RECONSTRUCTION
OF US-68 / KY-80
BETWEEN AURORA & CADIZ, KY
IN TRIGG AND MASHALL COUNTIES
Item NO. 1-180.00

VALUE ENGINEERING STUDY
for
Kentucky Transportation Cabinet

Study Date: March 31 - April 4, 1997

Final Report

April 9, 1997

Dames & Moore
A Dames & Moore Group Company

Acknowledgments
A thank you is given to the staff members from the Kentucky Transportation Cabinet, and Hazelet Erdal / Dames & Moore, Louisville Office for participating on the VE Team. A special thanks is also extended to Earl Berry and Nancy Skinner of Parsons Brinkerhoff, Ray Robison of Skees Engineering, Mike Bruce of Johnson Depp & Quisenberry, and Jerry Cottingham of EA Partners for attending the first day of the workshop to help educate the team in the details of the project. A thank you is extended to Lindsey Briggs for his support, and also to Daryl Greer and his VE staff for their able assistance throughout the workshop over and above their participation as team members. This charrette has been successful because of the dedication of the participants.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report documents the results of a value engineering study on the *Reconstruction of US-68 / KY-80 between Auroa and Cadiz*. The study workshop was conducted at Kentucky Dam Village State Park on Monday, 31 March through Friday, 4 April, 1997. The project was reviewed at the 10% to 25% design stage. The value engineering study team was from the Kentucky Transportation Cabinet and the firm of Dames & Moore Group, and was facilitated by a CVS team leader from Dames and Moore. The project is divided into 5 parts with 3 design firms; E.A. Partners; Johnson, Depp, and Quisenberry; and Skees Engineering. The owner's project manager is Lindsey Briggs, KTC District 1 Preconstruction Engineer. An oral presentation of the study results was made to Lindsey Briggs and representatives of the three design firms on Friday, 4 April, 1997. Names of those in attendance are listed in Appendix A.

The study team found no failure in the design as received. On the contrary, the design as given to the team proved workable in every way. That the value team has developed recommendations and suggestions for change should not be taken as a reflection on the design. The value team operates from a different base than does the design team. The value team represents a second opinion with the benefit of hindsight, and with the license to challenge the owner's instructions to the designer. The final decision as to the acceptance of these recommendations and suggestions rests ultimately with the owner and designer.

The Job Plan.
The study followed a five step job plan endorsed by S.A.V.E. International, the professional organization of value engineers in the United States.

The Project.
The project presented to the team is 27.7 km (17.2 miles) of 2-lane highway in Trigg and Marshall Counties. The proposed design involves upgrading the roadway through realignment, regrading, bridge replacement, and increase of certain sections from 2-lane to 4-lane.

Recommendations.
Recommendations for change to the design are put forth in this report. These recommendations represent, in the opinion of the study team, changes that will improve the overall project. The value study team however has no authority to impose change, but simply is making recommendations. The final decision as to implementation of the recommendations noted, will rest with the project owner in consultation with the project design team.

Savings.
The study generated 31 ideas, of which 8 were developed as recommendations to be submitted for consideration by the owner and design team. The total dollar amount represented by all 8 recommendations was $95,304,298, of which 2 recommendations involved added cost of $18,712,451, and 6 recommendations involved a reduction in cost of $116,016,749. All recommendations cannot be accepted together as some are mutually exclusive of others. The value team developed two suggested lists of what was, in their opinion, the best mix of recommendations for the overall good of the project, considering both cost savings and value

added. If either list of recommendations were to be accepted, the project would realize a potential savings of $31,842,256 or $36,145,793. The complete documentation of all recommendations is included in Section 3.

Design Suggestions.
Some ideas that did not make the selection for development as recommendations, were, never-the-less, judged to be worth further consideration. These ideas have been written up as "Design Suggestions" for review by the owner and design team. Documentation of all design suggestions can be found in Section 4.

Validated Items.
Some parts of the project that were selected for study did not result in any recommendations, or design suggestions for improvement. If a part of the design studied by the team did not result in any suggestion for change, then that part of the design can be accepted as having been validated by the team, and has been so noted.

That certain parts of the design have been validated by an outside team of professionals, can serve as additional justification for the design decisions thus made, and raises the owner's level of confidence in the direction the project is taking. Documentation of all validated items can be found in Section 5.

Cost Estimate.
The current estimate of construction cost was used as a base line for study. For the study to be valid, the base line estimate must be reasonably accurate. For this reason, the team reviewed the estimate to make sure there was general acceptance and agreement as to accuracy.

At the time of the study, the project had an estimated construction cost of $157,858,000. This estimate included contingencies, R.O.W., and utilities, and is the total cost to the owner.. The project funding is $130,780,000. The team estimates the cost of the bridges to be $20,510,345 more and the cost of landscaping is $448,345 less than the amount previously estimated. Taking these points into consideration, and escalating the estimate to 1999, the VE team estimates the total cost to the owner to be $191,426,000 in 1999 dollars. This is $33,000,000 more than the current estimate.

SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on The Reconstruction of US-68 / KY-80 held in Kentucky Dam Village State Park on 31 March through 4 April, 1997. The study team was from the Kentucky State Cabinet and the firm of Dames & Moore. The names of the team members are listed in the appendix.. Other participants of the study (other than the study team) are also listed in the Appendix. Study materials furnished to the study team are listed in the Appendix.

Boundary of the Study
The scope of the study as given to the team was as follows:
To study the corridor chosen between Aurora and Cadiz, Kentucky.

Study constraints given to the team were:

- The corridor has been defined in the environmental study and will be very difficult to alter.
- The Coast Guard requirements cannot be changed.

Study Objective
The study goals given to the team were:

- Validate the design.
- Find improvements to the design.
- Meet the requirements of the National Highway Designation Act for VE Studies.

Ideas and Recommendations
Part of the value methodology is to generate as many ideas as practical, and to then evaluate the ideas and select certain ones for further development. If the ideas thus selected, turn out to work in the manner expected, they are then put forth as formal recommendations. Only those ideas that are proven to the team's satisfaction are listed as recommendations. Each idea generated is given a unique identification number that remains with that idea throughout the study. If an idea graduates to the status of recommendation, the recommendation carries with it the same unique identification number as did the idea from which it came.

Organization of This Report
This report is divided into seven sections, which are described below.

SECTION ES - EXECUTIVE SUMMARY: The Executive Summary is a short overview of the significant and important parts of the report. The Executive Summary includes a table titled *Summary of Recommendations* that represents the concise summary of this study in one document.

SECTION 1 - INTRODUCTION: The Introduction familiarizes the reader with the contents and organization of the report, and with certain significant aspects of the study.

SECTION 2 - PROJECT DESCRIPTION: The Project Description orients the reader to the

project under study. The Project Description documents the project as it was presented to the team at the beginning of the study. It also brings the reader up to date through project background information, relevant politics, and an outline of the intended steps in the project schedule, as in-visioned at the time of the study.

SECTION 3 - RECOMMENDATIONS: The Recommendations Section forms the heart of the report, documenting the complete writeups of all recommendations put forth by the study team. The Recommendations Section includes the table titled *Summary of Recommendations* that summarizes all recommendations in one document.

SECTION 4 - DESIGN SUGGESTIONS: The Design Suggestions Section documents those ideas that were deemed worth further consideration by the team; but were, for certain reasons, not presented as formal recommendations in Section 3..

SECTION 5 - VALIDATED ITEMS. These are items, that after an independent review, suggest no apparent means for improvement. They are recorded in the report for the benefit of the reader.

APPENDICES - Contains data that supports the information given in the main body of the report.

Significant Aspects of This Study.

Because this project spans two large bodies of water, a major portion of the project includes two sets of long span bridges. Bridge design has not progressed very far, however the team opinion was that the design teams need to rethink their concept for the preferred long span structure; from steel girder to either one of; steel truss, steel box girder, or tied arch. The consensus was that the steel girder concept is at the limits of constructablility and design considering the Coast Guard channel requirements. In addition, the VE team's estimate for bridge costs to the owner are much greater than that shown in the concept estimate.

SECTION 2 - PROJECT DESCRIPTION

The proposed project is 27.7 km (17.2 miles) of highway, US 68 / KY 80, from Aurora, Kentucky, on the shore of Kentucky Lake, in Marshall County continuing east to Cadiz, Kentucky in Trigg County. The existing highway is two lanes, crossing Kentucky Lake, continuing through the Land Between the Lakes, crossing Lake Barkley, passing through the town of Canton, Kentucky continuing on to the west end of the Cadiz Bypass west of Cadiz, Kentucky.

The primary purpose of US-68 / KY-80 is twofold.

- To provide the main east-west route through western Kentucky for goods and services.
- To provide the primary east-west disaster and emergency route into and out of the area.

The basic functions of this project are to

- Stimulate economic growth in the corridor.
- Satisfy the public.
- Maintain the safety of the driving public.

The project is currently at between 10% and 25% design. Three design sections are at 10% design, two design sections are at 25% design. The conceptual cost estimate for entire project is $157,858,000. The amount represents the total cost to the owner, and includes right-of-way costs, utilities costs, contingencies, inspection, and engineering. The budged funds for the project is $130,780,000, much lower than the current estimate. The budgeted amount is taken from the table below.

Budgeted Funds for Construction

DESIGN SECTION	BUDGET FUNDS FOR ROADWAY			TOTAL BUDGETED FUNDS
	ROW	UTILITIES	CONSTRUCTION	
180.53 Aurora, KY	5,000	100,000	8,000,000	8,105,000
180.52	50,000	100,000	14,000,000	14,150,000
180.51	4,900,000	7,745,000	8,000,000	20,645,000
180.10	1,050,000	2,380,000	7,500,000	10,930,000
180.11 Cadiz, KY	950,000	2,200,000	6,500,000	9,650,000
TOTAL ROADWAY FUNDING	6,955,000	12,525,000	44,000,000	**63,480,000**
	BUDGETED FUNDS FOR BRIDGES			
Lake Barkley Bridge BRO funds	1,000,000	150,000	8,000,000	9,150,000
Lake Barkley Bridge STP funds	0	0	21,000,000	21,000,000
Kentucky Lake Bridge	1,000,000	150,000	36,000,000	37,150,000
TOTAL BRIDGE FUNDING	2,000,000	300,000	65,000,000	**67,300,000**
TOTAL FUNDING FOR ROADWAY AND BRIDGES				**130,780,000**

From *Preconstruction Status Report* dated 28 March, 1997.

Most of the route passes through wooded land. About a third of the route passes through pasture and crop land. The terrain of the proposed corridor is two thirds steeply rolling hills and valleys and one third gently rolling to relatively flat pasture and crop land.

The project is divided into 5 design sections (180.53, 180.52, 180.51, 180.10, 180.11) and 5 construction jobs, that are divided among three design firms. The table below documents this, and other significant information, regarding the five design jobs

DESIGN SECTION	DESIGN FIRM	DESIGN STAGE	PROJECT SEGMENTS	BEGINNING STATION	ENDING STATION	PROMINENT FEATURES (in station order)
180.53	EA Partners	10%	A, B, C, D	0+000	6+300	Aurora. KY. Kentucky Lake. Marshall County to Trigg County Line. Land Between the Lakes.
180.52	Skees Engineering	10%	E F, G, H	6+300	15+800	Land Between the Lakes. The Trace. Bifurcated section
180.51	Johnson Depp & Quisenberry	10%	I, J	15+180	19+100	Barkley Lake Canton, KY
180.10	Johnson Depp & Quisenberry	25%	J, K, L, M, N	19+100	24+800	
180.11	EA Partners	25%	O, P, Q, R	24+800	28+913	Cadiz, KY

The horizontal alignment was set primarily by responding to numerous geographic and topographic avoidance points. The vertical alignment was then adjusted to respons to concerns about cut and fill.

The highway to the west of this project is also being reconstructed. This is the roadway from Mayfield to Aurora. The planning is for that roadway to be 4-lane. The Mayfield to Aurora section will tie into this project at Aurora.

CONCERNS ABOUT THE PROJECT.

At the time of the workshop, several concerns were expressed by both the designers and the KTC. Four out of six of these concerns center around expressed and assumed needs of the TVA. These are amplified by past difficulties in working with the TVA, and questions as to design requirements put onto the project by the TVA that will ultimately have to be paid for, and maintained by, the KTC. These concerns are listed below.

Animal Migration Through the LBL - The TVA wants consideration given to designing into the project, a means by which the wildlife in the LBL can move back and forth between the areas north of the proposed roadway, and the areas south of the proposed roadway. Not stated in this request, but assumed, is a system of constructed animal crossings that are separated by grade. It is also assumed that this means more than just a box culvert under the roadway (some animals might not go into an enclosed space). One possibility that was discussed was a system of elevated roadway sections placed at strategic locations convenient to the movement of the animals. This is a late requirement placed on the project by TVA that has not been heretofore

considered in the current design.

Bike and Hiking Trails in the LBL - The TVA wants the new design to incorporate the interconnection of biking and hiking trails in both the east-west and the north-south directions. The assumption here is that this means the interconnection of trails that already exist within the LBL; and that the interconnection is that of both north-south trails across the proposed roadway, and east-west trails across waterways being crossed by the proposed roadway.

Esthetics - The TVA wants the proposed roadway through the LBL to reinforce the esthetics of the LBL. One thought that comes to mind is a roadway that resembles a parkway.

High Fencing Adjacent to the LBL - The TVA would like to have the right-of-way through the LBL defined by a 10' high fence. This is assumed to be a preventative of animals toping the fence and finding their way onto the roadway. This would also aid in funneling the animals into the prepared animal crossings described above.

Approval of the FONSI - The FONSI (finding of no significant impact) approval is showing signs of being slow.

Geotechnical work for the bridges - This could take time and could prove to be a problem. For that reason, could the geotechnical work for the bridges be started early? This could also influence the alignment.

PROJECT DESIRES.

As with all projects, there is many times differences between what the project is, and what the stakeholders would like it to be. At the time of the workshop, the following "project wants" were expressed. If one could wave the magic wand, then:

- Do 4 lanes all the way
- Eliminate the bifurcation
- Eliminate the causeways, and have a shore to shore bridge

SECTION 3 - RECOMMENDATIONS

This section contains the complete team writeups of all recommendations to come out of this study. Each "recommendation" is marked by a unique identification number. This is the same identification number that is found attached to the "idea" from which the recommendation was developed. These identification numbers are used throughout the report to uniquely refer to a given recommendation and corresponding idea.

Acceptance of Single Issues
Each recommendation is developed around a single issue. This simplifies the acceptance or rejection of the recommendation, and gives added flexibility to the implementation of the recommendations, in that several single issue recommendations can be combined as needed to achieve a desired result. When evaluating a recommendation, one is encouraged to look at each part of the recommendation on an independent basis. There is no need to discard a recommendation in total because one part of the recommendation is unacceptable.. A recommendation can be accepted in part, or accepted with a specified partial modification.

