Georgia Department of Transportation

STP-186-1(25)

Widening and Reconstruction of SR 92 from South of Nebo Road to North of SR 120

P.I. No. 621720

Paulding County, Georgia

Value Engineering Study Report

September 2006

Design Team

Georgia Department of Transportation

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.

Lewis & Zimmerman Associates, Inc.
Taking the Chance out of Change
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October 6, 2006

Ms. Lisa L. Myers
Design Review Engineer Manager
State of Georgia Department of Transportation, General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: Project Number STP-186-1(25), P. I. No. 621720, Widening and Reconstruction of SR 92 from South of Nebo Road to North of SR 120 in Paulding County, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report.

The project widens and reconstructs SR 92 in and around Hiram, Georgia with the purpose of improving system efficiency for motorists traveling on from Nebo Road to SR 120.

The only major concerned expressed by the Department was the desire to have the project underway as soon as possible. However, due to funding restrictions and higher priority projects, it appears an accelerated schedule is not currently possible. As such, the objective of the value engineering effort was to identify opportunities that would improve the value of the project and reduce capital cost.

We wish to take this opportunity to thank you and the State of Georgia Department of Transportation for your hospitality during the workshop. Please let us know if you have any questions about this report, and we look forward to the possibility of working with you again in the future.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

Luis M. Venegas, PE, CVS-Life, LEED™ AP
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was the project entitled Widening and Reconstruction of State Route (SR) 92 from South of Nebo Road to North of SR 120, Project STP-186-1(25), P. I. No. 621720 in Paulding County, Georgia. The project is being designed by GDOT. The VE workshop was conducted September 20-22, 2006.

PROJECT DESCRIPTION

The proposed project reconstructs SR 92 beginning at south of Nebo Road and extending north to SR 120. This roadway is to be widened from a two-lane, two-way section to a four-lane, two-way section containing a 20-foot raised median. The existing bridges over the Norfolk Southern Railroad and the Silver Comet Trail will be replaced as said bridges are classified as "Functionally Obsolete." The total length of the proposed improvement is 5.57 miles.

The current estimated cost of construction is $41,686,062 based on GDOT's *Preliminary Cost Estimate*, dated June 12, 2006. This figure includes the preliminary right-of-way cost estimate, prepared by GDOT, at $5,528,040.

CONCERNS AND OBJECTIVES

As the county has grown considerably, the project is needed to provide additional through lanes in order to improve the level of service and provide a safer driving environment. The only major concerned expressed by GDOT is the desire to have the project underway as soon as possible. However, due to funding restrictions and other higher-priority projects, it appears an accelerated schedule is not currently possible.

As such, the objective of the VE effort was to identify opportunities to improve the value of the project in terms of fulfilling the basic functions of (1) accommodating increased traffic, (2) improving the level of service, (3) improving safety, and (4) reducing congestion thereby reducing travel time. The VE study also sought to reduce capital cost.

HIGHLIGHTS OF THE STUDY

The greatest potential savings comes from eliminating the sidewalks, curb, and gutter in non-business areas of the project. This challenges the standard of providing sidewalks on both sides of the facility due to the major widening and reconstruction. However, as this facility is classified as "a rural minor arterial," the rationale for sidewalks does not appear to be warranted. Additionally, the distances between

the residential areas, the business areas, and downtown Hiram, suggest that the sidewalks will not be used frequently. Alternative No. 20 documents the initial savings of $1,260,000 that could result from this approach. In a similar manner, Alternative No. 19 limits the use of sidewalks to those areas having the most logical pedestrian connectivity needs and calculates savings of about $1,145,000. Finally, in keeping with the rural nature of the facility, Alternative No. 13 eliminates the sidewalks south of the Nebo Road improvements for potential savings of $220,000.

The current design calls for the use of 4:1 embankments slopes at the Norfolk Southern Railroad Bridge in the City of Hiram. It may be possible reduce the fill requirements by reducing the embankment slopes to 2:1 and using guardrails. This approach will not be as aesthetically pleasing, but it could save close to $550,000, as shown on Alternative No. 15.

Finally, as stated on Alternative No. 24, using mechanically stabilized earth walls between Church and Dallas Streets in downtown Hiram will reduce the taking of Historic Property No. 2 from 75% to less than 10%. As an added benefit, it also precludes the demolition of the existing Hiram Animal Hospital. However, this alternative will add almost $720,000 to the cost of the project, but it should be given serious consideration due to the potential of saving an environmentally historic property and the animal hospital.

The *Summary of Potential Cost Savings* worksheet follows this narrative and outlines all the alternatives and design suggestion developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that addition of all project cost savings does not equal total savings for the project.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

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
1	Provide precast concrete arch in lieu of a conventional bridge over the Silver Comet Trail	$1,444,228	$1,106,113	$338,115		$338,115
2	Minimize the length of Nebo Road improvements	$179,229	$0	$179,229		$179,229
3	Minimize the length of Hiram-Sudie Road improvements	$265,592	$0	$265,592		$265,592
6	Eliminate Hardy Circle access to SR 92 at Station 279+00	$162,366	$0	$162,366		$162,366
8	Reduce the northbound left turn lane to Hiram-Sudie Road	$46,543	$32,942	$13,601		$13,601
12	Reduce the northbound and southbound turn lanes to Macland Road	$380,871	$118,919	$261,952		$261,952
13	Eliminate sidewalks and associated curb and gutter south of Nebo Road	$219,486	$0	$219,486		$219,486
15	Reduce fill north of railroad by using guardrails and 2:1 embankment slopes	$652,225	$105,827	$546,398		$546,398
19	Eliminate sidewalks and curb and gutter south from Station 145+00 to SR 120	$1,144,990	$0	$1,144,990		$1,144,990
20	Eliminate all sidewalks and associated curb and gutter in non-business areas	$1,254,767	$0	$1,254,767		$1,254,767
22	Use landscaped medians	D E S I G N S U G G E S T I O N				
24	Use mechanically stabilized earth walls between Church and Dallas Streets	$1,140,079	$1,857,570	($717,491)		($717,491)

STUDY RESULTS

INTRODUCTION

The results are the major feature of a value engineering (VE) study since they represent the benefits that can be realized on the project by the owner, users and designer. The results will directly affect the project design and will require coordination among the designer, the user and the owner to determine the ultimate acceptance of each alternative.

The alternatives are organized according to the order in which they were originally generated by the VE team during their function analysis and creative sessions.

RESULTS OF THE STUDY

The VE team generated 25 ideas for change during the Function Analysis and Creative Ideas phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the 25 ideas generated, 17 of them were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 11 alternatives for change with an impact on project costs and one design suggestion that will enhance the value of the project in terms of long term maintenance and reduced labor effort/improved constructability. All of these alternatives and design suggestions are presented in detail following this narrative and on the *Summary of Potential Cost Savings* worksheets.

EVALUATION OF ALTERNATIVES

It is important to consider each part of an individual alternative on its own merit. There is a tendency to disregard an alternative because of concern about one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, is to be used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance should be shown within each alternative.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reader should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY** *Design Development*	ALTERNATIVE NO.:	**1**
DESCRIPTION:	**PROVIDE PRECAST CONCRETE ARCH IN LIEU OF CONVENTIONAL BRIDGE OVER THE SILVER COMET TRAIL**	SHEET NO.:	**1 of 6**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the use of a three-span, prestressed concrete (PSC) beam superstructure with multiple column pier substructure on pile caps.

ALTERNATIVE: (Sketch attached)

Use a single-span, precast concrete arch segment with retaining walls, spread footings, and backfill.

ADVANTAGES:

- Shorter construction time
- Less maintenance
- Less structure
- Common practice for this application
- Improves aesthetics

DISADVANTAGES:

- Shorter span/tunnel effect may require lighting
- Perceived loss of quality

DISCUSSION:

The use of an arch system for this application will not only require less structure; it will reduce the construction phasing and maintenance while improving the aesthetic quality of the Silver Comet Trail.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,444,228**	**—**	**$ 1,444,228**
ALTERNATIVE	**$ 1,106,113**	**—**	**$ 1,106,113**
SAVINGS	**$ 338,115**	**—**	**$ 338,115**

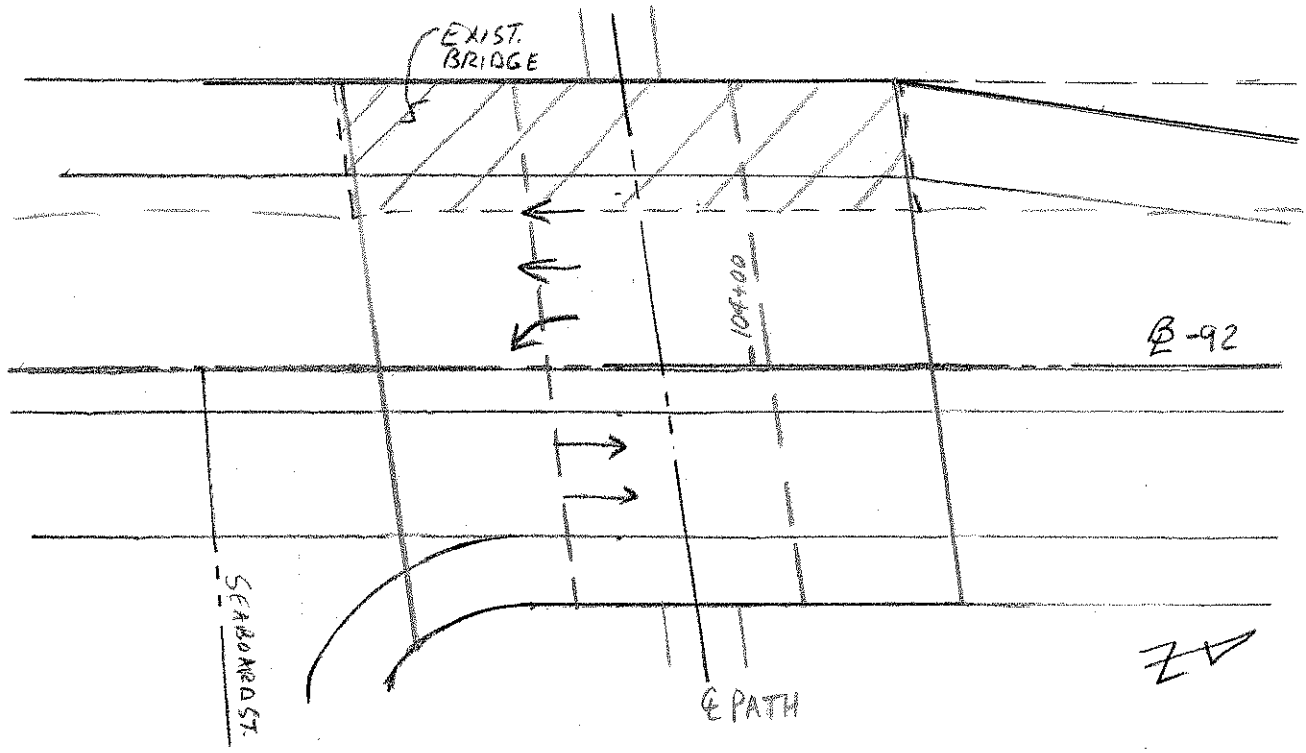
SKETCHES

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

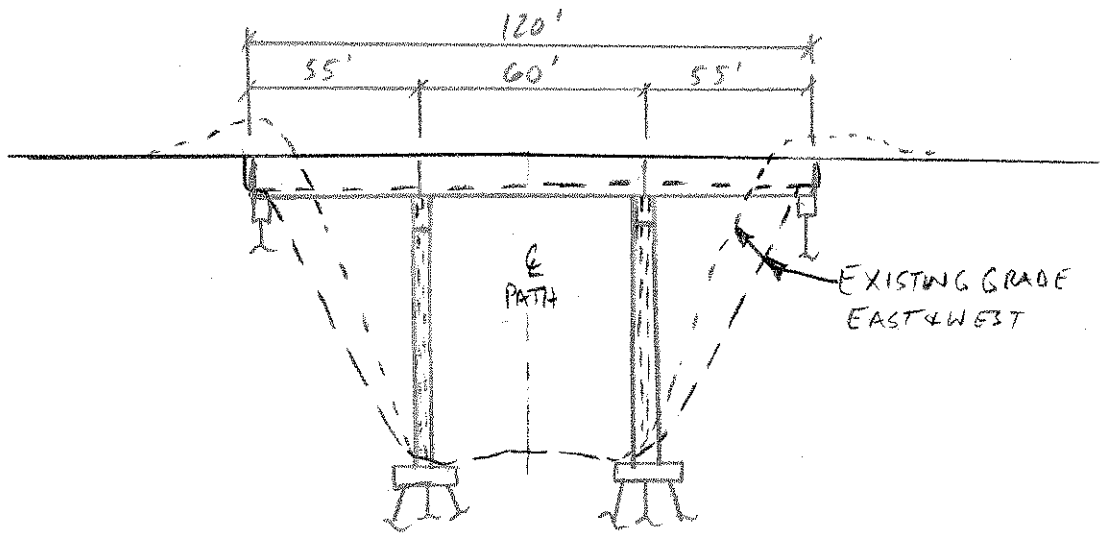
ALTERNATIVE NO.: 1

☑ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 6



PLAN



ELEVATION

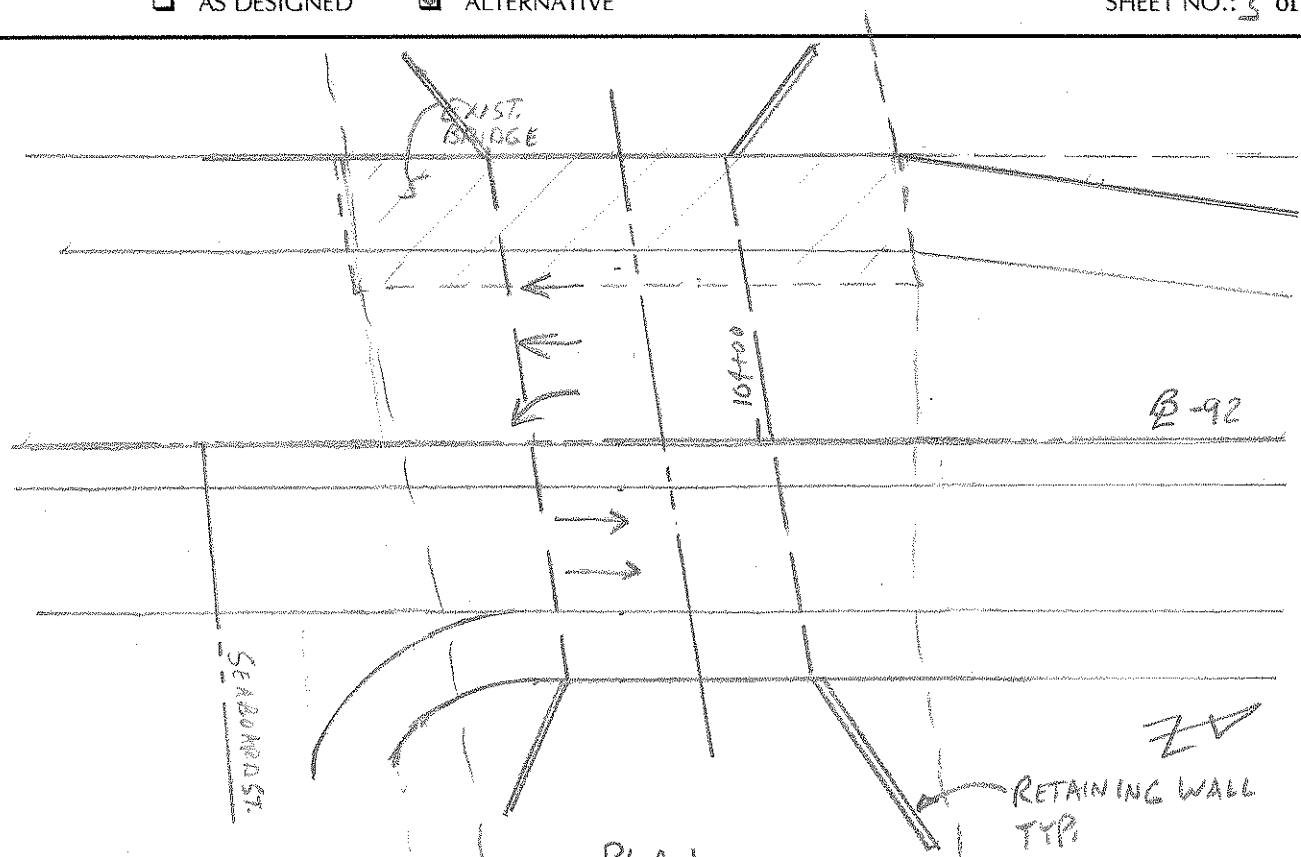
SKETCHES

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

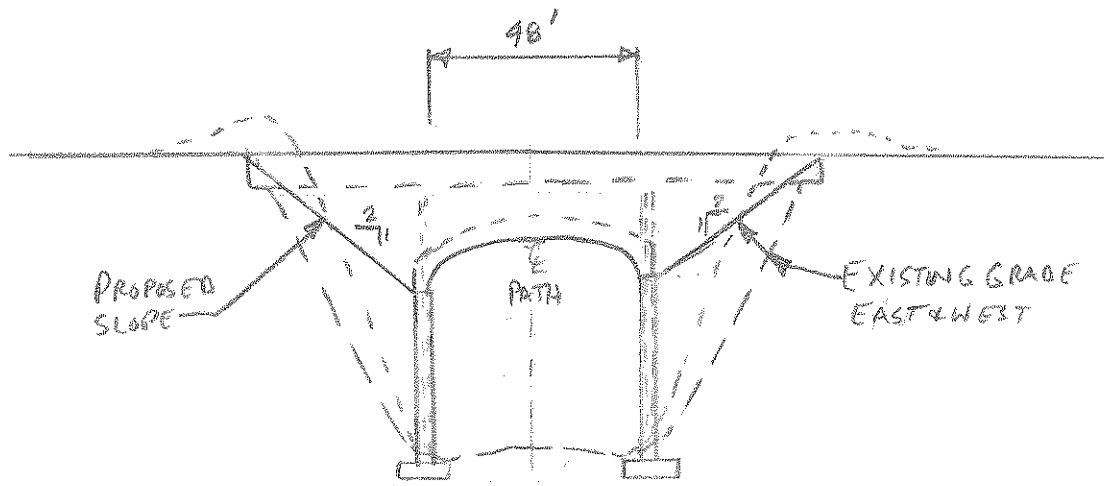
ALTERNATIVE NO.: 1

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 6



PLAN



ELEVATION

CALCULATIONS

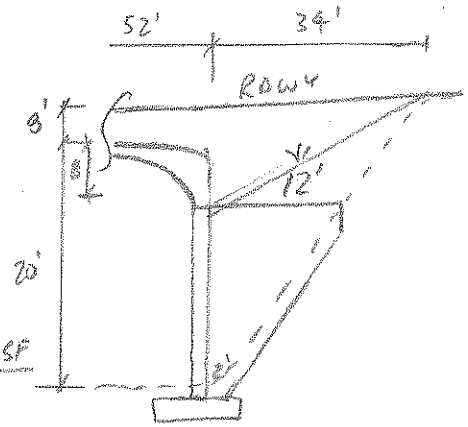
PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 1

