VALUE ENGINEERING DISCUSSIONS
I-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NUMBER 6-2021.00
NOVEMBER 1, 2011

INTRODUCTION

This report summarizes the results of a Value Engineering Study conducted by the project development team on August 25, 2011. The subject of the study was the pavement rehabilitation of I-471 in Campbell County.

The proposed letting for this project is February 24, 2012 with a final plan submittal date of January 2, 2012.

PROJECT DESCRIPTION

This project will replace the existing pavement on I-471 from MP 0.0 (I-471/US 27 intersection) to the Ohio River at MP 5.5. This particular section of interstate intersects I-275, US 27, Grand Avenue (Ky. 1892), Memorial Parkway (Ky. 1120), and Ky. 8. The typical section varies directionally from two to four lanes and due to deteriorating pavement conditions the cabinet has decided to move forward with a pavement rehabilitation project to enhance pavement ride. In addition, this project will replace substandard guardrail, upgrade substandard guardrail end treatments, enhance bridge deck quality, replace lighting, and widen the I-471 southbound ramp to I-275 westbound from one lane to two for additional capacity and improved operation. All work on this project will be completed within the existing Right of Way with minimal impact to utilities.

METHODOLOGY

The project design team identified four major topics that made up a majority of the project cost and were worthy of value engineering considerations. This report summarizes the results of the Value Engineering Study conducted by the project design team on August 25, 2011.

The evaluation criteria identified as a basis for the comparison of alternatives on this project included the following:

Construction Cost
Service Life
Traffic Control
Future Maintenance Cost
Future Traffic Flow

PROJECT TEAM MEMBERS

The following project development team members were present and participated in the Value Engineering discussions associated with this project.

James Napier	WMB, Inc.
Robert Franxman	KYTC D-6 Construction
Dan Hite	KYTC CO Design
Kevin Martin	KYTC CO Design
David Tipton	KYTC CO Maintenance
Robert Pennell	KYTC CO Maintenance
David Hamilton	KYTC CO Design
Danny Molen	KYTC CO Geotech.
Daryl Greer	KYTC CO Geotech.
Andre Johannes	KYTC CO Design
Paul Looney	KYTC CO Design
Dan Byers	WMB, Inc.
Wallace Bennett	WMB, Inc.
Jack Stewart	WMB, Inc.
Michael Loyselle	FHWA
Rob Harris	KYTC CO Construction
Gary Raymer	KYTC CO Quality Assurance
Bob Hill	KYTC D-6 Work Zone Safety Coord.
Larry Trenkamp	KYTC D-6 Construction
George Hoffman	KYTC D-6 Design
Greg Kreutzjans	KYTC D-6 Construction
Brandon Seiter	KYTC D-6 Bridge Maintenance
Rob Hans	KYTC D-6 Chief District Engineer
Bob Yeager	KYTC D-6 Design
Todd Von Behren	WMB, Inc.
Rick Davis	KYTC D-6 Engineering Support

In order to have an unbiased view of the project approach, the project team solicited the assistance of 2 outside members with construction and design experience to participate in the Value Engineering Study as related to this project. These two members had no prior knowledge of the project scope or the intended project outcome. The two members were Gary Raymer of the KYTC quality assurance branch and Kevin Martin of KYTC Highway Design Branch. Gary provided valuable insight and background into construction approach during VE discussions while Kevin provided a new perspective on Ramp A widening discussions (I-471SB to I-275 WB). Both Kevin and Gary are knowledgeable in value engineering techniques and procedures.

MAJOR DISCUSSION TOPICS

The following topics account for the majority of the project cost and therefore where discussed at length during the Value Engineering deliberations within the project team meeting.

Pavement Design

Two pavement designs were considered for Value Engineering Discussions on this project. These two alternates are as follows:

Alternate 1: <u>15.75 inches of Flexible (Bituminous) Pavement</u>

11.5 inches of CL4 ASPH BASE 1.0D PG 64-22
3.0 inches of CL4 ASPH BASE 1.0D PG 76-22
1.25 inches of CL4 ASPH SURF 0.38A PG 76-22

Alternate 2: <u>13.00 inches of Rigid (PCC) Pavement</u>

13" JPC Pavement

Both alternates will be stabilized with 4 inches of crushed stone base on 12 inches of cement stabilized roadbed. In addition, both alternates will include an edge drain system with 4" perforated pipe on the inside and outside shoulders. Experience with edge drain systems indicate an outlet spacing of 250 to 500 feet is effective in removing the water from the pavement, especially when one outlet becomes clogged. The two alternates were discussed by the project team with various evaluation criteria in mind. The construction or initial cost favors the concrete option with a 10.6 percent savings while the Life Cycle Cost alternate favors the concrete option with a 12.1 percent savings. The initial cost and Life Cycle cost (assuming a 4% discount factor) for each alternate are as follows:

	<u>Initial Cost</u>	<u>Life Cycle Cost</u>
Rigid Pavement	$17.40 Million	$18.90 Million
Flexible Pavement	$19.24 Million	$21.18 Million

See Figure A (attached) for a detailed cost analysis.

These two pavement designs are structurally equivalent, and were designed to carry the traffic loading for forty years. Past experience in the area indicates that the flexible alternate will require three rehabilitation cycles over the forty year life due to rutting and shoving associated with heavy truck traffic. Therefore, a rehabilitation cycle consisting of milling and resurfacing at ten year

intervals to enhance ride were selected for the flexible alternate. The rigid pavement will require rehabilitation cycles consisting of cleaning and resealing the joints along with diamond grinding at year 15 and year 30 in the pavements fatigue life. The attached life-cycle cost analysis was developed for discount rates of 0%, 2%, 4%, 6%, 8% and 10%. The discount rate reflects the difference between the interest rate and the inflation rate.

Although user costs were not of great consideration when discussing pavement type, figure A depicts general costs associated with future rehabilitation cycles. As the figure illustrates, it is reasonable to expect the Life Cycle Cost of the flexible pavement to be higher than the rigid alternate due to the additional rehabilitation cycle.

The current traffic using this section of urban interstate is in excess of 97,000 ADT. Currently there are no plans for widening this facility in the immediate future. Therefore, an objective in developing the pavement design was to develop a pavement rehabilitation strategy which would be durable and long lasting with a minimum number of future restoration, resurfacing or rehabilitation cycles. This is why a forty year design and analysis period was selected for this project.

Other Principal and Secondary factors as outlined in Appendix B of the AASHTO Pavement Design Guide that were considered important in selecting the pavement type are outlined below.

Principal Factor--Soil Characteristics:

It was discussed that PCC pavement might possibly be better for bridging weak soils or highly moisture sensitive soils that might be encountered. However, since mainline I-471 is designed for cement stabilized roadbed, this is not considered to be a great advantage.

Principal Factor--Construction Considerations:

Construction considerations were generally considered to favor asphalt pavements. This was due largely to the belief that asphalt pavements could be placed more quickly than PCC pavement and was not subject to greater curing considerations as was PCC pavements. However, the I 275 warranty project demonstrated that with an A + B bidding scenario, the PCC contractor bid less time to complete the project than the asphalt bidder and actually completed the project earning an incentive. Thus, construction time might not be a factor.

Secondary Factor--Availability of Local Materials or Contractor Capabilities:

There are several contractors (both asphalt and PCC) within the geographical location of this project that have the knowledge and capability of constructing this project. An abundant supply of materials exists to support either a PCC pavement contractor or an asphalt contractor. Therefore it was concluded that no advantage exists relative to an asphalt pavement versus a PCC pavement for this particular project.

Secondary Factor--Stimulation of Competition:

Stimulation of competition is desirable, especially where the potential for lack of competition exists. Kentucky has used alternate bidding on previous projects in an effort to demonstrate that alternate bidding can stimulate competition. These projects were considered very successful in drawing interest from additional contractors that may not have submitted a bid if only one pavement alternate were presented.

A Concrete overlay option was briefly discussed, but with the difference in construction cost of only 8 percent (See Figure B) and the fact that the team felt the problem with the existing pavement is found in the poor subgrade, it was determined that the best option was to utilize full depth replacement throughout the project thereby insuring a stabilized subgrade.

At the conclusion of the pavement discussion, the Value Engineering slightly favored the concrete alternate. This decision was primarily based on the fact that the surrounding pavement in the area was concrete, but felt that an asphalt alternate may have possibilities. Figure A illustrates cost analysis of the two alternates.

A subsequent meeting held by the project team in Covington on October 25, 2011 opened the discussion of pavement type selection again. While some factors pointed toward the selection of asphalt pavement, others lend themselves to the choice of a concrete pavement. While both the initial cost and life cycle cost favors the concrete alternate, the life cycle cost is within the comparable definition of 20 percent as outlined in Chapter 4 of the Alternate Pavement Bidding Document under Appendix E of the Kentucky Department of Transportation's Pavement Type Selection Policy.

In addition, there has been no overwhelming factor identified that clearly indicates a definite choice of one pavement type over the other. Geographical conditions are such that either pavement could be constructed. Also, both paving industries are represented in the area and have the capabilities to construct this project. The parameters identified in the 1993 AASHTO Guide—Appendix B does not clearly direct us toward a specific pavement type. This lack of a clear perspective regarding pavement type and the desire for competition is what caused the project team to believe this project might best be served by bidding alternate pavement type and therein giving both paving industries the opportunity to compete. The team ultimately concluded that alternative bidding of asphalt and concrete was best for this project.

