VALUE ENGINEERING STUDY

OF

I-64 RIVERSIDE REHABILITATION

ITEM NUMBER: 5-73.00/fd041550 C056

Shelby County, Kentucky

January 28-February 2, 2007

Prepared by:

VE GROUP, L.L.C.

In Association With:

KENTUCKY TRANSPORTATION CABINET

VALUE ENGINEERING STUDY TEAM LEADER

William F. Ventry, P.E., C.V.S.
C.V.S. No. 84063 (LIFE)

DATE

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by VE Group for the Kentucky Transportation Cabinet. The study was performed during the week of January 29-February 2, 2007.

The subject of the study was the rehabilitation of the I-64 Riverside Parkway.

PROJECT DESCRIPTION

I-64 Riverside Expressway was built during the late 1960's. Since being opened to traffic, only minor repairs have taken place to this key interstate over the past 35 years. The major components of the bridges and roadway need to be repaired. These repairs will extend the useful life of the interstate and most importantly, improve safety and drivability for motorists. The proposed repairs are as follows:

PRIMARY CONSTRUCTION ACTIVITIES

- Replace 132 Expansion Joints and Steel Repairs
- Full Overlay
- Recoat Barrier
- Concrete Pavement Repairs
- Substructure Repairs at Waterfront Park
- Guardrail End Treatments
- Replace Critical Overhead Sign Trusses

METHODOLOGY

The Value Engineering Team followed the basic Value Engineering procedure for conducting this type of analysis.

This process included the following phases:

1. Investigation
2. Speculation
3. Evaluation
4. Development
5. Presentation
6. Report Preparation

I. EXECUTIVE SUMMARY

METHODOLOGY *(continued)*

Evaluation criteria identified as a basis for the comparison of alternatives included the following:

- Traffic Control
- Construction Time
- Service Life
- Future Maintenance Cost
- Construction Cost

I. EXECUTIVE SUMMARY

RESULTS – AREAS OF FOCUS

The following areas of focus were analyzed by the Value Engineering team and from these areas the following Value Engineering alternatives were developed and are recommended for Implementation:

A. JOINT REPLACEMENT

Recommendation Number 1:

The Value Engineering Team recommends that the Value Enhancement Alternative be implemented. This alternative proposes to use a one piece steel joint rail.

If this recommendation can be implemented, there is a possible cost increase of ***$174,768.***

B. BRIDGE DECK OVERLAY

Recommendation Number 2:

The Value Engineering Team recommends that the "As Proposed" Alternative be implemented. This alternative uses a Rophalt overlay.

C. MAINTENANCE OF TRAFFIC

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will change Phase II MOT to a complete closure of the project from I-264/Shawnee Expressway to 3rd Street Off-ramp.

If this recommendation can be implemented, there is a possible savings of ***$1,226,323.***

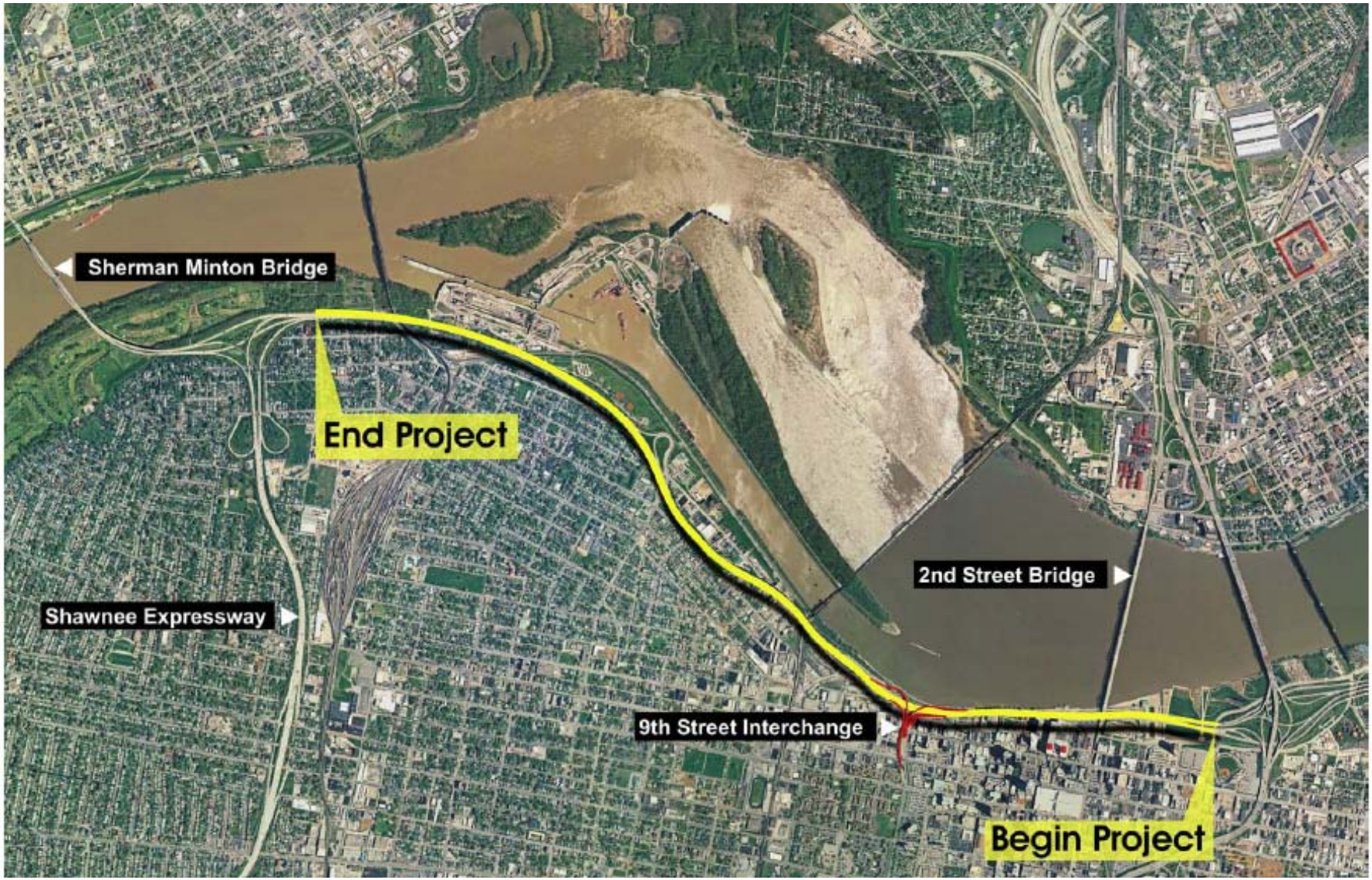
D. BRIDGE RAIL

Recommendation Number 4:

The Value Engineering Team recommends that the Value Enhancement Alternative be implemented. This alternative uses a crash worthy rail.

If this recommendation can be implemented, there is a possible cost increase of ***$2,695,914.***

II. LOCATION OF PROJECT



III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAMMEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
William F. Ventry, P.E., C.V.S.	VE Group	Team Leader	850/627-3900
Tom Hartley, P.E., C.V.S.	VE Group	Roadway/Construction	850/627-3900
John Ledbetter, P.E.	VE Group	Structures	850/627-3900
Mark Bloschock, P.E.	VE Group	Bridges	850/627-3900

III. TEAM MEMBERS AND PROJECT DESCRIPTION

PROJECT DESCRIPTION

PROJECT INFORMATION

In the spring and summer of 2007, repairs will be made to I-64 along Louisville's Riverfront. The interstate will close to through-traffic for 30 days starting July 5 and ending August 5. Working 24 hours a day, seven days a week, construction workers will make much needed repairs. By closing the interstate, repairs can be made in less than half the time of traditional construction. It will make the repair process safer for motorists and construction workers. Throughout the 30 day closure period, westbound traffic from 3rd Street to the 22nd Street interchange will be restricted. However, exits to many downtown streets will be accessible via 3rd Street and 22nd Street ramps from I-64. All I-65 access ramps will remain open except for the I-65 NB to I-64 WB ramp. In order to provide additional interstate access during Restore 64 construction, access to I-65 from the 2nd Street on-ramp will be provided.

I-64 Riverside Expressway was built during the late 1960's. Since being opened to traffic, only minor repairs have taken place to this key interstate over the past 35 years. The major components of the bridges and roadway need to be repaired. These repairs will extend the useful life of the interstate and most importantly, improve safety and drivability for motorists.

As currently proposed, the work will take place from Preston Street and extend westward to the I-64/Shawnee Expressway (I-264) Interchange. Repairs will take place during **Phase I** and **Phase II Construction**. The work happens around the clock – 24 hours a day during each construction phase.

Phase I Construction – 3 Consecutive Weekend Closures starting June 8, 2007. The initial construction work will begin during 3 identified weekends in June 2007. During the weekend work, the **ENTIRE LENGTH** of I-64 from Preston Street westward to the Shawnee Expressway **WILL BE CLOSED** from 8 pm Friday until 5 am Monday. **NO TRAFFIC** will enter I-64 during this time. Those weekends are:

- **June 8, 2007 through June 10, 2007**
- **June 15, 2007 through June 17, 2007**
- **June 22, 2007 through June 24, 2007**

Phase II Construction – A Continuous Closure starting July 5, 2007 through August 5, 2007. I-64 will be closed from 3rd Street to 22nd Street.

