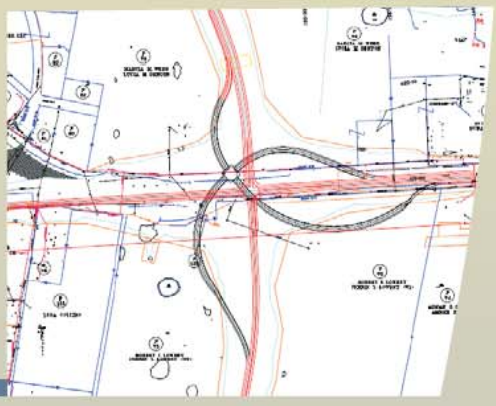


Value Engineering Study

EAST NICHOLASVILLE BYPASS
JESSAMINE COUNTY, KENTUCKY

ITEM NUMBER 7-87.01

Study Date: July 19 - 23, 2010
Draft Report Date: July 30, 2010

Kentucky Transportation Cabinet
Frankfort, Kentucky

URS

EAST NICHOLASVILLE BYPASS
JESSAMINE COUNTY, KENTUCKY

Item Number 7-87.01

VALUE ENGINEERING STUDY
for
Kentucky Transportation Cabinet
Frankfort, Kentucky

Study Date: July 19 – 23, 2010

Draft Report

June 30, 2010

URS

EXECUTIVE SUMMARY

General
URS conducted a value engineering (VE) study of the East Nicholasville Bypass in Jessamine County, Kentucky. The item number is 7-87.01. The topic was the 20% design submission prepared by HDR for the Kentucky Transportation Cabinet (KYTC).

The VE team undertook the task assignment using the value engineering work plan and approach. The ideas generated from this process and chosen for full development as VE Team Recommendations are presented in Section 3 of this report. These recommendations are presented to all project stakeholders for judgment as to whether they should be implemented.

Estimate of Construction Costs and Budget
The preliminary construction cost estimate provided to the VE team with the project documents indicates a total construction cost of $78,171,855. This project is scheduled to be let as a design/bid/build project, thus the cost of construction will be determined on a contractor bid.

As a result of this value engineering study, should all of the VE team's selected combination of recommendations be accepted for implementation, the potential cost savings for this project is $17,872,000 in first cost and $122,000 over a 20 year life cycle. These potentials are based upon the VE team's cost estimates of the individual recommendations selected by the VE team as noted on the Summary of Recommendations table below. Total cost savings realized will be based upon the final implementation status of these VE recommendations.

Summary of VE Study Results
During the speculation phase of this VE study, 41 creative ideas were identified. 23 of these ideas were developed into VE recommendations and design comments with cost implications where applicable. Many of the ideas represent changes in design approach, reconsideration of criteria, and in some cases, modification of the project scope. In general, the idea evaluation took into account the economic impact, other benefits obtained, and the effect on the overall project objectives.

The following table presents a summary of the ideas developed into recommendations and design comments with cost implications where applicable. Since cost is an important issue for comparison of VE proposals, the costs presented in this report are based upon original design quantities with unit rates obtained from the estimate as prepared by the design team and included in their submission, published cost databases, and VE team member experience.

The table also identifies the recommendations and alternatives that, in the opinion of the VE team, are the best combination of all the VE recommendations. This selection takes into account not only that the recommendations (and likewise their cost savings) are summarily additive, but also whether the cost savings or project improvement potential of the recommendations are worth the change to the project design.

SUMMARY OF RECOMMENDATIONS

DESCRIPTION		PRESENT WORTH AMOUNTS			
Rec #	Recommendation Title / Description	1st cost savings (or cost)	O & M savings (or cost)	Total LCC savings (or cost)	VE Selected Combo
VE-1	Utilize low grow grass or native grass in lieu of traditional ground cover	$0	$122,000	$122,000	X
VE-2	Utilize vertical wall abutment in lieu of a sloped earth embankment at the railroad abutments	$672,000		$672,000	X*
VE-3	Utilize a longer bridge at the railroad to provide property to property access in lieu of a separate wagon box for access	($184,000)		($184,000)	
VE-4	Locate the wagon box under the bypass west of any lane tapers to minimize its length	Comment		Comment	
VE-5	Revise embankment quantity to eliminate fill under bridges and wagon box	Comment		Comment	
VE-6	Consider improved inlets on box culverts	Comment		Comment	
VE-7	Utilize a single left in lieu of dual lefts from the existing bypass onto the new bypass at the southern terminus and eliminate any impact to the existing bridges	$271,000		$271,000	X
VE-8	Utilize 8 ft shoulders (6 ft paved) in lieu of 12 ft shoulders (10 ft paved) per the typical section	$1,737,000		$1,737,000	
VE-9	Adjust the profile grade by utilizing a 4% grade approaching US 27 from Station 395+00 to Station 416+50 (ahead) and lower the clearance over the railroad tracks to 23 ft and US 27 to 17 ft to reduce the required embankment	$3,696,000		$3,696,000	
VE-10	Utilize urban section for US 27 (Main Street) within mapping limits in lieu of current rural section to reduce ROW impacts and traffic calming	Comment		Comment	
VE-11	Utilize Tensar Geogrids to decrease the required asphalt pavement thickness	Comment		Comment	
VE-12	Utilize 11 ft lanes in lieu of 12 ft lanes throughout the new east bypass	$816,000		$816,000	
VE-13	Implement the KTC safety study entitled “Safety Evaluation of New Roads” dated September 2002	Comment		Comment	
VE-14	Add a shared use path along the new east bypass	($500,000)		($500,000)	
VE-15	Conduct a transportation planning study to identify parallel routes to the new east bypass to improve connectivity, and adopt it into the comprehensive plan	Comment		Comment	
VE-16	Preserve future needed ROW for the bypass with planning and zoning ordinance	Comment		Comment	

SUMMARY OF RECOMMENDATIONS

DESCRIPTION		PRESENT WORTH AMOUNTS			
Rec #	Recommendation Title / Description	1st cost savings (or cost)	O & M savings (or cost)	Total LCC savings (or cost)	VE Selected Combo
VE-17	Control access with limited full intersections and spaced directional openings using a plan and memorandum of understanding	Comment		Comment	
VE-18a	Utilize 2-lane bypass from southern terminus of the new bypass to KY 169 in lieu of a 4-lane bypass	$14,400,000		$14,400,000	
VE-18b	Utilize 2+1 lanes on the new east bypass in lieu of 4 lane typical section	$11,862,000		$11,862,000	X*
VE-19a	Right-size the SPUI by reducing the number of lanes and median width through the SPUI, US 27, and ramps (76 ft in lieu of 88 ft wide)	$1,574,000		$1,574,000	
VE-19b	Utilize a crossroad under design in lieu of the crossroad over design associated with the SPUI	$3,360,000		$3,360,000	
VE-19c	Utilize an at-grade diverging diamond interchange with existing alignment of the west bypass with US 27 bridged over the new interchange	$3,360,000		$3,360,000	
VE-19d	Utilize KIRK Intersection Design (KID) (at-grade intersection with two intersecting left-turn fly-over ramps) in lieu of SPUI	$5,403,000		$5,403,000	X

Summary of VE Team Selected Combination: $17,872,000 $122,000 $17,994,000

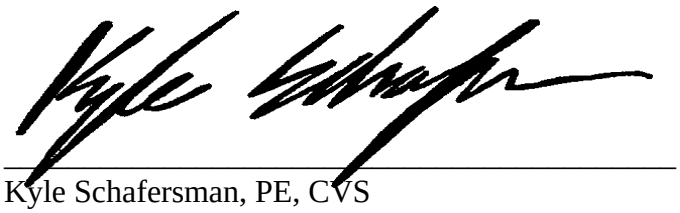
***** If Recommendation VE-18b is implemented, the cost savings associated with the implementation of Recommendation VE-2 will be reduced to $336,000

Acknowledgments
A thank you is given to the staff members from the Kentucky Transportation Cabinet and HDR for there participation. Special thanks are also extended to Mr. Brent Sweger for his assistance with this study.

Value Engineering Study - Core Team

Name	Discipline / Role	Organization	Telephone
Greg Groves, PE	Roadway Design Engineer	URS	502-569-2301
Adam Kirk, PE, PTOE, AICP	Traffic Engineer	KTC	859-257-7310
Kyle Schafersman, PE, CVS	VE Team Leader	URS	913-344-1019
Paul Slone, PE	Traffic Engineer	URS	502-569-2301
Brent Sweger, PE	VE Coordinator	KYTC	502-564-3280
Marvin Wolfe, PE	Bridge Engineer	KYTC	502-564-4560

Certification
This is to verify that the value engineering study was conducted in accordance with standard value engineering principles and practices.



Kyle Schafersman, PE, CVS
Value Engineering Program Manager

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SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on the East Nicholasville Bypass in Jessamine County, Kentucky. The item number is 7-87.01. The study workshop was held at the KYTC offices in Frankfort, KY on July 19-23, 2010. The study team was from URS. Kyle Schafersman, a Certified Value Specialist (CVS) and Professional Engineer (PE), team leader from URS, facilitated the study. The names and telephone numbers of all participants in the study are listed in Appendix A.

The Job Plan

This study followed the value engineering methodology as endorsed by SAVE International, the professional organization of value engineering. This report does not include any detailed explanations of the value engineering / value analysis processes used during the workshop in development of the results presented herein. This would greatly expand the size of the report. The sole purpose of this report is to document the results of the study. Additional information regarding the processes used during the study can be obtained by contacting the Certified Value Specialist team leader that facilitated the study.

Ideas and Recommendations

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

Design Comments

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

Level of Development

Value Engineering studies are working sessions for the purpose of developing and recommending alternative approaches to a given project. As such, the results and recommendations presented are of a conceptual nature, and are not intended as a final design. Detailed feasibility assessment and final design development of any of the recommendations presented herein, should they be accepted, remain the responsibility of the designer. The VE team members and report have not, and will not, sign or seal these recommendations and comments as certifiable engineering or architectural design.

Organization of the Report

The report is organized in the following outline.

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

SECTION 2 – PROJECT DESCRIPTION

The proposed project is located in central Jessamine County, Kentucky. The project will proceed in a north to northeast loop around Nicholasville, the County Seat. The new bypass will have a southern terminus (end point) on a portion of US 27 south of Nicholasville at a point approximately 1,200 feet north of Hoover Pike. As the project moves to the north and northeast, it will cross KY 39 (Sulpher Well Road), KY 169 (Union Mill Road) and will terminate near the US 27 intersection with the US 27 west bypass. The length of the project will be approximately 7 miles.

The typical section is comprised of four 12-foot driving lanes, one 40-foot depressed median, 12-foot shoulders, and a design speed of 60 miles per hour. The bypass is partially controlled access with at least 1,200 feet of spacing between access points. It is functionally classified as urban principal arterial meaning it is a system of streets and highways that serve major centers of activity. Urban principal arterial roadways typically carry the major portion of trips entering and leaving an urban area. This activity includes travel between business districts and major suburban centers.

The new bypass will divert traffic from congested areas on KY 39, KY 169, US 27B (Business Route) and the existing US 27 west bypass. It will enhance access and provide linkage between Nicholasville, its industrial parks, Lexington and Garrard County. The new bypass will facilitate existing and proposed development in the project area by providing an arterial to anticipated development in the Urban Growth Boundary located just east of the city limits. It will improve the existing northern intersection of US 27 and US 27B with its superelevated curve.

The existing US 27B (business route) and the US 27 west bypass are the main roadways in Jessamine County. Following are descriptions of each facility including speed limits, lane widths and other roadway-associated characteristics.

US 27B is a two-lane road – a portion of which is Main Street in Nicholasville. Posted speed limits within the project area range between 25 and 45 miles per hour. Lane widths vary between 10 and 14 feet. Shoulders are curbed along portions of the roadway within the downtown area while other sections are paved shoulders varying in width between 1 and 8 feet.

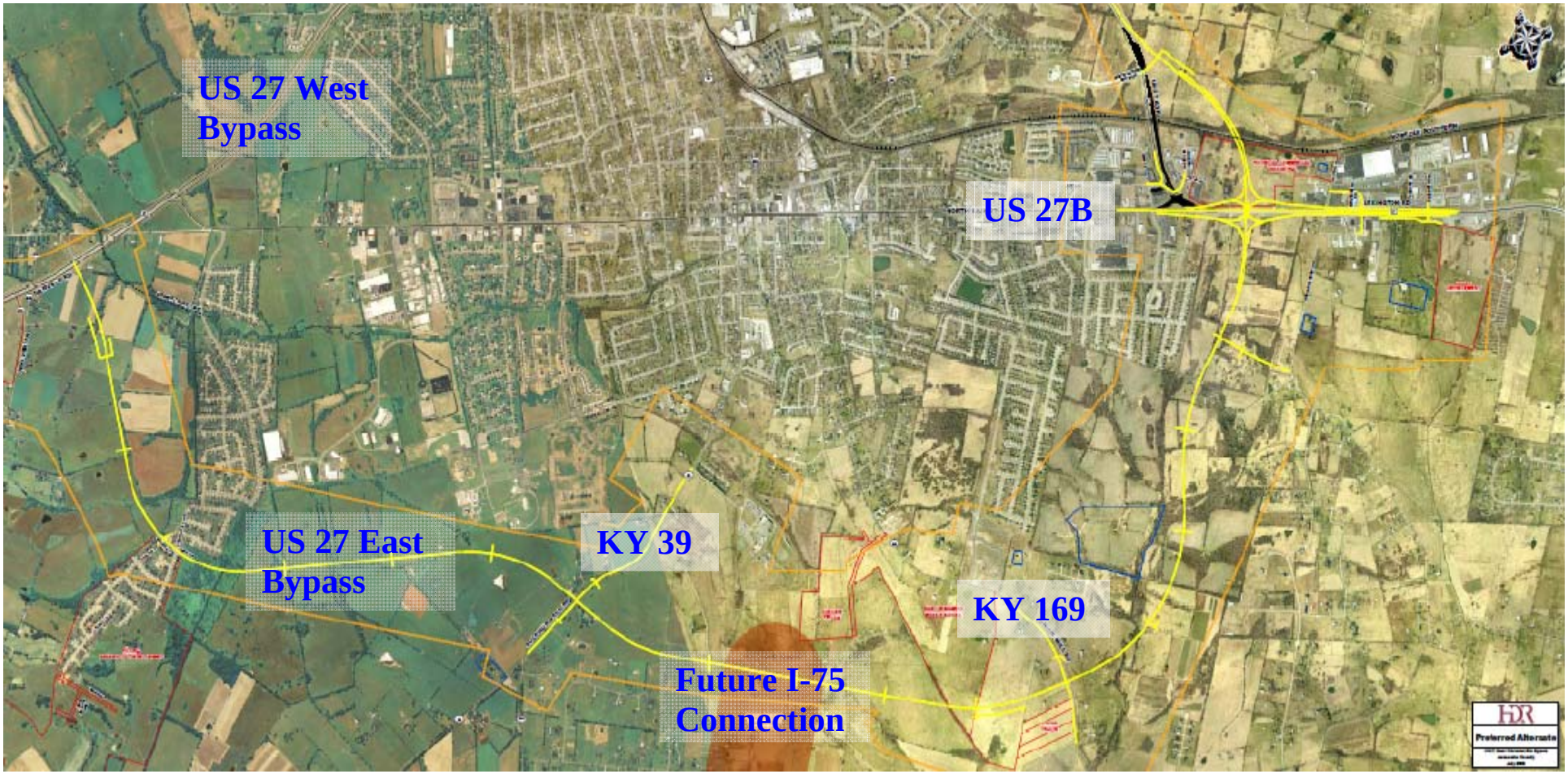
US 27 West Bypass (West Nicholasville Bypass) is a four-lane road which begins at a point approximately 0.6 miles north of Hoover Pike (KY 3374). The posted speed limit along the West Nicholasville Bypass is 55 miles per hour. Shoulders are curbed along the roadway. The functional classification of the existing bypass is an urban principal arterial. It is classified on the State System as a Primary Highway and is part of the Defense Highway Network.

The southern terminus of the project is located approximately 1,200 feet north of the US 27/Hoover Pike intersection to form an intersection with Vineyard Road. If the terminus had been placed south or north of this site, an additional, offset access point would have been created on US 27. If the terminus had been located just north of this point, it would have caused relocation of a bridge. The design team selected this point as the southern terminus to allow the intersections of the East Nicholasville Bypass and Vineyard Road to be placed directly across from each other, which is the American Association of State Highway and Transportation Officials (AASHTO) standard for maximum safety. The Current Year average daily traffic estimate for this intersection is 20,800 vehicles per day. The southern terminus provides a logical and complementary point for traffic to tie back into the four-lane US 27 south of Nicholasville. The southern portion of US 27 is a four-lane facility beyond the Jessamine/Garrard County line.

The northern terminus of the Selected Alternate is located near US 27 and the West Nicholasville Bypass intersection and will provide a link to US 27 and the West Nicholasville Bypass. The Current Year average daily traffic estimate for the US 27/US 27 West Nicholasville Bypass is 30,600 vehicles per day. This is a logical point for traffic to tie into the existing four-lane US 27. The northern terminus was moved southward from the original termination point to improve safety and level of service by reducing the superelevation of the curve that intersects US 27 and the US 27 West Nicholasville Bypass.

The northern terminus will provide motorists with a third travel option between northern and southern Jessamine County. This third option will provide traffic relief by diverting some vehicles from the US 27 business route through downtown Nicholasville and the West Nicholasville Bypass. US 27, north of the existing US 27 and US 27 West Nicholasville Bypass, is a four-lane facility that continues past the Jessamine/Fayette county line. Frequent traffic backups are experienced in southbound lanes as far back as the Fayette County line due to inadequate traffic facilities at the existing US 27B/US 27 West Nicholasville Bypass intersection. The northern terminus will result in traffic reductions in the area north of Nicholasville. If the terminus was located south of the intersection, the super-elevated curve would not be improved, and numerous businesses would be required to relocate. If the terminus had been located north of the US 27B/US 27 West Nicholasville Bypass intersection, numerous businesses would have been acquired, and numerous residences including a mobile home park would have been relocated.

Overall Arial Image of Project



Arial Image of existing US 27B/US 27 West Nicholasville Bypass intersection

SECTION 3 - VE RECOMMENDATIONS & DESIGN COMMENTS

Organization of Recommendations
This section contains the complete documentation of all recommendations that have resulted from this study. Each recommendation has been marked by a unique identification number.

The parent idea, or ideas from which the recommendation began, can be determined from the Creative Idea List located in Appendix D of this report.

Each recommendation is documented by a separate write-up that includes a description of both the original design and recommended change, a list of advantages and disadvantages, sketches where appropriate, calculations, cost estimate, and the economic impact of the recommendation on the first cost, and where applicable, the life cycle cost. The economic impact is shown in terms of savings or added cost.

Acceptance of VE Recommendations
The Summary of Recommendations table presented in the Executive Summary of this report identifies the recommendations that, in the opinion of the VE team, are the best combination of all the VE recommendations. This selection takes into account not only that the recommendations (and likewise their cost savings) are summarily additive, but also the likelihood and ease of implementing the recommendations.

However, this report also includes other recommendations that could enhance the value of this project. These recommendations are either mutually exclusive of the recommendations selected by the VE team (i.e. implementing one immediately precludes the implementation of another) or they require additional design and/or evaluation prior to implementation. These recommendations should be evaluated individually to determine whether they are worthy of implementation or not. Consideration should be given to the areas within a recommendation that are acceptable and implement those parts only. Any recommendation can be accepted in whole or in part as the owner and design team see fit.

Design Comments
Design Comments are ideas that in the opinion of the team were good ideas, but for any number of reasons were not selected for development as VE recommendations. Design Comments can be notes to the owner or designer, a documentation of various thoughts that come up during the course of the study, a reference to possible problems, suggested items that might need further study, or questions that the owner and designer might want to explore. Some comments might relate to things of which the owner or designer is already aware. Because the study is done on a design in progress and as an independent team, the VE team may not be aware of everything intended by the owner and designer. The following comments are presented with the intent that they may aid the design team in some way.

VALUE ENGINEERING RECOMMENDATION # VE-1

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize low grow grass or native grass in lieu of traditional ground cover.

ORIGINAL DESIGN:
The cost estimate for the original design specifies restoring the disturbed earth areas with seeding and protection for 650,000 SY in Section 2 and 206,000 SY in Section 1. The VE team assumes this 856,000 SY of seeding will required mowing three times a year through standard KYTC maintenance.

RECOMMENDED CHANGE:
The VE team recommends utilizing low grow grass in lieu of traditional grass seed to reduce maintenance. The VE team assumes this will reduce the number of mow operations per year from three to one.

