



Georgia Department of Transportation
District 3

STP-8042(6)

EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD/SR 22

P. I. No. 350850
Muscogee County, Georgia

Value Engineering Study Report

October 2006

Design Team



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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November 2, 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-8042(6), P. I. No. 350850, Eastern Connector from Buena Vista Road to
Macon Road/SR 22 in Muscogee 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.

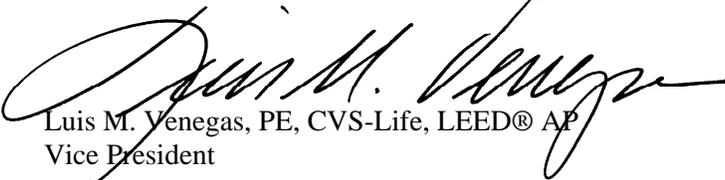
The objective of the VE effort was to identify opportunities that would improve the value of the project in terms of fulfilling the basic function of accommodating anticipated traffic for the potential economic development of the area, improving the level of service of the termini, and potentially reducing capital cost.

We take this opportunity to thank you and the State of Georgia Department of Transportation for your hospitality, the use of your office space, and in providing the information necessary for the VE team to generate creative, alternative solutions for this project. We also thank Jordan, Jones & Goulding, Inc. for providing pertinent project information that formed the basis of the VE team's effort.

We look forward to working with you on future assignments and stand ready to provide additional value engineering services.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



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

Attachment

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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 Project STP-8042(6), P. I. No. 350850, Eastern Connector from Buena Vista Road to Macon Road/SR 22, in Muscogee County, Georgia. This project is being designed by Jordan Jones & Goulding, Inc. (JJG). The VE workshop was conducted in GDOT's offices October 18 – 20, 2006.

PROJECT DESCRIPTION

The original concept report proposed widening existing Schatulga Road from Buena Vista Road to State Route (SR) 22 Spur/Macon Road/Unites State Route (US) 80 for a length of 3.76 miles. However, the project termini, location, and alignment have been revised to include widening of Schatulga Road from Buena Vista Road to 0.3 miles north of Luna Drive. From there, the roadway will be constructed on new location to the east of Schatulga Road through a tract of land owned by Columbus-Muscogee County. The roadway will continue northward on new location to the intersection of Lynch Road and US 80/SR 22/Macon Road. The alignment will then continue northward on existing Lynch Road for approximately 800 feet. The revised project length is 5.7 miles.

The approved typical section for Schatulga Road is an urban section with two 12-foot lanes in each direction with a 14-foot center turn lane and 6-foot-wide paved shoulders. The revised typical sections will be as follows:

- From Buena Vista Road to Forrest Road the proposed typical section is an urban section with two 12-foot lanes in each direction, a 14-foot center turn lane, two 4-foot bike lanes, 18-foot shoulders (12-foot shoulders in the vicinity of Green Acres Cemetery entrance), and 5-foot sidewalk.
- From Forrest Road to Chatsworth Road the proposed typical section is an urban section with two 12-foot lanes in each direction, a 44-foot raised median, two 4-foot bike lanes, 18-foot shoulders, and 5-foot sidewalk.
- From Chatsworth Road to the end of the project the proposed typical section is an urban section with two 12-foot lanes in each direction, a 20-foot raised median, two 4-foot bike lanes, 18-foot shoulders, and 5-foot sidewalk.

The current estimated cost of construction is \$31,324,807, based on JJG's "*Estimate Report for file "STP-8042(6)"*" dated May 24, 2006. This includes the Preliminary Right-of-Way Cost Estimate, prepared by GDOT, of \$500,000.

CONCERNS AND OBJECTIVES

The Eastern Connector is located on a tract of land within Planning District 11 in the Columbus Comprehensive Plan of the Columbus-Muscogee County Consolidated Government. It is a relatively straight forward project to provide a means to maximize the potential economic development of this area of the City into an office and technology district known as Muscogee Technology Park. As such, little or no right-of-way issues are known to exist.

The following project considerations were conveyed to the VE team to serve as a basis for the study: (1) the portion of the Eastern Connector that has already been constructed (STA 370+00 to STA 309+00) needs to be maintained as a four-lane, 44-foot raised median roadway that transitions to two-lanes at the Chattsworth Road intersection; (2) the aesthetics of the new facility are important as it forms an integral part of the contemplated image to attract new businesses/development; (3) consider the possibility of retaining the eastbound ramp from northbound traffic on SR 122 to Macon Road/SR 22/US 80; and (4) consider an on-site borrow area for construction contractor use.

As such, the objective of the effort was to identify opportunities that would improve the value of the project in terms of fulfilling the basic function of accommodating anticipated traffic for the potential economic development of the area, improving the level of service of the termini, and potentially reducing capital cost.

HIGHLIGHTS OF THE STUDY

Substantial savings can be achieved by challenging the Department's standards associated with providing sidewalks and bicycle lanes on both sides of the facility due to the extensive widening along the entire length of the project (5.7 miles). Although this facility is classified "rural principal arterial," the rationale for sidewalks and bicycle lanes does not appear to be warranted as noted on Alternative Nos. 3, 5, 6, and 7. Each of these alternatives addresses the elimination, or at least reconfiguration of the sidewalks and bicycle lanes. There are no "destinations" along or within this stretch of roadway where sidewalks or bicycle lanes would achieve their intended functions. Even if the area were to be developed as a light-industry technology park within the next 10 - 15 years, there are insufficient housing developments where pedestrians or bicyclists would use this facility as a commuter's route.

Eliminating the bicycle lanes as stated on Alternative 3 will initially save over \$1,660,000 and provide a safer mainline. If the sidewalks were eliminated in their entirety, including the corresponding shoulder, initial saving would approach \$740,000 as narrated on Alternative 5. Alternative 6 suggests converting the sidewalks into two-way bicycle lanes on one side of the facility. This permits a wider separation between vehicular traffic (primarily trucks) and bicyclists. Savings for this solution amount to about \$1,660,000. Alternative 7 recommends eliminating the concrete surface of the sidewalks but retaining the shoulders for future placement of the hard walking surface. This still permits a good, compacted walking surface and the needed separation between vehicular traffic and pedestrians, if ever used. Savings approach \$485,000 for this solution.

The current profile requires approximately 34-feet of fill before and after the bridge over Bull Creek. The bridge is approximately 14-feet above the 500-year storm event measured from the bottom of the bridge. Lowering the profile by 12-feet, as noted on Alternative 1, would keep the bridge 2 feet above the 500-year storm event and saves about \$1,100,000. The mainline profile has

an average of more than 20-feet of fill over 1,200 linear feet. This can be significantly reduced saving considerable cubic yardage of fill material.

The design calls for the use of a standard 44-foot raised median including curb and gutter for the entire length of the new Eastern Connector. However, Alternative 13 recommends using a 20-foot raised median. This will still allow for future turn lane cuts while initially saving close to \$2,000,000.

The *Summary of Potential Cost Savings* table follows this narrative and outlines all of 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.

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 creative ideas are organized according to the order in which they were originally generated by the VE team during their function analysis 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, 11 of them were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 12 alternatives for change with an impact on project costs. All of these alternatives and design suggestions are presented in detail following this narrative and on the *Summary of Potential Cost Savings* table.

EVALUATION OF ALTERNATIVES

Once the aforementioned ideas are developed, 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: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: 1
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **LOWER THE PROFILE AT BULL CREEK BRIDGE** SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current profile has approximately 34 feet of fill before and after the bridge over Bull Creek. The bridge is approximately 14 feet above the 500-year storm event measured from the bottom of the bridge.

ALTERNATIVE:

Lower the profile by 12 feet which would be 2-feet above the 500-year storm event.

ADVANTAGES:

- Reduces the amount of borrow needed
- Reduced quantities
- Reduces initial cost

DISADVANTAGES:

- None apparent

DISCUSSION:

The mainline profile has an average of more than 20 feet of fill over 1,200 linear feet. This can be significantly reduced saving considerable cubic yardage of fill material.

There is no apparent reason to have the profile as high as indicated on the design documents. If the concern of the City is the potential of developers misaligning and/or misplacing entrances, these can be overcome by instituting conditions of development. Furthermore, such a high profile would require developers an added expense of having extremely high ingress /egress roadways.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,306,229	—	\$ 1,306,229
ALTERNATIVE	\$ 140,529	—	\$ 140,529
SAVINGS	\$ 1,165,700	—	\$ 1,165,700

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

1

DESCRIPTION: *Lower Profile at Bridge*

SHEET NO.: 2 of 4

Increase Excavation - Sta 242+00 to Sta 248+00

	<u>Amount</u>	<u>Ave</u>	<u>Length</u>	<u>Volume (CY)</u>
242+00 -	100 SF	250	100 ÷ 27 =	926 CY
243+00 -	400 SF	500	100 ÷ 27 =	1852 CY
244+00 -	600 SF	775	100	2870 CY
245+00 -	950 SF	770	100	2852 CY
246+00 -	590 SF	465	100	1722 CY
247+00 -	340 SF	215	100	796 CY
248+00 -	90 SF			
				<u>10,418 CY</u>

Decrease Borrow - Sta 246+00 to Sta 267+00

	<u>Amt</u>	<u>Ave</u>	<u>Length</u>	<u>Volume</u>
246+00 -	250	500	100 ÷ 27 =	1850 CY
247	750	960		3555
248	1170	1485		5500
249	1800	2223		8230
250	2645	2948		10917
251	3250	3153		11675
252	3055	1528		5657
253	0	0		0
254	0	1188		4398
255	2375	2260		8370
256	2145	2033		7528
257	1920	1760		6519
258	1600	1468		5435
259	1335	1228		4546
260	1120			

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

1

DESCRIPTION: Lower Profile at Bridge

SHEET NO.: 3 of 4

	<u>Amt</u>	<u>Ave</u>	<u>Length</u>	<u>Volume</u>
260	1120	998	$\times 100 \div 27 =$	3694
261	875	788		2917
262	700	595		2204
263	490	343		1269
264	195	188		694
265	180	160		593
266	140	70		259
267	0			
				<u>95,541 CY</u>

Increased Excavation - Sta 263+00 to Sta 267+00

263	60	118	$\times 100 \div 27 =$	437
264	175	183		678
265	190	133		493
266	75	38		141
267	0			
				<u>1749 CY</u>

Total Increased Excavation - $10,418 + 1749 = 12,167 \text{ CY}$

Total Decreased Borrow - $12,167 + 95,541 = 107,708 \text{ CY}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD/S.R. 22
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.: 2

DESCRIPTION: **BALANCE THE CUT AND FILL**

SHEET NO.: 1 of 2

ORIGINAL DESIGN:

The current designed profile results in almost 200,000 cubic yards of needed borrow material.

ALTERNATIVE:

Lower the profile in fill areas to balance the cut and fill.

ADVANTAGES:

- Eliminates the need for a borrow pit
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- None apparent

DISCUSSION:

There are several locations along the proposed roadway where the profile could be lowered to reduce the amount of fill material needed: STA 218+50 to STA 242+00; STA 247+00 to STA 264+00; STA 281+00 to STA 290+00, and STA 376+00 to STA 381+50. This would result in a 7.00% construction cost savings with no impact on the function of the facility.

Further adjustment could be made which may result in substantially higher savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,238,991	—	\$ 2,238,991
ALTERNATIVE	\$ 2,082,261	—	\$ 2,082,261
SAVINGS	\$ 156,730	—	\$ 156,730

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **3**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **ELIMINATE BICYCLE LANES** SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current design calls for the use of 4-foot bicycle lanes on each side of the new facility.

ALTERNATIVE:

Eliminate the proposed bicycle lanes on both sides of the new facility.

ADVANTAGES:

- Reduces the amount of borrow needed
- Reduced facility's footprint
- Reduces initial cost
- Provides more developable land
- Simplifies construction
- Not needed

DISADVANTAGES:

- Loss of an amenity
- Perceived loss of safety
- May be needed for federal funding
- Challenges a department standard

DISCUSSION:

Eliminating the proposed bicycle lanes reduces the pavement width by 4 feet on each side for a total 8-foot reduction that not only reduces the facility's footprint, but provides for more developable land. It is realized that right-of-way is not an issue as the City already owns the land.