Usually all recommendations cannot be simultaneously accepted or combined. Some recommendations can be simultaneously accepted and combined, others cannot. This is because some recommendations are mutually exclusive of one another, and the acceptance of one recommendation will automatically preclude the acceptance of certain others.

Summary of Recommendations.
The reader will find a table titled *Summary of Recommendations* at the beginning of the recommendation writeups.. This table offers a convenient overview of all recommendations along with economic data associated with each. As mentioned above, all recommendations cannot be accepted together. For this reason. the reader is cautioned with regard to adding up the column of monetary savings. Since some recommendations are mutually exclusive of others, the addition of all monetary savings to form a sum total of savings will produce a fictitious and erroneous amount..

The team did develop what is, in the opinion of the team, an optimum mix selection of recommendations. that are the team's suggestion for combining recommendations. In this particular study. the team had difficulty agreeing upon one single suggested best mix of recommendations. For this reason. two suggested best mix lists are shown in this report. These two "optimum selections" will. in the opinion of the study team, provide maximum overall benefit to the project. These recommendations are keyed in the column *suggested best selection.* The recommendations so keyed can be accepted together and the corresponding monetary savings can be added. This will give the reader a reasonable estimate of the maximum potential savings that can be realized from this study. For this study this total savings is found to be $31,000,000 to $36,000,000 in potential first cost savings.

As noted, all eight recommendations cannot work together. There are four possible combinations of recommendations. Note that combination 3 and 4 are those suggested by the team as the best value.

1. 2-lane all the way. Use partial existing alignment and partial new alignment with selected spot improvements.

Recommendation	Initial Savings
G-7	$45,342,380
C-4a	$2,901,528
Total	$48,243,908

2. 4-lane all the way.

Recommendation	Initial Savings
G-5	$(2,971,531)
C-4b	$5,587,848
P-1	$1,136,504
Total	$3,752,821

3. 2-lane all the way with all new alignment.

Recommendation	Initial Savings
G-1	$33,244,265
C-4a	$2,901,528
Total	$36,145,793

4. 2 lane all the way with all new alignment except 4-lane through LBL.

Recommendation	Initial Savings
G-9	$27,804,224
C-4a	$2,901,528
P-1	$1,136,504
Total	$31,842,256

Organization of Recommendations.
The recommendations presented on the following pages are organized alphabetically by function identifier, and numerically within each function. The sequence of functions are as follows:

B = Bridge recommendations

C = Causeway recommendations

G - General recommendations

P = Profile recommendations

FORM 30 DEC 1996

SUMMARY OF RECOMMENDATIONS

Project: Reconstruction of US 68/KY 80 Between Aurora and Cadiz
Location: Trigg and Marshall County
Study Date: March 31 - April 4, 1997

DESCRIPTION		PRESENT WORTH AMOUNT					BEST
I.D. #	Recommendation	1st cost of original design	1st cost of recommen-dation	resulting 1st cost savings (or cost)	O & M savings (or cost)	total LCC savings (or cost)	suggest-ed best selection
B-6	Change preferred long span structure	60,800,000	76,525,162	(15,725,162)	(15,758.2)	(15,740,920.2)	Note 1
C-4a	Do not widen causeway (2 lane crossing)	19,019,448	16,117,920	2,901,528	0	2,901,528	☆, ✳
C-4b	Reuse existing causeway (4 lane crossing)	19,019,448	13,431,600	5,587,848	0	5,587,848	
G-1	2 lane all the way, new alignment	87,259,616	54,015,265	33,244,265	0	33,244,265	☆
G-5	4 lane all the way, new alignment	6,127,399	9,098,930	(2,971,531)	0	(2,971,531)	
G-7	Replace 2 lane bridges only and rehab 2 lane existing alignment with spot improvements	97,173,318	51,830,938	45,342,380	0	45,342,380	
G-9	Same as G-1 except do 4 lane thru LBL	86,838,868	59,034,644	27,804,224	0	27,804,224	✳
P-1	Adjust profile for better balance on segments D & F (LBL), 4 lane plan	4,826,019	3,689,515	1,136,504	0	1,136,504	✳

LEGEND: LCC = life cycle cost = 1st cost + all use-costs over the life of the project.
LCC savings = 1st cost savings (or adds) + all O & M cost savings (or adds) over the life of the project.
Note: savings in parenthesis "( )" = negative savings = added cost.
☆, ✳ = Designates the teams two suggested best selections
Note 1 = This recommendation would be added to both suggested best selections if the steel girder long span does not workout.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Reconstruction of US68/KY80 Between Aurora and Cadiz
LOCATION: Trigg and Marshall County
STUDY DATE: March 31 - April 4, 1997

IDENTIFICATION NUMBER: B-6
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Consideration of alternate designs (tied arch, through steel truss, and steel box girder) as compared to the proposed design (steel girder).

ORIGINAL DESIGN:

Steel girder bridge structure

RECOMMENDED CHANGE:

Steel tied arch, through steel truss, or steel box girder.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	60,800,000	60,800	60,860,800
RECOMMENDED DESIGN	76,525,162	76,558.2	76,601,720.2
ESTIMATED SAVINGS OR (COST)	(15,725,162)	(15,758.2)	(15,740,920.2)

ADVANTAGES:

- Allows for a wider variety of design structures.
- Provides an updated cost estimate.
- Easier accommodation of required span lengths.
- Less expensive substructure construction.
- Safer substructure construction.

DISADVANTAGES:

- If the steel girder bridge structure can be constructed the alternate design recommendations could be more expensive.

JUSTIFICATION:

- Required Coast Guard horizontal clearance of 500' will most likely exceed allowable span length of the steel girder design, rendering it unacceptable.
- The main spans proposed cost of $115/sf appears too low. We believe it to be closer to $175/sf.
- The approach spans proposed cost of $80/sf appears too low. We believe it to be closer to $100/sf.
- If further study indicates that the steel girder design is acceptable the revised above estimates are valid.

VALUE ENGINEERING RECOMMENDATION

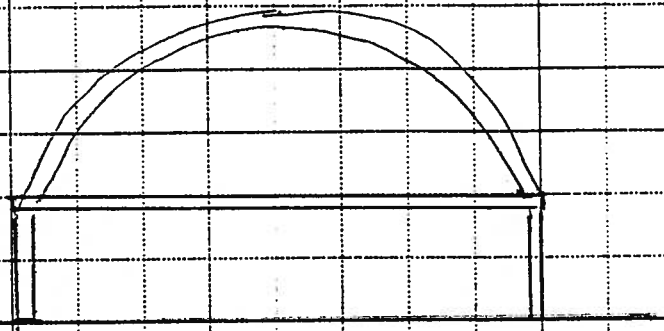
FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

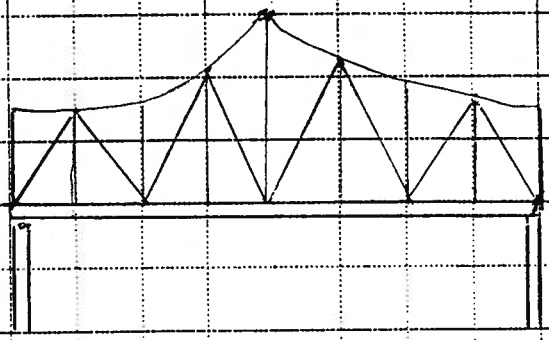
IDENTIFICATION NUMBER: B6

TYPICAL SKETCHES FOR MAIN SPAN ALTERNATES.

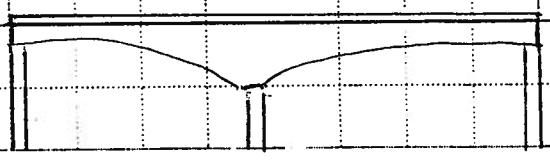
TIED STEEL ARCH



THROUGH STEEL TRUSS



STEEL BOX GIRDER



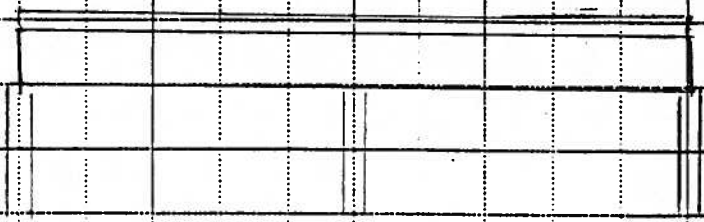
VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: B6

TYPICAL STEEL GIRDER



K.L.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS KENTUCKY LAKE

IDENTIFICATION NUMBER: B6

TOTAL LENGTH OF BRIDGE STRUCTURE IS 1100 METERS.

MAIN SPAN LENGTH IS FROM 22+730 TO 23+250 = 520m.

SCOTT FITZHUGH BRIDGE IS NOT AS COMPARABLE AS THE CENTRAL BRIDGE & COOPER RIVER BRIDGE DUE TO ANTICIPATED FOUNDATION PROBLEMS AND INFLATION. USE THESE TWO BRIDGES FOR COMPARISON.

C.B. COST = $173/S.F.

C.R.B COST = $150/S.F.

AVERAGE = (173+150)/2 ≈ $162

ADJUST FOR INFLATION USE $175/S.F.

APPROACH SPAN LENGTHS = 1100m - 520m = 580m

COST ESTIMATE FROM BRIDGE STUDY REPORT, OCT 1993 = $80/S.F. THIS MAY BE A LITTLE LOW DUE TO SCOUR POTENTIAL AROUND PIERS AND ~~AND~~ INVOLVED SUBSTRUCTURE CONSTRUCTION.

USE $100/S.F.

CALCULATE BRIDGE COST FOR SINGLE BRIDGE WITH FULL SHLD.

TOTAL STRUCTURE COST

APPROACH SPANS 580m x 3.28Ft/m x $100/SF X 84.67Ft = $16,107,621

MAIN SPANS 520m x 3.28Ft/m x $175SF X 84.67Ft = $25,272,302

CONCEPTUAL COST ESTIMATE, SEGMENT ALTERNATIVE B-2; C

STRUCTURES: 7A) TWIN BRIDGES

EXISTING ESTIMATE = $33,107,000

NEW ESTIMATE $16,107,621 + $25,272,302 = 41,380,000

~~COSTS~~ COAST GUARD REQUIRES A 500' MINIMUM HORIZONTAL CLEARANCE, SINCE THE BRIDGE WILL NOT BE ⊥ TO THE SAILING LINE AND ALLOWANCE MUST BE CONSIDERED FOR PIER WIDTH A BEARING TO BEARING CLEAR SPAN DISTANCE OF A MINIMUM 350' MUST BE CONSIDERED, IT IS DOUBTFUL THAT STEEL PLATE GIRDERS COULD

KL

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS KENTUCKY LAKE

IDENTIFICATION NUMBER: B6

BE USED FOR ~~THESE~~ THIS LONG A SPAN DISTANCE. A POSSIBLE ALTERNATE STRUCTURE TYPES COULD INCLUDE:

THROUGH STEEL TRUSS
TIED STEEL ARCH
STEEL BOX GIRDER

FOR THE APPROACH SPANS, ~~TO~~ ADDITIONAL THE PCI BEAMS AND STEEL PLATE GIRDER ALTERNATES ARE SATISFACTORY BUT FURTHER STUDY MAY SUGGEST INCLUDING LONGER SPAN LENGTHS.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996 **CALCULATIONS** ~~KENTUCKY~~ LAKE BARKLEY

IDENTIFICATION NUMBER: B6

TOTAL LENGTH OF BRIDGE STRUCTURE IS 946m.

THE PROPOSED MAIN LINE STRUCTURE IS 426 METERS.

THE SCOTT FITZHUGH BRIDGE IS NOT AS COMPARABLE AS THE CENTRAL BRIDGE & COOPER RIVER BRIDGE DUE TO ANTICIPATED FOUNDATION PROBLEMS AND INFLATION.

USE THESE TWO BRIDGES FOR COMPARISON.

C.B. COST = $173/S.F.

C.R.B. COST = $150/S.F.

AVERAGE = (173+150)/2 = $162

ADJUST FOR INFLATION USE $175/S.F.

APPROACH SPAN LENGTH = 946m - 426m = 520m

COST ESTIMATE FROM BRIDGE STUDY REPORT, OCT 1993 = $80/S.F. THIS MAY BE A LITTLE LOW DUE TO SCOUR POTENTIAL AROUND PIERS AND INVOLVED SUBSTRUCTURE CONSTRUCTION. USE $100 S.F.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS Barkley Lake

IDENTIFICATION NUMBER: B6

Use Single Bridge with Full Shoulder.

Total Cost - Approach Spans

520m x 3.28Ft/m x 100/SF x 84.67Ft = 14,441,315

Main Spans

476m x 3.28Ft/m x ~~420~~ 175/SF x 84.67Ft = ~~11,830,770~~ 20,703,847

35,145,162

From Conceptual Cost Estimate, Segment

Alternative I-2 Structures 7A) Twin Bridges

Existing Estimate = 27,693,000

New Estimate = 35,145,162

~~Cost~~ Coast Guard Requires A 500' Minimum Horizontal Clearance. This Increases to 550' Minimum Due To Skew + Pier Width. Plate Girder Design Is Questionable.

Alternate Structure Types could Include

1) Through Steel Truss

2) Tied Steel Arch

3) Steel Box Girder

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS LCC

IDENTIFICATION NUMBER:

FACTURE CRITICAL BRIDGE INSPECTION
@ 5 + 15 YEARS FOR 3 PROPOSED
DESIGN. NOT NECESSARY FOR STL. GIRDER STRUCTURE.

YEAR 5 -

3 GUYS / WEEK 3 × 17 × 40 × 2.8 =	5700
ACCESS EQUIPMENT	8000
SUPPORT PERSONNEL 2 GUYS	4000
EXPENSES 700 + 1400	2100
CONTINGENCIES	4000
	23,800

YEAR 15 23,800 ~~× 1.5~~ =
USE 24,000 FOR 5 + 15 YEARS

MAINTANENCE + REPAIRS - 0 } WITHIN
REPAINTING - 0 } 20 YEAR PERIOD

SUMMARY

	STL. GIRDER	3 PROPOSED DESIGN
INSPECTION 5 YR	0	24,000
15 YR	0	24,000
MAINTANENCE + REPAIRS	0	0
REPAINTING	0	0

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: B-6

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Sou-rce Code	Num of Units	Total $	Num of Units	Total $
SEG alt. B2 structures							
Twin bridges	1		1	1	33,107,000		
SEG alt. B2 structures							
Twin bridges	1		8			1	41,380,000
SEG alt. I2 structures							
Twin bridges	1		1	1	27,693,000		
SEG alt. I2 structures							
Twin bridges	1		8			1	35,145,162
Totals					60,800,000		76,525,162

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

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC. 1996 **COST ESTIMATE - O & M (LIFE CYCLE) COST**

IDENTIFICATION NUMBER: B-6

PRESENT WORTH METHOD

LIFE CYCLE PERIOD (YEARS) = 20

ANNUAL PERCENTAGE RATE = 4% Dollars in table are $ times 1,000

Initial Costs				Original Design PW $		Recommended Design PW $
Steel Girder				60,800		0
Recommended Truss/Box/Arch				0		76,525.2
Sub Totals of Initial Costs PW $				60,800		76,525.2

Later Costs Single Expenditure	In The Yr	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
F.C. Inspection	5	.8219	0	0	24	19.7
F.C. Inspection	15	.5553	0	0	24	13.3
Sub Total of Single Expenditure Costs PW $				0		33

Later Costs Annual Expense	For How Many Yrs	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Sub Totals of Annual Expense Costs PW $				0		0
Totals PW $ for Original & Recommended				60,800		76,558.2
Total PW $ Savings (or Added Cost) for Recommended Design						(15,758.2)

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Reconstruction of US68/KY80 Between Aurora and Cadiz
LOCATION: Trigg and Marshall County
STUDY DATE: March 31 - April 4, 1997

IDENTIFICATION NUMBER: C-4a
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Lengthen bridge in lieu of widening causeway.

