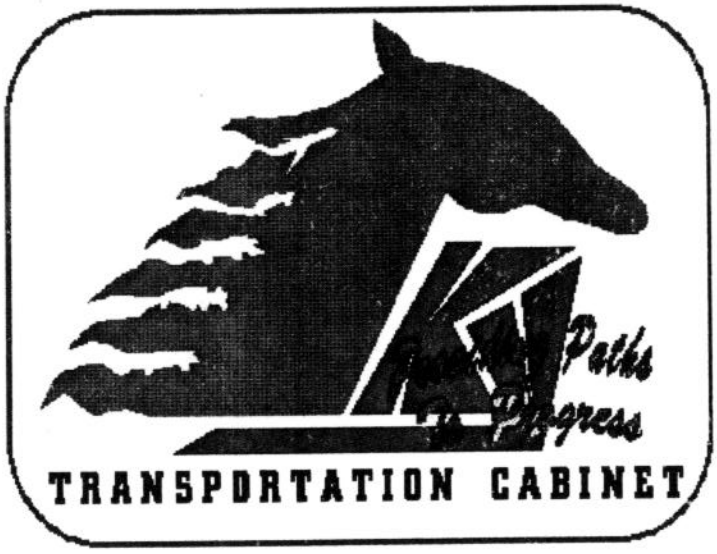
VALUE ENGINEERING SUMMARY
OF
CALLOWAY-GRAVES COUNTIES
KY 80
MURRAY-MAYFIELD ROAD
SECTION II



APRIL 26-30, 1999

VALUE ENGINEERING PROPOSAL

TEAM #3
APRIL 30, 1999
ITEM # 1-181.31
GRAVES-CALLOWAY COUNTIES
NEW ALIGNMENT
MAYFIELD TO US 641


TENNESSEE
VALLEY
TENNESSEE
VALLEY
Farmington
Little
Mayfield
Creek
Bethlehem Church
Harmony Ch
Watson
Branch
Smith Cem
F&H, Inc.
003

Sheet 1 of

Value Engineering - Study Identification

Project: 1-181.31 **Team:** 3

Location: Graves - Calloway Counties **Date:** 4/26-30/99

VE TEAM MEMBERS

Name	Title	Organization	Telephone
Barry Sanders	T.E. Supervisor	KyDOT	(502) 367 - 6411
Barry Fryman	T.E. II	KyDOT	(606) 845 - 2551
Jim Grider	T.E. Specialist	KyDOT	(502) 564 - 7111
Chuck Frederick	T.E. Tech II	KyDOT	(606) 743 - 3812
Gary Valentine	T.E. II	KyDOT	(270) 766 - 5066
Danl Hall	T.E. II	KyDOT	(606) 433 - 7791

PROJECT DESCRIPTION

Length: 11.4 KM	**Costs:**	17.5 MILLION	**Type of Funds:**
Design Speed:		100 Km/hr	**Projected Traffic:**
Projected Award Date:		Not known	
Major Project Elements:		Excavation Structures Surfacing R/W Fence	