Since the proposed office/industrial development is in a rural environment, it does not warrant bicycle lanes as few if any bicyclists would use the facility for commuting.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 18,632,400	—	\$ 18,632,400
ALTERNATIVE	\$ 16,964,657	—	\$ 16,964,657
SAVINGS	\$ 1,667,743	—	\$ 1,667,743

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

3

DESCRIPTION:

SHEET NO.: 2 of 4

Bike lane begins @ STA. 98+23

Bike lane ends @ STA. 396+76

Total bike lane length: 29,853 feet or 5.654 miles
(one way)

59,706 feet or 11.308 miles
(both ways)

Total square feet of pavement to be eliminated: 29,853 x 4 = 119,412
(one way)

59,706 x 4 = 238,824 sf
= 26,536 SY

A.C. 12.5 mm - 165 lbs/cy $\Rightarrow \frac{165 \times 26,536}{2000} = 2,189$ tons

A.C. 19 mm - 220 lbs/cy $\Rightarrow \frac{(220 \times 26,536)}{2000} = 2,919$ tons

A.C. 25 mm - 550 lbs/cy $\Rightarrow \frac{(550 \times 26,536)}{2000} = 7,297$ tons

Bituminous Tack coat - 0.07 Gal/sy $\Rightarrow 0.07 \times 26,536 = 1,858$ Gal

G.A.B. - 12" thick : $(110 \times 12 \times 26,536) \div 2,000 = 17,514$ tons

2' excavation : $26,536 \times \frac{2}{3} = 17,691$ cy

Reduction in length of storm drains and box culverts will also produce savings. Pipes that span the width of the road will see decrease in length anywhere from 4' to 8'.

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscookee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

3

DESCRIPTION:

SHEET NO.: 3 of 4

Number of 18" pipes on both sides: 42
Total length reduced = $42 \times 8 = 336'$

Number of 18" pipes on one side of the road: 48
Total length reduced = $48 \times 4 = 192'$

Total length of 18" ϕ pipe reduced = $336 + 192 = 528'$

Total length of 30" ϕ pipe reduced = $2 \times 8 = 16'$

Total length of 36" ϕ pipe reduced = $2 \times 8 = 16'$

Total shortened length of 18" ϕ pipe = $17,927 - 528 = 17,399'$
 " " " " " 30" ϕ pipe = $370 - 16 = 354'$
 " " " " " 36" ϕ pipe = $405 - 16 = 389'$

Length of 5' x 5' box culvert to be shortened: $5(4+4) = 40'$
 " " 7' x 6' " " " " " : $5(4+4) = 40'$
 " " 3- 8' x 6' " " " " " : $3(4+4) = 24'$
 " " 3- 7' x 4' " " " " " : $3(4+4) = 24'$
 Total: 128'

Length of all box culverts: 3,080 ft.

Cost of all box culverts: $873,870 + 13,298 + 86,246$
 $= 973,414$

Cost/ft = $973,414 \div 3,080 = 316$

Total length of shortened box culvert: $3,080 - 128 = 2,952$ ft.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **5**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **ELIMINATE SIDEWALKS AND SHOULDERS** SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current design calls for the use of 5-foot wide x 4-inch thick sidewalks on each side of the new facility.

ALTERNATIVE:

Eliminate the proposed sidewalks and their associated shoulders on both sides of the new facility.

ADVANTAGES:

- Reduces the amount of borrow needed
- Reduced facility's footprint
- Reduces initial cost
- Provides more developable land
- Simplifies construction
- Not needed

DISADVANTAGES:

- Loss of an amenity
- Perceived loss of safety as pedestrians, if any, would have to walk on the remaining 4.5-feet of shoulder
- May be needed for federal funding
- Challenges a department standard

DISCUSSION:

Eliminating the proposed sidewalks reduces the facility's footprint by 5 feet on each side and provides for more developable land. It is realized that right-of-way is not an issue as the City already owns the land.

Since the proposed office/industrial development is in a rural environment, it does not warrant sidewalks outside each of the proposed parcels as few if any pedestrians would use the facility as walking commute.

See related alternative: Alternative No. 7.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,925,895	—	\$ 2,925,895
ALTERNATIVE	\$ 2,190,193	—	\$ 2,190,193
SAVINGS	\$ 735,702	—	\$ 735,702

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

5

DESCRIPTION:

SHEET NO.: 3 of 4

Since we are eliminating the 5' shoulder associated with the sidewalk, we will have storm pipes and box culverts 5' shorter.

NO. of 18" pipes	to be shortened	:	3	×	5	=	15'
NO. of 24" "	" " " "	:	2	×	5	=	10'
NO. of 30" "	" " " "	:	2	×	5	=	10'
NO. of 36" "	" " " "	:	6	×	5	=	30'
NO. of 42" "	" " " "	:	2	×	5	=	10'
NO. of 48" "	" " " "	:	1	×	5	=	5'
Length of 5' x 5' box culverts	to be shortened	:	5	(5+5)	=	50'	
" " 7' x 6' "	" " " "	:	5	(8+5)	=	50'	
" " 3-8' x 6' "	" " " "	:	3	(5+5)	=	30'	
Length of 3-7' x 4' "	" " " "	:	3	(5+5)	=	30'	
Total :							<u>160'</u>

Length of all box culverts: 3,080 ft.

Cost of all box culverts: $893,869.7 + 13,298.4 + 86,246.3$
= 973,414.4

Cost per foot: $973,414.4 \div 3,080 = 316$

Total length of shortened box culverts: $3,080 - 160 = 2,920$ ft

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **6**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **CONVERT SIDEWALKS INTO BICYCLE LANES** SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

The current design calls for the use of a 4-foot asphalt bicycle lane and a 5-foot, 4-inch thick concrete sidewalk on each side of the new facility. Therefore, it is proposed to have a total of 8 feet of bicycle lanes and 10 feet of sidewalks across the roadway section.

ALTERNATIVE:

Eliminate the 8 feet of asphalt pavement associated with the bicycle lanes from both sides of the new facility. In addition, eliminate one 5-foot concrete sidewalk from the new facility. Expand the remaining 5-foot concrete sidewalk and into a 10-foot wide, 4-inch thick bicycle lane on one side of the new facility.

ADVANTAGES:

- Reduces the amount of borrow needed
- Reduced facility's footprint
- Reduces initial cost
- Provides more developable land
- Simplifies construction
- Maintains two-way bicycle traffic

DISADVANTAGES:

- Loss of sidewalk amenity
- Perceived loss of safety as pedestrian and bicyclist would use the same path
- May be needed for federal funding
- Challenges a department standard

DISCUSSION:

Eliminating separate sidewalks and bicycle lanes reduces the pavement width. Not only is the facility's footprint reduced, but provides for more developable land. It is realized that right-of-way is not an issue as the City already owns the land.

See Alternative No. 3 for calculated savings as the net result is the same.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 18,632,400	—	\$ 18,632,400
ALTERNATIVE	\$ 16,964,657	—	\$ 16,964,657
SAVINGS	\$ 1,667,743	—	\$ 1,667,743

VALUE ENGINEERING ALTERNATIVE



PROJECT:	STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22 Muscogee County, Georgia Department of Transportation, District 3 <i>Design Development Stage</i>	ALTERNATIVE NO.: 7
DESCRIPTION:	ELIMINATE SIDEWALKS AND RETAIN SHOULDERS	SHEET NO.: 1 of 3

ORIGINAL DESIGN:

The current design calls for the use of 5-foot wide x 4-inch thick sidewalks on each side of the new facility.

ALTERNATIVE:

Eliminate the proposed sidewalks but maintain their associated shoulders on both sides of the new facility.

ADVANTAGES:

- Reduces initial cost
- Simplifies construction
- Accommodates future installation of sidewalk
- Provides a grass shoulder/sidewalk

DISADVANTAGES:

- Loss of an amenity
- May be needed for federal funding
- Challenges a department standard

DISCUSSION:

Since the proposed office/industrial area is in a rural environment, the immediate need does not warrant sidewalks. There would be few, if any, pedestrians. However, retain the prepared shoulders for potential future expansion and addition of the hard surface.

See related alternative: Alternative No. 5.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 487,318	—	\$ 487,318
ALTERNATIVE	\$ 3,073	—	\$ 3,073
SAVINGS	\$ 484,245	—	\$ 484,245

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

7

DESCRIPTION: Retain underlying prepared shoulder

SHEET NO.: 2 of 3

16,000 SY of
concrete sidewalk, 5' wide & 4" thick on
both sides costs: \$421,920 - Savings.

Install permanent grassing on the prepared
shoulder.

$$16,000 \times 9 = 144,000 \text{ sf} = 3.3 \text{ acres}$$

At \$806.16 per acre, the cost of permanent
grassing is: $3.3 \times 806.16 = \$2,660$

Thus, the total savings is: $421,920 - 2,660$
 $= \$419,260$

At 15.5% mark-up the total savings
will be: \$484,295

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **8**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **INCREASE RADIUS OF EASTERN CONNECTOR CURVE NO. 7004 AT THE WEST CENTRAL GEORGIA REGIONAL HOSPITAL** SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design denotes Curve No. 7004 having its point of curvature at STA 183+89.13 and its point of tangency at STA 201+52.04 for a total length of 1,762.91 feet. The curve is south-southeast of the West Central Georgia Regional Hospitals campus.

ALTERNATIVE: (Sketch attached)

Increase Curve No. 7004's radius to 2,250 feet to flatten the curve and provide a smoother transit through this portion of the Eastern Connector.

ADVANTAGES:

- Provides smoother traffic flow
- Improves safety
- Avoids Fort Benning's Landfill
- Reduces roadway
- Reduces initial cost

DISADVANTAGES:

- Requires additional right-of-way within hospital's campus (assumed)

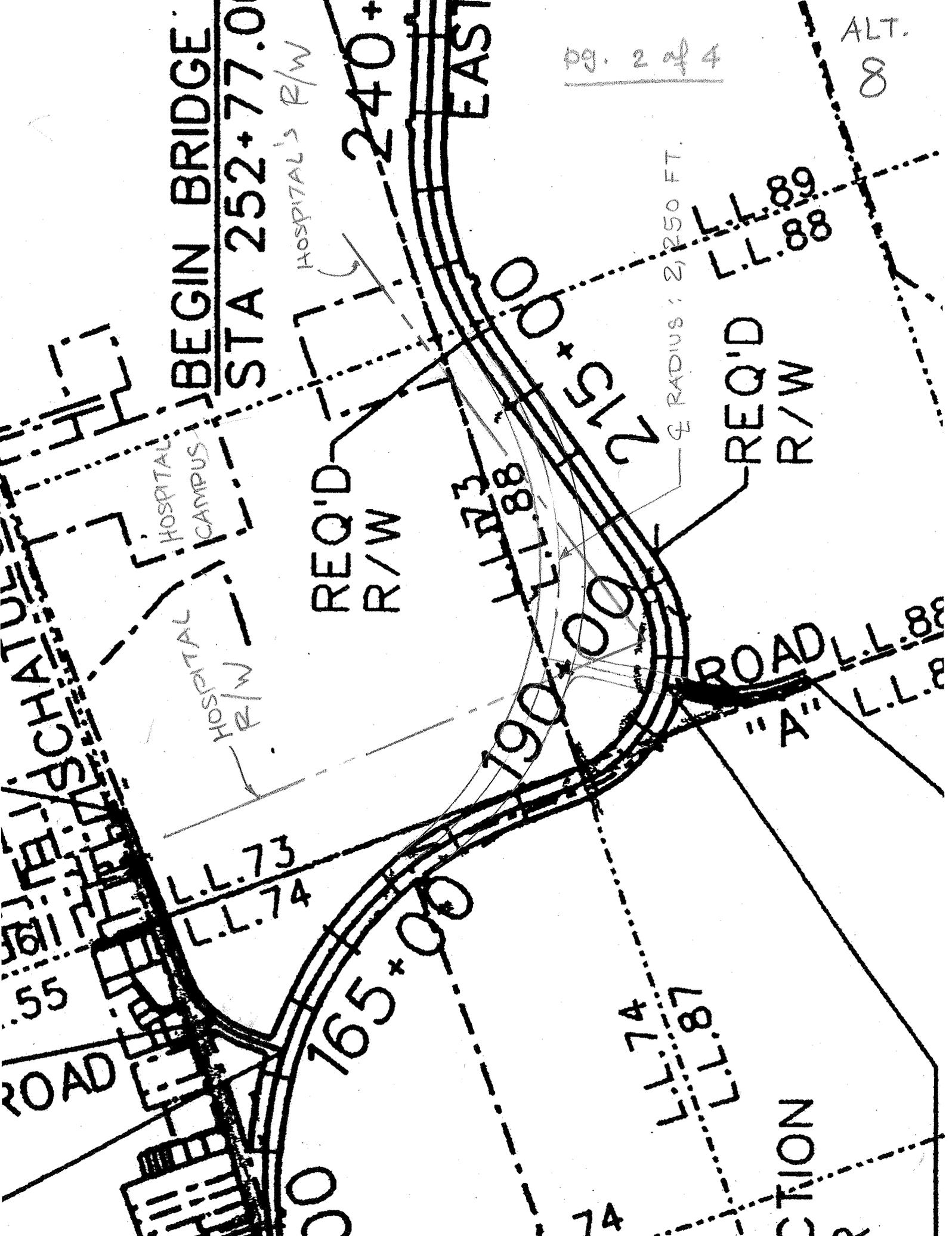
DISCUSSION:

The proposed change calls for the reverse curve to commence at STA 179+69.37 and run for a length of 3,000 feet. Alternately, the curve could begin at STA 170+00, have a tangent of 1,000 feet and let the curve begin at STA 180+00. The curve would then end at STA 210+00—a new station which would be STA 215+00 in the original design. This results in approximately 800 feet of pavement savings for the Eastern Connector.

