

VALUE ENGINEERING MOD 1 TRAINING REPORT

Lithonia Industrial Blvd Extension – Phase III

Project No. CSSTP-0006-00(889)

DeKalb County

PI No. 0006889

March 11, 2009

OWNER:



Georgia Department of Transportation
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Atlanta, GA 30308
(404.631.1770)

VALUE ENGINEERING
MOD 1 INSTRUCTOR:



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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

VALUE ENGINEERING MOD 1 TRAINING REPORT

Lithonia Industrial Blvd Extension – Phase III

Project No. CSSTP-0006-00(889)

DeKalb County

PI No. 0006889

March 11, 2009

Introduction

This report summarizes the results of a value engineering (VE) study of roadway improvements for the Lithonia Industrial Blvd. Extension, Phase III, in DeKalb County. The study was conducted as part of the Mod 1 training session held for select GDOT staff on February 23 to 27, 2009.

The main purpose of this project is to provide a north-south access route through this portion of DeKalb County. The project would also provide a more direct and shorter route from I-20 Evans Mill Road and the roadway capacity for current and future planned developments in the area.

A typical cross section for both mainline and cross-road consists of 4 – 12 ft lanes, 20 ft raised, landscaped median and variable with sidewalks, 5 – 10 ft, and a 2 ft grass strip. The total project length is 1.10 miles. The total estimated construction cost of the project including R/W is \$10,546,000. On Monday, February 23, 2009, the design team gave an overview of the project to the VE team and on Friday, February 27, 2009, the VE Team presented their recommendations.

This report presents the VE Team's recommendations and all back-up information for consideration by the decision-makers. This **Executive Summary** includes a brief description of each recommendation. The **Study Identification** section contains information about the project and the team. The **Recommendations** section presents a more detailed description and support information about each recommendation. The **Appendix** includes a complete record of the Team's activities and findings. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VE process.

VE-11

DEVELOPMENT PHASE - EXECUTIVE SUMMARY	
Project: PI 0006889 DeKalb	Team: 2
Location: Lithonia Industrial Blvd. Ph. III	Date: 2/26/09

Introduction

This report summarizes the results of a value engineering (VE) study conducted on the Lithonia Industrial Boulevard Extension, Phase III project in the southeastern part of DeKalb County. This project will create a connection between Evans Mill Road at its intersection with Rock Springs Road and existing Lithonia Industrial Boulevard at its intersection with I-20 eastbound ramps for a length of 1.1 miles. The estimated construction cost including Right of Way is \$ 10,546,000. The preliminary design is currently 31% complete with the EA in the final stages of approval. The project is being designed by GDOT's Consultant Arcadis of Atlanta, Georgia. The study was conducted February 23-27, 2009 at the GDOT offices in Atlanta using a 5 person VE team.

The main purpose of the project is to provide a north-south access route through this portion of DeKalb County. The project would also provide a more direct and shorter route from I-20 to Evans Mill Road; reduce cut-through traffic and congestion along a residential section of Evans Mill Road; and provide roadway capacity for current planned development in the area. This project is in the Mobility 2030 RTP. The proposed project would provide on new location a four-lane urban roadway with a raised median and two new signalized intersections. Major contract work items include roadway grading, pavement, curb and gutter, installation of drainage, traffic signals and the construction of sidewalks and a multi-use trail.

Considerations

The project being evaluated under this VE study has an estimated construction cost (including E&C and Inflation) of \$ 65 million. This project will require significant amounts of new ROW and ROW construction easements. Right of Way costs are estimated at \$2 million. The design of the project and ROW costs are being funded by DeKalb County. The construction cost will be paid by the State. The letting is proposed for March 2010.

The VE team focused their efforts on the high cost items of the project. The study generated 44 ideas with 10 being identified for additional evaluation as possible recommendations. The VE team developed 10 independent recommendations and one alternative recommendation. The implementation of all 10 independent recommendations (B-4, H-5, E-3, E-4, F-2, A-5, B-5, E-4a, I-1, & E-2) has the potential to reduce the project cost by approximately \$2,612,056. A detailed write-up of each recommendation is contained in the respective portion of this report.

STUDY IDENTIFICATION

VE-1

STUDY IDENTIFICATION

Project: Lithonia Industrial Blvd Phase III Extension	Dates: February 23 - 27, 2009
Location: GDOT HQ – Atlanta, 4th Floor; Conducted as part of Module 1 Training	

VE Team Members

Name:	Position:	Organization:	Telephone:
Tim Matthews	Road Design	GDOT	4-631-1552
Butch Welch	Urban Design	GDOT	4-631-1690
Steve Carter	Engineering Services	GDOT	4-631-1771
Terry Rogers	Program Delivery	GDOT	4-631-1567
Walt Taylor	Road Design	GDOT	4-631-1617

Project Description

The proposed construction will extend Lithonia Industrial Boulevard from I-20 on new location to the intersection of Evans Mill Road and Rock Springs Road. The proposed typical section consists of a 4 lane facility with a 20' raised median, curb and gutter, 5' and 10' sidewalks with 2' grass strip. Left and right turn auxiliary lanes will be provided at major intersections.

Project Constraints

Evans Mill connector cannot be removed due to commitment that was made during PIOH. Alignment location cannot be shifted near lake due to public involvement with schools and church.

Figure 1
Project Vicinity Map



County Map of Georgia

VE RECOMMENDATIONS

VE-9

DEVELOPMENT AND RECOMMENDATION PHASE			
Project: PI 0006889 DeKalb			
Idea No.: B-4	Sheet No.: 15 of 46	CREATIVE IDEA: Remove 20 ft. Raised Median/ROW	
Comp By: TWM/WDT/TR Date: 2/26/09			
Original Concept: 20 ft. Raised Median on Mainline from I-20 to Evans Mill Rd.			
Proposed Change: Remove 20 ft. Raised Median on Mainline from I-20 to Evans Mill Rd.			
Justification: Policy for 20 ft. Raised Median is required when Base ADT > 18,000 and Design ADT > 24,000. This project has a Base ADT of 6800 and a Design ADT of 12,500. This also reduces the amount of ROW needed.			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$373,514		
Proposed	\$ 6,000		
Savings	\$367,514		
FUTURE COST: Savings			
TOTAL PRESENT WORTH SAVINGS			\$367,514

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: 8-4
Client: :

REMOVE RAISED MEDIAN ON MAIN LINE

$$\begin{matrix} \text{STA} & & \text{STA} \\ 16353.51 & - & 10449.26 = 5904.25 \text{ LF.} \end{matrix}$$

WIDTH OF MEDIAN = 15'

$$5904.25 \times 15' = 88563.75 \text{ SF / 9}$$

$$\Rightarrow 9840.42 \text{ SY.}$$

$$9840.42 \times \$30 = \$295,212.50$$

ROW REDUCTION

FROM ABOVE LENGTH OF ROW = 5904.25 LF

WIDTH REDUCED 20'

$$5904.25' \times 20' = 118,085 \text{ SF}$$

94% OF REQD ROW is \$0.64/SF.

6% OF REQD ROW is \$1.03/SF

$$118,050 \times 94\% = 110999.9 \approx 111000 \text{ SF}$$

$$118,050 - 111000 = 7050 \text{ SF}$$

$$111000 \text{ SF} \times 0.64/\text{SF} = \$71,040$$

$$7050 \text{ SF} \times 1.03/\text{SF} = \$7262$$

$$\boxed{\$78,302}$$

STRIPING FOR MEDIAN

$5,904.25 \text{ LF} \times \$0.150/\text{LF} = \$2,952.13 / \text{STRIPE} \times 2 \text{ STRIPE}$
 $\text{ROW} = 33 = 5904.25 \times \$6,000 \Rightarrow$

0006889 DeKalb

DEVELOPMENT AND RECOMMENDATION PHASE			
Project: PI 0006889 DeKalb			
Idea No.: H-5	Sheet No.: 17 of 46	CREATIVE IDEA: Eliminate Sidewalks through corridor	
Comp By: SC Date: 2/26/09			
<p>Original Concept: The current urban roadway typical section for the proposed project includes 4 12 ft. lanes with 20 ft. raised median, 12 ft. and 16 ft. outside shoulders with a 5 ft. concrete sidewalk and 10 ft. concrete multi-use trail.</p> <p>Proposed Change: It is recommended that the sidewalk be eliminated in areas that have limited access or no residential/commercial developments.</p> <p>Justification: The project is being developed on new location in an underdeveloped area with a large percentage of the project proposed with limited access right of way control.</p>			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$258,425		
Proposed	\$153,700		
Savings	\$104,725		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$104,725

VE-9C

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: H-5
Client:

Sta. 138+40 to Sta. 163+40 Lt & Rt

$$2500' \times 5' = 12500 \text{ ft}^2 = 1388.89 \text{ yd}^2$$

x 2 (Lt & Rt)

$$2777.78 \text{ yd}^2$$

Sta. 111+80 to Sta. 137+20 Rt

$$2540' \times 5' = 12700 \text{ ft}^2 = 1411.11 \text{ yd}^2$$

$$4188.89 \text{ yd}^2$$

$$\approx 4189 \text{ yd}^2$$

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 DeKalb

Idea No.:
E-3

Sheet No.:

CREATIVE IDEA:
Revise Signal Support Configuration

Comp By: SC Date: 2/26/09

Original Concept: The current project proposes new traffic signals at two locations. The project proposes to use steel mast arms for signal head supports.

