe and Associates recommends eliminating the raised median based on GDOT's *Median Design Guidelines* dated July 2000. SR 156 will be designed as a 5-lane section roadway from Curtis Parkway/Warrior Path east to the I-75 south bound ramps. The roadway will be striped for a 14-foot two-way-left-turn lane, four (4) 12-foot travel lanes. A raised median will be designed west of the southbound ramp and extending further west to station 22+00. The roadway section under the bridge will remain as designed in the original concept plan. The roadway section east of the I-75 northbound ramps will include a raised median extending east to station 34+00.

6. In accordance to GDOT Manual of Guidance, the concept plan has been revised to reflect right turn (deceleration) lanes on SR 156 at all public access roads within the project limits.

I-75 Bridge Overpass and Walls

1. After analyzing the approved concept report and drawings we recommend that the required main span length of the bridge will be the approved 128 feet. The main bridge span over Redbud Road will be designed to clear an additional through lane on each side for future expansion of Redbud Road. The requirement to shift the Redbud Road lanes for staging can be eliminated by further raising the profile of I-75. The existing span over Redbud Road is

40 feet clear between intermediate bents and consists of 3'-0" deep T-beams. Recommending that the bridge be changed from a one span bridge to a three span bridge would bring the total length of the bridge to 222 feet. The required distance to reconstruct I-75 for the grade change is approximately 2500 feet, which is within the limits of the new ramp reconstruction. The proposed profile consists of two sag vertical curves and a crest vertical curve to raise the grade over Redbud Road the required 4.5 feet. All additional grade changes will be accomplished by raising I-75; therefore, it is recommended that the concept be changed to eliminate the staging and lowering of Redbud Road. See Figure 1 for proposed bridge plan.

2. There will be two walls on the project. Wall number one will be located parallel to I-75 ramp from Station 14+00 to 16+80 and will be required to support the relocated northbound I-75 exit ramp. Two alternates will be considered for wall design. The first will be a cast-in-place reinforced concrete wall and the second alternate design will be a stabilized embankment wall using panels and mechanical reinforcing strips.

3. Wall number two will be parallel to Redbud Road from station 33+00 to 34+80 and will be required to support the parking lot of the Scottish Inn property. Two alternatives will be considered for wall design. The first will be a gravity wall. The second alternate will be a cast-in-place reinforced concrete wall.

Project Constructibility

Challenges with Constructibility along Redbud Road include the section under the bridge. During construction, driveways may have to be stage constructed or temporary driveways provided for access during the construction of the permanent driveways. No problems with the Constructibility of the new connector roads are foreseen.

The bridge will be built in three stages. It appears that building a Mechanical Stabilizing Embankment (MSE) wall in threes stages would be more difficult and require more temporary shoring than building a three span bridge.

Based on our analysis of the existing grades on both I-75 and Redbud Road and the required additional grade separation needed for the new bridge, we recommend raising I-75 four and a half feet. We have analyzed the required distance to reconstruct I-75 for the grade change. This can be accomplished within the current proposed project limits of the new ramp reconstruction.

We also recommend that the ramp alignments, horizontal and vertical, be constructed to meet the requirements for the future eight-lane freeway. This will require the ramp alignments to be lengthened and shifted.

Maintenance of Traffic

The concept report requires I-75 to be staged to maintain three lanes of traffic in each direction. We have developed a staging scheme that allows the detour pavement to be retained as part of the completed interstate section. Stage I involves shifting the existing lanes outward onto the existing shoulders and building the first stage in the middle at final grade. Stages II and III would be the construction of the north and south bound sides of the bridge and interstate to the outside of traffic. For additional details and widths see Figure 2 and 3 - Staging Typical Section.

Construction along Redbud Road will be between the curb line and the right of way line. Traffic can be maintained where it is currently located without detours or minimum shifting. The staging scheme developed for Redbud Road would have two stages. Stage I would involve maintaining traffic on the existing roadway while the north side of Redbud is being constructed. Stage II will shift traffic to the north side of the widening while constructing the south side and installing the final topping across the entire roadway. Driveway access will be maintained at all times. See Figure 4.

Traffic will be maintained on Harmony Church Road during the construction of the realignment of the roadway. Traffic would be shifted to the new lanes during the extension of C.R. 321. The traffic on C.R. 321 will be detoured to another exit further east onto Redbud Road.

Traffic control regarding sign and marking during construction, would involve an agreement between the contractor and GDOT.

