VE # 201202
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & # 1-8002.00
Marshall County, Kentucky
Value Engineering Study Report – Final

Study Dates: February 14-17, 2012
Final Report Date: April 2012

Kentucky Transportation Cabinet
Division of Highway Design
200 Mero Street
Frankfort, KY 40622

Contact: Renee L. Hoekstra, CVS
(623) 266-3943
February 2012

RH & Associates, Inc.

KENTUCKY TRANSPORTATION CABINET

RH & Associates, Inc.

"Partnering, Public Information & Value Specialists"

April 20, 2012

Mr. Brent Sweger
Kentucky Transportation Cabinet
Division of Highway Design
200 Mero Street
Frankfort, KY 40622

Re: Julian M. Carroll Purchase Parkway Interchange & the Widening of KY 348
Project Items # 1-8101.00 and # 1-8002.00
Final Value Engineering Study Report

Dear Brent:

Transmitted herewith is the pdf copy of the Final Value Engineering Study Report for the above referenced project. A single hard copy will be delivered.

RHA appreciates your assistance and cooperation as well as that from the KYTC design team including the consultants and all other stakeholders. Should you have any questions please telephone me at (623) 266-3943.

Sincerely,

RH & ASSOCIATES, INC.

Renee L. Hoekstra, CVS
President

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RH & Associates, Inc.

Value Engineering Study
Kentucky Transportation Cabinet
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INTRODUCTION

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Introduction

The value methodology (Synonyms: value analysis, value engineering and value management) is a function-oriented, systematic, team approach to add customer value to a program, facility, system, or service. Improvements like performance, quality, initial and life cycle cost are paramount in the value methodology. The workshop was conducted in accordance with the methodology as established by SAVE International, the value society, and was structured using the Job Plan as outlined below:

Value Methodology

- **Pre-Study**
  - Identify team members
  - Define workshop location
  - Review project documentation
  - Prepare for the Value engineering study (workshop)
- **Value Study (Workshop) Job Plan**
  - *Information Phase*
    - Gather, organize and analyze data,
    - Define costs and cost models,
    - Define the problem/purpose of the study,
    - Define study scope, define project goals and workshop goals
  - *Function Analysis Phase*
    - Define and evaluate functions
    - Define needs versus wants
  - *Creative Phase*
    - What else will perform the functions?
    - Is this function required?
  - *Evaluation Phase*
    - Rank and rate the ideas to select
    - Refine the best ideas for further development
  - *Development Phase*
    - Develop the best ideas into VE Alternatives with support and justification
  - *Presentation/Implementation*
    - VE team presents results
    - Prepare and issue the report
    - Report implementation ideas
- **Post Study**
  - Implement approved alternatives
  - Monitor status

Value Engineering Study
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Report Content

The report provides the outcomes associated with this VE workshop. The report includes the following sections:

Introduction – This section outlines the VE process and explains the content of the report.

Executive Summary – An overview which includes the VE process, the VE punch list which is to be used during the implementation meeting, a list of the VE study team members and the certification is included.

Project Description – This section describes each of the projects in more detail for the reader to gain a better understanding of the projects under study. Vicinity maps and photographs, where appropriate, are included showing where each of the projects are located.

VE Recommendations and Design Suggestions – Each completed alternative and design suggestion has a separate workbook. Each workbook contains the following information:

Appendices

A – Study Participants
B – Pareto Cost Models
C – Function Analysis
D - Creative List and Evaluation
E – Supporting Data
    i. Team Observations
    ii. Risk Registry

EXECUTIVE SUMMARY

Value Engineering Study
Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway
Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

Executive Summary

Background

A Value Engineering (VE) study was conducted from February 14-17, 2012 for the Kentucky Transportation Cabinet (KYTC) for two projects. These projects included Julian M. Carroll Purchase Parkway, Item #1-8101.00 and Widening of KY 348, #1-8002.00 as described below. The decision makers identified the project goals as improving operations and capacity while obtaining the interstate designation.

The workshop objectives were identified at the start of the workshop; to assure the efficient use of funds, both capital and life cycle costs, and to ensure the best value is attained while meeting the project goals and performance attributes. The VE team identified the following goals and opportunities for the workshop:

- Review both projects for impacts and opportunities
- Evaluate access issues on both projects including at the interchange and at the hospital

Project Constraints

The decision makers/stakeholders identified the project constraint for the VE team at the start of the VE study as maintaining the wetland at the Wal-Mart fence line.

Project Descriptions

The VE study includes two projects. The overall purpose of these projects is to improve traffic flow by providing a safer and more efficient roadway while enhancing and promoting economic development in the area. The first project, Item #1-8101.00, is an interchange project being designed by American Engineers, Inc. The second project, Item #1-8002.00, is the widening of KY 348. This project is being designed by Florence & Hutchinson.

Summary of Results

The VE team brainstormed 56 ideas. Of those, 15 ideas were identified for further development into VE proposals, including cost impacts. Six Design Suggestions, without any cost impact were identified with two Design Suggestions written to provide additional information for KYTC and the designer to consider. The description and further discussion of these are included in the VE Workbooks section of this report. The following represents the alternatives developed and the cost impact, as necessary. The ideas developed are listed under the following functions or items of work: Accommodate Bicycles (AB), Eliminate Weaves (EW), Eliminate Turns (ET), Improve Operations (IO), Accommodate Pedestrians (AP), Reduce Crashes (RC), Accommodate Trucks (AT), Accommodate Medical Traffic (AM) and Miscellaneous (M). The following table shows the alternatives developed and the cost impacts. The costs shown in parenthesis represent an additional cost to the project. Those shown as positive numbers represent a savings.

No.	Alternative Description	Initial Costs	Life Cycle	Total Costs/ Savings
AB-03	Add bike lanes on both sides by reducing 12' lanes and medians	$0	$0	$0
AB-05	Shared lanes with signage only	($4,000)	$0	($4,000)
EW-02	Improve to a 3-lane urban on KY 348	$506,000	$0	$506,000
ET-01	Install non-mountable median on KY 348	($335,000)	$0	($335,000)
ET-09	Install roundabouts at all major intersections	$465,000	$2,232,000	$2,697,000
IO-01	Add right turn lanes instead of widening to 5 lanes	$666,000	$0	$666,000
IO-04	Develop Access Management Plan and MOU (memorandum of understanding)	($20,000)	$0	($20,000)
IO-05	Reduce the speed limit, change the breaking point	$0	$0	$0
AP-01	Extend the sidewalk across the bridge	($138,000)	$0	($138,000)
AP-03	Extend the sidewalk into businesses	($15,000)	$0	($15,000)
RC-02	Provide offset left turns using a wider TWLTL (two-way left turn lane)	$0	$0	$0
AT-02	Increase the left-turn radii for trucks	($70,000)	$0	($70,000)
AM-01	Extend project limits west to include the hospital entrance	($834,000)	$0	($834,000)
AM-02	Add a left turn lane into Old Symsonia Road (hospital)	($719,000)	$0	($719,000)
M-07	Combine both projects for construction	$300,000	$0	$300,000
M-12	Install wagon boxes on the ramps to reduce right-of-way purchase	$582,000	$0	$582,000

Risk Analysis

A formal risk analysis was completed on this project to identify any potential risks that might negatively or positively impact the project. Two risks were identified as Very High and the team provided ideas to aid in mitigating the risks. A risk registry was completed and is included in Appendix E, the support data section of this report.

Team Observations

Upon completion of the project presentation, the team discussed the various elements of the project including the project information they had studied prior to the workshop and the information that was provided during the presentation. These observations can be found in Appendix E.

Function Analysis

Function definition and analysis is the heart of Value Engineering. It is the primary activity that separates VE from all other "improvement" programs. The objective of this phase is to ensure the entire team agrees upon the purposes for the project elements. Furthermore, this phase assists with development of the most beneficial areas for continuing study. The data supporting the function analysis can be found in Appendix C.

The VE team identified the functions using active verbs and measurable nouns. This process allowed the team to truly understand all of the functions associated with the project. The basic function was defined as *Improve Operations*. A function analysis systems technique (FAST) diagram was completed and is included in Appendix C.

VE Study Team

Renee Hoekstra, CVS, RH & Associates, Inc. – VE Team Leader
Laurie Dennis, P.E., CVS, RH & Associates, Inc. – VE Team Leader
Brent Sweger, P.E., AVS, Kentucky Transportation Cabinet – Planning/VE Coordinator
Jan Cunningham, Qk4, Inc. - Constructability Specialist
David Kratt, P.E., Qk4, Inc. – Highway Specialist
Taylor Kelly, P.E., Qk4, Inc. – Highway Specialist
Phil Demosthenes, Transportation Consultant – Access Management Specialist

Certification

This is to verify that the Value Engineering Study was conducted in accordance with standard value engineering principles and practices.

Renee L. Hoekstra, CVS
RH & Associates, Inc.

VALUE ENGINEERING PUNCH LIST

ITEM NO. **1-8101.00 & 1-8002.00** PROJECT COUNTY: **Marshall** DATE OF STUDY: **2/14/2012 - 2/17/2012** **VE # 201202**

VE Alternative Number	VE Team Top Pick	Description	Activity (Y,N,UC-Date)	Implemented Life Cycle Cost Savings	Original Cost	Alternative Cost	Initial Cost Saving	Life Cycle Cost Savings (Total Present Worth)	FHWA Categories	Remarks
Item #1-8100.00 & # 1-8002.00										
AB-03		Add bike lanes on both sides by reducing 12' lanes and medians			$0	$0	$0			
AB-05		Shared lanes with signage only			$0	$4,000	($4,000)			
EW-02		Improve to a 3-lane urban on KY 348			$769,000	$263,000	$506,000			
ET-01		Install non-mountable median on KY 348			$0	$335,000	($335,000)			
ET-09		Install roundabouts at all major intersections			$769,000	$304,000	$465,000	$2,232,000		
IO-01		Add right turn lanes instead of widening to 5 lanes			$929,000	$263,000	$666,000			
IO-04		Develop access management plan and MOU (memorandum of understanding)			$0	$20,000	($20,000)			
IO-05		Reduce the speed limit, change the breaking point			$0	$0	$0			
AP-01		Extend the sidewalk across the bridge			$0	$138,000	($138,000)			
AP-03		Extend the sidewalk into businesses			$0	$15,000	($15,000)			
RC-02		Provide offset left turns using a wider TWLTL (two-way left turn lane)			$0	$0	$0			
AT-02		Increase the left-turn radii for trucks			$0	$70,000	($70,000)			
AM-01		Extend project limits west to include the hospital entrance			$0	$834,000	($834,000)			
AM-02		Add a left turn lane into Old Symsonia Road (hospital)			$0	$719,000	($719,000)			
M-07		Combine both projects for construction			$545,000	$245,000	$300,000			
M-12		Install wagon boxes on the ramps to reduce right-of-way purchase			$1,106,000	$524,000	$582,000			
Design Suggestions Item #1-8100.00 & # 1-8002.00										
IO-09		Increase the length of the dedicated turn lanes to meet current KYTC policy			NA	NA	NA	NA		
AP-06		Create a local street connection using the railroad underpass			NA	NA	NA	NA		
AM-03		Eliminate the private cut-through road to KY 348			NA	NA	NA	NA		
AM-04		Ensure the lane widths can accommodate emergency vehicles during construction			NA	NA	NA	NA		
IC-01		Widen the offramps to increase storage to meet current KYTC policy			NA	NA	NA	NA		
M-08		Apply the utility legislation to this project and start the utilities work sooner			NA	NA	NA	NA		
					Saf 0 Ops 0 Env 0 Con 0 Oth 0					

PROJECT DESCRIPTION

Value Engineering Study
Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway
Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

Introduction

The VE study includes two projects. The overall purpose of these projects is to improve traffic flow by providing a safer and more efficient roadway while enhancing and promoting economic development in the area. The first project, Item #1-8101.00, is an interchange project being designed by American Engineers, Inc. The second project, Item #1-8002.00, is the widening of KY 348. This project is being designed by Florence & Hutchinson.

Item # 1-8101.00 – Julian M. Carroll Purchase Parkway

Necessary improvements to the KY 348 interchange at the Julian M. Carroll Purchase Parkway is a segment of the I-69 corridor through Kentucky. It is imperative that this project be included in the "I-69 CORRIDOR IMPROVEMENT PROJECT".

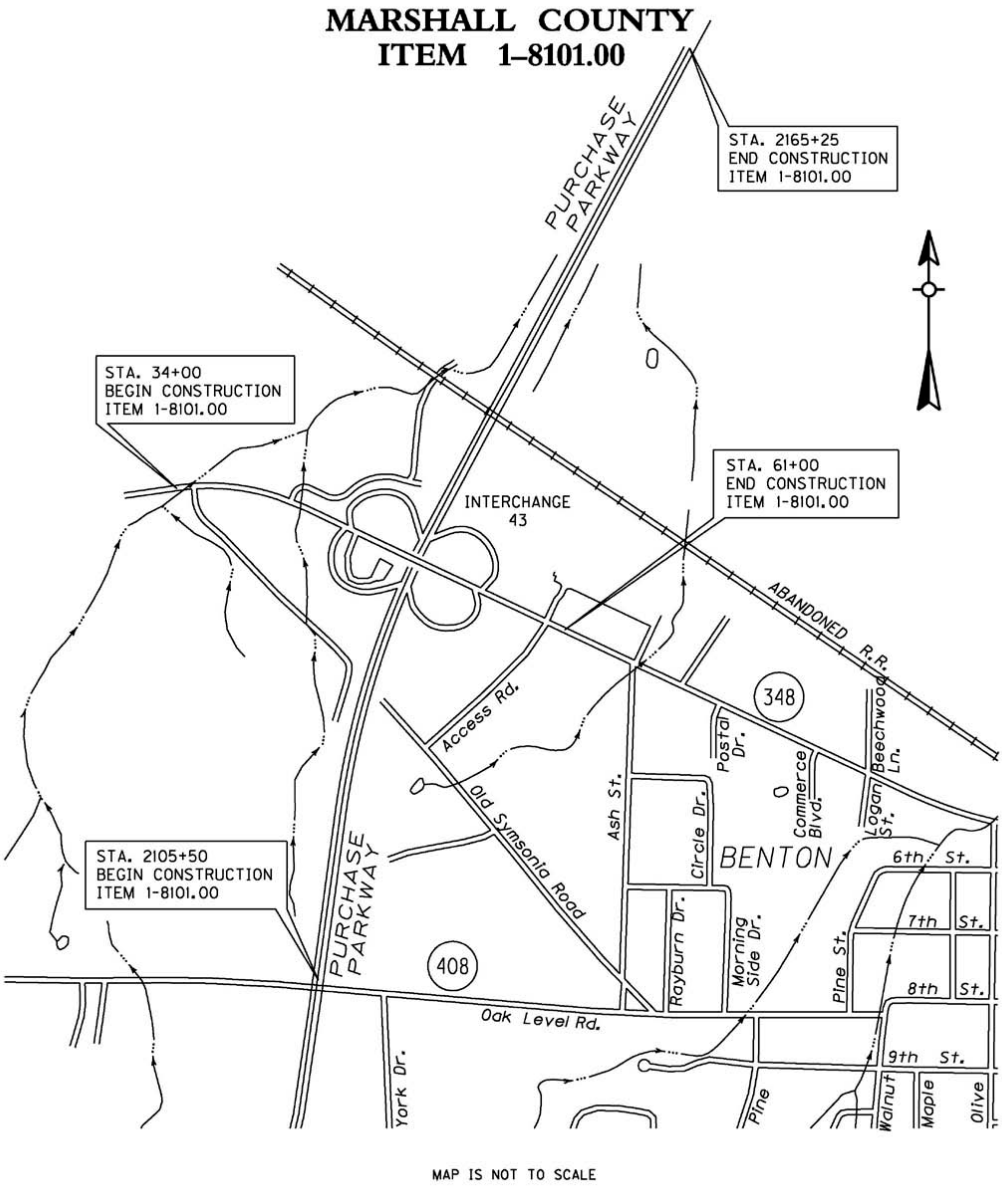
This project includes safety improvements for the I-69 corridor, coupled with improvements required to transport the increased traffic generated by I-69 through the interchange at an adequate Level of Service (LOS) in the Design Year 2028.

The existing facility was constructed in 1966 as a toll collection station requiring traffic to come to a stop condition for through and turning traffic. Turning movements utilized loop-type ramps with a minimal weaving section due to the full stop mainline operational conditions. The operational conditions changed when tolls were removed, allowing free flow traffic for both through and turning movements. This project improves safety and operational characteristics of all traffic entering and exiting the mainline resulting from the aforementioned restrictions, while providing proper Level of Service in the design year.

The Design Executive Summary (DES) phase of the project is nearly complete and is being designed by American Engineering. The KYTC Project Manager is Mike McGregor in District 1. The project involves the reconstruction of Julian Carroll Purchase Parkway Interchange and KY 348. This will replace the existing interchange. Mainline limits of construction will be approximately 1.132 miles. The decision to remove the structures over the abandoned Nashville-Chattanooga and St. Louis Railroad have not been made, so the final disposition of this structure is not known at this time. Improvements of KY 348 begin at a point approximately 1,600 feet west of the Julian M. Carroll Purchase Parkway near Old Symsonia Road and extend east approximately 0.511 mile to a point just east of Armory Drive. Improvements include replacement of the existing structure over the Julian M. Carroll Purchase Parkway to provide adequate vertical clearance ad additional lanes for through and turning traffic.

Project Limits Item # 1-8101.00

KY 348 /JULIAN M. CARROLL PURCHASE PARKWAY
VICINITY MAP



MAP IS NOT TO SCALE

Item # 1-8002.00 – Widening at KY 348

The proposed project improves KY 348, a heavily developed corridor in Benton, servicing commercial and light industrial development, the Marshall County Judicial Center, the Marshall County Hospital and the US Postal Service. Additionally, KY 348 is the primary access route from US 641 to the Julian M. Carroll Purchase Parkway (Future I-69) facility. KY 348 was constructed in 1966 as a two (2) lane rural roadway and has been upgraded to a three (3) lane rural roadway. The proposed five (5) lane urban facility with curb & gutter including sidewalk provides safe and efficient transportation for the traveling public and operates at a Level of Service commensurate with the projected 2024 traffic. This will result in an overall Level of Service D (a.m. and p.m.) at the KY 348/US 641 intersection.

This project involves the widening and reconstruction of 0.83 miles of KY 348 from the Julian M. Carroll Purchase Parkway (Future I-69) east ramp termini to just east of US 641 on south 5th Street. The existing KY 348 three (3) lane rural section with shoulders and ditches will be widened to a five (5) lane curb and gutter urban section with a ten foot (10') border area including sidewalks. This project also includes improvements to 0.12 miles of US 641 at the KY 348 intersection.

The proposed improvements to KY 348 and US 641 can be completed without major impacts to through traffic. The present three lane configuration can be maintained with a minor traffic shift and reduction of lane widths. With this shift in place, the project is widened on one side. The three (3) lane traffic configuration is shifted onto the newly constructed KY 348 facility and construction is completed.

Water related impacts will be minimal for this project. Two blueline streams exist within the project limits. Both of these streams have been altered from their natural conditions by development and flow into Clarks River downstream of the project crossing. Extensions of existing drainage structures and improving storm sewer networks constitute the majority of the drainage work. Extensive erosion control measures are used to insure minimal siltation in existing streams and proposed ditches.

Value Engineering Study
Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway
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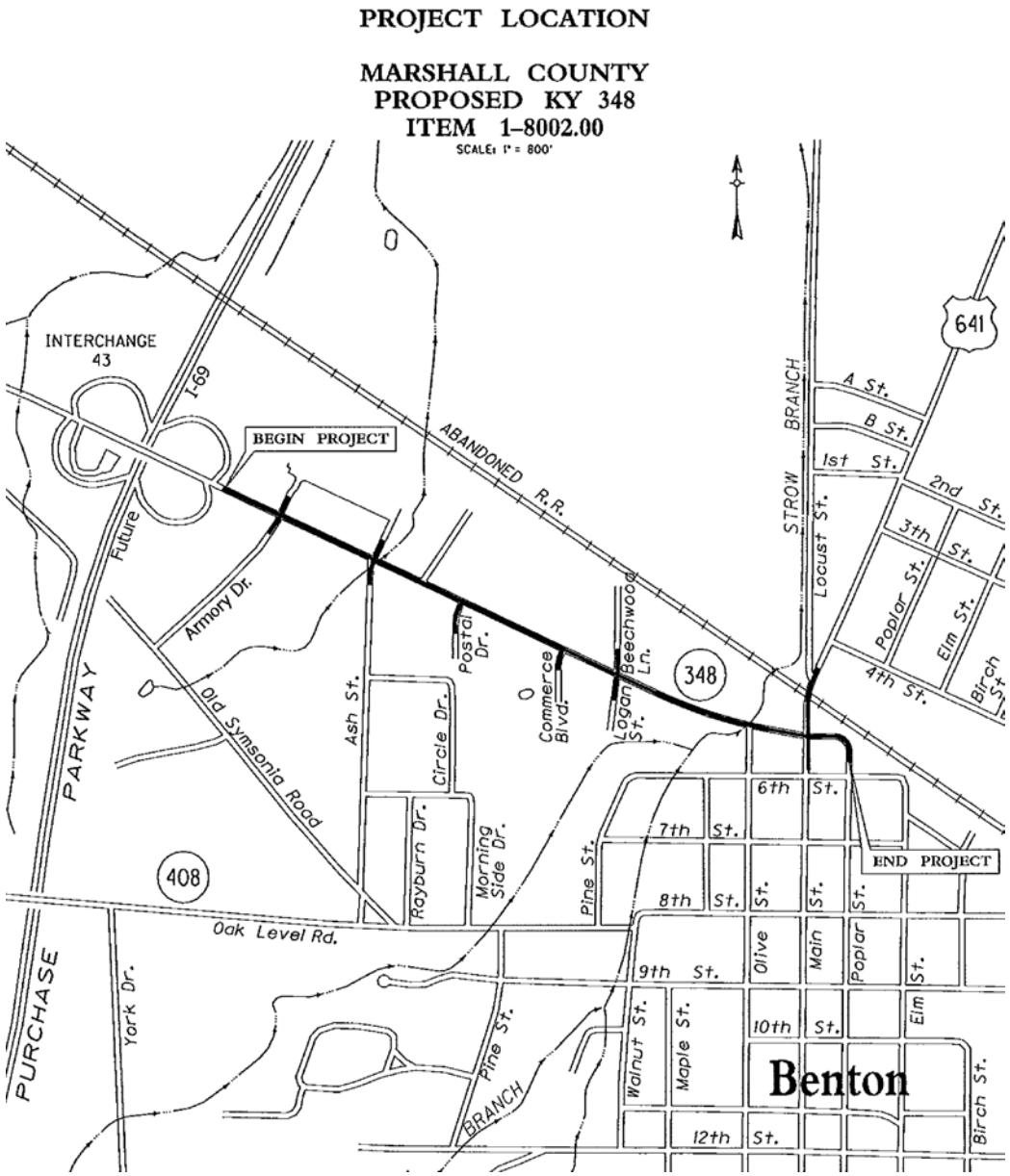
Items #1-8101.00 & #1-8002.00
Marshall County

Project Limits Item # 1-8002.00



VE RECOMMENDATIONS & DESIGN SUGGESTIONS

VE Recommendations & Design Suggestions

Introduction

The VE study evaluated the 56 ideas that were brainstormed during the Creative Phase for Items #1-8101.00 and #1-8002.00. The 15 completed alternatives and 2 design suggestions are located in this section of the report. The alternatives developed include, as needed, the following information:

- Baseline Alternative
- Proposed Alternative
- Benefits and Challenges of the Proposed Alternative
- Discussion and Justification
- Implementation Requirements
- Detailed Cost Estimate
- Drawings and/or Sketches for the Baseline and the Proposed Alternative

Additionally, two Design Suggestions were developed to provide some additional design direction to the design team.