An 800-foot extension would have to also be provided for the landfill road.

Nearly seven acres of hospital property would be required to accommodate this alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,681,955	—	\$ 1,681,955
ALTERNATIVE	\$ 1,278,195	—	\$ 1,278,195
SAVINGS	\$ 403,760	—	\$ 403,760



BEGIN BRIDGE
STA 252+77.0

pg. 2 of 4

ALT.
8

HOSPITAL'S R/W

240+00

EAST

RADIUS: 2,250 FT.

REQ'D
R/W

REQ'D
R/W

HOSPITAL
CAMPUS

HOSPITAL
R/W

ROAD

SCHATTUCK
ROAD

L.L. 73
L.L. 74

190+00
L.L. 88

165+00

L.L. 74
L.L. 87

L.L. 88
L.L. 88

"A"

SECTION

CALCULATIONS



PROJECT: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
 BUENA VISTA ROAD TO MACON ROAD / S.R. 22
 Muscogee County, Georgia Department of Transportation, District 3
 Design Development Stage

ALTERNATIVE NO.:

8

DESCRIPTION:

SHEET NO.: 3 of 4

EASTERN CONNECTOR: TOTAL LENGTH: 5.820 MILES
 LESS BRIDGE: 0.041
5.779 MILES
 X 5280 LF/MILE = 30,513 LF

EASTERN CONNECTOR: TOTAL COST (BEFORE MAKE UPS)
 \$26,419,405
 LESS BRIDGE \$1,215,000
\$25,204,405

$$\therefore \text{COST/LF} = \$25,204,405 / 30,513 \text{ LF} = \$826/\text{LF}$$

EXISTING CURVE (#7004): L = 1762.91 SAY 1763 LF
 R = 954.93 FT

PROPOSED CURVE: L = 963 LF
 R = 2025

\therefore ROADWAY SAVINGS = 800 LF

FROM ALT #10: NEW LANDFILL ROAD (BEFORE M/U) (800 LF)
 \$57,001 / 450 LF = \$126.67/LF SAY \$127
 ↑

VALUE ENGINEERING ALTERNATIVE



PROJECT:	STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22 Muscogee County, Georgia Department of Transportation, District 3 <i>Design Development Stage</i>	ALTERNATIVE NO.:	10
DESCRIPTION:	PROVIDE ACCESS TO THE WEST CENTRAL GEORGIA REGIONAL HOSPITAL FROM THE NEW FACILITY	SHEET NO.:	1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current design does not address the issue of accessing the West Central Georgia Regional Hospital from the new Eastern Connector.

ALTERNATIVE: (Sketch attached)

Provide a new 24-foot wide asphalt concrete pavement roadway with 5-foot shoulders and 30-inch curb and gutters on both sides to access West Central Georgia Regional Hospital.

ADVANTAGES:

- Improves access to the hospital
- Decreases emergency response times
- Improves access to new office/industrial developments

DISADVANTAGES:

- Adds initial cost
- Requires additional right-of-way cost within hospital's campus (assumed)
- Could be come an attractive nuisance; i.e.; cut-through road

DISCUSSION:

Under the current situation, access to the West Central Georgia Regional Hospital is only from Shaltuga Road. Due to the anticipated office/industrial development along the Eastern Connector, it may be prudent to provide for additional access to the hospital from the new facility. This new street is not intended as a thoroughfare but merely as access to the hospital proper, perhaps only for emergency vehicles.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 0	—	\$ 0
ALTERNATIVE	\$ 77,652	—	\$ 77,652
SAVINGS	\$ (77,652)	—	\$ (77,652)

10
SHEET 2055

HOSPITAL

211 1/2' x 113'

200'-00"



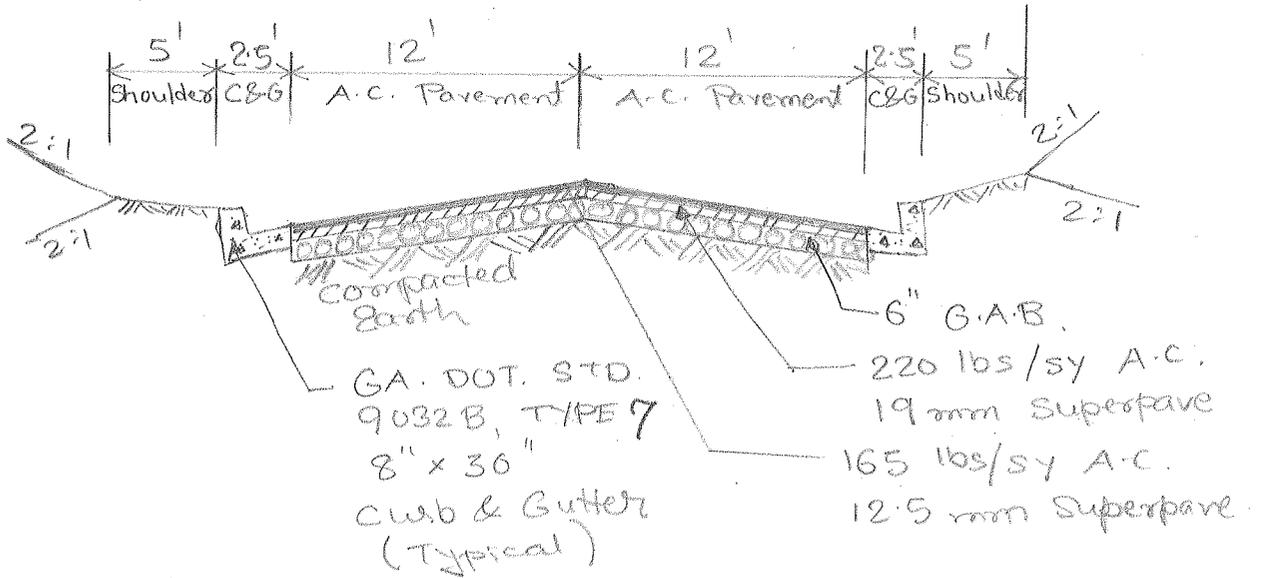
PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

10

AS DESIGNED ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

10

DESCRIPTION:

SHEET NO.: 4 of 5

Total length of access road: 450'

Pavement width: 24'

$$\therefore \text{Area} = 450 \times 24 = 10,800 \text{ sf} = 1,200 \text{ SY}$$

$$165 \text{ lbs/SY A.C. } 12.5 \text{ mm} \rightarrow \frac{165 \times 1,200}{2,000} = 99 \text{ tons}$$

$$220 \text{ lbs/SY A.C. } 19.5 \text{ mm} \rightarrow \frac{220 \times 1,200}{2,000} = 132 \text{ tons}$$

$$6'' \text{ G.A.B. } \rightarrow \frac{6 \times 110 \times 1,200}{2,000} = 396 \text{ tons}$$

(110 lbs/sy/in.)

$$\text{Bituminous Coat} \rightarrow 0.07 \times 1,200 = 84 \text{ Gal.}$$

(0.07 Gal/sy)

$$30'' \text{ Curb \& Gutter: } 450 + 450 = 900'$$

$$\text{Unclassified Excavation: } 450 \times \frac{1(5+2.5+12)^2}{27} = 650 \text{ CY}$$

Assume:

$$18'' \text{ Storm Drain: } 24 + 2.5 + 5 + 4.5 = 36'$$

(outfall)

18'' Flared End Section: 1

Catch Basin GP 1: 2

clearing & Grubbing, Erosion control etc. will be lump sum.

COST WORKSHEET



**PROJECT: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscogee County, Georgia Dept. of Transportation, District 3
Design Development Stage**

**ALTERNATIVE NO:
10**

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
Asphaltic Concrete - 12.5 mm	TN				99	75.00	7,425
Asphaltic Concrete - 19.0 mm	TN				132	75.00	9,900
Bituminous Tack Coat	GAL				84	2.00	168
GAB - 12"	TN				396	15.45	6,118
Unclassified Excavation	CY				650	10.00	6,500
18" Ø Pipe	LF				36	32.90	1,184
18" Flared End	EA				1	294.00	294
30" Curb and Gutter	LF				900	11.62	10,458
Catch Basin	EA				2	1,821.00	3,642
Clearing and Grubbing	LS				1	10,000	10,000
Erosion Control	LS				1	1,000.00	1,000
Miscellaneous	LS				1	311.00	311
Construction Subtotal							57,001
Mark-Up at 15.5%							6,555
Construction Total							63,556
Right-of-Way	AC				0.406	10,000	4,060
(450 LF x 39 LF)/43,260 SF/AC							
Right-of-Way Subtotal							4,060
Mark-Up at 247.20%							10,036
Right-of-Way Total							14,096
<i>Note: Unit cost per acre based on recent, previously known costs of rural, undeveloped land</i>							
	Sub-total						77,652
Mark-up at							INCL
	TOTAL						77,652

VALUE ENGINEERING ALTERNATIVE



PROJECT:	STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22 Muscogee County, Georgia Department of Transportation, District 3 <i>Design Development Stage</i>	ALTERNATIVE NO.:	13
DESCRIPTION:	USE A 20-FOOT RAISED MEDIAN IN LIEU OF 44-FOOT RAISED MEDIAN	SHEET NO.:	1 of 6

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the use of a standard 44-foot raised median including curb and gutter for the entire length of the new Eastern Connector.

ALTERNATIVE: (Sketch attached)

Use a standard 20-foot raised median with curb and gutter throughout the project.

ADVANTAGES:

- Reduces roadway footprint
- Reduces quantities
- Increases area that can be developed
- Reduces initial cost
- Common practice

DISADVANTAGES:

- Reduces area for landscaping
- Provides a narrower roadway section
- Does not match existing roadway section (STA 370+00 to STA 309+00)

DISCUSSION:

The 44-foot raised median is typically used for rural areas—the case in point with this project initially. The use of the 20-foot raised median continues to allow for future turn lane cuts.