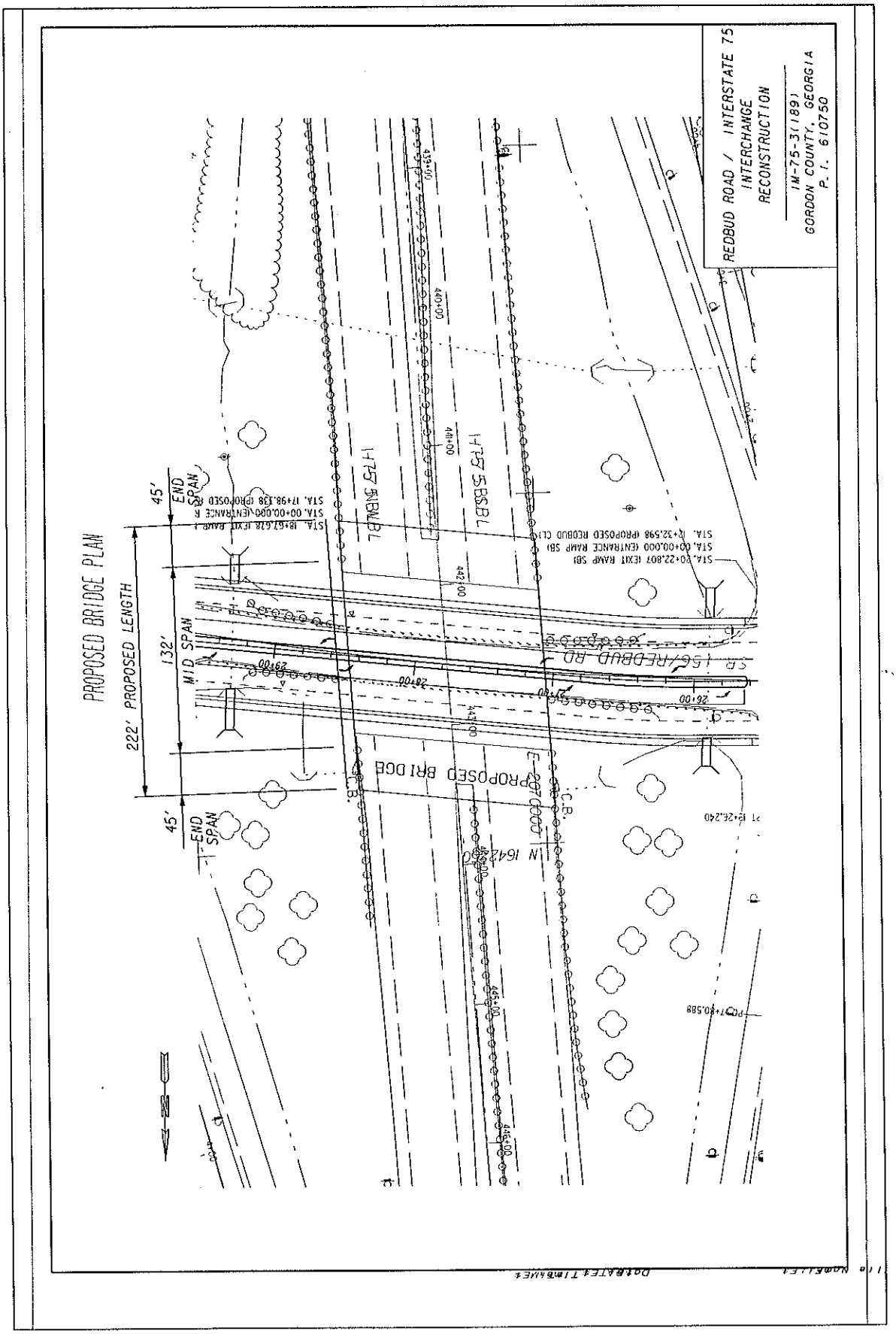


Figure 1. Proposed Bridge Plan

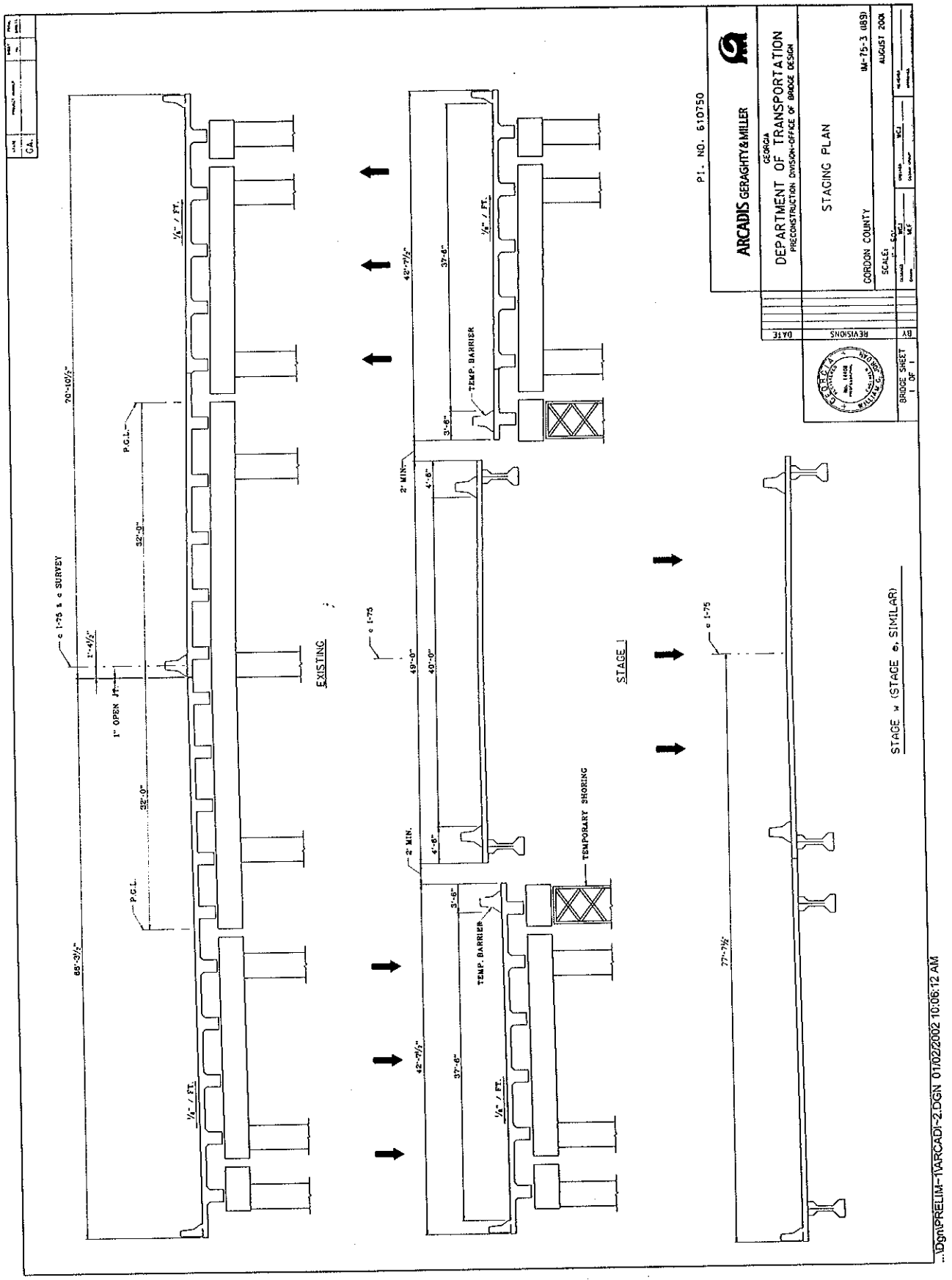


Figure 2. Bridge Staging Plan

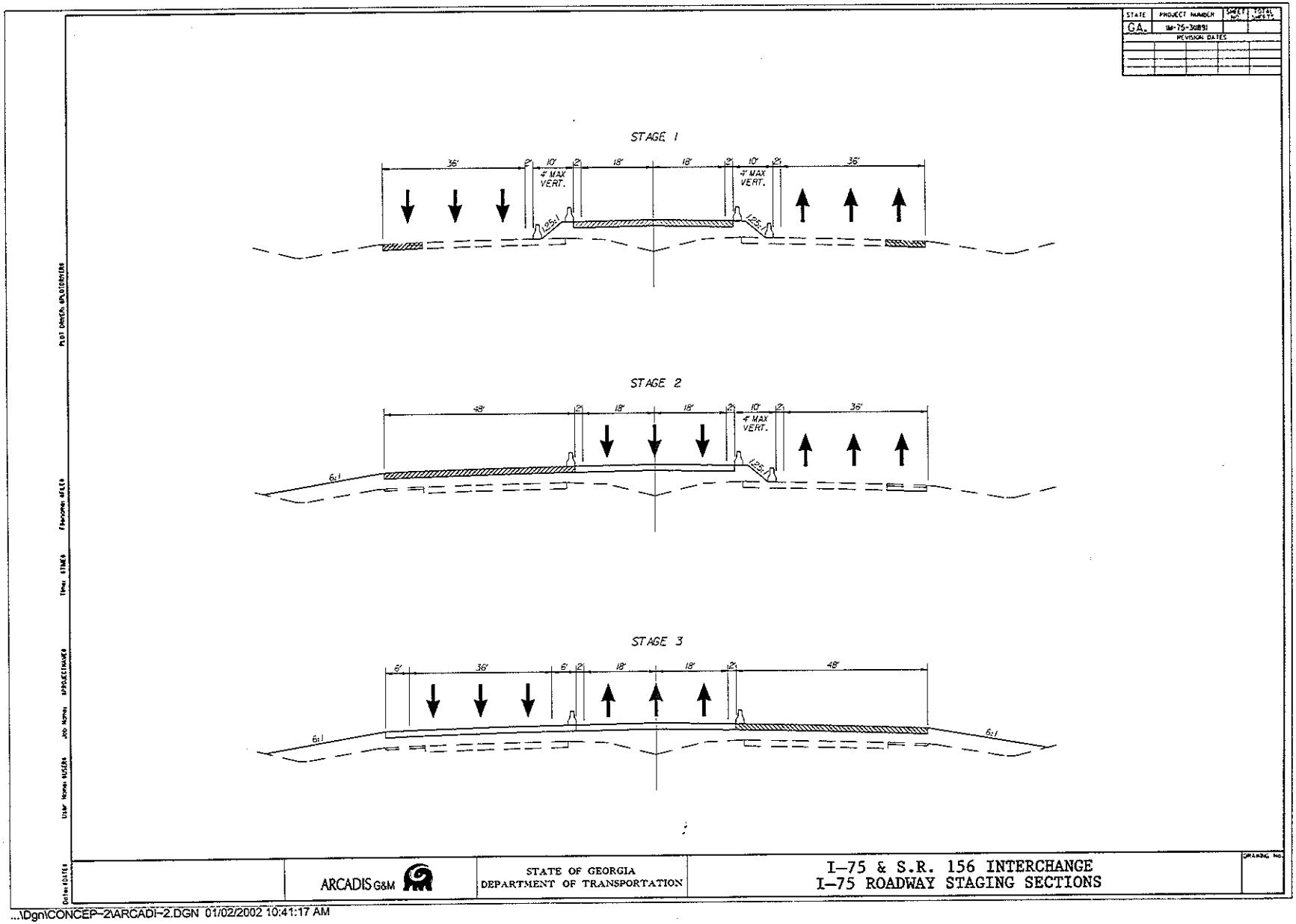


Figure 3. I-75 Roadway Staging Plan

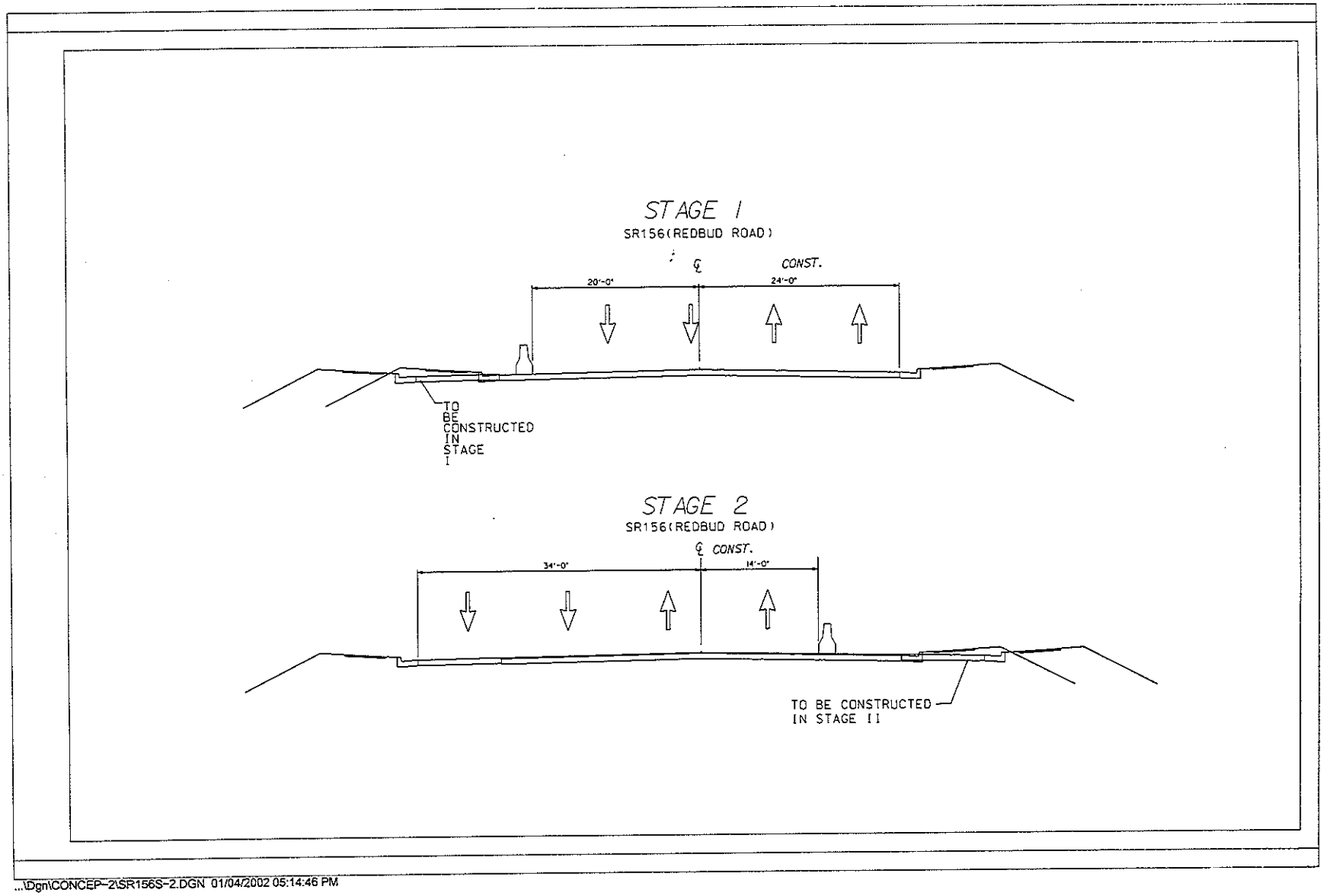


Figure 4. Redbud Road Staging Plan

Impacts to Properties (displacements)

The project portion of Redbud Road is an urban arterial serving commercial properties on both sides of the highway. No residential displacement is anticipated on this project.

The standard Federal Highway Administration's (FHWA) 300 feet limited access at the I-75 interchange, would displace all four gas stations. The GDOT concept 100 feet limited access from the ramps, will close one driveway into each of the gas stations. Figure 5a and 5b illustrate the limited access options discussed.

Twenty-seven properties will be affected by the widening project on Redbud Road.

Utility Conflicts

Data provided by Royce Turner, Assistant District Utility Engineer with the Department of Transportation, indicates that there are several utilities in the project area. These utilities include North Georgia EMC, BellSouth Telecommunications, Atlanta Gas and Light Company, City of Calhoun and Comcast Cable Company. The I-75/SR 156 Road Widening Project in varying degrees will impact these utilities. Coordination at the early stages of the preliminary design is important. This will permit the utility companies time to prepare for adjustments and/or the relocation of their services.

It is noted, from the Concept Team Meeting, August 4, 1999, that Mark Williamson, with the City of Calhoun, indicated a concern for existing utilities hanging under the existing bridge with respect to relocating them under the proposed bridge. He stated the City had both gravity flow and force main sewer and water that would require relocation due to the project. Coordination with the City of Calhoun, in the early stages of the preliminary design, will help to mitigate any complications due to this impact.

Additionally, the Department of Transportation's Traffic Operations Design Office is requesting conduit be installed within the limits of the project, as well as on the newly constructed I-75 bridge.

Lowe & Associate will coordinate the efforts between sub-consultants, government agencies and utility companies to review any complications due to this impact.

Steps to Minimize Environmental Impacts

The level of environmental documentation is a Categorical Exclusion, which was signed by FHWA on March 28, 1996. Several underground storage tank (UST) sites are located adjacent to the proposed right-of-way. A field survey identified 6 potential UST sites along the proposed project corridor. Subsurface testing will be required to determine the presence of contamination. This information will be included in the environmental reevaluation. If contamination is found then any soil from the contaminated parcels must stay on that parcel or must be placed in a permitted lined municipal solid waste landfill. This will be added to the plans if contamination is encountered.

An Environmental Report is included in this project; however, it is not included in this report since environmental studies are not completed as of this date. GDOT's Office of Environment &

Location has committed to having the studies completed by mid-January. When completed, the Environmental Report will be submitted and incorporated into this report.

Erosion control challenges associated with most construction activities will be addressed during final design. Soil erosion will require proper sedimentation and erosion control features. These should be implemented before any land disturbance and continued until the permanent vegetation is established.

Also, with businesses located along the roadway, dust control will be a concern. The contractor should have water trucks available during dry periods. The contractor should also make an inquiry regarding any city noise ordinances that might require obtaining permits to work beyond certain hours.

Steps to minimize unexpected design and right of way problems

As the project is fairly well developed, there should be a minimum of obscured areas. However, with the numerous properties and driveways along this corridor, it is recommended that significant coverage of field located topography be obtained. This will help improve the accuracy and enhance the aerial mapping done for this project.

Also, following the Department of Transportation's planed development process should help to isolate and identify potential problems as well as help resolve those identified. This should help to bring attention to problems or potential problems early in order to avoid or correct them prior to right-of-way acquisition and construction.

Summary of Concept Validation

The concept as proposed by the Department of Transportation with modifications as recommended meet the need and purpose for the project. The level of impact during construction will vary. It will be more difficult to construct a five-lane roadway through a corridor that is currently a two-lane roadway, than where a four-lane roadway exists. Redbud Road is characterized by predominately commercial properties. To widen the road, a review of each parcel along Redbud Road is required. This concept will meet both project goals to add capacity and improve safety with the least amount of disruption to the existing properties.

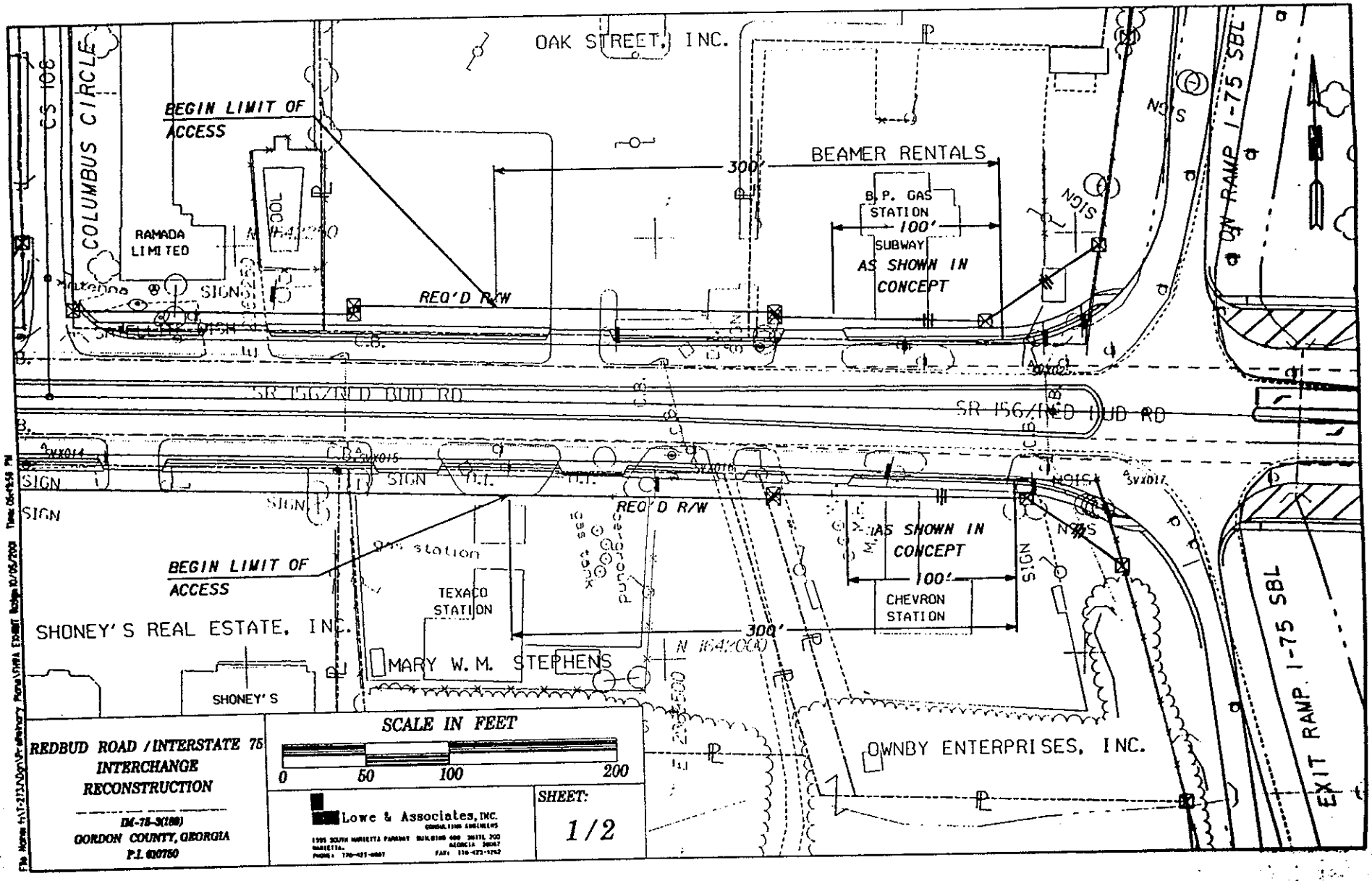


Figure 5a. Proposed Limited Access at I-75 SB ramp

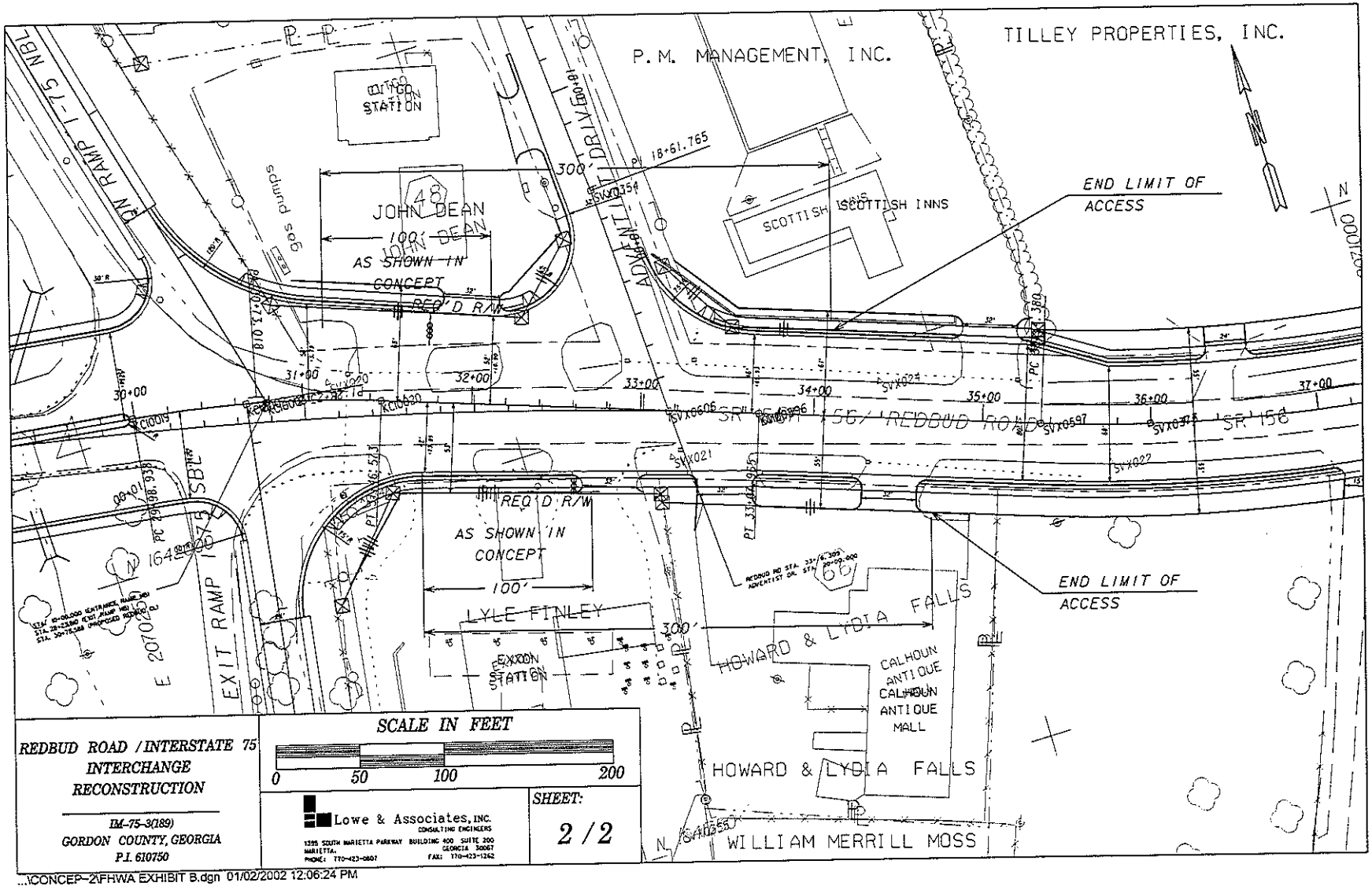


Figure 5b. Proposed Limited Access at I-75 NB ramp

I-75/SR 156 INTERCHANGE IMPROVEMENT TRAFFIC CONCEPT VALIDATION REPORT

Executive Summary

The Georgia Department of Transportation plans the reconstruction of the I-75/S.R. 156 interchange in Gordon County. This project will incorporate the reconstruction of S.R. 156, beginning on the west side of Curtis Parkway/Warrior Path and extending east crossing under I-75 to the Newton Church Road/Harmony Church Road intersection. See Figure 1. The primary goal for this project is to improve operational efficiency by reconfiguring the existing interchange.

S.R. 156 (Redbud Road) is a minor east-west urban arterial located in the northwest section of the State in the City of Calhoun.

The purpose of this study is to investigate the anticipated traffic operations along S.R. 156 to verify that the traffic along this facility will operate at an acceptable level of service.

Traffic data was provided by the Georgia Department of Transportation's Office of Environment and Location, and; the North Annex Office to support the morning and evening peak period capacity analyses at the intersections of:

- S.R. 156 (Redbud Road) and Curtis Parkway/Warrior Path
- S.R. 156 (Redbud Road) and I-75 Southbound Ramps
- S.R. 156 (Redbud Road) and I-75 Northbound Ramps
- S.R. 156 (Redbud Road) and Newton Church Road/Harmony Church Road

and to support traffic signal needs analyses at the following intersection:

- S.R. 156 (Redbud Road) and I-75 Northbound and Southbound Ramps

The traffic operations goal for intersections was a minimum Level of Service (LOS) D. Our investigation revealed that the intersections studied at S.R. 156 and the I-75 southbound and northbound ramps and S.R. 156 at Newton Church Road/Harmony Church Road would operate unacceptable as a two-lane stop controlled intersection through 2022. See Table 1.

The intersections at S.R. 156 at the I-75 southbound and northbound ramps and at Newton Church Road/Harmony Church Road were studied to determine the LOS as signalized intersections. The existing signalized intersection of S.R. 156 at Curtis Parkway/Warrior Path was also analyzed to determine its LOS for the design year 2022. The study revealed that the proposed and existing intersections would operate acceptably through 2022 as a signalized intersection as shown in Table 2.