- **2nd Street On-ramp –** Access to I-64 EB, I-65 NB/SB & I-71
- **3rd Street Off-ramp** – Access from I-64 WB, I-65 NB/SB & I-71
- **9th Street Interchange** – COMPLETELY CLOSED to all traffic
- **22nd Street Off-ramp**– Access from I-64 EB to Community and Downtown
- **22nd Street On-ramp –** Access to I-64 WB from Community and Downtown
- **22nd Street On-ramp** – CLOSED to I-64 EB

IV. INVESTIGATION PHASE

VALUE ENGINEERING STUDY BRIEFING

I-64 RIVERSIDE REHABILITATION **January 29, 2007**		
NAME	**AFFILIATION**	**PHONE**
William F. Ventry, P.E., C.V.S.	VE Group	850/627-3900
Tom Hartley, P.E., C.V.S.	VE Group	850/627-3900
John Ledbetter, P.E.	VE Group	850/627-3900
Mark Bloschock, P.E.	VE Group	850/627-3900
Darrell Dudgeon	KYTC	502/564-4556
Robert Semones	KYTC	502/564-4555

IV. INVESTIGATION PHASE

STUDY RESOURCES

I-64 RIVERSIDE REHABILITATION **January 29-February 2, 2007**		
NAME	**AFFILIATION**	**PHONE**
Tim Rountree	STV	919/673-3098
Darrell Dudgeon	KYTC Project Manager	502/564-4556
Mike Baron	PB Project Manager	502/479-9307
Nasby Stroop	KYTC Construction	502/564-4780
Sidney Thames	NC DOT	919/250-4072
Dale Carpenter	KYTC Bridge	502/564-4560
David Steele	KYTC Maintenance	502/564-4556
Lloyd Wolf	TxDOT Bridge	512/416-2279
Al Kenz	Modified Concrete Supplier	724/334-7877
Ryan Griffin	KYTC	502/564-3280

IV. INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET

I-64 RIVERSIDE REHABILITATION

January 29-February 2, 2007

ITEM	FUNCT. VERB	FUNCT. NOUN	* TYPE	COST	WORTH	VALUE INDEX
Joint Rehabilitation	Replace	Joints	B	$ 10,700,000	$11,500,000	0.93
Pavement Replacement	Replace	Pavement	B	$ 12,000,000	$ 12,000,000	1.0
Bridge Deck Overlay	Replace	Overlay	B	$ 9,500,000	$11,500,000	0.83
Sign Structures	Support	Signs	B	$ 1,600,000	$ 1,600,000	1.0
Maintenance of Traffic	Maintain	Traffic	B	$ 2,000,000	$1,000,000	2.0
Incentive/Disincentive	Complete	Work	B	$ 2,000,000	$ 2,000,000	1.0
ITS	Inform	Motorist	B	$ 1,000,000	$ 1,000,000	1.0
Bridge Rail	Retain	Vehicles	B	$ 500,000	$13,000,000	0.17

***B – Basic S - Secondary**

** Note: This worksheet is a tool of the Value Engineering process and is only used for determining the areas that the Value Engineering team should focus on for possible alternatives. The column for COST indicates the approximate amount of the cost as shown in the cost estimate. The column for WORTH is an estimated cost for the lowest possible alternative that would provide the FUNCTION shown. Many times the lowest cost alternatives are not considered implementable but are used only to establish a worth for a function. A value index greater than 1.00 indicates the Value Engineering team intends to focus on this area of the project.

IV. INVESTIGATION PHASE

The following areas have a value index greater than 1.00 on the preceeding Functional Analysis Worksheet and therefore have been identified by the Value Engineering Team as areas of focus and investigation for the Value Engineering process:

A. JOINT REPLACEMENT

B. BRIDGE DECK OVERLAY

C. MAINTENANCE OF TRFFIC

D. BRIDGE RAIL

V. SPECULATION PHASE

Ideas generated, utilizing the brainstorming method, for performing the functions of previously identified areas of focus.

A. JOINT REPLACEMENT

- Replace welded bracket with a one piece bracket

B. BRIDGE DECK OVERLAY

- Mill 2” of deck and use a dense concrete overlay
- Use a 4” concrete overly with steel
- Mill .5” of deck and use a 1.5” latex modified concrete

C. MAINTENANCE OF TRAFFIC

- Close entire project for thirty days
- Use redundant detour routes

D. BRIDGE RAIL

- Retrofit the entire project with a crash worthy rail

VI. EVALUATION PHASE

A. ALTERNATIVES

The following alternatives were formulated during the "eliminate and combine" portion of the Evaluation Phase.

A. JOINT REPLACEMENT

Value Enhancement Alternative: ***Replace welded bracket with a one piece bracket.***

B. BRIDGE DECK OVERLAY

Value Enhancement Alternative Number. 1: ***Mill 2" of deck and use a 2" dense concrete overlay.***

Value Enhancement Alternative Number 2: ***Mill .5" of deck and overly with 1.5" latex modified concrete.***

C. MAINTENANCE OF TRAFFIC

Value Engineering Alternative: ***Close entire project for thirty days and use redundant detour routes.***

D. BRIDGE RAIL

Value Enhancement Alternative: ***Retrofit the entire project with a crash worthy rail.***

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES

The following Advantages and Disadvantages were developed for the Value Engineering Alternatives previously generated during the speculation phase. It also includes the Advantages and Disadvantages for the "As Proposed".

A. JOINT REPLACEMENT

"As Proposed": Use a welded bracket.

Advantages

- None apparent.

Disadvantages

- Weld could break under truck loads.
- Studs may not have enough cover.

Conclusion

Carry forward for further evaluation.

Value Enhancement Alternative: ***Replace welded bracket with a one piece bracket and revise the stud angle.***

Advantages

- One piece bracket has less maintenance.
- Studs will be less susceptible to corrosion.
- Could be less construction time.
- May be less cost.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

B. BRIDGE DECK OVERLAY

"As Proposed": Mill 1.5" of deck and replace with 1.5" of Rosphalt.

Advantages

- Only requires 1.5" of milling.
- Maybe slightly less dead load.
- Maybe more waterproof.

Disadvantages

- Unproven technology.
- Needs FHWA approval.
- Requires sole source.

Conclusion

Carry forward for further evaluation.

Value Enhancement Alternative Number 1: ***Mill 2" of deck and replace with 2" dense concrete overlay.***

Advantages

- Proven technology.
- Does not require FHWA approval.

Disadvantages

- Requires 2'' of milling.

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

Value Enhancement Alternative Number 2: ***Mill .5" of deck and replace with 1.5" latex modified concrete overlay.***

Advantages

- Proven technology.
- Does not require FHWA approval.
- Less construction time.
- May be less cost.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

C. MAINTENANCE OF TRAFFIC

"As Proposed": Use a partial closure and partial bi-directional closure.

Advantages

- Previously discussed with the city.
- Does maintain some access to downtown.

Disadvantages

- Has the potential to increase construction time.
- Staging access will be difficult for the contractor.
- Increased risk to the motoring public as well as the contractor workers and equipment.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: ***Use a full closure.***

Advantages

- Could better meet 30 day construction time limit.
- Will increase production.
- Easier staging for contractor.
- Reduced risk for motorist, workers and equipment.

Disadvantages

- Less access to downtown.

Conclusion

Carry forward for further evaluation.

D. BRIDGE RAIL

"As Proposed": Limited reworking and application of coating.

Advantages

- Low construction cost.
- Easy construction.
- Shorter construction time.

Disadvantages

- May not be approved by FHWA.
- Increased risk of failure.

Conclusion

Carry forward for further evaluation.

Value Enhancement Alternative: Retrofit entire project with crash worthy rail.

Advantages

- Less risk of failure.
- Less maintenance.
- Will meet FHWA requirements.

Disadvantages

- Higher construction cost.

Conclusion

Carry forward for further evaluation.

VII. DEVELOPMENT PHASE

A. JOINT REPLACEMENT

(1) AS PROPOSED
(2) VALUE ENHANCEMENT ALTERNATIVE

B. BRIDGE DECK OVERLAY

(1) AS PROPOSED
(2) VALUE ENHANCEMENT ALTERNATIVE NUMBER 1
(3) VALUE ENHANCEMENT ALTERNATIVE NUMBER 2

C. MAINTENANCE OF TRAFFIC

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

D. BRIDGE RAIL

(1) AS PROPOSED
(2) VALUE ENHANCEMENT ALTERNATIVE

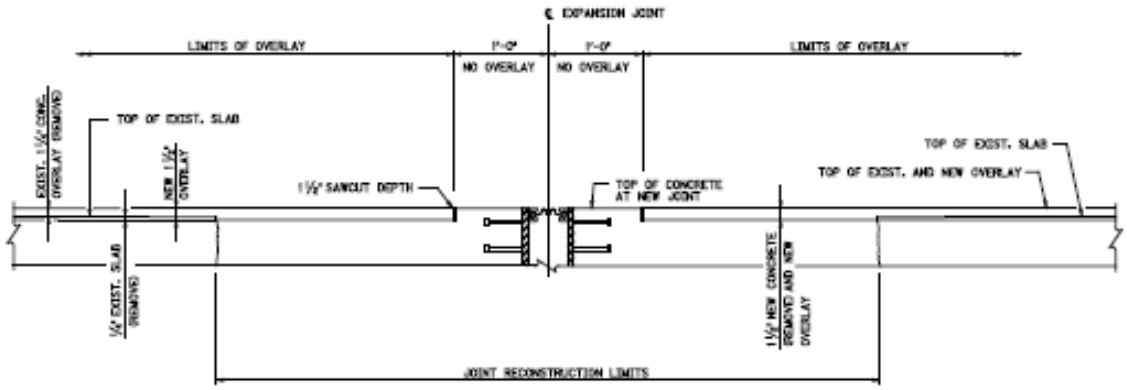
VII. DEVELOPMENT PHASE

A. JOINT REPLACEMENT

1. "As Proposed"

The existing project includes four main lane bridges and two ramp bridges. These bridges were originally constructed with a total of 132 expansion joints that are at the end of their useful service lives and now require replacement. The existing bridge joints include different types of joints (finger joints, sliding plate joints, strip seal joints and modular joints) that were originally chosen by the designers to accommodate calculated thermal expansion, beam end rotations, sealing and deck drainage options. Strip seals (also called sealed expansion joints) are proposed to replace all of the existing bridge joints. Most of the existing joints are leaking and the existing finger joints require periodic welded repairs that are not permanent. During the site visit, visual and aural observations suggests that some of the finger joints are broken as indicated by the loud "slapping" noise made by 18 wheel semi- truck tires traversing the open joint.

