FRANKLIN COUNTY
I-64
RELOCATION & WIDENING
BETWEEN
US 127 AND US 60

VALUE ENGINEERING STUDY -
FINAL REPORT

February 28, 1997

FRANKLIN COUNTY I-64
RELOCATION AND WIDENING
BETWEEN US 127 AND US 60

KTC Item #5-56.00

KTC State Project #FD520370064053-058017D

FHWA #NH00644070

VALUE ENGINEERING STUDY
for
Kentucky Transportation Cabinet

Study Date: February 17-21, 1997

Final Report

February 28, 1997

Dames & Moore
A Dames & Moore Group Company

Acknowledgments

A thank you is given to the staff members from the Kentucky Transportation Cabinet, American Consulting Engineers, and the Federal Highway Administration. A special thanks is also extended to Daryl Greer, John Sacksteder, Tom Layman, Martin VanMeter, Kevin Villier, and Robert Farley for their able assistance. This value engineering study 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 Franklin County I-64 Relocation and Widening between US 127 and US 60. The study workshop was conducted at the office of the Kentucky Transportation Cabinet in Frankfort Kentucky, February 17-21, 1997. The project was reviewed at the beginning stages of design. The bridges were at 10% design and the roadway was at a 30% design. The value engineering study team was from the Kentucky Transportation Department and Dames and Moore, and was facilitated by a CVS team leader from Dames and Moore. The project design firm is American Consulting Engineers in Louisville, Kentucky.. The owner's project manager is Kevin Villier with the Kentucky Transportation Cabinet. The design project manager is Glen Hardin with American Consulting Engineers. Glen Hardin is also the project lead designer. An oral presentation of the study results was made to the Kentucky Transportation Cabinet and American Consulting Engineers on Friday February 21, 1997.

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

The Project.
The project can be briefly described as an upgrade of a 4 lane highway to a 6 lane highway.

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 are worth consideration. 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.

The recommendations of the team can be grouped into two categories: (1) to defer construction of 6 lanes, rehab the existing 4 lanes and save and maximize the use of existing facilities; and (2) build 6 lanes while saving and reusing as much of the existing facilities as possible.

Savings From Recommendations.
At the time of the study, the project had an estimated construction cost of $51,391,026. This estimate included contingencies, site development, overhead, profit, design during construction, owner/designer supervision, and is the total cost to the owner.. The project budget was $46,000,000. This put the project over budget. The study generated 70 ideas, of which 7 were

developed as recommendations to be submitted for consideration by the owner and design team. The total dollar amount represented by all 7 recommendations was $46,155,309, of which 1 recommendation involved added cost of $220,000 and 6 recommendations involved a reduction in cost of $46,375,309. 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. One mix of recommendations (G-2B, G-2R, G-7, and ST-15) challenges the need to move to six lanes immediately. This suggestion would leave the alignment alone and reuse the existing roadway and bridges, putting both back in shape to provide another 20-30 years service. This concept is estimated to cost $15,741,738 in lieu of the $51,391,026, for a cost reduction of $35,649,288.

A second suggested mix of recommendations (G-3 or G-3a, G-7, and PR-6) preserves the six lane concept and the "2 lanes open in each direction during construction" for an estimated cost of $38,851,231 to $41,979,381 (depending upon how much work is done on the existing bridges). This would reduce cost by $9,411,645 to $12,539,795 from the $51,391,026 estimate. 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.

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. As a result of this review, the following conclusions were made:

The opinion of the value team is that the designer's cost estimate is on the low side. Daryl Greer has also asked that an additional $3,500,000 be put into the estimate to cover utilities, right of way, contingencies, and design. Taking these items into consideration, the value team estimates the total cost to the owner to be $65,439,025.

The Value Engineering Study Team.

The study team consisted of the following:

Value Engineering Team Members

NAME	*COMPANY*	*TELEPHONE*	*ROLE*
John Sankey	Dames & Moore	(913) 677-1490	Team Leader
Robert Semones	Div. Of Hwy Design, KTC	(502) 564-3280	Roadway Engineer
Dennis Baron	Hazelet & Erdal/D&M	(502) 583-2723	Bridge Engineer
James Boddy	Dames & Moore	(847) 228-0707	Geotechnical Engineer
James D. Wright	Div. Of Construction, KTC	(606) 433-7791	Construction Engr..
William R. Coy	Dames & Moore/Consultant	(402) 556-2682	Materials Engr.
James D. Wood	Div. Of Operations, KTC	(502) 564-4556	Maintenance Engr.
John Williams	Dames & Moore	(918) 446-8963	Cost Engr..
Scott Davis	Dames & Moore	(913) 677-1490	Technical Reporter

Summary of Recommendations.
A summary of the recommendations of this study will be found in Section 3 in the *summary of recommendations*. The recommendations are listed, along with the economic impact of each, in terms of savings or added cost. If there has been a decision regarding the recommendations, the table may be used to summarize the acceptance or rejection of the recommendation by the owner and designer. For this project the designer is American Consulting Engineers, and the owner is the Kentucky Transportation Cabinet. The column titled "Suggested Best Selection" marks the specific mix of recommendations deemed by the team as being the best choices to be made (the team's suggested choices) considering the effect of both savings and added quality on the overall project. At the end of this report in Appendix G, there is a Response to Recommendations Decision Worksheet which is provided to be used as a worksheet in the approval process.

SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on Franklin County I-64 Relocation and Widening Between US 127 and US 60 held in Frankfort, Kentucky, February 17-21, 1997. The study team was from the firm of Dames & Moore and the Kentucky Transportation Cabinet and is listed in the Executive Summary and Appendix. Other participants of the study (other than the study team) are listed in the Appendix. Study materials furnished to the study team are also listed in the Appendix.

Boundary of the Study
The scope of the study as given to the team was as follows:

- Study I-64 between US 127 and US 60.

Study constraints given to the team were:

- The project is to be kept within the current right-of-way boundary.
- Maintain two lanes of traffic each way during construction. This constraint was challenged by the team.

Study Objective
The study goals given to the team were:

- Study the project to uncover any suggestions that might improve the project.
- Cost savings is not a primary objective.
- Quality of project is a primary objective.

Ideas and Recommendations
Part of the value methodology is to generate as many ideas as practical, and to then evaluate the ideas and select the proposals that offer quality improvement 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 6 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 provides a brief concise

managerial overview of the study.

SECTION 1 - INTRODUCTION: The Introduction (this section) 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 a 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..

APPENDICIES - The appendicies contains backup information to the main body of the report.

Significant Aspects of This Study.
This report challenges the premise that existing facilities need to be abandoned and destroyed in order to provide adequate roadway along this stretch of I-64. Instead, recommendations are put forth that increase the reuse of existing roadway and bridges.

SECTION 2 - PROJECT DESCRIPTION

Project Limits

The project is located on interstate highway I-64 between Louisville to the east an Lexington to the west, just south of Frankfort, Kentucky. The project includes two interchanges. The two interchanges form the limits of the project; the US 127 interchange at the west end of the project, and the US 60 interchange at the east end of the project. The US 127 interchange is a partial cloverleaf interchange (a diamond with two cloverleaf loops). The US 60 interchange is a diamond interchange.

Slow Trucks

There is a problem with slow moving trucks coming up out of the valley surrounding the Kentucky River. There is a 4% grade coming up from the Kentucky River going east and a 3% grade coming up from the Kentucky River going west. The team was told that the eastbound grade presented a problem with slow moving trucks.

Local Traffic

The two interchanges form the two interstate I-64 connections to the city of Frankfort. I-644 gets added traffic between the two interchanges from (1) townspeople using the interstate to get from one side of the city to the other, and (2) those using the interstate to bypass Frankfort.

Four Alternatives

There were four alternatives studied by the designers during the development of this concept.

Alternative 1. Create six new lanes right down the middle of the R.O.W. between the existing east and westbound pavement. A new vertical profile is created that will flatten the steep grades east and westbound of the Kentucky River bridge. The six lanes are divided into two parts by a median barrier. The original east and westbound lanes are removed.

Alternative 1a Create six new lanes right down the middle of the R.O.W. between the existing east and westbound pavement. A new vertical profile is created that will flatten the steep grades east and westbound off of the Kentucky River bridge. The six lanes are divided into two parts by a 60 foot median. The original east and westbound lanes are removed.

Alternative 2 Create six lanes by widening the eastbound pavement by one lane in the center direction, and widening the westbound pavement by one lane in the center direction. Because the concept is physically tied to the exiting pavement, the existing vertical profile must be maintained. A later modification to this alternative added a truck lane to the eastbound pavement to alleviate the problem of slow moving trucks up the grade from the Kentucky River bridge. This alternative is the choice of the Kentucky Transportation Cabinet, and is the alternative that has been selected for development of the project. As such, this alternative is the one to be studied by the value team, and will serve as the base design from which value engineering recommendations will be compared.

Alternative 3 Create six lanes as follow. Build three new eastbound lanes down the middle of the R.O.W. between the existing east and westbound pavement. Widen the

westbound lanes by adding one more lane to the center, creating three westbound lanes. The vertical profile for the eastbound pavement is flattened to reduce the steep grade up from the Kentucky River bridge. The vertical profile of the westbound pavement is not altered. The original eastbound lanes are removed. This alternative is the choice of the design firm American Consulting Engineers. The reason that this alternative was not selected by the Kansas Transportation Cabinet is that it is perceived that it will appear too ambitious. It involves total replacement of some lanes. The political climate is focused more on widening / expansion of existing pavement to achieve the desired six lanes.

Project Deviation

It is noteworthy to mention that because of a desire to provide 18 feet of rock bench, and 30 foot of clear zone on both outer boundaries of the roadway, the proposed six lane highway in alternative 2 will be pushed so far to the center, that very little of the existing pavement will be reused. Because of this situation, alternative 2 is not a true widening of existing pavement to the center, but is the construction of six new lanes to the center. It could be argued that alternative 2 should be rejected for the same reason that alternative 2 was rejected.

Project Designer Concerns

1. Project Design Schedule.

   The project schedule could get out of hand. The deadline set for completion of design is October 1997. The schedule is short, and for that reason the project is being fast tracked. Normally a fast track project is a standard project that is well understood and accepted, in which there are easily defined design scope, criteria, and direction that is readily agreed upon, that will not change. This project is not like that. This project is not clearly defined or understood by the stakeholders. The project parameters continue to change, although the deadline does not change.

2. Existing Reinforced Concrete Box Culverts

   The existing box culverts have a step-down top slab as the box extends out toward to toe of the fill slope. The earth load is less toward to toe of the slope, hence the top slab thickness has been reduced in steps as the box approaches each end. If the pavement is widened to six lanes (three in each direction) the roadway fill section will b widened, and the height of fill on top of the box will increase over the ends of the box. Right now there is a concern as to how to handle this added load on a box whose section is reduced at the point of the added load.

3. Slow Truck Lane

   There is concern over where to end the slow truck lane. To function well, the lane must extend well past the crest of the grade. This is needed to give the slow trucks time and room to accelerate to the speed of adjacent traffic prior to merging back into the mi\mainline of vehicles. There is the possibility that this needed slow truck lane length will extend the end of the truck lane dangerously close to the end of the interchange.

Project Drivers (Root causes of design direction)

There appears to be certain project requirements that tend to be impacting the project in major

ways. These are:

1. Construction must be executed so as to maintain 2 lanes of traffic each way at all times.
2. An 18 foot rock bench must be provided as part of the roadway section.
3. A 30 foot clear zone must be maintained as part of the roadway section.
4. The project must be designed in such way so as to require no new right-of-way.
5. The existing bridges (especially the Kentucky River Bridge) which by the following, greatly restricts the project options:
   a. The existing bridges have no shoulders. This means that the only way to maintain two lanes of traffic each way during construction is to build a new bridge first, that is wide enough to handle two lanes while an existing bridge is worked on. This eliminates any option to just rehab the existing bridges if two lanes of traffic are to be maintained. There is no practical way to rehab one of the bridges without closing the entire bridge and routing traffic over the adjacent bridge. This in effect means that there is only one lane of traffic open each way.
   b. The existing bifabricated highway has caused the separation of the eastbound bridge from the west bound bridge. This separation of bridges limits the flexibility to rehab a bridge and keep lanes of the bridge open. This again forces the complete closure of a bridge during renovation.

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, each part of the recommendation is reviewed 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, two optimum mix selections of recommendations, that are the team's suggestion for combining recommendations. These two "optimum selections" will, in the opinion of the study team, provide increased 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 of the two optimums is found to be $9,411,645 and $35,649,288 in potential first cost savings, and $35,649,288 and $12,539,795 in potential life cycle savings, respectively.

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

G	General
PR	Provide Recovery
ST	Slow Trucks

FORM 30 DEC 1996

SUMMARY OF RECOMMENDATIONS

Project: Franklin County I-64 Relocation/Widening Between US 127 and US 60
Location: Frankfort, Kentucky
Study Date: February 17-21, 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
G-2B	Rehab the existing 4 lane bridges	13,755,000	3,279,836	10,475,164	0	10,475,164	(1)
G-2R	Rehab the existing roadway and add no additional lanes	29,000,000	7,000,000	22,000,000	(135,800)	21,864,200	(1)
G-3	Build a new 3 lane bridge adjacent to existing bridges; incorporate old bridge girders and piers	13,765,400	9,141,100	4,624,300	0	4,624,300	(2)*
G-3a	Build a new 3 lane bridge adjacent to existing bridges; incorporate old piers only	13,765,400	12,269,250	1,496,150	0	1,496,150	(2)*
G-7	Reconsider decision to overlay bridges and roadway prior to new construction	4,135,924	0	4,135,924	(606,000)	3,529,924	(1) (2)
PR-6	Use a barrier to reduce 30-foot clear zone to a 12-foot shoulder	15,152,639	10,767,068	4,385,571	0	4,385,571	(2)
ST-15	Improve detour routes	0	220,000	(220,000)	0	(220,000)	(1)

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.
(1) First of two suggested mixes. This mix maximizes the reuse of existing facilities.
(2) Second of two suggested mixes. This mix maintains the six lane concept.
* Use either G-3 or G-3a, but not both.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60

LOCATION: Frankfort, Kentucky

STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: G-2B

FUNCTION OF COMPONENT BEING CHANGED:

DESCRIPTIVE TITLE OF RECOMMENDATION: Rehab the existing 4 lane bridges

ORIGINAL DESIGN:

Widen I-64 to three lanes eastbound and westbound from US 127 interchange to US 60 interchange. A fourth truck climbing lane to be added eastbound between the east end of the Kentucky River bridge and the west end of the US 60 bridge. Three lanes to be carried westbound through the US 127 interchange and eastbound through the US 60 interchange. Four bridges to be replaced and one bridge to be widened. Stage construction to be used to maintain two lane traffic in each direction. With traffic using the existing roadway initial widening to be generally to the inside of the existing alignment placing sufficient roadway and shoulder to allow two lane traffic during the stage when the existing roadway is rebuilt to the new template.

RECOMMENDED CHANGE:

Place a high quality asphalt overlay over the roadway in each direction and replace the decks of the Kentucky River bridges. The decks of the Cedar Run Creek and Johnson Road bridges were overlaid during the summer of 1996 and rehab is not expected. Because there are no alignment changes, no rehab work is anticipated for the Henley Lane bridge over I-64 and the I-64 bridge over US 60. One lane traffic to be maintained at all times with no lane closures permitted during peak traffic hours. The lane closure to be generally during the night with work scheduled so that two lane traffic can be resumed for morning rush hour traffic. Day work shall likewise be scheduled to resume tow lane traffic for the afternoon rush hour. To minimize motorist inconvenience, the Kentucky River bridge deck replacement to be completed before beginning the roadway overlay. An Exodermic Deck system using precast concrete slabs to be specified to complete the deck replacement in the least amount of time. The current curb and parapet bridge railing to be replaced with barrier curbs.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	13,755,000	0	13,755,000
RECOMMENDED DESIGN	3,279,836	0	3,279,836
ESTIMATED SAVINGS OR (COST)	10,475,164	0	10,475,164

ADVANTAGES:

- Rehabilitating the roadway and bridges should maintain the current level of service for the next 20-30 years and delay the urgency to upgrade this portion of I-64 from 4-6 lanes.
- Allows time to plan needed improvements for incorporation into the widening project.
- Optimize the life cycle cost of the initial construction.

DISADVANTAGES:

- Traffic slowdown when one lane closure in place during non-peak traffic hours.
- Design variance to be required for deck replacement on Kentucky River bridge because standard shoulder width criteria cannot be met without adding beams.
- Rehabilitation instead of reconstruction will not alleviate traffic congestion during peak traffic hours due to heavy local traffic between US 60 and US 127.