Results of the Study

The team developed the following Proposals and Design Suggestions:

Summary of Propoosals

No.	Description	Initial Cost Savings / (Add)	O&M	Total Life Cycle Cost
AB	**Accommodate Bicycles**			
AB-03	Add bike lanes on both sides by reducing 12' lanes and medians	$0	$0	$0
AB-05	Shared lanes with signage only	($4,000)	$0	($4,000)
EW	**Eliminate Weaves**			
EW-02	Improve to a 3-lane urban on KY 348	$506,000	$0	$506,000
ET	**Eliminate Turns**			
ET-01	Install non-mountable median on KY 348	($335,000)	$0	($335,000)
ET-09	Install roundabouts at all major intersections	$465,000	$2,232,000	$2,697,000
IO	**Improve Operations**			
IO-01	Add right turn lanes instead of widening to 5 lanes	$666,000	$0	$666,000
IO-04	Develop access management plan and MOU (memorandum of understanding)	($20,000)	$0	($20,000)
IO-05	Reduce the speed limit, change the breaking point	$0	$0	$0
AP	**Accommodate Pedestrians**			
AP-01	Extend the sidewalk across the bridge	($138,000)	$0	($138,000)
AP-03	Extend the sidewalk into businesses	($15,000)	$0	($15,000)
AP-06	Create a local street connection using the railroad underpass			DS
RC	**Reduce Crashes**			
RC-02	Provide offset left turns using a wider TWLTL (two-way left turn lane)	$0	$0	$0
AT	**Accommodate Trucks**			
AT-02	Increase the left-turn radii for trucks	($70,000)	$0	($70,000)
AM	**Accommodate Medical Traffic**			
AM-01	Extend project limits west to include the hospital entrance	($834,000)	$0	($834,000)
AM-02	Add a left turn lane into Old Symsonia Road (hospital)	($719,000)	$0	($719,000)
M	**Miscellaneous**			
M-07	Combine both projects for construction	$300,000	$0	$300,000
M-08	Apply the utility legislation to this project and start the utilities work sooner			DS
M-12	Install wagon boxes on the ramps to reduce right-of-way purchase	$582,000	$0	$582,000

Design Suggestion (DS* Workbook Prepared)

No.	Description	Score
IO	**Improve Operations**	
IO-09	Increase the length of the dedicated turn lanes to meet current KYTC policy	DS
AP	**Accommodate Pedestrians**	
AP-06	Create a local street connection using the railroad underpass	DS*
AM	**Accommodate Medical Traffic**	
AM-03	Eliminate the private cut-through road to KY 348	DS
AM-04	Ensure the lane widths can accommodate emergency vehicles during construction	DS
IC	**Improve Capacity**	
IC-01	Widen the offramps to increase storage to meet current KYTC policy	DS
M	**Miscellaneous**	
M-08	Apply the utility legislation to this project and start the utilities work sooner	DS*

VALUE ENGINEERING PROPOSAL AB-03

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

RH & Associates, Inc.

TITLE:	**Add bike lanes on both sides by reducing 12' lanes and medians**
FUNCTION:	**Accommodate Bikes**

BASELINE ASSUMPTION:

The current design does not accommodate bicycles. The design calls for a five-lane section without any bike lanes.

PROPOSED ALTERNATIVE:

Restripe to reconfigure the lane widths to 11' with 12' center within the planned curb lines to accommodated bicycle lanes.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ -	$ -	$ -
TOTAL (Baseline less Proposed)	$ -	$ -	**$ -**

NO CHANGE

VALUE ENGINEERING PROPOSAL AB-03

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Add bike lanes on both sides by reducing 12' lanes and medians
BENEFITS	**RISKS/CHALLENGES**
• Provides a safe location for bicyclists to ride	• No current connection for the bicycle lane to the east or west on KY 348
• Connects land uses along the corridor for bicyclists	• Neither the City of Benton or Marshall County have a comprehensive bike plan
• Does not change vehicular capacity and safety	•
• Does not significantly change in the current design plans	•
• Narrower lanes may have a calming effect on mainline vehicular traffic	•
•	•
•	•
•	•
•	•
•	•
•	•

VALUE ENGINEERING PROPOSAL AB-03

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Add bike lanes on both sides by reducing 12' lanes and medians

DISCUSSION/JUSTIFICATION:

With numerous business destinations along the KY 348 and the community of Benton surrounding the KY 348 corridor, it is not unreasonable to expect bicyclists along KY 348. However, with no accommodations, bicyclists are forced to either encroach into traffic lanes or use the pedestrian sidewalks that are planned with the current projects. The City of Benton does not have a comprehensive bicycle plan but some potential single and multi-family residential, commercial growth is anticipated in the area along KY 348 and other roadways in the City of Benton. Additionally, there are subdivisions of single family residential dwellings along other corridors in the area. With this area available for growth, it is important for KYTC to plan for accommodating bicyclists in addition to pedestrians. The current design calls for sidewalks but nothing for bicycle transportation.

A simple approach, not requiring significant modification to the plans, is to reconfigure the lanes to narrower widths and to include bicycle lanes. This can be done by reducing the travel lanes from four 12' travel lanes plus a 14' TWLTL to four 11' travel lanes plus a 12' TWLTL. This will not effectively change capacity nor vehicular safety. The center turning lane would also need to be reduced by two feet. With this, five-foot bicycle lanes can be built; three feet would be on the asphalt and two feet would be within the gutter pan. This is an acceptable design, per the AASHTO Guide for the Development of Bicycle Facilities.

IMPLEMENTATION CONSIDERATIONS:

It is recommended that District 1 examine the feasibility of modifying KY 348 striping through the project. The bicycle lane should be carried through the intersections but should be to the left of any right-turn lanes that are built.

The inclusion of bicycle lanes with this project with help encourage development of additional bicycle facilities throughout the area. Continuity for bicycle facilities on adjacent streets such as US 641 throughout the City of Benton should be encouraged.

VALUE ENGINEERING PROPOSAL AB-03

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
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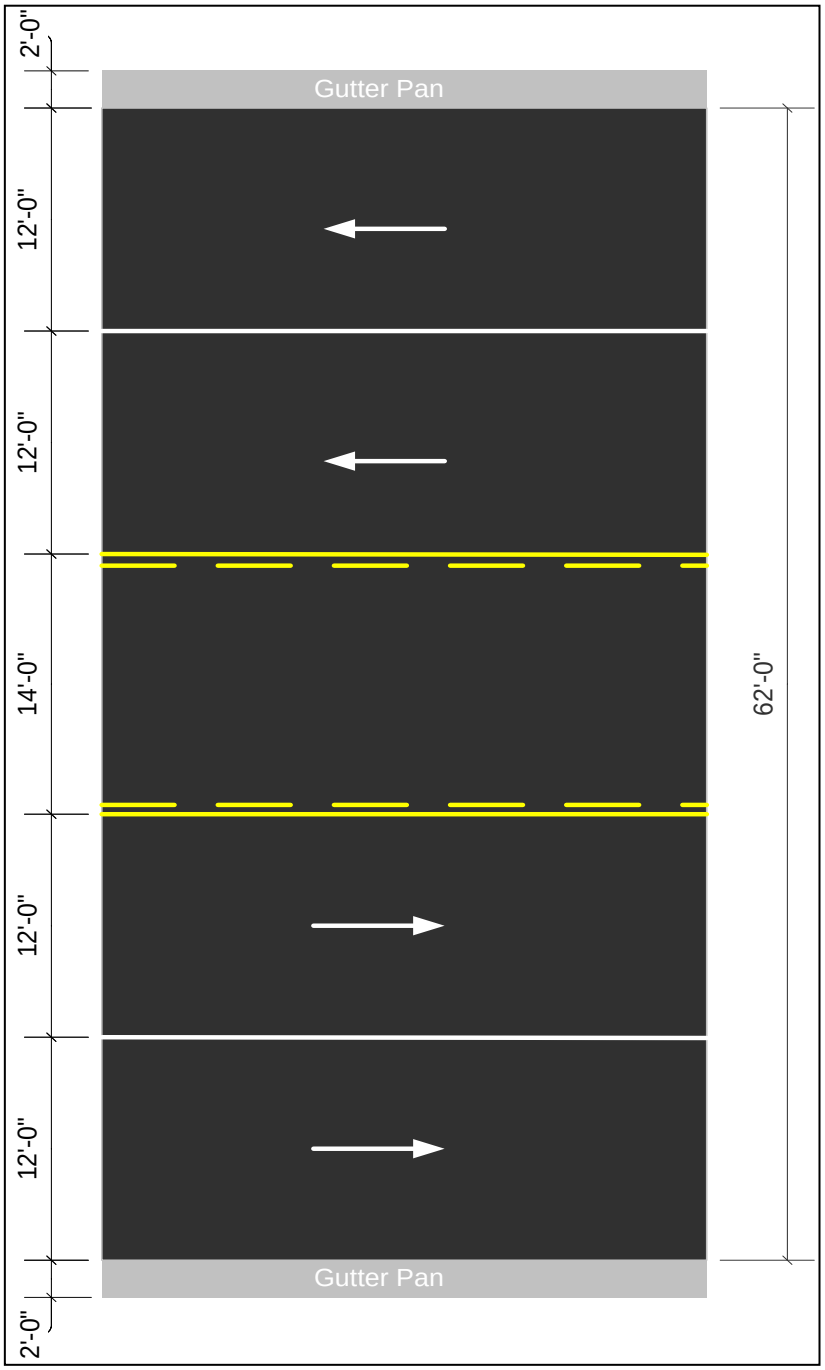
Marshall County

TITLE: Add bike lanes on both sides by reducing 12' lanes and medians

SKETCH OF BASELINE ASSUMPTION

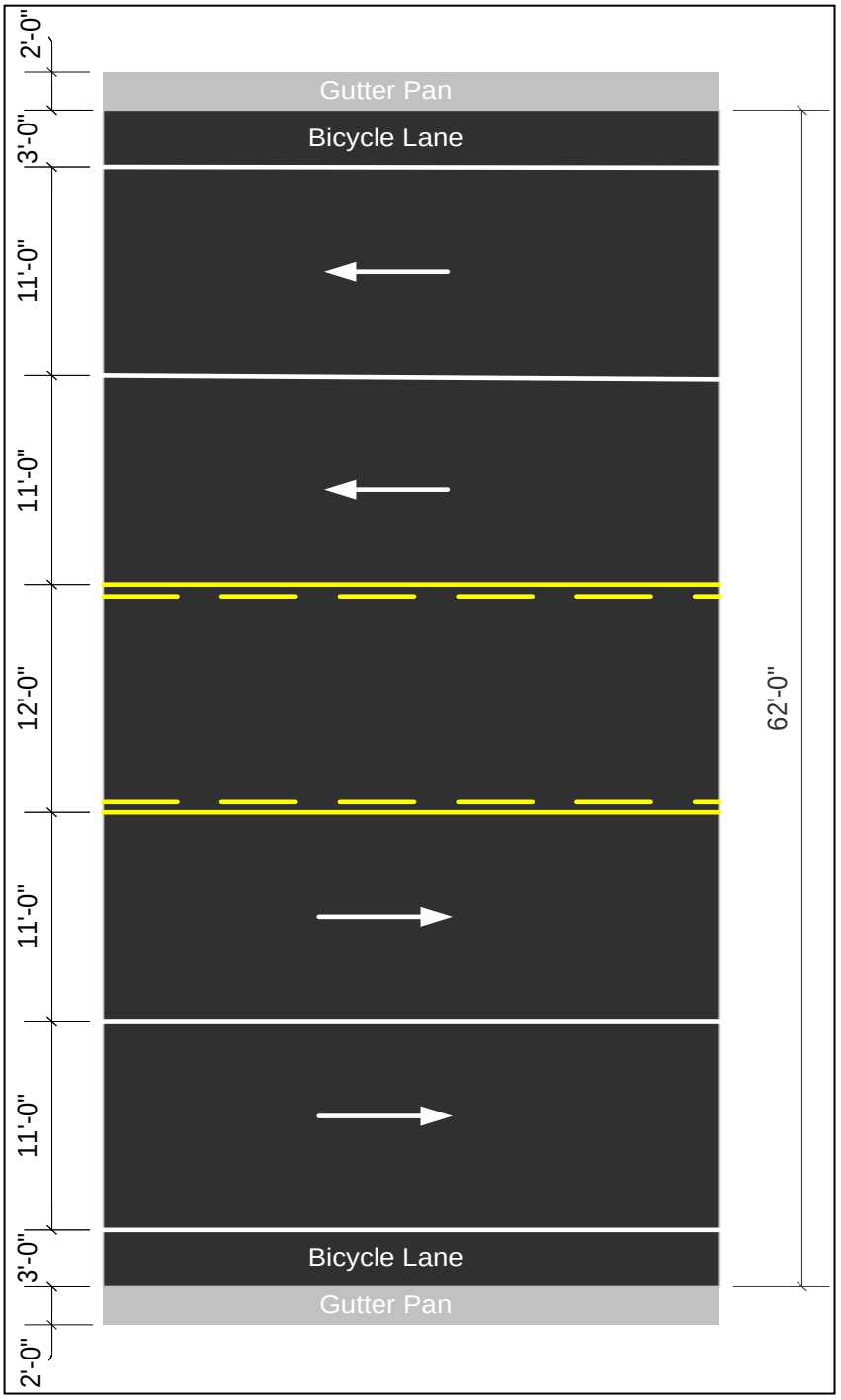


VALUE ENGINEERING PROPOSAL AB-03

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Add bike lanes on both sides by reducing 12' lanes and medians

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL AB-05

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Shared lanes with signage only**

FUNCTION: **Accommodate Bikes**

BASELINE ASSUMPTION:

The current design does not accommodate bicycles. The design calls for a five-lane urban section, 12', 12', 14', 12', 12' and 2' gutter pans on each side.

PROPOSED ALTERNATIVE:

In order to accommodate bicycles, sign outside lanes of KY 348 in the urban section for shared use lanes.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 4,000	$ -	$ 4,000
TOTAL (Baseline less Proposed)	$ (4,000)	$ -	**$ (4,000)**
			COST

TITLE:	Shared lanes with signage only
BENEFITS	**RISKS/CHALLENGES**
• Provides a location for bicyclists to ride	• Neither the City of Benton or Marshall County have a comprehensive bike plan
• Connects land uses along corridor for bicyclists	• Currently there is not a connection for the bicycle lane to the east or west on KY 348
• Does not change vehicular capacity	• Potential for vehicle/bicycle accidents with shared lanes
• Minimal cost and change in the current design plans	• Turning vehicles need education of who has the right-of-way
• The potential exists that shared use lanes may have a calming effect on mainline vehicular traffic	•
•	•
•	•
•	•
•	•
•	•
•	•

VALUE ENGINEERING PROPOSAL AB-05

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Shared lanes with signage only

DISCUSSION/JUSTIFICATION:

With numerous business destinations along the KY 348 and the community of Benton surrounding the KY 348 corridor, it is not unreasonable to expect bicyclists along KY 348. However, with no accommodations, bicyclists are forced to either encroach into traffic lanes where motorists do not anticipate bicycles or will use the pedestrian sidewalks that are planned with the current projects. The City of Benton does not have a bicycle plan. However, there are subdivisions of single family residential dwellings in the immediate area. Additionally, some potential single and multi-family residential and commercial growth is anticipated in the area along KY 348 and other roadways in the City of Benton. With this area available for growth, it is important for KYTC to plan for accommodating bicyclists in addition to pedestrians. The current design calls for sidewalks but nothing for bicycle transportation.

A simple and inexpensive approach to accommodate bicycles is to introduce shared use lanes. This can be done by designating the outside lanes of eastbound and westbound KY 348 as shared use lanes for both vehicles and bicycles. This technique does not change the proposed typical section (12' 12' 14' 12' 12' with 2' curb & gutter on each side) and will not negatively impact capacity. Shared lanes will require a small additional cost for signing and pavement marking with minimal modification to the plans.

IMPLEMENTATION CONSIDERATIONS:

It is recommended that District 1 examine the feasibility of modifying KY 348 plans and include shared use lanes for the project.

The inclusion of bicycle lanes with this project with help encourage development of additional bicycle facilities throughout the area. Continuity for bicycle facilities on adjacent streets throughout the City of Benton should be encouraged.

VALUE ENGINEERING PROPOSAL AB-05

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Shared lanes with signage only

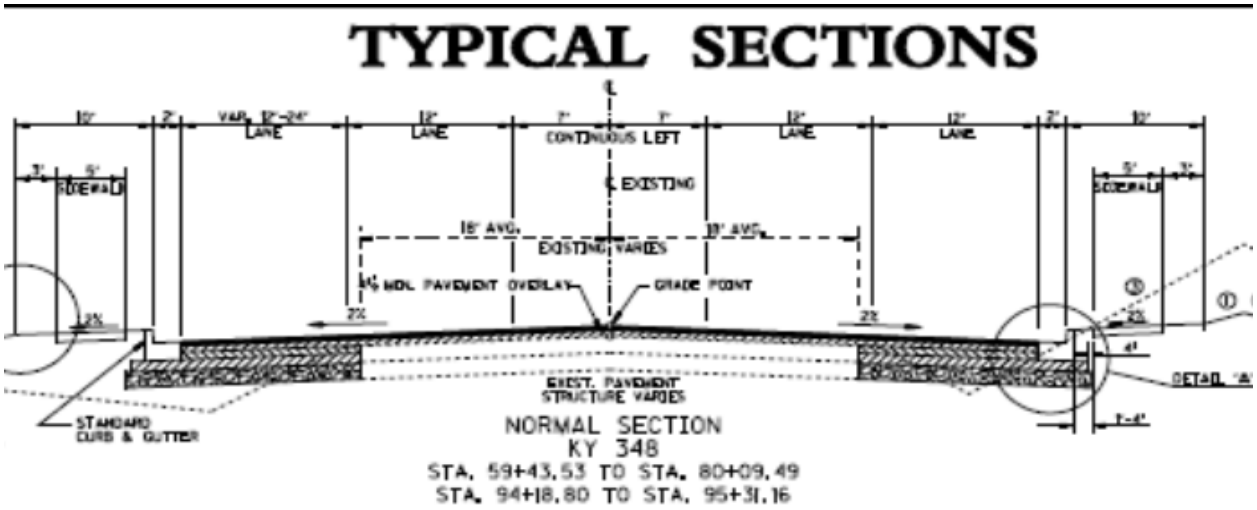
DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Shared lane signs		SF				250	6.00	1,500
Steel posts		LF				60	8.00	480
Sharrow pavement marking - thermo		EA				12	200.00	2,400
TOTAL COSTS*								**4,000**
							TOTAL (BASELINE LESS PROPOSED)	**(4,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

TITLE: Shared lanes with signage only

SKETCH OF BASELINE ASSUMPTION



TITLE: Shared lanes with signage only

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL EW-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Improve to a 3-lane urban on KY 348**

FUNCTION: **Eliminate Weaves**

BASELINE ASSUMPTION:

In the early 2000's when design alternatives for KY 348, from the Julian M. Carroll Parkway to US 641, were developed, the project team decided to advance a five-lane urban typical section. This typical section was determined to best address the commercial growth objectives as well as provide the additional capacity for current traffic and future growth.

When going from a three-lane section to a five-lane section, there is a potential for traffic to weave between through lanes to the turn lanes.

PROPOSED ALTERNATIVE:

Based on KYTC current traffic warrant policy, KY 348 can remain three lanes in the design year, with a volume to capacity ratio (V/C) less than 0.9 during the design hour (peak).

By staying with a three-lane typical section, KY 348 weaving movements have been eliminated and the potential for weaving crashes has been minimized.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 769,000	$ -	$ 769,000
PROPOSED ALTERNATIVE:	$ 263,000	$ -	$ 263,000
TOTAL (Baseline less Proposed)	$ 506,000	$ -	**$ 506,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL EW-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Improve to a 3-lane urban on KY 348
BENEFITS	**RISKS/CHALLENGES**
• Eliminates vehicles weaving across traffic lanes	• Traffic volumes in the future may grow beyond projected rates and require a five-lane typical section
• Reduces roadway footprint	• Public expectation is that when the roadway is improved, it will be five lanes
• Potential reduction to utility relocations	•
• Potential reduction to easements	•
• Maximizes green time for through movements by reducing the width that left turning vehicles have to traverse	•
•	•
•	•
•	•
•	•
•	•
•	•

TITLE: Improve to a 3-lane urban on KY 348

DISCUSSION/JUSTIFICATION:

The basis for any consideration to reduce the proposed typical section from five lanes to three lanes must be based on a three-lane typical section accommodating design year traffic. The attached analysis based on KYTC's current traffic policy yields the following results. The volume to capacity ratio, v/c, for the westbound through at the US 641 intersection does go over 1. The through movement at Ash Street all stay under 0.90. The mainline analysis for KY 348 west of US 641 and east and west of Ash Street are all 0.90 or under. The turn volumes at the US 641 intersection are probably high. The traffic forecasts in 2001 used a 3% growth rate for the forecast. The forecast for the interchange used a 1.5% growth rate. We used the 2024 turn volumes for the US 641 intersection, but at 3% they are still higher than if we grew their 2001 traffic to 2035. We have also attached the historical traffic counts per the KYTC CTS program that show 3%+ growth from 2001 to 2008, but show relatively low growth from this point forward. We highly recommend the project team review traffic projections and perhaps even get an updated forecast based on this information. As a three-lane typical section, the project meets the requirements of KYTC's traffic policy for v/c, therefore the VE team feels a three-lane section is a viable alternative.