ROUTE CONDITION / GEOMETRY

Adjacent Segments:	Overall Route:
New Alignment	New Alignment

Investigation Phase - Sources

Date: 4/27/99 Team: 3

AUTHORIZING PERSONS

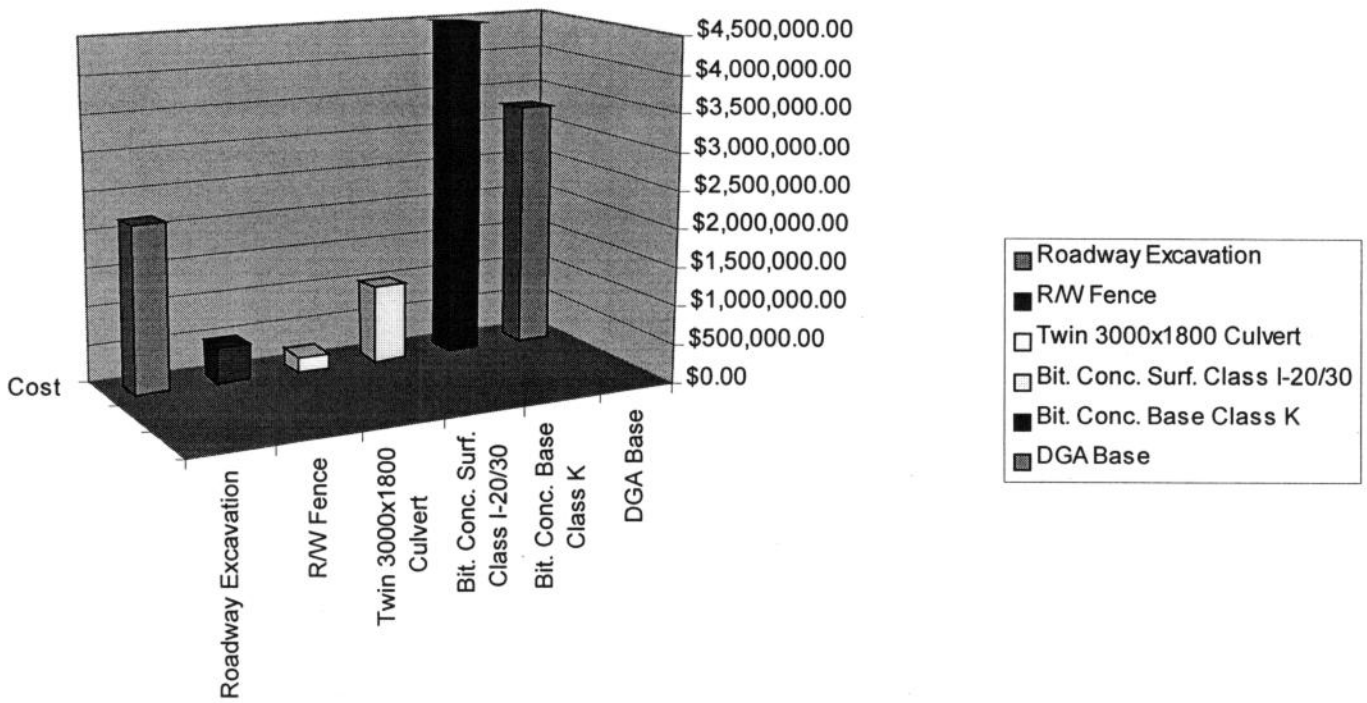
Name	Position	Telephone
Robert Semones	Value Engr. Coordinator, KyDOT	502-564-3280
Joetta Fields	Asst Value Engr. Coordinator, KyDOT	502-564-3280

PERSONAL CONTACTS

Contacts	Telephone	Notes
Darrel Taylor - Designer	**270-444-9691**	
Bob Clymer - Designer	**270-444-9691**	

DOCUMENTS / ABSTRACTS

References	Notes
Preliminary Estimate Costs	
Preliminary Line & Grade	
Manuscripts	
KY DOT Drainiage Manu.	
KY DOT Geo-Tech Manu.	


$4,500,000.00
$4,000,000.00
$3,500,000.00
$3,000,000.00
$2,500,000.00
$2,000,000.00
$1,500,000.00
$1,000,000.00
$500,000.00
$0.00
Cost
Roadway Excavation
R/W Fence
Twin 3000x1800 Culvert
Bit. Conc. Surf. Class I-20/30
Bit. Conc. Base Class K
DGA Base
Roadway Excavation
R/W Fence
Twin 3000x1800 Culvert
Bit. Conc. Surf. Class I-20/30
Bit. Conc. Base Class K
DGA Base