ADVANTAGES:

- Reduce maintenance by only mowing once per year
- Visually aesthetic or comparable o current condition

DISADVANTAGES:

- This product may not have been used on previous highway projects in this area
- Unknown track record of effectiveness within the cabinet

JUSTIFICATION:
Since maintenance is an ongoing annual cost, any reduction in maintenance requirements will result in compounded savings over the life of the facility. There are also safety benefits to minimizing the total amount of time that workers and equipment need to be within limited access right of way. The use of native grasses would help preserve and restore the local ecosystem. It may be possible to find native grasses that meet the "low grow" criteria. If none can be found, various commercially available lawn mixtures could be used.

The width of the mowing operation is assumed to be 90 feet for the length of the project along median and outside shoulders. Current standard is to mow 3 times per year. Proposal is to mow once per year. The cost of the new seed mixture is not significantly different than the standard seed mixture currently specified. See the attached life cycle cost analysis for this recommendation.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$0	$183,000	$183,000
RECOMMENDED DESIGN	$0	$61,000	$61,000
ESTIMATED SAVINGS OR (COST)	$0	$122,000	$122,000

VALUE ENGINEERING RECOMMENDATION # VE-1

PHOTOGRAPH OF RECOMMENDED DESIGN

This low maintenance "No Mow" turf mix contains single season rye grass seeds for soil stability and quick growth of green lawn. The Fescue seeds are no different from those in our other "No Mow" turf mix. Both contain a specially designed blend of six low-growing Fine Fescue turf grasses, which will: grow to form a dense turf, thrive in full sun or partial shade, require little if any watering or fertilizing, biologically reduce weed growth, once established, require limited mowing, usually only once or twice a year, and reduce your lawn maintenance dramatically.

VALUE ENGINEERING RECOMMENDATION # VE-1

CALCULATIONS

Assumed mowing costs = $30/acre

Amount of Seeding and Protection = 650,000 SY (Section 2) + 206,000 SY (Section 1) = $856,000 SY

Total mowed area = 856,000 SY x 9 SF/SY = 7,704,000 SF / 43,560 SF/acre = 176.86 acres

Cost of one mowing operation = 176.86 acres x $30/acres = $5,305.79 per mowing cycle

Original Design:
3 mowing cycle per year = $5,305.79/yr x 3 = $15,917.36/yr

Recommended Design:
1 mowing cycle per year = $5,305.79/yr

VALUE ENGINEERING RECOMMENDATION # VE-1

COST ESTIMATE - O & M (LIFE CYCLE) COST

PRESENT WORTH METHOD
LIFE CYCLE PERIOD (YEARS) = 20
ANNUAL PERCENTAGE RATE = 6%

O&M Costs. Single Expenditure	In the Yr	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Subtotal Single Life Cycle O&M Costs				$0		$0
O&M Costs. Annual Continuous Costs	For How Many Yrs	PW Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Annual Mowing Cost	20	11.4699	$15,917	$182,571	$5,306	$60,857
Subtotal Annual Life Cycle Costs				$182,571		$60,857
Total Life Cycle O&M Costs				$183,000		$61,000

VALUE ENGINEERING RECOMMENDATION # VE-2

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize vertical wall abutment in lieu of a sloped earth embankment at the railroad abutments.

ORIGINAL DESIGN:
The original design specifies a curved twin bridges over the Railroad. Span Lengths are not yet determined. The bridge outlines are indicated on the plan with a length of 240 ft. The deck widths scale to 44 and 64 ft. This equates to a bridge cost of $103/SF.

RECOMMENDED CHANGE:
The VE team recommends evaluation of vertical wall abutments to save bridge deck area and beam lengths by reducing the bridge length.

ADVANTAGES:
- Reduced bridge length
- Simple span configuration eliminates piers

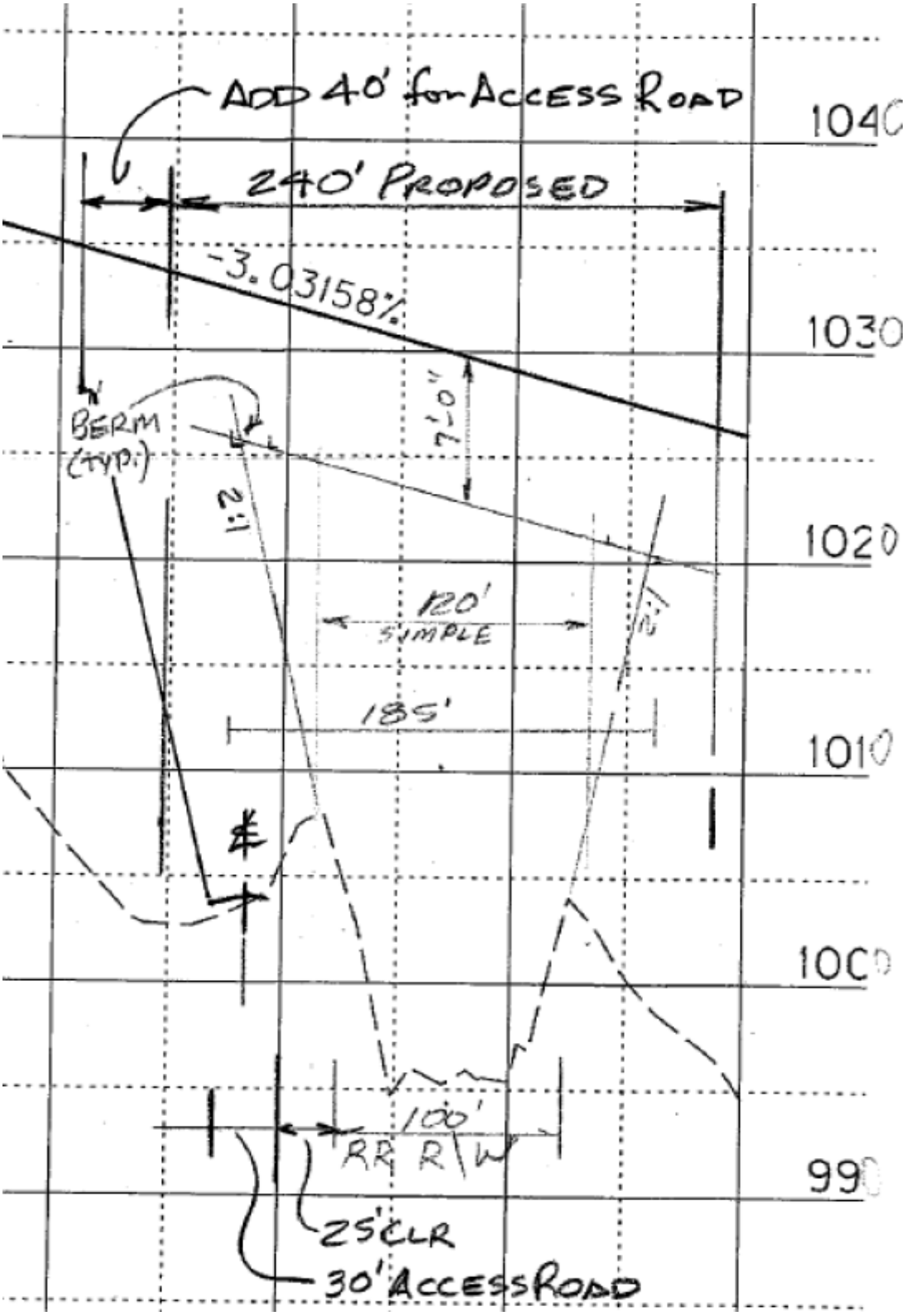
DISADVANTAGES:
- Vertical abutment less economic beyond 20 ft in height

JUSTIFICATION:
The spirit of this recommendation is to verify the most economic bridge type and end configuration is employed.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$2,680,000	$0	$2,680,000
RECOMMENDED DESIGN	$2,008,000	$0	$2,008,000
ESTIMATED SAVINGS OR (COST)	$672,000	$0	$672,000

VALUE ENGINEERING RECOMMENDATION # VE-2

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-2

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Twin Bridges at RR	LS	$2,680,000	1	1	$2,680,000		
Single Span Bridges	SF	$130.00	7			14,480	$1,882,400
Wingwalls	SF	$45.00	7			2,800	$126,000
Total					$2,680,000		$2,008,400

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

VALUE ENGINEERING RECOMMENDATION # VE-3

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a longer bridge at the railroad to provide property to property access in lieu of a separate wagon box for access.

ORIGINAL DESIGN:
The original design indicates a 60 ft wide wagon box to provide access to either side of a divided property between US 27 and the railroad. Realistically, this will be approximately 30 ft wide and 180 ft in length. The cost for this item is not in the provided cost estimate.

RECOMMENDED CHANGE:
The VE team recommends extending the railroad bridge for another span to allow access in lieu of constructing the wagon box. A 30 ft wide access road will provide much better access but after analysis, does represent an increase in cost.

ADVANTAGES:
- Eliminates a structure
- More horizontal and vertical clearance

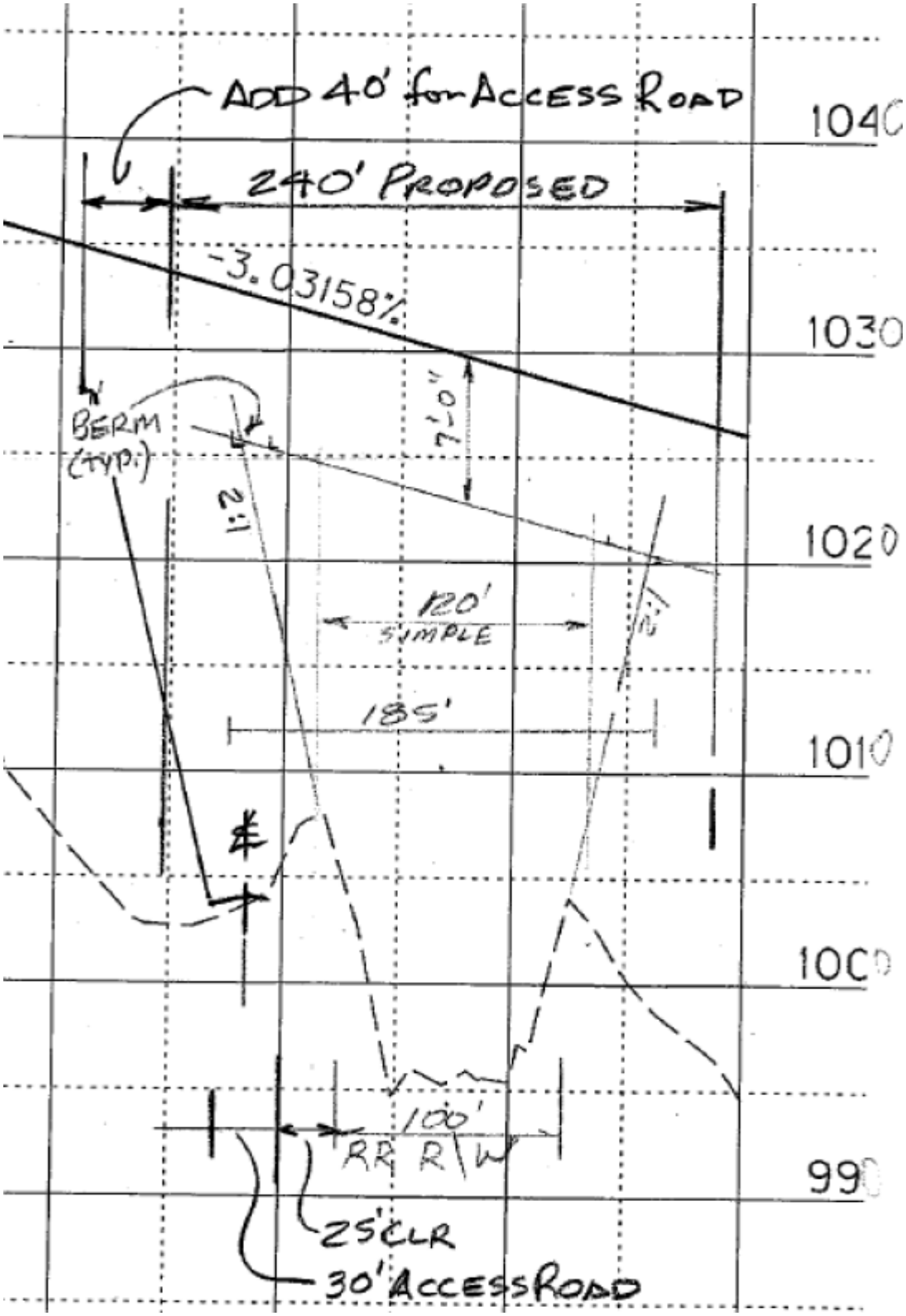
DISADVANTAGES:
- Eliminates possibility of spanning the RR with a simple span structure
- Cost is higher for the benefit of better access

JUSTIFICATION:
The railroad Right of Way is 100 ft and will be completely spanned by the bridges. During development, the VE team determined this recommendation would add cost to the overall project without a substantial benefit, so it is not recommended for implementation. This idea has been included in the report to share the analysis and information developed on this on this topic in the event it is ever considered in the future.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$261,000	$0	$261,000
RECOMMENDED DESIGN	$445,000	$0	$445,000
ESTIMATED SAVINGS OR (COST)	($184,000)	$0	($184,000)

VALUE ENGINEERING RECOMMENDATION # VE-3

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-3

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Wagon Box							
Class A Conc	CY	$473.73	7	380	$180,017		
Reinforcement	LB	$1.07	7	47,500	$50,825		
Fdn Prep	LS	$30,000	7	1	$30,000		
40 ft Longer Bridge	SF	$103.00	1&7			4,320	$444,960
Total					$260,842		$444,960

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

VALUE ENGINEERING DESIGN COMMENT # VE-4

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Locate the wagon box under the bypass west of any lane tapers to minimize its length.

COMMENTARY:
The wagon box is currently located at center of property and is past the end of the lane tapers. If the intersection is modified and tapers change to extend over the wagon box then it should be moved to the west to remain under the uniform width section. This design comment is simply a reminder to use minimum structure length.

VALUE ENGINEERING DESIGN COMMENT # VE-5

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Revise embankment quantity to eliminate fill under bridges and wagon box.

COMMENTARY:
The embankment quantity may be in error due to it including the portions at the structure locations which are spanned and should be deducted. Phase I quantity calculations usually skip over the bridge lengths. This may have been done but was not evident in the information presented to the VE team. This design comment is a reminder to deduct the quantity of embankment under the structures in phase II design.

VALUE ENGINEERING DESIGN COMMENT # VE-6

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Consider improved inlets on box culverts.

COMMENTARY:
Box culverts that cross the mainline are of sufficient length to realize savings from use of improved inlets. The designer should consider the use of side tapered improved inlets to allow use of a smaller barrel size. Reduction in culvert width (span) also permits thinner top and bottom slabs. Reduction in culvert height (rise) reduces length, width and footing size of wings.

VALUE ENGINEERING RECOMMENDATION # VE-7

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a single left in lieu of dual lefts from the existing bypass onto the new bypass at the southern terminus and eliminate any impact to the existing bridges.

ORIGINAL DESIGN:
The original design specifies a dual left turn lane from the existing US 27 Bypass south of Nicholasville to the proposed bypass. The required widening for the dual left turn lanes extends into the existing bridge on US 27, thus requiring it to be widened.

RECOMMENDED CHANGE:
The VE team recommends eliminating the dual left turn lanes and shortening the left turn lane storage. This would eliminate the need to widen the existing US 27 bridge.

ADVANTAGES:
- Eliminates the need to widen the US 27 bridge
- Eliminates impact to Town Branch below the bridge
- Eliminates the need to construct an extra left turn lane

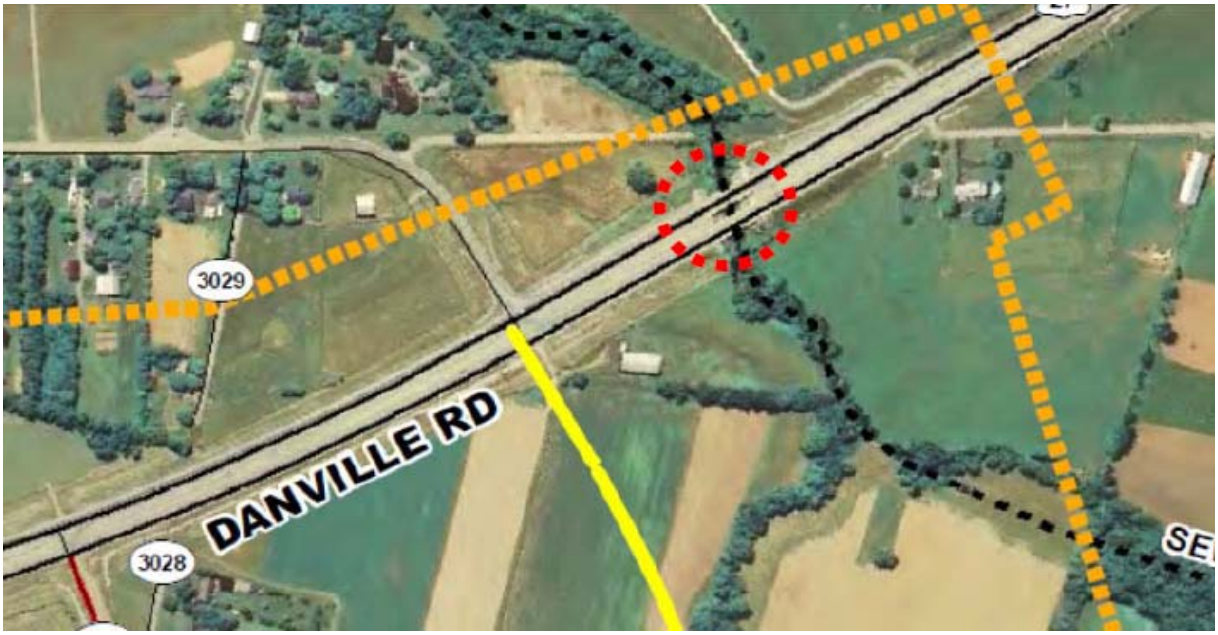
DISADVANTAGES:
- In the future years, may increase the signal cycle length if traffic greatly increase

JUSTIFICATION:
The draft traffic forecast shows 200 DHV turning left onto the proposed bypass. Based on capacity analysis, a minimum of 470 ft (storage + taper + deceleration) is needed for the left turn lane. The distance between the end of the existing bridge to the nose of median at the bypass is 505 ft. Therefore, a single left turn lane would operate effectively at this location and fit into the space available without modifying the bridge.

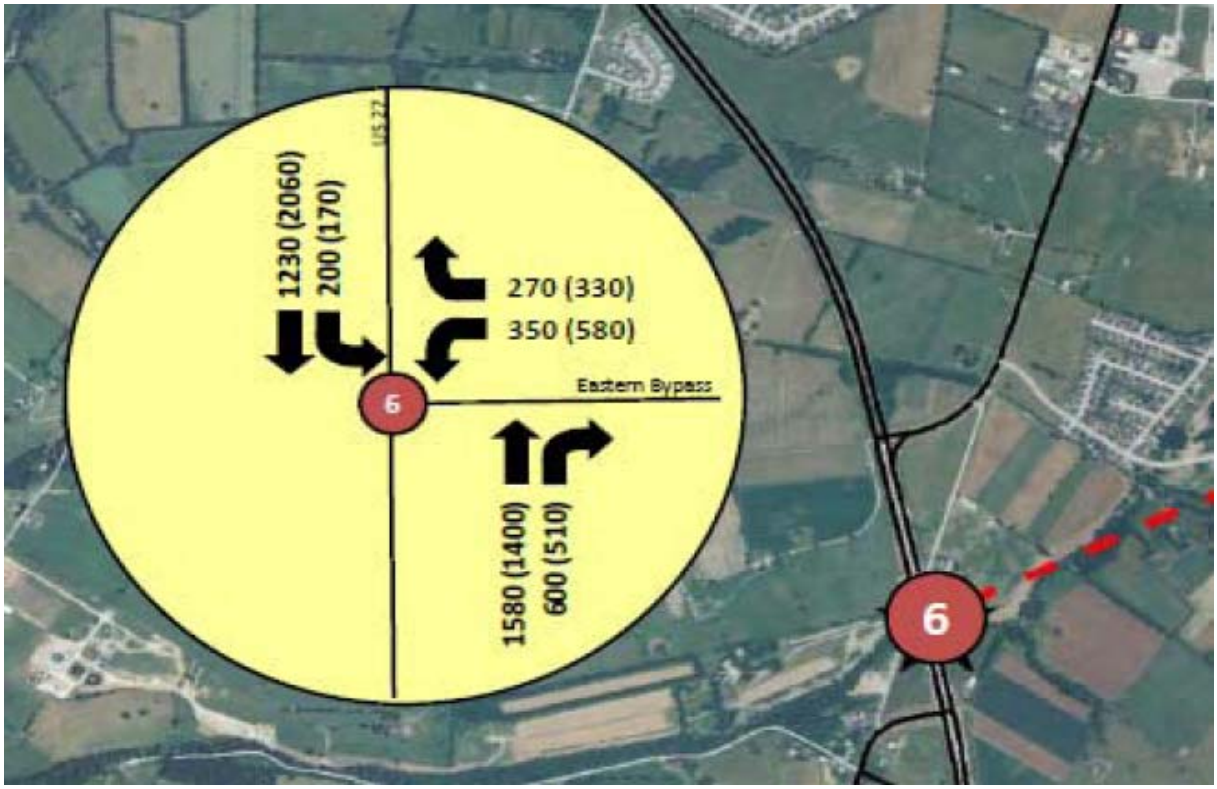
SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$271,000	$0	$271,000
RECOMMENDED DESIGN	$0	$0	$0
ESTIMATED SAVINGS OR (COST)	$271,000	$0	$271,000

VALUE ENGINEERING RECOMMENDATION # VE-7

PHOTOGRAPH OF EXISTING CONDITION



Areal photograph of existing bridge (red circle)



Projected traffic turning volumes for the design year (2034)

VALUE ENGINEERING RECOMMENDATION # VE-7

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Bridge Widening on US 27 South (Danville Road)	LS	$250,000	1	1	$250,000		
Left Turn Lane Pavement Widening	SF	$3.52	1	6,000	$21,120		
Total					$271,120		$0

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

VALUE ENGINEERING RECOMMENDATION # VE-8

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 8 ft shoulders (6 ft paved) in lieu of 12 ft shoulders (10 ft paved) per the typical section.