By reducing the typical section from five lanes to three lanes, the weaving movements along KY 348 are reduced for through vehicles shifting lanes to make turns or weaving for speed.

For estimation purposes, we have identified the following locations for right turn lanes within the existing project limits:
Left and Right Sides at Armory Drive - Total of 600 lineal ft x 12' lane width
Left and Right Sides at Ash Street - Total of 850 lineal ft x 12' lane width
Right Side at Postal Drive - 300 lineal ft x 12' lane width
Right Side at Commerce Boulevard - 300 lineal ft x 12' lane width
Left Side at Beechwood Lane - 300 lineal ft x 12' lane width
Left and Right Sides at US 641 - Total of 800 lineal ft x 12' lane width

Basic Number of Lanes. The basic number of lanes will identify the recommended number of through lanes on a facility necessary to meet anticipated demand. Initial traffic engineering design should determine the basic number of lanes recommended for the facility to achieve a targeted Volume to Capacity ratio (V/C).

A targeted V/C ratio of 1.0 in urban areas and 0.90 in rural areas based on the design hour volume is recommended for roadway elements. If it is not possible or recommended by the project team to achieve the targeted V/C value, documentation should be provided in the Design Executive Summary (DES). This documentation may include design life analysis, off-peak traffic analysis, identification of alternative designs, or project mpacts (i.e. Engineering, Environmental, and Economic impacts) necessary to achieve the targeted V/C or other measures evaluated by the project team.

IMPLEMENTATION CONSIDERATIONS:

For any alternative considering three lanes in lieu of five lanes, we recommend the following implementation considerations:
- Update the traffic forecasts for both the current and design year.
- Evaluate the traffic warrants utilizing the new KYTC Policy.
- Consider other operational improvements to increase capacity, safety, and travel conditions at critical locations along KY 348.
- For the three-lane urban section, the designer must consider drainage design, access management, and pedestrian/bicycle features as part of the design

VALUE ENGINEERING PROPOSAL EW-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Improve to a 3-lane urban on KY 348

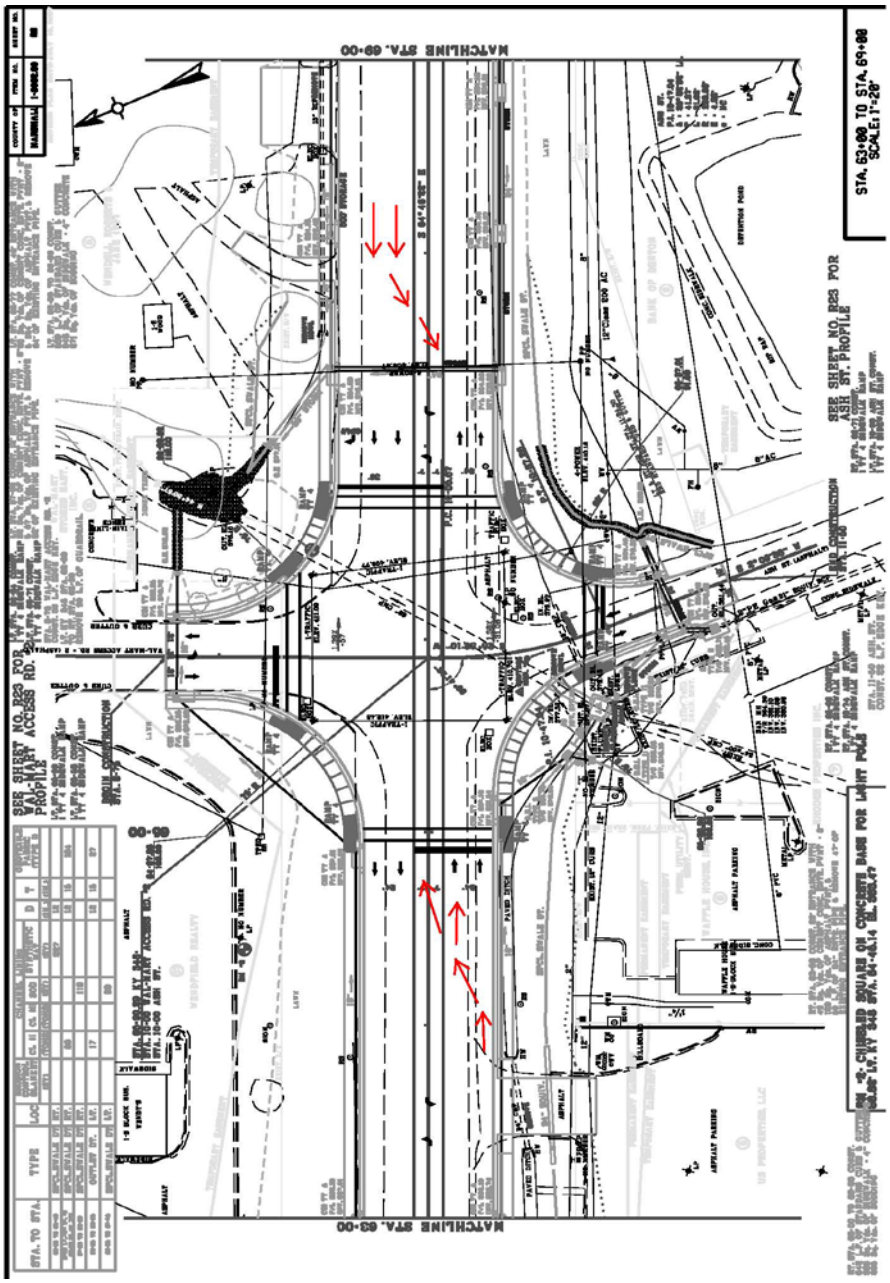
DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement - outside of existing template		SY	12300	50.00	615,000	4200	50.00	210,000
Miscellaneous - 25% Include utility and right-of-way easement reductions		LS	1	153,750.00	153,750	1	52,500.00	52,500
TOTAL COSTS*					**769,000**			**263,000**
							TOTAL (BASELINE LESS PROPOSED)	**506,000**

*Note: Total Costs are rounded to nearest thousand dollars

SAVINGS

TITLE: Improve to a 3-lane urban on KY 348

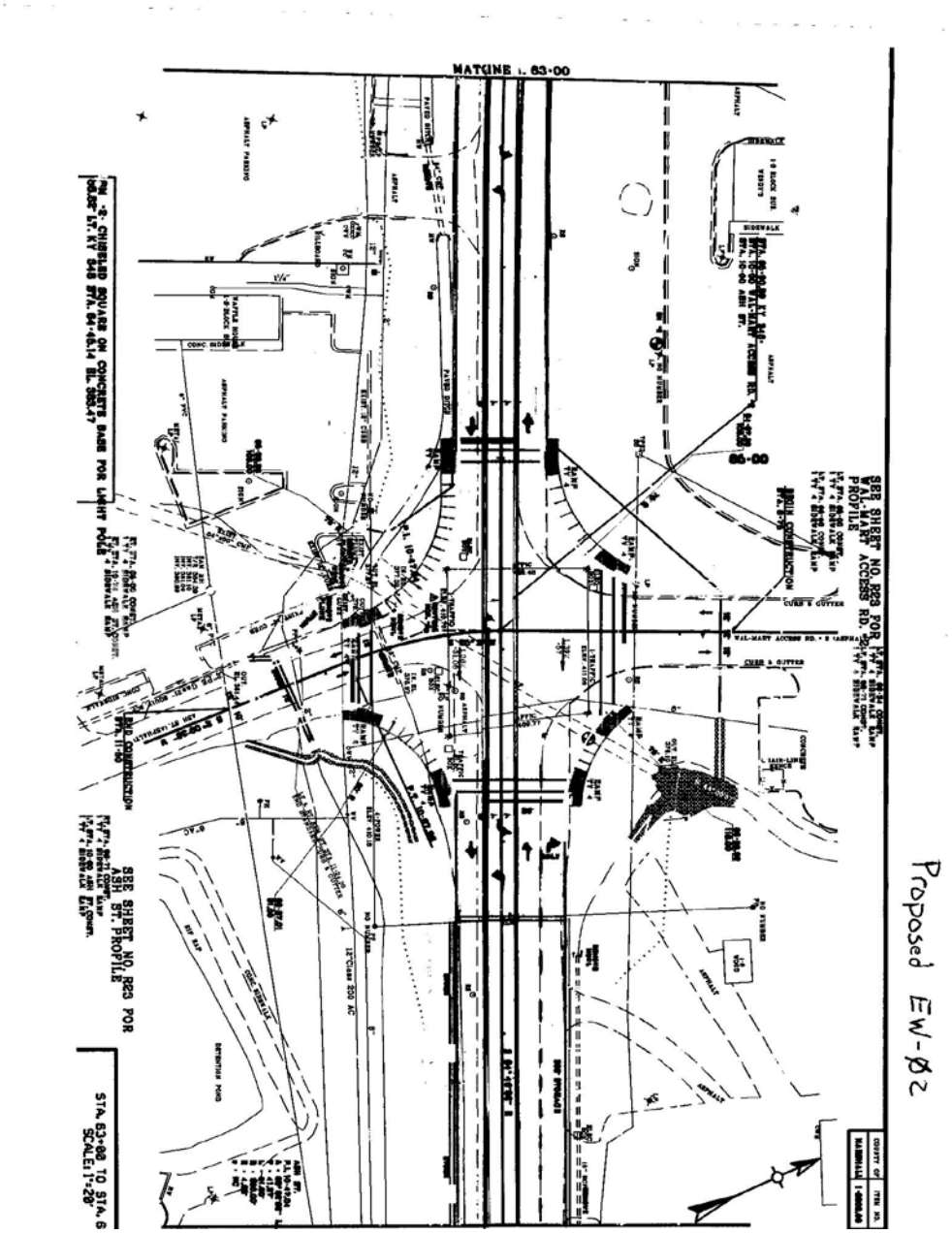
SKETCH OF BASELINE ASSUMPTION



Example of Weaving

TITLE: Improve to a 3-lane urban on KY 348

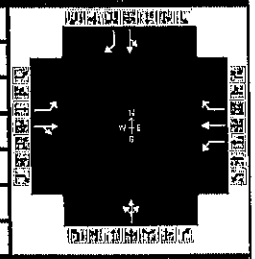
SKETCH OF PROPOSED ALTERNATIVE



3-Lane Roadway

2010 HCS Signalized Intersection Results Summary

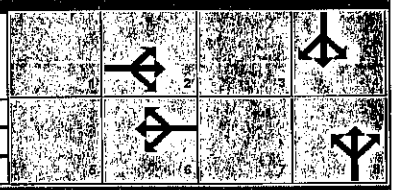
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	Feb 15, 2012	Area Type	Other
Jurisdiction		Time Period		PHF	0.90
Intersection	KY 348 & Ash St	Analysis Year	~~2012~~ 2035	Analysis Period	1> 7:00
File Name	KY 348 & Ash AM.xus				
Project Description	2035 AM Design Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	610	100	70	350	190	80	40	60	110	30	50

Signal Information			
Cycle, s	84.1	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	47.4	26.8	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	1.0	1.0	0.0	0.0	0.0	0.0	



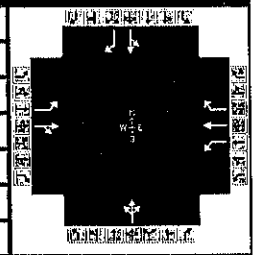
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	2	2	6	6	8	8	4	4
Case Number	6.0	6.0	5.0	5.0	8.0	8.0	7.0	7.0
Phase Duration, s	52.4	52.4	52.4	52.4	31.8	31.8	31.8	31.8
Change Period, (*Y*+*Rc*), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2
Queue Clearance Time (*gs*), s	34.4	34.4	44.3	44.3	26.4	26.4	13.8	13.8
Green Extension Time (*ge*), s	3.4	3.4	3.1	3.1	0.4	0.4	0.8	0.8
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.01	0.01	0.07	0.07	0.76	0.76	0.00	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	33	0	789	78	389	211	200	0	0	156	0	56
Adjusted Saturation Flow Rate (*s*), veh/h/ln	919	0	1685	634	1727	1464	698	0	0	878	0	1464
Queue Service time (*gs*), s	1.8	0.0	32.4	9.7	10.7	6.2	12.6	0.0	0.0	0.0	0.0	2.3
Cycle Queue Clearance Time (*gc*), s	12.5	0.0	32.4	42.3	10.7	6.2	24.4	0.0	0.0	11.8	0.0	2.3
Capacity (*c*), veh/h	485		945	197	971	823	284			356		467
Volume-to-Capacity Ratio (*X*)	0.069	0.000	0.833	0.395	0.400	0.256	0.703	0.000	0.000	0.437	0.000	0.119
Available Capacity (*ca*), veh/h	623		1201	292	1232	1044	321			384		522
Back of Queue (*Q*), veh/ln	0.3		10.1	1.4	3.1	1.5	4.4			2.6		0.7
Overflow Queue (*Q3*), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (*RQ*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uniform Delay (*d1*), s/veh	14.0		15.2	32.6	10.4	9.4	29.4			23.3		20.3
Incremental Delay (*d2*), s/veh	0.0	0.0	3.3	0.5	0.1	0.1	4.4	0.0	0.0	0.3	0.0	0.0
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	14.0		18.5	33.1	10.5	9.5	33.9			23.7		20.3
Level of Service (LOS)	B		B	C	B	A	C			C		C
Approach Delay, s/veh / LOS	18.3		B	12.8		B	33.9		C	22.8		C
Intersection Delay s/veh / LOS	18.5						B					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.2	B	2.4	B	2.3	B
Bicycle LOS Score / LOS	1.8	A	1.6	A	0.8	A	0.8	A

2010 HCS Signalized Intersection Results Summary

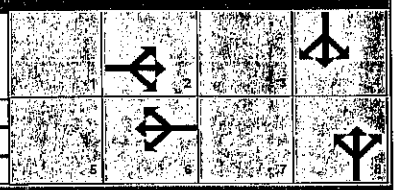
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	Feb 15, 2012	Area Type	Other
Jurisdiction		Time Period		PHF	0.90
Intersection	KY 348 & Ash St	Analysis Year	~~2012~~ 2035	Analysis Period	1> 7:00
File Name	KY 348 & Ash PM.xus				
Project Description	2035 PM Design Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	40	580	80	70	430	430	70	60	70	360	80	50

Signal Information			
Cycle, s	86.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	46.0	30.0	0.0	0.0	0.0	0.0	
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	
Red	1.0	1.0	0.0	0.0	0.0	0.0	



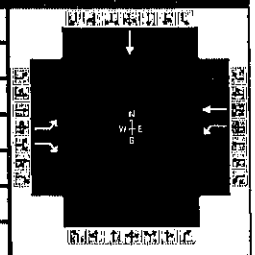
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	2	2	6	6	8	8	4	4
Case Number	6.0	6.0	5.0	5.0	8.0	8.0	7.0	7.0
Phase Duration, s	51.0	51.0	51.0	51.0	35.0	35.0	35.0	35.0
Change Period, (*Y*+*Rc*), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.1	3.1	3.1	3.1	3.4	3.4	3.4	3.4
Queue Clearance Time (*gs*), s	32.6	32.6	41.9	41.9	32.0	32.0	32.0	32.0
Green Extension Time (*ge*), s	4.2	4.2	4.0	4.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.02	0.02	0.09	0.09	1.00	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	44	0	733	78	478	478	222	0	0	489	0	56
Adjusted Saturation Flow Rate (*s*), veh/h/ln	847	0	1690	668	1727	1464	201	0	0	687	0	1464
Queue Service time (*gs*), s	3.1	0.0	30.6	9.3	15.3	19.4	0.0	0.0	0.0	0.0	0.0	2.2
Cycle Queue Clearance Time (*gc*), s	18.3	0.0	30.6	39.9	15.3	19.4	30.0	0.0	0.0	30.0	0.0	2.2
Capacity (*c*), veh/h	387		904	204	924	783	127			315		510
Volume-to-Capacity Ratio (*X*)	0.115	0.000	0.811	0.382	0.517	0.610	1.756	0.000	0.000	1.550	0.000	0.109
Available Capacity (*ca*), veh/h	525		1179	312	1205	1021	127			315		510
Back of Queue (*Q*), veh/ln	0.5		9.8	1.4	4.7	5.1	14.6			29.3		0.7
Overflow Queue (*Q3*), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (*RQ*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uniform Delay (*d1*), s/veh	18.7		16.4	32.7	12.9	13.8	27.4			31.6		19.0
Incremental Delay (*d2*), s/veh	0.0	0.0	2.5	0.4	0.2	0.3	370.6	0.0	0.0	262.5	0.0	0.0
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	18.7		18.9	33.2	13.0	14.1	398.1			294.1		19.0
Level of Service (LOS)	B		B	C	B	B	F			F		B
Approach Delay, s/veh / LOS	18.9		B	15.0		B	398.1		F	266.1		F
Intersection Delay s/veh / LOS	102.2						F					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.2	B	2.4	B	2.3	B
Bicycle LOS Score / LOS	1.8	A	2.2	B	0.9	A	1.4	A

2010 HCS Signalized Intersection Results Summary

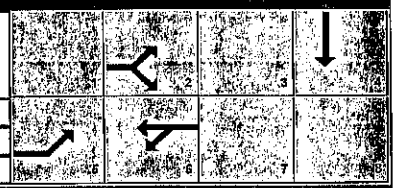
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	Feb 15, 2012	Area Type	Other
Jurisdiction		Time Period		PHF	0.90
Intersection	KY 348 & US 641	Analysis Year	~~2012~~ 2024	Analysis Period	1> 7:00
File Name	KY 348 & US 641 AM.xus				
Project Description	2024 AM Design Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	390		750	20	970						730	

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	20.0	50.0	35.0	0.0	0.0	0.0	
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	
Red	1.0	1.0	1.0	0.0	0.0	0.0	



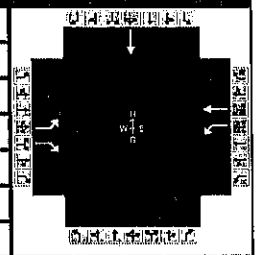
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	6	6	0		4	4
Case Number	1.0	3.0	6.3	6.3	3.0		12.0	12.0
Phase Duration, s	25.0	80.0	55.0	55.0	0.0		40.0	40.0
Change Period, (*Y*+*Rc*), s	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.1	3.1	3.1	0.0		2.9	2.9
Queue Clearance Time (*gs*), s	22.0	61.5	52.0	52.0			37.0	37.0
Green Extension Time (*ge*), s	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00			1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00			1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	433	0	833	22	1078	0	0			0	811	0
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1645	1900	1464	1645	1727	1610	0			1810	1727	1610
Queue Service time (*gs*), s	20.0	0.0	59.5	1.0	50.0	0.0	0.0			0.0	35.0	0.0
Cycle Queue Clearance Time (*gc*), s	20.0	0.0	59.5	1.0	50.0	0.0	0.0			0.0	35.0	0.0
Capacity (*c*), veh/h	334	1187	915	745	720						504	
Volume-to-Capacity Ratio (*X*)	1.297	0.000	0.911	0.030	1.498	0.000	0.000			0.000	1.610	0.000
Available Capacity (*ca*), veh/h	334	1187	915	745	720						504	
Back of Queue (*Q*), veh/ln	21.9	0.0	20.5	0.4	65.8						53.9	
Overflow Queue (*Q3*), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Queue Storage Ratio (*RQ*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Uniform Delay (*d1*), s/veh	39.2	0.0	19.6	20.7	35.0						42.5	
Incremental Delay (*d2*), s/veh	154.0	0.0	12.8	0.0	231.2	0.0	0.0			0.0	283.6	0.0
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
Control Delay (*d*), s/veh	193.2	0.0	32.3	20.7	266.2						326.1	
Level of Service (LOS)	F		C	C	F						F	
Approach Delay, s/veh / LOS	87.4	F		261.2	F		0.0			326.1	F	
Intersection Delay s/veh / LOS	208.5						F					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	A	1.4	A	1.7	A	2.3	B
Bicycle LOS Score / LOS		F	2.3	B			1.8	A

2010 HCS Signalized Intersection Results Summary

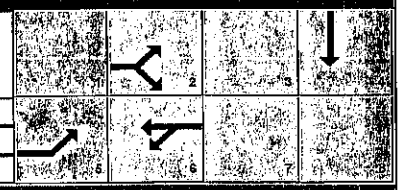
General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	Feb 15, 2012	Area Type	Other
Jurisdiction		Time Period		PHF	0.90
Intersection	KY 348 & US 641	Analysis Year	~~2017~~ 2024	Analysis Period	1> 7:00
File Name	KY 348 & US 641 PM.xus				
Project Description	2024 PM Design Hour				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	410		970	20	750						750	

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	20.0	50.0	35.0	0.0	0.0	0.0	
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	
Red	1.0	1.0	1.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	6	6	0		4	4
Case Number	1.0	3.0	6.3	6.3	3.0		12.0	12.0
Phase Duration, s	25.0	80.0	55.0	55.0	0.0		40.0	40.0
Change Period, (*Y+Rc*), s	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.1	3.1	3.1	0.0		2.9	2.9
Queue Clearance Time (g_s), s	22.0	77.0	52.0	52.0			37.0	37.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00			1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00			1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	456	0	1078	22	833	0	0			0	833	0
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1645	1900	1464	1645	1727	1610	0			1810	1727	1610
Queue Service time (g_s), s	20.0	0.0	75.0	1.0	50.0	0.0	0.0			0.0	35.0	0.0
Cycle Queue Clearance Time (g_c), s	20.0	0.0	75.0	1.0	50.0	0.0	0.0			0.0	35.0	0.0
Capacity (*c*), veh/h	334	1187	915	745	720						504	
Volume-to-Capacity Ratio (*X*)	1.363	0.000	1.178	0.030	1.158	0.000	0.000			0.000	1.654	0.000
Available Capacity (c_a), veh/h	334	1187	915	745	720						504	
Back of Queue (*Q*), veh/ln	24.5	0.0	45.1	0.4	36.8						56.7	
Overflow Queue (Q_3), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Queue Storage Ratio (*RQ*)	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
Uniform Delay (d_1), s/veh	39.2	0.0	22.5	20.7	35.0						42.5	
Incremental Delay (d_2), s/veh	181.7	0.0	91.5	0.0	86.2	0.0	0.0			0.0	303.1	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
Control Delay (*d*), s/veh	220.9	0.0	114.0	20.7	121.2						345.6	
Level of Service (LOS)	F		F	C	F						F	
Approach Delay, s/veh / LOS	145.8		F	118.6		F	0.0			345.6		F
Intersection Delay s/veh / LOS	190.2						F					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.9	A	1.4	A	1.7	A	2.3	B
Bicycle LOS Score / LOS		F	1.9	A			1.9	A

