I-66 North Bypass

Somerset, Kentucky

Transportation Building

Study Date: January 27-31, 2003

VALUE ENGINEERING STUDY

for the

Kentucky Transportation Cabinet

URS CORPORATION

I-66 North Bypass

Somerset, Kentucky

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Study Date: January 27 - 31, 2003

Final Report

February 6, 2003

URS Corporation

EXECUTIVE SUMMARY

General

The Value Engineering (VE) study for the construction of the I-66 North Bypass of Somerset, KY, was conducted during the period of January, 27-31, 2003 in the office of the Kentucky Transportation Cabinet (KYTC), Frankfort, Kentucky. A value engineering study on the I-66/US 27 Interchange was previously completed and was not a part of this study. Team members were from the KYTC and team leadership was furnished by URS. The subject project was designed by American Engineers Inc. and Johnson, Depp, and Quisenberry, under the direction and management of the KYTC.

The VE team undertook the task assignment using the value engineering work plan and approach. The work plan depends on what is commonly referred to as a "bottom up" approach. With this approach, the VE Team subdivided the project into it's component parts and examines the functions and requirements, and then identified alternate approaches. The ideas that were generated from this process and chosen for full development are presented in Section 3 of this report.

However, given that this VE study was conducted late in the project design schedule and that this project is only a part of a larger project, the VE team also considered a "top down" approach where the team looks at the project as independently and objectively as possible. This approach relies on the experience and professional background of the team and tends to be highly judgmental and is difficult to verify with an analytical process. The analysis and subsequent recommendations resulting from this approach are worthy of review.

The result of both approaches are recommendations for value improvement to this project. These recommendations are presented to all project stakeholders for a decision as to whether they should be implemented or not.

Significant Aspects of the Study

Prior to the commencement of this study, the KYTC studied several alternative routes for the project and with input from public meetings and a citizen advisory council, selected the northern route as the preferred solution. The value engineering team used the preferred northern route as the basis for the study. The project was in the final decision stage with contract award of the first segment, I-66/US 27 interchange, scheduled in 2003. Re-design costs and potential project delays were considered in the evaluation of potential proposals. The VE team concluded, after considerable study of the plans, that the design team had done a creditable job to this point in producing an economical project. The team noted that as presently designed the project is a borrow job with approximately 1,327,000 cubic yards required. With that in mind the team concentrated on areas to improve the balance of cut and fills.

Conclusion

The value engineering team found that the project had been well thought out by the Kentucky Transportation Cabinet and the design team. Due to the good work of the design team, value engineering opportunities were somewhat limited, however, the VE team developed several alternatives worthy of further consideration. As suspected, the major project savings will be in the adjustment of grades to reduce the borrow requirements.

The following table presents a summary of the ideas developed into recommendations and design comments with cost implications where applicable. Since cost is an important issue for comparison of VE proposals, the costs presented in this report are based upon original design quantities with unit rates obtained from the original cost estimate. Where proposed alternate designs included items not in the original scope, costs from similar projects and the VE team member expertise were used. The estimates include a mark-up of 20% for the JDQ Section and 27% for the AEI Sections, consistent with the project estimate furnished to the team.

SUMMARY OF RECOMMENDATIONS

I-66 North Bypass

Rec.#	Recommendation Title / Description	1st cost savings (or cost)
	AEI West Section	
1	Place ramps # 1 and # 2 under I-66 in lieu of fly-over	$ 1,665,176
2	Use at-grade intersection at southwest by-pass interchange	Dropped
3	Eliminate ramp # 4 and use Louie B. Nunn Parkway	$ 126,000
	JDQ Section	
4	Use culvert at Pittman Road	Design Comment
5	Use Wagonbox Bridge at Nelson Valley Road	Design Comment
6	Change grades to improve cut/fill balance	$ 5,840,000
7	Use rock roadbed and modify pavement design	$ 821,000
	AEI East Section	
8	Change grades to improve cut/fill balance	2,618,000
9	Use rock roadbed and modify pavement design (combined with #8)	
10	Drainage structure for Big Spring Branch not shown	Design Comment
11	Add edge drain cost	Design Comment

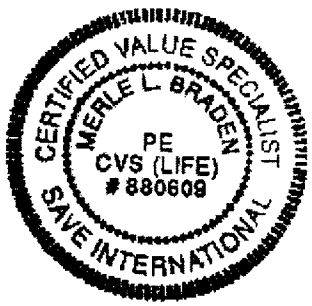
Acknowledgments
The team appreciates the input and able assistance of Robert Semones and Siamak Shafaghi and all the staff members of the Kentucky Transportation Cabinet who participated throughout the study. Without their assistance, this successful value engineering study would not have been possible.

Value Engineering Study - Core Team

Name	Discipline / Role	Organization	Telephone
Joe Waits, PE, CVS	Team Leader	URS	251-666-5892
Rob Franxman, EIT	Construction	KYTC – D6	859-356-5300
James Miracle, P.E.	Bridge Design	KYTC	502-564-4560
Richard Wilson	Geotechnical	KYTC	502-564-2374
Steve Criswell, P.E.	Construction	KYTC	502-564-4780
Kevin Martin, EIT	Highway Design	KYTC	502-564-3280
Royce Meredith, EIT	Highway Design	KYTC – D5	502-935-3461
Emily Johnson	Technical Recorder	URS	913-344-1152

Certification
This is to verify that the Value Engineering Study was conducted in accordance with standard Value Engineering principles and practices.

Merle Braden, PE, CVS
Value Engineering Program Manager



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Section and Title *Page No.*

SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on the construction of the I-66 North Bypass, Pulaski County, Kentucky. The I-66 North Bypass, a part of I-66 east-west corridor across the state of Kentucky, is just north of Somerset, Kentucky. The value engineering study team consisted of an interdisciplinary team of engineers from the Kentucky Transportation Cabinet under the leadership of a professional engineer with CVS certification from URS. The names and telephone numbers of all participants in the study are listed in Appendix A.

The Job Plan
The study followed the value engineering methodology as endorsed by SAVE International, the professional organization of value engineers. This report does not include an explanation of standard value engineering / value analysis processes used during the workshop in development of the results presented herein. This would greatly expand the size of the report. The purpose of the report is to document only the results of the study.

Ideas and Recommendations
Part of the value engineering methodology is to generate as many ideas as is practical, evaluate each idea, and then select as candidates for further development only those ideas that offer added value to the project. If an idea thus selected, turns out to work in the manner expected, that idea is presented as a formal value engineering recommendation. Recommendations represent only those ides that are proven to the VE team's satisfaction.

Design Comments
Some ideas that did not make the selection for development as recommendations were judged to be worthy of further consideration. These ideas have been written up as Design Comments and are included in Section 3.

Level of Development
Value Engineering studies are working sessions for the purpose of developing and recommending alternative approaches to a given project. As such, the results and recommendations presented are of a conceptual nature, and are not intended as a final design. Detailed feasibility assessment and final design development of any of the recommendations presented herein, should they be accepted, remain the responsibility of the designer.

Organization of the Report
The report is organized in the following outline.

1. Introductory Information
    a. Section 1- Introduction
    b. Section 2- Project Description
2. Primary body of results.....Section 3- Recommendations and Design Comments
4. Supporting documentation.....Appendices

SECTION 2 – PROJECT DESCRIPTION

This project consists of construction of the I-66 North Bypass in the vicinity of Somerset, Kentucky. This section of the I-66 corridor is a part of the east-west corridor that will run across the state of Kentucky when completed. The interchange at the intersection of I-66 and US 27 is not a part of this study. The North Bypass consists of a diamond type interchange at the intersection of the southwest bypass and Louie B. Nunn Parkway, a trumpet type interchange at I-66, and diamond interchanges at KY-39 and KY-80. Construction will terminate at KY-80. The project is divided into four segments, the AEI West Section, SKEES US 27 Interchange (not a part of this study), the JDQ Section, and the AEI East Section. Contract award of the first segment, the I-66/US 27 Interchange, is scheduled in 2003, with remaining segments to follow.

SECTION 3 - VE RECOMMENDATIONS

This section contains the complete documentation of all recommendations to result from this study. Each recommendation is marked by a unique identification number. This number is assigned from the Creative Idea List and is used throughout the report to uniquely refer to a given recommendation. The parent idea, or ideas, from which the recommendation began can be determined from the Creative Idea List where the recommendation number is shown adjacent to the corresponding parent idea.

Organization of Recommendations

The recommendations presented on the following pages are organized numerically by identification number. Each recommendation is documented by a separate write-up that includes a description of the recommendation, a list of advantages and disadvantages, sketches where appropriate, calculations, cost estimate, and the economic impact of the recommendation on the first cost, and where applicable, the life cycle cost. The economic impact is shown in terms of savings or added cost.

VALUE ENGINEERING RECOMMENDATION # 1

PROJECT: I-66 North Bypass
LOCATION: Somerset, Kentucky
STUDY DATE: January 27-31, 2003

DESCRIPTIVE TITLE OF RECOMMENDATION:
Place ramps #1 and #2 under I-66 in lieu of fly-over

ORIGINAL DESIGN:
The current design is for the interchange on I-66 is to elevate ramps # 1 and # 2 to go over I-66 at the southwest by-pass.

RECOMMENDED CHANGE:
It is recommended that ramps # 1 and # 2 of the I-66/Southwest By-pass go underneath I-66.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$12,938,000		$12,938,000
RECOMMENDED DESIGN	$11,272,824		$11,272,824
ESTIMATED SAVINGS OR (COST)	$1,665,176	$0	$1,665,176

VALUE ENGINEERING RECOMMENDATION # 1

ADVANTAGES:

- Reduces the amount of embankment-in-place needed to construct ramps #1, #2, #3, and #4.
- With the height of embankment reduction, the length of the box culverts under ramps #1 and #2 can be reduced. This will reduce the stream impact to Sulfur Springs.
- Reduce the costs of the culverts.
- Changes this job to a roadway excavation project, which may allow rock roadbeds, pending boring evaluation.

DISADVANTAGES:

- Requires additional right-of-way at ramp #3, due to the cut.

JUSTIFICATION:

The elevation of ramps #1 and #2 over I-66 creates a deep fill and cover over the culverts for Sulfer Springs. The reduction in the embankment will reduce the length of the culverts as well as the cover, reducing the overall project cost. The overall impact could be the changing the project to an excavation project, and provide material for a rock roadbed.

VALUE ENGINEERING RECOMMENDATION # 1

COST ESTIMATE - FIRST COST

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
6'x6' Box Culvert RCBC	L.F.	270.44	1	662	$179,031	483	$130,623
72" Pipe	L.F.	230.00	1	446	$102,580	429	$98,670
48" Pipe	L.F.	85.00	1	354	$30,090	0	$0
Drop Box Inlet Type 1	Each	2,400	1	1	$2,400	0	$0
Stream Impact Cost	L.F.	150.00	1	1,108	$166,200	912	$136,800
SW Bypass over I-66							
Ramp 1 Bridge	S.F.	65.00		9,440	$613,600	0	$0
Ramp 2 Bridge	S.F.	65.00		13,275	$862,875		$0
I-66 Over SW Bypass							
I-66 Bridge	C.Y.	65.00	1	0	$0	20,250	$1,316,250
Emb-In-Place	C.Y.	4.00	1	2,057,582	$8,230,328		$0
Roadway Excavation	C.Y.	3.61	1	0	$0	1,992,769	$7,193,896
Subtotal					$10,187,104		$8,876,239
Mark-up (27%)					$2,750,518		$2,396,585
Redesign Costs							
Total					$12,937,622		$11,272,824

SOURCE CODE:
1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 3

PROJECT: I-66 North Bypass
LOCATION: Somerset, Kentucky
STUDY DATE: January 27-31, 2003

DESCRIPTIVE TITLE OF RECOMMENDATION:
Eliminate ramp # 4 and use Louie B. Nunn Parkway

ORIGINAL DESIGN:
East bound I-66 traffic will exit to the southwest by-pass through ramp # 4. The new alignment for I-66 ties into the Louie B. Nunn Parkway which will also tie into the southwest by-pass at a grade separated interchange. The portion of the Louie B. Nunn Parkway between I-66 and the southwest by-pass will not be utilized.

RECOMMENDED CHANGE:
Eliminate ramp # 4 and utilize the Louie B. Nunn Parkway as an exit ramp which will provide access to the southwest by-pass at the grade separated interchange.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$235,710		$235,710
RECOMMENDED DESIGN	$109,640		$109,640
ESTIMATED SAVINGS OR (COST)	$126,070	$0	$126,070

VALUE ENGINEERING RECOMMENDATION # 3

ADVANTAGES:

- By exiting on the Louie B. Nunn Parkway, the traveling public will pass through a smoother transition from I-66 than ramp # 4 provides.
- By exiting traffic on the parkway, a short merging and weaving area will be eliminated where ramps # 1 and # 4 converge onto the southwest by-pass.
- The elimination of ramp # 4 could result in a smaller amount of right-of-way acquisition.

