Georgia Department of Transportation

NH-IM-575-1(33)

I-575 Interchange at SR-20

P.I. No. 612270

Cherokee County, Georgia

Value Engineering Study Report

Preliminary Design

April 2006

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.
Taking the Chance out of Change

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May 5, 2006

Ms. Lisa L. Myers
Design Review Engineer Manager
GDOT General Office
No. 2 Capitol Square, Room 265
Atlanta, Georgia 30334

re: I-575 Interchange at SR-20 Project
Cherokee County, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. (LZA), is pleased to submit four print copies and one CD containing the value engineering (VE) study report for the I-575 Interchange at SR-20 project. This report documents the results of the VE study conducted April 19–21, 2006, with representatives from GDOT, HNTB, and Delon Hempton Associates.

The current cost estimate for the project is $44 million, and the VE team identified several alternatives to reduce this cost. The VE team also recommends that GDOT investigate the viability of the VE alternatives that reduce the scope of the ramp intersection improvements in conjunction with those alternatives that increase the operations of the interchange in other locations. Although some of these alternatives add cost, they will improve the level of service for this interchange.

We thank you, the GDOT design team, and others who assisted the team in completing its assignment. Please do not hesitate to call upon LZA for assistance in implementing the alternatives presented.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

George C. Hunter, PE, CVS, PMP
Vice President

Attachments

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EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA), for the Georgia Department of Transportation (GDOT). The subject of the study was project NH-IM-575-1(33), I-575 Interchange at SR-20 in Cherokee County, P.I. No. 611279, being designed by GDOT. The project was at the preliminary design phase at the time of the study.

The VE study was conducted April 19–21, 2006, at GDOT's offices in Atlanta, Georgia. The VE team comprised a highway designer, a structures engineer, a constructability specialist, and the VE team leader. The team followed the six-phase VE job plan to guide its deliberations.

- Information Gathering Phase
- Function Identification and Analysis Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

PROJECT DESCRIPTION

The proposed modifications to the I-575 interchange at SR-20 will remedy existing and future congestion at the intersection of the I-575 and SR-20 ramps caused by the EB 20/SB 20 and NB 575/ EB 20 left-turn configurations. The NB 575/EB 20 configuration, in addition to causing excessive queuing at the ramp intersection, causes backups on the NB 575 mainline. Additional objectives for this project are to combine successive ramp entrances and exits with single entrances and exits and to rehabilitate the entire pavement within the confines of the I-575 at SR-20 interchange.

The proposed construction will add an exit ramp from I-575 northbound to SR-20 and add an entrance ramp from SR-20 to I-575 southbound. All the existing ramps will be retained. The existing loop ramp on the east side of the interchange will be reconfigured to allow traffic from I-575 northbound to continue on SR-20 westbound. The new ramp on the east side of the interchange will allow northbound I-575 traffic to continue east on SR-20. No ramp improvement will be made for traffic traveling SR-20 eastbound to I-575 northbound.

The existing ramp from I-575 southbound will be reconfigured for dual left turns to SR-20 eastbound and a right turn lane to SR-20 westbound. A new ramp on the west side of the interchange will be added to allow vehicles to travel from SR-20 eastbound to I-575 southbound. The existing loop ramp on the west side of the interchange will be reconfigured to allow travel from SR-20 westbound to I-575 southbound.

CONCERNS AND OBJECTIVES

The GDOT design team indicated the following as the main project constraints:

- Environmental impacts and related permitting negotiations for Canton Creek, tributary streams, and the Cherokee Darter (an animal on the endangered species list);
- Steep, undulating topography, making the construction of Ramps "C" and "F" difficult; and
- The location of the adjacent crossing roadway along SR-20.

GDOT requested that the VE team investigate the modifications to the interchange in the current design, with particular attention to the following issues:

- The elimination of the EB 20/SB 20 and NB 575/EB 20 left turn movements at their current ramp intersections;
- The deceleration and acceleration lanes along I-575;
- Rehabilitation of the pavement within the interchange;
- High cost of retaining walls; and
- Reduction of impacts to Canton Creek.

RESULTS

The VE team generated over 43 ideas that could enhance the value of the project and address GDOT's concerns. Evaluation and research of the ideas yielded eight technically feasible alternatives with definable cost implications and six design suggestions that will improve the project in areas other than cost such as operations, safety, constructability, reliability, etc., or produce nonquantifiable cost reductions. Each of the alternatives and design suggestions are summarized on the attached Summary of Potential Cost Savings worksheet. Note that the alternatives were developed independently of each other. Thus, the total potential cost savings achievable is dependent on the combination of alternatives selected for implementation.

The VE team developed three alternatives to address the operational deficiencies caused by the high-volume NB 575/EB 20 and EB 20/SB 575 left turn movements. VE Alt. No. MIC-1 proposes double laning Ramp "D" in lieu of constructing Ramp "C." This alternative could be implemented at less cost than the current design. VE Alt. No. MIC-3 suggests roundabout intersections, which would require very little capital investment, in lieu of signalized intersections and new ramp construction. Finally, VE Alt. No. MIC-5, recommends a tight diamond configuration on the east side of the interchange in lieu of the partial cloverleaf configuration of the current design. This replaces the NB 575/EB 20 left turn movement and introduces a new NB 575/WB 20 left turn movement with an associated cost savings of $5 million.

Although these alternatives save substantial construction costs, they do not remove the problematic movement, nor do they provide the same level of service as the current design. Thus, the VE team developed VE Alt. Nos. RP-6, RP-7, and RP-12, which, if combined with one of the above alternatives, will improve the operations of the I-575 at SR-20 interchange in ways not addressed by the current design.

VE Alt. No. RW-4 recommends replacing Wall #4 on Ramp "C" with a bridge. Although cost savings with this alternative are minimal, this alternative directly addresses GDOT's objective of reducing the environmental impact of this construction project.

The remaining design suggestions provide recommendations in the area of construction technique, intersection design, and construction staging. We encourage GDOT to review these as they may yield additional ideas for improving the value of the project.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **I-575 Interchange at SR-20**

Preliminary Design

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
	Modify Interchange Configurations					
MIC-1	Double lane Ramp "D" in lieu of Ramp "C" and eliminate C/D Road	$9,959,000	$384,000	$9,575,000		$9,575,000
MIC-2	Provide six-lane facility on SR-20 between easterly proposed parkway and Brown Industrial Parkway	$0	$930,000	($930,000)		($930,000)
MIC-3	Replace signalized intersection at both ramp termini intersections with roundabouts in lieu of interchange modifications	$27,720,000	$460,000	$27,260,000		$27,260,000
MIC-5	Convert NB SR-20 ramps to damond interchange ramps on the east side of I-575	$27,680,000	$22,040,000	$5,640,000		$5,640,000
	Retaining Walls					
RW-4	Provide a bridge in lieu of Wall #4	$2,730,000	$2,240,000	$490,000		$490,000
	Improve Intersections					
RP-6	Realign Birchwood Street easterly on SR-20	$22,500,000	$25,250,000	($2,750,000)		($2,750,000)
RP-7	Add stop-and-go traffic signal at SR-20 and Brown Industrial Parkway	$0	$80,000	($80,000)		($80,000)
RP-11	Provide adequate turning radius at Intersection #2	DESIGN SUGGESTION				
RP-12	Provide protected phase for WB to NB left turn at Intersection #2	$50,000	$51,000	($1,000)		($1,000)
	Innovate Construction					
ICT-1	Steepen sopes with stabilized Earth	DESIGN SUGGESTION				
ICT-2	Accelerate concrete setting via addition of admixtures like silica	DESIGN SUGGESTION				
ICT-4	Convert temporary sediment Pond #2 to permanent detention basin	DESIGN SUGGESTION				

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **I-575 Interchange at SR-20**

Preliminary Design

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
	Innovate Construction (continued)					
RP-9	Identify and avoid rock locations/consider steeper slopes	DESIGN SUGGESTION				
	Stage Project					
SP-1	Stage proposed project	DESIGN SUGGESTION				

STUDY RESULTS

GENERAL

The results are the major feature of this VE study conducted on the I-575 Interchange at SR-20 project since they portray the benefits that can be realized by GDOT, the owner, and the users. The results will directly affect the project's design and will require coordination within GDOT to determine the disposition of each alternative.

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

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

The capital cost comparisons used unit quantities contained in the project cost estimate whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted. A composite markup of 15.5% was used to generate an all-inclusive project cost for the construction items being compared.

The design suggestions contain the same information as the VE alternatives except for cost information. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved facility operation, ease of maintenance, ease of construction, safer working conditions, reduction in project risk, etc. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

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

CATEGORY	PREFIX
Modify Interchange Configurations	MIC
Retaining Walls	RW
Reverse Problems (Improve Intersections, Rock Removal)	RP
Innovate Construction	IC
Stage Project	SP

Summaries of the alternatives and design suggestions are provided on the Summary of Potential Cost Savings worksheet. The worksheet is divided into the categories listed above for the reviewer's convenience. The complete documentation of the developed alternatives and design suggestions follows the Summary of Potential Cost Savings worksheet.

KEY ISSUES

The proposed modifications to the I-575 interchange at SR-20 will remedy existing and future congestion at the intersection of the I-575 and SR-20 ramps caused by the EB 20/SB 575 and NB 575/EB 20 left turn configuration. The NB 575/EB-20 ramp intersection, in addition to causing excessive queuing at the intersection, causes backups on the NB 575 mainline. This project also entails the rehabilitation of all ramp and SR-20 pavement. The ramp pavement, currently hot-mix asphalt, will be replaced by Portland cement concrete pavement.

The current design concept calls for the construction of ramps in the southeast and southwest quadrants, Ramps "C" and Ramp "F." Ramps "C" and "F" will require large amounts of right-of-way take, earthwork, and structures (retaining walls and bridges). The terrain in this area is steep and varied, and the two ramps encounter five creek crossings. Furthermore, the new construction of Ramp "C" and Ramp "F" impacts Canton Creek, the riparian habitat of the Cherokee Darter, an endangered species.

STUDY OBJECTIVES

During the project briefing, the owner challenged the team to find less expensive ways to deliver the project objectives while reducing the project impacts to the terrain and environment. The project plans did not address staging; therefore, the design team also requested that the VE team investigate the potential for staging this project.

RESULTS OF THE STUDY

Eight alternatives and six design suggestions were developed for consideration by the owner. These alternatives and design suggestions present less costly design concepts to provide the main project objective: Reduction of the queuing of the NB 575/EB 20 and EB 20/SB 575 movements. In addition, the VE team recommends complementary operational improvements described below.

VE Alt. Nos. MIC-1, MIC-3, and MIC-5 offer three less expensive ways to remedy the operational problems associated with the NB 575/EB 20 left turn movement:

- MIC-1 suggests double laning Ramp "D" in lieu of constructing Ramp "C." This solution will cost a fraction of the current design proposal.
- MIC-3 suggests using roundabout intersections with very little capital investment in lieu of signalized intersections and new ramp construction.
- MIC-5 suggests a tight diamond configuration on the east side of the interchange in lieu of a partial cloverleaf configuration.

VE Alt. Nos. MIC-1 and MIC-3 will save substantial construction costs but will not improve Intersection #2 to the same level of service as the current design concept, as neither removes the NB 575/EB 20 left turn movement. VE Alt. No. MIC-5 would replace the NB 575/EB 20 left turn movement while introducing a new NB-575/WB-20 left turn movement. It would generate approximately $5 million in cost savings by sacrificing the NB 575/WB 20 free-right movement that exists with Loop Ramp "D."

To achieve the highest level of service at the lowest cost, the VE team developed VE Alt. Nos. RP-6, RP-7, and RP-12, which require additional capital investment but provide operational improvements that are not addressed in the current project design. These improvements, if combined with either Alt. No. MIC-1, MIC-3, or MIC-5, could make the interchange modifications more technically viable and deliver a similar level of service compared to the current design concept.

VE Alt. No. RW-4 recommends replacing Wall #4 on Ramp "C" with a bridge. This type of construction would be similar to that currently proposed at the crossing of Ramp "C" over Stream #5. Although cost savings with this alternative are minimal, this alternative directly addresses GDOT's objective of reducing the environmental impact of this construction project.

The six design suggestions provide recommendations to the design team on innovative construction techniques and intersection design as well as a staging scenario.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

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

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

part of one or more suggestions from being implemented if another design suggestion is also implemented.

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

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **I-575 Interchange at SR-20**

Preliminary Design

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
		PRESENT WORTH OF COST SAVINGS				
	Modify Interchange Configurations					
MIC-1	Double lane Ramp "D" in lieu of Ramp "C" and eliminate C/D Road	$9,959,000	$384,000	$9,575,000		$9,575,000
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	Retaining Walls					
RW-4	Provide a bridge in lieu of Wall #4	$2,730,000	$2,240,000	$490,000		$490,000
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RP-6	Realign Birchwood Street easterly on SR-20	$22,500,000	$25,250,000	($2,750,000)		($2,750,000)
RP-7	Add stop-and-go traffic signal at SR-20 and Brown Industrial Parkway	$0	$80,000	($80,000)		($80,000)
RP-11	Provide adequate turning radius at Intersection #2	DESIGN SUGGESTION				
RP-12	Provide protected phase for WB to NB left turn at Intersection #2	$50,000	$51,000	($1,000)		($1,000)
	Innovate Construction					
ICT-1	Steepen sopes with stabilized Earth	DESIGN SUGGESTION				
ICT-2	Accelerate concrete setting via addition of admixtures like silica	DESIGN SUGGESTION				
ICT-4	Convert temporary sediment Pond #2 to permanent detention basin	DESIGN SUGGESTION				

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**MIC-1**
DESCRIPTION:	**DOUBLE LANE RAMP "D" IN LIEU OF RAMP "C" AND ELIMINATE "C-D" ROAD**	SHEET NO.:	**1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The addition of proposed Ramp "C" to the SR-20/I-575 interchange has shifted the Ramp "D" deceleration lane about 30 ft. to the east with a 3,400-ft. deceleration lane (Station 8+75 to 42+75). Ramp "D" and Ramp "C" separate at Station 33+00. The existing condition for the Ramp "D" deceleration lane appears to adhere to GDOT standards.

ALTERNATIVE: (Sketch attached)

Retain existing Ramp "D" and make it double laned. Increase the phase time and add two left turn signals at SR-20. Currently during peak hours, vehicles queue up to several hundred feet on I-575. This queuing can be alleviated by the addition of the second lane to Loop Ramp "D," providing an additional 900 ft. of storage and two turning lanes for high-volume movement (NB 575/EB 20). The right turn lane (NB 575/WB 20) at the terminus of Ramp "D" will provide a free right turning lane with 200 ft. of storage. The deceleration lane at the diverge point with I-575 can be lengthened if it is believed that exiting vehicles will not be able to negotiate the tight turning radius on Ramp "D."