It is noted this alternative does not change that portion of the Eastern Connector already constructed to the 44-foot raised median criteria.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,030,925	—	\$ 2,030,925
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 2,030,925	—	\$ 2,030,925



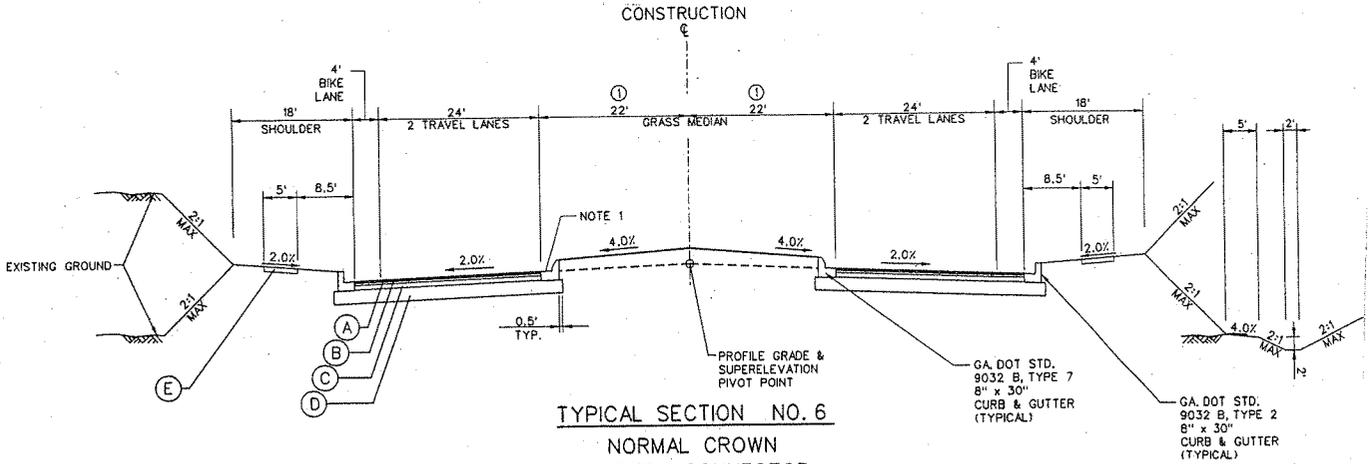
PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

13

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 6



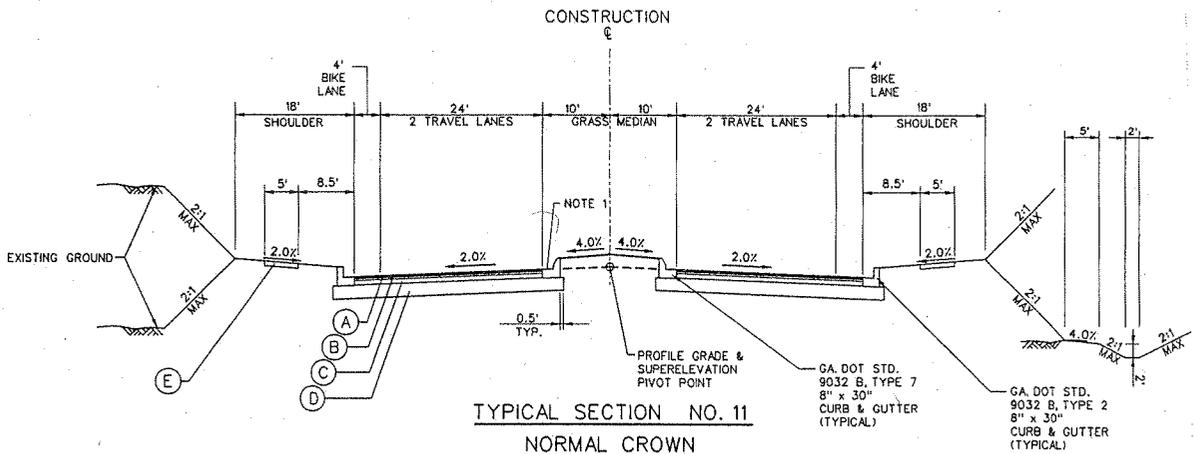
TYPICAL SECTION NO. 6

NORMAL CROWN
 EASTERN CONNECTOR
 STA 205+75 TO STA 214+50
 STA 236+82 TO STA 263+73

From: 146+50 (No. 7)
 (TRANSITION TO 151+00)

AS-DESIGNED

To: 375+88 (No. 7)
 (TRANSITION TO: 381+50)
 309+00 → BUILT ALREADY



TYPICAL SECTION NO. 11

NORMAL CROWN
 EASTERN CONNECTOR
 STA 382+01 TO STA 393+85

ALTERNATIVE

CALCULATIONS



PROJECT: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
 BUENA VISTA ROAD TO MACON ROAD / S.R. 22
 Muscogee County, Georgia Department of Transportation, District 3
 Design Development Stage

ALTERNATIVE NO.:

13

DESCRIPTION: 20' RAISED MEDIAN IN LIEU OF 44'

SHEET NO.: 3 of 6

REDUCTION IN TYPICAL SECTION DUE TO MEDIAN REDUCTION:

FILL:	STATION	WIDTH	DEPTH	AREA
TRANSITION	146+50	0	3'	$\left(\frac{0+24}{2}\right)\left(\frac{3+6}{2}\right)(150+50-146+50)\left(\frac{1}{27}\right) = 800 \text{ cy}$
	150+50	24	6'	
	161+50		2'	9,200 cy
	170+50		21'	3,264
	174+00		0	4,632
	180+50		16'	1,798
	183+00		0	
	187+50		0	3120
ROAD 'A' →	191+00		20'	
	192+50		18'	2400
	195+50		0	
	207+50		0	1,056
	211+50		6'	1,333
	214+00		6'	533
	215+50		2'	
	218+50		3'	1,689
	220+50		16'	4,267
	223+50		16'	2,363
	225+00		12'	6,075
	229+50		12'	2,363
	233+00		0	338
	233+50		12'	2,672
	236+00		7'	4,303
240+50		10'	1,125	
	242+50	24'	0'	
			Σ	53,311 cy (THIS SH)

CONT'D

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

13

DESCRIPTION: 20' RAISED MEDIAN IN LICH OF 44'

SHEET NO.: 4 of 6

FILL CONT'D:		STATION	WIDTH	DEPTH	AREA
		245+50	24'	0	
		248+50	↑	10'	1,688
		250+00		30'	3,375
		252+50		34'	9,000
BRIDGE →		255+00		34'	16,088
		260+50		18'	3,375
		263+50		2'	5,850
		270+00		14'	5,119
		276+50		0	
		280+50		6'	5,569
		286+00		18'	5,063
		291+00	0		
		304+50	24'	0	400
TRANSITION →		309+00	0	4'	

ALREADY BUILT

$E = 55,527 \text{ cy}$

RAISED MEDIAN FILL ⇒ $(309+00) - (146+50) (24' \times 1.5') \frac{1}{2} = 21,667 \text{ cy}$

+ 53,311 cy (PREVIOUS SHEET)

TOTAL FILL = 130,505 cy

CONT'D

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscookee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

13

DESCRIPTION: 20' RAISED MEDIAN IN LIEU OF 44'

SHEET NO.: 5 of 6

CUT:	STATION	WIDTH	DEPTH	AREA	
SCHATULGA RA. →	151+00	24'	6'	2925	
	153+00		20'	8,438	
	156+00		30'	5,119	
	157+50		25'	1'	
	161+00		1'	0	1,506
	183+00		0	10'	1,125
	185+50		10'	0	
	187+50		0	0	3,656
	195+50		0	10'	5,063
	202+00		10'	10'	563
	206+50		10'	0	
	207+50		0	2'	169
	215+50		2'	4'	1,350
	216+00		4'	12'	478
	217+50		12'	5'	
	218+00		5'	0	1,125
	276+50		0	10'	1,125
	278+50		10'	0'	
	280+50		0'	0'	6,694
	291+00		0'	14'	3,938
299+50	14'		0		
304+50	0	24'			
				Σ 43,174 CY CUT	

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **15**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **RECONFIGURE THE RAMP FROM SR 22 SPUR TO US 80/MACON ROAD EASTBOUND** SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for a 75-foot radius turn from SR 22 Spur onto SR 22/Macon Road eastbound.

ALTERNATIVE: (Sketch attached)

Increase the radius of the northbound to eastbound ramp for SR 22 Spur onto SR 22/Macon Road to 250 feet.

ADVANTAGES:

- Increases flow characteristics
- Reduces acceleration/deceleration
- Simplifies design
- Improves safety

DISADVANTAGES:

- Adds initial cost

DISCUSSION:

The traffic design hourly vehicle (DHV) is 250 (300) for this ramp. The current layout will require traffic to slow considerably and stop at congested periods. The increased radius will allow traffic to maintain higher speed for better flow and possible lane changing on US 80/Macon Road. This alternative will shorten the dedicated lane slightly while eliminating the hazardous acceleration zone of the current layout.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 23,522	—	\$ 23,522
ALTERNATIVE	\$ 42,105	—	\$ 42,105
SAVINGS	\$ (18,583)	—	\$ (18,583)

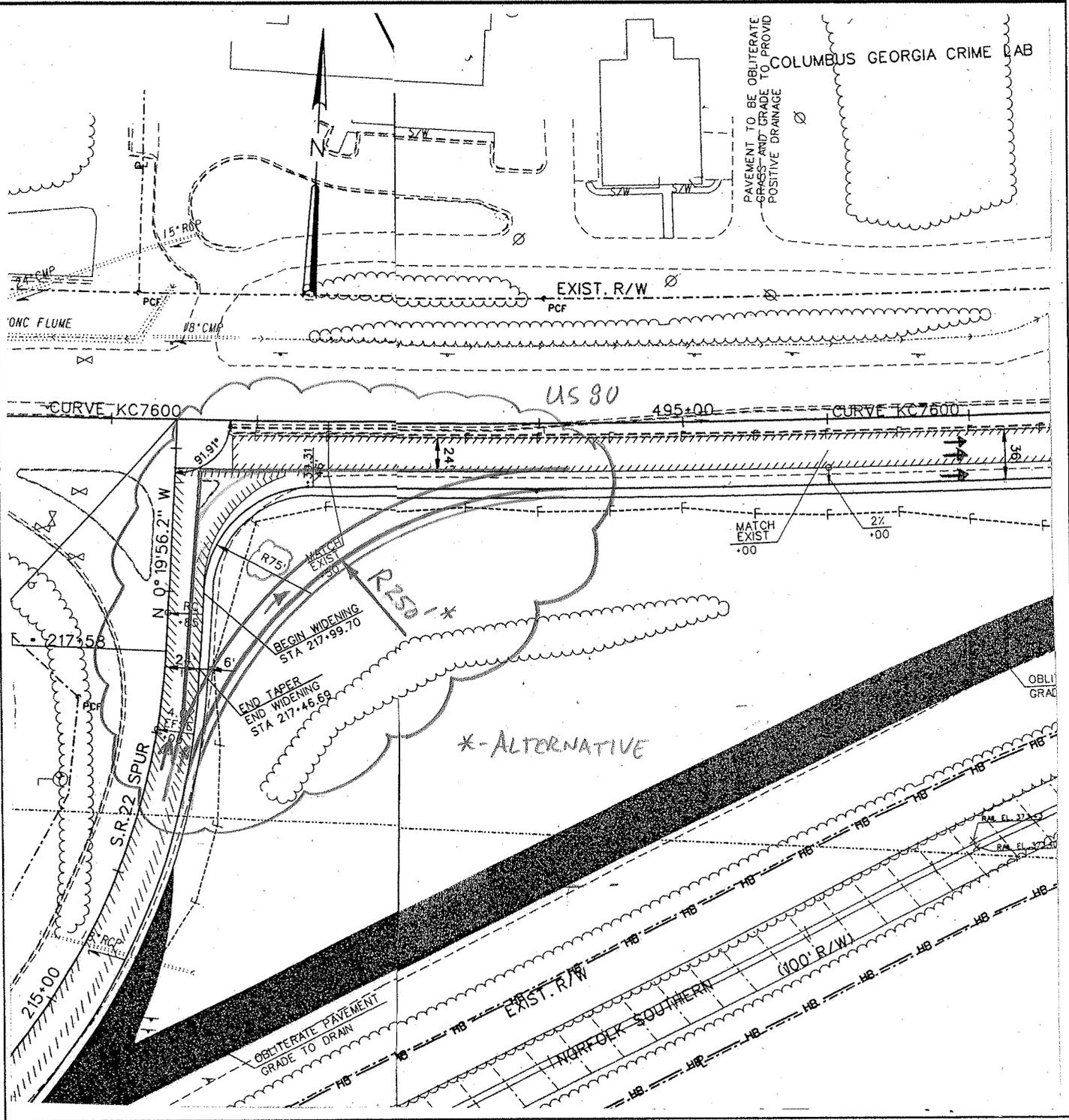
PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