Proposed Change: It is recommended that the signal support structures be revised from TP IV Steel Strain Poles with mast arms to TP IV Strain Poles with a “crushed box” signal span wire configuration.

Justification: The TP IV Strain Poles will function the same as the TP V with a cost savings.

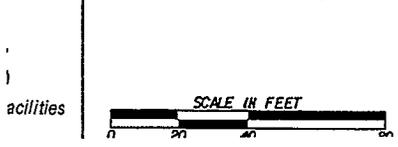
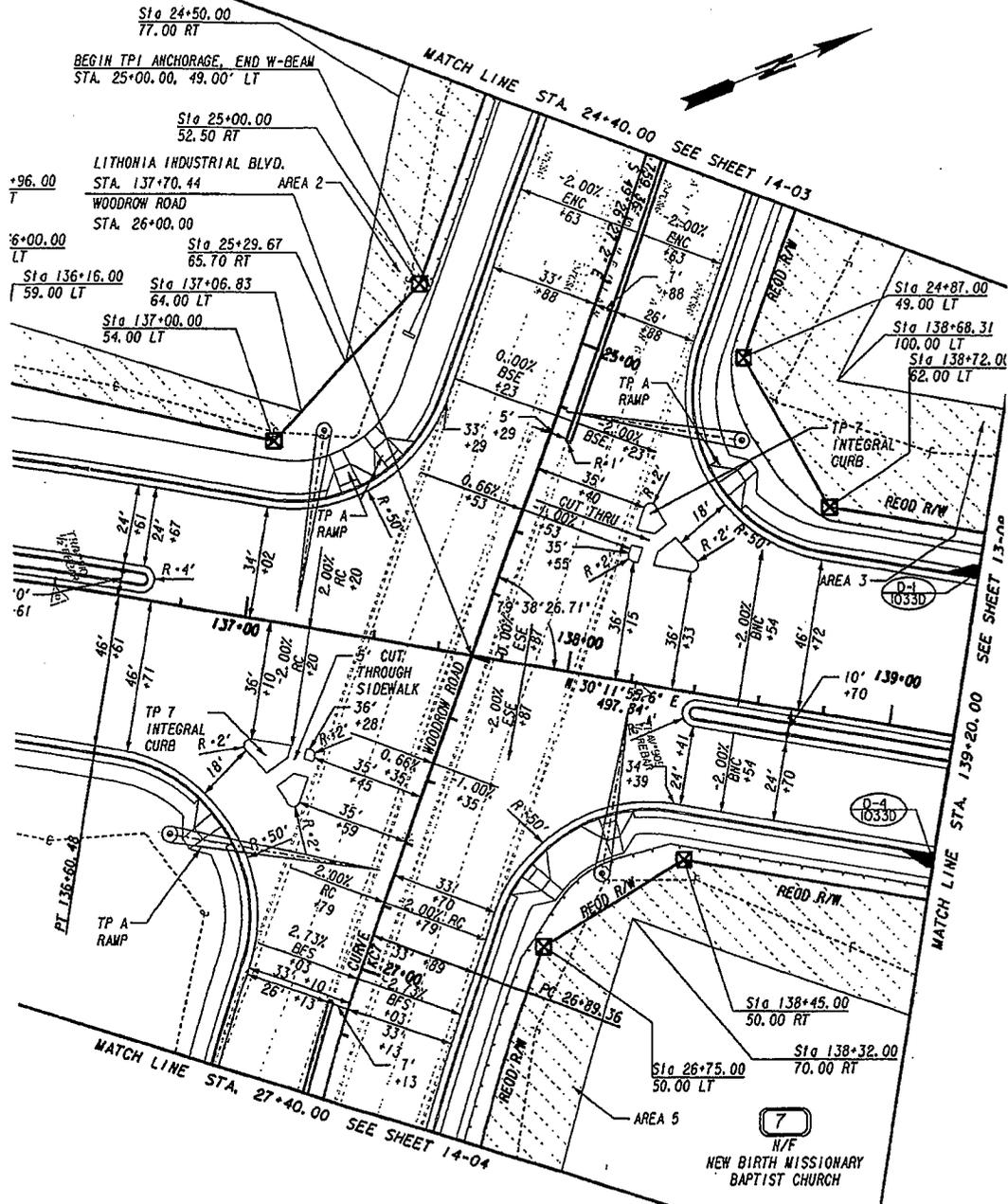
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$86,250		
Proposed	\$54,250		
Savings	\$32,000		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$32,000

SKETCH

Project: 0006889 DEKALB

Idea No.: E-3
Client: :

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	CSSTP-0006-0018891	35	354



REVISION DATES

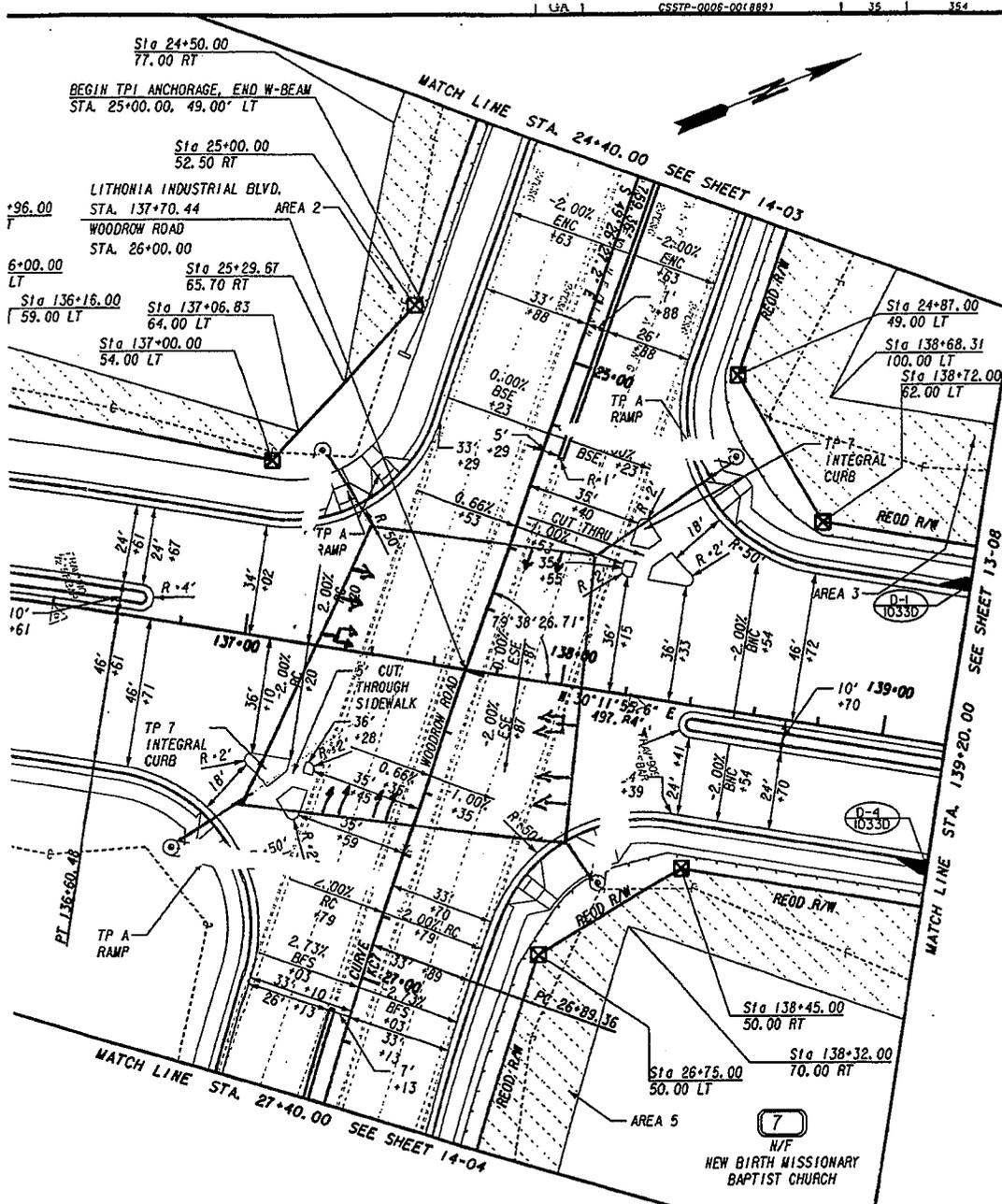
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE, GDOT DISTRICT 7
MAINLINE PLAN
Existing Configuration
LITHONIA INDUSTRIAL BLVD.