ORIGINAL DESIGN:
The original design specifies using 12 ft shoulders (10 ft paved) through the proposed bypass.

RECOMMENDED CHANGE:
The VE team recommends uses 8 ft shoulders (6 ft paved) through the proposed bypass.

ADVANTAGES:

- Reduces the amount of shoulder pavement needed
- Reduces the amount of deck area at the railroad bridge
- Reduces the amount of earthwork needed
- Reduces the amount of deck area at the SPUI bridge

DISADVANTAGES:

- Provides less width for emergency parking
- Could create a maintenance problem on the unpaved portion with wheels from the right side (passenger car side) running over it

JUSTIFICATION:
The use of a narrower shoulder would reduce the amount of pavement and bridge width required on the project without appreciably reducing the safety. In addition, this was recently discussed within the Project Team and agreed it was a practical solution to reduce cost.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$16,876,000	$0	$16,876,000
RECOMMENDED DESIGN	$15,139,000	$0	$15,139,000
ESTIMATED SAVINGS OR (COST)	$1,737,000	$0	$1,737,000

VALUE ENGINEERING RECOMMENDATION # VE-8

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Pavement	SF	$3.52	1	770,880	$2,713,498	462,528	$1,628,099
Embankment	CY	$6.00	1	1,750,000	$10,500,000	1,700,000	$10,200,000
SPUI Bridge	SF	$110.00	7	22,700	$2,497,000	21,420	$2,356,200
Railroad Bridge	SF	$110.00	7	10,600	$1,166,000	8,680	$954,800
Total					$16,876,498		$15,139,099

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

VALUE ENGINEERING RECOMMENDATION # VE-9

DESCRIPTIVE TITLE OF RECOMMENDATION:
Adjust the profile grade by utilizing a 4% grade approaching US 27 from Station 395+00 to Station 416+50 (ahead) and lower the clearance over the railroad tracks to 23 ft and US 27 to 17 ft to reduce the required embankment.

ORIGINAL DESIGN:
The original design specifics the bypass approach grade to US 27 as 2.98296% from Station 395+00 to Station 416+50 (ahead). This section is in an embankment and requires a borrow site. Additionally, the proposed clearance of the bypass over US 27 appears to be 21 ft and the clearance over the railroad appears to be 27 ft.

RECOMMENDED CHANGE:
The VE team recommends extending the 0.70927% grade from Station 395+00 to Station 409+80 and then utilizing a 4% approach grade in lieu of the 2.98296% to Station 416+50 (ahead). The VE team also recommends changing the overhead clearance over US 27 to 17 ft and the railroad clearance to 23 ft.

ADVANTAGES:
- Reduces the required embankment
- Reduces bridge height
- Reduces the time for construction
- Reduces the right of way cost

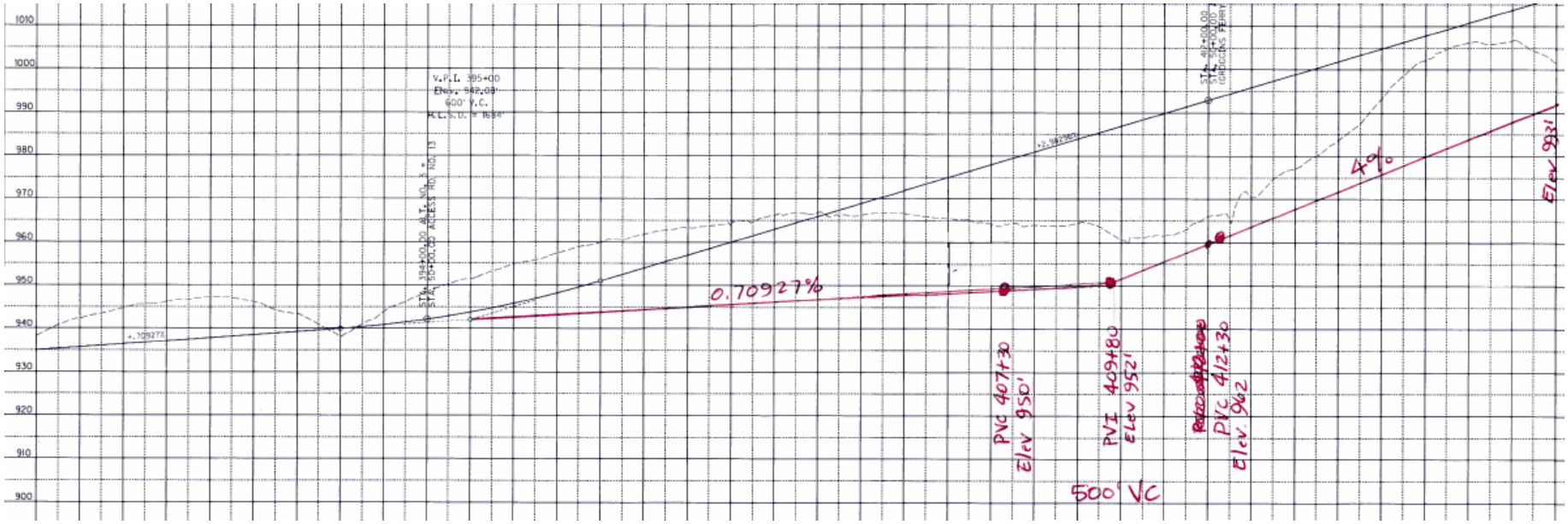
DISADVANTAGES:
- Increases grade for trucks to climb

JUSTIFICATION:
The changes in the profile grade will reduce the amount of embankment on this project which is a borrow job. This change does not require any design exceptions and does not violate the clearance requirements of KYTC or Norfolk Southern. This change will significantly reduce cost and help with the current earthwork unbalance. It will also reduce the project footprint and right of way needs.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$37,716,000	$0	$37,716,000
RECOMMENDED DESIGN	$34,020,000	$0	$34,020,000
ESTIMATED SAVINGS OR (COST)	$3,696,000	$0	$3,696,000

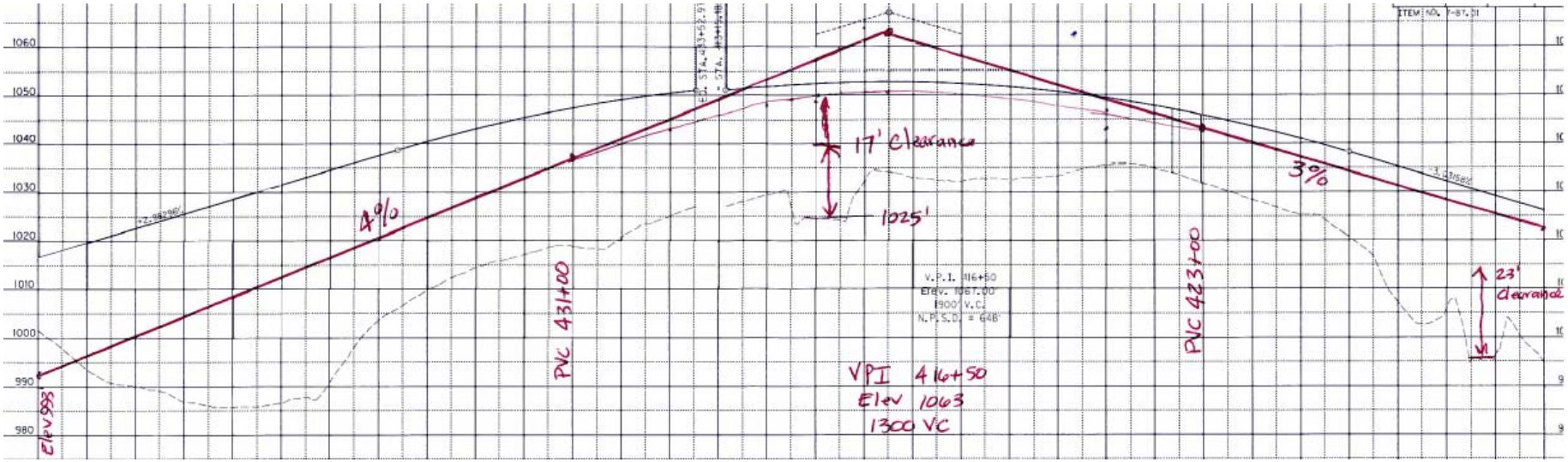
VALUE ENGINEERING RECOMMENDATION # VE-9

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-9

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-9

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment in Place	CY	$6.00	1	1,750,000	$10,500,000	1,170,000	$7,020,000
Right of way	SF	$4.32	1	6,300,000	$27,216,000	6,250,000	$27,000,000
Total					$37,716,000		$34,020,000

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

VALUE ENGINEERING DESIGN COMMENT # VE-10

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize urban section for US 27 (Main Street) within mapping limits in lieu of current rural section to reduce ROW impacts and traffic calming.

COMMENTARY:
The proposed design shows a rural section (with shoulders) for US 27 that is widened and extends directly into Main Street in Nicholasville. Given the current posted limit of 55 MPH near the proposed SPUI interchange, the widened road will most certainly increase the speeds on US 27 since the signal system will be on top of the interchange, stopping mainline bypass traffic and not traffic on US 27.

The VE team is concerned with this potential safety issue and felt US 27 should include features to help transition the traveling public into Main Street in hopes of reducing their speed. Therefore, the VE team recommends the Project Team consider utilizing an urban section (w/curbs) on US 27. This would reduce the roadway's overall width and would be a visual/psychological feature that could cue the driver to step down their speed as they are entering a different area. This should also include lowering the posted speed limit to 45 MPH with visible police enforcement when it is opened. Other ideas such as coloring the pavement, visual radar, transverse pavement markings, etc should be considered by the Project Team to determine their potential effectiveness.

The urban section will also allow for the inclusion of sidewalks for pedestrians, reduction in right of way requirements and possibly lessen the impact on existing utilities. It is recognized the urban section could potentially have greater impact on utilities if the storm sewer system caused more impact below grade. This would have to be considered by the Project Team after the exact locations of underground utilities are known.

VALUE ENGINEERING DESIGN COMMENT # VE-11

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize Tensar Geogrids to decrease the required asphalt pavement thickness.

COMMENTARY:

The use of geogrid is gaining wide spread acceptance as a means to reduce costs of pavement. This is accomplished by talking advantage of the geogrid's unilateral strength which acts as a mechanically stabilized layer. This allows for less pavement thickness and therefore a reduction in paving material.

Since a pavement design has not been prepared for this project, the VE team will use an example from a recent KYTC VE Study on another project. The original design for the example project specified using a pavement design consisting of 1.25 inch asphalt surface, 8.75 inch asphalt base, 4 inch drainage blanket, and 4 inch DGA with Type IV filter fabric over 24 inch rock roadbed. The VE team recommended using Tensar TX 5 Geogrid to reduce the amount of asphalt base needed. The use of geogrid reduced the thickness of the asphalt base by 2.75 inch and increased the DGA base by 3 inch. This allowed more DGA to be used in exchange of asphalt, thus reducing the overall cost.

Installation of geogrid is fairly new to the KYTC and will require close supervision. Therefore, use of geogrid by a contractor that is unfamiliar could cause problems with the appropriate oversight by the supplier.

VALUE ENGINEERING DESIGN COMMENT # VE-11

PHOTOGRAPHS OF RECOMMENDED DESIGN

VALUE ENGINEERING RECOMMENDATION # VE-12

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 11 ft lanes in lieu of 12 ft lanes throughout the new east bypass.

ORIGINAL DESIGN:
The original design specifies 12 ft lanes throughout the proposed bypass.

RECOMMENDED CHANGE:
The VE team recommends utilizes 11 ft lanes in lieu of 12 ft.

ADVANTAGES:

- Reduces pavement needed
- Help to reduce bypass operating speeds
- Reduces deck area on the SPUI bridge
- Reduces deck area on the railroad bridge
- Reduces the amount of earthwork required

DISADVANTAGES:

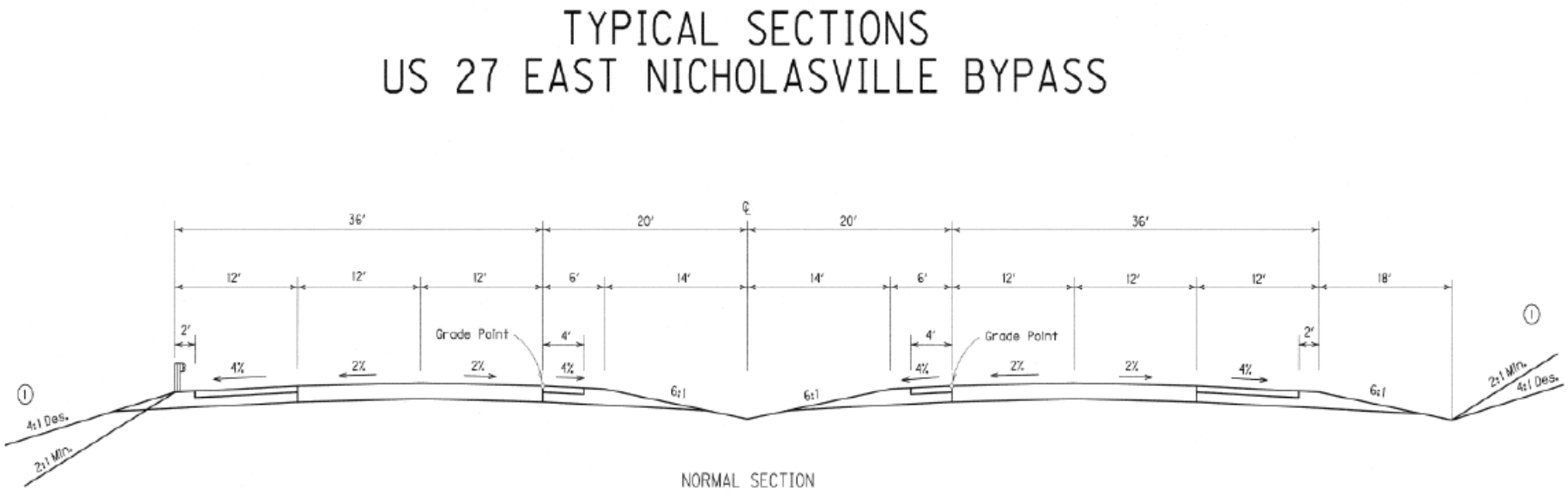
- Reduces maneuverability for trucks, buses or other large vehicles

JUSTIFICATION:
Research has shown there is not an appreciable difference in safety between 11 ft and 12 ft lanes. This is especially true with the presence of paved shoulders. Research has also concluded the narrower lane widths could be beneficial in reducing the operating speeds. Therefore, utilizing 11 ft lanes on the bypass could be helpful in reducing speeds while also reducing the cost of the project.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$20,675,000	$0	$20,675,000
RECOMMENDED DESIGN	$19,859,000	$0	$19,859,000
ESTIMATED SAVINGS OR (COST)	$816,000	$0	$816,000

VALUE ENGINEERING RECOMMENDATION # VE-12

SKETCH OF ORIGINAL DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-12

CALCULATIONS

Reduce the lane width from 12 ft lane to 11 ft:

Pavement Cost Reduction:
1 ft x 4 lanes x 7.3 miles x 5,280 ft/mile = 154,176 SF @ $3.52/SF = $542,700

VALUE ENGINEERING RECOMMENDATION # VE-12

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Pavement	SF	$3.52	1	1,850,112	$6,512,394	1,695,936	$5,969,695
Embankment	CY	$6.00	1	1,750,000	$10,500,000	1,733,700	$10,402,200
SPUI Bridge	SF	$110.00	7	22,700	$2,497,000	22,060	$2,426,600
Railroad Bridge	SF	$110.00	7	10,600	$1,166,000	9,640	$1,060,400
Total					$20,675,394		$19,858,895

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

VALUE ENGINEERING DESIGN COMMENT # VE-13

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Implement the KTC safety study entitled "Safety Evaluation of New Roads" dated September 2002.

COMMENTARY:
The construction of a bypass alters the travel patterns in the local community once it is opened to traffic. A negative effect of this can be the sudden increase of traffic on the existing roads it crosses. These local roads become cut through routes to gain access to the bypass, potentially causing an increase in the crash rate. This would be a concern for KY 169 and KY 39. Another concern is the increase in operating speeds on US 27 after the project is constructed; which creates a direct connection to downtown Nicholasville and Main Street.

UK and the Kentucky Transportation Center completed a study entitled ***Safety Evaluations of New Roads (KTC-02-24/U13-02-1F).*** This study made several recommendations that are repeated below and should be implemented if possible. The recommendations were developed in the following general areas: public information, enforcement, traffic control and design. The recommendations were further divided into those which **should** be done and those that **may** be done. The recommendations relate to intersections since that was where the large majority of crashes occurred. Below is a summary of the recommendations that should be considered when a new road is opened:

MEASURES WHICH SHOULD BE USED

Public Information
- ✓ Work with local media to inform motorists of the opening date.
- ✓ Work with local media to inform drivers of the characteristics of the high speed rural roadway and safety considerations at intersections.
- ✓ Use variable message signs on major side road approaches to the new road for a few days prior to opening to inform motorists of the opening date.
- ✓ Utilize the Public Information Officer position in the district offices to provide information to the media.

Enforcement
- ✓ Work with local and state police and motor vehicle enforcement to provide an enforcement presence during the first weeks after opening.

Traffic Control
- ✓ Use variable message signs for about one month after the opening of new intersections on approaches where there is a potential for a driver disregarding a stop sign or traffic signal indication.
- ✓ Place stop bars at the proper stopping location on all stop approaches.
- ✓ Place intersection warning signs on the mainline in advance of major intersections.
- ✓ Place "cross traffic does not stop" sign where appropriate on stop signs.
- ✓ Place temporary rumble strips on stop approaches (use thermoplastic striping to provide both an audible and visual warning).

VALUE ENGINEERING DESIGN COMMENT # VE-13

DISCUSSION CONTINUED

Design

- ✓ Add turn lanes with pavement arrow markings on side road approaches as a method of altering the alignment for drivers on the side road approaching the new road (note that a possible line of sight limitation from an adjacent vehicle must be considered).

MEASURES WHICH MAY BE USED

Public Information

- ✓ Place flaggers at major intersections on opening date to inform motorists of changes.

Traffic Control

- ✓ Dual mount and oversize stop signs.
- ✓ Dual mount and oversize stop ahead signs if sight distance to intersection is limited.
- ✓ Consider use of intersection beacons at major intersections.
- ✓ Consider use of beacon on stop ahead or stop sign.
- ✓ Consider use of technology which would either a) warn a driver on the side road that his speed was too high to stop at the upcoming stop sign or b) warn a driver on the main road that a vehicle was stopped on the side road approach at the next intersection.
- ✓ Use "cross traffic does not stop" sign as an advance sign on the approach to the stop sign.
- ✓ Use projected or actual traffic volume information to determine if a traffic signal is warranted at major intersections.
- ✓ Consider exclusive left turn phasing for signals at intersections with 55 mph speed limit.
- ✓ Consider partial roadway lighting at major intersections, (especially if traffic signal installed).
- ✓ If sight distance is limited, consider placing stop ahead word message on pavement.
- ✓ At traffic signals where there are factors such as a grade, high truck volume, restricted sight distance, or high speeds consider use of an advance warning flasher.
- ✓ Consider placement of a permanent active sign displaying the speed of motorists on the new road at the approach to major intersections where the side road has a stop condition.