JUSTIFICATION:

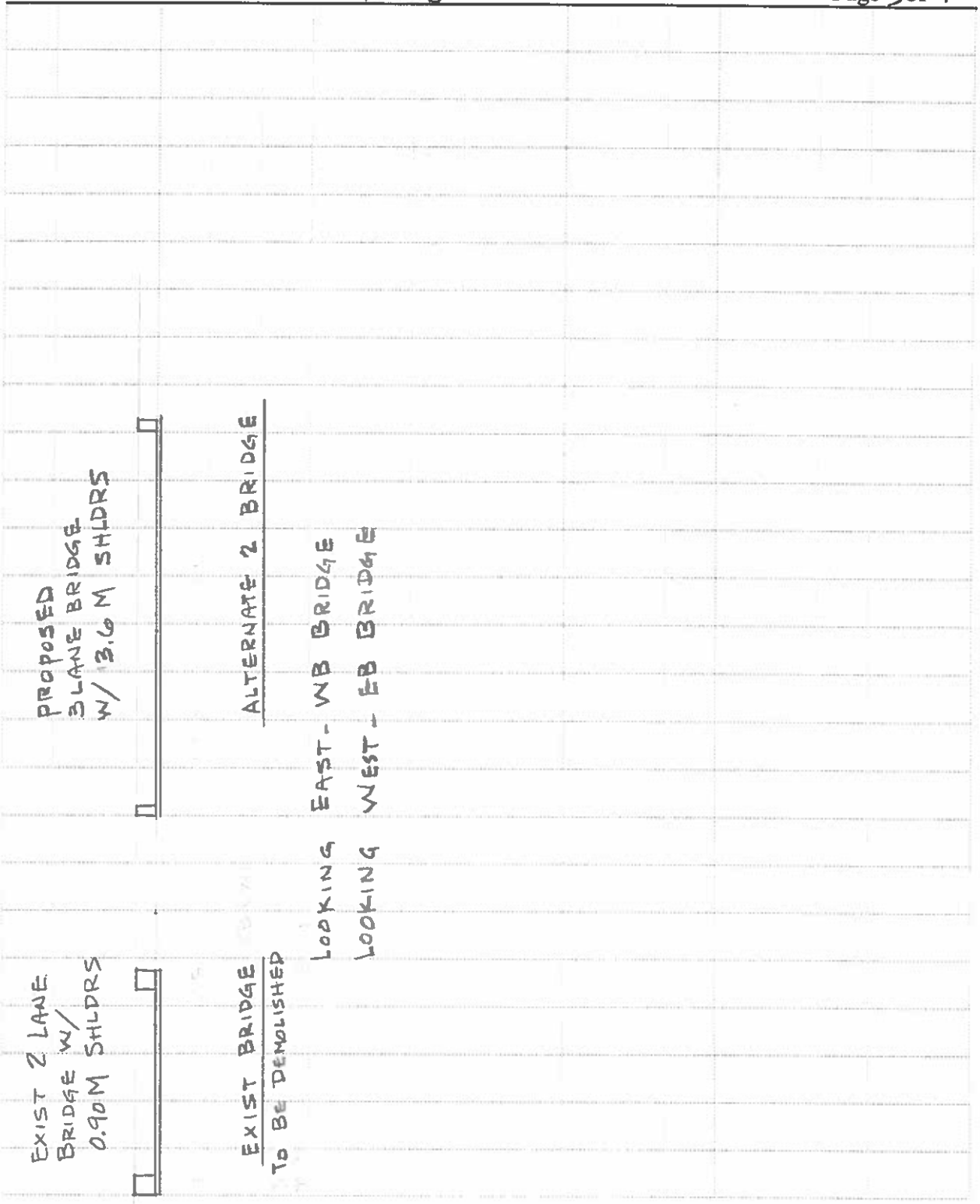
If repairs are made as recommended as a result of a 1988 in-depth inspection of the bridge, the remaining life in the bridge is predicted to be 20 to 30 years. The recommended repairs include moderate structural steel repairs and a complete deck replacement. Although a functional deficiency due to non-standard shoulder width cannot be alleviated without costly retrofit, a design variance exception may be obtained for non-standard shoulder widths for deck replacements on bridges over 400 feet in length. Rehabilitating the bridge and placing a high quality overlay on the roadway allows time to acquire adequate funding or, if funding is available, that money can be directed to other projects that may have a higher priority ranking. Rehabilitation will also allow time to plan an design needed upgrading at the I-64/US 60 interchange to improve traffic flow exiting I-64 on to US 60 and entering I-64 from US 60. If the requirement that two lanes of traffic be maintained at all times must be met without exception, then rehabilitation is not possible. However, several of the I-64 bridges between Frankfort and Louisville and portions of the roadway have been overlaid using a single lane closure. Single lane closures for the rehabilitation work are proposed only during non-peak traffic hours and work is to be scheduled so that both lanes can be used during peak traffic hours. The initial cost of rehabilitation is estimated to be 30% of the initial cost of widening. Since there are no structural deficiencies or other conditions that would jeopardize the predicted remaining life of the bridges, rehabilitation can be a cost effective option that permits additional time to plan and acquire funding. Public perception outside the local Frankfort area may question the priority ranking given to upgrade this portion of I-64 to six lanes when there are other roads in the state that have worse traffic congestion or worse road conditions.

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: G-2B

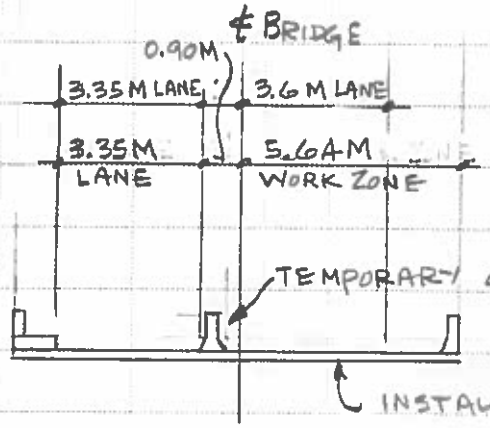


VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: G-2B



2 LANE TRAFFIC PEAK TRAFFIC HOURS

1 LANE TRAFFIC NON-PEAK TRAFFIC HOURS

BRIDGE REHAB

EB & WB

EXISTING BRIDGE TO BE RE-USED

NEW BRIDGE NOT NEEDED

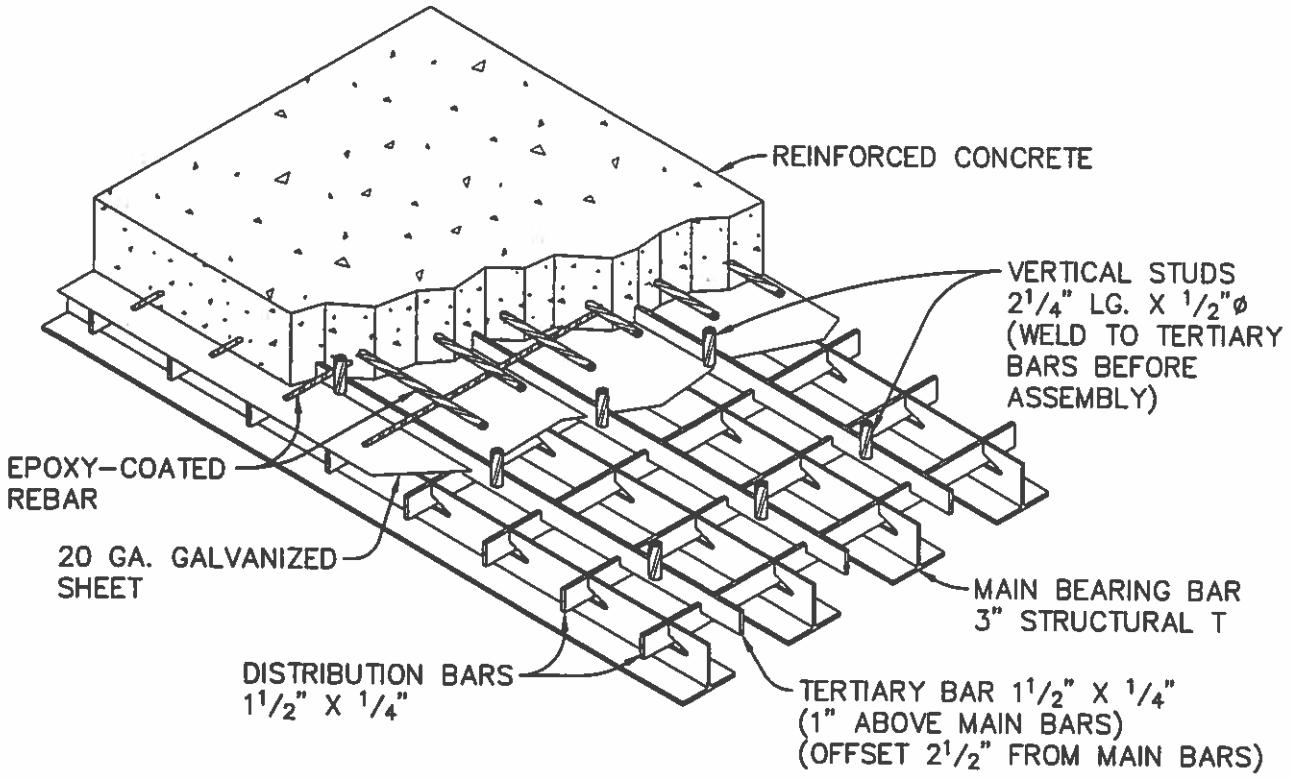
VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

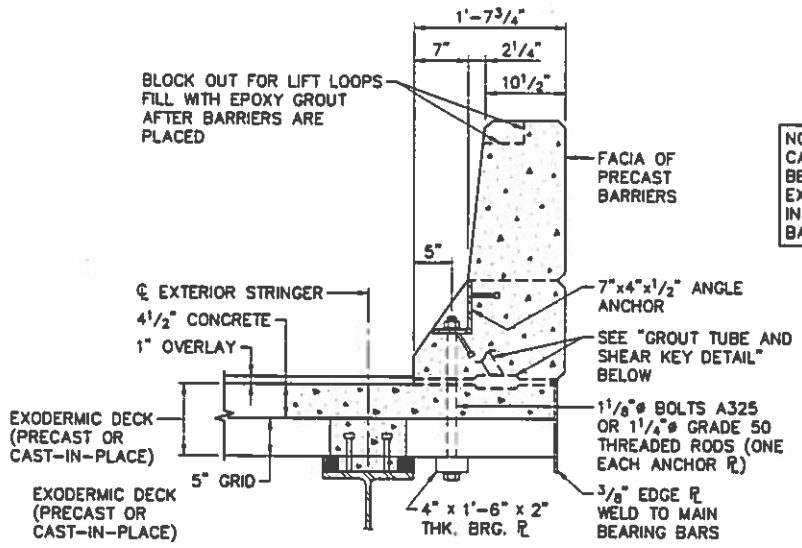
SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: G-2B

3" T GRID



BARRIERS



NOTE:
CAST-IN-PLACE BARRIER CAN BE USED, WITH REBAR FROM EXODERMIC DECK EXTENDING INTO FORM AND TIED TO BARRIER REINFORCEMENT.

PRECAST BARRIER SECTION

3-8

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: G-2B

BRIDGE LENGTH

$L = (225 \times 2 + 315) + 2 \times 1.3 = 767.6$ FT O/O DECK

CONC BARRIER

33×19.75	=	652
$-\frac{1}{2} \times (9.25 + 7.00) \times 20$	=	-163
$-\frac{1}{2} \times 7 \times 10$	=	-35
		454 SQ IN

$454 \text{ SQ IN} \times \frac{1}{144} \times \frac{1}{27} = .1168 \text{ CY/FT}$

VOL $= .1168 \times 767.6 \times 2 = 180$ CY/BRIDGE

$= 180 \times .764555 \times 2 = 275 \text{ M}^3$

REMOVE CONC

SLAB	765.4
PLINTH	74.8
	840.2 CY EA BRIDGE

$840.2 \text{ CY} \times .764555 \text{ M}^3/\text{CY} = 642.4 \text{ M}^3/\text{BRIDGE}$

AREA

$767.6 \times 37.00 = 28401$ SFT/BRIDGE

$= 2640$ SQ M/BRIDGE

MACH PREP

$767.6 \times 30.00 = 23028$ SFT/BRIDGE

$= 2140$ SQ M/BRIDGE

LATEX CONC OVERLAY

$23028 \text{ SFT} \times \frac{1.5}{12} = 2878$ CFT/BRIDGE

$= 81.5 \text{ M}^3/\text{BRIDGE}$

VALUE ENGINEERING RECOMMENDATION

FORM 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: G-2B

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Maintain traffic	LS.	1	7			1	100,000
Temp. conc. barrier	M	25	1			468	11,700
Remove concrete	M^3	222	1			1285	285,270
Exodermic deck	M^2	431	7			5280	2,275,680
Concrete barrier	M^3	445	1			275	122,375
Mach prep exit slab	M^2	12	1			4280	51,360
Blast cleaning	M^2	4.80	1			4280	20,544
Latex conc. overlay	M^3	980	1			163	159,740
Steel repair	L.S.	1	7			1	100,000
Mobilization	L.S.	1	1			1	78,167
Engineering	L.S.	1	7			1	75,000
Original design							
KY river design	L.S.	1	1	1	12,042,000		
Remove exist bridge	L.S.	1	1		1,713,000		
Totals					13,755,000		3,279,836

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 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60

LOCATION: Frankfort, Kentucky

STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: G-2R

FUNCTION OF COMPONENT BEING CHANGED:

DESCRIPTIVE TITLE OF RECOMMENDATION: Rehab the existing roadway and add no additional lanes

ORIGINAL DESIGN:

The original design moves the roadway alignment into the median. Three new lanes with shoulders and new ditches will be built in each direction. Most of the space occupied by the existing roadway will be used to build a 30 foot clear zone, improve the shoulder width and provide space for an 18 foot fall bench for the rock cut sections. An additional truck lane is provided for trucks u the hill in the eastbound direction beyond the Kentucky River bridge. All shoulders, guardrails, guardrail end treatments, and clear zone requirements are built to current design standards.

RECOMMENDED CHANGE:

The existing pavement life can be extended by twenty or more ears through pavement rehabilitation. The recommended method is breaking and seating of the existing concrete pavement and adding a thick asphalt base and surface on top. This asphalt surface would be approximately 8 inches total thickness. The shoulders are currently constructed with asphalt. The same thick overlay would be added to the shoulders. Shoulder asphalt could be added in variable lifts during construction and would enable the contractor to maintain an additional traffic lane on the shoulder to facilitate traffic flow. The inside and outside shoulders will be widened to current standards and slopes flattened to required limits. Obstacles in the clear zone will be removed or protected by guardrails or barriers. The existing guardrail throughout the project will be replaced and receive current safety end treatments. Additional guardrail will be installed when required unneeded guardrail will not be reinstalled. Acceleration/deceleration lengths will be lengthened when appropriate. Ramps will be resurfaced if needed.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	29,000,000	63,400	29,063,400
RECOMMENDED DESIGN	7,000,000	199,200	7,199,200
ESTIMATED SAVINGS OR (COST)	22,000,000	(135,800)	21,864,200

ADVANTAGES:

- Realizes a large saving in initial cost, $7 million versus $29 million.
- Eliminates cost of $3.2 million for temporary rehabilitation prior to the start of alternate 2 work.
- Provides new riding surface.
- Upgrades shoulders and guardrails to current standards.
- Avoids public perception of wasting useable pavement.
- Delays decision of widening I-64 from Lexington to Louisville.
- Can be completed in one construction season versus 3 years for alternate 2.

DISADVANTAGES:

- Delays from reducing I-64 to one lane each way at times.
- Project life approximately 10 years less than alternate 2.
- Will not improve level of service.
- Will not relieve truck congestion on eastbound hill.
- Will not improve rock fall condition.
- May need additional lanes before 20 year life is realized. May require FHWA to deviate from current roadway standards.

JUSTIFICATION:

The estimated cost of roadway in the original design, alternate 2, is $29 million. The expected life is 30 years. The approximate cost of the recommended change is $7 million. The expected life is 20 years. The additional 10 year life is provided at a cost of $22 million. The original design provides desirable features including a third lane, a clear zone, a fall bench, and a truck lane. The traffic volume, present and near future, does not require a third lane. The other features are considered desirable but not a necessity. The future widening of I-64 from Louisville to Lexington is understood to be some 20 years away. Deferring construction of alternate 2 provides more flexibility in planning this corridor. Fully utilizing the existing infrastructure and eliminating the need for temporary rehabilitation of the pavement should be seen as making the best use of assets.

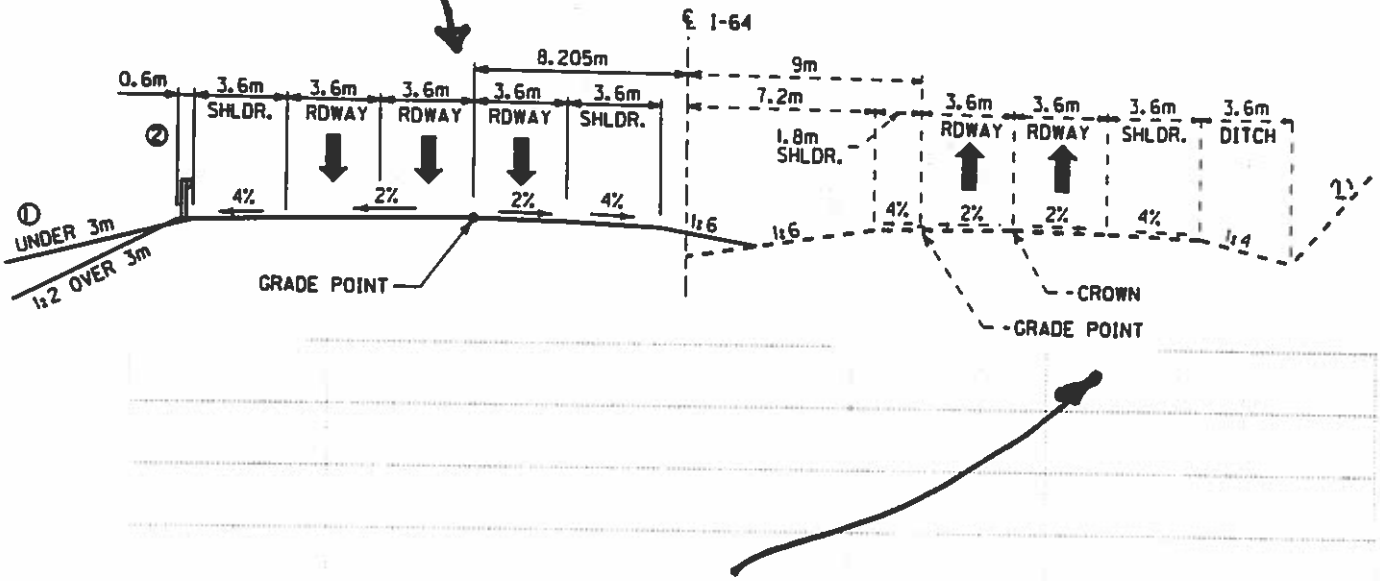
VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: G-2R

ORIGINAL DESIGN WILL ADD 3 LANES (AND A TRUCK LANE WHEN NEEDED). CONSTRUCTION IS TOWARD THE MEDIAN CONCRETE PAVEMENT IS USED.