ORIGINAL DESIGN:

Widen existing causeway to reduce bridge length.

RECOMMENDED CHANGE:

Lengthen bridge and do not widen causeway. Causeway would still be used for future E.B. of four lane crossing.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	19,019,448	0	19,019,448
RECOMMENDED DESIGN	16,117,920	0	16,117,920
ESTIMATED SAVINGS OR (COST)	2,901,528	0	2,901,528

ADVANTAGES:

- Cost: It would appear that a bridge is cheaper than obtaining and placing rock fill in water.
- Environmental: Less disturbance to mussel beds.
- Lake Volume: Does not reduce lake volume, which would require excavation at some other location to replace lost volume

DISADVANTAGES:

- Bridges are generally more expensive to maintain than a roadway on a causeway over a 75 bridge life.

JUSTIFICATION:

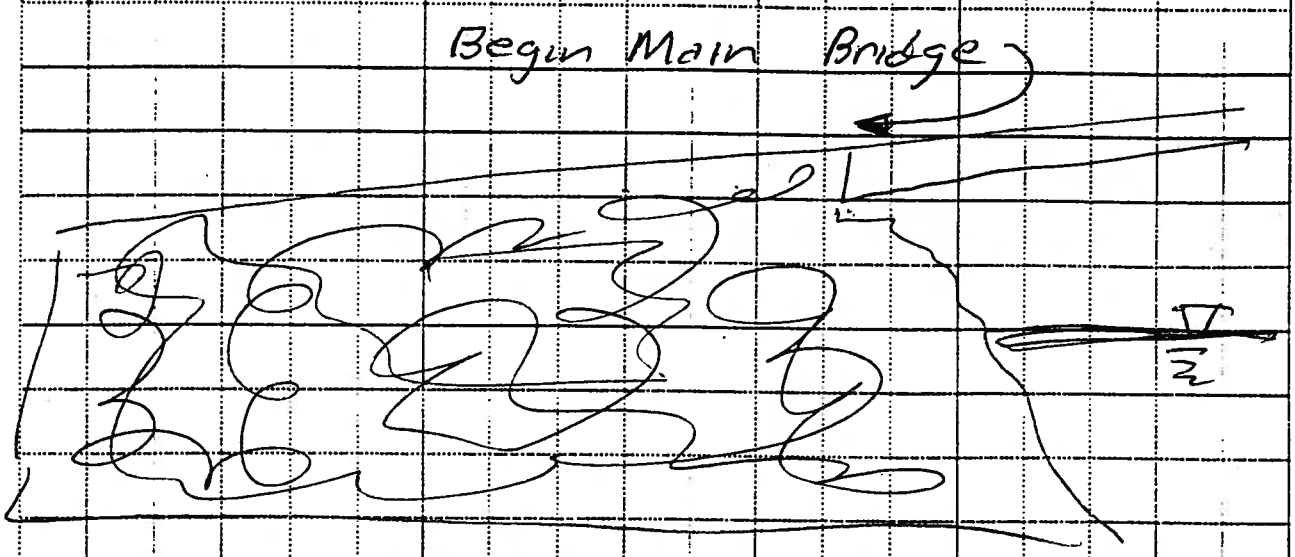
The environmental factors alone would dictate not adding to the causeways. The fact that it would cost less and would not adversely effect lake volume are added benefits. The added maintenance cost of the approach spans over the causeway is insignificant over the 20 year life considered in this study.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: C42

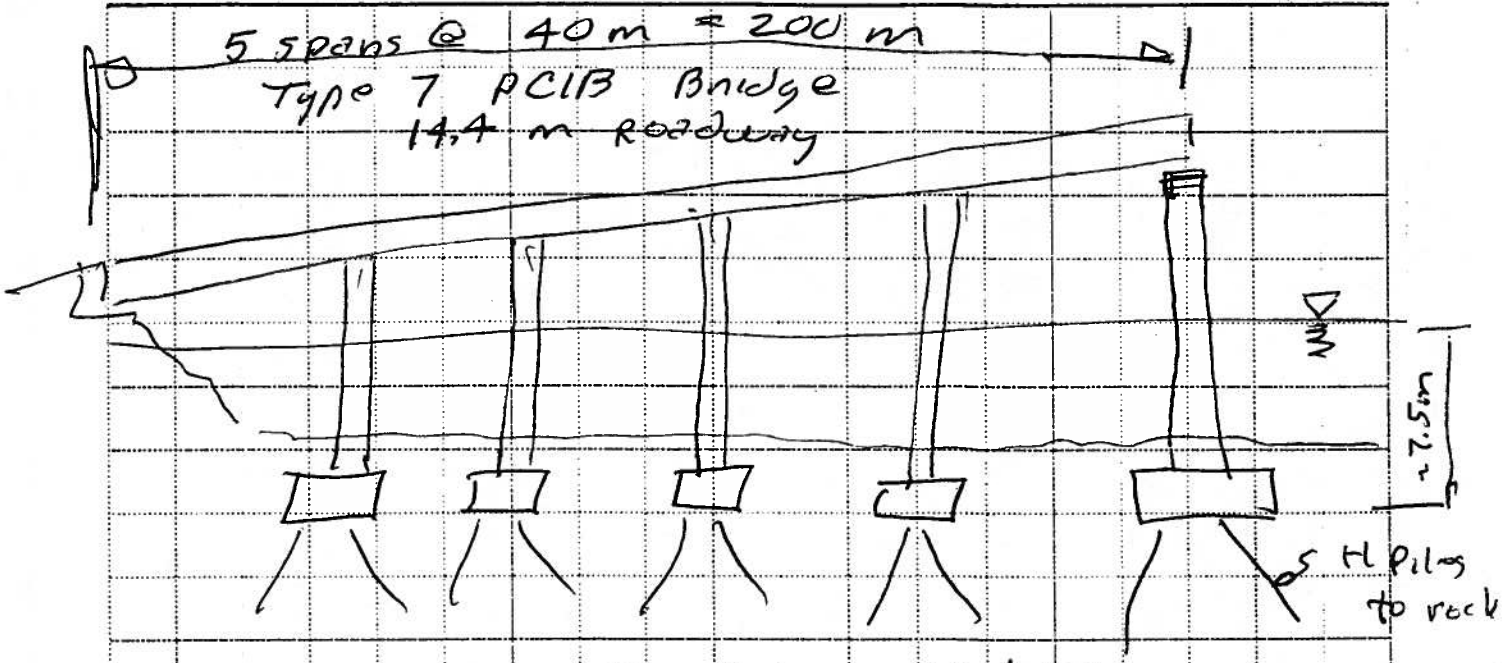


VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: C4a



Barkley W & E

Ky Lake West 15 spans @ 40 = 600

East " @ 37.5 = 300

Ky Lake West Causeway 600 } 900
300 }

200 } 400
200 }

Bridge Width 14.4 m

Area Ky Lake (B2) 900 x 14.4 = 12 960

" Barkley " (I2) 400 x 144 = 5 760

No Life Cycle Effect ~~for~~ 20 years

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: C-4a

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Sou-rce Code	Num of Units	Total $	Num of Units	Total $
For I2							
Cyclopean Stone Rip Rap	M. Ton	13.23	1	647,000	8,559,810	0	0
Type 7 PCIB Bridge	S.M.	861	8			5,760	4,959,360
For B2							
Cyclopean Stone Rip Rap	M. Ton	13.23	1	790,600	10,459,638	0	0
Type 7 PCIB Bridge	S.M.	861	8			12,960	11,158,560
Totals					19,019,448		16,117,920
No apparent 20 year life cycle cost effect.							

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources - Bridge Study Reports For Each Bridge (Chapter 4)

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Reconstruction of US68/KY80 Between Aurora and Cadiz
LOCATION: Trigg and Marshall County
STUDY DATE: March 31 - April 4, 1997

IDENTIFICATION NUMBER: C-4b
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Use bridge instead of widening causeway (for 4 lane crossing).

ORIGINAL DESIGN:

Widen existing causeway to reduce bridge length.

RECOMMENDED CHANGE:

Lengthen bridge and do not widen causeway. Use causeway for E.B. traffic.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	19,019,448	0	19,019,448
RECOMMENDED DESIGN	13,431,600	0	13,431,600
ESTIMATED SAVINGS OR (COST)	5,587,848	0	5,587,848

ADVANTAGES:

- Cost: It would appear that a bridge is cheaper than obtaining and placing the rock fill in water.
- Environmental: Less disturbance to mussel beds.
- Lake Volume: Does not reduce lake volume, which would require excavation at some other location to replace volume.

DISADVANTAGES:

- Bridges are generally more expensive to maintain than roadways on causeways.

JUSTIFICATION:

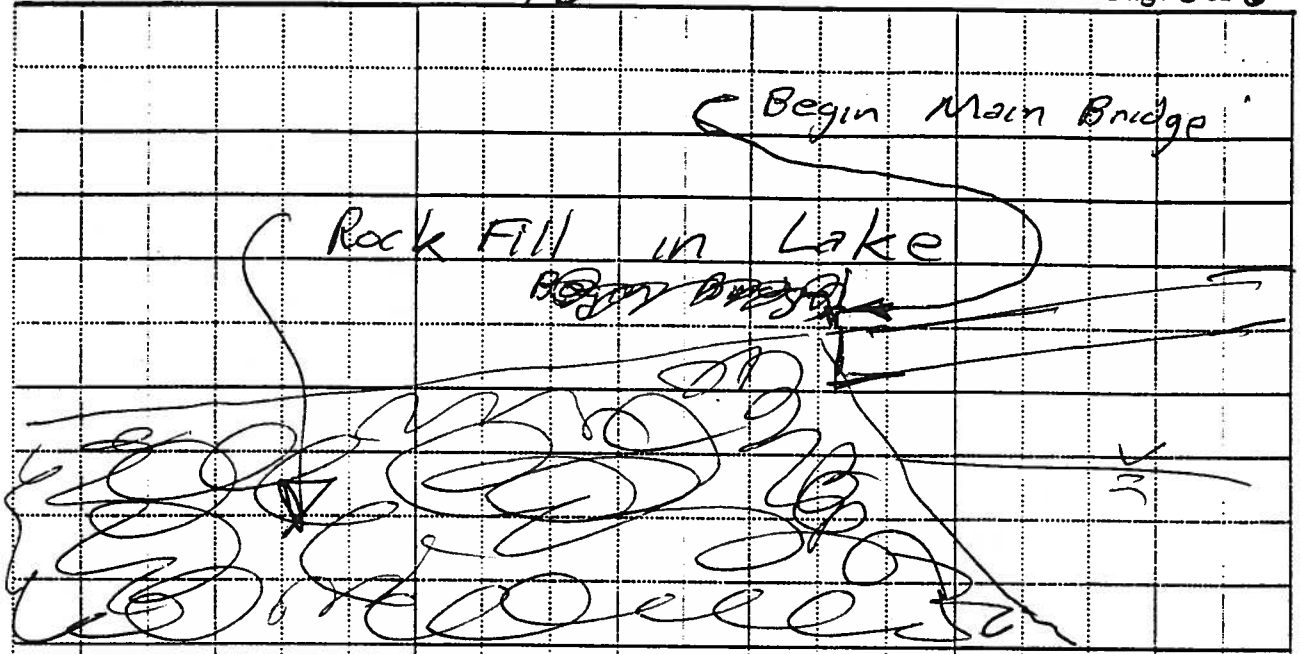
The environmental factors alone would dictate not adding to the causeways. The fact that it would cost less and would not adversely effect lake volume is an added benefit.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: C4B

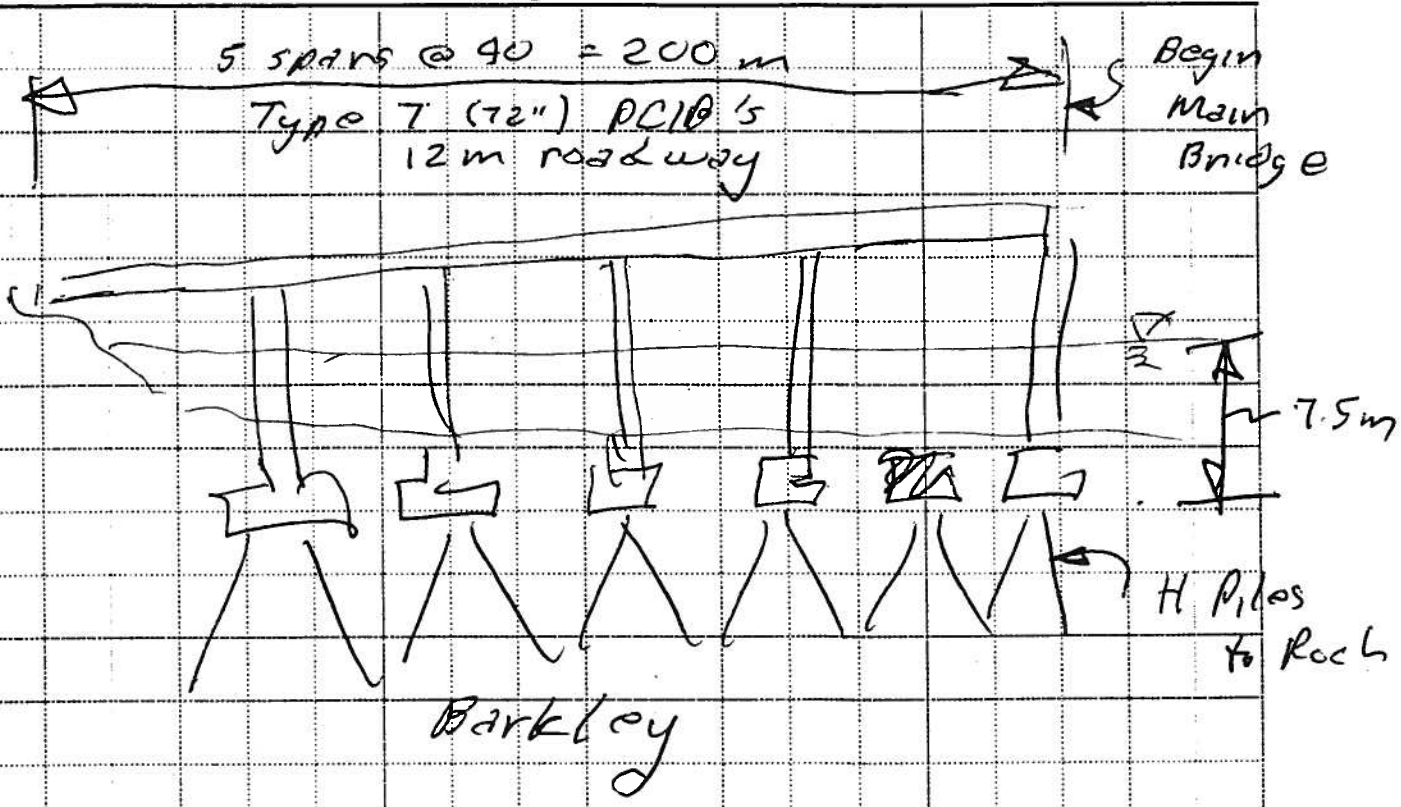


VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: C 48



Ky Lake West 15 spans @ 40 = 600

Ky Lake East 8 spans @ 37.5 = 300

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: C4B

Ky Lake West Causeway 600 } 900
East 300 }

Barkley West 200 } 400
East 200 }

Bridge Width 12 on

Area Ky Lake (B2) 900 x 12 = 10800
Barkley (I2) 400 x 12 = 4800

~~For 2 lanes only 800 x 4 x 200 x 2 = 9120~~

No Life Cycle Effect (20 years)