Design

- ✓ Provide a traffic calming device such as painted or mountable islands for channelization for the side road approaches (use of a PCC mountable median with an asphalt pavement provides a visual outline of the island).
- ✓ Consider a design which reduces the number of conflict points (the design could involve either allowing right turns only from the side road with U-turns adjacent to the intersection or the use of a roundabout).
- ✓ Use a different type of pavement in the immediate approach to the intersection on the side road to provide warning to drivers approaching the intersection.
- ✓ Consider use of speed humps on side street approach.
- ✓ If possible, do not provide a long tangent with high design speed on side road approaches.

VALUE ENGINEERING DESIGN COMMENT # VE-13

ADDITIONAL INFORMATION

Research Report
KTC-02-24/UI3-02-1F

KENTUCKY TRANSPORTATION CENTER

SAFETY EVALUATION OF NEW ROADS

VALUE ENGINEERING RECOMMENDATION # VE-14

DESCRIPTIVE TITLE OF RECOMMENDATION:
Add a shared use path along the new east bypass.

ORIGINAL DESIGN:
The original design does not specify any pedestrian and bicycle accommodations.

RECOMMENDED CHANGE:
The VE team recommends the addition of a 10 ft shared-use path to accommodate safe connectivity of land uses that will likely develop in the future along or near the corridor. The path will be located six feet from the shoulder edge. It will be paved with bituminous asphalt.

ADVANTAGES:

- Separates vehicular and non-motorized traffic
- Provides for a walkable environment to schools, neighborhoods and future development
- Potentially allow for a small reduction in vehicular trips

DISADVANTAGES:

- Requires additional ROW

JUSTIFICATION:
A shared use path is the appropriate type of accommodation for pedestrians and bicyclists for the given condition. With limited access and high vehicular speeds, separating non-motorized travelers is the best solution. There may be no additional ROW costs if other recommendations that reduce roadway width, identified in this report are implemented. The cost estimate for this recommendation is approximated from the Jacksonville Urban Area MPO in the City of Berea, KY.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$0	$0	$0
RECOMMENDED DESIGN	$500,000	$0	$500,000
ESTIMATED SAVINGS OR (COST)	($500,000)	$0	($500,000)

VALUE ENGINEERING RECOMMENDATION # VE-14

PHOTOGRAPH OF RECOMMENDED DESIGN

VALUE ENGINEERING RECOMMENDATION # VE-14

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Shared Use Path 10 ft bituminous	LF	$80,000	8			6.25	$500,000
Total					$0		$500,000

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

VALUE ENGINEERING DESIGN COMMENT # VE-15

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Conduct a transportation planning study to identify parallel routes to the new east bypass to improve connectivity, and adopt it into the comprehensive plan.

COMMENTARY:
Providing a strong connected network of roads and pedestrian facilities can help distribute traffic, reduce travel distances and times, improve routing for transit and reduce walking distances. Good connectivity also provides better routing opportunities for emergency and delivery (solid waste, recycling, mail) vehicles. All of these effects can play a positive role in reducing congestion on the street network.

Connectivity is achieved by providing connections within individual developments, between developments and by having a well planned collector road network to compliment the arterial highway network. Connectivity of an area can be measured using a connectivity index – commonly defined as the ratio of links to nodes. To achieve network connectivity, one guideline is to have arterials spaced approximately ½ mile apart and collectors every ¼ mile.

To achieve connectivity and to minimize traffic volume stress at intersections along the bypass, it is recommended that a local road plan be developed to identify locations of new collector roads and locations of connections for existing roads. Having such a plan will allow better planning and implementation of a supportive road network in future land-use decisions. An example rendering is below.

VALUE ENGINEERING DESIGN COMMENT # VE-15

SKETCH OF RECOMMENDED DESIGN

VALUE ENGINEERING DESIGN COMMENT # VE-16

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Preserve future needed ROW for the bypass with planning and zoning ordinance.

COMMENTARY:

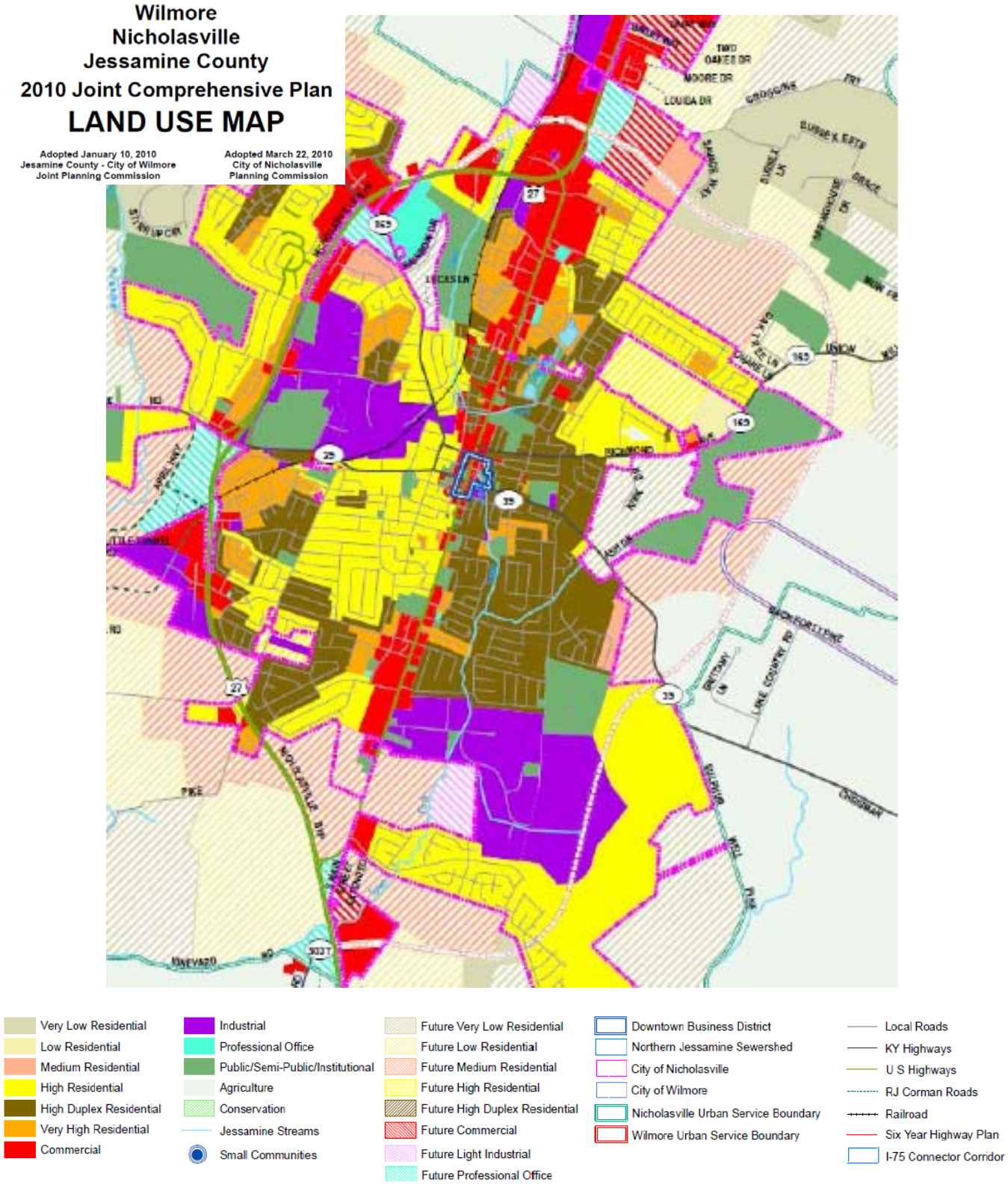
It may take many years to complete the project for several reasons. Likely, the northern part of the project will be built first. Because there is no identified funding for the southern portion, it is unknown when it will be built. Also, for much of the project a four-lane ultimate design is not warranted at this time, but the local government may want to plan for a widening. Additionally, KYTC cannot purchase and hold ROW for longer than seven years prior to project construction. In the meantime, owners of property along the project alignment may decide to build structures or large developments that would adversely affect the ROW of costs for future phases. An example of this has already happened in the residential development just northeast of the southern terminus.

For these reasons, it is recommended that the local government adopt regulations and ordinances to preserve the corridor to protect the ROW from development. Identified future ROW lines will allow planning staff to work with landowners to keep buildings and development from encroaching. This strategy will help to preserve the necessary land for the project thus minimizing ROW costs and impacts in the future. This can be accomplished by implementing these three actions:

1. Develop a transportation map in the Comprehensive Plan(s) that identifies this roadway as a future corridor with a functional class of major arterial.
2. Adopt building and parking setback requirements in the zoning ordinance. Reference the transportation map for specific location.
3. Adopt building and parking setback requirements in the subdivision regulations. Reference the transportation map for specific alignment.

VALUE ENGINEERING DESIGN COMMENT # VE-16

ADDITIONAL INFORMATION



VALUE ENGINEERING DESIGN COMMENT # VE-17

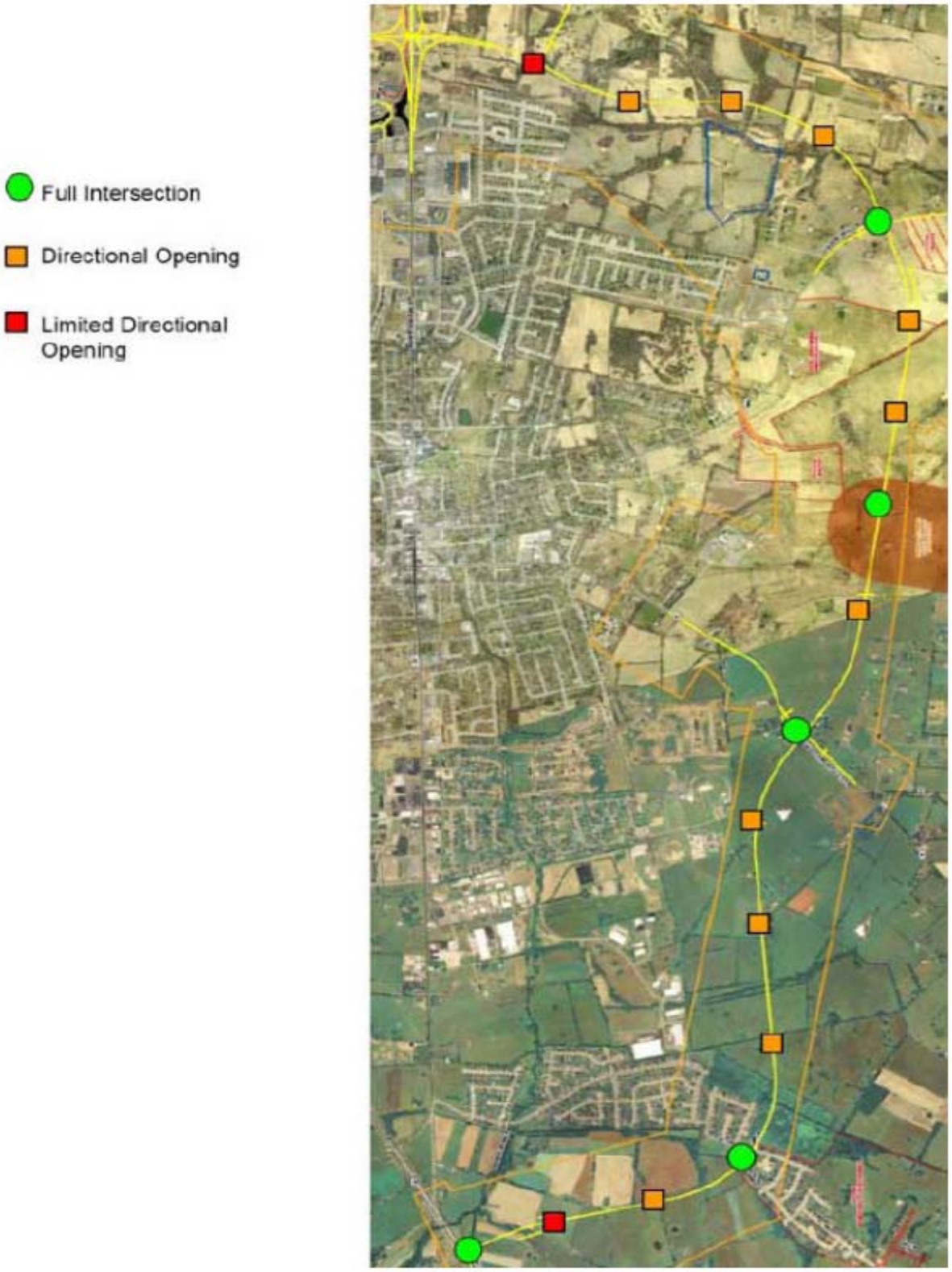
DESCRIPTIVE TITLE OF DESIGN COMMENT:
Control access with limited full intersections and spaced directional openings using a plan and memorandum of understanding.

COMMENTARY:
Traffic flow and safety are directly affected by the number of conflict points. Eliminating and therefore, minimizing crossover and left-turn movements should be a strategy adopted in the phase II project design. It is recommended that the only full opening intersections be located at the five at-grade intersections (US 27, Harlan Drive, KY 39, I-75 Connector, and KY 169). The intersection of the I-75 Connector could be Continuous Green T intersection without allowing access on the west side of the intersection. Following the approximate locations identified in Phase I (roughly 2,000 ft spacing) for access, directional openings would be permitted. Should a two lane cross section be implemented, all directional opening locations should contain exits with right-turn only.

To accomplish this, the local governments, planning units, MPO and KYTC should enter into a memorandum of understanding. The MOU should define the location and type of future access points. It should also define the process for amending the plan that includes agreement by all parties. This access management plan should be adopted as part of transportation element of the local comprehensive plans. This will help the planning staffs and planning commissions determine access location when considering land subdivision, future zoning, and development requests.

VALUE ENGINEERING DESIGN COMMENT # VE-17

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-18a

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 2-lane bypass from southern terminus of the new bypass to KY 169 in lieu of a 4-lane bypass.

ORIGINAL DESIGN:
The original design specifies a four-lane divided cross section for the entire Nicholasville eastern bypass (6.25 miles).

RECOMMENDED CHANGE:
The VE team recommends the implementation of a 2-lane bypass south of KY 169 (4.5 miles) because the future traffic volumes (design hourly volumes) do not warrant a four-lane highway south of KY 169.

ADVANTAGES:
- Reduced ROW takes and impacts to property owners
- Reduced Construction materials and labor
- Adequate for traffic flow
- Reduced Environmental Impacts

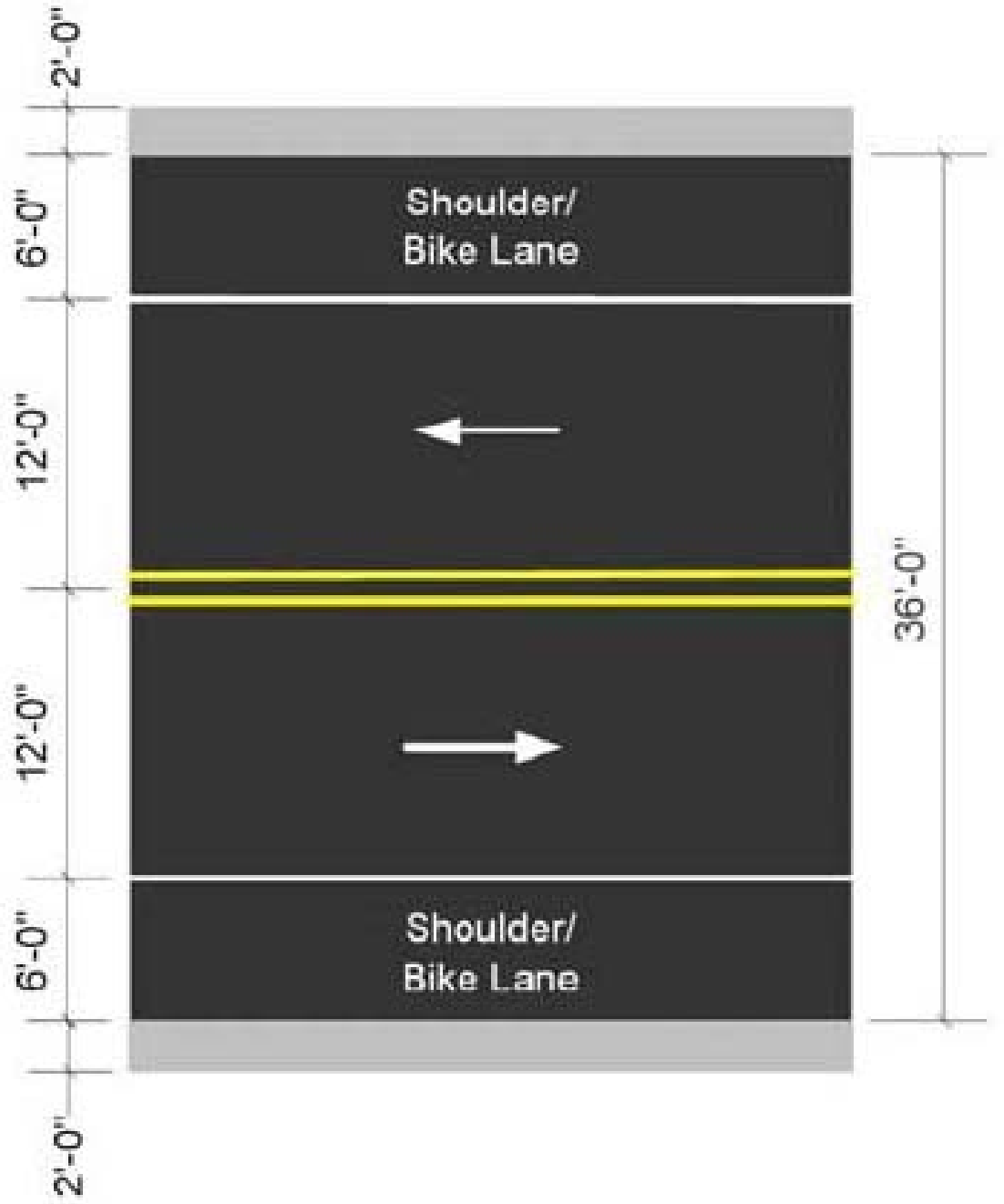
DISADVANTAGES:
- Passing maneuvers require moving to the opposite travel lane
- Less safe than 4-lane (with limited median breaks) or 2+1 lane alternatives

JUSTIFICATION:
Using the DHV from the preliminary traffic forecast, there is reserve capacity using a 2-lane cross section for all segments of the eastern bypass. For all sections south of KY 169, this is between 22 and 43% reserve capacity for the peak hours, more than adequate for future growth beyond year 2034. Building more than two lanes is not justified from a cost standpoint. Calculations are attached.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$18,224,000	$0	$18,224,000
RECOMMENDED DESIGN	$3,824,000	$0	$3,824,000
ESTIMATED SAVINGS OR (COST)	$14,400,000	$0	$14,400,000