VE-9A

SKETCH

Project: **0006889 DEKALB**

Idea No.: **E3**
Client:



<p>3 facilities</p>	<p>REVISION DATES</p> <table border="1"> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>							<p>STATE OF GEORGIA DEPARTMENT OF TRANSPORTATION OFFICE: GDOT DISTRICT 7</p>
<p>SCALE IN FEET</p>	<p>MAINLINE PLAN VE Proposal LITHONIA INDUSTRIAL BLVD.</p>							
		<p>DRAWING No. 12-07</p>						

VE-9B

COST WORKSHEET

Project: 0006889 DEKALB					Idea No.: E3 Client: _____		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
LIB / Rock Springs							
Steel Strain Pole TPIV	EA	1	\$12000	12000			
w/ 35' Mast Arm							
Steel Strain Pole TPIV	EA	1	\$17500	17500			
Incl Lum Arm w/ 60' Mast Arm							
Steel Strain Pole TPIV	EA	1	12500	12500			
Incl Lum Arm w/ 45' Mast Arm							
Strain Pole TPIV	EA				2	\$7000	14000
Strain Pole TPIV	EA				2	\$8000	16000
Incl Lum Arm							
Span Wire	Reel				2	500	1000
Misc Hardware	Lump				1	125	125
LIB / Woodrow							
Steel Strain Pole TPIV	EA	1	\$12750	\$12750			
Incl Lum Arm w/ 50' Mast Arm							
Steel Strain Pole TPIV	EA	1	\$15000	\$15000			
w/ 65' Mast Arm							
Steel Strain Pole TPIV	EA	1	\$13000	\$13000			
w/ 55' Mast Arm							
Steel Strain Pole TPIV	EA	1	\$13500	\$13500			
Incl Lum Arm w/ 55' Mast Arm							
Strain Pole TPIV	EA				2	\$7000	\$14000
Strain Pole TPIV	EA				2	\$8000	\$8000
w/ Lum Arm							
Span Wire	Reel				2	500	1000
Misc Hardware	Lump				1	\$125	125
Subtotal:				\$86250			54250
Mark-up (%)							
Total				86250			54250
Total Rounded				86250			54250

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
E-4

Sheet No.:
23 of 46

CREATIVE IDEA:
Removal of Fiber Optic Interconnect

Comp By: SC Date: 2/26/09

Original Concept: The project proposes to interconnect the 3 traffic signals (1 existing, 2 proposed) within the project limits to provide communication capabilities.

Proposed Change: It is recommended that fiber optic interconnect be eliminated from this project.

Justification: The traffic signals are at a spacing of more than ½ mile. At this distance, platooning of vehicles is not maintained. The land usage is proposed with limited access which will eliminate the need for future traffic signals and therefore no need for interconnectivity.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$34,730		
Proposed	0		
Savings	\$34,730		
FUTURE COST: Savings			0
TOTAL PRESENT WORTH SAVINGS			\$34,730

VE-9B

COST WORKSHEET

Project: 0006889 DEXALD					Idea No.: E-4 Client::		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
Outside Plant Fiber Optic Cable, Drop, Single Mode, 72 Fiber	LF	6100	3.60	21,960			
OSP Fiber Optic Cable, Drop, SM 6 Fiber	LF	150	0.50	525			
Fiber Optic Closure Underground 6 fiber	EA	3	587.16	1761.48			
Fiber Optic Closure Underground, 24 fiber	EA	1	664.12	664.12			
Fiber Optic splice, Fusion	EA	12	55.00	660.00			
Fiber Optic patch cord SM	EA	12	55.00	660.00			
Fiber Optic splice fusion	EA	36	105.00	3780.00			
Testing	Lump	Lump	650	650.00			
Subtotal:				34,730.00			
Mark-up (%)							
Total				34,730.00			
Total Rounded				34,730.00			

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
F-2

Sheet No.:
25 of 46

CREATIVE IDEA:
Remove Curb & Gutter

Comp By: WDT/TR Date: 2/26/09

Original Concept: Proposes curb & gutter on mainline from I-20 to Evans Mill Rd. and includes longitudinal drainage system.

Proposed Change: Remove curb & gutter on mainline from I-20 to Woodrow Rd.. Use rural shoulder typical section and remove longitudinal drainage system from same location.

Justification: Project is on new location and is undeveloped from I-20 to Woodrow Rd.. Economic development is not in the immediate future. Therefore urban shoulder is not needed.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$204,742		
Proposed	\$ 89,083		
Savings	\$115,659		
FUTURE COST: Savings			0
TOTAL PRESENT WORTH SAVINGS			\$115,659

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: F-2
Client:

CURB & GUTTER FROM STATION 140+00 - 163+53.51
LIN FT 2353.51 x \$12.00 = \$28,242.02

REMOVE CURB & GUTTER BETWEEN 140+00 - 163+53.51

~~\$0.00~~ ~~SMIS~~ ~~\$28,242.02~~

COST OF 2' PAVED SHOULDER

2353.51' x 4' (2-2' PAVED SHOULDERS) = 9,414.04 SF x $\frac{1 \text{ sy}}{9 \text{ sf}} = 1046 \text{ sy}$

9.5mm: $1046 \text{ sy} \times \frac{135 \#}{\text{SY} \cdot \text{IN}} = 141,210 \# \times \frac{1 \text{ TN}}{2000 \#} = 70.61 \text{ TN}$
 $70.61 \text{ TN} \times \frac{\$70}{\text{TN}} = \underline{\$4,943}$

19mm: $1046 \text{ sy} \times \frac{220 \#}{\text{SY} \cdot \text{IN}} = 230,120 \# \times \frac{1 \text{ TN}}{2000 \#} = 115.06 \text{ TN}$
 $115.06 \text{ TN} \times \frac{\$85}{\text{TN}} = \underline{\$9,780}$

25mm: $1046 \text{ sy} \times \frac{330 \#}{\text{SY} \cdot \text{IN}} = 345,180 \# \times \frac{1 \text{ TN}}{2000 \#} = 172.59 \text{ TN}$
 $172.59 \text{ TN} \times \frac{\$75}{\text{TN}} = \underline{\$12,945}$

GAB: $1046 \text{ sy} \times \frac{\$20.10}{\text{sy}} = \underline{\$21,025}$

TOTAL COST = \$48,693

CALCULATIONS

Project: 0006889 DERAUG

Idea No. : F-2
Client::

ITEMS TO BE REMOVED :	<u>SAVINGS</u>
1,267' OF 18" PIPE :	1,267' x \$35.00/ft = \$44,345
792' OF 24" PIPE :	792' x \$40.00/ft = \$31,680
2,615sy OF SIDEWALK :	2,615sy x \$25/sy = \$65,375
21 CATCH BASINS :	21 x \$1500/EA = \$31,500
2 DROP INLETS :	2 x \$1800/EA = \$3,600
	TOTAL SAVINGS : \$176,500

ADDITIONAL ROW COST

ASSUME 30' OF PERMANENT EASEMENT FOR CUT SECTIONS
ASSUME 15' OF PERMANENT EASEMENT FOR FILL SECTIONS

COST OF PERMANENT EASEMENT

$$$.64/sf \times 75\% = $.48/sf$$

AVG ADDITIONAL WIDTH $\frac{L_T}{15.64'}$ $\frac{R_T}{20.11'}$

$$\frac{L_T}{15.64' \times 2353.51' = 36,810 sf} \times \frac{$.48}{sf} = \$17,670$$

$$\frac{R_T}{20.11' \times 2353.51' = 47,330 sf} \times \frac{$.48}{sf} = \$22,720$$