Investigation Phase - Function Analysis

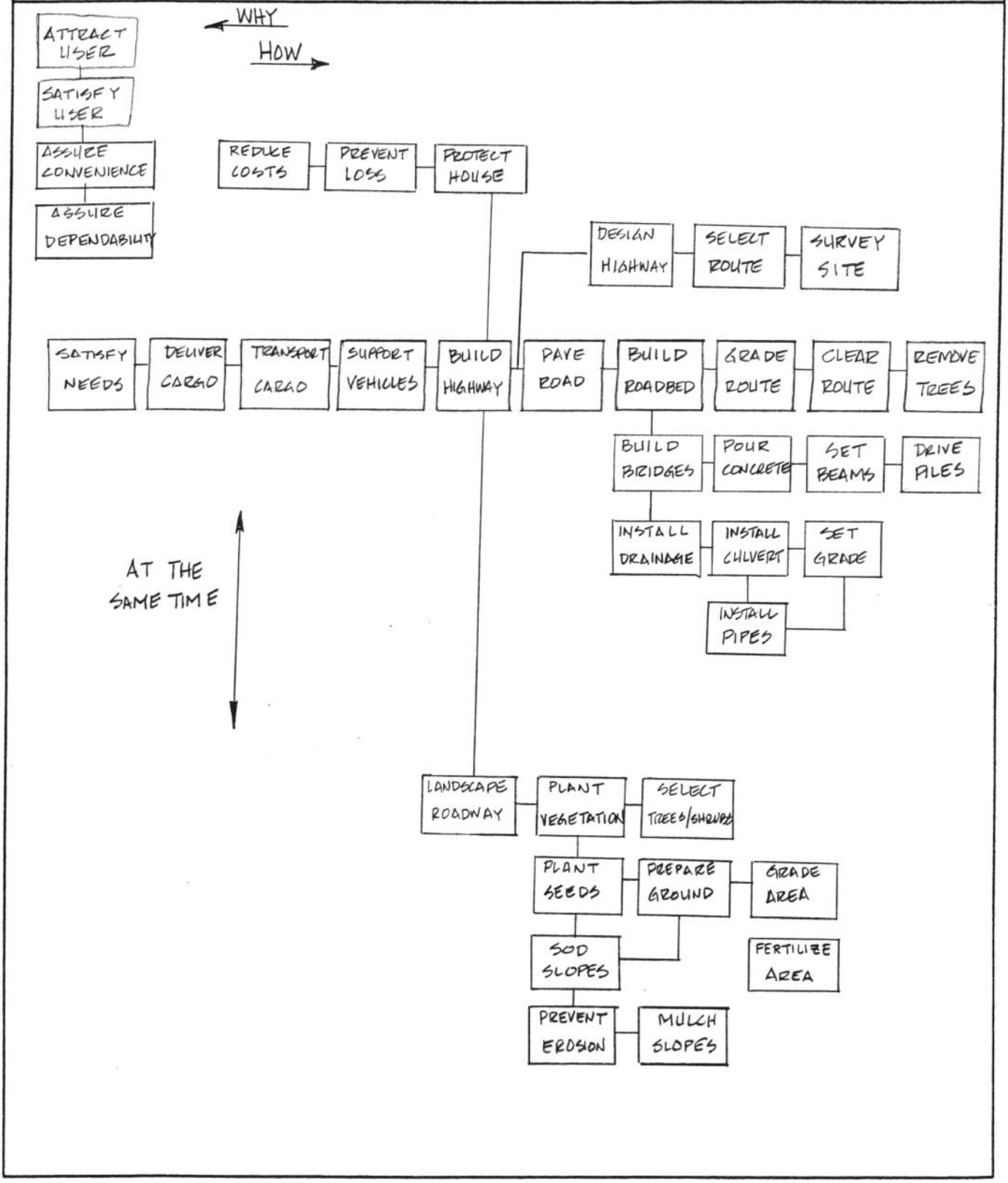
Project: Graves - Calloway **Team No.:** 3

Overall Project Function: Satisfy Needs **Date:** 4/27/99

Item #	Description	Function		Cost (Millions)	Worth (Millions)	Value Index	Comments
		Verb	Nound				
2230	Embankment in Place	Stabilize	Road	2.9			
	R/W Fence	Control	Access	0.5	0.3	1.666666667	
	Twin 70m PCIB Bridge	Span	Channel	1.1	0.55	2	
0154	Bit Conc Surface Class I-20/30	Transmit	Load	0.8	0.4	2	
0123	Bit Conc Base Class K	Transmit	Load	3.6	1.8	2	
0001	D G A Base	Transmit	Load	2.6	1.3	2	

Investigation Phase – FAST Diagram

Date: 4-27-99 **Team:** 3



Speculation Phase - Brainstorming

Date: 4/27/99 **Team:** 3

Item: Highway
Function: Satisfy Needs

1. Is the 4 - lane valid
2. Combine sections 1 & 2 or portions
3. Change Grade
4. Is the bridge justified
5. Combining Horz. and Vert. Align for Earthwork Consideration.
6. 2 lane initial - 4 lane ultimate
7. Is Partially controlled access necessary
8. Using 5 Lane typical to reduce ROW
9. Is ROW Fence needed in large cuts or fills
10. Barrier instead of depressed median
11. Using metal end sections instead of Concrete headwalls.
12. Eliminate some guardrail by 2 lane initial or by flattening slopes
13. Concrete instead of asphalt for longevity
14. Eliminate Flood Road Acess