We conducted a traffic signal warrant analysis according to the *2000 Manual on Uniform Traffic Control Devices* for the intersections at S.R. 156 and I-75 SB/NB and S.R. 156 at Newton Church Road/Harmony Church Road. Warrants 1, 2, and 3 were applied for the analyses.

The traffic signal warrant analysis for the intersection at S.R. 156 and I-75 SB and NB revealed that Warrants 1, 2 and 3 was met. The traffic signal warrant analysis for the intersection at S.R. 156 at Newton Church Road/Harmony Church Road revealed that Warrants 2 and 3 were met.

Table 1. Approved Concept Intersection Level of Service

Intersections S.R. 156(Redbud Rd) at	**Existing LOS**	**Concept LOS**
I-75 Southbound Ramps	F	F
I-75 Northbound Ramps	F	F
Newton Church Road/ Harmony Church Road	F	F

Table 2. Recommended 2022 Signalized Intersection Level of Service

Intersections S.R. 156(Redbud Rd) at	**AM LOS**	**PM LOS**
Curtis Parkway / Warrior Path	C	C
I-75 Southbound Ramps	C	C
I-75 Northbound Ramps	D	B
Newton Church Road/ Harmony Church Road	C	B

As a result of this study, Lowe and Associates recommends:

1. New traffic signals be installed at:

    - S.R. 156 (Redbud Road) and I-75 Northbound Ramps
    - S.R. 156 (Redbud Road) and I-75 Southbound Ramps
    - S.R. 156 (Redbud Road) and Newton Church Road/Harmony Church Road

These signals should be coordinated with the existing signal at S.R. 156 and Curtis Parkway/Warrior Path

2. The limits of the project should be extended 500 feet west of Curtis Parkway/Warrior Path to provide 200 feet of five-lane section west through the intersection and 300 feet taper west of Curtis Parkway. This would provide for an improved geometric design, design speed lane reduction taper, and a left turn lane for eastbound traffic onto Warrior Path.

3. Adding a left-turn lane should be provided for westbound traffic on S.R. 156 at Newton Church Road/Harmony Church Road. Left-turn lanes should be provided on both side streets - Newton Church Road and Harmony Church Road at S.R. 156.

4. The realignment of the new connector road between Warrior Path and Columbus Drive to eliminate the offset.

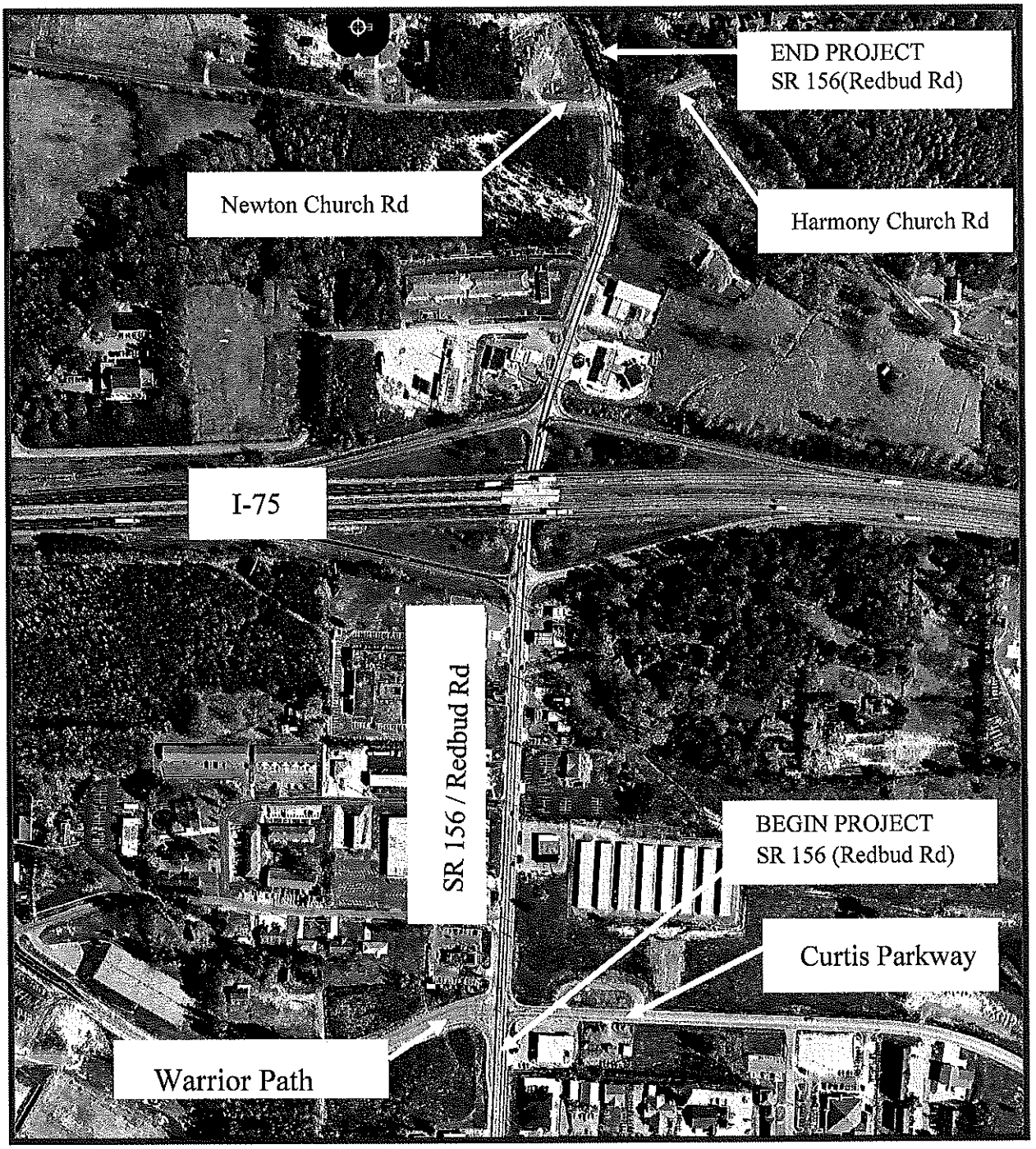
5. Delete the variable raised median and design S.R. 156 as a 5-lane roadway in accordance with GDOT raised median guidelines. Build cross section as recommended in concept report to provide the median between the ramps under the bridge.

6. Upgrade the existing signalized intersection at S.R. 156 and Curtis Parkway/Warrior Path with raised islands, crosswalks, pedestrian signals and overhead street name signs.

7. The proposed signalized intersections should have pedestrian signals installed and crosswalks across one leg of the mainline and across both legs on the side streets. All striped islands 100 square feet in area should be made raised. Overhead street name signs installed at Newtown Church Road/Harmony Church Road.

Figure 1. Vicinity Map

East



North

South

West

Existing Conditions

S.R. 156 (Redbud Road) is a two to four lane highway with curb and gutter on 60 feet of right-of-way. Turn lanes exist at all analyzed intersections. The posted speed is 40 miles per hour.

The intersection of S.R. 156 at Curtis Parkway/Warrior Path is a three phase signalized intersection with a protected-premissive left-turn phase for eastbound traffic. The eastbound left turn movements are shared with the through movements. All other intersections in the studied area are operating as a two-way stop sign condition. The following conditions exist at the side streets:

- Curtis Parkway is a local road on the south approach of S.R. 156 with a separate left turn lane and a shared through lane with a right turn movement. 2002 ADT – 5770 vpd

- Warrior Path is a local road on the north approach of S.R. 156 with a separate left turn lane, through lane and right turn lane. 2002 ADT – 2543 vpd

- The I-75 southbound and northbound ramps have separate left and right turn lanes. 2002 ADT – 3600 vpd.

- Newtown Church Road and Harmony Church Road are local roads with one through lane with shared left and right turning movements. 2002 ADT – 2875 vpd.

Proposed Design Concept

The design concept proposes the widening and reconstruction of the S.R. 156/I-75 interchange and incorporate the reconstruction of S.R. 156/Redbud Road beginning on the west side of I-75, west of Curtis Parkway/Warrior Path and extending east for 0.56 miles crossing under I-75 to a point east of the Newton Church Road/Harmony Church Road intersection. Figure 2 indicates the traffic data provided by the Georgia Department of Transportation (GDOT). The base year (2002) traffic is 16,700 vpd and the design year (2022) traffic is 26,900 vpd.

Lowe and Associates developed the 2022 peak hour traffic projections for Redbud Road at Curtis Parkway/Warrior Path by using the 2001 traffic volumes counts provided by GDOT's North Annex office as shown in Appendix A.

The proposed design speed is 45 miles per hour. Of the four intersections included in this study, three were analyzed as un-signalized intersections (S.R. 156 at I-75 southbound and northbound ramps and S.R. 156 at Newton Church/Harmony Church Rd) and one was analyzed a signalized intersection (S.R. 156 at Curtis Parkway/Warrior Path).

The concept design for S.R. 156/Redbud Road will provide two east and west bound lanes separated by a variable width six-inch high-curbed median on right-of-way of sixty feet. Median openings are planned at each intersection with exclusive left turn lanes except at the intersection of Curtis Parkway/Warrior Path in the eastbound direction and Newton Church Road/Harmony Church Road in the westbound direction. The median will continue on S.R. 156/Redbud Road and end on the west side of Newton Church Road/Harmony Church Road.

A raised median would result in safer operations, but would also result in significant U-turns, and increased traffic at all four of the planned S.R. 156 intersections. The median would also have a

negative access impact on the businesses along S.R. 156; especially the businesses that are specifically related to I-75.

Lowe and Associates recommends that the raised median be deleted and S.R. 156 be designed as a five-lane section on the recommended concept cross section in accordance with GDOT's *Median Design Guidelines* (July 2000). Lowe and Associates recommends maintaining the cross-section will allow median construction in the future when traffic operations and safety concerns require a raised median.

Table 3. Median Design Guidelines

Post or Design Speed less than or equal to 45 mph	Base year traffic volumes less than or equal to 18,000 (vpd)	Design year traffic volumes greater than or equal to 24,000 (vpd)
S.R. 156 (Redbud Rd) – posted speed limit 40	16,700	26,900

On-system Arterials: 68 feet, consisting of 14 foot flush median with 4 – 12.5 foot lanes and 2 foot paved shoulders to allow for future construction of a 20 foot raised median with 4 -12 foot lanes

Lowe and Associates recommends the following revisions to the adopted concept:

- Construct westbound left-turn lane on S.R. 156 at Newtown Church Road/Harmony Church Road.
- Realignment of the new connector road between Warrior Path and Columbus Drive to eliminate the proposed offset.

In addition to the signals proposed in the concept design, traffic signals are recommended at the following intersection:

- S.R. 156 at I-75 southbound and northbound ramps
- S.R. 156 at Newton Church Road/Harmony Church Road

Intersection Analyses

The following intersections were analyzed to assure that an acceptable level of service (LOS) would be provided in the design year (2022) by the proposed design. LOS D corresponding to 55 seconds of delay per vehicle or less was considered acceptable.

S.R. 156 (Redbud Road) at:

- Curtis Parkway/Warrior Path
- I-75 Southbound Ramps
- I-75 Northbound Ramps
- Newtown Church Road/Harmony Church Road

The procedures documented in the Highway Capacity Manual were followed. The Highway Capacity Software (HCS) version 3.2 computer software was used to facilitate the analyses for the proposed signalized intersections and the existing signalized intersection for 2022.

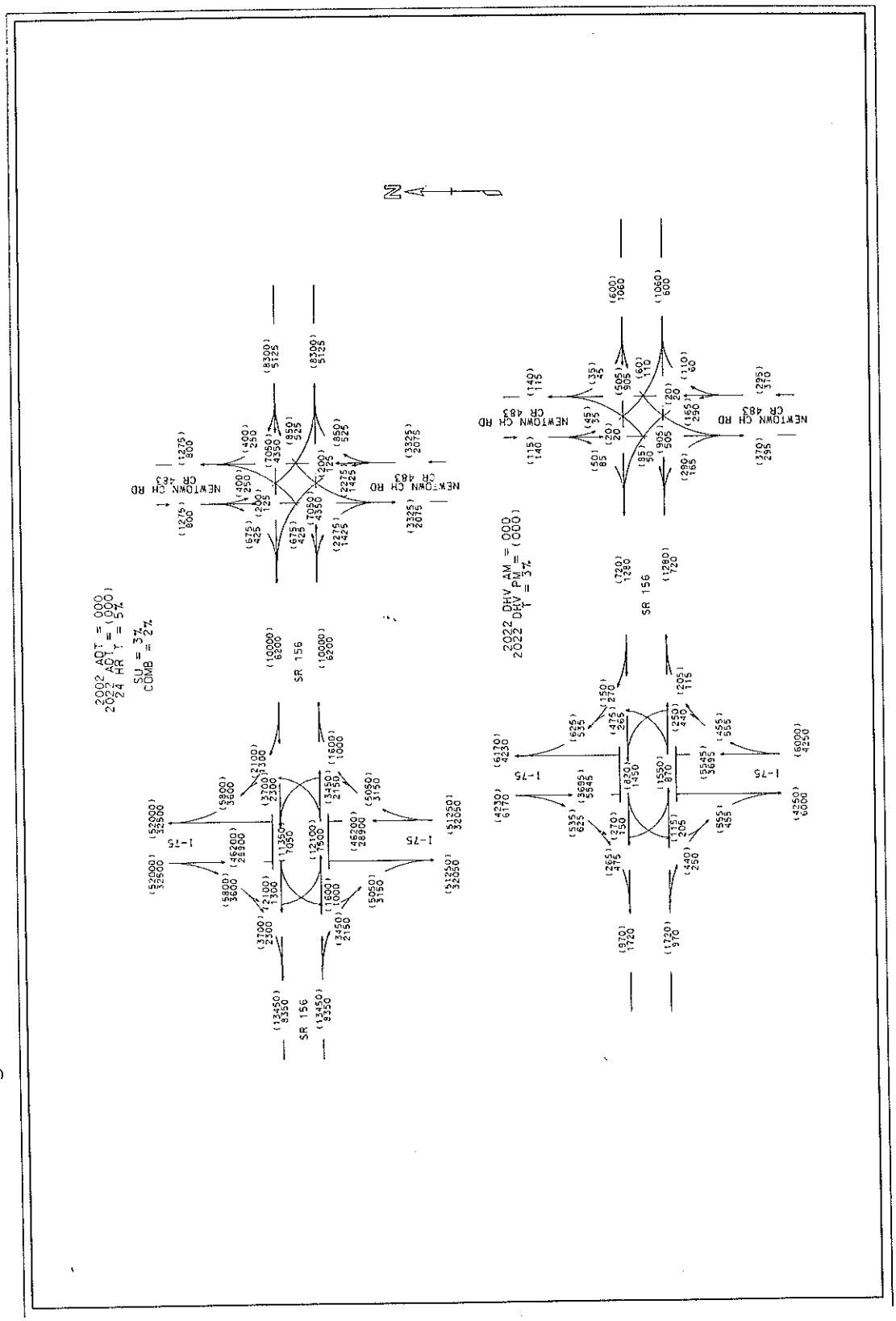
GDOT's Office of Environment and Location provided 2002 and 2022 average daily traffic (ADT) projections, as well as the 2022 morning and evening peak design hour volumes (DHV). These are shown in Figure 2.

According to Gordon County High School administrators, they are anticipating the opening of another high school within the next two years. Assuming the school is built, it would result in a reduction or no change in traffic volumes generated by the school. By taking the 2001 traffic volumes counts provided by GDOT's North Annex office, Lowe & Associates developed the 2022 peak hour traffic projections for Redbud Road at Curtis Parkway/Warrior Path. Utilizing GDOT's 20-year traffic projections, we calculated a 61% increase in traffic volumes. By multiplying that value by the 2001 count and dividing by 20, the 2002 volumes were produced. We then multiplied the 2002 volumes by the 61% and added that value to the 2002 volumes to produce the 2022 volumes for the intersection as illustrated in Appendix A.

The right turns on red were discounted from the northbound right turn movements during the AM peak period to bring that lane group to an acceptable LOS D. Based on the concept design, capacity analysis at the intersection of S.R. 156 and Curtis Parkway/Warrior Path revealed that the intersection would the overall operate at an acceptable level of service of C for the design year 2022.

Tables 4 through 13 show the results of the capacity analyses for each intersection based on the 2002 and 2022 concept design. Copies of each of the capacity analyses are located in the Design Data Book.

