VALUE ENGINEERING STUDY
OF
US 41A
HOPKINS COUNTY
PROJECT ITEM NUMBER: 02-0137.00

FINAL REPORT: AUGUST 31, 2011

Study was conducted in
Frankfort, Kentucky
June 27-July 1, 2011

Prepared by:

VE GROUP, L.L.C.

In Association With:

KENTUCKY TRANSPORTATION CABINET
~DIVISION OF HIGHWAY DESIGN~
VALUE ENGINEERING STUDY

OF

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VALUE ENGINEERING STUDY
TEAM LEADER

William F. Ventry, P.E., C.V.S.
C.V.S. Registration No.840603

August 31, 2011
DATE
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<td>34</td>
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<td>E. TYPICAL SECTION</td>
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I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering study performed by VE Group, L.L.C., for the Kentucky Transportation Cabinet (KYTC). The study was performed during the week of June 27-July 1, 2011.

The subject of the study was US 41A in Hopkins County.

PROJECT DESCRIPTION

The US 41A project is divided into two parts.

The first part of the design begins at Industrial Road and goes to the KY 1178 Connector. This part of the project connects with a two lane rural section at Industrial Road and has a three lane rural typical section until the KY 1178 Connector.

The KY 1178 Connector has a four lane typical section and runs between US 41A and KY 1178 approximately 400'.

The second part of the project design begins at the KY 1178 Connector and continues to the US 41 intersection. This part of the project has a five lane urban typical section with curb and gutter.

A realignment begins at approximately station 555+00 and ends at approximately station 634+00.

There currently are signalized intersections proposed at Industrial Road, Pride Avenue and US 41.

The estimated construction cost is approximately $19,000,000 and estimated Right-of-Way is approximately $5,500,000.
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

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

- Future Maintenance Cost
- Construction Time
- Construction Cost
- Constructability
- Service Life
- Salvage Value
- Design Requirements
- Maintenance Of Traffic
- Life Cycle 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:

### SUMMARY OF RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Recommendation Number and Areas of Focus</th>
<th>Description of Recommendation</th>
<th>Const. Cost Savings</th>
<th>Life Cycle Cost(LCC) Savings</th>
<th>VE Team Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation Number 1: ALIGNMENT</td>
<td>VE ALTERNATIVE NO. 1: Use the existing alignment, leave the roadway connection as is, lengthen the right turn lane on US 41A and use a preemptive signal.</td>
<td>$880,645</td>
<td>$880,645</td>
<td>X</td>
</tr>
<tr>
<td>Recommendation Number 2: ALIGNMENT</td>
<td>VE ALTERNATIVE NO. 2: Use the existing alignment and close the US 41A/ KY 1178 connection between US 41A and KY 1178 and remove the railroad crossing.</td>
<td>$1,830,132</td>
<td>$1,830,132</td>
<td>X</td>
</tr>
<tr>
<td>Recommendation Number 3: ROADWAY EXCAVATION</td>
<td>VE ALTERNATIVE NO. 3: Steepen the cut slopes to 2:1.</td>
<td>$109,264</td>
<td>$109,264</td>
<td>X</td>
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<tr>
<td>Recommendation Number 4: TYPICAL SECTION</td>
<td>VE ALTERNATIVE NO. 4: Use a 4’ raised median.</td>
<td>$2,347,250</td>
<td>$2,347,250</td>
<td>INCREASE INCREASE</td>
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<tr>
<td>Recommendation Number 5: TYPICAL SECTION</td>
<td>VE ALTERNATIVE NO. 5: Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00 and Pride Avenue and use a 3 lane section for the remainder of the project.</td>
<td>$239,163</td>
<td>$239,163</td>
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<td>Recommendation Number 6: TYPICAL SECTION</td>
<td>VE ALTERNATIVE NO. 6: Use a 14’ flush median.</td>
<td>$469,850</td>
<td>$469,850</td>
<td>INCREASE INCREASE</td>
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</tbody>
</table>
## I. EXECUTIVE SUMMARY

### RESULTS – AREAS OF FOCUS

<table>
<thead>
<tr>
<th>Recommendation Number and Areas of Focus</th>
<th>Description of Recommendation</th>
<th>Const. Cost Savings</th>
<th>Life Cycle Cost(LCC) Savings</th>
<th>VE Team Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation Number 7: RAILROAD CROSSINGS</td>
<td>VE ALTERNATIVE NO.7: Purchase the Industrial Park spur line.</td>
<td>$1,223,530</td>
<td>$1,223,530</td>
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<tr>
<td>Recommendation Number 8: INTERSECTIONS</td>
<td>VE ALTERNATIVE NO. 8: Use a continuous flow intersection at the US 41A/US 41 intersection.</td>
<td>$272,086 INCREASE</td>
<td>$272,086 INCREASE</td>
<td>X</td>
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<tr>
<td>Recommendation Number 9: INTERSECTIONS</td>
<td>VE ALTERNATIVE NO. 9: Use a roundabout at Industrial Road.</td>
<td>$198,923</td>
<td>$198,923</td>
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<td>Recommendation Number 10: INTERSECTIONS</td>
<td>VE ALTERNATIVE NO. 10: Use a roundabout at Pride Avenue.</td>
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<td>$55,328</td>
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<tr>
<td>Summary/combination of VE Team selected Alternatives</td>
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<td>$4,264,899</td>
<td>$4,264,899</td>
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</table>
II. LOCATION OF PROJECT
III. TEAM MEMBERS AND PROJECT DESCRIPTION

VALUE ENGINEERING TEAM MEMBERS

<table>
<thead>
<tr>
<th>NAME</th>
<th>AFFILIATION</th>
<th>EXPERTISE</th>
<th>PHONE</th>
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<tbody>
<tr>
<td>William F. Ventry, P.E., C.V.S.-Life</td>
<td>VE Group, L.L.C.</td>
<td>Project Manager/Team Leader</td>
<td>850/627-3900</td>
</tr>
<tr>
<td>Duncan Silver, P.E, L.S.</td>
<td>VE Group, L.L.C.</td>
<td>Traffic Analysis/Geometric Design</td>
<td>850/627-3900</td>
</tr>
<tr>
<td>Brent Sweger, P. E.</td>
<td>KYTC</td>
<td>Traffic, Planning, VE</td>
<td>502/564-3280</td>
</tr>
<tr>
<td>Gary Raymer, P.E.</td>
<td>KYTC</td>
<td>Construction</td>
<td>502/564-3280</td>
</tr>
<tr>
<td>Ben Baker, P.E.</td>
<td>KYTC</td>
<td>Construction</td>
<td>502/564-4780</td>
</tr>
</tbody>
</table>

III. TEAM MEMBERS AND PROJECT DESCRIPTION

PROJECT DESCRIPTION

The US 41A project is divided into two parts.