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	JJL
Agency/Co.	Qk4
Date Performed	2/15/2012
Analysis Time Period	Design Hour
Highway	KY 348
From/To	West of US 641
Jurisdiction	KYTC
Analysis Year	2024
Description	

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	6.0	ft	% Trucks and buses	10	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	50	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 1380 veh/h
Opposing direction volume, Vo 1140 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	1.000		1.000	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	1533	pc/h	1267	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access point density, (note-3) fA	2.0	mi/h
Free-flow speed, FFSd	58.0	mi/h
Adjustment for no-passing zones, fnp	0.7	mi/h
Average travel speed, ATSd	35.6	mi/h
Percent Free Flow Speed, PFFS	61.3	%

Percent Time-Spent-Following

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	1533	pc/h	1267	pc/h
Base percent time-spent-following, (note-4) BPTSFd	90.2	%		
Adjustment for no-passing zones, fnp	8.4			
Percent time-spent-following, PTSFd	94.8	%		

Level of Service and Other Performance Measures

West of US 641

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.90	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	3105	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	35.6	mi/h
Percent time-spent-following, PTSFd (from above)	94.8	
Level of service, LOSd (from above)	E	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	JJL
Agency/Co.	Qk4
Date Performed	2/15/2012
Analysis Time Period	Design Hour
Highway	KY 348
From/To	East of Ash
Jurisdiction	KYTC
Analysis Year	2035
Description	

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	6.0	ft	% Trucks and buses	10	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	50	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 1010 veh/h
Opposing direction volume, Vo 930 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	1.000		1.000	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	1122	pc/h	1033	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access point density, (note-3) fA	2.0	mi/h
Free-flow speed, FFSd	58.0	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h
Average travel speed, ATSd	40.5	mi/h
Percent Free Flow Speed, PFFS	69.9	%

Percent Time-Spent-Following

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	1122	pc/h	1033	pc/h
Base percent time-spent-following, (note-4) BPTSFd	81.3	%		
Adjustment for no-passing zones, fnp	14.5			
Percent time-spent-following, PTSFd	88.8	%		

Level of Service and Other Performance Measures

East of Ash ☆

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.70	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	3073	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	40.5	mi/h
Percent time-spent-following, PTSFd (from above)	88.8	
Level of service, LOSd (from above)	E	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	JJL
Agency/Co.	Qk4
Date Performed	2/15/2012
Analysis Time Period	Design Hour
Highway	KY 348
From/To	West of Ash
Jurisdiction	KYTC
Analysis Year	2035
Description	

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	6.0	ft	% Trucks and buses	10	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	50	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 700 veh/h
Opposing direction volume, Vo 550 veh/h

Average Travel Speed

Direction		Analysis (d)		Opposing (o)	
PCE for trucks, ET		1.1		1.1	
PCE for RVs, ER		1.0		1.0	
Heavy-vehicle adj. factor, (note-5)	fHV	0.990		0.990	
Grade adj. factor, (note-1)	fg	1.00		1.00	
Directional flow rate, (note-2)	vi	786	pc/h	617	pc/h

Free-Flow Speed from Field Measurement:			
Field measured speed, (note-3)	S FM	-	mi/h
Observed total demand, (note-3)	V	-	veh/h
Estimated Free-Flow Speed:			
Base free-flow speed, (note-3)	BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3)	fLS	0.0	mi/h
Adj. for access point density, (note-3)	fA	2.0	mi/h
Free-flow speed, FFSd		58.0	mi/h
Adjustment for no-passing zones, fnp		1.4	mi/h
Average travel speed, ATSd		45.7	mi/h
Percent Free Flow Speed, PFFS		78.9	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	778	pc/h	611	pc/h
Base percent time-spent-following, (note-4) BPTSFd	66.7	%		
Adjustment for no-passing zones, fnp	24.5			
Percent time-spent-following, PTSFd	80.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.46	West of Ash St
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	3034	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	45.7	mi/h
Percent time-spent-following, PTSFd (from above)	80.4	
Level of service, LOSd (from above)	E	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

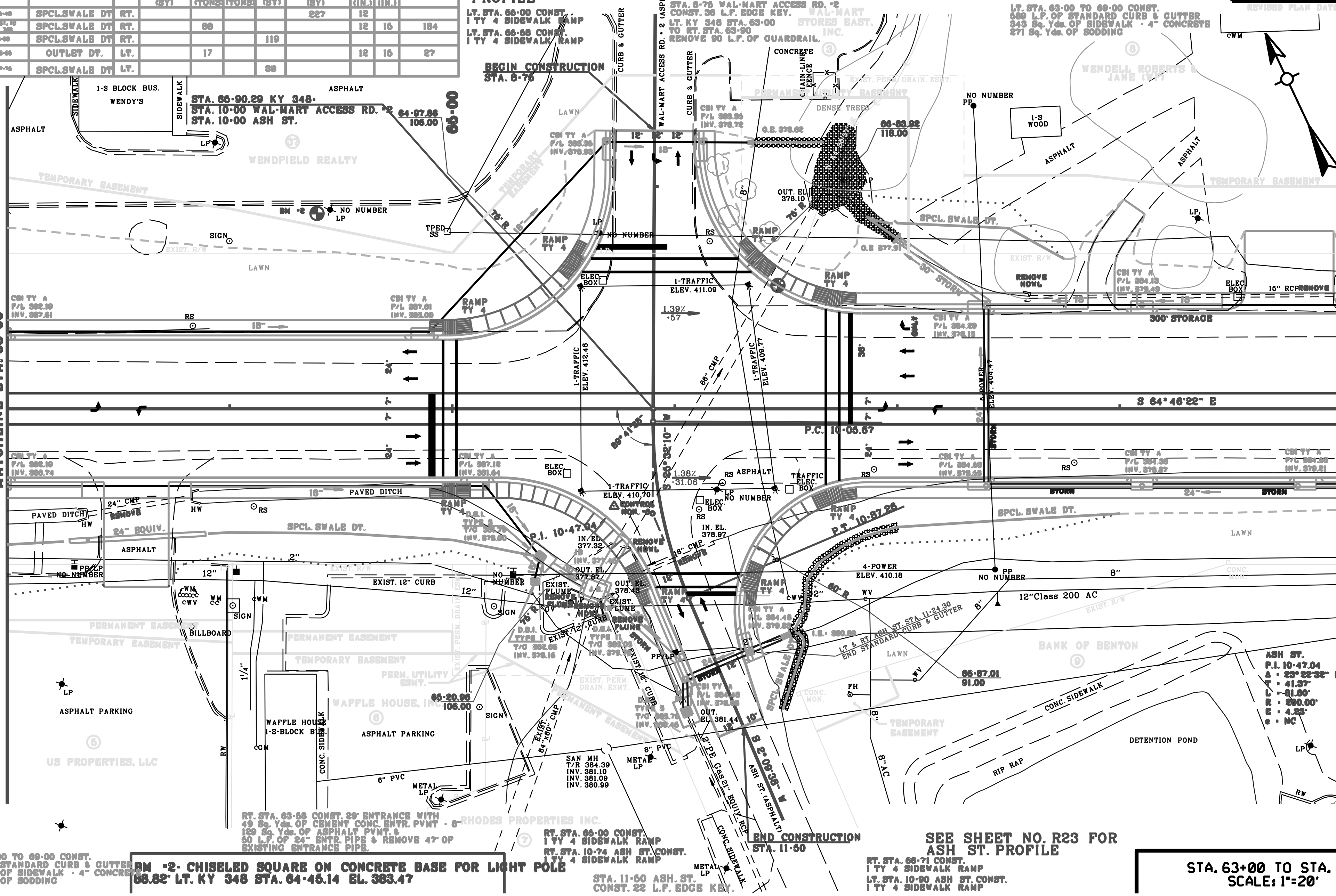
Bicycle Level of Service

STA. TO STA.	TYPE	LOC	EROSION CONTROL BLANKET (SY)	CHANNEL LINING CL II (TONS)	CHANNEL LINING CL III (TONS)	CHANNEL LINING SOD (SY)	CHANNEL LINING SYNTHETIC MAT (SY)	D (IN.)	T (IN.)	GEOTEXILE FABRIC (TYPE I)
63-00 TO 65-40	SPCL.SWALE DT	RT.					227	12		
11-50 LT. ASH ST. TO 67-[illegible] RT. KY 348	SPCL.SWALE DT	RT.		80				12	15	184
67-00 TO 68-00	SPCL.SWALE DT	RT.				119				
66-35 TO 66-65	OUTLET DT.	LT.		17				12	15	27
66-85 TO 67-25	SPCL.SWALE DT	LT.				80				

SEE SHEET NO. R23 FOR WAL-MART ACCESS RD. 2 PROFILE

COUNTY OF	ITEM NO.	SHEET NO.
MARSHALL	1-8002.00	R8

REVISED PLAN DATE: JULY 10, 2007



SEE SHEET NO. R23 FOR ASH ST. PROFILE

BM 2 CHISELED SQUARE ON CONCRETE BASE FOR LIGHT POLE 56.82' LT. KY 348 STA. 64+46.14 EL. 383.47

STA. 63+00 TO STA. 69+00
SCALE: 1"=20'

Kentucky Traffic Counts

Route: KY 348 **Street:**

From MP: 7.448 **At:** JULIAN M CARROLL PARKWAY

To MP: 8.325 **At:** US 641 (MAIN STREET)

District: 1
County: MARSHALL
City: BENTON

Last Actual Count:
13,252 **in** 2008

Station ID: A02 **Station Cnty:** MARSHALL

Station Type: Full Coverage

Functional Class: RURAL - Principal Arterial

New Road Year:
Impact Year:

Year	Count	Type
2011	13,500	Computer Estimate
2010	13,300	Computer Estimate
2009		
2008	13,300	Actual Count
2007		
2006		
2005	10,000	Actual Count
2004		
2003	10,500	Actual Count
2002		
2001		
2000	10,500	Actual Count
1999		
1998		
1997		
1996		
1995		
1994		
1993		
1992	4,450	Actual Count
1991		
1990		
1989		
1988		
1987		
1986	3,110	Actual Count
1985		
1984		
1983		
1982	2,330	Actual Count
1981		
1980		
1979		
1978		
1977		
1976		
1975		
1974		
1973	2,110	Actual Count
1972		
1971		

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst
Agency/Co.
Date Performed 2/15/2012
Analysis Time Period
Highway
From/To
Jurisdiction
Analysis Year
Description

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.90	
Shoulder width	4.0	ft	% Trucks and buses	10	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	0.0	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	30	%
Up/down	-	%	Access point density	8	/mi

Analysis direction volume, Vd 1380 veh/h
Opposing direction volume, Vo 920 veh/h

2300 vehicles per hour total

≈ 23,000 ADT

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	1.000		1.000	
Grade adj. factor, (note-1) fg	1.00		1.00	
Directional flow rate, (note-2) vi	1533	pc/h	1022	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, (note-3) S FM	-	mi/h
Observed total demand, (note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	60.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	1.3	mi/h
Adj. for access point density, (note-3) fA	2.0	mi/h
Free-flow speed, FFSd	56.7	mi/h
Adjustment for no-passing zones, fnp	0.6	mi/h
Average travel speed, ATSd	36.3	mi/h
Percent Free Flow Speed, PFFS	64.0	%

Percent Time-Spent-Following

Direction	Analysis (d)	Opposing (o)
PCE for trucks, ET	1.0	1.0
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	1.000	1.000
Grade adjustment factor, (note-1) fg	1.00	1.00
Directional flow rate, (note-2) vi	1533 pc/h	1022 pc/h
Base percent time-spent-following, (note-4) BPTSFd	88.8 %	
Adjustment for no-passing zones, fnp	8.6	
Percent time-spent-following, PTSFd	94.0 %	

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.90	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h
Capacity from ATS, CdATS	1700	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	2833	veh/h

v/c threshold for rural areas

Passing Lane Analysis

Total length of analysis segment, Lt	0.0	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	36.3	mi/h
Percent time-spent-following, PTSFd (from above)	94.0	
Level of service, LOSd (from above)	E	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	-	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

VALUE ENGINEERING PROPOSAL ET-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: **Install non-mountable median on KY 348**

FUNCTION: **Eliminate Turns**

BASELINE ASSUMPTION:

The current project calls for a five-lane section with a 14-foot two-way left turn lane (TWLTL).

PROPOSED ALTERNATIVE:

Replace the TWLTL with a non-mountable median with openings in the raised median only at select locations such as an intersection with a roundabout or a traffic signal. The best combination is using a raised median with roundabouts. The raised median prohibits mid-block left turns. U-turns can be accommodated at the roundabouts. Signals or other median openings allow U-turns but it is more difficult and less safe than a roundabout U-turn.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 335,000	$ -	$ 335,000
TOTAL (Baseline less Proposed)	$ (335,000)	$ -	**$ (335,000)**
			COST

VALUE ENGINEERING PROPOSAL ET-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE:	Install non-mountable median on KY 348
BENEFITS	**RISKS/CHALLENGES**
• Eliminates mid-block left turns	• Increases construction costs
• Eliminates most cross over crash types.	• Perceived as a dis-benefit to abutting property owners
• Allows median landscaping to present a gateway entering the commercial area	• By eliminating mid-block left turns, reduces the convenience of left turns into property
• Reduces congestion caused by left turn movements	• Places a 6 inch "object" within the roadway
• Reduces the likelihood of severe crashes related to making left turns on a 45 mph highway	• May change drainage flows at certain locations
• Reduces mid-block crashes, in the range of 50%	•
• Directs full movement access at well designed median openings or traffic signals with dedicated turn lanes	•
• Reduces the likelihood of head on crashes that would happen within a TWLTL	•
•	•
•	•
•	•

VALUE ENGINEERING PROPOSAL ET-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install non-mountable median on KY 348

DISCUSSION/JUSTIFICATION:

As much as 75% of all crashes along an open highway are related to left turns. A restrictive median prevents mid-block left turns and directs turning traffic to better designed intersections. In the research of TWLTLs, roadway speeds above 35 mph are not recommended. This creates a faster entry into the TWLTL and increased likelihood of a head-on crash with another vehicle entering the TWLTL from the opposite direction. A TWLTL is safer when the highway is only two through lanes. The widening to a four-lane highway is likely to increase the crash rate in the corridor relative to left turns to and from the TWLTL.

Vehicles slowing in through lanes to enter the TWLTL reduce the capacity and safety of the inside through lane.

The safety of each mid-block driveway is increased. Difficulties created by turning movements from driveways on the opposite side of the roadway.

IMPLEMENTATION CONSIDERATIONS:

The non-mountable median will work best in combination with roundabouts, especially if the highway cross section is two through lanes.

VALUE ENGINEERING PROPOSAL ET-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install non-mountable median on KY 348

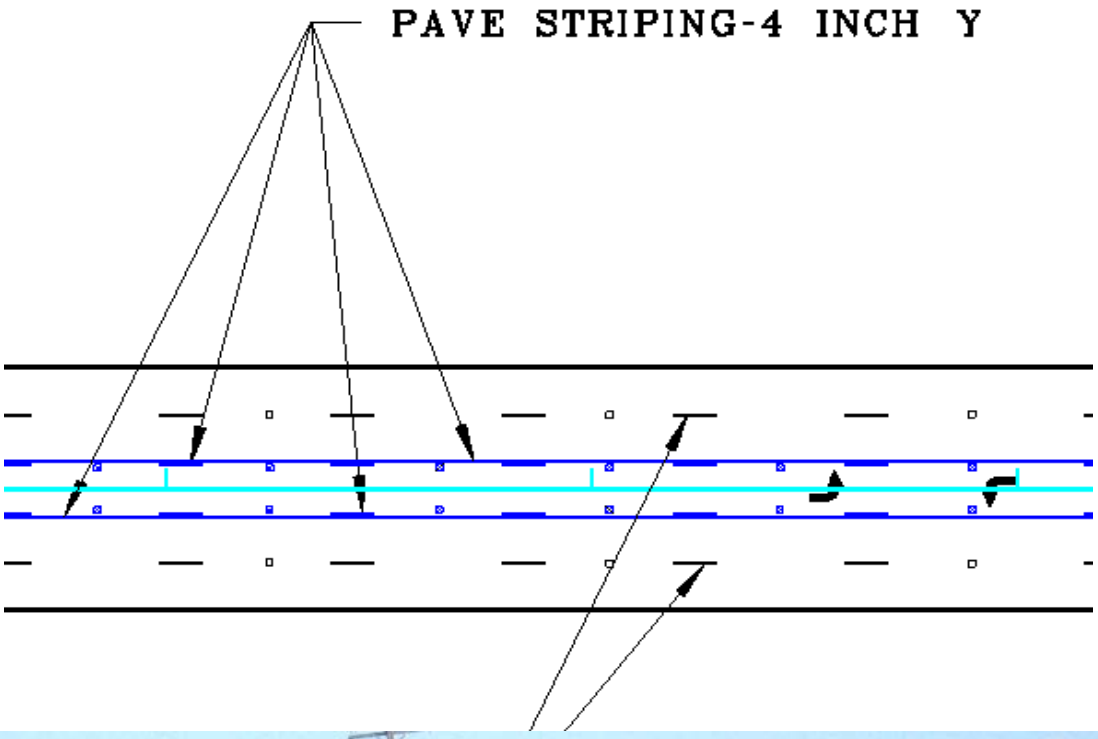
DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
16' wide, raised median with curbs and asphalt		LS				1	335,200.00	335,200
TOTAL COSTS*								**335,000**
							TOTAL (BASELINE LESS PROPOSED)	**(335,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

TITLE: Install non-mountable median on KY 348

BASELINE



VALUE ENGINEERING PROPOSAL ET-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install non-mountable median on KY 348

PROPOSED SKETCH

MEDIAN BETWEEN ROUNDABOUTS. KY 348 is proposed as 16 ft wide with asphalt cover

VALUE ENGINEERING PROPOSAL ET-09

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Install roundabouts at all major intersections**

FUNCTION: **Eliminate Turns**

BASELINE ASSUMPTION:

The current proposal calls for a typical five-lane section with two lanes in each direction and a painted 14' two-way left turn lane (TWLTL). Left turns are allowed almost anywhere. When traffic signal warrants are met along the project, traffic signals are the assumed intersection traffic control. The speed limit in the commercial area is 45 mph.

PROPOSED ALTERNATIVE:

Instead of using traffic signals for intersection control, consider roundabouts. Based on current conditions, up to six single lane roundabouts could be installed between Symsonia (hospital access) and US 641. This includes Symsonia, west ramp, east ramp intersection, Ash St./Wal-Mart, Commerce Boulevard (new signal in progress) and the junction of US 641.

As a result, KY 348 would only need to be two travel lanes. Pavement cross section of KY 348 would be about 36 feet including two twelve-foot lanes and a raised median.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 769,000	$ 2,232,000	$ 3,001,000
PROPOSED ALTERNATIVE:	$ 304,000	$ -	$ 304,000
TOTAL (Baseline less Proposed)	$ 465,000	$ 2,232,000	**$ 2,697,000**
			SAVINGS

TITLE: Install roundabouts at all major intersections

BENEFITS	RISKS/CHALLENGES
• Eliminates left turns at the intersection	• Not a common intersection control design for this area
• Supports the installation of a raised median between full movement intersections	• Requires additional ROW at some locations to accommodate the circular
• Decreases total crashes by 40-60%, injury crashes by 60 to 90% and fatal crashes by 80 to 95%.	• Will need to be properly designed prior to letting the project to construction
• Reduces rural speeds to 35 mph between roundabouts creating an environment more supportive of economic development	• Will cost very little additional at time of KY 348 reconstruction but will be much more expensive if installed independently of a roadway project
• Lower speeds allow lower design criteria, based on a lower design speed	• Educating the public about roundabouts
• Eliminates the need to install left turn lanes	•
• Allows highway cross section to be two lanes with raised median, not five-lane road	•
• A single lane roundabout should be sufficient to handle KY 348 traffic to year 2035	•
• No traffic signal hardware and structures are necessary	•
• Roundabouts can provide a transition area between high-speed rural and lower-speed urban environments.	•
• Typically, lower operating and maintenance costs than a traffic signal due to the lack of technical hardware, signal timing equipment and electricity needs	•
• Allows safer U-turns	•
• Reduces the amount of widening needed on the approaches in comparison to alternative intersection forms	•
• Reduces the number of conflict points	•
• Eliminates the need for a traffic signal and the costs associated with signal equipment and maintenance	•

VALUE ENGINEERING PROPOSAL ET-09

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install roundabouts at all major intersections

DISCUSSION/JUSTIFICATION:

Roundabouts are proving to be a very successful intersection traffic control strategy. Both FHWA and ITE are strongly supporting their use. Roundabouts have been successful at many locations that are similar to conditions on KY 348. Analysis shows that a single lane roundabout will have adequate capacity (LOS C or better) at the Wal-Mart driveway. A series of roundabouts will allow a raised median to be installed between the roundabouts. The roundabouts will accommodate U-turns. Traffic signals have three to six times the crash history, including seven to nine times the severe injury rate compared to traffic signals. Roundabouts will improve traffic safety in the community by reducing crashes.

Safety Performance: The most comprehensive and recent study showed overall reductions of 35 percent in total crashes and 76 percent in injury crashes. Severe, incapacitating injuries and fatalities are rare, with one study reporting 89-percent reduction in these types of crashes and another reporting 100-percent reduction in fatalities [from FHWA safety publication].

Operational Performance: When operating within their capacity, roundabouts typically have lower overall delay than signalized and all-way stop-controlled intersections. The delay reduction is often most significant during non-peak traffic periods. These performance benefits can often result in reduced lane requirements between intersections. When used at the terminals of freeway interchanges, roundabouts can often reduce width requirements for bridges over or under the freeway, thus substantially reducing construction costs and allowing the existing bridge to remain in place (FHWA).

IMPLEMENTATION CONSIDERATIONS:

An experienced roundabout designer will be necessary.