ADVANTAGES:

- Reduces environmental impact
- Saves cost
- Reduces construction duration

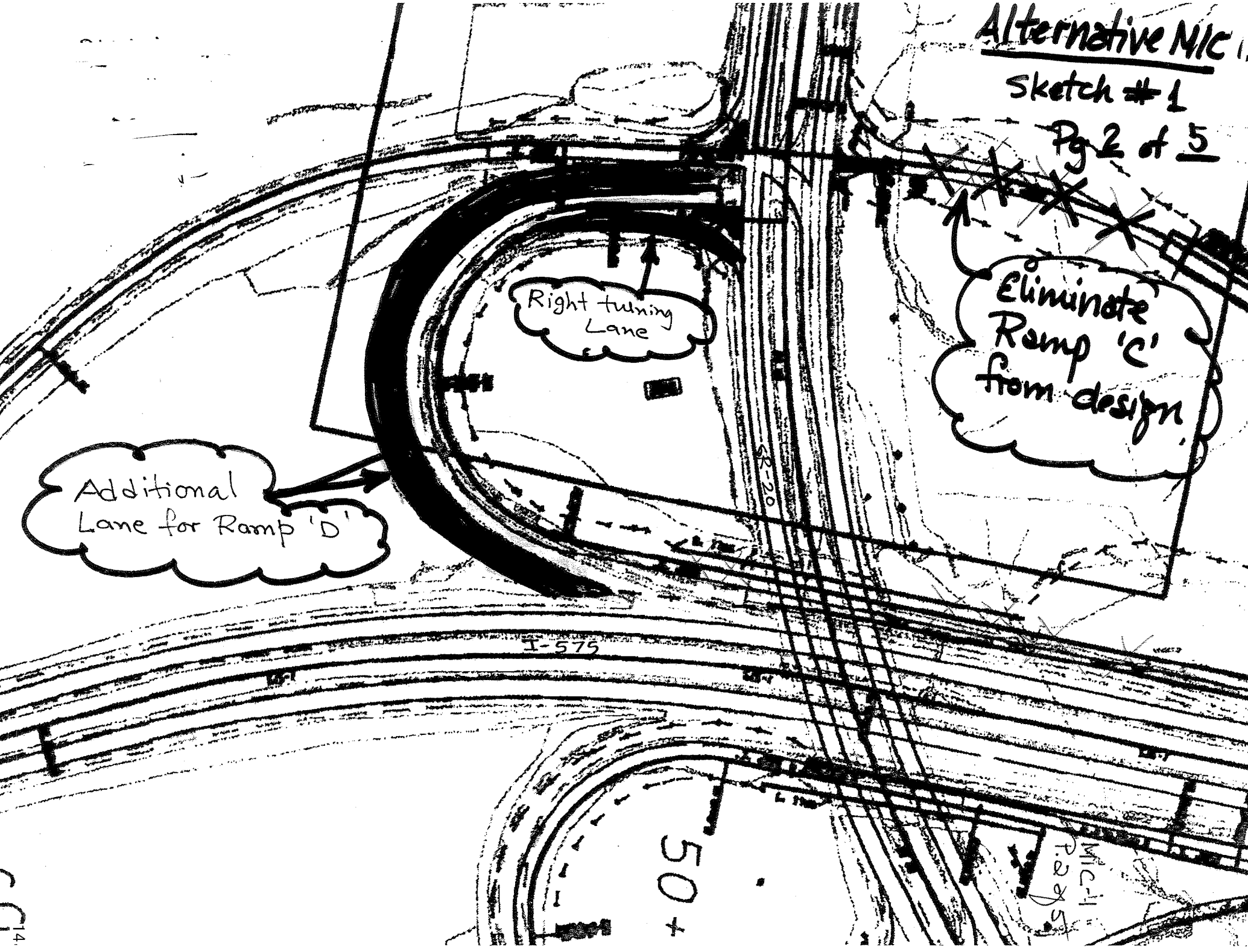
DISADVANTAGES:

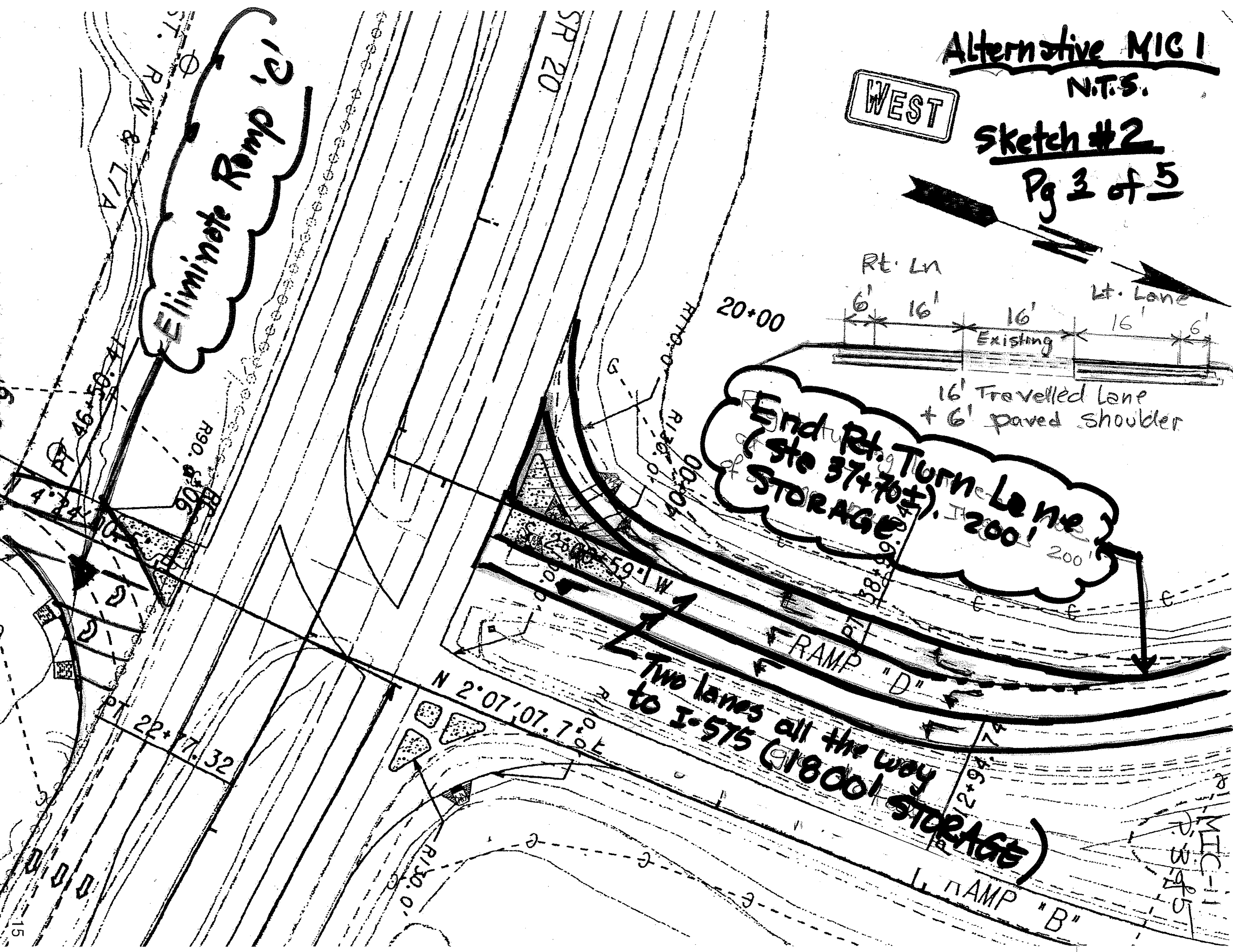
- Level of service may not be as good as with current design

DISCUSSION:

This alternative may remedy the congestion at the Ramp "D"/SR-20 terminus while addressing the ramp queuing issue onto NB 575 without the high cost and environmental impact associated with Ramp "C." A traffic simulation model can quickly assess the level of service at Intersection #2 (Ramp "D" and SR-20).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 9,959,000	—	$ 9,959,000
ALTERNATIVE	$ 384,000	—	$ 384,000
SAVINGS	$ 9,575,000	—	$ 9,575,000


Alternative MIC
Sketch #1
Pg 2 of 5
Right turning Lane
Eliminate Ramp 'C' from design
Additional Lane for Ramp 'D'
SR-20
I-575
50+
MIC-1



Alternative MIC I
N.T.S.
WEST
Sketch #2
Pg 3 of 5
Rt. Ln
Lt. Lane
6'
16'
16'
Existing
16'
6'
16' Travelled Lane
+ 6' paved shoulder
End Rt. Turn Lane
(Sta 37+70±). 200'
STORAGE
Eliminate Ramp 'C'
Two lanes all the way
to I-575 (1800' STORAGE)
SR 20
RAMP "D"
RAMP "B"
20+00
R110.0'
R130.0'
R90.0'
R130.0'
N 2°07'07.7"E
PT 22+77.32
PT 46+50.41
MIC-1
P. 3 of 5

CALCULATIONS

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO M1C-1

SHEET NO.: 4 of 5

Ramp 'C' - (Paved) - As designed

Length: (47+76) - (9+48) - 800 (Bridge) = 3,028'

Width: 34'

Area = (3,028 × 34)/9 = 11,439 SY.

Ramp 'D' (Paved) - As designed

Length: (40+70) - (12+70) = 2,800'

Width: 34'

Area = (2,800 × 34)/9 = 10,578 SY.

Ramp 'O' - As ~~proposed~~ alternative

Double Lane + Rt. turn Lane

Length = 900 + 200 = 1,100'

width = 16' + 6' = 22'

Travel way ↑ ↖ Shoulder.

Area = (1100 × 22)/9 = 2689 SY

Aggregate Base = 330 lbs/SY = 0.165 tons/SY

Asphatic Concrete Superpave = 550 lbs/SY = 0.275 tons/SY

COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-1

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Earthwork							
Ramp 'C' Cut	C.Y.	81,698	5.25	428,914			
Ramp 'c' Fill	C.Y	38,607	5.25	202,687			
Ramp 'D' Cut	C.Y.	61,708	5.25	323,967	2,689	5.25	14,117
Ramp 'D' Fill	C.Y.	42,902	5.25	225,236			
Bridge on Ramp 'C'	S.F.	12,350	65	802,750			
Wall '3' on Ramp 'D'	FT	1,092	550	600,000			
Wall '4' on Ramp 'C'	FT	800	2,325	1,860,000			
Paving Ramp 'C'							
Aggregate Base	Ton	1,887	16.50	31,136			
Asphaltic Conc. Superpave	Ton	3,146	50	157,300			
Concrete Paving	S.Y.	11,429	78	892,242			
Paving Ramp 'D'							
Aggregate Base	Ton	1,745	16.50	28,792	444	16.50	7,326
A.C. Superpave	Ton	2,910	50	145,500	740	50	37,000
Concrete Paving	S.Y.	10,578	78	226,904	2,689	78	209,742
Misc.	L.S.			1,500,000			50,000
Drainage	L.S.			500,000			15,000
R/W Cost	L.S.			1,500,000			—
Sub-total				8,622,428			333,185
Mark-up at 15.5 %				1,336,476			51,644
TOTAL				9,958,904			384,829

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**MIC-2**
DESCRIPTION:	**PROVIDE SIX-LANE FACILITY ON SR-20 BETWEEN EASTERLY PROPOSED PARKWAY AND BROWN INDUSTRIAL PARKWAY**	SHEET NO.:	**1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The original design uses the existing two lanes for SR-20.

ALTERNATIVE: (Sketch attached)

Add one lane in each direction on SR-20 between the location of the proposed parkway east of the SR-20/I-575 interchange and Brown Industrial Parkway.

ADVANTAGES:

- Allows for a dedicated lane for traffic on WB SR-20 taking Loop Ramp "E" onto SB I-575
- Improves the capacity of SR-20 within the current interchange
- Aligns with future six-lane SR-20 corridor

DISADVANTAGES:

- Requires additional cost and time for pavement and bridge widening

DISCUSSION:

Although the traffic analysis does not warrant the addition of lanes proposed in this alternative, this proposal may improve the viability of other interchange configurations proposed in this VE study that do not provide the level of service in the current design.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 0	—	$ 0
ALTERNATIVE	$ 930,000	—	$ 930,000
SAVINGS	$ (930,000)	—	$ (930,000)

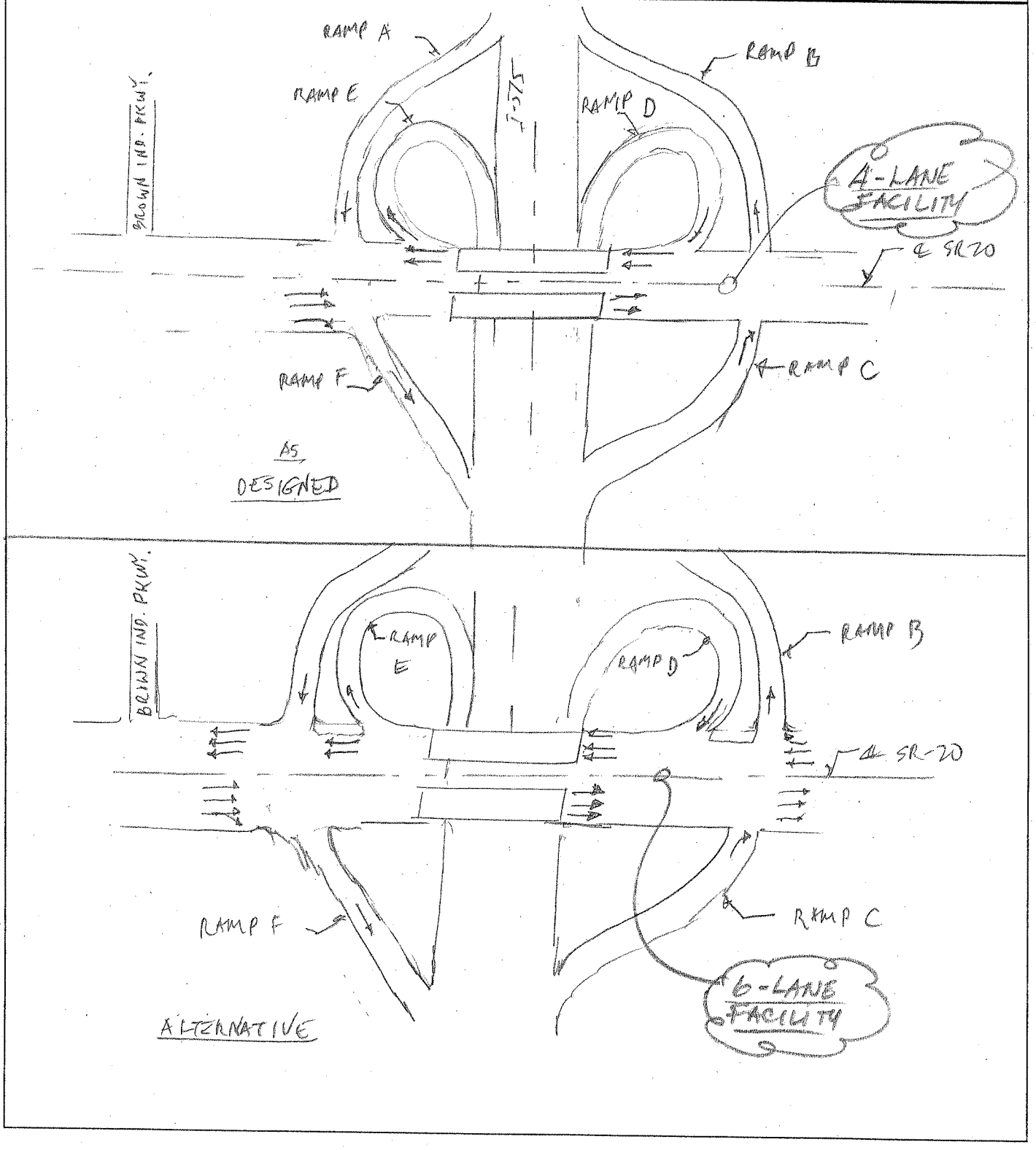
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-2