The first part begins at Industrial Road and goes to the KY 1178 Connector. This part of the project connects with a two lane rural section at Industrial Road and has a three lane rural typical section until the KY 1178 Connector.

The KY 1178 Connector has a four lane typical section and runs between US 41A and KY 1178 approximately 400’.

The second part of the project begins at the KY 1178 Connector and continues to the US 41 intersection. This part of the project has a five lane urban typical section with curb and gutter.

A realignment begins at approximately station 555+00 and ends at approximately station 634+00.

There are signalized intersections proposed at Industrial Road, Pride Avenue and US 41.

The estimated construction cost is approximately $19,000,000 and estimated Right-of-Way is approximately $5,500,000.
The proposed improvement to US 41A begins at Industrial Road and continues eastward to its intersection with US 41 in Madisonville. The proposed roadway follows the existing corridor with minor shifts to minimize right-of-way and utility impacts, facilitate maintenance of traffic during construction and improve tie-ins to cross roads. The route is classified as an Urban Principal Arterial.

The current design begins at the Industrial Road intersection with a rural Typical Section that consists of three 11’ lanes with 8’ shoulders, 2’ of which are paved. From there, using the same typical section, it generally follows the existing corridor, with minor shifts to the north or south to minimize right-of-way impacts, to KY 1178.

At KY 1178, there is a larger shift to the north to provide adequate stacking distance between the intersection and the at-grade railroad crossing on KY 1178. Also at KY 1178, the Typical Section changes to an urban five lane section with 11’ lanes and no shoulders. From KY 1178, the alignment continues eastward transitioning over 3500’ to match the existing centerline. It then follows the existing centerline eastward to US 41.
### IV. INVESTIGATION PHASE

#### VALUE ENGINEERING STUDY BRIEFING

**US 41A**  
**HOPKINS COUNTY**  
**June 27-July 1, 2011**

<table>
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<tr>
<th>NAME</th>
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<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>William F. Ventry</td>
<td>VE Group, L.L.C.</td>
<td>850/627-3900</td>
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<tr>
<td>Tom Hartley</td>
<td>VE Group, L.L.C.</td>
<td>850/627-3900</td>
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<tr>
<td>Duncan Silver</td>
<td>VE Group, L.L.C.</td>
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<td>Brent Sweger</td>
<td>KYTC</td>
<td>502/564-3280</td>
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<td>Gary Raymer</td>
<td>KYTC</td>
<td>502/564-3280</td>
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<td>KYTC</td>
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<tr>
<td>Richard Guidi</td>
<td>GRW Engineers</td>
<td>859/331-9220</td>
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### IV. INVESTIGATION PHASE

#### STUDY RESOURCES

**US 41A**  
**HOPKINS COUNTY**  
**June 27-July 1, 2011**

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<th>NAME</th>
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<tr>
<td>Allen Rust</td>
<td>KYTC, Railroad</td>
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<td>Everett Green</td>
<td>KYTC, District 2</td>
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<td>Jennifer Cox</td>
<td>KYTC, D 2, R/W</td>
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<tr>
<td>Adam Kirk</td>
<td>Kentucky Transportation Center</td>
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IV. INVESTIGATION PHASE

PARETO WORKSHEET

PARETO CHART
## IV. INVESTIGATION PHASE

### FUNCTIONAL ANALYSIS WORKSHEET

**US 41A**  
**HOPKINS COUNTY**  
**June 27-July 1, 2011**

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<th>ITEM</th>
<th>FUNCT. VERB</th>
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<th>VALUE INDEX</th>
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<td>Water</td>
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<td>Establish</td>
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<td>Arch Culvert</td>
<td>Convey</td>
<td>Water Creek</td>
<td>B, S</td>
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<td>Prepare</td>
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<td>Right-of-Way</td>
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</tbody>
</table>

*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 proceeding 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. ALIGNMENT

B. DRAINAGE

C. ROADWAY EXCAVATION

D. ARCH CULVERT

E. TYPICAL SECTION

F. RAILROAD CROSSINGS

G. INTERSECTIONS

H. DESIGN COMMENTS
V. SPECULATION PHASE

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

A. ALIGNMENT

- Use the existing alignment
- Realign KY 1178
- Close the roadway connection between US 41A and KY 1178
- Leave the roadway connection as is and lengthen the right turn lane on US 41A and provide a traffic signal

B. DRAINAGE

- Use the existing outfalls for the new closed drainage system outfalls
- Use curb and gutter on the north side with open ditches on the south side
- Use curb and gutter with open ditches

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.

C. ROADWAY EXCAVATION

- Dispose of waste in the area between the new US 41A alignment and old US 41A
- Raise the profile of the new alignment
- Raise the grades in the cut areas
- Steepen the cut slopes to 2:1

D. ARCH CULVERT

- Use a single span bridge
- Use a double box culvert
- Use a steel arch

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.
V. SPECULATION PHASE

E. TYPICAL SECTION

- Use a 4’ raised median
- Use median openings a roadways only
- Use a 14’ flush median
- Use a 6’ median, eliminate the continuous turn lanes with roundabouts at the intersections
- Begin the 5 lane section at station 638+00 with the three lane section for the remainder of the project

F. RAILROAD CROSSINGS

- Purchase the Industrial Park spur line
- Close the crossing between US 41 A and KY 1178

G. INTERSECTIONS

- Use a continuous flow intersection at the US 41A/US 41 Intersection
- Use a roundabout at Industrial Road
- Use a roundabout at Pride Avenue

H. ACCESS ROADS

- Develop an access road plan in conjunction with the city

-MOVED TO DESIGN COMMENTS-

13
VI. EVALUATION PHASE

◆ ALTERNATIVES

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

A. ALIGNMENT

Value Engineering Alternative No. 1: Use the existing alignment, leave the roadway connection as is and lengthen the right turn lane on US 41 A and provide a traffic signal.

Value Engineering Alternative No. 2: Use the existing alignment and close the roadway connection between US 41A and KY 1178.

B. DRAINAGE

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.

C. ROADWAY EXCAVATION

Value Engineering Alternative No. 3: Steepen the cut slopes to 2:1.

D. ARCH CULVERT

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.

E. TYPICAL SECTION

Value Engineering Alternative No. 4: Use a 4’ raised median.

Value Engineering Alternative No. 5: Begin the 6’ median at station 640, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640, station 664, Pride Avenue and use a 3 lane typical section for the remainder of the project.

Value Engineering Alternative No. 6: Use a 14’ flush median.
VI. EVALUATION PHASE

◆ ALTERNATIVES

F. RAILROAD CROSSINGS

Value Engineering Alternative No. 7: Purchase the Industrial Park spur line.