VALUE ENGINEERING RECOMMENDATION # VE-18a

SKETCH OF RECOMMENDED DESIGN

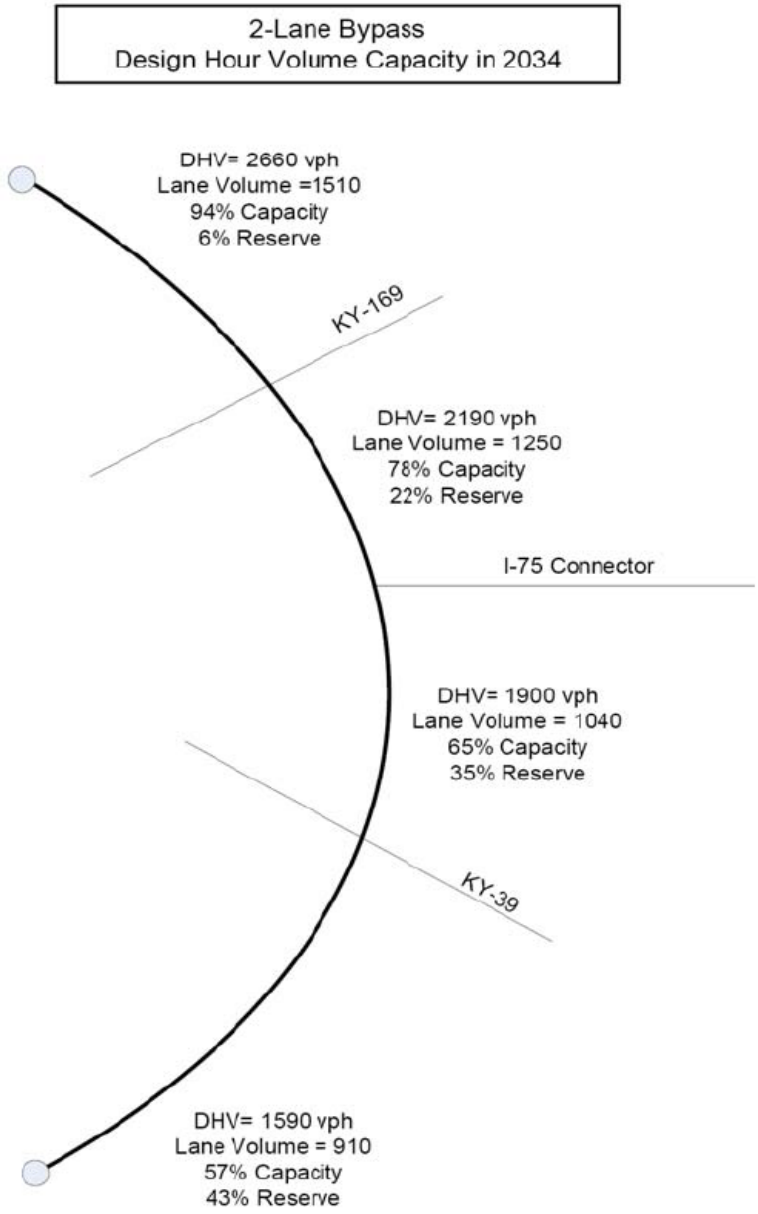


VALUE ENGINEERING RECOMMENDATION # VE-18a

CAPACITY CALCULATIONS

Beginning	Ending	DHV	Peak Lane Direction	Peak Lane Volume	% of Capacity	Reserve Capacity
Southern Terminus	KY 39	1590	SB	910	94	6
KY 39	I-75 Connector	1900	SB	1040	78	22
I-75 Connector	KY 169	2190	SB	1250	65	35
KY 169	US 27	2660	SB	1510	57	43

Assumptions: Capacity lane volume: 1600 VPD (this capacity is conservative for a rural, controlled access facility)
Volumes came from preliminary forecast report developed for Phase II design



VALUE ENGINEERING RECOMMENDATION # VE-18a

CALCULATIONS

23,800LF (southern terminus to KY 169)

Original Pavement: 23,800 (48+28) = 1,808,800 SF
New Pavement: 23,800 X (28+12) = 952,000 SF [2 12 ft lanes and 4 ft flush median]
Savings of Pavement: 856,000 SF

Elimination of Grass Median: 23,800 X 28 = 666,400 = 74,044

ROW Savings:
Subtract (28+6+36+18) = 88 ft x 23,800 = 2,094,400 SF

Embankment:
525,000 CY x .40 = 210,000 CY

Excavation:
480,000 CY x .40 = 192,000 CY

VALUE ENGINEERING RECOMMENDATION # VE-18a

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment	CY	$6.00	1	210,000	$1,260,000		
Excavation	CY	$4.00	1	192,000	$768,000		
ROW	SF	$4.32	1	2,094,400	$9,047,808		
Culvert Pipe 18”	LF	$40.00	1	5,000	$200,000	2,500	$100,000
Culvert Pipe 24”	LF	$50.00	1	1,000	$50,000	500	$25,000
Culvert Pipe 30”	LF	$70.00	1	450	$31,500	225	$15,750
Culvert Pipe 36”	LF	$85.00	1	450	$38,250	225	$19,125
Culvert Pipe 42”	LF	$90.00	1	350	$31,500	175	$15,750
Culvert Pipe 48”	LF	$100.00	1	50	$5,000	25	$2,500
Culvert Pipe 54”	LF	$130.00	1	550	$71,500	275	$35,750
Culvert Pipe 60”	LF	$140.00	1	100	$14,000	50	$7,000
Culvert Pipe 72”	LF	$170.00	1	100	$17,000	50	$8,500
Clearing & Grubbing	LS	$89,000	1	1	$89,000	0.5	$44,500
Seeding & Protection	SY	$0.50	1	472,500	$236,250	398,455	$199,228
Asphalt Roadway	SF	$3.52	1	1,808,000	$6,364,160	952,000	$3,351,040
Total					$18,223,968		$3,824,143

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

VALUE ENGINEERING RECOMMENDATION # VE-18b

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 2+1 lanes on the new east bypass in lieu of 4 lane typical section.

ORIGINAL DESIGN:
The original design specifies a four-lane divided cross section for the entire Nicholasville eastern bypass (6 miles).

RECOMMENDED CHANGE:
The VE team recommends the implementation of a concept called 2 + 1 road design. This calls for a continuous three-lane cross section, with alternating passing lanes. They have been used extensively in Europe as a more cost effective alternate to a four-lane roadway. As a rule-of-thumb, 2 + 1 designs work effectively with ADTs ranging from 15,000 to 25,000 vehicles per day (VPD). Germany uses these designs with ADTs up to 30,000 VPD; they have found crash rates are 36% lower than conventional two-lane roads.

Passing lanes generally are alternated at spacing ranging from ½ mile to 1 mile. This allows for frequent passing opportunities and ability to improve the level-of-service (LOS). It is recommended that a four foot buffer (flush median) be used to separate opposing traffic. A cable barrier may be used to minimize crossover crashes. This recommendation may be used for the entire eastern bypass. A variation to the this alternative would be to implement the 2 + 1 from the southern terminus to KY 169 (4.5 miles length) because of the higher traffic flow on the segment between KY 169 and the northern terminus.

ADVANTAGES:

- Reduced ROW Cost & Impacts to Property Owners
- Reduced Construction Cost
- Reduced Environmental Impacts
- Adequate for traffic flow
- Safe design

DISADVANTAGES:

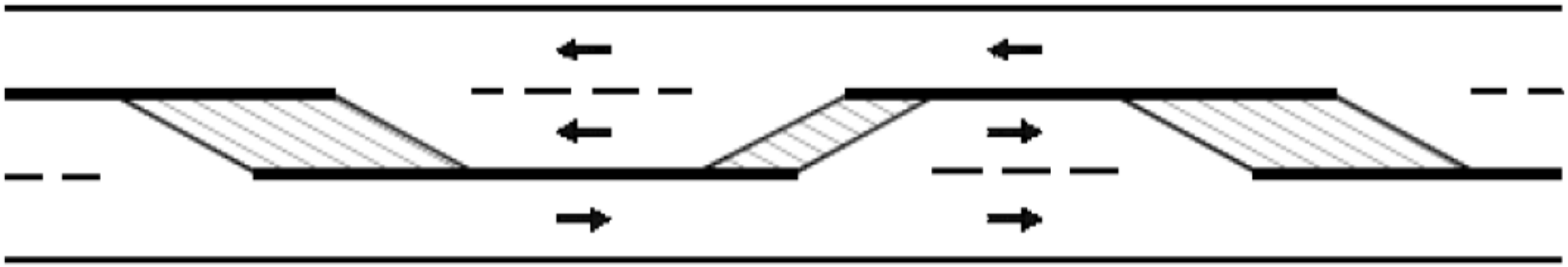
- Reduced reserve capacity

JUSTIFICATION:
Using the DHV from the preliminary traffic forecast, there is reserve capacity using a 2-lane cross section for all segments of the eastern bypass. By enhancing a two-lane design to a 2+1 design, the LOS (based on time spent following) should be improved by allowing many safe opportunities for passing.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$16,737,000	$0	$16,737,000
RECOMMENDED DESIGN	$4,875,000	$0	$4,875,000
ESTIMATED SAVINGS OR (COST)	$11,862,000	$0	$11,862,000

VALUE ENGINEERING RECOMMENDATION # VE-18b

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-18b

CALCULATIONS

Original Pavement: 23,800 (48+28) = 1,808,800 SF
New Pavement: 23,800 X (40+12) = 1,237,600 SF [3 12 ft lanes and 4 ft flush median]
Savings of Pavement: 571,200 SF

ROW Savings:
Subtract (28+6+24+18) = 76 ft x 23,800 = 1,808,800 SF

Difference in Embankment:
525,000 CY x .35 = 183,750 CY

Difference in Excavation:
480,000 CY x .35 = 168,000 CY

VALUE ENGINEERING RECOMMENDATION # VE-18b

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment	CY	$6.00	1	183,750	$1,102,500		
Excavation	CY	$4.00	1	168,000	$672,000		
ROW	SF	$4.32	1	1,808,800	$7,814,016		
Culvert Pipe 18”	LF	$40.00	1	5,000	$200,000	3,000	$120,000
Culvert Pipe 24”	LF	$50.00	1	1,000	$50,000	600	$30,000
Culvert Pipe 30”	LF	$70.00	1	450	$31,500	270	$18,900
Culvert Pipe 36”	LF	$85.00	1	450	$38,250	270	$22,950
Culvert Pipe 42”	LF	$90.00	1	350	$31,500	210	$18,900
Culvert Pipe 48”	LF	$100.00	1	50	$5,000	30	$3,000
Culvert Pipe 54”	LF	$130.00	1	550	$71,500	330	$42,900
Culvert Pipe 60”	LF	$140.00	1	100	$14,000	60	$8,400
Culvert Pipe 72”	LF	$170.00	1	100	$17,000	60	$10,200
Clearing & Grubbing	LS	$89,000	1	1	$89,000	0.5	$44,500
Seeding & Protection	SY	$0.50	1	472,500	$236,250	398,455	$199,228
Asphalt Roadway	SF	$3.52	1	1,808,000	$6,364,160	1,237,600	$4,356,352
Total					$16,736,676		$4,875,330

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

VALUE ENGINEERING RECOMMENDATION # VE-19a

DESCRIPTIVE TITLE OF RECOMMENDATION:
Right-size the SPUI by reducing the number of lanes and median width through the SPUI, US 27, and ramps (73 ft in lieu of 87 ft wide).

ORIGINAL DESIGN:
The original design specifies a Single Point Urban Interchange (SPUI) utilizing a standard intersection template. The intersection template for the SPUI includes dual left turn lanes on the realigned bypass and all ramps to/from US 27 are dual lane ramps.

RECOMMENDED CHANGE:
The VE team recommends reducing the number of through lanes on the SPUI bridge to one in each direction in the east/west direction (through traffic from the eastern to western bypass and vice versa). Removing one lane in the westbound lane also removes one lane from the proposed westbound bridge over the railroad. Another recommendation is to reduce the ramps on the south side of the SPUI to one lane ramps due to traffic forecasts for these ramps. Similarly, the number of lanes on US 27 can be reduced to one lane in each direction under the bridge due to anticipated traffic. A final recommendation is to move the bridge abutment wall to 30 feet of the travel way for the clear zone. As currently shown the abutment wall is approximately 40 feet from the travel way in both directions of US 27.

ADVANTAGES:
- Reduces areas on two bridges (SPUI and westbound bridge over railroad)
- Reduces paved surfaces in interchange area
- Reduces embankment in interchange area

DISADVANTAGES:
- Does not improve poor peak hour performance

JUSTIFICATION:
The number of through lanes and median width across the SPUI bridge can be minimized to save construction cost to the bridge, embankment and approaching roadway surface. This is based upon the low demand of through traffic from the eastern to western bypasses (and vice versa). The primary movements on the subject bridge are turns, not through traffic

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$19,682,000	$0	$19,682,000
RECOMMENDED DESIGN	$18,108,000	$0	$18,108,000
ESTIMATED SAVINGS OR (COST)	$1,574,000	$0	$1,574,000

VALUE ENGINEERING RECOMMENDATION # VE-19a

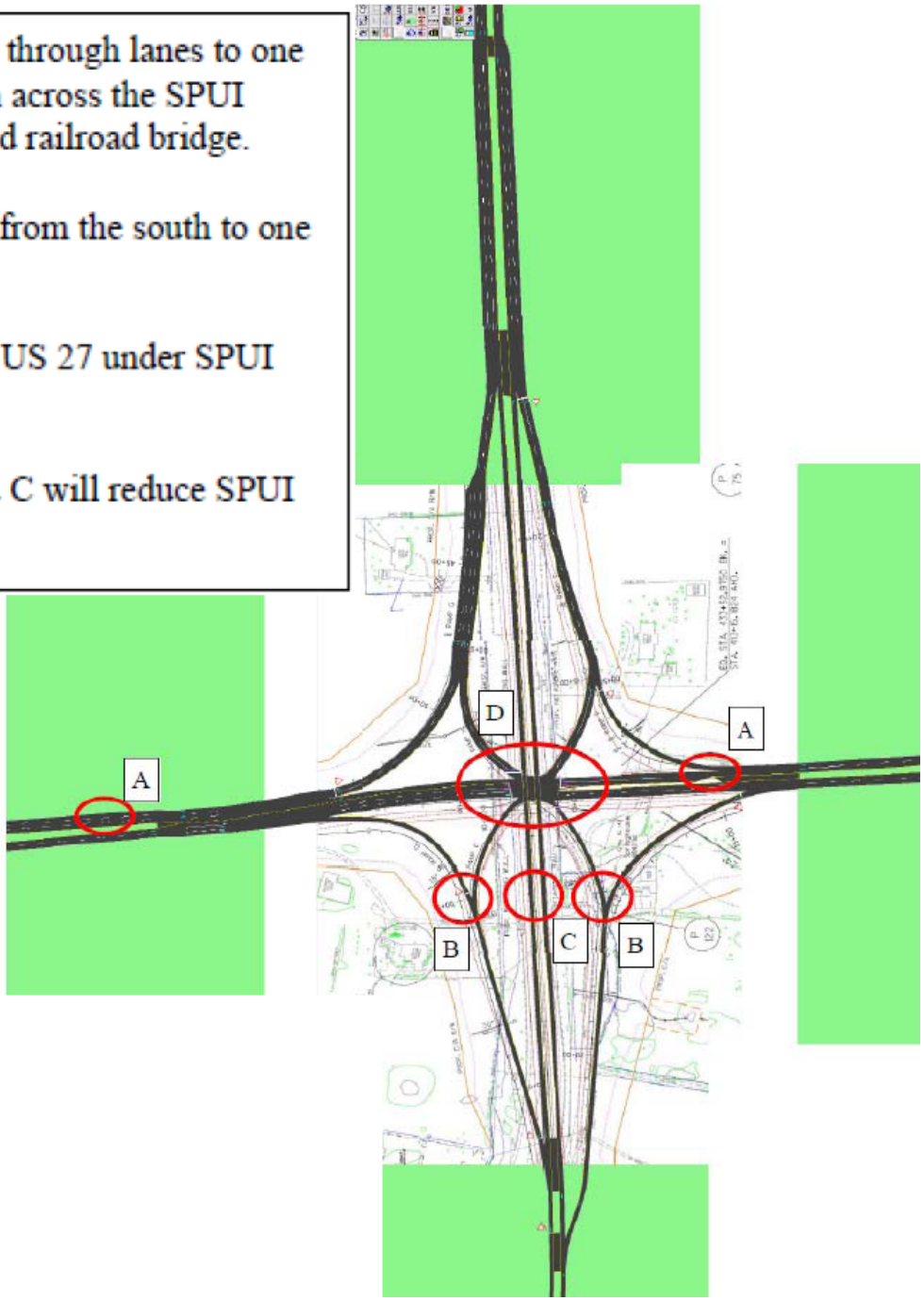
SKETCH OF RECOMMENDED DESIGN

A - Reduce east/west through lanes to one lane in each direction across the SPUI Bridge and westbound railroad bridge.

B - Reduce ramps to/from the south to one lane.

C - Reduce mainline US 27 under SPUI Bridge to one lane.

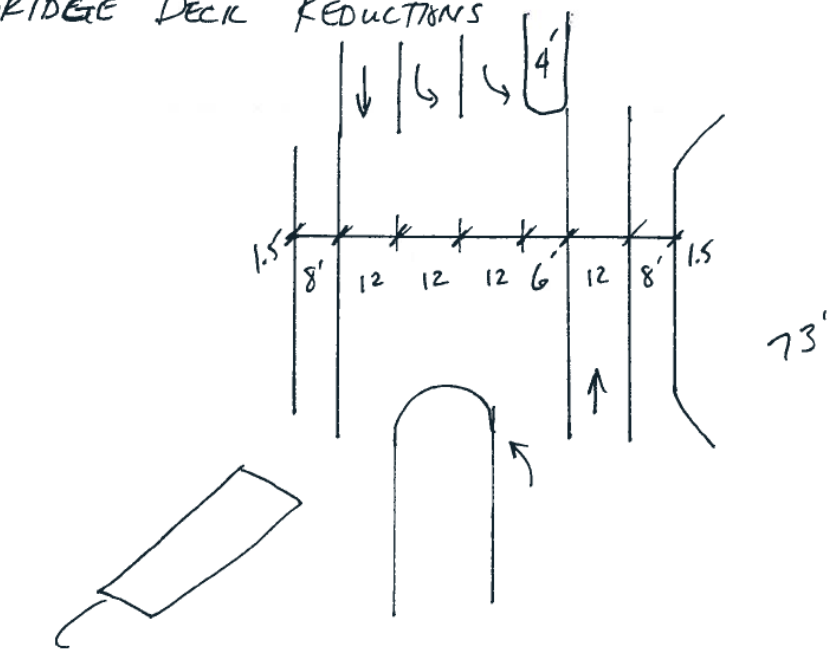
D - Sum of A, B, and C will reduce SPUI bridge deck area.



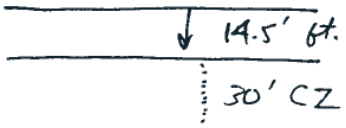
VALUE ENGINEERING RECOMMENDATION # VE-19a

CALCULATIONS

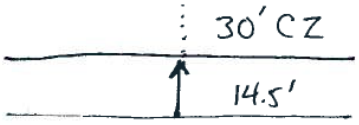
BRIDGE DECK REDUCTIONS



Br AREA SUBTRACTED FROM WING SE & SW CORNER



MOVE ABUTMENT to 30' CLEAR ZONE.



REDUCTION OF BRIDGE AREA.

★ CALC BY CAD. 15,150 SF.

RR#1 UNCHANGED = 10,600 SF

−2280 off RR#2

15,100

Σ = 12820 SF

NEW TOTAL 38,570

VALUE ENGINEERING RECOMMENDATION # VE-19a

CALCULATIONS

EMBANKMENT REDUCTIONS

AVERAGE EX SECT

433+00	(14x25)+25+10	= 385
432+00	(16x25)+25+20	= 445
431+00	(19x25)+10	= 485
430+00	(15x25)+10	= 385
429+00	(12x25)	= 300
428+00	(13x25)+15	= 340
427+00	(11x25)+15	= 290
426+00	(6x25)+15	= 165
425+00	(7x25)	175
424+00	(7x25)	175
423+00	(6x25)+15	165
422+00	(5x25)	125
421+00	(5x25)+15	140
420+00	(6x25)+10	160

eq sta

419	(7x25)	175
418	(7x25)+15	190
417	(7x25)+15	190
416	(11x25)	275
415	(7x25)+20	190
414	(8x25)+20	220
433	(8x25)+20	220

Σ = 5,195 SF / AVE (259.75)

X 2,000 lin Ft.

519,500 CF / 27

= CY

- 19,250

PAVEMENT AREAS

SOUTH RAMPS FROM SPUI. 2 LANES TO 1 LANE

12 FT x 1300 = - 15,600 SF

12 FT X 1100 = - 13,200 SF

12 FT X 530 = - 6,360 SF

12 FT X 2000 = - 24,000 SF

- 59,160 SF

1.096 M

Σ

1,036,840 - 48,000 = 988,840

REDUCING US 27 FROM 4 TO 2 LANES

2 x 12 = 24

X 2000 ft.

- 48,000 ft²

VALUE ENGINEERING RECOMMENDATION # VE-19a

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Bridge Deck Area	SF	$110.00	7	48,400	$5,324,000	38,570	$4,242,700
Pavement Area	SF	$3.52	1	1,096,000	$3,857,920	988,840	$3,480,717
Embankment	CY	$6.00	1	1,750,000	$10,500,000	1,730,750	$10,384,500
Total					$19,681,920		$18,107,917

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

VALUE ENGINEERING RECOMMENDATION # VE-19b

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a crossroad under design in lieu of the cross road over design associated with the SPUI.