DESCRIPTION: PROVIDE PRECAST CONCRETE ARCH IN LIEU OF CONVENTIONAL BRIDGE OVER SILVER COMET TRAIL

SHEET NO.: 4 of 6

CONCRETE ARCH = $(48'+4')\ 110' = \boxed{5,720\ SF}$

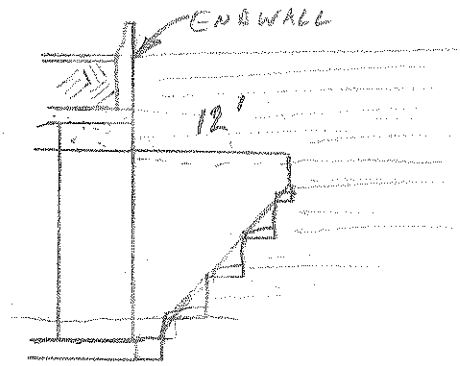


SECTION

RETAINING WALL:

- ARCH SUPPORT=>
  $(12' \times 110')\ 2 = 2,640\ SF$
- ENDWALLS=>
  $\left[(11' \times 52') + (18' \times 34' \times \tfrac{1}{2})2\right] \times 4 = 4,736\ SF$
- WINGWALLS=>
  $\left[(2' \times 12') + (\sqrt{2(12)^2} \times 10' \times \tfrac{1}{2})\right] 4 = 435\ SF$
  (12')

$\boxed{TOTAL = 7811\ SF}$



ELEVATION

FOUNDATION:
$(2' \times 10')\left[(110' \times 2) + (17' \times 4)\right]\ (1/27) = \boxed{214\ CY}$

BACKFILL:
$-\left[(7' \times 52' \times 106') + (15' \times 34' \times 106')2 + (12' \times 12' \times \tfrac{1}{2} \times 120')2\right] 1/27$
$= \boxed{6,106\ CY}$

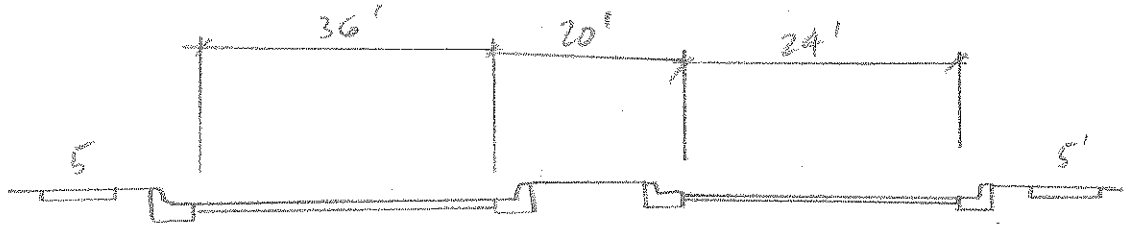
CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 1

DESCRIPTION: PROVIDE PRECAST CONCRETE ARCH IN LIEU OF CONVENTIONAL BRIDGE OVER SILVER COMET TRAIL

SHEET NO.: 5 of 6



TYP. SECTION

ASPHALT:

(A) 12.5_{mm} GAP 2 @ 165 #/SY ⇒ (36'+24') 1' (1/9) = 6.67 SY (165 #/SY / 2000) = 0.55 TON × 71 $/T = 39 $/LF

(B) 19 mm ⇒ 6.67 SY (220 #/SY / 2000) = 0.73T × 66 $/T = 48.4 $/LF

(C) 25mm ⇒ 6.67 SY (770 #/SY / 2000) = 2.57T × 65 $/T = 166.9 $/LF

GAB, 12" ⇒ (36'+24'+3'+3') 1' (1/9) = 7.33 SY × 22.30 $/SY = 163.5 $/LF

C&G ⇒ 2 × 14.32 $/LF = 28.6 $/LF

SIDEWALK ⇒ 5' × 2' × 1' (1/9) = 1.11 SY × 37.39 $/SY = 41.5 $/LF

FILL ⇒ (10.5' × 1' × 1') 2 (1/27) = 0.77 CY × 6 $/CY = 4.7 $/LF

TOTAL TYP. SECTION ⇒ 492.6 $/LF

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 1

DESCRIPTION

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge - 120 feet long x 110 feet wide PSC beams	SF	13,200	87.00	1,148,400			
Concrete Arch							
Concrete Arch	SF				5,720	55.00	314,600
Retaining Wall	SF				7,811	45.00	351,495
Concrete Foundation	CY				214	550.00	117,700
Backfill	CY				6,106	6.00	36,636
Roadway	LF				120	492.60	59,112
	Sub-total			1,148,400			879,543
Mark-up at	25.76%			295,828			226,570
	TOTAL			1,444,228			1,106,113

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **2**

DESCRIPTION: **MINIMIZE THE LENGTH OF NEBO ROAD IMPROVEMENTS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for Nebo Road to be reconstructed from Station (STA) 12+00 to STA 22+80.90, a distance of 1,080.9 feet.

ALTERNATIVE: (Sketch attached)

Reduce the length of reconstruction of Nebo Road from STA 17+00 to STA 22+80.9, a distance of 580.9 feet.

ADVANTAGES:

- Shorter construction time
- Reduced initial construction cost
- Less right-of-way take
- Not required

DISADVANTAGES:

- Loss of immediate additional improvement to Nebo Road

DISCUSSION:

It appears the traffic volumes associated with the improvements of this portion of Nebo Road do not warrant the additional 500 feet of reconstruction and right-of-way take. The proposed 581 feet of improvement will accommodate the reconstructed intersection at US 92.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 179,229	—	$ 179,229
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 179,229	—	$ 179,229

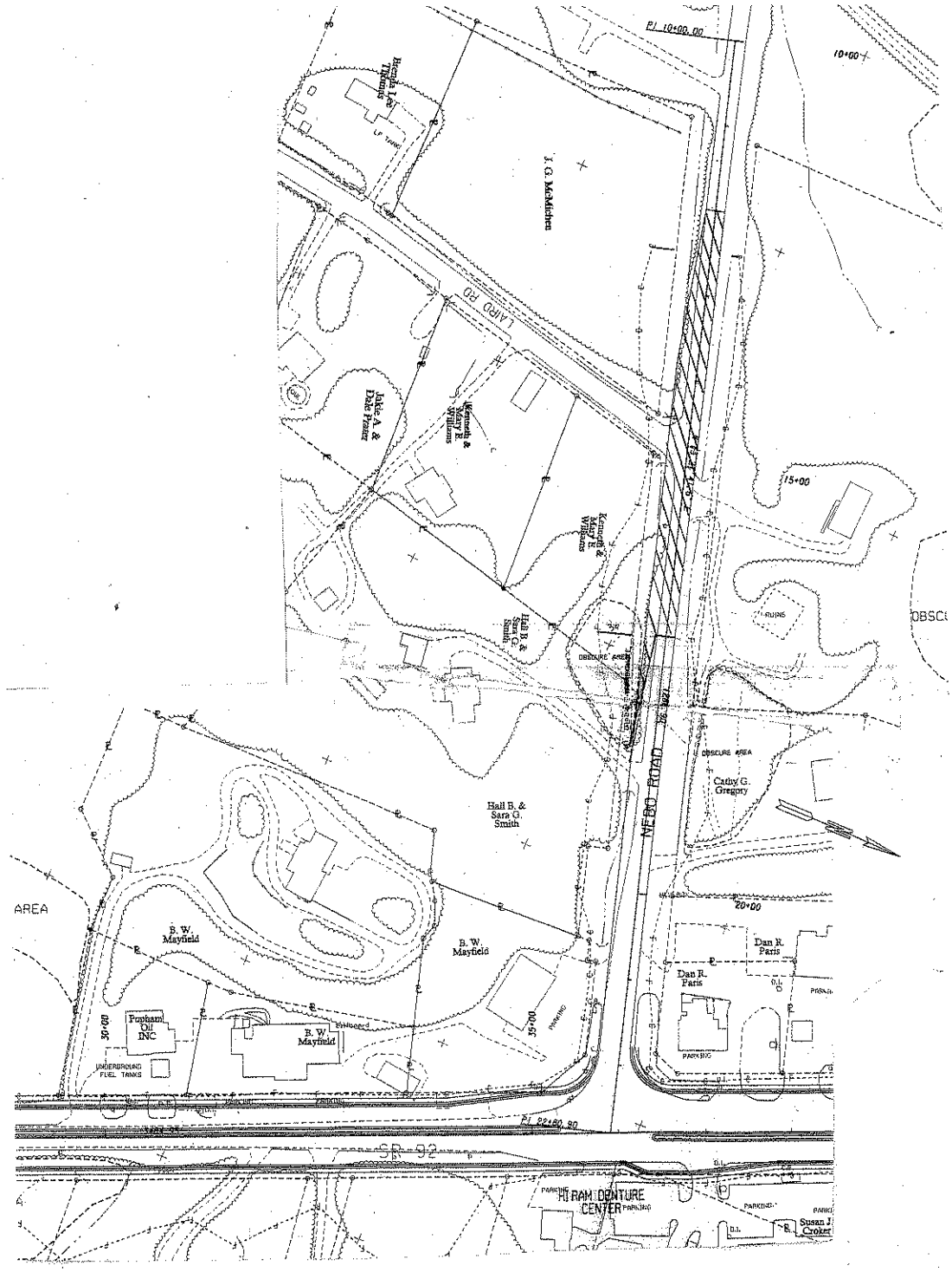
SKETCHES

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 2

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 2

DESCRIPTION: Minimize Length of Nebo Rd. Improvements

SHEET NO.: 3 of 4

Pavement - 500' x 36' ÷ 9 = 2000 SY

Earthwork - Fill - 200' x 170^{sf} ÷ 27 = 1260 CY
Cut - 300' x 220^{sf} ÷ 27 = 2440 CY

R/W = 17' x 500' ÷ 43560 = 0.20 AC
10' x 200' ÷ 43560 = 0.05 AC

Pav't - 12.5 mm Superpave - 165#/SY ÷ 2000#/ton x $71.00/ton = $5.86/SY
19 mm " 220# x $66.00/ton = 7.26
25 mm 770# 65.00/ton = 25.03
GAB - 110#/in x 12 in ÷ 2000#/ton x $22.30/ton = 14.72
$52.87/SY

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 2

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Excavation	CY	2,440	8.00	19,520			
Pavement	SY	2,000	52.87	105,740			
Subtotal				125,260			
Markup at 25.76%				32,267			
Construction Subtotal				157,527			
Right-of-Way	AC	0.25	25,000	6,250			
Markup at 247.24%				15,453			
Right-of-Way Subtotal				21,703			

	Sub-total		179,229		
Mark-up at	25.76%		INCL		
	TOTAL		179,229		

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **3**

DESCRIPTION: **MINIMIZE THE LENGTH OF HIRAM-SUDIE ROAD IMPROVEMENTS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the Hiram-Sudie Road to be reconstructed from Station (STA) 12+00 to STA 26+02.32, a distance of 1,402.32 feet.

ALTERNATIVE: (Sketch attached)

Reduce the length of reconstruction of the Hiram-Sudie Road from STA 18+00 to STA 26+02.32, a distance of 802.32 feet.

ADVANTAGES:

- Shorter construction time
- Reduced initial construction cost
- Less right-of-way take
- Not required

DISADVANTAGES:

- Loss of immediate additional improvement to the Hiram-Sudie Road

DISCUSSION:

It appears the traffic volumes associated with the improvements of this portion of the Hiram-Sudie Road do not warrant the additional 600 feet of reconstruction and right-of-way take. The proposed 802 feet of improvement will still accommodate the reconstructed intersection at US 92.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 265,592**	**—**	**$ 265,592**
ALTERNATIVE	**$ 0**	**—**	**$ 0**
SAVINGS	**$ 265,592**	**—**	**$ 265,592**

3

SHEET 2 OF 4

AS DESIGNED

ALTERNATIVE

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 3

DESCRIPTION: Minimize Length of Hiram-Sudie Rd Improvements

SHEET NO.: 3 of 4

Cut - 600' x 315$^{\square}$ ÷ 27 = 7000 CY

Pavement - 600' x 36' ÷ 9 = 2400 SY

R/W - 600' x 30' ÷ 43560 = 0.41 AC

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 3

DESCRIPTION

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Excavation	CY	7,000	8.00	56,000			
Pavement	SY	2,400	52.87	126,888			
Subtotal				182,888			
Markup at 25.76%				47,112			
Construction Subtotal				230,000			
Right-of-Way	AC	0.41	25,000	10,250			
Markup at 247.24%				25,342			
Right-of-Way Subtotal				35,592			

	Sub-total		265,592		
Mark-up at	25.76%		INCL		
	TOTAL		265,592		

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **6**

DESCRIPTION: **ELIMINATE HARDY CIRCLE ACCESS TO STATE ROUTE 92 AT STATION 279+00**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design provides access to State Route (SR) 92 at both Hardy Circle locations.

ALTERNATIVE: (Sketch attached)

Eliminate the SR 92 and Hardy Circle intersection at Station (STA) 297+00.