15

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.: **15**

DESCRIPTION: **RECONFIGURE RAMP FROM SR 22 TO US 80-EB**

SHEET NO.: **3 of 4**

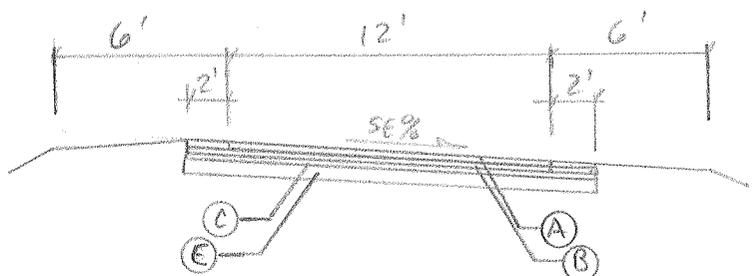
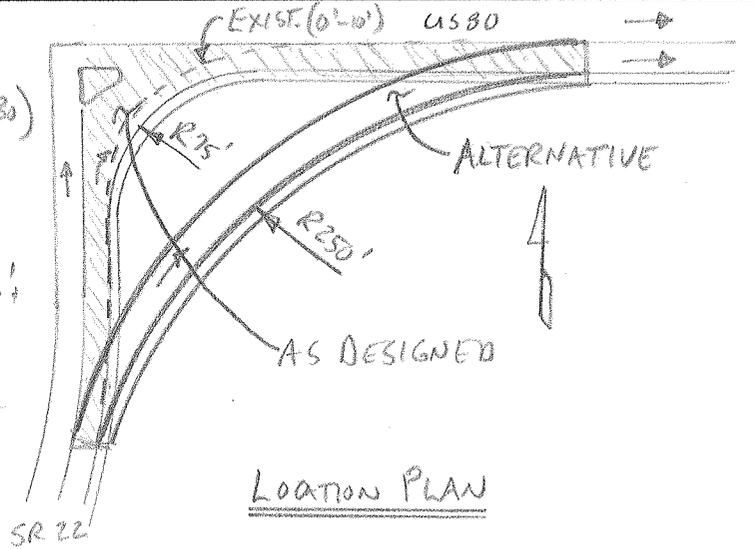
* NO PROFILE DATA AVAILABLE

AREA AS DESIGNED: (TYP. SECT. NO. 30)

$$\begin{aligned} \textcircled{A} + \textcircled{B} &\Rightarrow \left[\frac{2\pi(75 + \frac{10}{2})}{4} \right] 5' + \\ &+ (262' - 87') 12' + \left(\frac{2\pi(75 - \frac{6}{2})}{4} \right) 6' + \\ &+ 2(247' - 72') 6' \frac{1}{4} = \underline{611.9 \text{ SY}} \end{aligned}$$

$$\begin{aligned} \textcircled{C} + \textcircled{E} &\Rightarrow \left[\frac{2\pi(75 + \frac{10}{2})}{4} \right] 5' + \\ &+ (262' - 87') 12' \frac{1}{4} = \underline{303.2 \text{ SY}} \end{aligned}$$

$$\begin{aligned} \textcircled{D} &\Rightarrow \left[\frac{2\pi(75 - \frac{6}{2})}{4} \right] 6' + 2(247' - 72') 6' \frac{1}{4} \\ &= \underline{308.7 \text{ SY}} \end{aligned}$$



AREA - ALTERNATIVE:

$$\begin{aligned} \textcircled{A} + \textcircled{B} + \textcircled{C} + \textcircled{D} &\Rightarrow \left(\frac{2\pi(250 + 16')}{4} \right) 16' \left(\frac{1}{4} \right) \\ &= \underline{714.9 \text{ SY}} \end{aligned}$$

ITEM	UNIT WT.	AS DESIGNED		ALTERNATIVE	
		SY	UNITS (TN)	SY	UNITS (TN)
Ⓐ	12.5mm 165 #/SY	611.9	50.5	714.9	59.0
Ⓑ	19mm 220 #/SY	611.9	67.3		78.6
Ⓒ	25mm 550 #/SY	303.2	83.4		196.6
Ⓓ	8" AGGR 880 #/SY	308.7	135.8		—
Ⓔ	12" AGGR 1320 #/SY	303.2	200.1		471.8
BITUMINOUS COAT 0.07 G/SY		611.9	43 GAL		50 GAL

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **16**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **USE PREFABRICATED ARCH SPAN STRUCTURES IN LIEU OF MULTI-CELL CONCRETE BOX CULVERTS** SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for the use of multi-cell concrete box culverts at two locations:

- Triple 6-foot x 6-foot at Stream No. 7, STA 379+50; and
- Triple 7-foot x 4-foot at Stream No. 8, STA 389+75.

ALTERNATIVE: (Sketch attached)

Use single span prefabricated structures in lieu of the multi-cell concrete box culverts for these two locations.

ADVANTAGES:

- Minimizes construction time
- Minimizes maintenance of traffic
- Increases stream flow capacity
- Reduces stream blockage/debris build-up
- Reduces initial cost

DISADVANTAGES:

- None apparent

DISCUSSION:

The structures are below the 100-year high-water elevation. Removing mid-stream obstructions will improve the stream flow and potentially help avoid flooding. Furthermore, the maintenance associated with debris removal is minimized.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 489,272	—	\$ 489,272
ALTERNATIVE	\$ 464,310	—	\$ 464,310
SAVINGS	\$ 24,962	—	\$ 24,962



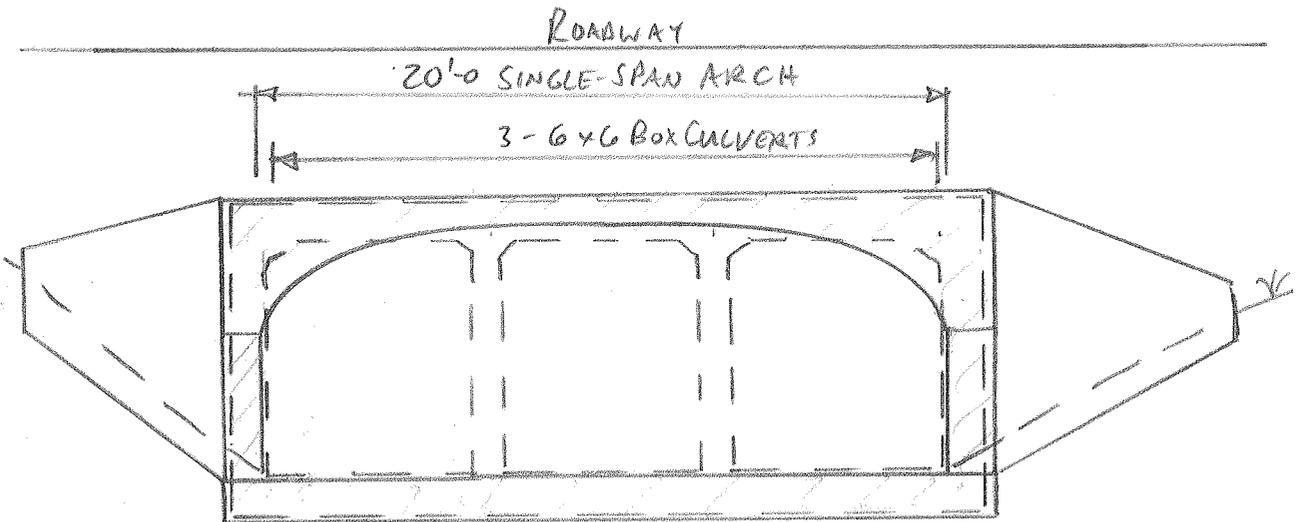
PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

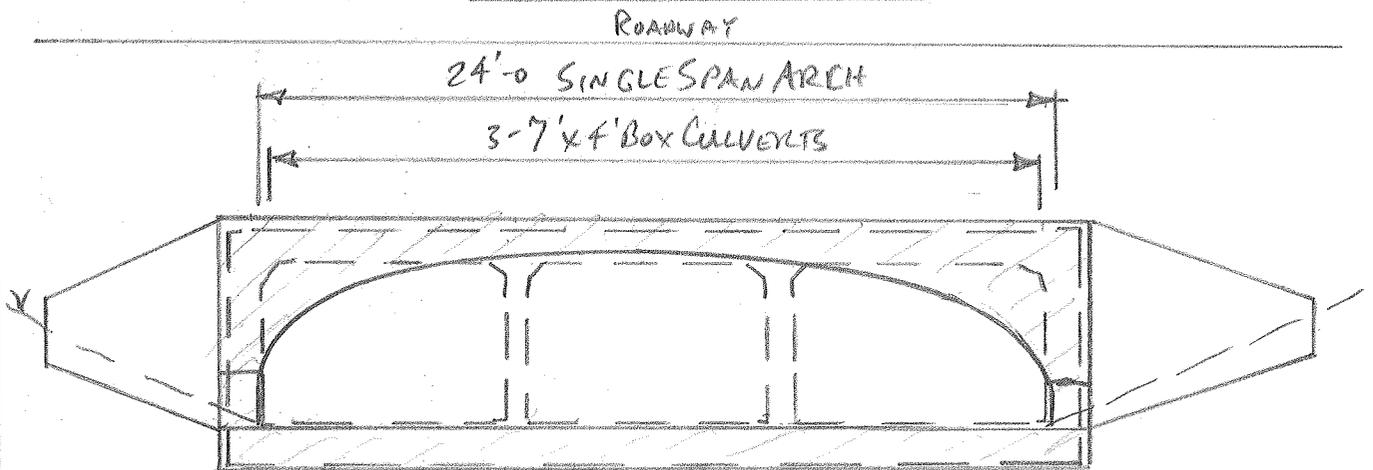
16

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 4



TYPICAL SECTION @ STREAM #7



TYPICAL SECTION @ STREAM #8

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

16

DESCRIPTION: ARCH IN LIEU OF BOX CULVERT

SHEET NO.: 3 of 4

Box Culverts:

QUANTITIES \Rightarrow STD 2325

BAR REINF. STEEL \Rightarrow	<u>BARREL</u>		<u>WING WALLS</u>	<u>TOTAL</u>
6x6	222.3	#/LF (210') = 46,683#	+ 500#	= 47,183#
7x4	255.7	(150') = 38,355	+ 681	= 39,036
CLASS A CONC. \Rightarrow	6x6	1.926 CY/LF (210') = 404.46	+ 20.88 CY	= 425.34 CY
	7x4	2.174	(150') = 326.10 + 18.52	= 344.62

COSTS \Rightarrow 500-3101 CLASS A CONCRETE = 467.31 \$/CY
1000 BAR REINF STEEL = 0.74 \$/#

CONC. ARCH: (FROM CONSPAN ESTIMATE)

$$20' \times 150' = \underline{\$150,000}$$

$$24' \times 210' = (\$180,000 @ 150') \frac{210'}{150'} = \underline{\$252,000}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22** ALTERNATIVE NO.: **18**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

DESCRIPTION: **ELIMINATE CURB AND GUTTER ON MEDIAN SIDE ONLY** SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The current project has a 44-foot raised median with curb and gutter for most of the project.

ALTERNATIVE:

Eliminate the curb and gutter from the raised median and use a 44-foot depressed median.

ADVANTAGES:

- Reduces initial cost
- Simplifies design
- Simplifies construction
- Improves drainage

DISADVANTAGES:

- Excludes the use of larger vegetation for landscaping
- Perceived loss of safety
- Will not match the existing portion of the Eastern Connector

DISCUSSION:

Eliminating the raised median and associated curb and gutter will also reduce the amount earthwork and storm drainage needed. However, this will not match the existing roadway section between STA 370+00 to STA 309+00 (south of Chattsworth Road).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 934,382	—	\$ 934,382
ALTERNATIVE	\$ 116,516	—	\$ 116,516
SAVINGS	\$ 817,866	—	\$ 817,866

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22
Muscookee County, Georgia Department of Transportation, District 3
Design Development Stage**

ALTERNATIVE NO.:

18

DESCRIPTION: Eliminate Curb & Gutter on Median Side Only

SHEET NO.: 2 of 4

Curb & Gutter, Type 7 - 50,032 LF (From Detailed Estimate)

Storm Drain Pipe - Move inlets from C/G at median to center of depressed median in 45 locations at a reduction of 22' / location = 990 LF

Remove system at Sta 180+00 Lt - 220 LF & 3 inlets
Sta 321+00 Lt - 120 LF & 2 inlets
Sta 365+00 Lt - 220 LF & 3 inlets

Move inlets from C/G at narrow median at left turn lanes in 8 locations at a reduction of 8' / location = 64 LF.