The As Proposed strip seal joint consists of two 5/8" x 8" vertical plates with two horizontal rows of 6" long, straight, horizontal studs welded to each plate and embedded in the concrete bridge slab. On the open side of each vertical plate there is a steel knuckle with a "C" shaped indentation welded top and bottom to the vertical plate. These knuckles engage a one-piece neoprene expansion seal or gland that is intended to prevent almost all deck drainage from leaking on to the lower bridge superstructure and substructure.



OVERLAY DETAILS AT EXPANSION JOINT – PIERS

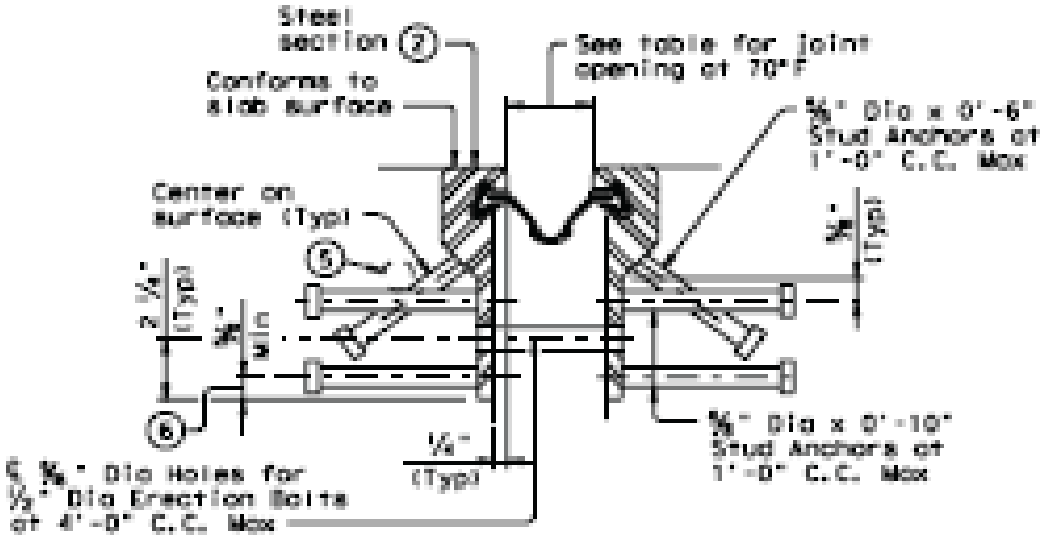
Experience in other states suggests that welded knuckles, such as these, eventually break loose under the pounding of 18 wheeler tires, especially on those bridges with high speed, heavy truck traffic volumes. Some state DOT's have written their specifications to eliminate welded knuckles and have standard drawings that specify one-piece steel "P" cross section joint rails that engage the neoprene seal.

VII. DEVELOPMENT PHASE

A. JOINT REPLACEMENT

2. Value Enhancement Alternative

Replace welded bridge joint rail with one-pieced steel joint rail that requires no welding, and revise welded stud detail. The upper row of horizontal welded studs should be lengthened and bent down so as to provide more concrete clearance and therefore increased corrosion protection from de-icing chemicals (see current Texas DOT sealed expansion detail included as an example).



SECTION THRU SEALED EXPANSION JOINT

VALUE ENHANCEMENT ALTERNATIVE

JOINT REPLACEMENT
VALUE ENHANCEMENT ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Strip Seal Joint with Welded Knuckles	LF	$100.00	5,975.0	$597,500	0.0	$0
Strip Seal Joint with One Piece Vertical Bracket	LF	$125.00	0.0	$0	5,975.0	$746,875
SUBTOTAL				**$597,500**		**$746,875**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)			5.0%	$32,863	5.0%	$41,078
DEMOBILIZATION			1.5%	$8,963	1.5%	$11,203
CONTINGENCY			10.0%	$59,750	10.0%	$74,688
GRAND TOTAL				**$699,076**		**$873,844**

POSSIBLE COST INCREASE: $174,768

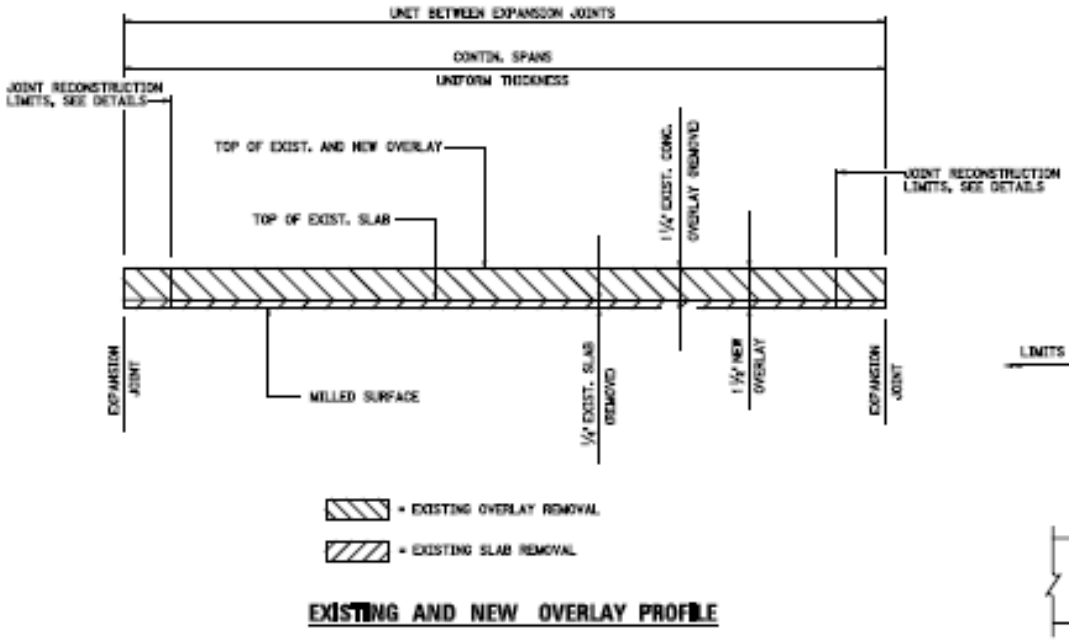
VII. DEVELOPMENT PHASE

B. BRIDGE DECK OVERLAY

1. "As Proposed"

An existing 1.25" thick concrete overlay placed on the bridges approximately 30 years ago is deteriorated, has required patching and is experiencing ride quality degradation. As part of this project, the overlay is to be rehabilitated. According to the presentation made by Darrell Dudgeon of the KYTC Division of Maintenance, the inspection engineers claim that the existing slab, underneath the existing overlay, is in good condition and a new concrete overlay is sufficient to extend the life of the bridge slab. The VE team was told that slab cores were not taken to determine chloride penetration into the existing slab. Experience suggests that bridge slabs of this age with frequent applications of de-icing chemicals, have some corrosion of the top mat of rebar.

The "As Proposed" plans call for milling off the existing concrete overlay full depth plus an additional .25" of the existing bridge deck concrete. Overlaying with 1.5" total depth of Rosphalt on the bridge deck. The Value Engineering team was told that, based on the experience in Wisconsin and elsewhere and on one other project in Kentucky, this proprietary overlay product is readily available and provides a more waterproof membrane for the continued corrosion protection of the existing bridge slab.