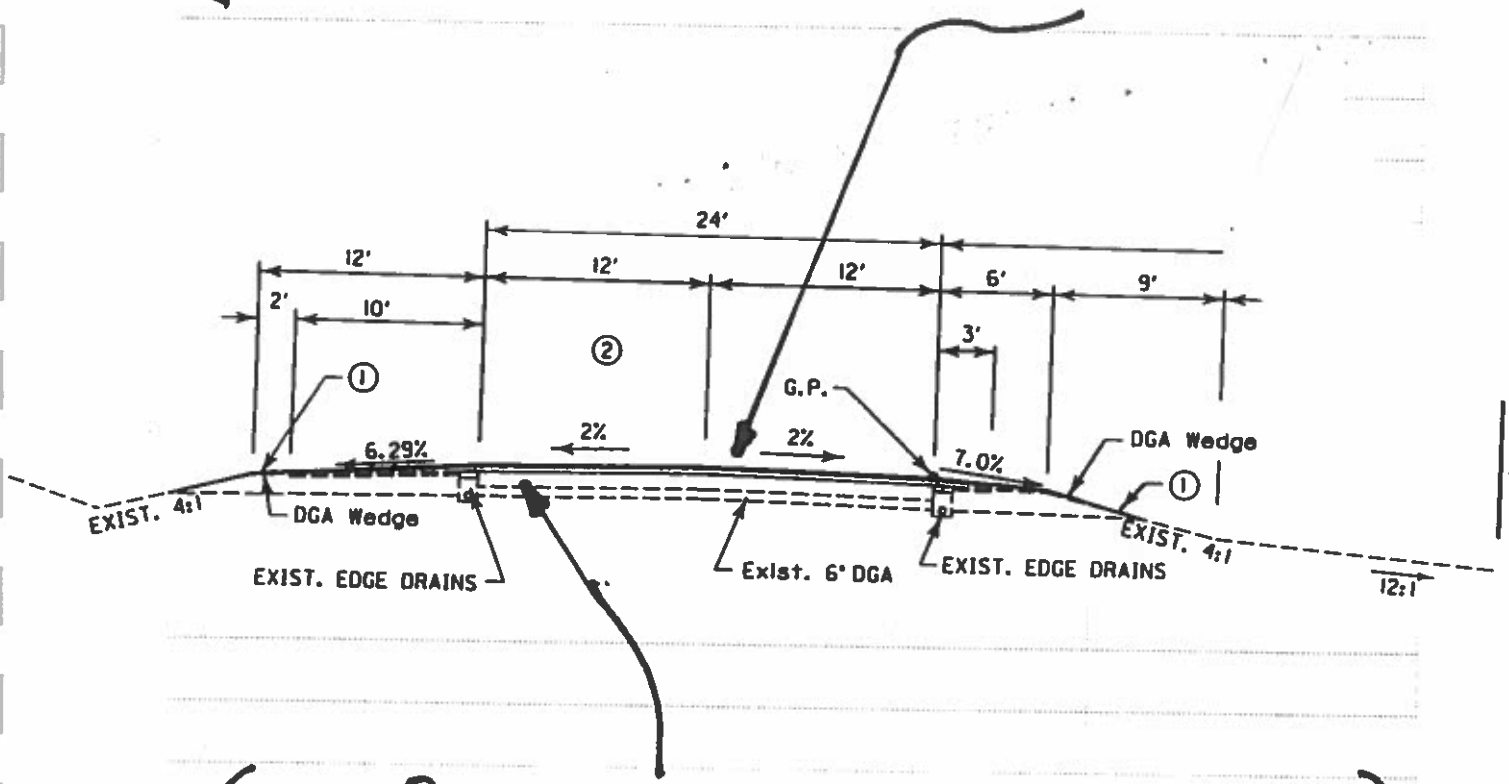
THE EXISTING ROADBED WILL BE USED TO PROVIDE FLATTER FILL SLOPES, A CLEAR ZONE (30'+), AND A ROCK BENCH IN THE CUTS.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966 **SKETCH OF RECOMMENDED DESIGN**

IDENTIFICATION NUMBER: G-2R

BREAK AND SEAT THE EXISTING PAVEMENT. ADD THICK OVERLAY TO LANES AND SHOULDERS. ADD POLYMERS TO EXTEND LIFE



8 INCHES TOTAL THICKNESS ON LANES AND SHOULDERS

IN 1994 A PROJECT COMPARABLE TO THIS ONE WAS CONSTRUCTED ON I64 APPROXIMATELY 15 MILES EAST OF THE PROPOSED SITE. THE PROJECT COST WAS $1,044,780 /PER MILE. THE PROJECT LENGTHS ARE SIMILAR. HOWEVER, NO LARGE ROCK CUTS WERE INVOLED AND THE TERRAIN WAS FLATTER. SIMILAR PROJECTS STATEWIDE ARE IN THIS COST RANGE.

RECOMMENDED PROJECT LENGTH 4.78 MI

EXCLUDE BRIDGE LENGTH - 0.26 MI

NET LENGTH 4.52 MI

ESTIMATED COST* 4.52 (1,044,780) = $4,722,406

*INCLUDES BREAK, SEAT, OVERLAY ROADWAY AND SHOULDERS, IMPROVE SHOULDERS AND SIDE SLOPE, RESEED, INSTALL PAVEMENT EDGE DRAINS, AND TRAFFIC CONTROL

ADDITIONAL COST** $2,277,594

** INCLUDES Polymers FOR ASPHALT, ADDITIONAL EARTH WORK, ADDITIONAL TRAFFIC CONTROL, ADDITIONAL GUARDRAIL

TOTAL ESTIMATED COST $7,009,000

(BRIDGE COSTS ARE PRESENTED SEPARATELY)

Compare 2 Lane Asphalt (G-2) with 3 Lane Concrete (Alt 2)

2 Lane Asphalt (Recommendation G-2R)

At 10 year intervals will need to mill and overlay

Road Length = 4.52 miles

Asphalt width = 2 lanes = 24'

Total asphalt area = 53211 m^2

Cost to mill and overlay = \$3.30/m^2 = \$176,000

3 Lane Concrete (Alt 2)

At 25 year - re seal joints

Road Length = 4.52 miles = 4.52(5280) = 23,865.6'

Assume joint between each lane = 4 joints = 95,462.4' of jt

Assume transverse joint every 25' @ 3×12 length = 36' jt

Length transverse joint = $\frac{23,865.6}{25} \times 36 = 34,366.5'$

Total length of joint = 129,829' = 129,900

@ \$1.30/LF = \$168,870

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: G-2R

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
A/C pavement 8"	Mile	1,044,780	7			4.52	4,722,406
Add polymers, etc.	Mile	503,892	7			4.52	2,277,594
Alternate 2 roadway	L.S.		1		29,000,000		
Totals					29,000,000		7,000,000

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: G-2R

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

Dollars in table are $ times 1,000

Initial Costs				Original Design PW $		Reccomd Design PW $
				29,000		7,000
Sub Totals of Initial Costs PW $				29,000		7,000

Later Costs Single Expenditure	In The Yr	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Mill & overlay	10	.6756	0	0	176	118.9
Mill & overlay	20	.4564	0	0	176	80.3
Reseal joints	25	.3751	168.9	63.4		
Sub Total of Single Expenditure Costs PW $				63.4		199.2

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				29,063.4		7,199.2
Total PW $ Savings (or Added Cost) for Recommended Design						21,864.2

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60
LOCATION: Frankfort, Kentucky
STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: G-3
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Build a new 3 lane bridge adjacent to existing bridges; incorporate old bridge girders and piers

ORIGINAL DESIGN:

The original design proposes the construction of a completely new three lane (with full shoulders) bridge each direction. Construction will be in the median between existing bridges. The existing bridges will carry traffic until the new bridges are traffic ready, then they will be demolished.

RECOMMENDED CHANGE:

The recommended method is to build a new structure immediately beside the old one. The new bridge will be at least three lanes wide. When this new structure can be opened to traffic, the deck of the old bridge will be replaced. A new deck is added and the resulting structure, existing bridge plus adjacent new bridge, is 3 lanes and 2 shoulders wide. The existing beams are incorporated into the "new" bridge.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	13,765,400	0	13,765,400
RECOMMENDED DESIGN	9,141,100	0	9,141,100
ESTIMATED SAVINGS OR (COST)	4,624,300	0	4,624,300

ADVANTAGES:

- Fully utilizes existing superstructure and substructure
- No disruption of two lane traffic flow on bridges
- Gives a public perception of an effort to conserve resources
- No demolition cost
- Less encroachment into median
- Less disturbance in flood plain
- Less realignment

DISADVANTAGES:

- Fixes span lengths on river portion of bridge
- Must protect existing piers and girders during construction
- Incorporates old girders into final product
- Old girders are still non-redundant
- May have differential settlement
- Will require moderate repairs to steel
- Will be difficult to repair or replace old beams if required in future

JUSTIFICATION:

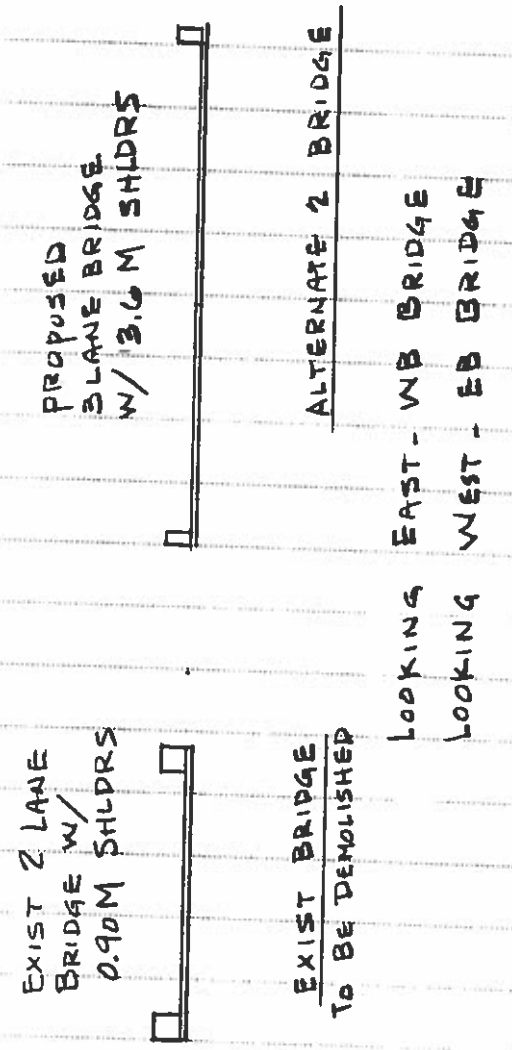
The 1988 bridge report (Burgess & Niple) gives the bridge 40-50 years (from 1988) of additional life. The bridge deck is to be replaced and will be new. Prudent use of state funds would suggest that it would do well to not demolish and replace two river bridges that appear to have 30-40 years of additional life left. This recommendation saves both bridges while meeting all project requirements (including the requirement to maintain 2 lane traffic both ways at all times). This is done at a savings of several million dollars for the state that can be allocated to some other project. This recommendation will also save construction time.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: G-3

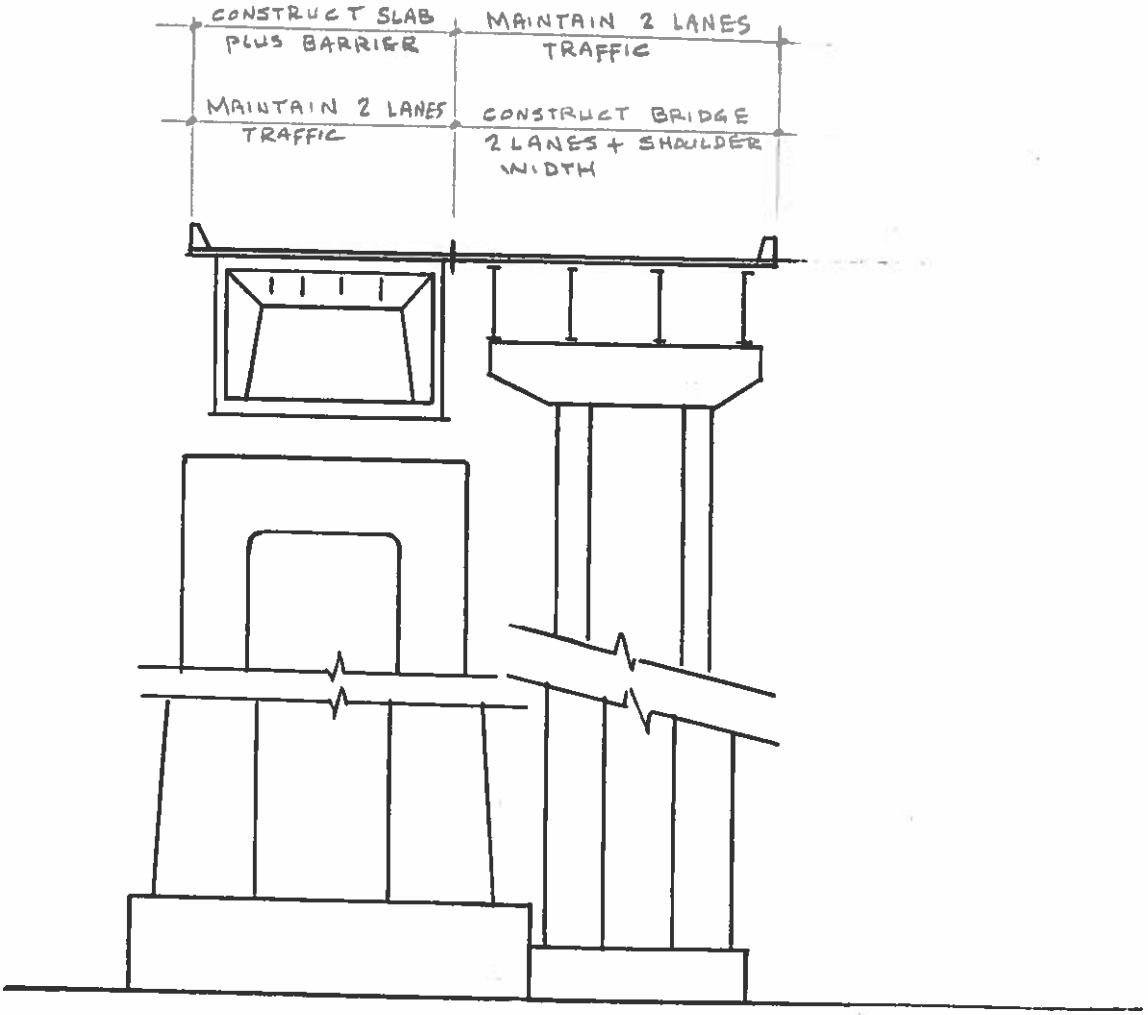


VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: G-3



VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: G-3

KY RIVER BRIDGE

ALT 2 COST FOR 2 LANES & ONE SHOULDER

REMOVE ONE 3.6 M LANE
3.6 M SHLDR
0.5 M BARRIER
7.7 M

AREA REMOVED = 238 M x 7.7 M = 1832.6 M

SUPER COST = $\frac{\$4538,712}{4522 \text{ SQ M}} \times (4522 - 1833) = \$2,699,000$

SUB COST = 1,881,120 - 399,600 = 1,481,520

$4,180,520 EB & WB

PLACING NEW DECK ON EXIST STEEL

USE CONC AND REBAR FROM AS BUILT

765 CY x .764 555 = 585 M^3

153,000 LBS x .453 592 = 69 400 KG

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: G-3

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Alt. 2 EB-modified	L.S.					1	4,180,520
Alt. 2 WB-modified	L.S.					1	4,180,520
Conc. Class "AA"	M^3	388				1170	453,960
Epoxy rebar	.KG	1.50				139,000	208,500
Struct. Steel repair	L.S.					1	100,000
Shear conn.	L.S.					1	17,600
Alt. 2 EB	L.S.			1	6,871,600		
Alt. 2 WB	L.S.			1	6,893,800		
Totals					13,765,400		9,141,100

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 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60
LOCATION: Frankfort, Kentucky
STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: G-3a
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Build a new 3 lane bridge adjacent to existing bridges, incorporate old piers only

ORIGINAL DESIGN:

The original design proposes the construction of a completely new three lane (with full shoulders) bridge in each direction. Construction will be in the median between existing bridges. The existing bridges will carry traffic until the new bridges are traffic ready, then they will be demolished.

