

VALUE ENGINEERING REPORT

I-575/Sixes Road Interchange
CSSTP-0006-00(041)
PI NO. 0006041

July 27, 2007

OWNER AND DESIGN TEAM:

Georgia Department of Transportation
No.2 Capitol Square
Atlanta, GA 30334



VALUE ENGINEERING CONSULTANT:

MACTEC Engineering and Consulting, Inc.
3200 Town Point Drive NW, Suite 100
Kennesaw, GA 30144



TABLE OF CONTENTS

VALUE ENGINEERING STUDY

I-575/Sixes Road Interchange
CSSTP-0006-00(041)
PI NO. 0006041

July 27, 2007

EXECUTIVE SUMMARY	4
Recommendation Highlights	5
Summary of Potential Cost Savings	7
STUDY IDENTIFICATION	11
VE Team Members.....	11
Project Description	11
Project Location Map	14
VALUE ENGINEERING RECOMMENDATIONS	16
APPENDIX.....	51
Sources.....	51
Cost Model / Distribution	52
Information Phase – Function Analysis	54
Creative Ideas / Idea Evaluation.....	56

EXECUTIVE SUMMARY

Executive Summary

VALUE ENGINEERING STUDY

I-575/Sixes Road Interchange
July 27, 2007

Introduction

MACTEC was very pleased to provide a four-person team for the VE study of this important project. This report contains a complete record of all the Team's activities, findings, and recommendations. The **Executive Summary** includes a brief description of each recommendation. The **Study Identification** section includes project background information, a team list, and a location map. The **VE Recommendations** portion of the report presents the Team's recommendations in detail, including cost estimates and sketches. Lastly, the **Appendix** includes information on the various activities that the Team conducted during the study. The reader is encouraged to review all sections of the report in order to get a complete overview of this value engineering study.

Considerations

The VE Team noted that the project includes a large amount of cost associated with the functions "Facilitate Construction" and "Enhance Constructability". The proposed new ramps will be offset from the existing alignments in order to facilitate the construction of the planned concrete pavement. Also, the Sixes Road alignment will be shifted to facilitate the construction of the new bridge across I-575. The Team concentrated much of its efforts on these aspects of the project.

No formal constraints to VE study were noted during the kick-off meeting. The Team understood, however, that use of PCCP on ramps is an informal policy at this time and is desired by GDOT management.

Results Obtained

The Team generated nine recommendations, some of which are mutually exclusive, for consideration by the decision-makers. There are numerous possible combinations of these recommendations with the potential for as much as a \$6M reduction of construction cost while retaining the required functionality and meeting the need and purpose of the project.

The VE Team presented its recommendations briefly to GDOT management on July 12, 2007. The following were in attendance: Lisa Myers, Brian Summers, Ron Wishon, Tim Matthews, Christopher Rudd, and Jack Muirhead.

Recommendation Highlights

S-2 Reduce Median Width

Between the two ramp intersections, the median function related to access control is not required. Eliminating the 8' median would reduce the bridge width but continue to provide the required capacity.

The total potential savings if accepted is \$330,000.

B-3 Eliminate One Turn Lane on Bridge

It appears that two turn lanes rather than three would provide adequate storage based on the Design Hour Volumes projected for 2032.

The total potential savings if accepted is \$390,000.

S-4 AC Pavement in Sixes Road

This change would facilitate construction of the ramp intersections.

The total potential savings if accepted is \$140,000.

S-8 Use 11' Turn Lanes

This change would presumably require a design exception but would reduce construction cost. The relatively slow speeds anticipated in the interchange area may support this concept.

The total potential savings if accepted is \$115,000.

R-1/2/4 Retain Existing Ramps

The proposed ramps have been offset from the existing in order to facilitate construction of the concrete pavement. The existing ramps are in good condition and meet standards. Widening them to the inside with AC pavement would meet the need and purpose. There would be some increase in O&M but on a life-cycle cost basis, this would not outweigh the significant construction cost reduction.

The total potential savings if accepted is \$4,190,000.

B-1 Retain Existing Bridge – Construct Parallel Bridge on the North Side

The existing bridge has a high rating and could be retained. Constructing the parallel bridge to the north requires less alignment revision but conflicts with the superelevation of the existing bridge.

The total potential savings if accepted is \$1,740,000.

S-7 Retain Existing Bridge – Construct Parallel Bridge on the South Side

This alternate approach to retaining the existing structure would require more realignment of Sixes Road but the Team believes this can be accomplished and meet the 45 MPH design speed. The parallel structure would fit with the superelevation of the existing bridge and would be narrower than under Recommendation B-1.

The total potential savings if accepted is \$2,100,000.

S-1 Adjust Sixes Road Alignment – Construct New Bridge in one Stage

If the existing bridge cannot be retained, the VE Team recommends that the alignment be shifted such that the entire new structure can be built at one time, facilitating construction and MOT. There would likely be a significant construction cost reduction.

The total potential savings if accepted was not estimated.

B-7 Two-Span Bridge

A two-span AASHTO girder or bulb tee structure would span the anticipated I-575 width and reduce the new bridge length by 80', using full-height abutments. The Team assumed that this concept would involve the removal of the existing bridge, but it is possible that some combination of this recommendation and B-1/S-7 could be designed.

The total potential savings if accepted is \$665,000

I-575/Sixes Road - - Cherokee County
SUMMARY OF VALUE ENGINEERING RECOMMENDATIONS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	COMMENTS
	ROADWAY/TRAFFIC						
S-2	Reduce Median Width Between Ramp Termini	330,000	0	330,000	Nominal	330,000	Access control not a problem between ramps
B-3	Eliminate One Turn Lane	3,640,000	3,250,000	390,000	Nominal	390,000	On Bridge Only
S-4	Use AC Pavement in Sixes Road	840,000	700,000	140,000	Increased	140,000-	Facilitates constructability
S-8	Narrow Turn Lanes to 11'	3,655,000	3,540,000	115,000	Minor Savings	\$115,000	Design Exception

I-575/Sixes Road - - Cherokee County
SUMMARY OF VALUE ENGINEERING RECOMMENDATIONS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	COMMENTS
	RAMPS						
R1/2/4	Retain Existing Ramps; Widen to the Inside; Use AC Pavement	5,330,000	840,000	4,490,000	(300,000)	4,190,000	Ramps in good condition
	BRIDGE/ALIGNMENT						
B-1	Retain Existing Bridge; Build Parallel Structure – North Side	3,840,000	2,100,000	1,740,000	Significant	1,740,000	Does not fit with existing super
S-7	Shift Alignment South Rather Than North – Construct Parallel Bridge	3,860,000	1,760,000	2,100,000	Significant	2,100,000	Fits with existing superelevation
S-1	Adjust Sixes Road Alignment – Construct Bridge in One Stage	4,200,000	4,187,000	13,000	N/A	Not Estimated	MOT savings could be signif.
B-7	Two-Span Bridge; Full Height Abutments; Remove Existing Br.	3,895,000	3,230,000	665,000	Significant	665,000	Reduces length 80'

I-575/Sixes Road - - Cherokee County
SUMMARY OF VALUE ENGINEERING RECOMMENDATIONS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	COMMENTS
	DESIGN SUGGESTIONS						
R-5	Minimize Retaining Walls						
R-6	Reduce Length of 2-Lane NB Exit Ramp						

STUDY IDENTIFICATION

Study Identification

Project: I-575/ Sixes Road	Dates: July 9-12, 2007
Location: Atlanta – GDOT GO	

VE Team Members

Name:	Discipline:	Organization:	Telephone:
George Obaranec	Highway Design	MACTEC	
Dipi Chandra	Bridge Design	MACTEC	
Tom Gandolfi	Constructability	Parsons	
Rod Curtis	VE Team Facilitator	MACTEC	

Project Description

This project will upgrade the I-575/Sixes Road (SR5) Interchange in order to keep pace with intense growth of development and traffic volumes in the area. The work will include upgraded ramps in all four quadrants, a revised and reconstructed Sixes Road, and a new 340' four-span bridge over I-575. The project is currently in the conceptual phase, with a completed Concept Report expected soon. The current project estimate is \$18.1M, including R/W. A Cost Model based on this estimate is included in the Appendix. Key items of work include:

Pavement and Base (AC and PCCP)	\$4.9M
AASHTO Girder Bridge	4.3M
Right of Way (rough estimate)	2.9M
Earthwork	1.7M

The project is currently not programmed for construction (long range) but is likely to be advanced by GDOT management.