G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection.

Value Engineering Alternative No. 9: Use a roundabout at Industrial Road.

Value Engineering Alternative No. 10: Use a roundabout at Pride Avenue.

H. DESIGN COMMENTS

Design Comment No. 1: Use rock and fabric rather than chemical stabilization.

Design Comment No. 2: Use the area between the new and existing alignment for waste.

Design Comment No. 3: Develop an access plan with the city.
VI. EVALUATION PHASE

◆ 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 Original Design.

A. ALIGNMENT

**Original Design:** Lengthen the connection between US 41A and KY 1178 and realign US 41A.

**Advantages**
- Eliminates the backup from the railroad crossing onto US 41A
- Waste can be used on the new alignment
- Low traffic control during construction
- Single phase construction of arch culvert

**Disadvantages**
- Higher Right-of-Way costs
- Does not use the remaining life of the existing pavement
- Higher construction cost

**Conclusion**
**CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.**

**Value Engineering Alternative No. 1:** Use the existing alignment, leave the roadway connection as is and lengthen the right turn lane on US 41A and provide a traffic signal.

**Advantages**
- Less Right-of-Way cost
- Less construction cost
- Less environmental impact

**Disadvantages**
- Higher traffic control costs
- Requires two phase arch culvert construction

**Conclusion**
**CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.**
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

A. ALIGNMENT

**Original Design:** Lengthen the connection between US 41A and KY 1178 and realign US 41A (continued).

*Value Engineering Alternative No. 2:* Use the existing alignment and close the roadway connection between US 41A and KY 1178.

**Advantages**

- Eliminates a railroad crossing
- Eliminates traffic backup on US 41A
- Lower construction cost
- Lower Right-of-Way cost
- Low environmental impacts

**Disadvantages**

- Loss of direct access to KY 1178
- Longer travel time for some local drivers

**Conclusion**

CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

B. DRAINAGE

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

C. ROADWAY EXCAVATION

Original Design: Use 4:1 cut slopes.

Advantages

• Easier maintenance
• May be less erosion
• Better site distance

Disadvantages

• Requires disposal of waste
• Requires additional Right-of-Way

Conclusion

CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 3: Steepen the cut slopes to 2:1.

Advantages

• Reduces waste
• Reduce Right-of-Way
• Lower construction cost

Disadvantages

• May be more difficult maintenance

Conclusion

CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

D. ARCH CULVERT

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

E. TYPICAL SECTION

Original Design: 11’ flush median with 11’ lanes.

Advantages

• Improves capacity
• Reduces left turn conflicts
• Separation between opposing lanes

Disadvantages

• Risk of cross over accidents
• Narrow turn lanes

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 4: Use a 4’ raised median.

Advantages

• Reduced crossover accidents
• Clearly defines turning locations

Disadvantages

• Higher construction cost
• Raised median may cause drainage issues

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

E. TYPICAL SECTION

Original Design: 11’ flush median with 11’ lanes (continued).

Value Engineering Alternative No. 5: Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00, Pride Avenue and use a 3 lane typical section for the remainder of the project.

Advantages

• Removes crossover accidents
• Clearly defines turning movements
• Provides for u-turns at roundabouts
• Fewer conflict points
• Less construction cost
• Better traffic operation

Disadvantages

• Requires additional Right-of-Way at intersections
• Possible additional utility conflicts

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 6: Use a 14’ flush median.

Advantages

• Improves left turn operations because lane is wider

Disadvantages

• Higher construction cost

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

F. RAILROAD CROSSINGS

Original Design: Improve the existing crossings.

Advantages

- No disruption to railroad
- Better crossing
- Upgraded warning system

Disadvantages

- High construction cost
- Roadway has to match the railroad grade
- One of the railroad crossings may be abandoned

Conclusion

CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 7: Purchase the Industrial Park spur line.

Advantages

- Allows the improvement of the grades on US 41A
- Eliminates a railroad crossing
- Eliminates the Bean Cemetery Road retaining walls
- Allows for the opportunity to improve nearby access roads
- Existing rail line may be abandoned or be a candidate for abandonment

Disadvantages

- Removes access to the north side of the industrial park

Conclusion

CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VI. EVALUATION PHASE

◆ ADVANTAGES AND DISADVANTAGES

G. INTERSECTIONS

Original Design: Conventional intersection designs, some single left turn lanes, some double left turn lanes and some are signalized.

Advantages

• Drivers are familiar with the design.

Disadvantages

• Limited capacity
• One’s with signals have off peak delays

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection.

Advantages

• Increase capacity
• Reduced delays

Disadvantages

• Higher Right-of-Way cost
• May be higher construction cost
• More difficult pedestrian crossing

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
G. INTERSECTIONS

Original Design: Conventional intersection designs, some single left turn lanes, some double left turn lanes and some are signalized (continued).

Value Engineering Alternative No. 9: Use a roundabout at Industrial Road.

Advantages

- Provides a transition from rural to urban
- No signal required
- Low maintenance cost because no signal
- Fewer conflict points

Disadvantages

- May be a conflict for through traffic during a shift change
- Small amount of additional Right-of-Way
- Possible additional utility conflict

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.

Value Engineering Alternative No. 10: Use a roundabout at Pride Avenue.

Advantages

- Accommodates geometry better
- Improves access management
- Eliminates a signal
- Low maintenance cost because no signal
- Fewer conflict points

Disadvantages

- Small amount of additional Right-of-Way
- Possible additional utility conflict

Conclusion
CARRY FORWARD FOR FURTHER DEVELOPMENT AND EVALUATION.
VII. DEVELOPMENT PHASE

A. ALIGNMENT

- ORIGINAL DESIGN
- Value Engineering Alternative No. 1: Use the existing alignment, leave the roadway connection as is and lengthen the right turn lane on US 41A and provide a traffic signal.
- Value Engineering Alternative No. 2: Use the existing alignment and close the roadway connection between US 41A and KY 1178.

B. DRAINAGE

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.

C. ROADWAY EXCAVATION

- ORIGINAL DESIGN
- Value Engineering Alternative No. 3: Steepen the cut slopes to 2:1.

D. ARCH CULVERT

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.

E. TYPICAL SECTION

- ORIGINAL DESIGN
- Value Engineering Alternative No. 4: Use a 4' raised median.
- Value Engineering Alternative No. 5: Begin the 6' median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00, Pride Avenue and use a 3 lane typical section for the remainder of the project.
- Value Engineering Alternative No. 6: Use a 14' flush median.
F. RAILROAD CROSSINGS

- ORIGINAL DESIGN
- Value Engineering Alternative No. 7: Purchase the Industrial Park spur line.