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: C-4b

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
For I2							
Cyclopean Stone Rip Rap	M. Ton	13.23	1	647,000	8,559,810	0	0
Type 7 PCIB Bridge	S.M.	861	8			4,800	4,132,800
For B2							
Cyclopean Stone Rip Rap	M. Ton	13.23	1	790,600	10,459,638	0	0
Type 7 PCIB Bridge	S.M.	861	8			10,800	9,298,800
Totals					19,019,448		13,431,600
No apparent 20 year life cycle cost effect.							

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 Richardson's
6 Vendor Lit or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources - Bridge Study Reports For Each Bridge (Chapter 4)

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Reconstruction of US68/KY80 Between Aurora and Cadiz
LOCATION: Trigg and Marshall County
STUDY DATE: March 31 - April 4, 1997

IDENTIFICATION NUMBER: P-1
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Reduce excavation in order to decrease waste in section 180.53 and 180.52.

ORIGINAL DESIGN:

Cross sections indicates backslopes vary from 1:4 to 1:2.25. Both Sections.
Section F - 180.52 -3.588% grade from station 10+800 to PI station 11+740.

RECOMMENDED CHANGE:

Use 1:2 backslopes for cuts of 3 meters and greater. Both sections.
Section F - 180.52 - Revise grade from -3.588% to -4.00% from 11+740 back to 10+800.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	4,826,019	0	4,826,109
RECOMMENDED DESIGN	3,689,515	0	3,689,515
ESTIMATED SAVINGS OR (COST)	1,136,504	0	1,136,504

ADVANTAGES:

- Sec. D 180.53. By revising backslopes to 1:2 an approximate balance can be achieved. It reduces required excavation by ±95,000 cubic meters. Reduces need for waste site in a sensitive area.
- Sec. F 180.52. By revising backslopes to 1:2 and changing grade, a reduction in excavation of ±244,000 m^3 can be made. Reduces permanent easement needed.

DISADVANTAGES:

- Steeper slopes require additional erosion control measures. Additional geotechnical information will be necessary to justify steeper slopes. Both sections.

JUSTIFICATION:

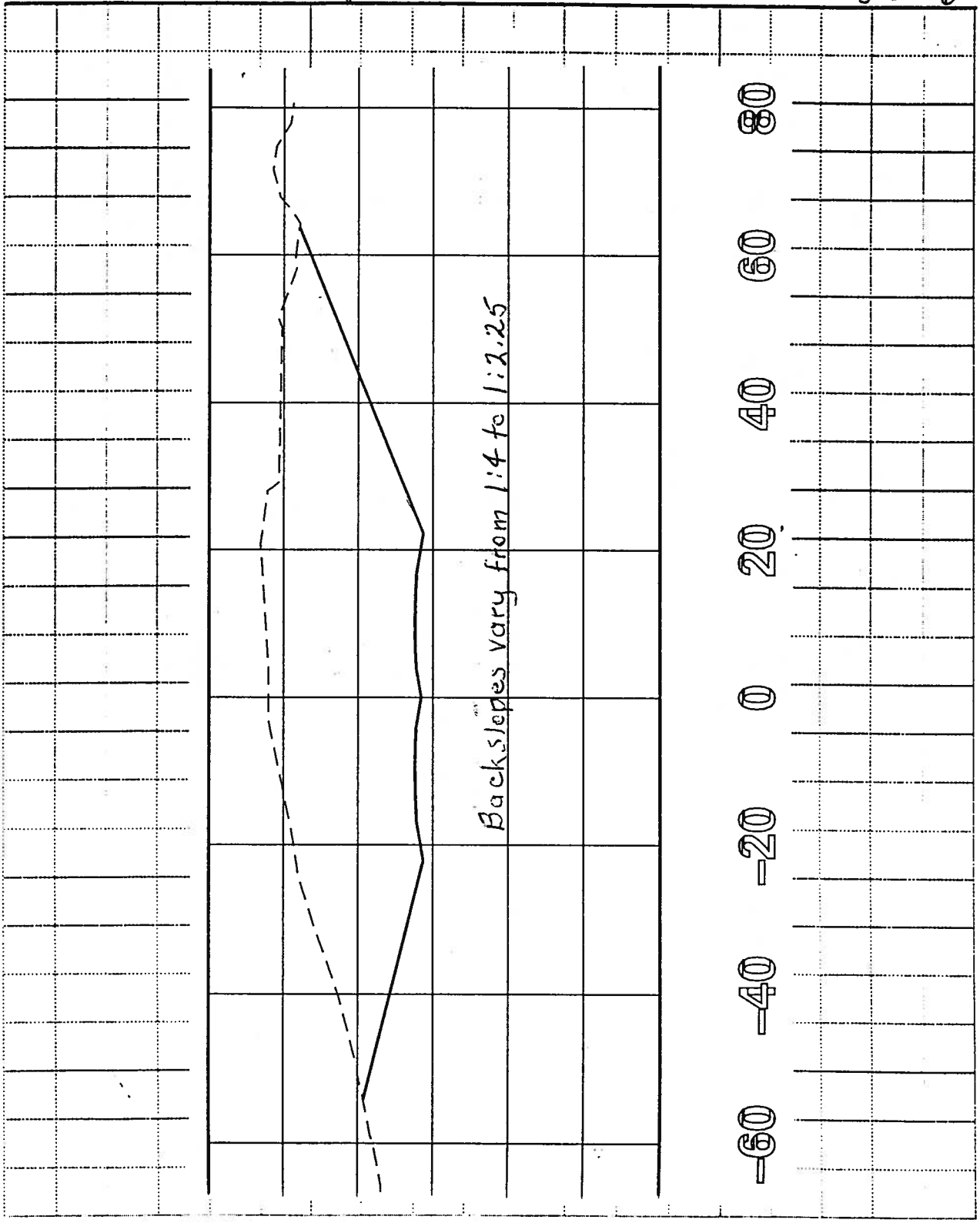
1:2 backslopes over 3 meters are in concurrence with the proposed typical section. Reduces permanent easement required in land between the lakes area.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: P-1

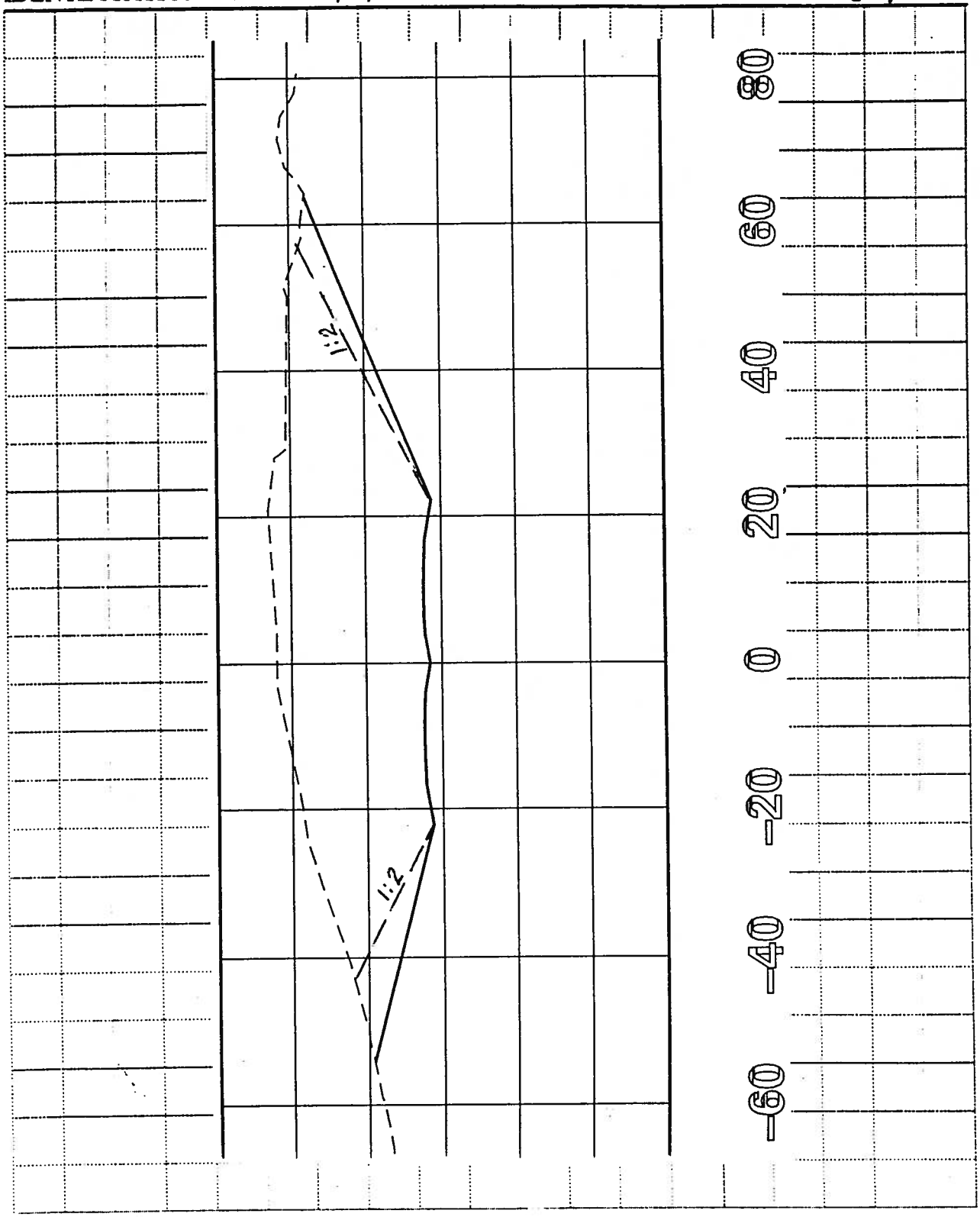


VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: P-1



VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: P-1

Section D - 180.53

Roadway Excavation -

Original Design - 543,442 Cu. Meter

*Revised Design - 447,800

95,642

* Backslopes revised to 1:2. Revision brought section into balance.

Section F - 180,52

Roadway Excavation -

** Original Design - 816,000 Cu. Meter

Revised Design - 591,500

224,500

** Cross Sections indicated a greater amount of excavation than shown on original estimate.

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: P-1

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Section D 180.153							
Roadway Exc.	m^3	3.55	2200	543,442	1,929,219	447,800	1,589,690
Section F 180.52							
Roadway Exc.	m^3	3.55	2200	816,000	2,896,000	591,500	2,099,825
Totals					4,826,019		3,689,515

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

SECTION 4 - DESIGN SUGGESTIONS

Several Design Suggestions are presented in this section. Design Suggestions are ideas that were, in the opinion of the team, good ideas, but were, never-the-less, not selected for development and writeup as a formal recommendation. Design Suggestions, by definition, have not been developed (proven) through team development and writeups. The team presents these ideas for further consideration by the owner and designer, and if accepted, subsequent development by the designer.

Geotechnical Study of the Causeway.
The Preliminary Geotechnical Overview indicates that the construction of new causeways might not be possible. There is a need for additional geotechnical study of causeway foundation material. For this reason, it is suggested that the schedule for the geotechnical study for the causeway be moved to an earlier time. If this is not done, the project work will be waiting on the redesign of an alternative to the causeway.

Back Slope in Cut Section.
Much of the project shows a 3:1 cross slope through cut sections. A 3:1 slope is not required by design standards, and a 2:1 slope is acceptable. In fact, the typical section for the design shows a 2:1 slope as an option. The 2:1 slope can be used as a tool to fine tune the earthwork balance. It is suggested that the design team consider modifying the slope from 3:1 to 2:1 in combination with an erosion control plan. This could be especially effective in removing excess waste.

Zero Grade.

Attention is called to certain portions of the project which have a zero grade in a cut section. This creates problems with the drainage ditch on the side of the roadway requiring a special ditch design. A suggestion would be to roll the grade slightly to create a crest through the cut, thus eliminating the need for a special ditch.

The Preferred Long Span Structure.
The Coast Guard requires a 500 foot minimum horizontal clearance for the navigation channel. Also the centerline of structure is skewed to the sail line and the width of the piers will need to be taken into account. These conditions will probably require the navigation span to be a minimum of 550 feet from centerline of bearing to centerline of bearing. Given the channel profile and the depth of overburden that must be addressed to anchor the main span piers to bedrock, it may be difficult to use a steel PL girder design since maximum span length of this type of structure is 500 to 550 feet. Other types of structures to be considered are steel tied arch, steel through truss and steel box girder.

SECTION 5 - VALIDATED ITEMS

Validated Items are presented in this section. Parts of the design were studied, that did not produce recommendations or design suggestions. In the opinion of the team, no workable alternatives could be found. In other words, the value engineering team is coming up with the same solutions as did the design team.. In that case, the study is, in effect, validating those parts of the design. These items are listed below.

The Major Design Concept.
No recommendations have been presented that significantly challenge the major design concepts of the project. In most cases the recommendations that have been made, suggest alternatives to directives that were given to the design team, e.g. the number of lanes proposed for the new design, etc.. In this sense, this study has validated the major design concept.