ORIGINAL DESIGN:
The original design specifies a SPUI with the bypass over the existing US 27 grade. This design requires extensive fill to raise the grade of the bypass.

RECOMMENDED CHANGE:
The VE team recommends that the SPUI be placed at the existing US 27 grade and that US 27B/Main Street be taken over the SPUI. This saves extensive fill over the original design by reducing fill for the Bypass and the ramps associated with the SPUI.

ADVANTAGES:

- Significant reduction in fill

DISADVANTAGES:

- Same poor level of service as the original design
- Potential visibility concerns for the intersection under the proposed overpass

JUSTIFICATION:
The proposed design matches the existing contours along the bypass alignment, significantly reducing the amount of fill need for the bypass.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$10,948,000	$0	$10,948,000
RECOMMENDED DESIGN	$7,588,000	$0	$7,588,000
ESTIMATED SAVINGS OR (COST)	$3,360,000	$0	$3,360,000

VALUE ENGINEERING RECOMMENDATION # VE-19b

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment	CY	$6.00	1	710,000	$4,260,000	150,000	$900,000
Asphalt Roadway	SF	$3.50	1	573,600	$2,007,600	573,600	$2,007,600
Bridges over US 27/27 Bypass	LS	$2,000,000	7	1	$2,000,000	1	$2,000,000
Railroad Bridges	EA	$2,680,000	1	1	$2,680,000	1	$2,680,000
Total					$10,947,600		$7,587,600

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

VALUE ENGINEERING RECOMMENDATION # VE-19c

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize an at-grade diverging diamond interchange with existing alignment of the west bypass with US 27 bridged over the new interchange.

ORIGINAL DESIGN:
The original design specifies the use of a single point urban interchange over US 27/US 27B. North-south traffic into and out of downtown Nicholasville is free flow with all bypass traffic stopped at the SPUI. This designs requires significant fill to raise the bypass over the existing US 27 roadway. Operational analysis of the design indicates that significant delay and queues will form for the eastbound left turn movement and the southbound left and right turn movements onto the bypass.

RECOMMENDED CHANGE:
The VE team recommends the use of a Diverging Diamond Interchange (DDI) in order to better serve the conflicting left turn movements at the intersection. Operational analysis of the DDI indicates that it will operate at LOS D at the critical point with significantly reduced critical movement queues during peak periods. The proposed design would also place the DDI ramp terminals at the existing US 27 grade and raise US 27B/US 27, greatly reducing the amount of fill in the interchange area and utilizing the existing US 27 bridges over the railroad.

ADVANTAGES:
- Improved operations
- Significant reduction in fill
- Eliminates proposed bridges over railroad, retains use of existing bridges
- Reduce ROW area requirements

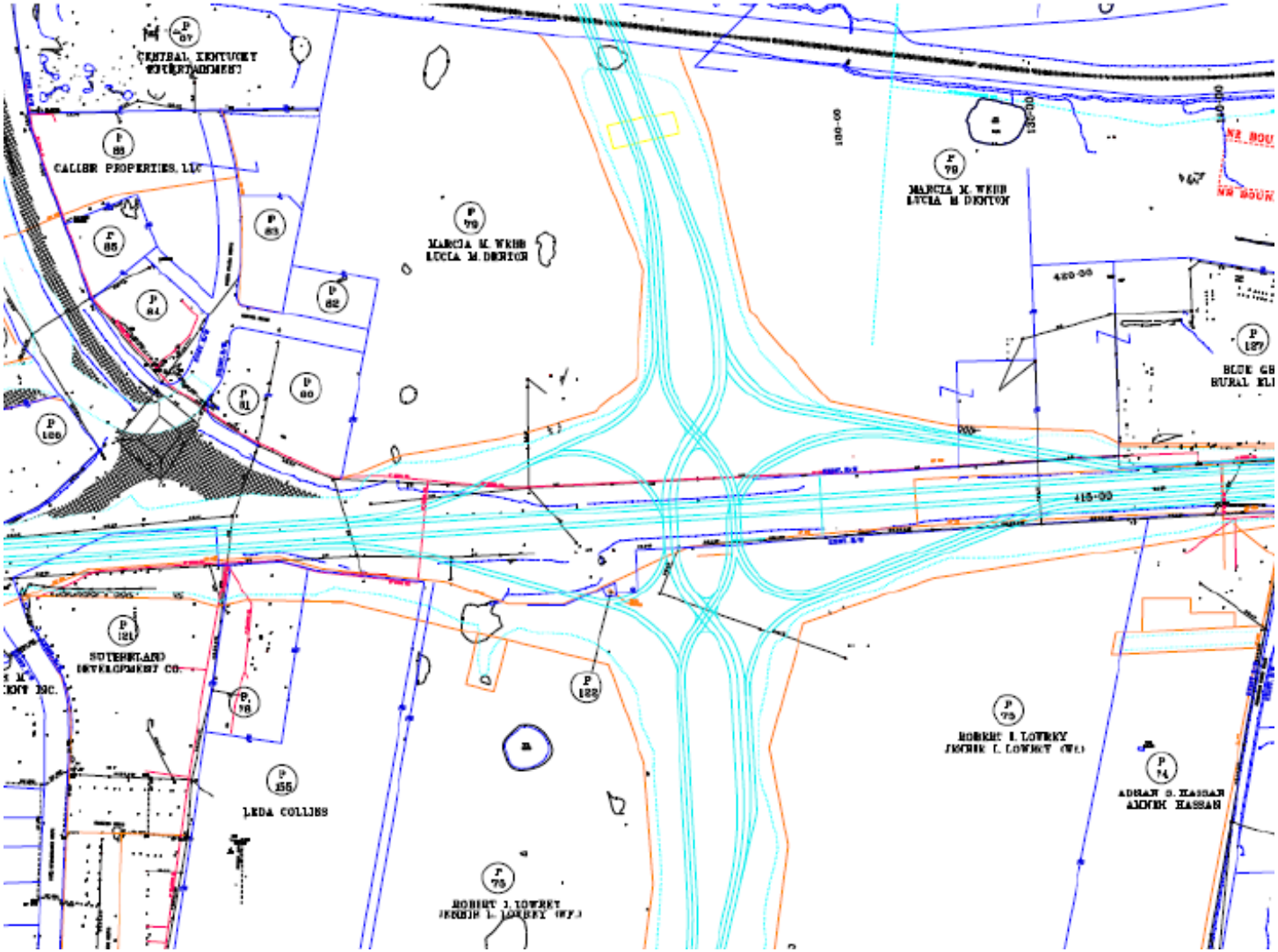
DISADVANTAGES:
- Innovative Design Configuration
- Future Capacity Limitations
- Greater impact to some commercial properties

JUSTIFICATION:
The proposed design provides a significant operational improvement in intersection operations and will meet the design year demand unlike the proposed SPUI design.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$10,948,000	$0	$10,948,000
RECOMMENDED DESIGN	$7,588,000	$0	$7,588,000
ESTIMATED SAVINGS OR (COST)	$3,360,000	$0	$3,360,000

VALUE ENGINEERING RECOMMENDATION # VE-19c

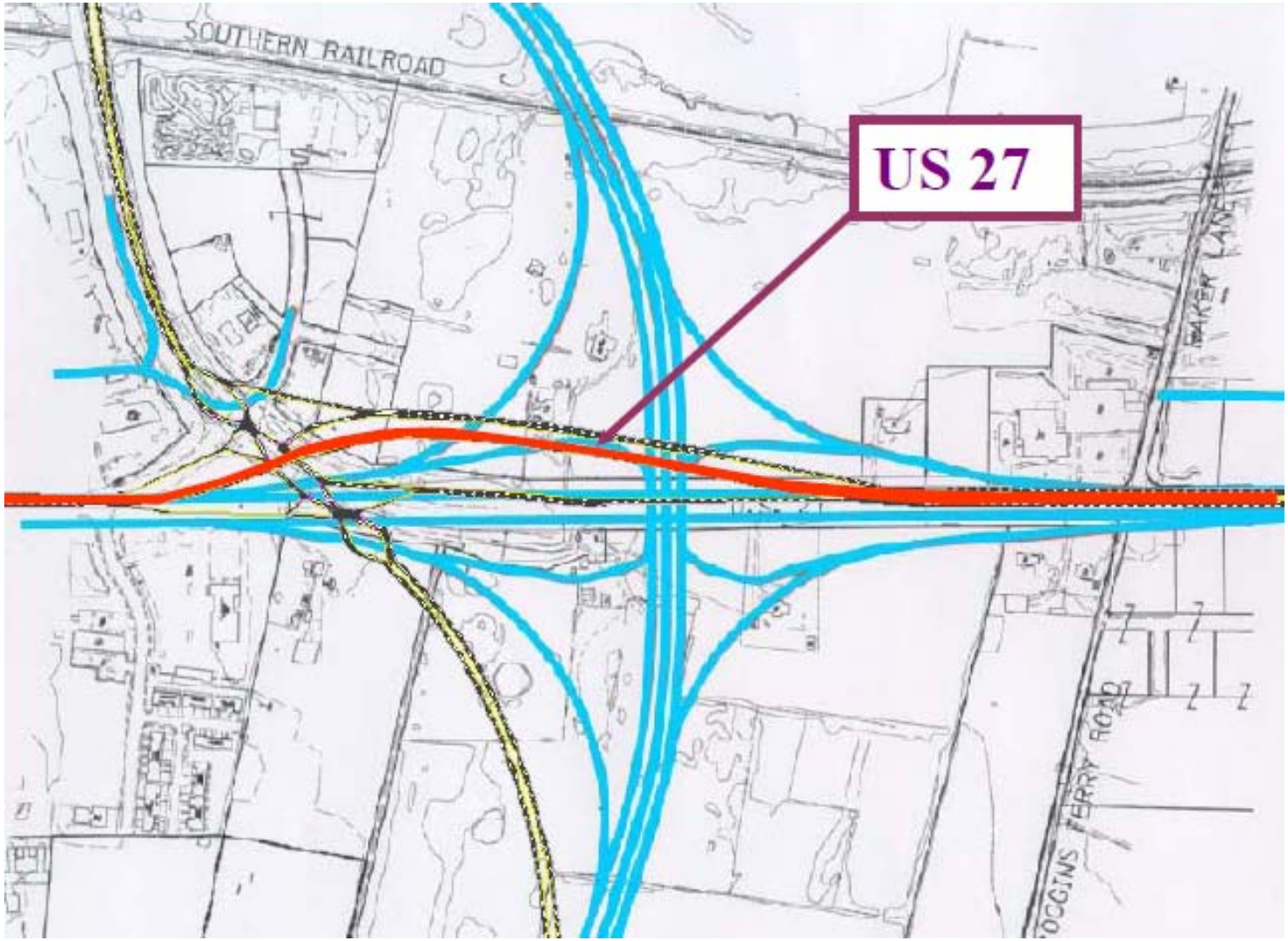
SKETCH OF RECOMMENDED DESIGN



Diverging Diamond Interchange (DDI) located in the proposed SPUI alignment

VALUE ENGINEERING RECOMMENDATION # VE-19c

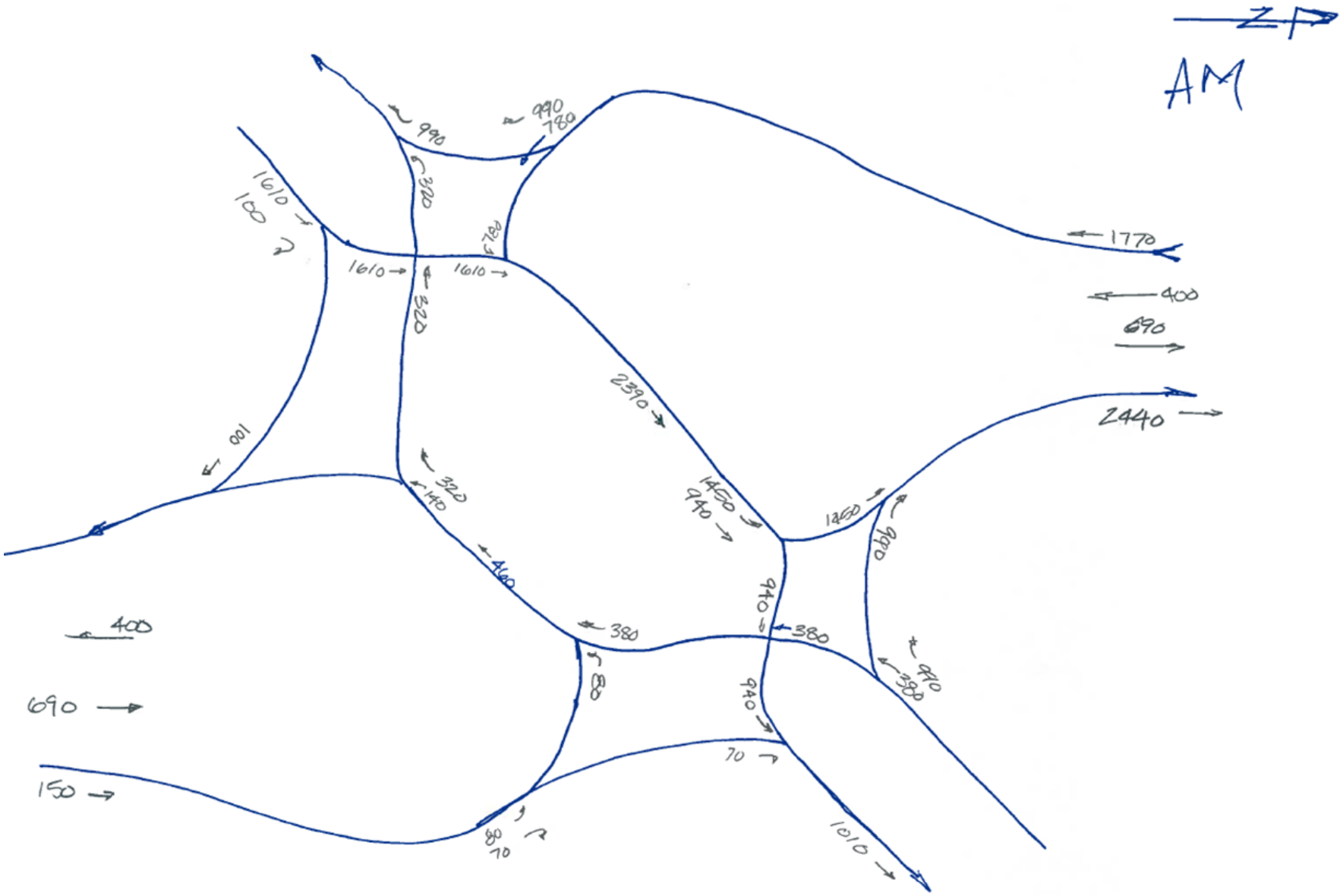
SKETCH OF RECOMMENDED DESIGN



Diverging Diamond Interchange (DDI) located in the existing interchange alignment

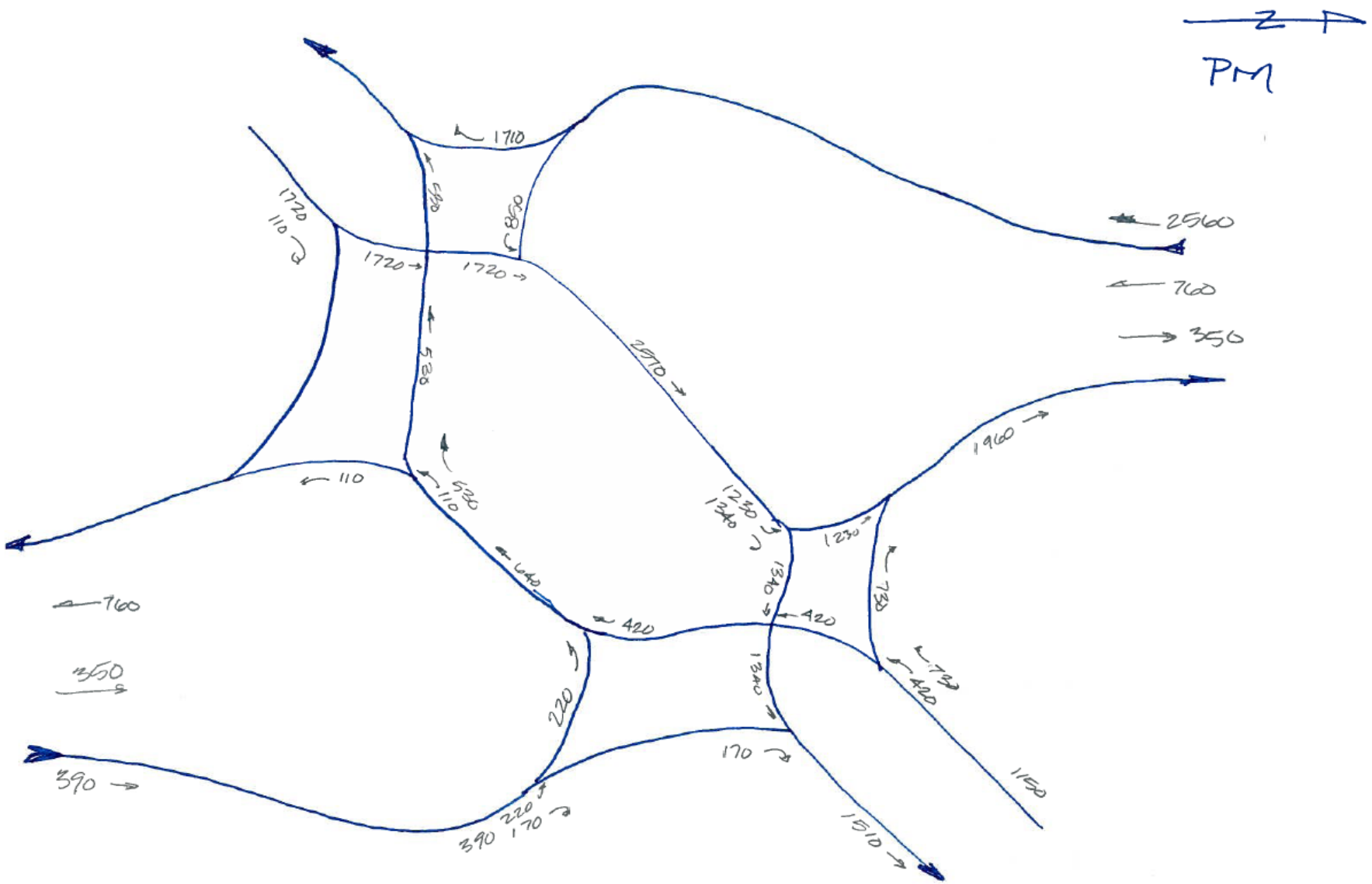
VALUE ENGINEERING RECOMMENDATION # VE-19c

FORECASTED TRAFFIC (2034)



VALUE ENGINEERING RECOMMENDATION # VE-19c

FORECASTED TRAFFIC (2034)



VALUE ENGINEERING RECOMMENDATION # VE-19c

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment	CY	$6.00	1	710,000	$4,260,000	150,000	$900,000
Asphalt Roadway	SF	$3.50	1	573,600	$2,007,600	573,600	$2,007,600
Bridges over US 27/27 Bypass	EA	$2,000,000	7	1	$2,000,000	1	$2,000,000
Railroad Bridges	EA	$2,680,000	1	1	$2,680,000	1	$2,680,000
Total					$10,947,600		$7,587,600

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

VALUE ENGINEERING RECOMMENDATION # VE-19d

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize KIRK Intersection Design (KID) (at-grade intersection with two intersecting left-turn fly-over ramps) in lieu of SPUI.

ORIGINAL DESIGN:
The original design specifies the use of a single point urban interchange over US 27/US 27B. North-south traffic into and out of downtown Nicholasville is free flow with all bypass traffic stopped at the SPUI. This designs requires significant fill to raise the bypass over the existing US 27 roadway. Operational analysis of the design indicates that significant delay and queues will form for the eastbound left turn movement and the southbound left and right turn movements onto the bypass.

RECOMMENDED CHANGE:
The VE team recommends that a split level intersection design be used to separate the high volume turning movements associated with eastbound left turn and southbound left turn movements. The east and west bypass would approach on the same alignment as with the original design, though at a significantly lower grade intersect with existing US 27 at the approximate location of the SPUI. The eastbound left turn movement and Southbound left turn movement would be grade separated over this intersection and meet at a signalized intersection.