At four intersections, a small amount of additional ROW will be necessary. There may be a need to add width for slope easements.

A multi-lane roundabout is not necessary to accommodate 2035 traffic, therefore a two-lane highway with non-mountable median can be built rather that a five-lane.

Works best with the addition of a raised median between roundabouts.

A very large cost savings occurs by putting a roundabout at each ramp intersection. This makes it feasible to retain a three-lane section across the bridge and not install traffic signals. Traffic signals will require additional width and it is assumed that a combination of growing through traffic and turning traffic will necessitate the replacement of the bridge. It is likely that the continuing development of the new hospital area will increase bridge traffic.

A single lane roundabout with outside sidewalk and utility strip (10-feet) is assumed to be 170 feet in diameter. Existing ROW is normally at 140 feet.

It would be much cheaper to build all six when and where KY 348 is reconstructed. Alternative cost analysis from other projects indicate that there is very little cost difference to construct a roundabout compared to a signalized intersection when the entire roadway is being reconstructed as part of the project.

It is assumed that the roundabouts would be single lane. Capacity analysis indicates that a multi-lane roundabout would have excessive capacity, which is undesirable, leading to higher speeds and higher crash rates.

KY 348 would only need to be two lanes as well. The cross section of KY 348 would be about 36 feet including two twelve ft lanes with a raised median.

Roundabouts at the ramps would be a significant long-term cost savings.

While thorough research on life-cycle costs comparing signals to roundabouts has not been complete nationally, it is generally acknowledged that avoiding the equipment costs of traffic signals, repair and maintenance by the installation of a roundabout is a life-cycle cost benefit in favor of roundabouts.

VALUE ENGINEERING PROPOSAL ET-09

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install roundabouts at all major intersections

DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Right-of-way at Wal-Mart/Ash		SF		4.60		3000	4.60	13,800
Right-of-way at Commerce		SF		4.60		3000	4.60	13,800
Right-of-way at 641, not needed		SF						
Right-of-way at E ramp, not needed								
Right-of-way at W ramp, not needed								
Right-of-way at Symsonia		SF		4.60		3000	4.60	13,800
Asphalt pavement		SY	12300	50.00	615,000	4200	50.00	210,000
Miscellaneous - 25% includes utility and right-of-way easement reductions		LS	1	153,750.00	153,750	1	52,500.00	52,500
TOTAL COSTS*					**769,000**			**304,000**
							TOTAL (BASELINE LESS PROPOSED)	**465,000**

*Note: Total Costs are rounded to nearest thousand dollars

SAVINGS

VALUE ENGINEERING PROPOSAL ET-09

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

RH & Associates, Inc.

TITLE:	Install roundabouts at all major intersections

Assumptions			
Interest/Discount Rate(%):	3%	**Economic Life (yrs):**	20

LIFE CYCLE COST ANALYSIS

Salvage & Replacement Costs			**Baseline Assumption**		**Proposed Alterative**	
Item	**Description**	**Yr**	**Est Cost**	**Pres Worth**	**Est Cost**	**Pres Worth**
1	Bridge replacement in 2022	10	3,000,000	2,232,282		
2						
3						
4						
5						
Total Salvage & Replacement Costs			**3,000,000**	**2,232,282**		

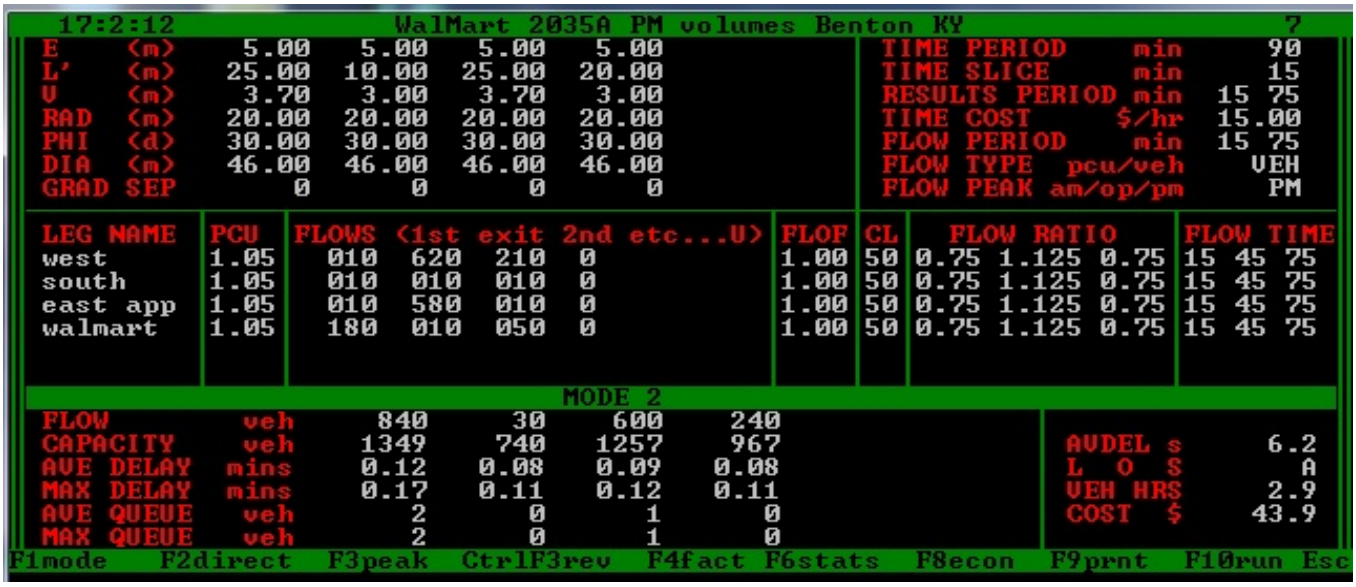
Annual Costs (pres worth calculated over 20 yr		**Baseline Assumption**		**Proposed Alternative**	
Item	**Description**	**Est Cost**	**Pres Worth**	**Est Cost**	**Pres Worth**
1					
2					
3					
4					
5					
Total Annual Costs					

SUMMARY	**Baseline Present Worth**	**Proposed Present Worth**
Total Present Worth (salvage+annual pres worth)	2,232,000	
RESULTS (Proposed less baseline)		

Notes: 1) Total Present Worth is rounded to the nearest thousand dollars, 2) Initial costs are covered in the Detail sheet.

TITLE: Install roundabouts at all major intersections

RODEL Analysis



17:2:12 WalMart 2035A PM volumes Benton KY 7

E (m)	5.00	5.00	5.00	5.00	TIME PERIOD min		90
L' (m)	25.00	10.00	25.00	20.00	TIME SLICE min		15
V (m)	3.70	3.00	3.70	3.00	RESULTS PERIOD min		15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST $/hr		15.00
PHI (d)	30.00	30.00	30.00	30.00	FLOW PERIOD min		15 75
DIA (m)	46.00	46.00	46.00	46.00	FLOW TYPE pcu/veh		VEH
GRAD SEP	0	0	0	0	FLOW PEAK am/op/pm		PM

LEG NAME	PCU	FLOWS (1st exit	2nd	etc...U)	FLOF	CL	FLOW RATIO	FLOW TIME
west	1.05	010	620	210 0	1.00	50	0.75 1.125 0.75	15 45 75
south	1.05	010	010	010 0	1.00	50	0.75 1.125 0.75	15 45 75
east app	1.05	010	580	010 0	1.00	50	0.75 1.125 0.75	15 45 75
walmart	1.05	180	010	050 0	1.00	50	0.75 1.125 0.75	15 45 75

MODE 2

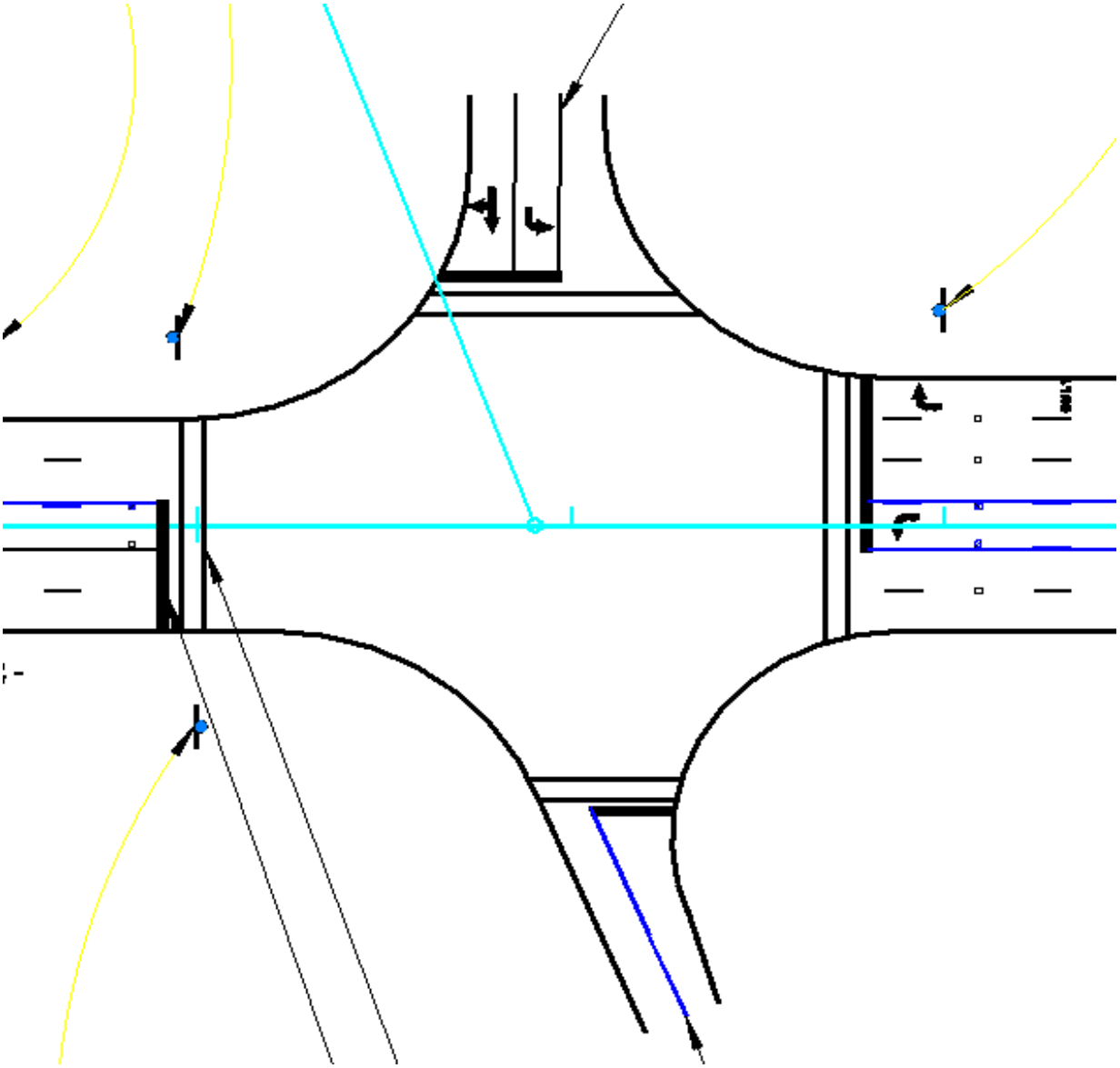
FLOW	veh	840	30	600	240		
CAPACITY	veh	1349	740	1257	967		
AVE DELAY	mins	0.12	0.08	0.09	0.08	AVDEL s	6.2
MAX DELAY	mins	0.17	0.11	0.12	0.11	L O S	A
AVE QUEUE	veh	2	0	1	0	VEH HRS	2.9
MAX QUEUE	veh	2	0	1	0	COST $	43.9

F1mode F2direct F3peak CtrlF3rev F4fact F6stats F8econ F9prnt F10run Esc

TITLE: Install roundabouts at all major intersections

BASELINE SKETCH

SKETCH OF TYPICAL FULL MOVEMENT INTERSECTION KY348 AT WAL-MART



TITLE: Install roundabouts at all major intersections

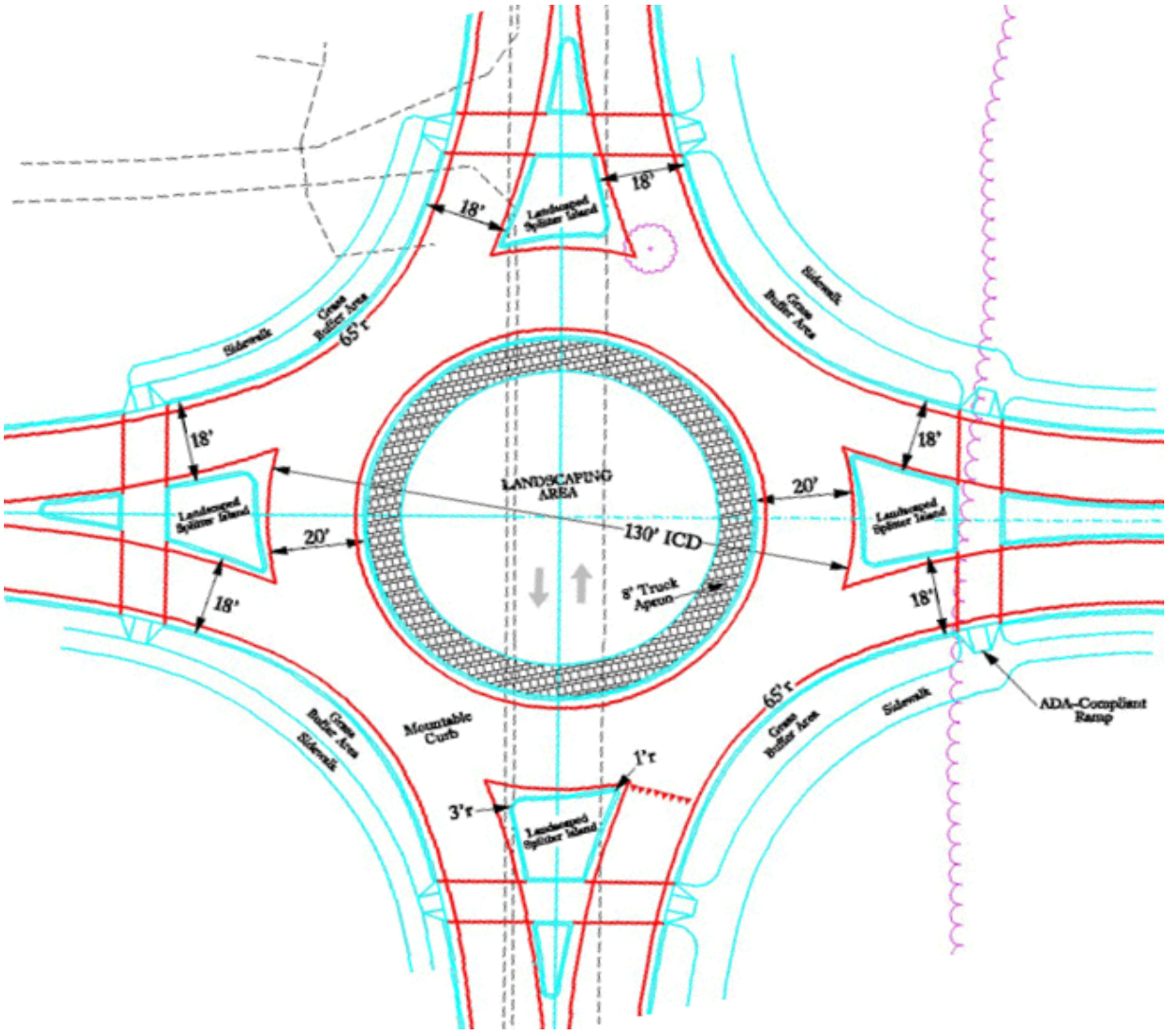
BASELINE SKETCH

Photo of existing conditions that use regular traffic signals

TITLE: Install roundabouts at all major intersections

PROPOSED SKETCH

SKETCH OF TYPICAL ROUNDABOUT ALTERNATIVE
(Not to KY 348 Scale)



TITLE: Install roundabouts at all major intersections

PROPOSED SKETCH

SKETCH OF TYPICAL ROUNDABOUT ALTERNATIVE

VALUE ENGINEERING PROPOSAL ET-09

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install roundabouts at all major intersections

PROPOSED SKETCH

Illustration of four roundabouts in series in commerical strip

TITLE: Install roundabouts at all major intersections

PROPOSED SKETCH

Illustration of seven roundabouts in a mixed use area, (Kansas)

VALUE ENGINEERING PROPOSAL IO-01

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Add right turn lanes instead of widening to 5 lanes**

FUNCTION: **Improve Operations**

BASELINE ASSUMPTION:

KY 348 from the Julian Carroll Purchase Parkway to US 641 is proposed as a five-lane urban curb and gutter typical section with added right turn lanes at critical locations.

PROPOSED ALTERNATIVE:

The existing KY 348 from the Julian Carroll Purchase Parkway to US 641 consists of a three-lane rural typical section. As seen in the traffic analysis justifications in EW-02, a three-lane section meets the design year traffic warrants.

Existing KY 348 has a two-way left turn lane (TWLTL) to accommodate left turning vehicles. However, through movements and right turning vehicles share a lane in each direction. By providing right turn lanes at critical locations throughout the project, vehicles can enter and leave KY 348 allowing for better traffic flow for both through traffic and right turning vehicles.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 929,000	$ -	$ 929,000
PROPOSED ALTERNATIVE:	$ 263,000	$ -	$ 263,000
TOTAL (Baseline less Proposed)	$ 666,000	$ -	**$ 666,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL IO-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE:	Add right turn lanes instead of widening to 5 lanes
BENEFITS	**RISKS/CHALLENGES**
• Reduces construction costs	• Traffic volumes in the future may grow beyond projected rates and require a five-lane typical section
• Reduces right-of-way costs	• A five-lane section has been looked at for a number of years and the public expectation is that when the roadway is improved, it will be five lanes
• Reduces utility costs	•
• Allow for separating right turning traffic from through movements	•
• Greater operational characteristics at traffic signals allowing more vehicles through the intersection during green time	•
•	•
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•	•

VALUE ENGINEERING PROPOSAL IO-01

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Add right turn lanes instead of widening to 5 lanes

DISCUSSION/JUSTIFICATION:

By separating the right turning movements from the through movements, KY 348 will have improved operational characteristics. Right turning movements generally slow down their turns producing slowdowns and backups in the through lanes. This improvement will allow more through vehicles through intersections.

In addition to providing right turn lanes at intersections, right turn acceleration lanes may need to be considered at critical intersection points.

This alterative would keep a rural three-lane section and add right turn lanes at critical locations.

For estimation purposes, we have identified the following locations for right turn lanes within the existing project limits:
Left and Right Sides at Armory Drive - Total of 600 lineal ft x 12' lane width
Left and Right Sides at Ash Street - Total of 850 lineal ft x 12' lane width
Right Side at Postal Drive - 300 lineal ft x 12' lane width
Right Side at Commerce Boulevard - 300 lineal ft x 12' lane width
Left Side at Beechwood Lane - 300 lineal ft x 12' lane width
Left and Right Sides at US 641 - Total of 800 lineal ft x 12' lane width

IMPLEMENTATION CONSIDERATIONS:

To evaluate using right turn lanes on KY 348, the following implementation considerations must be given:

Identify critical intersections with a high number of right turners or locations where the combined through / right turn movements are reaching capacity and it makes sense to separate the movements.