The horizontal alignment. The team found the alignment to be, in fact, outstanding in the way it follows the existing corridor while at the same time minimizing any impact on environmental, sensitive, problematic, geographic features.

The Vertical Alignment. Although the vertical alignment was adjusted slightly in one recommendation (Recommendation P-1), the overall concept is in accord with what the team would use in similar circumstances.

The Cross Sectional Template. The cross section meets all requirements of good design for this type of roadway.

Cost Estimate. Aside from two items that are challenged (see discussion of the cost estimate in the appendix) the team finds no significant problems with the cost estimate. The unit prices appear correct, and no categories or line items were found missing. The team complimented the organization and methodology of the cost estimate for its logical, clear and easy to follow layout.

Other Items Not Studied.
Certain other items were by default not validated because they were not studied, either because of time or because the necessary information does not currently exist. Items not studied were:
Drainage
Paving
Frontage roads and connectors
Bridge details
Superelevations
Landscaping

APPENDICES

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

CONTENTS

APPENDIX A
Participants.

Appendix A documents the persons who participated in the workshop.

Value Engineering Team Members

NAME	*COMPANY*	*TELEPHONE*	*ROLE*
John Sankey	Dames & Moore	(913) 677-1490	Team Leader
John Williams	Dames & Moore	(918) 446-8963	Cost Engr.
Scott Davis	Dames & Moore	(913) 677-1490	Technical Reporter
Robert Semones	KTC - Highway Design	(502) 564-3280	Roadway Engineer
Daryl Greer	KTC - Highway Design	(502) 564-3280	VE Coordinator
Joette Fields	KTC - Highway Design	(502) 564-3280	Team Member
Allan W. Frank	KTC - Bridge Design	(502) 564-4560	Bridge Engineer
Dallas E. Montgomery	Hazelet & Erdal / Dames & Moore	(502) 583-2723	Project/Construction Engineer
Lowell S. McGowan	Hazelet & Erdal / Dames & Moore	(502) 583-2723	Roadway Engineer

Value Engineering Participation									
NAME	*COMPANY*	*TELEPHONE*	*WORKSHOP SESSIONS*					*MEETINGS*	
			M	T	W	R	F	Intro	Presentation
John Sankey	Dames & Moore	(913) 677-1490	X	X	X	X	X	X	X
John Williams	Dames & Moore	(918) 446-8963	X	X	X	X	X	X	X
Scott Davis	Dames & Moore	(913) 677-1490	X	X	X	X	X	X	X
Robert Semones	KTC - Highway Design	(502) 564-3280	X	X	X	X	X	X	X
Daryl Greer	KTC - Highway Design	(502) 564-3280	X	X	X	X	X	X	X
Joette Fields	KTC - Highway Design	(502) 564-3280	X	X	X	X	X	X	X
Allan W. Frank	KTC - Bridge Design	(502) 564-4560	X	X	X	X	X	X	X
Dallas E. Montgomery	Hazelet & Erdal / Dames & Moore	(502) 583-2723	X	X	X	X	X	X	X
Lowell S. McGowan	Hazelet & Erdal / Dames & Moore	(502) 583-2723	X	X	X	X	X	X	X
Earl Berry	Parsons Brinckerhoff	(504) 499-1533	X					X	
Nancy Skinner	Parsons Brinckerhoff	(615) 327-8514	X					X	
Lindsey Briggs	KTC District 1	(502) 898-2431	X					X	X
Bryan E. Stewart	KTC District 1	(502) 898-2431	X					X	
Jerry Cottingham	EA Partners	(606) 272-8320	X					X	X

Value Engineering Participants (continued)									
NAME	*COMPANY*	*TELEPHONE*	*WORKSHOP SESSIONS*					*MEETINGS*	
			M	T	W	R	F	Intro	Presentation
Ray Robison	Skees Engineering	(502) 499-0358	X					X	X
Mike Bruce	Johnson Depp & Quisenberry	(502) 926-1808	X					X	X
Jim Gray	KTC - District 1	(502) 898-2431							X

APPENDIX B.
List of Study Material.

The following pages contain a list of the study material furnished to the team during the workshop.

List of Study Material

Preconstruction Status Report, Parsons/Brinkerhoff, March 28, 1997

US 68/KY 80 Roadway and Bridge Costs, Costs in 1993 Dollars, Parsons/Brinckerhoff

Kentucky Transportation Cabinet US 68/KY 80 Cost Estimate, Johnson, Depp, and Quisenberry

Department of Transportation Bureau of Highways Estimate Sheet North Alignment

Conceptual Phase Cost Estimate Summary US 68/KY 80, Cost in 1993 Dollars

Cost Estimate Comparison of Varied Alignments US 68/KY 80

Black and White Aerial Photographs of US 68/KY 80, 1" = 1000', March 6, 1993

Black and White Aerial Photographs of US 68/KY 80, 1:12000, February 24, 1993

Color Aerial Photographs of US 68/KY 80, 1" = 200'

Horizontal Alignment Drawings of US 68/KY 80, KTC

Vertical Alignment Drawings of US 68/KY 80, KTC

Typical Sections of US 68/KY 80, KTC

Kentucky Transportation Cabinet Department of Highways, Frankfort Standard Specifications for Road and Bridge Construction, 1994 edition

Bridge Study Report, Henry R. Lawrence Memorial Bridge Over the Cumberland River (Lake Barkley), Commonwealth of Kentucky Transportation Cabinet Department of Highways, October 1993

APPENDIX C.
Cost Information.

The team studied the cost estimate provided at the beginning of the workshop. Aside from two exceptions, no problems were found with the overall cost estimate. The team was in agreement with the unit prices used. No major cost categories were missing. The organization of the estimate was very logical, and the methods used to rough in the conceptual estimate was well thought out.

Two differences were noted by the team. The landscaping estimate is, the opinion of the team, too high; and the bridge estimate is too low. The overall estimate of the total cost to the owner from the estimate given to the team was $157,858,000 (in 1993 - 1994 dollars). The opinion of the VE team is that this estimate should be $177,920,000 (in 1993 - 1994 dollars) which escalates to $191,426,000 in 1999 dollars.

$157,858,000 *initial estimate of total owner cost in 1993 - 1994 dollars.*
- 448,345 *suggested reduction in landscape estimate.*
+20,510,345 *suggested increase in bridge estimate.*

$177,920,000 *suggested estimate of total owner cost in 1993 - 1994 dollars.*

$191,426,000 *suggested estimate of total owner cost in 1999 dollars.*

Current budgeted funds for the total owners cost of the construction = $130,780,000

The team suggests that the project is going to cost $33,000,000 more than is currently funded.

Unit Price of RipRap.
CYCLOPEAN STONE RIP RAP IS SHOWN IN THE ESTIMATE AS $13.23/ MT. THIS COST WAS VERIFIED BY THE A/E THROUGH A LOCAL QUARRY OPERATOR. THE KENTUCKY PRICE LIST SHOWS $19.98 MT. **RECOMMEND** THAT **$13.23/ MT** BE USED.

Price of Landscaping.
ON THE ONE-TIME CALCULATION OF TYPICAL ROADWAY UNIT, DATED 09/08/93, AND LOCATED UNDER THE HEADING "OTHER", VERIFY THE COST PER METER OF $115.00 FOR SEED AND PROTECT. THIS HAS A DIRECT BEARING ON THE $671 TOTAL COST PER METER. ANY ADJUSTMENT SHOULD THEN BE APPLIED TO THE CONCEPTUAL COST ESTIMATE. THIS REPRESENTS A DISTANCE OF APPROXIMATELY 24,258 METERS. AT A REDUCTION OF $15.00 PER METER THIS WOULD REPRESENT A **SAVINGS** TO THE OWNER OF **$448,345.00.**

OWNER COST SAVINGS FOR EACH SEGMENT, BASED ON PARAGRAPH 2, ARE AS FOLLOWS:

	ORIGINAL	REVISED	SAVINGS
CORRIDOR SEGMENT A-2	$1,794,816	$1,781,744	$13,072
CORRIDOR SEGMENT B-2	$56,060,629		
CORRIDOR SEGMENT C-1	$2,051,731	$2,030,833	$20,898
CORRIDOR SEGMENT D-3	$5,048,711	$5,003,312	$45,399
CORRIDOR SEGMENT E-3	$2,837,624	$2,802,142	$35,482
CORRIDOR SEGMENT F-6	$6,294,511	$6,243,474	$51,037
CORRIDOR SEGMENT G-2	$2,836,817	$2,806,472	$43,780
CORRIDOR SEGMENT H-4	$2,563,436	$2,536,879	$26,557
CORRIDOR SEGMENT J-2	$5,157,196	$5,097,940	$59,256
CORRIDOR SEGMENT K-1	$ 847,286	$ 832,272	$15,014
CORRIDOR SEGMENT L-2	$1,509,083	$1,484,096	$24,987
CORRIDOR SEGMENT M-1	$1,963,847	$1,947,897	$15,940
CORRIDOR SEGMENT N-1	$2,330,872	$2,305,380	$25,492
CORRIDOR SEGMENT O-1	$1,415,796	$1,394,526	$21,270
CORRIDOR SEGMENT P-1	$1,094,569	$1,078,154	$16,415
CORRIDOR SEGMENT Q-1	$ 965,554	$ 951,771	$13,783
CORRIDOR SEGMENT R-3	$1,513,900	$1,493,937	$19,963
TOTAL SAVINGS			$448,345

Price of 4 new bridges (2 over Kentucky Lake and 2 over Lake Barkley).

Kentucky Lake Bridge.
Total length = 3105'
Main span = 550'
Approach spans = 3105 - 550 = 2555'
Width of deck = 47.25'
Increase unit cost of main span from $115/sf to $175/sf = increase of $60/sf.
Increase unit cost of approach spans from $60/sf to $80/sf = increase of $20/sf
Increase in estimated cost =

Main span = 550' x 47.25' x $60/sf	= $1,559,250
Approach Spans = 2555' x 47.25' x $20/sf	= $2,414,000

	= $3,973,250 for one bridge
	= $7,946,500 for two bridges

Lake Barkley Bridge.
Total length = 3496'
Main span = 550'
Approach spans = 3496 - 550 = 2946'
Width of deck = 47.25'
Increase unit cost of main span from $115/sf to $175/sf = increase of $60/sf.
Increase unit cost of approach spans from $60/sf to $80/sf = increase of $20/sf
Increase in estimated cost =

Main span = 550' x 47.25' x $60/sf	= $1,559,250
Approach Spans = 2946' x 47.25' x $20/sf	= $2,783,970

	= $4,343,220 for one bridge
	= $8,686,440 for two bridges

Add R.O.W. and utilities and contingencies	= $3,877,405

Added Amount to Designers Estimate For Bridges	= $20,510,345

ADJUSTED COST ESTIMATE

The next 9 pages contain the VE estimate of total cost to the owner for the total project, adjusted for the reduction in landscaping cost and the increase in bridge cost.

ADJUSTED COST ESTIMATE 1993-1994 DOLLARS

US 68/KY80 AURORA TO CADIZ BYPAS
REVISED CONCEPTUAL ESTIMATE
DECREASE SEED & PROTECTION
INCREASE MAIN & SUPPORT SPANS

Designed By:
Estimated By: DAMES & MOORE

Prepared By: JOHN H WILLIAMS
(918)446-8963

Preparation Date: 04/04/97
Effective Date of Pricing: 04/04/97

Sales Tax: 0.00%

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

		QUANTITY	UOM	NHRS	ABOR	PMNT	RIAL	UNITCOST	TOTAL COST	UNIT COST
A2	SEGMENT ALTERNATE A-2									
A2.01	ROADWAY COSTS	700.00	M	0	0	0	0	474,000	474,000	677.82
A2.02	CROSSROADS	700.00	M	0	0	0	0	36,000	36,000	50.86
A2.04	ROADWAY EXCAVATION	231639.00	M3	0	0	0	0	822,000	822,000	3.55
A2.05	CLEARING AND GRUBBING	4.80	HEC	0	0	0	0	65,000	65,000	13481.00
A2.06	MAINTENANCE OF TRAFFIC			0	0	0	0	34,000	34,000	
A2.10	MOBILIZATION			0	0	0	0	39,000	39,000	
A2.11	DEMOBILIZATION			0	0	0	0	25,000	25,000	
A2.12	ENGINEERING & CONTINGENCY			0	0	0	0	286,000	286,000	
	TOTAL SEGMENT ALTERNATE A-2	700.00	M	0	0	0	0	1,782,000	1,782,000	2545.35
B2	SEGMENT ALTERNATE B-2									
B2.01	ROADWAY COSTS	700.00	M	0	0	0	0	375,000	375,000	535.00
B2.06	MAINTENANCE OF TRAFFIC			0	0	0	0	87,000	87,000	
B2.07	STRUCTURES			0	0	0	0	41,780,000	41,780,000	
B2.08	STRUCTURE REMOVAL			0	0	0	0	1,000,000	1,000,000	
B2.09	CYCLOPEAN STONE RIP RAP	790600.00	MT	0	0	0	0	10,460,000	10,460,000	13.23
B2.10	MOBILIZATION			0	0	0	0	1,480,000	1,480,000	
B2.11	DEMOBILIZATION			0	0	0	0	940,000	940,000	
B2.12	ENGINEERING & CONTINGENCY			0	0	0	0	10,700,000	10,700,000	
	TOTAL SEGMENT ALTERNATE B-2	700.00	M	0	0	0	0	66,822,000	66,822,000	95459.47
C1	SEGMENT ALTERNATE C-1									
C1.01	ROADWAY COSTS	1119.00	M	0	0	0	0	743,000	743,000	664.15
C1.04	ROADWAY EXCAVATION	124281.00	M3	0	0	0	0	441,000	441,000	3.55
C1.05	CLEARING AND GRUBBING	8.40	HEC	0	0	0	0	113,000	113,000	13481.00
C1.06	MAINTENANCE OF TRAFFIC			0	0	0	0	48,000	48,000	
C1.09	SLOPE PROTECTION	14105.00	MT	0	0	0	0	286,000	286,000	20.28
C1.10	MOBILIZATION			0	0	0	0	45,000	45,000	
C1.11	DEMOBILIZATION			0	0	0	0	29,000	29,000	
C1.12	ENGINEERING & CONTINGENCY			0	0	0	0	326,000	326,000	
	TOTAL SEGMENT ALTERNATE C-1	1119.00	M	0	0	0	0	2,031,000	2,031,000	1814.86
D3	SEGMENT ALTERNATE D-3									
D3.01	ROADWAY COSTS	700.00	M	0	0	0	****	12,000	1,607,000	2295.57
D3.04	ROADWAY EXCAVATION	543442.00	M3	0	0	0	0	1,929,000	1,929,000	3.55
D3.05	CLEARING AND GRUBBING	18.20	HEC	0	0	0	0	245,000	245,000	13481.00
D3.06	MAINTENANCE OF TRAFFIC			0	0	0	0	117,000	117,000	
D3.07	STRUCTURES			0	0	0	0	99,000	99,000	
D3.08	STRUCTURE REMOVAL			0	0	0	0	22,000	22,000	