G. INTERSECTIONS

- ORIGINAL DESIGN
- Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection.
- Value Engineering Alternative No. 9: Use a roundabout at Industrial Road.
- Value Engineering Alternative No 10: Use a roundabout at Pride Avenue.
VII. DEVELOPMENT PHASE

A. ALIGNMENT

Original Design

In the Original Design, the new US 41A roadway is relocated to the north of existing US 41A, approximately 250’.

This realignment was to provide additional storage for vehicles turning onto the KY 1178 connector from US 41A, when a train was crossing and traffic backed up onto US 41A.
VII. DEVELOPMENT PHASE

A. ALIGNMENT

Original Design (continued)
VII. DEVELOPMENT PHASE

A. ALIGNMENT

Value Engineering Alternative No. 1: Use the existing alignment, leave the roadway connection as is and lengthen the right turn lane on US 41A and provide a traffic signal.

Value Engineering Alternative No. 1 consists basically of using the existing US 41A alignment by overlaying the existing pavement and widening on the north side of the roadway from station 575+00 to station 630+00.

The additional storage required when a train is present at the railroad crossing, will be provided by increasing the proposed right turn lane another 250’ for storage.

The Value Engineering Team also suggest adding a Railroad Preemptive Signal for the turn lanes to prevent the left turn from blocking the through traffic when trains are crossing the connector.

This would possibly save $410,645 in construction costs and possibly save $470,000 in reduced Right-of-Way for a total possible savings of $880,645.
## ALIGNMENT
### VALUE ENGINEERING ALTERNATIVE NO. 1
#### COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
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<td>TONS</td>
<td>$15,00</td>
<td>6647.0</td>
<td>$99,705</td>
<td>3878.0</td>
<td>$58,170</td>
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<td>TONS</td>
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<td>11560.0</td>
<td>$416,160</td>
<td>6744.0</td>
<td>$242,784</td>
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<tr>
<td>ASPHALT BASE</td>
<td>TONS</td>
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<td>$441,720</td>
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<td>1987.0</td>
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<td>1987.0</td>
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<td>$100,000</td>
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<td>$500,000</td>
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<td>$500,000</td>
</tr>
</tbody>
</table>

### SUBTOTAL

| SUBTOTAL                      |         | $1,793,013 | $1,511,894 |

### MOBILIZATION (THIS IS SUB+CONTIN. X % =)

| MOBILIZATION                  | 4.5%    | $108,926   | $91,848    |

### MAINTENANCE OF TRAFFIC

| MAINTENANCE OF TRAFFIC        | 5.0%    | $89,651    | $75,595    |

### ENGINEERING & CONTINGENCIES

| ENGINEERING & CONTINGENCIES  | 35.0%   | $627,555   | $529,163   |

### RIGHT OF WAY

| RIGHT OF WAY                  | LS      | $695,000   | $225,000   |

### GRAND TOTAL

| GRAND TOTAL                   |         | $3,314,144 | $2,433,499 |

### POSSIBLE SAVINGS:

| POSSIBLE SAVINGS:            | $880,645 |
VII. DEVELOPMENT PHASE

A. ALIGNMENT

**Value Engineering Alternative No. 2: Use the existing alignment and close the roadway connection between US 41A and KY 1178.**

Value Engineering Alternative No. 2 is similar to Value Engineering Alternative No. 1 by using the existing alignment but in lieu of providing right turn storage, the connector to KY 1178 will be closed and the railroad crossing will be removed.

There are other access points west and east of this connector available for the public to get from US 41A to KY 1178.

This results in $1,830,130 possible savings plus eliminating potential conflicts with the railroad during construction.
# Alignment

**Value Engineering Alternative No. 2**

**Cost Comparison Sheet**

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Unit Cost</th>
<th>Prop'D Qty.</th>
<th>Prop'D Cost</th>
<th>V.E. Qty.</th>
<th>V.E. Cost</th>
</tr>
</thead>
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<td>Tons</td>
<td>$15.00</td>
<td>6647.0</td>
<td>$99,705</td>
<td>3878.0</td>
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<tr>
<td>Asphalt Treated Drainage Blanket</td>
<td>Tons</td>
<td>$36.00</td>
<td>11560.0</td>
<td>$416,160</td>
<td>6744.0</td>
<td>$242,784</td>
</tr>
<tr>
<td>Asphalt Base</td>
<td>Tons</td>
<td>$54.00</td>
<td>10332.0</td>
<td>$557,928</td>
<td>8180.0</td>
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<td>$60.00</td>
<td>1987.0</td>
<td>$119,220</td>
<td>1987.0</td>
<td>$119,220</td>
</tr>
<tr>
<td>Railroad Crossing</td>
<td>Each</td>
<td>$100,000.0</td>
<td>1.0</td>
<td>$100,000</td>
<td>0.0</td>
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<tr>
<td>Railroad Utility Costs</td>
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<td>1.0</td>
<td>$500,000</td>
<td>0.0</td>
<td>0.0</td>
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**Subtotal**

<p>| | | | | | | |</p>
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<tbody>
<tr>
<td></td>
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<td>$1,793,013</td>
<td></td>
<td></td>
<td>$861,894</td>
<td></td>
</tr>
</tbody>
</table>

**Mobilization (This is Sub+Contin. X % =)**

|                  |       | 4.5%      |             | $108,926    | $52,360   |

**Maintenance of Traffic**

|                  |       | 5.0%      |             | $89,651     | $43,095   |

**Engineering & Contingencies**

|                  |       | 35.0%     |             | $627,555    | $301,663  |

**Right of Way**

|                  |       |           |             | $695,000    | $225,000  |

**Grand Total**

|                  |       | $3,314,144|             | $1,484,012  |           |

**Possible Savings:**

|                  |       | $1,830,132|             |             |           |
VII. DEVELOPMENT PHASE

B. DRAINAGE

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.
VII. DEVELOPMENT PHASE

C. ROADWAY EXCAVATION

Original Design

The Original Design for the project has approximately 182,000 cubic yards of excavation and 119,000 cubic yards of fill which results in 63,000 cubic yards of waste not taking in consideration any shrinkage or swell factors.

The roadway cross section is shown to be constructed between stations 620+00 and 633+00 using 4:1 cut slopes.
VII. DEVELOPMENT PHASE

C. ROADWAY EXCAVATION

*Value Engineering Alternative No. 3: Steepen the cut slopes to 2:1.*

Value Engineering Alternative No. 3 would change the slopes from station 620+00 to 633+00 from a maximum of 4:1 to a maximum of 2:1. This will result in a reduction of approximately 8,500 cubic yards of waste material without any impact to the stability of the slopes.