Key items noted from a review of the information packet:

- - I-575 is heavily congested at this location. The Sixes Interchange ramps cannot handle the volume of traffic exiting the interstate, creating overflow onto the mainline, adding to the congestion and creating a safety concern.
- - Land use to the west of the interchange is largely residential and to the east it is largely commercial with rapid growth in both areas.
- - A Categorical Exclusion is anticipated for this project
- - Sixes Road AADT in 2012 is estimated at 28,100 and in 2032 at 52,450; DHV ranges from 900 to 2300 in 2032.

- - Sixes Road and the Interstate ramps will be realigned to facilitate construction and maintenance of traffic.
- - A significant quantity of borrow will be required.
- - The estimate includes both concrete and asphalt pavement but the typical sections show only AC
- - Sixes Road Design Speed = 45MPH
- - There are no major utilities in the area.
- - A seven-lane, four-span, pre-stressed girder bridge is proposed over I-575.
- - Accident frequency on Sixes Road has been somewhat higher than the statewide average.

A Design Presentation/Kick-off Meeting was held at the outset of the study, with the following in attendance:

Lisa Myers	GDOT	Engineering Services
Kenny Beckworth	GDOT	District 6 Construction
Chris Rudd	GDOT	Road Design
Tim Matthews	GDOT	Road Design PM
Jack Muirhead	GDOT	Bridge Design
Jerry Milligan	GDOT	R/W
Christy Poon-Atkins	FHWA	
Alex Stone	JJG	Project Manager
George Obaranic	MACTEC	VE Team
Dipi Chandra	MACTEC	VE Team
Tom Gandolfi	Parsons	VE Team
Rod Curtis	MACTEC	VE Team

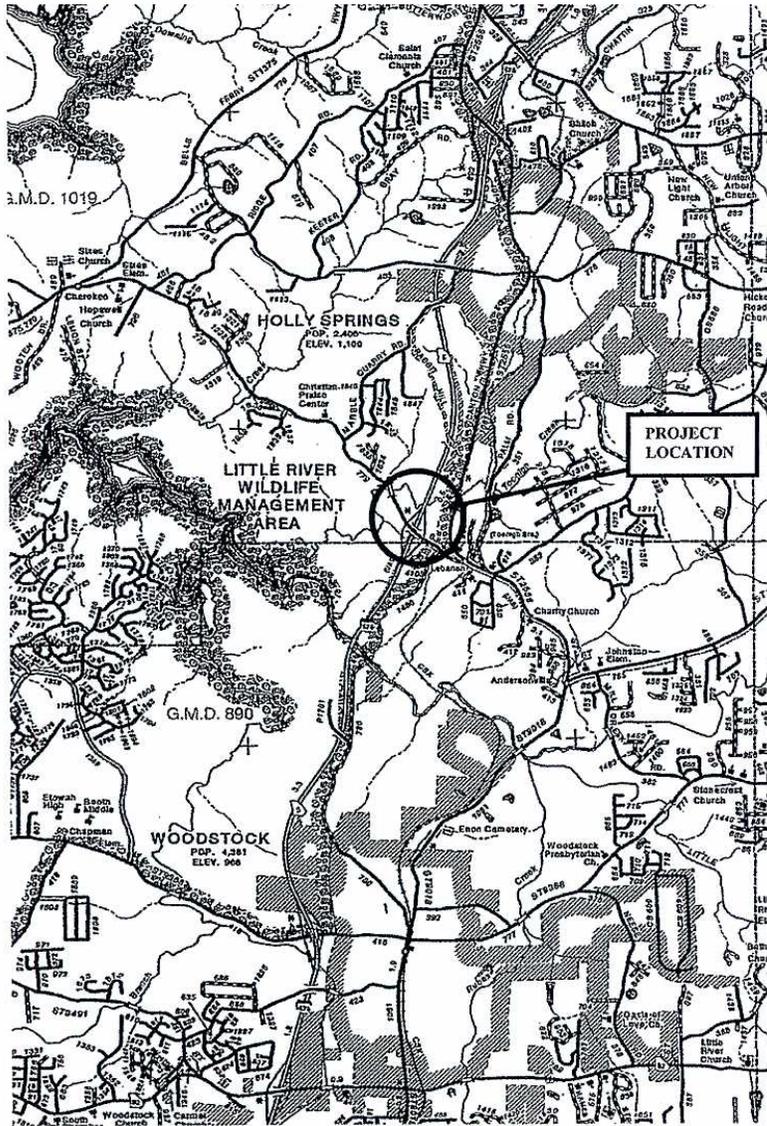
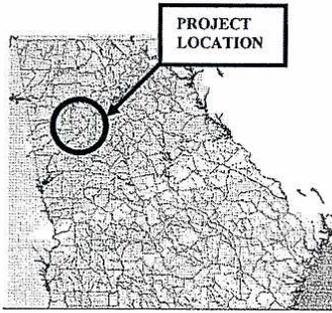
Alex Stone of JJG gave a very informative overview of the project. The following items were noted:

- The existing bridge is a 3-lane box girder. The project team decided not to keep it although it is in good condition. Given that the bridge is superelevated, widening it would present technical problems.
- Two adjoining four lane projects are done or underway; this project will complete the upgrade of Sixes Road.
- There is a County sewage pump station in the NE quadrant that should not affect this project.
- A creek runs under the ramps and mainline on the north side – fairly small.
- Existing clearance of bridge is good; profile will be raised only minimally.
- Existing ramps have no design deficiencies; will be concrete – GDOT policy plus rutting prevention at terminals
- Mainline work restricted to tying in ramps only
- The new bridge will span the assumed upgrade of I-575, including HOV lanes
- The R/W estimate is just a rough estimate at this point. Property is mostly required for

ramps, but some on Sixes road as well

- Existing mill is likely to be considered historic
- The earthwork quantities are only a rough estimate at this time..
- The pavement design is not done at this point. The Design Team assumes 12"/5"/12" for concrete.
- The proposed typical section will be up to 7 lanes, plus 16' shoulders, sidewalk on both sides.
- No specific constraints to the value study were identified

Project Location Map



VE RECOMMENDATIONS

DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: S-2	Sheet No.: 1 of 4	CREATIVE IDEA: Reduce Median Width Between Ramp Termini	
Prepared By: G.O. Date: 7/11/07 Checked By: RHC Date: 07/23/07			
<p>Original Concept:</p> <p>The baseline concept calls for a median width that varies between 20' and 44' depending on the number of turn lanes. This would provide an 8' raised median for the roadway and bridge between the ramp termini. The 8' width would include two curb and gutter sections and an approximately 4' raised section of roadway/deck between them.</p> <p>Proposed Change:</p> <p>The VE recommendation is to eliminate the 8' raised median and substitute a double yellow stripe or other narrow device for delineation if necessary. (See Sketch)</p> <p>Justification:</p> <p>One of the major functions of the raised median is to prevent left-turn access off or onto the roadway. That function is not needed in this section of the roadway. Given the signals at both termini and the number of turn lanes, speeds in this area should be low, and a stripe or other raised device for delineation would be sufficient. This change would significantly reduce construction and O&M costs, and might have a nominal positive impact on the R/W need and cost. Earthwork cost would also be somewhat less.</p>			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	330,000		
- Proposed	0		
- Savings	330,000		330,000
FUTURE COST – Savings		Nominal	
TOTAL PRESENT WORTH SAVINGS			\$330,000