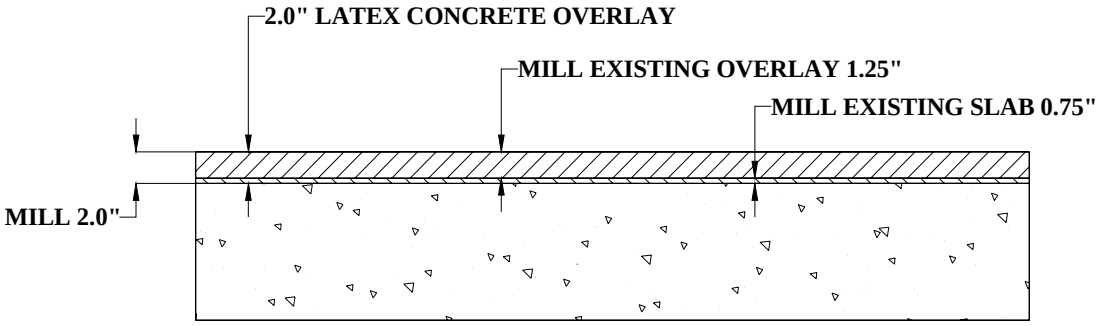


AS PROPOSED

B. BRIDGE DECK OVERLAY

2. Value Enhancement Alternative Number 1

Mill off the existing concrete overlay full depth plus an additional .75” of the existing bridge deck concrete. Install a 2” thick dense concrete/ latex-modified overlay on the bridge deck. Experience in other states suggests that a 2” minimum dense concrete/ latex-modified overlay will bond well to the existing bridge deck, while providing protection for the existing bridge slab from the intrusion of corrosives and has a service life of approximately 15 to 20 years under heavy traffic.



VALUE ENHANCEMENT ALTERNATIVE NUMBER 1

Because of the additional cost of this alternative, it was dropped from further consideration.

BRIDGE DECK OVERLAY
VALUE ENHANCEMENT ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
$1^1/_2$" Rosphalt 50 Overlay	Tons	$323.00	12,632.0	$4,080,136		
Milling	SY	$15.00	160,533.0	$2,407,995		
Milling	SY	$20.00			160,533.0	$3,210,660
Blast Cleaning	SY	$9.00	160,667.0	$1,446,003	160,667.0	$1,446,003
Partial Depth Patching	CY	$8.00	1,160.0	$9,280	1,160.0	$9,280
2" Latex Concrete Overlay	CY	$1,000.00			8,960.0	$8,960,000
Grinding	SY	$6.00			145,921.0	$875,526
SUBTOTAL				**$7,943,414**		**$14,501,469**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)			5.0%	$436,888	5.0%	$797,581
DEMOBILIZATION			1.5%	$119,151	1.5%	$217,522
CONTINGENCY			10.0%	$794,341	10.0%	$1,450,147
GRAND TOTAL				**$9,293,794**		**$16,966,719**

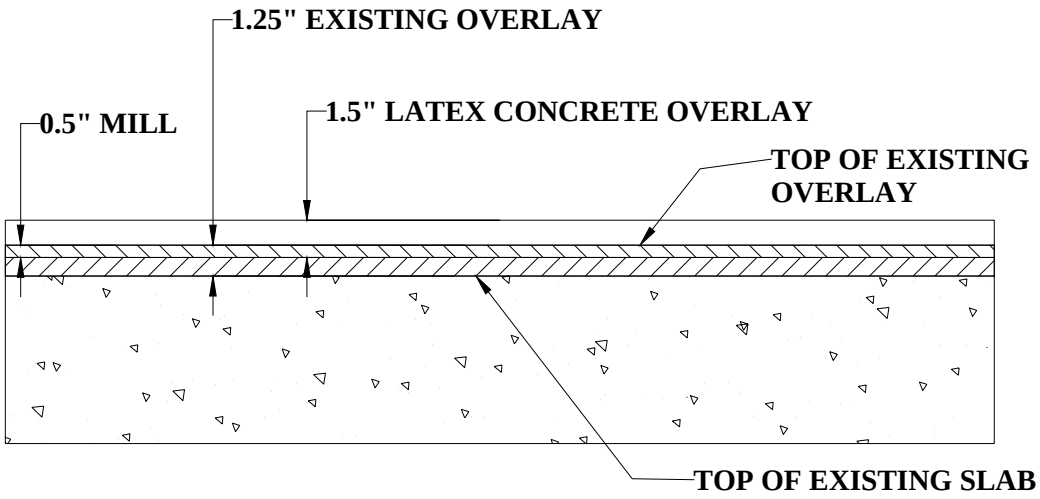
POSSIBLE COST INCREASE: $7,672,925

VII. DEVELOPMENT PHASE

B. BRIDGE DECK OVERLAY

2. Value Enhancement Alternative Number 2

Mill off .5” of the existing concrete overlay and install 1.5” of dense concrete/latex modified concrete overlay.



VALUE ENHANCEMENT ALTERNATIVE NUMBER 2

Because of the additional cost of this alternative, it was dropped from further consideration.

BRIDGE DECK OVERLAY
VALUE ENHANCEMENT ALTERNATIVE NUMBER 2
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Rosphalt 50 Overlay	Tons	$323.00	12,632.0	$4,080,136		
Milling	SY	$15.00	160,533.0	$2,407,995		
Blast Cleaning	SY	$9.00	160,667.0	$1,446,003	160,667.0	$1,446,003
Partial Depth Patching	CY	$8.00	1,160.0	$9,280	1,160.0	$9,280
$1^{1}/_{2}$" Latex Modified Conc with $^{1}/_{2}$" Milling	CY	$1,000.00			6,720.0	$6,720,000
1/2 inch Milling	SY	$5.00			160,533.0	$802,665
Grinding	SY	$6.00			145,921.0	$875,526
SUBTOTAL				**$7,943,414**		**$9,853,474**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)			5.0%	$436,888	5.0%	$541,941
DEMOBILIZATION			1.5%	$119,151	1.5%	$147,802
CONTINGENCY			10.0%	$794,341	10.0%	$985,347
GRAND TOTAL				**$9,293,794**		**$11,528,564**

POSSIBLE COST INCREASE: $2,234,770

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

The As Proposed Maintenance of Traffic and Construction Phasing (Alternative 8 – Hybrid) will be completed in 2-Phases. During Phase I, the entire I-64 project will be closed to traffic for 3-consecutive weekends for approximately 57 hours/weekend.

PHASE I – 3 Consecutive Weekend Closures starting June 8, 2007. The initial construction work will begin during 3 identified weekends in June 2007. During the weekend work, the **ENTIRE LENGTH** of I-64 from Preston Street westward to I-264/Shawnee Expressway **WILL BE CLOSED** from 8 PM Friday until 5 AM Monday. **NO TRAFFIC** will enter I-64 during this time. Those weekends are:

- June 8, 2007 through June 10, 2007
- June 15, 2007 through June 17, 2007
- June 22, 2007 through June 24, 2007

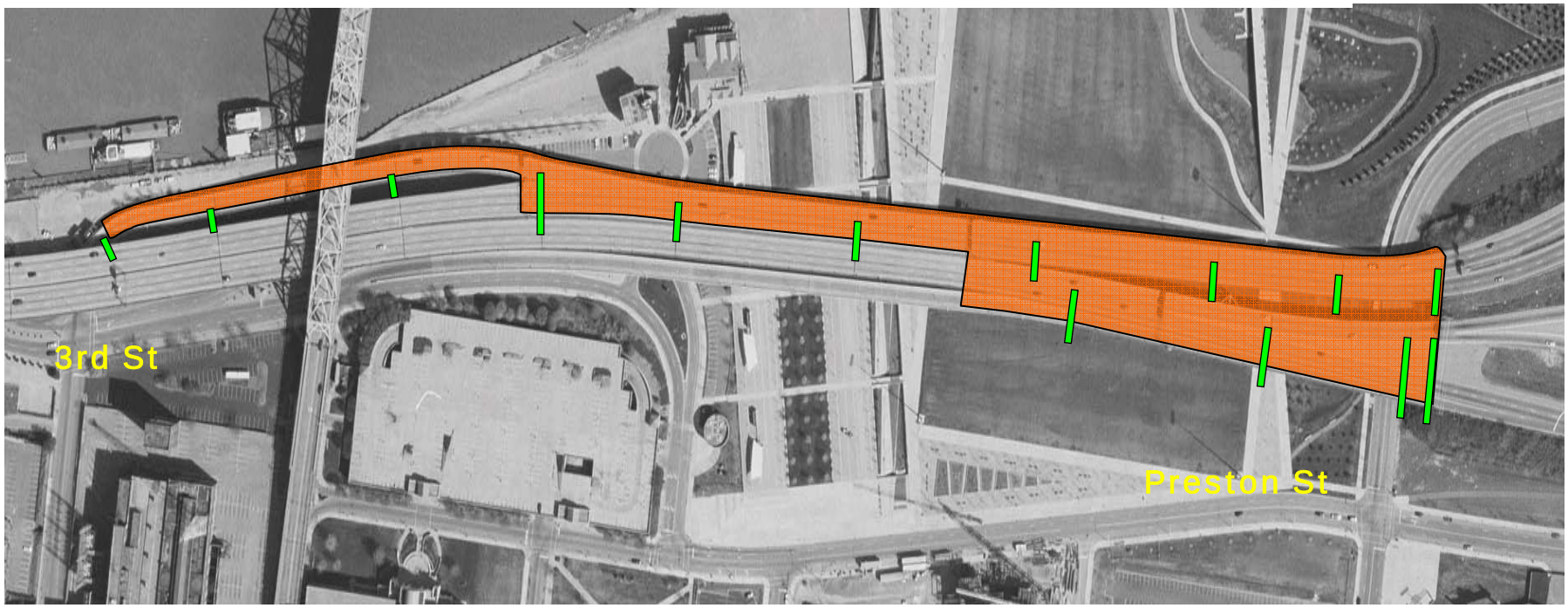
VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

Work accomplished during this phase will allow the Phase II work to be completed:

- EB I-64 Bridge over Preston Street – Deck overlay and Joint Replacement
- WB I-64 Bridge over Preston Street – Deck overlay and Joint Replacement