This would result in a possible savings of $109,264 and also reduce the amount of Right-of-Way needed.
### ROADWAY EXCAVATION
### VALUE ENGINEERING ALTERNATIVE NO. 3
### COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROADWAY EXCAVATION</td>
<td>CY</td>
<td>$8.80</td>
<td>182000.0</td>
<td>$1,601,600</td>
<td>173500.0</td>
<td>$1,526,800</td>
</tr>
</tbody>
</table>

**SUBTOTAL**

$1,601,600  $1,526,800

| MOBILIZATION (THIS IS SUB+CONTIN. X % =) | 4.5%  | $97,297   | $92,753 |
| MAINTENANCE OF TRAFFIC                  | 5.0%  | $80,080   | $76,340 |
| ENGINEERING & CONTINGENCIES             | 35.0% | $560,560  | $534,380 |

**GRAND TOTAL**

$2,339,537  $2,230,273

**POSSIBLE SAVINGS:** $109,264
D. ARCH CULVERT

-DROPPED DURING SPECULATION PHASE SINCE NO REASONABLE ALTERNATIVES COULD BE FORMULATED.
VII. DEVELOPMENT PHASE

E. TYPICAL SECTION

Original Design

The Original Design provides for two different cross sections along the mainline:

- Rural two 11’ travel lanes plus a 11’ two-way left-turn lane (TWLTL) plus eight foot shoulders (2’ paved/6’ DGA.)
- Urban four 11’ travel lanes plus a 11’ TWLTL plus curb and gutter.
VII. DEVELOPMENT PHASE

**E. TYPICAL SECTION**

Value Engineering Alternative No. 4: Use a 4’ raised median.

The Value Engineering Team recommends modifying the typical section throughout the project to add a raised median to form channelized turning lanes in lieu of the continuous two-way left turn lane (TWLTL.)

The median would serve several purposes. It would reduce the potential for crossover vehicular crashes (compared to an undivided roadway.) The median also helps clearly delineate the turning locations for entrances to drivers. Finally, the positive separation will keep turning vehicles and those that may be using it as an acceleration lane from conflicting. Finally, it will clearly outline where current and future access will be along the corridor.

To achieve this, the road will need to be widened by six feet, which is an increase to the project cost. An integral concrete four feet six-inch raised concrete median. An additional one foot of pavement would be added to allow for a 12’ travel lane. The project team will also need to accommodate for intermittent drainage outlets along the median in the superelevated section.
## TYPICAL SECTION
### VALUE ENGINEERING ALTERNATIVE NO. 4
#### COST COMPARISON SHEET

<table>
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<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
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<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
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<td>98200.0</td>
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<td>110520.0</td>
<td>$4,752,360</td>
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<td>0.0</td>
<td>18400.0</td>
<td>$1,012,000</td>
</tr>
</tbody>
</table>

| SUBTOTAL                             |       |           |             |             |           |             |
|                                      |       |           |             |             |           | $5,950,920  |

| MOBILIZATION (THIS IS SUB+CONTIN. X % =) | 4.5% | $361,518   | $459,136    |
| MAINTENANCE OF TRAFFIC               | 5.0% | $297,546   | $377,890    |
| ENGINEERING & CONTINGENCIES         | 35.0%| $2,082,822 | $2,645,230  |

| GRAND TOTAL                          |       |           |             |             |           |             |
|                                      |       |           |             |             |           | $8,692,806  |

**INCREASED COST:** $2,347,250
E. TYPICAL SECTION

Value Engineering Alternative No. 5: Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00, Pride Avenue and use a 3 lane typical section for the remainder of the project.

The Value Engineering Team recommends modifying the urban typical section throughout the project to add a six-foot raised median between stations 635+00 and 705+00. There are three roundabouts located on this section to allow for u-turns to facilitate access to properties along the corridor. The division point between two through lanes (rural section) and four through lanes (urban section) is shifted from station 605+00 to 635+00 (3,000’).

The projected volumes on this section of road for 2032 are 22500 vehicles per day. Using the traffic forecasts assumed 2% growth rate factor, by 2036, the volumes on this road may exceed 24,000 per day. Design memo 03-09, recommends that a non-traversable median be used in lieu of a TWLTL when daily volumes exceed 24,000. This is to help better facilitate traffic flow and maintain a safer roadway environment by controlling turning movements.

Preliminary analysis indicates that roundabouts will work sufficiently at the given intersections. Pride Avenue was analyzed because it will the intersection with the heaviest traffic volumes. Forecasted PM design hour volumes using a 2031 forecast year were input into both the Kentucky Transportation Center (KTC), Roundabout Capacity Tool, KTC Intersection Tool and the FHWA Alternative Intersection Selection Tool (AIST) show that a major/minor roundabout design will work for this location. A major/minor roundabout typically has two lanes entering the roundabout along the mainline highway and one lane entering from the side street or entrance. During the future DHV, delays are be project at less than 9 seconds on average for all vehicles and there is no more than one car queued in all directions.

This design will not require additional right-of-way (ROW) through most of the corridor. It will require additional minor ROW takings at the three intersections to fit the roundabouts. Overall, the construction costs will in increase slightly with this alternative.
VII. DEVELOPMENT PHASE

E. TYPICAL SECTION

Value Engineering Alternative No. 5: Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00, Pride Avenue and use a 3 lane typical section for the remainder of the project (continued).
 VII. DEVELOPMENT PHASE

E. TYPICAL SECTION

Value Engineering Alternative No. 5: Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00, Pride Avenue and use a 3 lane typical section for the remainder of the project (continued).

Output from KTC Roundabout Capacity Tool: US41A at Pride Avenue
## TYPICAL SECTION
### VALUE ENGINEERING ALTERNATIVE NO. 5
## COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVEMENT</td>
<td>SY</td>
<td>$43.00</td>
<td>98200.0</td>
<td>$4,222,600</td>
<td>86200.0</td>
<td>$3,706,600</td>
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<tr>
<td>EARTHWORK</td>
<td>CY</td>
<td>$8.80</td>
<td>196400.0</td>
<td>$1,728,320</td>
<td>172400.0</td>
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### SUBTOTAL

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<td></td>
<td><strong>$5,950,920</strong></td>
<td></td>
<td><strong>$5,776,720</strong></td>
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<tr>
<td>MOBILIZATION (THIS IS SUB+CONTIN. X % =)</td>
<td>4.5%</td>
<td>$361,518</td>
<td>$350,936</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAINTENANCE OF TRAFFIC</td>
<td>5.0%</td>
<td>$297,546</td>
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<td></td>
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</tr>
<tr>
<td>ENGINEERING &amp; CONTINGENCIES</td>
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<td>$2,082,822</td>
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<tr>
<td>RIGHT OF WAY (ROUNDABOUT ONLY)</td>
<td>SF</td>
<td>$1.70</td>
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<td>9,000</td>
<td>$15,300</td>
<td></td>
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</tbody>
</table>

### GRAND TOTAL

|                       |       | **$8,692,806** |            | **$8,453,644** |

### POSSIBLE SAVINGS: $239,163
Value Engineering Alternative No. 6: Use a 14’ flush median.

The Value Engineering Team recommends modifying the typical section to increase the TWLTL from 11’ to 14’. The purpose is to allow for a greater space for turning vehicles to maneuver safely. This should reduce the chances for sideswipe crashes between turning vehicles and vehicles traveling in both directions. It also gives sufficient room for wider commercial vehicles to queue for making left turns.