Item:
Function:

Evaluation Phase

Date: 4/28/99 **Team No.:** 3

Idea #	Creative Idea Listing	Idea Evaluation		Idea R
		Advantages	Disadvantages	
1	2 lane Initial - 4 lane Ultimate	Potential Cost Savings up	Additional Future Contract	1
2	Is ROW Fence Needed in large cuts and / or fills	Potential Cost Savings eliminating fence	Public Relations	3
3	Use Metal End Sections	Potential Cost Savings ease of construction	Possible Maintainence Problems Possible life reduction	4
4	Eliminate Flood Road Access	Eliminate ROW Purchase Cost Savings, less impact on property owner	Possible Property Owner Conflict	2
G.C.	Combine Portion of Sec.2 with Sec.1	First 1000M of Sec 2 is Cut will balance Sec. 1 better		G.

Sheet 6 of

Evaluation Phase - Matrix Analysis

ate: 4/29/99 **Idea:** 1

Two Lane Initial Four Lane Ultimate		Criteria						
		Meet Function	Safety	Cost	Construction	Maintance		
Alternatives	**Weights**	10	10	8	9	7	**Totals**	**Rank**
Original		5	5	2	5	3	20	182
		50	50	16	45	21		
Alternate		5	4	4	5	4	22	195
		50	40	32	45	28		

Sheet 7 of

Evaluation Phase - Matrix Analysis

ate: 4/28/99 **Idea:** 3

Use Metal End Sections for Pipe		Criteria						
		Meet Function	Safety	Cost	Construction	Maintance		
Alternatives	**Weights**	10	10	8	9	7	**Totals**	**Rank**
Original		5	5	3	3	4	20	179
		50	50	24	27	28		
Alternate		5	4	5	5	3	22	196
		50	40	40	45	21		

Sheet 8 of

Evaluation Phase - Matrix Analysis

ate: 4/28/99 **Idea:** 4

Eliminating Flood Road Access		Criteria						
		Meet Function	Safety	Cost	Construction	Maintance		
Alternatives	**Weights**	10	10	8	9	7	**Totals**	**Rank**
Original		3	4	2	3	2	14	127
		30	40	16	27	14		
Alternate		5	5	5	5	5	25	220
		50	50	40	45	35		

Evaluation Phase - Matrix Analysis

ate: 4/28/99 **Idea:** 2

Eliminating Portions of R/W Fence All areas with backslope of 2:1

Alternatives	Weights	Criteria: Meet Function	Safety	Cost	Construction	Maintance	Totals	Rank
Original		5	5	2	2	2	16	148
		50	50	16	18	14		
Alternate		4	4	5	5	4	22	193
		40	40	40	45	28		

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: New Alignment from Murray to Mayfield. Item 1-181.31

LOCATION: Graves - Calloway Counties

STUDY DATE: 30-Apr-99

IDENTIFICATION NUMBER: Item 1-181.31 Recommendation # 1

FUNCTION OF COMPONENT BEING CHANGED: Move Vehicles

DECSCRIPTIVE TITLE OF RECOMMENDATION:

Construct 2 lane Initial - 4 lane Ultimate

ORIGINAL DESIGN:

To build a 4 lane divided highway with a depressed median.

RECOMMENDED CHANGE:

To construct a 2 lane initial and a 4 lane Ultimate highway. Grade, Drain, & Right-of-Way shall be constructed as in the original design. A surfacing contract will only be let for 2 lanes at the completion of grade and drain. When traffic justifies, a 4 lane facility surfacing contract shall be let for the remaining 2 lanes.

SUMMARY OF COST ANALYSIS

	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$ 8,600,000.00	$ 2,270,000.00	$ 10,870,000.00
RECOMMENDED DESIGN	$ 4,750,000.00	$ 5,570,000.00	$ 10,295,000.00
ESTIMATED SAVINGS OR (COST)			$ 575,000.00

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER:	Item 1-181.31	Sheet		of	

Advantages:
Up front cost savings.
Life cycle cost savings.
Reduction of Maintenance costs.
Why Build if not needed?