Earthwork - Sta 147+00 to Sta 148+00 - 44 CY Borrow
148+00 to 153+00 - 926 CY Excavation
161+00 to 162+00 - 44 CY Excavation
162+00 to 174+00 - 1111 CY Borrow
174+00 to 175+00 - 44 CY Excav
175+00 to 183+00 - 1481 CY Borrow
183+00 to 187+00 - 741 CY Excav
196+00 to 209+00 - 2407 CY Excav
209+00 to 215+00 - 1111 CY Borrow
215+00 to 218+50 - 648 CY Excav
218+50 to 242+00 - 4352 CY Borrow
242+00 to 246+00 - 741 CY Excav
246+00 to 272+50 - 4907 CY Borrow
272+50 to 281+00 - 1574 CY Excav
281+00 to 290+00 - 1667 CY Borrow

CALCULATIONS



PROJECT: **STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM
BUENA VISTA ROAD TO MACON ROAD / S.R. 22**
Muscogee County, Georgia Department of Transportation, District 3
Design Development Stage

ALTERNATIVE NO.:

18

DESCRIPTION: *Eliminate Curb & Gutter on Median Side Only*

SHEET NO.: 3 of 4

290+00 to	306+00 -	2963 CY	Excav
306+00 to	309+00 -	556 CY	Borrow
361+50 to	366+00 -	833 CY	Borrow
374+00 to	379+00 -	926 CY	Borrow

Total Add'l Excavation - 10,088 CY

Total Decrease in Borrow - 16,988 CY

PROJECT DESCRIPTION

BACKGROUND

The proposed Eastern Connector project is located within Planning District 11 in the Columbus Comprehensive Plan of the Columbus - Muscogee County Consolidated Government. Within District 11, land uses include single-family housing, the Corporate Ridge Industrial Park, and many city and state public offices. Fort Benning also borders the district to the east. United States Interstate Highway 185 (I-185), United States Route (US) 80, US 27 and US 280 currently provide access to these developments. Buena Vista Road and St. Mary's Road serve as the east - west highways through District 11.

The proposed project would improve and construct a new location roadway through a tract of land within District 11 that has been exchanged between Fort Benning and Columbus - Muscogee County. The land exchange between these two entities is a result of Columbus - Muscogee County's need for suitable land for economic development near its existing industrial development area; the land will be the site of the proposed Muscogee Technology Park. Upon Congressional approval of the Defense Appropriation Bill, a Memorandum of Agreement between Columbus - Muscogee County and Fort Benning was prepared along with an Environmental Impact Statement (EIS) in 1999. The EIS addressed the potential environmental impacts of the land exchange. Within the EIS, the proposed Spine Road (Eastern Connector) construction alternative was identified as the preferred transportation alternative and as the alternative with the least amount of environmental impacts. As a result of the EIS, Columbus - Muscogee County owns a tract of land consisting of 2,124 acres, of which 1,423 will be used for economic development. The remaining 690 acres would be used for passive recreation, wetland banking, trail systems and educational opportunities. The Eastern Connector project would provide a much-needed multi-lane facility through the proposed Muscogee Technology Park in Columbus - Muscogee County, as well as provide a north-south multi-lane facility between US 80 and Buena Vista Road, where no facility currently exists.

Additional studies in eastern Columbus - Muscogee County include the Columbus Eastern Connector Feasibility Study prepared in 1999 by Presnell Associates Inc./CRA Consulting, Inc. The purpose of the Eastern Connector would be to improve mobility and accessibility within the Columbus - Muscogee County urbanized area and the Valley Partnership. The Eastern Connector project would begin at Buena Vista Road, continue northeast to Schatulga Road through the planned industrial park, and terminate at US 80. Six alternatives were studied in the Eastern Connector feasibility study. The alternative using the proposed Eastern Connector was the preferred alternative.

The tract of land proposed for development is located between US 80/Macon Road and Buena Vista Road. Fort Benning borders to the east and Schatulga Road borders at the west. Within the tract, several unimproved roads exist that were used for moving Fort Benning's equipment, vehicles, and as a footpath. The proposed Eastern Connector project would provide a north-south connector from Schatulga Road to Macon Road using new location roadway, as well as some existing roads. The Eastern Road Connector project would also provide direct access from Macon Road or Schatulga Road into a planned industrial park to be constructed on the western side of the tract of land near the existing Corporate Ridge Industrial Park. Without the construction of the Eastern Connector,

adequate access to and through the proposed industrial park would not be provided. Therefore, the proposed industrial park could not reach its full development potential, thus decreasing the planned economic growth and new jobs the Eastern Connector project would aid in bringing to the area.

Currently, the primary travel corridors within the project area are Macon Road and Schatulga Road. The existing daily traffic volume on Macon Road east of Schatulga Road is 5,800 vehicles per day and is predicted to increase to 15,000 vehicles per day by 2025 without the construction of Eastern Connector and would operate at a level of service (LOS) D. With the construction of the Eastern Connector, the daily traffic volume would be reduced to 10,000 vehicles per day on Macon Road improving to LOS C. The existing daily traffic volume on Schatulga Road between Forrest Road and Macon Road is 9,400 vehicles per day and is predicted to increase to 18,000 vehicles per day by 2025 without the construction of the Eastern Connector. Schatulga Road would operate with a LOS F. With the construction of the Eastern Connector, the daily traffic volume between Forest Road and Macon Road would be reduced to 11,000 vehicles per day improving to LOS C. The development of a new industrial park located off of Schatulga Road would create more jobs in the eastern section of Columbus-Muscogee County. Therefore, improved access within the industrial park, as well as improved accessibility from Macon Road and Schatulga Road, is needed. The Eastern Connector would provide the needed north-south routing of traffic. Without the Eastern Connector, congestion would build along the residential/commercial sections of Schatulga Road, and access to the industrial park would be limited to one location for entering and exiting. From U.S. 80, there is no access into the tract of land proposed for development. Forest Road at Schatulga Road currently provides the only public access into the tract of land.

The Eastern Connector would have a northern terminus at the existing Macon Road/US 80 intersection. The southern terminus would be located south of the existing intersection of Schatulga Road and Forest Road. The Georgia Department of Transportation (GDOT) is presently preparing plans for the widening of Forrest Road from a two-lane roadway to a four-lane divided roadway from Macon Road just east of I-185 to Schatulga Road. The construction of The Eastern Connector would provide a continuous four-lane roadway from Macon Road to US 80. Improvements would also be made along Schatulga Road south to Buena Vista Road. Therefore, the Connector would also provide a north-south link between US 80 and US 27. The Connector would also facilitate traffic movement through Muscogee County from neighboring Harris, Marion, and Chattahoochee Counties.

NEED AND PURPOSE

The need for the proposed Eastern Connector project is to provide access from U.S. 80 to U.S. 27 and facilitate traffic within the proposed Muscogee Technology Park. Improved access would also be provided for motorists trying to move through the eastern section of Columbus - Muscogee County into Harris, Marion, and Chattahoochee Counties.

Project location: The project is located in central Muscogee County, beginning just north of the Buena Vista Road/Schatulga Road intersection and ending at Macon Road/SR 22/US 80. The project length is 5.7 miles and is located entirely within the city limits of Columbus.

Description of Approved Concept: The plan development process classifies the facility as being exempt and having a functional classification of rural principal arterial. The Average Annual Daily Traffic (AADT) as shown in the approved concept was 7,500 for the year 1998, and 12,650 in the design year 2018.

Proposed features to be revised: The original concept report proposed to widen existing Schatulga Road from Buena Vista Road to Macon Road/SR 22 Spur/US 80 for a length of 3.76 miles. The typical section proposed was two 12-foot lanes in each direction with a 14-foot center turn lane and 6-foot wide paved shoulders. Minimum required right-of-way was 124 feet.

The location and alignment described in the original concept has been revised to include widening of Schatulga Road from Buena Vista Road to 0.3 miles north of Luna Drive. From there, the roadway will be constructed on new location to the east of Schatulga Road through a tract of land owned by Columbus - Muscogee County. The roadway will continue northward on new location to the intersection of Lynch Road and Macon Road/SR 22/US 80. The alignment will continue northward on existing Lynch Road for approximately 800 feet.

Describe the revised feature(s) to be approved:

1. Typical section — From Buena Vista to south of Forrest Road
 - Four 12-foot lanes with outside curb and gutter;
 - 14-foot flush median;
 - Two 4-foot bike lanes; and
 - 18-foot shoulder with 5-foot sidewalk (12-foot shoulder in the vicinity of the Green Acres Cemetery entrance).
2. From south of Forrest Road to Chattsworth Road:
 - Four 12-foot lanes with outside curb and gutter;
 - 44-foot raised median with Type 7 curb and gutter;
 - Two 4-foot bike lanes; and
 - 18-foot shoulder with 5-foot sidewalk.
3. From Chattsworth Road to end of project:
 - Four 12-foot lanes with outside curb and gutter;
 - 20-foot raised median with Type 7 curb and gutter;
 - Two 4-foot bike lanes; and
 - 18-foot shoulder with 5-foot sidewalk.

Project Termini: Begins at Buena Vista Road/Schatulga Road to Macon Road/SR 22/US 80 for a length of 5.7 miles.

Changes in right-of-way limits: Impacts to the natural, cultural and social environment have been identified in an EIS between Columbus/Muscogee County and Fort Benning. It is anticipated the results of this study can be used for the Eastern Connector. Any changes in environmental analysis necessary due to the change in the location of the project from the original concept will be addressed in this study.

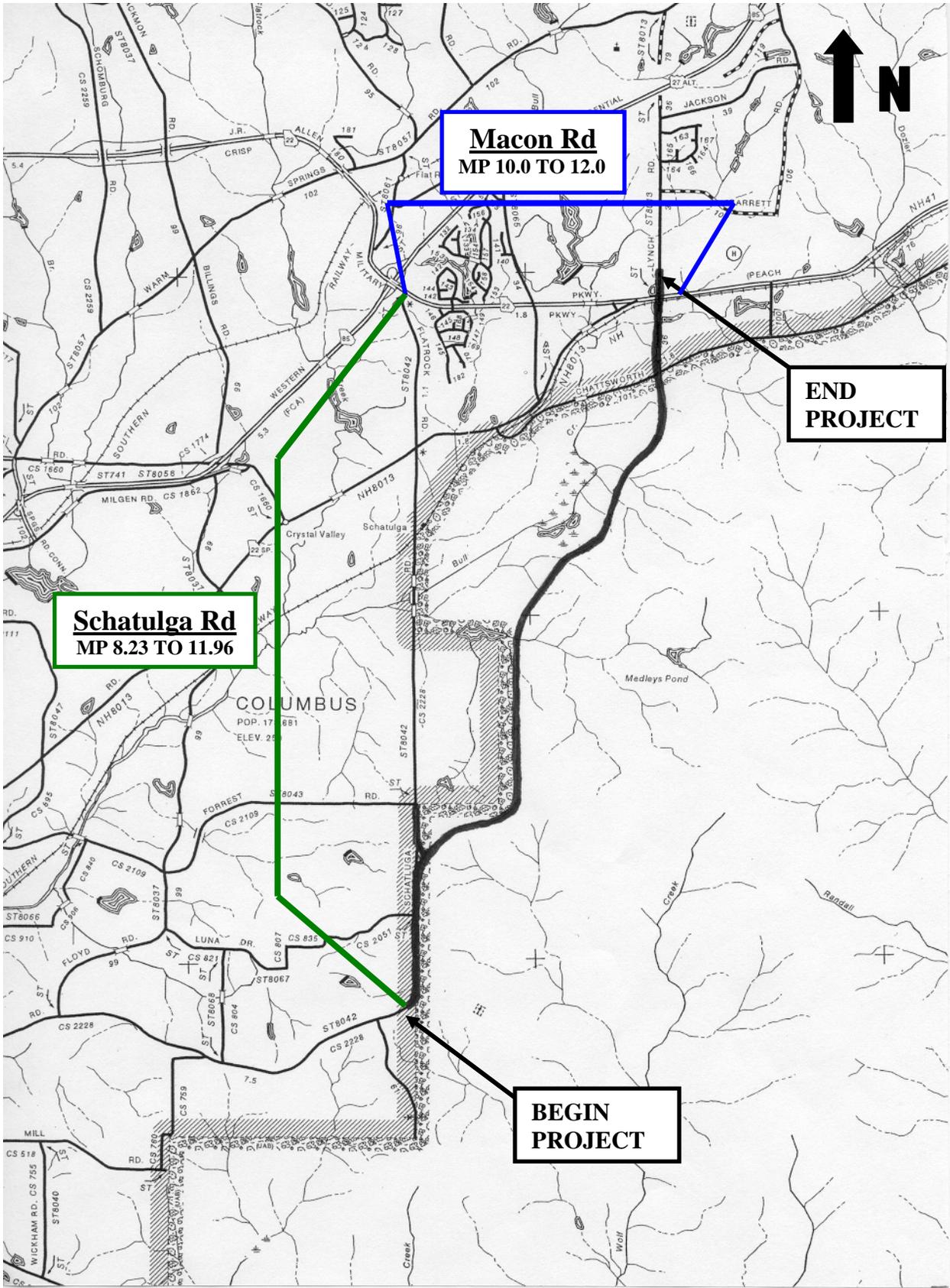
Alignments revised: Widening of Schatulga Road from Buena Vista Road to 0.3 miles north of Luna Drive. From there, the roadway will be constructed on new location to the east of Schatulga Road through a tract of land owned by Columbus - Muscogee County. The roadway will continue northward on new location to the intersection of Lynch Road and Macon Road/SR 22/US 80. The alignment will continue northward on existing Lynch Road for approximately 800 feet.