RECOMMENDED CHANGE:

The recommended method is to build a new structure immediately beside the old one. This new bridge will be two lanes plus a shoulder. When this new structure can be opened to traffic the deck and beams from the old bridge will be demolished. The old pier will be modified to enable new beams of like size to be incorporated into the "new" structure.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	13,765,400	0	13,765,400
RECOMMENDED DESIGN	12,269,250	0	12,269,250
ESTIMATED SAVINGS OR (COST)	1,496,150	0	1,496,150

ADVANTAGES:

- Fully utilizes existing substructure
- No disruption of two lane traffic flow on bridges
- Gives a public perception of an effort to conserve resources
- Lower demolition cost
- Less encroachmen into median. No repairs to old steel.
- Less bisturbance in floodplain
- Less realignment
- Eliminates non-redundancy
- Differential settlement can be addressed more easily
- Uniform strength and durability is provided in superstructure

DISADVANTAGES:

- Fixes span lengths on river spans
- Must protect piers during construction
- May have differential settlement
- Allows less variance in roadway realignment
- Difference in age of substructure components

JUSTIFICATION:

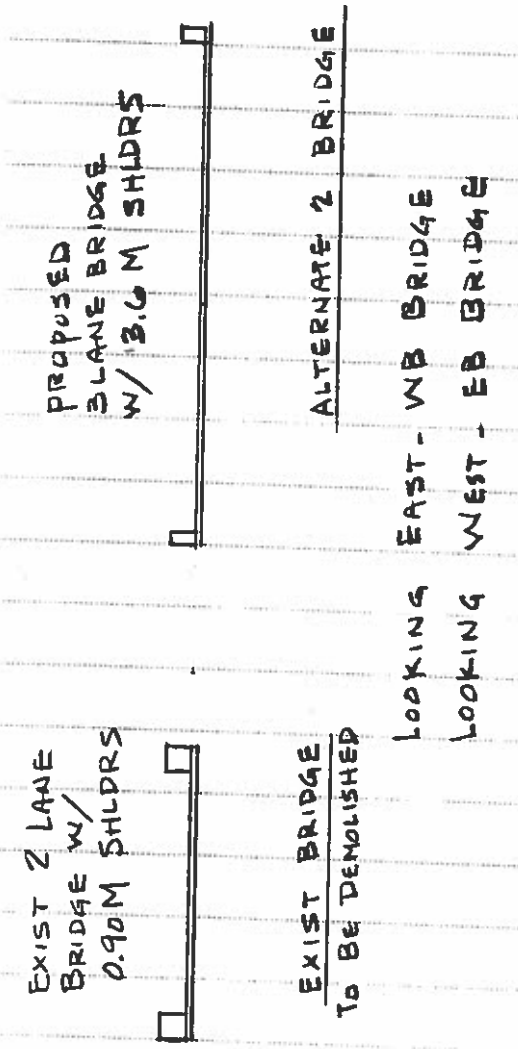
The 1988 bridge report (Burgess & Niple) gives the bridge 40-50 years (from 1988) of additional life. The bridge deck is to be replaced and will be new. Prudent use of state funds would suggest that it would not be wise to demolish and replace two river bridges that appear to have 30-40 years of additional life left. This recommendation saves both bridges while meeting all project requirements (including the requirement to maintain 2 lane traffic both ways at all times). This is done at a savings of several million dollars for the state that can be allocated to some other project. This recommendation will also save construction time.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: G-3A

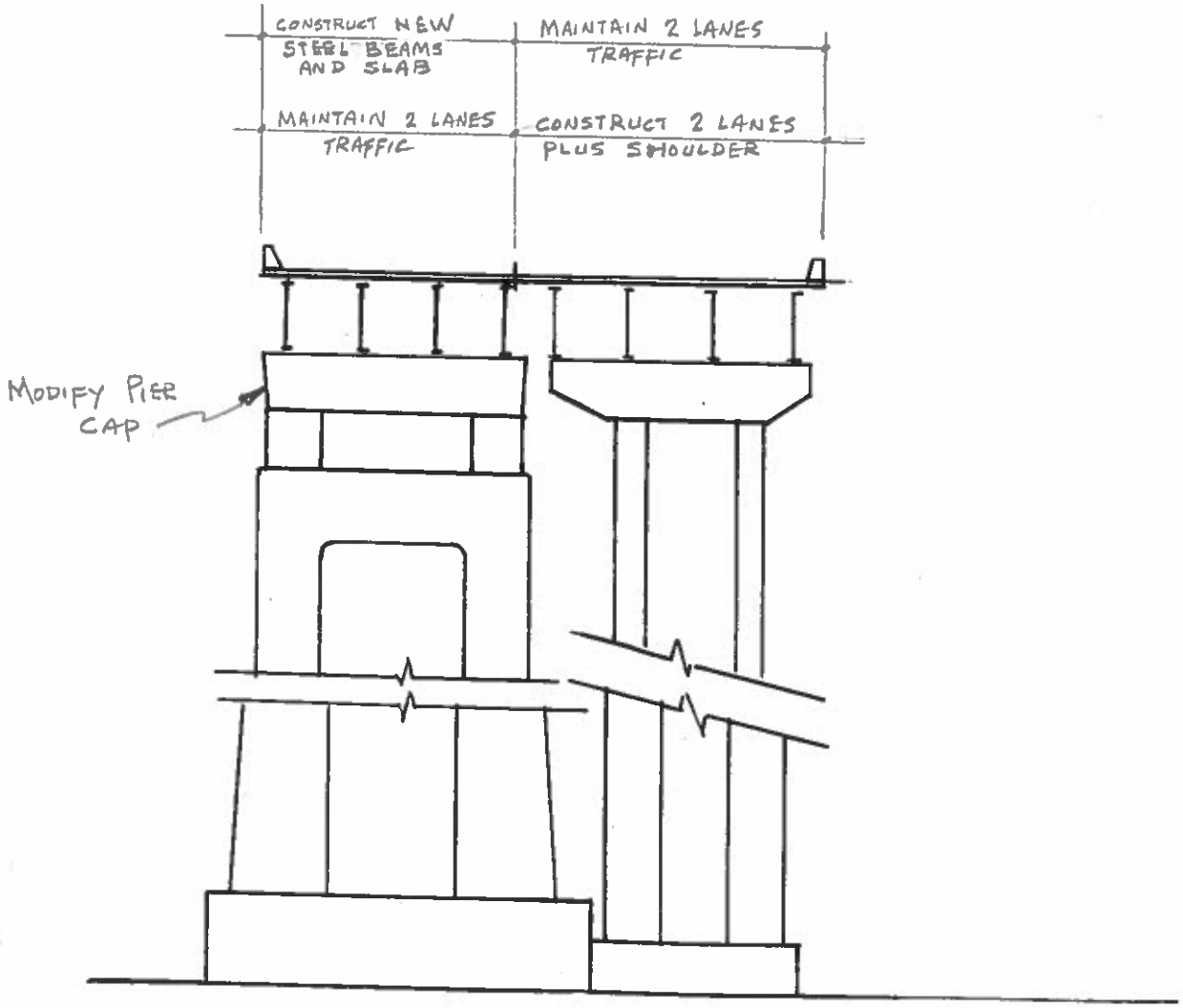


VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: G-3A



VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: 4-3A

KY RIVER BRIDGE

PLACING NEW DECK AND NEW STEEL

NEW STRUCT STEEL

AREA = 238 M x (3.6M x 2 + 1M) = 1952 SQ M

STEEL WGT = $\frac{1952}{4522}$ x 1,511,503 = 652,500 KG

NEW CONC DECK 585 M^3

NEW REBAR 69400 KG

VALUE ENGINEERING RECOMMENDATION

FORM: 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: G-3a

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Alt. 2 EB-modified	L.S.					1	4,180,520
Alt. 2 WB-modified	L.S.					1	4,180,520
Conc. Class "AA"	M^3	388				1170	453,960
Epoxy rebar	.KG	1.50				139,000	208,500
Struct. Steel repair	KG	2.43				1,305,000	3,171,150
Shear conn.	L.S.						17,600
Bearing-Ty 2	EA	1500				18	27,000
Bearing-Ty 3	EA	5000				6	30,000
Alt. 2 EB	L.S.			1	6,871,600		
Alt. 2 WB	L.S.			1	6,893,800		
Totals					13,765,400		12,269,250

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 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60
LOCATION: Frankfort, Kentucky
STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: G-7
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Reconsider decision to overlay bridges and roadway prior to new construction

ORIGINAL DESIGN:

This is not a part of the original design but was a decision made by the transportation cabinet. The intent is to upgrade to condition of the existing bridge and roadway pavement to a level that will be accepted by the public. It is expected that the construction project will last 3 years and the existing pavement and bridge deck will not last that long. This rehab project will begin in spring 1997. The construction project will most likely begin in spring 1998. The estimated cost is approximately $3,200,000 which includes $500,000 for the bridge deck repairs. The estimated additional use provided is 5 years for the roadway and 10-15 years for the bridge deck.

RECOMMENDED CHANGE:

It is recommended that this amount of money not be spent on items that will be replaced or reconstructed in less than 3 years. Rather than providing a total overlay of the entire route consider patching only those areas that are unacceptable now and include items in the construction contract to repair other sections when and if they deteriorate. As a minimum, the proposed overlay should be delayed until the reconstruction/widening plans are completed and a method to maintain and control traffic are discussed.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	4,135,924	0	4,135,924
RECOMMENDED DESIGN	0	606,000	606,000
ESTIMATED SAVINGS OR (COST)	4,135,924	0	3,529,924

ADVANTAGES:

- The public will not understand the destruction/removal of pavement that was "paid for" only 1-2 years ago.

- If the break and seat option is used to produce the final riding surface, then this recently added material must be removed at an additional cost. This removed material can be recycled but the dollar savings will become the property of the contractor.

DISADVANTAGES:

- Without short term improvements, the riding quality of the roadway will get worse and "may" not be acceptable by the time the project is completed 3-4 years from now.

JUSTIFICATION:

The justification is in the savings of the $3,200,000 initially spent to do the preliminary rehab and the potential cost of approximately $940,000 to remove it if the break and seat operation is utilized. This gives a total amount of $4,140,000. These funds could be used to fund part of the long range construction project or other projects. We could be criticized for spending over $4,000,000 on a temporary measure that might not be needed. This recommendation makes sense because it suggests a wait and see, spending only what is needed.

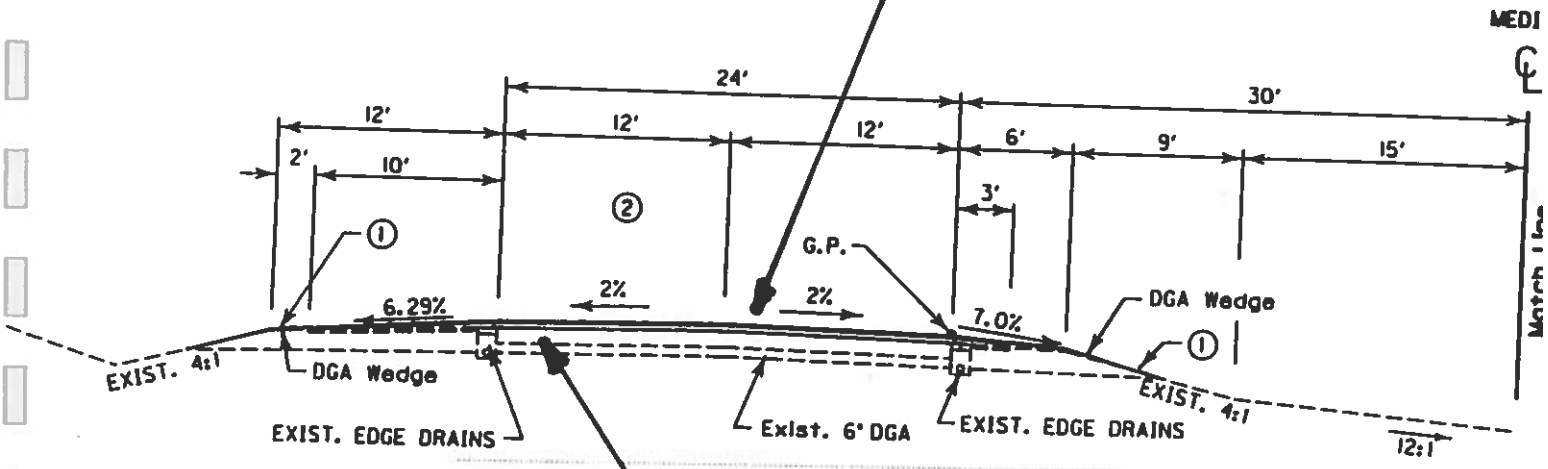
VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: G-7

ORIGINAL DESIGN
ADD 4 INCHES ASPHALT WITH
Polymer MODIFIERS THROUGHOUT
THE PROJECT



ADD 4" INCHES IN THE DRIVING
LANES AND A VARIABLE
TAPER ON SHOULDERS

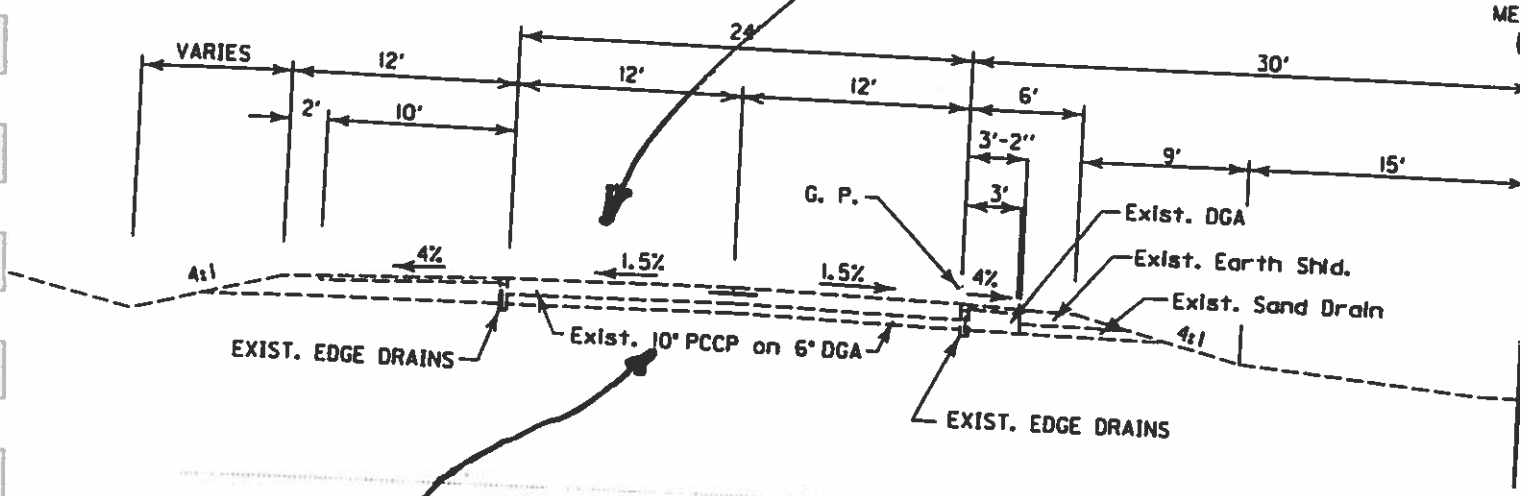
VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER:

{RECOMMENDED DESIGN
PATCH OR REPAIR ONLY
WHEN NEEDED}



{EXISTING ROADWAY
ONE DIRECTION SHOWN}

REHAB COST $3,195,926 - SEE ATTACHED SHEETS

COST TO REMOVE PRIOR TO BROAK AND SEAT

LEVEL & WEDGE	3000	TONS
SURFACE	17,351	TONS
BASE	28,919	TONS
	49,270	TONS

REMOVAL

BITUMINOUS PAVEMENT MILLING & TEXTURING

1996 AVERAGE UNIT COST $19.0785 / TON

49,270 (19.0785) = $939,998

WITH PRE-CONSTRUCTION REHAB OF ROADS & BRIDGES

Assume no significant maintenance required through construction $0

WITH NO PRE-CONSTRUCTION REHAB OF ROADS & BRIDGES. REPAIR AS NEEDED.

- Assume that over 3 years there will be $500,000 spent in required fixes of problems,

$= \frac{500,000}{3} = \$166,667/\text{YR}$ maintenance.

- Must keep road open for 4 years till end of construction

2001 End of Construction
1997
4 YRS

$166,667/YR FOR 4 YRS

KENTUCKY TRANSPORTATION CABINET
DIVISION OF HIGHWAY DESIGN
PAVEMENT BRANCH

TD 61-29A
REV. 1-95

Pavement Design

Sheet 1

County Franklin Item 99-2020.00 UPN FD52 037 0064 053-058 021 D

Road Name I-64 (Lexington - Louisville Road) F.P. NH 0644 077

From U.S. 127 (M.P. 53.12) TO U.S. 60 (M.P. 57.90).

Repair AC Overlay and Guardrail

Traffic 29,000, 1996 52,400, 2020 E.S.A.L. 3.3×10^7 (20 yrs.)

Existing PCC on DGA Thickness 10" ON 6"

Length 4.78 miles. Design Speed 65 M.P.H. Design CBR 4 (Est.)

FOR TYPICAL SECTION SEE ATTACHED SHEET(S)

PAVEMENT

Traffic Lanes		
190	BIT MIX FOR LEVEL & WEDGE PG 64-22	TON(Est. from X-Sect.)
120	BIT CONC BASE CLASS I PG64-22	2 3/4" DEPTH
159	BIT SURF CL I-40/20 PG76-22/ER	1 1/4" DEPTH
356	BITUMINOUS MATERIAL FOR TACK	SEE PLAN NOTE NO. 453

SHOULDERS

1	DGA BASE	WEDGE
190	BIT MIX FOR LEVEL & WEDGE PG 64-22	TON(Est. from X-Sect.)
120	BIT BASE CLASS I PG64-22	2 3/4" DEPTH
149	BIT CONC SURF CL I-0 PG64-22	1 1/4" DEPTH
356	BITUMINOUS MATERIAL FOR TACK	SEE PLAN NOTE NO. 453

Bituminous Seal required from outside edge of paved shoulder to a point where the DGA ties into the existing ditch or fill slope. Two applications of the following:

291	EMULSIFIED ASPHALT RS-2	2.40 LB/SQ YD
100	BITUMINOUS SEAL AGGREGATE	20 LB/SQ YD (Size No. 8 or 9M

(Cont. on Sheet No. 2)

SUBMITTED _____ DATE _____ Asst. Dir., Division of Design

RECOMMENDED _____ DATE _____ Director of Design

APPROVED _____ DATE _____ Asst. State Highway Engineer

APPROVED _____ DATE _____ For Division Administrator FHWA

3-36A

PAVEMENT (Cont.)

NOTES:

(1) All work in the median shall be done so as to insure positive drainage to all existing drainage structures.

(2) The Contractor is advised that the compaction of asphalt mixtures furnished for mainline usage, at 25mm (one inch) or greater, on this project will be accepted by OPTION A of the **Special Note for Control and Acceptance of Asphalt Mixtures (8b)**. The compaction of all other asphalt mixtures will be accepted by OPTION B.

(3) A quantity of Bituminous Mix for Level and Wedge PG64-22 has been included t correct the pavement cross slope from 1.5% to 2%.

(4) Bituminous Overlays for the Mainline shall be carried to the Ramp Nose. Fr the Ramp Nose, the Overlay shall be tapered to zero inches at a rate of 1" p 100'.