SKETCH	
Project Name: <u>I-575</u>	IDEA No: <u>SZ</u> CLIENT:
Comp By: <u>60</u> Date: <u>7/11/07</u> Ckd By: <u>RHC</u> Date: <u>7/16/07</u>	Sheet <u>2</u> of <u>4</u>
<p>The sketch shows a cross-section of a bridge with two lanes. A vertical line with arrows at both ends is labeled 'PROPOSED MEDIAN' and '8ft ON BRIDGE'. To the right, a vertical line is labeled 'ELIMINATE MEDIAN' and 'DOUBLE YELLOW LINE'. The bridge structure is drawn with a top and bottom flange and a central vertical section.</p>	

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: S-2

Sheet 4 of 4

Assume: Striping would be contained within the lane widths

Assume: Bridge cost = \$95/sf (\$110/sf in baseline estimate exceeds GDOT guidance and is assumed to include cost of existing bridge demolition and contingency)

Assume: average height of fill on bridge approaches = 10'

Assume: Concrete pavement cost including base = \$90/SY

- - Bridge Width reduction: 340' length X 8' = 2720 sf

- - Roadway 500' X 8' X 1/9 = 444 SY

- - Curb and gutter : 200' one side, 250' other side of bridge = 450' LF

- - Raised median – roadway only : 450' X 2' X 1/9 = 100 SY

- - Earthwork – 8' X 10' height X 500' = say 1500 CY

DEVELOPMENT AND RECOMMENDATION PHASE

I-575/Sixes Road Interchange

IDEA No.: B3	Sheet No.: 1 of 3	CREATIVE IDEA: Eliminate One Turn Lane on Bridge
------------------------	-----------------------------	---

Prepared By: GO **Date:** 07/11/07 **Checked By:** RHC **Date:** 07/23/07

Original Concept:

The baseline concept proposes three turn lanes across the new bridge in order to provide storage space for vehicles turning both south- and northbound from Sixes Road onto I-575.

Proposed Change:

The VE Team recommends the provision of only two turn lanes across the bridge.

Justification:

- This recommendation would significantly reduce Construction and O&M cost.
- From traffic standpoint, some of the left turn storage lanes seem excessive as explained below:
 - For I-575 NB exit ramp, left to Sixes Road, DHV is 1145; storage for 2 lanes is 2X650' = 1300'
 - For Sixes Road WB to I-575 SB Ramp, DHV is 800; storage for 2 lanes is 2X1100' = 2200'
 - For Sixes Road EB to I-575 NB Ramp, DHV is 160; storage for 1 lane is 1X700' = 700'
- Basically, there are 3 left turn storage/left turn lanes on the bridge which seemingly could be reduced to 2 lanes, while still providing an acceptable LOS and suitable storage. This would have to be verified by traffic analysis and modeling. However, if 1300' of storage is acceptable for 1145 vehicles, 2200' seems excessive for 800 vehicles, even though there is an opposing movement. Our estimate is about 500' of storage required for 800 left turning vehicles. In addition, the relatively minor left turn movement of 160 vehicles would require less than 200' of storage.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	\$3,640,000		
- Proposed	\$3,250,000		
- Savings	\$390,000		\$390,000
FUTURE COST – Savings		Nominal	
TOTAL PRESENT WORTH SAVINGS			\$390,000

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: B-3

Sheet 3 of 3

Assume: Cost of bridge = \$95/SF per GDOT guidance (Baseline estimate of \$110 assumed to include cost of demo of existing bridge)

Assume: reduction of 12' bridge deck width results in proportional reduction of overall structure

Assume: roadway width between termini remains the same.

Reduction = 340' X 12' = 4080 sf of deck

DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: S-4	Sheet No.: 1 of 3	CREATIVE IDEA: Use Asphalt Pavement In Lieu of Concrete – Sixes Road	
Prepared By: G.O. Date: 07/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline concept proposes to construct concrete pavement from the ends of the bridge to and through the ramp intersections, on both sides.			
Proposed Change: The VE Team recommends the use of AC pavement in this location.			
Justification: This change would reduce construction cost and increase construction staging flexibility, particularly in the intersections where it would be desirable to reduce the number of joints. It would also facilitate the installation of signal conduits and loops. There is no specific GDOT requirement to use concrete pavement in this area and the VE Team believes that AC would adequately provide the required functionality. There would be some increase in O&M required over time, but this would be nominal, given that the adjacent roadway will be constructed of AC.			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	840,000		
- Proposed	700,000		
- Savings	140,000		140,000
FUTURE COST – Savings		Some Increase	
TOTAL PRESENT WORTH SAVINGS			\$140,000

COST WORKSHEET

Project Name: I-575/Sixes Road Interchange					IDEA No: S-4		
					Sheet 2 of 3		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
ITEM	UNITS	Nº UNITS	COST/ UNIT	TOTAL COST	Nº UNITS	COST/ UNIT	TOTAL COST
Concrete Pavement	SY	9333	90.00	839,970			
Asphalt Pavement	SY				9333	75.00	699,975
TOTAL				839,970			699,975
TOTAL ROUNDED				840,000			700,000

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: S-4

Sheet 3 of 3

Assume: Concrete pavement at \$90/sy including base; AC at \$75/sy including base

Assume: Traffic control costs remain the same (probably would be some reduction)

Assume: Approximately 500 lf on each side proposed in PCCP; average width = 84'

$1000 \text{ lf} \times 84' \times \frac{1}{9} = 9,333 \text{ SY}$ of pavement to be changed..

DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: S-8	Sheet No.: 1 of 3	CREATIVE IDEA: Use 11' Width For Turn Lanes on Sixes Road	
Prepared By: GO Date: 07/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline proposes to construct 12' through and turn lanes for the entire project.			
Proposed Change: The VE recommendation is to use an 11' width for turn lanes on Sixes Road, between ramp termini only.			
Justification: This recommendation would result in a construction cost reduction. Given the number of turn lanes, high turning movements, and the signals at the ramp intersections, speeds in this area should be low. Although a design exception may be required, and some minor operational issues may arise, the Team felt that this change would yield a value enhancement while continuing to provide the required functionality. The width of the proposed gutter adds to the effective width of the two inside lanes, and this would facilitate truck turning movements. As the area continues to develop and become more urban, 11' lanes become more acceptable.			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	3,655,000		
- Proposed	3,540,000		
- Savings	115,000		115,000
FUTURE COST – Savings		Nominal	
TOTAL PRESENT WORTH SAVINGS			\$115,000

COST WORKSHEET							
Project Name: I-575/Sixes Road Interchange					IDEA No: S-8		
					Sheet 2 of 3		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
ITEM	UNITS	Nº UNITS	COST/UNIT	TOTAL COST	Nº UNITS	CO ST/UNIT	TOTAL COST
Bridge Reduction	SF	38,295	95	3,638,025	37,275	95	3,541,125
Roadway Reduction	SY	167	90	15,030			
TOTAL				3,653,055			3,541,125
TOTAL ROUNDED				3,655,000			3,540,000

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: S-8

Sheet 3 of 3

Assume: Bridge cost = \$95/SF (Baseline estimate of \$110/sf likely includes demolition)