DISADVANTAGES:

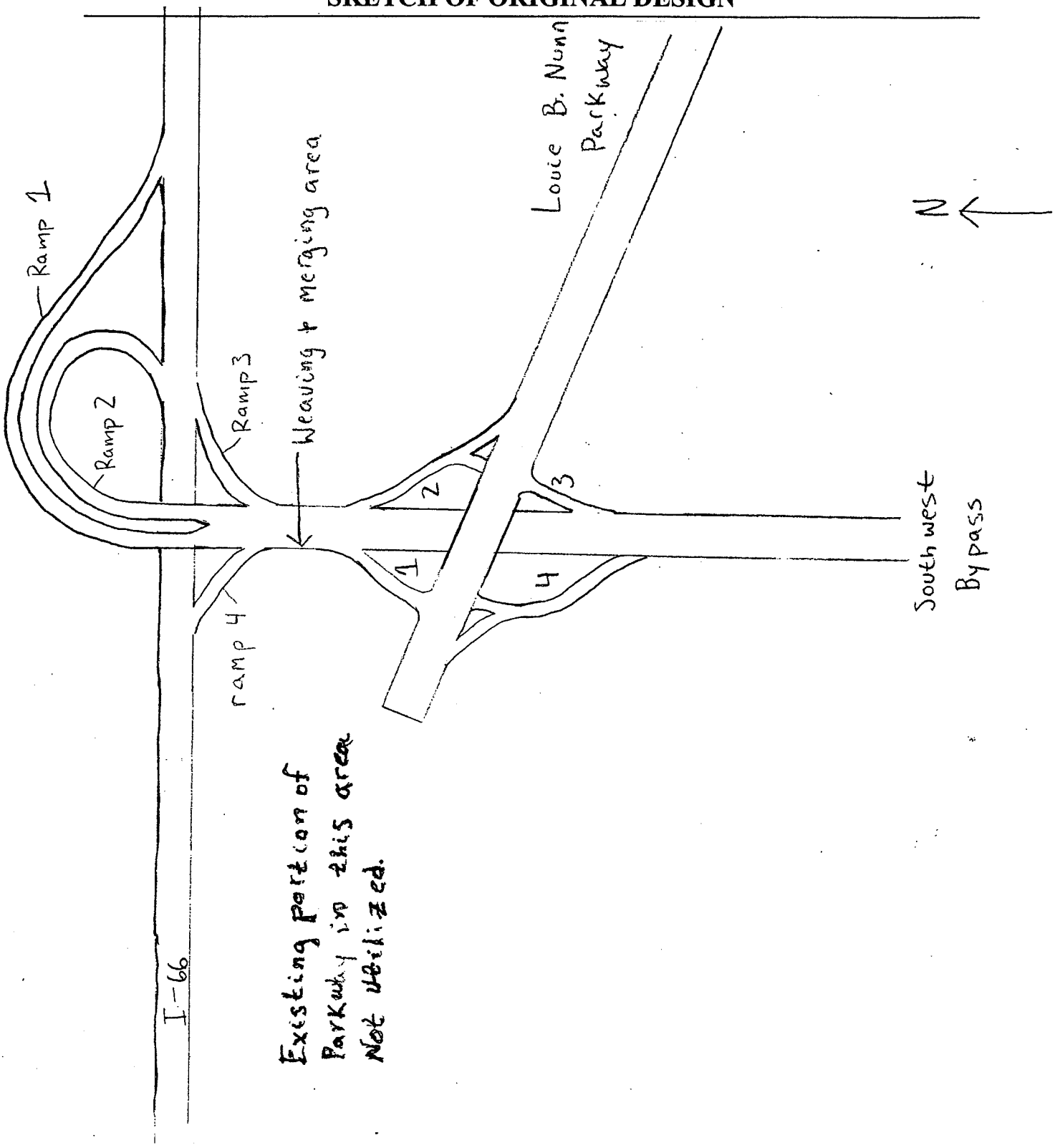
- Because the transition from I-66 to the parkway would be straight and smooth, the ramp speed could increase as traffic approaches the Louie B. Nunn and southwest by-pass interchange.

JUSTIFICATION:

The proposal would create an outer loop connection for eastbound I-66 traffic onto the southwest by-pass, eliminating a dangerous merging and weaving area on the by-pass. This, coupled with the estimated cost savings, indicates that the proposal should be reviewed further.

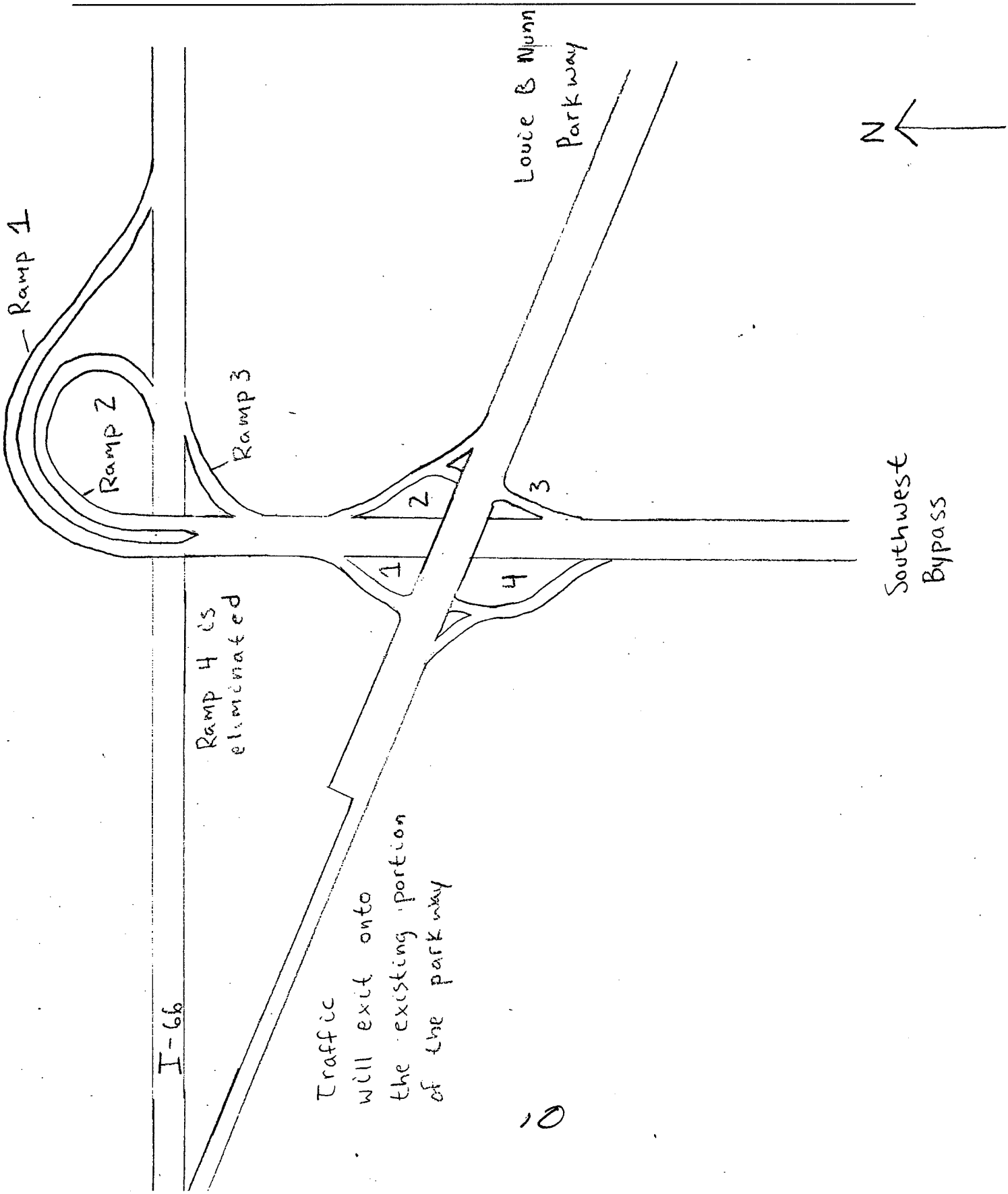
VALUE ENGINEERING RECOMMENDATION # 3

SKETCH OF ORIGINAL DESIGN



VALUE ENGINEERING RECOMMENDATION # 3

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # 3

CALCULATIONS

Surfacing Calculations for Ramp 4:

Shoulder:

CL4 76-22 Surface	1½"	x	2450 SY	x 110 lb/SY/in	=	185 ton
CL4 76-22 Base	4"	x	2450 SY	x 110 lb/SY/in	=	540 ton
DGA	12"	x	2450 SY	x 115 lb/SY/in	=	1690 ton

Driving Lanes:

CL4 76-22 Surface	1½"	x	3060 SY	x 110 lb/SY/in	=	250 ton
CL4 76-22 Base	4"	x	3060 SY	x 110 lb/SY/in	=	675 ton
CL 3 64-22 Base	8"	x	3060 SY	x 110 lb/SY/in	=	1350 ton
Drainage Blanket	4"	x	3060 SY	x 115 lb/SY/in	=	700 ton
DGA	4"	x	3060 SY	x 115 lb/SY/in	=	705 ton

Ramp 4 Totals:

CL 4 76-22 Surface	=	435 ton
CL4 76-22 Base	=	1215 ton
CL 3 64-22 Base	=	1350 ton
Drainage Blanket	=	700 ton
DGA	=	2395 ton

Calculate totals for 500' transition from I-66 to existing park way using ramp typical:

Transition totals:

CL 4 76-22 Surface	=	125 ton
CL 4 76-22 Base	=	335 ton
CL 3 64-22 Base	=	365 ton
Drainage Blanket	=	190 Ton
DGA	=	650 ton

//

VALUE ENGINEERING RECOMMENDATION # 3

CALCULATIONS

Resurfacing Louie B. Nunn parkway ramp:

Approximate Length of ramp = 3700'

Subtract Length of transition = 500'

Total Length to resurface = 3200'

Width of ramp = 29'

Yardage to resurface = 10,300 SY

10,300 SY x 110 lb/SY/in x 1.5 in = 850 ton

Total CL4 Surface 76-22 = 975 ton
(including transition)

VALUE ENGINEERING RECOMMENDATION # 3

CALCULATIONS

Guardrail:

Upon inspection of the profile of Ramp #4 it appears approximately 900 ft of Guardrail and one End treatment type 1 could be eliminated.

VALUE ENGINEERING RECOMMENDATION # 3

COST ESTIMATE - FIRST COST

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Embankment in place	C.Y.	4.00	1	2,830	$11,320	0	$0
CL 4 76-22 Surface	Ton	49.00	1	435	$21,315	975	$47,775
CL 4 76-22 Base	Ton	43.00	1	1,215	$52,245	335	$14,405
CL 3 64-22 Base	Ton	32.00	1	1,350	$43,200	365	$11,680
Drainage Blanket	Ton	28.00	1	700	$19,600	190	$5,320
DGA	Ton	11.00	1	2,395	$26,345	650	$7,150
Guardrail	L.F.	10.00	1	900	$9,000	0	$0
GR End. Type I	Each	2,583	1	1	$2,583	0	$0
Subtotal					$185,600		$86,330
Mark-up (27%)					$50,110		$123,310
Redesign Costs							
Total					$235,710		$109,640

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING DESIGN COMMENT # 4

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Replace bridge structure with culvert at Pittman Creek

COMMENTARY:
The proposed alignment of I-66 calls for a three span bridge structure over Pittman Creek at Station 437+30. While this design is both feasible and adequate, the use of a reinforced concrete box culvert could be an equally functional alternative. The use of a culvert could reduce the first cost of the structure and speed the pace of construction while eliminating the effects of the large 45 degree skew needed for construction of the bridge. As well, the culvert would have a much smaller life cycle cost than that of the bridge. The concerns that would have to be overcome would be the impact on the creek itself, and the additional embankment that would be required. However, it seems that the grades could possibly be lowered in the area, decreasing the length of the culvert, and henceforth the amount of embankment needed as well as the stream impact. Lastly, a reinforced concrete box culvert has been used downstream on Pittman Creek under the southeast by-pass. Thus, the projected savings, and earlier effective use of a culvert in a similar situation indicates that the use of a culvert in this situation should be further researched.

VALUE ENGINEERING DESIGN COMMENT # 5

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Use Wagon Box culvert at Nelson Valley Road

COMMENTARY:
The proposed alignment for I-66 provides a three span bridge structure over Nelson Valley Road at Station 426+05.75. The value engineering team has concluded that a "wagon box" structure could also be a viable alternative. This structure could be built nearly identical to that designed for Coleman Road at Station 574+00. The construction of this pass thru would result in considerable time savings and possibly reduced construction cost. As well, the life cycle maintenance cost would be much less than that of a higher ADT interstate bridge. Also, considering the profile grade in this area will likely lower, the length of the "wagon box", and the amount of fill required to go over the structure will also be lowered. Thus, even though the initial cost of the "wagon box" structure could be only slightly lower, the structure will likely save millions in bridge maintenance costs in the future, while serving the very same function as the twin spans proposed over Nelson Valley Road.