VALUE ENGINEERING PROPOSAL IO-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Add right turn lanes instead of widening to 5 lanes

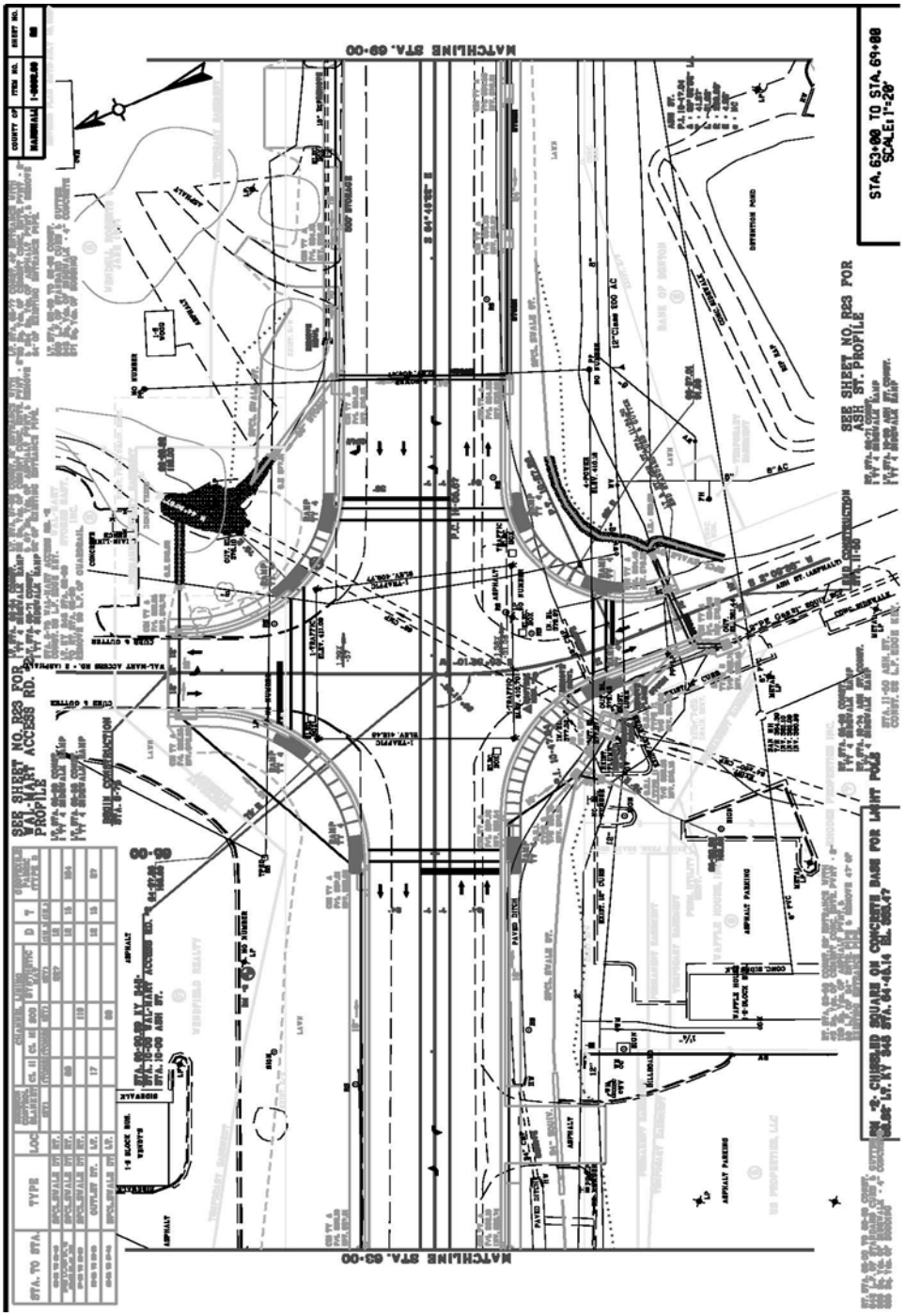
DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement - outside of existing three lane		SY	12300	50.00	615,000	4200	50.00	210,000
Curb and gutter		LF	7547	16.98	128,148			
Misc. - Const. / right-of-way / utilities - 25%		LS	1	185,787.02	185,787	1	52,500.00	52,500
TOTAL COSTS*					**929,000**			**263,000**
							TOTAL (BASELINE LESS PROPOSED)	**666,000**

*Note: Total Costs are rounded to nearest thousand dollars

SAVINGS

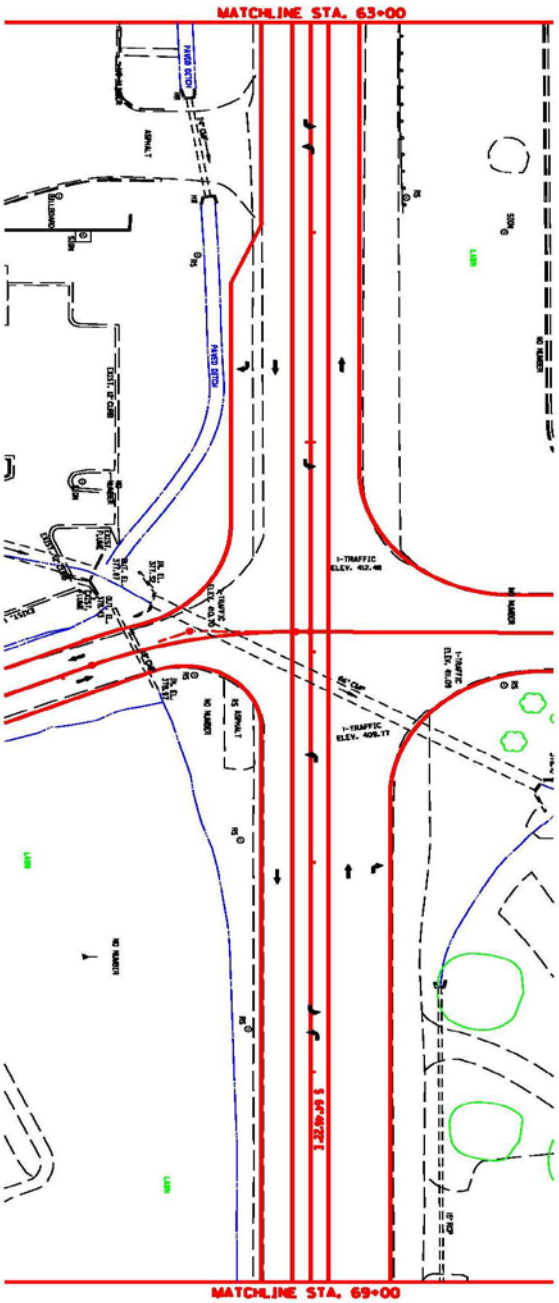
TITLE: Add right turn lanes instead of widening to 5 lanes

SKETCH OF BASELINE ASSUMPTION



TITLE: Add right turn lanes instead of widening to 5 lanes

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL IO-04

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Develop access management plan and MOU (memorandum of understanding)**

FUNCTION: **Improve Operations**

BASELINE ASSUMPTION:

The project is being designed using by-permit access control.

PROPOSED ALTERNATIVE:

Develop a long-term access management plan to identify current and future access points, signal locations and median openings. Develop a memorandum of understanding (MOU) between KYTC and local government to adopt the plan and process for modification.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 20,000	$ -	$ 20,000
TOTAL (Baseline less Proposed)	$ (20,000)	$ -	**$ (20,000)**

COST

TITLE:	Develop access management plan and MOU (memorandum of understanding)
BENEFITS	**RISKS/CHALLENGES**
• Protects long-term access and corridor functionality	• Creating understanding for the need of a MOU with local government
• Reduces the through and left-turn conflicts throughout the corridor	•
• Predictable permit decision-making	•
• Improves accessibility for local businesses	•
• Improves long-term functionality of the interchange	•
• Improves signal coordination	•
•	•
•	•
•	•
•	•
•	•

TITLE: Develop access management plan and MOU

DISCUSSION/JUSTIFICATION:

The main reason for reconstructing KY 348 is to improve traffic flow from the interchange to US 641. The corridor has significant commercial development but has a lot of opportunities to grow more. In fact, with Wal-Mart and the hospital currently serving as anchors for the area and adding I-69, it is likely to be the primary growth corridor for Benton. With growth will come pressure to gain additional access to KY 348 and possibly add traffic signals. Additional access and traffic signals will negatively impact traffic flow and be detrimental to business development.

To protect this function of the primary arterial, access should be planned and managed. This means minimizing conflict points and traffic signals that create delays and potential crash locations. To maintain this design and control future access, it is important to having a binding agreement between the state, planning and zoning commission, city and county in the form of a MOU. This agreement would include a plan that identifies current and future access locations, signal locations and median openings (should a median be implemented). There are several examples of this type of access management MOU done in Kentucky, which can be obtained on the Congestion Toolbox webpage.

One of the best ways to control or manage access is limit the number of median openings and control the design of median openings. Certain median designs eliminate movements, such as left turns or through from the access point in order to remove the potential for t-bone crashes.

Access points should be minimized to reduce conflict points, where possible. Redundant driveways should be closed. Cross-access, between parcels, agreements should be developed to allow for local travel to occur without using the main highway, KY 348.

IMPLEMENTATION CONSIDERATIONS:

Consensus will need to be reached between KYTC and local officials on the need and then the specifics within the plan. Training about how access management is good for business will need to be done. Ideally, the plan should be developed before ROW offers are made.

VALUE ENGINEERING PROPOSAL IO-04

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Develop access management plan and MOU (memorandum of understanding)							
DESIGN ELEMENT	**Markup**	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Access Management Plan/MOU		LS				1	20,000.00	20,000
TOTAL COSTS*								**20,000**
							TOTAL (BASELINE LESS PROPOSED)	**(20,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

VALUE ENGINEERING PROPOSAL IO-05

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: **Reduce the speed limit, change the breaking point**

FUNCTION: **Improve Operations**

BASELINE ASSUMPTION:

Signing plans propose the following speed limits for KY 348:

55 mph - West of interchange and project to intersection of KY 358/Armory Dr./Wal-Mart Access Rd. #1

45 mph - Intersection of KY 358/Armory Dr./Wal-Mart Access Rd. #1 to east of Beechwood Lane

35 mph - East of Beechwood Lane to end of project

PROPOSED ALTERNATIVE:

In order to improve operations and safety, modify the step-down speed limit on KY 348 from 55 mph to 45, and then from 45 mph to 35 mph as follows:

45 mph - As traffic approaches from the west on KY 348, transition from 55 mph to 45 mph prior to the entrance to the Marshall County Hospital at Old Symsonia Road.

35 mph - Transition from 45 mph to 35 mph along KY 348 between Armory Drive/Wal-Mart Access Road #1 and Ash St/Wal-Mart Access Road #2.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ -	$ -	$ -
TOTAL (Baseline less Proposed)	$ -	$ -	**$ -**

NO CHANGE

VALUE ENGINEERING PROPOSAL IO-05

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Reduce the speed limit, change the breaking point
BENEFITS	**RISKS/CHALLENGES**
• Safer operating speeds through the interchange and ramp terminals	• Difficulty enforcing changing speeds
• Safer operating speeds at Old Symsonia Road / KY 348 intersection where hospital traffic is increasing	• Failure to reduced speeds decreases safety and increases severity of accidents
• Minimal potential additional costs and design modifications	• Existing and proposed roadway geometry does not inherently limit speeds in the absence of other traffic calming techniques
• Decreases risk of accident severity without decreasing level of operations	•
• Turning movements have more time to clear through traffic	•
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VALUE ENGINEERING PROPOSAL IO-05

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Reduce the speed limit, change the breaking point

DISCUSSION/JUSTIFICATION:

Theoretically, there would be a slight increase with travel times when slower speeds are introduced. However, since this is a relatively short project and capacity is not reached in the design year, any increase in travel time would be negligible.

With the additional traffic accessing the hospital west of the interchange, a decrease in travel speed would be a distinct safety improvement for the traffic entering and exiting Old Symsonia Road. The speed reduction would also occur when traffic is approaching the interchange ramp terminals as well as the urban typical section to the east of the interchange. Basically, the speed reduction to 45 mph beginning at Old Symsonia Road is a good indicator of transitioning roadside characteristics to a more urban environment.

While there is no calculated cost savings for modification of the signed speed limits, there could be potential cost savings in right-of-way, utility relocation and construction cost if the lane widths are reduced to 11'. Another potential benefit of reducing lane widths could be to include bike lanes within the roadway. Bike lanes would not decrease construction costs but would obviously provide space outside of the vehicle lanes for bicyclists.

IMPLEMENTATION CONSIDERATIONS:

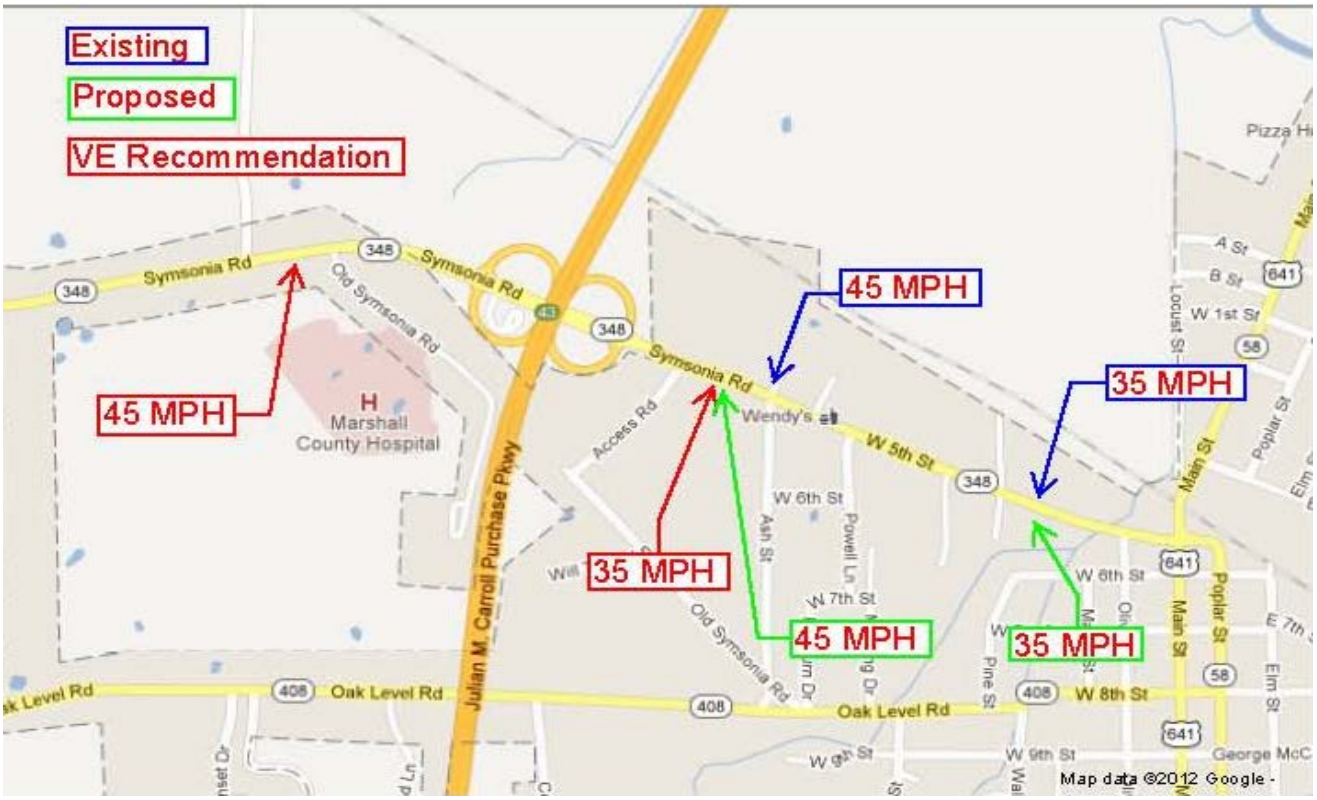
The existing and proposed roadway geometry does not limit speeds below 55 mph in the absence of other traffic calming techniques. In other words, drivers are not going to slow down just because a regulatory sign indicating a slower speed ahead. Reducing speeds on KY 348 at Old Symsonia Road could also dovetail with other VE Proposals to widen KY 348 to three lanes west of the interchange and to add a left turn lane on KY 348 to Old Symsonia Road.

Consider traffic calming techniques to encourage slower speeds, such as reducing lane widths to 11'. Also consider the inclusion of roundabouts. For example, a roundabout at the intersection of KY 358 and Ash St./Wal-Mart Access Rd. #2 could not only provide improved operations at the intersection but also result in reduced speeds for traffic east and west of the roundabout. Also, roundabouts at the ramp terminals at the interchange would decrease speeds and improve safety along KY 348.

Reducing speeds along a developed corridor also could be more palatable to the businesses along the route. Owners generally accept lower through speeds along their frontage as a means to increase business traffic.

TITLE: Reduce the speed limit, change the breaking point

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL AP-01

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	**Extend the sidewalk across the bridge**
FUNCTION:	**Accommodate Pedestrians**

BASELINE ASSUMPTION:

The sidewalks begin at the intersection of Armory Drive. To the east, the cross section has no curb and gutter and no sidewalks.

PROPOSED ALTERNATIVE:

Extend the sidewalk through the interchange to the Symsonia Drive (hospital entrance).

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 138,000	$ -	$ 138,000
TOTAL (Baseline less Proposed)	$ (138,000)	$ -	**$ (138,000)**
			COST

VALUE ENGINEERING PROPOSAL AP-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE:	Extend the sidewalk across the bridge
BENEFITS	**RISKS/CHALLENGES**
• Provides safe access for pedestrians traveling to the west of the interchange	• Adds construction cost
•	• Must accommodate drainage
•	• Must be coordinated in the typical section
•	• Pedestrian crossings occur at unsignalized ramps
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VALUE ENGINEERING PROPOSAL AP-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend the sidewalk across the bridge

DISCUSSION/JUSTIFICATION:

A hospital has been built on the west side of the interchange. It is also likely, based on other similar locations around the state that have built new hospitals, that ancillary medical offices and other commercial development will be built nearby. There is a need to connect the residences of Benton and downtown to the commercial area with a safe pedestrian facility. This is important for both patronizing the businesses and access for employment. A sidewalk will provide a better accommodation for pedestrians than a paved shoulder.

This write-up considers installation of a sidewalk on the south side of KY 348 beginning at Armory Drive, through the interchange and ends at the intersection of Old Symsonia Drive.

IMPLEMENTATION CONSIDERATIONS:

The estimate is based on installing a sidewalk on one side of the road only. The design team may consider constructing it on both sides of the road to better serve future growth. Another option to consider is to build a shared-use path in lieu of a sidewalk in order to accommodate both pedestrians and bicyclists.

VALUE ENGINEERING PROPOSAL AP-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend the sidewalk across the bridge

DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Standard curb and gutter		LF				2400	26.09	62,616
4" Sidewalk (5' wide)		SY				1333	38.06	50,734
Curb box inlet		EA				8	2,529.00	20,232
Remove median barrier on bridge		LF				2400	2.00	4,800
TOTAL COSTS*								**138,000**
							TOTAL (BASELINE LESS PROPOSED)	**(138,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

VALUE ENGINEERING PROPOSAL AP-01

Kentucky Transportation Cabinet

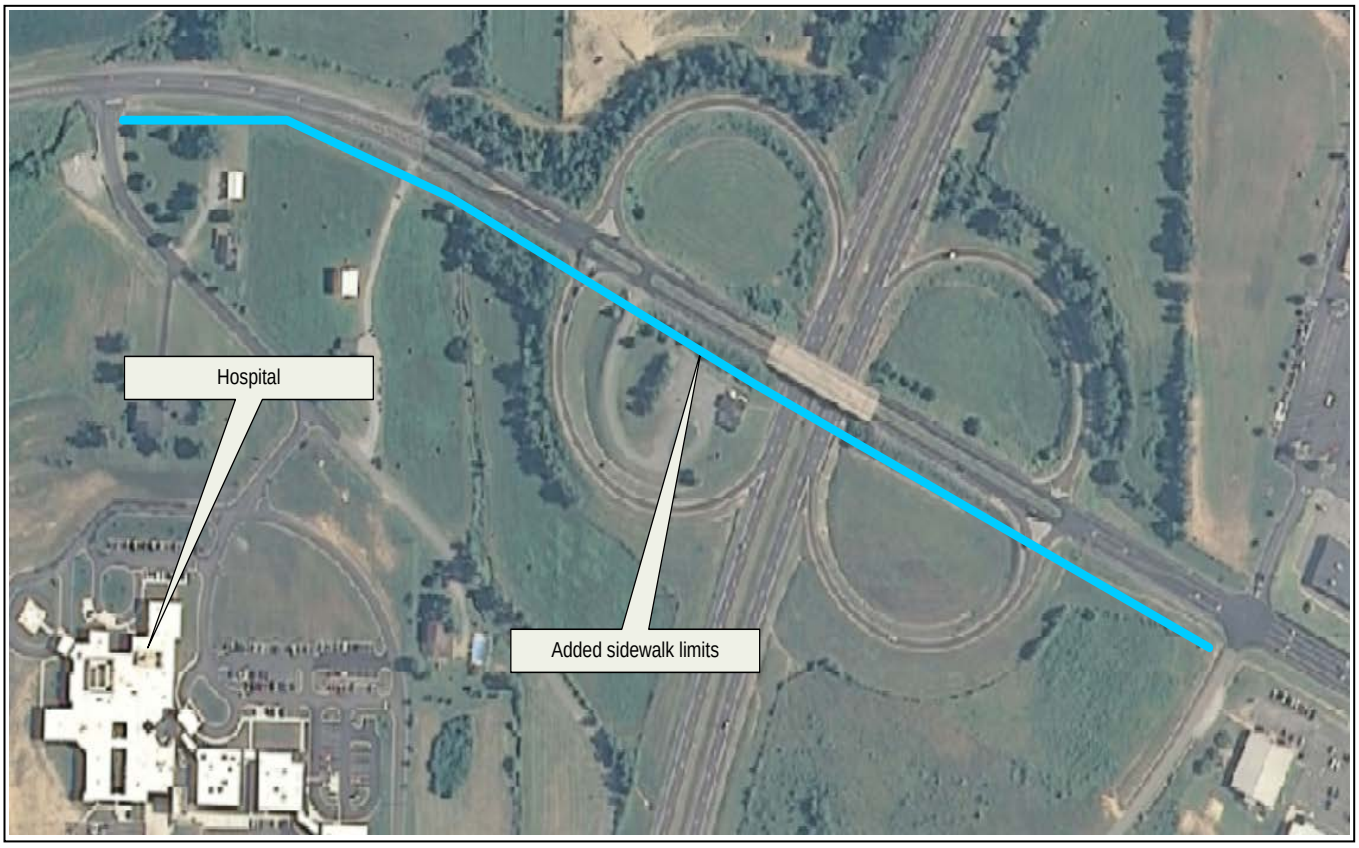
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend the sidewalk across the bridge

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL AP-03

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

RH & Associates, Inc.

TITLE:	**Extend the sidewalk into businesses**
FUNCTION:	**Accommodate Pedestrians**

BASELINE ASSUMPTION:

The sidewalk is designed to parallel KY 348.

PROPOSED ALTERNATIVE:

In addition to the currently designed sidewalk, add connections to the businesses along KY 348.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 15,000	$ -	$ 15,000
TOTAL (Baseline less Proposed)	$ (15,000)	$ -	**$ (15,000)**
			COST

TITLE:	Extend the sidewalk into businesses
BENEFITS	**RISKS/CHALLENGES**
• Provides convenient connections for pedestrians to businesses	• Adds construction cost
• Enhances walkability of the corridor	• Must work with business owners for easements
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VALUE ENGINEERING PROPOSAL AP-03

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend the sidewalk into businesses

DISCUSSION/JUSTIFICATION:

Current design calls for a five-foot sidewalk on each side of KY 348. For most of the properties along the corridor, there is not a convenient connection to the businesses. By adding sidewalk connections, pedestrian conflicts with automobile traffic will be reduced and they will not have to walk through dirt and mud. The cost is relatively low for the benefit gained.

For this write-up, it was assumed that there would be 30 connections, each 30 feet long.

IMPLEMENTATION CONSIDERATIONS:

For sidewalks that will extend beyond the current right-of-way limits, construction easements can be secured through the right-of-way negotiation process. Additionally, building these connections can be done when the property owner is amenable to the idea and not done if the owner disagrees.