This Alternative will have an increased construction costs for wider pavement.
## TYPICAL SECTION
### VALUE ENGINEERING ALTERNATIVE NO. 6
#### COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP’D QTY.</th>
<th>PROP’D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
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<tr>
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<td>$2,195,400</td>
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<td></td>
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<td></td>
<td><strong>$9,162,657</strong></td>
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</table>

**INCREASED COST** $469,850
The Original Design accommodates an existing railroad industrial spur across US 41A. US 41A’s vertical alignment is a sag vertical curve with the low point the existing railroad spur grade. In order to provide the desired sight distance the east side of the vertical curve is flatten. The Original Design vertical alignment results in a nine to ten foot cut on the east side of the railroad spur. The resulting cut necessitates the Right-of-Way acquisition of an industrial facility, retaining walls on an access road and relocation of an industrial access. The project has excess excavation that will have to be wasted.
F. RAILROAD CROSSINGS

Value Engineering Alternative No. 7: Purchase the Industrial Park spur line.

The Value Engineering Team recommends purchasing the railroad spur. The removal of the railroad spur will eliminate the railroad protection system and crossing material. Without the railroad spur the profile of US 41A could be modified to increase the sight distance, reduce the amount of excavation, and eliminate the purchasing of an industrial facility. The vertical alignment will reduce the excavation and bring the project closer to a balance project.

The Value Engineering Team estimated the value of the railroad spur to be the same per acre cost as the cost to purchase parcel #14 Gary E. Peyton, the industrial facility purchased in the Original Design.

VALUE ENGINEERING RECOMMENDED US 41A PROFILE
VII. DEVELOPMENT PHASE

F. RAILROAD CROSSINGS

Value Engineering Alternative No. 7: Purchase the Industrial Park spur line (continued).

VALUE ENGINEERING RECOMMENDED US 41A PROFILE

[Diagram showing railroad crossings with a measurement of 260']
### RAILROAD CROSSING

**VALUE ENGINEERING ALTERNATIVE NO. 7**

**COST COMPARISON SHEET**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
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<td>WALLS</td>
<td>CY</td>
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<td>400.0</td>
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<td><strong>SUBTOTAL</strong></td>
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<td></td>
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<td></td>
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<td>450,000</td>
<td>$450,000</td>
<td>650,000</td>
<td>$650,000</td>
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<td>$1,923,020</td>
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**POSSIBLE SAVINGS:** $1,223,530
G. INTERSECTIONS

Original Design

The Original Design for this intersection is for a conventional 4 legged intersection with dual left turn lanes for North Main Street/US 41 and single left turn lanes for Nebo Road/US 41A.

TYPICAL SECTIONS

NORTH MAIN STREET/US 41 SOUTH APPROACH

NORTH MAIN STREET/US 41 NORTH APPROACH
Traffic analysis on the original intersection design indicates this intersection will operate satisfactorily for the design hour traffic.
G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection.

This Value Engineering Alternative will configure the interchange with a Partial Continuous Flow Intersection or also know as a Partial Displaced Left Turn Intersection as shown below.

It is a Partial Displaced Left Turn Intersection because only the north and south left turn movements are displaced. This unique configuration removes the north and south left turn movements from the signal timing by allowing the left turn movement to occur at the same time as the through movement has a green light. This eliminates one signal phase providing additional time to the other three phases.

This design will require more curb and gutter, have a slightly larger foot print, more pavement and a more complex signalization system. The signal system will require additional signals for the displaced lefts.
G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

VALUE ENGINEERING NORTH APPROACH
Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

VALUE ENGINEERING SOUTH APPROACH

As seen in the sketch above and on the previous page, the left turns cross the opposing traffic lanes in advance of the signal and are queued at the stop until they get a green arrow at the same time as the through movement and for the same length of time. Cross traffic right turns are channeled outside the left turn lane and merge into traffic upstream from the signal that allow left turns into their displaced left turn lane.

Traffic analysis was completed on the FHWA Alternative Intersection Selection Tool. The analysis indicated both the conventional as well as the Displaced Left Turn Intersection will operate satisfactorily in the design year, but the Displaced Left Turn Intersection will provide more capacity and should have a longer useful design life.
## INTERSECTIONS

*US 41A/US 41 INTERSECTION*

### VALUE ENGINEERING ALTERNATIVE NO. 8

### COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVEMENT</td>
<td>SY</td>
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<td>15635.9</td>
<td>$672,343</td>
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<td><strong>GRAND TOTAL</strong></td>
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<td><strong>$1,616,711</strong></td>
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</table>

**INCREASED COST:** $272,086
VII. DEVELOPMENT PHASE

G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

TRAFFIC ANALYSIS:

Conventional Intersection

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<th>Lane</th>
<th>Volume (pceph)</th>
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<tr>
<td>1</td>
<td>270</td>
</tr>
<tr>
<td>2</td>
<td>660</td>
</tr>
<tr>
<td>1</td>
<td>290</td>
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PM PEAK

<table>
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<tr>
<th>Lane</th>
<th>Volume (pceph)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>280</td>
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<tr>
<td>2</td>
<td>620</td>
</tr>
<tr>
<td>1</td>
<td>370</td>
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Critical lane volume sum

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<th>Volume Range</th>
<th>Critical Lane Volume</th>
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<td>&lt; 1200</td>
<td>1 lane</td>
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<tr>
<td>1200 -1400</td>
<td>2 lanes</td>
</tr>
<tr>
<td>1400 -1600</td>
<td>1 lane</td>
</tr>
<tr>
<td>&gt; 1600</td>
<td>2 lanes</td>
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</table>


VII. DEVELOPMENT PHASE

G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

"Partial" Displaced Left Turn Intersection

Critical lane volume sum

PM PEAK
G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

Conventional Intersection

Critical lane volume sum

AM PEAK
VII. DEVELOPMENT PHASE

G. INTERSECTIONS

Value Engineering Alternative No. 8: Use a continuous flow intersection at the US 41A/US 41 Intersection (continued).