VALUE ENGINEERING RECOMMENDATION # 6

PROJECT: I-66 North Bypass
LOCATION: Somerset, Kentucky
STUDY DATE: January 27-31, 2003

DESCRIPTIVE TITLE OF RECOMMENDATION:
Change roadway grade from Station 395+00 to 454+00.

ORIGINAL DESIGN:
The original profile grade starts at Station 395+00 on a 3.5% downhill grade to a vertical P.I. at Station 429+90.30. Then proceed on a 2.75% uphill grade to Station 454+00.

RECOMMENDED CHANGE:
Change the profile grade starting at Station 395+00 on a 4.03% to a vertical curve P.I. at 429+72. Then proceed on a 3.29% uphill grade to Station 454+00.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$21,840,000		$21,840,000
RECOMMENDED DESIGN	$16,000,000		$16,000,000
ESTIMATED SAVINGS OR (COST)	$5,840,000	$0	$5,840,000

VALUE ENGINEERING RECOMMENDATION # 6

ADVANTAGES:

- Decreases the amount of borrow material needed for the project.
- It increases the probability that the last abatement for the Pittman Creek Bridge will be more uniform since it will be deeper in the cut.
- Reduces bridge length at Pittman Creek.

DISADVANTAGES:

- Slightly steeper grades.

JUSTIFICATION:

This project, as designed, has over 1,000,000 cubic yards of borrow material needed. By reducing the grade in this one area, the amount of borrow material needed can be reduced. Due to historical concerns, the grades were not touched at Station 385+00. A cemetery located RT of Station 468+88 was the reason the grade profile was not adjusted beyond this point.

VALUE ENGINEERING RECOMMENDATION # 6

DISCUSSION CONTINUED

The length of both the I-66 over Nelson Valley Road and Pittman Creek will be reduced with this revised profile. Since the bridge has not been sized at this time it is difficult to determine a savings.

Workshop Attendance

Attendees				Participation							
				Meetings			Study Sessions				
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and FAX. (Tel first with FAX underneath)	Role in wk shop	Intro	Mid Wk Rev	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Richard Wilson	Kentucky Department of Highway	502-564-2374	Team Member	X			X				
Joe Waits	URS Corporation	251-666-2184	Team Leader	X	X	X	X	X	X	X	X
James Miracle	Kentucky Transportation Cabinet- C.O. Bridges	502-564-4550	Team Member	X	X		X	X	X		
Robert Franxman	Kentucky Transportation Cabinet-D6	859-356-5300	Team Member	X	X	X	X	X	X	X	X
Steven Criswell	Kentucky Transportation Cabinet- C.O. Construction	502-564-4780	Team Member	X	X	X	X	X	X/2	X	X
Kevin Martin	Kentucky Transportation Cabinet- C.O. Design	502-564-3280	Team Member	X	X	X	X/2	X	X	X	X
Royce Meredith	Kentucky Transportation Cabinet-D5	503-367-6411	Team Member		X	X		X/2	X	X	X
Emily Johnson	URS Corporation	913-344-1152	Team Member	X	X	X	X	X	X	X	X
Kenneth W. Young	American Engineers, Inc.	270-651-7220				X					
Douglas McKinnon	SKEES Engineering	502-254-2344				X					
Steve McDevitt	SKEES Engineering	502-254-2344				X					
Rob Martin	Kentucky Transportation Cabinet-D4	502-348-5866				X					
Gary Raymer	Kentucky Transportation Cabinet-D4	270-766-5066				X					
Siamak Shafanghi	Kentucky Transportation Cabinet-Design	502-564-3280				X					
David Kratt	Kentucky Transportation Cabinet-C.O. SHE'S Office	502-564-3388				X					
David Beattie	Kentucky Transportation Cabinet-D8	606-677-4017				X					
Roy Polly	Kentucky Transportation Cabinet-C.O. SHE Office	502-564-3388				X					

	Location/Station	Original Design Earthwork			VE Study Earthwork			Change
		Cut	Fill	Balance	Cut	Fill	Balance	
AEI Section 1	Ramp 1	89	429,016	(428,927)	123,493	103,451	20,042	448,969
	Ramp 2	0	276,723	(276,723)	27,675	194,642	(166,967)	(109,756)
	Ramp 3	2,436	27,437	(25,001)	42,376	3,643	38,733	63,734
	Southwest Bypass (Sta 313+90 to 339+15)	99,331	384,563	(285,232)	585,272	4,958	580,314	865,546
JDQ	Sta 395+00 to 454+00	54,844	1,007,594	(952,750)	199,631	457,202	(257,571)	(695,179)
AEI Section 4	Sta 545+00 to 642+73	1,537,260	904,891	632,369	1,824,821	410,935	1,413,886	781,517

Earthwork Totals Per Section

	Earthwork (cu yds)	VE Earthwork (cu yds)
AEI Sec 1	(650,805)	617,688
JDQ	(1,055,000)	(359,821)
AEI Sec 4	(676,390)	105,127

VALUE ENGINEERING RECOMMENDATION # 6

COST ESTIMATE - FIRST COST

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Emb-In-Place	C.Y.	7.00	1	2,600,000	$18,200,000	1,904,821	$13,333,747
Subtotal					$18,200,000		$13,333,747
Mark-up (20%)					$3,640,000		$2,666,749
Redesign Costs							
Total					$21,840,000		$16,000,496

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 7

PROJECT: I-66 North Bypass
LOCATION: Somerset, Kentucky
STUDY DATE: January 27-31, 2003

DESCRIPTIVE TITLE OF RECOMMENDATION:
Use rock roadbed for subgrade and revise pavement design by reducing pavement thickness.

ORIGINAL DESIGN:
The design currently does not specify rock roadbed for the subgrade in the JDQ Section

RECOMMENDED CHANGE:
Providing there is enough good quality rock (SDI $\geq$ 95) that could be generated on the project, a rock roadbed could be specified to reduce the amount of pavement thickness. Two feet of rock roadbed would eliminated four inches of bituminous base.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$2,521,000		$2,521,000
RECOMMENDED DESIGN	$1,700,000		$1,700,000
ESTIMATED SAVINGS OR (COST)	$821,000	$0	$821,000

VALUE ENGINEERING RECOMMENDATION # 7

ADVANTAGES:

- It would provide a better foundation for the pavement
- Allow for better drainage

DISADVANTAGES:

- There needs to be enough good quality rock. Presently, the borings have not been taken, so a determination cannot be taken at this time of the quality and quantity of rock.

JUSTIFICATION:

If this project has waste, it will require 174,074 cubic yards of rock to place a two foot rock roadbed. With this type of subgrade, approximately four inches of bituminous base can be eliminated at a savings of approximately $ 882,000.

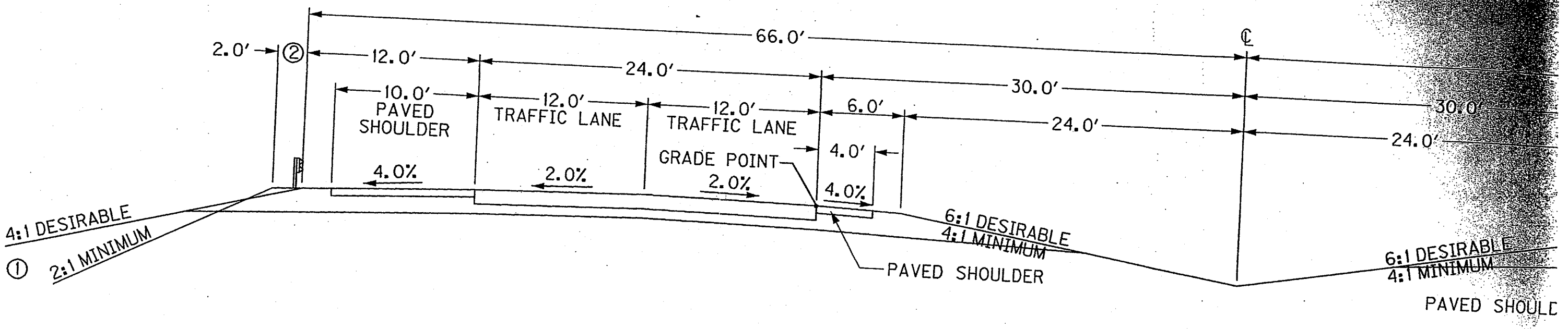
VALUE ENGINEERING RECOMMENDATION # 7

DISCUSSION CONTINUED

It is recognized that this project is an embankment in place project requiring the contractor to borrow material. This area is known to have good quality limestone. However, the borings would need to be studied closely to determine if mud seams or voids exist in the rock. An evaluation of the available rock would have to be made to determine if it is economically feasible to process to the required gradation. An additional $0.25/C.Y. was added to the cost of rock roadbed to account for the possible increased cost for processing.

TYPICAL SECTI

I–66 MAINLINE
STA. 97+00 TO STA. 251+00
STA. a 545+00 TO STA. a 712+10.78



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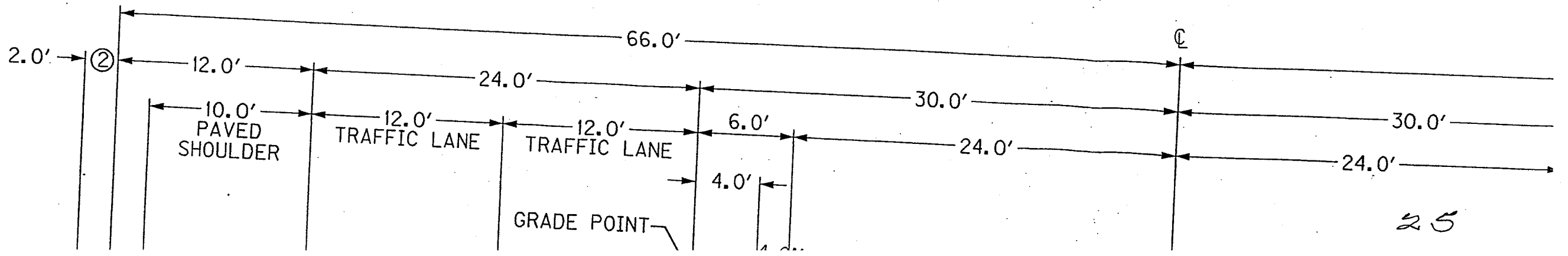

TYPICAL SECTI

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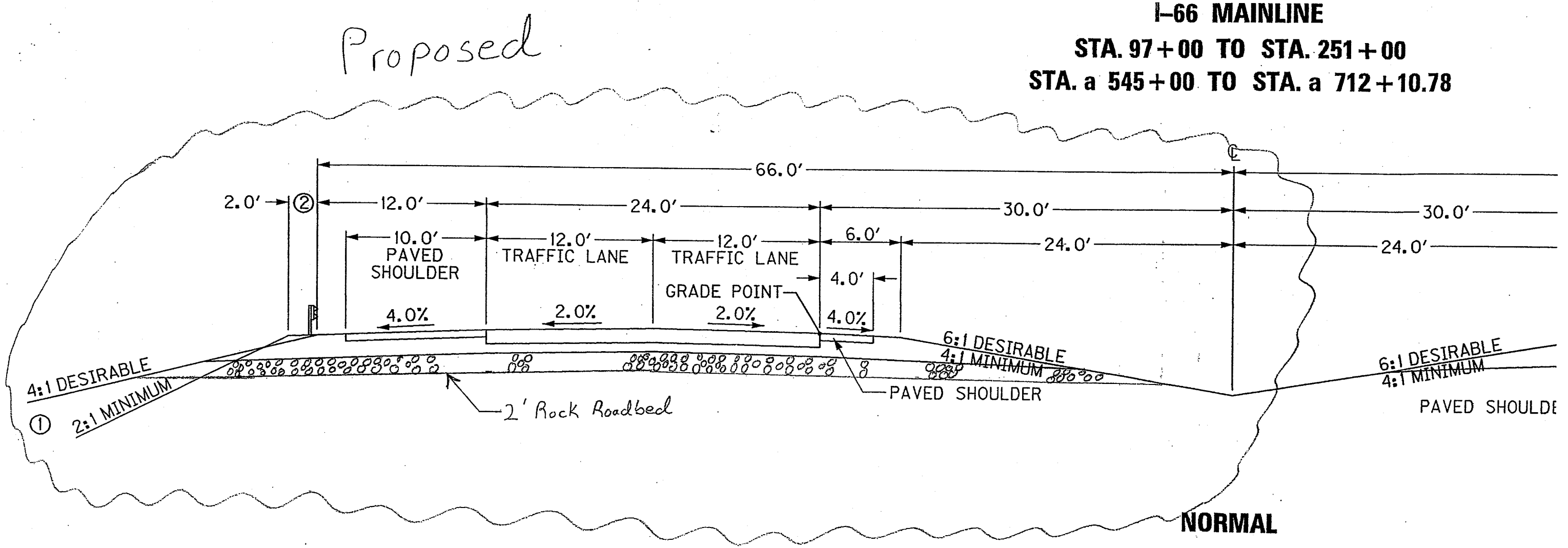