Disadvantages:
Possible traffic conflicts on two lane facility.

Justification:
Traffic forecasts justify 2 lane facility.
Section 2 Forecasts:
- 1997 ADT = 2300
- 2002 ADT = 2580
- 2022 ADT = 4100
- 2022 DHV = 490

* see hand written attachments for level of service calculations.

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER: Item 1-181.31 Sheet of

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/ Unit	Source Code	Number of Units	Total $	Number of Units	Total $
Surfacing Contract	Lp. Sum		1		$ 8,600,000.00		~~$~~ 4,725,000

Source Code:

1 Project Cost Estimate
2 CES Database
3 CACES Database
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote
7 Professional Experience
8 Other Sources

VALUE ENGINEERING RECOMMENDATION

Form 30 Dec, 1996

COST ESTIMATE - O & M (LIFE CYCLE) COST

IDENTIFICATION NUMBER: Item 1-181.31 Sheet [ ] of [ ]

Recommendation#1

PRESENT WORTH METHOD

LIFE CYCLE PERIOD (YEARS)= 25

ANNUAL PERCENTAGE RATE= 4

Initial Costs				**Original Design PW $**		**Reccommended Design PW $**
Surface Contract				8600		4725
Sub Totals of Initial Costs PW $				8600		4725

Later Costs Single Expenditure	**In the Yr**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Resurface	10	0.6756	1000	680		
Surfacing Contract	10	0.6756			6260	4230
Resurface	20	0.4564	1200	550	1200	550
Sub Total of Single Expenditure Costs PW $				1230		4780

Later Costs Annual Expense	**For How Many Yrs**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Annual Maintenance	1st 10	8.111	60	490	30	240
Annual Maintenance	yr. 10 - 25	11.118	73		73	
	to present	0.6756		550		550
Sub Totals of Annual Expense Costs PW $				1040		790
Total PW $ for Original & Recommended				10870		10295
Total PW $ Savings (or Added Cost) for Recommended						575

Remarks:

1) Surfacing contrac for alternative includes all materials required for 2 lanes of construction, tie ins to approach roads and entrances and seeding and protection of the 2 lanes that will not be surfaced at this time.

2) Surfacing contract includes all materials required for 2 lanes of construction and resurfacing of the existing 2 lanes.

Note: All future contract items have been adjusted using a 2% inflation factor.

LEVEL OF SERVICE CALCULATIONS

Highway Characteristics-

Design Speed - 60 mph
Lane Width - 12 ft.
Shoulder Width - 10 ft
20 % No Passing Zones (Estimated (Level Terrain))
Length of Section 7 Miles
2 Lane Rural Collector

Traffic Characteristics

DHV - 490 vph in Year 2022 From Division of Planning Traffic Forecasts
50/50 Split (Assumed)
18% Trucks in Design Year
82% Passenger Cars

v=V/PHF

V = 490 Given
PHF = 0.91 From Table 8.3 in Highway Capacity Manual

v = 539 vph calculated

SF = 2800 x (v/c) x fd x fw x fhv
fhv = 1/(1+Pt(Et-1))

v/c=0.02 for LOS A, 0.12 for LOS B, 0.20 for LOS C, 0.37 for LOS D, for LOS E
fd=1.00 From Table 8.4 in Higway Capacity Manual
fw=1.00 From Table 8.5 in Higway Capacity Manual
Et=2.0 For LOS A, 2.2 For LOS B and C, 2.0 For LOS D and E

fhv = 0.85 for LOS A, 0.82 for LOS B and C, 0.85 for LOS D and E

SF(A) = 48 vph
SF(B) = 276 vph
SF(C) = 459 vph
SF(D) = 881 vph
SF(E) = 1904 vph

Level Of Service For the Design Year is between a LOS C and a LOS D. This is for a 2 lane facility. ADT estimates for 2002 are about 60% of the design year. This justifies looking at a 2 lane initial 4 lane ultimate alternative.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Item # 1-181.31

LOCATION: Graves - Calloway Counties New Route (Mayfield - US 641)

STUDY DATE: 4-26-99 to 4-30-99

IDENTIFICATION NUMBER: Recommendation # 2

FUNCTION OF COMPONENT BEING CHANGED: Control Access

DECSCRIPTIVE TITLE OF RECOMMENDATION: To elimiinate installation of the right of way fence on the sections with slopes of 2:1

ORIGINAL DESIGN:

The original design calls for installation of right of way fencing alon the entire route. The installation of portions of the fence are located on slopes of 2:1. The route is located in rural sections of Graves and Calloway counties with very little business activity.