ADVANTAGES:

- Shorter construction time
- Reduced initial construction cost
- Less right-of-way take
- May not required
- Eliminates one close-by intersection
- May be safer

DISADVANTAGES:

- Loss of one of the SR 92/Hardy Circle intersections
- Loss of amenity
- Increased inconvenience to traveling public

DISCUSSION:

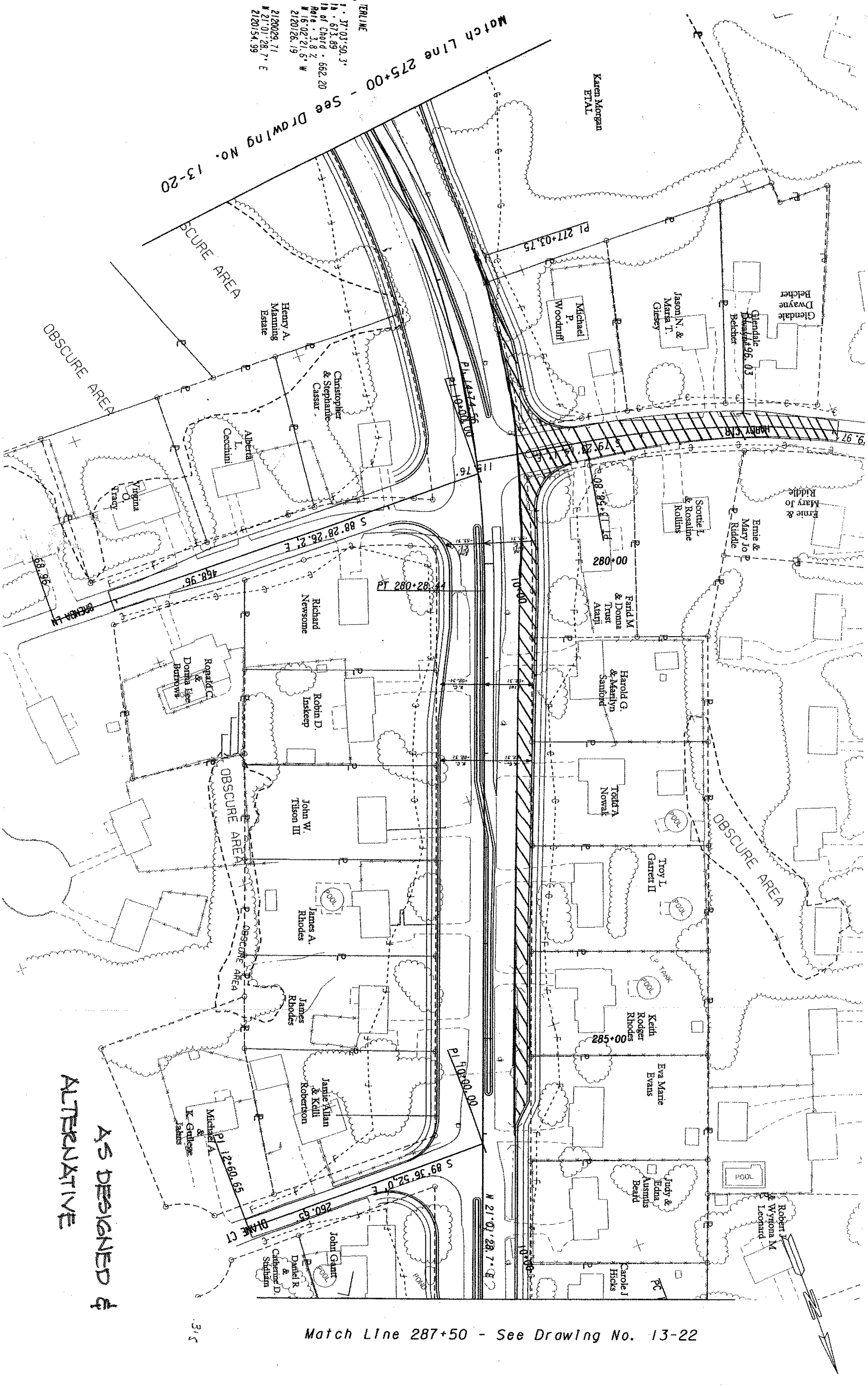
There are two intersections accessing SR 92 from Hardy Circle approximately 1,000 feet apart. By eliminating the southernmost intersection at STA 297+00, potential problems of near-by intersections are eliminated while providing a safer access to SR 92. Although some inconvenience is noted, overall accessibility is not hampered.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 162,366**	**—**	**$ 162,366**
ALTERNATIVE	**$ 0**	**—**	**$ 0**
SAVINGS	**$ 162,366**	**—**	**$ 162,366**

6

SHEET 2 OF 4

AS DESIGNED & ALTERNATIVE



CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 6

DESCRIPTION: Eliminate Hardy Circle Access to SR 92 at Sta. 279+00

SHEET NO.: 3 of 4

R/W - 12' x 850' ÷ 43560 = 0.23 Ac
8' x 175' ÷ 43560 = 0.03 Ac
0.26 Ac.

Earthwork - Cut - 200' x 15' ÷ 27 = 111 CY
- 400' x 10' ÷ 27 = 148 CY
259 CY

Fill - 200' x 20' ÷ 27 = 148 CY
250' x 35' ÷ 27 = 324 CY
200' x 12' ÷ 27 = 89 CY
561 CY

Pavement - 800' x 12' ÷ 9SY = 1067 SY

320' x 26' ÷ 9 = 924 SY

Curb & Gutter - 32 LF

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 6

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Excavation	CY	259	8.00	2,072			
Borrow	CY	561	6.00	3,366			
Pavement	SY	1,991	52.87	105,264			
Curb and Gutter	LF	32	14.32	458			
Subtotal				111,160			
Markup at 25.76%				28,635			
Construction Subtotal				139,795			
Right-of-Way	AC	0.26	25,000	6,500			
Markup at 247.24%				16,071			
Right-of-Way Subtotal				22,571			
Sub-total				162,366			
Mark-up at	25.76%			INCL			
TOTAL				162,366			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **8**

DESCRIPTION: **REDUCE THE NORTHBOUND LEFT TURN LANE TO HIRAM-SUDIE ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design provides for a standard left turn lane with a length of 1,125 feet to accommodate average daily traffic (ADT) count of 1,100 in the year 2009 and 1,900 ADT in the year 2029.

ALTERNATIVE: (Sketch attached)

Use a standard left turn lane having a length of 500 feet.

ADVANTAGES:

- Shorter construction time
- Reduced initial construction cost
- Longer length not required

DISADVANTAGES:

- Increases the amount of median
- If a longer turning lane is needed in the future (not likely), it will be more expensive to construct

DISCUSSION:

The turn lane is in a 1,718.87 foot radius (nominal) and the profile has a slight downward slope; as such, visibility is adequate. The minimal length is sufficient.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 46,543**	**—**	**$ 46,543**
ALTERNATIVE	**$ 32,942**	**—**	**$ 32,942**
SAVINGS	**$ 13,601**	**—**	**$ 13,601**

8

SHEET 2 of 4

STATE	PROJECT NUMBER
GA.	STP-186-1(25)

ATTIC SELF SRORAGE

Attic IV Self Storage INC.

PARKING

Carolina Child Care Properties

RECOVERY POND

PARKING

Samuel T. Clark

J Wayne & Brock Charles Cohran

Cohran Ventures INC.

PARKING

billboard

Cohran Ventures INC.

UNDERGROUND FUEL TANKS

UTIL.BOX

TRANSMISSION LINE

HIRAM-SUDIE ROAD

Kirby

Charles W. Smith

25+00

55+00

50+00

45+00

M.H.

D.I.

billboard

billboard

Wetland #1

Attic IV Self Storage INC.

PARKING

COASTAL GAS

SR 92

KC 818 A

PI 26+02.32

C.B.

3 billboard

UNDERGROUND FUEL TANKS

44+84.95

47+50

PARKING

TEXACO

625.0' REDUCTION

MEGGAMAX

Hosanna INC II

John A. Walton

HIRAM CAR WASH

OBSCURE AREA

STORAGE AREA

Hiram Car Wash

Marvin G & Barbara S Elsberry

TRANSMISSION LINE

PAUL'S SALES &SERVICE CYCLE

Wetland #3 Stream #5

Marvin G & Barbara S Elsberry

Colleen Power Hill

RIVER AREA

Stream #4

OBSCURE AREA

41+25

Susan J. Croker

COTTON FIELD PLAZA

PARKING

UTIL.BOX

Smith

MAUDE P RAGSDALE LIBRARY

Marvin G & Barbara S Elsberry

Williams

Susan J. Croker

Paulding County Board of Commissioners

Paulding County Board of Commissioners

Susan J. Croker

PARKING

D.I.

D.I.

H BBQ

hy G. egory

DENSE WOODS

SR 92 CONSTRUCTION CENTERLINE KC818 A

Degree = 3°20'00.0"	Delta = 56°55'25.3"
Radius = 1718.87	Length = 1707.71
Tangent = 931.79	Length of Chord = 1638.34
External = 236.31	S.E. Rate = 4.8 %
PC Sta = 44+84.95	BB = N 23°22'53.2" W
North 1407542.98	East 2115166.50
PI Sta = 54+16.74	
North 1408398.25	East 2114796.72
PT Sta = 61+92.66	DA = N 33°32'32.1" E
North 1409174.88	East 2115311.58

AS DESIGNED & ALTERNATIVE

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 8

DESCRIPTION: REDUCE NB LEFT TURN LANE TO HIRAM-SUDIE RD.

SHEET NO.: 3 of 4

ROADWAY REDUCTION:

LENGTH => $625' - 2(100') + (100' \times 2)\frac{1}{2} = 525'$

WIDTH => 12'

AREA => $525 \times 12\ (\frac{1}{9}) =$ **700 S.Y.**

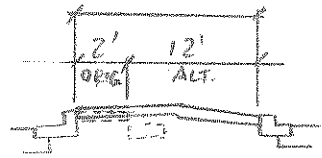
ROWY COST =>

ASPH	12.5	71 $/T
	19	66 $/T
	25	65 $/T
12" GAB		22.3 $/SY

} 52.87 $/SY

CURB & GUTTER: NO CHANGE

4" CONC. MEDIAN:



LENGTH = 525'
WIDTH = 12'
AREA = **700 S.Y.**

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 8

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Roadway reduction	SY	700	52.87	37,009			
4" Concrete Median	SY				700	37.42	26,194
	Sub-total			37,009			26,194
Mark-up at	25.76%			9,534			6,748
	TOTAL			46,543			32,942

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **12**

DESCRIPTION: **REDUCE THE NORTHBOUND AND SOUTHBOUND TURN LANES TO MACLAND ROAD**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design provides for a standard left/right turn lanes with lengths of 1,015 feet northbound and 1,080 feet southbound at the intersection of State Route (SR) 92 and Macland Road. These lanes are to accommodate average daily traffic (ADT) count of 300 in the in the year 2009, 400 ADT in the year 2029, 1,475 ADT in 2009, and 2,000 ADT in the year 2029 for left turning lanes, and 1,800 ADT in the year 2009, 2,400 ADT in 2029, and 325 ADT in 2009 and 450 ADT in 2029 for right turning lanes.

ALTERNATIVE: (Sketch attached)

Use a standard left turn lane having a length of 500 feet at the intersection of SR 92 and Macland Road.

ADVANTAGES:

- Shorter construction time
- Reduced initial construction cost
- Longer length not required

DISADVANTAGES:

- Increases the amount of median
- If a longer turning lane is needed in the future (not likely), it will be more expensive to construct

DISCUSSION:

The road alignment at this location is straight and Macland Road is at the top of the crest (599.0 vertical curve/slopes between 4.6375% to (-) 5.1783%; as such, visibility is adequate and the minimal length is sufficient.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 380,871**	**—**	**$ 380,871**
ALTERNATIVE	**$ 118,919**	**—**	**$ 118,919**
SAVINGS	**$ 261,952**	**—**	**$ 261,952**

GA. | STP-186-1(25)

OBSCURE AREA

Claude B. Lee

C. W. Burleson

C. B. & Dolores Nalley

Match Line 31+50
See Sheet 14-17

OBSCURE AREA

LP. TANK

Raiph & Susan Harmon

William & Jo Driskell

Belle Allen

Belle Allen

Belle Allen

Bill & C. W. Burleson

Mrs. Fred Clark

PC 31+40.74

PI 32+45.46

PT 33+50.03

10+00

Lynn H. Hester & M. T. Henderson

190+00

PC 188+41.58

10+00

OBSCURE AREA

ADD'L MEDIAN

195+00

PI 10+08.00

ALLEN ROAD

10+00

200+00

PT 19+8...

S.R. 360 MACLAND RD

35+00

LP TANK

SR 92

PI 93+12.61

1,015'

500'

OBSCURE AREA

OBSCURE AREA

Carol & Richard Murtha

LP TANK

Marion Virginia Rickerson

REDUCED ROW

Marion Virginia

PI 38+43.00

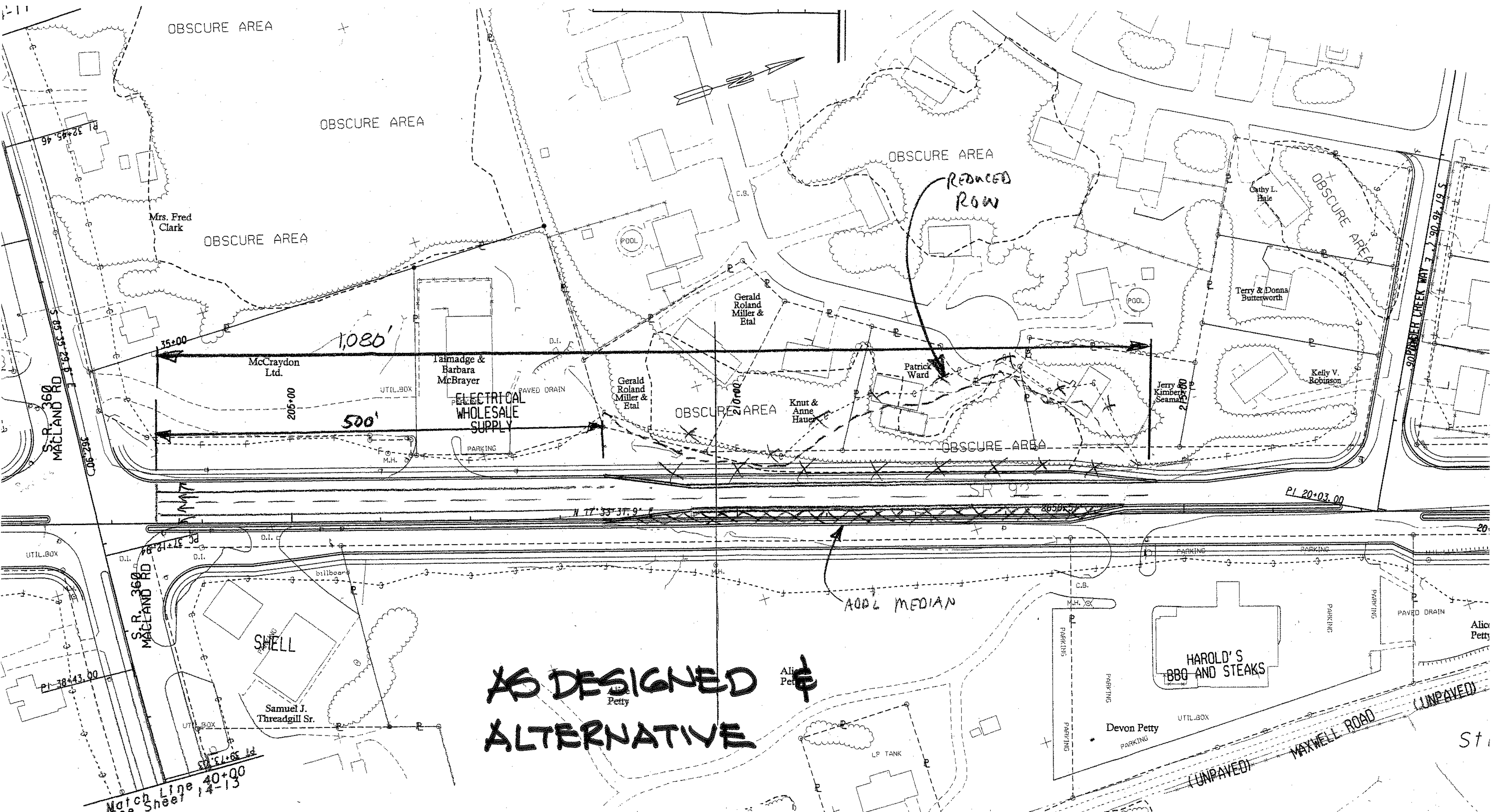
S.R. 360 MACLAND RD

Match Line 40

AS DESIGNED & ALTERNATIVE

12

SHEET 3 OF 5



CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 12

DESCRIPTION: REDUCE NB/SB TURN LANES TO MACLAND RD.

SHEET NO.: 4 of 5

ROADWAY REDUCTION:

LENGTH => NB = 1015 - 2(100) + (100'x2)½ = 915' x2 = 1,830'
SB = 1080 - 2(100) + (100'x2)½ = 980' x2 = 1,960'
↑ RT+LFT

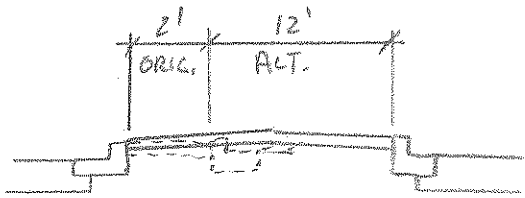
WIDTH => 12'

AREA = 1830 x12 (1/9) = 2,440 SY NB
1960 x12 (1/9) = 2,613 SY SB

ROAD COST => ASPH 12.5 71 $/T
19 66 $/T
25 65 $/T
12" GAB 22.3 $/SY
} 52.57 $/SY

CURB & GUTTER => NO CHANGE

4" CONC. MEDIAN =>



LENGTH = 915' NB
980' SB
WIDTH = 12'

AREA = 1,220 SY NB
1,307 SY SB

ROW:

NB => 915'x12' = 10,980 SF = 0.25 ACRE
SB => 980'x12' = 11,760 SF = 0.27 ACRE

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 12

DESCRIPTION

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Roadway Reduction - NB	SY	2,440	52.87	129,003			
Roadway Reduction - SB	SY	2,613	52.87	138,149			
4" Concrete Median - NB	SY				1,220	37.42	45,652
4" Concrete Median - SB	SY				1,307	37.42	48,908
Construction Subtotal				267,152			94,560
Markup at 25.76%				68,578			24,359
Construction Total				335,730			118,919
Right-of-Way Reduction - NB	AC	0.25	25,000	6,250			
Right-of-Way Reduction - SB	AC	0.27	25,000	6,750			
Right-of-Way Subtotal				13,000			
Markup at 247.24%				32,141			
Right-of-Way Total				45,141			
	Sub-total			380,871			118,919
Mark-up at	25.76%			INCL			INCL
	TOTAL			380,871			118,919

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **13**

DESCRIPTION: **ELIMINATE SIDEWALKS AND ASSOCIATED CURB AND GUTTER SOUTH OF NEBO ROAD**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The current design calls for the use of sidewalks and associated curb and gutter from STA 12+00 to Nebo Road at STA 35+90± and it includes the area of the taper of about 1,100 linear feet (LF).

The businesses near the corner of SR 92 and Nebo Road will have sidewalks and concrete curb and gutter constructed in front of the establishments as opposed to the original asphalt pavement.