\$40,390

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
A-5

Sheet No.:
28 of 46

CREATIVE IDEA:
Reduce pavement thickness

Comp By: TWM Date: 2/26/09

Original Concept: Proposed pavement structure on mainline and Woodrow Rd. is

12.5 mm 1.5"
19.0 mm 2.0"
25.0 mm 6.0"
GAB 12.0"

Proposed Change: Reduce pavement thickness on mainline and Woodrow Rd. to

12.5 mm 1.5"
19.0 mm 2.0"
25.0 mm 3.0"
GAB 10.0"

Justification: Due to low traffic volumes, the pavement section can be reduced. Economic development is not in the immediate future.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$2,032,957		
Proposed	\$1,259,220		
Savings	\$ 773,737		
FUTURE COST: Savings			0
TOTAL PRESENT WORTH SAVINGS			\$ 773,737

SKETCH

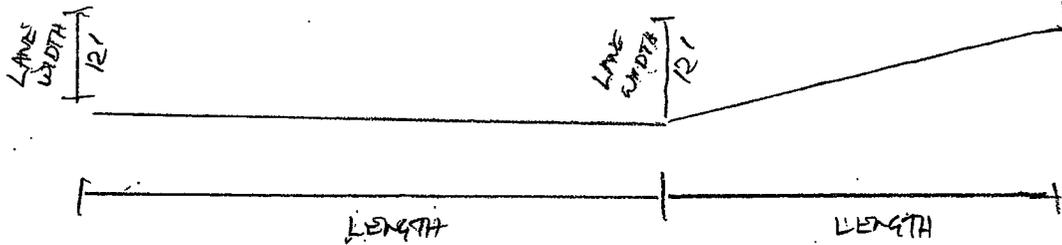
Project: 0006889 DEKALB

Idea No.: A-5
Client:

① TWIN LANES.

TAPER
 $107+76 - 108+76 = 100'$

LANE
 $108+76 - 111+52 = 276'$



② TAPER
 $114+68 - 117+48 = 280'$
 LANE
 $111+52 - 114+68 = 316'$

⑤ TAPER
 $146+58 - 147+58 = 100'$
 LANE
 $147+58 - 151+84 = 426'$

③ TAPER
 $131+87 - 133+67 = 180'$
 LANE
 $133+67 - 138+03 = 436'$

⑥ LANE
 $151+84 - 154+30 = 246'$
 TAPER
 $154+30 - 155+30 = 100'$

④ TAPER
 $141+37 - 143+17 = 180'$
 LANE
 $138+03 - 141+37 = 334'$

⑦ TAPER
 $157+89 - 159+69 = 180'$
 LANE
 $159+69 - 162+69 = 300'$

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: A-5
Client:.

EXISTING PUMP STRUCTURE MAINLINE

FROM PLANS USING STATIONS & WIDTH ON TYPICALS.

STAT 163+53.51 - STA 104+49.26

$$LF = 5904.25 \times 4'8" = 283404 \text{ SF} \Rightarrow 31789 \text{ yd}^2$$

TWIN LANES FROM SKETCH

$$\textcircled{1} \text{ LANE } 276' \times 12' = 3312 \text{ SF} \Rightarrow 368 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(100)(12) = 600 \text{ SF} = 67 \text{ yd}^2$$

$$\textcircled{2} \text{ LANE} = 316' \times 12' = 3792 \text{ SF} \Rightarrow 421 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(280)(12) = 1680 \text{ SF} = 187 \text{ yd}^2$$

$$\textcircled{3} \text{ LANE} = 436' \times 12' = 5232 \text{ SF} \Rightarrow 581 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(180)(12) = 1080 \text{ SF} \Rightarrow 120 \text{ yd}^2$$

$$\textcircled{4} \text{ LANE} = 334' \times 12' = 4008 \text{ SF} \Rightarrow 445 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(180)(12) = 1080 \text{ SF} \Rightarrow 120 \text{ yd}^2$$

$$\textcircled{5} \text{ LANE} = 426' \times 12' = 5112 \text{ SF} \Rightarrow 568 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(100)(12) = 600 \text{ SF} \Rightarrow 67 \text{ yd}^2$$

$$\textcircled{6} \text{ LANE} = 246' \times 12' = 2952 \text{ SF} = 328 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(100)(12) = 600 \text{ SF} \Rightarrow 67 \text{ yd}^2$$

$$\textcircled{7} \text{ LANE} = 300' \times 12' = 3600 \text{ SF} = 400 \text{ yd}^2$$

$$\text{TAPER} = \frac{1}{2}bh = \frac{1}{2}(180)(12) = 1080 \text{ SF} \Rightarrow 120 \text{ yd}^2$$

MAINLINE + TURN LANES

$$31789 + 3859 = 35348 \text{ yd}^2$$

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: A-5
Client: :

EXISTING PUMP WOODROW

STAT 19+80 - STA 33+00

$$LF = 1320' \times 48' = 63360 \text{ SF} \Rightarrow 7040 \text{ yd}^2$$

TOTAL SY = 42,388 SY.

EXISTING STRUCTURE

$$12.5 \text{ mm} \Rightarrow 1.65 \frac{\text{in}}{\text{ft}} \Rightarrow 42388 \text{ SY} \Rightarrow 3498 \text{ TN} \Rightarrow \$825/\text{TN} = \$288,585$$

$$19.0 \text{ mm} \Rightarrow 2.20 \frac{\text{in}}{\text{ft}} \Rightarrow 42388 \text{ SY} \Rightarrow 4663 \text{ TN} \Rightarrow \$85/\text{TN} = \$396,355$$

$$25.0 \text{ mm} \Rightarrow 660 \frac{\text{in}}{\text{ft}} \Rightarrow 42388 \text{ SY} \Rightarrow 13988 \text{ TN} \Rightarrow \$75/\text{TN} = \$1,049,103$$

$$\text{GAB} \Rightarrow 18 \frac{\text{in}}{\text{ft}} \Rightarrow 48948 \text{ SY} \Rightarrow \$20.10/\text{SY} = \$983,854$$

$$\text{GAB UNDER C&G} = 5904 \times 10' = 59040 \Rightarrow 6560 \text{ SY.}$$

PROPOSED \Rightarrow CHANGE 25 mm & GAB

$$25 \text{ mm} \Rightarrow 330 \frac{\text{in}}{\text{ft}} \Rightarrow 42388 \Rightarrow 7000 \text{ TN} \Rightarrow \$75/\text{TN} = \$525,000$$

$$\text{GAB} \Rightarrow 10 \frac{\text{in}}{\text{ft}} \Rightarrow 48948 \Rightarrow \$15/\text{SY} = \$734,220$$

EXIST

PROPOSED

$$25 \text{ mm} \quad \$1,049,103 - \$525,000 = \$524,103$$

$$\text{GAB} \quad \$983,854 - 734,220 = \$249,634$$

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
B-5

Sheet No.:
32 of 46

CREATIVE IDEA:
Reduce lane width to 11 ft lanes on mainline

Comp By: TWM Date: 2/26/09

Original Concept: 4 12 ft lanes with a 20 ft. Raised Median from I-20 to Evans Mill Rd.

Proposed Change: Reduce lane width to 11 feet on mainline from I-20 to Evans Mill Rd.