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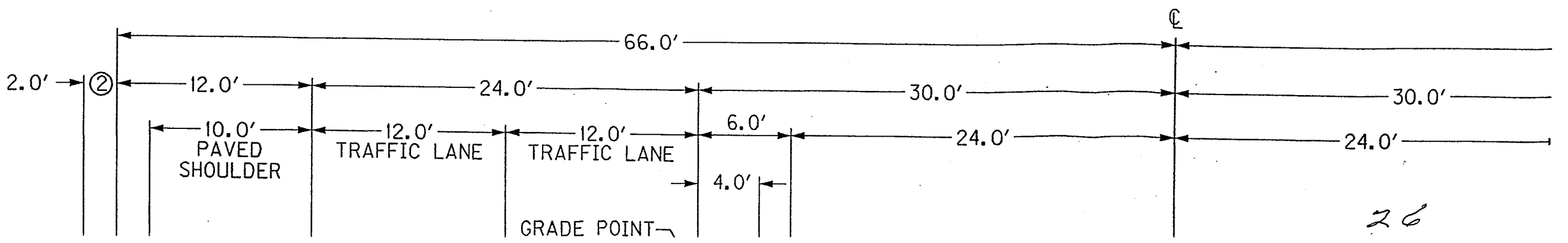


Original Design

DATE: 01-28-2003

PROJECT IDENTIFICATION NO.:

CBR = 3

ESAL's= 30000000

13" PCCP

PERCENT OF ASPHALT CONCRETE = 33%

TOTAL THICKNESS REQUIRED = 35.1 in. (891 millimeters)

ASPHALT CONCRETE THICKNESS = 11.6 in. (294 millimeters)

AGGREGATE THICKNESS = 24 in. (597 millimeters)

An equivalent design is 18.4 inches bituminous on 4 inches DGA
(468 millimeters) (100 millimeters)

STRUCTURE NUMBER = 7.97
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

11
12
11

PERCENT OF ASPHALT CONCRETE = 50%

TOTAL THICKNESS REQUIRED = 28.4 in. (721 millimeters)

ASPHALT CONCRETE THICKNESS = 14.2 in. (360 millimeters)

AGGREGATE THICKNESS = 14 in. (360 millimeters)

An equivalent design is 17.8 inches bituminous on 4 inches DGA
(451 millimeters) (100 millimeters)

STRUCTURE NUMBER = 7.71
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

PERCENT OF ASPHALT CONCRETE = 75%

TOTAL THICKNESS REQUIRED = 21.8 in. (555 millimeters)

ASPHALT CONCRETE THICKNESS = 16.4 in. (416 millimeters)

AGGREGATE THICKNESS = 5 in. (139 millimeters)

An equivalent design is 16.9 inches bituminous on 4 inches DGA
(429 millimeters) (100 millimeters)

STRUCTURE NUMBER = 7.37
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

27

8" LMR = 8(0.13)/0.2 = 2.6" A.B. 4" DB = 4(0.20)/0.4 = 2" A.B.

DATE: 01-28-2003

PROJECT IDENTIFICATION NO.: Proposed Design

CBR = 9 2' Rock

ESAL's= 30000000

1' Rock = 12"(0.11)/0.4 = 3.3" AC

PERCENT OF ASPHALT CONCRETE = 33% 11" PCCP

TOTAL THICKNESS REQUIRED = 26.7 in. (677 millimeters)

ASPHALT CONCRETE THICKNESS = 8.8 in. (223 millimeters)

AGGREGATE THICKNESS = 18 in. (454 millimeters)

An equivalent design is 13.6 inches bituminous on 4 inches DGA
(347 millimeters) (100 millimeters)

STRUCTURE NUMBER = 6.07
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

11"

PERCENT OF ASPHALT CONCRETE = 50%

TOTAL THICKNESS REQUIRED = 22.4 in. (569 millimeters)

ASPHALT CONCRETE THICKNESS = 11.2 in. (284 millimeters)

AGGREGATE THICKNESS = 11 in. (284 millimeters)

An equivalent design is 13.7 inches bituminous on 4 inches DGA
(348 millimeters) (100 millimeters)

STRUCTURE NUMBER = 6.10
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

PERCENT OF ASPHALT CONCRETE = 75%

TOTAL THICKNESS REQUIRED = 18.2 in. (461 millimeters)

ASPHALT CONCRETE THICKNESS = 13.6 in. (346 millimeters)

AGGREGATE THICKNESS = 5 in. (115 millimeters)

An equivalent design is 13.8 inches bituminous on 4 inches DGA
(351 millimeters) (100 millimeters)

STRUCTURE NUMBER = 6.13
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

VALUE ENGINEERING RECOMMENDATION # 7

CALCULATIONS

- Station 310+00 to 545+00 $\Rightarrow$ 23,500 ft.
- Use 50 ft. roadway width (which will daylight out for drainage)

$$\left[\frac{23500' \times 50' \times 2'}{27}\right] \times 2 \text{ directions} = 174,074 \text{ C.Y.}$$

With 2' Rock Roadbed 4-inches of bituminous base

- 24' pavement width
- 110 lbs/SY/inch

$$\frac{23500' \times 24'}{9} \times 110 \text{ lbs/SY/inch} \times 4 \text{ inches} = 27,573,333 \text{ lbs}$$

$$\frac{27,573,333 \text{ lbs}}{2000 \text{ lbs/Ton}} = 13,786.7 \text{ Tons}$$

$$13,786.7 \text{ Tons} \times \$32.00/\text{Ton} = \$441,173.30$$

For both directions & Total Cost:

$$\$441,173.30 \times 2 = \$882,347.00$$

VALUE ENGINEERING RECOMMENDATION # 7

COST ESTIMATE - FIRST COST

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Class 3 Asphalt Base 1.00 PG 64-22	Tons	32.00	1	27,574	$882,368	0	$0
Emb-In-Place	C.Y.	7.00	1	174,074	$1,218,518	22,049	$154,343
Rock Roadbed	C.Y.	7.25	7	0	$0	174,074	$1,262,037
Subtotal					$2,100,886		$1,416,380
Mark-up (20%)					$420,177		$283,276
Redesign Costs							
Total					$2,521,063		$1,699,655

SOURCE CODE:
1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 8

PROJECT: I-66 North Bypass
LOCATION: Somerset, Kentucky
STUDY DATE: January 27-31, 2003

DESCRIPTIVE TITLE OF RECOMMENDATION:
Change grades to create additional excavation and less embankment

ORIGINAL DESIGN:
The profile grade for I-66 between stations a544+90 and a67780.12 creates a project requiring 676,390 cubic yards of borrow material.

RECOMMENDED CHANGE:
Lower the profile grade to reduce the amount of embankment and create more excavation eliminating the need for material borrow, while at the same time providing the ability to build rock roadbed.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$13,056,000		$13,056,000
RECOMMENDED DESIGN	$10,438,000		$10,438,000
ESTIMATED SAVINGS OR (COST)	$2,618,000	$0	$2,618,000

VALUE ENGINEERING RECOMMENDATION # 8

ADVANTAGES:

- Reducing the amount of embankment will increase the amount of excavation, eliminating the need for borrow material.
- The increased excavation amount should produce enough rock material to construct a more stable and durable rock roadbed.
- The construction of a rock roadbed will enable the reduction of some paving quantities.

DISADVANTAGES:

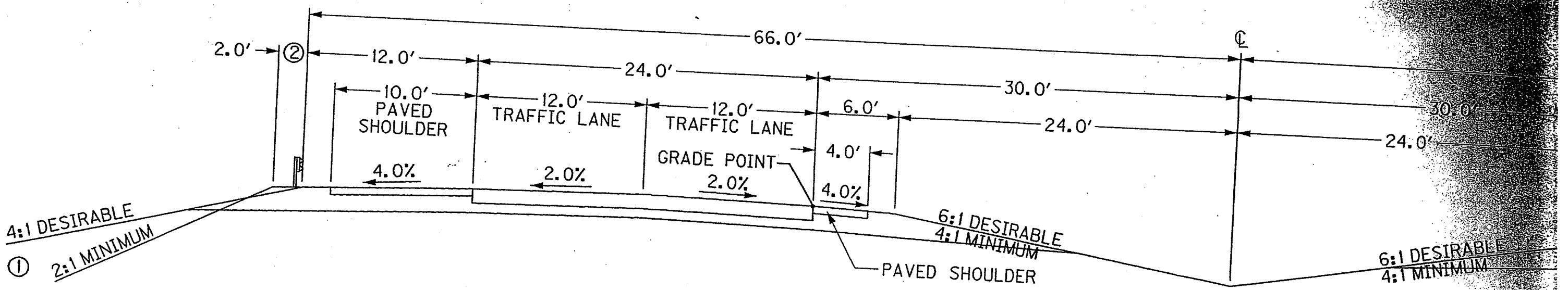
- The increase of excavation depths will increase the amount of right-of-way required; however, the lowering of embankments will offset some of this increase.

JUSTIFICATION:

By lowering the profile grades it will be possible to reduce the amount of embankment and increase the amount of excavation. This will reduce the cost needed for the large amount of borrow material, as well as providing rock for a rock roadbed. The rock roadbed, in turn will add significant savings, by enabling reduction of the asphalt pavement depth.

TYPICAL SECTI

I–66 MAINLINE
STA. 97+00 TO STA. 251+00
STA. a 545+00 TO STA. a 712+10.78



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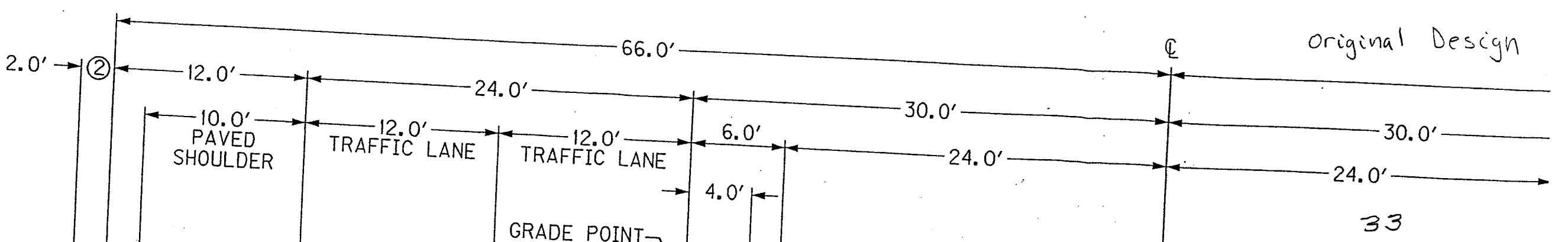

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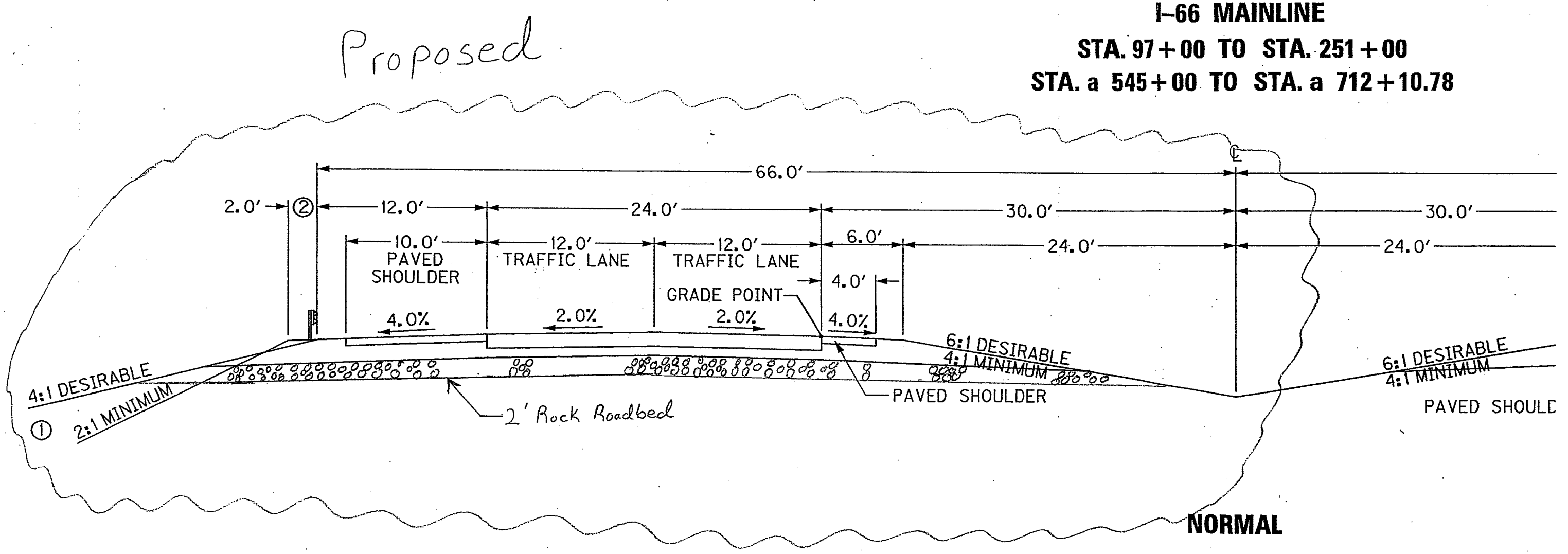