Figure 2. 2002 & 2022 ADT and 2022 AM & PM DHV



Volumes provided by Georgia Department of Transportation

Table 4
2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at Curtis Parkway/
Warrior Path (signalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
EB	L/T/T/R	C	B
WB	L/T/T/R	C	C
SB	LTR	D	C
NB	L/TR	D	D
Intersection		**C**	**C**

Figure 3. Recommended Design for S.R. 156 at Curtis Parkway/Warrior Path (signalized)

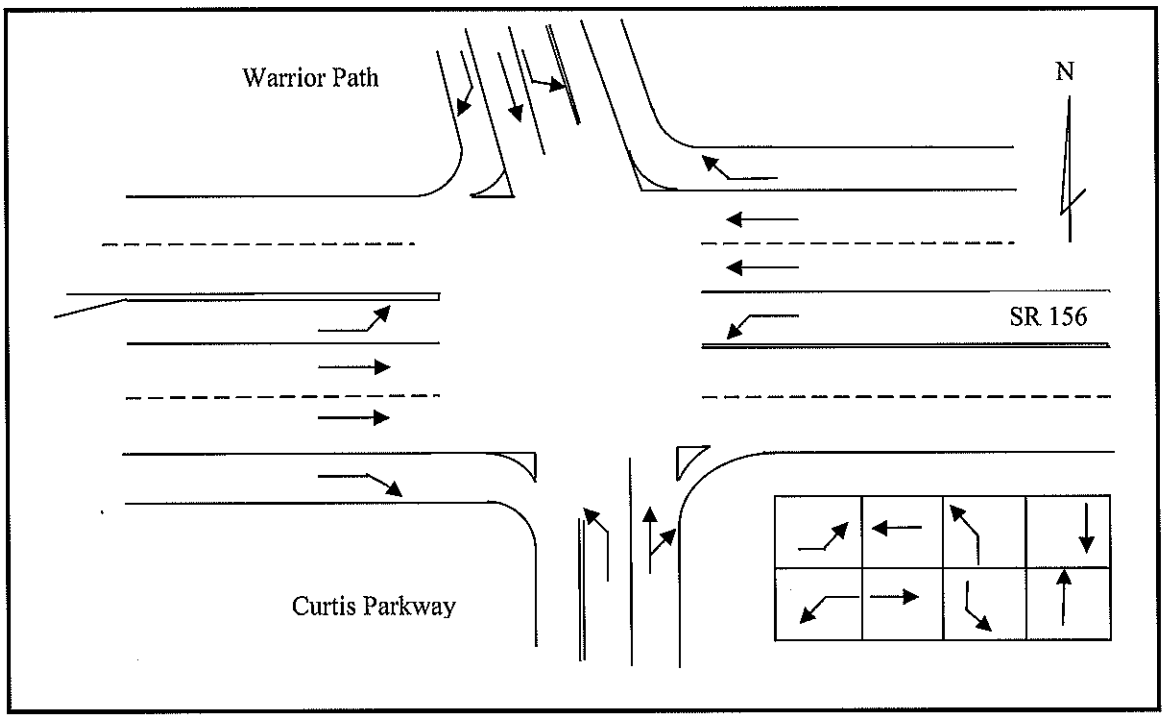


Table 5
2002 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Southbound Ramp (unsignalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
WB	L/T/T	A	B
SB	L/R	F	F

Table 6
2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Southbound Ramp (unsignalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
WB	L/T/T	B	C
SB	L/R	F	F

Table 7
Recommended 2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Southbound Ramp (signalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
WB	L/T/T	B	B
EB	L/R	D	C
SB	L/R	E	D
Intersection		**C**	**C**

Figure 4. Recommended Concept Design for S.R. 156 at I-75 SB ramps (signalized)

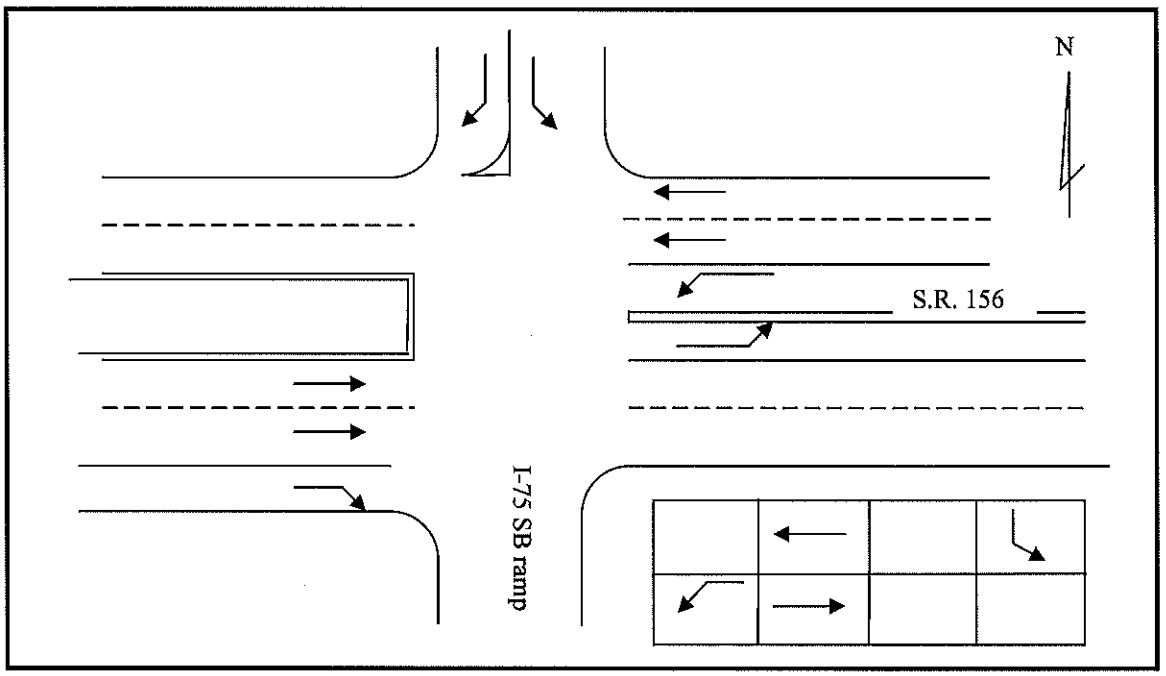


Table 8
2002 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Northbound Ramp (unsignalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
EB	L/T/T	B	A
NB	L/R	F	F

Table 9
2002 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Northbound Ramp (signalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
WB	TR	C	A
EB	L/T	A	A
NB	L/R	F	F
Intersection		**C**	**C**

Table 10
Recommended 2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at I-75 Northbound Ramp (signalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
WB	T/T/R	C	B
EB	L/T/T	C	A
NB	L/R	E	D
Intersection		**D**	**B**

Figure 5. Recommended Concept Design for S.R. 156 at I-75 NB ramps (signalized)

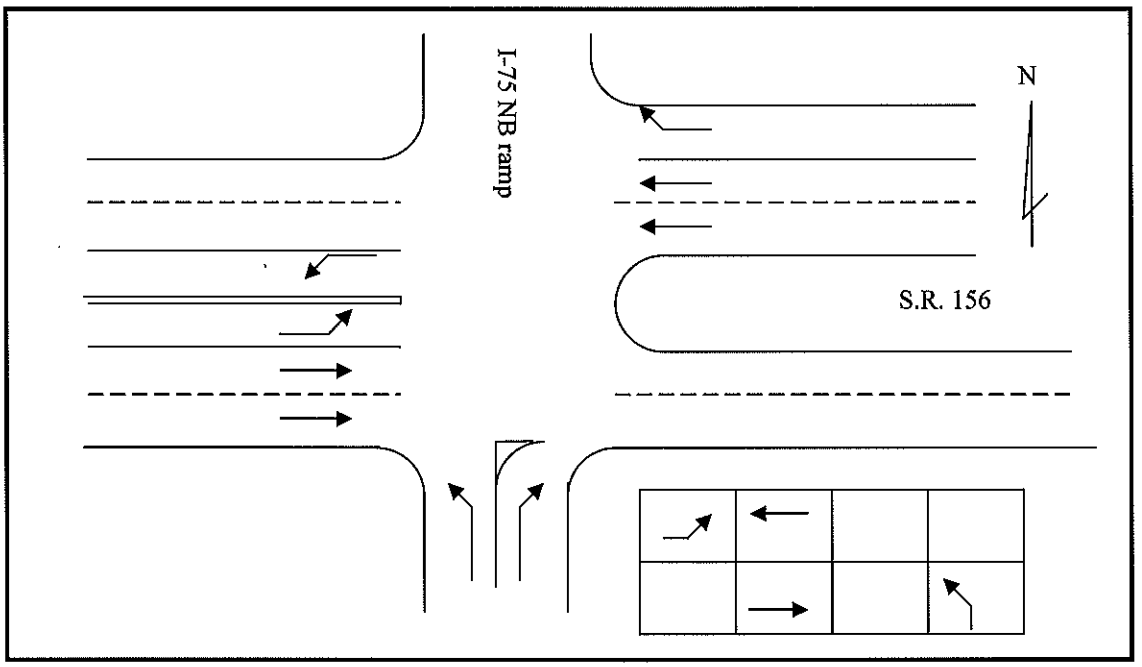


Table 11
2002 Concept LOS Summary:
S.R. 156 (Redbud Rd) at Newton Church Road/
Harmony Church Road (unsignalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
EB	L/T/R	A	A
WB	LTR	A	A
SB	LTR	C	C
NB	LTR	F	D

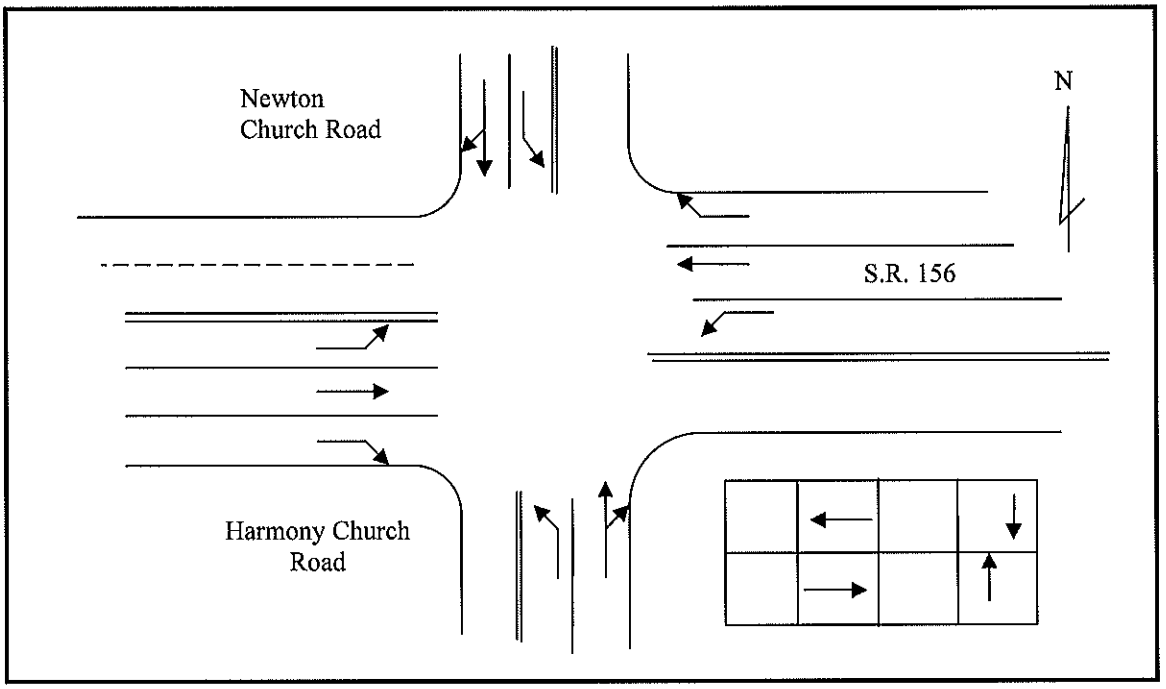
Table 12
2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at Newton Church Road/
Harmony Church Road (unsignalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
EB	L/T/R	B	A
WB	LTR	A	B
SB	LTR	F	F
NB	LTR	-	F

Table 13
Recommended 2022 Concept LOS Summary:
S.R. 156 (Redbud Rd) at Newton Church Road/
Harmony Church Road (signalized)

Direction	Lanes	AM Peak LOS	PM Peak LOS
EB	L/T/R	B	A
WB	L/T/R	C	B
SB	L/T/R	C	C
NB	L/T/R	D	D
Intersection		**C**	**B**

Figure 6. Recommended Concept Design for S.R. 156 at Newton Church Road/ Harmony Church Road (signalized)



Traffic Signal Warrant Analyses

Lowe & Associates conducted traffic signal warrant analyses at the following intersections:

- S.R. 156 Redbud Road at I-75 SB ramps
- S.R. 156 Redbud Road at I-75 NB ramps
- S.R. 156 Redbud Road at Newton Church Road/Harmony Church Road

Hourly volumes were provided by GDOT's North Annex office.

The procedures documented in the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (2000 edition) were followed. The PC-Warrants 0.9 version computer software was used to facilitate the analyses of the proposed signalized intersections.

The traffic signal warrant analyses, based on the concept design, indicates both intersections met the warrants for signal consideration. Warrants 1, 2 and 3 were evaluated. Table 14 shows the results of the signal warrant analyses. The analyses can be seen in the Appendix B.

Table 14. RESULTS OF TRAFFIC SIGNAL WARRANT ANALYSES (*MUTCD* 2000 edition)

MUTCD (2000) Warrant		S.R. 156 Redbud Road		
Number	**Condition**	**I-75 SB ramp**	**I-75 NB ramp**	**Newtown Church Road/ Harmony Church Road**
1	8-Hour Vehicular Volume	Yes	Yes	No
2	4-Hour Vehicular Volume	Yes	Yes	Yes
3	Peak Hour	Yes	Yes	Yes
Should signal be considered further?		Yes	Yes	Yes

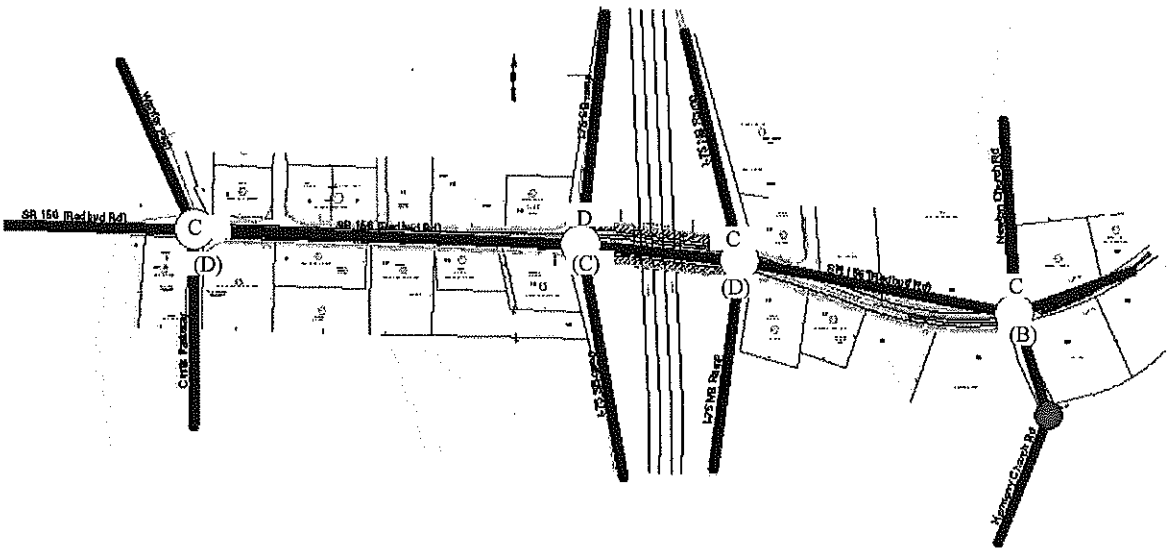
Arterial Level of Service Analysis

The purpose of this study is to investigate the anticipated traffic operations along S.R. 156 to verify that the traffic along this arterial will operate at an acceptable level of service for the design year 2022. The S.R. 156 arterial was analyzed to assure that an acceptable level of service (LOS) would be provided in the design year (2022) by the proposed design. LOS D corresponding to the average travel speeds being about 40 % of the free flow speed was considered acceptable.