Justification: This project has a Base ADT of 6800 and a Design ADT of 12,500. The low volumes do not require 12 ft. lanes and the project is on new location.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$2,717,897		
Proposed	\$ 1,910,128		
Savings	\$807,769		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$807,769

CALCULATIONS

Project: 0006889 DEKMB

Idea No.: B-5
Client:

FROM PAGE #

$$LF 5904.25 \times 44' = 259,787 SF \Rightarrow 28,865 yd^2$$

USE CALCS FROM PAGE # CHANGE TO 11'

① TURN LANE = 400 yd²

② 557 yd²

③ 642 yd²

④ 518 yd²

⑤ 583 yd²

⑥ 363 yd²

⑦ 477 yd²

$$3540 yd^2 + 28865 yd^2 = 32405 yd^2$$

EXISTING FROM PAGE # \$2,717,897

USING 11' LANES

12.5mm 165 $\frac{lb}{yd}$ $\Rightarrow 32405 yd^2 \Rightarrow 2674 \text{ TN} \Rightarrow 82.5 \frac{\$}{\text{TN}} = \$220605$

19.0mm 220 $\frac{lb}{yd}$ $\Rightarrow 32405 yd^2 \Rightarrow 3565 \text{ TN} \Rightarrow 85 \frac{\$}{\text{TN}} = \$303025$

25.0mm 260 $\frac{lb}{yd}$ $\Rightarrow 32405 yd^2 \Rightarrow 18697 \text{ TN} \Rightarrow 75 \frac{\$}{\text{TN}} = \$1,402,275$

GAB 12" $\Rightarrow 38965 yd^2 \Rightarrow 15 \frac{\$}{\text{yd}} = \$584,475$

EXIST

PROPOSED 11'

$$2,717,897 - 1,910,128 = \$807,769$$

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
A-1

Sheet No.:
34 of 46

CREATIVE IDEA:
Use concrete on mainline instead of asphalt

Comp By: TWM Date: 2/26/09

Original Concept: 4 12 ft. lanes with 20 ft. Raised Median on Mainline from I-20 to Evans Mill Rd. using asphalt structure:

12.5 mm 1.5"
19.0 mm 2.0"
25.0 mm 6.0"
GAB 12.0"

Proposed Change: Use concrete pavement on mainline instead of asphalt from I-20 to Evans Mill Rd. with 9" concrete and 10" GAB.

Justification: Using a life cycle cost analysis, using concrete will save a future maintenance cost of \$1,051,923. However there is an additional upfront cost of \$137,203.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$2,717,897		
Proposed	\$ 2,855,100		
Savings	-\$ 137,203		
FUTURE COST: Savings		\$1,189,126	\$1,189,126
TOTAL PRESENT WORTH SAVINGS			\$1,051,923

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: A-1
Client:

CALCULATIONS FOR CONCRETE

MAINLINE PAVEMENT AREA \Rightarrow 35,348 yd²

CONC. UNIT = SY.

$$35,348 \text{ yd}^2 \times \$60 = \$2,120,880$$

GAB

$$48,948 \text{ yd}^2 \times \$15/\text{yd}^2 = \$734,220$$

\$2,855,100

EXISTING PMT STRUCTURE

12.5 mm 1.5"

19.0 mm 2.0"

25.0 mm 6.0"

GAB 12"

\$2,717,897

* SEE LCCA.

REPAIR CONCRETE AT 20 yr. assume 12% repair

$$12\% \times 35,348 \text{ yd}^2 = 4,242 \text{ yd}^2 \times \$60/\text{yd}^2 = \$254,520$$

$$12\% \times 48,948 \text{ yd}^2 = 5,874 \text{ yd}^2 \times \$15/\text{yd}^2 = \$88,110$$

REPAIR CONCRETE AT 40 yr. not within 30 yr
Life cycle.

REPAIR ASPHALT @ 10 yr. REPLACE 12.5 mm **\$288,585**

REPAIR ASPHALT @ 20 yr REPLACE 12.5 + 19 **\$684,940**

REPAIR ASPHALT @ 30 yr REPLACE 12.5, 19, 25, GAB **\$2,717,897**

VE-9D

Life Cycle Cost Analysis – Present Worth Method Future Cost Calculation

PROJECT: PI 0006889 Dekalb

Creative Idea No. A-1

Sheet: 36 of 46

Discount Rate: 4%

Economic Life: 30 ___ Years

	A B		C D	
	Original Design		Alternate Design	
	Cost	PW	Cost	PW
1. Single Expenditures: (i.e., stage Construction, Major Maintenance)				
a. Year <u>10</u> PWF 0.6756	\$288,585	\$194,968		
b. Year <u>20</u> PWF 0.4564	\$684,940	\$312,608	\$342,630	\$156,376
c. Year 30 PWF 0.3083	\$2,717,897	\$837,928		
d. Salvage / Unused Service Life Year ___ PWF _____				
1. Total Future Single Costs:		\$1,345,502		\$156,376
2. Annual Costs:				
a. General Maintenance PWF' =				
b. Other Annual Costs PWF' =				
2. Total Future Annual Costs				
3. Total Future Costs: (1 + 2)		\$1,345,502		\$156,376
4. Total Future Cost Savings on a Present Worth Basis (3B-3D)		\$1,189,126		
5. Total Future Cost Savings on an Annual Basis (4B X crf)				

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.:
E-4a

Sheet No.:
37 of 46

CREATIVE IDEA:
Use loop detection vs. video detection

Comp By: SC Date: 2/26/09

Original Concept: The project proposes to use video detection devices for vehicular detection at the traffic signal locations.

Proposed Change: Recommend using electromagnetic loop detectors instead of video detection.

Justification: Loop detection has proven to be effective in undeveloped areas with low volumes. The maintenance costs are minimal in these areas.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$79,600		
Proposed	\$ 10,800		
Savings	\$68,800		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$68,800

CALCULATIONS

Project: 0006889 DEKAUS

Idea No.: E4 a
Client:

Loop Wire

2 - 1000' Reels / Intersection @ \$200 ea

$$3 \text{ int} \times 2 = 6 \text{ reels}$$

$$6 \text{ reels} \times \$200 \text{ ea} = \$1200$$

Loop Lead Wire

1 - 1000' Reels / Int @ \$300 ea

$$3 \text{ int} \times 1 = 3 \text{ reels}$$

$$3 \text{ reels} \times \$300 \text{ ea} = \$900$$

Conduit

2" nonmetal

L1B Loop to intersection (330')

Rock Bridge intersection 330' x 2 approaches (660')

Woodrow Rd intersection 330' x 2 approaches (660')

I-20 E/R Ramp 330' x 1 approach (330')

\$1650'

@ 5.25/ft

\$8662.50

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.: I-1	Sheet No.: 40 of 46	CREATIVE IDEA: Eliminate guardrail
-------------------------	-------------------------------	--

Comp By: WDT Date: 2/26/09

Original Concept: The project proposes 2:1 slopes with guardrail throughout the project.

Proposed Change: Recommend using 4:1 slopes and eliminate guardrail where possible.

Justification: Guardrail creates safety issues as well as maintenance issues. Flattening slopes eliminates guardrail and reduces cost.

LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$271,450		
Proposed	\$123,235		
Savings	\$148,215		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$148,215

CALCULATIONS

Project: 0006889 DEKALB

Idea No.: I-1
Client:

1,450 FE OF GUARDRAIL, 8 TYPE 1 ANCHORS, AND 8 TYPE 12 ANCHORS WILL BE RETAINED TO PROTECT PROPOSED CROSS DRAINS.

GUARDRAIL TO BE REMOVED:

$$6,460 - 1,450 = 5010 \text{ FE} \times \frac{\$30}{\text{FE}} = \$150,300$$

TYPE 1 ANCHORS TO BE REMOVED:

$$11 - 8 = 3 \text{ EA} \times \frac{\$900}{\text{EA}} = \$2,700$$

TYPE 12 ANCHORS TO BE REMOVED:

$$11 - 8 = 3 \text{ EA} \times \frac{\$2500}{\text{EA}} = \$7,500$$

$$\text{SAVINGS} = \$160,500$$

ADDITIONAL ROW NEEDED FOR 4:1 SLOPES

AVG ADDITIONAL WIDTH = 20' LENGTH OF AREA OF CONCERN = 3700'

$$3700' \times 20' = 74,000 \text{ SF}$$

* 25% OF ROW COST

RESIDENTIAL ACREAGE

$$94\% \text{ OF } 74,000 \text{ SF} = 69,560 \text{ SF} \times \$0.16^* = \$11,130$$

RESIDENTIAL LOT

$$6\% \text{ OF } 74,000 \text{ SF} = 4,440 \text{ SF} \times \$0.26^* = \$1,155$$

$$\text{TOTAL ADDITIONAL COST} = \$12,285$$

$$\text{OVERALL SAVINGS} = \$148,215$$

DEVELOPMENT AND RECOMMENDATION PHASE

Project: PI 0006889 Dekalb

Idea No.: E-2	Sheet No.: 42 of 46	CREATIVE IDEA: Round About
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Comp By: BW Date: 2/26/09

Original Concept: The project proposes to install a signal at the intersection of Lithonia Industrial Blvd. and Woodrow Rd.

Proposed Change: Recommend construction of a Round About and eliminate the signal at that location.