= Joint Locations To Replace

= Construction Area

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

- EB I-64 22nd Street Off-ramp – Deck overlay and Joint replacement

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

- EB I-64 west of I-264 Interchange – rework 1- lane of pavement

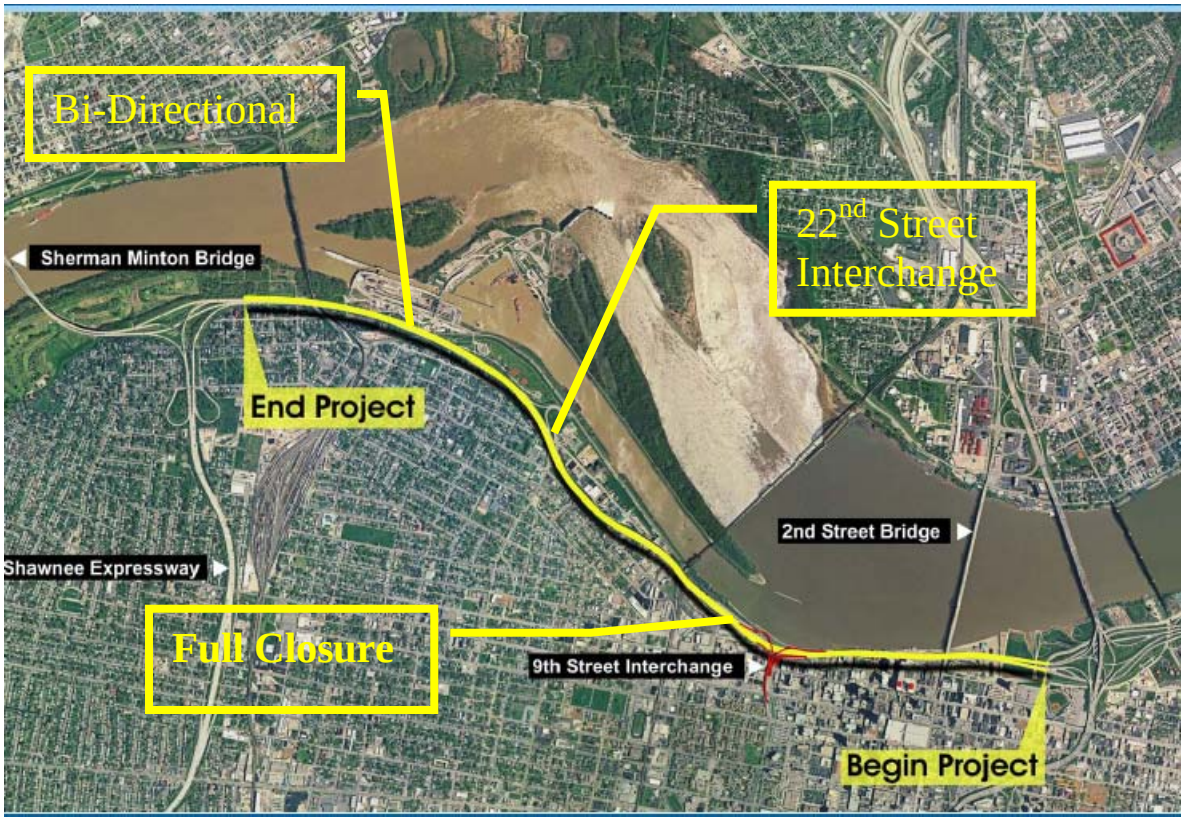
= Construction Area

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

PHASE II Construction – A Continuous Closure starting July 5, 2007 through August 5, 2007. I-64 will be closed from 3rd Street to the 22nd Street.



- **2nd Street On-ramp –** Access to I-64 EB, I-65 NB/SB& I-71EB
- **3rd Street Off-**ramp – Access from I-64 WB, I-65 NB/SB & I-71 WB
- **9th Street Interchange –** Completely close to all traffic
- **22nd Street Off-**ramp – Access from I-64 EB to community and Downtown
- **22nd Street On-**ramp – Access to I-64 WB from Community and Downtown
- **22nd Street On-**ramp – Closed to I-64 EB from Community and Downtown

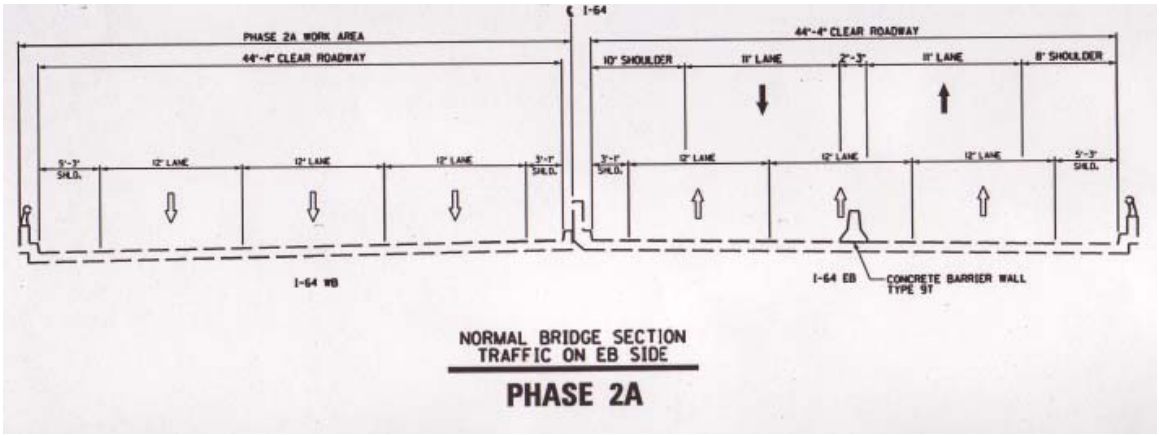
In Phase II, because of the full closure of I-64; the contractor will have open access to the I-64 Bridges and Roadway from 3rd Street Off-ramp and the 2nd Street On-ramp to the 22nd Street Interchange.

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

1. "As Proposed" *(continued)*

There will be limited access to the Community and Downtown for the EB I-64 traffic and limited access from the Community and Downtown to WB I-64 through the 22nd Street Interchange. One barrel of I-64 will contain 1-lane EB & 1-lane WB separated by temporary median barrier as shown below. Approximately half way through Phase II the traffic will be switched to the other barrel until the work is sufficiently completed to allow all the lanes to be reopened.



The VE Team had considerable discussion on the "As Proposed" MOT and feel this is a very aggressive schedule. The following areas of concern were identified:

1. PHASE I:

A. During the weekend closures to prepare the for the Phase II closure; the contractor will rehabilitate the I-64 Bridge over Preston toward the west and the 3rd Street Off-ramp (joint replacement and deck overlay). Since this appears to be the most work of Phase I that needs to be completed in a single weekend, it appears nearly impossible for a single contractor to complete the work in 57 hours (8 PM Friday to 5 AM Monday):

- Replace 13 joints
- Overlay approximately 12,600 SY of bridge deck

1. "As Proposed" *(continued)*

B. Using production rates provided by the Cabinet yields:

- One joint can be replaced in the 57 hours with questionable quality; so therefore, to complete all 13 joints will take 13 crews. It appears that because of the short period of time for curing the concrete before putting traffic on it, even with the High Early Concrete, the quality may suffer.
- Milling the 12,600 SY concrete bridge deck at the rate of 100 SY/machine (9' wide) X 5 milling machines yields approximately 26 hrs of work.
- Milling will be all but impossible with the joints removed or with newly installed joints in uncured concrete. Replacing the joints require cutting the existing pavement back about 3.5' either side of the joint leaving a 7' gap the milling machine and other vehicles will be unable to cross.
- Placing the Rosphalt ® would take about 12 hours.

C. Based on the above work rates the joints would be the critical path and should be completed in a separate weekend to avoid other trades getting in the way of this work. The Milling and overlay will have to be completed during another weekend closure.

2. PHASE II:

A. The Value Engineering Team questions the value of the Bi-Directional Concept with respect to meeting the 30-day closure constraint.

B. Phase II requires:

- Milling and overlaying the remaining bridge deck area (approximately 135,000 SY) results in about 12-24 hour workdays of milling with the 5 milling machines.
- Replacing the remaining 121 joints @ 2-24 hour days each (does not include a realistic cure time of 5 days) with 13 crews (same as Phase I) results in about 10 workdays plus the 5 cure day would be 15 days total for traffic ready to ride over the joints.
- Remove 74,000 SY of existing concrete pavement – assume broken concrete takes up 2.5 times the space of the concrete in place yields approximately 60,000 CY of concrete to haul off in 18 yard trucks or about 3,150 truck loads of concrete. Each truck takes 20 minutes to load and yields about 44 days of work. If three areas operating, about 15 days of work.
- Place 16,940 tons of crushed stone base – 12 tons per truck at 15 minutes per truck yields about 15 days of work.
- Place 15" of asphalt over 74,000 SY yields 61,050 tons of asphalt at 3,500 tons/24 hour day yields 18 days.

1. "As Proposed" *(continued)*

D. Also included in the work are various other activities such as cleaning edge drains, replacing sign trusses, resetting MOT pavement markings and temporary barriers.

E. Many of these activities require access to structure or pavement to get material in and out and with pavement torn out or the joints torn out will require alternate access routes or not being able to complete work.