RECOMMENDED CHANGE:

Eliminate those sections of fencing located in areas having back slopes/fill slopes of 2:1. Eliminate R/W fencing along the following:
STA. 21+100 - 22+400 = 2,680 meters
STA. 22+560 - 23+200 = 1,280 meters
STA. 24+100 - 24+480 = 760 meters
STA. 25+700 - 26+460 = 1,520 meters

SUMMARY OF COST ANALYSIS

	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$ 477,100.00	$ 15,600.00	$ 492,700.00
RECOMMENDED DESIGN	$ 265,100.00		$ 265,100.00
ESTIMATED SAVINGS OR (COST)	$ 212,000.00		$ 227,600.00

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER:	Recommendation #2	Sheet		of	

Advantages:

1) Reduces initial and maintenance costs for right of way fencing areas.
2) Aids constructability of route.
3) promotes aesthetics of route.

Disadvantages:

1) Possible encroachment of farm fencing.
2) Possible animal migration onto roadway surface.

Justification:

The Design Executive Summary, TC 61-9 indicates the control of access required on a project. While fencing has generally been required on partially controlled access highways, this has generally resulted in the practice of fencing the entire length of th route. This is not always justified. The Design Guidance Manual recommends that the plans-in-hand inspection party should review the use of fence. In the areas of backslopes/fillslopes of 2:1, the R/W fefnce is not needed. Generally, no access can be gained easily along the sections. By eliminating these sections of fence, we reduce the initial construction cost greatly. We also eliminate maintenance costs over the life of th project. While most people infer a mandatory use of fencing along an

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER: Recommendation #2 Sheet | | of | |

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/ Unit	Source Code	Number of Units	Total $	Number of Units	Total $
R/W Fence	meter	$ 20.00	1	23855	$ 477,100.00	10600	$ 212,000.00

Source Code:

1 Project Cost Estimate
2 CES Database
3 CACES Database
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote
7 Professional Experience
8 Other Sources

VALUE ENGINEERING RECOMMENDATION

Form 30 Dec, 1996 — **COST ESTIMATE - O & M (LIFE CYCLE) COST**

IDENTIFICATION NUMBER: Recommendation # 2 — Sheet [ ] of [ ]

PRESENT WORTH METHOD
LIFE CYCLE PERIOD (YEARS)= 25
ANNUAL PERCENTAGE RATE= 4

Initial Costs				**Original Design PW $**		**Reccommended Design PW $**
R/W Fence				477.1		265.1
Sub Totals of Initial Costs PW $				477.1		265.1

Later Costs Single Expenditure	**In the Yr**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
none						
Sub Total of Single Expenditure Costs PW $						

Later Costs Annual Expense	**For How Many Yrs**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Repair Expences	25	15.622	1	15.6		
Sub Totals of Annual Expense Costs PW $				15.6		
Total PW $ for Original & Recommended				492.7		265.1
Total PW $ Savings (or Added Cost) for Recommended						227.6

Remarks:

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Item # 1-181.37

LOCATION: New Route (Mayfield - US 641) Mayfield, KY

STUDY DATE: 4/30/99

IDENTIFICATION NUMBER: Recommendation #3

FUNCTION OF COMPONENT BEING CHANGED: Pipe Headwalls

DECSCRIPTIVE TITLE OF RECOMMENDATION: Change S&F I/O Boxes to Metal End Sections

ORIGINAL DESIGN:

The original design requires Sloped and Flared Inlet/Outlet Boxes to be constructed at the ends of various 450mm, 600mm, 750mm, and 900mm pipe culverts.

RECOMMENDED CHANGE:

It is recommended to change these boxes to sloped metal end sections.

SUMMARY OF COST ANALYSIS

	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$ 111,900.00	$ 23,500.00	$ 135,400.00
RECOMMENDED DESIGN	$ 79,400 ~~69,100.00~~	$ 24,800.00	$ ~~93,900.00~~ 104,100
ESTIMATED SAVINGS OR (COST)	$ ~~42,800.00~~ 32,500	$ 1,300.00	$ 41,500.00

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER:	Recommendation #3	Sheet		of	

Advantages: It is estimated that the life span of the metal end sections is in excess of 25 years. These end sections have the slope and configuration to meet the safety requirements of constructing next to the roadway. They are also easier to install and less expensive than the compariable concrete ends.