The procedures documented in the Highway Capacity Manual were followed. Synchro version 4.0 computer software was used to facilitate the analysis of the arterial level of service for the 2022 PM peak period to obtain a LOS D.

Our investigation revealed that the arterial classification of S.R. 156 is Level II. The average total travel time for both EB and WB traffic from east of Curtis Parkway/Warrior Path to west of Newtown Church Road/Harmony Church Road is 145 seconds over a distance of approximately 4752 feet for an average total arterial speed of 23 miles per hour. Resulting in an acceptable level of service C as shown in Figure 7. See Appendix C for Arterial Level of Service Report and Time- Space Diagram.

Figure 7. 2022 PM Peak Arterial Level of Service



LOS – Eastbound
(LOS) - Westbound

Conclusions and Recommendations

Based upon the above analyses, it is concluded that the proposed design concept will result in the following Levels of Service for the proposed signalized intersections studied as shown in the following table.

Table 15. Concept design intersection LOS (2022)

Intersection	Morning Peak	Evening Peak
Curtis Parkway/Warrior Path	C	C
I-75 Southbound Ramp	C	C
I-75 Northbound Ramp	D	B
Newton Church/Harmony Church Road	C	B

Lowe and Associates makes the following recommendations based on these findings for the project intersections:

1. Lane requirements:

   We recommend that the limits of the project be extended 500 feet west of Curtis Parkway/Warrior Path to provide a 200-foot five-lane section west through the intersection and 300 feet taper west of Curtis Parkway. This would provide for an improved geometric design, design speed lane reduction taper, and a left turn lane for eastbound traffic onto Warrior Path.

   The realignment of Harmony Church Road would provide adequate sight distance and transition at the design speed of 40 mph. Left turn lanes are recommended on Newton Church Road, Harmony Church Road and the westbound approach on S.R. 156.

   We recommend, as required by GDOT that right turn lanes be added at the intersections of S.R. 156 and Curtis Parkway, Warrior Path, Columbus Drive, Columbus Circle, I-75 NB and SB on-ramps, Adventis Drive, and Newton Church Road.

2. Our analyses indicated that the following intersections will operate acceptably as signalized intersections and met the warrants for signalization. We are recommending the installation of traffic signals for:

   - S.R. 156 and I-75 southbound and northbound ramps
   - S.R. 156 and Newton Church Road/Harmony Church Road

   These signals should be coordinated with the existing signal on S.R. 156 at Curtis Parkway/Warrior Path.

3. The realignment of the new connector road between Warrior Path and Columbus Drive to eliminate the offset.

4. Existing signalized intersection upgrades:

   - Mountable islands in the NW, SW and SE quadrants to install pedestals for pedestrian signal heads, and; to decrease intersection size to reduce pedestrian walk distance

   - Crosswalks should be installed across all legs of the intersection

   - Overhead street name signs

5. Proposed signalized intersections:

   - All islands over 100 square feet in area be made mountable

   - Crosswalks and pedestrian signals be installed to cross one leg of the mainline and both legs of the side roads

   - Overhead street name signs be installed at Newtown Church Road and Harmony Church Road

APPENDICES

APPENDIX A

TRAFFIC COUNTS

2022 PEAK HOUR TURNING MOVEMENT PROJECTIONS FOR SR 156 – REDBUD ROAD AT CURTIS PARKWAY/ WARRIOR PATH HARMONY CHURCH RD

Southern Traffic Services, Inc.
2911 Westfield Road
Gulf Breeze, FL 32563
800-786-3374

INTERSECTION: SR 156(Rosebud Rd) @
Curtis Pkwy/Warrior Path
dor/GA

File Name : 1633
Site Code : 00001633
Start Date : 11/01/2001
Page No : 1

Groups Printed- Automobiles - Trucks & Buses

	Warrior Path Southbound				SR 156(Redbud Rd) Westbound				Curtis Parkway Northbound				SR 156(Redbud Rd) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
07:00	7	7	5	0	11	65	10	0	18	11	20	0	18	59	20	0	251
07:15	16	13	20	0	36	114	31	0	29	70	33	0	39	71	13	0	485
07:30	10	56	32	0	23	126	48	0	37	106	34	0	36	107	23	0	638
07:45	26	50	36	0	43	108	29	0	30	82	29	0	30	94	20	0	577
Total	59	126	93	0	113	413	118	0	114	269	116	0	123	331	76	0	1951
08:00	13	23	20	0	32	106	6	0	31	12	28	0	6	76	16	0	369
08:15	5	10	3	0	27	90	4	0	24	8	28	0	3	58	21	0	281
08:30	2	4	4	0	22	94	2	0	20	6	18	0	2	69	12	0	255
08:45	7	2	2	0	24	76	4	0	27	3	16	0	5	61	16	0	243
Total	27	39	29	0	105	366	16	0	102	29	90	0	16	264	65	0	1148
09:00	4	3	2	0	19	72	2	0	20	3	12	0	5	45	13	0	200
09:15	1	4	3	0	20	74	2	0	10	4	11	0	7	47	15	0	198
09:30	2	7	3	0	20	74	2	0	27	8	21	0	7	63	32	2	268
09:45	2	4	4	0	18	68	1	0	27	5	16	0	5	59	25	0	234
Total	9	18	12	0	77	288	7	0	84	20	60	0	24	214	85	2	900
10:00	2	3	5	1	24	68	3	0	16	5	23	0	6	63	15	0	234
10:15	3	11	2	0	19	58	4	0	26	4	19	0	6	49	25	0	226
10:30	2	8	8	0	10	58	4	0	23	4	1	0	3	50	26	0	197
10:45	5	7	2	0	21	68	3	0	30	8	11	0	3	65	21	0	244
Total	12	29	17	1	74	252	14	0	95	21	54	0	18	227	87	0	901
11:00	4	5	7	0	22	72	5	0	26	10	22	0	2	64	24	0	263
11:15	6	8	6	0	19	59	5	0	22	6	26	0	3	76	22	0	258
11:30	3	6	2	0	13	80	2	0	29	3	26	0	3	74	18	0	259
11:45	6	6	5	0	16	82	6	0	32	5	18	0	3	91	24	0	294
Total	19	25	20	0	70	293	18	0	109	24	92	0	11	305	88	0	1074
12:00	8	4	4	1	22	85	3	0	28	8	27	0	4	92	32	0	318
12:15	9	9	6	0	21	90	3	0	38	4	25	0	3	77	28	0	313
12:30	2	4	3	0	23	89	4	0	33	2	20	0	7	72	25	0	284
12:45	8	15	3	2	23	85	3	0	33	13	21	0	2	75	27	0	310
Total	27	32	16	3	89	349	13	0	132	27	93	0	16	316	112	0	1225
13:00	1	12	3	0	22	60	7	0	27	4	13	0	3	65	25	0	242
13:15	8	5	17	0	20	78	5	0	29	7	19	0	3	80	22	0	293
13:30	6	9	7	0	19	84	5	0	25	4	29	0	2	70	25	0	285
13:45	6	4	7	0	17	80	2	0	30	3	26	0	5	76	19	0	275
Total	21	30	34	0	78	302	19	0	111	18	87	0	13	291	91	0	1095
14:00	9	11	8	0	19	88	2	0	33	7	30	0	10	77	26	0	320
14:15	2	8	10	0	24	91	8	0	23	12	21	0	4	69	22	0	294
14:30	5	5	6	0	25	91	9	0	19	24	17	0	13	82	17	0	313
14:45	13	8	9	0	20	72	10	0	35	29	23	0	12	76	24	0	331
Total	29	32	33	0	88	342	29	0	110	72	91	0	39	304	89	0	1258
15:00	45	53	55	0	24	87	10	0	28	27	24	0	12	75	22	0	462
15:15	65	83	84	0	28	98	12	0	24	28	30	0	12	79	23	0	566
15:30	22	38	36	0	32	98	8	1	32	16	23	0	11	102	28	0	447
15:45	10	19	15	0	26	92	8	0	27	6	43	0	12	105	40	1	404
Total	142	193	190	0	110	375	38	1	111	77	120	0	47	361	113	1	1879
16:00	13	18	18	0	33	101	8	0	42	10	33	0	9	102	34	0	421
16:15	7	19	14	0	25	94	7	0	37	7	47	0	6	106	31	0	400
16:30	7	6	11	0	31	89	8	0	28	9	37	0	4	138	29	0	397
16:45	7	15	7	1	29	98	6	0	22	13	38	0	7	135	22	0	400
Total	34	58	50	1	118	382	29	0	129	39	155	0	26	481	116	0	1618

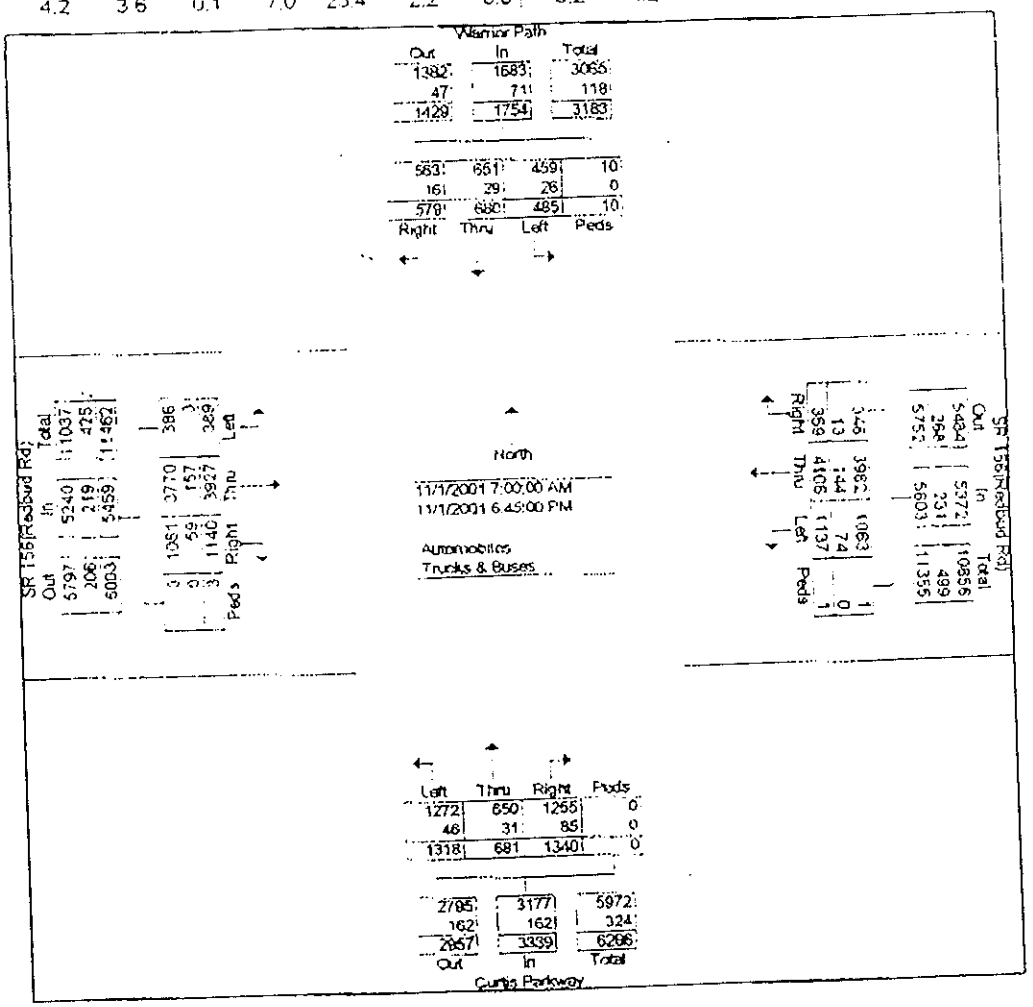
Southern Traffic Services, Inc.
2911 Westfield Road
Gulf Breeze, FL 32563
800-786-3374

INTERSECTION: SR 156(Rosebud Rd) @
Curtis Pkwy/Warrior Path
Auburn/GA

File Name : 1633
Site Code : 00001633
Start Date : 11/01/2001
Page No : 2

Groups Printed- Automobiles - Trucks & Buses

	Warrior Path Southbound				SR 156(Redbud Rd) Westbound				Curtis Parkway Northbound				SR 156(Redbud Rd) Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
17:00	13	16	13	0	32	98	13	0	36	11	63	0	9	129	38	0	471
17:15	9	10	18	3	31	129	8	0	30	20	60	0	8	122	38	0	486
17:30	27	20	15	2	32	94	8	0	28	10	59	0	8	121	25	0	449
17:45	15	14	10	0	36	111	7	0	32	8	61	0	9	114	34	0	451
Total	64	60	56	5	131	432	36	0	126	49	243	0	34	486	135	0	1857
18:00	10	12	11	0	21	99	6	0	22	9	42	0	5	119	24	0	380
18:15	15	8	9	0	25	85	6	0	28	9	43	0	7	106	22	0	363
18:30	11	9	7	0	21	73	5	0	27	12	36	0	5	71	22	0	299
18:45	6	9	2	0	17	55	5	0	18	6	18	0	5	51	15	0	207
Total	42	38	29	0	84	312	22	0	95	36	139	0	22	347	83	0	1249
Grand Total	485	680	579	10	1137	4106	359	1	1318	681	1340	0	389	3927	1140	3	16155
Apprch %	27.7	38.8	33.0	0.6	20.3	73.3	6.4	0.0	39.5	20.4	40.1	0.0	7.1	71.9	20.9	0.1	
Total %	3.0	4.2	3.6	0.1	7.0	25.4	2.2	0.0	8.2	4.2	8.3	0.0	2.4	24.3	7.1	0.0	

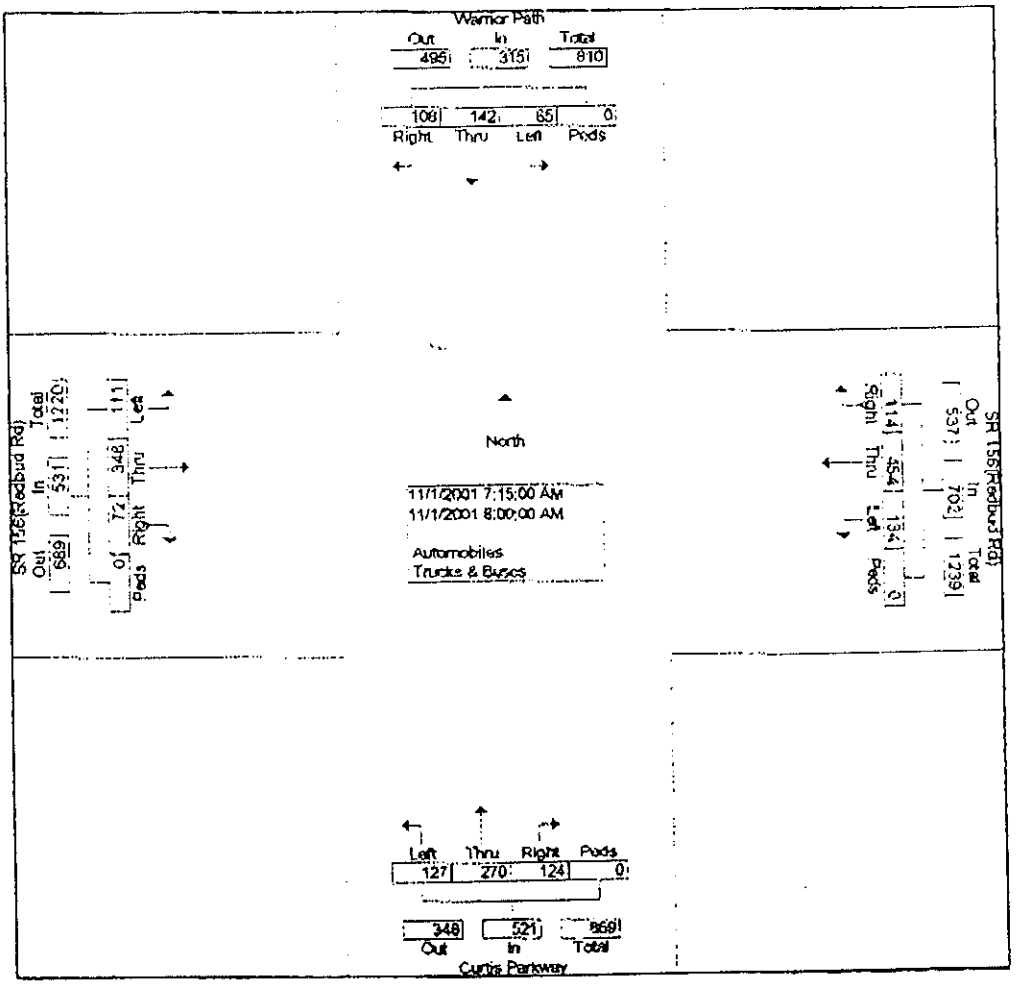


Southern Traffic Services, Inc.
2911 Westfield Road
Gulf Breeze, FL 32563
800-786-3374