To accomplish this work within 30-days will require intensive management to keep the different trades from interfering with their production, as well as maintaining access to the different work areas during the replacement of joints since traffic will not be able to cross joint replacement areas. In addition, adding the 1-lane of traffic in each direction for half the project will also create many conflicts with the construction. There also appears to be little leeway for rain/thunder storm delays, breakdowns, or any other incident that would shut the project down.

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

2. Value Engineering Alternative

The Value Engineering Team has many concerns about completing the As Proposed Phase II MOT Plan in 30 days. The following charts using production rates from the KYTC indicates possible problems finishing the work in 30 days.

PHASE II PRODUCTION RATES/DURATION (24/7)

ACTIVITY	RATE	UNITS	ESTIMATED QUANTITY	UNITS	WORK FACTOR*	DURATION	UNITS
Remvove & Replace Joint (No Concrete Curing)	3	Days	121	EA	10	**41**	Days **
Mill Concrete Bridge Deck	2400	SY/ 24 HR - Day	135,000	SY	5	12	Days
Place Rosphalt ®	3500	TN/24 HR -Day	7,425	TN	1	3	Days
Remove Concrete Pavement	20	Minutes/ Truck Load	3,423	Truck Load	3	16	Days
Crushed Stone Base	15	Minutes/ Truck Load	1412	Truck Load	1	15	Days
15" Asphalt Pavement	3,500	TN/24 HR -Day	61,050	TN	1	18	Days
Relocate Barrier	2	Days/Each	2	Days	1	2	Days

* INDICATES NUMBER OF CONCURRENT OPERATIONS
** ADDED 4 DAYS CURING TO THE LAST SET OF JOINTS REPLACED
*** NO RAIN/INCIDENT/BREAKDOWN DELAYS

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

2. Value Engineering Alternative *(continued)*

B1 DIRECTIONAL CLOSURE

PHASE II a & b PRODUCTION RATES/DURATION (24/7)

ACTIVITY	RATE	UNITS	ESTIMATED QUANTITY	UNITS	WORK FACTOR*	DURATION EB	RELOCATE BARRIER	DURATION WB	TOTAL DURATION	UNITS
Remvove & Replace Joint (No Concrete Curing)	3	DAYS	11	EA	10	8	2	8	**18**	Days **
Mill Concrete Bridge Deck	2,400	SY/ 24 HR – Day	18,000	SY	5	2	2	2	6	Days
Place Rosphalt ®	3,500	TN/ 24 HR –Day	990	TN	1	1	2	1	4	Days
Remove Concrete Pavement	20	Minutes/ Truck Load	453	Truck Load	3	3	2	3	8	Days
Crushed Stone Base	15	Minutes/ Truck Load	60	Truck Load	1	1	2	1	4	Days
15" Asphalt Pavement	3,500	TN/ 24 HR -Day	8,067	TN	1	3	2	3	8	Days

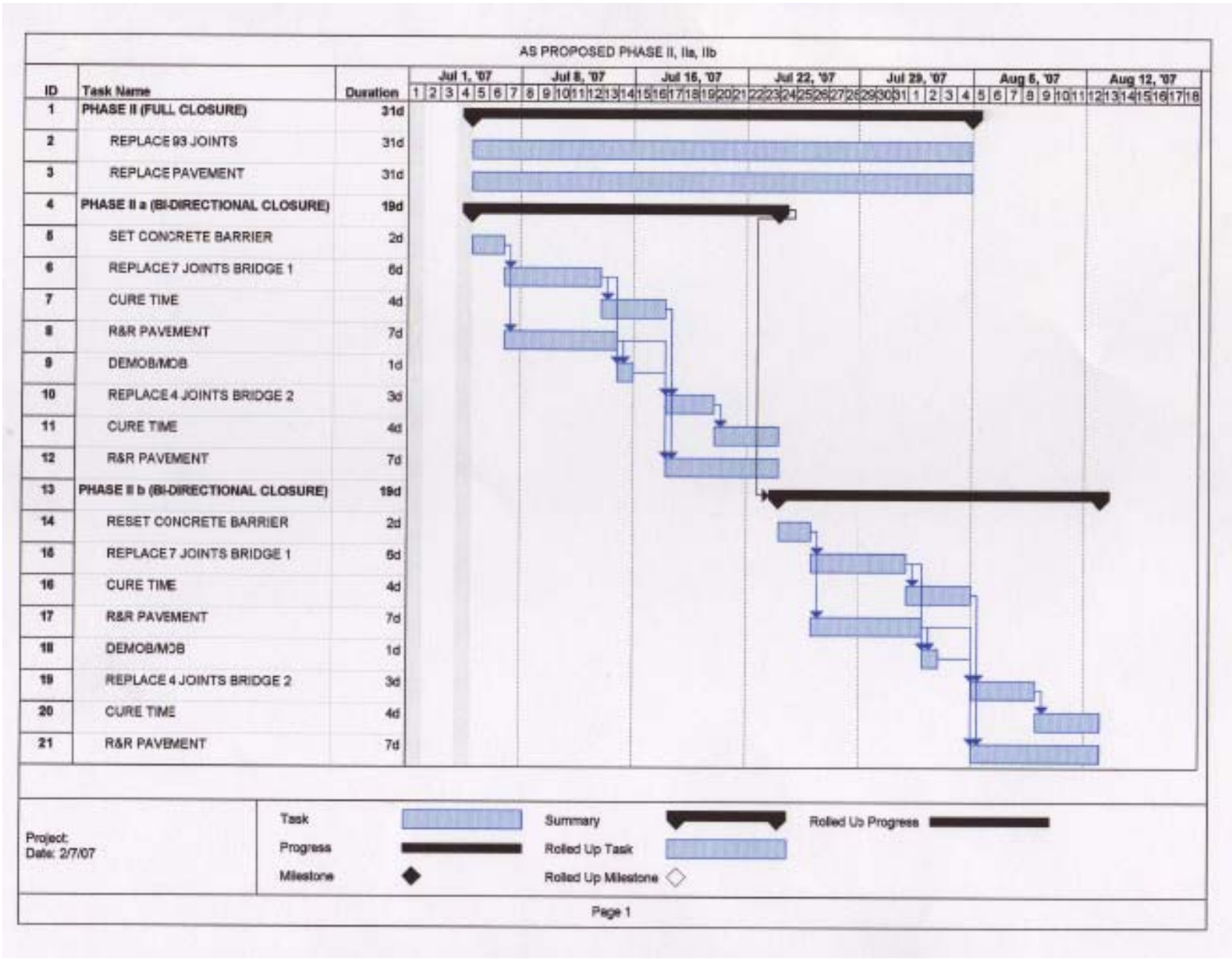
* INDICATES NUMBER OF CONCURRENT OPERATIONS
** ADDED 4 DAYS CURING TO THE LAST SET OF JOINTS REPLACED
*** NO RAIN/INCIDENT/BREAKDOWN DELAYS

2. Value Engineering Alternative (continued)

These concerns about the potential fatal flaws are as follows:

- Logistics in staging equipment (access to bridge joints and replacing pavement concurrently)
- Number of available trained crews working simultaneously to replace joints (e.g. as many as 10 crews)
- The amount of specialized equipment required to complete the work expeditiously (e.g. 5-6 concrete milling machines)
- No allowance for rain days
- No allowance for incidents (e.g. construction related damage)
- No allowance for equipment breakdowns
- No allowance for unknowns (e.g. discovery of additional safety related work that has to be done)

The schedule on the following page was developed by VE Group which shows that the "As Proposed" B1-Directional closing has the potential to overrun the 30-day limit by 8 days.



VII. DEVELOPMENT PHASE
C. MAINTENANCE OF TRAFFIC
2. VALUE ENGINEERING ALTERNATIVE *(continued)*

2. Value Engineering Alternative (continued)

In order to reduce the risk of these concerns, the VE Team recommends reducing Phase I to the bridges between 3rd Street and Preston to ensure access to the Downtown:

- Replace the bridge joints
- Mill and overlaying the bridge decks

Phase I will be 2 - weekend closures; one weekend to replace joints and the second to mill and overlay the bridge deck.