ALTERNATIVE:

Construct the proposed roadway widening and associated taper with a 10-foot-wide paved shoulder. Drainage in this area would be handled by a ditch.

Access to the businesses near SR 92 at Nebo Road would remain basically the same.

ADVANTAGES:

- Existing drainage flow maintained
- Decreases initial cost
- Decreases earthwork

DISADVANTAGES:

- Increased storm water run-off to the ditches
- Sidewalks not available
- Loss of amenity

DISCUSSION:

This area of the alignment includes a rural, large-parcel residential area where the sidewalk would not be used. If the citizens living in this area are not requesting sidewalks, their elimination should be considered. Point-to-point destinations are not evident to have sidewalks constructed at this time or in the near future.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 219,486**	**—**	**$ 219,486**
ALTERNATIVE	**$ 0**	**—**	**$ 0**
SAVINGS	**$ 219,486**	**—**	**$ 219,486**

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 13

DESCRIPTION: Eliminate Sidewalk & Associated Curb & Gutter So. of Nebo Rd SHEET NO.: 2 of 3

Quantities

Sidewalk (SY):

$5' \cdot (35+90 - 12+00) \cdot \frac{1\,SY}{9\,ft^2} \cdot 2 = 2656\ SY$ ✓

Curb & Gutter (LF)

$(35+90 - 12+00)\,ft \cdot 2 = 4790\ LF$ ✓

Property (Acre)

± 4' decrease for high fill sections

$(150' + 200' + 200' + 140' + 200') \cdot 4' \cdot \frac{1\,Acre}{43{,}560\,ft^2}$

± 17+50 Rt; ± 24+50 Rt & Lt; ± 29+50 Rt; ± 31+50 Rt; ± 33+50 Rt

$= 0.1\ Acre$

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 13

DESCRIPTION

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Sidewalk	SY	2,656	37.34	99,175			
Curb and Gutter	LF	4,780	14.32	68,450			
Construction Subtotal				167,625			
Markup at 25.76%				43,180			
Construction Total				210,805			
Right-of-Way Reduction	AC	0.10	25,000	2,500			
Markup at 247.24%				6,181			
Right-of-Way Total				8,681			
Sub-total				219,486			
Mark-up at 25.76%				INCL			
TOTAL				219,486			

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY** *Design Development*	ALTERNATIVE NO.:	**15**
DESCRIPTION:	**REDUCE FILL NORTH OF RAILROAD BY USING GUARDRAILS AND 2:1 EMBANKMENT SLOPES**	SHEET NO.:	**1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the use of 4:1 embankments slopes at the railroad bridge.

ALTERNATIVE: (Sketch attached)

Use 2:1 embankment slopes and guardrails from the north end of the railroad bridge to where the alignment is close to existing ground elevation.

ADVANTAGES:

- Reduces right-of-way takes
- Decreases initial cost
- Easier to construct
- Could reduce construction time

DISADVANTAGES:

- Increases maintenance cost associated with the guardrails
- Perhaps not as aesthetically pleasing

DISCUSSION:

This proposed alignment of the railroad bridge necessitates fills in excess of 20 feet at the north end of the bridge. Using 2:1 slopes the right-of-way takes to decrease impacts and save money.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 652,225**	**—**	**$ 652,225**
ALTERNATIVE	**$ 105,827**	**—**	**$ 105,827**
SAVINGS	**$ 546,398**	**—**	**$ 546,398**

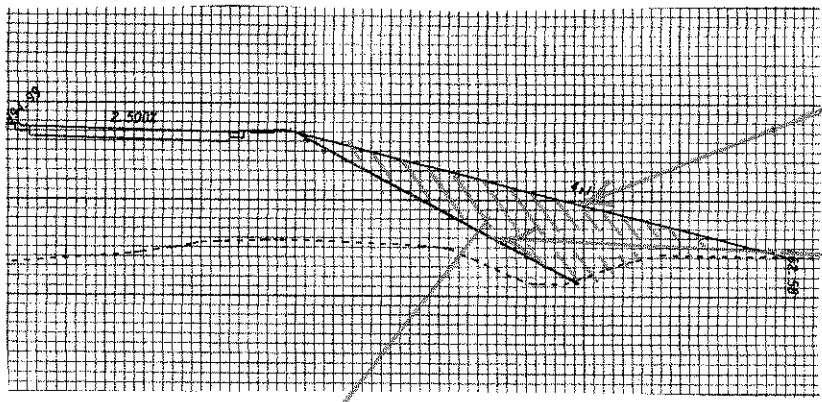
SKETCHES

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 15

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



Sketch S-1

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 15

DESCRIPTION: Reduce Fill North of Railroad Bridge by Using Guardrail & 2:1 Slopes

SHEET NO.: 3 of 4

Quantities

Fill:

Reduction in fill from Sta 77+50 to 86+00
= 38,118 CY

Right of Way Reduction:

Area = 59,700 SF = 1.4 Acre

Guardrail Increase:

Sta 77+50 to 86+00
L= 1700 LF

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 15

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Fill (Borrow)	CY	38,118	6.00	228,708			
Guardrail	LF				1,700	49.50	84,150
Subtotal Construction				228,708			84,150
Markup at 25.76%				58,915			21,677
Total Construction				287,623			105,827
Right-of-Way Reduction	AC	1.40	75,000	105,000			
Markup at 247.24%				259,602			
Right-of-Way Total				364,602			
	Sub-total			652,225			105,827
Mark-up at	25.76%			INCL			INCL
	TOTAL			652,225			105,827

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **19**

DESCRIPTION: **ELIMINATE SIDEWALKS AND ASSOCIATED CURB AND GUTTER FROM STATION 145+00 TO STATE ROUTE 120**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The current design calls for the use of sidewalks and associated curb and gutter for the entire project.

ALTERNATIVE:

Eliminate the sidewalks and associated curb and gutter from north of the business area near SR 92 and US 278/SR 6 through a rural, large-parcel residential area, up to the area where another business area exists south of SR 120 and STA 264+00.

ADVANTAGES:

- No change in drainage flow conditions
- Decreases in initial cost
- Does not construct sidewalks where it use is dubious
- Decreases earthwork
- Reduces the right-of-way takes

DISADVANTAGES:

- Increased storm water run-off to the ditches
- Sidewalks not available
- Loss of amenity

DISCUSSION:

This area of the alignment includes a rural, large-parcel residential area where the sidewalk would not be used. If the citizens living in this area are not requesting sidewalks, their elimination should be considered. Point-to-point destinations are not evident to have sidewalks constructed at this time or in the near future.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,144,990**	**—**	**$ 1,144,990**
ALTERNATIVE	**$ 0**	**—**	**$ 0**
SAVINGS	**$ 1,144,990**	**—**	**$ 1,144,990**

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 19

DESCRIPTION: Eliminate Sidewalks and Curb & Gutter From Sta 145+00 to SR 120 SHEET NO.: 2 of 3

Quantities

Length :

145+00 to 264+00, $L = 2 \cdot 11{,}900 = 23{,}800\,ft$

Sidewalk (SY)

Area $= 23{,}800\,ft \cdot 5\,ft \cdot \frac{1\,SY}{9\,ft^2} = 13{,}222\,SY$

Curb & Gutter

$L = 23{,}800\,ft$

Right of Way

Est. 2' decrease

Area $= 23{,}800\,ft \cdot 2\,ft \cdot \frac{1\,Acre}{43{,}560\,ft^2}$

$= 1.1\,Acre$

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 19

DESCRIPTION

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Sidewalk	SY	13,222	37.34	493,709			
Curb and Gutter	LF	23,800	14.32	340,816			
Construction Subtotal				834,525			
Markup at 25.76%				214,974			
Construction Total				1,049,499			
Right-of-Way Reduction	AC	1.10	25,000	27,500			
Markup at 247.24%				67,991			
Right-of-Way Total				95,491			
	Sub-total			1,144,990			
Mark-up at	25.76%			INCL			
	TOTAL			1,144,990			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **20**

DESCRIPTION: **ELIMINATE ALL SIDEWALKS AND ASSOCIATED CURB AND GUTTER IN NON-BUSINESS AREAS**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The current design calls for the use of sidewalks and associated curb and gutter for the entire project.

ALTERNATIVE:

Eliminate the sidewalks and associated curb and gutter in rural, large-parcel residential areas of the alignment. These areas include: (1) STA 12+00 to 25+50, (2) STA 53+00 to 68+00, (3), STA 79+00 to 109+50, and (4) STA 145+50 to 307+00.

ADVANTAGES:

- No change in drainage flow conditions
- Decreases initial cost
- Decreases earthwork
- Reduces the right-of-way takes
- Decreases storm water run-off

DISADVANTAGES:

- Increased storm water run-off to the ditches
- Sidewalks not available in rural residential areas
- Loss of amenity

DISCUSSION:

Constructing sidewalks only in areas where businesses exist provides connectivity for pedestrians in those specific areas. Sidewalks constructed in rural residential areas will not be used add unnecessary costs to the project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,254,767**	**—**	**$ 1,254,767**
ALTERNATIVE	**$ 0**	**—**	**$ 0**
SAVINGS	**$ 1,254,767**	**—**	**$ 1,254,767**

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 20

DESCRIPTION: Eliminate All Sidewalks and Curb & Gutter in Non-Business Areas

SHEET NO.: 2 of 3

Quantities

Lineal Feet of Sidewalk and Curb & Gutter:

Sta 12+00 to 35+50, L = 2350 ft · 2
Sta 53+00 to 68+00, L = 1,500 ft · 2
Sta 79+00 to 109+50, L = 3,050 ft · 2
Sta 145+50 to 307+00, L = 16,150 ft · 2

L = 46,100 ft

Sidewalk (SY):

$$\text{Area} = 46{,}100\ \text{ft} \cdot 5\ \text{ft} \cdot \frac{1\ \text{SY}}{9\ \text{ft}^2} = 5{,}122\ \text{SY}$$

Curb & Gutter

L = 46,100 ft

Right of Way

Est 2' decrease

$$\text{Area} = 46{,}100\ \text{ft} \cdot 2\ \text{ft} \cdot \frac{1\ \text{Acre}}{43{,}560\ \text{ft}^2}$$

= 2.12 Acre

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 20

DESCRIPTION

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Sidewalk	SY	5,122	37.34	191,255			
Curb and Gutter	LF	46,100	14.32	660,152			
Construction Subtotal				851,407			
Markup at 25.76%				219,323			
Construction Total				1,070,730			
Right-of-Way Reduction	AC	2.12	25,000	53,000			
Markup at 247.24%				131,037			
Right-of-Way Total				184,037			
Sub-total				1,254,767			
Mark-up at	25.76%			INCL			
TOTAL				1,254,767			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **22**

DESCRIPTION: **USE LANDSCAPED MEDIANS**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The intended design appears to provide raised concrete medians throughout the project, including the crossroad improvements.

ALTERNATIVE: (Sketch attached)

Consider the use of landscaped or grassed medians throughout the project area.

ADVANTAGES:

- Enhances the aesthetics of the facility
- Improves the surrounding environment
- Provides for community pride
- Improves the Department's good neighbor image
- Allows for community involvement
- Promotes sustainable/"green" design

DISADVANTAGES:

- Could increase the initial cost dependent on the type of selected vegetation and plantings beyond just grassing
- Increases operation and maintenance costs associated with pruning, mowing, watering, etc.
- Requires periodic replacement of some plantings

DISCUSSION:

The Department's desire to minimize long term maintenance costs, especially in a "rural minor arterial" facility, does not preclude the potential for some landscaping. Such an undertaking could be carried out by the Department or by entering into an agreement(s) with local civic, gardening, or wives' clubs to maintain the landscaping after initial planting. The use of xeriscape should be considered wherein drought tolerant species or wild flowers can be used to minimize the maintenance and watering demands.

Use of landscaping could promote civic pride in what would otherwise be considers a utilitarian facility. With sufficient local participation, a show-case environment could be developed that focuses attention to the City of Hiram its immediate surroundings and communities.

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

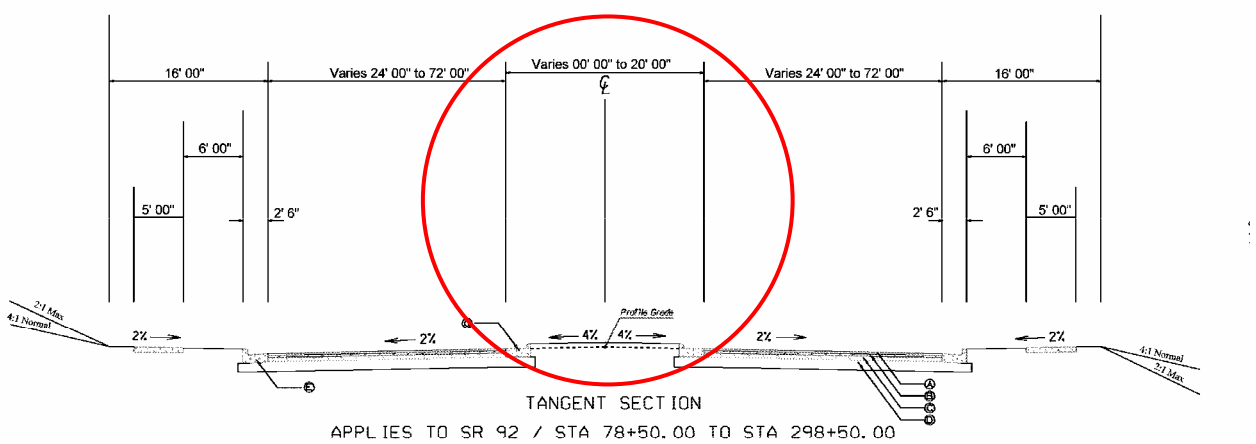
SKETCHES

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: 22

☑ AS DESIGNED ☐ ALTERNATIVE

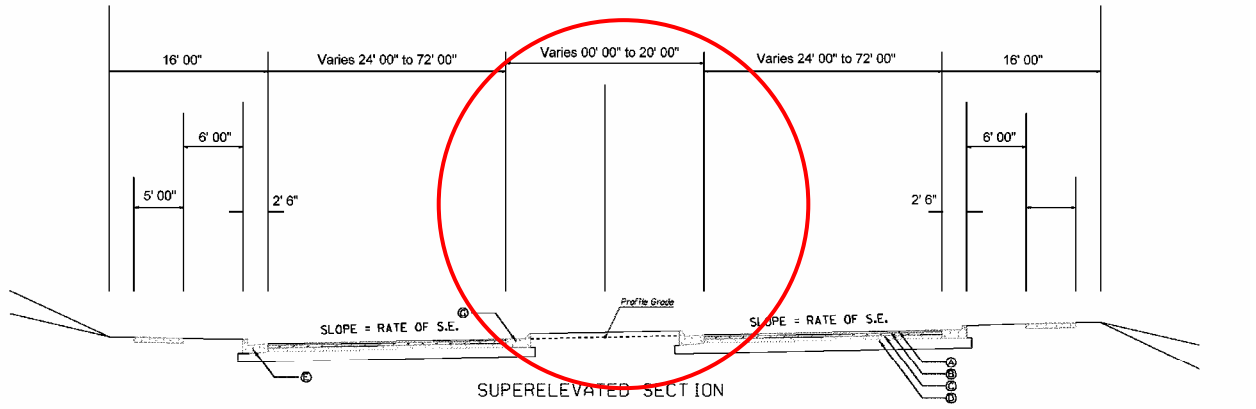
SHEET NO.: 2 of 3



TANGENT SECTION

APPLIES TO SR 92 / STA 78+50.00 TO STA 298+50.00

REQUIRED PAVEMENT
Ⓐ RECYCLED ASPH CONC 12.5 mm SUPERPAVE GP 2 ONLY, 165 lbs/yd2 MIX DESIGN LEVEL "C"
Ⓑ RECYCLED ASPH CONC 19 mm SUPERPAVE GP 1 OR GP 2, 220 lbs/yd2 MIX DESIGN LEVEL "B"
Ⓒ RECYCLED ASPH CONC 25 mm SUPERPAVE GP 1 OR GP 2, 770 lbs/yd2 MIX DESIGN LEVEL "B"
Ⓓ GRADED AGGREGATE BASE, 12"
Ⓔ 8" X30" CONC. CURB & GUTTER GA. STD. 9032 B, TYPE 2
Ⓕ 8" X30" CONC. CURB & GUTTER GA. STD. 9032 B, TYPE 7



SUPERELEVATED SECTION

SEE PLANS FOR THE SUPERELEVATED LOCATIONS.