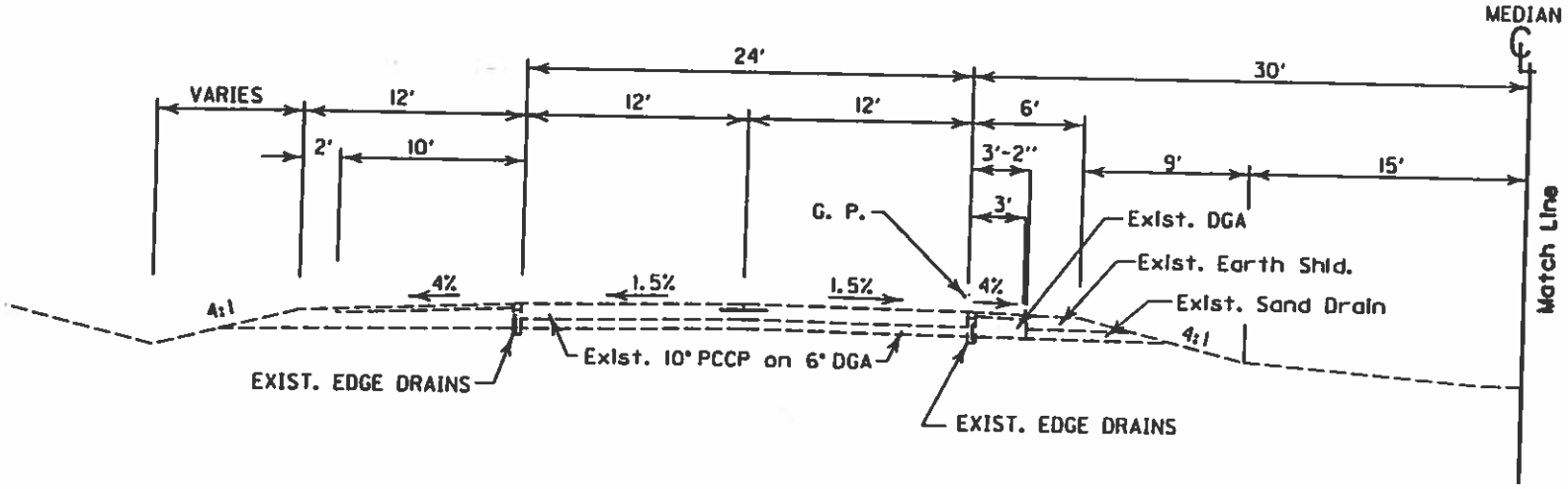
(5) Removed Guardrail shall be delivered to the Franklin County Maintenance Barr

PLAN NOTE NO. : 444; 446

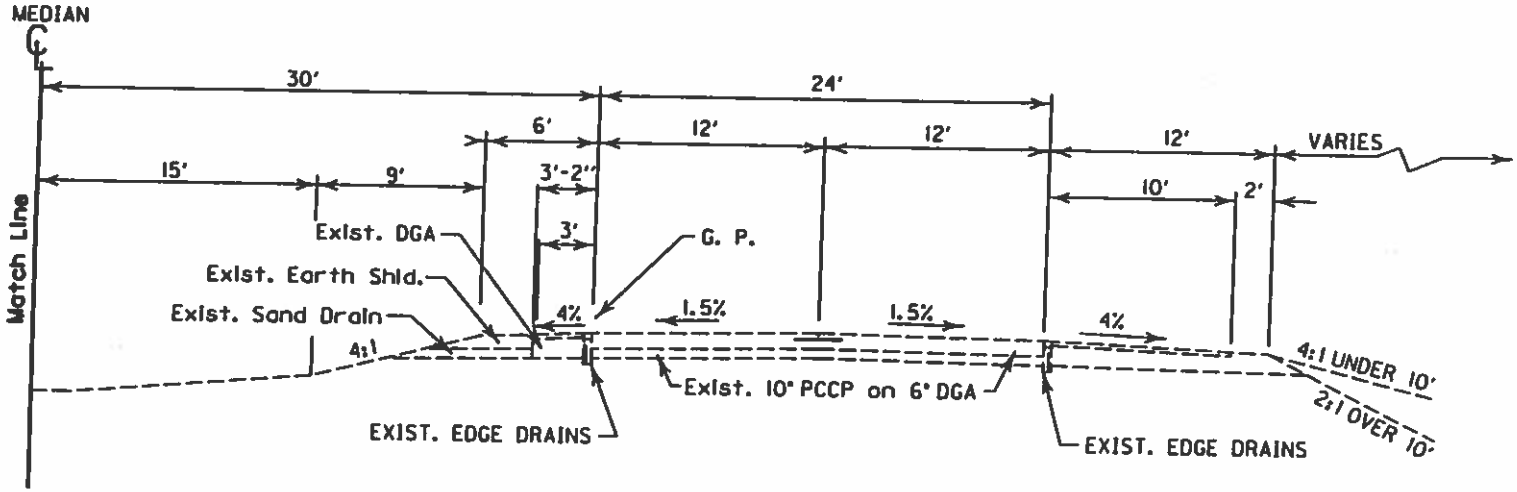
SPECIAL PROVISION
(1043) No. 43F (94)MARSHALL DESIGN METHOD CRITERIA CLASS I MIXTURES
(1094) No. 94 (94)COMPACTION TEST STRIPS CLASS I MIXTURES

SPECIAL NOTE FOR
(2067) BITUMINOUS INDENTED RUMBLE STRIPS (5-2-95)
(2094) POLISH RESISTANT AGGREGATE REQUIREMENTS (6-6-95)
(2100) CONTROL AND ACCEPTANCE OF ASPHALT MIXTURES (3-20-96)
( ) PERFORMANCE GRADED ASPHALT BINDERS (9-30-96) ATTACHED

Franklin County
Item # 99-2020.00
NH 0644 077



WESTBOUND LANES



EASTBOUND LANES

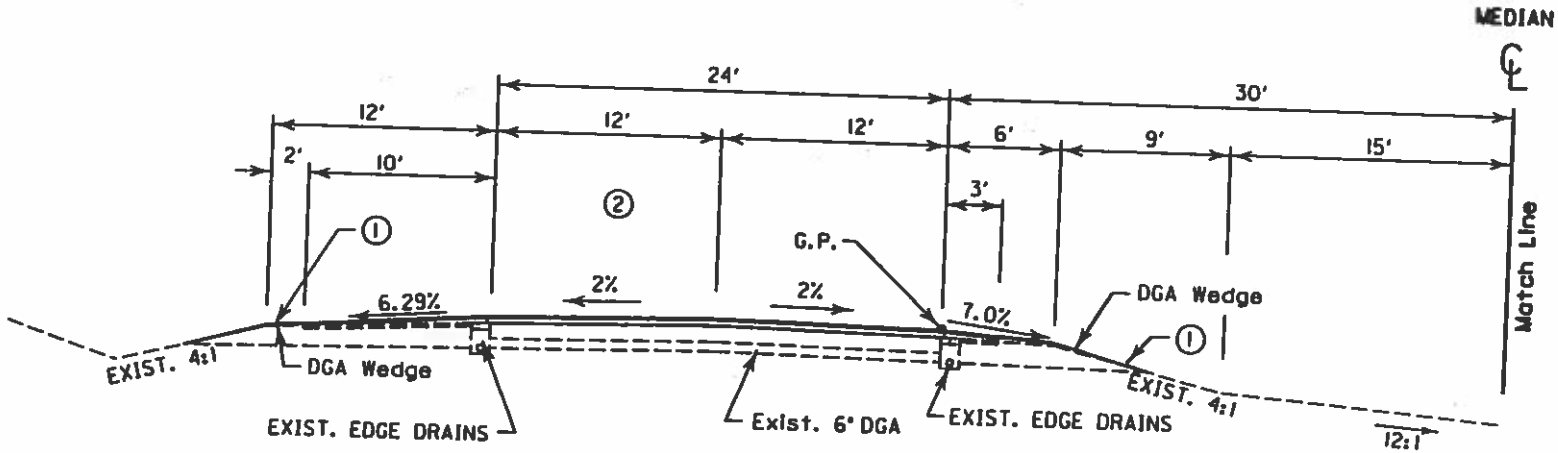
3-362

Existing Typical Tangent Section

Lexington - Louisville Road (I-64)

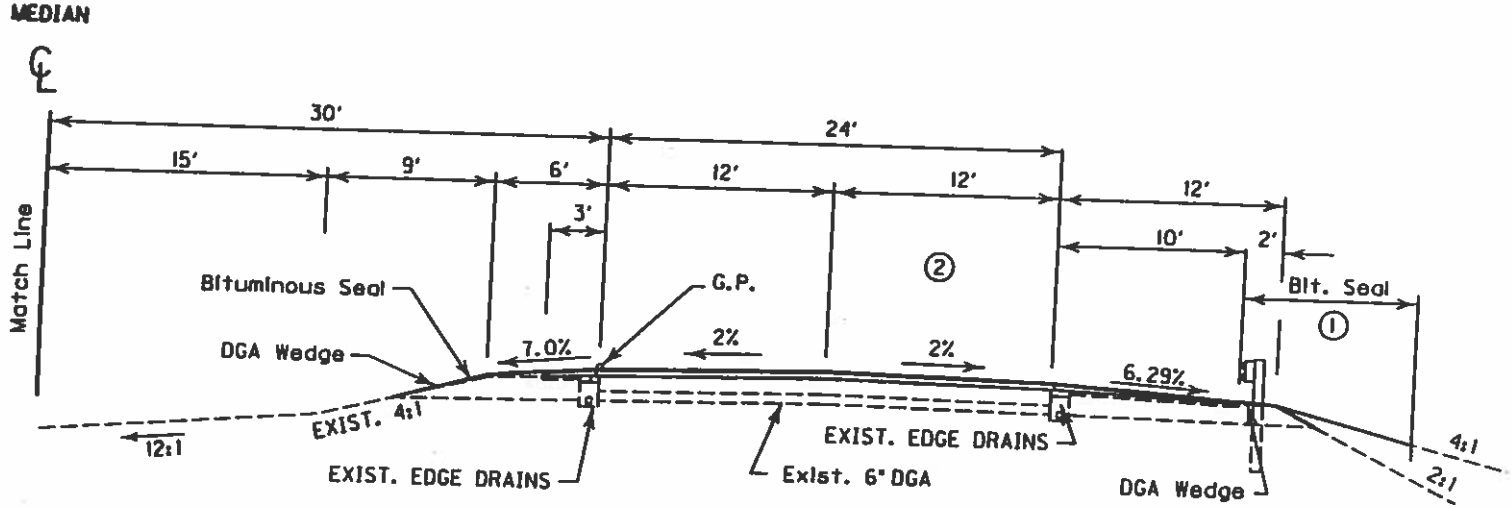
Sheet 3

Franklin County
Item # 99-2020.00
NH 0644 077



WESTBOUND LANES

① Bituminous Seal.
② See Overlay Detail



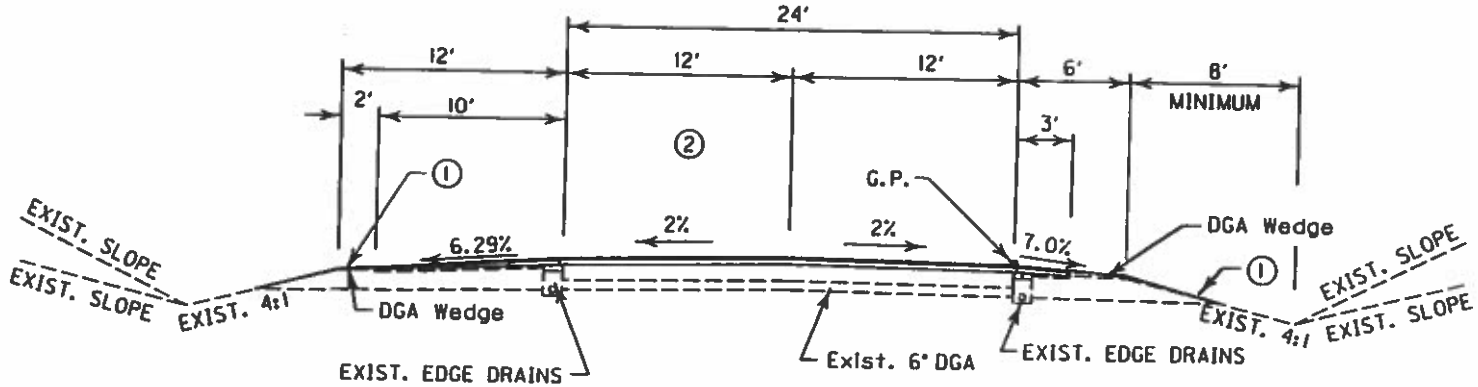
EASTBOUND LANES

Proposed Typical Tangent Section

I-64

3-360

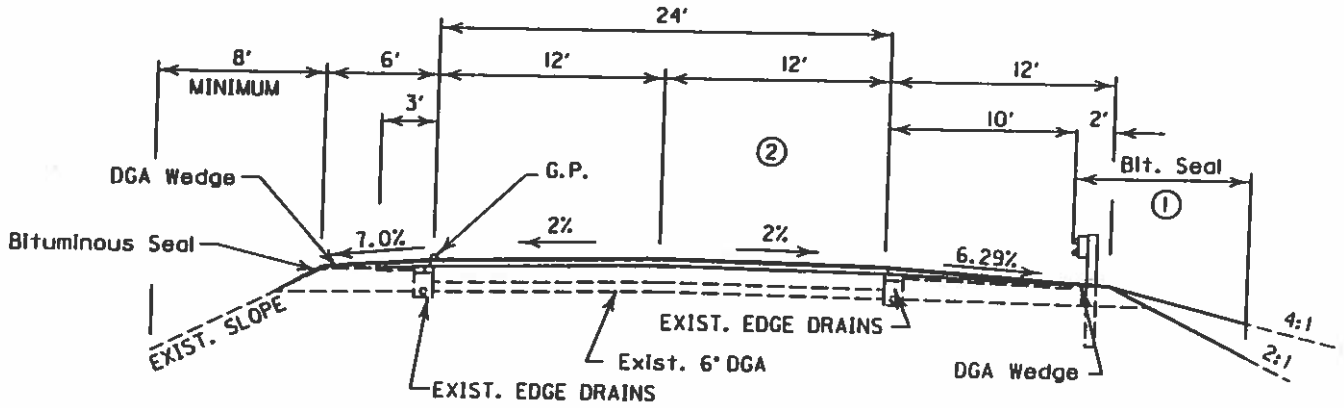
Sheet 4



WESTBOUND LANES

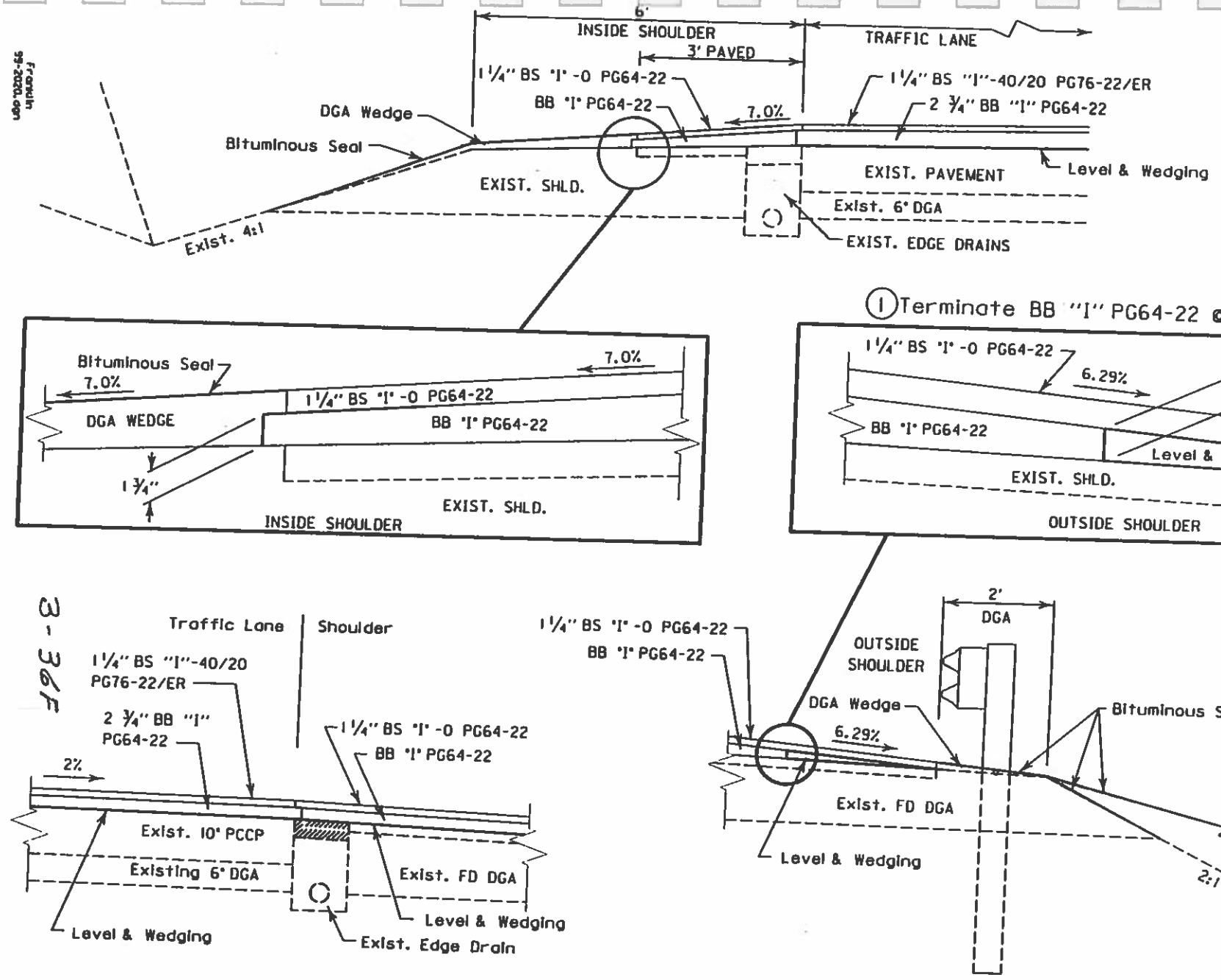
① Bituminous Seal.
② See Overlay Detail

3-36E



EASTBOUND LANES

Proposed Typical Bifurcated Tangent Section



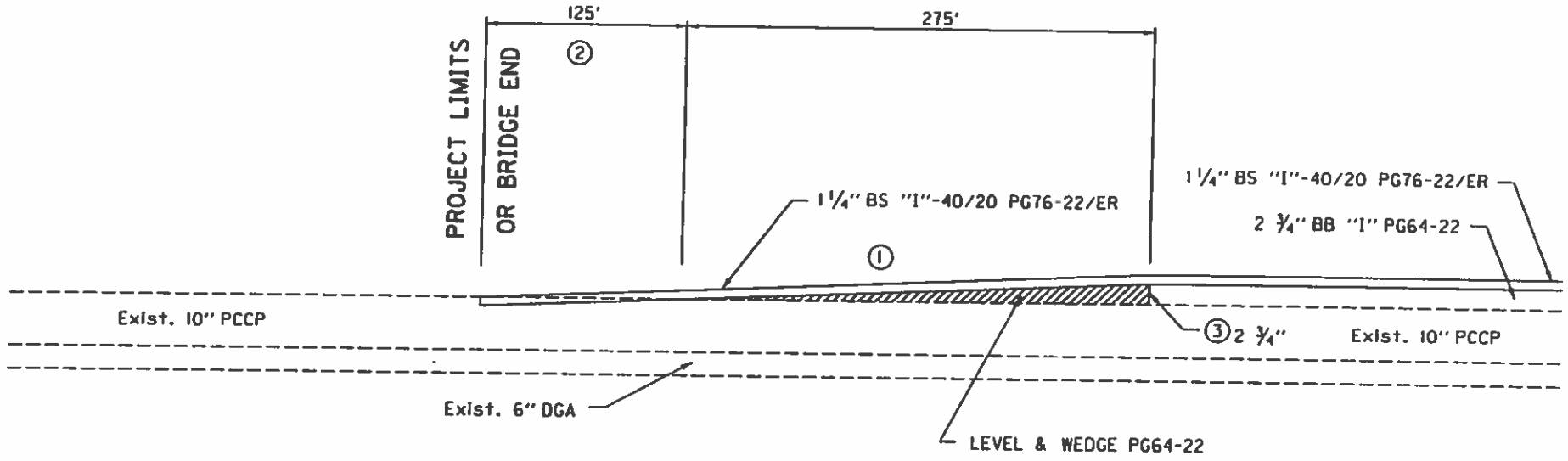
OVERLAY DETAIL I-64

FD52 037 0064 053-058 021 D

Sheet 6

Franklin County
Item # 99-2020.00
NH 0644 077

Franklin 99-2020.00



3-369

① Taper @ 1":100'
② Mill existing pavement to receive 1¼" Bituminous Concrete Surface Class "I"-40/20 PG76-22/ER
◯ 3 Terminate BB "I" PG64-22 @ 2 ¾" thickness
④ Taper Ramps in similar fashion.