INTERSECTION: SR 156(Rosebud Rd) @
Curtis Pkwy/Warrior Path
rdon/GA

File Name : 1633
Site Code : 00001633
Start Date : 11/01/2001
Page No : 3

	Warrior Path Southbound					SR 156(Redbud Rd) Westbound					Curtis Parkway Northbound					SR 156(Redbud Rd) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:00 to 09:45 - Peak 1 of 1																					
Intersection	07:15																				
Volume	65	142	108	0	315	134	454	114	0	702	127	270	124	0	521	111	348	72	0	531	2069
Percent	20.6	45.1	34.3	0.0		19.1	64.7	16.2	0.0		24.4	51.8	23.8	0.0		20.9	65.5	13.6	0.0		
Volume	65	142	108	0	315	134	454	114	0	702	127	270	124	0	521	111	348	72	0	531	2069
Volume	10	56	32	0	98	23	126	48	0	197	37	106	34	0	177	36	107	23	0	166	638
Peak Factor																					0.811
High Int.	07:45					07:30					07:30					07:30					
Volume	26	50	36	0	112	23	126	48	0	197	37	106	34	0	177	36	107	23	0	166	
Peak Factor					0.703					0.891					0.736					0.800	

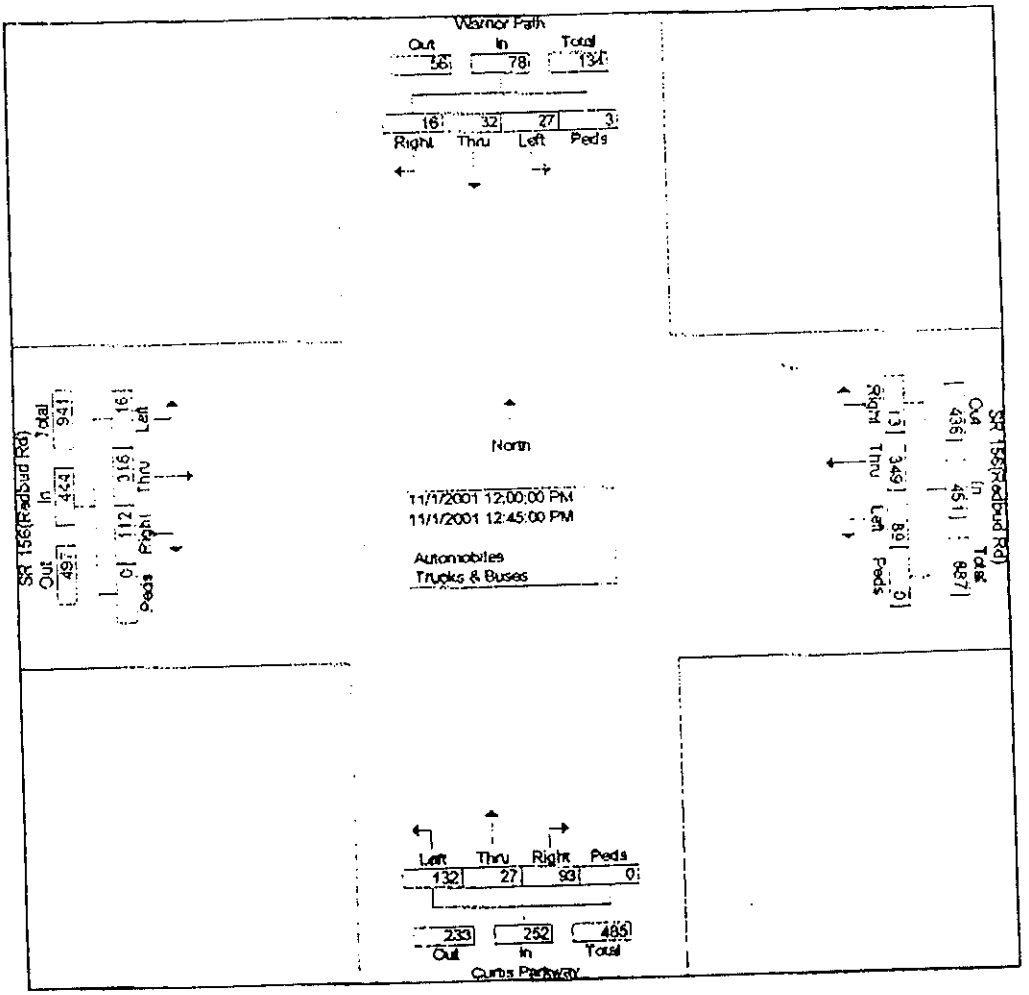


Southern Traffic Services, Inc.
2911 Westfield Road
Gulf Breeze, FL 32563
800-786-3374

INTERSECTION: SR 156(Rosebud Rd) @
Curtis Pkwy/Warrior Path
Gordon/GA

File Name : 1633
Site Code : 00001633
Start Date : 11/01/2001
Page No : 4

	Warrior Path Southbound					SR 156(Redbud Rd) Westbound					Curtis Parkway Northbound					SR 156(Redbud Rd) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 10:00 to 13:45 - Peak 1 of 1																					
Intersection	12:00																				
Volume	27	32	16	3	78	89	349	13	0	451	132	27	93	0	252	16	316	112	0	444	1225
Percent	34.6	41.0	20.5	3.8		19.7	77.4	2.9	0.0		52.4	10.7	36.9	0.0		3.6	71.2	25.2	0.0		
Volume	27	32	16	3	78	89	349	13	0	451	132	27	93	0	252	16	316	112	0	444	1225
Volume	8	4	4	1	17	22	85	3	0	110	28	8	27	0	63	4	92	32	0	128	318
Peak Factor																					0.963
High Int.	12:45					12:30					12:15					12:00					
Volume	8	15	3	2	28	23	89	4	0	116	38	4	25	0	67	4	92	32	0	128	
Peak Factor					0.696					0.972					0.940					0.867	

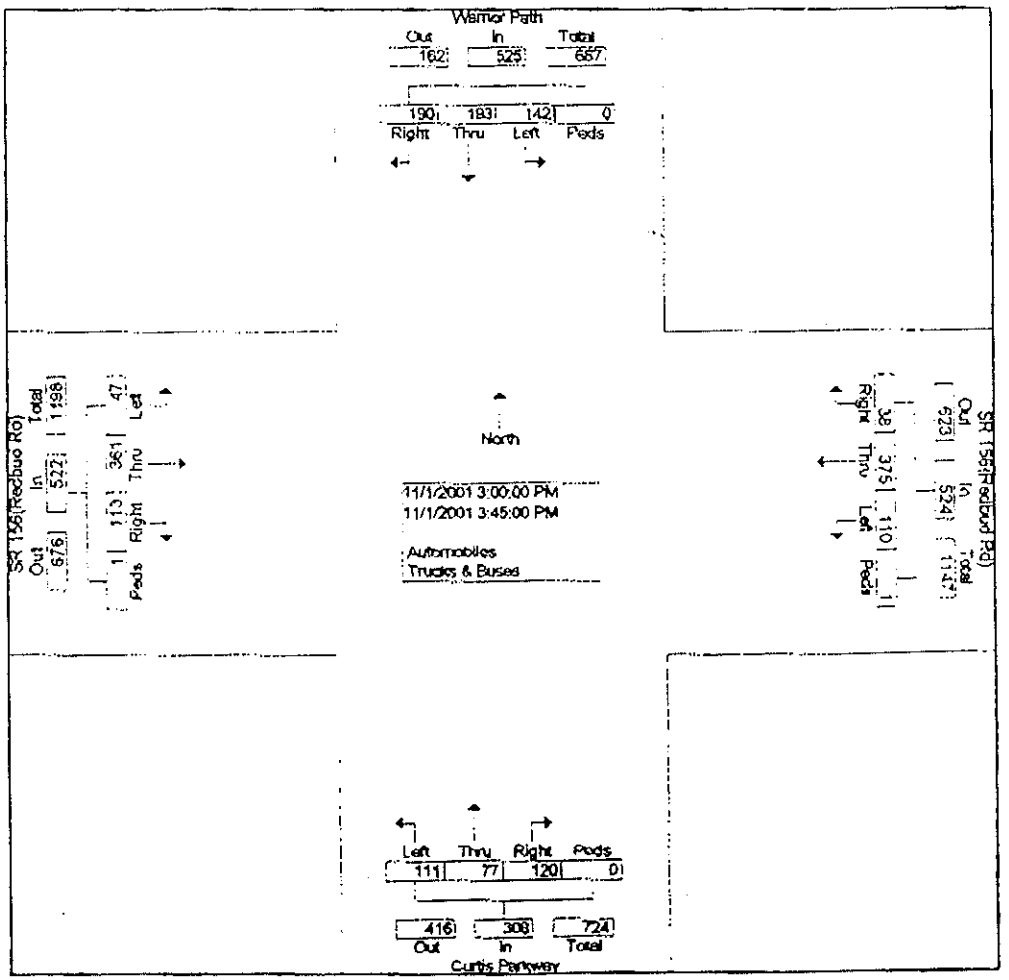


Southern Traffic Services, Inc.
2911 Westfield Road
Gulf Breeze, FL 32563
800-786-3374

INTERSECTION: SR 156(Rosebud Rd) @
Curtis Pkwy/Warrior Path
Gordon/GA

File Name : 1633
Site Code : 00001633
Start Date : 11/01/2001
Page No : 5

	Warrior Path Southbound					SR 156(Redbud Rd) Westbound					Curtis Parkway Northbound					SR 156(Redbud Rd) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 14:00 to 18:45 - Peak 1 of 1																					
Intersection	15:00																				
Volume	142	193	190	0	525	110	375	38	1	524	111	77	120	0	308	47	361	113	1	522	1879
Percent	27.0	36.8	36.2	0.0		21.0	71.6	7.3	0.2		36.0	25.0	39.0	0.0		9.0	69.2	21.6	0.2		
Volume	142	193	190	0	525	110	375	38	1	524	111	77	120	0	308	47	361	113	1	522	1879
Volume	65	83	84	0	232	28	98	12	0	138	24	28	30	0	82	12	79	23	0	114	566
Peak Factor																					0.830
High Int.	15:15					15:30					15:15					15:45					
Volume	65	83	84	0	232	32	98	8	1	139	24	28	30	0	82	12	105	40	1	158	
Peak Factor					0.566					0.942					0.939					0.826	



SR 156 at I-75 Widening Project - Gordon County, GA

SR 156 (Redbud Road) at Warrior Path/Curtis Parkway

Peak Hour Turning Movement Projections

SR 156 WB	2001 AM Peak Hour	2002 AM Peak Hour	2022 AM Peak Hour
Left	134	138	222
Through	454	468	754
Right	114	117	* 117
SR 156 EB			
Left	111	114	* 114
Through	348	359	561
Right	72	74	116
Curtis Pkwy NB			
Left	127	131	205
Through	270	278	* 278
Right	124	128	200
Warrior Path SB			
Left	65	67	* 67
Through	142	146	* 146
Right	108	111	* 111

SR 156 WB	2001 PM Peak Hour	2002 PM Peak Hour	2022 PM Peak Hour
Left	110	113	183
Through	375	386	622
Right	38	39	* 39
SR 156 EB			
Left	47	48	* 48
Through	361	372	599
Right	113	116	188
Curtis Pkwy NB			
Left	111	114	184
Through	77	79	* 79
Right	120	124	199
Warrior Path SB			
Left	142	146	* 146
Through	193	199	* 199
Right	190	196	* 196

2002 ADT = 16700
2022 ADT = 26900

* Based on the assumption that another school is built; traffic volumes generated by Gordon County High School

APPENDIX B

TRAFFIC SIGNAL WARRANT ANALYSES

SR 156 - REDBUD ROAD AT I-75 SB RAMP

SR 156 - REDBUD ROAD AT NEWTOWN CHURCH ROAD/HARMONY CHURCH ROAD

LAI Engineering

SR 156 and I-75 Northbound Ramps

2002 Signal Warrant Investigations

Study Name : **SR 156 & I-75 NB Ramps**
Study Date : **12/13/04**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **SR 156 Redbud Rd**
Number of Lanes: **2**
Approach Speed: **45**
Total Approach Volume: **7,502**

Westbound: **SR 156 Redbud Rd**
Number of Lanes: **2**
Approach Speed: **45**
Total Approach Volume: **6,201**

Minor Street Approaches

Northbound: **I-75 NB Ramp**
Number of Lanes: **2**

Total Approach Volume: **3,150**

Southbound: **I-75 NB Ramp**
Number of Lanes: **1**

Total Approach Volume: **0**

Warrant Summary (Rural values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Satisfied**
Required volumes reached for 12 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Satisfied**
Required volumes reached for 10 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Satisfied**
Required volumes reached for 12 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Satisfied**
Number of hours (12) volumes exceed minimum >= minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 3B - Peak Hour Delay ..... **Satisfied**
Number of hours (48) volumes exceed minimum >= required (1). Delay data not evaluated.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Evaluated**

Warrant 7 - Crash Experience ..... **Not Evaluated**

Warrant 8 - Roadway Network ..... **Not Evaluated**

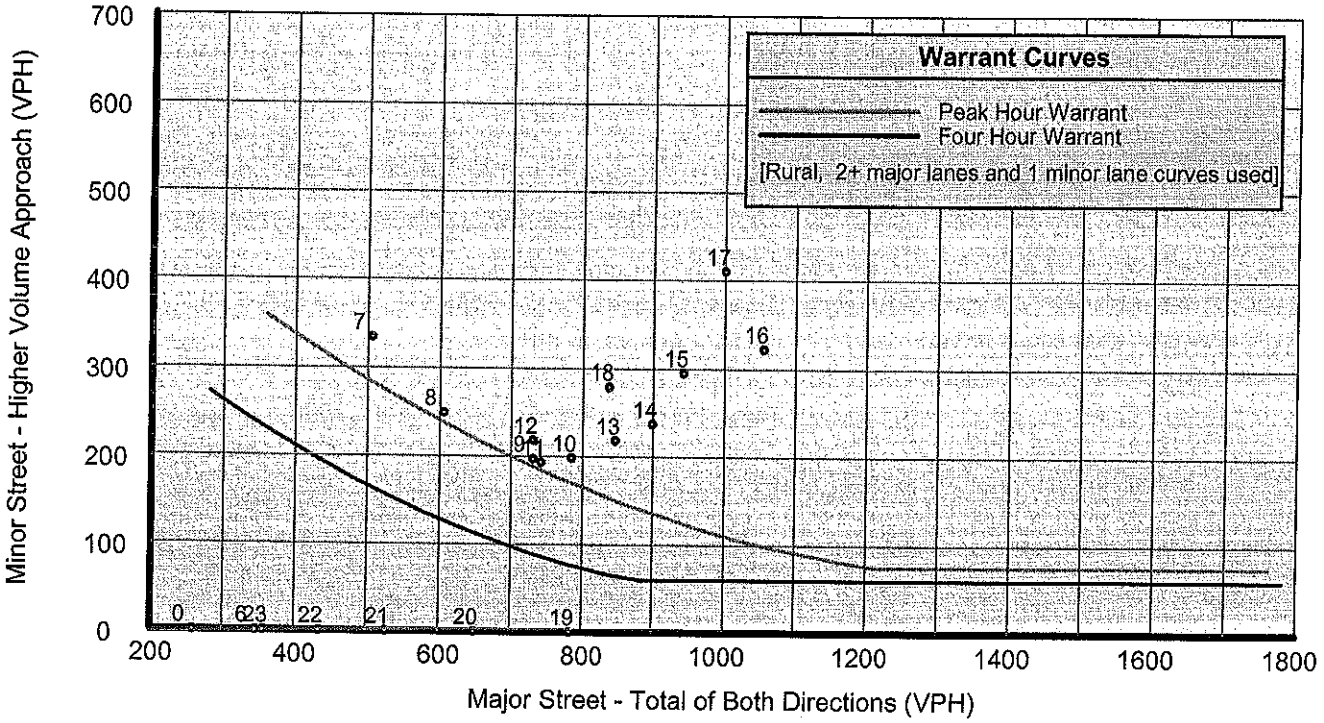
LAI Engineering

SR 156 and I-75 Northbound Ramps

2002 Signal Warrant Investigations

Study Name : **SR 156 & I-75 NB Ramps**
Study Date : **12/13/04**
Page No. : **2**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants (Maj Crit = Major Criteria, Min Crit = Minor Criteria):

Hour	Major	Higher Minor		War-1A			War-1B			War-1A&B		
Begin	Total	Vol	Dir	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?
00:00	259	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
01:00	181	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
02:00	124	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
03:00	104	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
04:00	104	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
05:00	144	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
06:00	347	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
07:00	506	334	NB	420-Yes	105-Yes	Both	630-No	52-Yes	Minor	504-Yes	84-Yes	Both
08:00	606	249	NB	420-Yes	105-Yes	Both	630-No	52-Yes	Minor	504-Yes	84-Yes	Both
09:00	731	197	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
10:00	785	198	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
11:00	742	193	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
12:00	731	218	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
13:00	847	218	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
14:00	899	237	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
15:00	943	295	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
16:00	1,056	322	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
17:00	1,001	410	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
18:00	838	279	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
19:00	784	0	NB	420-Yes	140-No	Major	630-Yes	70-No	Major	504-Yes	112-No	Major
20:00	650	0	NB	420-Yes	140-No	Major	630-Yes	70-No	Major	504-Yes	112-No	Major
21:00	528	0	NB	420-Yes	140-No	Major	630-No	70-No	---	504-Yes	112-No	Major
22:00	435	0	NB	420-Yes	140-No	Major	630-No	70-No	---	504-No	112-No	---
23:00	358	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---

Traffic Signal Warrant Analysis

Prepared by
Lowe & Associates, Inc.