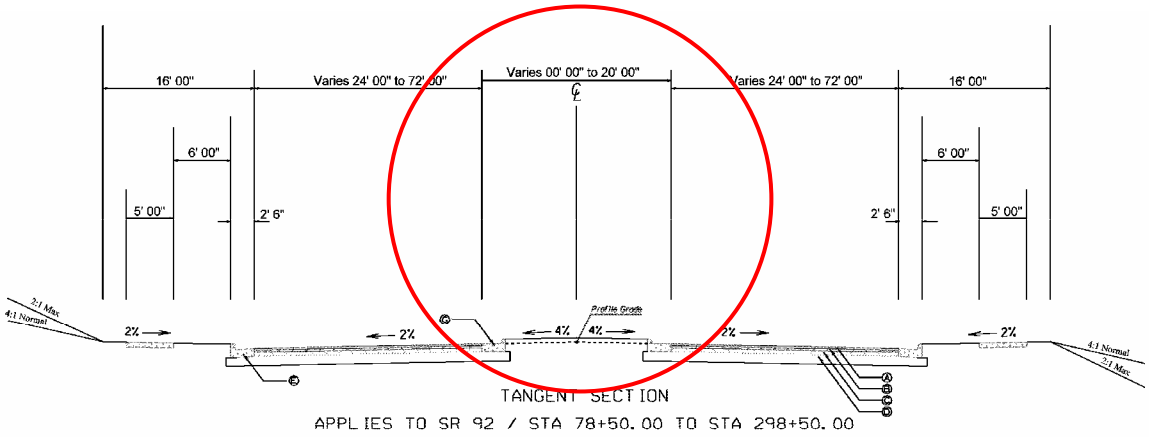
SKETCHES

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: 22

❑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 3



TANGENT SECTION

APPLIES TO SR 92 / STA 78+50.00 TO STA 298+50.00

REQUIRED PAVEMENT
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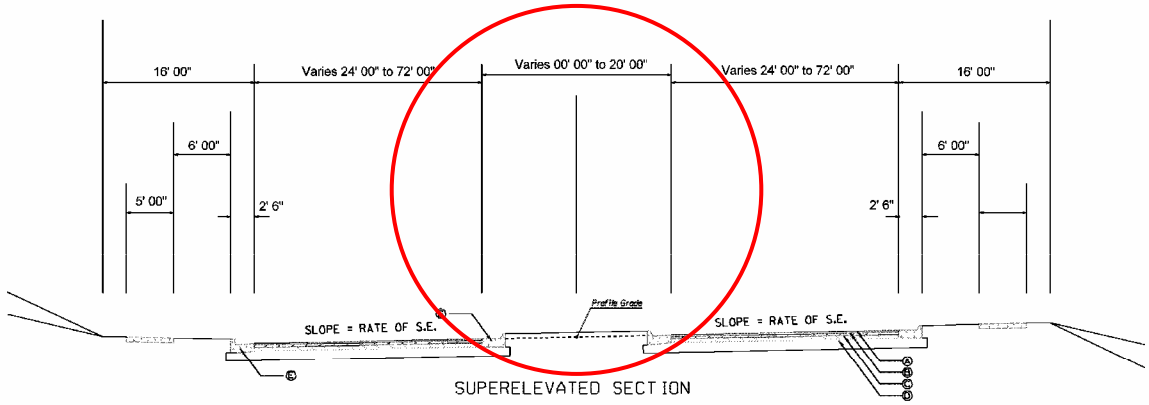
Ⓒ RECYCLED ASPH CONC 25 mm SUPERPAVE GP 1 OR GP 2, 770 lbs/yd2 MIX DESIGN LEVEL "B"
Ⓓ GRADED AGGREGATE BASE, 12"
Ⓔ 8" X30" CONC. CURB & GUTTER GA. STD. 9032 B, TYPE 2
Ⓕ 8" X30" CONC. CURB & GUTTER GA. STD. 9032 B, TYPE 7



SUPERELEVATED SECTION

SEE PLANS FOR THE SUPERELEVATED LOCATIONS.

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120, PAULDING COUNTY**
Design Development

ALTERNATIVE NO.: **24**

DESCRIPTION: **USE MECHANICALLY STABILIZED EARTH WALLS BETWEEN CHURCH AND DALLAS STREETS**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design solutions indicates an elevated section requiring the use of a standard 4:1 sloped embankments along SR 92 at Church and Dallas Streets in Hiram, Georgia.

ALTERNATIVE: (Sketch attached)

Use mechanically stabilized earth (MSE) walls with barrier to eliminate the necessary backfill on SR 92 between Church and Dallas Streets.

ADVANTAGES:

- Reduces fill requirements
- Reduce right-of-way takes
- Reduces Historic Property No. 2 loss from 75% to <10%
- Saves Hiram Animal Hospital from demolition and relocation

DISADVANTAGES:

- Adds initial cost
- Changes the aesthetic appearance of downtown Hiram

DISCUSSION:

The new profile is off-line and with an average height of 16 feet. MSE walls are being used for the adjacent bridge abutments and roadway along the Hiram Historic District.

The taking <10% of the Historic Property No. 2 vs. a 75% take and the saving of the Hiram Animal Hospital warrants serious consideration of this alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,140,079**	—	**$ 1,140,079**
ALTERNATIVE	**$ 1,857,570**	—	**$ 1,857,570**
SAVINGS	**$ (717,491)**	—	**$ (717,491)**

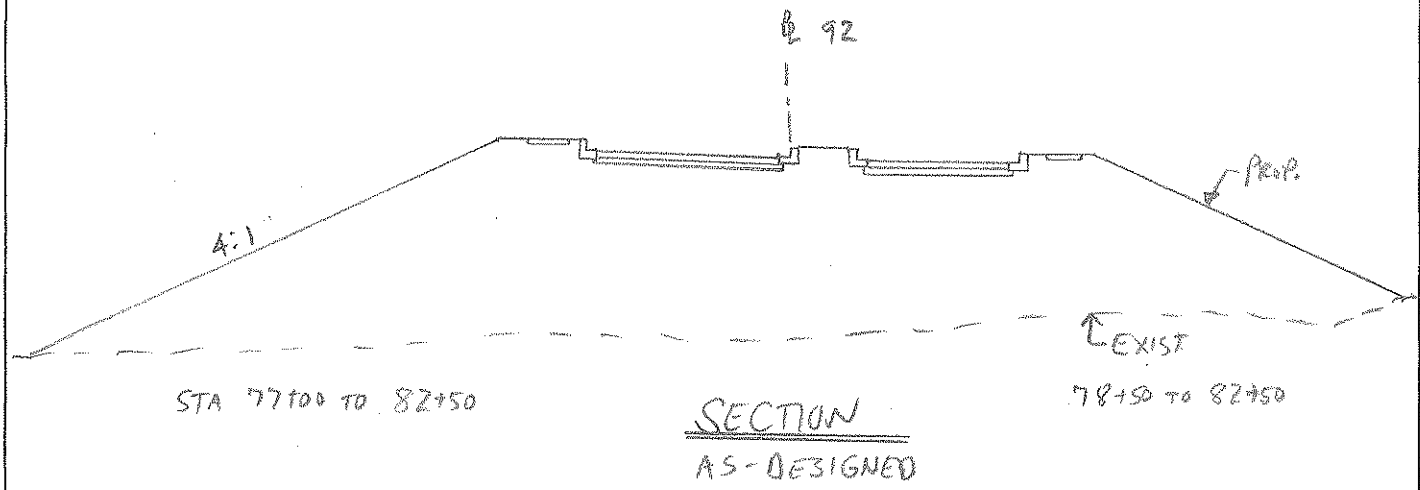
SKETCHES

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

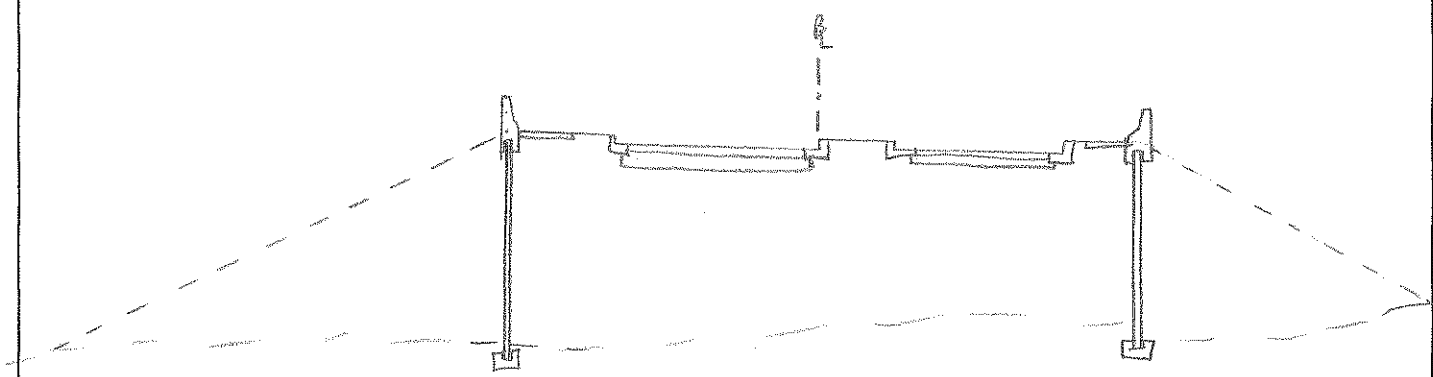
ALTERNATIVE NO.: 24

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 5



SECTION
AS-DESIGNED



SECTION
ALTERNATIVE

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 2 4

DESCRIPTION: USE MSE WALLS BETWEEN CHURCH + DALLAS STREETS

SHEET NO.: 3 of 5

MSE WALL => WEST: (36'+36'+32'+34'+42'+44'+42'+38'+32'+22'+16'+12') 1/12 = 32' AVE$_W$

WEST => (8250 - 7750) 32' = 16,000 SF

EAST: (12'+12'+13'+13'+13'+12'+12'+11'+9') 1/9 = 23.8' AVE$_E$

=> (8250 - 7850) 23.8 = 9,520 SF

TOTAL = 25,520 SF

BARRIER => 900'

GRAVITY WALL => W: 12' AVE HT, 50' TO DALLAS + 75' ALONG DALLAS ST.

= 12' (50'+75') = 1300 SF

E: 6' AVE HT., 50' + 180' ALONG CHURCH ST.
+ 50' + 220' ALONG DALLAS ST.

= 12 (50+180+50+220) = 6,000 SF

RETAINING WALL COST => 550 $/CY [(12'x1.5'x1') + (12'x2'x1')] 1/27 = 855 $/LF

TOTAL => 625 LF

ROW:

W: (0+85+185+185+185+175+165+150+160+70+40+30+30+0) 1/14 = 100' AVE

(8300 - 7700) + 75' = 675 LF A_W = (675 x 100) 1/43,560 = 1.55 ACRES

E: (0+105+100+100+135+130+110+90+80+75+105+80+70+20) 1/14 = 85' AVE

(8300 - 7800) + 50' + 220 + 50 + 180 = 1000' A_E = (1000' x 85) 1/43,560 = 1.95 ACRES

3.5 ACRES

CALCULATIONS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

ALTERNATIVE NO.: 24

DESCRIPTION: USE MSE WALLS BETWEEN CHURCH + DALLAS ST.

SHEET NO.: 4 of 5

SLOPE FILL:

	WEST L	WEST H (½)	WEST A (CY)	EAST L	EAST H (½)	EAST A (CY)
77+00	0	0				
+50	85	36	1416.7			
78+00	185	32	4157.4			
+50	185	34	5652.8	0	0	1166.6
79+00	185	42	6509.2	105	24	2277.5
+50	175	44	7162.0	100	24	2314.8
80+00	165	42	6773.2	100	26	2528.8
+50	150	38	5847.2	135	26	3989.5
81+00	100	32	4120.4	130	26	2757.0
+50	70	22	2194.4	110	24	2222.2
82+00	40	16	1009.2	90	24	1814.8
+50	30	12	463.0	80	22	1439.8
83+00	30	12	333.4	75	18	
DALLAS 75'	0	0	250.0	CHURCH 250'	125	24 – 13.8
				DALLAS 275'	125	18 – 10.4
			45,858 CY			20,069 CY

TOTAL = 65,957 CY

COST WORKSHEET

PROJECT: **STP-186-1(25), PI 621720, WIDENING & RECONSTRUCTION OF SR 92 FROM S OF NEBO ROAD TO N OF SR 120**
Paulding County, Georgia Dept. of Transportation, District 6
Design Development

ALTERNATIVE NO: 24

DESCRIPTION

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Slope Embankment - Fill	CY	65,957	6.00	395,742			
MSE Walls							
MSE Walls	SF				25,520	35.00	893,200
Barrier	LF				900	55.00	49,500
Retaining Wall	LF				625	855	534,375
Construction Subtotal				395,742			1,477,075
Markup at 25.76%				101,943			380,495
Total Construction				497,685			1,857,570
Right-of-Way Costs							
Residential	AC	1.55	25,000	38,750			
Commercial	AC	1.95	75,000	146,250			
Right-of-Way Subtotal				185,000			
Markup at 247.24%				457,394			
Total Right-of-Way				642,394			
Sub-total				1,140,079			1,857,570
Mark-up at 25.76%				INCL			INCL
TOTAL				1,140,079			1,857,570

PROJECT DESCRIPTION

BACKGROUND

The Atlanta Regional Commission (ARC) adopted the 2025 Transportation Plan for the 13-county Atlanta Metropolitan area in April 2000. The Plan addresses travel needs through the year 2025. The Regional Transportation Plan (RTP) is the direct result of a comprehensive, cooperative, and continuous planning process conducted by ARC, local governments and the Georgia Department of Transportation in cooperation with the Federal Highway and Federal Transit Administrations. The proposed project is recommended for widening in the Transportation Improvement Plan/RTP.

TRAVEL DEMAND AND OPERATIONAL CHARACTERISTICS

State Route 92 between Nebo Road and SR 120 is presently operating at an unacceptable level of service (LOS) "F." With the proposed improvement, the LOS would change to LOS "C" and "D" in the year 2029. The existing traffic on SR 92 between Nebo Road and SR 120 varies between 19,900 average annual daily traffic (AADT) and 29,550 AADT. It is anticipated that traffic will increase to 28,900 AADT and 42,400 AADT, respectively, in the year 2029. This is an increase in of approximately 62% for this section of roadway. The additional lanes would improve traffic movement and would improve the Level of Service and travel conditions.

SAFETY

The following table compares the accident rate on SR 92 to the statewide average for a similar classified facility for the traffic station with the highest present traffic. The 2000, 2001, and 2002 accident rates along SR 92 in Paulding County were over the statewide average for a road of this type (rural minor arterial).

SR 92, Paulding County — Rural Minor Arterial, Milepost 5.68 to 10.10	Year 2000	2001	2002
Total Accidents	93	86	85
Accidents Per 100 Monthly Vehicle-Miles of Travel (MVMT)	288	283	275
Statewide Accidents Per 100 MVMT	182	190	208
Accident Ratio	1.58	1.49	1.32

The above accident analysis indicates SR 92, on average, experiences accidents at a rate exceeding the statewide average for similar classified facilities. The total number of injuries for 2000, 2001 and 2002 was 177 injuries with two fatalities and the majority of the accidents were classified as "rear end" or "angle intersecting."

NEED AND PURPOSE

The purpose of this project is to improve system efficiency for motorists traveling on SR 92 from Nebo

Road to SR 120. The traffic can be attributed to accelerated growth in the county. The need and purpose of the proposed improvements are to provide additional through lanes in order to improve the LOS to acceptable levels and provide a safer driving environment.

DESCRIPTION OF THE PROPOSED PROJECT

The proposed project, a rural minor arterial, reconstructs SR 92 beginning at Nebo Road and extending north to SR 120. The above mentioned section of road would be widened from a two-lane, two-way section to a four-lane, two-way section and would contain a 20-foot raised median. The existing bridges over the Norfolk Southern Railroad and the Silver Comet Trail will be replaced. The original design load capacity is H-15 and in accordance with GDOT policy these bridges are classified as "Functionally Obsolete." Also, the sufficiency ratings on the structures are 48 and 47.9 respectively. The Office of Bridge Maintenance has determined that any structure with a sufficiency rating less than 50 should be replaced rather than improved. The total length of the proposed improvement is 4.52 miles.

Existing Design Features:

- Typical Section: two-lane roadways with 12-foot lane width except at major improved intersections;
- Posted speed: 45 miles per hour (mph);
- Width of right-of-way: 80 feet;
- Major structures: Bridges over the Norfolk Southern Railroad, Powder Springs Creek and Silver Comet Trail.
- Bridge/Culvert structures: (1) Mill Creek, sufficient rating = 87.00, (2) Norfolk Southern Railroad, sufficient rating = 48.00, (3) Silver Comet Trail, sufficient rating = 47.90, (4) Rake Straw Creek, sufficient rating = 89.90, and (5) Powder Springs Creek, sufficient rating = 90.30.
- Major interchanges or intersections along the project: US 278/SR 6, SR 360 and SR 120.
- Existing length of roadway segment and the beginning mile logs for each county segment: length of roadway - 4.5 miles and beginning mile log at Nebo Road - 5.68 miles.

Proposed Design Features:

- Proposed typical section(s): Four 12-foot lanes with a 20-foot raised medium, turning lanes at major intersections. Curb, gutter and sidewalks will be furnished.
- Proposed Design Speed Mainline: 45 mph.
- Proposed Maximum grade Mainline: 5% maximum grade; allowable 6%.
- Proposed Maximum grade Side Street: 5% Maximum grade; allowable 6%.
- Proposed Maximum grade driveway: 12.5%.
- Proposed Maximum degree of curve: 3° maximum; allowable 4.75º.
- Right of way: (1) width 100 feet, (2) permanent easements, (3) access control by permit, (4) number of parcels is 52 and number of business displacements is four.
- Structures: (1) bridges over Norfolk Southern Railroad and Silver Comet Trail will be replaced, (2) retaining walls - along SR 92 approaching the bridge over the Norfolk Southern Railroad.
- Major intersections: US 278/SR 6, SR 360, and SR 120.
- Traffic control during construction - traffic will be maintained during the construction.
- Design exceptions to controlling criteria anticipated: horizontal alignment.
- Design Variances: None.
- Environmental concerns: (1) no permits anticipated, (2) minimal contamination sites were identified at the following business locations: Jim Smith Wrecker/Body Shop, Hawg Cycles and Kirby Trucking.
- Level of environmental analysis: (1) No time savings procedures, (2) Environmental

assessment/finding of no significant impact
- Utility involvements: GreyStone Power Corporation, Atlanta Gas Light Company, and BellSouth.