Assume: savings in bridge proportional to deck width reduction

Assume: Roadway Pavement – Concrete per baseline – at \$90/SY including base

Assume: 3 turn lanes across entire length per baseline concept

Bridge reduction = 3 lanes X 1' X 340' length = 1020 sf

Roadway reduction = 3 lanes X 1' X 500' +/- = 167 SY

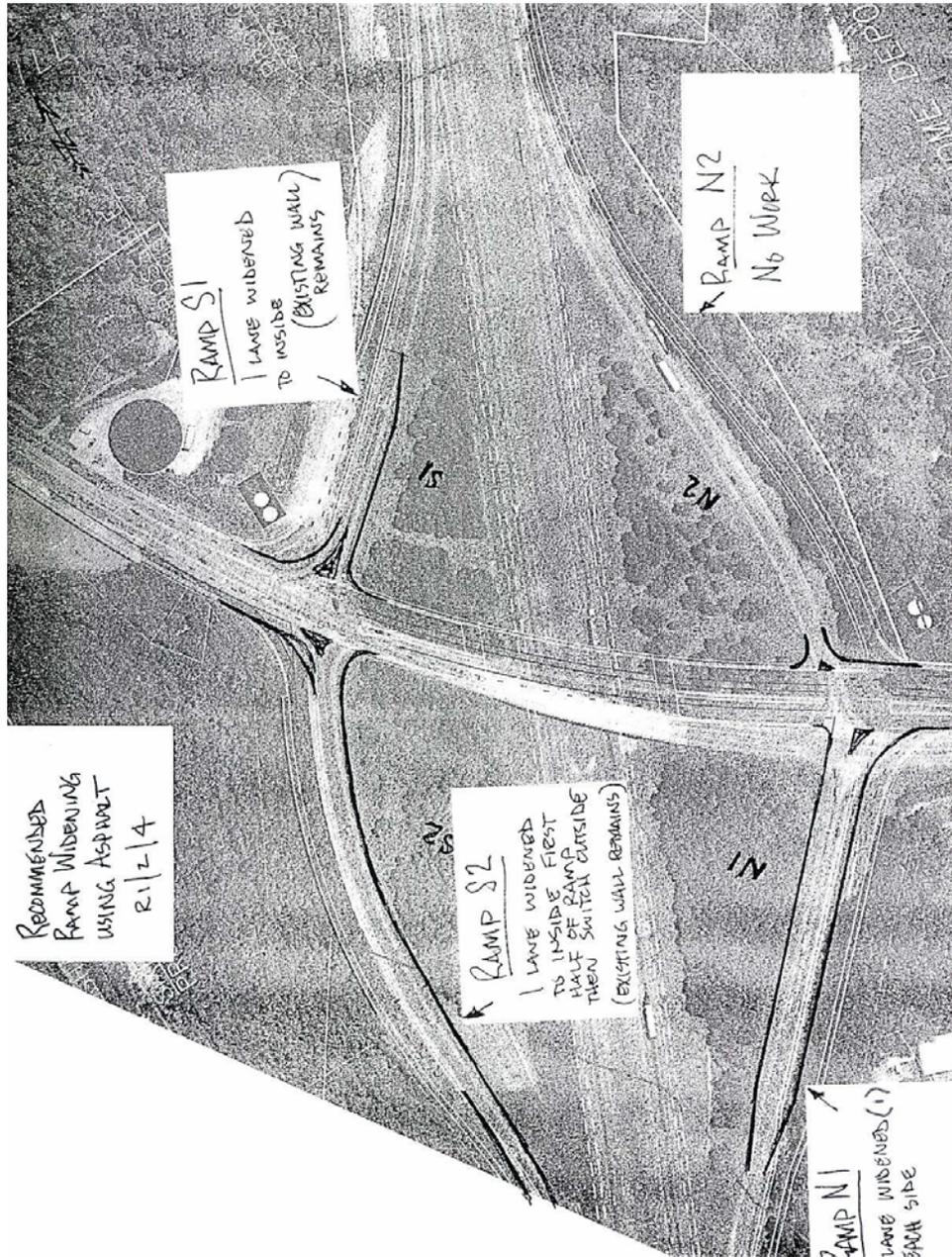
DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: R1/2/4	Sheet No.: 1 of 5	CREATIVE IDEA: Use Existing Ramps – Asphalt Pavement	
Prepared By: T.G. Date: 7/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline concept for the ramp upgrades is to offset new ramps from the existing in order to facilitate construction, and to construct the ramps with concrete pavement. Additional capacity will be added at the intersections with Sixes Road.			
Proposed Change: The VE Team recommends that the existing ramps be retained and widened with asphalt pavement. (See Sketch)			
Justification: The existing ramps appear to be in excellent condition, and to meet the applicable design parameters. Widening these ramps to the inside to provide the required capacity would meet the need and purpose of the project, and significantly reduce construction cost. Although there would be some increase in O&M cost over time, the Team believes that on a life-cycle basis the O&M cost would be greatly outweighed by the reduction in construction cost. The VE Team understood that GDOT has an interest in replacing asphalt ramps with concrete but we feel that in this case the higher-value solution would be to retain as much of the existing resource as possible.			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	5,330,000		
- Proposed	840,000		
- Savings	4,490,000		4,490,000
FUTURE COST – Savings		(300,000)	(300,000)
TOTAL PRESENT WORTH SAVINGS			\$4,190,000

SKETCH

Project Name: I-575/Sixes Road Interchange

IDEA No: R-1/2/4

Sheet 2 of 5



CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: R-1/2/4

Sheet 4 of 5

Assume: Use 4' inside shoulder per Design Policy Manual rather than 6'

Assume that 12.5mm lift of AC would be 1.25" Then assume that other lifts would be proportional - (depths not specified, assume quantities are fairly close)

8200 tons/1200 tons X 1.25" = 8.5" for 19 mm;

2900 tons/1200 tons X 1.25 = 3" for 25mm

Assume AC design is 8.5" + 3" + 1.25" = 12.75 inches

From plans takeoffs: ramp AC represents approximately 75% of total (including tapers)

From plans take offs: ramp PCCP represents approx. 73% of total

PCCP on ramps = 73% X 39,000 SY = 28,470 SY = 256,230 sf (amount to be eliminated)

Recommended Surface Area for Widened ramps: (AC to be added)

N1 - (750' X 14') + (2 x 12 x 600') + (12x150) = 26,700 sf

N2 - No work recommended

S1 - (400 X 4) + (12/2 X 150) + (12 X 250) = 5,500

S2 - (800 X 4) + (12 X 800) = 12,800
45,000 sf

45,000 SF / 9 = 5000 SY @ 110 lbs/SY/in X 12.75 in = 3500 tons Added to project

Aggregate Base: Adding 45,000 sf AC and deducting 256,000 sf of PCCP -

net reduction = 211,000 sf Assume 12" of Base = 211,000 cf /27 = 7800 CY deleted

At say 2 Tons/CY = 15,600 tons eliminated.

Clearing and Grubbing, Earthwork, Erosion Control - Assume approx 75% reduction in area/volume

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: R-1/2/4

Sheet 5 of 5

Rough Life Cycle Comparison

Assume: No maintenance cost for PCCP ramps (conservative)

Assume : One mill and overlay at 10 years and 20 years (20 year life cycle)

Use: 4% discount rate – conservative since low rates favor higher construction cost

Added AC area = 5000 sy Say 10,000 sy for total reconstructed ramps in AC

Say \$25/sy for mill and overlay = \$250,000 per overlay

PW of AC Maintenance = $\$250,000 (.6756) + \$250,000 (.4564) = \$283,000$ say \$300k

This is a rough analysis but indicates that the present worth of the avoided maintenance due to using PCCP would be unlikely to come close to the present worth of the avoided construction cost (\$4.5M+/-)

DEVELOPMENT AND RECOMMENDATION PHASE

I-575/Sixes Road Interchange

IDEA No.: B1	Sheet No.: 1 of 5	CREATIVE IDEA: Retain Existing Bridge, Build Parallel Structure on the North Side
------------------------	-----------------------------	--

Prepared By: DC Date: 07/11/07 Checked By: RHC Date: 07/23/07

Original Concept:

The baseline proposes to demolish the existing 320' post-tensioned box girder bridge and replace it with a 340' four-span AASHTO girder bridge. The proposed deck width is approximately 112'.

Proposed Change: The VE Recommendation is to retain the existing bridge, use it for eastbound traffic on Sixes Road, and build a new bridge parallel to the existing bridge to carry the westbound traffic on Sixes Road. Sixes Road would need to be realigned accordingly. The new bridge would be a separate structure with superstructure preferably made of prestressed concrete I-girders. The new structure would be on the northern side of the existing structure. Because the new bridge would be constructed on the low side of the existing bridge's superelevation, there would be a profile difference between the two bridges. The new bridge would be approximately 69' wide to accommodate the required lanes – seven total for both bridges, per baseline. **(Please see the attached sketches)**

Justification:

- Save the existing structure which is in good shape (its sufficiency rating is 97.58 per bridge inspection done in March 2006)
- Eliminate complex and costly demolition operation.
- This change gives more design options (type of superstructure – steel, concrete, etc.) to choose from and to reduce cost.
- This recommendation would simplify construction staging and flipping traffic would not be necessary.
- This would allow building only the new width that is needed, significantly reducing construction cost.
- Even though the existing bridge is 27 years+/- old, its excellent condition would likely result in a similar O&M cost for both bridges over time.