TAPERING OF OVERLAYS AT PROJECT TERMINI AND BRIDGE ENDS
I-64
FD52 037 0064 053-058 021 D

Sheet 7

SPECIAL NOTE FOR PERFORMANCE GRADED ASPHALT BINDERS

The asphalt pavement for this project is specified in accordance with the Superpave Performance Grading System for Asphalt Binders. The following comparison of conventional grading versus performance grading is provided for reference:

Conventional Grade	Performance Grade
AC 10	PG 58-22
AC 20	PG 64-22
PMAC-1C	PG 70-22
PMAC-1D	PG 76-22 with 50% Elastic Recovery

All asphalt pavement on this project will be bid as and will meet the specifications for a performance graded asphalt PG64-22.

September 30, 1996

3-36H

COST FOR REHAB PRIOR TO CONSTRUCTION

FROM DIVISION OF DESIGN - PAVEMENT SECTION

Cost Estimate

Pavement Rehabilitation
Franklin County, I 64
US 127 (MP 53.118) to US 60 (MP 57.860)

Bituminous Leveling and Wedging	3000 Tons @ $29.00 per Ton		$ 87,000
Bituminous Surface Class AK	17,351 Tons @ $29.00 per Ton		$ 503,179
Bituminous Material For Tack	50 Tons @ $225.00 per Ton		$ 11,250
Temporary Striping	112,672 L.F @ $.40 per L.F.		$ 45,069
Permanent Striping	112,672 L.F. @ $.40 per L.F.		$ 45,069
Removing Pavement Markers Type V	1,252 EA @ $5.00 EA.	$6,260	
Pavement Markers Type V	1,252 EA @ $30.00 EA		$ 37,560
Bituminous Concrete Base Class I	28, 919 Tons @ $29.00 per ton		$ 838,651
Full Depth Patching	1,100 Sq. Yd. @ $450.00 per Sq. Yd.		$ 495,000 (BRIDGES
Traffic Control	Lump Sum		$ 75,000
Polymer Modification for Base and Surface	27,672 Tons @ 10.00 per Ton		$ 276,720
Median/Shoulder Slope Reconstruction Items	estimated		$ 100,000
Guardrail Items	estimated		$ 100,000
Pavement Drainage/Subdrainage Items	estimated		$ 100,000
		Subtotal	$2,820,764
Mobilization/Demobilization			$ 84,623
		Subtotal	$2,905,387
Engineering and Contingencies			$ 290,539
		TOTAL	$3,195,926

VALUE ENGINEERING RECOMMENDATION

FORM 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: G-7

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Sou-rce Code	Num of Units	Total $	Num of Units	Total $
Temporary overlay	L.S.		8		3,195,926		
To remove temp. overlay prior to construction	L.S.		8		939,998		
Total					4,135,924		
No apparent life cycle 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 (specify)

VALUE ENGINEERING RECOMMENDATION

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

IDENTIFICATION NUMBER: G-7

PRESENT WORTH METHOD
LIFE CYCLE PERIOD (YEARS) =
ANNUAL PERCENTAGE RATE = 4% Dollars in table are $ times 1,000

Initial Costs				Original Design PW $		Reccomd Design PW $
				4,136		0
						0
Sub Totals of Initial Costs PW $				4,136		

Later Costs Single Expenditure	In The Yr	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Sub Total of Single Expenditure Costs PW $				0		0

Later Costs Annual Expense	For How Many Yrs	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Repair	4	3.6299	0	0	167	606
Sub Totals of Annual Expense Costs PW $				0		606
Totals PW $ for Original & Recommended				4,136		606
Total PW $ Savings (or Added Cost) for Recommended Design						3,530

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60
LOCATION: Frankfort, Kentucky
STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: PR-6
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Use a barrier to reduce 30-foot clear zone to a 12-foot shoulder

ORIGINAL DESIGN:

The original design calls for a typical section along the cut areas that includes (1) a fall bench 5.5 meters (m) wide, (2) a clear zone 9 m wide (including a 3.6 m wide shoulder), (3) three roadway lanes, and (4) a 3.6 m shoulder and 5.4 m ditch on the inside.

RECOMMENDED CHANGE:

The recommended change is to place a concrete barrier on the outside edge of the new shoulder thus allowing a defined fall bench with a minimum width of about 4.3 m.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	15,152,639	0	15,152,639
RECOMMENDED DESIGN	10,767,068	0	10,767,068
ESTIMATED SAVINGS OR (COST)	4,385,571	0	4,385,571

ADVANTAGES:

- The decrease of 18 feet in the overall typical section will result in a decrease in the amount of roadway cut in rock.
- The reduced volume of rock cut will help in acquiring a balance cut and fill west of the Kentucky river.
- In addition to reducing the width of the zone, the concrete barrier will serve to contain falling rocks from landing beyond the boundary of the fall bench.
- The concrete barrier will isolate the maintenance activities of removing fall rock from the roadway and shoulder; cleanup equipment may be kept behind the barrier reducing disturbance to traffic flow.
- The new shoulder may utilize the full section of the existing outside roadway lane eliminating the need to construct a structural section for the new outside shoulder lane.
- By using the barrier and eliminating a portion of the clear zone, the new shoulder will fall on top of the existing roadway lane.

DISADVANTAGES:

- A full 30-foot clear zone would not be maintained; thus, the change would decrease the esthetics of a widened template through the cut areas.
- By not utilizing a full 30-foot clear zone in combination with an 18-foot fall bench, there is a slightly greater potential that a massive rock slope failure will encroach onto the roadway.

JUSTIFICATION:

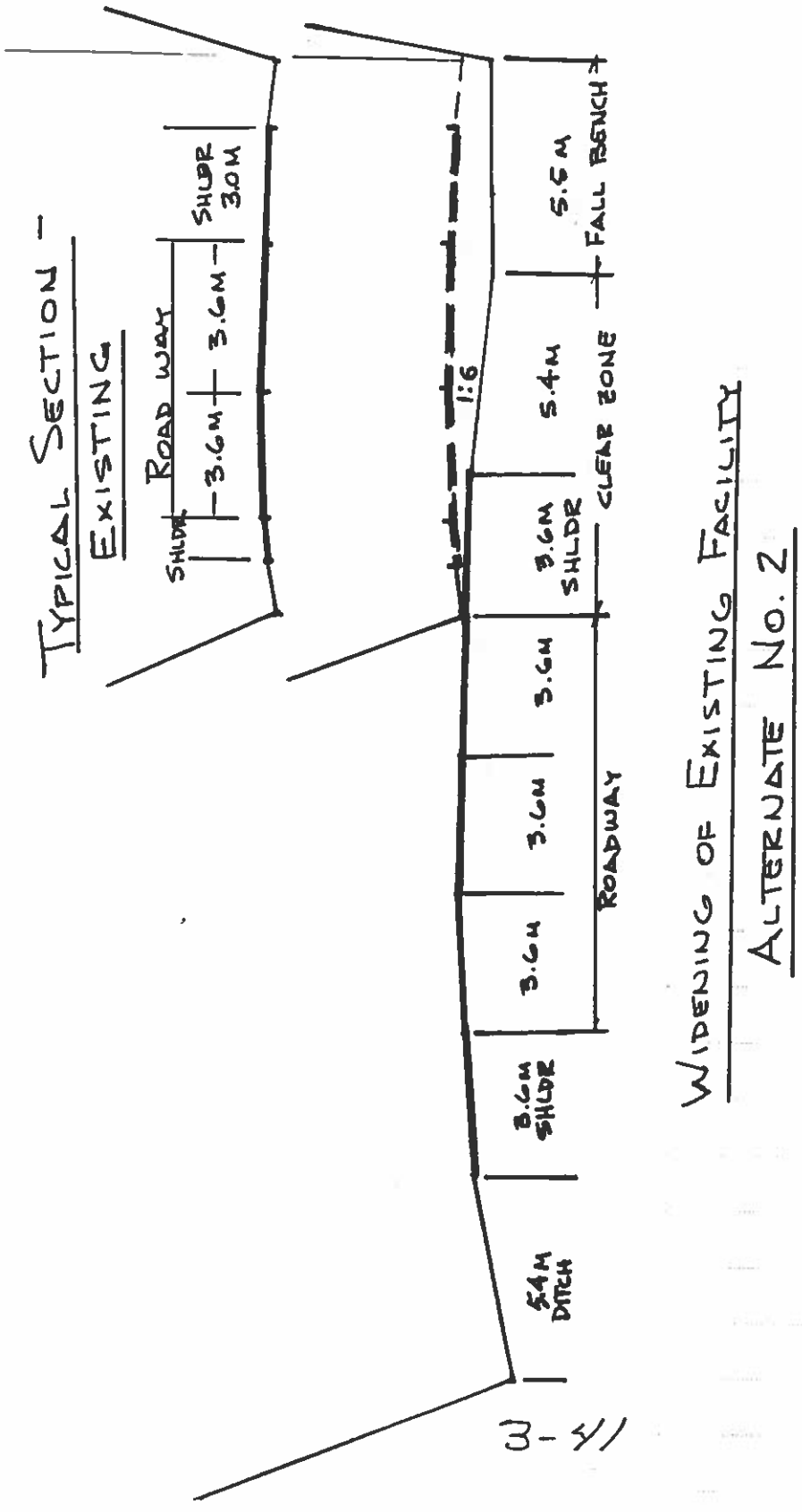
The objective of alternate 2 is to keep as much of the present horizontal and vertical alignment as possible. Further, utilizing some of the components of the existing roadway without compromising the design criteria is also part of the objective. This recommended change will help to satisfy the objectives by using a portion of existing roadway into the new design section while also satisfying design criteria. The new alignment will be closer to the existing alignment which will allow incorporating the existing bridges into the new design. The criteria of leaving 2 lanes of traffic open in each direction may still be met with this recommended change.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: PR-6

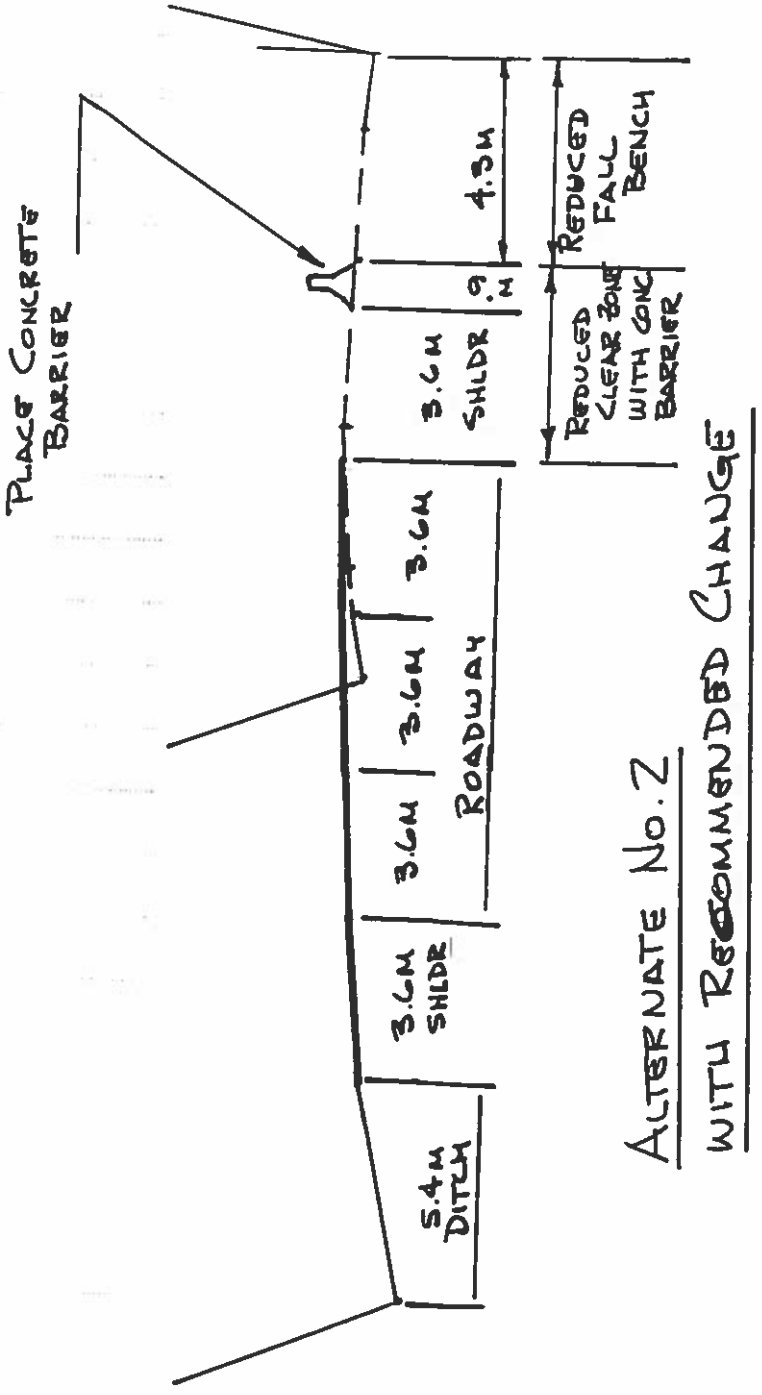


3-41

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966 **SKETCH OF RECOMMENDED DESIGN**

IDENTIFICATION NUMBER: PR-6



ALTERNATE NO. 2
WITH RECOMMENDED CHANGE

NOT TO SCALE

EARTHWORK (10% SWELL) @ $3.00/m³

Proposed earthwork

CUT - 828,791 m³ (including 10% sw)

FILL - 778,769 m³

WASTE - 30,022 m³

ORIGINAL EARTHWORK

CUT - 1,836,237 m² (including 10% sw)

FILL - 1,230,940 m³

WASTE - 605,297 m³

SAVINGS

1,669,307 - 753,446 = 915,861 m³ x $3.00/m³

= $2,747,583.00

MEDIAN BARRIER $185.00/meter

WESTBOUND - 2,536m

COST = 2,536m x $185.00/m = $469,160

EASTBOUND - 2,817m

COST = 2,817m x $185.00/m = $521,145

TOTAL COST OF MEDIAN BARRIER = $990,305

BREAK + SEAT EXISTING PAVEMENT ($0.87/m²)

8.1 m between M.P. 53.12 - 57.90

7,571.4m - 388.2m (bridge lengths) = 7,183.2m

7,183.2m x 8.1m = 58,184m²/direction x 2

= 116,368m² x $0.87/m²

= + $101,240.00

ASPHALT ON BREAK + SEAT AREA ($33/Mton)

69,540

116,368m² or ~~57,460~~ M ton

COST = ~~57,460~~ x 33 =
69,540 = $2,295,000

ASPHALT ON ADDITIONAL 2 LANES + SHOULDER

10.8m wide 425mm 7,183.2m/direction

7,183.2 x 2 = 14,366.4m x 10.8

= 155,157m² x $33/Mton)

= + $5,120,185

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1996

CALCULATIONS

IDENTIFICATION NUMBER: PR-6

DELETE PCC PAVEMENT

322,899 m² x $30.00/m² = $9,686,970.00

DELETE D.G.A. FOR BREAK & SEAT SECTION

30,030 M ton x $15.24 M ton

= $457,748

TOTAL SAVINGS = $4,385,571

VALUE ENGINEERING RECOMMENDATION

FORM 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: PR-6

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Sou-rce Code	Num of Units	Total $	Num of Units	Total $
Earthwork	M^3	3		1,669,307	5,007,921	753,446	2,260,338
Median Barrier	M	185				5,353	990,305
Break & seat pavmt	M^2	0.87				116,368	101,240
Asphalt for B&S	MTON	33				69,540	2,295,000
Asphalt on additional 2 lanes and shoulder	MTON	33				155,157	5,120,185
PCC pavement	M^2	30		322,899	9,686,970		
DGA under B&S	MTON	15.24		457,748	457,748		
Totals					15,152,639		10,767,068

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 20 DEC 1996

PROJECT: Franklin County I-64 Relocation/Widening of US 127 to US 60
LOCATION: Frankfort, Kentucky
STUDY DATE: February 17-21, 1997

IDENTIFICATION NUMBER: ST-15
FUNCTION OF COMPONENT BEING CHANGED:
DESCRIPTIVE TITLE OF RECOMMENDATION: Improve detour routes

ORIGINAL DESIGN:

The original design, designated alternate 2, maintains two lanes of traffic in each direction for the duration of construction. Only bridge delays, on the order of 20 minutes, for blasting is anticipated. Therefore, there is no need for detour routes.