Scheduling — Responsible Parties' Estimate:

- Time to complete the environmental process: 6 months;
- Time to complete preliminary construction plans: 12 months;
- Time to complete right-of-way plans: 12 months;
- Time to complete the Section 404 Permit: 0 months;
- Time to complete final construction plans: 12 months; and
- Time to complete to purchase right of way: 24 Months.

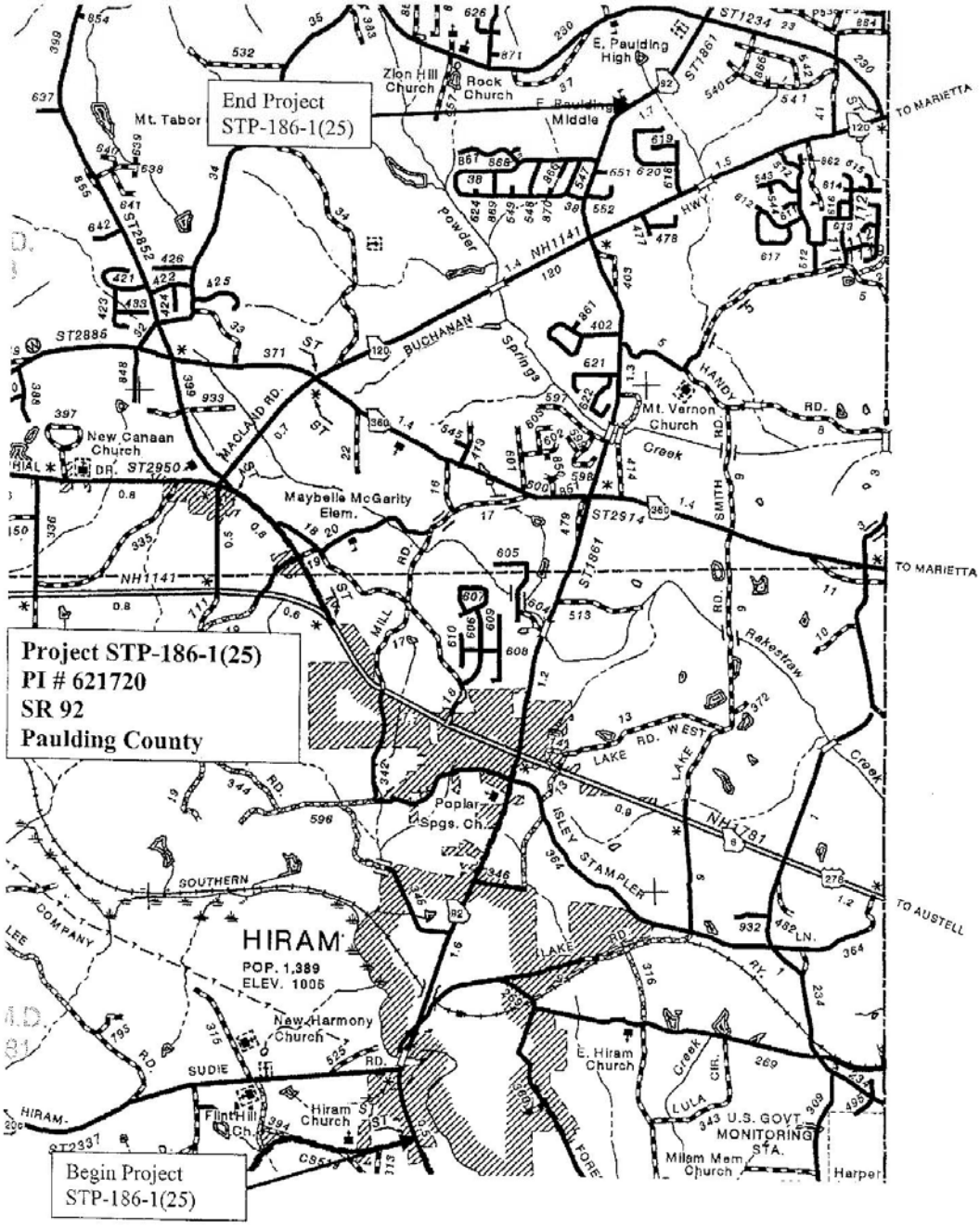
OTHER ALTERNATES CONSIDERED

- Reconstruct SR 92 beginning just south of Nebo Road and extending north to SR 120. The above mentioned section of road would be widened from two-lanes, one in each direction, to four-lanes, two in each direction, with a 20 foot raised median, curb and gutter, and sidewalks. The existing bridges over Mill Creek, the Norfolk Southern Railroad, and the Silver Comet Trail would be replaced. The total length of the proposed project is 4.65 miles. This alternate shifts the SR 92 alignment west over the section extending from the creek to just north of the Norfolk Southern Railroad tracks.

- Reconstruct SR 92 beginning just north of the bridge over Mill Creek and extending north to SR 120. The above mentioned section of road would be widened from two-lanes, one in each direction, to four-lanes, two in each direction, with a 20 foot raised median, curb and gutter, and sidewalks. The existing bridges over Mill Creek, the Norfolk Southern Railroad, and the Silver Comet Trail would be replaced. The total length of the proposed project is 4.85 miles. This alternate would shift the SR 92 alignment east at the south end of the project, crosses Mill Creek at a new location requiring a new bridge and effectively bypasses the southern part of Hiram.

PROJECT COSTS

The current projected probable cost of construction is listed to be $41,686,062 and is based on GDOT's *Preliminary Cost Estimate* dated June 12, 2006. This figure includes: inflation (based on 5.00% per annum for three years) at 15.76% for $4,449,004 and engineering and construction at 10.00% for $2,822,524. Furthermore, the Preliminary Right-of-Way Cost Estimate, prepared by GDOT, is noted to be $5,528,040 that includes a Scheduling Contingency of 55.02% for $875,875, an Administration/Court Cost of 60.00% for $1,480,725, and an Inflation Factor of 40.00% for $1,579,440. Thus, the total project cost is $41,686,062.


End Project
STP-186-1(25)
Project STP-186-1(25)
PI # 621720
SR 92
Paulding County
Begin Project
STP-186-1(25)
HIRAM
POP. 1,389
ELEV. 1005
TO MARIETTA
TO MARIETTA
TO AUSTELL
Mt. Tabor
Zion Hill Church
Rock Church
E. Paulding High
E. Paulding Middle
Powder
Springs
BUCHANAN
HWY.
NH1141
ST2885
ST2852
ST1234
ST1861
MACLAND RD.
New Canaan Church
ST2950
Maybelle McGarity Elem.
Mt. Vernon Church
Creek
HANDY
RD.
SMITH
ST2514
MILL
Rakestraw
LAKE
RD. WEST
Poplar Spgs. Ch.
ISLEY STAMPLER
SOUTHERN
COMPANY
LEE
SUDIE
New Harmony Church
Flint Hill Ch.
Hiram ST
E. Hiram Church
LULA
343 U.S. GOVT. MONITORING STA.
Milam Mem. Church
Harper

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis procedure used during the value engineering study. It is followed by separate narratives and conclusions concerning:

- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

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

PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks; gathering necessary background information on the facility; and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase *(not conducted)*

Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information about the

project to the VE team on first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- ***Project Concept Report Approval*** prepared by the Department of Transportation, State of Georgia, Office of Preconstruction for the SR-92 Widening/Reconstruction, Project Number STP-186-1(25) Paulding County, P. I. Nos. 621720, 621002, and 632921 dated February 9, 2005; Containing: Cost Estimates including Construction, Right-of-Way, and Utilities costs; Sketch Location Map; Typical Sections; Accident Summaries; Capacity Analysis; Letter of Concept Conformity; and Minutes of Initial Concept and Concept meetings;
- ***Detailed Estimate Report*** for file "311910" prepared by Kimley-Horn and Associates, Inc. dated June 13, 2006;
- ***Half Size Drawings of Plan and Profile*** of the proposed Widening and Reconstruction of SR 92 from South of Nebo Road to North of SR 120, Federal Aid Project STP-186-1(25), Paulding County, Federal Route N/A, State Route No. 92, P. I. No. 621720 prepared by the Department of Transportation, State of Georgia, printed January 3, 2006;
- ***General Highway Map***, Paulding County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Planning Data Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1987;
- ***Aerials*** of the three considered alternatives for STP-186-1(25); and
- ***Compact Disc*** containing the design drawings for SR-92 Widening/Reconstruction, Project Number STP-186-1(25) Paulding County, P. I. Nos. 621720, prepared by the Department of Transportation, State of Georgia, dated September 20, 2006.

Function Identification and Analysis Phase

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element; serve as a basis for alternative functional categorization; and to assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and Function Analysis Systems Technique (F.A.S.T.) diagram.

Speculation Phase

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and association of ideas.

The Georgia Department of Transportation (GDOT) representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the speculation phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts, in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally high-rated items may not have been developed into alternatives.

Development Phase

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

Presentation Phase

The last phase of the VE study would have been to present the findings of the study; however GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending either incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. 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.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour Value Engineering (VE) study on the **STP-186-1(25), P. I. No. 621720, Widening and Reconstruction of SR 92 from South of Nebo Road to North of SR 120** project located in Paulding County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) who is also the design team, will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

VE Study Agenda

The VE study will follow the outline described below and be conducted September 20 - 22, 2006. The study will be conducted in Room 444, Road Design Room in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

Wednesday, September 20th

9:00 am – 9:15 am	**General Introduction of all Parties and review of the VE Process**
9:15 am - 11:15 am	**Owner's / Designer's Presentation**

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

11:15 am - 12:00 noon	**Commence Function Analysis Phase**

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

12:00 noon - 1:00 pm	**Lunch**
1:00 pm - 5:00 pm	**Conclude the Function Analysis Phase and Commence the Creative Phase**

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

Thursday, September 21st

8:30 am - 10:00 am **Conclude Creative Phase and Complete Evaluation / Analytical Phase**

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

10:00 am - 12:00 noon **Development Phase**

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

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

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

Friday, September 22nd

8:30 am - 12:00 am **Continue Development Phase**

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

1:00 pm - 4:00 pm **Conclude Development Phase and Commence Summary Worksheets**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise on the unique project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following professionals:

Dominic F. Saulino	Transportation Engineer	HNTB
Lawrence D. Prescott, PE	Structural/Bridge Engineer	HNTB
Jeffery G. Dingle, PE	Construction Specialist/ Transportation Engineer	Delon Hampton and Associates
Luis M. Venegas, PE, CVS-Life, LEED® AP	Value Engineering Facilitator	Lewis & Zimmerman Associates, Inc.

OWNER'S/DESIGNER'S PRESENTATION

The Georgia Department of Transportation (GDOT) presented an overview of the project on Wednesday, September 20, 2006. 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. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention.

A copy of the meeting participants is attached for reference.

VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Friday, September 22, 2006 to GDOT; however, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT personnel.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120 Paulding County, Georgia Department of Transportation, District 6** ***Design Development***		Date: **September 20 – 21, 2006**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Clay C. Bastian em: clay.bastian@dot.state.ga.us	State of Georgia, Department of Transportation (GDOT), Office of Road and Aviation Design Design Group Manager	ph: 404-656-5400 cell: fx: 404-657-0653
Kenny Beckworth em: kenny.beckworth@dot.state.ga.us	GDOT, District 6 Assistant District Construction Engineer	ph: 770-387-3609 cell: fx:
Paul F. Condit, EIT em: paul.condit@dot.state.ga.us	GDOT, Office of Environmental / Location Transportation Environmental Planner	ph: 404-699-4413 cell: fx: 404-699-4440
Judy Meisner em: judy.meisner@dot.state.ga.us	GDOT, Office of Bridge Design Bridge Design Assistant Group Engineer	ph: 404-476-5196 cell: fx:
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office Design Review Engineer Manager, Value Engineering Coordinator	ph: 404-651-7468 cell: fx: 404-463-6131
Walter D. Taylor, EIT em: walter.taylor@dot.state.ga.us	GDOT, Office of Road and Aviation Design Assistant Design Group Manager	ph: 404-656-5400 cell: fx: 404-657-0653
Ken Werho em: ken.werho@dot.state.ga.us	GDOT, Office of Traffic Safety and Design Traffic Operations Design Review and Concept Engineer	ph: 404-635-8144 cell: fx: 404-635-8116
Terry McCollister em: terrymacarmy@mindspring.com	ARCG, Inc. Right-of-Way Services Consultant	ph: cell: 404-702-3959 fx:
Jeffery G. Dingle, PE em: jdingle@delonhampton.com	Delon Hampton & Associates, Chartered Vice President, Southern Regional Office / Construction Specialist and Transportation Engineer	ph: 404-524-8030 cell: 404-427-0155 fx: 404-524-2575

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120 Paulding County, Georgia Department of Transportation, District 6** ***Design Development***		Date: **September 20 – 21, 2006**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Lawrence (Larry) Prescott, Jr., PE em: lprescott@hntb.com	HNTB Corporation Director of Structural Engineering	ph: 404-946-5743 cell: 77-231-8579 fx: 404-841-2820
Dominic (Dom) F. Saulino em: dsaulino@hntb.com	HNTB Corporation Director of Transportation	ph: 404-946-5743 cell: 706-313-1762 fx: 404-841-2820
Luis M. Venegas, PE, CVS-Life, LEED® AP em: lvenegas@lza.com	Lewis & Zimmerman Associates, Inc. VE Facilitator	ph: 770-992-3032 cell: 678-488-4287 fx: 770-435-2666
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ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation design team. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	**2006**
Construction Start Up:	**2009**
Construction Duration:	±**24** Months (2011)
Economic Planning Life: Economic Planning Life:	**35** years for Pavement **50** years for Bridges
Discount Rate / Interest:	**1.60%** (Latest United States Office of Management and Budget Circular A-94)
Inflation / Escalation Rate:	**5.00%** (Per GDOT)
Uniform Present Worth (UPW) Factor:	**26.6408** for 35 years **34.2385** for 50 years

Cost

Composite Mark-Up (Construction): *(Composed of: Inflation at 15.76% based 5.00% per annum for three years, and Engineering and Construction at 10.00%.)*	**25.76%** (1.2576)
Composite Mark-Up (Right-of-Way): *(Composed of: Scheduling Contingency at 55.02%; Administration / Court Costs at 60.00%; and Inflation Factor at 40.00 %.)*	**247.24%** (2.4724)

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

The VE team prepared several cost models for the project that is included following this page. The cost models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on *Preliminary Cost Estimate* for Project No. STP-186-1(25) prepared by the Georgia Department of Transportation Office of Road and Airport Design dated June 12, 2006. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

- Base and Paving
  - 5-inch Asphalt Paving - Base
  - 12-inch Aggregate Base
  - 2-inch Asphalt Paving - Binder
- Grading and Drainage
  - Curb and Gutter
  - Cross Drain Piping
  - Earthwork
- Major Structures
  - Bridge Replacement
- Miscellaneous
  - Sidewalks
  - Guardrail

DESIGNER'S COST ESTIMATE

The cost estimate, as described above, did contain sufficiently detailed information to perform a VE when considering the current, conceptual level of design.