Justification: LIB and Woodrow Rd. are off-system roads. The majority of the turning movements at this intersection occur on Wednesday and Sunday for services at the New Birth Missionary Church. Traffic volumes along LIB are less than 16,000 ADT and the project is located on new location. Eliminating the signal reduces cost.

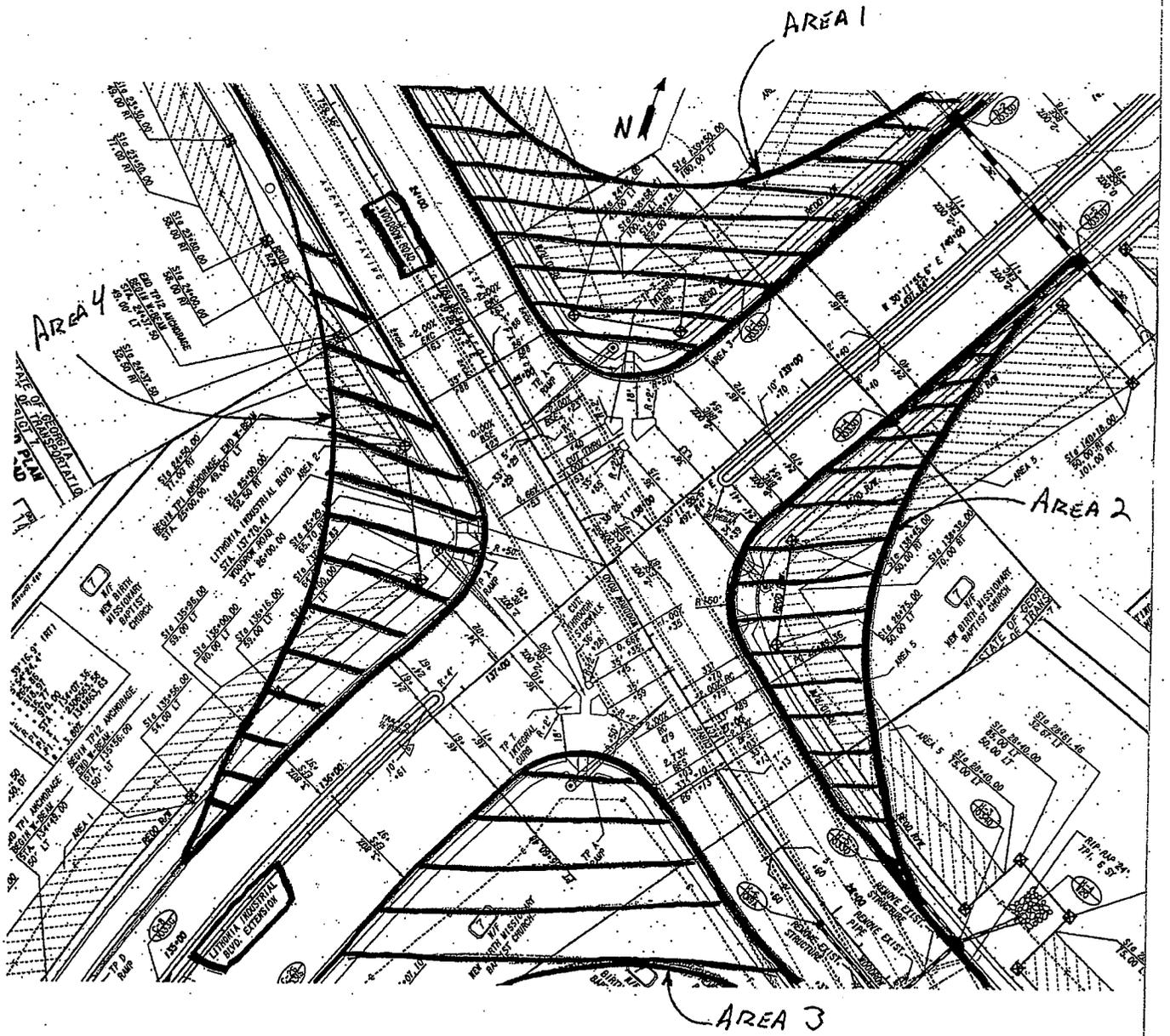
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
INITIAL COST: Original	\$177,217		
Proposed	\$ 18,310		
Savings	\$158,907		
FUTURE COST: Savings		0	0
TOTAL PRESENT WORTH SAVINGS			\$158,907

VE-9A

SKETCH

Project: 0006889 DETAILS

Idea No.: E-2
Client::



VE-9B

COST WORKSHEET							
Project: 0006889 DEKALB					Idea No.: E-2		
					Client: :		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
ROW	1				15,050	0.64	9632
	2				6,185	0.64	3958
	3				0	0.64	0
	4				7,375	0.64	4720
SIGNAL # 2							18,310
TP IV STRAIN POLE W/ 65FT		1	15,000	15,000			
TP IV STRAIN POLE W/ 50FT		1	12,750	12,750			
TP IV STRAIN POLE W/ 55FT ILLUM		1	13,500	13,500			
TP IV STRAIN POLE W/ 55FT		1	13,000	13,000			
FIELD SWITCH TPC		1	2825	2825			
PULL BOX		4	1500	6000			
OPTIC CABLE		6100	3.60	21,960			
VIDEO DETECTION		5	6300	31,500			
INSTALLATION # 2		1	60,682	60,682			
				177,217			
Subtotal:				177,217			18,310
Mark-up (%)							
Total							158,907
Total Rounded							NET SAVINGS = 159,000

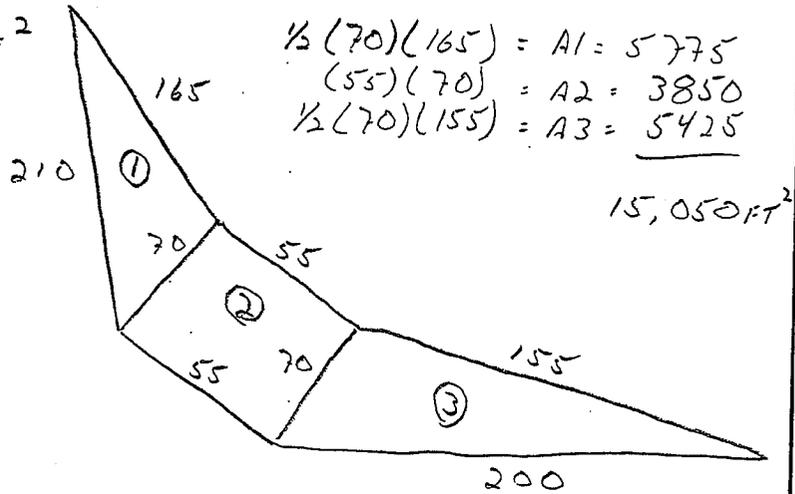
VE-9A C

SKETCH

Project: 0006889 DEKALB

Idea No.: E-2
Client::

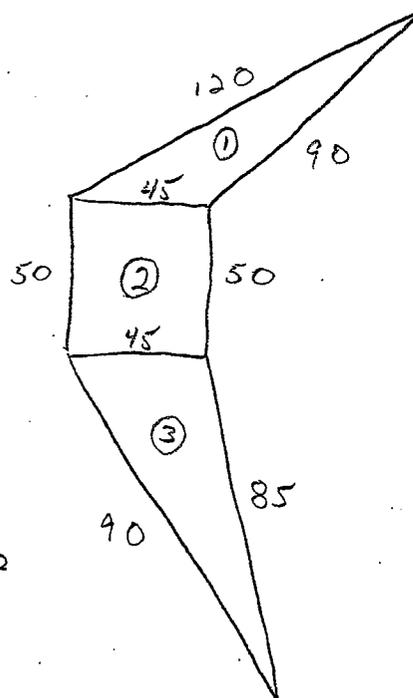
AREA 1: 15,050 FT²



$$\begin{aligned} \frac{1}{2}(70)(165) &= A1 = 5775 \\ (55)(70) &= A2 = 3850 \\ \frac{1}{2}(70)(155) &= A3 = 5425 \end{aligned}$$

15,050 FT²

AREA 2: 6,185 FT²



$$\begin{aligned} A1 &= \frac{1}{2}(45)(90) = 2025 \\ A2 &= (45)(50) = 2250 \\ A3 &= \frac{1}{2}(45)(85) = 1910 \end{aligned}$$