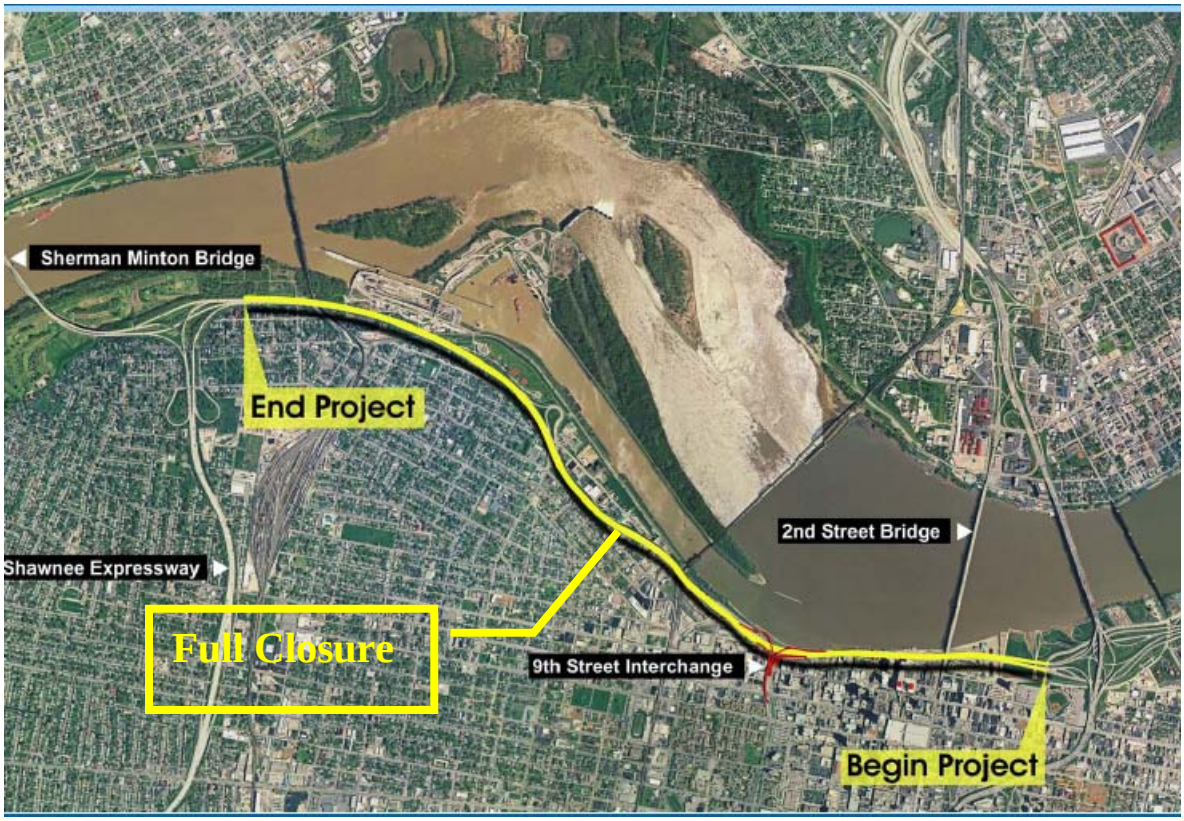
Phase II would be a complete closure of the project from I-264/Shawnee Expressway to 3rd Street Off-ramp, allowing the contractor full access to the project for more efficient work scheduling/staging. This approach will provide the contractor more access to the project and enhances his ability to schedule and stage the require work. In the VE Team's opinion, this VE Alternative Phasing/ MOT Scheme has a better chance of success in completing the work in 30-days because of the access to the work site, no interference with traffic and less work by eliminating the Bi-Direction MOT in Phase II.

Discussions with the Cabinet also indicated that with this approach, Joint Replacement Quality would increase due to the availability of more time to let the concrete next to the Joints cure before putting traffic on bridges.

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

2. *Value Engineering Alternative* *(continued)*



PHASE II MOT

The following would be the access to the surrounding areas:

- WB I-64 Traffic access to the Downtown area will still be 3rd Street.

WB I-64 Traffic access to the Community will be either:

- 3rd Street Off-ramp and through the Downtown area
- SB I-65 to I-264 and Exit 1 (Bank Street)
- SB I-65 to I-264 and Exit 2 (River Park Drive)
- WB I-64 to WB I-264 to Exit 1 (Bank Street)
- WB I-64 to WB I-264 to Exit 2 (River Park Drive)

2. Value Engineering Alternative (continued)

EB I-64 Traffic will access the Community by using:

- I-264 Exit 1 (Bank Street)
- I-264 Exit 2 (River Park Drive)

EB I-64 access to Downtown by either:

- I-265 to I-65 to I-64 to the 3rd Street Off-ramp
- I-264 Exit 1 (Bank Street)
-
- I-264 Exit 2 (River Park Drive)
- I-264 to I-65 NB to I-64 WB to the 3rd Street Off-ramp

EB Bank Street crosses under a RR Bridge, which appears to have sufficient clearance for most vehicles, but Exit 1 should be signed for a Minimum Clearance of 13’ 11”.

WB Portland Street crosses under the same RR and has a Minimum Clearance of 14’ 3”. Both of these underpasses have enough clearances for most traffic.

MAINTENANCE OF TRAFFIC
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Relocate Temp Median Barrier	LF	$7.92	600.0	$4,752	0.0	$0
Maintain & Control Traffic	LS	$1,000,000.00	1.0	$1,000,000	1.0	$1,000,000
Lane Closures	EA	$1,400.00	24.0	$33,600	0.0	$0
Crossover	EA	$50,000.00	4.0	$200,000	0.0	$0
Variable Message Sign	EA	$4,000.00	25.0	$100,000	16.0	$64,000
Flashing Arrow	EA	$6,000.00	12.0	$72,000	6.0	$36,000
Crash Cushion Type Vi-T	EA	$6,317.70	4.0	$25,271	0.0	$0
Relocate Crash Cushion	EA	$1,920.81	4.0	$7,683	0.0	$0
Concrete Barrier Wall Type 9t	LF	$31.86	14,300.0	$455,598	1,430.0	$45,560
Pave Striping-Temp Paint 6-In	LF	$0.22	26,000.0	$5,720	2,600.0	$572
Pave Striping Removal	LF	$0.78	25,000.0	$19,500	2,500.0	$1,950
Pave Striping-Temp Rem Tape-B	LF	$2.14	75,000.0	$160,500	7,500.0	$16,050
Pave Stirping-Temp Tape W	LF	$1.43	45,000.0	$64,350	4,500.0	$6,435
Pave Striping-Temp Tape Y	LF	$1.52	45,000.0	$68,400	4,500.0	$6,840
Pavement Marker Ty Iva-Mw Temp	EA	$4.54	500.0	$2,270	50.0	$227
Pavement Marker Ty Iva-Mytemp	EA	$4.54	1,500.0	$6,810	150.0	$681
SUBTOTAL				**$2,226,454**		**$1,178,315**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		5.0%		$122,455		$64,807
DEMOBILIZATION		1.5%		$33,397		$17,675
CONTINGENCY		10.0%		$222,646		$117,832
GRAND TOTAL				**$2,604,952**		**$1,378,629**

POSSIBLE SAVINGS: $1,226,323

VII. DEVELOPMENT PHASE

C. MAINTENANCE OF TRAFFIC

COST COMPARISON SHEET BACK UP CALCULATIONS

The Value Engineering Alternative Temporary Striping was assumed to be 10% of the As Proposed Temporary Striping.

VII. DEVELOPMENT PHASE

D. BRIDGE RAIL

1. "As Proposed"

No retrofit of the bridge rail, aesthetic surface sealing with a two-application coating.

The existing bridge rail on the project bridges is a pre-1964 design that has a curb at the base of the rail that was designed to allow for a narrow pedestrian sidewalk/refuge for a stranded motorist to more safely walk off a bridge in the event of a vehicular mechanical breakdown. Subsequent observations led to the 1964 interim AASHTO Bridge Specification language for first mention of a bridge rail impact loading and for the elimination of the curb/sidewalk at the base of bridge rails. This curb/sidewalk had been noted to occasionally contribute to the vaulting up of errant vehicles under some conditions and in other conditions, rarely causing a complete override of the errant vehicle over the top of the rail.

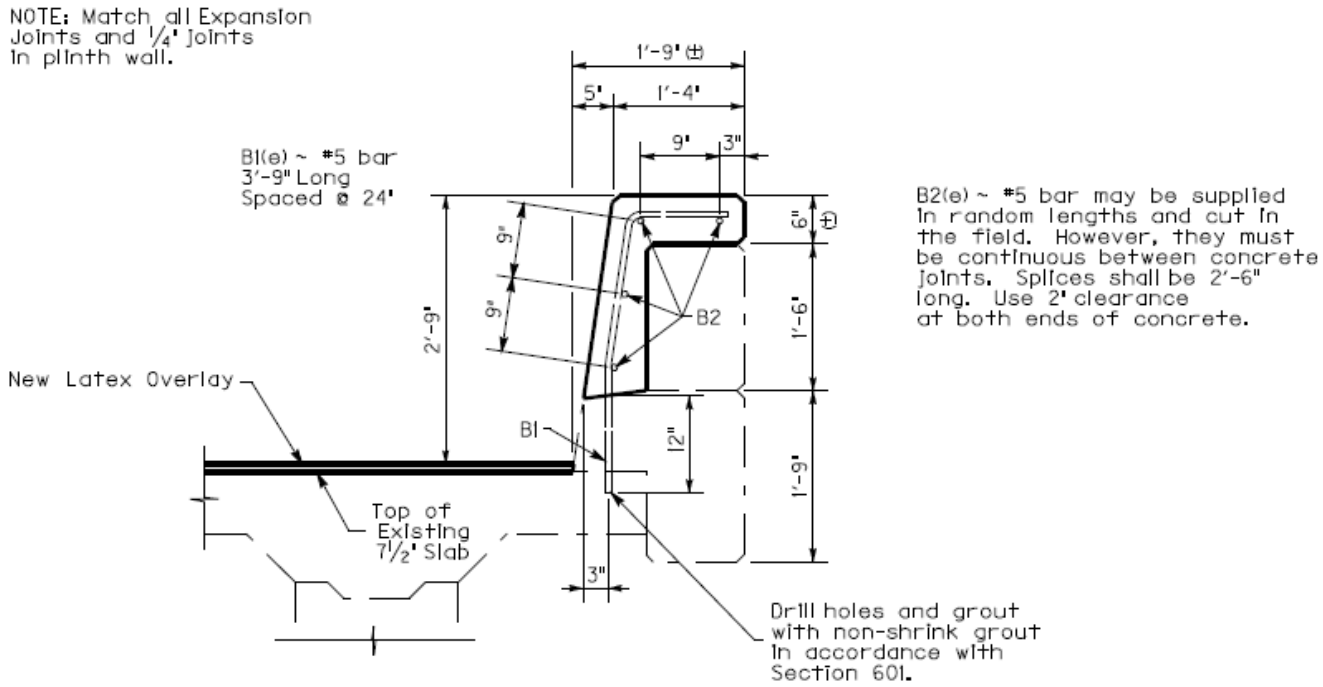
D. BRIDGE RAIL

2. Value Enhancement Alternative

Retrofit the bridges on this project with a crashworthy bridge rail.