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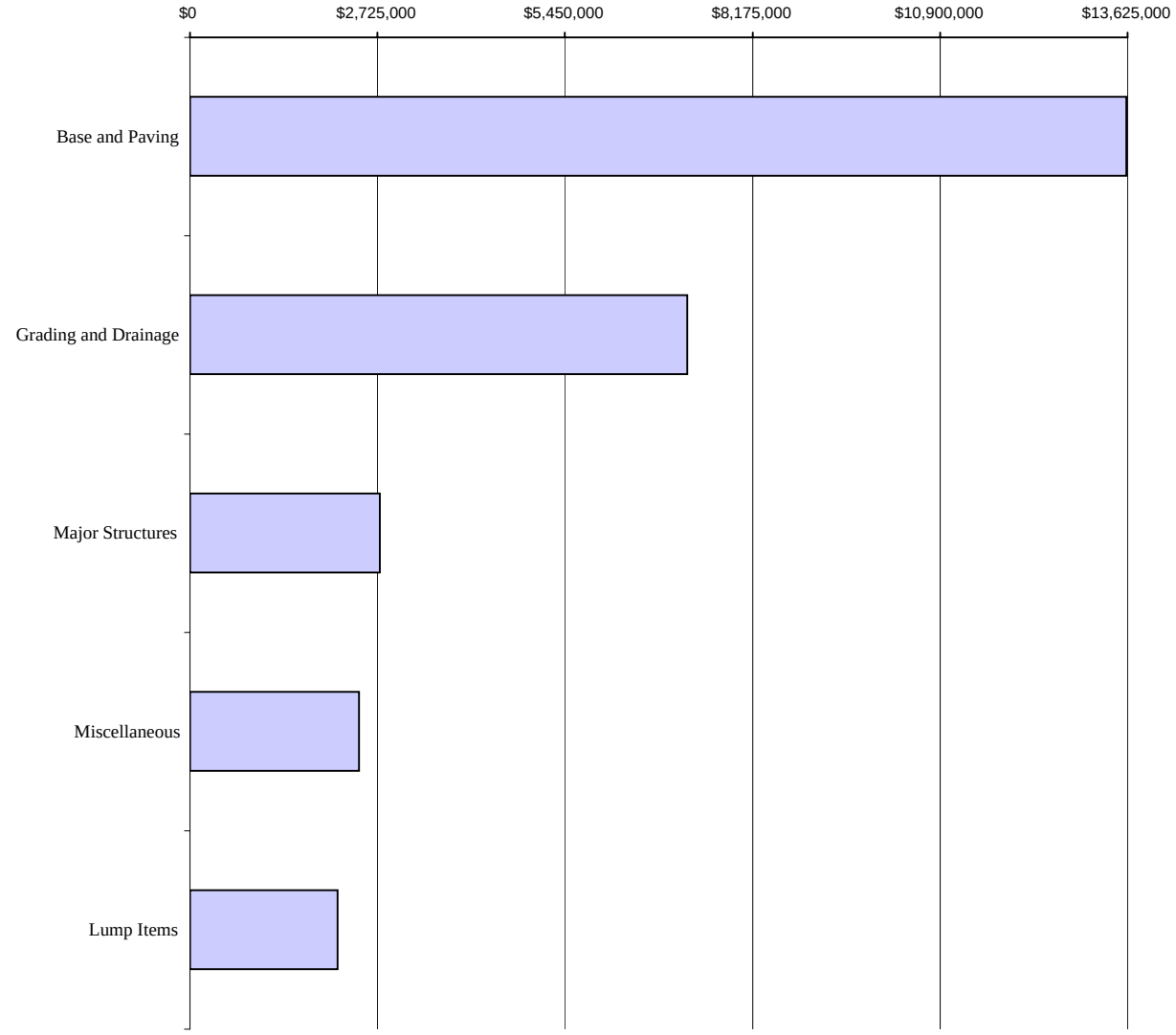
COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development Stage

TOTAL PROJECT		COST	PERCENT	CUM. PERCENT
Base and Paving		13,616,109	48.24%	48.24%
Grading and Drainage		7,233,780	25.63%	73.87%
Major Structures		2,764,450	9.79%	83.66%
Miscellaneous		2,460,905	8.72%	92.38%
Lump Items		2,150,000	7.62%	100.00%
Construction Subtotal		**$ 28,225,244**	**100.00%**	
Inflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 4,449,004		
Engineering and Construction @	10.00%	$ 2,822,524	**Construction**	
Construction Total		**$ 35,496,772**	Mark-Up:	25.76%
Net Right-of-Way		$ 1,592,000		
Right-of-Way Scheduling Contingency	55.02%	$ 875,875		
Right-of-Way Administration / Court Costs	60.00%	$ 1,480,725		
Right-of-Way Inflation Factor	40.00%	$ 1,579,440	**ROW**	
Right of Way Total		**$ 5,528,040**	Mark-Up:	247.24%
Reimbursable Utilities		$ 661,250		
GRAND TOTAL		**$ 41,686,062**		

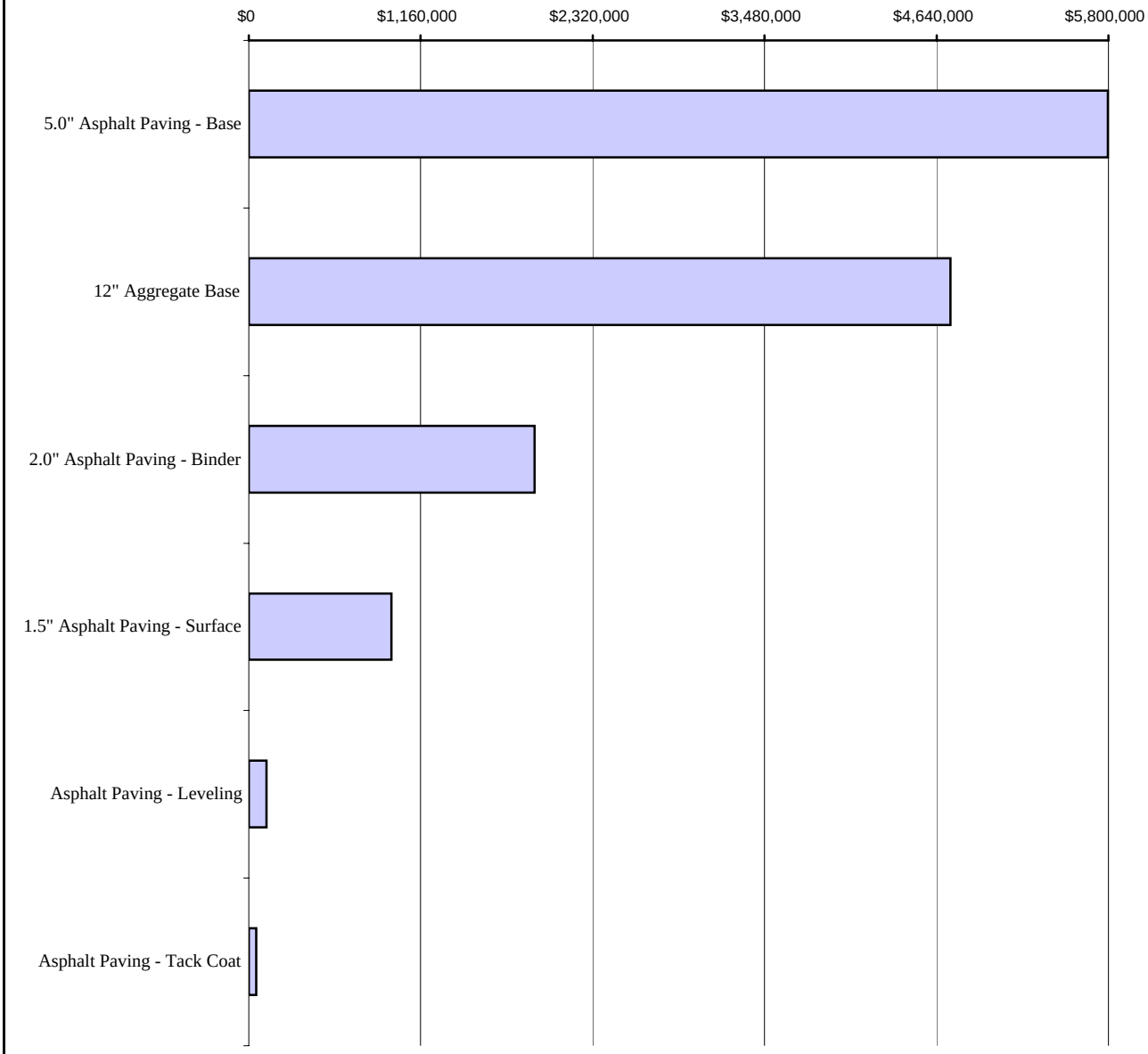


Costs in graph are not marked-up.

COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development Stage

BASE AND PAVING		COST	PERCENT	CUM. PERCENT
5.0" Asphalt Paving - Base		5,799,786	42.60%	42.60%
12" Aggregate Base		4,739,330	34.81%	77.40%
2.0" Asphalt Paving - Binder		1,933,262	14.20%	91.60%
1.5" Asphalt Paving - Surface		966,631	7.10%	98.70%
Asphalt Paving - Leveling		122,100	0.90%	99.60%
Asphalt Paving - Tack Coat		55,000	0.40%	100.00%
Construction Subtotal		**$ 13,616,109**	**100.00%**	
Inflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 2,146,239		
Engineering and Construction @	10.00%	$ 1,361,611	**Construction**	
Construction Total		**$ 17,123,959**	Mark-Up:	25.76%

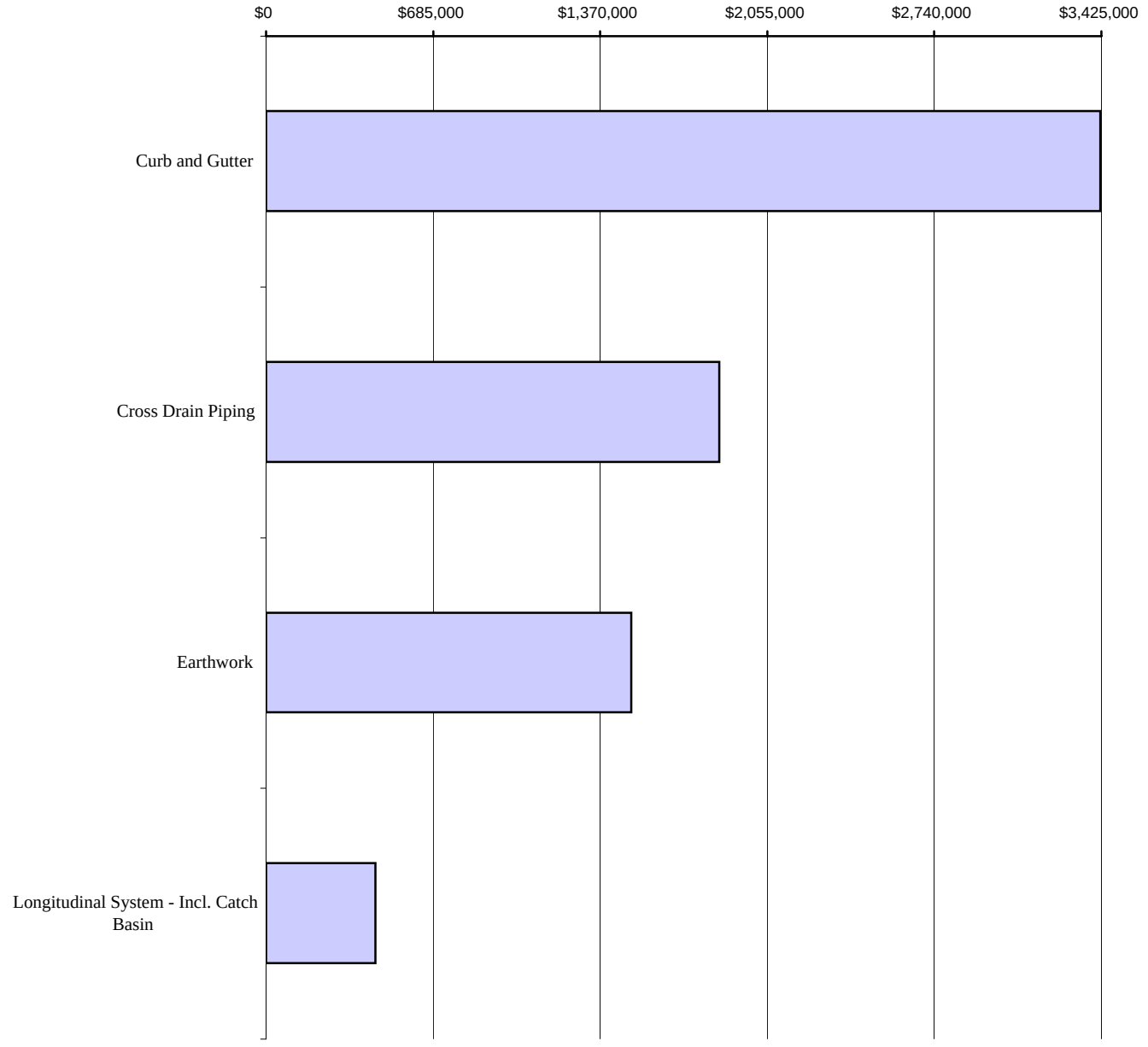


Costs in graph are not marked-up.

COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District
Design Development Stage

GRADING AND DRAINAGE		COST	PERCENT	CUM. PERCENT
Curb and Gutter		3,423,780	47.33%	47.33%
Cross Drain Piping		1,860,000	25.71%	73.04%
Earthwork		1,500,000	20.74%	93.78%
Longitudinal System - Incl. Catch Basin		450,000	6.22%	100.00%
Construction Subtotal		**$ 7,233,780**	**100.00%**	
nflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 1,140,225		
Engineering and Construction @	10.00%	$ 723,378	**Construction**	
Construction Total		**$ 9,097,383**	Mark-Up:	25.76%



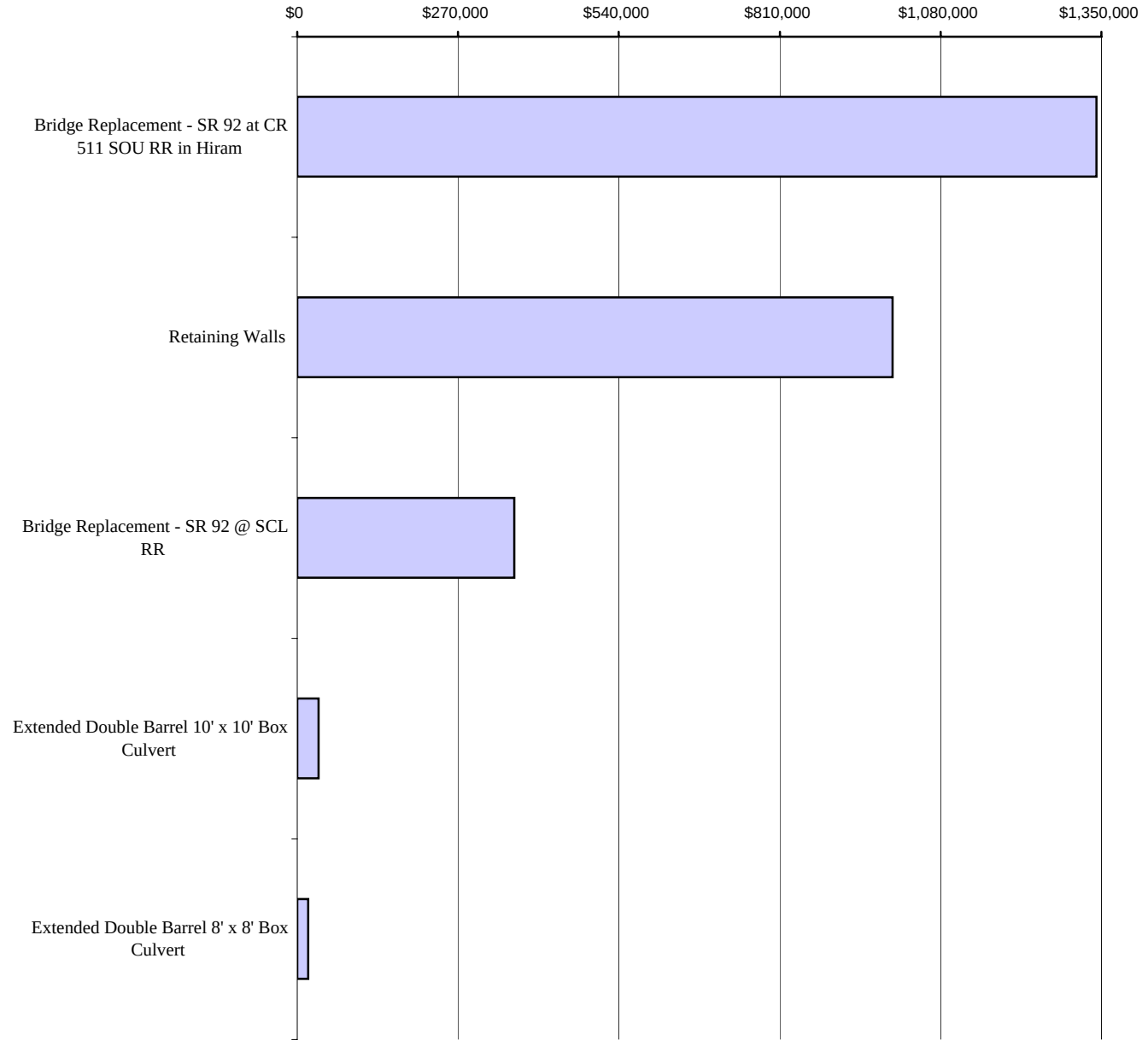
Costs in graph are not marked-up.

COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 12(Paulding County, Georgia Department of Transportation, District (**

Design Development Stage

MAJOR STRUCTURES		COST	PERCENT	CUM. PERCENT
Bridge Replacement - SR 92 at CR 511 SOU RR in Hiram		1,342,835	48.58%	48.58%
Retaining Walls		1,000,000	36.17%	84.75%
Bridge Replacement - SR 92 @ SCL RR		365,170	13.21%	97.96%
Extended Double Barrel 10' x 10' Box Culvert		37,065	1.34%	99.30%
Extended Double Barrel 8' x 8' Box Culvert		19,380	0.70%	100.00%
Construction Subtotal		**$ 2,764,450**	**100.00%**	
Inflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 435,746		
Engineering and Construction @	10.00%	$ 276,445	**Construction**	
Construction Total		**$ 3,476,641**	Mark-Up:	25.76%

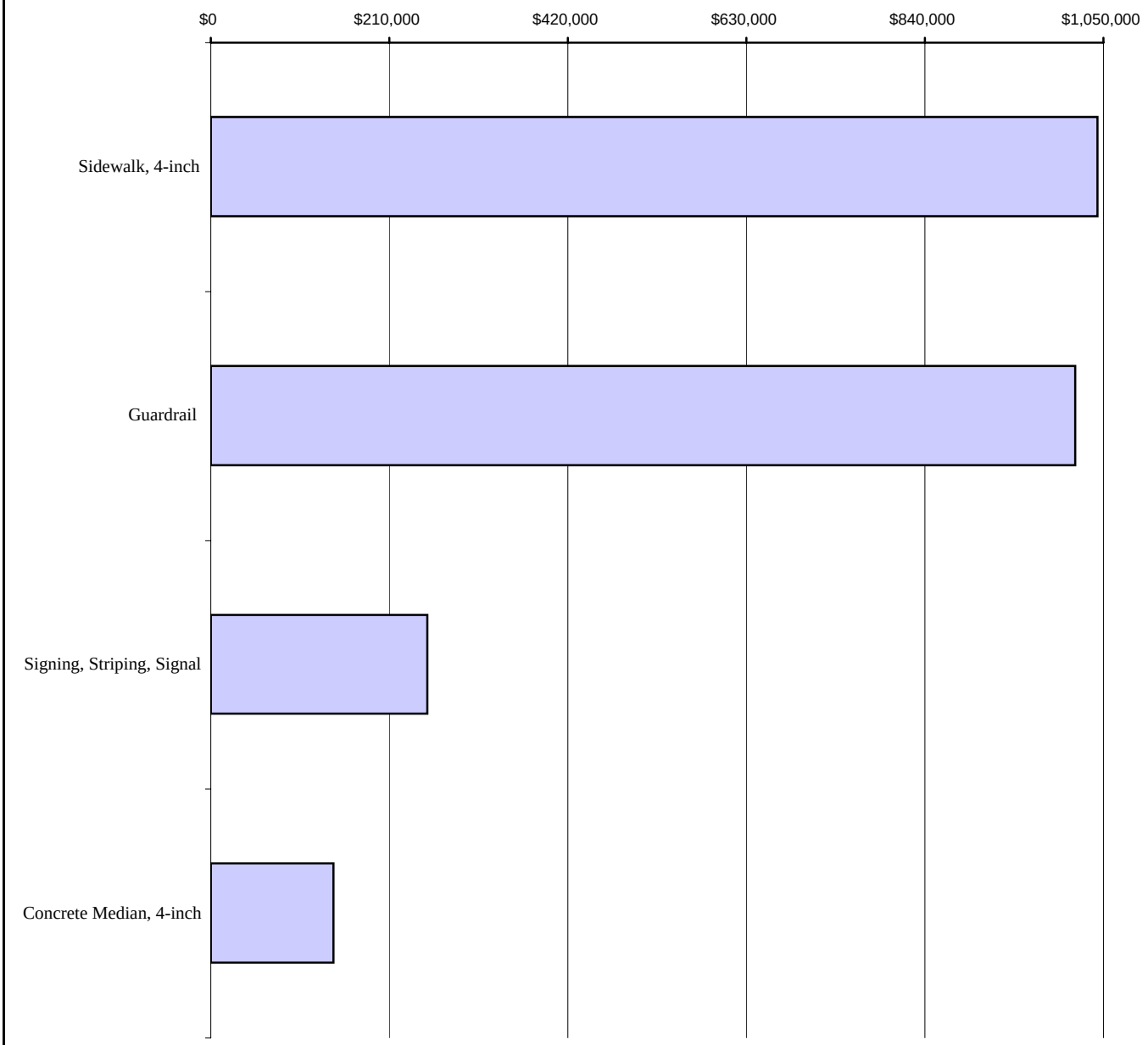


Costs in graph are not marked-up.

COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District
Design Development Stage

MISCELLANEOUS		COST	PERCENT	CUM. PERCENT
Sidewalk, 4-inch		1,043,305	42.40%	42.40%
Guardrail		1,017,600	41.35%	83.75%
Signing, Striping, Signal		255,000	10.36%	94.11%
Concrete Median, 4-inch		145,000	5.89%	100.00%
Construction Subtotal		**$ 2,460,905**	**100.00%**	
nflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 387,900		
Engineering and Construction @	10.00%	$ 246,091	**Construction**	
Construction Total		**$ 3,094,896**	Mark-Up:	25.76%



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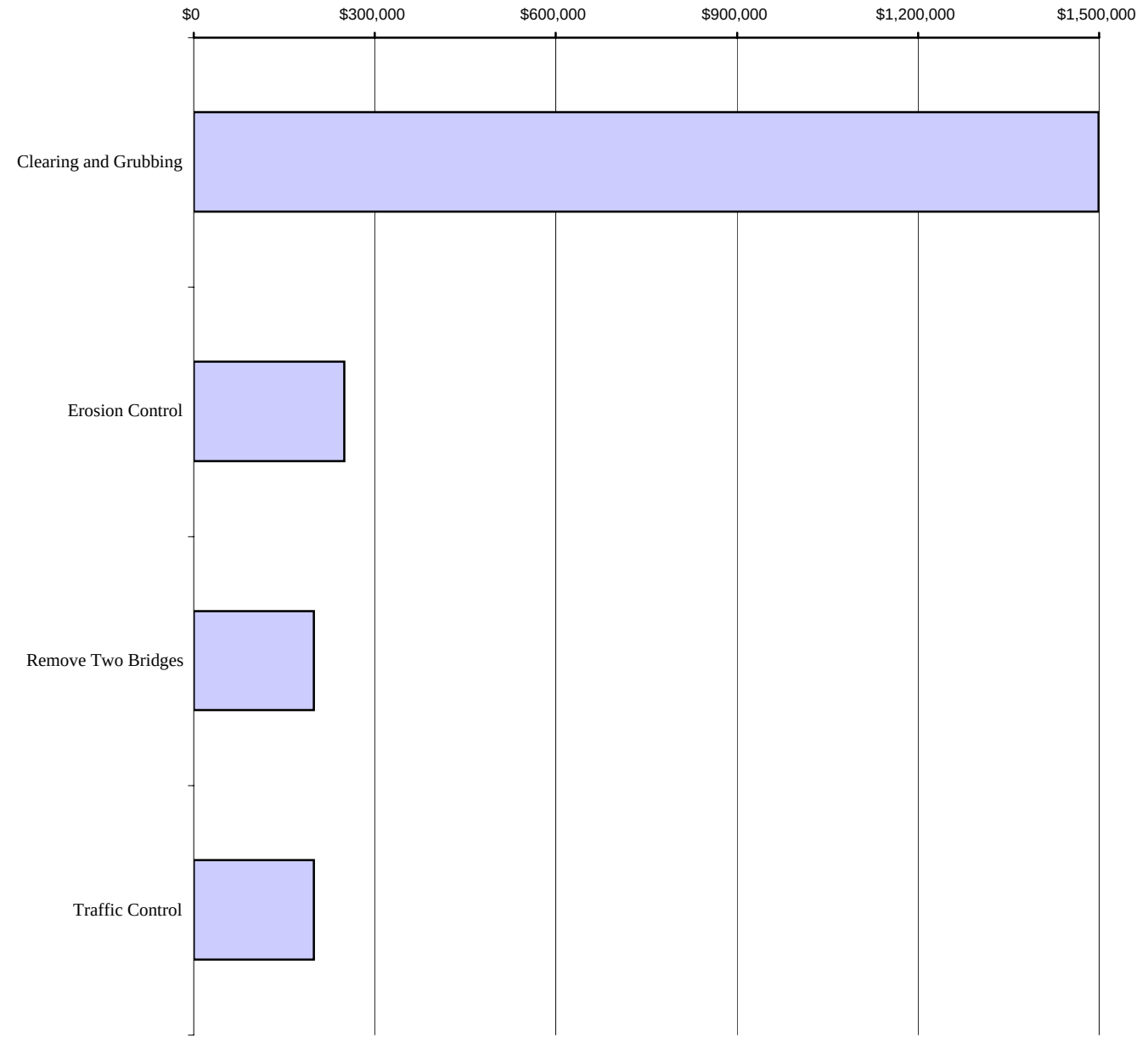
COST HISTOGRAM

Project: **STP-186-1(25), P.I. No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District
Design Development Stage

LUMP ITEMS		COST	PERCENT	CUM. PERCENT
Clearing and Grubbing		1,500,000	69.77%	69.77%
Erosion Control		250,000	11.63%	81.40%
Remove Two Bridges		200,000	9.30%	90.70%
Traffic Control		200,000	9.30%	100.00%
Construction Subtotal		**$ 2,150,000**	**100.00%**	
nflation Based on 5.00% per annum for Three Year (1.05^3)	15.76%	$ 338,894		
Engineering and Construction @	10.00%	$ 215,000	**Construction**	
Construction Total		**$ 2,703,894**	Mark-Up:	25.76%



Costs in graph are not marked-up.

FUNCTION ANALYSIS

A function analysis was performed to: (1) define the requirements for each project element, and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. *Random Function Analysis* worksheets for the project are attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

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

In addition to the random function analysis, the VE Facilitator worked with members of the study team to develop a Function Analysis System Technique (F.A.S.T.) diagram for each phase. The F.A.S.T. diagrams were used to show the flow of function within the phases. It helps to confirm the project is addressing those issues that have been voiced by the owner as being important. The diagrams were generated by asking the key question: "What is the most important function to be accomplished by this phase?" The answer is characterized by a verb / noun pair. In turn, another question is asked: "Why?" The answer is again listed in a verb / noun pair, and the process continued from left to right. If the result is a true F.A.S.T. diagram, the flow of functions from right to left will answer the question "Why?" No F.A.S.T. diagram is ever completed. The readers of this report may wish to challenge themselves to see how far they can carry the construction of the F.A.S.T. diagram.

This F.A.S.T. diagram notes the critical function paths and identifies the project's basic functions as ACCOMMODATE / GROWTH and INCREASED TRAFFIC by Improving / Level of Service and Safety and Reducing / Congestion. The F.A.S.T. diagram is included at the end of this section of the report.

RANDOM FUNCTION ANALYSIS

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

SHEET NO.: 1 of 1

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
Widening and Reconstruction of SR 92 From South of Nebo Road to North of SR 120	Reduce	Congestion	RS
	Reduce	Travel Time	RS
	Improve	**Safety**	**B**
	Improve	**Level of Service**	**B**
	Accommodate	**Increased Traffic**	**B**
	Access	Facility	RS
	Access	City of Hiram	RS
	Increase	Capacity	S
	Move	Goods / People	HO
	Widen	Facility	RS
	Facilitate	Turning Movements	RS
	Reconstruct	Intersections	RS
	Span	Streams (12)	RS
	Span	Railroad	RS
	Accommodate	**Growth**	**B**

Function defined as: Action Verb, Measurable Noun

Kind: B = Basic; S = Secondary; RS = Required Secondary; HO = Higher Order; LO = Lower Order; O = Objective; G = Goal; U = Unwanted

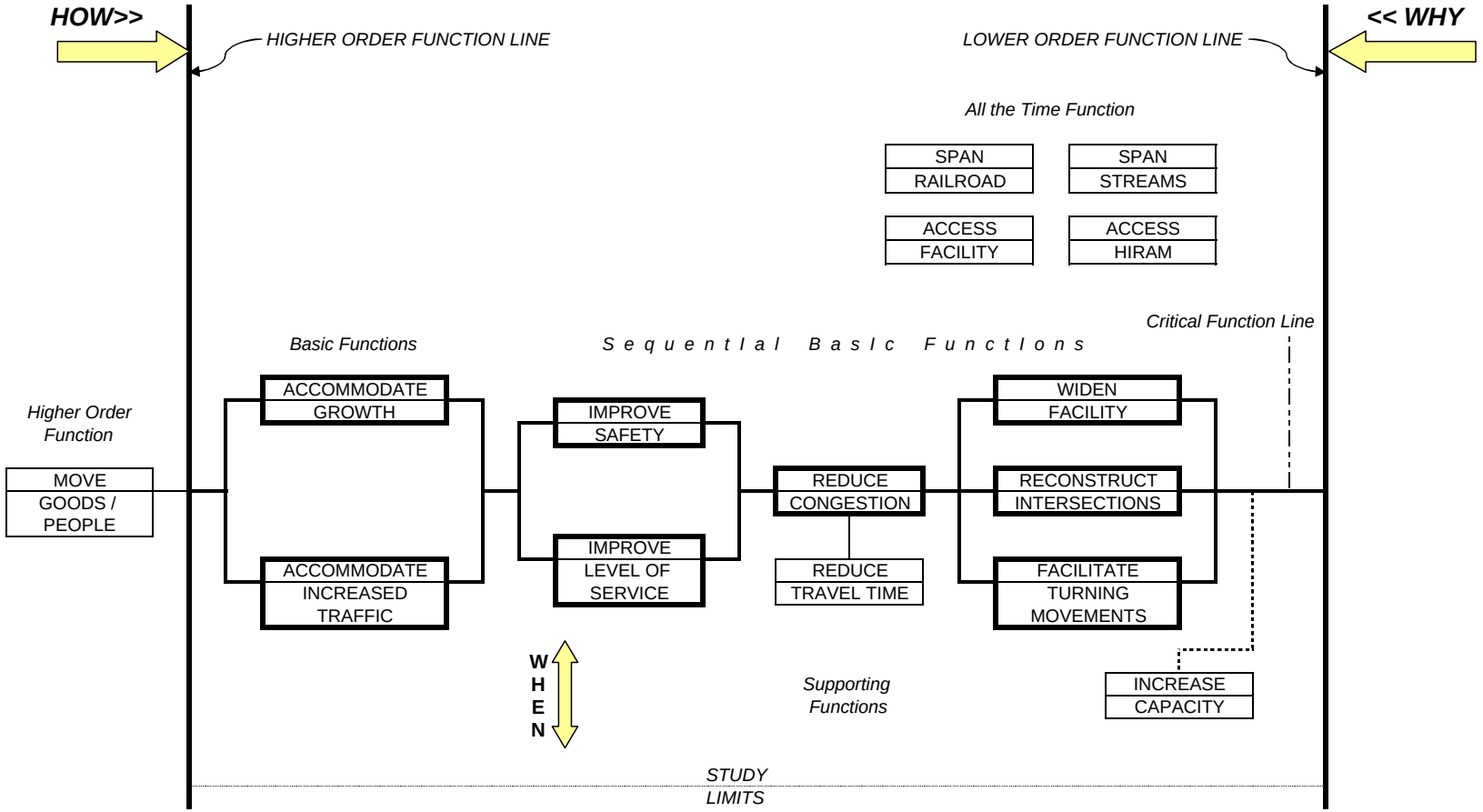
FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)

WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120

STP-186-1(25), PI No. 61270

Georgia Department of Transportation, District 6

City of Hiram, Paulding County, Georgia



CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas, alternative proposals and / or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were then discussed and the advantages / disadvantages of each listed. The VE design team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of 1 to 5 on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestions. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator or designer.

Typically, all ideas rate 4 or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept as not being cost-effective or technically feasible.

All readers are encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

SHEET NO.: 1 of 2

NO.	IDEA DESCRIPTION	RATING
1	Provide a CON/SPAN® over the Silver Comet Trail	4
2	Minimize the length of Nebo Road improvements	4
3	Minimize the length of Hiram-Sudie Road improvements	4
4	Minimize the length of Oak Street improvements; both east and west	4
5	Minimize the length of Rosedale Road improvements	4
6	Eliminate the Hardy Circle access to State Road (SR) 92	4
7	Provide a "U" turn at Hiram-Sudie Road (southbound on SR 92)	4
8	Reduce northbound left turn lane to Hiram-Sudie Road	4
9	Grade separate SR 92 and United States Route (US) 278 / SR 6	1
10	Grade separate SR 92 and SR 360 – Macland Road	1
11	Grade separate SR 92 and SR 120	1
12	Reduce left turn lanes in both directions to SR 360 – Macland Road	4
13	Eliminate sidewalks south of Nebo Road	4
14	Reduce fill north of railroad bridge by lowering the profile	3
15	Reduce fill north of railroad bridge by using guard rails and 2:1 slopes	4
16	Use culvert in lieu of bridge at Mill Creek	2
17	Do not realign SR 92 to avoid Stream Nos. 9 and 10	2
18	Reduce the length of improvements east of SR 92 on SR 360 – Macland Road	4
19	Eliminate sidewalks from Station 145+00 to SR 120	4
20	Eliminate all sidewalks in non-business / commercial areas and associated curb and gutter	4
21	Eliminate curb and gutter	1
22	Use landscaped median	DS
23	Reconsider a modified Alternate No. 2	3

Rating: 1 → 2 = Not To Be Developed; 3 → 4 = Varying Degree of Development Potential; 5 = Most Likely to Be Developed
ADB = Already Being Done; N/A = Not Applicable

CREATIVE IDEA LISTING

PROJECT: **STP-186-1(25), PI No. 621720, WIDENING AND RECONSTRUCTION OF SR 92 FROM SOUTH OF NEBO ROAD TO NORTH OF SR 120**
Paulding County, Georgia Department of Transportation, District 6
Design Development

SHEET NO.: 2 of 2

NO.	IDEA DESCRIPTION	RATING
24	Use mechanically stabilized earth (MSE) walls between Church and Dallas Streets	4
25	Use MSE walls between Dallas and Center Streets on the east side only	4

Rating: 1 → 2 = Not To Be Developed; 3 → 4 = Varying Degree of Development Potential; 5 = Most Likely to Be Developed
ADB = Already Being Done; N/A = Not Applicable