"Partial" Displaced Left Turn Intersection

AM PEAK
G. INTERSECTIONS

Original Design

The Original Design shows a four legged signalized intersection at the junction of Industrial Road and Nebo Road/US 41A as shown below.
VII. DEVELOPMENT PHASE

G. INTERSECTIONS

**Value Engineering Alternative No. 9: Use a roundabout at Industrial Road.**

The Value Engineering Team recognizes that at this intersection the roadway will change its characteristics from a high speed rural two lane roadway to a more congested roadway with industrial complexes on both sides of the roadway and within a few miles along with a reduction in speed from 55 MPH to a 45 MPH posted speed.

The Value Engineering Alternative is to construct a roundabout in this location as shown below.

![VALUE ENGINEERING ALTERNATIVE ROUNDABOUT](image)

The roundabout will alert the driver to the change in characteristics of the roadway. It will also reduce overall delay for the drivers because there is no signal to stop traffic. Additional adjustments to the alignment can be made to avoid any adverse Right-of-Way takes.
# INTERSECTIONS
(NEBO ROAD/US 41A ROUNDABOUT)
VALUE ENGINEERING ALTERNATIVE NO. 9
COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
<th>PROP'D QTY.</th>
<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVEMENT</td>
<td>SY</td>
<td>$43.00</td>
<td>3824.6</td>
<td>$164,456</td>
<td>2659.6</td>
<td>$114,361</td>
</tr>
<tr>
<td>CURB &amp; GUTTER</td>
<td>LF</td>
<td>$20.00</td>
<td>1594.4</td>
<td>$31,888</td>
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<td>EA</td>
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<td>1.0</td>
<td>$100,000</td>
<td>0.0</td>
<td>$0</td>
</tr>
</tbody>
</table>

**SUBTOTAL**

| MOBILIZATION (THIS IS SUB+CONTIN. X % =) | 4.5% | $18,003 | $9,264 |
| MAINTENANCE OF TRAFFIC               | 5.0% | $14,817 | $7,625 |
| ENGINEERING & CONTINGENCIES          | 35.0% | $103,720 | $53,375 |
| RIGHT OF WAY                          | LS    | $11,195.50 | 1 | $11,196 |

**GRAND TOTAL**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tr>
<td><strong>POSSIBLE SAVINGS:</strong></td>
<td>$198,923</td>
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</tbody>
</table>
These Right-of-Way costs assume a commercial cost of land at $1.70/SF and residential land at $0.25/SF. The City property is considered as a donation.
Value Engineering Alternative No. 9: Use a roundabout at Industrial Road (continued).

TRAFFIC ANALYSIS:

1 Lane Roundabout

Predicted approach capacity
534 pceph conflict with 750 pceph

Predicted approach capacity
982 pceph conflict with 140 pceph

Predicted approach capacity
498 pceph conflict with 820 pceph

Predicted approach capacity
1043 pceph conflict with 80 pceph
VII. DEVELOPMENT PHASE

G. INTERSECTIONS

Original Design

The Original Design shows a four legged signalized intersection at the junction of Pride Avenue and Nebo Road/US 41A as shown below.
VII. DEVELOPMENT PHASE

G. INTERSECTIONS

Value Engineering Alternative No. 10: Use a roundabout at Pride Avenue.

The Value Engineering Team recognizes that this section of roadway has Access Management issues. Between Pride Avenue and North Main Street/US 41 there are three commercial driveways and one residential driveway. During the AM and PM peaks traffic hours it will be difficult and risky to make left turns into these driveways. To reduce these risks, this Value Engineering Alternative will construct a 4' raised median from Pride Street to North Main Street/US 41 and a roundabout at Pride Avenue. This will require drives wishing to make left turn to make U-Turns either at the roundabout or the signalized intersection at North Main Street/US 41.

VALUE ENGINEERING ALTERNATIVE ROUNDBOOUT WITH RAISED MEDIAN

The roundabout will require corner clips in 2 of the 4 corners. It is also understood this intersection is not designed to be signalized now, but it may soon warrant a signal.
# INTERSECTIONS

*(PRIDE AVENUE - NEBO ROAD/US 41A ROUNDABOUT)*

## VALUE ENGINEERING ALTERNATIVE NO. 10

## COST COMPARISON SHEET

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT COST</th>
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<th>PROP'D COST</th>
<th>V.E. QTY.</th>
<th>V.E. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAVEMENT</td>
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<td>$43.00</td>
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<td>$164,456</td>
<td>2659.6</td>
<td>$114,361</td>
</tr>
<tr>
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<td>1594.4</td>
<td>$31,888</td>
<td>1907.0</td>
<td>$38,140</td>
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**POSSIBLE SAVINGS:** $55,328
VII. DEVELOPMENT PHASE

H. DESIGN COMMENTS

DESIGN COMMENT NO. 1

On section one, US 41A, the Geotechnical notes and the Pavement Design both indicate using Chemical Stabilization to create a working platform and is part of the pavement design. Although this can be accomplished from station 575+00 to Station 635+00 the remainder of the project is primarily widening and overlay or so piecemeal that it wouldn’t be practical to use chemical stabilization and should use rock and fabric or some other alternative. We recommend the Project Team discuss this issue and decide whether Chemical Stabilization is practical to use in this instance.

DESIGN COMMENT NO. 2

The project as proposed has approximately 182,000 cubic yards of excavation and 119,000 cubic yards of fill resulting in 63,000 cubic yards of waste not considering shrink or swell factors. The area between the new alignment and the existing alignment from right of station 598+00 to station 606+00 appears to become a non usable R/W remnant and could be purchased and identified as a waste area to be used by the contractor, possibly reducing the roadway excavation price.

DESIGN COMMENT NO. 3

The area served by this road improvement has continued to grow with industrial and commercial development. A short distance from the corridor includes residential and agricultural uses. The Madisonville Zoning Map shows that the property directly fronting the corridor is zoned primarily for industrial and commercial uses.
Much of the land currently does have any development or low density residential which would allow for future growth in this area.

To accommodate this growth and minimize traffic impacts on the US 41A highway, the Value Engineering Team recommends that the city, in conjunction with KYTC, develop a plan to create an interconnected road system to serve these properties as they develop. This plan would allow local officials to coordinate future development site layouts and incrementally build these roads. By carefully planning and building these backage roads, access control can successfully be preserved on US 41A while giving local traffic the opportunity to travel short distances without needing to access US 41A. This will allow the volumes on US 41A to be minimized, maximize the operational efficiency, and extend the useful life of the highway.