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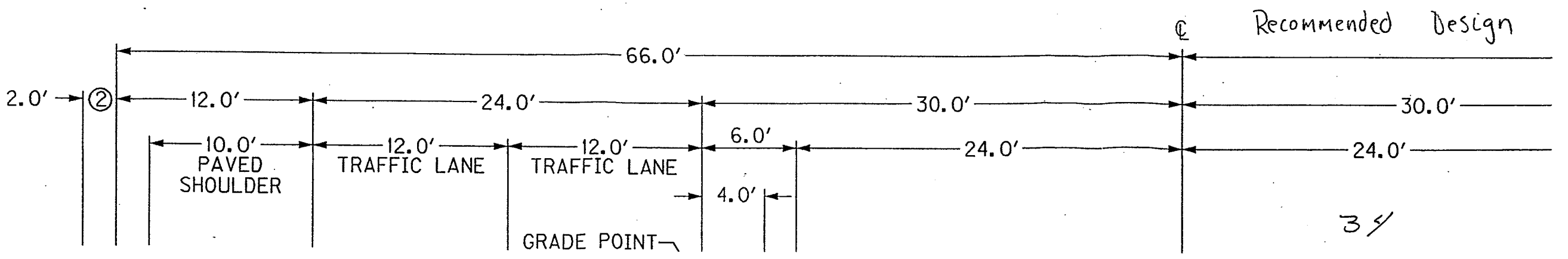

DATE: 01-28-2003

PROJECT IDENTIFICATION NO.:

CBR = 3

ESAL's= 30000000

13" PCCP

PERCENT OF ASPHALT CONCRETE = 33%

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Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

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PERCENT OF ASPHALT CONCRETE = 50%

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(451 millimeters) (100 millimeters)

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(429 millimeters) (100 millimeters)

STRUCTURE NUMBER = 7.37
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

8" LmR = 6(0.15)/0.4 = 2.6" A.B. 4" DB = 4(0.20)/0.4 = 2" A.B.

DATE: 01-28-2003

PROJECT IDENTIFICATION NO.:

CBR = 9 2' Rock

ESAL's= 30000000

1' Rock = 12"(0.11)/0.4 = 3.3" AC

11" PCCP

PERCENT OF ASPHALT CONCRETE = 33%

TOTAL THICKNESS REQUIRED = 26.7 in. (677 millimeters)

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Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

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PERCENT OF ASPHALT CONCRETE = 50%

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(351 millimeters) (100 millimeters)

STRUCTURE NUMBER = 6.13
Add 0.01 to SN if surface thickness is 40 mm instead of 30 mm

VALUE ENGINEERING RECOMMENDATION # 8

CALCULATIONS

Earthwork Calculations:

Developed all calculations from profile plotted in In Roads.

Rock Road Bed calculations:

Allowing for a 2' rock road bed, the pavement design can be thinned by approximately 4" of Bituminous base, see the attached pavement design calculations

Length of project = 13290 ft
Width of Driving Lanes = 48 Ft = 70,880 SY

70,880 SY
110 lb/sy/in
× 4 in

15,590 Ton of CL 3 Base 64-22 can be eliminat

Guardrail:

It was estimated from the new profile dereloped by the V.E. Team that 500' of Guardrail and one end treatment could be elimiated.

VALUE ENGINEERING RECOMMENDATION # 8

CALCULATIONS

New Earthwork totals:

Station	Cut (cy)	Fill (cy)
545 - 642+73	1,824,821	410,935
642+73 - Old KY 80	116	207,120
KY 80 - End	0	698,583
Coleman Rd.	5,324	4,410
KY 1317	2,101	1,962
Old KY 80	50,959	13,158
KY 80 Ramp 1	100	331,096
KY 80 Ramp 4	0	111,030
New Total:	1,883,421	1,778,294

Previous amount of Embankment = 2,272,250

Use New total of **Excavation = 1,883,421 cy**

VALUE ENGINEERING RECOMMENDATION # 8

COST ESTIMATE - FIRST COST

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Embankment In Place	C.Y.	4.00	1	2,272,250	$9,089,000	0	$0
Roadway Excavation	C.Y.	4.00	1	0	$0	1,883,421	$7,533,684
CL 3 Base 64-22	Ton	32.00	1	36,603	$1,171,296	21,013	$672,416
Guardrail	L.F.	10.00	1	1,761	$17,610	1,261	$12,610
G.R. End Type 1	Each	2,583	1	1	$2,583	0	$0
Subtotal					$10,280,489		$8,218,710
Mark-up (27%)					$2,775,732		$2,219,052
Redesign Costs							
Total					$13,056,221		$10,437,762

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING DESIGN COMMENT # 10

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Drainage structure(s) location(s) for AEI West Section

COMMENTARY:
There are three double box (dbl.) 10 foot by 5 foot Reinforced Concrete Box Culverts (RCBC) included in the AEI West Section, but they are not shown on the respective plan/profile views. For example, one may be required at Spring Branch west of KY 80 under I-66 approximately at station 673+50, but it is not shown.

The culverts' description in the AEI West Section estimate is as follows:

	295'	dbl. 10'x5' RCBC	$ 200,920
	375'	dbl. 10'x5' RCBC	$ 253,210
	160'	dbl. 10'x5' RCBC	$ 112,690
Total	830'	dbl. 10'x5' RCBC	$ 566,820

VALUE ENGINEERING DESIGN COMMENT # 11

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Add edge drain cost

COMMENTARY:
The cost estimates provided by American Engineers Inc. for section 1 from station 97+00 to station 251+00, and for section 4 from station a544+90 to station a677+80.12, do not include costs for edge drains. The cost estimates show the use of type II drainage blankets; however, where the blanket will drain is not indicated. Since the drainage will be collected with perforated pipe and expelled through headwalls, then these quantities should be included in the estimates, and detailed on the plans.

APPENDICES

The appendices in this report contain backup information supporting the body of the report, and the mechanics of the workshop. The following appendices are included.

CONTENTS

APPENDIX A
Participants

Workshop Attendance

Attendees				Participation							
				Meetings			Study Sessions				
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and FAX. (Tel first with FAX underneath)	Role in wk shop	Intro	Mid Wk Rev	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Richard Wilson	Kentucky Department of Highway	502-564-2374	Team Member	X			X				
Joe Waits	URS Corporation	251-666-2184	Team Leader	X	X	X	X	X	X	X	X
James Miracle	Kentucky Transportation Cabinet- C.O. Bridges	502-564-4550	Team Member	X	X		X	X	X		
Robert Franxman	Kentucky Transportation Cabinet-D6	859-356-5300	Team Member	X	X	X	X	X	X	X	X
Steven Criswell	Kentucky Transportation Cabinet- C.O. Construction	502-564-4780	Team Member	X	X	X	X	X	X/2	X	X
Kevin Martin	Kentucky Transportation Cabinet- C.O. Design	502-564-3280	Team Member	X	X	X	X/2	X	X	X	X
Royce Meredith	Kentucky Transportation Cabinet-D5	503-367-6411	Team Member		X	X		X/2	X	X	X
Emily Johnson	URS Corporation	913-344-1152	Technical Recorder	X	X	X	X	X	X	X	X
Kenneth W. Young	American Engineers, Inc.	270-651-7220				X					
Douglas McKinnon	SKEES Engineering	502-254-2344				X					
Steve McDevitt	SKEES Engineering	502-254-2344				X					
Rob Martin	Kentucky Transportation Cabinet-D4	502-348-5866				X					
Gary Raymer	Kentucky Transportation Cabinet-D4	270-766-5066				X					
Siamak Shafanghi	Kentucky Transportation Cabinet-Design	502-564-3280				X					
David Kratt	Kentucky Transportation Cabinet-C.O. SHE'S Office	502-564-3388				X					
David Beattie	Kentucky Transportation Cabinet-D8	606-677-4017				X					
Roy Polly	Kentucky Transportation Cabinet-C.O. SHE Office	502-564-3388				X					

David Depp	Johnson, Depp, Quisenberry	859-277-3639				X					
Mike Bruce	Johnson, Depp, Quisenberry	270-926-1808				X					
Jim King	Kentucky Transportation Cabinet- C.O. Bridges	564-4560				X					
Gary W. Sharpe	Kentucky Transportation Cabinet- C.O. Highway Design	564-3280				X					
Ken Sperry	Kentucky Transportation Cabinet	564-3730				X					
Wallace Bennett	T.H.E. Engineers	859-263-0009				X					
Robert Semones	Kentucky Transportation Cabinet-C.O. Design	502-564-3280				X					
Mary Murray	FHWA	502-223-6745				X					

APPENDIX B
Cost Information

COUNTY: PULASKI COUNTY
UPN:
ROAD NAME: INTERSTATE 66
LOCATION: AEI SECTION 1 - FROM STA. 97+00 (FISHING CREEK BRIDGE) TO STA. 251+00

ITEM NO: 8-59.20
FED. NO.:

Class of Road: INTERSTATE
Type of Construction: Grade, Drain, and Surfacing
Net Length, Miles: 2.862

Bid Item	Item	Quantity	Unit	Unit Price	Amount
GRADE & DRAIN					
0440	ENTRANCE PIPE-15 INCH	30	LIN FT	$24.00	$720.00
0441	ENTRANCE PIPE-18 INCH	30	LIN FT	$30.00	$900.00
0462	CULVERT PIPE-18 INCH	1938	LIN FT	$46.00	$89,148.00
0464	CULVERT PIPE-24 INCH	2112	LIN FT	$52.00	$109,824.00
0466	CULVERT PIPE-30 INCH	795	LIN FT	$58.00	$46,110.00
0468	CULVERT PIPE-36 INCH	685	LIN FT	$55.00	$37,675.00
0469	CULVERT PIPE-42 INCH	610	LIN FT	$80.00	$48,800.00
0470	CULVERT PIPE-48 INCH	1199	LIN FT	$85.00	$101,915.00
0472	CULVERT PIPE-60 INCH	401	LIN FT	$115.00	$46,115.00
0474	CULVERT PIPE-72 INCH	446	LIN FT	$230.00	$102,580.00
1490	DROP BOX INLET TYPE 1	2	EACH	$2,400.00	$4,800.00
1505	DROP BOX INLET TYPE 5B	9	EACH	$2,600.00	$23,400.00
1517	DROP BOX INLET TYPE 5F	9	EACH	$2,600.00	$23,400.00
2230	EMBANKMENT IN PLACE	2057582	CU YD	$4.00	$8,230,328.00
2242	WATER	300	M GAL	$3.00	$900.00
2434	R/W MARKER RURAL TYPE 1	212	EACH	$60.00	$12,720.00
2483	CHANNEL LINING CLASS II	9919	TON	$15.00	$148,785.00
2484	CHANNEL LINING CLASS III	7878	TON	$19.00	$149,682.00
2545	CLEARING AND GRUBBING	1	LP SUM	$196,441.00	$196,441.00
2650	MAINTAIN AND CONTROL TRAFFIC	1	LP SUM	$60,000.00	$60,000.00
2651	DIVERSIONS (BY-PASS DETOURS)	1	LP SUM	$60,000.00	$60,000.00
2701	TEMPORARY SILT FENCE	1000	LIN FT	$2.50	$2,500.00
2705	SILT CHECK	190	EACH	$104.00	$19,760.00
2708	CLEAN SILT CHECK	570	EACH	$49.00	$27,930.00
5950	EROSION CONTROL BLANKET	29590	SQ YD	$2.00	$59,180.00
5966	TOPDRESSING FERTILIZER	21.7	TON	$363.00	$7,877.10
5985	SEEDING AND PROTECTION	419788	SQ YD	$0.30	$125,936.40
5989	SPECIAL CROWN VETCH	86507	SQ YD	$0.40	$34,602.80
8100	CONCRETE-CLASS A	149.1	CU YD	$306.00	$45,624.60
8150	STEEL REINFORCEMENT	8770	LB	$0.70	$6,139.00
9139	CLEAN TEMP SILT FENCE	2000	LIN FT	$2.00	$4,000.00
	SUB - TOTAL GRADE & DRAIN:				$9,827,792.90
SURFACING					
0001	D G A BASE	85011	TON	$11.00	$935,121.00
0018	DRAINAGE BLANKET-TYPE II-ASPH	61506	TON	$28.00	$1,722,168.00
0212	CL 2 ASPHALT BASE 1.0D PG 76-22	1397	TON	$31.00	$43,307.00
0214	CL 3 ASPHALT BASE 1.0D PG 64-22	66253	TON	$32.00	$2,120,096.00
0216	CL 3 ASPHALT BASE 1.0D PG 76-22	4487	TON	$38.00	$170,506.00
0217	CL 4 ASPHALT BASE 1.0D PG 64-22	89814	TON	$38.00	$3,412,932.00
0219	CL 4 ASPHALT BASE 1.0D PG 76-22	21519	TON	$43.00	$925,317.00
0274	CL 3 ASPHALT BINDER 0.50A PG 64-22	5153	TON	$42.00	$216,426.00
0279	CL 4 ASPHALT BINDER 0.50A PG 76-22	10659	TON	$46.00	$490,314.00
0301	CL 2 ASPHALT SURFACE 0.38D PG 64-22	460	TON	$34.00	$15,640.00
0311	CL 3 ASPHALT SURFACE 0.50E PG 76-22	2216	TON	$48.00	$106,368.00
0312	CL 3 ASPHALT SURFACE 0.50D PG 64-22	6281	TON	$44.00	$276,364.00
0335	CL 4 ASPHALT SURFACE 0.50A PG 76-22	10559	TON	$49.00	$517,391.00
2262	R/W FENCE-WOVEN WIRE	32833	LIN FT	$3.85	$126,407.05
2351	GUARDRAIL-STEEL W BEAM-S FACE	27924	LIN FT	$10.00	$279,240.00
2363	GUARDRAIL CON. TO BR END TYPE A	6	EACH	$496.00	$2,976.00
2365	CRASH CUSHION TYPE IX-A	6	EACH	$4,718.00	$28,308.00
2367	GUARDRAIL END TREATMENT TYPE 1	51	EACH	$2,583.00	$131,733.00
2369	GUARDRAIL END TREATMENT TYPE 2A	49	EACH	$453.00	$22,197.00
2387	GUARDRAIL CON TO BR END TYPE A-1	6	EACH	$161.00	$966.00
2562	SIGNS	261	SQ FT	$6.00	$1,566.00
6514	PAVE STRIPING-PERM PAINT-4 INCH	65670	LIN FT	$0.20	$13,134.00
6542	PAVE STRIPING-THERMO-6 INCH W	44218	LIN FT	$0.60	$26,530.80
6543	PAVE STRIPING-THERMO-6 INCH Y	34600	LIN FT	$0.60	$20,760.00
6592	PAVEMENT MARKER TYPE V - B W/R	385	EACH	$36.00	$13,860.00