Updated traffic data (AADT): The proposed AADT for the Eastern Connector would be 11,870 vehicles per day during the build year 2005, and 16,130 vehicles per day during the design year

2025. The LOS for both the build year and design year with a four lane divided roadway would be LOS C or better.

PROJECT COSTS

The current projected probable cost of construction is listed to be \$31,324,807 and is based on Jordon, Jones & Goulding, Inc.'s *Estimate Report for file STP-8042(6)*, dated May 24, 2006. This figure includes: Engineering and Construction at 10.00% for \$2,642,840 and inflation (based on 5.00% per annum for one year) at 5.00% for \$1,452,562. Furthermore, the Preliminary Right-of-Way Cost Estimate, prepared by GDOT, is noted to be \$500,000 that includes a Scheduling Contingency of 55.00% for \$79,205, an Administration/Court Cost of 60.00% for \$133,929, and an Inflation Factor of 40.00% for \$142,857. Additionally, \$300,000 in Reimbursable Utilities costs is noted.



Macon Rd
MP 10.0 TO 12.0

END PROJECT

Schatulga Rd
MP 8.23 TO 11.96

BEGIN PROJECT

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

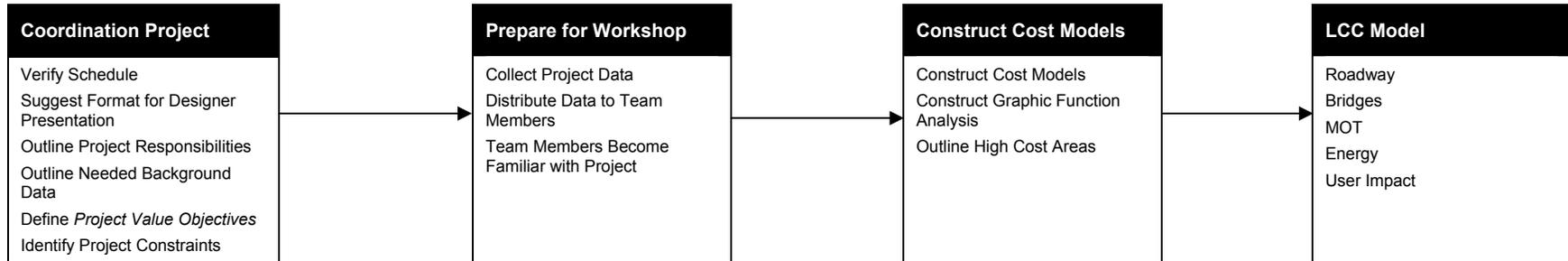
The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase (*Not conducted*)

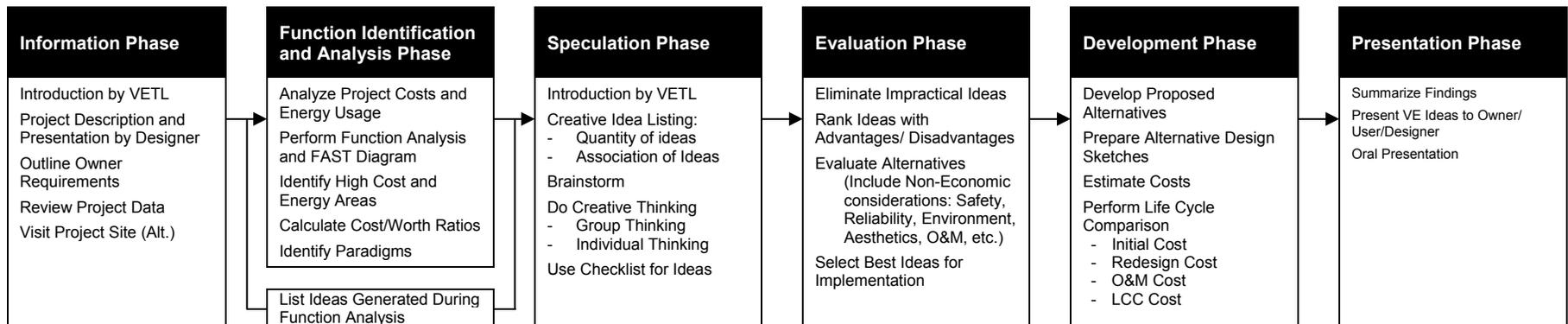


Value Engineering Study Task Flow Diagram

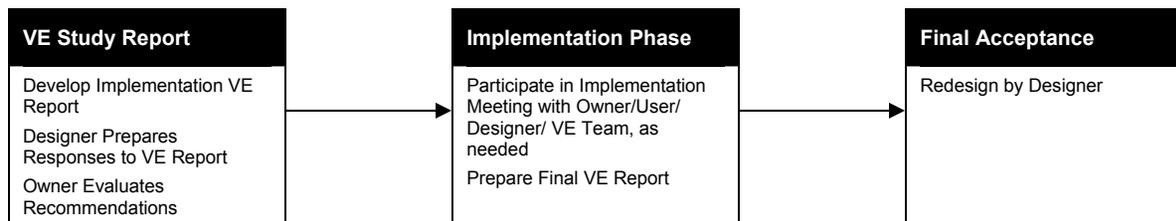
Preparation Effort



Workshop Effort



Post-Workshop Effort



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:

- **Revised Project Concept Report Approval** prepared by the Department of Transportation, State of Georgia, Office of Preconstruction for the Schatulga Road/Eastern Connector from Buena Vista Road to U.S. 80/Macon Road, Project Number STP-8042(6), Muscogee County, P. I. No. 350850 dated April 21, 2003;
- **Detailed Estimate Report** for file “STP-8042(6)” prepared by Jordan, Jones & Goulding, Inc.; dated July 24, 2006;
- **Half Size Drawings of Plan and Profile** of the proposed Eastern Connector from Buena Vista Road to Macon Road/S.R. 22, Federal Aid Project STP-8042(6), Muscogee County, GDOT P. I. No. 350850 prepared for the Department of Transportation, State of Georgia by Jordan, Jones & Goulding, Inc., undated;
- **General Highway Map**, Muscogee 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 1985;
- **Accident Analysis Report** for Eastern Connector from Buena Vista Road to U.S. 80/Macon Road, Project Number STP-8042(6), Muscogee County, P. I. No. 350850 prepared by Jordan, Jones & Goulding, Inc., undated;
- **Preliminary Field Plan Review Inspection Report**, Project Number STP-8042(6), Muscogee County, PI No. 350850, Schatulga Road/Eastern Conn. From Buena Vista Rd to US 80, Inspection Date: July 14, 2006; Report Date: July 17, 2006; Response Date: August 31, 2006;
- **Hydrological/Hydraulic Study of Eastern Connector Over Bull Creek Tributary**, STP-8042(6), Muscogee County, P.I. No. 3050850, No FEMA Coordination Required, prepared for the Department of Transportation, State of Georgia, Office of Bridge Design by Jordan, Jones & Goulding, Inc.; dated march 2003;
- **Soil Survey Report**, Eastern Connector from Buena Vista Road to Macon Road, STP-8042(6), Muscogee County, P.I. No. 350850, Columbus, Georgia, prepared by United Consultants for Jordan, Jones & Goulding, Inc.; dated February 6, 2003, Revised October 7, 2003;
- **PowerPoint Presentation** entitled Muscogee Technology Park, Development and Mitigation plan, Joint Development Committee, Muscogee County, Georgia, prepared by Jordan, Jones & Goulding, Inc.; undated
- **Aerial Plans** for STP-8042(6); and

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 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/or Function Analysis Systems Technique (F.A.S.T.) diagram.

Creative 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) and Jordan Jones & Goulding, Inc. (JJ&G) 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 creative 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 and JJ&G 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-8041(6), P. I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22** project located in Muscogee County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) and the design team of Jordan, Jones & Goulding (JJ&G) 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 October 18 - 20, 2006. The study will be conducted in Personnel's Conference Room, Room 274B of 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, October 18th

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 and JJ&G are 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, October 19th

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, October 20th

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
Paresh J. Parikh, PE	Construction Specialist/ Transportation Engineer	Delon Hampton and Associates
Luis M. Venegas, PE, CVS	Value Engineering Facilitator	Lewis & Zimmerman Associates

OWNER'S /DESIGNER'S PRESENTATION

The Georgia Department of Transportation (GDOT) and a representative from the design team of Jordan Jones & Goulding, Inc. (JJ&G) presented an overview of the project on Wednesday, October 18, 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.

VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Friday, October 20, 2006 to GDOT; however, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT personnel.