The following are examples of what could be included in a local plan.
Example of backage road plan, east side of highway project

Example of backage road plan, east side of highway project
<table>
<thead>
<tr>
<th>NAME</th>
<th>AFFILIATION</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>William F. Ventry, P.E., C.V.S.~Life</td>
<td>VE Group, L.L.C.</td>
<td>850/627-3900</td>
</tr>
<tr>
<td>Duncan Silver, P.E, L.S.</td>
<td>VE Group, L.L.C.</td>
<td>850/627-3900</td>
</tr>
<tr>
<td>Tom Hartley, P.E., C.V.S.</td>
<td>VE Group, L.L.C.</td>
<td>850/627-3900</td>
</tr>
<tr>
<td>Richard Guidi</td>
<td>GRW Engineers</td>
<td>859/331-9220</td>
</tr>
<tr>
<td>Warren Iulq</td>
<td>GRW Engineers</td>
<td>859/331-9220</td>
</tr>
<tr>
<td>Everett Green</td>
<td>KYTC, District 2</td>
<td>270/824-7080</td>
</tr>
<tr>
<td>Rachel Catchings</td>
<td>KYTC CO Design</td>
<td>502/564-3280</td>
</tr>
<tr>
<td>Jill Asher</td>
<td>KYTC CO Planning</td>
<td>502/564-7183</td>
</tr>
<tr>
<td>Jeff Jasper</td>
<td>KYTC CO Design</td>
<td>502/564-3280</td>
</tr>
</tbody>
</table>

VALUE ENGINEERING STUDY PRESENTATION
# IX. VE PUNCH LIST

## Project County: Hopkins  
**DATE OF STUDY:** 6/27-7/1, 2011

<table>
<thead>
<tr>
<th>VE Alt. #</th>
<th>Description</th>
<th>VE Team Top Picks</th>
<th>Implemented Life Cycle Cost Savings</th>
<th>Original Cost</th>
<th>Alternative Cost</th>
<th>Initial Cost Saving</th>
<th>Tot. Present Worth Life Cycle Cost Savings</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use exist. Align., leave the roadway conn. as is</td>
<td></td>
<td></td>
<td>$3,314,144</td>
<td>$2,433,499</td>
<td>$880,645</td>
<td>$880,645</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Use exist. Align, close the connection</td>
<td></td>
<td></td>
<td>$3,314,144</td>
<td>$1,484,012</td>
<td>$1,830,132</td>
<td>$1,830,132</td>
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</tr>
<tr>
<td>3</td>
<td>Steepen the cut slopes to 2:1.</td>
<td></td>
<td></td>
<td>$2,339,537</td>
<td>$2,230,273</td>
<td>$109,264</td>
<td>$109,264</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Use a 4’ raised median.</td>
<td></td>
<td></td>
<td>$8,692,806</td>
<td>$11,040,056</td>
<td>$(2,347,250)</td>
<td>$(2,347,250)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6’ median, eliminate continous turn lanes</td>
<td></td>
<td></td>
<td>$8,692,806</td>
<td>$8,453,644</td>
<td>$239,163</td>
<td>$239,163</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Use a 14’ flush median.</td>
<td></td>
<td></td>
<td>$8,692,806</td>
<td>$9,162,657</td>
<td>$(469,850)</td>
<td>$(469,850)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Purchase the Industrial Park spur line.</td>
<td></td>
<td></td>
<td>$1,923,020</td>
<td>$699,490</td>
<td>$1,223,530</td>
<td>$1,223,530</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Use a continuous flow intersection</td>
<td></td>
<td></td>
<td>$1,344,625</td>
<td>$1,616,711</td>
<td>$(272,086)</td>
<td>$(272,086)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Use a roundabout at Industrial Road.</td>
<td></td>
<td></td>
<td>$432,884</td>
<td>$233,961</td>
<td>$198,923</td>
<td>$198,923</td>
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</tr>
<tr>
<td>10</td>
<td>Use a roundabout at Pride Avenue.</td>
<td></td>
<td></td>
<td>$286,809</td>
<td>$231,482</td>
<td>$55,328</td>
<td>$55,328</td>
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</tr>
</tbody>
</table>

## DESIGN SUGGESTIONS

<table>
<thead>
<tr>
<th>Design Suggestion #</th>
<th>Description</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use rock and fabric rather than chemical stabilization.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Use the area between the new and existing alignment for waste.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Develop an access plan with the city.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Roadway/Earthwork/Pavement

## Intersections

## IX. DESIGN SUGGESTIONS
### VIII. FHWA TABLES

**US 41A**  
**HOPKINS COUNTY**  
June 27-July 1, 2011

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>Safety</th>
<th>Environment</th>
<th>Operation</th>
<th>Construction</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendation Number 1:</strong> ALIGNMENT. VE ALTERNATIVE NO. 1: Use the existing alignment, leave the roadway connection as is, lengthen the right turn lane on US 41A and use a preemptive signal.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Recommendation Number 2:</strong> ALIGNMENT. VE ALTERNATIVE NO. 2: Use the existing alignment and close the US 41A/KY 1178 connection between US 41A and KY 1178 and remove the railroad crossing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Recommendation Number 3:</strong> ROADWAY EXCAVATION. VE ALTERNATIVE NO. 3. Steepen the cut slopes to 2:1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Recommendation Number 4:</strong> TYPICAL SECTION. VE ALTERNATIVE NO. 4. Use a 4’ raised median.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Recommendation Number 5:</strong> TYPICAL SECTION. VE ALTERNATIVE NO. 5. Begin the 6’ median at station 640+00, eliminate the continuous turn lanes, use roundabouts at the intersections at station 640+00, station 664+00 and Pride Avenue and use a 3 lane section for the remainder of the project.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Recommendation Number 6:</strong> TYPICAL SECTION. VE ALTERNATIVE NO. 6. Use a 14’ flush median.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
## VIII. FHWA TABLES

### FHWA CATEGORIES (continued)

#### US 41A  
**HOPKINS COUNTY**  
**June 27-July 1, 2011**

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>Safety</th>
<th>Environment</th>
<th>Operation</th>
<th>Construction</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation Number 7: RAILROAD CROSSINGS. VE ALTERNATIVE NO.7. Purchase the Industrial Park spur line.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Recommendation Number 8: INTERSECTIONS. VE ALTERNATIVE NO. 8: Use a continuous flow intersection at the US 41A/US 41 intersection. Purchase the Industrial Park spur line.</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Recommendation Number 9: VE ALTERNATIVE NO. 9. INTERSECTIONS. Use a roundabout at Industrial Road.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Recommendation Number 10: VE ALTERNATIVE NO. 10: INTERSECTIONS. Use a roundabout at Pride Avenue.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4</strong></td>
<td><strong>1</strong></td>
<td><strong>6</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: X indicates action recommended.*