	SUB - TOTAL SURFACING:				$11,619,627.85
	SUB - TOTAL GRADE, & DRAIN & SURFACING:				$21,447,420.75
STRUCTURES					
BRIDGES					
	HART RD. BRIDGE OVER MAINLINE	1	LP SUM	$809,200.00	$809,200.00
	SW BYPASS INTERCHANGE BRIDGES	1	LP SUM	$1,491,000.00	$1,491,000.00
	LOUIE B. NUNN PKWY BRIDGE	1	LP SUM	$1,805,440.00	$1,805,440.00
	RINGGOLD RD. BRIDGE	1	LP SUM	$712,880.00	$712,880.00
			LP SUM	$809,200.00	$809,200.00
BOX CULVERT					
	662' - 6' X 6' RCBC	1	LP SUM	$179,030.00	$179,030.00
	SUB - TOTAL GRADE, & DRAIN & SURFACING & SRUCTURES:				$27,254,170.75
MISCELLANEOUS					
2568	MOBILIZATION @ 3.0%	1	LP SUM	$817,625.12	$817,625.12
2569	DEMOBILIZATION @ 1.5%	1	LP SUM	$408,812.56	$408,812.56
2726	STAKING @ 1.5%	1	LP SUM	$408,812.56	$408,812.56
				SUB - TOTAL:	$28,889,420.99
				20% ENGR. & CONTG:	$5,777,884.20
				GRAND TOTAL:	$34,667,305.19
				Cost Per Mile Grade & Drain:	$3,433,889.90
				Cost Per Mile G & D & Surf:	$12,112,964.78

Last Revision:

Estimated By: AMERICAN ENGINEERS INC. DATE: 01/27/2003 TIME: 8:07:23 AM

COUNTY: PULASKI COUNTY ITEM NO: 8-59.20

UPN: FED. NO.:

ROAD NAME: INTERSTATE 66

LOCATION: AEI SECTION 2 - FROM STA. a544+90 TO STA.a677+80.12

Class of Road: INTERSTATE

Type of Construction: Grade, Drain, and Surfacing

Net Length, Miles: 2.470

Bid Item	Item	Quantity	Unit	Unit Price	Amount
GRADE & DRAIN					
0441	ENTRANCE PIPE-18 INCH	60	LIN FT	$30.00	$1,800.00
0462	CULVERT PIPE-18 INCH	1365	LIN FT	$46.00	$62,790.00
0464	CULVERT PIPE-24 INCH	785	LIN FT	$52.00	$40,820.00
0466	CULVERT PIPE-30 INCH	685	LIN FT	$58.00	$39,730.00
0468	CULVERT PIPE-36 INCH	760	LIN FT	$55.00	$41,800.00
0469	CULVERT PIPE-42 INCH	700	LIN FT	$80.00	$56,000.00
0470	CULVERT PIPE-48 INCH	1225	LIN FT	$85.00	$104,125.00
0472	CULVERT PIPE-60 INCH	200	LIN FT	$115.00	$23,000.00
0474	CULVERT PIPE-72 INCH	87	LIN FT	$230.00	$20,010.00
1490	DROP BOX INLET TYPE 1	2	EACH	$2,400.00	$4,800.00
1505	DROP BOX INLET TYPE 5B	9	EACH	$2,600.00	$23,400.00
1517	DROP BOX INLET TYPE 5F	9	EACH	$2,600.00	$23,400.00
2230	EMBANKMENT IN PLACE	2272250	CU YD	$4.00	$9,089,000.00
2242	WATER	300	M GAL	$3.00	$900.00
2434	R/W MARKER RURAL TYPE 1	212	EACH	$60.00	$12,720.00
2483	CHANNEL LINING CLASS II	7936	TON	$15.00	$119,040.00
2484	CHANNEL LINING CLASS III	6302	TON	$19.00	$119,738.00
2545	CLEARING AND GRUBBING	1	LP SUM	$131,421.00	$131,421.00
2650	MAINTAIN AND CONTROL TRAFFIC	1	LP SUM	$40,000.00	$40,000.00
2651	DIVERSIONS (BY-PASS DETOURS)	1	LP SUM	$40,000.00	$40,000.00
2701	TEMPORARY SILT FENCE	1300	LIN FT	$2.50	$3,250.00
2705	SILT CHECK	90	EACH	$104.00	$9,360.00
2708	CLEAN SILT CHECK	270	EACH	$49.00	$13,230.00
5950	EROSION CONTROL BLANKET	23670	SQ YD	$2.00	$47,340.00
5966	TOPDRESSING FERTILIZER	21.4	TON	$363.00	$7,768.20
5985	SEEDING AND PROTECTION	414177	SQ YD	$0.30	$124,253.10
5989	SPECIAL CROWN VETCH	99621	SQ YD	$0.40	$39,848.40
8100	CONCRETE-CLASS A	98.78	CU YD	$306.00	$30,226.68
8150	STEEL REINFORCEMENT	6968	LB	$0.70	$4,877.60
9139	CLEAN TEMP SILT FENCE	2600	LIN FT	$2.00	$5,200.00
	SUB - TOTAL GRADE & DRAIN:				$10,279,847.98
SURFACING					
0001	D G A BASE	49756	TON	$11.00	$547,316.00
0018	DRAINAGE BLANKET-TYPE II-ASPH	34828	TON	$28.00	$975,184.00
0212	CL 2 ASPHALT BASE 1.0D PG 76-22	3351	TON	$31.00	$103,881.00
0214	CL 3 ASPHALT BASE 1.0D PG 64-22	36603	TON	$32.00	$1,171,296.00
0216	CL 3 ASPHALT BASE 1.0D PG 76-22	1313	TON	$38.00	$49,894.00
0217	CL 4 ASPHALT BASE 1.0D PG 64-22	47967	TON	$38.00	$1,822,746.00
0219	CL 4 ASPHALT BASE 1.0D PG 76-22	11447	TON	$43.00	$492,221.00
0274	CL 3 ASPHALT BINDER 0.50A PG 64-22	3270	TON	$42.00	$137,340.00
0279	CL 4 ASPHALT BINDER 0.50A PG 76-22	5665	TON	$46.00	$260,590.00
0301	CL 2 ASPHALT SURFACE 0.38D PG 64-22	1104	TON	$34.00	$37,536.00
0311	CL 3 ASPHALT SURFACE 0.50E PG 76-22	599	TON	$48.00	$28,752.00
0312	CL 3 ASPHALT SURFACE 0.50D PG 64-22	3541	TON	$44.00	$155,804.00
0335	CL 4 ASPHALT SURFACE 0.50A PG 76-22	5606	TON	$49.00	$274,694.00
2262	R/W FENCE-WOVEN WIRE	26267	LIN FT	$3.85	$101,127.95
2351	GUARDRAIL-STEEL W BEAM-S FACE	1761	LIN FT	$10.00	$17,610.00
2352	GUARDRAIL-STEEL W BEAM-D FACE	825	LIN FT	$17.00	$14,025.00
2360	GUARDRAIL TERMINAL SECT NO 1	6	EACH	$92.00	$552.00
2363	GUARDRAIL CON TO BR END TY A	6	EACH	$496.00	$2,976.00
2365	CRASH CUSHION TY IX-A	6	EACH	$4,718.00	$28,308.00
2367	GUARDRAIL END TREATMENT TYPE 1	13	EACH	$2,583.00	$33,579.00
2369	GUARDRAIL END TREATMENT TYPE 2A	14	EACH	$453.00	$6,342.00
2387	GUARDRAIL CON TO BR END TYPE A-1	6	EACH	$161.00	$966.00
2562	SIGNS	209	SQ FT	$6.00	$1,254.00
6514	PAVE STRIPING-PERM PAINT-4 INCH	31216	LIN FT	$0.20	$6,243.20
6542	PAVE STRIPING-THERMO-6 INCH W	33225	LIN FT	$0.60	$19,935.00
6543	PAVE STRIPING-THERMO-6 INCH Y	26580	LIN FT	$0.60	$15,948.00
6592	PAVEMENT MARKER TYPE V - B W/R	332	EACH	$36.00	$11,952.00

	SUB - TOTAL SURFACING:				$6,318,072.15
	SUB - TOTAL GRADE, & DRAIN & SURFACING:				$16,597,920.13
STRUCTURES					
	M.L. a574+00 Wagon Box 24'x15' @ Colemai	1	LP SUM	$550,000.00	$550,000.00
BOX CULVERT					
	295' - DBL. 10' X 5' RCBC	1	LP SUM	$200,920.00	$200,920.00
	375' - DBL. 10' X 5' RCBC	1	LP SUM	$253,210.00	$253,210.00
	160' - DBL. 10' X 5' RCBC	1	LP SUM	$112,690.00	$112,690.00
	SUB - TOTAL GRADE, & DRAIN & SURFACING & SRUCTURES:				$17,714,740.13
MISCELLANEOUS					
2568	MOBILIZATION @ 3.0%	1	LP SUM	$531,442.20	$531,442.20
2569	DEMOBILIZATION @ 1.5%	1	LP SUM	$265,721.10	$265,721.10
2726	STAKING @ 1.5%	1	LP SUM	$265,721.10	$265,721.10
				SUB - TOTAL:	$18,777,624.53
				20% ENGR. & CONTG:	$3,755,524.91
				GRAND TOTAL:	$22,533,149.44
				Cost Per Mile Grade & Drain:	$4,161,881.77
				Cost Per Mile G & D & Surf:	$9,122,732.57

Last Revision: 11/07/2002 16:38
Estimated By: AMERICAN ENGINEERS INC. DATE: 01/27/2003 TIME: 8:10:24 AM

1.5 excavation
1.8 embankment

net 278,000 short -

JOHNSON, DEPP, & QUISENBERRY
CONSULTING ENGINEERS

COUNTY:	Pulaski	ITEM NO:	8-59.00
UPN:		FED. NO.:	
AD NAME:	Somerset North Bypass	Class of Road:	Rural Freeway
LOCATION:	Somerset, KY	Type of Construction:	Grade, Drain, and Surfacing
		Net Length, Miles:	4.45