Widening of Ramp A (I-471SB to I-275 WB)

During preliminary planning discussions on this project, the project team identified a need to widen the ramp that directs traffic from I-471 Southbound to I-275 Westbound. The department directed the design consultant to prepare a study on the feasibility of this proposed ramp widening. The results of the study can be found in Figure C. The existing ramp exits I-471 southbound in a free flow condition with one lane carrying approximately 1800 vehicles in the peak hour. The ramp joins I-275 with 400 feet of acceleration lane and an additional 300 feet of lane drop just prior to the bridge crossing over 3-Mile Road. The project team decided to evaluate widening Ramp A to two lanes for improved operation and additional capacity.

Three alternates were studied as potential solutions. Alternate 1 would widen Ramp A to two lanes and provide the recommended distance to drop the two lanes based on AASHTO criteria. In order to construct Alternate 1, Right of Way would have to be purchased, and the cost of such Right of Way is not reflected in the estimate below.

Alternate 2 is basically the same as Alternate 1 above but with the addition of a retaining wall. The retaining wall would be placed along the shoulder line of the Three Mile Road entrance ramp and serve as a barrier to eliminate the excavation and therefore keep construction inside the existing right of way.

Alternate 3 would widen Ramp A to two lanes and provide for 2160 feet of distance to drop the two lanes of I-275 leaving 350 feet of separation between the lane drop and the entrance ramp from Three Mile Road. This alternate would add lanes from Ramp A to the outside as in Alternate 1 and would require widening of the cut just east of Three Mile Road and extending the Three Mile Road Bridge. All of this work would be done within existing Right of Way. While this alternate does not provide the recommended distance for dropping the two lanes onto I-275 as recommended by AASHTO, the distance added appears to provide operational benefits with a reduced cost. A Corsim analysis found in Figure C was developed to look at the benefits of the Ramp widening.

	Estimated Cost
Alternate #1	$4.4 Million
Alternate #2 (Alternate 1 with Wall)	$5.3 Million
Alternate #3	$2.3 Million

Based on discussions above, the conclusion of the Value Engineering team was to proceed with Alternate #3 for this project.

Maintenance of Traffic Schemes & Typical Section Widening

Several maintenance of traffic strategies were discussed during the value engineering study. There was general agreement among team members that the best traffic control plan would be to shift all traffic to lanes on the opposite travel way while construction was taking place. This would allow for construction to ensue unhampered by motor vehicles and would allow for improved traffic flow. The team felt that by reducing the number of contact points with construction entrances and reducing the "rubber necking" effect, construction would be expedited. However, given that there are five interchanges, three sets of twin bridges with open medians, and a raised planter type median with a 16 foot width through much of the project, it was realized that moving traffic to one side would be difficult without adding cost and time to the project.

The value engineering team settled on three traffic control schemes to analyze from an economic and timeliness perspective. The first alternate discussed was the traditional part width construction. This approach would maintain two lanes of traffic in both the north and southbound directions in the three and four lane sections for a majority of the project. In the existing 2 lane sections, traffic would be reduced to 1 lane. Since the existing outside concrete shoulders are only six inches in thickness, Phase 1 construction would involve strengthening the outside shoulders to carry traffic. Phase 2 would involve shifting traffic to the outside lane and newly constructed outside shoulder while the inside shoulder, inside lane, and half of the center lane was constructed. Phase 3 would shift traffic to the inside lane, and inside shoulder while the remaining section was constructed.

In examining the existing inside shoulders, it was discovered that dowel bar retrofits had been installed in isolated locations throughout the length of the project. Discussions with District maintenance personnel revealed that the retrofits where placed in the shoulders when mainline pavement repairs were done. These repairs required traffic to be shifted onto the shoulders. This caused concern among team members since it brought into question whether the inside shoulders would support traffic for short periods of time while the outside shoulder and lanes were constructed. The team settled on allowing traffic to use the inside 2 lanes and inside shoulder while constructing the outside shoulder in Phase 1. This would maintain the existing number of lanes in Phase 1 for the longest amount of time possible. If the inside shoulder began to fail in this Phase, then traffic would be prohibited from using the inside shoulder at that point, and the section would then be reduced by 1 lane. The total cost of this plan is estimated at 39.9 million. (a detailed cost analysis and typical section are illustrated in Figure D.) This estimate includes the replacement of all driving lanes and shoulders, the widening for Ramp A (I-471 southbound to I-275 westbound ramp) to two lanes, repair of damaged areas on the ramps in the four interchanges north of the I-275 interchange, and bridge maintenance work as previously discussed.

The second alternate discussed by the value engineering team would widen the typical section toward the median by eliminating the raised median and constructing an additional lane in each direction. Additional costs associated with this option include closing up the median on three sets of twin bridges, relocating the conventional light poles from the existing raised median to the new median barrier and relocating five overhead sign bases from the raised median to the

new median barrier. This alternate would assist in traffic control during construction but have an enhanced value of an additional lane in each direction for the majority of the project when construction was complete. The total cost of this plan is estimated at 56.1 million and includes all work described in alternate 1. (a detailed cost analysis and typical section are illustrated in Figure D.) This alternate would require design exceptions for reduced shoulder width, and ramp tapers lengths in a few locations along the project.

The third alternate discussed by the value engineering team involved the shifting of traffic to the opposite roadway direction and using moveable barrier wall to maintain three lanes of traffic in the direction of peak flow with two lanes of traffic in the non-peak flow direction. This alternate would require the removal of approximately 1000 feet of the raised median barrier at each crossover location, and would require the removal of several hundred feet of the median at any ramp access point provided. This alternate would also require the barrier wall to be moved twice a day for the duration of the project to accommodate peak flow conditions. Another concern of the team with this alternate was the existing lighting, overhead truss supports for signs, and median drainage structures all of which would have to be removed or relocated if this alternate were pursued. Due to the additional costs associated with alternate 3, and the additional time needed to prepare plan details, alternate 3 was considered undesirable by the value engineering team.

The team concluded that while widening the pavement and eliminating the planter boxes would assist in traffic control, there would still be significant amounts of time when traffic would be reduced to two lanes. In addition, the Transportation Cabinet is planning an extensive Public Involvement Plan for advising the public of lane restrictions and closure times associated with the project. The team recognized that the Cabinet would also be in communication with local governmental officials and agencies, major traffic generators, employers, etc. to advise of scheduled construction events, phasing times and dates, thereby assisting in traffic flow and reduced congestion.

The conclusion of the Value Engineering team was to proceed with Alternate #1.

Bridge Deck Overlays

The value engineering team discussed the existing bridge conditions and proposed rehabilitation strategies for bridges within the project limits. The bridges that will be receiving a deck treatment are as follows:

I-471 SB over US 27
I-471 NB over US 27
I-471 SB over Grand Ave
I 471 NB over Grand Ave
I-471 SB over Chesapeake Ave
I-471 NB over Chesapeake Ave
I-471 NB Ramp to KY 8
I-471 SB over KY 8
I-471 SB over Ohio River
I-471 NB over Ohio River

The team noted that the following bridge decks were in good condition and that no deck treatment would be required.

I-471 SB over 6th St
I-471 NB over 6th St
I-471 NB over KY 8

The three alternates discussed for deck treatment were: 1) 6" Concrete Overlay 2) Epoxy Urethane Overlay 3) 1 ½" Latex Concrete Overlay.

The team agreed that the 6" Concrete Overlay alternate was not a good option on this project since it is only used when the deck is very bad condition. The bridge decks throughout this project were judged to be in fair to good condition. In addition, since the pavement strategy is to remove the existing pavement to the bridge ends, there would be no need for a thick bridge deck overlay to minimize bridge end dig out length due to pavement tapers if it were not needed. Therefore the team eliminated the 6" concrete overlay option.

The Epoxy Urethane Overlay was the second alternate discussed by the team. This type of overlay is used as a water sealant and also serves to increase friction between the vehicle and riding surface. This overlay material is generally used when the bridge deck is in good shape and there are limited deck patches required. While the team thought this alternate may be viable on some of the bridges throughout the project, they were more comfortable with the concrete latex overlay option and felt that the latex option would last longer. Cost analysis shown in Figure E indicate that the concrete latex option and the epoxy urethane option were relatively similar in cost.

The Concrete Latex Overlay alternate was the final alternate discussed by the team. Cost considerations show it to be slightly less expensive than the other two options and the team felt that this option would have a much better performance period than the Epoxy Urethane option.

Thus Latex Concrete Overlay option was selected by the Value Engineering team. Figure E documents the cost of each alternate discussed.

SUMMARY AND CONCLUSIONS

The following areas were analyzed by the Value Engineering Team and from multiple discussions the following alternatives were developed and are recommended for implementation.

Recommendation #1: Pavement Design

The Value Engineering Team recommends that bidding alternate pavement types be implemented on this project. This strategy is believed to be best for the project by allowing both the asphalt and concrete industries to compete. In addition, a huge savings in initial cost should be recognized by bidding alternate pavements.