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 5



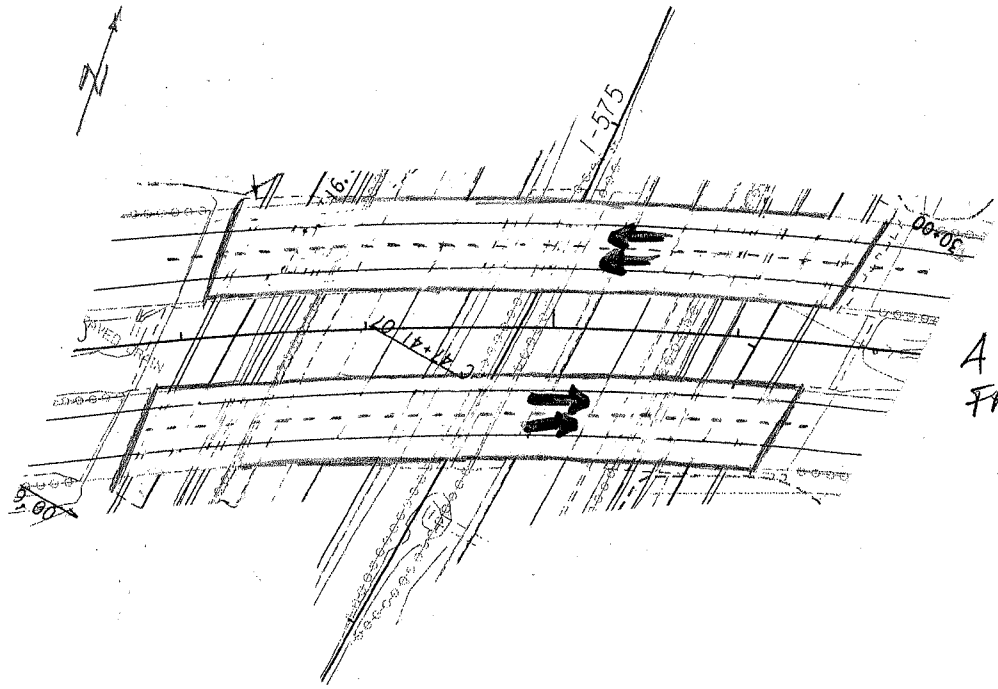
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-2

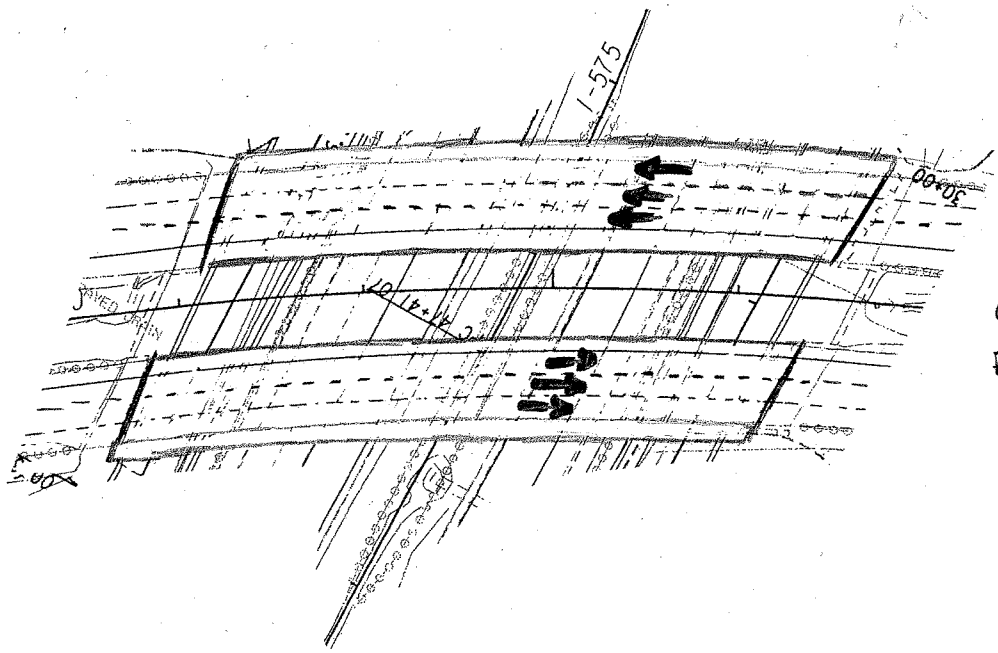
☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 5



4-LANE FACILITY

AS DESIGNED



6-LANE FACILITY

ALTERNATIVE

CALCULATIONS

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO MIC-2

SHEET NO.: 4 of 5

ADDITIONAL COST FOR BRIDGE:

= 2 SIDES x 12' x 344.50' = 8,268 SF.

LENGHT OF ADDITIONAL LANE OF ROADWAY

= 2 SIDES x (2720 - 960.42 - 344.50) = 2870.16 LF.

ASPHALT PAVING: 12' x 2870.16'/9 = 3827 SQ. YDS.

COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-2

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
BRIDGE	SF				8,268	$65	$537,420
ASPHALT PAVING	SY				3,827	$70	$267,890
Sub-total				0			$805,310
Mark-up at 15.5 %				0			$124,823
TOTAL				0			$930,133

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**MIC-3**
DESCRIPTION:	**REPLACE SIGNALIZED INTERSECTIONS AT RAMP TERMINI WITH ROUNDABOUTS IN LIEU OF INTERCHANGE MODIFICATIONS**	SHEET NO.:	**1 of 5**

ORIGINAL DESIGN: (Sketch attached)

Northbound Ramp Intersection

Four-legged intersection with the following approaches:

- Northbound – dual right turn lanes (signalized) with RTOR for outside lane
- Southbound – single right turn lane (signalized or yield)
- Eastbound – single left turn lane and two through lanes (signalized)
- Westbound – short right turn lane (yield) and two through lanes (signalized)

Southbound Ramp Intersection

Four-legged intersection with the following approaches:

- Southbound – dual left turn lanes (signalized) and single right turn lane (yield)
- Eastbound – single right turn lane (yield) and two through lanes (signalized)
- Westbound – short right turn land (free flow) and two through lanes (signalized)

ALTERNATIVE: (Sketch attached)

Northbound ramp and southbound ramp intersections (same at both locations). Two-lane roundabout with one-lane exits (roundabout bypass).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 27,720,000	—	$ 27,720,000
ALTERNATIVE	$ 460,000	—	$ 460,000
SAVINGS	$ 27,260,000	—	$ 27,260,000

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**MIC-3**
DESCRIPTION:	**REPLACE SIGNALIZED INTERSECTIONS AT BOTH RAMP TERMINI INTERSECTIONS WITH ROUNDABOUTS IN LIEU OF INTERCHANGE MODIFICATIONS**	SHEET NO.:	**2 of 5**

ADVANTAGES:

- Lowers initial and life cycle costs
- Improves safety
- Reduces construction duration
- Reduces environmental impact

DISADVANTAGES:

- Lowers intersection traffic capacity
- Unusual intersection configuration for interstate interchange
- Does not address safety issue related to high-speed exit for I-575 northbound to Ramp "D"

DISCUSSION:

This alternative may provide the necessary additional traffic capacity and improved safety at a fraction of the cost. It also eliminates the environmental impact and significantly reduces the project duration. This solution would need an operational analysis to confirm viability. On the surface, it would benefit the turning movements at the expense of throughput on SR-20.

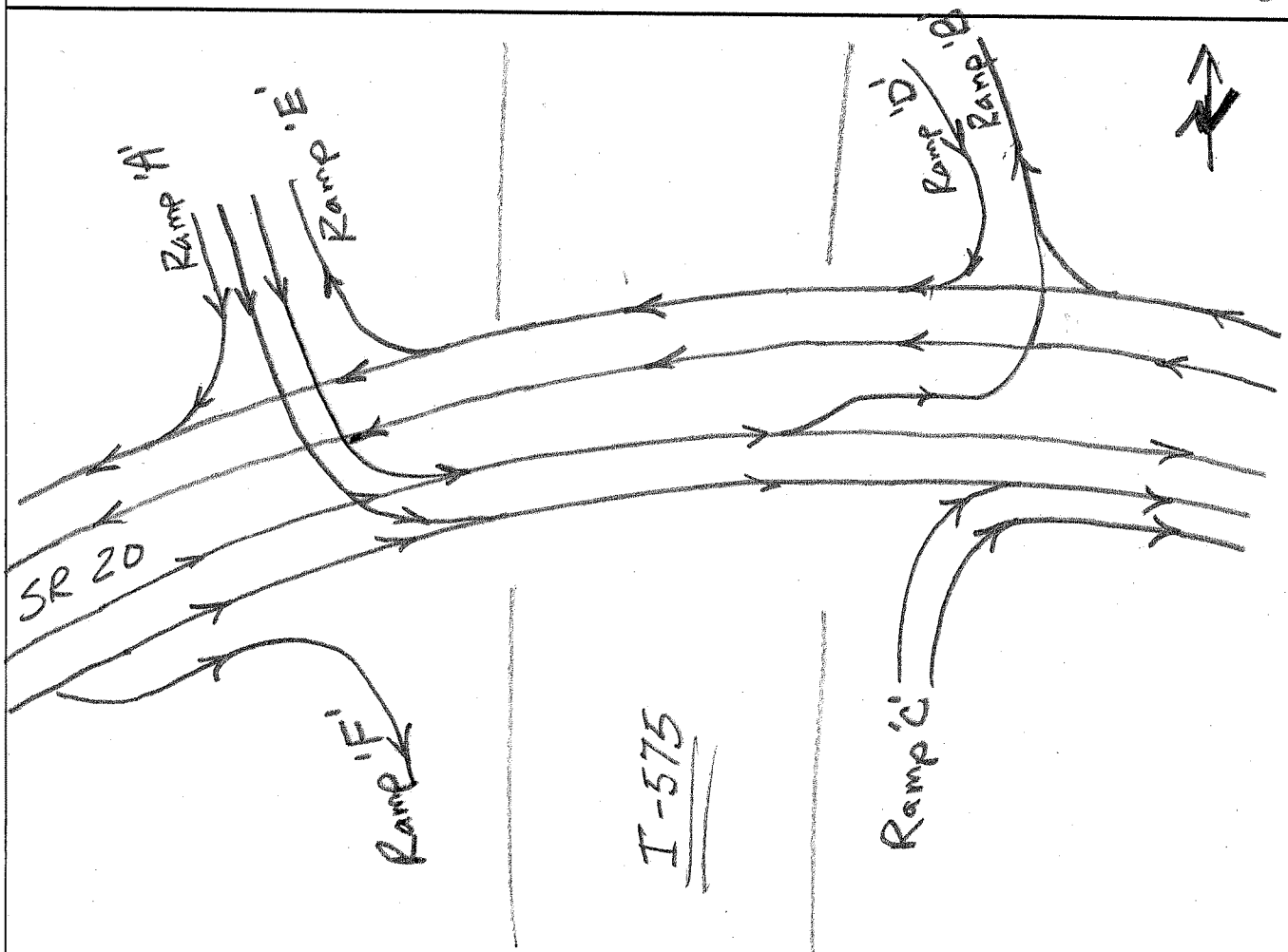
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-3

☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 3 of 5



AS DESIGNED

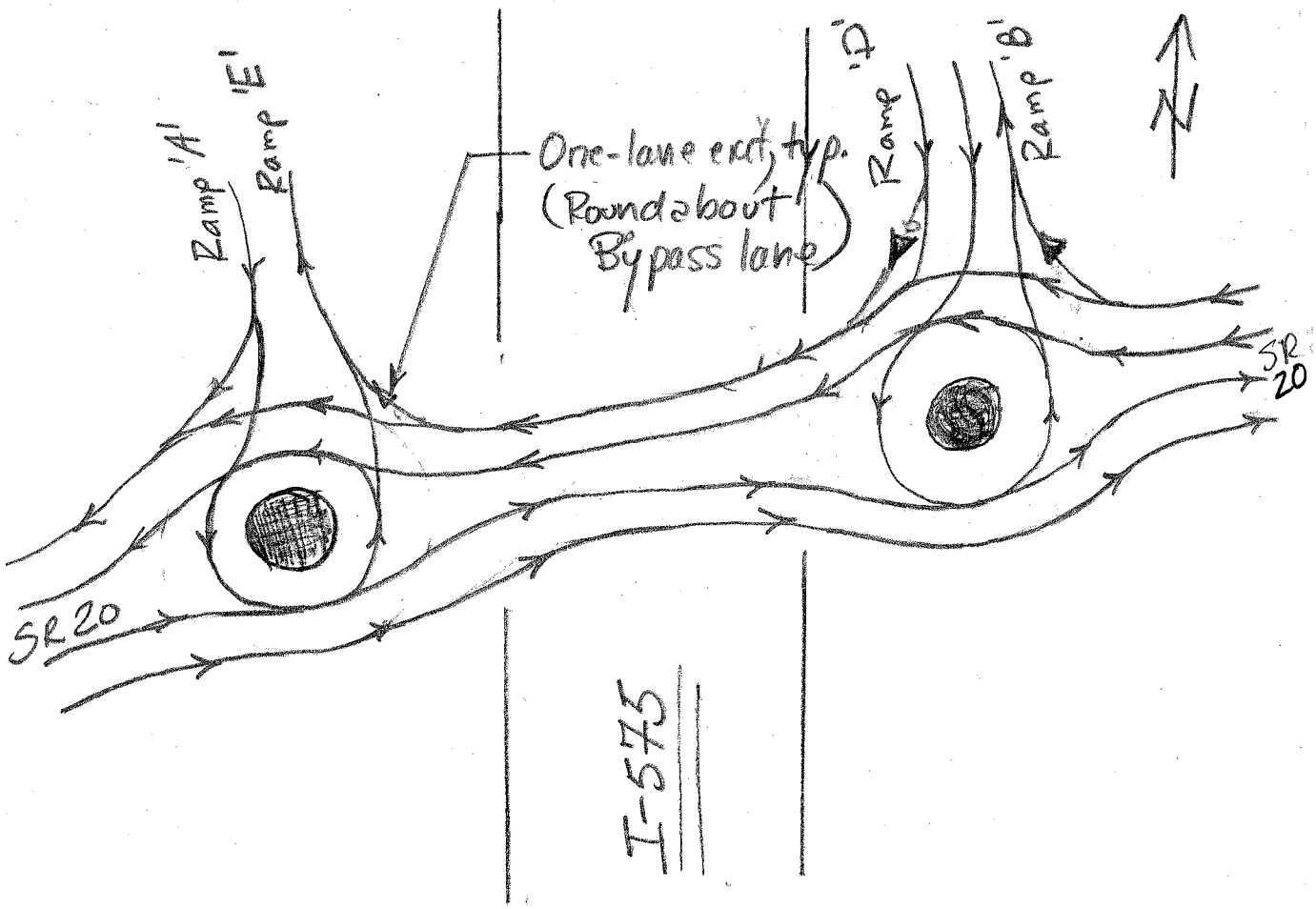
SKETCHES

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

☐ AS DESIGNED ☑ ALTERNATIVE

ALTERNATIVE NO.: MIC-3

SHEET NO.: 4 of 5



ROUNDABOUT PROPOSAL

COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: M IC-3

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way			LS	1,914,000			—
Utilities			LS	42,000			—
Major Structures			LS	4488750			—
Grading + Drainage			LS	5650000	1	LS	100,000
Base + Paving			LS	8368230	1	LS	200,000
Lump Items			LS	3000000	1	LS	50,000
Miscellaneous			LS	800,000	1	LS	50,000
Sub-total				24262980			400,000
Constr. Mark-up at 15.5 %				3457580			62,000
TOTAL				27,720,560			462,000

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**MIC-5**
DESCRIPTION:	**CONVERT NORTHBOUND SR-20 RAMPS TO DIAMOND INTERCHANGE RAMPS ON EAST SIDE OF I-575**	SHEET NO.:	**1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Current design maintains the existing northbound-to-westbound loop ramp (Ramp "D") and adds a new northbound-to-eastbound slip ramp. This is an efficient but expensive design that maintains the weave situation between the two loop ramps along westbound SR-20.