VALUE ENGINEERING PROPOSAL AP-03

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend the sidewalk into businesses

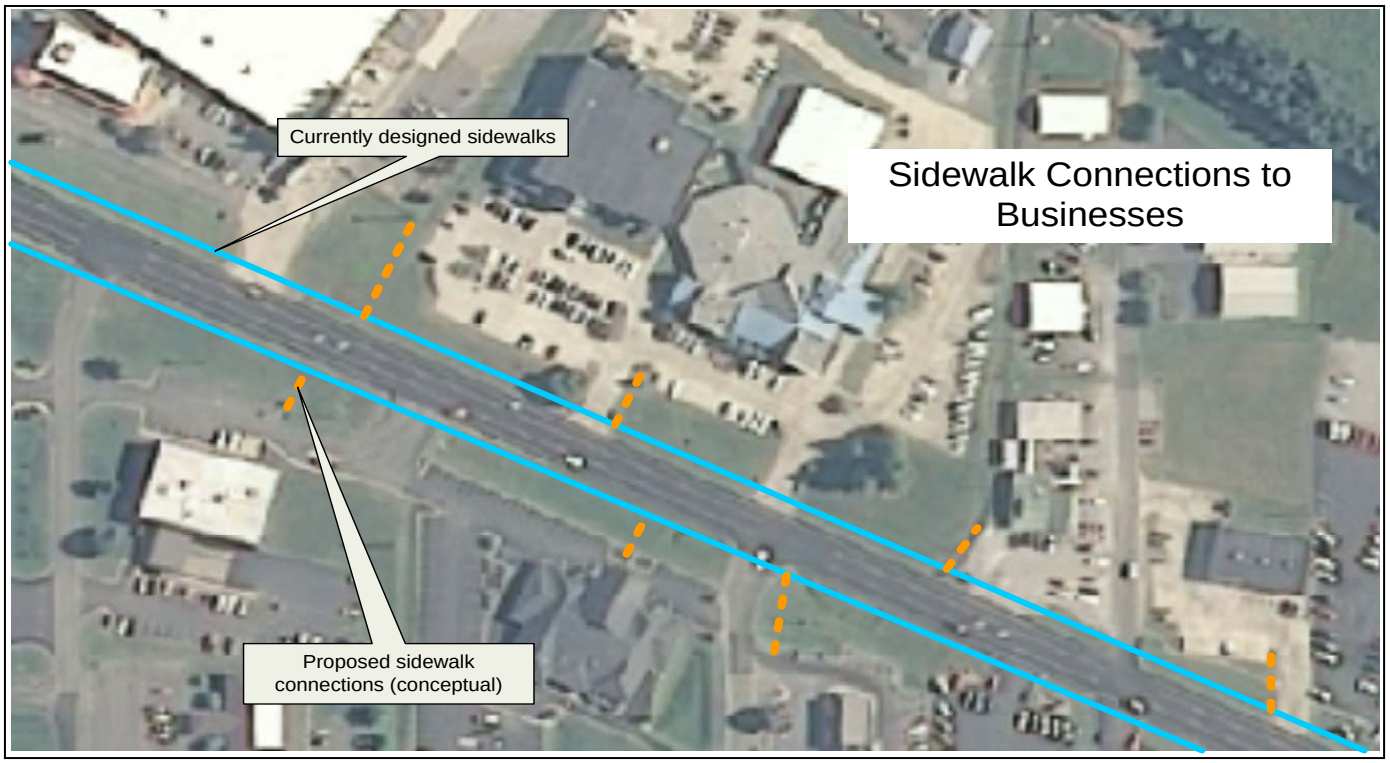
DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
4" Sidewalk (4' wide)		SY		38.06		400	38.06	15,224
TOTAL COSTS*								**15,000**
							TOTAL (BASELINE LESS PROPOSED)	**(15,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

TITLE: Extend the sidewalk into businesses

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL AP-06 DS

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: **Create a local street connection using the railroad underpass**

FUNCTION: **Accommodate Pedestrians**

BASELINE ASSUMPTION:

The current interchange plans show the new ramp construction with embankment over the current local access road. By constructing the ramps on embankment, the access road will have to be closed during construction.

PROPOSED ALTERNATIVE:

As referenced in M-12, if ramp 3 and ramp 4 are constructed over a 12'x 15' wagon box, then a future pedestrian/multi-use or access road could be constructed along the existing road (gravel) to provide an alternative access from the southeast portion of the interchange to the northwest.

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL AP-06 DS

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Create a local street connection using the railroad underpass
BENEFITS	**RISKS/CHALLENGES**
• Future connectivity between commercial properties (back entrance to Wal-Mart) and the hospital	• Width of wagon box structure only allows for single lane passage at a time, if utilized for vehicular traffic
• Reduces traffic on the bridge	• Don't have clearance information under the parkway structures, unsure of clearance
• Provides an alternative emergency access to medical facilities	• Would have to introduce signals for vehicles so access to power and long-term cost for operations need to be considered
• If used for pedestrian / multi-use, provides for cross parkway access without carrying pedestrians through the interchange	• Added future right-of-way acquisition cost for improvements not currently in place
• Provides a more picturesque path for multi-use facility as opposed to a parkway bridge	• Added future construction costs for improvements not currently in place
• Reduces the risk for pedestrian accidents by removing them from the higher volume KY 348	• Requires long-term maintenance of the facility
• Possible purchase of land-locked parcel by local city for a park	•
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TITLE: Create a local street connection using the railroad underpass

DISCUSSION/JUSTIFICATION:

Flexibility is key to any design. This approach plans for future traffic, future development and future uses. By using wagon boxes (or structures) on ramp 3 and 4 provides the project team and the City of Benton the flexibility for future uses. These uses include a pedestrian facility, a multi-use facility and an alternative access road facility.

IMPLEMENTATION CONSIDERATIONS:

Implementation considerations for using the access road for a future pedestrian / multi-use / or access road facility include:

What is the future use going to be?

If the future use includes vehicular traffic then are wagon boxes with signals the primary consideration or should bridges be considered. Also, horizontal and vertical clearances along the access road under the existing parkway need to be verified.

Maintenance and operations of the facility needs to be considered as well.

TITLE: Create a local street connection using the railroad underpass

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL RC-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE:	**Provide offset left turns using a wider TWLTL (two-way left turn lane)**
FUNCTION:	**Reduce Crashes**

BASELINE ASSUMPTION:

Project calls for a 14-foot two-way left turn lane (TWLTL).

PROPOSED ALTERNATIVE:

Increase the TWLTL width to 16 feet. This includes additional width from US 641 west to Symsonia.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ -	$ -	$ -
TOTAL (Baseline less Proposed)	$ -	$ -	**$ -**
			NO CHANGE

TITLE:	Provide offset left turns using a wider TWLTL (two-way left turn lane)
BENEFITS	**RISKS/CHALLENGES**
• Allows motorists in TWLTL to see around other vehicles in the TWLTL	• Increases construction costs
• Increases the sight distance for motorist in TWLTL when facing another vehicle in TWLTL	•
• Increases the maneuvering space in the TWLTL when dealing with other motorists in and entering the TWLTL	•
• Increases the sight distance when entering the TWLTL	•
• Allows the potential for the addition of a non-mountable median alternative in the future	•
• A 16-foot median is sufficient to allow the addition of a non-mountable median in the future without changing the rest of the roadway	•
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VALUE ENGINEERING PROPOSAL RC-02

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Provide offset left turns using a wider TWLTL (two-way left turn lane)

DISCUSSION/JUSTIFICATION:

Two-way left turn lanes are shared lane areas where opposing traffic may enter the TWLTL at the same moment from the opposite direction at close to 45 mph. The additional width aids the entering driver to see further down the TWLTL as they enter, with increased area for both vehicles to take evasive action.
When two opposing motorists are in the TWLTL, they can block each other's left turn sight distance. The additional width makes it easier to maneuver in the lane to obtain sight distance around the opposing vehicle.

IMPLEMENTATION CONSIDERATIONS:

There will be safety benefits relative to TWLTL users. The wider median area is convertible to a non-mountable median in the future. It allows a 11-12 foot turn lane with a four foot raised median along side, at any location, a median opening allows a left turn. The additional two feet can be gained by reducing the through lane widths to 11 feet.

VALUE ENGINEERING PROPOSAL RC-02

Kentucky Transportation Cabinet

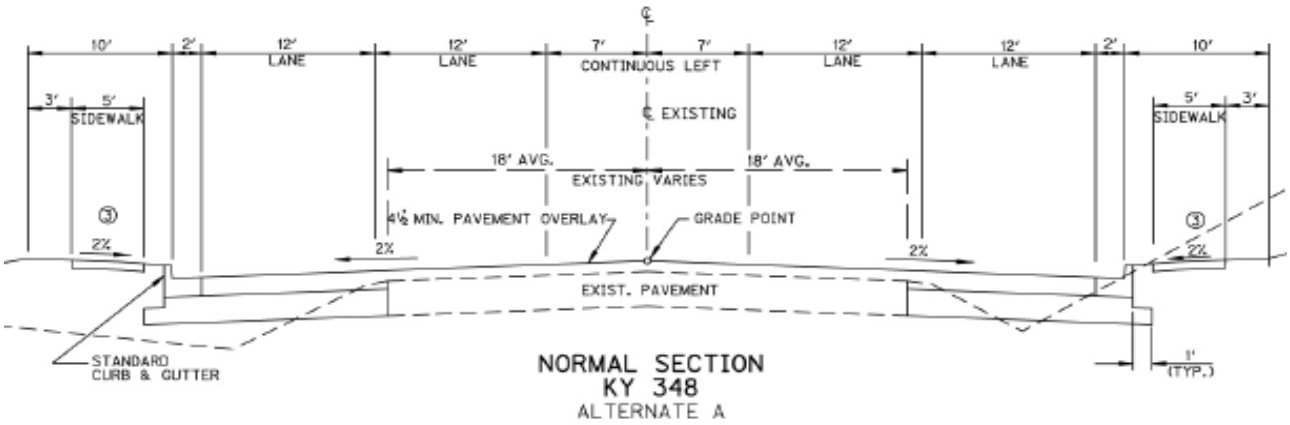
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Provide offset left turns using a wider TWLTL (two-way left turn lane)

BASELINE SKETCH



VALUE ENGINEERING PROPOSAL RC-02

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

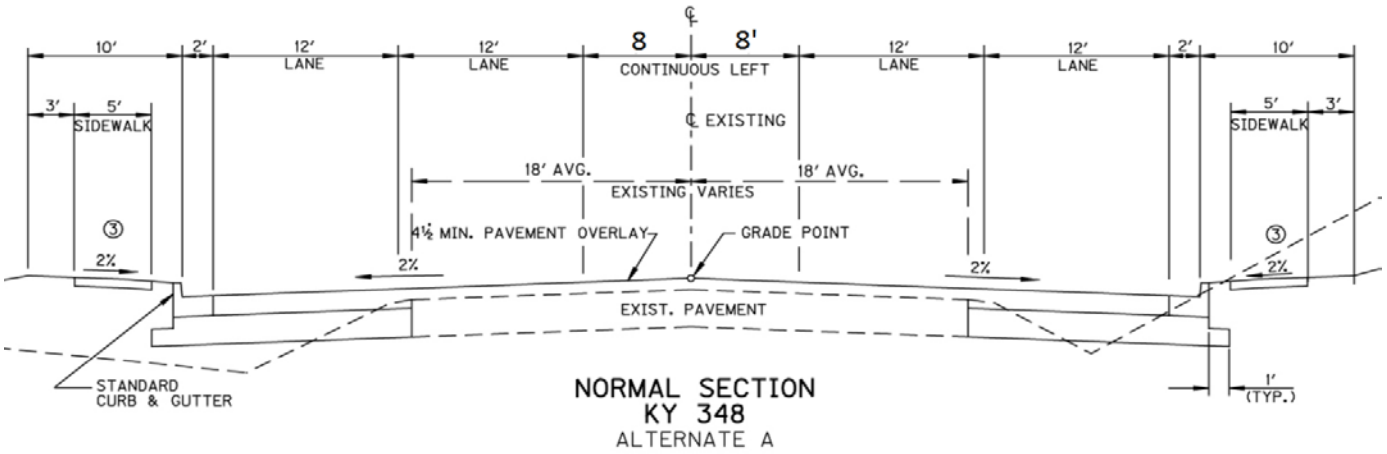
Items #1-8101.00 & #1-8002.00

Marshall County

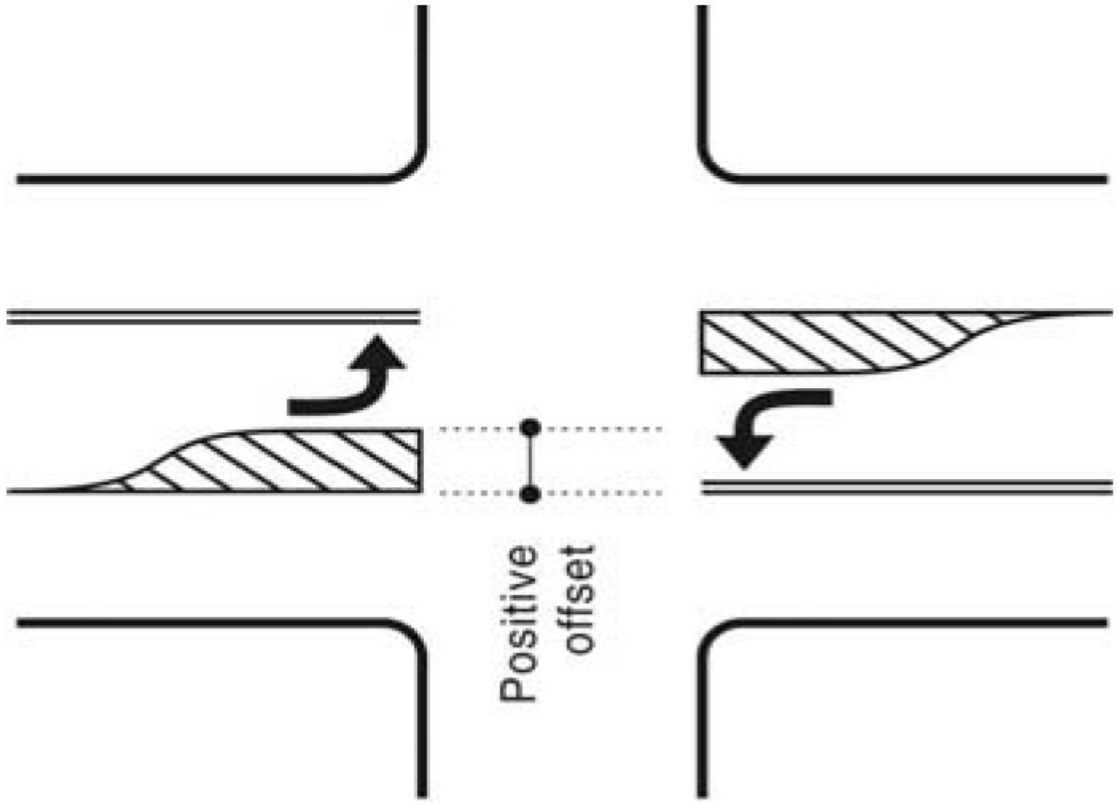
TITLE: Provide offset left turns using a wider TWLTL (two-way left turn lane)

PROPOSED SKETCH

16 ft TWLTL - Off-set for increased turing sight distance



NORMAL SECTION
KY 348
ALTERNATE A



TITLE: Provide offset left turns using a wider TWLTL (two-way left turn lane)

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL AT-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Increase the left-turn radii for trucks**

FUNCTION: **Accommodate Trucks**

BASELINE ASSUMPTION:

For critical intersections such as Ash Street, it appears that KY 348 as designed has large turning radii for right turn movements but consideration for truck turning paths for left turners has not been given full consideration. The widths of the access points are designed as traditional widths and do not take into account truck travel path. An example of this would be the entrance to Wal-Mart which is currently shown as a 36' wide entrance with a 12' ingress lane and a 24' egress lane. The width is wider at the tie to KY 348 due to the right turn taper.

PROPOSED ALTERNATIVE:

We propose using AutoTURN to develop the ingress and egress widths for critical access points along KY 348. Our recommendation would be limited to approach roads such as Ash Street / Wal-Mart, Commerce Drive, US 641, Post Office Road and both Parkway ramps. We recommend widening the proposed width based on the outcome of the AutoTURN analysis to keep turning vehicles from encroaching on the opposing traffic.

In addition, by providing wider access points to allow proper widths for truck turning movements, there will be a more "free flow" movement for trucks allowing for more vehicles to make turns during green time which should result in better overall operations of travel flow along KY 348.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 70,000	$ -	$ 70,000
TOTAL (Baseline less Proposed)	$ (70,000)	$ -	**$ (70,000)**
			COST

TITLE:	Increase the left-turn radii for trucks
BENEFITS	**RISKS/CHALLENGES**
• Trucks can makes turns easier	• Wider construction of access points
• Less encroachment on opposing travel lanes	• Potentially higher costs (more pavement)
• Quicker turning movements, increased green time operations	• Potentially more right-of-way impacts
• Less risk for sideswipe accidents	• Potentially more utility impacts
• Reduces likelihood of maintenance costs to repair curbs, sidewalks or off pavement cutting	• Additional crossing time needed for pedestrians for wider crossing
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TITLE: Increase the left-turn radii for trucks

DISCUSSION/JUSTIFICATION:

Since original plans were developed, roadway designers have begun to use truck turning analysis programs such as AutoTURN to ensure large trucks have the proper roadway widths to accommodate turning paths at intersections. The critical intersections that have a higher probability for daily truck traffic should be analyzed using AutoTURN or comparable turning analysis software to make sure that access point / entrance widths are developed to accommodate trucks without encroaching on opposing traffic.

In addition to the safety benefits by providing increased access point widths, we feel like there are operational benefits. Trucks will be able to make turns at a reasonable turning speed without having to worry about encroaching on opposing travel lanes (getting cars to back up to allow trucks to pass). This should allow for more vehicles to make left turns in a traffic signal cycle and potentially allow for greater utilization of green time.

IMPLEMENTATION CONSIDERATIONS:

Implementation considerations when developing the design for access points are as follows:
- Develop a list of all critical intersections/access points that currently have truck traffic.
- Determine the type of truck traffic that utilizes each location (e.g. WB-50 or WB-67).
- Run the AutoTURN analysis for each location, both for ingress and egress.
- Widen the access points, as needed, based on the findings.

VALUE ENGINEERING PROPOSAL AT-02

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

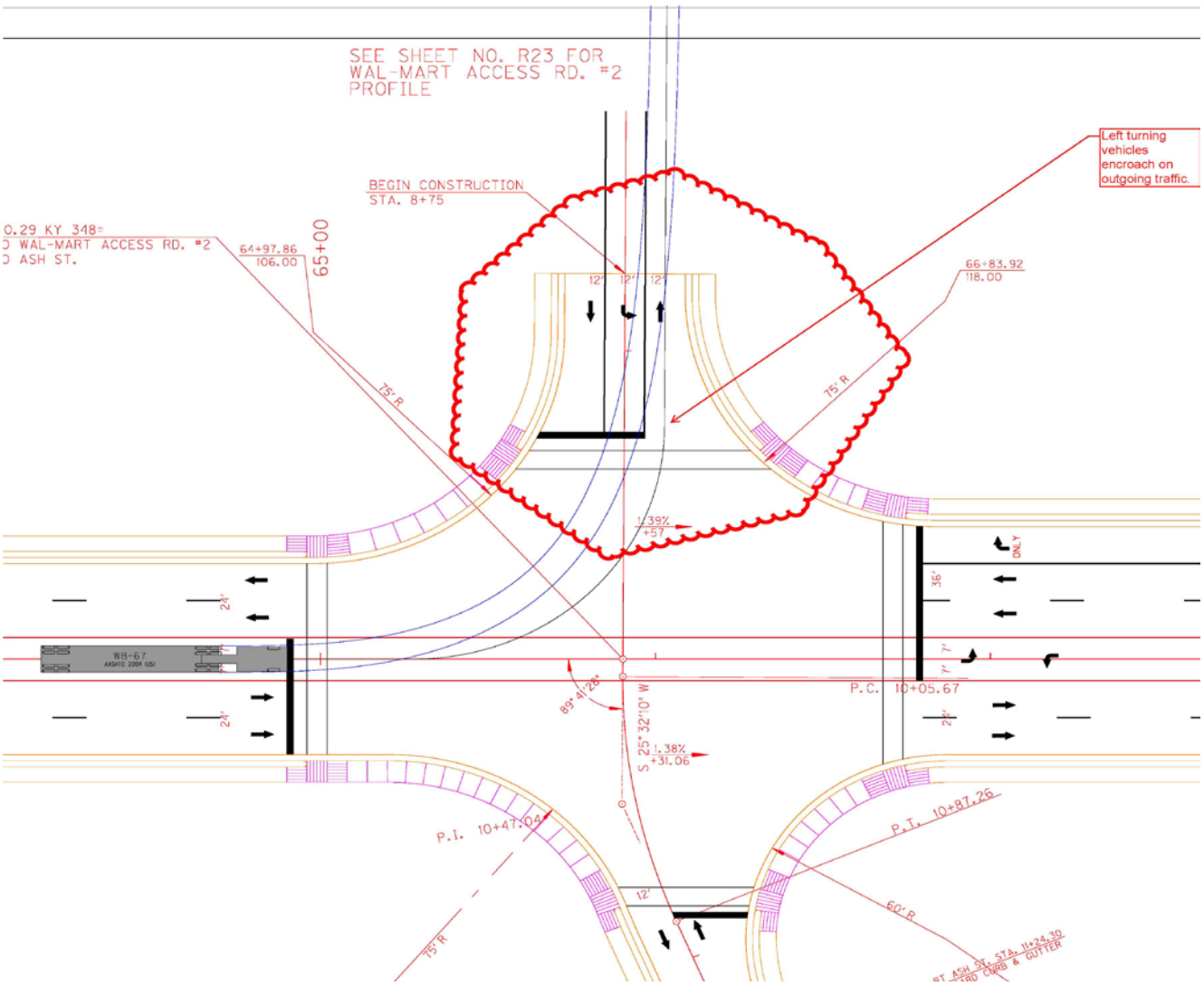
TITLE:	Increase the left-turn radii for trucks							
DESIGN ELEMENT	**Markup**	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Additional pavement (seven locations)		SY		50.00		1400	50.00	70,000
TOTAL COSTS*								**70,000**
							TOTAL (BASELINE LESS PROPOSED)	**(70,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