Recommendation #2: Widening of Ramp A (I-471SB to I-275 WB)

The Value Engineering Team recommends that Alternative Number 3 be implemented. This Alternate would accomplish the goals of the project team and is the least expensive alternate. This alternate would recognize a savings of 2.1 million dollars.

Recommendation #3: Maintenance of Traffic Schemes & Typical Section Widening

The Value Engineering Team recommends that Alternative Number 1 be implemented. This Alternate would accomplish the goals of the project team and is the least expensive alternate.

Recommendation #4: Bridge Deck Overlays

The Value Engineering Team recommends that Alternative Number 3 be implemented. This Alternate is the least expensive of the three alternates discussed, and the team believes this alternate to be superior to alternate 2 with respect to longevity. In addition, this alternate would recognize a cost savings of 286,000 dollars.

Figure A

Date: 9/28/2011

Project Description: 6-2021.00, Campbell County I-471 MP 0-5.5 (100M Design)

Include Salvage Costs(Y/N): N

Include User Costs (Y/N): N

Hide Unit Prices (Y/N)? n

NET PRESENT WORTH ANALYSIS

APHALT OVERLAY	Thick (in)	Price ($)	Unit
CL4 ASPH SURF 0.38A PG76-22	1.25	60.65	ton
CL4 ASPH BASE 1.0D PG76-22	3.0	48.15	ton
CL4 ASPH BASE 1.0D PG64-22	11.5	45.65	ton
CL4 ASPH BASE 1.0D PG64-22	0.0	45.65	ton
Total	15.75		
ASPHALT FULL-DEPTH			
CL4 ASPH BASE 1.0D PG64-22	0.0	45.65	ton
DRAINAGE BLANKET TYPE II	4.0	38.00	ton
DGA	4.0	20.00	ton
Asphalt Milling & Texturing		19.03	ton

Alternate 1

15.75 in. Asphalt

	Improvement Year	Discount Rate 0 Cost ($) Agency	0 User	2 Agency	2 User	4 Agency	4 User	6 Agency	6 User	8 Agency	8 User	10 Agency	10 User
Initial Construction Alt 1	2012	19,244,582	5,439,495	19,244,582	5,439,495	19,244,582	5,439,495	19,244,582	5,439,495	19,244,582	5,439,495	19,244,582	5,439,495
Rehabilitation 1 (Mill 1.25"/Fill 1.25")	2022	1,341,399	4,815,745	1,100,414	3,950,588	906,201	3,253,345	749,030	2,689,087	621,327	2,230,622	517,167	1,856,678
Rehabilitation 2 (Mill 1.25"/Fill 1.25")	2032	1,341,399	13,415,461	902,723	9,028,221	612,197	6,122,641	418,255	4,183,004	287,795	2,878,263	199,390	1,994,123
Rehabilitation 3 (mill 1.25"/Fill 1.25")	2042	1,341,399	0	740,547	0	413,578	0	233,551	0	133,305	0	76,874	0
Salvage	2052	0		0		0		0		0		0	
Alt-1 Subtotal		23,268,779	0	21,988,267	0	21,176,559	0	20,645,418	0	20,287,009	0	20,038,014	0
Alt.-1 Total NPV			23,268,779		21,988,267		21,176,559		20,645,418		20,287,009		20,038,014

PCC OVERLAY	Thick (in)	Price ($)	Unit
PCC PAVEMENT	13.0	53.00	sq yd
PCC SHOULDER	13.0	49.50	sq yd
0	0.0	0.00	ton
PCC FULL-DEPTH			
PCC BASE	0.0	0.00	sq yd
PCC Drainage Blanket	0.0	0.00	ton
DGA	4.0	20.00	ton
Clean and Seal Trans. Joints		1.15	in ft
Clean and Seal Long. Joints		1.15	in ft
Diamond Grinding		3	sq yd

Alternate 2

13 in. PCC

	Improvement Year	Discount Rate 0 Cost ($) Agency	0 User	2 Agency	2 User	4 Agency	4 User	6 Agency	6 User	8 Agency	8 User	10 Agency	10 User
Initial Construction Alt 2	2012	17,395,605	5,439,495	17,395,605	5,439,495	17,395,605	5,439,495	17,395,605	5,439,495	17,395,605	5,439,495	17,395,605	5,439,495
PCC Repair & Diamond Grinding	2027	1,874,695	8,388,284	1,392,926	6,232,618	1,040,951	4,657,716	782,245	3,500,138	590,982	2,644,337	448,787	2,008,088
PCC Repair & Diamond Grinding	2042	2,460,141		1,358,172		461,535	0	117,667		37,121		18,117	
FALSE													
Salvage	2052	0		0		0		0		0		0	
Alt-2 Subtotal		21,730,441	0	20,146,704	0	18,898,092	0	18,295,517	0	18,023,708	0	17,862,510	0
Alt.-2 Total NPV			21,730,441		20,146,704		18,898,092		18,295,517		18,023,708		17,862,510
Initial Cost Difference =		-1,848,977	-10.63%										
LCCA Cost Difference (with User Costs) =			-7.08%		-9.14%		-12.06%		-12.84%		-12.56%		-12.18%
LCCA Cost Difference (without User Costs) =		-7.08%		-9.14%		-12.06%		-12.84%		-12.56%		-12.18%	
Asph Rehab Costs =		4,024,197	18,231,206	2,743,685	12,978,809	1,931,976	9,375,986	1,400,836	6,872,091	1,042,427	5,108,885	793,431	3,850,801
PCC Rehab Costs =		4,334,836	8,388,284	2,751,098	6,232,618	1,502,487	4,657,716	899,912	3,500,138	628,103	2,644,337	466,904	2,008,088
Rehab Cost Difference =		-310,639		-7,413		429,490		500,924		414,324		326,527	

NOTE: Asphalt prices are from I-71 Gallatin/Boone and JPC Prices are from Campbell Co. I-275

NOTE: Night work only assumed to begin in 2035.

Figure B

SUMMARY OF OVERLAY VS FULL DEPTH ESTIMATES
1-471 RAMPS PAVEMENT REHABILITATION
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COST	FULL DEPTH REPLACEMENT	JPC OVERLAY
3 LANE SECTION	$7,894,709	$7,563,924
4 LANE SECTION	$5,623,775	$5,004,640
BIFURCATED SECTION	$2,615,657	$1,728,327
RAMPS	$0	$576,893
TOTAL ESTIMATED PROJECT PAVING COSTS	**$16,134,141**	**$14,873,783**
TOTAL ESTIMATED COST DIFFERENCE FULL DEPTH VS OVERLAY	***$1,260,357***	

ONLY AREAS WHERE A JPC OVERLAY WOULD BE AN OPTION WERE INCLUDED IN THIS REPORT.

OVERLAY VS FULL DEPTH ESTIMATES
4 LANE SECTION
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

CODE	ITEM	UNIT	QUANTITY - FULL DEPTH OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST FULL DEPTH	QUANTITY - OVERLAY OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST OVERLAY
1	DGA	TON				0.17	$ 25.00	$ 4.32
3	CRUSHED STONE BASE	TON	0.84	$ 25.00	$ 20.97			
8	CEMENT STABILIZED ROADBED	SQ YD	7.56	$ 6.00	$ 45.33			
72	CRUSHED AGGREGATE SIZE NO. 57	TON				0.18	$ 31.40	$ 5.63
269	MODIFIED OPEN-GRADED DRAINAGE COURSE	TON				0.06	$ 80.88	$ 4.45
358	ASPHALT CURING SEAL	TON	0.0076	$ 632.00	$ 4.78			
1615	CONC MED BARR BOX INLET TY 14B2 1)	LF				1	$ 6.98	$ 6.98
2058	REMOVE PCC PAVEMENT	SQ YD	7.56	$ 11.00	$ 83.11	0.22	$ 11.00	$ 2.44
2069	JPC PAVEMENT - 10 IN	SQ YD				8.22	$ 50.00	$ 411.11
2086	JPC PAVEMENT - 13 IN	SQ YD	7.56	$ 53.00	$ 400.44			
2200	ROADWAY EXCAVATION	CU YD	1.68	$ 15.00	$ 25.19	0.09	$ 15.00	$ 1.34
2542	CEMENT	TON	0.15	$ 110.00	$ 16.25			
2702	SAND FOR BLOTTER	TON	0.02	$ 30.00	$ 0.57			
21935EN	REMOVE CONC MEDIAN BARRIER	LF				1	$ 30.00	$ 30.00
23045ES508	CONCRETE MEDIAN BARRIER TY 14B(50)	LF				1	$ 45.00	$ 45.00
		TOTAL PER FOOT OF ROADWAY			$ 596.63			$ 511.28
			LENGTH OF 4 LANE SECTION		8,200			8,200
	LENGTH FOR BARRIER WALL REPLACEMENT ITEMS REQUIRED IN FULL DEPTH TAPERS							2,000
				SUBTOTAL	$ 4,892,366.00			$ 4,353,753.48
2568	MOBILIZATION	LP SUM			$ 146,770.98			$ 130,612.60
2569	DEMOBILIZATION	LP SUM			$ 73,385.49			$ 65,306.30
	TOTAL ESTIMATED CONSTRUCTION COSTS				**$ 5,112,522.47**			**$ 4,549,672.39**
	10% ENGINEERING & CONTINGENCIES				$ 511,252.25			$ 454,967.24
	TOTAL ESTIMATED 4 LANE SECTION COSTS				**$ 5,623,774.72**			**$ 5,004,639.63**