ALTERNATIVE: (Sketch attached)

Replace existing northbound-to-westbound loop ramp (Ramp "D") with a higher capacity northbound-to-eastbound slip ramp (Ramp "C"). This two-lane ramp would accommodate the northbound-to-westbound movement with signalized dual left turn lanes. The ramp terminal intersection would be shifted 200 ft. west of the existing intersection.

ADVANTAGES:

- Eliminates need for new bridge at Stream #5 and reduces need for retaining walls, thus reducing right-of-way costs and environmental impacts
- Eliminates rollover issue on loop ramp
- Increases intersection spacing between Birchwood St. and the interchange
- CORSIM traffic simulation of interchange indicates satisfactory level of service

DISADVANTAGES:

- Adds one left turn to ramp terminal intersection
- Reduces overall intersection traffic capacity
- Requires steep upgrade for Ramp "C"
- Shifts ramp terminal intersection onto a curve on SR-20

DISCUSSION:

The disadvantages of this alternative are greatly offset by the advantages. GDOT must decide if the incremental increase in intersection capacity of the original justifies the additional construction cost. The cost advantage of this alternative may be reduced if the eastbound bridge over I-575 requires widening for corner sight distance. The decrease in safety related to shifting the intersection onto a curve should be offset by the improved safety of more separation between Birchwood St. and the interchange.

GDOT should verify operational acceptability with additional traffic modeling. This alternative could be modified to a roundabout intersection as described in Alternative No. MIC-3.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 27,680,000	—	$ 27,680,000
ALTERNATIVE	$ 22,040,000	—	$ 22,040,000
SAVINGS	$ 5,640,000	—	$ 5,640,000

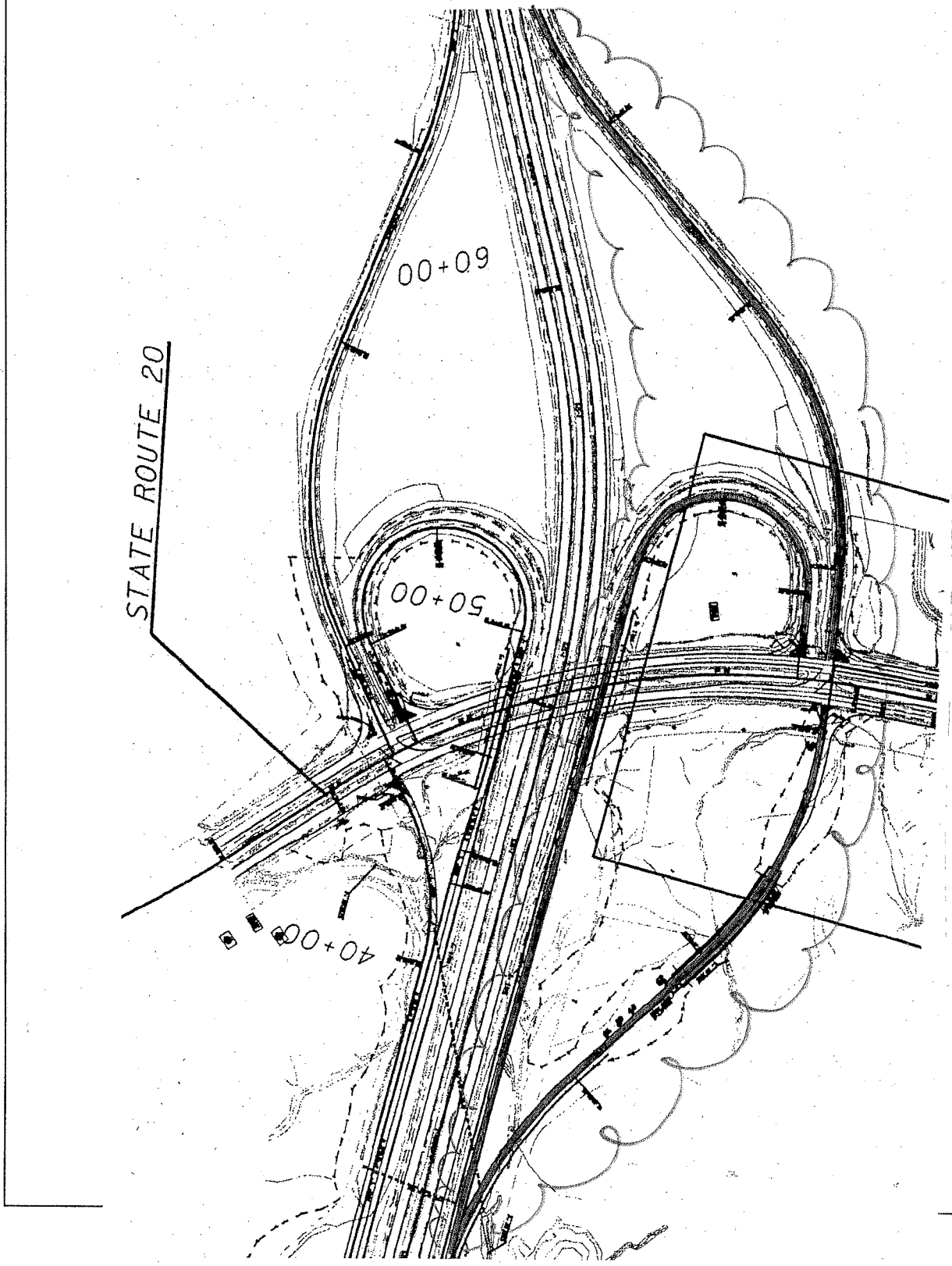
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-5

☑ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 4



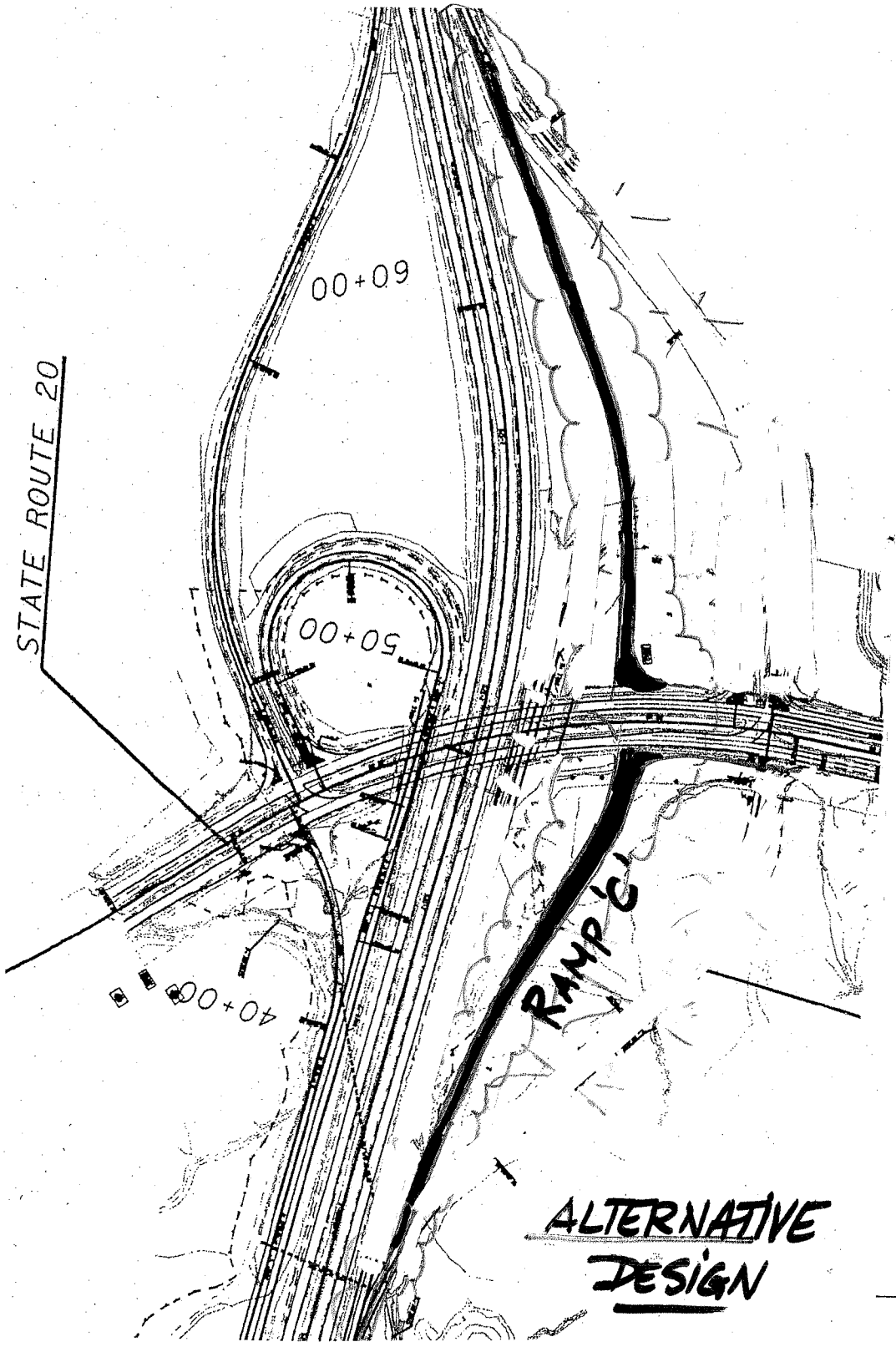
SKETCHES

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

☐ AS DESIGNED ☑ ALTERNATIVE

ALTERNATIVE NO.: M1C-5

SHEET NO.: 3 of 4



COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: MIC-5

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way				1914000			1000000
Grading + Drainage				56.50000		84%	4725000
Base & Paving				8368230		80%	6695000
Lump Items				3000000			3000000
Miscellaneous				800,000			800000
Major Structures				4488750			3000000
Construction Subtotal				22306980			18220000
Sub-total				24220980			19,220,000
Mark-up at 15,5 %				3457600			2824100
TOTAL				27678580			22044100

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RW-4**
DESCRIPTION:	**PROVIDE A BRIDGE IN LIEU OF WALL #4**	SHEET NO.:	**1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Wall #4 is part of the Ramp "C" alignment and bridges a deep ravine with MSE-type wall on one side and sloped embankment on the other side.

ALTERNATIVE: (Sketch attached)

Replace Wall #4 with a bridge of the same length. Use Bulb-T superstructure type as with the proposed Stream #5 bridge.

ADVANTAGES:

- Uses same construction as the bridge further down Ramp "C"
- Saves cost due to deletion of backfill for wall
- Reduces footprint (with shadows)

DISADVANTAGES:

- None apparent

DISCUSSION:

Replacing the proposed Wall #4 with a bridge of the same length will result in moderate cost savings. The desirability of the alternative lies in the minimal impact of the structure to the site and environment. Using a bridge is also consistent with using a bridge at the end of Ramp "C."

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 2,730,000	—	$ 2,730,000
ALTERNATIVE	$ 2,240,000	—	$ 2,240,000
SAVINGS	$ 490,000	—	$ 490,000

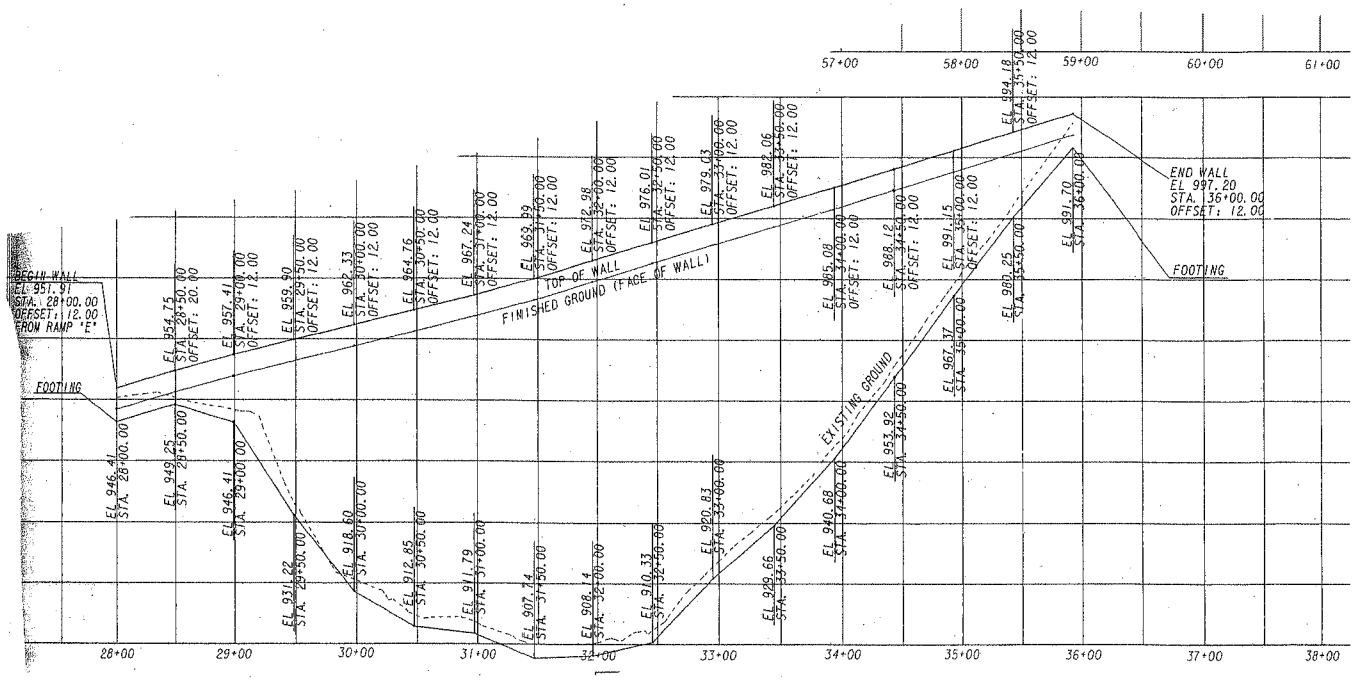
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

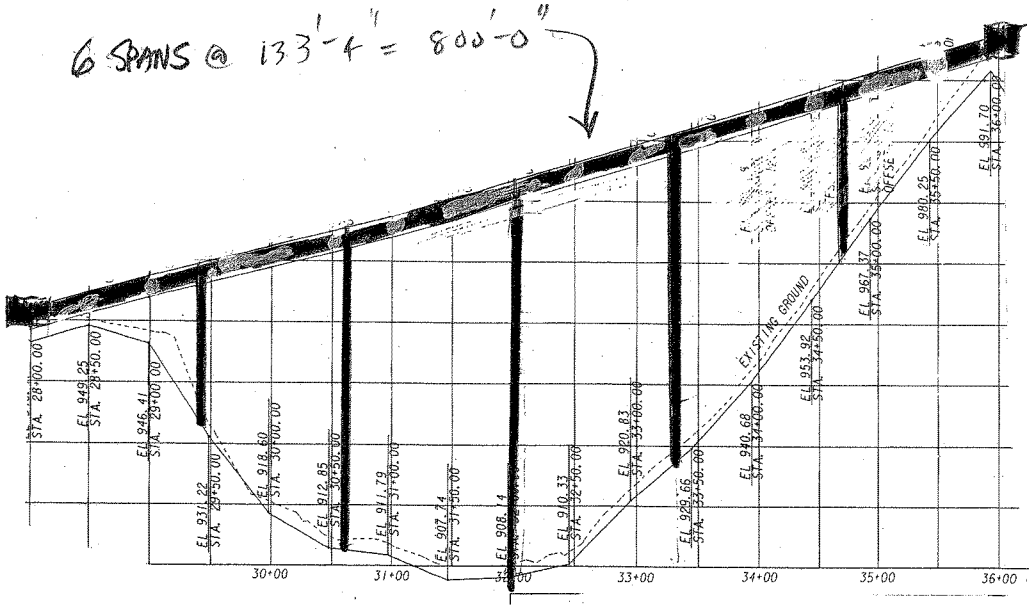
ALTERNATIVE NO.: RW-4

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



WALL #4 (AS DESIGNED)



BRIDGE (ALTERNATIVE DESIGN)

CALCULATIONS

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO RW-4

SHEET NO.: 3 of 4

BRIDGE

AREA = 37.25' (CURB TO CURB) x 800' = 29,800

WALL = $1.86 M. (PROJECT ESTIMATE)

RAMP "C" BACKFILL = 96,244 CUBIC YDS.

COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: RW-4

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
WALL # 4	EA	1		$1,860,000			
BACKFILL (RP. "C")	CY	96244	$5.25	$ 505,281			
BRIDGE	SF				29,800	$65	$1,937,000
Sub-total				$2,365,281			$1,937,000
Mark-up at 15.5 %				366,619			300,235
TOTAL				$2,731,900			2,237,235

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RP-6**
DESCRIPTION:	**REALIGN BIRCHWOOD ST. EASTERLY ON SR-20**	SHEET NO.:	**1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Birchwood St. intersects SR-20 about 500 ft. east of the existing SR-20/I-575 interchange. With the proposed Ramp "C" improvements, there will be a weave condition created between Ramp "C" and Birchwood St.

ALTERNATIVE: (Sketch attached)

Cul-de-sac existing Birchwood St. immediately north of SR-20. Realign approximately 1,000 ft. of Birchwood St. to intersect with SR-20 at the primary access road for the proposed Canton Marketplace development. Close the existing median opening on SR-20 at Birchwood St.

ADVANTAGES:

- Improves operations at Ramp "C" intersection
- Reduces weave condition between Birchwood St. and the interchange

DISADVANTAGES:

- Adds cost
- Impacts adjacent properties

DISCUSSION:

The realignment will reduce existing and future weave conditions. By eliminating the need for a signal at Birchwood St. in the future, the progression of traffic through the interchange will be improved.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 22,500,000	—	$ 22,500,000
ALTERNATIVE	$ 25,250,000	—	$ 25,250,000
SAVINGS	$ (2,750,000)	—	$ (2,750,000)

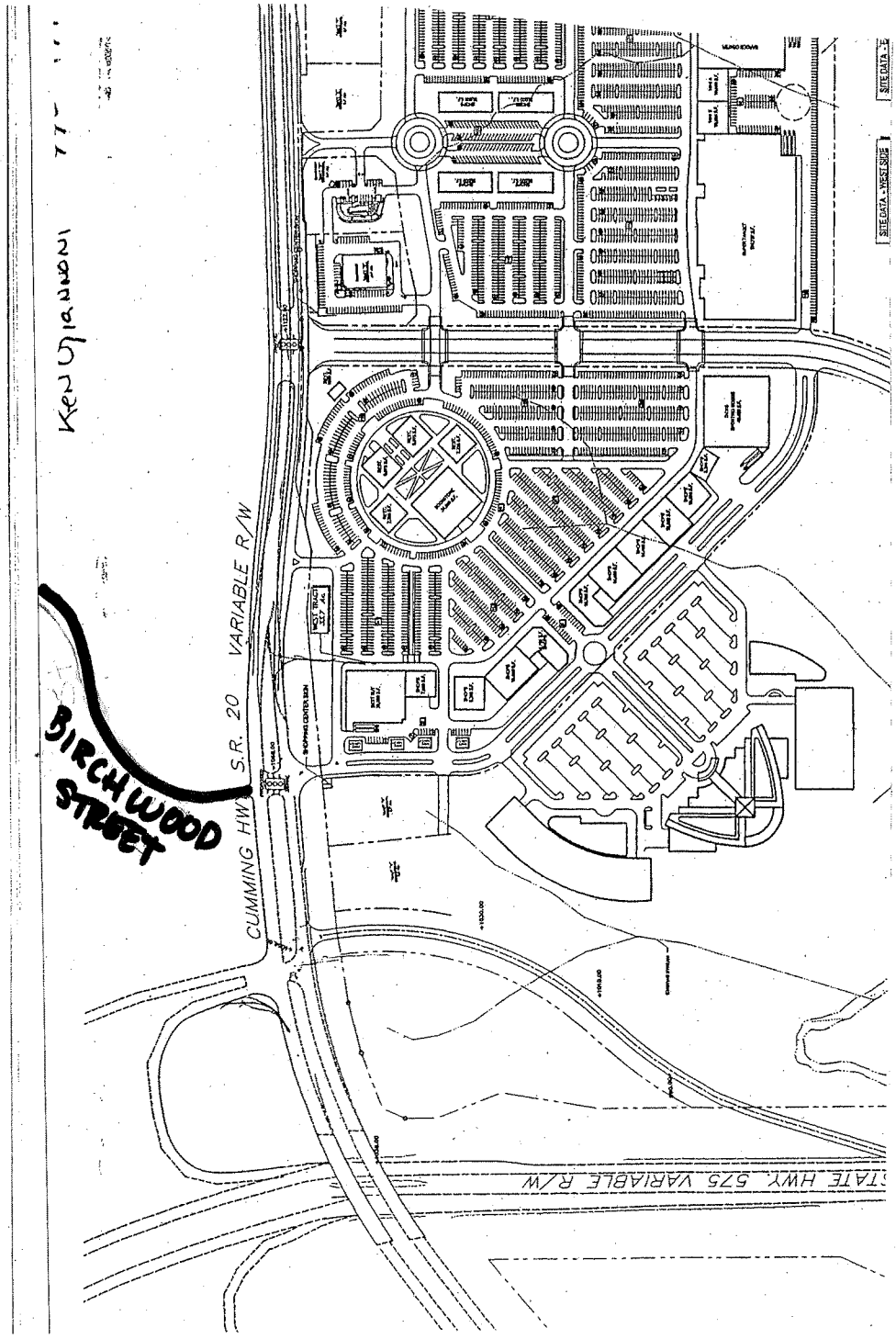
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: RP-6

☑ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 4



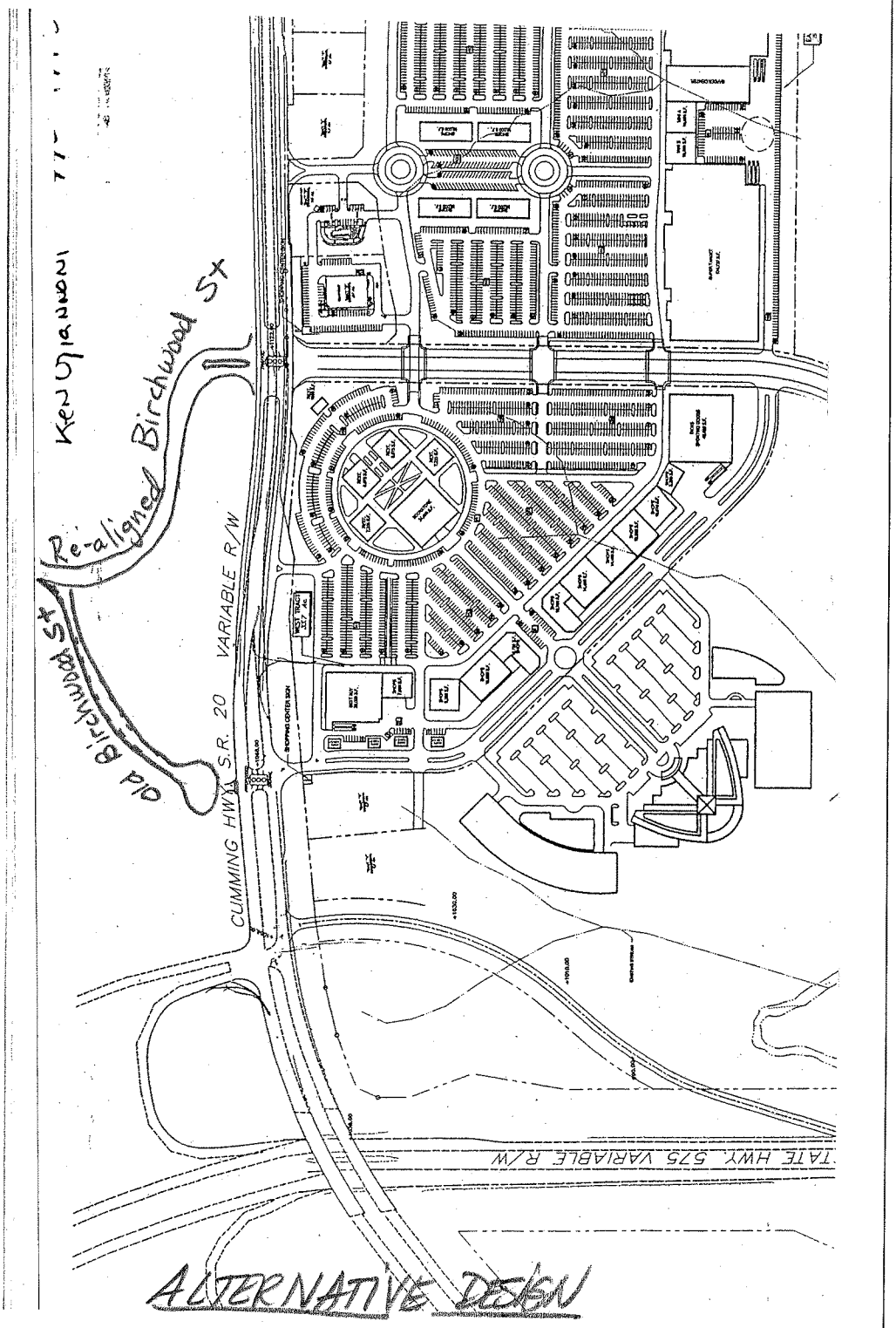
SKETCHES

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

ALTERNATIVE NO.: RP-6

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 4



COST WORKSHEET

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: RP-6

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way				1,914,000			3,000,000
Grading + Drainage				5,650,000			6,500,000
Base + Paving				8368230			8,600,000
Lump Items				3,000,000			3,300,000
Miscellaneous				800,000			850,000
Construction Subtotal				17818230			19,250,000
Sub-total				19732230			22,250,000
Const. Mark-up at 15.5 %				2761,800			2,983,800
TOTAL				22,494,030			25,233,800

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RP-7**
DESCRIPTION:	**ADD STOP-AND-GO TRAFFIC SIGNAL AT SR-20 AND BROWN INDUSTRIAL PARKWAY**	SHEET NO.:	**1 of 2**

ORIGINAL DESIGN:

No traffic signal is currently proposed for this intersection.

ALTERNATIVE: Sketch attached

Add three-phase, stop-and-go traffic signal (fully actuated) at the SR-20 and Brown Industrial Parkway intersection. Connect proposed signal to southbound ramp terminal intersection with overhead fiber optic cable. This will allow left-turning vehicles easy access to Ramp "F." Lump sum estimate is $80,000.

ADVANTAGES:

- Reduces risk of right-angle collisions
- Increases intersection capacity for Brown Industrial Parkway
- Mitigates the short weave between Brown Industrial Parkway and interchange

DISADVANTAGES:

- Increases risk of rear-end collisions on SR-20
- Traffic volumes may not warrant new signal

DISCUSSION:

The feasibility of this improvement is contingent on the growth of traffic volume on Brown Industrial Parkway. As volumes increase, the lack of capacity and weaving condition will become unacceptable.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 0	—	$ 0
ALTERNATIVE	$ 80,000	—	$ 80,000
SAVINGS	$ (80,000)	—	$ (80,000)

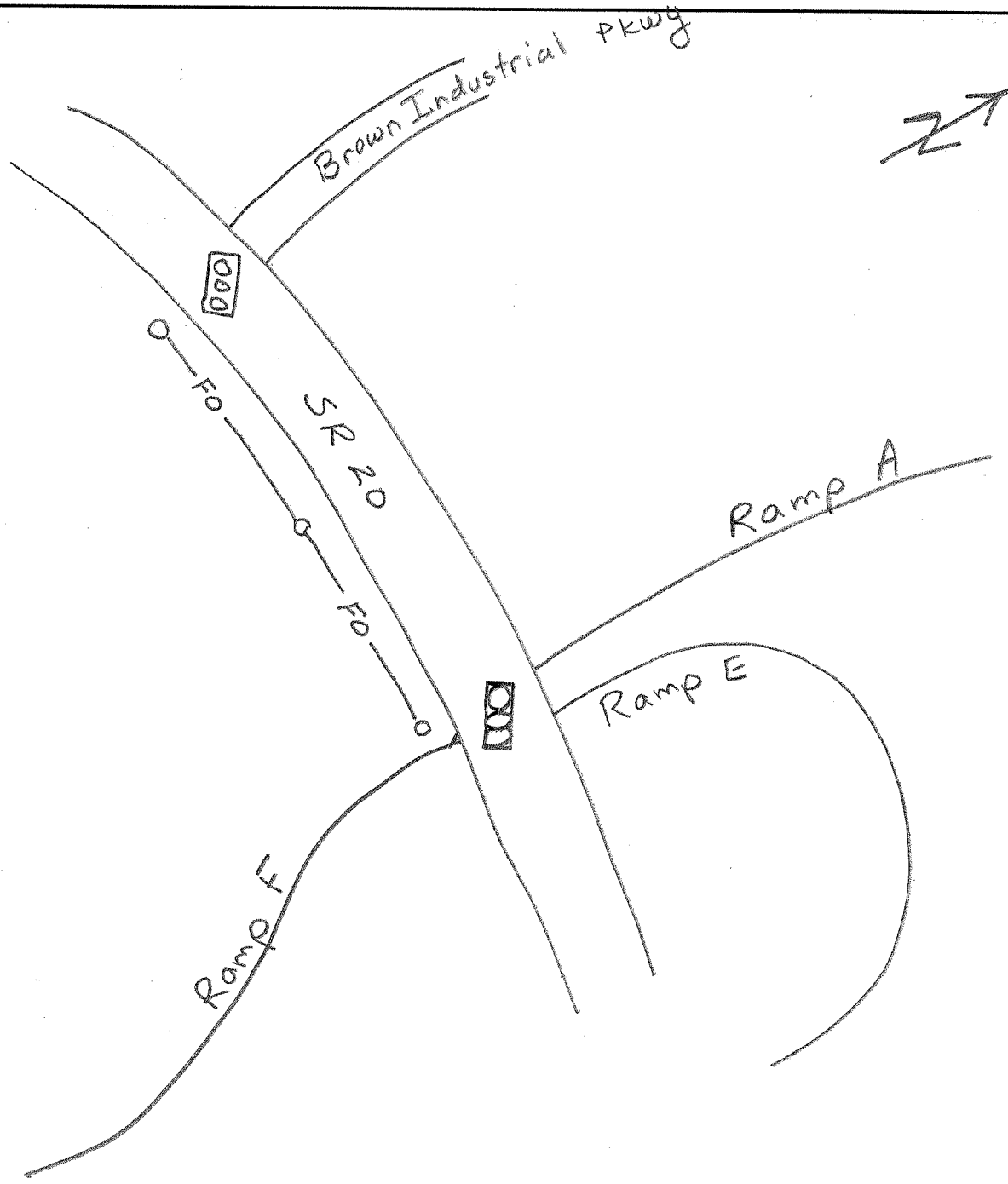
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: RP-7

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 2 of 2



VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RP-11**
DESCRIPTION:	**PROVIDE ADEQUATE TURNING RADIUS AT INTERSECTION #2**	SHEET NO.:	**1 of 2**

ORIGINAL DESIGN:

EB 20/NB 575 left turn bay with tight turning radius.