		QUANTITY	UOM	NHRS	ABOR	PMN	TRIAL	UNITCOST	TOTAL COST	UNIT COST
D3.10	MOBILIZATION			0	0	0	0	111,000	111,000	
D3.11	DEMOBILIZATION			0	0	0	0	70,000	70,000	
D3.12	ENGINEERING & CONTINGENCY			0	0	0	0	804,000	804,000	
	TOTAL SEGMENT ALTERNATE D-3	2431.00	M	0	0	0	****	3,409,000	5,003,000	2058.13
E3	SEGMENT ALTERNATE E-3									
E3.01	ROADWAY COSTS	1900.00	M	0	0	0	0	1,265,000	1,265,000	665.64
E3.04	ROADWAY EXCAVATION	104992.00	M3	0	0	0	0	373,000	373,000	3.55
E3.05	CLEARING AND GRUBBING	6.70	HEC	0	0	0	0	90,000	90,000	13481.00
E3.06	MAINTENANCE OF TRAFFIC			0	0	0	0	102,000	102,000	
E3.07	STRUCTURES			0	0	0	0	421,000	421,000	
E3.10	MOBILIZATION			0	0	0	0	62,000	62,000	
E3.11	DEMOBILIZATION			0	0	0	0	39,000	39,000	
E3.12	ENGINEERING & CONTINGENCY			0	0	0	0	450,000	450,000	
	TOTAL SEGMENT ALTERNATE E-3	1900.00	M	0	0	0	0	2,802,000	2,802,000	1474.81
F6	SEGMENT ALTERNATE F-6									
F6.01	ROADWAY COSTS	700.00	M	0	0	0	0	2,182,000	2,182,000	3116.79
F6.02	CROSSROADS	700.00	M	0	0	0	0	32,000	32,000	45.77
F6.03	PAVEMENT REMOVAL	4500.00	M2	0	0	0	0	31,000	31,000	6.83
F6.04	ROADWAY EXCAVATION	585892.00	M3	0	0	0	0	2,080,000	2,080,000	3.55
F6.05	CLEARING AND GRUBBING	29.90	HEC	0	0	0	0	403,000	403,000	13481.00
F6.06	MAINTENANCE OF TRAFFIC			0	0	0	0	91,000	91,000	
F6.07	STRUCTURES			0	0	0	0	154,000	154,000	
F6.08	STRUCTURE REMOVAL			0	0	0	0	34,000	34,000	
F6.10	MOBILIZATION			0	0	0	0	138,000	138,000	
F6.11	DEMOBILIZATION			0	0	0	0	88,000	88,000	
F6.12	ENGINEERING & CONTINGENCY			0	0	0	0	1,010,000	1,010,000	
	TOTAL SEGMENT ALTERNATE F-6	3256.00	M	0	0	0	0	6,242,000	6,242,000	1917.17
G2	SEGMENT ALTERNATE G-2									
G2.01	ROADWAY COSTS	2023.00	M	0	0	0	0	1,370,000	1,370,000	677.11
G2.04	ROADWAY EXCAVATION	195377.00	M3	0	0	0	0	694,000	694,000	3.55
G2.05	CLEARING AND GRUBBING	10.10	HEC	0	0	0	0	136,000	136,000	13481.00
G2.06	MAINTENANCE OF TRAFFIC			0	0	0	0	112,000	112,000	
G2.07	STRUCTURES			0	0	0	0	59,000	59,000	
G2.08	STRUCTURE REMOVAL			0	0	0	0	13,000	13,000	
G2.09	SLOPE PROTECTION	20886.00	MT	0	0	0	0	424,000	424,000	20.28
G2.10	MOBILIZATION			0	0	0	0	71,000	71,000	
G2.11	DEMOBILIZATION			0	0	0	0	49,000	49,000	
G2.12	ENGINEERING & CONTINGENCY			0	0	0	0	561,000	561,000	

		QUANTITY	UOM	NHRS	ABOR	PMNT	RIAL	UNITCOST	TOTAL COST	UNIT COST
	TOTAL SEGMENT ALTERNATE G-2	2023.00	M	0	0	0	0	3,488,000	3,488,000	1724.20
H4	SEGMENT ALTERNATE H-4									
H4.01	ROADWAY COSTS	1422.00	M	0	0	0	0	963,000	963,000	677.48
H4.04	ROADWAY EXCAVATION	245752.00	M3	0	0	0	0	872,000	872,000	3.55
H4.05	CLEARING AND GRUBBING	4.70	HEC	0	0	0	0	63,000	63,000	13481.00
H4.06	MAINTENANCE OF TRAFFIC			0	0	0	0	89,000	89,000	
H4.07	STRUCTURES			0	0	0	0	31,000	31,000	
H4.08	STRUCTURE REMOVAL			0	0	0	0	7,000	7,000	
H4.09	SLOPE PROTECTION	543.00	MT	0	0	0	0	11,000	11,000	20.28
H4.10	MOBILIZATION			0	0	0	0	56,000	56,000	
H4.11	DEMOBILIZATION			0	0	0	0	36,000	36,000	
H4.12	ENGINEERING & CONTINGENCY			0	0	0	0	408,000	408,000	
	TOTAL SEGMENT ALTERNATE H-4	1422.00	M	0	0	0	0	2,537,000	2,537,000	1784.02
I2	SEGMENT ALTERNATE I-2									
I2.01	ROADWAY COSTS	387.00	M	0	0	0	0	207,000	207,000	535.00
I2.07	STRUCTURES			0	0	0	0	35,740,000	35,740,000	
I2.08	STRUCTURE REMOVAL			0	0	0	0	750,000	750,000	
I2.09	SLOPE PROTECTION	647000.00	MT	0	0	0	0	8,560,000	8,560,000	13.23
I2.10	MOBILIZATION			0	0	0	0	1,250,000	1,250,000	
I2.11	DEMOBILIZATION			0	0	0	0	793,000	793,000	
I2.12	ENGINEERING & CONTINGENCY			0	0	0	0	9,060,000	9,060,000	
	TOTAL SEGMENT ALTERNATE I-2	387.00	M	0	0	0	0	56,360,000	56,360,000	145631.99
J2	SEGMENT ALTERNATE J-2									
J2.01	ROADWAY COSTS	3173.00	M	0	0	0	0	2,210,000	2,210,000	696.42
J2.02	CROSSROADS	700.00	M	0	0	0	0	324,000	324,000	462.80
J2.04	ROADWAY EXCAVATION	150265.00	M3	0	0	0	0	533,000	533,000	3.55
J2.05	CLEARING AND GRUBBING	12.70	HEC	0	0	0	0	171,000	171,000	13481.00
J2.06	MAINTENANCE OF TRAFFIC			0	0	0	0	138,000	138,000	
J2.07	STRUCTURES			0	0	0	0	657,000	657,000	
J2.08	STRUCTURE REMOVAL			0	0	0	0	62,000	62,000	
J2.10	MOBILIZATION			0	0	0	0	113,000	113,000	
J2.11	DEMOBILIZATION			0	0	0	0	72,000	72,000	
J2.12	ENGINEERING & CONTINGENCY			0	0	0	0	819,000	819,000	
	TOTAL SEGMENT ALTERNATE J-2	3173.00	M	0	0	0	0	5,098,000	5,098,000	1606.66
K1	SEGMENT ALTERNATE K-1									
K1.01	ROADWAY COSTS	804.00	M	0	0	0	0	530,000	530,000	659.78

		QUANTITY	UOM	NHRS	ABOR	PMT	RIAL	UNITCOST	TOTAL COST	UNIT COST
K1.04	ROADWAY EXCAVATION	9626.00	M3	0	0	0	0	34,000	34,000	3.50
K1.05	CLEARING AND GRUBBING	1.90	HEC	0	0	0	0	26,000	26,000	13481.00
K1.06	MAINTENANCE OF TRAFFIC			0	0	0	0	30,000	30,000	
K1.07	STRUCTURES			0	0	0	0	40,000	40,000	
K1.08	STRUCTURE REMOVAL			0	0	0	0	9,000	9,000	
K1.10	MOBILIZATION			0	0	0	0	18,000	18,000	
K1.11	DEMOBILIZATION			0	0	0	0	12,000	12,000	
K1.12	ENGINEERING & CONTINGENCY			0	0	0	0	134,000	134,000	
TOTAL	SEGMENT ALTERNATE K-1	804.00	M	0	0	0	0	832,000	832,000	1035.16
L1	SEGMENT ALTERNATE L-1									
L1.01	ROADWAY COSTS	1338.00	M	0	0	0	0	948,000	948,000	708.47
L1.02	CROSSROADS	700.00	M	0	0	0	0	18,000	18,000	25.43
L1.04	ROADWAY EXCAVATION	30160.00	M	0	0	0	0	107,000	107,000	3.55
L1.05	CLEARING AND GRUBBING	5.20	HEC	0	0	0	0	70,000	70,000	13481.00
L1.06	MAINTENANCE OF TRAFFIC			0	0	0	0	49,000	49,000	
L1.10	MOBILIZATION			0	0	0	0	33,000	33,000	
L1.11	DEMOBILIZATION			0	0	0	0	21,000	21,000	
L1.12	ENGINEERING & CONTINGENCY			0	0	0	0	238,000	238,000	
TOTAL	SEGMENT ALTERNATE L-1	1340.00	M	0	0	0	0	1,484,000	1,484,000	1107.53
M1	SEGMENT ALTERNATE M-1									
M1.01	ROADWAY COSTS	854.00	M	0	0	0	0	591,000	591,000	691.77
M1.02	CROSSROADS	700.00	M	0	0	0	0	45,000	45,000	64.84
M1.04	ROADWAY EXCAVATION	215308.00	M3	0	0	0	0	764,000	764,000	3.55
M1.05	CLEARING AND GRUBBING	7.70	HEC	0	0	0	0	104,000	104,000	13481.00
M1.06	MAINTENANCE OF TRAFFIC			0	0	0	0	12,000	12,000	
M1.07	STRUCTURES			0	0	0	0	39,000	39,000	
M1.08	STRUCTURE REMOVAL			0	0	0	0	9,000	9,000	
M1.10	MOBILIZATION			0	0	0	0	43,000	43,000	
M1.11	DEMOBILIZATION			0	0	0	0	27,000	27,000	
M1.12	ENGINEERING & CONTINGENCY			0	0	0	0	313,000	313,000	
TOTAL	SEGMENT ALTERNATE M-1	854.00	M	0	0	0	0	1,948,000	1,948,000	2280.91
N1	SEGMENT ALTERNATE N-1									
N1.01	ROADWAY COSTS	1365.00	M	0	0	0	0	902,000	902,000	660.45
N1.04	ROADWAY EXCAVATION	219655.00	M3	0	0	0	0	780,000	780,000	3.55
N1.05	CLEARING AND GRUBBING	11.80	HEC	0	0	0	0	159,000	159,000	13481.00
N1.06	MAINTENANCE OF TRAFFIC			0	0	0	0	11,000	11,000	
N1.10	MOBILIZATION			0	0	0	0	51,000	51,000	
N1.11	DEMOBILIZATION			0	0	0	0	32,000	32,000	

	QUANTITY	UOM	NHRS	ABOR	PMNT	RIAL	UNITCOST	TOTAL COST	UNIT COST
N1.12 ENGINEERING & CONTINGENCY			0	0	0	0	370,000	370,000	
TOTAL SEGMENT ALTERNATE N-1	1365.00	M	0	0	0	0	2,305,000	2,305,000	1688.92
01 SEGMENT ALTERNATE 0-1									
01.01 ROADWAY COSTS	1139.00	M	0	0	0	0	769,000	769,000	674.75
01.02 CROSSROADS	1139.00	M	0	0	0	0	16,000	16,000	14.06
01.04 ROADWAY EXCAVATION	46820.00	M	0	0	0	0	166,000	166,000	3.55
01.05 CLEARING AND GRUBBING	11.90	HEC	0	0	0	0	160,000	160,000	13481.00
01.06 MAINTENANCE OF TRAFFIC			0	0	0	0	9,000	9,000	
01.10 MOBILIZATION			0	0	0	0	31,000	31,000	
01.11 DEMOBILIZATION			0	0	0	0	20,000	20,000	
01.12 ENGINEERING & CONTINGENCY			0	0	0	0	224,000	224,000	
TOTAL SEGMENT ALTERNATE 0-1	1139.00	M	0	0	0	0	1,395,000	1,395,000	1224.34
P1 SEGMENT ALTERNATE P-1									
P1.01 ROADWAY COSTS	879.00	M	0	0	0	0	595,000	595,000	676.83
P1.02 CROSSROADS	700.00	M	0	0	0	0	27,000	27,000	38.14
P1.04 ROADWAY EXCAVATION	26760.00	M3	0	0	0	0	95,000	95,000	3.55
P1.05 CLEARING AND GRUBBING	7.20	HEC	0	0	0	0	97,000	97,000	13481.00
P1.06 MAINTENANCE OF TRAFFIC			0	0	0	0	7,000	7,000	
P1.07 STRUCTURES			0	0	0	0	45,000	45,000	
P1.10 MOBILIZATION			0	0	0	0	24,000	24,000	
P1.11 DEMOBILIZATION			0	0	0	0	15,000	15,000	
P1.12 ENGINEERING & CONTINGENCY			0	0	0	0	173,000	173,000	
TOTAL SEGMENT ALTERNATE P-1	879.00	M	0	0	0	0	1,078,000	1,078,000	1226.57
Q1 SEGMENT ALTERNATE Q-1									
Q1.01 ROADWAY COSTS	738.00	M	0	0	0	0	515,000	515,000	697.39
Q1.02 CROSSROADS	738.00	M	0	0	0	0	83,000	83,000	112.15
Q1.03 PAVEMENT REMOVAL	1680.00	M2	0	0	0	0	11,000	11,000	6.83
Q1.04 ROADWAY EXCAVATION	19281.00	M3	0	0	0	0	68,000	68,000	3.55
Q1.05 CLEARING AND GRUBBING	5.20	HEC	0	0	0	0	70,000	70,000	13481.00
Q1.06 MAINTENANCE OF TRAFFIC			0	0	0	0	17,000	17,000	
Q1.10 MOBILIZATION			0	0	0	0	21,000	21,000	
Q1.11 DEMOBILIZATION			0	0	0	0	13,000	13,000	
Q1.12 ENGINEERING & CONTINGENCY			0	0	0	0	153,000	153,000	
TOTAL SEGMENT ALTERNATE Q-1	738.00	M	0	0	0	0	952,000	952,000	1289.66
R3 SEGMENT ALTERNATE R-3									

		QUANTITY	UOM	NHRS	ABOR	PMN	TRIAL	UNITCOST	TOTAL COST	UNIT COST
R3.01	ROADWAY COSTS	1069.00	M	0	0	0	0	762,000	762,000	713.14
R3.02	CROSSROADS	700.00	M	0	0	0	0	71,000	71,000	101.71
R3.04	EMBANKMENT IN PLACE	60223.00	M	0	0	0	0	249,000	249,000	4.14
R3.05	CLEARING AND GRUBBING	5.60	HEC	0	0	0	0	75,000	75,000	13481.00
R3.06	MAINTENANCE OF TRAFFIC			0	0	0	0	42,000	42,000	
R3.10	MOBILIZATION			0	0	0	0	33,000	33,000	
R3.11	DEMOBILIZATION			0	0	0	0	21,000	21,000	
R3.12	ENGINEERING & CONTINGENCY			0	0	0	0	240,000	240,000	
TOTAL	SEGMENT ALTERNATE R-3	1069.00	M	0	0	0	0	1,494,000	1,494,000	1397.51
TOTAL	US 68/KY80 AURORA TO CADIZ BYPAS	25304.00	M	0	0	0****		162,058,000	163,652,000	6467.45

ADD RIGHT-OF-WAY COSTS $2,253,000
ADD UTILITIES COST 12,015,000
TOTAL COST TO OWNER $177,920,000

No errors detected...