1) 11 TOTAL BOX INLETS @ $5,200 EA / LENGTH OF OVERLAY

OVERLAY VS FULL DEPTH ESTIMATES
3 LANE SECTIONS
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
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1	DGA	TON				0.17	$ 25.00	$ 4.32
3	CRUSHED STONE BASE	TON	0.69	$ 25.00	$ 17.27			
8	CEMENT STABILIZED ROADBED	SQ YD	6.22	$ 6.00	$ 37.33			
72	CRUSHED AGGREGATE SIZE NO. 57	TON				0.18	$ 31.40	$ 5.63
269	MODIFIED OPEN-GRADED DRAINAGE COURSE	TON				0.05	$ 80.88	$ 3.71
358	ASPHALT CURING SEAL	TON	0.0062	$ 632.00	$ 3.93			
1615	CONC MED BARR BOX INLET TY 14B2 1)	LF				1	$ 10.79	$ 10.79
2058	REMOVE PCC PAVEMENT	SQ YD	6.22	$ 11.00	$ 68.44	0.22	$ 11.00	$ 2.44
2069	JPC PAVEMENT - 10 IN	SQ YD				6.89	$ 50.00	$ 344.44
2086	JPC PAVEMENT - 13 IN	SQ YD	6.22	$ 53.00	$ 329.78			
2200	ROADWAY EXCAVATION	CU YD	1.38	$ 15.00	$ 20.74	0.09	$ 15.00	$ 1.34
2542	CEMENT	TON	0.12	$ 110.00	$ 13.38			
2702	SAND FOR BLOTTER	TON	0.02	$ 30.00	$ 0.47			
21935EN	REMOVE CONC MEDIAN BARRIER	LF				1	$ 30.00	$ 30.00
23045ES508	CONCRETE MEDIAN BARRIER TY 14B(50)	LF				1	$ 45.00	$ 45.00
		TOTAL PER FOOT OF ROADWAY			$ 491.34			$ 447.68
		LENGTH OF 3 LANE SECTIONS			13,978			13,978
	LENGTH FOR BARRIER WALL REPLACEMENT ITEMS REQUIRED IN FULL DEPTH TAPERS							4,000
				SUBTOTAL	$ 6,867,950.52			$ 6,580,186.00
2568	MOBILIZATION	LP SUM			$ 206,038.52			$ 197,405.58
2569	DEMOBILIZATION	LP SUM			$ 103,019.26			$ 98,702.79
	TOTAL ESTIMATED CONSTRUCTION COSTS				**$ 7,177,008.29**			**$ 6,876,294.37**
	10% ENGINEERING & CONTINGENCIES				$ 717,700.83			$ 687,629.44
	TOTAL ESTIMATED 3 LANE SECTION COSTS				**$ 7,894,709.12**			**$ 7,563,923.81**

1) 29 TOTAL BOX INLETS @ $5,200 EA / LENGTH OF OVERLAY

OVERLAY VS FULL DEPTH ESTIMATES
BIFURCATED SECTION
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

CODE	ITEM	UNIT	QUANTITY - FULL DEPTH OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST FULL DEPTH	QUANTITY - OVERLAY OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST OVERLAY
1	DGA	TON				0.35	$ 25.00	$ 8.64
3	CRUSHED STONE BASE	TON	0.59	$ 25.00	$ 14.80			
8	CEMENT STABILIZED ROADBED	SQ YD	5.33	$ 6.00	$ 32.00			
269	MODIFIED OPEN-GRADED DRAINAGE COURSE	TON				0.04	$ 80.88	$ 2.97
358	ASPHALT CURING SEAL	TON	0.0053	$ 632.00	$ 3.37			
2058	REMOVE PCC PAVEMENT	SQ YD	5.33	$ 11.00	$ 58.67			
2069	JPC PAVEMENT - 10 IN	SQ YD				5.33	$ 50.00	$ 266.67
2086	JPC PAVEMENT - 13 IN	SQ YD	5.33	$ 53.00	$ 282.67			
2200	ROADWAY EXCAVATION	CU YD	1.19	$ 15.00	$ 17.78			
2542	CEMENT	TON	0.10	$ 110.00	$ 11.47			
2702	SAND FOR BLOTTER	TON	0.01	$ 30.00	$ 0.40			
			TOTAL PER FOOT OF ROADWAY		$ 421.15			$ 278.28
	LENGTH SB + NB I-275 BIFURCATED SECTION				5,403			5,403
				SUBTOTAL	$ 2,275,473.45			$ 1,503,546.84
2568	MOBILIZATION	LP SUM			$ 68,264.20			$ 45,106.41
2569	DEMOBILIZATION	LP SUM			$ 34,132.10			$ 22,553.20
	TOTAL ESTIMATED CONSTRUCTION COSTS				**$ 2,377,869.76**			**$ 1,571,206.45**
	10% ENGINEERING & CONTINGENCIES				$ 237,786.98			$ 157,120.64
	TOTAL ESTIMATED BIFURCATED SECTION COSTS				**$ 2,615,656.73**			**$ 1,728,327.09**

NOTE: AN AVERAGE ROADWAY WIDTH OF 48 FEET WAS USED FOR ESTIMATING.

OVERLAY VS FULL DEPTH ESTIMATES
1-471 RAMPS PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

COST OF RAMP VERTICAL TAPERS

CODE	ITEM	UNIT	QUANTITY - FULL DEPTH OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST FULL DEPTH	QUANTITY - OVERLAY OPTION PER FOOT OF ROADWAY	COST/UNIT	TOTAL COST OVERLAY
3	CRUSHED STONE BASE	TON	0.32	$ 25.00	$ 8.02			
8	CEMENT STABILIZED ROADBED	SQ YD	2.89	$ 6.00	$ 17.33			
269	MODIFIED OPEN-GRADED DRAINAGE COURSE	TON						
358	ASPHALT CURING SEAL	TON	0.0029	$ 632.00	$ 1.83			
2058	REMOVE PCC PAVEMENT	SQ YD	2.89	$ 11.00	$ 31.78			
2086	JPC PAVEMENT - 13 IN	SQ YD	2.89	$ 53.00	$ 153.11			
2200	ROADWAY EXCAVATION	CU YD	0.64	$ 15.00	$ 9.63			
2542	CEMENT	TON	0.06	$ 110.00	$ 6.21			
2702	SAND FOR BLOTTER	TON	0.01	$ 30.00	$ 0.22			
			TOTAL PER FOOT OF ROADWAY		$ 228.12			
			7 RAMPS TO RECEIVE 275' TAPERS		2,200			
				SUBTOTAL	$ 501,864.00			
2568	MOBILIZATION	LP SUM			$ 15,055.92			
2569	DEMOBILIZATION	LP SUM			$ 7,527.96			
	TOTAL ESTIMATED CONSTRUCTION COSTS				**$ 524,447.88**			
	10% ENGINEERING & CONTINGENCIES				$ 52,444.79			
	TOTAL ESTIMATED RAMP COSTS 1)							**$ 576,893**

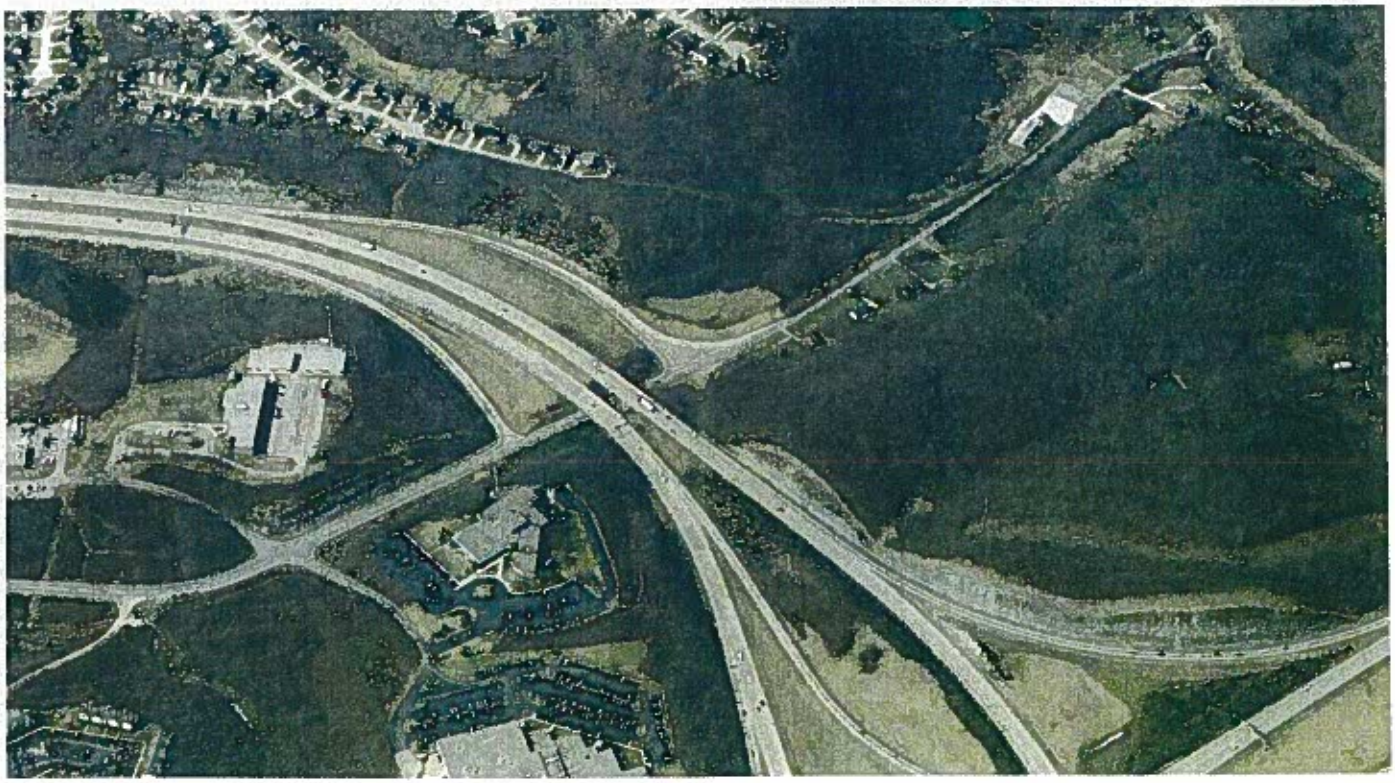
1) THIS IS SHOWN AS AN OVERLAY COST SINCE IT WOULD NOT BE REQUIRED WITH A FULL DEPTH DIGOUT ON MAINLINE I-471