ALTERNATIVE: (Sketch attached)

Ensure that the nose of the EB 20/NB 575 left turn bay adequately accommodates the design vehicle.

ADVANTAGES:

- Ensures turning radius for design vehicle

DISADVANTAGES:

- None apparent

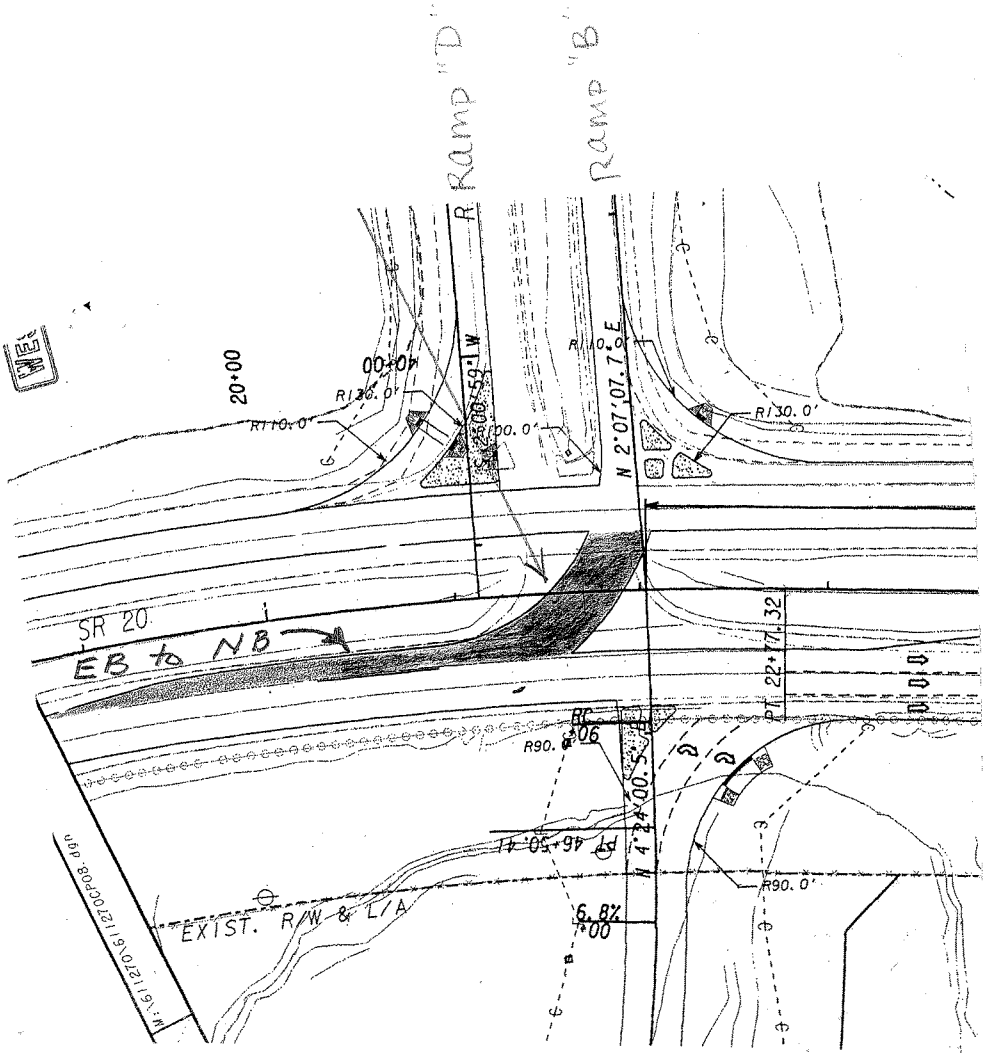
DISCUSSION:

This issue was brought up during the project briefing.

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

SKETCHES

PROJECT:	**SR-20/I-575 Interchange**	ALTERNATIVE NO.:	**RP-11**
☐ AS DESIGNED	☑ ALTERNATIVE	SHEET NO.:	**2 of 2**



VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RP-12**
DESCRIPTION:	**PROVIDE PROTECTED PHASE FOR WESTBOUND TO NORTHBOUND TURN LANE AT INTERSECTION #2**	SHEET NO.:	**1 of 2**

ORIGINAL DESIGN:

Intersection #1 is a four-legged intersection with a minimum of four traffic signal–controlled movements: Eastbound through, westbound through, northbound right, and eastbound left. It is assumed that all the above movements will have protected phases except for eastbound left.

ALTERNATIVE: (Sketch attached)

Add third phase to traffic signal to provide protected left turn.

Cost = $1,000 to purchase a five-section signal head in lieu of current three-section signal head.

ADVANTAGES:

- Reduces risk of collisions related to left-turn movements conflicting with through movements
- Increases capacity for left turns

DISADVANTAGES:

- Decreases capacity of other traffic signal–controlled movements

DISCUSSION:

The improvements in intersection capacity and the increase in safety provided by a protected left turn warrant the additional cost.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 50,000	—	$ 50,000
ALTERNATIVE	$ 51,000	—	$ 51,000
SAVINGS	$ (1,000)	—	$ (1,000)

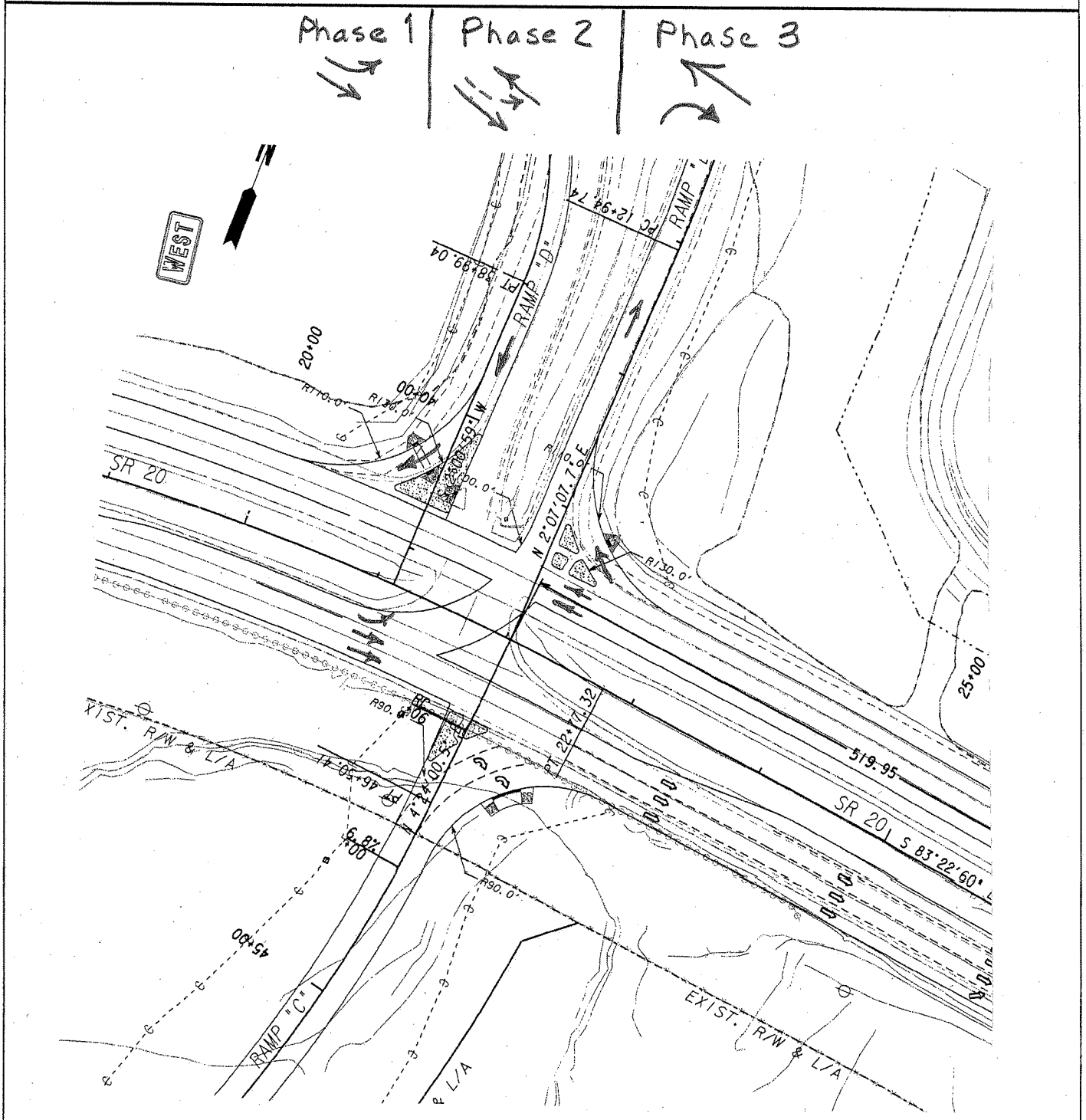
SKETCHES

PROJECT: **SR-20/ I-575 Interchange**
GDOT

ALTERNATIVE NO.: RP-12

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 2 of 2



ALTERNATIVE DESIGN (INTERSECTION # 1)

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**ICT-1**
DESCRIPTION:	**STEEPEN SLOPES WITH STABILIZED EARTH**	SHEET NO.:	**1 of 2**

ORIGINAL DESIGN: (Sketch attached)

Typical sections identify fill slopes at 2:1 (horizontal/vertical).

ALTERNATIVE: (Sketch attached)

Provide steeper fill slopes with stabilized earth.

ADVANTAGES:

- Lowers right-of-way costs
- Reduces environmental impact

DISADVANTAGES:

- More expensive compared to constructing a slope at 2:1

DISCUSSION:

Instead of constructing slopes at 2:1, slopes can be safely constructed at .5:1 by employing earth-stabilization techniques. One such technique is using hexagonal or circular-shaped Geowebs made up of semi-flexible HDPE (high-density polyethylene). These perforated rolls of Geoweb sheets are laid out at 3 to 4-ft. lifts and filled with earth. Presto is a local manufacturer.

The steepened slopes are stabilized by growing grass/vegetation on it through hydroseeding.

Alternative Design: Steepen the slopes by stabilizing the earth with geotextiles and hydroseeding.

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

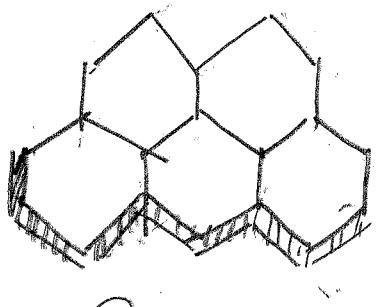
SKETCHES

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

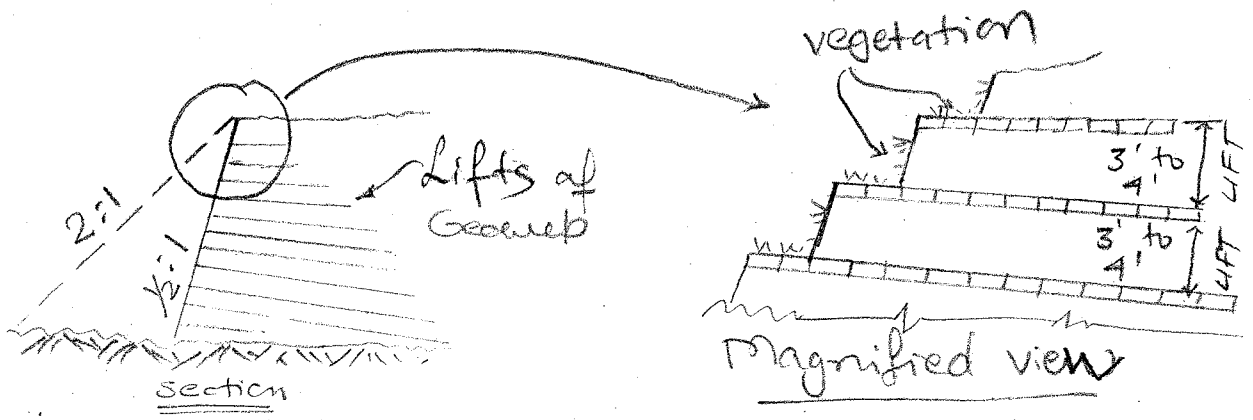
☑ AS DESIGNED ☑ ALTERNATIVE

ALTERNATIVE NO.: ICT-1

SHEET NO.: 2 of 2



PLAN



VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**ICT-2**
DESCRIPTION:	**ACCELERATE CONCRETE SETTING VIA ADDITION OF ADMIXTURES LIKE SILICA**	SHEET NO.:	**1 of 1**

ORIGINAL DESIGN:

Standard Portland cement concrete mix.

ALTERNATIVE:

Accelerate setting of Portland cement concrete with silica admixtures.

ADVANTAGES:

- Saves time and thus cost

DISADVANTAGES:

- Additional cost of admixtures

DISCUSSION:

The proposed design does not mention any means or method of quickening the setting of concrete, which can be achieved by adding admixtures like silica.

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

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**ICT-4**
DESCRIPTION:	**CONVERT TEMPORARY SEDIMENT POND #2 TO PERMANENT DETENTION BASIN**	SHEET NO.:	**1 of 1**

ORIGINAL DESIGN:

Provide a temporary pond at I-575 Station 25=50±.

ALTERNATIVE:

Convert temporary sediment Pond #2 to permanent detention basin.

ADVANTAGES:

- Minimizes construction cost.
- Saves time since there will not be any need for a new, separate detention basin.

DISADVANTAGES:

- Location of detention basin may not be the ideal one with respect to topography and catchment area, thus requiring additional piping.

DISCUSSION:

The runoff from the proposed development of ramps on the east side of I-575 is expected to flow toward Canton Creek. It is important to limit this runoff to a predevelopment rate. Therefore, a permanent detention basin is needed to protect Canton Creek from overflowing and damaging its habitat.