Bid Item	Item	Quantity	Unit	Unit Price	Amount
GRADE & DRAIN					
440	ENTRANCE PIPE-15 INCH	1,000.0	LIN FT	30.00	30,000.00
441	ENTRANCE PIPE-18 INCH	1,000.0	LIN FT	35.00	35,000.00
461	CULVERT PIPE-15 INCH	3,760.0	LIN FT	45.00	169,200.00
462	CULVERT PIPE-18 INCH	2,560.0	LIN FT	70.00	179,200.00
464	CULVERT PIPE-24 INCH	2,325.0	LIN FT	65.00	151,125.00
466	CULVERT PIPE-30 INCH	605.0	LIN FT	55.00	33,275.00
468	CULVERT PIPE-36 INCH	705.0	LIN FT	80.00	56,400.00
469	CULVERT PIPE-42 INCH	760.0	LIN FT	95.00	72,200.00
470	CULVERT PIPE-48 INCH	1,610.0	LIN FT	100.00	161,000.00
1000	PERFORATED PIPE-4 INCH	94000	LIN FT	3.50	329,000.00
1010	NON-PERFORATED PIPE-4 INCH	5640	LIN FT	8.00	45,120.00
1015	INSP & CERT EDGE DRAIN SYS	1	EACH	12,000.00	12,000.00
1020	PERF PIPE HEADWALL TY 1 - 4 IN	125	EACH	425.00	53,125.00
1028	PERF PIPE HEADWALL TY 3 - 4 IN	125	EACH	425.00	53,125.00
1032	PERF PIPE HEADWALL TY 4 - 4 IN	125	EACH	425.00	53,125.00
1432	SLOPED BOX OUTLET TYPE 1-15	47	EACH	1,500.00	70,500.00
1450	S & F BOX INLET-OUTLET-18 INCI	16	EACH	2,010.00	32,160.00
1451	S & F BOX INLET-OUTLET-24 INCI	20	EACH	2,400.00	48,000.00
1452	S & F BOX INLET-OUTLET-30 INCI	4	EACH	3,000.00	12,000.00
1453	S & F BOX INLET-OUTLET-36 INCI	6	EACH	3,300.00	19,800.00
1456	CURB BOX INLET TYPE A	2	EACH	2,500.00	5,000.00
1490	DROP BOX INLET TYPE 1	3	EACH	2,500.00	7,500.00
1517	DROP BOX INLET TYPE 5F	47	EACH	2,400.00	112,800.00
1967	CONC MEDIAN BARRIER TYP 12C	400.0	LIN FT	85.00	34,000.00
2014	BARRICADE - TYPE III	40	EACH	200.00	8,000.00
2230	EMBANKMENT IN PLACE	2,600,000	CU YD	7.00	18,200,000.00
2262	R/W FENCE-WOVEN WIRE TYPE	51700	LIN FT	10.00	517,000.00
2351	GUARDRAIL-STEEL W BEAM-S FA	17500.00	LIN FT	10.00	175,000.00
2363	GUARDRAIL CON TO BR END TYF	12	EACH	500.00	6,000.00
2365	CRASH CUSHION TYPE IX-A	2	EACH	4,800.00	9,600.00
2369	Guardrail-End Treatment Type 2A	14	EACH	500.00	7,000.00
2370	Guardrail-End Treatment Type 4	14	EACH	1,500.00	21,000.00
2387	GUARDRAIL CON TO BR END TYP A	12	EACH	500.00	6,000.00
2545	CLEARING & GRUBBING	1	EACH	500,000.00	500,000.00

JOHNSON, DEPP, & QUISENBERRY

CONSULTING ENGINEERS

KENTUCKY TRANSPORTATION CABINET

COUNTY: Pulaski
UPN:
ROAD NAME: Somerset North Bypass
LOCATION: Somerset, KY

ITEM NO: 8-59.00
FED. NO.:
Class of Road: Rural Freeway
Type of Construction: Grade, Drain, and Surfacing
Net Length, Miles: 4.45

Bid Item	Item	Quantity	Unit	Unit Price	Amount
2650	MAINTAIN & CONTROL TRAFFIC	1	EACH	150,000.00	150,000.00
4811	JUNCTION BOX TYPE B	5	EACH	1,000.00	5,000.00
6514	PAVE STRIPING-PERM PAINT- 4 INC	1000	LIN FT	0.50	500.00
6542	PAVE-STRIPING THERMO 6 INCH WI	58750	LIN FT	0.65	38,187.50
6543	PAVE-STRIPING THERMO 6 INCH YE	47000	LIN FT	0.65	30,550.00
6546	PAVE-STRIPING THERMO 12 INCH W	1000	LIN FT	2.00	2,000.00
6591	PAVEMENT MARKER, TYPE V, B Y	200	EACH	40.00	8,000.00
6592	PAVEMENT MARKER, TYPE V, B W	590	EACH	40.00	23,600.00
6593	PAVEMENT MARKER, TYPE V, B Y	200	EACH	40.00	8,000.00
8100	CONCRETE-CLASS A	126.66	CU YD	360.00	45,597.60
8150	STEEL REINFORCEMENT	9450	LB	0.60	5,670.00
10000	CPM SCHEDULE	1	LP SUM	10,000.00	10,000.00
10001	QC (SOIL EMBANKMENT)	1	LP SUM	25,000.00	25,000.00
	Add for Miscellaneous Items	Additional 5%			1,078,818.01
BRIDGES		(estimated @ $60/SF)			
BRIDGE:	SNB over U.S. 27/SOUTHERN R.R.	1	LP SUM	2,428,800	2,428,800.00
BRIDGE:	SNB over NELSON VALLEY ROAD	1	LP SUM	1,267,200	1,267,200.00
BRIDGE:	SNB over PITTMAN CREEK	1	LP SUM	3,168,000	3,168,000.00
BRIDGE:	SNB over KY 39	1	LP SUM	1,214,400	1,214,400.00
BRIDGE:	KY 1247 over SNB	1	LP SUM	537,600	537,600.00
BRIDGE:	OLD STILESVILLE RD over SNB	1	LP SUM	633,600	633,600.00
	SUB - TOTAL GRADE & DRAIN:				**$ 31,839,778.11**

JOHNSON, DEPP, & QUISENBERRY

CONSULTING ENGINEERS

KENTUCKY TRANSPORTATION CABINET

COUNTY:	Pulaski	ITEM NO:	8-59.00
UPN:		FED. NO.:	
ROAD NAME:	Somerset North Bypass	Class of Road:	Rural Freeway
LOCATION:	Somerset, KY	Type of Construction:	Grade, Drain, and Surfacing
		Net Length, Miles:	4.45

Bid Item	Item	Quantity	Unit	Unit Price	Amount
SURFACING					
	TRAVEL LANES - NORTH BYPASS	125330	SQ YD	50.50	6,329,165.00
	SHOULDERS - NORTH BYPASS	73110	SQ YD	47.50	3,472,725.00
	RAMP PAVEMENTS	8883	SQ YD	35.00	310,905.00
	TRAVEL LANES - MINOR SIDE ROAI	24140	SQ YD	16.50	398,313.67
	TRAVEL LANES - KY 39	18693	SQ YD	37.50	700,983.33
	ACCESS ROADS - ROCK	23272	SQ YD	5.00	116,360.00
	SUB - TOTAL SURFACING:				**$ 11,328,452.00**
	SUB - TOTAL GRADE, & DRAIN & SURFACING:				**$ 43,168,230.11**
MISCELLANEOUS					
2568	MOBILIZATION	1	LP SUM	1,295,047	1,295,046.90
2569	DEMOBILIZATION	1	LP SUM	647,523	647,523.45
				SUB - TOTAL:	45,110,800.46
				10% ENGR. & CONTG:	4,511,080.05
				GRAND TOTAL:	**$ 49,621,880.51**
				Cost Per Mile Grade & Drain:	$ 7,153,788.44
				Cost Per Mile G & D & Surf:	$ 11,149,086.34

Last Revision: January 27, 2003

Estimated By:
Tom Williams

APPENDIX C
Function Analysis

APPENDIX C - Function Analysis

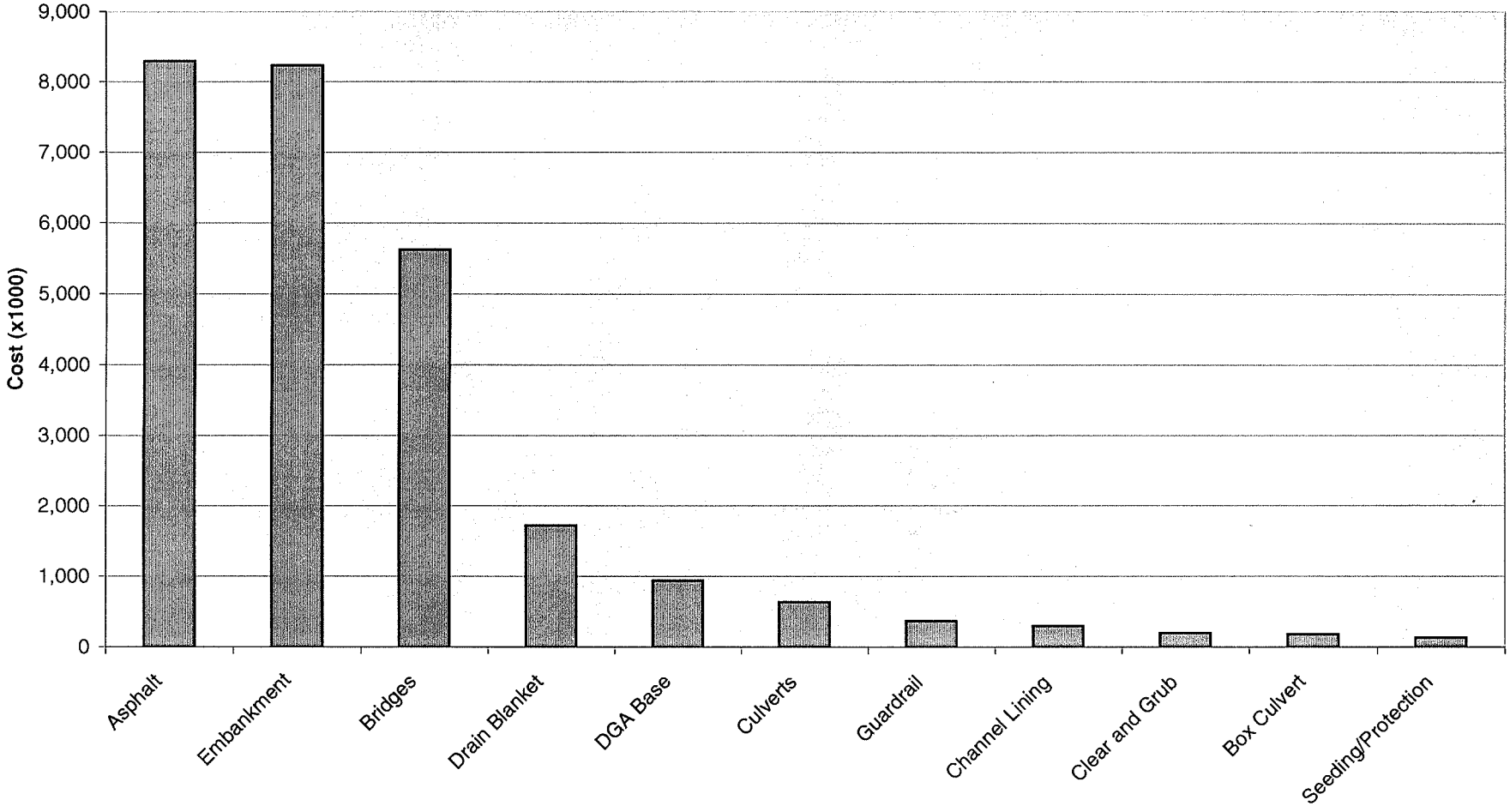
FUNCTION ANALYSIS

AEI WEST

Item	Function					
	Verb	Noun	Type	Cost	Worth	C/W
GRADE AND DRAIN	Establish	Elevation	B			
	Remove	Water	B			
Embankment	Fill	Site	S	8,230,000	7,500,000	1.10
Clear and Grub	Clean	Site	S	196,000	196,000	1.00
Channel Lining	Prevent	Erosion	S	299,000	299,000	1.00
Culverts	Transport	Water	S	634,000	600,000	1.06
Seeding/Protection	Prevent	Erosion	S	134,000	134,000	1.00
SURFACING	Support	Traffic	B			
	Satisfy	User	B			
DGA Base	Support	Load	S	935,000	935,000	1.00
Drain Blanket	Remove	Water	S	1,722,000	1,722,000	1.00
Asphalt	Support	Load	S	8,294,000	8,294,000	1.00
Guardrail	Prevent	Injury	S	365,000	365,000	1.00
STRUCTURES	Span	Obstruction				
Bridges	Span	Obstruction	B	5,627,000	4,627,000	1.22
Box Culvert	Span	Obstruction	B	179,000	179,000	1.00