NOTES: AN AVERAGE ROADWAY WIDTH OF 26 FEET WAS USED FOR ESTIMATING.
THE NORTHBOUND OFF RAMP AT THE I-471/US 25 INTERCHANGE IS NOT INCLUDES SINCE IT IS ALREADY SCHEDULED FOR FULL DEPTH REPLACEMENT FOR THE ENTIRE LENGTH OF THE RAMP.

Figure C

Kentucky
UNBRIDLED SPIRIT™

EVALUATION OF TWO-LANE RAMP WIDENING ON RAMP A FROM I-471 SB TO I-275 WB IN CAMPBELL COUNTY



PREPARED BY:

WMB INC.

James Napier, PE

PREPARED FOR:

KYTC CENTRAL OFFICE DESIGN

DAN HITE, PE

KENTUCKY TRANSPORTATION CABINET

FINAL

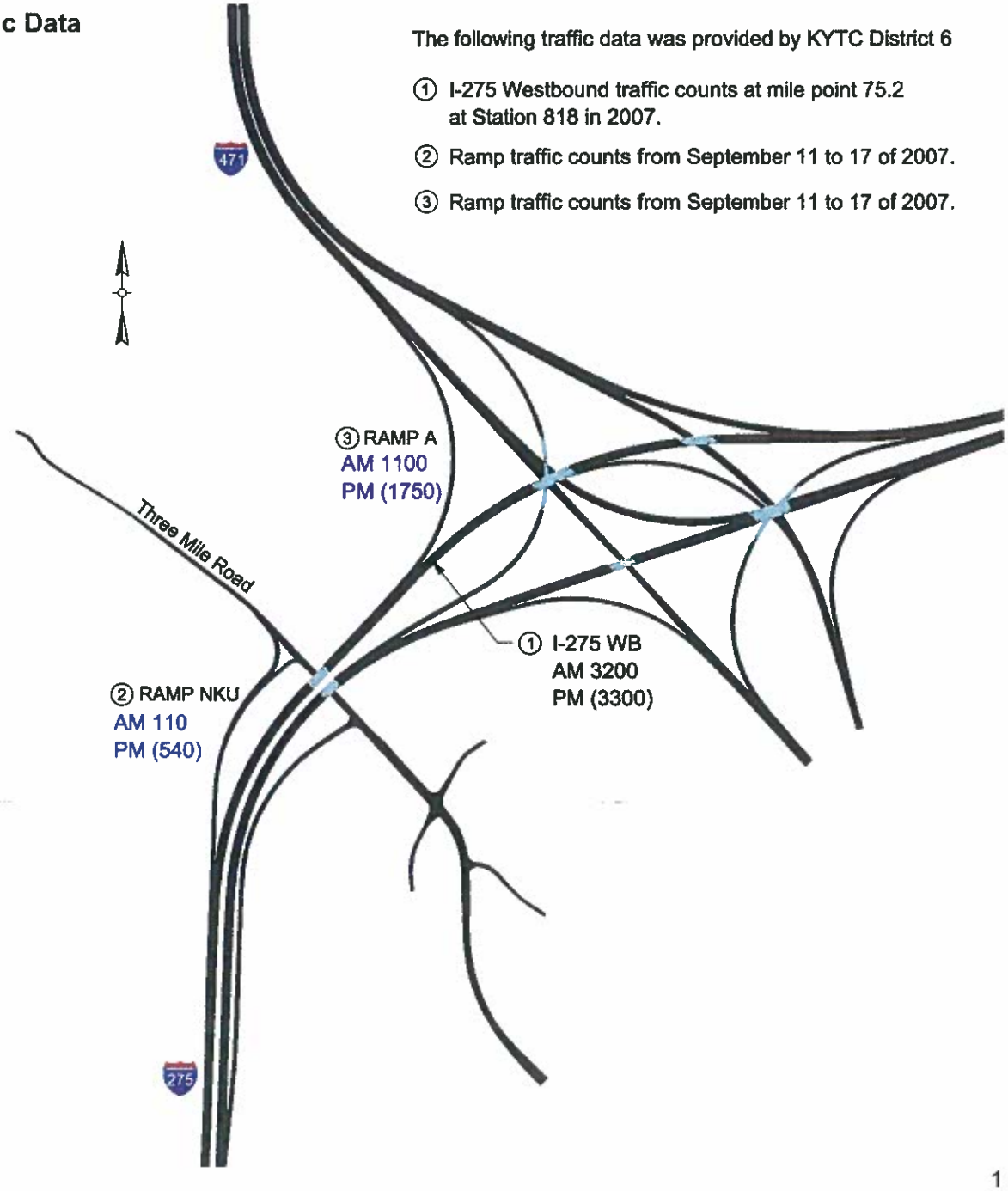
July 15, 2011

WMB CONSULTING ENGINEERS

EVALUATION OF TWO LANE RAMP WIDENING ON RAMP A FROM I-471 SB TO I-275 WB IN CAMPBELL COUNTY

The following study was prepared on the proposed widening of Ramp A from I-471 Southbound to I-275 Westbound in Campbell County. The existing ramp exits I-471 Southbound in a free flow condition with one lane that carries approximately 1800 vehicles in the peak hour to I-275. The ramp joins I-275 Westbound with 400' of acceleration lane and a 300' lane drop just prior to the bridge crossing over 3-mile Road. Given the short acceleration distance and current traffic volumes on Ramp A and I-275 Westbound, the project team decided to evaluate widening Ramp A to two lanes for additional capacity and improved operation.

Traffic Data



Alternate 1

Alternate 1 would widen Ramp A to two lanes and provide 2500 feet of distance to drop the two lanes on I-275 based on the recommended distance in AASHTO "A Policy on Geometric Design of Highway and Streets 2004". This configuration would overlap the entrance ramp from Three Mile Road and result in reconstructing the Three Mile road ramp approximately 800ft to the west. The additional lanes along I-275 for Ramp A were added to the outside for this alternate which results in widening the cuts and fills along I-275 and the Westbound bridge over Three Mile Road. Shifting the entrance ramp and taper from Three Mile Road requires significant excavation and is likely to extend outside the existing right of way. An option is included with Alternate 1 that uses a retaining wall along the shoulder line of the Three Mile Road entrance ramp to eliminate the excavation and keep the construction inside the existing right of way. The approximate construction costs are as follows with an itemized breakdown on Page 4.

Alternate 1 – $4,387,770

Alternate 1 w/ Wall – $5,282,130

Alternate 2

Alternate 2 would widen Ramp A to two lanes and provide 2160 feet of distance to drop the two lanes on I-275 which would leave 350 feet of separation between the lane drop and the entrance ramp from Three Mile Road. This alternate would add the lanes from Ramp A to the outside as in Alternate 1 which requires widening the cut just east of Three Mile Road and the bridge, but is expected to be constructed within the existing right of way. While this alternate does not provide the recommended distance for dropping the two lanes onto I-275 as mentioned with Alternate 1, the distance provided does appear to provide operational benefits with reduced cost.

Alternate 2 – $2,252,670

Note:
PDFs are included with this study that show plan, profile, and cross sections for the alternates described here.