: 6185 FT²

VE-9AC

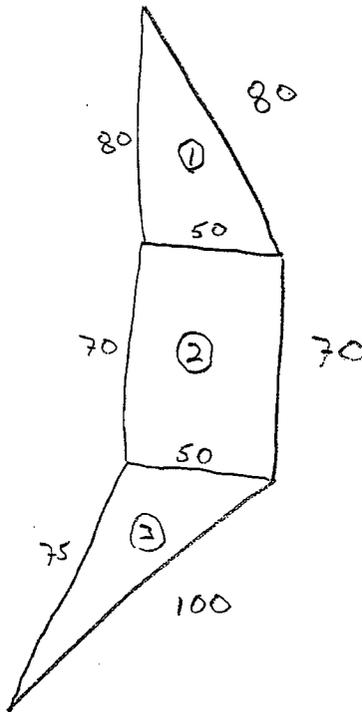
SKETCH

Project: 0006889 DEKALB

Idea No.: E-2
Client:

AREA 3: 0 NO ROW REQUIRED

AREA 4: 7375 FT²



$$A_1 = \frac{1}{2}(50)(80) = 2000$$

$$A_2 = (70)(50) = 3500$$

$$A_3 = \frac{1}{2}(50)(75) = 1875$$

$$\underline{7375 \text{ FT}^2}$$

APPENDIX

VE-2

INFORMATION PHASE - SOURCES Approving/Authorizing Persons

Name:	Position:	Telephone:
Gerald Ross	Chief Engineer	

Personal Contacts

Name:	Telephone:	Notes:
Kevin McKeen	770-431-8666	Received Traffic Report
A J Jubran	404-363-7582	Pavement Analysis
Ashlyn Morgan	404-635-8125	Signal Analysis

Documents/Abstracts

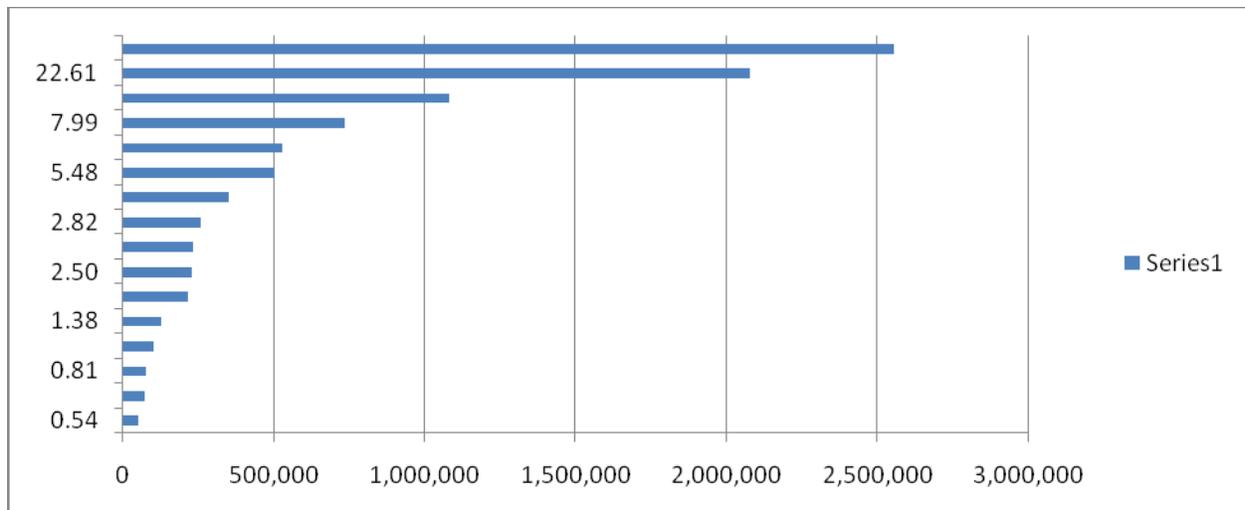
Reference:	Notes:
GDOT Design Policy Manual	
Round About Manual	
Plans	
Traffic Report	
Layout/Roll Plots	

VE-3

INFORMATION PHASE - COST MODEL

Project Name PI 0006889 Dekalb

Item	Description	\$ Amount	% of Total Project
A	Pavement	2,552,388	27.80
B	ROW	2,076,002	22.61
C	GAB	1,082,130	11.79
D	Earthwork	733,700	7.99
E	Signals	503,180	5.48
F	Drainage	526,850	5.74
80% Cost Line			
G	Median	349,020	3.80
H	Sidewalks	258,455	2.82
I	Guardrail	231,200	2.52
J	Erosion	229,205	2.50
K	Curb and Gutter	217,008	2.36
L	Traffic Control	127,050	1.38
M	Clearing & Grubbing	100,000	1.09
N	Misc (ROW markers/Field office	74,385	0.81
O	Signing & Marking	71,092	0.77
P	Misc concrete	49,245	0.54
	TOTAL	9,180,910	100.00