Disadvantages: These items are a relitavely new product, therefore, the actual longevity has not been established. There has been some indication that roadway mowers have damaged some of these sections thereby causing additional maintenance.

Justification: The metal end sections offer an economic alternative to the concrete sloped and flared boxes without compromising safety. The design of the box is similar to a sloped and flared box, therefore, the maintenance is virtually the same for the two structures.

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER: Recommendation #3 Sheet | | of | |

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/ Unit	Source Code	Number of Units	Total $	Number of Units	Total $
450mm S&F Box	ea.	$ 1,695.34	1	28	$ 47,469.52		
600mm S&F Box	ea.	$ 2,025.79	1	10	$ 20,257.90		
750mm S&F Box	ea.	$ 2,462.76	1	6	$ 14,766.56		
900mm S&F Box	ea.	$ 2,937.54	1	10	$ 29,375.40		
450mm metal end	ea.	$ ~~650.00~~	10198			28	$ ~~18,200.00~~ 25530
600mm metal end	ea.	$ 1,000.00	8			10	$ 10,000.00
750mm metal end	ea.	$ 1,816.00	8			6	$ 10,896.00
900mm metal end	ea.	$ 3,000.00	8			10	$ 30,000.00

Source Code:

1 Project Cost Estimate
2 CES Database
3 CACES Database
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote
7 Professional Experience
8 Ky Ave. unit bid prices 1998

VALUE ENGINEERING RECOMMENDATION

Form 30 Dec, 1996 — **COST ESTIMATE - O & M (LIFE CYCLE) COST**

IDENTIFICATION NUMBER: Recommendation #3 Sheet [ ] of [ ]

PRESENT WORTH METHOD
LIFE CYCLE PERIOD (YEARS)= 25
ANNUAL PERCENTAGE RATE= 4

Initial Costs				**Original Design PW $**		**Reccommended Design PW $**
Conc. S&F I/O Box				111.9		
Metal end sections						79.4 ~~69.1~~
Sub Totals of Initial Costs PW $				111.9		79.4 ~~69.1~~

Later Costs Single Expenditure	**In the Yr**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Conc. S&F I/O Box						
Metal end sections	12	0.6246			2	1.3
Sub Total of Single Expenditure Costs PW $						1.3

Later Costs Annual Expense	**For How Many Yrs**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Conc. S&F I/O Box	25	15.662	1.5	23.5		
Metal end sections	25	15.662			1.5	23.5
Sub Totals of Annual Expense Costs PW $				23.5		23.5
Total PW $ for Original & Recommended				135.4		104.1 ~~93.9~~
Total PW $ Savings (or Added Cost) for Recommended						31.2 ~~42.5~~

Remarks: Later costs for metal end sections is estimated that 2 -3% of ends need to be replace due to damage.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Item #1-181.37 New Route (Mayfield - US 641)

LOCATION: Graves - Calloway Counties; Section #2

STUDY DATE: 4/30/99

IDENTIFICATION NUMBER: Recommendation #4

FUNCTION OF COMPONENT BEING CHANGED: Access to Flood Road

DECSCRIPTIVE TITLE OF RECOMMENDATION: Delete Proposed access to Flood Road.

ORIGINAL DESIGN:

Flood Road, a low volume, county road is being severed in such a way by the new route that the new access points are offset by 480 meters. The new access to the north of the new route is located at STA. 24+400 and requires the construction of 200 meters of new roadway on a 4.5 meter embankment. The proposed access road requires obtaining 2.5 acres of right-of-way including a barn.

RECOMMENDED CHANGE:

Eliminating proposed access to Flood Road and barricading the severed section. Access to Flood Road could be achieved by using the access to Galloway Road at STA. 24+885 without any measurable increase in travel length.

A field entrance will be constructed at STA. 24+400, as a private access.