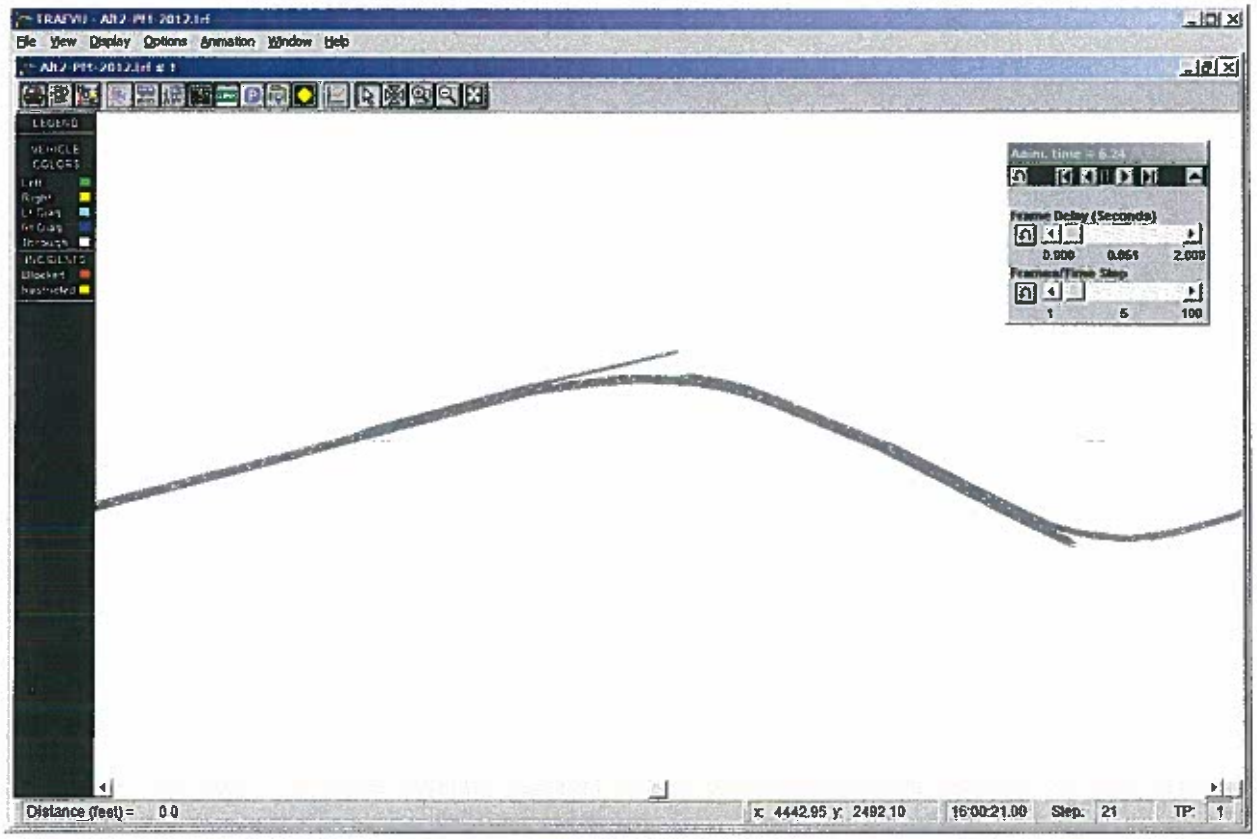
Traffic Analysis

A Corsim network was developed for the project area using the PM peak traffic counts shown earlier and increasing to 2012 and 2022 volumes using a 2% growth rate. Traffic simulations were run for the existing condition, Alternate 1 and Alternate 2. The network wide results below are based on an average of ten one hour simulations for each condition.

PM DHV	I-275 WB	From I-471	From Three Mile Road
2007	3300	1750	540
2012	3650	1950	590
2022	4450	2370	690

	Existing Condition			Alternate 1			Alternate 2		
Analysis Year	Avg Speed (mph)	Delay Travel (veh-hrs)	Total Travel (hours)	Avg Speed (mph)	Delay Travel (veh-hrs)	Total Travel (hours)	Avg Speed (mph)	Delay Travel (veh-hrs)	Total Travel (hours)
2012	56.18	10.70	114.94	58.07	6.51	111.20	57.73	7.79	111.86
2022	46.00	41.74	168.28	53.09	20.30	147.78	50.00	30.12	156.98

Snapshot of Corsim network



Alternate 1

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Excavation	155000	CY	$10.00	$1,550,000.00
Barrier Wall	1010	LF	$20.00	$20,200.00
Crash Cushion	1	EA	$5,000.00	$5,000.00
13" Concrete Pavement	23500	SY	$45.00	$1,057,500.00
DGA	16600	TON	$16.50	$273,900.00
Drainage Blanket	2500	TON	$37.00	$92,500.00
Bridge Widening	3185	SF	$175.00	$557,375.00
Signing	1	LS	$100,000.00	$100,000.00
Misc	1	LS	$731,295.00	$731,295.00
				$4,387,770.00

Alternate 1 With Retaining Wall

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Excavation	52000	CY	$10.00	$520,000.00
Barrier Wall	1010	LF	$20.00	$20,200.00
Retaining Wall	17400	SF	$100.00	$1,740,000.00
Crash Cushion	2	EA	$5,000.00	$10,000.00
13" Concrete Pavement	24100	SY	$45.00	$1,084,500.00
DGA	16800	TON	$16.50	$277,200.00
Drainage Blanket	2500	TON	$37.00	$92,500.00
Bridge Widening	3185	SF	$175.00	$557,375.00
Signing	1	LS	$100,000.00	$100,000.00
Misc	1	LS	$880,355.00	$880,355.00
				$5,282,130.00

Alternate 2

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Excavation	45000	CY	$10.00	$450,000.00
13" Concrete Pavement	13000	SY	$45.00	$585,000.00
DGA	8400	TON	$16.50	$138,600.00
Drainage Blanket	1250	TON	$37.00	$46,250.00
Bridge Widening	3185	SF	$175.00	$557,375.00
Signing	1	LS	$100,000.00	$100,000.00
Misc	1	LS	$375,445.00	$375,445.00
				$2,252,670.00