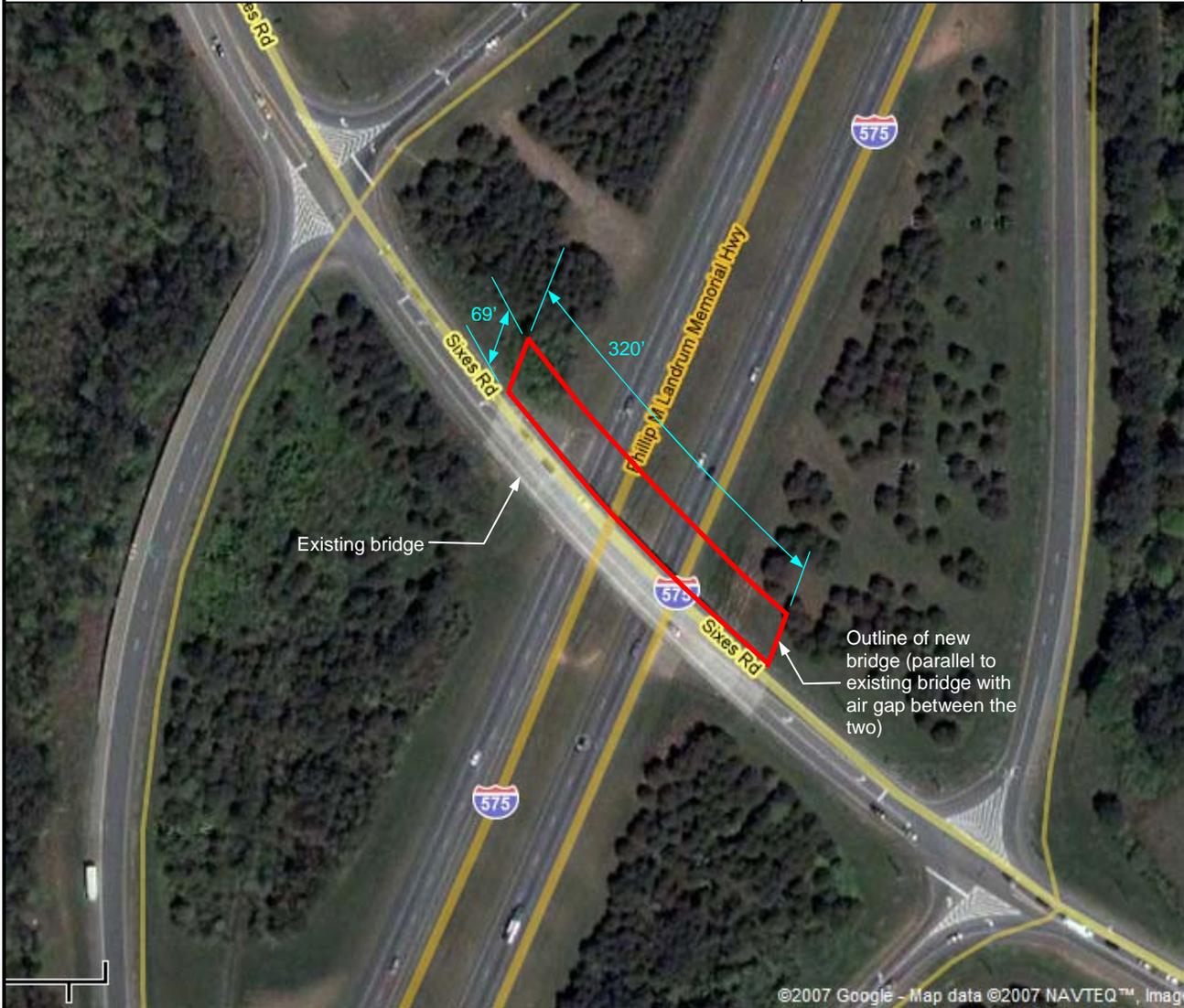
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	\$3,840,000		
- Proposed	\$2,100,000		
- Savings	\$1,740,000		\$1,740,000
FUTURE COST – Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$1,740,000

SKETCH

Project Name: I-575/Sixes Road Interchange

IDEA No: B1

Sheet 2 of 5



SKETCH	
Project Name:	IDEA No: B1 CLIENT:
Comp By: <u>GO</u> Date: <u>7/1/07</u> Ckd By: <u>RK</u> Date: <u>7/1/07</u>	Sheet <u>3</u> of <u>5</u>
<p>The sketch consists of two parts. On the left is a plan view of a bridge cross-section. It shows a central roadway of 4'-12" width. On either side of the roadway, there is a 6'-0" wide shoulder. The total width of the bridge deck is 48 feet. The bridge is supported by two abutments, each 27'-6" wide. On the right is a side elevation of the bridge, showing a trapezoidal deck supported by two abutments. The bridge is labeled as a 'RURAL SECTION'.</p>	
<p>NORTH SIDE WIDENING INCLUDES 10' INSIDE SHOULDER RURAL SECTION</p>	

CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: B-1

Sheet 5 of 5

Assume: Roadway and R/W costs would remain essentially the same with the required realignment, which would not be significantly different than the baseline.

Assume: Bridge cost = \$95/SF per GDOT guidance (both baseline and VE proposed)

Assume: 10' rural standard shoulder required on new bridge (urban standard may be appropriate which would reduce overall width)

Assume: Demolition cost = \$200,000 (cost could be much higher)

Assume; new bridge same length as existing = 320'

Assume: no significant investment needed to existing bridge except possibly sidewalk