* * * END OF ERROR REPORT * * *

ADJUSTED COST ESTIMATE

The next 16 pages contain the VE estimate of total cost to the owner for the total project, adjusted for the escalation from 1993-1994 dollars to 1999 dollars.

ADJUSTED COST ESTIMATE ESCALATED TO 1999

US 68/KY80 AURORA TO CADIZ BYPAS
REVISED CONCEPTUAL ESTIMATE
DECREASE SEED & PROTECTION
INCREASE MAIN & SUPPORT SPANS

Designed By:
Estimated By: DAMES & MOORE

Prepared By: JOHN H WILLIAMS
(918)446-8963

Preparation Date: 04/04/97
Effective Date of Pricing: 04/04/97

Sales Tax: 0.00%

SUMMARY REPORTS SUMMARY PAGE

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

		QUANTITY	UOM	CONTRACT	ESCALATN	CONTINGN	SIOH	TOTAL COST	UNIT COST	NOTES
A2	SEGMENT ALTERNATE A-2									
A2.01	ROADWAY COSTS	700.00	M	474,000	39,000	0	0	514,000	733.76	
A2.02	CROSSROADS	700.00	M	36,000	3,000	0	0	39,000	55.05	
A2.04	ROADWAY EXCAVATION	231639.00	M3	822,000	68,000	0	0	890,000	3.84	
A2.05	CLEARING AND GRUBBING	4.80	HEC	65,000	5,000	0	0	70,000	14593.56	
A2.06	MAINTENANCE OF TRAFFIC			34,000	3,000	0	0	37,000		
A2.10	MOBILIZATION			39,000	3,000	0	0	43,000		
A2.11	DEMOBILIZATION			25,000	2,000	0	0	27,000		
A2.12	ENGINEERING & CONTINGENCY			286,000	24,000	0	0	310,000		
TOTAL	SEGMENT ALTERNATE A-2	700.00	M	1,782,000	147,000	0	0	1,929,000	2755.41	
B2	SEGMENT ALTERNATE B-2									
B2.01	ROADWAY COSTS	700.00	M	375,000	31,000	0	0	405,000	579.15	
B2.06	MAINTENANCE OF TRAFFIC			87,000	7,000	0	0	95,000		
B2.07	STRUCTURES			41,780,000	3,448,000	0	0	45,228,000		
B2.08	STRUCTURE REMOVAL			1,000,000	83,000	0	0	1,083,000		
B2.09	CYCLOPEAN STONE RIP RAP	790600.00	MT	10,460,000	863,000	0	0	11,323,000	14.32	
B2.10	MOBILIZATION			1,480,000	122,000	0	0	1,602,000		
B2.11	DEMOBILIZATION			940,000	78,000	0	0	1,018,000		
B2.12	ENGINEERING & CONTINGENCY			10,700,000	883,000	0	0	11,583,000		
TOTAL	SEGMENT ALTERNATE B-2	700.00	M	66,822,000	5,515,000	0	0	72,336,000	103337.54	
C1	SEGMENT ALTERNATE C-1									
C1.01	ROADWAY COSTS	1119.00	M	743,000	61,000	0	0	805,000	718.96	
C1.04	ROADWAY EXCAVATION	124281.00	M3	441,000	36,000	0	0	478,000	3.84	
C1.05	CLEARING AND GRUBBING	8.40	HEC	113,000	9,000	0	0	123,000	14593.56	
C1.06	MAINTENANCE OF TRAFFIC			48,000	4,000	0	0	51,000		
C1.09	SLOPE PROTECTION	14105.00	MT	286,000	24,000	0	0	310,000	21.95	
C1.10	MOBILIZATION			45,000	4,000	0	0	49,000		
C1.11	DEMOBILIZATION			29,000	2,000	0	0	31,000		
C1.12	ENGINEERING & CONTINGENCY			326,000	27,000	0	0	353,000		
TOTAL	SEGMENT ALTERNATE C-1	1119.00	M	2,031,000	168,000	0	0	2,198,000	1964.64	
D3	SEGMENT ALTERNATE D-3									
D3.01	ROADWAY COSTS	700.00	M	1,607,000	133,000	0	0	1,740,000	2485.01	
D3.04	ROADWAY EXCAVATION	543442.00	M3	1,929,000	159,000	0	0	2,088,000	3.84	
D3.05	CLEARING AND GRUBBING	18.20	HEC	245,000	20,000	0	0	266,000	14593.56	
D3.06	MAINTENANCE OF TRAFFIC			117,000	10,000	0	0	126,000		
D3.07	STRUCTURES			99,000	8,000	0	0	107,000		
D3.08	STRUCTURE REMOVAL			22,000	2,000	0	0	24,000		

	QUANTITY UOM	CONTRACT	ESCALATN	CONTINGN	SIOH	TOTAL COST	UNIT COST	NOTES
D3.10 MOBILIZATION		111,000	9,000	0	0	120,000		
D3.11 DEMOBILIZATION		70,000	6,000	0	0	76,000		
D3.12 ENGINEERING & CONTINGENCY		804,000	66,000	0	0	870,000		
TOTAL SEGMENT ALTERNATE D-3	2431.00 M	5,003,000	413,000	0	0	5,416,000	2227.98	
E3 SEGMENT ALTERNATE E-3								
E3.01 ROADWAY COSTS	1900.00 M	1,265,000	104,000	0	0	1,369,000	720.57	
E3.04 ROADWAY EXCAVATION	104992.00 M3	373,000	31,000	0	0	403,000	3.84	
E3.05 CLEARING AND GRUBBING	6.70 HEC	90,000	7,000	0	0	98,000	14593.56	
E3.06 MAINTENANCE OF TRAFFIC		102,000	8,000	0	0	111,000		
E3.07 STRUCTURES		421,000	35,000	0	0	455,000		
E3.10 MOBILIZATION		62,000	5,000	0	0	67,000		
E3.11 DEMOBILIZATION		39,000	3,000	0	0	43,000		
E3.12 ENGINEERING & CONTINGENCY		450,000	37,000	0	0	487,000		
TOTAL SEGMENT ALTERNATE E-3	1900.00 M	2,802,000	231,000	0	0	3,033,000	1596.52	
F6 SEGMENT ALTERNATE F-6								
F6.01 ROADWAY COSTS	700.00 M	2,182,000	180,000	0	0	2,362,000	3374.01	
F6.02 CROSSROADS	700.00 M	32,000	3,000	0	0	35,000	49.55	
F6.03 PAVEMENT REMOVAL	4500.00 M2	31,000	3,000	0	0	33,000	7.39	
F6.04 ROADWAY EXCAVATION	585892.00 M3	2,080,000	172,000	0	0	2,252,000	3.84	
F6.05 CLEARING AND GRUBBING	29.90 HEC	403,000	33,000	0	0	436,000	14593.56	
F6.06 MAINTENANCE OF TRAFFIC		91,000	8,000	0	0	99,000		
F6.07 STRUCTURES		154,000	13,000	0	0	167,000		
F6.08 STRUCTURE REMOVAL		34,000	3,000	0	0	37,000		
F6.10 MOBILIZATION		138,000	11,000	0	0	149,000		
F6.11 DEMOBILIZATION		88,000	7,000	0	0	95,000		
F6.12 ENGINEERING & CONTINGENCY		1,010,000	83,000	0	0	1,093,000		
TOTAL SEGMENT ALTERNATE F-6	3256.00 M	6,242,000	515,000	0	0	6,757,000	2075.39	
G2 SEGMENT ALTERNATE G-2								
G2.01 ROADWAY COSTS	2023.00 M	1,370,000	113,000	0	0	1,483,000	732.99	
G2.04 ROADWAY EXCAVATION	195377.00 M3	694,000	57,000	0	0	751,000	3.84	
G2.05 CLEARING AND GRUBBING	10.10 HEC	136,000	11,000	0	0	147,000	14593.56	
G2.06 MAINTENANCE OF TRAFFIC		112,000	9,000	0	0	121,000		
G2.07 STRUCTURES		59,000	5,000	0	0	64,000		
G2.08 STRUCTURE REMOVAL		13,000	1,000	0	0	14,000		
G2.09 SLOPE PROTECTION	20886.00 MT	424,000	35,000	0	0	459,000	21.95	
G2.10 MOBILIZATION		71,000	6,000	0	0	77,000		
G2.11 DEMOBILIZATION		49,000	4,000	0	0	53,000		
G2.12 ENGINEERING & CONTINGENCY		561,000	46,000	0	0	608,000		

		QUANTITY	UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
N1.12	ENGINEERING & CONTINGENC			370,000	0	0	0	0	370,000	
TOTAL SEGMENT ALTERNATE N-1		1365.00	M	2,305,000	0	0	0	0	2,305,000	1688.92
01 SEGMENT ALTERNATE 0-1										
01.01	ROADWAY COSTS	1139.00	M	769,000	0	0	0	0	769,000	674.75
01.02	CROSSROADS	1139.00	M	16,000	0	0	0	0	16,000	14.06
01.04	ROADWAY EXCAVATION	46820.00	M	166,000	0	0	0	0	166,000	3.55
01.05	CLEARING AND GRUBBING	11.90	HEC	160,000	0	0	0	0	160,000	13481.00
01.06	MAINTENANCE OF TRAFFIC			9,000	0	0	0	0	9,000	
01.10	MOBILIZATION			31,000	0	0	0	0	31,000	
01.11	DEMOBILIZATION			20,000	0	0	0	0	20,000	
01.12	ENGINEERING & CONTINGENC			224,000	0	0	0	0	224,000	
TOTAL SEGMENT ALTERNATE 0-1		1139.00	M	1,395,000	0	0	0	0	1,395,000	1224.34
P1 SEGMENT ALTERNATE P-1										
P1.01	ROADWAY COSTS	879.00	M	595,000	0	0	0	0	595,000	676.83
P1.02	CROSSROADS	700.00	M	27,000	0	0	0	0	27,000	38.14
P1.04	ROADWAY EXCAVATION	26760.00	M3	95,000	0	0	0	0	95,000	3.55
P1.05	CLEARING AND GRUBBING	7.20	HEC	97,000	0	0	0	0	97,000	13481.00
P1.06	MAINTENANCE OF TRAFFIC			7,000	0	0	0	0	7,000	
P1.07	STRUCTURES			45,000	0	0	0	0	45,000	
P1.10	MOBILIZATION			24,000	0	0	0	0	24,000	
P1.11	DEMOBILIZATION			15,000	0	0	0	0	15,000	
P1.12	ENGINEERING & CONTINGENC			173,000	0	0	0	0	173,000	
TOTAL SEGMENT ALTERNATE P-1		879.00	M	1,078,000	0	0	0	0	1,078,000	1226.57
Q1 SEGMENT ALTERNATE Q-1										
Q1.01	ROADWAY COSTS	738.00	M	515,000	0	0	0	0	515,000	697.39
Q1.02	CROSSROADS	738.00	M	83,000	0	0	0	0	83,000	112.15
Q1.03	PAVEMENT REMOVAL	1680.00	M2	11,000	0	0	0	0	11,000	6.83
Q1.04	ROADWAY EXCAVATION	19281.00	M3	68,000	0	0	0	0	68,000	3.55
Q1.05	CLEARING AND GRUBBING	5.20	HEC	70,000	0	0	0	0	70,000	13481.00
Q1.06	MAINTENANCE OF TRAFFIC			17,000	0	0	0	0	17,000	
Q1.10	MOBILIZATION			21,000	0	0	0	0	21,000	
Q1.11	DEMOBILIZATION			13,000	0	0	0	0	13,000	
Q1.12	ENGINEERING & CONTINGENC			153,000	0	0	0	0	153,000	
TOTAL SEGMENT ALTERNATE Q-1		738.00	M	952,000	0	0	0	0	952,000	1289.66
R3 SEGMENT ALTERNATE R-3										

** PROJECT INDIRECT SUMMARY - Facility (Rounded to 1000's) **

		QUANTITY	UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
R3.01	ROADWAY COSTS	1069.00	M	762,000	0	0	0	0	762,000	713.14
R3.02	CROSSROADS	700.00	M	71,000	0	0	0	0	71,000	101.71
R3.04	EMBANKMENT IN PLACE	60223.00	M	249,000	0	0	0	0	249,000	4.14
R3.05	CLEARING AND GRUBBING	5.60	HEC	75,000	0	0	0	0	75,000	13481.00
R3.06	MAINTENANCE OF TRAFFIC			42,000	0	0	0	0	42,000	
R3.10	MOBILIZATION			33,000	0	0	0	0	33,000	
R3.11	DEMOBILIZATION			21,000	0	0	0	0	21,000	
R3.12	ENGINEERING & CONTINGENC			240,000	0	0	0	0	240,000	
TOTAL SEGMENT ALTERNATE R-3		1069.00	M	1,494,000	0	0	0	0	1,494,000	1397.51
TOTAL US 68/KY80 AURORA TO CAD		25304.00	M	163,652,000	0	0	0	0	163,652,000	6467.45
Escalation									13,506,000	533.75
TOTAL INCL OWNER COSTS									177,158,000	7001.20

ADD RIGHT-OF-WAY COSTS 2,253,000
ADD UTILITIES COSTS 12,015,000
TOTAL COST TO OWNER $191,426,000

No errors detected...

* * * END OF ERROR REPORT * * *

COST REVIEW Wednesday, 02 April, 1997

FOR: RECONSTRUCTION OF US68/KY80 BETWEEN AURORA AND CADIZ LOCATED IN TRIGG AND CADIZ COUNTIES, KENTUCKY.

1. CYCLOPEAN STONE RIP RAP IS SHOWN IN THE ESTIMATE AS $13.23 MT. THIS COST WAS VERIFED BY THE A/E THROUGH A LOCAL QUARRY OPERATOR. THE KENTUCY PRICE LIST SHOWS $19.98 MT. RECOMMEND THAT $13.23 MT BE USED.