A copy of the meeting participants is attached for reference.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS



PROJECT: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD / S.R. 22 Muscogee County, Georgia Department of Transportation, District 3 <i>Design Development Stage</i>		Date: October 18 – 20, 2006
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Douglas Franks, PE em: douglas.franks@dot.state.ga.us	State of Georgia Department of Transportation (GDOT) Office of Bridge Design Bridge Design Engineer III	ph: 404-656-5289 cell: fx: 404-651-7076
Marc Mastronardi em: marc.mastronardi@dot.state.ga.us	GDOT Office of Construction Construction Liaison Engineer	ph: 404-656-5306 cell: fx: 404-657-0783
Neal O'Brien em: neal.obrien@dot.state.ga.us	GDOT, Office of Urban Design Design Group Manager	ph: 404-656-5442 cell: Fx: 404-657-7921
Wayne Pittman em: wayne.pittman@dot.state.ga.us	GDOT, District 3, Office of Construction, Columbus Area 7 Area Engineer	ph: 706-568-2165 cell: fx: 706-569-3071
Robert P. Simpson em: robert.simpson@dot.state.ga.us	GDOT Office of Bridge Design Transportation Engineer Associate	ph: 404-656-5289 cell: fx: 404-651-7076
Ken Werho em: ken.werho@dot.state.ga.us	GDOT, Office of Traffic and Design Design Review Manager	ph: 404-635-8144 cell: fx: 404-635-8116
Christina Wilkinson em: christina.wilkinson@dot.state.ga.us	GDOT, Office of Environmental / Location NEPA Specialist	ph: 404-699-4437 cell: fx: 404-699-4440
Alex R. Stone, PE em: astone@jjg.com	Jordan, Jones & Goulding, Inc. Project Presenter	ph: 678-333-0429 cell: fx: 770-455-7391
Paresh J. Parikh, PE em: pparikh@delonhampton.com	Delon Hampton & Associates, Chartered Manager, Engineering Services / Transportation Engineer	ph: 404-524-8030 cell: fx: 404-524-2575
Lawrence (Larry) Prescott, Jr., PE em: lprescott@hntb.com	HNTB Corporation Director of Structural Engineering	ph: 404-946-5743 cell: 770-231-8579 fx: 404-841-2820

ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation and the Jordan, Jones & Goulding, Inc. 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:	2012
Construction Duration:	±24 - 36 Months (2014 - 2016)
Economic Planning Life:	35 years for Pavement
Economic Planning Life:	50 years for Bridges
Discount Rate / Interest:	2.76% (Extrapolated from latest United States Office of Management and Budget Circular A-94, Appendix C – January 2006)
Inflation / Escalation Rate:	5.00% (Per GDOT)
Uniform Present Worth (UPW) Factor:	22.2602 for 35 years 28.9447 for 50 years
Composite Mark-Up (Construction): <i>(Composed of: Inflation at 5.00% based 5.00% per annum for one year, and Engineering and Construction at 10.00%.)</i>	15.50% (0.1550)
Composite Mark-Up (Right-of-Way): <i>(Composed of: Scheduling Contingency at 55.00%; Administration / Court Costs at 60.00%; and Inflation Factor at 40.00 %.)</i>	247.20% (2.4720)

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:

- Roadway (Including Drainage)
 - Unclassified Excavation
 - Recycled Asphalt Concrete
 - Aggregate Base Course
 - Borrow Excavation
 - Clearing and Grubbing
- Bridge

DESIGNER'S COST ESTIMATE

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

COST HISTOGRAM



Project: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22
Design Development Stage

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
Roadway Including Drainage	24,053,847	91.02%	91.02%
Bridge	1,215,000	4.60%	95.61%
Temporary Erosion Control	644,364	2.44%	98.05%
Permanent Erosion Control	242,755	0.92%	98.97%
Signing and Marking	210,891	0.80%	99.77%
Signalization	61,547	0.23%	100.00%
Construction Subtotal	\$ 26,428,404	100.00%	
Engineering and Construction @	10.00%	\$ 2,642,840	
Inflation Based on 5.00% per annum for One Year	5.00%	\$ 1,453,562	Construction
Construction Total	\$ 30,524,807		Mark-Up: 15.50%
Net Right-of-Way	\$ 144,009		
Right-of-Way Scheduling Contingency	55.00%	\$ 79,205	
Right-of-Way Administration / Court Costs	60.00%	\$ 133,929	
Right-of-Way Inflation Factor	40.00%	\$ 142,857	ROW
Right of Way Total	\$ 500,000		Mark-Up: 247.20%
Reimbursable Utilities	\$ 300,000		
GRAND TOTAL	\$ 31,324,807		



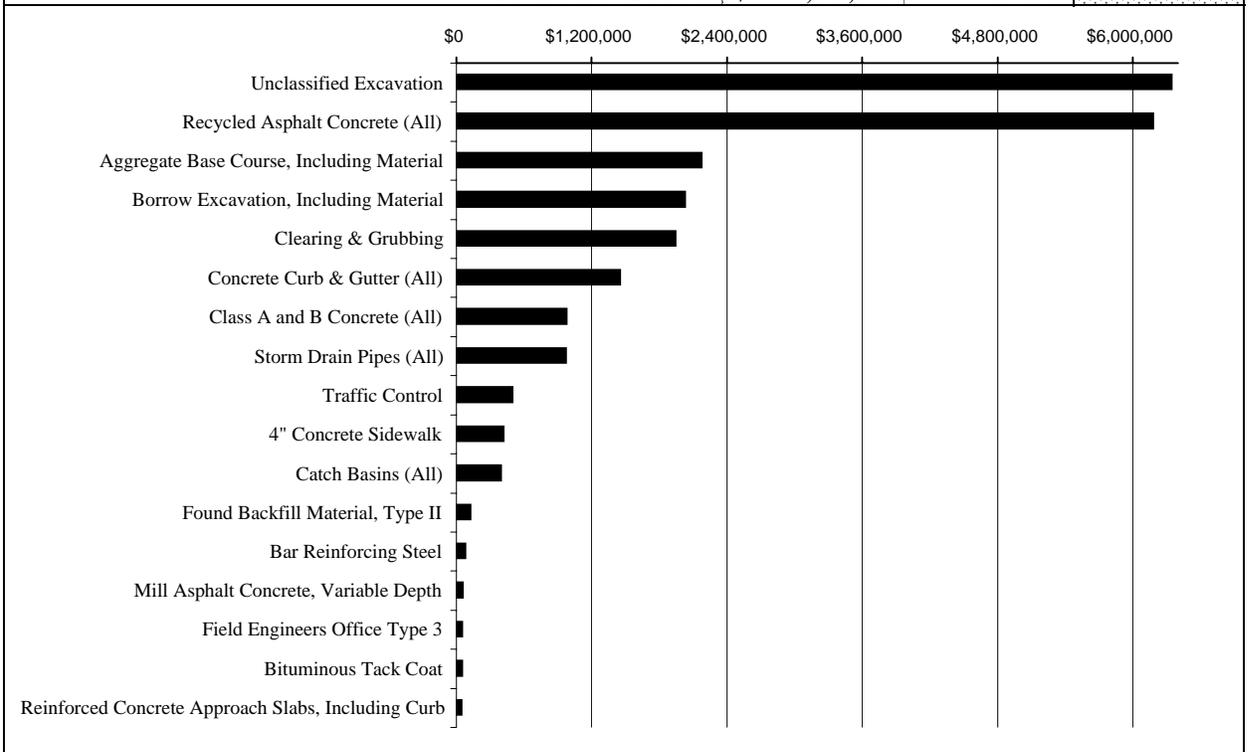
Costs in graph are not marked-up and excludes the "Roadway and Drainage" elements.

COST HISTOGRAM



Project: STP-8042(6), P.I. No. 350850, EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD/S.R. 22
Design Development Stage

Roadway (Including Drainage)	COST	PERCENT	CUM. PERCENT
Unclassified Excavation	6,348,512	26.39%	26.39%
Recycled Asphalt Concrete (All)	6,187,350	25.72%	52.12%
Aggregate Base Course, Including Material	2,178,450	9.06%	61.17%
Borrow Excavation, Including Material	2,035,453	8.46%	69.63%
Clearing & Grubbing	1,948,145	8.10%	77.73%
Concrete Curb & Gutter (All)	1,456,911	6.06%	83.79%
Class A and B Concrete (All)	981,218	4.08%	87.87%
Storm Drain Pipes (All)	978,042	4.07%	91.94%
Traffic Control	500,000	2.08%	94.01%
4" Concrete Sidewalk	421,920	1.75%	95.77%
Catch Basins (All)	403,602	1.68%	97.45%
Found Backfill Material, Type II	130,620	0.54%	97.99%
Bar Reinforcing Steel	86,246	0.36%	98.35%
Mill Asphalt Concrete, Variable Depth	59,607	0.25%	98.60%
Field Engineers Office Type 3	57,024	0.24%	98.83%
Bituminous Tack Coat	56,000	0.23%	99.07%
Reinforced Concrete Approach Slabs, Including Curb	48,026	0.20%	99.27%
Concrete Valley Gutter (All)	34,767	0.14%	99.41%
Guardrails (All)	31,599	0.13%	99.54%
4" Concrete Median	28,172	0.12%	99.66%
Drop Inlets (All)	19,558	0.08%	99.74%
Flared End Sections (All)	17,287	0.07%	99.81%
Driveway Concrete (All)	11,499	0.05%	99.86%
Aggregate Surface Course	10,050	0.04%	99.90%
Side Drain Pipes (All)	8,729	0.04%	99.94%
Storm Sewer Manholes (All)	7,910	0.03%	99.97%
Right of Way Markers	4,519	0.02%	99.99%
Pavement Reinforced Fabric Strips, Type 2	2,630	0.01%	100.00%
Construction Subtotal	\$ 24,053,846	100.00%	



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/ANTICIPATED TRAFFIC** and **PROVIDE/ACCESS (DEVELOPMENT)** by **Providing/New, Widened Facility**. The F.A.S.T. diagram is included at the end of this section of the report.

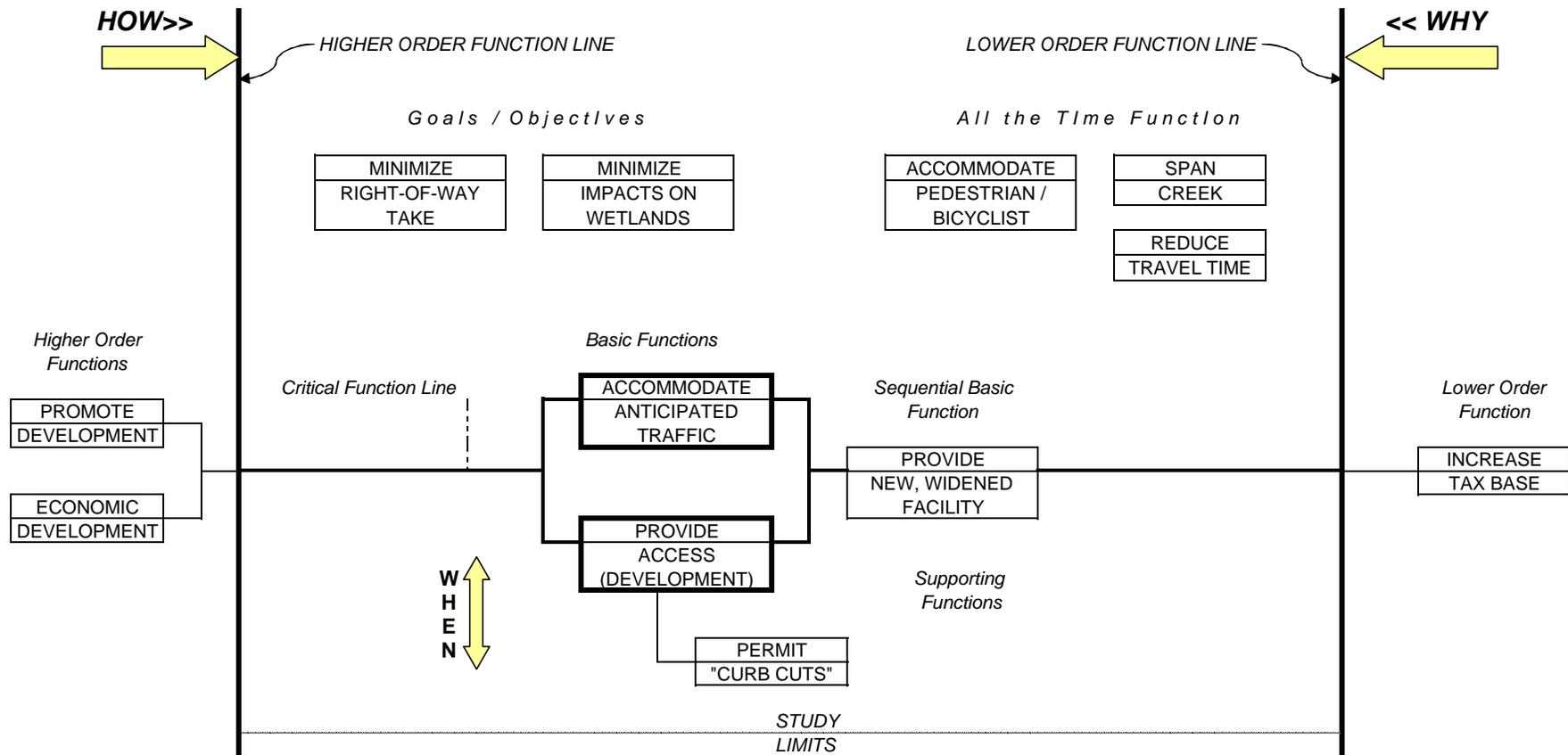
FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)

EASTERN CONNECTOR FROM BUENA VISTA ROAD TO MACON ROAD (US 80 / SR 22)



STP-8042(6), P.I. 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 rated 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.