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

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **I-575 Interchange at SR-20**

Preliminary Design

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
	Innovate Construction (continued)					
RP-9	Identify and avoid rock locations/consider steeper slopes	DESIGN SUGGESTION				
	Stage Project					
SP-1	Stage proposed project	DESIGN SUGGESTION				

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	ALTERNATIVE NO.:	**RP-9**
DESCRIPTION:	**IDENTIFY AND AVOID ROCK LOCATIONS/CONSIDER STEEPER SLOPES**	SHEET NO.:	**1 of 1**

ORIGINAL DESIGN:

Does not identify locations where rock may be encountered.

ALTERNATIVE:

Identify rock locations at the design stage through geotechnical investigations.

ADVANTAGES:

- Avoids blasting and excavation expenses
- Reduces RW acquisition requirements due to steeper rock slopes

DISADVANTAGES:

- Requires extensive geological report with closely spaced boreholes
- Increases design cost

DISCUSSION:

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

PROPOSED STAGING

The VE team developed SP-1, a design suggestion, in reponse to the GDOT design team's request that the VE team investigator staging for this project. The VE team recommends constucting in the following stages:

1) Stage 1: Build retention ponds and related erosion control measures at the outset; build all structures and control measures in preparation for considerable earthwork.
2) Stage 2: Build Ramps "C" and "F." The major part of Ramps "C" and "F" can be constructed because they are in new locations outside the current configuration. Construct other "widenings" that will have less impact on current traffic, but coordinate around the Ramp "D" entrance (where the traffic problem of backing up occurs) and at exit and entrance of Ramp "E."
3) Stage 3
   a) Shift Ramp "D" traffic to Ramp "C." Provide a temporary left turn to westbound SR-20 at end of Ramp "C." Repave Ramp "D." Construct remainder of "C-D" Road past the Ramp "C" entrance.
   b) Shift Ramp "E" traffic to Ramp "F." Provide a temporary left turn to Ramp "F" from westbound SR-20. Repave Ramp "E" and remainder of "C-D" Road.
4) Stage 4: Put northbound I-575 to westbound SR-20 traffic on repaved Ramp "E."
5) Stage 5: Repave Ramps "A" and "B" under traffic control.

PROJECT DESCRIPTION

INTRODUCTION

The goal of GDOT project NH-IM-575-1(33), P.I. No. 612270, is to reconstruct and rehabilitate the I-575 interchange at SR-20. The proposed modifications will remedy existing and future congestion at the intersection of the I-575 and SR-20 ramps caused by the EB 20/SB 20 and NB 575/EB 20 left turn configurations. The NB 575/EB 20, in addition to causing excessive queuing at the ramp intersection, causes backups on the NB 575 mainline. Additional objectives for this project are to combine successive ramp entrances and exits with single entrances and exits and to rehabilitate the entire pavement within the confines of the I-575 at SR-20 interchange. The length of the project is 0.5 miles along I-575 and 0.3 miles along SR-20. The cost estimate for this project has been established at $44 million.

PROJECT DESCRIPTION

The existing interchange is currently operating at a level of service "F" and will worsen as Cherokee County continues residential and commercial developments. Accident analysis for data years 1995 to 1997 indicates the interchange experiences accidents at a rate exceeding the statewide average for similarly classified facilities. I-575 consists of four lanes, two in each direction, separated by a 64-ft. grassed median with a posted speed limit of 65 MPH. The base year traffic volumes for I-575 at SR-20 are 35,000 VPD (2000) with future design volumes expected to be 55,000 VPD (2020).

The proposed construction will add an exit ramp from I-575 northbound to SR-20 and add a southbound entrance ramp from SR-20 to I-575 southbound. All the existing ramps will be retained. The existing loop ramp on the east side of the interchange will be reconfigured to allow traffic from I-575 northbound to continue on SR-20 westbound. The new ramp on the east side of the interchange will allow I-575 northbound traffic to continue east on SR-20. No ramp improvement will be made for traffic traveling SR-20 eastbound to I-575 northbound.

The existing ramp from I-575 southbound will be reconfigured for dual left turns to SR-20 eastbound and a right turn lane to SR-20 westbound. The new ramp on the west side of the interchange will be added to provide traffic from SR-20 eastbound to I-575 southbound. The existing loop ramp on the west side of the interchange will be reconfigured to allow SR-20 westbound traffic to I-575 southbound traffic.

Additional key project elements that are part of the current design proposal include the following:

- Replacement of asphalt concrete with Portland cement concrete on the ramps;
- Rehabilitation of asphalt concrete on SR-20;
- Impacts and mitigation to the Canton Creek riparian habitat, including the Cherokee Darter, which is on the endangered species list;
- Addition of BMP ponds to mitigate the additional impervious surfaces;
- Five stream crossings consisting of culverts or bridges;

- Right-of-way purchases within the southeast and southwest quadrants of the interchange; and
- Large amounts of embankment and retaining walls to negotiate the undulating, steep terrain that impact the proposed ramp construction in the southeast and southwest quadrants of the interchange.

Additional improvements to I-575 are being considered in a separate GDOT project that will provide auxiliary lanes along I-575 from the SR-20 interchange to the next interchange to the north.

The current design concept includes the following features:

- Proposed I-575 Typical Section: 4 to 12 ft. lanes (each direction) separated by a 64-ft. depressed grass median with 14-ft. shoulders (10-ft. paved/4-ft. grassed)
- Ramp Typical Section: 16-ft. wide lane with 10-ft. shoulders (6-ft. paved/4-ft. grassed)
- Proposed Design Speed Mainline: 65 MPH
- Proposed Maximum Grade Mainline: 2.90%/Maximum Grade Allowable: 4.0%
- Proposed Maximum Grade Side Street: N/A/ Maximum Grade Allowable: N/A
- Proposed Maximum Grade Driveway: N/A
- Proposed Maximum Degree of Curvature: 1° 30 ft./Maximum Degree of Curvature Allowable: 3° 45 ft.
- Right-of-Way Width: 500 ft.

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis procedure used during the VE study on the I -575 Interchange at SR-20 project conducted by Lewis & Zimmerman Associates, Inc., for GDOT. The workshop was performed April 19–21, 2006, at GDOT's offices in Atlanta, Georgia. GDOT's designers provided information for the VE team to use as the basis of the study.

A systematic approach was used in the VE study. The key steps taken were organized into three distinct parts: (1) Pre-study preparation, (2) VE orientation/kickoff meeting and workshop, and (3) post-study reporting and implementation. A Task Flow Diagram, which outlines each of the procedures included in the VE study, is attached for reference.

In the sections following the VA procedure, separate narratives and supporting documentation identify the following:

- Value Engineering Workshop Agenda
- Value Engineering Workshop Participants
- Cost Model
- Function Analysis
- Creative Ideas and Evaluation

PRE-STUDY PREPARATION

The study was conducted in a workshop format. Pre-study preparation for the workshop consisted of scheduling study participants and tasks and gathering necessary project documents to distribute to team members for review prior to attending the workshop. Throughout the study, the following documents were used as the basis for generating alternative approaches for achieving project functions and for determining the cost implications of the alternatives that have potential for enhancing the value of the project.

- Approved Concept Report, dated May 11, 2005
- Updated cost estimate, dated February 7, 2006
- Half-size plans, current as of April 2006

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

Project cost data provided by the designers were used by the VE team as the basis for a comparative analysis with other similar projects. To prepare for this exercise, the VE Team Leader used the cost

Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project
- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Define *Project Value Objectives*
- Identify Project Constraints

→

Prepare for Workshop
- Collect Project Data
- Distribute Data to Team Members
- Verify Cost Data
- Team Members Become Familiar with Project

→

Construct Cost Models
- Construct Cost Models
- Construct Graphic Function Analysis
- Outline High Cost Areas

→

LCC Model
- Process Areas
- Staffing
- Chemicals
- Energy
- User Impact

Workshop Effort

Information Phase
- Introduction by VETL
- Project Description and Presentation by Designer
- Outline Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)

→

Function Identification and Analysis Phase
- Analyze Project Costs and Energy Usage
- Perform Function Analysis and prepare FAST Diagram
- Identify High Cost and Energy Areas
- Calculate Cost/Worth Ratios
- Identify Paradigms

List Ideas Generated During Function Analysis

→

Speculation Phase
- Introduction by VETL
- Creative Idea Listing:
  - Quantity of Ideas
  - Association of Ideas

Brainstorming

Creative Thinking:
- Group & Individual

Use Checklist for Ideas

→

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

→

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

→

Presentation Phase
- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Oral Presentation

Post-Workshop Effort

VE Study Report
- Prepare Preliminary VE Report
- Designer Prepares Responses to VE Report
- Owner Evaluates Recommendations

→

Implementation Phase
- Participate in Implementation Meeting with Owner/User/Designer/VE Team, as needed
- Prepare Final VE Report

→

Final Acceptance
- Redesign by Designer

estimate prepared by GDOT to develop a cost model for the project. The model (described in the Cost Model section of this report) was used to distribute the total project cost among the various elements or functions of the project. The VE team used these data to identify the high-cost elements or functions that drive the project and the elements or functions providing little or no value so that the team could effectively use its time and focus on reducing or eliminating the impact of those elements. During the workshop, the VE team and GDOT designers identified a mathematical error in the retaining wall cost data, which should reduce construction costs by approximately $19 million.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop effort consisted of a 3-day workshop beginning with an orientation/kickoff meeting on April 19, 2006. During the workshop, the VE job plan was followed in compliance with the FHWA and SAVE International guidelines for conducting a VE study. The job plan guided the search for alternatives to mitigate or eliminate high-cost drivers, support functions providing little or no value, and potential project risk elements. Alternatives to specifically address the project owner's concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructability, and providing missing or less than optimum functionality were also entertained. The job plan includes six phases:

- Information Gathering Phase
- Function Identification and Analysis Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Information Gathering Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods had to be reviewed and understood. For this reason, GDOT's design team sent information (described above) to the VE team prior to the study, and following a short orientation session, the workshop was kicked off with a presentation of the project to the team. The presentation highlighted the information provided in the written documentation and expanded on that information to include a history of the project's development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarifications of the information provided.

Function Identification and Analysis Phase

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

Function is defined as the "intended use" of a physical or process element. In the VA process, the team attempted to identify functions in the simplest manner using active verb/measurable noun word combinations. Sometimes modifying adjectives were used with the noun to clarify the definition. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions, which were recorded on Random Function Analysis Worksheets (provided in the Function Analysis section). Then the individual functions were identified for the major components of the project depicted on the cost model.

After identifying the functions, the team classified the functions according to the following:

Abbreviation	Type of Function	Definition
HO	Higher Order	The primary reason the project is being considered, or project goal.
B	Basic	A function that must occur for the project to meet its higher order functions.
S	Secondary	A function that occurs because of the concept or process selected and may or may not be necessary.
R/S	Required Secondary	A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed.
G	Goal	Secondary goal of the project.
O	Objective	Criteria to be met.
LO	Lower Order	A function that serves as a project input.

Higher order and basic functions provide value, while secondary functions tend to reduce value. Thus, the team works in future phases to reduce the impact of secondary functions and thereby enhance project value.

To further clarify the impact of the various functions, the team assigned costs to provide the functions or group of functions provided by a specific project element using the cost estimate and cost model. Where possible, they seek to benchmark the costs for providing functions; i.e., finding the lowest cost, or worth, to perform the function using published data from other sources or team knowledge obtained from working on other similar projects to establish cost goals and then comparing them to the current costs. By identifying the cost and worth of a function or group of functions, cost/worth ratios were calculated. Cost/worth ratios greater than one indicate that less than optimum value is being provided. Those project functions or elements with high cost/worth ratios became prime targets for value improvement.

As well as looking at areas with high cost/worth ratios, the team used the cost model to seek out the areas where most of the project funds are being applied. Because of the magnitude of these high-cost elements or functions, they too became initial targets for value enhancement.

Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

Speculation Phase

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

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

Evaluation Phase

Since the goal of the Creative Idea Generation phase was to conceive as many creative ideas as possible without regard for technical merit or applicability to respond to the project goals, this phase of the workshop focused on identifying those ideas that respond to the Project Value Objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of evaluating the ideas originated during the Creative Idea Generation phase based on the value objectives identified in the earlier phases.

Based on the team's understanding of the owner's value objectives, each idea was compared with the present design concept, and the advantages and disadvantages of each idea were discussed. How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of one to five, with five or four indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, three indicating an idea that provides marginal value but could be used if the project was having budget problems, two indicating an idea with a major technical flaw, and one indicating an idea that does not respond to project requirements. Generally, ideas rated four and five are pursued in the next phase.

The team also used the designation "DS" to indicate a Design Suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, ease maintenance, reduce schedule time, or enhance project value in other ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. These are also developed in the next phase of the VA process.

Development Phase

In this phase, each highly rated idea was expanded into a workable solution, designated as a Value Engineering Alternative. The development consists of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The Value Engineering Alternatives are included in the Study Results section of this report. Design

suggestions include the same information as the alternatives except that no cost analysis is performed. They too are included in the the Study Results section.

Presentation Phase

The last phase of the workshop was to summarize the results of the study and prepare a Draft Summary of Potential Cost Saving worksheet to hand out at the presentation and to present the key Value Engineering Alternatives and design suggestions to GDOT. The purpose of the presentation meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed and arrangements were made for the reviewers of the VE report to contact the VE team in order to obtain further clarifications, if necessary. Draft copies of the Summary of Potential Cost Savings worksheets were given to the owner and design team to facilitate a timely review and speedy implementation of the selected ideas.

POST-WORKSHOP EFFORT

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, the owner will select those VE Alternatives and Design Suggestions that provide good value to incorporate into the project.

VALUE ENGINEERING WORKSHOP AGENDA

Lewis & Zimmerman Associates, Inc. will conduct a 3-day value engineering (VE) workshop on the **SR-20/I-575 Interchange Project** for Georgia DOT on April 19-21, 2006. The project is preliminary design stage of development.

The study will be conducted at:

Room 274-B of
GDOT General Office Facility
No. 2 Capitol Square, Atlanta, GA 30334.
VE Coordinator: Lisa Myers (404) 651-7468

The Design Team will present the design at the beginning of the VE workshop and will be available to answer questions during the study effort. A suggested outline for the Designer's presentation follows the agenda. Representatives from the GDOT are encouraged to attend.

AGENDA

Wednesday, April 19, 2006

8:30 am - 9:00 am **VE Team Gathers To Review Project**

9:00 am - 9:15 am **Designer's Presentation/ Introduction to the Workshop**

Welcome and opening remarks
Team Member Introductions
VE Process, Workshop Organization and Agenda
Objectives of the Workshop

9:15 am - 11:00 am **Designer's Presentation/Information Gathering Phase**

The Design Engineers will present information concerning the project including: Project goals; the rationale for the design; criteria for specific areas of study, project constraints and the reasons for the design decisions. (***The Designer may want to present specific data to individual team members and familiarize themselves with the cost model and the project data and be available to answer questions concerning the project. - Optional***)
Project Budget review and confirmation

11:00 am - 12:30 pm **Information Phase/Document Review**

The VE team reviews project documentation provided and lists project concerns and issues.

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

1:30 pm - 3:30 pm **Function Analysis Phase**

The VE team will familiarize themselves with the cost model(s) and the project data for each area of study. The cost model(s) will be refined, as necessary. The VE team will perform a function analysis by defining the function of each project element or system in the cost model, selecting the primary or basic functions, and determining the worth, or least cost, to provide the function. Cost/worth or value index ratios will be calculated, and high cost/low worth areas for study identified. If applicable, a Function Analysis Systems Technique Diagram will be constructed using the functions identified for the project elements. Areas for value enhancement will be identified.