RECOMMENDED CHANGE:

The need for a detour arises if one were to rehabilitate the existing pavement and bridges one lane at a time. This will incur delay at peak periods, making a detour route desirable. It is recommended that Rte. 676, a 4-lane east-west connector road, be designated as a detour for cars only. All through trucks would be required to travel the one open lane of I-64

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	0	0	0
RECOMMENDED DESIGN	220,000	0	220,000
ESTIMATED SAVINGS OR (COST)	(220,000)	0	(220,000)

ADVANTAGES:

- Separation of cars and trucks will reduce total traffic on I-64 without sending Lexington-bound trucks through a built-up area.
- Will reduce the uncertainty of delay times for cars.
- Will promote safety by reducing driver's impatience and temptation to pass on the shoulder.
- Local merchants will benefit by the increased traffic.

DISADVANTAGES:

- The increased traffic may cause slower travel times on Rte. 676.
- Difficulty in merging on US 127 and US 60 at peak hours will occur.
- Public annoyance with detour traffic through their area.

JUSTIFICATION:

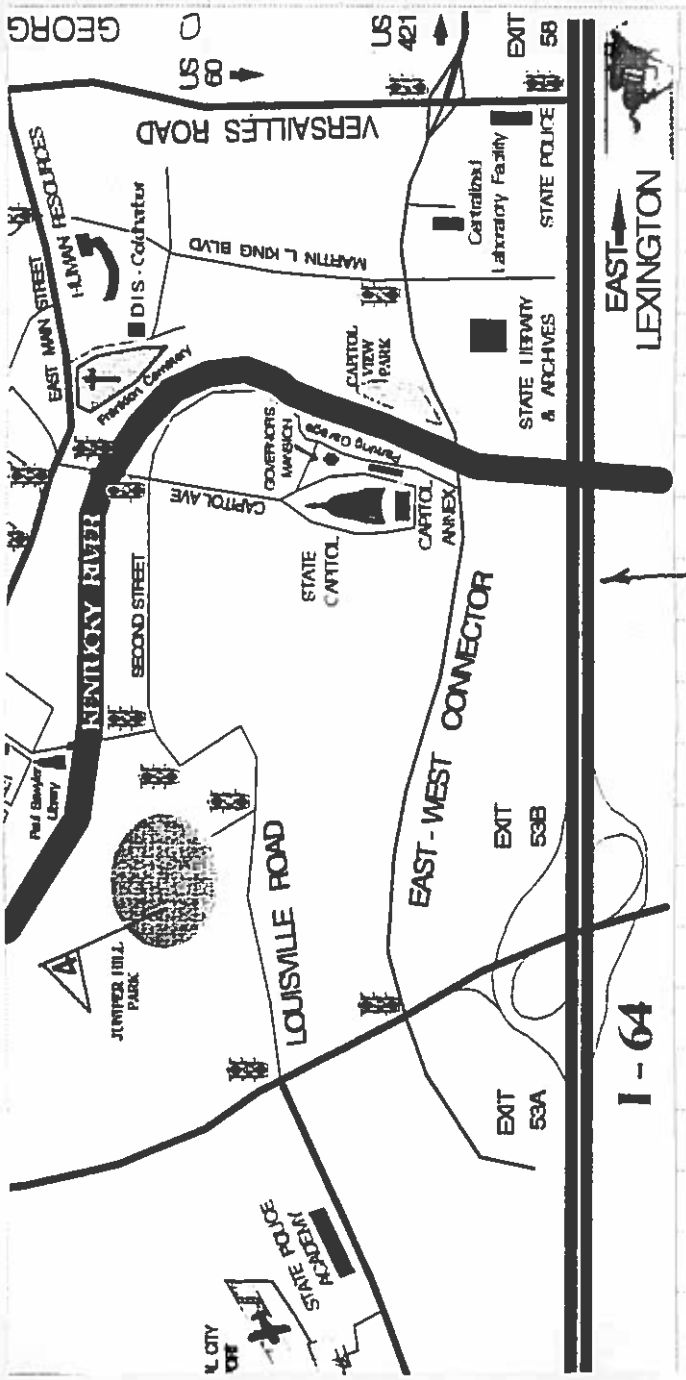
Travel time between intersections via Rte. 676 is approximately 15 minutes. Delays on I-64 on the order of 20-30 minutes can be expected, especially during bridge deck rehabilitation if pilot cars are used to control speeds. Separation of cars and trucks should reduce delay for cars by avoiding the construction entirely, and reduce delay for trucks by reducing the total number of vehicles on the single lane portion of I-64. Rte. 676 appears to be a good detour.

VALUE ENGINEERING RECOMMENDATION

FORM 20 DEC 1966

SKETCH OF ORIGINAL DESIGN

IDENTIFICATION NUMBER: ST-15



lanes each way used during construction

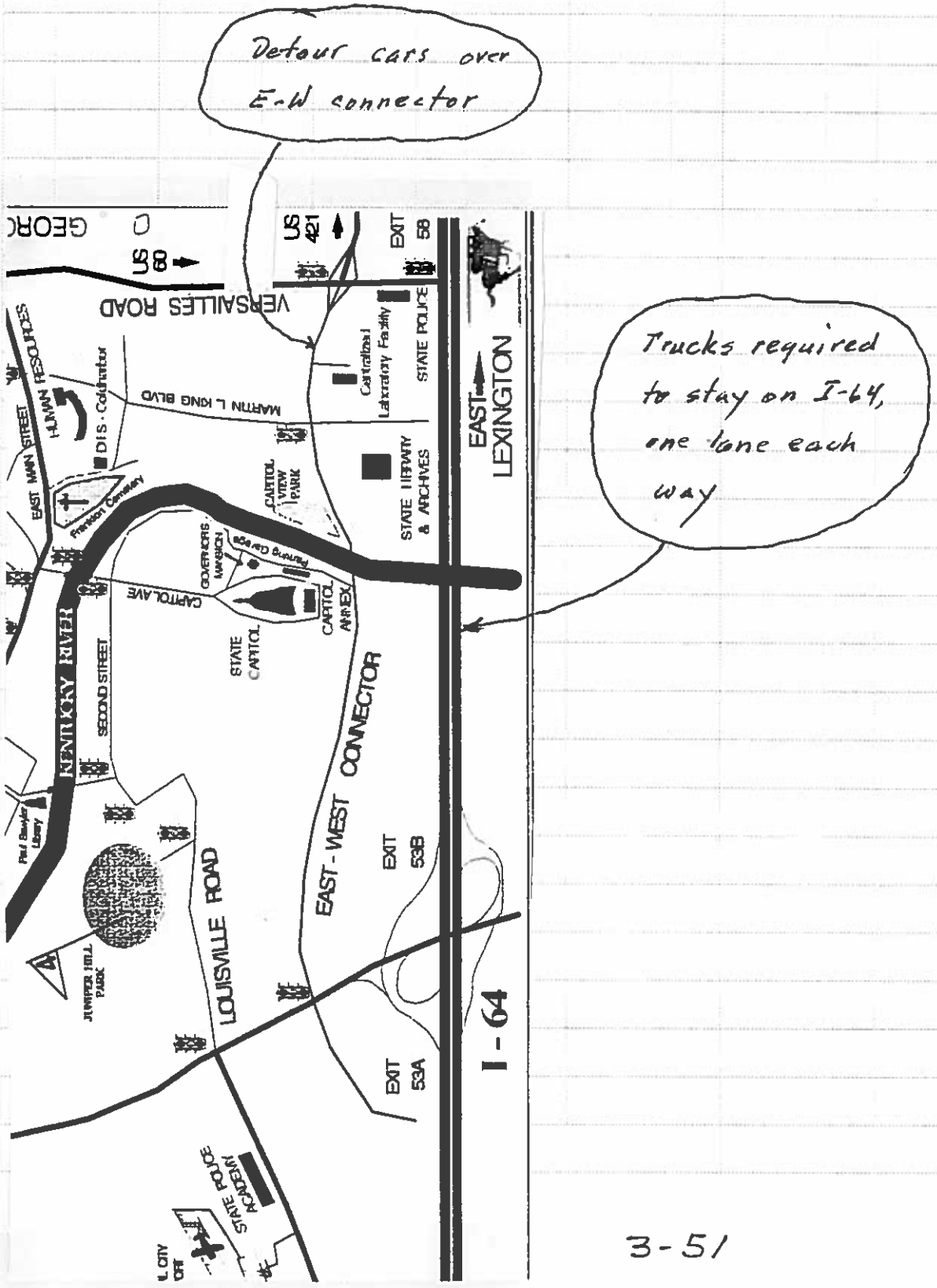
3-50

VALUE ENGINEERING RECOMMENDATION

FORM: 20 DEC 1966

SKETCH OF RECOMMENDED DESIGN

IDENTIFICATION NUMBER: ST 15



VALUE ENGINEERING RECOMMENDATION

FORM 30 DEC 1996

COST ESTIMATE - FIRST COST

IDENTIFICATION NUMBER: ST-15

Cost Item	Units	Unit Cost		Original Design		Recommended Design	
		$/Unit	Source Code	Num of Units	Total $	Num of Units	Total $
Signage	L.S.				None		220,000
includes detour							
sign & variable							
message boards							
Public meeting	L.S.				None		5,000
No apparent life cycle 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 (specify)

VALUE ENGINEERING RECOMMENDATION

FORM 30 DEC 1996

COST ESTIMATE - BACK UP

IDENTIFICATION NUMBER: ST-15

2650 - Maintain and control traffic	$28,957.51	
2652 - Detour signage (m^2)	$138.07	
2671 - Var. message sign port 3 line	$19,272.73	
2747 - Removable striping tape (m)	$4.46	
2775 - Flashing arrow	$4196.23	

Assume:

1. Detour to be maintained for 1 year
2. Purchase message sign and flashing arrow. Provide man to maintain.
3. Mobilize and demobilize equipment

All costs are contractor average bid prices

1. Detour signage @ $138.07/m^2 x 24 ea.
   24" x 30"' = 5 sf x 0.0929 = 0.46 m^2
   0.46 m^2 x 24 ea. = 11.04 m^2 x $138.07 = $1524.00/mo.
   1.524 x 12 mo. = $18,288/yr

2. Variable message sign with local power
   8 required @ $19,272.73 = $154,181.84
   Local power @ $25/mo. x 12 x 8 = $2400

3. Flashing arrow with local power
   2 required @ $4196.23 = $8,392.46
   Local power @ $25/mo x 12 x 2 = $600

4. Removable striping tap 100m @ $4.46 = $446

5. Provide maintenance man
   2 hrs/day 5 day work week x 52 weeks = 520 man-hours
   $14.19(labor base) + $3.76(fringe) + $1.47(FDIC comp) = $19.42
   19.42 x 22.8%(burden) = 4.43 + 19.42 = $23.85 x 520 hrs. = $12,402
   Truck rental @ 520 hrs. @ $6.34 = $3,297

Total Contract Cost = $200,007.30

Total Contract Cost @ 10% = $20,000

Total $220,000

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.

1. Incorporate the US 60 Interchange into the I-64 project.
2. Incorporate the US 60 Interchange planning into the project, even if the US 60 Interchange is not made part of the project.
3. Divide the project into two parts and include the US 60 Interchange in one of the parts.

APPENDICES

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

CONTENTS

APPENDIX A

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
Robert Semones	Div. Of Highway Design	(502) 564-3280	Roadway Engineer
Dennis Baron	Hazelet & Erdal/D&M	(502) 583-2723	Bridge Engineer
James Boddy	Dames & Moore	(847) 228-0707	Geotechnical Engineer
James D. Wright	Div. Of Construction	(606) 433-7791	Construction Engr.
William R. Coy	Consultant	(402) 556-2682	Materials Engr.
James D. Wood	Div. Of Operations	(502) 564-4556	Maintenance
John Williams	Dames & Moore	(918) 446-8963	Cost Engr.
Scott Davis	Dames & Moore	(913) 677-1490	Technical Reporter

Value Engineering Participation											
NAME	*COMPANY*	*TELEPHONE*	*WORKSHOP SESSIONS*					*MEETINGS*			
			M	T	W	R	F	Intro	Mid Week	Presentation	
John Sankey	Dames & Moore	(913) 677-1490	X	X	X	X	X	X	X	X	
Robert Semones	Div. Of Highway Design	(502) 564-3280	X	X	X	X	X	X	X	X	
Dennis Baron	Hazelet & Erdal/D&M	(502) 583-2723	X	X	X	X	X	X	X	X	
James Boddy	Dames & Moore	(847) 228-0707	X	X	X	X	X	X	X	X	
James D. Wright	Div. Of Construction	(606) 433-7791	X	X	X	X	X	X	X	X	
William R. Coy	Consultant	(402) 556-2682	X	X	X	X	X	X	X	X	
James D. Wood	Div. Of Operations	(502) 564-4556	X	X	X	X	X	X	X	X	
John Williams	Dames & Moore	(918) 446-8963	X	X	X	X	X	X	X	X	
Scott Davis	Dames & Moore	(913) 677-1490	X	X	X	X	X	X	X	X	
Daryl Greer	Div. of Highway Design	(502) 564-3280	X				X	X	X	X	
Tom Layman	Amer. Consult. Engr., PLC	(606) 233-2100						X	X	X	
Jack L. Conway	KTC-Geotechnical Branch	(502) 564-2374	X					X			
Joette Fields	Div. Of Highway Design	(502) 564-3280	X	X	X	X	X	X	X	X	
Allan W. Frank	Div. Of Bridge Design	(502) 564-4560	X					X	X	X	
Glenn Hardin	Amer. Consult. Engr., PLC	(606) 233-2100	X					X	X	X	

Value Engineering Participants (continued)											
NAME	*COMPANY*	*TELEPHONE*	*WORKSHOP SESSIONS*					*MEETINGS*			
			M	T	W	R	F	Intro	Mid Week	Presentation	
Daryl Carter	Amer. Consult. Engr., PLC	(606) 233-2100	X					X	X	X	
Martin VanMeter	Amer. Consult. Engr., PLC	(606) 233-2100	X					X	X		
Andre Johannes	C.O. Design	(502) 564-3280	X					X	X	X	
Kevin Villier	District 5 Design	(502) 367-6411							X	X	
John Sacksteder	KYTC Design	(502) 564-3280							X	X	
Glenn Givan	Div. Of Operations	(502) 564-4556							X		
Mike Sullivan	Amer. Consult. Engr., PLC	(606) 233-2100								X	
Steve Goodpaster	KTC Bridges	(502) 564-4560								X	
Robert Farley	FHWA	(502) 223-6744		(1)						X	
Don Herd	KYTC Operations	(502) 564-4556								X	
Charles Briggs	Div of Operations	(502) 564-4556								X	
W.A. Grace	KYDOH	(502) 564-4556								X	

(1) Was not at the Monday introduction meeting but came Tuesday to present FHWA information.

APPENDIX B

Appendix B lists the study materials used in the workshop

List of Project Materials

Topographic map of I-64 from US 127 to US 60, scale 1:2000, American Consulting Engineers

Centerline profile of I-64 from US 127 to US 60, scale 1:2000, American Consulting Engineers

Typical sections of I-64 from US 127 to US 60, scale 1:250, American Consulting Engineers

Bridge inspection report of the Kentucky river bridge, 08-1996, Kentucky Transportation Cabinet

Bridge inspection report of the Kentucky river bridge, 10-1988, Burgess & Niple, Limited Engineers and Architects

Summary comparative analysis chart of I-64 Franklin County relocation/widening between US 127 and US 60, American Consulting Engineers

Standard drawings of I-64 from US 127 to US 60, American Consulting Engineers

Cross sections of I-64 from US 127 to US 60, American Consulting Engineers

Aerial photographs from US 127 to US 60, Kentucky Transportation Cabinet

Map of Frankfort, Kentucky Transportation Cabinet

Roadside Design Guide, Kentucky Transportation Cabinet

Kentucky Transportation Cabinet Department of Highways, Frankfort Standard specifications for road and bridge construction, 1994 ed.