Assume: baseline bridge would be 112.6' wide per estimate

Bridge reduction: construct = 320' X 69' = 22,080 sf

Original = 38,295 sf Reduction = 16,215 sf

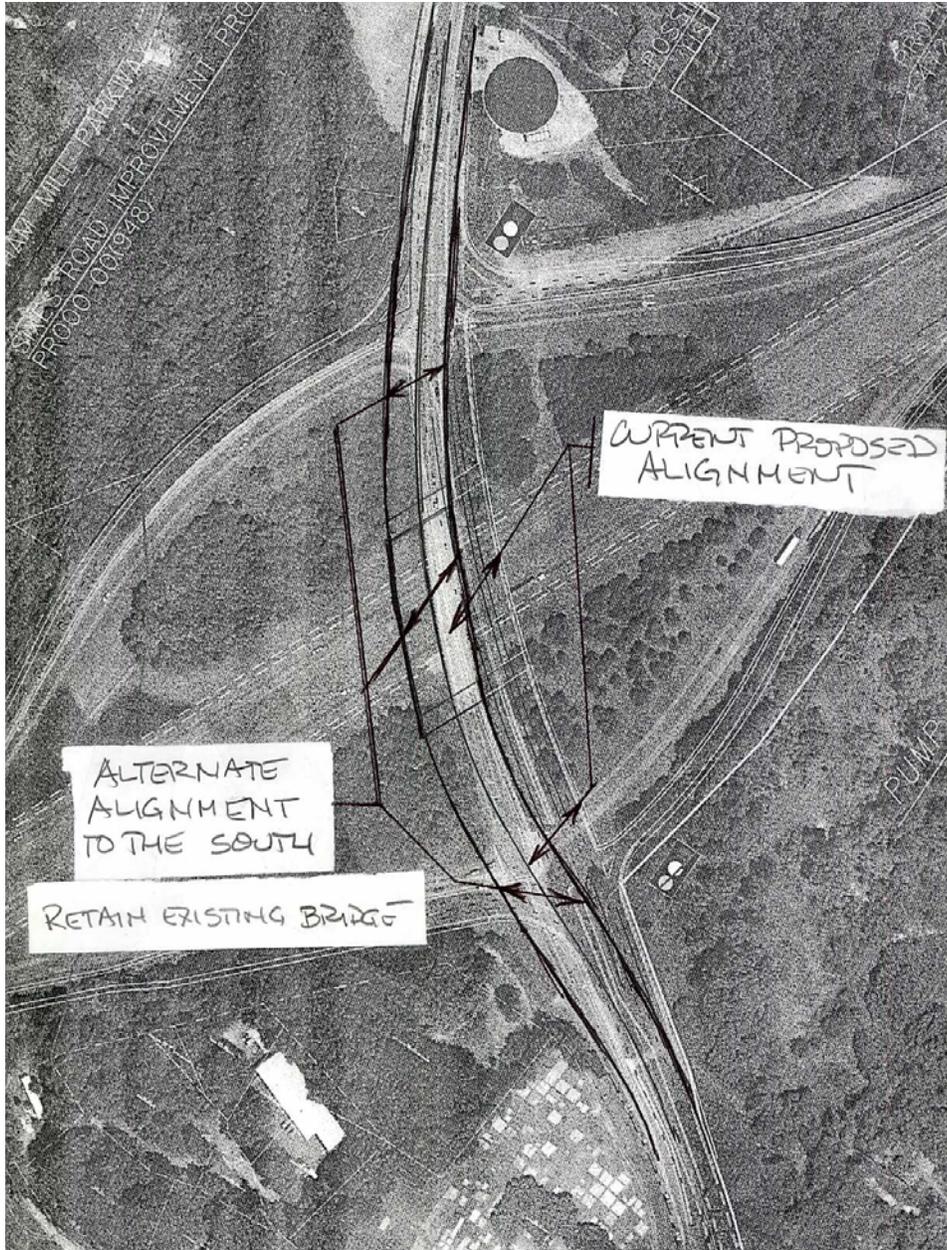
DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: S-7	Sheet No.: 1 of 5	CREATIVE IDEA: Retain Existing Bridge, Build Parallel Structure on the South Side	
Prepared By: DC Date: 07/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline proposes to demolish the existing 320' post-tensioned box girder bridge and replace it with a 340' four-span AASHTO girder bridge. The proposed deck width is approximately 112'.			
Proposed Change: This recommendation is similar to the previous (B-1). The existing bridge would be retained, and a new, smaller structure would be built parallel to the existing. In this case, the new bridge would be built on the southern side. This would require a more significant realignment of Sixes Road but the team felt that this could be accomplished and retain a 45 mph design speed per the baseline. Because the new bridge would be built on the existing high side of the superelevation, it could be matched more easily to the existing bridge. The required widening would be significantly less (57.5') than that for Recommendation B-1. (See Sketches)			
Justification:			
<ul style="list-style-type: none"> • Save the existing structure which is in good shape (its sufficiency rating is 97.58 per bridge inspection done in March 2006) • Eliminate complex and costly demolition operation. • This change gives more design options (type of superstructure – steel, concrete, etc.) to choose from and to reduce cost. • This recommendation would simplify construction staging and flipping traffic would not be necessary. • This would allow building only the new width that is needed, significantly reducing construction cost. • Even though the existing bridge is 27 years+/- old, its excellent condition would likely result in a similar O&M cost for both bridges over time. • The required alignment would introduce reverse curves but a suitable layout for 45 mph seems feasible. • Roadway costs would likely be very similar to the baseline. Some additional R/W may be needed along the EB roadway, west of the interchange. The ramps could be reconfigured to match the new alignment. • Constructing on the high side may allow space for falsework if a box girder is selected (we assumed the use of AASHTO girders per baseline) 			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	3,860,000		
- Proposed	1,760,000		
- Savings	2,100,000		2,100,000
FUTURE COST – Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$2,100,000

SKETCH

Project Name: I-575/Sixes Road Interchange

IDEA No: S-7

Sheet 2 of 5



SKETCH

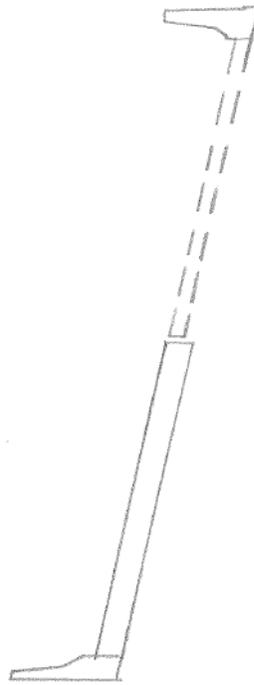
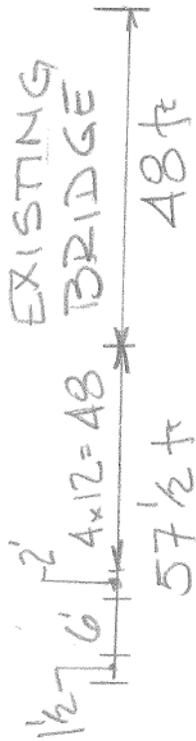
Project Name:

IDEA No:
CLIENT:

1
S7

Comp By: 60 Date: 7/1/07 Ckd By: RRV Date: 7/1/07

Sheet 3 of 5



CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: S-7

Sheet 5 of 5

Assume : Add 4-12' lanes (7 lanes total per baseline; three lanes carried on existing bridge) and sidewalk.

Assume: new bridge would be a separate structure but with only a minimal air gap between

Assume: roadway costs essentially the same – beyond scope of VE study to attempt this

Assume demo cost = \$200,000

Required width = 48' + 8' for Sidewalk + 1.5' barrier = 57.5'

Construct: 320' length X 57.5 ' = 18,400 sf

Baseline = 38,295 sf

Reduction = 19,895 sf

Additional R/W = say $\frac{1}{2} \times 300' \times 50' = 7500 \text{ sf} = 0.2 \text{ Acre}$