Figure D

PRE-DESIGN ESTIMATES
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

CODE	ITEM	UNIT	FULL DEPTH REPLACEMENT EXIST LANES & OUTSIDE SHLD	COST/UNIT	TOTAL COST	FULL DEPTH REPLACEMENT ENTIRE ROADWAY & ADD TWO LANES IN MEDIAN	COST/UNIT	TOTAL COST
1	DGA BASE	TON	68,981	$ 18.00	$ 1,241,658.00	85,517	$ 18.00	$ 1,539,306.00
8	CEMENT STABILIZED ROADBED	SQ YD	299,919	$ 2.00	$ 599,838.00	371,813	$ 2.00	$ 743,626.00
19	DRAINAGE BLANKET TYPE III-CEM	SQ YD	299,919	$ 10.00	$ 2,999,190.00	371,813	$ 10.00	$ 3,718,130.00
100	ASPHALT SEAL AGGREGATE	TON	582	$ 42.00	$ 24,460.80	565	$ 42.00	$ 23,742.60
291	EMULSIFIED ASPHALT RS-2	TON	69.9	$ 651.00	$ 45,504.90	67.8	$ 651.00	$ 44,137.80
358	ASPHALT CURING SEAL	TON	299.9	$ 632.00	$ 189,536.80	371.8	$ 632.00	$ 234,977.60
521	STORM SEWER PIPE-15 IN	LF				450	$ 50.00	$ 22,500.00
1001	PERFORATED PIPE-6 IN	LF	103,355	$ 5.40	$ 558,117.00	81,565	$ 5.40	$ 440,451.00
1015	INSPECT AND CERTIFY EDGE DRAIN SYSTEM	LP SUM	1	$ 15,000.00	$ 15,000.00	1	$ 15,000.00	$ 15,000.00
1021	PERF PIPE HEADWALL TY 1-6 IN	EACH	104	$ 516.00	$ 53,664.00	100	$ 516.00	$ 51,600.00
1615	CONC MED BARR BOX INLET TY 14B2	EACH				45	$ 5,200.00	$ 234,000.00
1982	DELINEATOR FOR GUARDRAIL-WHITE	EACH	294	$ 8.50	$ 2,499.00	294	$ 8.50	$ 2,499.00
1984	DELINEATOR FOR BARRIER-WHITE	EACH	61	$ 7.55	$ 458.41	61	$ 7.55	$ 458.41
1985	DELINEATOR FOR BARRIER-YELLOW	EACH	61	$ 7.55	$ 458.41	61	$ 7.55	$ 458.41
2003	RELOCATE TEMP CONC BARRIER	LF	55,833	$ 4.40	$ 245,665.20	55,833	$ 4.40	$ 245,665.20
2014	BARRICADE-TYPE III	EACH	25	$ 83.00	$ 2,075.00	25	$ 83.00	$ 2,075.00
2058	REMOVE PCC PAVEMENT	SQ YD	302,611	$ 15.00	$ 4,539,165.00	341,242	$ 15.00	$ 5,118,630.00
2086	JPC PAVEMENT - 13 IN	SQ YD	304,082	$ 42.00	$12,771,444.00	371,813	$ 42.00	$15,616,146.00
2200	ROADWAY EXCAVATION	CU YD	33,325	$ 15.00	$ 499,875.00	52,230	$ 15.00	$ 783,450.00
2237	DITCHING	LF	10,000	$ 2.00	$ 20,000.00	10,000	$ 2.00	$ 20,000.00
2363	GUARDRAIL CONNECTOR TO BRIDGE END TY A	EACH	10	$ 2,222.00	$ 22,220.00	10	$ 2,222.00	$ 22,220.00
2367	GUARDRAIL END TREATMENT TYPE 1	EACH	4	$ 2,288.00	$ 9,152.00	4	$ 2,288.00	$ 9,152.00
2369	GUARDRAIL END TREATMENT TYPE 2A	EACH	8	$ 696.00	$ 5,568.00	8	$ 696.00	$ 5,568.00
2373	GUARDRAIL END TREATMENT TYPE 3	EACH	2	$ 727.00	$ 1,454.00	2	$ 727.00	$ 1,454.00
2381	REMOVE GUARDRAIL	LF	21,188	$ 1.30	$ 27,543.75	21,188	$ 1.30	$ 27,543.75
2387	GUARDRAIL CONNECTOR TO BRIDGE END TY A-1	EACH	7	$ 430.00	$ 3,010.00	7	$ 430.00	$ 3,010.00
2391	GUARDRAIL END TREATMENT TYPE 4A	EACH	7	$ 1,984.00	$ 13,888.00	7	$ 1,984.00	$ 13,888.00
2542	CEMENT	TON	5,863	$ 110.00	$ 644,974.00	7,269	$ 110.00	$ 799,634.00
2562	SIGNS	SQ FT	3,000	$ 4.59	$ 13,770.00	3,000	$ 4.59	$ 13,770.00
2650	MAINTAIN & CONTROL TRAFFIC	LP SUM	1	$1,500,000.00	$ 1,500,000.00	1	$2,000,000.00	$ 2,000,000.00
2671	PORTABLE CHANGEABLE MESSAGE SIGN	EACH	20	$ 3,200.00	$ 64,000.00	20	$ 3,200.00	$ 64,000.00
2701	TEMP SILT FENCE	LF	25,000	$ 2.00	$ 50,000.00	25,000	$ 2.00	$ 50,000.00
2702	SAND FOR BLOTTER	TON	750	$ 30.00	$ 22,500.00	930	$ 30.00	$ 27,900.00
2705	SILT TRAP TYPE C	EACH	200	$ 131.00	$ 26,200.00	200	$ 131.00	$ 26,200.00
2708	CLEAN SILT TRAP TYPE C	EACH	200	$ 29.00	$ 5,800.00	200	$ 29.00	$ 5,800.00
2709	CLEAN TEMP SILT FENCE	LF	25,000	$ 0.67	$ 16,750.00	25,000	$ 0.67	$ 16,750.00
2726	STAKING	LP SUM	1	$ 50,000.00	$ 50,000.00	1	$ 150,000.00	$ 150,000.00
2775	ARROW PANEL	EACH	5	$ 900.00	$ 4,500.00	5	$ 900.00	$ 4,500.00
2894	CRASH CUSHION TYPE VI-T	EACH	10	$ 5,000.00	$ 50,000.00	10	$ 5,000.00	$ 50,000.00
3171	CONCRETE BARRIER WALL TYPE 9T	LIN FT	55,833	$ 20.70	$ 1,155,743.10	55,833	$ 20.70	$ 1,155,743.10
5950	EROSION CONTROL BLANKET	SQYD	50,000	$ 0.97	$ 48,500.00	50,000	$ 0.97	$ 48,500.00

PRE-DESIGN ESTIMATES
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

CODE	ITEM	UNIT	FULL DEPTH REPLACEMENT EXIST LANES & OUTSIDE SHLD	COST/UNIT	TOTAL COST	FULL DEPTH REPLACEMENT ENTIRE ROADWAY & ADD TWO LANES IN MEDIAN	COST/UNIT	TOTAL COST
5985	SEEDING AND PROTECTION	SQYD	50,000	$ 0.35	$ 17,500.00	50,000	$ 0.35	$ 17,500.00
6417	FLEXIBLE DELINEATOR POST-W	EACH	161	$ 30.00	$ 4,816.24	161	$ 30.00	$ 4,816.24
6418	FLEXIBLE DELINEATOR POST-Y	EACH	69	$ 30.00	$ 2,076.89	69	$ 30.00	$ 2,076.89
6511	PAVE STRIPING-TEMP PAINT-6 IN	LF	200,000	$ 0.20	$ 40,000.00	200,000	$ 0.20	$ 40,000.00
6549	PAVE STRIPING-TEMP REM TAPE-B	LF	20,000	$ 2.28	$ 45,600.00	20,000	$ 2.28	$ 45,600.00
6550	PAVE STRIPING-TEMP REM TAPE-W	LF	20,000	$ 1.43	$ 28,600.00	20,000	$ 1.43	$ 28,600.00
6551	PAVE STRIPING-TEMP REM TAPE-Y	LF	20,000	$ 1.54	$ 30,800.00	20,000	$ 1.54	$ 30,800.00
6592	PAVEMENT MARKER TYPE V-B W/R	EACH	1,050	$ 22.00	$ 23,091.93	1,050	$ 22.00	$ 23,091.93
6585	PAVEMENT MARKER TYPE IVA-MW TEMP	EACH	2,000	$ 6.95	$ 13,900.00	2,000	$ 6.95	$ 13,900.00
10020NS	FUEL ADJUSTMENT	DOLL	1	$ 67,224.00	$ 67,224.00	1	$ 82,568.00	$ 82,568.00
21802EN	G/R STEEL W BEAM-S FACE (7 FT POST)	LF	21,187.5	$ 16.00	$ 339,000.00	21,187.5	$ 16.00	$ 339,000.00
21935EN	REMOVE CONC MEDIAN BARRIER	LF				33,641	$ 30.00	$ 1,009,230.00
22854EN	PAVE STRIPE PERM-6 IN HD21-WHITE	LF	81,202	$ 0.24	$ 19,488.48	91,851	$ 0.24	$ 22,044.26
22855EN	PAVE STRIPE PERM-6 IN HD21-YELLOW	LF	56,442	$ 0.24	$ 13,546.15	56,442	$ 0.24	$ 13,546.15
22856EN	PAVE STRIPE PERM-12 IN HD21-WHITE	LF	10,500	$ 0.48	$ 5,040.00	10,500	$ 0.48	$ 5,040.00
23045ES508	CONCRETE MEDIAN BARRIER TY 14B(50)	LF				17,958	$ 45.00	$ 808,110.00
	RAMP REPAIRS (1)	LP SUM	1	$2,000,000.00	$ 2,000,000.00	1	$2,000,000.00	$ 2,000,000.00
	BRIDGE MAINTENANCE REPAIR COSTS (2)	LP SUM	1	$4,525,070.00	$ 4,525,070.00	1	$4,525,070.00	$ 4,525,070.00
	US 27 TWIN BRIDGES WIDENING (3)	LP SUM				1	$1,680,000.00	$ 1,680,000.00
	GRAND AVE TWIN BRIDGES WIDENING (3)	LP SUM				1	$1,440,000.00	$ 1,440,000.00
	CHESAPEAKE AVE TWIN BRIDGES WIDENING (3)	LP SUM				1	$1,104,000.00	$ 1,104,000.00
	LIGHTING COSTS (4)	LP SUM				1	$2,000,000.00	$ 2,000,000.00
	SIGNING COSTS (5)	LP SUM				1	$ 200,000.00	$ 200,000.00
				SUBTOTAL	$34,719,936.06			$48,787,479.35
2568	MOBILIZATION	LP SUM			$ 1,039,581.36			$ 1,461,147.34
2569	DEMOBILIZATION	LP SUM			$ 519,790.68			$ 730,573.67
	TOTAL ESTIMATED CONSTRUCTION COSTS				**$36,279,308.10**			**$50,979,200.36**
	10% ENGINEERING & CONTINGENCIES				$ 3,627,930.81			$ 5,097,920.04
	TOTAL ESTIMATED PROJECT COSTS				**$39,907,238.91**			**$56,077,120.40**

NOTES:
(1) Estimated cost of repairs to all ramp pavement within limits of project not including I-275 interchange ramps which are being repaired in a separate project
(2) Includes all bridge repair work recommended by the District within the project limits (see attached spreadsheet for detailed breakdown of costs by bridge number)
(3) Costs for closing up the median on these twin bridges for two additional lanes (see attached spreadsheet for detailed breakdown of costs by bridge number)
(4) Costs to remove existing conventional lighting from raised median and place on new median barrier
(5) Costs to remove existing overhead sign bases from raised median and reconstruct in new median barrier (assumes existing trusses and signs will be used)