Kentucky Transportation Cabinet project wage rates, 1997

1997 unit price list for items commonly used in structures, Kentucky Transportation Cabinet

Intra-departmental memo from Bruce S. Siria to Kevin Villier; subject: Franklin County traffic forecast I-64 from US 127 to US 60, 12-27-96

Letter from Sherril Smith to Kevin Villier; subject: capacity analysis, 1-14-97

Letter from J.M. Yowell to Paul E. Toussaint; subject: Project team meeting and preliminary line & grade inspection report, 1-22-97

Memorandum from Gary W. Sharpe to Charles Raymer; subject: pavement rehabilitation project, 6-17-96

List of Project Materials (continued)

Memorandum from C.S. Raymer to J.M. Yowell; subject: Franklin County, I-64 US 127 to US 60, 7-17-96

Letter from J.M. Yowell to Paul E. Toussaint; subject: Franklin County I-64 from US 60 to US 127, 2-6-97

Design drawings for existing I-64 Kentucky River bridge, Kentucky Transportation Cabinet

APPENDIX C

Appendix C documents the cost information

Franklin County, I-64 No.5-56.00
Between US 127 and US 60
Frankfort, KY

Designed By: American Consulting Engineers
Estimated By: Dames & Moore - Avg Bid Price

Prepared By: John Williams
(918) 446 8963

Preparation Date: 02/19/97
Effective Date of Pricing: 02/19/97
Est Construction Time: 1095 Days

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
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Release 5.30

SUMMARY REPORTS SUMMARY PAGE

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

	QUANTITY	UOM	CONTRACT	ESCALATN	CONTINGN	SIOH	TOTAL COST	UNIT COST
01 Bridge Work								
01.01 I-64 WB Over KY 420/Cedar Run Ck	2637.00	M2	2,762,084	214,095	148,809	156,249	3,281,237	1244.31
01.02 I-64 EB Over KY 420/Cedar Run Ck	2637.00	M2	2,791,610	216,383	150,400	157,920	3,316,312	1257.61
01.03 I-64 WB Over Johnson Road	760.00	M2	484,384	37,546	26,096	27,401	575,428	757.14
01.04 I-64 EB Over Johnson Road	636.50	M2	421,612	32,680	22,715	23,850	500,857	786.89
01.05 I-64 WB Over Kentucky River	4522.00	M2	7,163,974	555,294	385,963	405,262	8,510,493	1882.02
01.06 I-64 EB Over Kentucky River	4522.00	M2	7,313,974	566,920	394,045	413,747	8,688,686	1921.43
01.07 Relocated Hanley Lane O/ I-64	1100.00	M2	1,173,103	90,930	63,202	66,362	1,393,596	1266.91
TOTAL Bridge Work			22,110,741	1,713,847	1,191,229	1,250,791	26,266,608	
02 Roadway Work								
02.01 Bituminous Paving			351,697	27,261	18,948	19,895	417,800	
02.02 Culverts			110,631	8,575	5,960	6,258	131,425	
02.03 Storm Water Collection			137,658	10,670	7,416	7,787	163,532	
02.04 Box Outlets			803,206	62,258	43,273	45,437	954,174	
02.05 Barriers			944,290	73,194	50,874	53,418	1,121,776	
02.06 Junction Boxes			25,058	1,942	1,350	1,417	29,767	
02.07 PCC Pavement, 300mm			25,221,336	1,954,955	1,358,815	1,426,755	29,961,860	
02.08 Guardrails			307,755	23,855	16,581	17,410	365,600	
02.09 Traffic Control			100,000	7,751	5,388	5,657	118,796	
02.10 Crash Cushions			38,712	3,001	2,086	2,190	45,988	
02.11 Concrete Median Barrier, 355A1			295,540	22,908	15,922	16,719	351,089	
TOTAL Roadway Work	1.00	EA	28,335,882	2,196,370	1,526,613	1,602,943	33,661,808	33661808
03 Mob/Demobilization								
03.01 Mobilization	1.00	EA	1,340,000	0	0	0	1,340,000	1340000
03.02 Demobilization	1.00	EA	670,609	0	0	0	670,609	670609.00
TOTAL Mob/Demobilization	1.00	EA	2,010,609	0	0	0	2,010,609	2010609
04 Utilities	1.00	EA	500,000	0	0	0	500,000	500000.00
05 Right-Away Costs	1.00	EA	500,000	0	0	0	500,000	500000.00
06 Design Cost By District	1.00	EA	2,500,000	0	0	0	2,500,000	2500000
TOTAL Franklin County, I-64 No.5-56.00	1.00	EA	55,957,232	3,910,217	2,717,842	2,853,734	65,439,025	65439025

		QUANTITY	UOM	DIRECT UNIT COST	TOTAL COST
01	Bridge Work				
01.01	I-64 WB Over KY 420/Cedar Run Ck	2637.00	M2	2,762,084 1047.43	2,762,084
01.02	I-64 EB Over KY 420/Cedar Run Ck	2637.00	M2	2,791,610 1058.63	2,791,610
01.03	I-64 WB Over Johnson Road	760.00	M2	484,384 637.35	484,384
01.04	I-64 EB Over Johnson Road	636.50	M2	421,612 662.39	421,612
01.05	I-64 WB Over Kentucky River	4522.00	M2	7,163,974 1584.25	7,163,974
01.06	I-64 EB Over Kentucky River	4522.00	M2	7,313,974 1617.42	7,313,974
01.07	Relocated Hanley Lane O/ I-64	1100.00	M2	1,173,103 1066.46	1,173,103
TOTAL	Bridge Work			22,110,741	22,110,741
02	Roadway Work				
02.01	Bituminous Paving			351,697	351,697
02.02	Culverts			110,631	110,631
02.03	Storm Water Collection			137,658	137,658
02.04	Box Outlets			803,206	803,206
02.05	Barriers			944,290	944,290
02.06	Junction Boxes			25,058	25,058
02.07	PCC Pavement, 300mm			25,221,336	25,221,336
02.08	Guardrails			307,755	307,755
02.09	Traffic Control			100,000	100,000
02.10	Crash Cushions			38,712	38,712
02.11	Concrete Median Barrier, 355Al			295,540	295,540
TOTAL	Roadway Work	1.00	EA	28,335,882 28335882	28,335,882
03	Mob/Demobilization				
03.01	Mobilization	1.00	EA	1,340,000 1340000	1,340,000
03.02	Demobilization	1.00	EA	670,609 670609.00	670,609
TOTAL	Mob/Demobilization	1.00	EA	2,010,609 2010609	2,010,609
04	Utilities	1.00	EA	500,000 500000.00	500,000
05	Right-Away Costs	1.00	EA	500,000 500000.00	500,000
06	Design Cost By District	1.00	EA	2,500,000 2500000	2,500,000
TOTAL	Franklin County, I-64 No.5-56.00	1.00	EA	55,957,232 55957232	55,957,232
	ESCALATION FEB 97 TO MIDPOINT AUG 98				3,910,217
	SUBTOTAL				59,867,449
	OWNER CONTIGENCY @ 5%				2,717,842
	SUBTOTAL				62,585,291
	OWNER INSPECTION @ 5%				2,853,734

	QUANTITY	UOM	DIRECT UNIT COST	TOTAL COST
TOTAL INCL OWNER COSTS				65,439,025

		QUANTITY	UOM	MATERIAL	TOTAL COST	UNIT COST
01	Bridge Work					
01.01	I-64 WB Over KY 420/Cedar Run Ck	2637.00	M2	2762084	2,762,084	1047.43
01.02	I-64 EB Over KY 420/Cedar Run Ck	2637.00	M2	2791610	2,791,610	1058.63
01.03	I-64 WB Over Johnson Road	760.00	M2	484,384	484,384	637.35
01.04	I-64 EB Over Johnson Road	636.50	M2	421,612	421,612	662.39
01.05	I-64 WB Over Kentucky River	4522.00	M2	7163974	7,163,974	1584.25
01.06	I-64 EB Over Kentucky River	4522.00	M2	7313974	7,313,974	1617.42
01.07	Relocated Hanley Lane O/ I-64	1100.00	M2	1173103	1,173,103	1066.46
	TOTAL Bridge Work			22110741	22,110,741	
02	Roadway Work					
02.01	Bituminous Paving			351,697	351,697	
02.02	Culverts			110,631	110,631	
02.03	Storm Water Collection			137,658	137,658	
02.04	Box Outlets			803,206	803,206	
02.05	Barriers			944,290	944,290	
02.06	Junction Boxes			25,058	25,058	
02.07	PCC Pavement, 300mm			25221336	25,221,336	
02.08	Guardrails			307,755	307,755	
02.09	Traffic Control			100,000	100,000	
02.10	Crash Cushions			38,712	38,712	
02.11	Concrete Median Barrier, 355A1			295,540	295,540	
	TOTAL Roadway Work	1.00	EA	28335882	28,335,882	28335882
03	Mob/Demobilization					
03.01	Mobilization	1.00	EA	1340000	1,340,000	1340000
03.02	Demobilization	1.00	EA	670,609	670,609	670609.00
	TOTAL Mob/Demobilization	1.00	EA	2010609	2,010,609	2010609
04	Utilities	1.00	EA	500,000	500,000	500000.00
05	Right-Away Costs	1.00	EA	500,000	500,000	500000.00
06	Design Cost By District	1.00	EA	2500000	2,500,000	2500000
	TOTAL Franklin County, I-64 No.5-56.00	1.00	EA	55957232	55,957,232	55957232
	ESCALATION FEB 97 TO MIDPOINT AUG 98				3,910,217	
	SUBTOTAL				59,867,449	
	OWNER CONTIGENCY @ 5%				2,717,842	
	SUBTOTAL				62,585,291	
	OWNER INSPECTION @ 5%				2,853,734	

	QUANTITY	UOM	MATERIAL	TOTAL COST	UNIT COST
TOTAL INCL OWNER COSTS				65,439,025	

No errors detected...

* * * END OF ERROR REPORT * * *

APPENDIX D

Appendix D documents the function analysis.

Function Analysis

Function analysis was performed on the project drivers. What is the function of each driver?

Maintain 2 Lanes of Traffic Each Way

#	VERB	NOUN	TYPE
1	Reduce	Congestion (traffic)	S
2	Allow	Differential-speed	B
3	Lessen	Inconvenience	S
4	Improve	Safety	S
5	Minimize	Backup (traffic)	S
6	Avoid	Delay	S
7	Avoid	Protest (public outcry)	B

18 Foot Rock Bench

#	VERB	NOUN	TYPE
1	Collect	Rocks	B
2	Protect	Motorists	B
3	Maintain	Traffic	S
4	Collect	Drainage	S
5	Permit	Maintenance	S
6	Save	R.O.W.	S
7	Allow	Steep-Rockface-Cuts	S
8	Improve	Sight-Distance	S
9	Postpone	Maintenance	S
10	Reduce	Hazards	B

30 Foot Clear Zone

#	VERB	NOUN	TYPE
1	Improve	Safety	B
2	Permit	Recovery (of vehicle control)	B
3	Improve	Sight	S

4	Eliminate	Guardrail	S
5	Permit	Stopping (of vehicle)	S
6	Access	Emergency (by emergency vehicles)	S
7	Promote	Confidence (of driver)	S
8	Remove	Hazards (road)	B
9	Permit	Detours (around roadblocks)	S
10	Permit	Alternate-Path (around roadblocks)	S
11	Permit	Laneshift	S

Take No New R.O.W.

#	VERB	NOUN	TYPE
1	Save	Money	S
2	Save	Time	B
3	Avoid	Environmental Study	B
4	Reduce	Environmental Impact	B
5	Avoid	Condemnation (hassles)	B

Function analysis was also performed on other selected topics

Pavement Design

#	VERB	NOUN	TYPE
1	Avoid	Problem (maintenance)	S
2	Extend	Life (pavement)	S
3	Smooth	Ride	B
4	Reduce	LCC	S
5	Add	Safety	S
6	Reduce	Maintenance (vehicle)	S

7	Increase	Capacity (traffic) (increase speed)	S

Acceleration Lane

#	VERB	NOUN	TYPE
1	Avoid	Accident	
2	Facilitate	Merging	

Note: Store Vehicle is not a legitimate function of the acceleration lane.

Deceleration Lane

#	VERB	NOUN	TYPE
1	Prevent	Accident	
2	Disengage	Vehicle (from traffic safety)	

Note: Store Vehicle is not a legitimate function of the deceleration lane.

Intermediate Bench-Ledge

#	VERB	NOUN	TYPE
1	Catch	Rock	
2	Reduce	Weathering (differential)	
3	Reduce	Speed (falling rock)	
4	Facilitate	Construction	
5	Flattens	Side Slope	
6	Isolates	Failure	
7	Reduce	Effect (failure)	

B=Basic Function
S-Secondary Function

Judgement Count	Number of ideas with the number of votes
0	46
1	10
2	0
3	4
4	4

5	4
6	2
7	1
Total Number of Ideas	71

APPENDIX E

Appendix E documents the creative idea list and evaluation

CREATIVE IDEA LIST

I.D.	IDEA	TEAM VOTE	NOTES
	How do we maintain 2 lanes?		
2L-1	Temporary bridge-2 lanes	0	
2L-2	2 new permanent new bridges inside 3 lanes	3	
2L-3	Construction off site-work away from existing lanes	0	
2L-4	Use detours	1	
2L-5	Regulate work time & lane closure	6	
2L-6	Drive on shoulder	0	
2L-7	Create temporary road	0	
BDT-1	Use exothermic deck	5	(1)
	How do we collect rocks?		
CR-1	Create rock bench	4	(2)
CR-2	Build barrier-jersey barrier	3	(2)
CR-3	Build rock bolt net on face of cut	1	
CR-4	Flatten slope of cut	0	
CR-5	Shot Crete	0	
CR-6	Presplit-to reduce loose rock remaining	1	
CR-7	Smoothen the face of the cut	0	
CR-8	Eliminate the cut	0	
CR-9	Eliminate the hill	0	
CR-10	Bench the face	0	
CR-11	Plant trees	0	
CR-12	Use ground cover/on slope	0	
	How do we extend box culverts?		
EB-1	Light weight fill	3	
EB-2	Liners grout	1	
EB-3	Pipe up to upstream end of box, no pipe in box-must continue through reduced slab size/thickness	0	

CREATIVE IDEA LIST (continued)

I.D.	IDEA	TEAM VOTE	NOTES
EB-4	Thicken top slab-use sheet pile to hold back slope	1	
EB-5	Test top slab of box prior to metal pipe sleeving the box	0	
	General Items		
G-1	Break up existing pavement-outside of shoulder-leave in place	0	
G-2	Just rehab the 2 existing bridges-compute deck replacement, new guard rail, moderate steel repair	5	
G-3	Add 2 new 3 lanes bridges immediately adjacent to existing bridges and replace deck on existing bridges-operate as one 3 lane bridge with shoulder on each side, moderate steel repair to existing bridge	6	
G-4	Just rehab existing 4 lane roadway-break and seat, use modified asphalt overlay (8"), clean ditches	5	(1)
G-5	Add truck lane eastbound	3	(3)
G-6	Just rehab existing 4 lane roadway, use thin bond concrete overlay, clean ditches	1	
G-7	Revisit initial decision to upgrade prior to new construction		(4)
	How do we permit recovery?		
PR-1	Flatten side slopes	0	
PR-2	Widen shoulder	0	
PR-3	Erect barrier	4	
PR-4	Build clear zone	5	(5)
PR-5	Build guard rail	0	(5)
PR-6	Use barrier to serve as part of bench & to reduce clear zone-add 1 new lane each way with 10' shoulder both sides, 3 lanes each way, maintain existing grade	0	
PR-7	Use crash cushions	0	
PR-8	Reduce speed	0	
PR-9	Reduce traffic	0	
PR-10	Use shoulder rubble	0	

CREATIVE IDEA LIST (continued)

I.D.	IDEA	TEAM VOTE	NOTES
PR-11	Use cables in lieu of guard rails	0	
PR-12	Driver training-retesting	0	
PR-13	Eliminate/reduce pavement thickness-snow, ice	0	
PR-14	Straighten roadway	0	
PR-15	Light the roadway	1	
PR-16	Stripe the driving lanes	1	
PR-17	Use pavement reflectors on center line of road	1	
PR-18	Use post delineators on outside of shoulder	1	
PR-19	Widen the median	0	
PR-20	Plant vegetation to slow and cushion the vehicle	0	
PR-21	Place sand to slow and cushion the vehicle	0	
	What are the ways to get rid of slow trucks?		
ST-1	Ban trucks	0	
ST-2	Separate trucks from cars	0	
ST-3	Detour trucks	0	
ST-4	Ship by rail	0	
ST-5	Flatten grade-raise bridge (KY river), trim crest, eliminate truck lane	4	
ST-6	Raise bridge	0	
ST-7	Lower weight limits	0	
ST-8	Increase tab of trucks	0	
ST-9	Raise the speed limit	0	
ST-10	Eliminate cars	0	
ST-11	Have a cable that pulls trucks	0	
ST-12	Regulate hours of truck operation	0	
ST-13	Pay trucks to go different way	0	
ST-14	Increase tax for trucks that use roads with steep grades	0	

CREATIVE IDEA LIST (continued)

I.D.	IDEA	TEAM VOTE	NOTES
ST-15	Improve detour routes	4	
ST-16	Increase lane width	0	
ST-17	Ticket slow trucks	0	

(1) Combined with G-2
(2) Removed from development-already a part of PR-6
(3) Idea removed because it already exists in original design
(4) Late edition
(5) Already included in other ideas

APPENDIX F

Appendix F documents other information generated during the course of the workshop

Important Project Items

The following items are determined to be the important items to this highway project. These are the basic characteristics that make the highway a good highway. These are the characteristics that cannot be sacrificed when developing value engineering recommendations.

The road surface must be smooth.
The road surface must be well drained.
There must be adequate sight distance to travel safely.
There must be no hole/bumps in the roadway surface.
There must be room to pull over in case of a problem that requires stopping.
The driver must be able to maintain a desire speed.
The road must be able to maintain a high level of service (accommodate large volumes of traffic).
The grades must not be too steep.
There must be no slow trucks to interrupt traffic.
There must be no roadside hazards.
The driver needs to experience a high comfort level (feel secure driving on the road).
The public perception of the road must be good.
The lighting on the interchanges must be good.
The travelers must be safe (have safe travel experience).
There needs to be longevity (quality materials that will last a long time before needing replacement)
There must be construct ability (a design that is easy to build).

An Added Alternative

The following option (given the designation Alternative 4) is presented by the team. This is a "most economical" alternative for a reasonably good fix that will not unduly cheapen the product. This alternative is built around the following ideas:

1. Do not destroy the existing bridges. They still have useful life remaining (30-40 years).
2. Stay with two lane service in each direction (4 driving lanes). The traffic data does not indicate a need for immediate increase in number of lanes. It will be fifteen years before a need for additional lanes is mandated.
3. Minimize the shifting of horizontal alignment. This saves resources, and can be accomplished by substituting a barrier for the clear zone, which will also mitigate the requirement for a rock bench.

The features of Alternative 4

1 Rehab the roadway pavement with 8"-10" of "modified asphalt" using a break and seat technique
2. Reuse the existing bridges.
   Add a new deck to the exiting bridges.
   Add a new guard rail (or barrier) to the existing bridges.
3. Clean out the ditches.
4. Estimate Cost
   $15,741,738
5. Expected life = 20 to 40 years

<u>Alternative Option 2</u>

Replace bridges

Add 2 lanes
    Rebuild 6 lanes & shoulder
Change vertical profile
    Reduce grade
Rock bench
Clear zone
$51,000,000
    30-50 years

What we gain with alternative 2 as opposed to alternative 4 (rehab existing 4 lanes)
10 years life
Less maintenance
Safer
Ability to maintain with 2 lanes
Increased capacity
$40,000,000

Comments to recommendations discussed during the mid week meeting

Recommendation	Comments
2L-5	This item is not addressed in alternate 2 simply because it is too early in the project. Standard procedure in the KTC is to always consider variations in work schedule to minimize.
G-2	The political climate would never allow this. The KTC has been told that they must have 2 lanes of traffic open at all times during construction.
G-3	Has been looked at but were told not to consider using existing super structure. The clear zone rock bench moved design far enough.
G-7	Perhaps this would work. The existing roadway could possibly last through construction. They could just do an asphalt overlay on the bridge. (Asphalt collects moisture)
PR-6	
ST-5	Done as much as can be done Side slope overlaps existing road
ST-15	The local politicians and public would never stand for routing truck traffic through town. East-west connectage has a steep grade (7%) that would cause trucks to slow down.

APPENDIX G

Appendix G is the table for the response to recommendations.