2. ON THE ONE-TIME CALCULATION OF TYPICAL ROADWAY UNIT, DATED 09/08/93, AND LOCATED UNDER THE HEADING "OTHER", VERIFY THE COST PER METER OF $115.00 FOR SEED AND PROTECT. THIS HAS A DIRECT BEARING ON THE $671 TOTAL COST PER METER. ANY ADJUSTMENT SHOULD THEN BE APPLIED TO THE CONCEPTUAL COST ESTIMATE. THIS REPRESENTS A DISTANCE OF APPROXIMATELY 24,258 METERS. AT A REDUCTION OF $15.00 PER METER THIS WOULD REPRESENT A SAVINGS TO THE OWNER OF $448,345.00.

3. OWNER COST SAVINGS FOR EACH SEGMENT, BASED ON PARAGRAPH 2, ARE AS FOLLOWS:

	ORIGINAL	REVISED	SAVINGS
CORRIDOR SEGMENT A-2	$1,794,816	$1,781,744	$13,072
CORRIDOR SEGMENT B-2	$56,060,629		
CORRIDOR SEGMENT C-1	$2,051,731	$2,030,833	$20,898
CORRIDOR SEGMENT D-3	$5,048,711	$5,003,312	$45,399
CORRIDOR SEGMENT E-3	$2,837,624	$2,802,142	$35,482
CORRIDOR SEGMENT F-6	$6,294,511	$6,243,474	$51,037
CORRIDOR SEGMENT G-2	$2,836,817	$2,806,472	$43,780
CORRIDOR SEGMENT H-4	$2,563,436	$2,536,879	$26,557
CORRIDOR SEGMENT J-2	$5,157,196	$5,097,940	$59,256
CORRIDOR SEGMENT K-1	$ 847,286	$ 832,272	$15,014
CORRIDOR SEGMENT L-2	$1,509,083	$1,484,096	$24,987
CORRIDOR SEGMENT M-1	$1,963,847	$1,947,897	$15,940
CORRIDOR SEGMENT N-1	$2,330,872	$2,305,380	$25,492
CORRIDOR SEGMENT O-1	$1,415,796	$1,394,526	$21,270
CORRIDOR SEGMENT P-1	$1,094,569	$1,078,154	$16,415
CORRIDOR SEGMENT Q-1	$ 965,554	$ 951,771	$13,783
CORRIDOR SEGMENT R-3	$1,513,900	$1,493,937	$19,963
TOTAL SAVINGS			$448,345

APPENDIX D
Function Analysis.

The following functions were analyzed during the workshop.

High Order Functions of US-68 and KY-80

Major east-west mover of goods & services.
Major east-west emergency corridor for disaster relief.

The Function of the Project

FUNCTION	FUNCTION TYPE
To stimulate economic growth in corridor	B
Satisfy public	B
Eliminate deficiencies - horizontal, vertical, structural, seismic	RS
Increase safety	RS
Save time	RS
Maintain safety	B
Increase capacity (goods, services, vehicles)	RS
Provide emergency access	S

The Function of Removing the Bridges.

FUNCTION	FUNCTION TYPE
Obtain permit	RS
Widen channel	RS
Allow taller vessels	RS
Maintain safety	B
Increase safety	B
Maintain load (to reuse the bridges will result in a reduction in load capacity)	B
Reuse causeway	S

The Function of 4-lanes.

FUNCTION	FUNCTION TYPE
Increase capacity	B
Increase safety	B
Please public	S
Avoid detours	S
Avoid delays	S
Optimize funds-use	S
Minimize TVA-problems	S
Limit access	S

The Function of "Partially Controlled Access".

FUNCTION	FUNCTION TYPE
Maintain Capacity	B
Maintain Safety	B
Limit Maintenance	S
Facilitate future widening	S

Note: there are three types of access. These are listed below from least limited to most limeted.

Access by Permit
Partially Controlled Access
Controlled Access

The Function of the Causeway.

FUNCTION	FUNCTION TYPE
Shorten bridge	B
Provide bridge - approach	S
Elevate road	S
Allow fishing	S

APPENDIX E
Creative Idea List and Evaluation.

The following 31 ideas were generated during the workshop.

The Generation of Ideas.

ID #	Idea Description	Value Index
B-1	Eliminate 4 lane bridges - KY/Barkley lakes and use 2 lane bridges, new alignment, wide shoulders	0
B-2	lengthen bridges and reduce causeway	0
B-3	in lieu of twin bridges use single bridge, 4 lane	1
B-4	look at cable bridge in lieu of girder or truss bridge	0
B-5	look at tied arch bridge in lieu of girder or truss bridge	1
B-6	post-tension segmental concrete bridge in lieu of girder or truss	0
B-7	do bridge substructure for 4-lanes now, and do the superstructure for 2-lanes now, and do the superstructure for the other 2-lanes later.	0
C-1	mechanically stabilized embankments (mse) - above normal pool	0
C-2	pontoon bridge	0
C-3	drive pile, drop in rock, and build a retaining wall	0
C-4	eliminate existing causeway, use long span bridge, don't build new causeway, use longer bridge	4
C-4a	for 2 lane highway build new 2 lane bridge along side existing bridge, do not build causeway, use longer bridge, demolish existing bridge, abandon existing causeway	4
C-4b	for a 4 lane highway same as C-4a but replace existing bridge with a new 2 lane bridge, reuse existing causeway	4
C-5	construct coffer dams, put road on top	0
C-6	epoxy together crushed car blocks	0
C-7	use a ferry	0
C-8	drain the lake	0
C-9	cofferdam and build causeway in the dry, two different materials	0
C-10	Build causeway in 2 materials - rock below full pool, native material above	0
G-1	2 lane all the way in lieu of 4 lanes and 2 lanes, roads and bridges	5
G-2	2 lane construction - total shut down of traffic during job	0
G-3	Do nothing	0

ID #	Idea Description	Value Index
G-4	Rehab total job, 2 lanes, widen shoulders - total upgrade for 2 lane roadway, replace bridge, existing alignment, full safety	0
G-5	4 lane upgrade all the way in lieu of 4 lane and 2 lane/4 lane ultimate, bridges and roads	3
G-6	Replace bridges only - leave roads as is	1
G-7	Replace bridges - rehab 2 lane road, only as need, spot improvement, existing alignment	2
G-8	Reduce design speed to lessen needed upgrades	0
G-9	2 lane all the way except do 4 lane thru LBL, buy ROW for 4 lane, 2 lane bridge	3
P-1	adjust profile for better balance	4
X-1	in lieu of 40' depressed median barrier 2 7' inside shoulders (14' flush median with barrier)	0
X-2	instead of 4:1 cut slope use 2:1 and erosion control measures (blankets)	2

APPENDIX F
Miscellaneous Items.

This appendix documents miscellaneous items that do not fit other places within the report.

The Existing Bridges Cannot Be Reused.

There are several reasons why the existing bridges cannot be reused, but must be removed. They are listed as follows.

1. Not up to current seismic design.
2. Section not to current standards.
   - Lane width
   - Shoulder width.
3. Channel span not to current Coast Guard requirements.
   - Need wider channel span
     - Current span = 300'
     - Need 500'
   - Need greater clear height.
     - Current high water clearance = 42'
     - Need high water clearance = 47'.

Considering the above reasons for bridge removal, the team sees no means by which the reuse of the existing bridges can be justified.

The team explored several attempts to first find ways that the existing bridges could be reused as highway bridges. None were found. The team then attempted to find a way to reused the existing fridges for non highway use, e.g. as crossings for pedestrian / bick trails in coordination with the existing trails through the LBL. This could at least save the cost of demolition, and provide an ammentity to the LBL preserve for very little money. This also failed.

Even if the existing bridges could be accredited safe for pedestrian use (in spite of their advanced age and lack of seismic design) the bridges will still fail when measured against Coast Guard requirements. Any new bridge will be required to accomodate Coast Guard requirements for a widened barge channel, along with the repositioning of piers to make the turn in the channel less of a hazard to barges, along with an increase of five feet in vertical clearance. This means that the new bridges will have different pier positioning with respect to the channel, and will have greater vertical clearance over the channel. To leave the existing bridges in place along side new bridges, designed to Coast Guard requirements. would counteract the design of the new bridges in responding the the Coast Guard requirements.

The team has therefore accepted the demolition of the existing bridges as a given.

The Bridges Involve Input from Several Agencies.

One of the complicating factors in the design of the bridges is that there are several additional agencies interested in the bridges, and each agency insists on putting requirements onto the design. This information is outlined in the table below.

Agencies that Want Input into Bridge Design.

BRIDGE	INTERESTED AGENCY	AREAS OF CONCERN
Lake Barkley	Corps of Engineers	Flood control
		Wet lands
	US Coast Guard	Navigation
		Historical Bridges
Kentucky Lake	Corps of Engineers	Flood control
		Wet lands
	US Coast Guard	Navigation
		Historical Bridges
	TVA	Bike and hiker crossings

Some Questions.
Do we need 4 lane bridges now?
Do we need 4 lanes now?
Do 4 lane substructure with 2 lane superstructure?
4 lane or 2 lane all the way, not a mixture.
Do LBL 4 lanes now to get all environmental issues out of the way. Bridges can be built later.

Who is the Customer?
The public is the ultimate customer of our work. Unfortunately, the public is removed from the direct chain of command (influence) and does not have an immediate and direct voice into the design and building of roads. The voice of the public is not consistant, clear, nor organized. The public elects politicians to request and fund the design and construction of roads. The politicians have a place at the top of the chain of command, and their voice can be easily heard. For reasons of practicality in road design and construction, the politicians are considered the customer to be listened too.

The heirarchy of authority for this project can be outlined as follows.

The hierarchy of authority
- The public. *The ultimate beneficiary of this project.*
- The politicians. *The high order driver of this project.*
- The non merit employees
- The Kentucky Transportation Cabinet. *The implimentor of this project.*

Traffic Count.
Traffic Counts (from Div of Planning)
Current count (1992) = 2700 - 4600 ADV with 12% - 18.5% trucks.
Future count (2012) = 3800 - 6500 ADV with 12% - 18.5% trucks.

The Driving Public.

The driving public is the ultimate beneficiery of this project. Although it is difficult for the public to have a direct voice in projects of this type, the question still arises; what does the public want in a roadway?

Based on an opinion poll, two items of significance to the driving public were found.

1. The ridability of the road is the most important item. 75% of the respondents listed this as important. Ridability can be defined as:
    a. smoothness of driving surface.
        absence of holes, cracks, and bumps.
    b. gentleness of alignment.
        horizontal curvature.
        steepness of grades.
        sharpness of crests over hills.
2. Fear of bridges
    a. height of bridges coupled with passenger's perception of that height.
    b. narrowness of bridges (narrow lanes, narrow or no shoulders, closeness to barriers).

Safety.

Based on a review by the District One Office, of the current accident report, the existing highway under study is not considered hazardous or dangerous. There have been two significant accident reported. One was a fatal accident west of Cadiz, that was determined to be non roadway related. The other more recent accident has not been as yet evaluated. There have been several non serious accidents reported on the bridges due to the narrowness of the brdges. This will be helped by the proposed new bridges. There have also been several non serious accidents reported on the roadway. Non have been judges as roadway related.

Why 4 Lanes?

In October, 1996, the project was planned to 2-lane with 4-lane ultimate. When the VE workshop began, the team found that the project is now planned as both 2-lane (4-lane ultimate) and 4-lane. There are four lanes proposed through the LBL. The question was then asked, as to what prompted the change in plan.

The reason given for proposing 4 lanes through the LBL is that this is intended to keep all work within the LBL confined to one project, done at one time. The concern is that to divide the project on the TVA property into parts is to invite later delays with TVA involvement each time additional construction is planned.

Why a combination of 2-lanes and 4-lanes?

The was some discussion by the team of why the combination of 2-lane and 4-lane on the same project. There was support for the idea of doing one or the other as being a better solution than combining both on the same project.

There was also some discussion on the aspect of having bridges of a different number of lanes than the adjacent roadway. It was thought that ideally, bridges and roads should have the same number of lanes. There was some support for allowing the bridges to vary from the roadway in number of lanes if funding were a problem, but this support was mixed If the highway were to be loaded to capacity, there would be traffic backups anywhere 4-lanes changed to 2-lanes. That the traffic count projections on this project do not suggest that 4-lanes are necessary, any 4-lane sections would not be loaded to capacity, and in that sense, 4-lanes could exist along side of 2-lanes. There was mixed discussion as to whether there should be 4-lane bridges next to 2-lane highway, or 4-lane highway next to 2-lane bridges.

APPENDIX G - Implementation

This appendix can be used to document the final decision on each recommendation and design suggestion as to acceptance or rejection. As mentioned previously, a decision regarding a recommendation or design suggestion can take on several forms.

Accepted Recommendations and Design Suggestions.

Partially Accepted Recommendations and Design Suggestions.

Recommendations and Design Suggestions Accepted with Modifications

Recommendations and Design Suggestions Left Open for Further Study.

Recommendations and Design Suggestions Tabled for Later Decision.

Rejected Recommendations and Design Suggestions.

On the following page is a form for recording decisions about the recommendations and design suggestions presented in this report.

FORM: 31 DEC 1996

SUMMARY OF RESULTS

Project: Reconstruction of US 68/KY 80 Between Aurora and Cadiz
Location: Trigg and Marshall County
Study Date: March 31 - April 4, 1997

DESCRIPTION		PRESENT WORTH AMOUNT			BEST	DECISION		
I.D. #	Recommendation	1st cost of original design	1st cost of recommen-dation	resulting 1st cost savings (or cost)	suggest-ed best selection	designer decision	owner decision	final decision
B-6	Change preferred long span structure	60,800,000	76,525,162	(15,725,162)	Note 1			
C-4a	Do not widen causeway (2 lane crossing)	19,019,448	16,117,920	2,901,528	☆, ✳			
C-4b	Reuse existing causeway (4 lane crossing)	19,019,448	13,431,600	5,587,848				
G-1	2 lane all the way, new alignment	87,259,616	54,015,265	33,244,265	☆			
G-5	4 lane all the way, new alignment	6,127,399	9,098,930	(2,971,531)				
G-7	Replace 2 lane bridges only and rehab 2 lane existing alignment with spot improvements	97,173,318	51,830,938	45,342,380				
G-9	Same as G-1 except do 4 lane thru LBL	86,838,868	59,034,644	27,804,224	✳			
P-1	Adjust profile for better balance on segments D & F (LBL), 4 lane plan	4,826,019	3,689,515	1,136,504	✳			

DECISION LEGEND A=Accepted AP=Accepted Parts of Recommendation AM=Accepted with Modification
FS=Further Study Required LD=Tabled for Later Decision R=Rejected

END OF REPORT