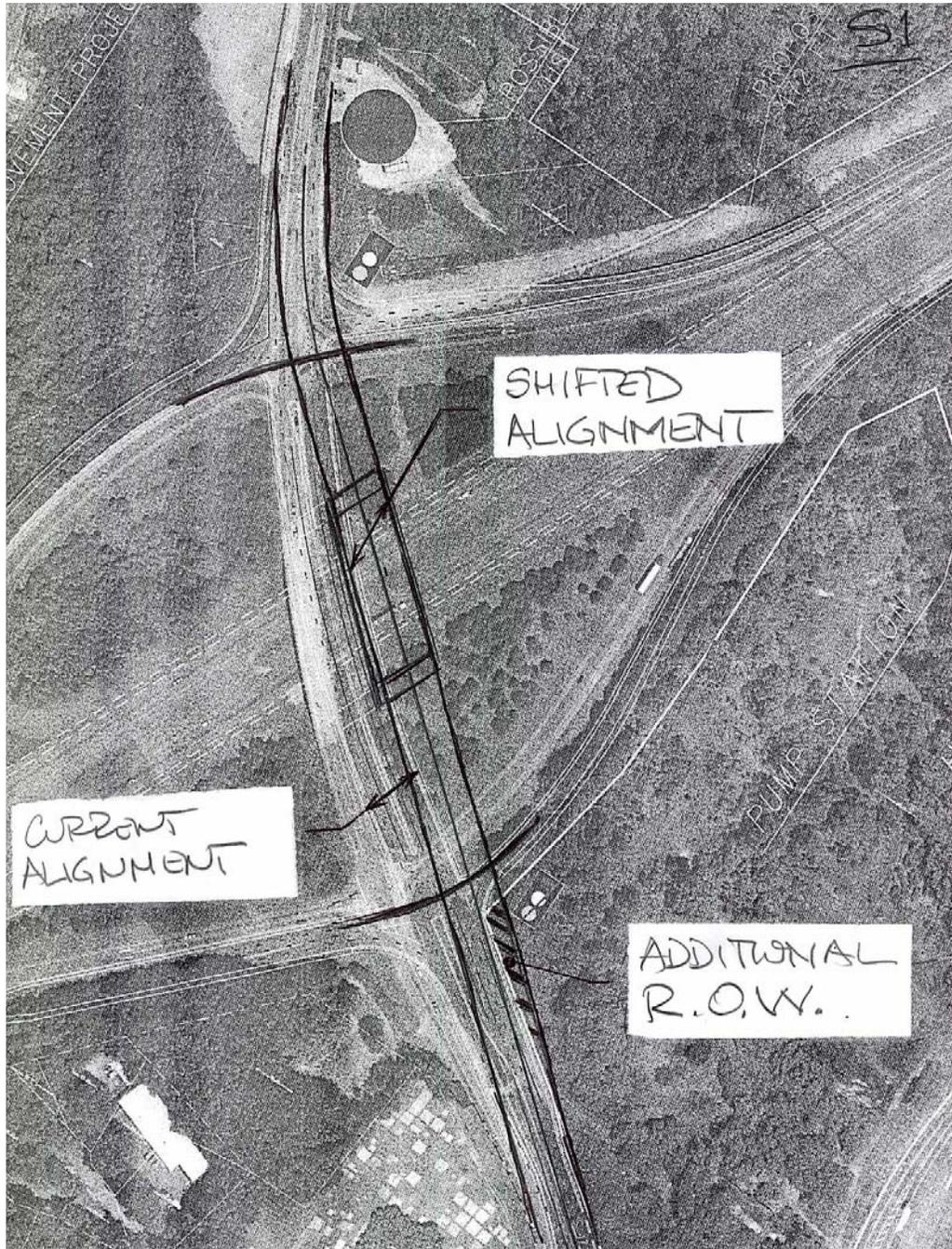
DEVELOPMENT AND RECOMMENDATION PHASE			
I-575/Sixes Road Interchange			
IDEA No.: S-1	Sheet No.: 1 of 2	CREATIVE IDEA: Adjust Alignment – Construct Bridge in One Stage	
Prepared By: GO Date: 07/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline proposes to demolish the existing 320' post-tensioned box girder bridge and replace it with a 340' four-span AASHTO girder bridge. The proposed deck width is approximately 112'.			
Proposed Change: If neither of the previous two recommendations can be implemented and the existing bridge will be removed, the VE Team recommends that the Design Team investigate a realignment of Sixes Road that would allow the new bridge to be constructed in one stage. (See Sketch)			
Justification:			
<ul style="list-style-type: none"> • The proposed new alignment would likely allow for the bridge to be constructed on tangent, and would eliminate the need to mobilize the bridge crew a second time. • This recommendation would take the demolition off the critical path which could be very helpful if that activity becomes as complex as it potentially could be. • This change would simplify the MOT significantly. • Traffic on the new bridge would be farther away from the existing bridge during demolition, which would increase safety and flexibility for the contractor. • The proposed alignment would require a small amount of additional R/W at the Home Depot site but we did not see this as critical. (+/- 0.14 acre at Say \$50k per acre) • The impact to the existing gas station would be greater, but we understood that GDOT intends to acquire this property for access control purposes anyway. • Ramp and intersection geometry could be adjusted to meet the proposed alignment. • This change would continue to provide all functionality, number of lanes, etc as the baseline. • There would likely be a significant cost reduction due to easier MOT and construction but we did not attempt an estimate. 			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original			
- Proposed			
- Savings			
FUTURE COST – Savings			
TOTAL PRESENT WORTH SAVINGS			Not Estimated

SKETCH

Project Name: I-575/Sixes Road Interchange

IDEA No: S-1

Sheet 2 of 2



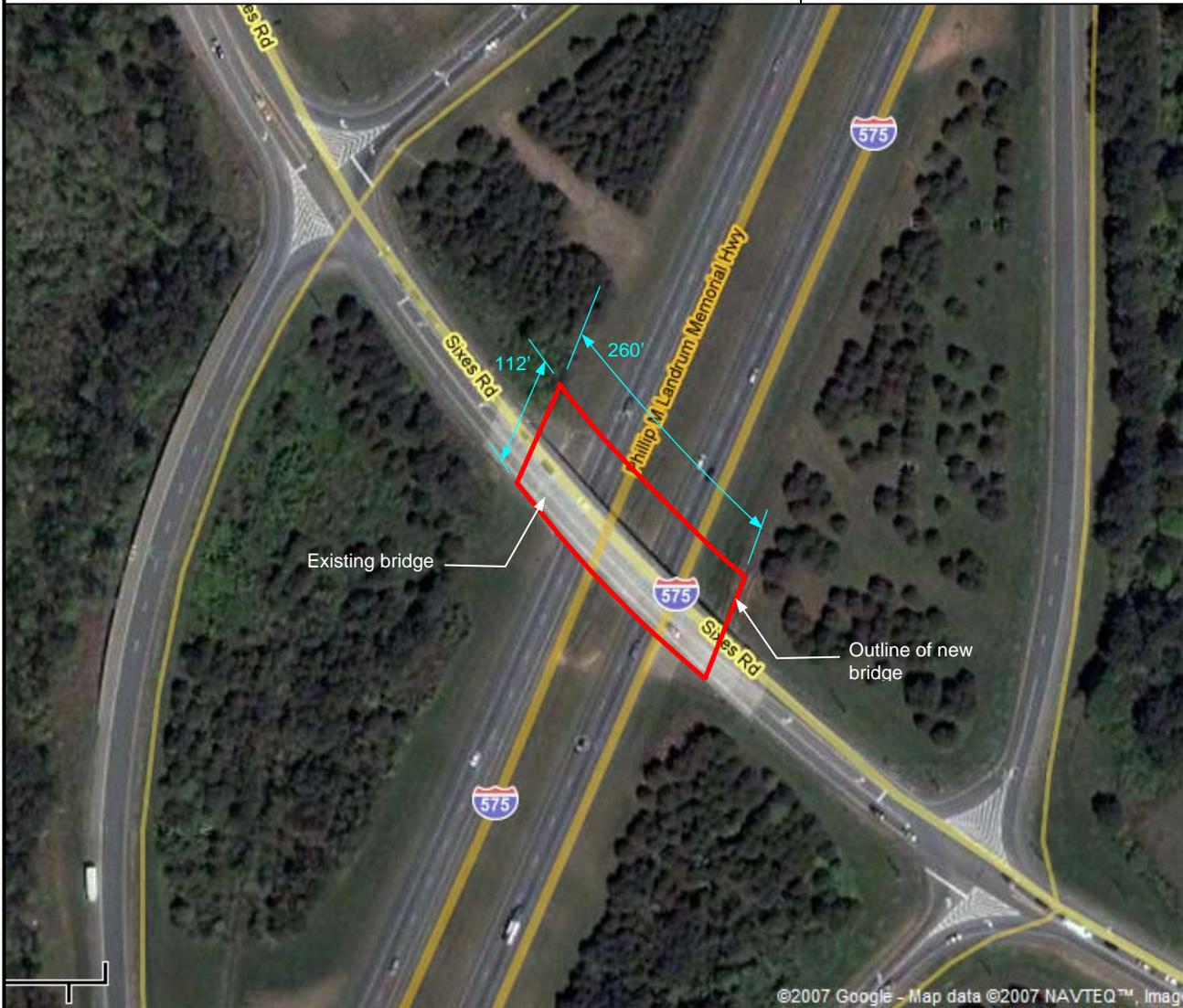
DEVELOPMENT AND RECOMMENDATION PHASE			
Project Name I-575/Sixes Road Interchange			
IDEA No.: B7	Sheet No.: 1 of 4	CREATIVE IDEA: Two-Span Bridge to Replace Existing Bridge	
Prepared By: DC Date: 07/11/07 Checked By: RHC Date: 07/23/07			
Original Concept: The baseline concept is to demolish existing bridge, build a new bridge with 4 spans (total length: 340 feet) and slope paving at two end bents.			
Proposed Change: If neither recommendation involving the retention of the existing bridge can be implemented (B-1, S-7), the VE Team recommends the construction of a new bridge with two spans having a total length of 260 feet and no slope paving at the two end bents. The new bridge would have full-height cantilever retaining walls as end bents. (See Sketch)			
Justification:			
<ul style="list-style-type: none"> • The proposed bridge configuration would reduce Construction and Operation and Maintenance costs because of the shorter bridge length. • An AASHTO girder or possibly bulb-tee type structure would be feasible at these spans, so that falsework would not be required. • The 260' length would provide for the anticipated widening of I-575 plus the required clear zones. • This recommendation could be implemented in conjunction with the retention of the existing bridge but this would create a lack of symmetry at the bridge ends. • This concept would be facilitated by Recommendation S-1 under which the alignment would be shifted to allow the entire new bridge to be constructed in one stage. If S-1 is not implemented, temporary retaining walls might be needed and this would reduce the potential construction cost reduction. 			
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST - Original	\$3,895,000		
- Proposed	\$3,230,000		
- Savings	\$665,000		\$665,000
FUTURE COST – Savings		Significant	
TOTAL PRESENT WORTH SAVINGS			\$665,000

SKETCH

Project Name: I-575/Sixes Road Interchange

IDEA No: B7

Sheet 2 of 4



CALCULATIONS

Project Name: I-575/Sixes Road Interchange

ITEM No: B-7

Sheet 4 of 4

Assume: Vertical end bent requires 20' high retaining walls, estimated at 218' in length for both ends.