ADVANTAGES:
- LOS A/B with minimal delay for peak hour
- Significant reduction of fill
- Reduced cross-section on US 27B and US 27
- At-grade crossing for adjacent property

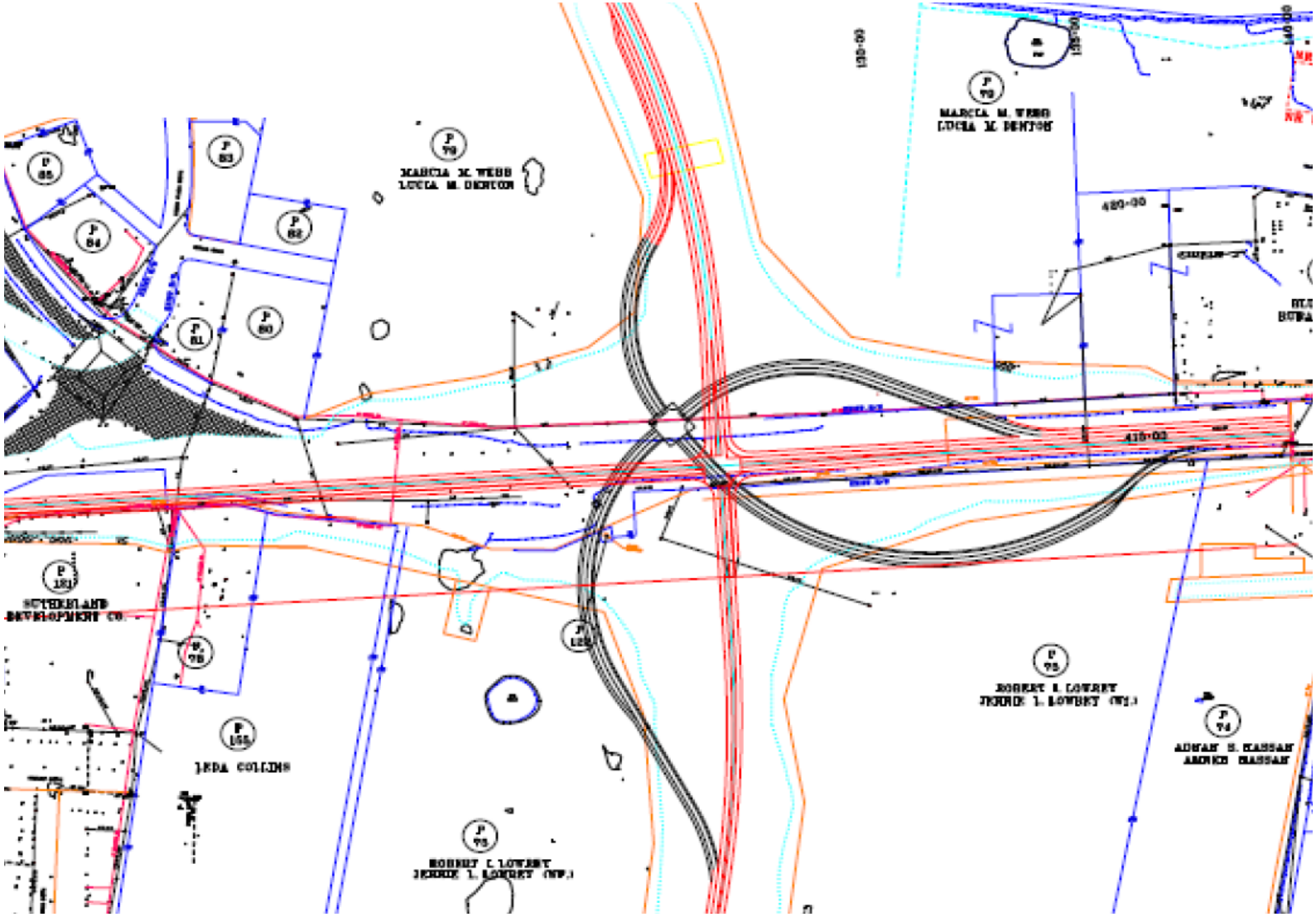
DISADVANTAGES:
- Requires redesign

JUSTIFICATION:
The proposed design will save approximately 650,000 CY of fill for a total cost savings over $3M. In addition, the proposed design will operate at LOS A or B during the AM and PM peak periods of the design year. This level of operation is significantly better than the original SPUI design which is estimated to operate at LOS E and F during the AM and PM design periods. The design also provides for a reduced cross section of US 27 by reducing the number of through lanes at the major intersection and still accommodating free flowing right turn movements for the heavy WB to NB and SB to WB movements.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$11,352,000	$0	$11,352,000
RECOMMENDED DESIGN	$5,949,000	$0	$5,949,000
ESTIMATED SAVINGS OR (COST)	$5,403,000	$0	$5,403,000

VALUE ENGINEERING RECOMMENDATION # VE-19d

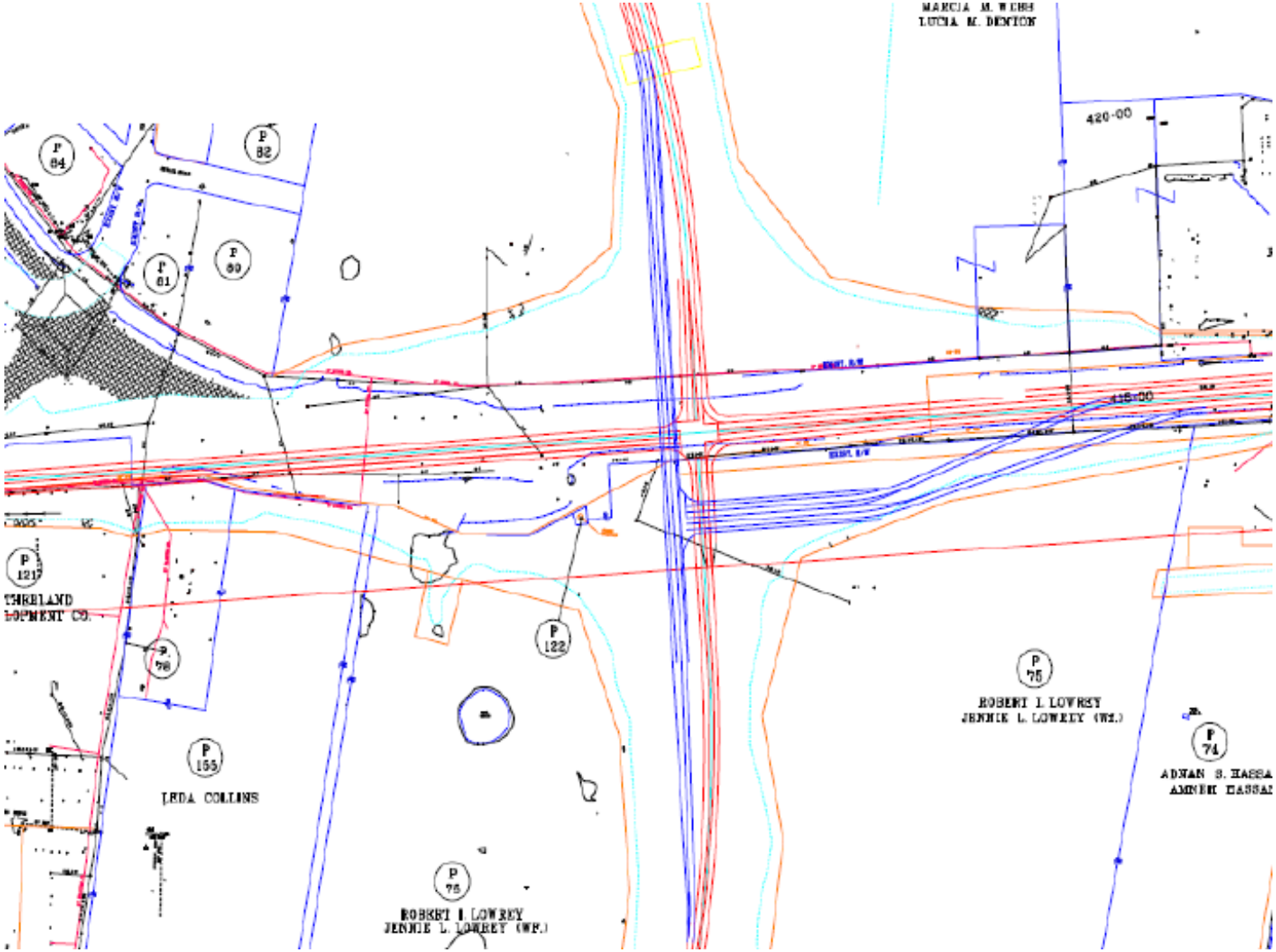
SKETCH OF RECOMMENDED DESIGN



KID Interchange - Option 1

VALUE ENGINEERING RECOMMENDATION # VE-19d

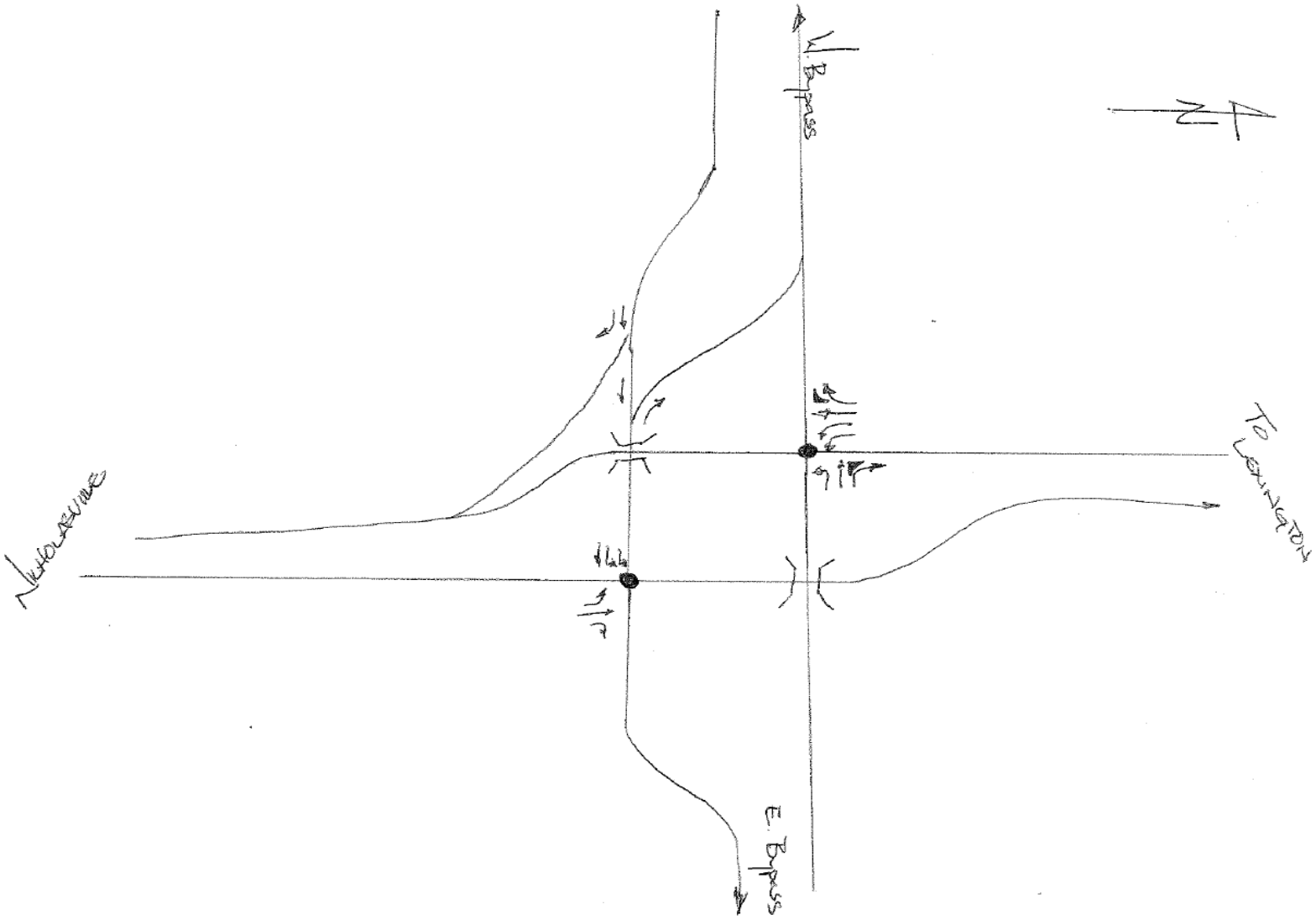
SKETCH OF RECOMMENDED DESIGN



KID Interchange - Option 2

VALUE ENGINEERING RECOMMENDATION # VE-19d

SKETCH OF RECOMMENDED DESIGN



KID Interchange - Option 3

Interchange Type Comparison

Interchange/Intersection Alternative	AM Peak LOS	PM Peak LOS
Original Design (SPUI)	F	E/F
Reduced SPUI (ID 5)	F	E/F
KID Split-Level Intersection (ID 35)	A B	C/D B
Diverging Diamond (ID 31)	A D/E	D/E B
Trumpet Interchange (ID 2)	F	Did not analyze
Offset At-grade Intersecction Design	C D/E	F C

VALUE ENGINEERING RECOMMENDATION # VE-19d

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Embankment	CY	$6.00	1	710,000	$4,260,000	82,000	$492,000
Asphalt Roadway	SF	$3.50	1	573,600	$2,007,600	460,848	$1,612,968
Bridges over US 27/27 Bypass	LS	$2,000,000	7	1	$2,000,000	0.85	$1,700,000
Railroad Bridges	LS	$2,680,000	1	1	$2,680,000	0.8	$2,144,000
ROW	SF	$4.32	1	93,600	$404,352		
Total					$11,351,952		$5,948,968

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

APPENDICES

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

CONTENTS

A. Study Participants A-2

B. Cost Information A-7

C. Function Analysis A-10

D. Creative Idea List and Evaluation A-14

APPENDIX A
Participants

APPENDIX A - Participants

Workshop Attendance

Attendees				Participation						
				Meetings		Study Sessions				
Name	**Organization and Address (Organization first, with complete address underneath)**	**Tel # and Email (Tel first with Email underneath)**	**Role in wk shop**	**Intro**	**Out Brief**	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Kelly Baker	KYTC – District 07	859-246-2355	Owner Representative		X					
James Ballinger	KYTC – District 07	859-246-2355	Owner Representative		X					
Boday Borres	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Boday.borres@ky.gov	Owner Representative	X	X					
Keith Caudill	KYTC 200 Mero Street Frankfort, KY 40602	Keith.Caudill@ky.gov	Owner Representative	X	X					
Joe Cochran	HDR 2517 Sir Barton Way Lexington, KY 40509	859-223-3755 Joe.Cochran@hdrinc.com	Design Team	X	X					
Max Conyers	Lexington Area MPO	859-258-3167 Maxc2@lexingtonky.gov	Observer		X					
Ben Edelen	HDR 2517 Sir Barton Way Lexington, KY 40509	859-223-3755 Ben.Edelen@hdrinc.com	Design Team	X	X					
Brad Eldridge	KYTC 200 Mero Street Frankfort, KY 40602	Brad.Eldridge@ky.gov	Owner Representative		X					
Heidi Franklin	KYTC 200 Mero Street Frankfort, KY 40602		Owner Representative		X					
Greg Groves	URS Corporation 325 W. Main Street, Suite 1200 Louisville, KY 40202	502-569-2301 Greg_Groves@urscorp.com	VE Roadway Designer	X	X	X	X	X	X	X
Barry House	KYTC Planning	Barry.House@ky.gov	Owner Representative		X					
Jeff Jasper	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3288	Owner Representative		X					
Adam Kirk	Kentucky Transportation Center 176 Raymond Building University of Kentucky Lexington, KY 40506-0281	859-257-7310 akirk@engr.uky.edu	VE Traffic Engineer	X	X	X	X	X	X	X
Bob Lewis	KYTC State Highway Engineer's Office 200 Mero Street Frankfort, KY 40602	502-564-3730 Bob.Lewis@ky.gov	Assistant State Highway Engineer		X					
Rodney Little	KYTC – Highway Design Quality Assurance Branch	606-677-4017 Charles.Little@ky.gov	Owner Highway Design	X						

Workshop Attendance											
Attendees				Participation							
				Meetings		Study Sessions					
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and Email (Tel first with Email underneath)	Role in wk shop	Intro	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Tony McGaha	KYTC – District 07	859-246-2067	Owner Representative		X					
Mary Munay	FHWA	502-223-6745	FHWA Representative		X					
Bob Nunley	KYTC – District 07 Project Development	859-246-2355 Robert.nunley@ky.gov	Owner Representative		X					
Kyle Schafersman	URS Corporation 8300 College Boulevard, Suite 200 Overland Park, KS 66210	913-344-1019 Kyle_Schafersman@urscorp.com	VE Team Leader	X	X	X	X	X	X	X
Ajay Shah	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4560x3999 Ajay.shah@ky.gov	VE Bridge Engineer	X		X	X			
Paul Slone	URS Corporation 36 East Seventh Street, Suite 2300 Cincinnati, OH 45202	502-569-2301 Paul_Slone@urscorp.com	VE Traffic Engineer	X	X	X	X	X	X	X
Ken Sperry	HMB	502-695-9800 ksperry@hmbpe.com	Phase 2 Design Team		X					
Rob Sprague	KYTC D-7 Design	859-246-2355 Robin.Sprague@ky.gov	Owner Representative	X	X					
Roy Sturgill	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4780	Owner Representative		X					
Brent Sweger	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Brent.Sweger@ky.gov	Owner VE Coordinator	X	X	X	X	X	X	X
Marvin Wolfe	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4560 Marvin.Wolfe@ky.gov	VE Bridge Engineer	X	X	X	X	X	X	X