AEI West Section

Cost Model

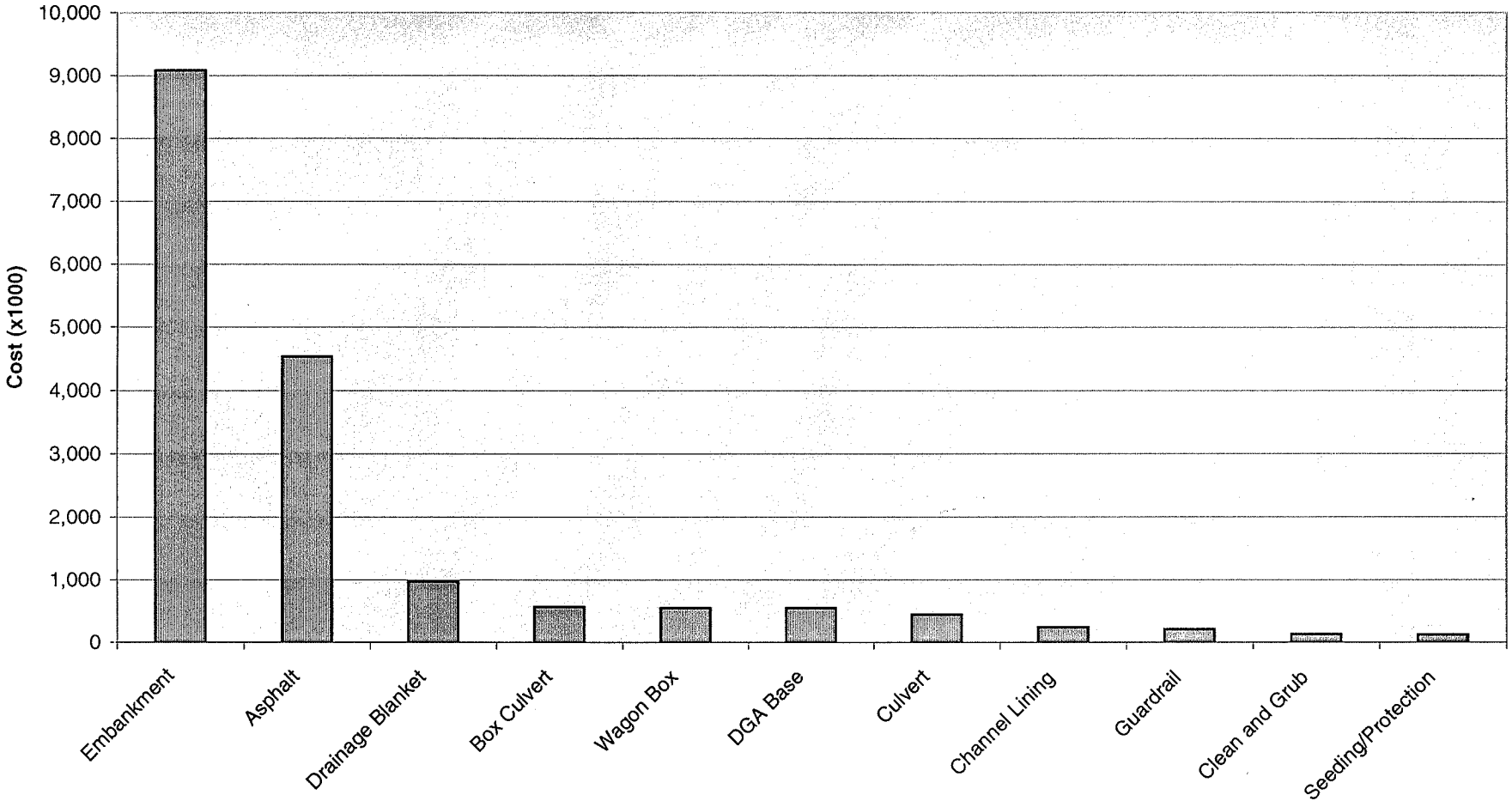


AEI EAST

Item	Function					
	Verb	Noun	Type	Cost	Worth	C/W
GRADE AND DRAIN	Establish	Elevation	B			
	Drain	Site	B			
Embankment	Establish	Grade	S	9,089,000	8,500,000	1.10
Culvert	Transport	Water	S	442,000	350,000	1.26
Channel Lining	Protect	Channel	S	239,000	239,000	1.00
Clean and Grub	Clean	Site	S	131,000	131,000	1.00
Seed and Protect	Prevent	Erosion	S	124,000	124,000	1.00
SURFACING	Support	Traffic	B			
	Satisfy	User	B			
DGA Base	Support	Load	S	547,000	547,000	1.00
Asphalt	Support	Load	S	4,536,000	3,750,000	1.21
Drainage Blanket	Drain	Water	S	975,000	975,000	1.00
Guardrail	Prevent	Injury	S	206,000	206,000	1.00
STRUCTURES	Span	Obstruction	B			
Wagon Box	Span	Obstruction	B	550,000	550,000	1.00
Box Culvert	Span	Obstruction	B	567,000	567,000	1.00

AEI East Section

Cost Model

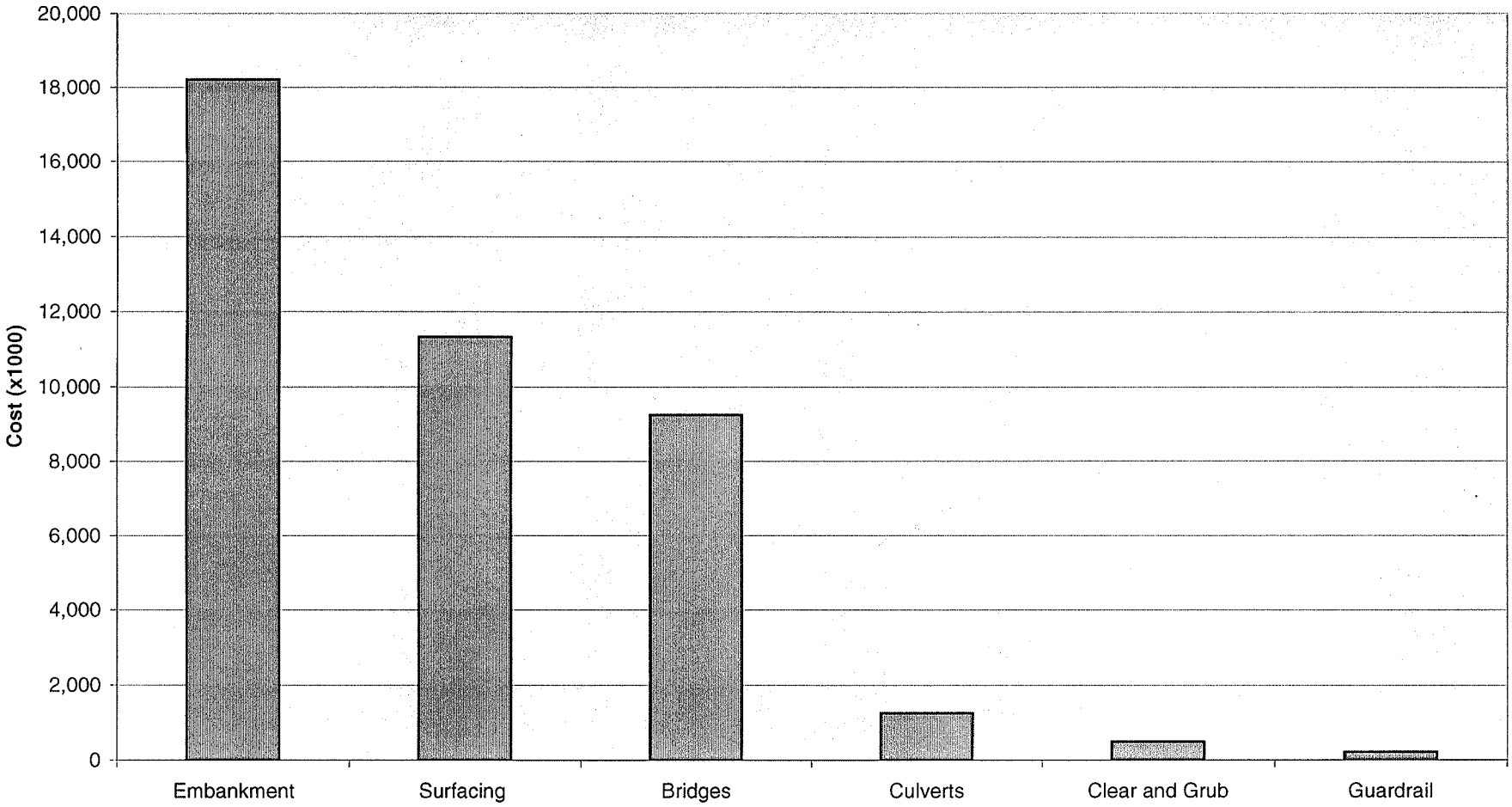


JDQ SECTION

Item	Function					
	Verb	Noun	Type	Cost	Worth	C/W
GRADE AND DRAIN	Establish	Elevation	B			
	Drain	Site	B			
Embankment	Establish	Grade	S	18,200,000	16,500	1.10
Culverts	Transport	Water	S	1,260,000	1,000	1.26
Clear and Grub	Clean	Site	S	500,000	500,000	1.00
Guardrail	Prevent	Injury	S	217,000	217,000	1.00
SUFACING	Support	Traffic	B	11,328,000	10,500	1.10
	Satisfy	User	B			
BRIDGES	Span	Obstruction	B	9,250,000	7,000,000	1.32

JDQ Section

Cost Model



APPENDIX D
Creative Idea List and Evaluation

APPENDIX D - Creative Idea List and Evaluation

List of CREATIVE IDEAS			
ID #	**Name of Idea / description**	**TM Resp.**	**Develop Status**
	AE West Section		
1	Place ramps #1 and # 2 under I-66 in lieu of fly-over	Steve	Develop
3	Eliminate ramp # 4 and use Louie B. Nunn Parkway	Rob	Develop
	JDQ Section		
4	Use culvert at Pittman Creek	Jim	Make Design Comment
5	Use Wagonbox Bridge at Nelson Valley Road	Jim	Make Design Comment
5	Change grades to improve cut/fill balance	Kevin/ Steve/ Royce	Develop
7	Use rock roadbed and modify pavement	Steve	Develop
	AEI East Section		
8	Changes grades to improve cut/fill balance	Rob/ Kevin/ Royce	Develop
9	Use rock roadbed and modify pavement design	Steve	Develop
10	Drainage structure for Big Spring Branch not shown	Jim	Make Design Comment
11	Add edge drain cost	Rob	Make Design Comment

APPENDIX E
Analysis Phase

Analysis Phase

AEI West Section

1. **Place Ramps # 1 and # 2 under I-66 in lieu of fly-over**
   Advantages
   - Reduce Embankment
   - Reduces depth of culvert

   Disadvantages
   - Grade may not work
   - May increase cost of bridge

   Conclusion:
   Continue developing idea

2. **Use at-grade intersection at southwest by-pass interchange**
   Advantages
   - Eliminate structures
   - Reduce embankment

   Disadvantages
   - Public may not like
   - May increase accidents

   Conclusion:
   Drop idea

3. **Eliminate ramp # 4 and use Louie B. Nunn Parkway**
   Advantages
   - Easier movement
   - Eliminates merge

   Disadvantages
   - Ramp speed may be excessive approaching interchange

   Conclusion:
   Continue developing idea

JDQ Section

4. **Use culvert at Pittman Creek**
   Advantages
   - Reduce cost
   - Faster construction
   - Reduce maintenance cost

   Disadvantages
   - More embankment
   - Environmental impact
   - Modify channel alignment

   Conclusion:
   Make design comment

5. **Use Wagonbox Bridge at Nelson Valley Road**
   Advantages
   - Reduce initial and life cycle costs
   - Less construction time

   Disadvantages
   - More embankment

   Conclusion:
   Make design comment

6. **Change grades to improve cut/fill balance**
   Advantages
   - Reduces embankment
   - Reduces structure costs

   Disadvantages
   - May require more right-of -way

   Conclusion:
   Continue developing idea

7. **Use rock roadbed and modify pavement design**
   Advantages
   - Utilize rock waste
   - Reduce pavement cost
   - Better structure

   Disadvantages
   - None noted

   Conclusion:
   Continue developing idea

AEI East Section

8. Change grades to improve cut/fill balance

Advantages
- Reduces embankment

Disadvantages
- May require additional right-of-way

Conclusion:
Continue developing idea

9. Use rock roadbed and modify pavement design

Advantages
- Better structure
- Reduces cost

Disadvantages
- None noted

Conclusion:
Continue developing idea

10. Drainage structure for Big Spring Branch

Conclusion:
Make design comment

11. Add edge drain cost

Conclusion:
Make design comment

END OF REPORT

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