20' X 218' = 4360 sf of retaining wall required.

Cost of baseline and recommended bridge = \$95/SF based on GDOT guidance for this type bridge – AASHTO girder

Bridge reduction: Construct 112' X 260' = 29,120 sf

Baseline = 38,295 sf Reduction = 9,175 sf

Estimate: Slope paving eliminated = 45' long and 218' wide – total both ends

Slope paving eliminated = 45' X 218' X 1/9 = 1090 SY

APPENDIX

Sources

Approving/Authorizing Persons

Name:	Position:	Telephone:

Personal Contacts

Name:	Telephone:	Notes:
Jack Muirhead		GDOT Bridge – discuss bridge Alternates
Peng Zhang		MACTEC Traffic – turn lane Requirements

Documents Used

Document:	Source:
Concept Report (in progress)	GDOT/JJG
As-Built Plans – Sixes Road Bridge	GDOT
Aerial Photo	JJG
Cost Estimate	JJG

FAST DIAGRAM

Study

Project Name: I-575

**Basic
Function**

Mitigate
Congestion

Accomm.
Growth

Improve
Operations

Mitigate
Congestion

Create
Continuity

Increase
Capacity

Widen
Roadway

Facilitate
Constructability

Adjust
Alignment

Avoid
Impacts

Upgrade
Ramps

HOW?

>>>

<<<
WHY?

=INFORMATION PHASE – FUNCTION ANALYSIS

Project: I-575

Function: Mitigate Congestion

ITEM No.	DESCRIPTION	FUNCTION		COST/COMPLEXITY		
		Verb	Noun	C. Cost	O&M R/W	Complexity
					-5to+5	
B	Bridge	Create	Continuity	\$4.3M	+2 Low	Low
		Span	Interstate			
		Facilitate	Constructability			
D	Demolish Existing Bridge	Accomm (new)	Alignment	\$0.3M ??	N/A N/A	High
R	Ramps	Meet	Policy	\$5.4M +/-	-1 High	Low
		Increase	Capacity			
		Facilitate	Construction			
RW	Right of Way	Create	Space	\$2.9M??	0 N/A	Low
		Facilitate	Construction			
S	Sixes Road	Facilitate	Construction	\$2.0M+/-	-1 Low	Low
		Avoid	Impacts			
		Create	Continuity			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: I-575

Function: Mitigate Congestion

ITEM No.	DESCRIPTION	FUNCTION		COST/COMPLEXITY		
		Verb	Noun	C. Cost	O&M R/W	Complexity
M	Maintenance of Traffic	Maintain	Safety	\$0.8M	N/A N/A	Medium/High
		Maintain	Capacity			
E	Erosion Control	Control	Erosion	\$0.6M	N/A Med	Low
		Minimize	Runoff			
TE	Traffic Engineering	Ensure	Safety	\$0.5M	+1 N/A	Low
		Control	Traffic			
		Accomm.	Geometry			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
	Ideas Dropped in First Cut of Evaluation	First Cut by Team Consensus	
S-3	Narrow Lanes		
S-5	Use all PCCP in lieu of both pavement types		
S-6	Use header curb in lieu of C&G		
R-3	Reduce concrete pavement thickness		
R-7	Minimize work on north-side ramps – low volumes		
R-8	Grandfather the gas station as per access condition		
B-2	Widen existing bridge		
B-5	Use cantilever sidewalk		
B-6	Optimize span arrangement		
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
	Ideas Dropped in First Cut of Evaluation	First Cut by Team Consensus	
B-9	Bascule bridge		
B-7	Alternate end span concept		
B-11	Increase overlap with existing bridge		
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
	SIXES ROAD		
S8	Use 11' turn lanes	Reduces construction and O&M cost	✓
		Curb and gutter width adds to actual lane width	
		Does not meet standard lane width	
		Design exception would be needed	
		Nominal savings only	
S2	Narrower median – eliminate 8' nominal median	Reduces construction cost	✓
	in turn lane sections	Reduces O&M cost	
		Reduces drainage system and cost	
		Would not prevent possible u-turns	
		May require design variance	
		Might require slot drain	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
S7	Shift alignment to the south	Facilitates widening of existing bridge	
		Use superelevation in our favor	✓
		Need to check mainline grade	
		Requires a more difficult alignment	
		May require more R/W (probably a wash)	
		Would not fit projects on either side as well	
		Reduces construction cost	
		Use existing bridge; avoid demolish of bridge	
		Must avoid cemetery	
		Falsework would lower clearance temporarily	
S1	New bridge in one stage – shift Sixes alignment	Requires gas station	✓
		Easier staging – build entire new bridge	
		Demolition of existing bridge easier	
		Facilitates construction of ramp termini	
		Possibly eliminate curve on bridge	
		Enhanced constructability ; Easier MOT	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
S4	Asphalt in lieu of PCCP on Sixes Road	Facilitates constructability	✓
		Reduce construction cost – probably	
		Reduces traffic impact	
	RAMPS		
R1/2/4	Asphalt vs. Concrete	Reduces construction cost	✓
	Widen to inside	Increases O&m effort and cost	
	Use existing ramps	Facilitates construction staging	
		Minimize alignment shifts	
		Reuse existing ramps	
		Existing ramps have no design deficiencies	
R5	Minimize or eliminate walls	Possible reduced cost	DS
		Easier construction	
		Alternate wall type	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
R6	I-575 two-lane exit lane (on mainline) –Reduce length	May negatively affect signal operations	DS
		Seems very long for the given volumes	
		Significant cost reduction – const and O&M	
		Two-lane off ramp could be used for additional	
	BRIDGE	Mainline capacity	
B1	Retain existing bridge, build second structure adjacent	Save existing structure which is in good shape	✓
		Eliminate complex demolition operation	
		More options to choose from and reduce cost.	
		Improved staging – no flipping traffic	
		Build only new width needed	
		New bridge would be somewhat higher due to	
		superelevation – impact on adjacent roadway	
		Existing bridge may not work with future	
		typical section. – but can be worked around	
		Sidewalk could be added to existing bridge	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
B3	Two turns lanes instead of three	Reduces construction and O&M cost	✓
		Would seem to handle future volumes (checking)	
		Reduce impact on gas station	
		May have negative impact on traffic ops	
B4	Sidewalk one side only	Might reduce construction and O&M costs	X
		Requires some peds to cross road to reach s'wk	
		Puts sidewalk on north side-stay away from left	
		turns	
		Would require wider shoulder instead per st'dh	
B10	Alternate end span arrangement – two span - MSE	Shorter bridge – less cost	✓
		Requires deeper superstructure than baseline	
		Ample space exists for future I-575 section	
		May not be seen as open and aesthetic	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		EVALUATION PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
B8	Steel bridge	Typically more costly than construction	X
		Permits two long spans without falsework	
		Eliminates two piers	
		Steel requires more maintenance	
B12	Jack existing bridge and widen	May not be feasible for post-tensioned box	X
		Avoids clearance problem	
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			