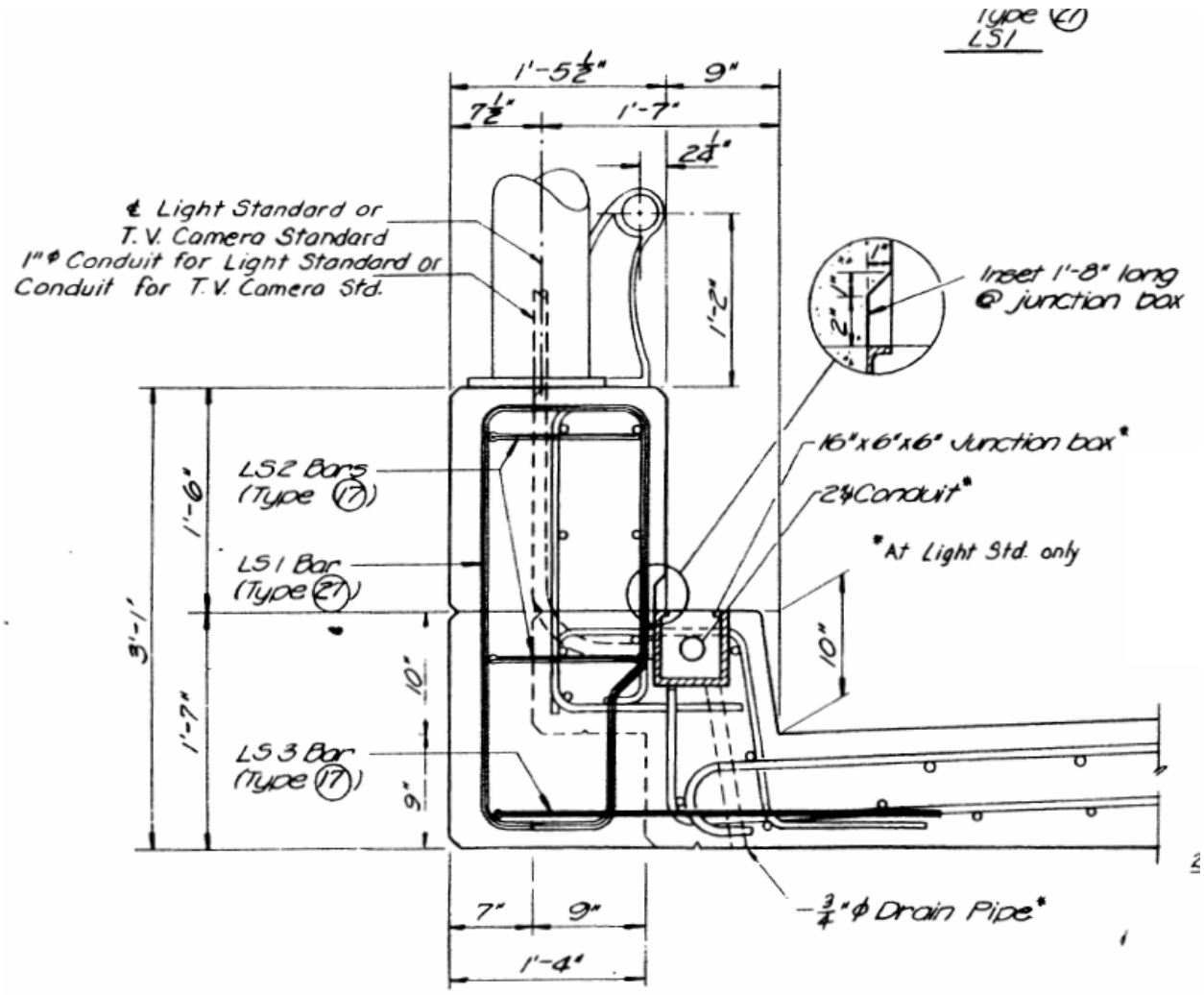
Although the existing rail has considerable strength to prevent rail breaches from impacts, its discontinuous aluminum top rail and the presence of the curb resulted in this rail never being crash tested and therefore it is considered not crashworthy and such a rail would not be approved to be built on new projects.

It is however, allowed to remain in service until such time as the bridge is widened, replaced or major maintenance work is preformed on the structure. As there is federal funding associated with this project and therefore an FHWA review of the final project plans, the FHWA would be unlikely to grant an exception for the continued use of the existing rail, especially when there is an easy retrofit available for use. Dale Carpenter of KYTC Division of Bridges provided the Value Engineering team with working drawing details for the bridge rail upgrade and with estimated costs for the work.



DALE CARPENTER'S BRIDGE RAIL RETRO FIT

2. Value Enhancement Alternative *(continued)*



LIGHTING CONDUIT FOR EXISTING BRIDGE RAIL

The bridge rail retrofit will also have to accommodate electrical service for lighting.

BRIDGE RAIL
VALUE ENHANCEMENT ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
2 Coat Paint System Applied to Existing Bridge Rail	SF	$11.00	40,000.0	$440,000		
Retrofit Existing Rail to Crashworthy Rail	LF	$100.00			27,442.0	$2,744,200
SUBTOTAL				**$440,000**		**$2,744,200**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)			5.0%	$24,200	5.0%	$150,931
DEMOBILIZATION			1.5%	$6,600	1.5%	$41,163
CONTINGENCY			10.0%	$44,000	10.0%	$274,420
GRAND TOTAL				**$514,800**		**$3,210,714**

POSSIBLE COST INCREASE: $2,695,914

VII. DEVELOPMENT PHASE

D. BRIDGE RAIL

COST COMPARISON SHEET BACK UP CALCULATIONS

Note: The As Proposed cost of the bridge rail coating and the breaking back of the existing rail was subsidiary to the cost of the joint replacement, so the cost of this function in the As Proposed design is unknown. The cost for retrofitting the VE Alternate, new upgraded rail, comes from a prior KYTC project in Laurel County on I-75 over KY 80 where the bid was $60 per LF for the rail and $350 for retrofitting the bridge wing wall sections with the rail. For this project, in recognition of the speed of construction required, assume the cost of the retrofitted rail, per Dale Carpenter of KYTC, is $100 per LF. So, for this VE Alternate any savings or additional cost required cannot be calculated.

The cost of retrofitting the upgraded rail on the four bridges on this project is approximately:

13,721 LF of bridge measured along the centerline of bridge
Two rails on each bridge
$100 per LF of retrofitted rail

13,721 x 2 x $100= $2,745,000

VIII. SUMMARY OF RECOMMENDATIONS

It is the recommendation of the Value Engineering Team that the following Value Engineering Alternatives be carried into the Project Development process for further development.

A. JOINT REPLACEMENT

Recommendation Number 1:

The Value Engineering Team recommends that the Value Enhancement Alternative be implemented. This alternative proposes to use a one piece steel joint rail.

If this recommendation can be implemented, there is a possible cost increase of ***$174,768.***

B. BRIDGE DECK OVERLAY

Recommendation Number 2:

The Value Engineering Team recommends that the As Proposed Alternative be implemented. This alternative uses a Rophalt overlay.

C. MAINTENANCE OF TRAFFIC

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will change Phase II MOT to a complete closure of the project from I-264/Shawnee Expressway to 3rd Street Off-ramp.

If this recommendation can be implemented, there is a possible savings of ***$1,226,323.***

D. BRIDGE RAIL

Recommendation Number 4:

The Value Engineering Team recommends that the Value Enhancement Alternative be implemented. This alternative uses a crash worthy rail.

If this recommendation can be implemented, there is a possible cost increase of ***$2,695,914.***

NAME	AFFILIATION	PHONE
William F. Ventry, P.E., C.V.S.	VE Group	850/627-3900
Tom Hartley, P.E., C.V.S.	VE Group	850/627-3900
John Ledbetter, P.E.	VE Group	850/627-3900
Mark Bloschock, P.E.	VE Group	850/627-3900
Rob Harris	KYTC D-5 Construction	502/367-6411
Darrell Dudgeon	KYTC CO Maintenance	502/564-4556
Jim Wathen	KYTC Program Perf. Div.	502/564-4555
Nancy Albright	Div. of Maintenance	502/564-4556
Mary Murray	FHWA	502/223-6745
Dale Carpenter	Division of Structural Design	502/564-4560
Ananias Calvin III	KYTC CO Highway Design	502/564-3280
Mary Wade	KYTC Program Perf. Div.	502/564-4555
Robert Farley	KYTC Design	502/564-3280
Tom Wright	KYTC D-5 Bridges	502/367-6411
Mike Baron	Parsons Brickerhoff	502/479-3907
Robert Semones	KYTC Program Performance VE Coordinator	502/564-4555
Carl Jenkins	KYTC D-5 Design	502/367-6411