SUMMARY OF COST ANALYSIS

	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$ 83,146.00	$ 12,881.00	$ 96,027.00
RECOMMENDED DESIGN	$ 8,239.00	$ -	$ 8,239.00
ESTIMATED SAVINGS OR (COST)	$ 74,907.00	$ 12,881.00	$ 87,788.00

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER:	Recommendation #4	Sheet		of	

Advantages:
1) Removes a major access point along new route which increases safety.
2) Cost savings by not constructing & maintaining 200 meters of new roadway.
3) Cost savings by not acquiring additional right-of-way.
4) Less impact on property owner.

Disadvantages:
1) Possible property owner concerns for the two owners on the dead-end, barricaded section of Flood Road.

Justification:
Access to Flood Road is available by using the Galloway Road access with negligible increase in travel length. The costs of construction, R/W, and maintance of the orginally designed access would be money spent for no service to the general public.

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER: Recommendation #4 Sheet of

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/ Unit	Source Code	Number of Units	Total $	Number of Units	Total $
Roadway emb.	cM	$ 3.00	1	7605	$ 22,815.00	1593	$ 4,779.00
dga	mTon	$ 40.00	1	418	$ 16,720.00	39	$ 1,560.00
Asph. Base Cl. K	mTon	$ 35.27	1	401	$ 14,143.00	38	$ 1,340.00
Asph. Surf. I 20/30	mTon	$ 40.00	1	150	$ 6,000.00	14	$ 560.00
Guardrail	lin. M.	$ 30.34	1	200	$ 6,068.00	0	$ -
Right of Way	ac.	$ 2,000.00	7	2.5	$ 5,000.00	0	$ -
C/A Fence	lin. M.	$ 20.00	1	200	$ 4,000.00	0	$ -
Barn	ea.		7	1	$ 8,400.00	0	$ -

Source Code:

1 Project Cost Estimate
2 CES Database
3 CACES Database
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote
7 Professional Experience
8 Other Sources

VALUE ENGINEERING RECOMMENDATION

IDENTIFICATION NUMBER: Recommendation #4 Sheet of

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/ Unit	Source Code	Number of Units	Total $	Number of Units	Total $
Roadway emb.	cM	$ 3.00	1	7605	$ 22,815.00	1593	$ 4,779.00
dga	mTon	$ 40.00	1	418	$ 16,720.00	39	$ 1,560.00
Asph. Base Cl. K	mTon	$ 35.27	1	401	$ 14,143.00	38	$ 1,340.00
Asph. Surf. I 20/30	mTon	$ 40.00	1	150	$ 6,000.00	14	$ 560.00
Guardrail	lin. M.	$ 30.34	1	200	$ 6,068.00	0	$ -
Right of Way	ac.	$ 2,000.00	7	2.5	$ 5,000.00	0	$ -
C/A Fence	lin. M.	$ 20.00	1	200	$ 4,000.00	0	$ -
Barn	ea.		7	1	$ 8,400.00	0	$ -

Source Code:

1 Project Cost Estimate
2 CES Database
3 CACES Database
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote
7 Professional Experience
8 Other Sources

VALUE ENGINEERING RECOMMENDATION

Form 30 Dec, 1996 — **COST ESTIMATE - O & M (LIFE CYCLE) COST**

IDENTIFICATION NUMBER: Recommendation #4 — Sheet [ ] of [ ]

PRESENT WORTH METHOD
LIFE CYCLE PERIOD (YEARS)= 25
ANNUAL PERCENTAGE RATE= 4

Initial Costs				**Original Design PW $**		**Reccommended Design PW $**
Access Road				83.1		0
Field Entrance				0		8.2
Sub Totals of Initial Costs PW $				83.1		8.2

Later Costs Single Expenditure	**In the Yr**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Resurface	10	0.6756	4.9	3.3	0	0
Resurface	20	0.4564	5.9	2.7		
Sub Total of Single Expenditure Costs PW $				6		0

Later Costs Annual Expense	**For How Many Yrs**	**PW Factor**	**Original Design**		**Recommended Design**	
			Est $	**PW $**	**Est $**	**PW $**
Roadway Maintenance	25	15.622	0.4	6.9	0	0
Sub Totals of Annual Expense Costs PW $				6.9		0
Total PW $ for Original & Recommended				96		8.2
Total PW $ Savings (or Added Cost) for Recommended						87.8

Remarks: All future expenditures are based on a 2% annual inflation rate.

VALUE ENGINEERING RECOMMENDATION

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