Study Name : **SR 156 & I75 SB**
Study Date : **11/20/01**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **Redbud Road**
Number of Lanes: **2**
Approach Speed: **41**
Total Approach Volume: **5,331**

Westbound: **Redbud Road**
Number of Lanes: **2**
Approach Speed: **45**
Total Approach Volume: **4,865**

Minor Street Approaches

Northbound: **I-75 SB Enter Ramp**
Number of Lanes: **2**

Total Approach Volume: **0**

Southbound: **I-75 SB Exit Ramp**
Number of Lanes: **2**

Total Approach Volume: **2,273**

Warrant Summary (Rural values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Satisfied**
Required volumes reached for 11 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Satisfied**
Required volumes reached for 10 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Satisfied**
Required volumes reached for 12 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Satisfied**
Number of hours volumes exceed minimum (9) >= minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 3B - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Evaluated**

Warrant 7 - Crash Experience ..... **Not Evaluated**

Warrant 8 - Roadway Network ..... **Not Evaluated**

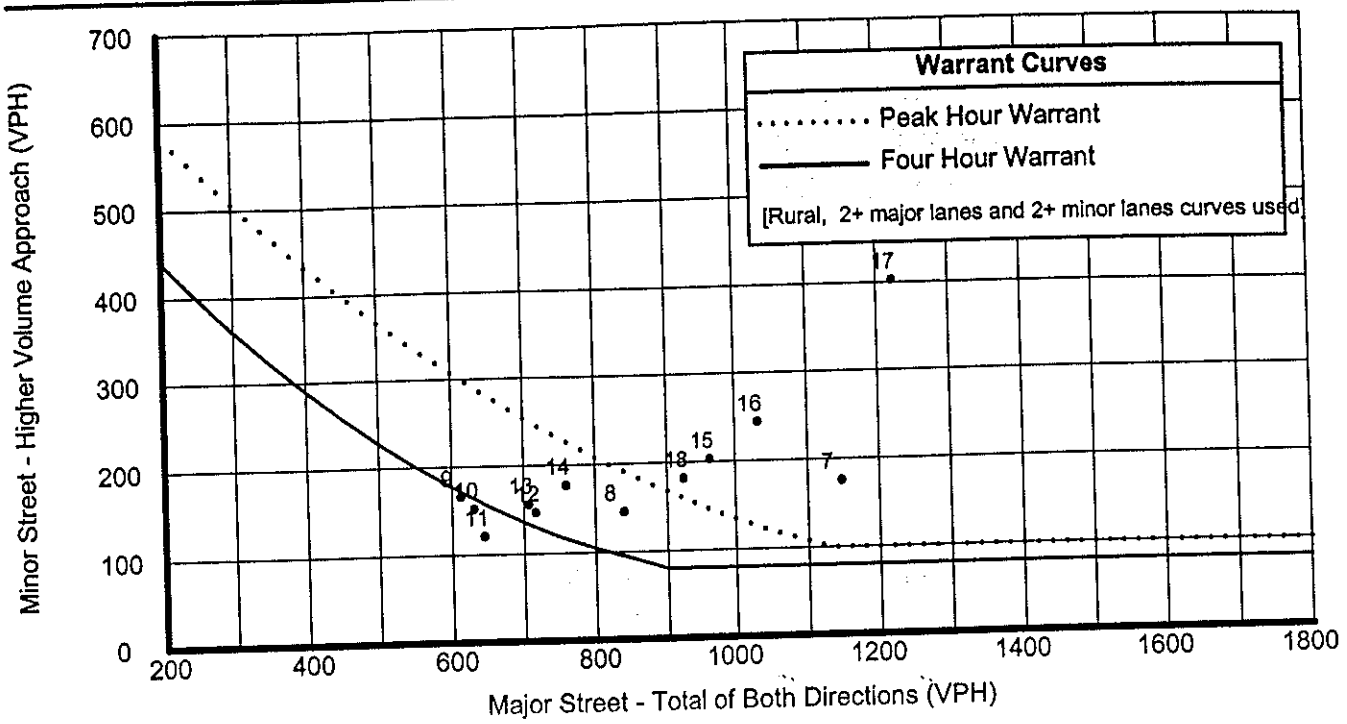
Traffic Signal Warrant Analysis

Prepared by

Lowe & Associates, Inc.

Study Name : **SR 156 & I75 SB**
Study Date : **11/20/01**
Page No. : **2**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants (Maj Crit = Major Criteria, Min Crit = Minor Criteria):

Hour Begin	Major Total	Higher Minor Vol	Higher Minor Dir	War-1A Major Crit	War-1A Minor Crit	War-1A Meets?	War-1B Major Crit	War-1B Minor Crit	War-1B Meets?	War-1A&B Major Crit	War-1A&B Minor Crit	War-1A&B Meets?
00:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
01:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
02:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
03:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
04:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
05:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
06:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
07:00	1,147	176	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
08:00	840	146	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
09:00	612	166	SB	420-Yes	140-Yes	Both	630-No	70-Yes	Minor	504-Yes	112-Yes	Both
10:00	630	152	SB	420-Yes	140-Yes	Both	630-No	70-Yes	Minor	504-Yes	112-Yes	Both
11:00	644	121	SB	420-Yes	140-No	Major	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
12:00	716	147	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
13:00	707	156	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
14:00	759	177	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
15:00	963	203	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
16:00	1,032	244	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
17:00	1,222	403	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
18:00	924	182	SB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
19:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
20:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
21:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
22:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
23:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---

Traffic Signal Warrant Analysis

Prepared by
Lowe & Associates, Inc.

Study Name : **SR156 at Newton Church Rd**
Study Date : **11/20/01**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **Redbud Road**
Number of Lanes: **2**
Approach Speed: **41**
Total Approach Volume: **4,860**

Westbound: **Redbud Road**
Number of Lanes: **2**
Approach Speed: **45**
Total Approach Volume: **3,521**

Minor Street Approaches

Northbound: **Harmony Church Rd**
Number of Lanes: **2**

Total Approach Volume: **1,205**

Southbound: **Newton Church Road**
Number of Lanes: **2**

Total Approach Volume: **747**

Warrant Summary (Rural values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 5 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 4 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Satisfied**
Number of hours volumes exceed minimum (5) >= minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 3B - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Evaluated**

Warrant 7 - Crash Experience ..... **Not Evaluated**

Warrant 8 - Roadway Network ..... **Not Evaluated**

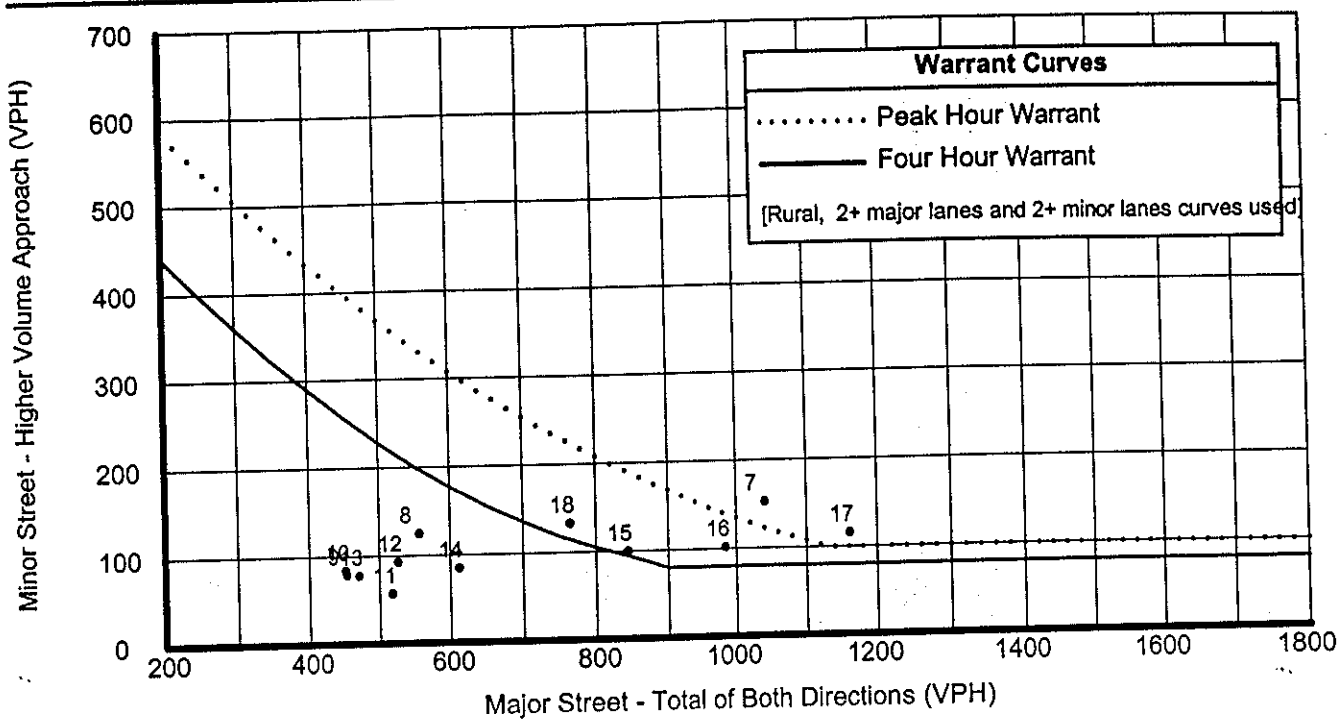
Traffic Signal Warrant Analysis

Prepared by

Lowe & Associates, Inc.

Study Name : **SR156 at Newton Church Rd**
Study Date : **11/20/01**
Page No. : **2**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants (Maj Crit = Major Criteria, Min Crit = Minor Criteria):

Hour Begin	Major Total	Higher Minor Vol	Higher Minor Dir	War-1A Major Crit	War-1A Minor Crit	War-1A Meets?	War-1B Major Crit	War-1B Minor Crit	War-1B Meets?	War-1A&B Major Crit	War-1A&B Minor Crit	War-1A&B Meets?
00:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
01:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
02:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
03:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
04:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
05:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
06:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
07:00	1,041	153	NB	420-Yes	140-Yes	Both	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
08:00	557	125	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-Yes	112-Yes	Both
09:00	453	79	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-No	112-No	---
10:00	451	84	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-No	112-No	---
11:00	518	57	NB	420-Yes	140-No	Major	630-No	70-No	---	504-Yes	112-No	Major
12:00	526	93	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-Yes	112-No	Major
13:00	470	78	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-No	112-No	---
14:00	612	85	NB	420-Yes	140-No	Major	630-No	70-Yes	Minor	504-Yes	112-No	Major
15:00	843	100	NB	420-Yes	140-No	Major	630-Yes	70-Yes	Both	504-Yes	112-No	Major
16:00	984	102	NB	420-Yes	140-No	Major	630-Yes	70-Yes	Both	504-Yes	112-No	Major
17:00	1,161	116	NB	420-Yes	140-No	Major	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
18:00	765	133	NB	420-Yes	140-No	Major	630-Yes	70-Yes	Both	504-Yes	112-Yes	Both
19:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
20:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
21:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
22:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---
23:00	0	0	NB	420-No	140-No	---	630-No	70-No	---	504-No	112-No	---

APPENDIX C

ARTERIAL LEVEL OF SERVICE

TIME-SPACE DIAGRAM

Arterial Level of Service: EB SR 156 (Redbud Rd)

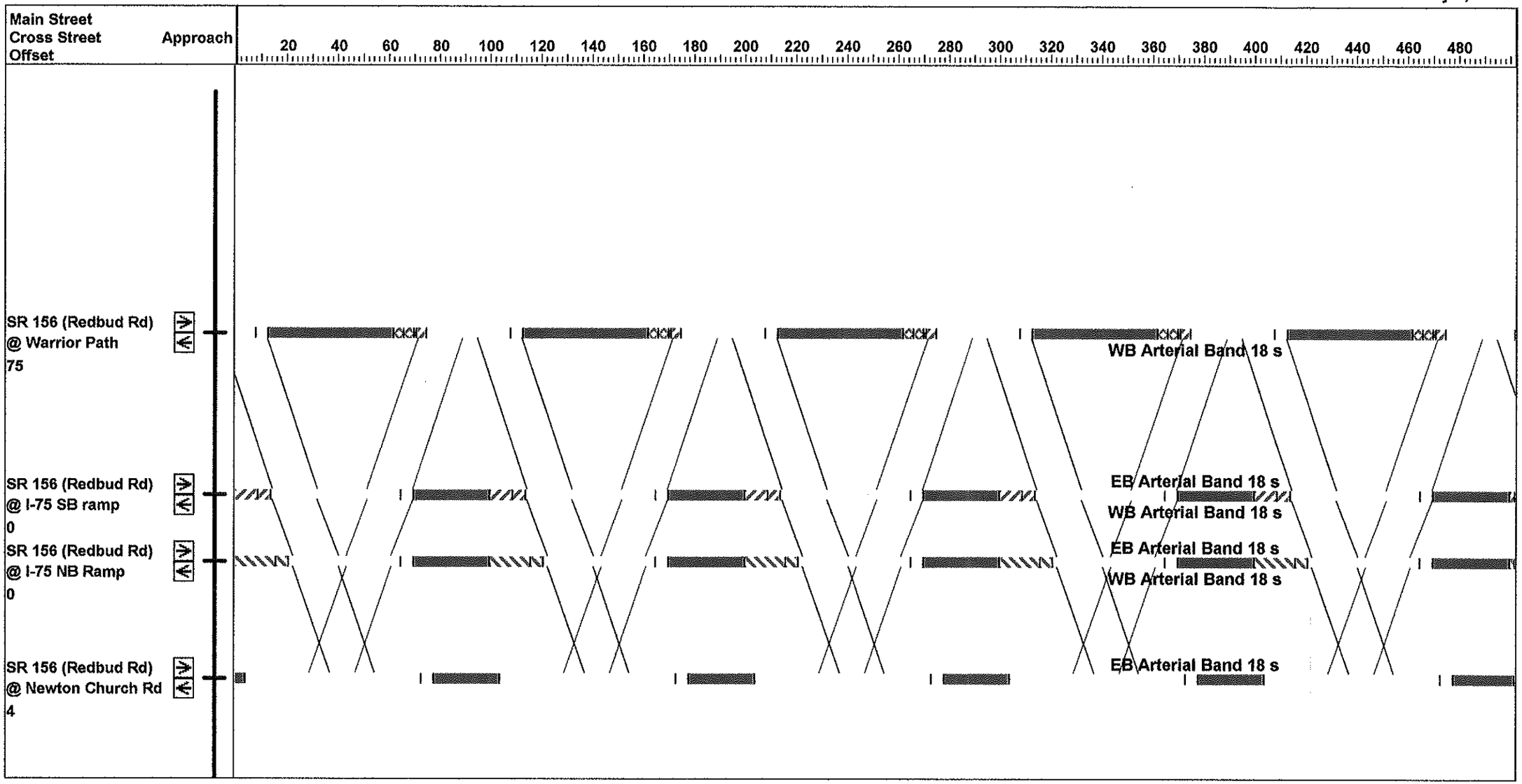
Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Curtis Parkway	II	45	35.6	22.6	58.2	0.4	23.4	C
I-75 SB ramp	II	45	25.7	22.6	48.3	0.2	18.4	D
I-75 NB Ramp	II	45	11.1	4.4	15.5	0.1	23.7	C
Harmony Church Rd	II	45	19.5	6.8	26.3	0.2	24.5	C
Total	II		91.9	56.4	148.3	0.9	22.0	C

Arterial Level of Service: WB SR 156 (Redbud Rd)

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Newton Church Rd	II	45	35.6	5.9	41.5	0.4	32.9	B
I-75 NB Ramp	II	45	19.5	17.2	36.7	0.2	17.5	D
I-75 SB ramp	II	45	11.1	5.7	16.8	0.1	21.9	C
Warrior Path	II	45	25.7	22.7	48.4	0.2	18.4	D
Total	II		91.9	51.5	143.4	0.9	22.8	C

Time-Space Diagram - SR 156 (Redbud Rd)
Arterial Bandwidths, 90th Percentile Green Times

January 8, 2002



Recommended
Data Date: 9/26/2001
Timing Plan: 2022 PM PEAK

White
T:\T-273.1\Docs\Reports\Synchro\PM2022 SR 156D Recommend.sy6

Value Engineering Process

VALUE ENGINEERING PROCESS

Introduction

This report summarizes the analysis and conclusions by the PBS&J Value Engineering team as they performed a VE Study during the period of March 12-15, 2007 in Atlanta, Georgia, for the Georgia Department of Transportation.