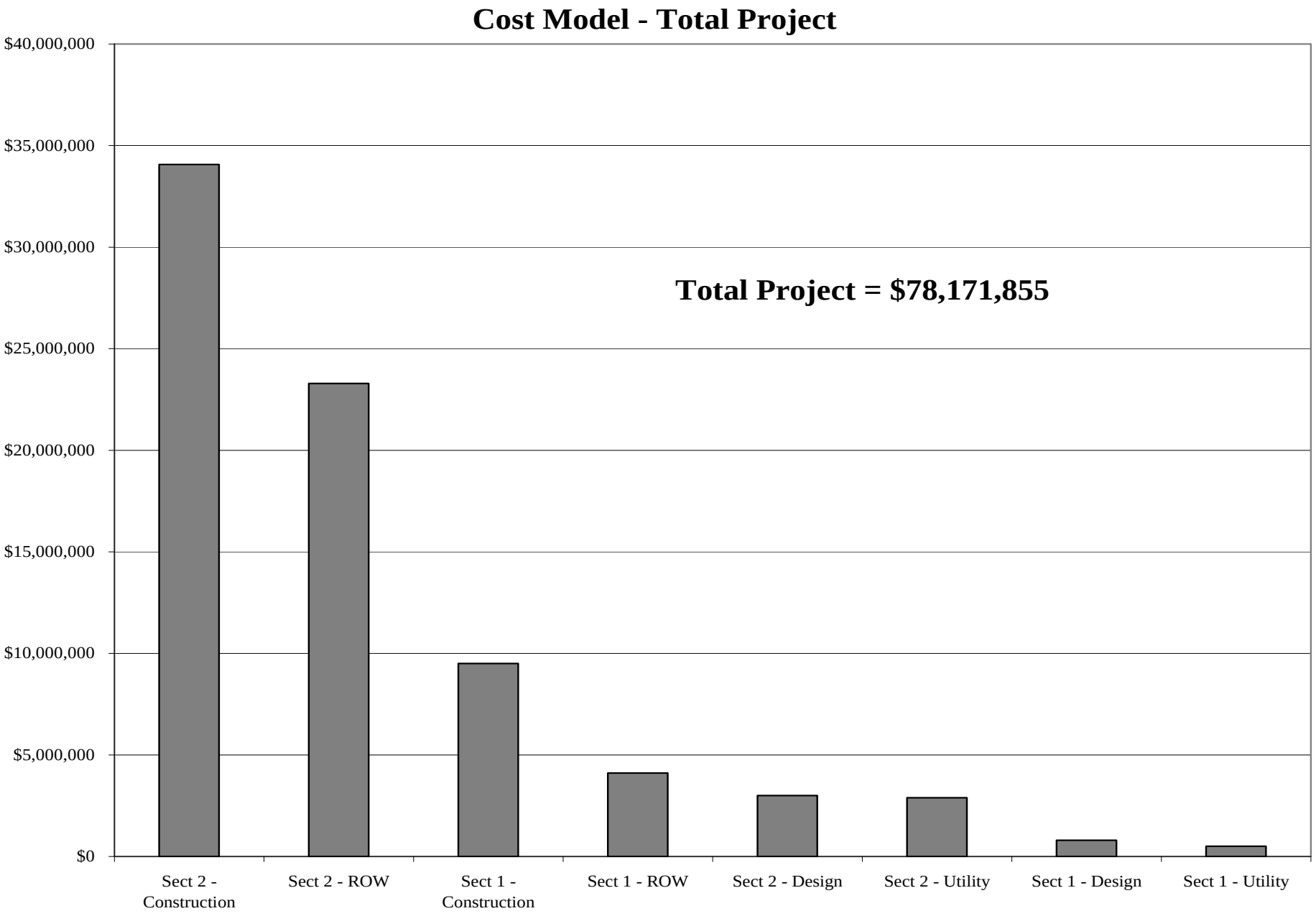
Workshop Attendance

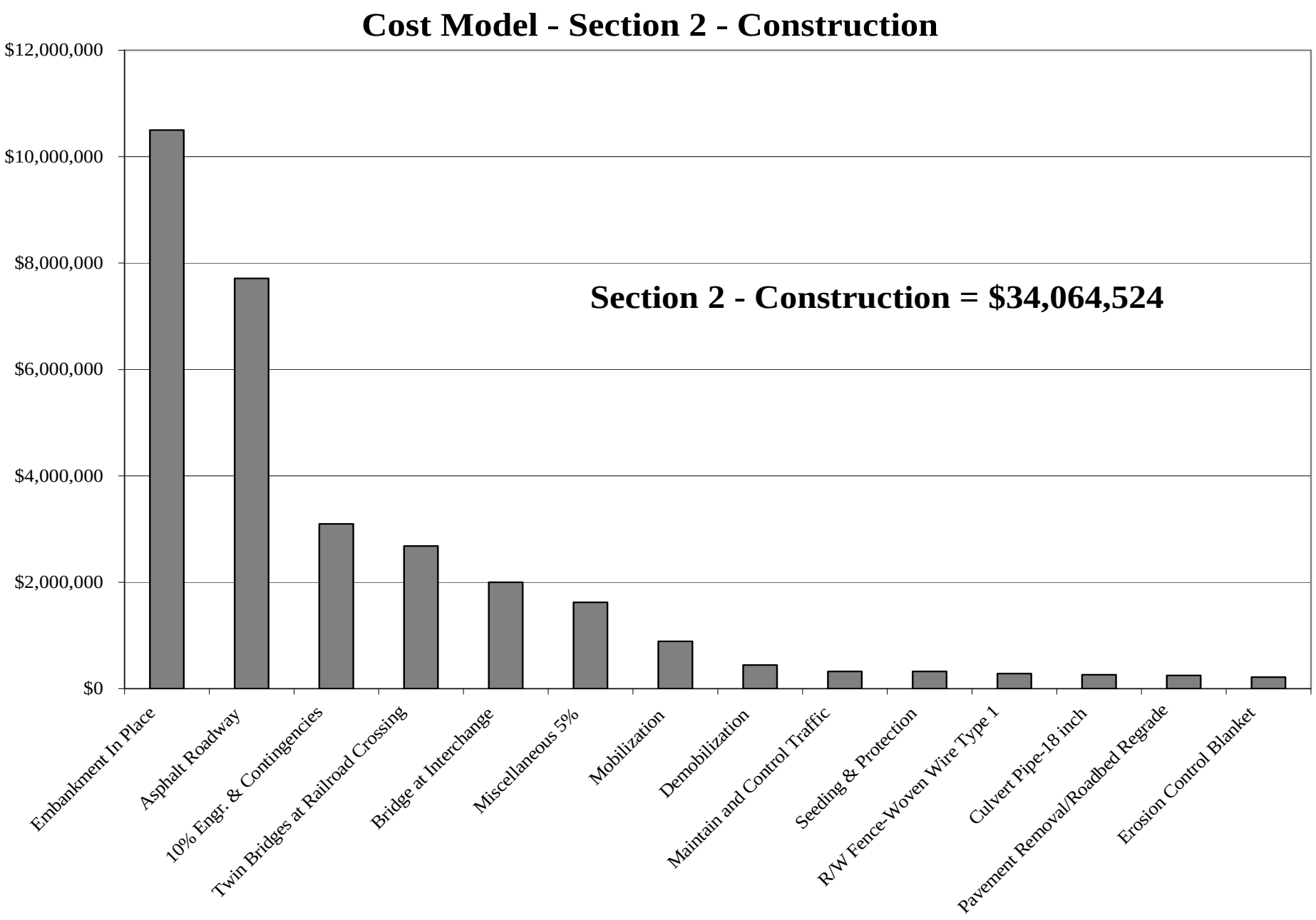
Attendees				Participation						
				Meetings		Study Sessions				
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and Email (Tel first with Email underneath)	Role in wk shop	Intro	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Boday Borres	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Boday.borres@ky.gov	Owner Representative	X	X					
Keith Caudill	KYTC 200 Mero Street Frankfort, KY 40602	Keith.Caudill@ky.gov	Owner Representative	X	X					
Joe Cochran	HDR 2517 Sir Barton Way Lexington, KY 40509	859-223-3755 Joe.Cochran@hdrinc.com	Design Team	X	X					
Ben Edelen	HDR 2517 Sir Barton Way Lexington, KY 40509	859-223-3755 Ben.Edelen@hdrinc.com	Design Team	X	X					
Greg Groves	URS Corporation 325 W. Main Street, Suite 1200 Louisville, KY 40202	502-569-2301 Greg_Groves@urscorp.com	VE Roadway Designer	X	X	X	X	X	X	X
Adam Kirk	Kentucky Transportation Center 176 Raymond Building University of Kentucky Lexington, KY 40506-0281	859-257-7310 akirk@engr.uky.edu	VE Traffic Engineer	X	X	X	X	X	X	X
Rodney Little	KYTC – Highway Design Quality Assurance Branch	606-677-4017 Charles.Little@ky.gov	Owner Highway Design	X						
Kyle Schafersman	URS Corporation 8300 College Boulevard, Suite 200 Overland Park, KS 66210	913-344-1019 Kyle_Schafersman@urscorp.com	VE Team Leader	X	X	X	X	X	X	X
Ajay Shah	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4560x3999 Ajay.shah@ky.gov	VE Bridge Engineer	X		X	X			
Paul Slone	URS Corporation 36 East Seventh Street, Suite 2300 Cincinnati, OH 45202	502-569-2301 Paul_Slone@urscorp.com	VE Traffic Engineer	X	X	X	X	X	X	X
Rob Sprague	KYTC D-7 Design	859-246-2355 Robin.Sprague@ky.gov	Owner Representative	X	X					
Brent Sweger	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Brent.Sweger@ky.gov	Owner VE Coordinator	X	X	X	X	X	X	X
Marvin Wolfe	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4560 Marvin.Wolfe@ky.gov	VE Bridge Engineer	X	X	X	X	X	X	X
HEIDI FRANKLIN	"				X					
ROY STURGILL	"	564-4780			X					

Workshop Attendance											
Attendees				Participation							
				Meetings		Study Sessions					
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and Email (Tel first with Email underneath)	Role in wk shop	Intro	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Kelly Baker	KYTC - D7	859-246-2155			X					
Jamie Ballinger	KYTC - D7	859-246-2355			X					
Bob Lewis	KYTC - SHE office	502-564-3730			X					
JEFF JASPER	KYTC - HIGHWAY DESIGN	502-564-3280			X					
MARY Murray	FHWA	502-223-6745			✓					
BOB RENFRO	KYTC D7 PROJ. DEV.	859 246 2355 ROBERT.RENFRO@KY.GOV			✓					
Tony McGaha	KYTC D7	859 246 2067			✓					
KEN SPERRY	HMB	502-695-9800 ksperry@hmbpc.com			X					
Max Conyers	Lex Area MPO	859-258-3167 maxc2@lexingtonky.gov			X					
Barry House	KYTC - Planning	Barry.House@ky.gov			✓					
Brad Eldridge	KYTC - Hwy Design	Brad.Eldridge@ky.gov			✓					
Keith Caudill	" "	Keith.caudill@ky.gov		✓	✓					

APPENDIX B
Cost Information

APPENDIX B - Cost Information


Cost Model - Total Project
$40,000,000
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
Total Project = $78,171,855
Sect 2 - Construction
Sect 2 - ROW
Sect 1 - Construction
Sect 1 - ROW
Sect 2 - Design
Sect 2 - Utility
Sect 1 - Design
Sect 1 - Utility


Cost Model - Section 2 - Construction
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
Section 2 - Construction = $34,064,524
Embankment In Place
Asphalt Roadway
10% Engr. & Contingencies
Twin Bridges at Railroad Crossing
Bridge at Interchange
Miscellaneous 5%
Mobilization
Demobilization
Maintain and Control Traffic
Seeding & Protection
R/W Fence-Woven Wire Type 1
Culvert Pipe-18 inch
Pavement Removal/Roadbed Regrade
Erosion Control Blanket

APPENDIX C
Function Analysis

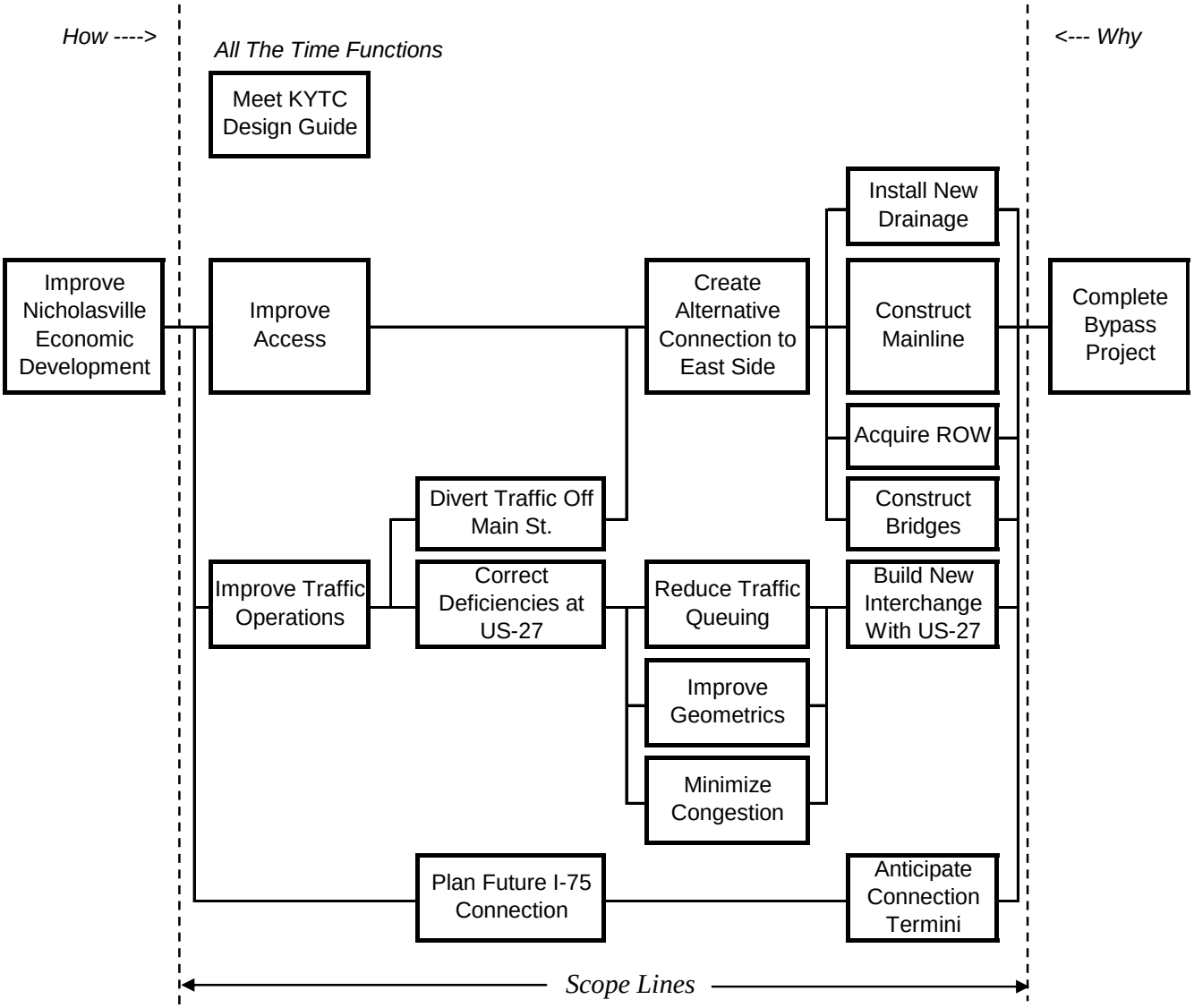
APPENDIX C - Function Analysis

Function Model

Item	Cost	Function
Total Project	$78,171,855	Relieve congestion Balance traffic Improve access to east side Reduce delay Connect to I-75
Sect 2 - ROW	$23,290,000	Accommodate construction
Sect 1 - Construction	$9,507,331	Create access to south Disperse traffic
Sect 1 - ROW	$4,110,000	Accommodate construction
Sect 2 - Design	$3,000,000	Prepare design
Sect 2 - Utility	$2,890,000	Relocate utilities to accommodate for construction
- around US 27 interchange		
Sect 1 - Design	$800,000	Prepare design
Sect 1 - Utility	$510,000	Relocate utilities to accommodate for construction
Sect 2 - Construction	$34,064,524	Relieve congestion Balance traffic Improve access to east side Reduce delay Connect to I-75
Embankment In Place	$10,500,000	Elevate roadway
- 1,750,000 CY @ $6/CY		
- approaching interchange at 3%		
- need 23 ft clearance grade-to-grade over US 27 (15 ft minimum clearance to bottom of beam)		
- need 23 ft clearance for double-stacked railroad (7 ft bridge deck)		
Asphalt Roadway	$7,710,000	Drain roadway Support traffic
- unit price appears low		
10% Engr. & Contingencies	$3,096,775	Account for unknown Pay construction inspectors
Twin Bridges at Railroad Crossing	$2,680,000	Accommodate new interchange alignment
- 6 lanes, twin curved bridges, concrete, 250 ft length, $100/SF		
Bridge at Interchange	$2,000,000	Separate traffic Improve traffic flow
- $120/SF, flared girders, 6 lanes, 40 ft median,		
- crossing 4 lanes, median, 12 ft shoulders for US 27B		

Item	Cost	Function
Miscellaneous 5%	$1,625,000	Cover unaccounted items
- appears high		
Mobilization	$889,026	Mobilize contractor and equipment
Demobilization	$444,513	Demobilize contractor and equipment
Maintain and Control Traffic	$325,000	Control and maintain traffic
- Along US 27, 39, and 169		
Seeding & Protection	$325,000	Reduce erosion
R/W Fence-Woven Wire Type 1	$282,500	Delineate ROW
Culvert Pipe-18 inch	$260,000	Drain stormwater
Pavement Removal/Roadbed Regrade	$250,000	Improve aesthetics Reuse fill material
Erosion Control Blanket	$214,500	Control erosion during construction
Retaining walls	$150,000	Reduce fill
- $45-$50/SF for retaining walls		

FAST Diagram



APPENDIX D
Creative Idea List and Evaluation

APPENDIX D - Creative Idea List and Evaluation

List of CREATIVE IDEAS			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
1	Utilize 2+1 lanes on the new east bypass in lieu of 4 lane typical section	1	A. Kirk & B. Sweger
2	Utilize a trumpet or partial interchange in lieu of the new SPUI	4	
3	Lower the road grade over the railroad tracks (23-ft) and US 27 (14.5-ft) to the minimum clearance possible to reduce imported fill	1 w/ 4	G. Groves
4	Utilize 5% grade on approaches to US 27 and railroad overpasses in lieu of approximately 3% slope	1 w/ 3	G. Groves
5	Right-size the SPUI by reducing the number of lanes and median width through the SPUI, US 27, and ramps (76 ft in lieu of 104 ft wide)	1	P. Slone
6	Utilize an off-set at-grade intersection in lieu of the SPUI	4	
7	Utilize an at-grade intersection extending the existing alignment of US 27 east bypass in lieu of the SPUI	4	
8	Utilize an interchange at US 27 and US 27B in lieu of the SPUI	4	
9	Utilize MSE vertical wall in lieu of a sloped earth embankment at the railroad abutments	1	M. Wolfe
10	Realign bypass to the west at KY 39 to reduce amount of improvement on KY 39	4	
11	Construct 2-lane initial bypass with ROW capacity at 4-lanes in the future	4	
12	Preserve future needed ROW for the bypass with planning and zoning ordnance	DC	B. Sweger
13	Utilize 2-lane bypass from southern terminus of the new bypass to KY 169 in lieu of a 4-lane bypass	1	B. Sweger
14	Utilize 2-lane bypass from southern terminus of the new bypass to KY 39 in lieu of a 4-lane bypass	4	
15	Utilize roundabout at each of the three intersections of bypass at KY 39, KY 169, and the I-75 connector	DC w/ 23	B. Sweger
16	Utilize urban section for US 27 (Main Street) within mapping limits in lieu of current rural section to reduce ROW impacts and traffic calming	DC	G. Groves
17	Add a shared use path along the new east bypass	2	B. Sweger
18	Locate the wagon box under the bypass as far to the west of the SPUI as possible before the railroad to reduce the wagon box length	4	
19	Utilize a longer bridge at the railroad to provide property to property access in lieu of a separate wagon box for access	2	M. Wolfe
20	Utilize Tensar Geogrids to decrease the required asphalt pavement thickness	DC	G. Groves
21	Utilize 8-foot shoulders (6-foot paved) in lieu of 12-foot shoulders (10-foot paved) per the typical section	1	G. Groves
22	Utilize a single left in lieu of duel lefts from the existing bypass onto the new bypass at the southern terminus and eliminate any impact to the existing bridges	1	G. Groves
23	Eliminate all median openings on the new bypass except for the intersections of KY 39, I-75 connector, KY 169, and the Cannonball neighborhood	DC w/ 15	B. Sweger

List of CREATIVE IDEAS			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
24	Develop agreement between KYTC, Jessamine County, and the City of Nicholasville to define access control to the new east bypass	DC	B. Sweger
25	Utilize 11-foot lanes in lieu of 12-foot lanes throughout the new east bypass	1	G. Groves
26	Conduct a transportation planning study to identify parallel routes to the new east bypass to improve connectivity, and adopt into the comprehensive plan	DC	B. Sweger
27	Eliminate the ROW fencing throughout the project	4	
28	Utilize a tunnel under US 27 from the new bypass	4	
29	Evaluate the no build option	4	
30	Install noise walls for the impacted neighborhood in the southern portion of new bypass	4	
31	Utilize an at-grade diverging diamond interchange with existing alignment of the west bypass with US 27 bridged over the new interchange	1	A. Kirk
32	Utilize piers in lieu of fill embankment for the portion of the bypass west of the SPUI and over the railroad tracks	3	M. Wolfe
33	Utilize low grow grass or native grass in lieu of traditional ground cover	2	K. Schafersman
34	Revise the cost estimate to show a Miscellaneous of 3% in lieu of 5%	4	
35	Utilize at-grade intersection with two left-turn fly-over ramps (modified cloverleaf concept) in lieu of SPUI	2	P. Slone
36	Utilize cane in the medians to create glare screen	DC	K. Schafersman
37	Install monorail in lieu of bypass	4	
38	Implement the KYTC safety bypass plan entitled “Safety Evaluation of New Roads” dated September 2002	DC	G. Groves
39	Revise embankment quantity to eliminate fill under bridges and wagon box	DC	M. Wolfe
40	Utilize a crossroad under design in lieu of the cross road over design associated with the SPUI	2	A. Kirk
41	Consider improved inlets on box culverts	DC	M. Wolfe

Development Status Legend:

1: Idea is considered by the VE team to be the best value enhancement possibility and is currently being developed as a VE recommendation
2: Idea is considered by the VE team to be a good value enhancement possibility and will be developed as a VE recommendation after all the “1s” have been developed
3: Idea is considered by the VE team to be of marginal value enhancement possibility and may be developed as a VE recommendation after all the “1s” and “2s” have been developed
4: Idea was not considered to enhance the value of the project and has been eliminated from further consideration by the VE team
DC: Idea is being developed as a Value Engineering Design Comment to the designers with no easily quantifiable cost associated

END OF REPORT

This report was compiled and edited by:
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913-344-1011 Fax

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This report was released for publication by:
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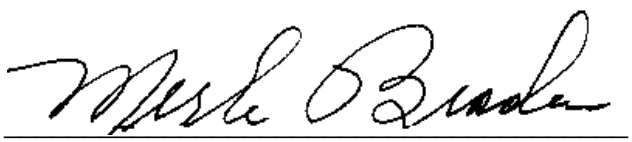

Approved by Merle Braden, PE, CVS-Life (URS)