VE-4

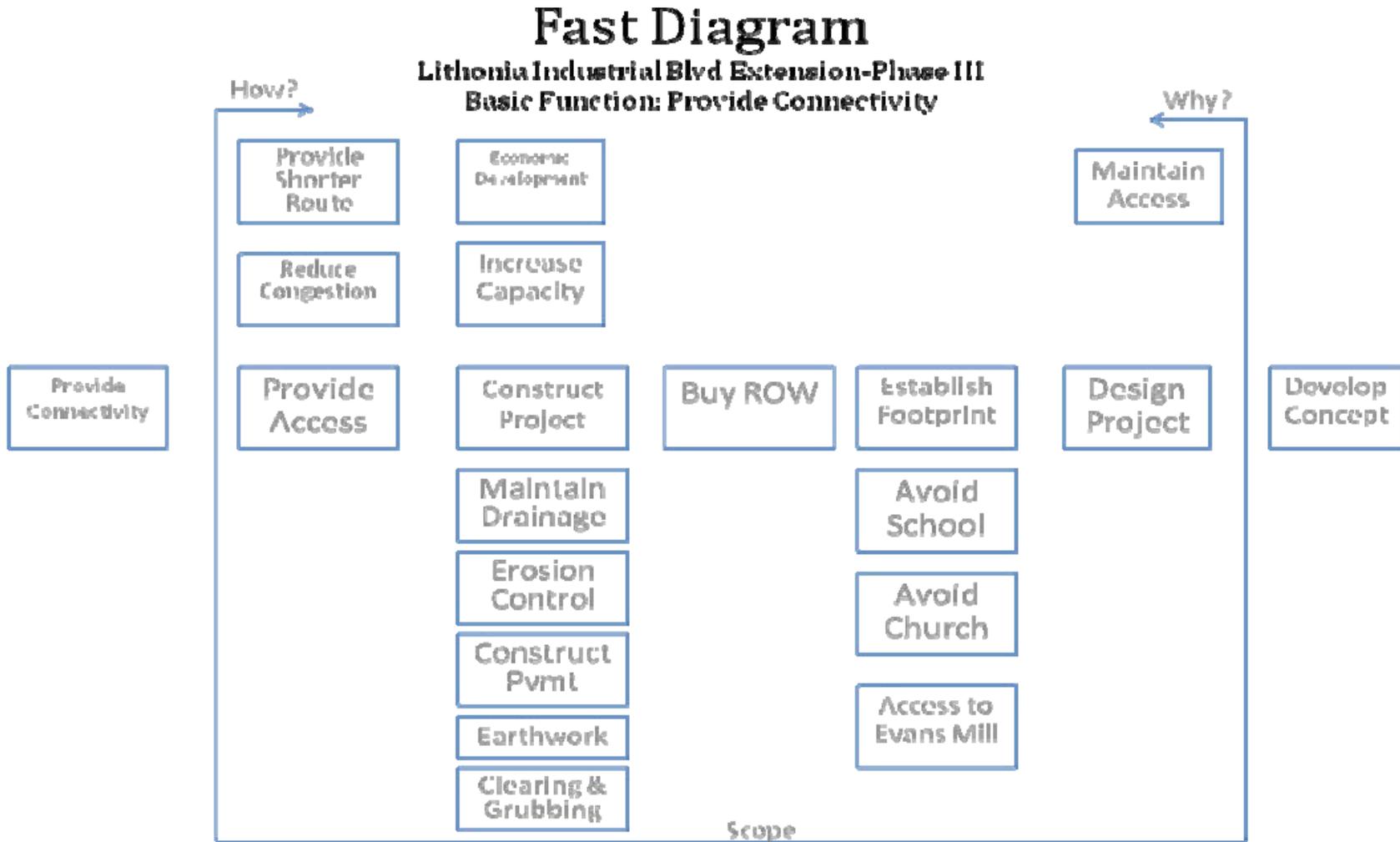
INFORMATION PHASE – FUNCTION ANALYSIS

Project: PI 0006889 Dekalb

Project Function: Provide Connectivity

ITEM	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	Worth	Comments
A	Pavement	Improve	Ride	2,552,388		Reduce thickness
					2,000,000	Reduce width
B	ROW	Define	Footprint	2,076,002	1,750,000	Reduce Width
C	GAB	Support	load	1,082,130	800,000	Reduce Thickness
D	Earthwork	Move	Material	733,700	650,000	Change Grade
E	Signals	Control	Traffic	503,180		Remove Signals
					150,000	Revise Configuration
F	Drainage	Convey	Water	526,850	250,000	Remove Curb
G	Median	Divide	Traffic	349,020		Remove Median
					250,000	Reduce Width
H	Sidewalks	Provide	Path	258,455	100,000	Reduce sidewalk
I	Guardrail	Protect	Object	231,200	0	Flatten Slopes
J	Erosion	Protect	Material/enviro nment	229,205	200,000	Flatten Slopes
K	Curb and Gutter	Convey/protect	Water/shoulder	217,008	0	Remove Curb
L	Traffic Control	Maintain	Traffic	127,050	127,050	
M	Clearing & Grubbing	Remove	Material	100,000	75,000	Reduce foot print
N	Misc (ROW markers/Field office)	Support	Project	74,385		Use alternate matl
					25,000	Use local office
O	Signing & Marking	Provides	Information	71,092	71,092	
P	Misc concrete	Prepares	Surface	49,245	35,000	Use alternate

INVESTIGATION PHASE - FAST DIAGRAM



VE-6 & 7 PI 0006889 Dekalb

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation		
No.	CREATIVE IDEA	ADVANTAGES	DISAVANTAGES	IDEA RATING
A-1	CONCRETE	USE THINNER, SECTION/DURABLE	CONSTRUCTABILITY ISSUES	10
A-2	RECYCLED ASPHALT	REDUCED COST/TYPICAL	MAINTENANCE PROBLEM	9
A-3	MIX TYPE (AGGREGATE SIZE)	LESS MATERIAL/COST/	MAINTENANCE PROBLEM	7
A-5	THICKNESS	LESS MATERIAL/COST/	MAINTENANCE PROBLEM	10
B-1	EASEMENT	REDUCE ROW COST/ACQ TIME		3
B-2	ADJUST ALIGNMENT	REDUCE ROW/ EARTHWORK COST/	DESIGN SCHEDULE	3
B-3	SHOULDER TYPE	REDUCE ROW/REDUCE DRAINAGE/	EROSION ISSUES	9
B-4	REMOVE MEDIAN	REDUCE ROW/COST/,	AFFECTS CAPACITY	10
B-5	NARROW LANES	REDUCE ROW/COST	AFFECTS CAPACITY	10
B-6	ADJUST TIE SLOPES	/ REDUCE GUARDRAIL/	INCREASE EASEMENT, EROSION ISSUES	5

VE-6 & 7 PI 0006889 Dekalb

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation		
No.	CREATIVE IDEA	ADVANTAGES	DISAVANTAGES	IDEA RATING
C-1	REDUCE THICKNESS	LESS COST	DURABILITY/LIFE CYCLE	10
C-2	SOIL	LESS COST	DURABILITY/LIFE CYCLE	5
C-3	REINFORCEMENT FABRIC	EASE OF CONSTRUCTABILITY	COST	2
C-4	RECYCLED CONCRETE MATERIAL	DURABLE	AVAIBILITY	8
D-1	BLASTING	ONSITE MATERIALS	SAFETY	1
D-2	ADJUST GRADE	REDUCE EARTHWORK	MORE ROW	6
D-3	ADJUST TYPICAL	REDUCE EARTHWORK	MORE ROW	10
E-1	SIGNS	REDUCE COST/CONSTRUCTABILITY	MAY WARRANT SIGNAL	2
E-2	ROUND ABOUT	COST? OPERATION COST	COST?	9
E-3	ALTERNATE CONFIGURATION	EFFICIENCY		8
E-4	ALTERNATE OPERATIONS/DETECTION	OPERATION COST/ LESS MAINTENANCE		8

VE-6 & 7 0006889 Dekalb

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation		
No.	CREATIVE IDEA	ADVANTAGES	DISAVANTAGES	IDEA RATING
F-1	DITCHES	REDUCE DRAINAGE STRUCTURE	MORE EASEMENT	6
F-2	SHOULDER TYPE	REDUCE DRAINAGE STRUCTURES	EROSION ISSUES	10
F-3	POND	REDUCE X-DRAINS	COSTLY, ROW IMPACTS, MAINTENANCE	2
F-4	PIPE SIZE	REDUCE COST	FLOW CAPACITY ISSUES	3
F-5	V-GUTTER	REPLACE CURB	FLOW CAPACITY ISSUES	6
G-1	GUARDRAIL	REDUCES MEDIAN WIDTH	SAFETY ISSUE/CAPACITY ISSUE/ADDED COST	1
G-2	STRIPING / NO BARRIER	REDUCES COST	SAFETY ISSUE/ CAPACITY ISSUE	10
G-3	BARRIER WALL	REDUCED MEDIAN WIDTH	INCREASE COST? CAPACITY ISSUE	1
G-4	RPM	REDUCE COST	SAFETY/ DRIVER COMFORT	4
G-5	PYLONS	REDUCE COST	SAFETY/ MAINTENANCE ISSUE	4
G-6	FLUSH MEDIAN	REDUCE COST/ REDUCE WIDTH AND ROW,	MORE PVMT MATERIAL/ MORE CONFLICT POINTS	8
H-1	ASPHALT	REDUCE COST/ EASE OF CONSTRUCTABILITY		9
H-2	BRICK / PAVERS	POSITIVE ASTHETICS	MORE COSTLY/LABOR INTENSIVE	3

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation		
No.	CREATIVE IDEA	ADVANTAGES	DISAVANTAGES	IDEA RATING
H-3	WOOD	REDUCE COST	MAINTENANCE ISSUES	4
H-4	ADJUST WIDTH	REDUCE COST	LIMITED MOBILITY	10
H-5	NO BUILD	NO COST	NO MOBILITY	9
I-1	FLATTEN SLOPES	REMOVES GUARDRAIL	INCREASE ROW COST EARTHWORK	10
I-2	BERM	REMOVES GUARDRAIL/	INCREASED EARTHWORK DRAINAGE IMPLICATIONS?	6
I-3	ADJUST GRADE	REMOVE GUARDRAIL/ DRAINAGE?	EARTHWORK? DRAINAGE?	5
I-4	MOVE OUT OF CLEARZONE	REMOVE GUARDRAIL/ COST?	INCREASED ROW/ COST?	2
J-1	FLATTEN SLOPES	LESS SLOPE MATS,	MORE EARTHWORK/ EASEMENT	1
K-1	V-GUTTER	REPLACE CURB	FLOW CAPACITY ISSUE	4
K-2	HEADER CURB	REDUCE COST	FLOW CAPACITY ISSUE	4
K-3	RURAL SHOULDERS	REPLACE C&G	MORE EROSION/	10
K-4	GRADE	DECREASED INLETS	EARTHWORK?	5
K-5	SIZE	REDUCE COST	FLOW CAPACITY ISSUES	4
L-1	ALTERNATE ROUTE	REDUCE CONSTRUCTION COST/ TIME	AVAILABLE ROUTE? USER DELAY	1

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation		
No.	CREATIVE IDEA	ADVANTAGES	DISAVANTAGES	IDEA RATING
N-1	IRON PINS	REDUCE COST	LESS VISIABLE	10
N-2	TYPE OF FIELD OFFICE	REDUCE COST	ENOUGH SPACE?	6
N-3	AREA OFFICE	LOCATION/ REMOVES COST OF FIELD OFFICE	TRAVEL TIME	9
N-4	EXISTING FACILITY	LOCATION/ REMOVES COST OF FIELD OFFICE	TRAVEL TIME	8
0-1	MATERIAL	REDUCE COST	AVAIBLE MATERIALS?	4
P-1	MATERIAL	REDUCE COST	AVAIBLE MATERIALS?	4