I-471 BRIDGE REHABILITATION ESTIMATE
FROM I-275 TO OHIO RIVER
CAMPBELL COUNTY
9/23/2010

Bridge Maint. No.	Location	Proposed Work	Area (SY)	Area (SF)	LIN FT	Unit Cost	Cost
019B00049L&R	I-471 SB & NB over US 27	Seal Decks	4,510			$81	$365,310
		Replace Joints			280	$700	$196,000
						Total	**$561,310**
019B00052L&R	I-471 SB & NB over Grand Ave (KY 1892)	Replace Joint Seals			330	$50	$16,500
		Patch Spalled Areas Around Joints		100		$200	$20,000
		Seal Decks	3,930			$81	$318,330
						Total	**$354,830**
019B00053L&R	I-471 SB & NB over Chesapeake Ave	Replace Joints			268	$700	$187,600
		Seal Decks	3,230			$81	$261,630
						Total	**$449,230**
019B00056L&R	I-471 SB & NB over 6th St	Replace Elastomeric Bearing Pads Are Walking Out On Several Piers; Replace As Needed SB Piers: 2, 3, 9, 10, 16, 21, 26 NB Piers: 3, 4, 10, 11, 17, 22, 27, 28	29,900			$10	$299,000
						Total	**$299,000**
019B00065N	I-471 NB Ramp to KY 8	Replace Joint Seals And Armored Edge Where Necessary			104	$700	**$72,800**
019B00082L&R	I-471 SB & NB over KY 8 (First 5 Approach Spans to Dan Beard / Big Mac Bridge over Ohio River)	Overlay Deck	5,821			$100	$582,100
		Replace Joints			390	$700	$273,000
						Total	**$855,100**
019B00039L&R	I-471 SB & NB over Ohio River (Dan Beard / Big Mac Bridges)	Overlay Deck	16,192			$100	$1,619,200
		Replace Joints			448	$700	$313,600
						Total	**$1,932,800**
						Project Total	**$4,525,070**

I-471 BRIDGE WIDENING TO CLOSE MEDIAN ESTIMATE
FROM I-275 TO OHIO RIVER
CAMPBELL COUNTY
9/23/2010

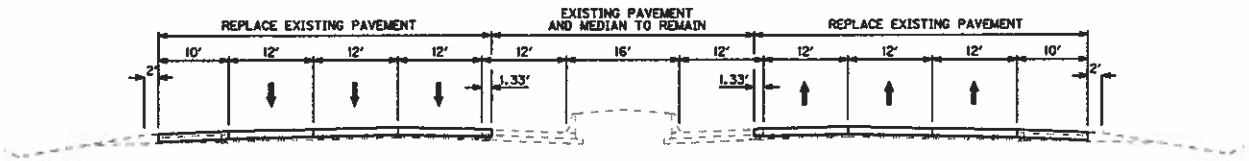
Bridge Maint. No.	Location	Description	Area (SF)	Unit Cost	Cost
019B00049L&R	I-471 SB&NB over US 27	3 Span Steel	8,400	$200	$1,680,000
019B00052L&R	I-471 SB&NB over Grand Ave (KY 1892)	2 Span Steel	7,200	$200	$1,440,000
019B00053L&R	I-471 SB&NB over Chesapeake Ave	3 Span Concrete	5,520	$200	$1,104,000
				TOTAL	**$4,224,000**

COUNTY OF	ITEM NO.	SHEET NO.
CAMPBELL	6-2021.00	RI

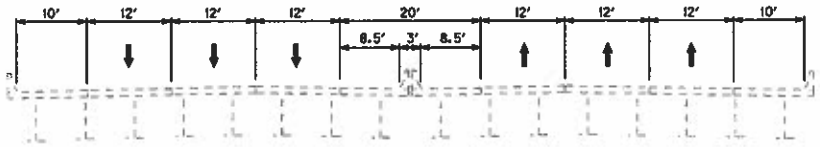
I-471 TYPICAL SECTIONS

ALTERNATE 1 - PAVEMENT REHABILITATION ONLY

I-275 TO KY 1120 (MEMORIAL PARKWAY)

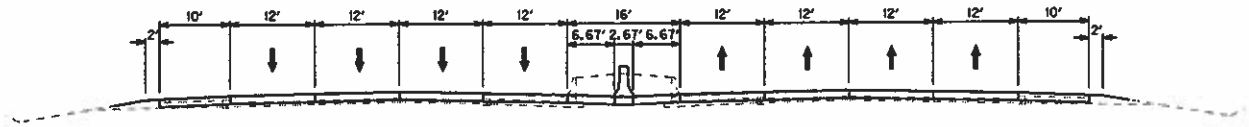


KY 1120 (MEMORIAL PARKWAY) TO OHIO RIVER

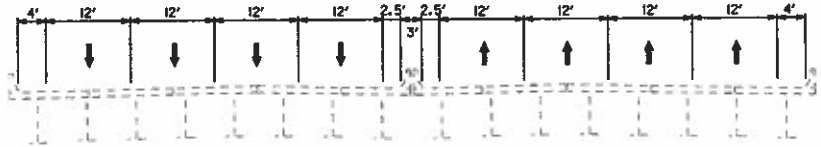


ALTERNATE 2 - PAVEMENT REHABILITATION WITH WIDENING FOR ADDITIONAL LANES

I-275 TO KY 1120 (MEMORIAL PARKWAY)



KY 1120 (MEMORIAL PARKWAY) TO OHIO RIVER



I-471 TYPICAL SECTIONS

KY 80 AT KY 461

				9/6/2011		ITEM NO.	8-0909.00																										
Sign			OMSS								POST																	Flex. Del. Post					
	size horiz	size vert	9400 Type A lbs	20919ED Type C lbs	9490 Conc cy	9491 Rebar lbs	9495 Panel sf	9496 0.08 oa	9497 0.125 oa	21098MD Type D each	9490 Type 1 LF	9511 Type 2 LF	9449 Remove Overhead Sign Sup	9450 Remove Overhead Sign Sup Cen Base	9451 Remove Sign Sup Beams	21373MD Remove Sign	9415 Oss Gal Sft Cantilever Sign Sup	20418ED Remove Relocate Sign	9436 80 ft Truss	9445 90 ft Truss	9457 165 ft Truss	9471 140 Truss	9448 Sign Bridge Attach	4003 Reference Marker	4904 Barrier Mounting Bracket	20912MD Barrier Wall Post	20419MD Rdwy X-Sect	9417 White	9418 Yellow	9483 120 ft truss	9412 Markers	20995MD Move Cantilever Sign Sup	comments
P1	13	14		1425.6	4.16	220	182																				1						
P2	13	14		1276	4.16	220	182																				1						
P3	15	15		1452	4.16	220	225																				1						
P4	13	14		1425.6	4.16	220	182																				1						
P5	16	13	1436.8		4.16	0	208																				1						
P6	15	15		1458.6	4.16	220	225																				1						
P7	11	6	376.2		1.19	0	66																				1						
totals			1812.8	7837.8	26.27	1166	1276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	nil

	size horiz	size vert	9400 Type A	9441 Type C lbs	9490 Conc cy	9491 Rebar lbs	9495 Panel sf	9496 0.08 oa	9497 0.125 oa	21098MD Type D each	9510 Type 1 LF	9511 Type 2 LF	9449 Remove Overhead Sign Sup	9450 Remove Overhead Sign Sup Cen Base	9451 Remove Sign Sup Beams	21373MD Remove Sign	9415 Oss Gal Sft Cantilever Sign Sup	20418EU Remove Relocate Sign	9436 80 ft Truss	9445 90 ft Truss	9457 165 ft Truss	9471 140 Truss	9448 Sign Bridge Attach	4003 Reference Marker	4904 Barrier Mounting Bracket	20912MD Barrier Wall Post	20419MD Rdwy X-Sect	Flex. Del. Post 9417 White	9418 Yellow	9483 120 ft truss	9412 Markers	20995MD Move Cantilever Sign Sup	comments

Figure E

COMPARISON OF BRIDGE OVERLAY OPTIONS
1-471 PAVEMENT REHABILITATION
CAMPBELL COUNTY
ITEM NO. 6-2021.00

				Option		
				6" Concrete Overlay	1.5" Latex Concrete Overlay	Epoxy Urethane Overlay
Bridge	Maint. No.	Location	Area (SF)	Option Cost / SF		
				$15	$8	$9
				Cost		
B1	019B00049L	I-471 SB Over US 27	19836	$297,540	$158,688	$178,524
B2	019B00049R	I-471 NB Over US 27	19836	$297,540	$158,688	$178,524
B3	019B00052L	I-471 SB Over Grand Ave	17217	$258,255	$137,736	$154,953
B4	019B00052R	I-471 NB Over Grand Ave	17217	$258,255	$137,736	$154,953
B5	019B00053L	I-471 SB Over Chesapeake Ave	13419	$201,285	$107,352	$120,771
B6	019B0053R	I-471 NB Over Chesapeake Ave	13419	$201,285	$107,352	$120,771
B7	019B00056L	I-471 SB Over 6th St	0	$0	$0	$0
B8	019B00056R	I-471 NB Over 6th St	0	$0	$0	$0
B9	019B00065N	I-471 NB Ramp To KY 8	0	$0	$0	$0
B10	019B00082L	I-471 SB Over KY 8	29196	$437,940	$233,568	$262,764
B11	019B00082R	I-471 NB Over KY 8	23463	$351,945	$187,704	$211,167
B12	019B00039L	I-471 SB Over Ohio River	66627	$999,405	$533,016	$599,643
B13	019B00039R	I-471 NB Over Ohio River	66627	$999,405	$533,016	$599,643
TOTAL COST PER OPTION				**$4,302,855**	**$2,294,856**	**$2,581,713**