3:30 pm - 5:30 pm **Creative Phase**

The team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment. The VE Team Coordinator will be responsible for developing an idea listing for the team.

Thursday, April 20, 2006

8:00 am - 10:00 am **Creative Phase** (Continued)

10:00 am - 12:00 pm **Evaluation Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas based on established criteria obtained and a discussion of the ideas advantages and disadvantages. This will be accomplished by assigning each idea a *Gut Feel Index* rating between 1 and 5, with 5 being the best, based on the Team's consensus of how well the idea meets the noted criteria.

If it is necessary to chose one of several ideas for providing the same function, then the team may engage in an analysis that weighs the various criteria and then uses these weighted criteria to compare each of the alternative ideas prior to making the selection.

The Team selects the highly rated ideas for research and development.

12:00 pm - 1:00 pm **Lunch**
1:00 pm - 5:30 pm **Development of VE Alternatives Phase**

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

substantiation for change. Suppliers of materials and equipment will be contacted and specialists consulted, as necessary. The VE team leader will describe how the forms used to present the VE alternatives are prepared.

Friday, April 21, 2006

8:00 am - 8:15 am **Review Status and Progress of the Team**

The VE team will assess their status and plan for completion of the alternatives development.

8:15 am - 12:00 pm **Development Phase** (continued)

Alternative development is finalized and present worth life cycle cost analyses are prepared for selected alternatives. Calculations are checked, sketches completed, and advantages and disadvantages reviewed for potential modification of the alternative to overcome the disadvantages. An implementation plan is generated, if necessary.

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

2:00 pm - 4:00 pm **Recommendation Phase**

The VE team prepares a summary of the value engineering alternatives with descriptions and initial and life cycle costs for GDOT. *Summary of Potential Cost Saving* sheets are copied for distribution to VE presentation attendees will be provided at the conclusion of the study.

4:00 pm **Adjourn**

OUTLINE FOR VE TEAM PRESENTATION

The Designers are actively involved in the planning and design of the project to be value engineered. They have spent a great deal of time and effort in developing their design.

However, the design is influenced by outside input from many sources. In order to perform its work most efficiently, the value engineering team needs to understand the factors that have influenced the design. The object is to avoid duplication of efforts and to aid the team in becoming familiar with the project.

To achieve this objective, the Designer is asked to give a presentation at the beginning of the VE workshop session. To assist the Designer, we have outlined the information that, as a minimum, should be addressed:

- Scope of the Designer's effort
- Participating firms
- Existing site conditions
- Regulatory requirements
- Basis of design
- Rationale and steps in development of design
- Design concepts for process, chemicals, civil, structural, mechanical, electrical, instrumentation & controls, security, etc.
- Hours of operation - Staffing Plan
- Pertinent information from user participation
- Constraints imposed by the Owner
- Appropriate codes
- Explanation of information provided by the Designer to the VE team
- Summary of cost estimate
- Construction phasing

This information is provided as an outline to aid the Designers. The presentation is the Designers' responsibility and they may conduct the initial presentation in the manner they feel most comfortable.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the project elements involved with the I-575 Interchange at SR-20 project. Team members formed a multidisciplinary group with professional planning, design, and construction experience and a working knowledge of VE procedures. The VE team members were:

Participant	Specialization	Affiliation
Keith Strickland, PE	Highway Design Engineer	HNTB
Alex Pascual, PE	Structures Engineer	HNTB
Paresh Parikh, PE	Constructability	Delon Hampton & Associates
George C. Hunter, PE, CVS	VE Team Leader	Lewis & Zimmerman Associates

DESIGNER'S PRESENTATION

An overview of the project was presented on April 19, 2006, by representatives from GDOT and the FHWA. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE study, was to bring the VE team "up to speed" regarding the overall project specifics. Additionally, the meeting afforded the owner the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VE STUDY SIGN-IN SHEET

Project No.: NH-IM-575-1(33) County: Cherokee PI No.: 612270 Date: April 19, 20, 21, 2006

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
Lisa L. Myers	00244168	Engineering Services	404-651-7468	lisa.myers@dot.state.ga.us
Laura Rish	00901402	Environment/Location	404-699-4439	Laura.Rish@dot.state.ga.us
THOMAS FAMBRO	00276727	TRAFFIC SAFETY & DESIGN	404-635-8159	THOMAS.FAMBRO@DOT.STATE.GA.US
Paresh J. Parikh		Delon Hampton & Asso.	404-524-8030	pparikh@delonhampton.com
ALEX PASCUAL		HNTB CORP.	404-946-5738	apascual@hntb.com
Keith Strickland		HNTB	404 946 5744	kstrickland@hntb.com
Jack Muirhead	00237324	DOT Bridge Design Office	404 656 5197	jack.muirhead@dot.state.ga.us
Lonnie Jones		DOT Construction	404 656 5306	lonnie.jones@ ...
Andy Casey		DOT Road Design	404 656 5406	andy.casey@ ...
Kenny Beckwith		DOT District Construction	770 387 3609	kenny.beckworth@ ...

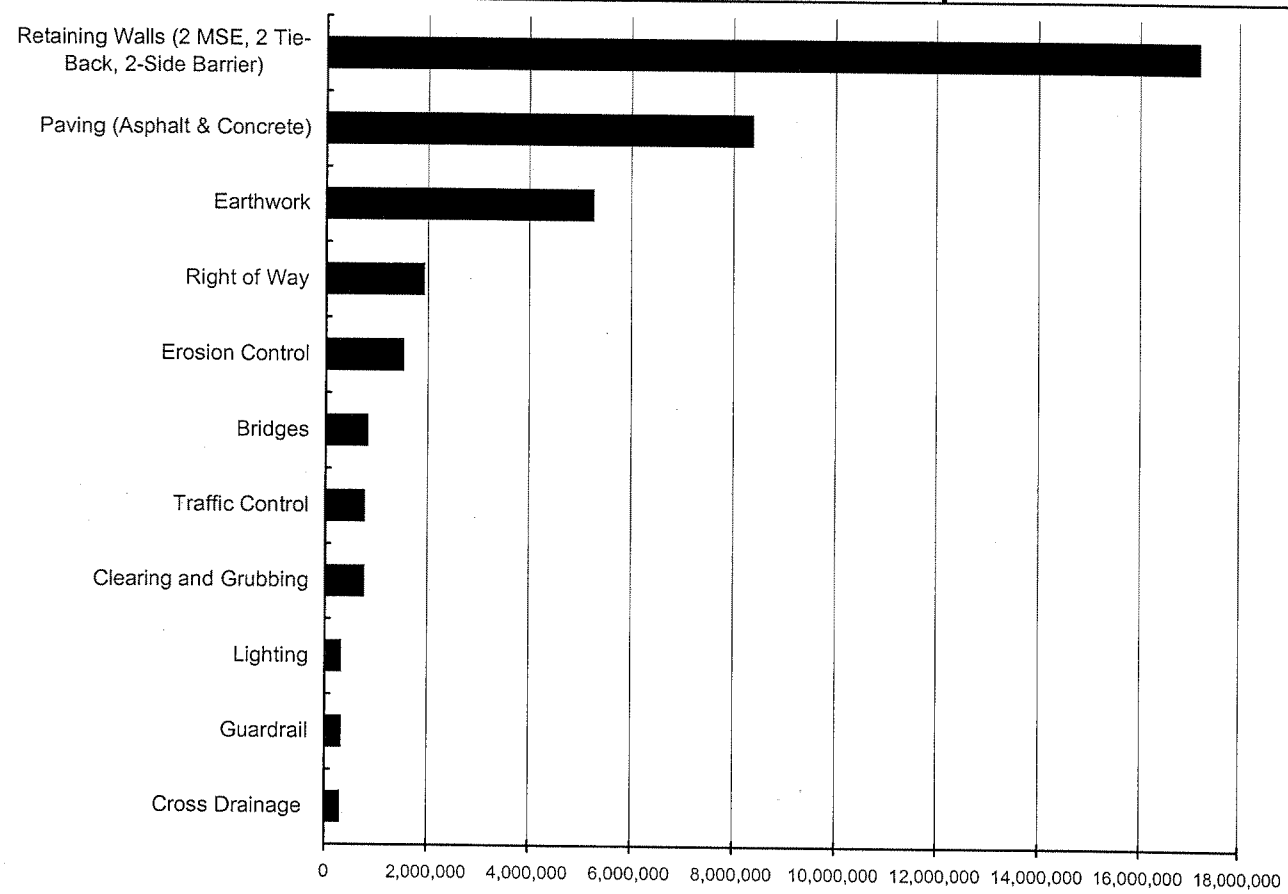
COST MODEL

The VE team leader prepared a Pareto Chart, or cost histogram, for the project that follows this page. This cost histogram displays the major construction elements identified in the cost estimate prepared by the design team in descending order of magnitude and thus identifies the high-cost areas in the project and provides the VE team with a focus for its work during the study.

COST HISTOGRAM

PROJECT: **I -575 Interchange at SR-20**
Preliminary Design

PROJECT ELEMENT	COST	PERCENT	CUM. PERCENT
Retaining Walls (2 MSE, 2 Tie-Back, 2-Side Barrier)	17,180,000	45.20%	45.20%
Paving (Asphalt & Concrete)	8,368,230	22.02%	67.22%
Earthwork	5,250,000	13.81%	81.03%
Right of Way	1,914,000	5.04%	86.07%
Erosion Control	1,500,000	3.95%	90.02%
Bridges	802,750	2.11%	92.13%
Traffic Control	750,000	1.97%	94.10%
Clearing and Grubbing	750,000	1.97%	96.07%
Lighting	300,000	0.79%	96.86%
Guardrail	300,000	0.79%	97.65%
Cross Drainage	275,000	0.72%	98.38%
Box Culverts	250,000	0.66%	99.03%
Signing- Striping-Signal	200,000	0.53%	99.56%
Longitudinal Drains	125,000	0.33%	99.89%
Reimbursable Utility Relocation (Transmission Lines)	42,000	0.11%	100.00%
Subtotal	**$ 38,006,980**	**100.00%**	
E&C 10.00%	**$ 3,800,698**		
Inflation @ 5.00%	**$ 2,090,384**		
TOTAL	**$ 43,898,062**	**Comp Mark-up:**	15.50%



Costs in graph are not marked-up.

FUNCTION ANALYSIS

A function analysis of the I-575 Interchange at SR-20 project was prepared to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic functions needed to attain the given project purpose and need, (4) identify other public goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow.

RANDOM FUNCTION ANALYSIS

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

SHEET NO.: **1 of 1**

DESCRIPTION	FUNCTION		
	VERB	DESCRIPTION	VERB
Project	Improve	LOS	HO
	Increase	Intersection Capacity	HO
	Eliminate	Left Turn (NB 575/EB 20)	Basic Function
	Eliminate	Left Turn (EB 20/SB 575)	Basic Function
C-D Road	Decelerate	Traffic (off I-575)	RS
	Accelerate	Traffic (onto I-575)	RS
Pavement on Existing Ramps	Extend	Service Life	S

Function defined as: Action Verb
Measurable Noun

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

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the creative phase, numerous ideas were generated for the I-575 Interchange at SR-20 project using conventional brainstorming techniques as recorded on the following pages. For the convenience of tracking an idea through the VA process, the ideas were grouped into the following categories and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the categories:

CATEGORY	PREFIX
Modify Interchange Configurations	MIC
Retaining Walls	RW
Reverse Problems (Improve Intersections, Rock Removal)	RP
Innovate Construction	IC
Stage Project	SP

Creative Idea Evaluation

The ideas were then ranked on a qualitative scale of one to five on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea compared to the existing design solution were discussed. After discussing each idea, the team then evaluated the ideas by consensus. This produced eight ideas evaluated as fours and fives to carry forward and research and develop into formal VE Alternatives and six ideas to develop as Design Suggestions to be included in the Study Results section of the report. When this is not the case, an idea may have been combined with another related idea or discarded as a result of the additional research that indicated the concept as not being cost-effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheet since it may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **I-575 Interchange at SR-20**
Preliminary Design

SHEET NO.: **1 of 2**

NO.	IDEA DESCRIPTION	RATING
	Modify Interchange	
1	Double lane Ramp "D" prior to intersection ILO Ramp "C" and increase deceleration lane	5
2	Add one lane in each direction on SR-20 from easterly proposed parkway to Brown Industrial Parkway ILO current design	3
3	Roundabout interchanges with current ramps	4
4	Place Ramp "D"/SR-20 loci west	2
5	Diamond on east side of I-575 and eliminate loop off Ramp "D"	3
6	Eliminate SB loop on Ramp "E" with bridge widening (WB 20/ SB 575 LT turn)	2
7	Tight diamond	2
8	Single poin urban interchange	2
9	Continuous flow interchange WB 20/SB 575 movement	2
9	Direct connector WB 20/SB 575	2
10	Shift beginning Ramp "F" east ±150 ft.	2
11	Third lane WB 20 trapped off @ Ramp "E"	See MIC-2
12	Two-lane loop at Ramp "E"	2
13	Dual lefts at EB 20/SB 575	2
14	PARCLO—Eliminate Ramp "D" and add loop-on in southeast quad	2
15	SB 575/EB 20 crossover	2
16	Move noses north for Ramp "C" and "E" audio impacts to Canton Creek	1
17	Two lane Ramp "C"	2
18	Reduce Wall 1 and Wall 2 by providing ++ separation between M/L and ramp	3
19	Shift freeway (I-575) west	1
20	Shift freeway (I-575 east	1
	Retaining Walls	
1	Geoweb (Presto) ILO MSE walls	1
2	Bin walls ILO MSE	1
3	Reconstruct abutments ILO tiebacks	2
4	Bridge ILO Wall 4	4

Rating: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential;
5 = Most likely to be Developed; DS = Design Suggestion; ABD = Already Being Done

CREATIVE IDEA LISTING

PROJECT:	**I-575 Interchange at SR-20** ***Preliminary Design***	SHEET NO.:	**2 of 2**

NO.	IDEA DESCRIPTION	RATING
	Retaining Walls (continued)	
5	Use RCB and retaining walls ILO Stream 5 bridge	4
6	Shift I-575 to minimize retaining Wall 3	1
	Reverse Problem	
1	Add EB 20/NB 575 loop-on (eliminate LT turn)	2
2	SB 575/EB 20 loop-off	2
3	Direct connector EB 20/NB 575	2
4	Direct connector SB 575/EB 20	2
5	Add auxiliary lane between loop-off/loop-on along WB 20	See MIC-2
6	Increase distance between Birchwood and Ramp "C" interchange	4
7	Signalize Brown Industrial Parkway to allow easy access to Ramp "F"	DS
8	Move Birchwood St. Interchange east (increase interchange spacing); consider opposite proposed parkway	See RP-6
9	Identify rock locations and consider steeper cut slopes	DS
10	Identify rock and avoid	See RP-9
11	Provide adequate turning radius at Interchange #2	DS
12	Provide protected EB 20/NB 575 LT turn at Interchange #2 to improve safety	DS
	Stage Project	
1	Consider major staging phases	DS
	Innovate Construction Techniques	
1	Steeper slopes with stabilized earth	DS
2	Accelerated PCC setting via silica or other techniques	DS
3	Underground VS surface retention pond	DS
4	Convert sediment Pond #2 into retention basin	DS

Rating: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential;
5 = Most likely to be Developed; DS = Design Suggestion; ABD = Already Being Done