The Value Engineering Study team and its leadership were provided by PBS&J. This VE Team consisted of the following:

Les Thomas, P.E., CVS-Life	VE Team Leader
Randy Thomas, AVS	Assistant Team Leader
Ramesh Kalvakaalva, PE	Structural Engineer
Chris Carbuto, P.E.	Highway Design Engineer
Gary King	Highway Construction Specialist

The Value Engineering Team followed the Seven Step Value Engineering job plan as promulgated by SAVE International. This Seven Step job plan includes the following:

- **Investigation/Information Phase** – during this phase of the VE Team's work, the team received a briefing from the designers and project delivery team representatives of the Georgia Department of Transportation (GDOT). This briefing included discussions of the design intent behind the project and the cost concerns. Gary King visited the project site and provided the team with photos and his insight.
  In the working session that followed, the VE Team developed cost models from the cost data provided by GDOT and the designers and familiarized themselves with the construction drawings and other data that was available to the team. Some of the representative project information (concept report and cost estimate,) may be found in the tabbed section of this report entitled ***Project Description***. Following this current narrative, the reader will also find a cost model done in the Pareto fashion, i.e., identifying the highest costs down to the lowest costs for the larger construction cost elements. This cost model, developed by the VE Team, was used by the VE Team to help focus their week of work. The headings on the Pareto Chart also were used as headings for creative phase activities.

- **Analysis Phase** – during this phase the VE Team determined the "**Functions**" of the project. This was accomplished by reviewing the project from the simplest format in asking the questions of "What is the project suppose to do?", and "How is it suppose to accomplish this purpose? In the Value Engineering vernacular, the answers to these questions are cast in the form of active verbs and measurable nouns. These verb/noun pairs form the basis of the function analysis which distinguishes a Value Engineering effort from a potentially damaging cost cutting exercise.

- The important functions of the project were identified as follows:

    - **Project Objective/Goals**
        - **Improve Safety**
        - **Improve Line-of-Sight**
        - **Increase Capacity**
        - **Separate Traffic**

    - **Project Basic Functions**
        - **Provide Traffic Signals**
        - **Widen Bridge**
        - **Provide Additional Traffic Lanes**
        - **Provide Additional Turn Lanes**
        - **Provide Raised Median**
        - **Provide U-Turn Lane**
        - **Route Stormwater**
        - **Direct Traffic**

  This function analysis is documented further through the inclusion of the Function Analysis and Cost –Worth worksheets. The Cost-Worth Ratios that are included helped the VE Team to identify areas of interest for the brainstorming session. When a function has a current cost-worth ration of greater than 1.00 it is often found that there are opportunities for reducing the cost, thereby better matching its actual worth for the project.

- **Speculation Phase -** The VE team performed a brainstorming session to identify ideas that might help meet the project objectives:

    - Improve Safety
    - Improve Line-of-Sight
    - Increase Capacity
    - Separate Traffic
    - Clarify risks and opportunities associated with the project and acts to mitigate risks and to act on opportunities.

  This brainstorming session initially identified numerous ideas that were then evaluated in the Judgment phase. The reader will find the creative worksheets enclosed. These same work sheets were also used to record the results of the Judgment/Evaluation Phase.

- **Evaluation Phase –** Once the VE Team identified the creative ideas, it was necessary to decide which alternatives should be carried forward. This is the work of the Evaluation or Judgment Phase. The VE Team reflected back on the project constraints and objectives shared with the team by the owner's representatives, in the kick-off meeting on the first day of the workshop. From that guidance, the team selected ideas that they believed would improve the project by a vote process.

- Following that selection process, the VE Team used the following values as measures of whether or not an alternative had enough merit to be carried forward in the VE process:

    - Construction Cost Savings
    - Maintainability
    - Ability to Implement the Idea
    - General Acceptability of the Alternatives
    - Constructability

    Based on these measurement sticks, the VE Team evaluated the alternatives and graded them from 5 (Excellent) down to 1 (Poor). Other notes about the alternatives are annotated at the bottom of the enclosed creative and evaluation sheets.

- **Development Phase** – During this phase, the VE Team developed each of the selected design alternatives. This effort included a detailed explanation of the idea with sketches as appropriate to clarify the idea from the original concept, advantages and disadvantages, a technical explanation and an estimation of the cost and resultant savings if implemented. (see the tabbed section – Study Results)

- **Recommendation Phase –** During this phase the VE Team reviews the alternative ideas to confirm which ones are appropriate for the project, have an opportunity for success and which will improve the value of the project if implemented.

- **Presentation Phase** – As noted earlier, the team made an informal "out-briefing" on the last day of the workshop, designed to inform the Owners and the Designers of the initial findings of the VE Study. This written report is intended to formalize those findings.

The VE team is enclosing a copy of the attendance sheets so that the reader can be informed about who participated in the workshop proceedings. The cost model developed in the information phase is also enclosed. This cost model is done in the Pareto Fashion. This means that it is intended to highlight the high cost items in the current working estimate for the construction of the project. These high cost items were then evaluated by the VE Team as to whether the team might be able to have an effect on these line items. Where it was felt that the team might affect the line items, they were typically used as the topics for the creative phase.

Function analysis and cost-worth

PROJECT: **IM-75-3(189) Department of Transportation**
P.I. Number: 610750 Gordon County

SHEET NO.: **1** of **3**

NO.	ELEMENT	FUNCTION VERB	FUNCTION Noun	FUNCTION KIND	COST (000)	WORTH (000)	COMMENTS
	(EW) EARTHWORK	**Prepare**	**Vertical Alignment**	**B**	**$1,900**	**$1,500**	**C/W Ratio = 1.26**
		Support	Alignment	B			
		Level	Ground	S			
		Avoid	Flooding	RS			
		Connect	Points	B			
		Disturb	Land	U			
		Enhance	**Commerce**	**HO**			
	(DR) Drainage	**Protect**	**Traffic**	**RS**	**$400**	**$200**	**C/W Ratio = 2.0**
		Divert	Runoff	RS			
		Control	Flows	RS			
		Protect	Land Owners	RS			Avoid flooding
		Minimize	Erosion	RS			

Function defined as: **Action Verb**
Measurable Noun

Kind:
B = Basic
S = Secondary
RS = Required Secondary
HO = Higher Order
LO = Lower Order
U = Unwanted

Function analysis and cost-worth

PROJECT: **IM-75-3(189) Department of Transportation**
P.I. Number: 610750 Gordon County

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

NO.	ELEMENT	FUNCTION VERB	FUNCTION Noun	FUNCTION KIND	COST (000)	WORTH (000)	COMMENTS
	(CI) CONCRETE ITEMS	**Channelize**	**Traffic, Flows**	**S**	**$900**	**$500**	**C/W Ratio = 1.80**
		Facilitate	Driveway	RS			
		Accommodate	Pedestrians	RS			
		Contain	Traffic	S			Curb and Gutter
		Contain	Drainage	S			Curb and Gutter
	(AP) ASPHALT PAVEMENT	**Enhance**	**Safety**	**B**	**$13,000**	**$10,000**	**C/W Ratio = 1.3**
		Support	Traffic	B			
		Shed	Water	RS			
		Expedite	Commerce	HO			
		Enhance	Access	HO			
		Improve	Connectivity	HO			
		Distribute	Traffic	S			

Function defined as: **Action Verb**
Measurable Noun

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

Cost/Worth Ratio = (Total Cost ÷ Basic Worth)

Function analysis and cost-worth

PROJECT: **IM-75-3(189) Department of Transportation**
P.I. Number: 610750 Gordon County

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

NO.	ELEMENT	FUNCTION			COST (000)	WORTH (000)	COMMENTS
		VERB	Noun	KIND			
	(ROW) Right-of-Way	**Provide**	**Area**	**RS**			
	(B) Replace Bridge	Separate	Traffic	RS	$3,900	$3,000	C/W Ratio=1.3
		Support	Traffic	B			
		Divert	Runoff	RS			
		Enhance	Safety	HO			

Function defined as: **Action Verb**
Measurable Noun

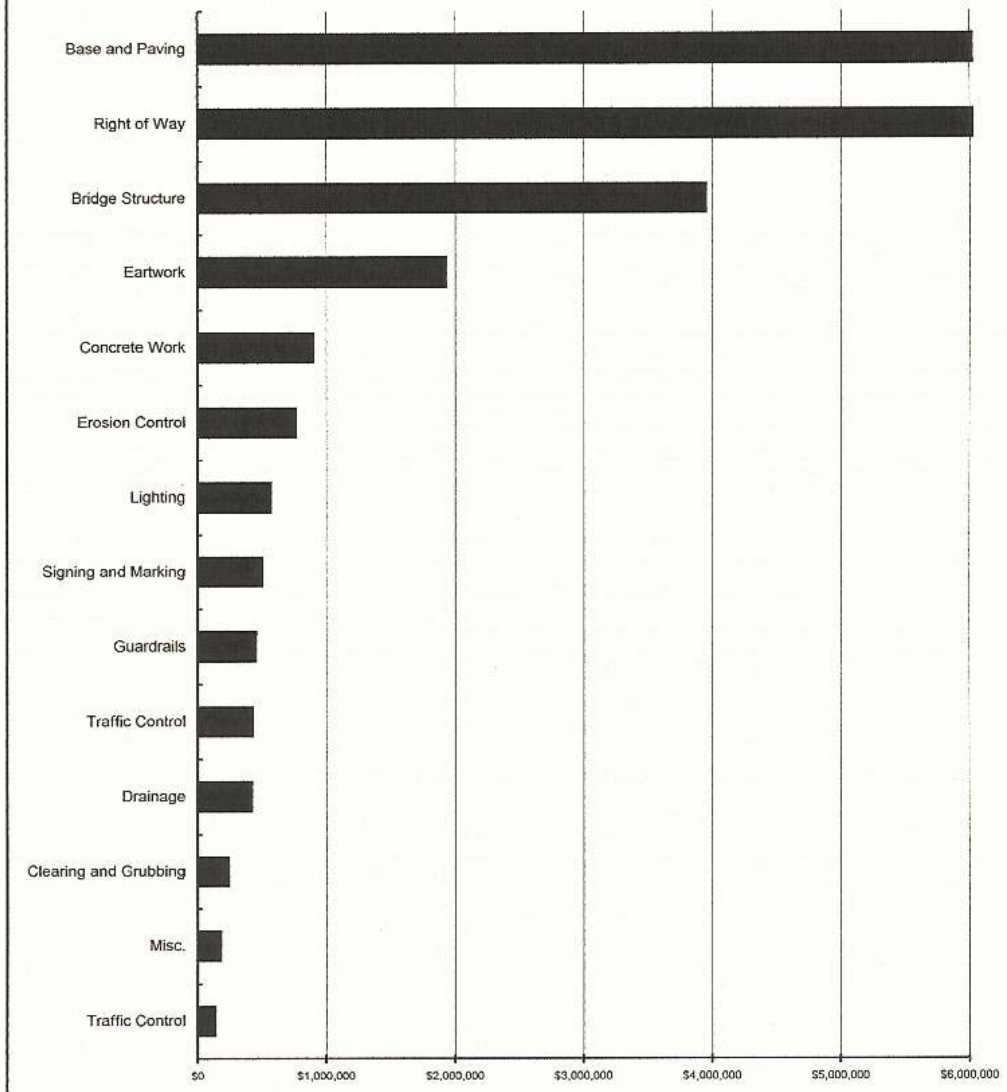
Kind: B = Basic; S = Secondary; RS = Required Secondary; HO = Higher Order; LO = Lower Order

Cost/Worth Ratio = (Total Cost ÷ Basic Worth)

PARETO CHART - COST HISTOGRAM

PROJECT: IM-75-3(189) Redbud Road
Gordon County, Georgia

PROJECT ELEMENT		COST	PERCENT	CUM. PERCENT
Base and Paving		$13,032,000	42.58%	42.58%
Right of Way		$7,100,000	23.20%	65.79%
Bridge Structure		$3,951,000	12.91%	78.70%
Eartwork		$1,928,000	6.30%	85.00%
Concrete Work		$899,000	2.94%	87.93%
Erosion Control		$763,000	2.49%	90.43%
Lighting		$567,818	1.86%	92.28%
Signing and Marking		$499,000	1.63%	93.91%
Guardrails		$451,000	1.47%	95.39%
Traffic Control		$425,000	1.39%	96.78%
Drainage		$420,000	1.37%	98.15%
Clearing and Grubbing		$240,000	0.78%	98.93%
Misc.		$177,000	0.58%	99.51%
Traffic Control		$134,646	0.44%	99.95%
Grassing and Landscaping		$15,000	0.05%	100.00%
	Subtotal	**$ 30,602,464**	**100.00%**	
E & C Rate @ 10%	**INCL**	**$ 3,060,246**		
	TOTAL	**$ 33,662,710**	**Comp Mark-up:**	10%



Costs in graph include mark-ups.

DESIGNER'S PRESENTATION

PBSJ

MEETING PARTICIPANTS

Project: Georgia Department of Transportation		**I-75 & SR 156**	Date: 12 March 2007
IM-75-3(189)	**Gordon**	**PI No. : 610750**	
NAME	ORGANIZATION & TITLE	E-MAIL	PHONE
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VE TEAM PRESENTATION

MEETING PARTICIPANTS

Project: Georgia Department of Transportation **I-75 & SR 156** Date: 15 March 2007

IM-75-3(189) **Gordon** **PI No. : 610750**

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CREATIVE IDEA LIST and EVALUATION

PROJECT: GEORGIA DEPARTMENT OF TRANSPORTATION SHEET NO.: **1** of **1**

Project No.: IM-75-3(189) Gordon County– P.I. Number: 610750

I-75 & SR 156 Redbud Road

NO.	IDEA DESCRIPTION	RATING
	(B) Bridge Work	
B-1	Remove end spans and use wall abutments	5
B-2	Build entire right side and shift traffic and then build balance of bridge	5
B-3	Lower Redbud Road Finish Grade	1
	(P) Paving	
P-1	Construct Round-a-bout at North/South bound ramps and Hwy 156	1
P-2	Use GDOT separation of 100' limited access	5
P-3	For future growth planning condition, use minimum 11' lane widths	4
P-4	Delete Columbus Circle extension	1
P-5	Delete right turn lane Sta8+00 to12+00 East bound 156	DS
P-6	Eliminate concrete paving on ramps	5
P-7	Use keystone wall in lieu of pour in place retaining wall	5
P- 8	Eliminate all construction west of Curtis Drive	DS
P-9	Provide additional left turn storage for north movement. on 156	1
P-10	Lower Redbud grade ----Newtown Church Road	1
P-11	Move South bound on/off ramps to the east	5
P-12	Move North bound on/off ramps to the west	5
P-13	Construct per concept design	1
P-14	Straighten SR 156	1
P-15	Lengthen on/off ramps	2

Rating: 1→2 = Generally not acceptable; 3 = Little Opportunity for Positive Change; 4→5 = Most likely to be Developed; DS = Design Suggestion; ABD = Already Being Done