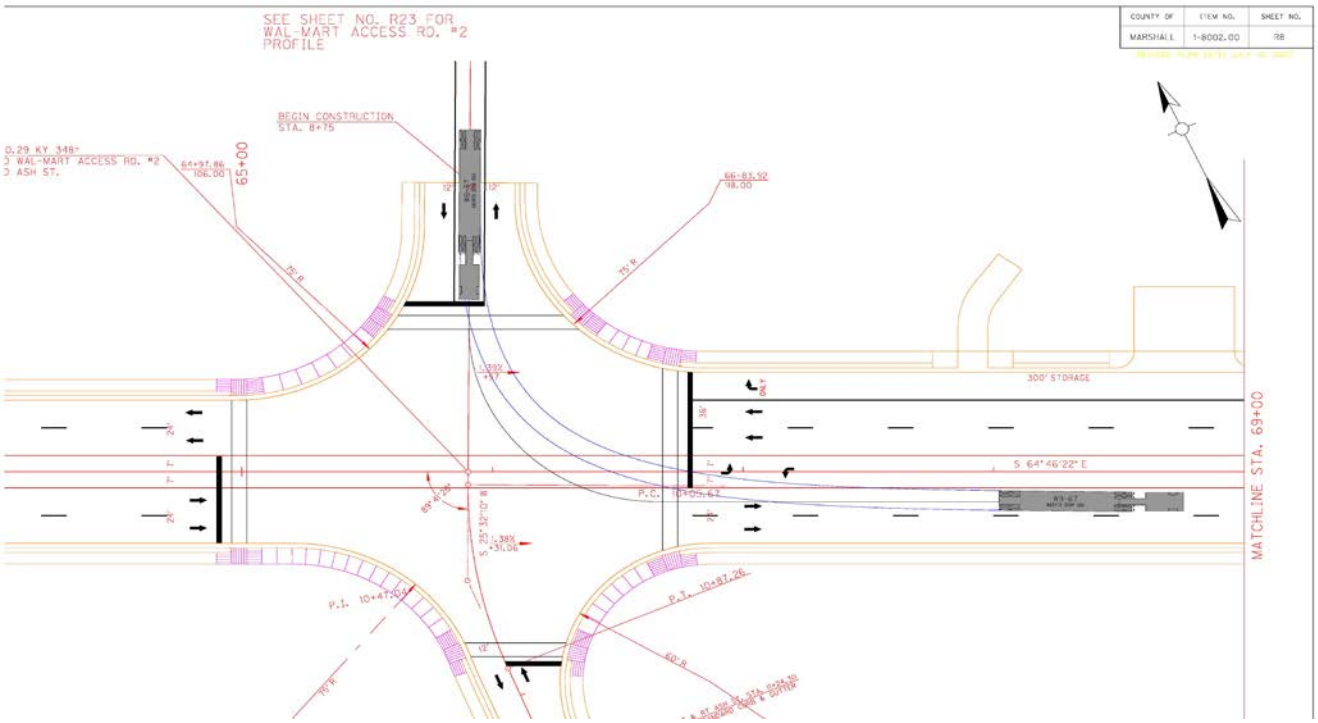
TITLE: Increase the left-turn radii for trucks

SKETCH OF BASELINE ASSUMPTION



TITLE: Increase the left-turn radii for trucks

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL AT-02

Kentucky Transportation Cabinet

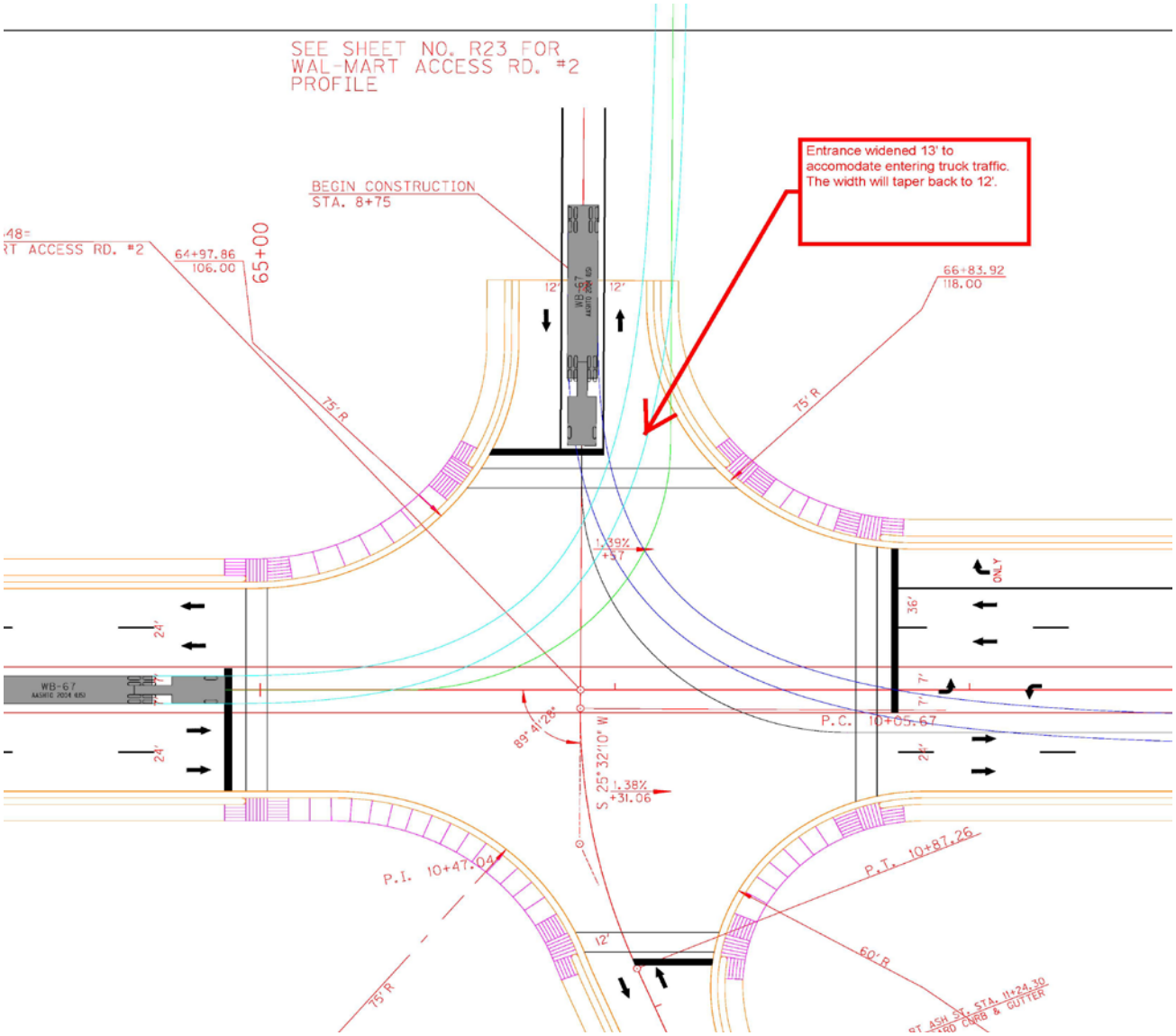
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

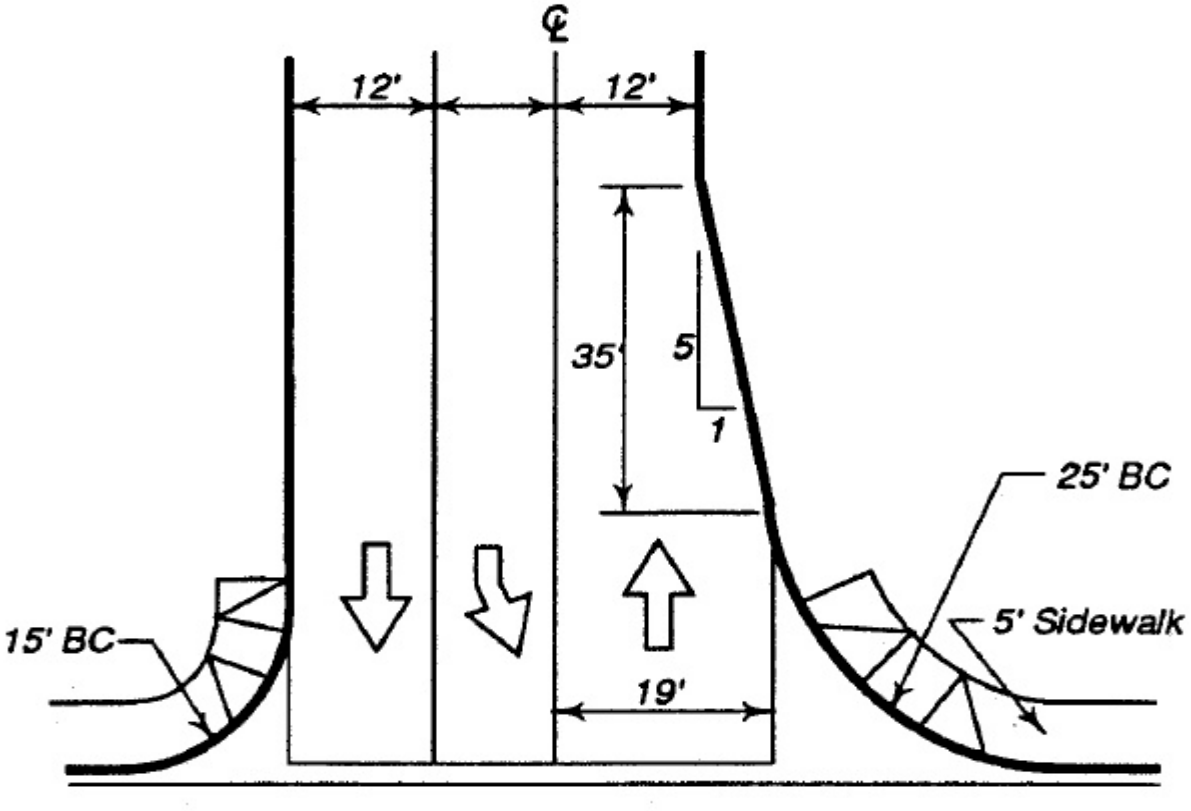
TITLE: Increase the left-turn radii for trucks

SKETCH OF PROPOSED ALTERNATIVE



TITLE: Increase the left-turn radii for trucks

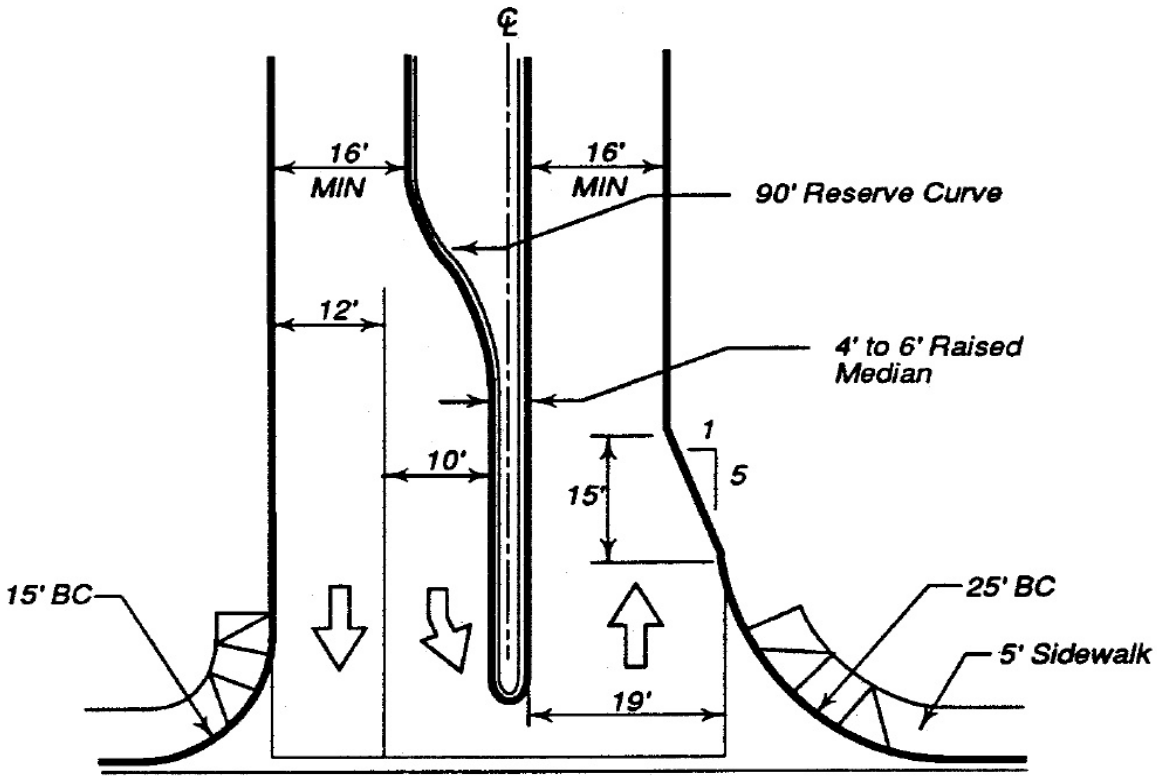
SKETCH OF PROPOSED ALTERNATIVE



Example of Flared Entry to Increase Radii for Left Turn Entries

TITLE: Increase the left-turn radii for trucks

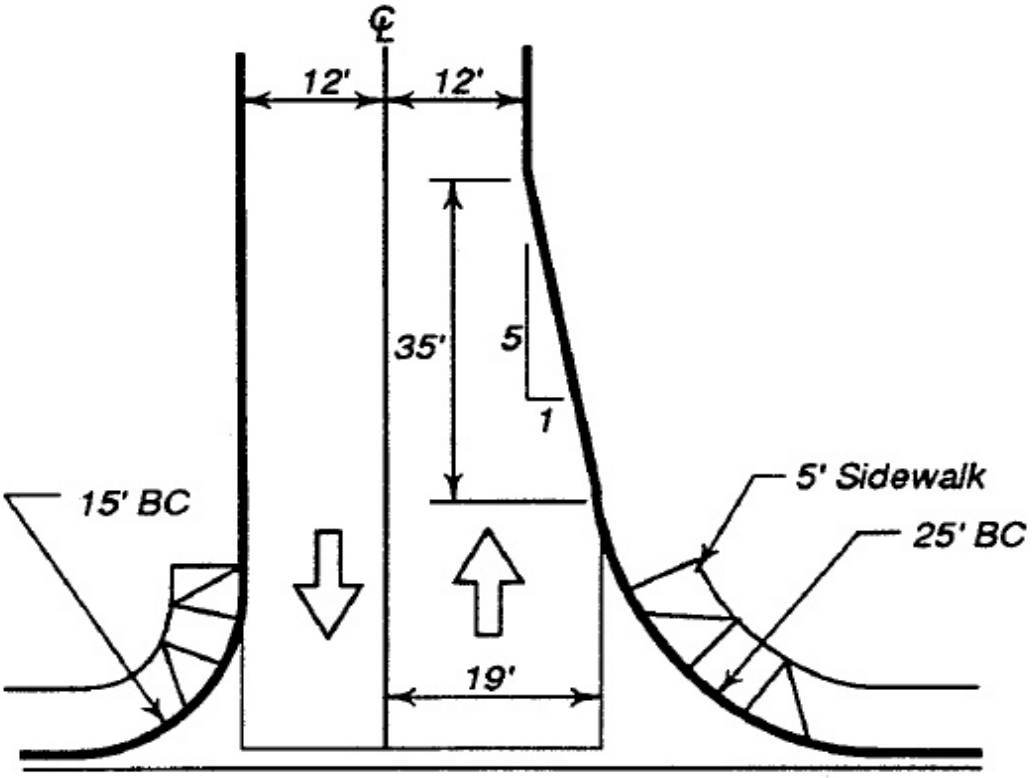
SKETCH OF PROPOSED ALTERNATIVE



Example of Driveway with Raised Median

TITLE: Increase the left-turn radii for trucks

SKETCH OF PROPOSED ALTERNATIVE



Example of 2-Lane Driveway with Entry Flare

TITLE: Increase the left-turn radii for trucks

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL AM-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: **Extend project limits west to include the hospital entrance**

FUNCTION: **Accommodate Medical Traffic**

BASELINE ASSUMPTION:

Current project limits for the 1-8002.00 project begin on the southeast side of the parkway interchange and extend southeast to US 641. The other project, 1-8101.00, includes modifications to the existing medians on the bridge and at the ramps, not extending to the west beyond the ramp limits. Neither project will include work in the area of Old Symsonia Road.

PROPOSED ALTERNATIVE:

Extend the current KY 348 widening project, 01-8002.00, to the west to include improvements to three lanes west of Old Symsonia Road and the removal of the existing raised medians.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 834,000	$ -	$ 834,000
TOTAL (Baseline less Proposed)	$ (834,000)	$ -	**$ (834,000)**
			COST

TITLE:	Extend project limits west to include the hospital entrance
BENEFITS	**RISKS/CHALLENGES**
• Improves turning movements into the hospital	• Unexpected material issues at culvert extension
• Safety improvements by providing left turns into both sides of KY 348	• May need drainage/construction easements at culvert extension
• Removes existing medians	• Additional funding requirements beyond the six-year plan
• Provides left turn lane for potential development on the north side of KY 348	•
• Provides shoulders along roadway from interstate to just west of Old Symsonia Road	•
• All work is accomplished within existing right-of-way	•
• Better access for emergency vehicles traveling to the hospital	•
• Anticipates development growth on the west side	•
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TITLE: Extend project limits west to include the hospital entrance

DISCUSSION/JUSTIFICATION:

Extension of the three-lane section from the east would not involve a complete road rebuild, only removal of the existing medians and the slight widening near the entrance to Old Symsonia Road intersection. The existing roadway should be utilized for maintenance of traffic, with work taking place within the median and outside of the existing roadway section. With the possible expansion of the hospital and/or possible development on the north side of KY 348, left turn lanes would be warranted on both sites. Since the road work will already be occurring in the area, this extension will not impact the traveling public as a separate project. Removal of the median may help with through traffic by not having a hazard adjacent to the driving lane, but would also help with maintenance issues, most likely snow removal.

IMPLEMENTATION CONSIDERATIONS:

Meetings with the hospital may need to occur to decide if their concerns are covered with this project. Additional widening on Old Symsonia Road may need to occur to help turning movements.

VALUE ENGINEERING PROPOSAL AM-01

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend project limits west to include the hospital entrance

DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
6' shoulders		SY				1870	50.00	93,500
Roadway widening		SY				9800	60.00	588,000
Remove median		SY				1000	30.00	30,000
Maintain and control traffic		LS				1	15,000.00	15,000
Extend box culvert/drainage pipe		LS				1	95,000.00	95,000
Embankment in place		CY				1500	8.00	12,000
TOTAL COSTS*								**834,000**
							TOTAL (BASELINE LESS PROPOSED)	**(834,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

TITLE: Extend project limits west to include the hospital entrance

SKETCH OF BASELINE ASSUMPTION

Baseline Sketch. No work proposed with either project west of the Purchase Parkway Interchange

VALUE ENGINEERING PROPOSAL AM-01

Kentucky Transportation Cabinet

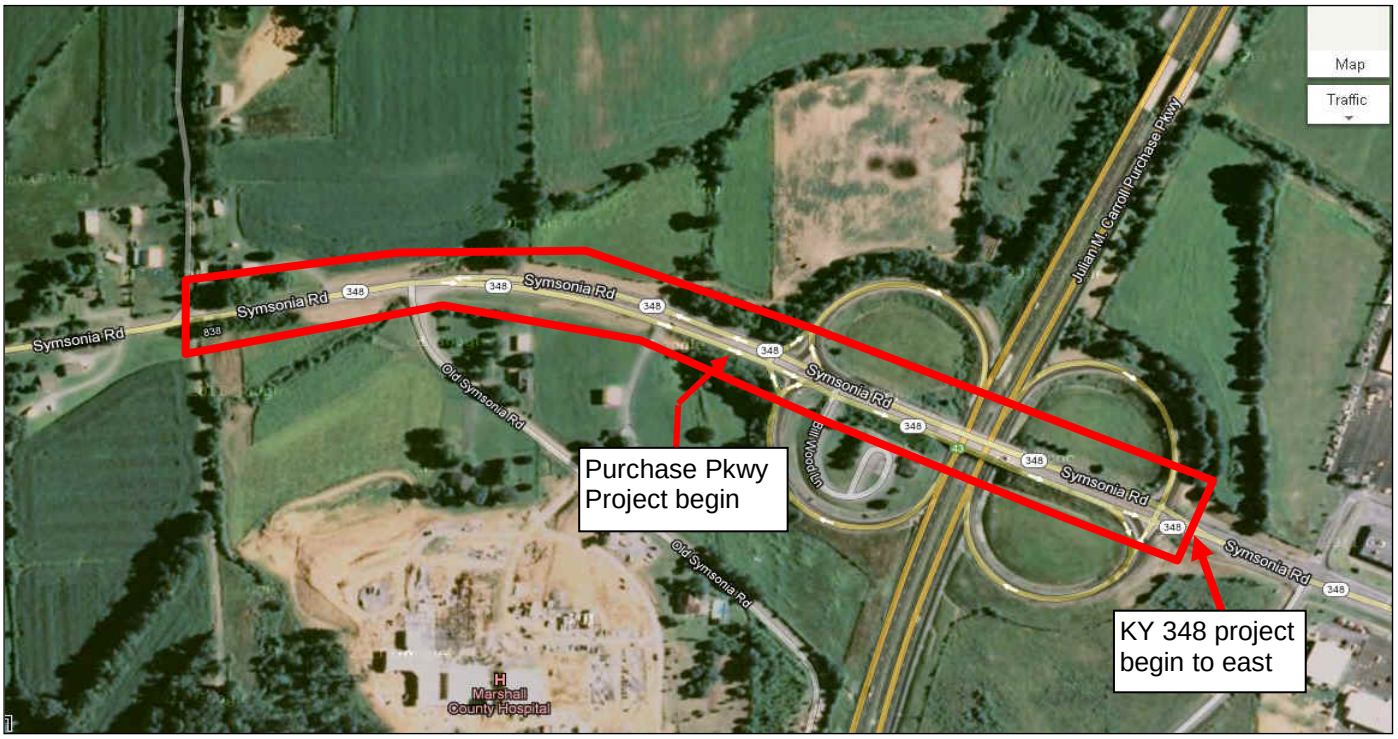
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Extend project limits west to include the hospital entrance

SKETCH OF PROPOSED ALTERNATIVE



Proposed Sketch including project limits for 1-8002 KY 348 Widening Project and proposed extension of three-lane section, extending just west of the Old Symsonia Road intersection. Beyond the Old Symsonia Road intersection to the west are tapers at 55:1 back to the existing two-lane roadway.

VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE:	**Add a left turn lane into Old Symsonia Road (hospital)**
FUNCTION:	**Accommodate Medical Traffic**

BASELINE ASSUMPTION:

Current project limits for the 1-8002.00 project begin on the southeast side of the parkway interchange and extend southeast to US 641. The other project, 1-8101.00, includes modifications to the existing medians on the bridge and at the ramps, not extending to the west beyond the ramp limits. Neither project will include work in the area of Old Symsonia Road.

PROPOSED ALTERNATIVE:

Construction of a left turn lane from KY 348 to Old Symsonia Road, by removing the existing median and widening KY 348 to accommodate this turning lane to the west and east.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 719,000	$ -	$ 719,000
TOTAL (Baseline less Proposed)	$ (719,000)	$ -	**$ (719,000)**

COST

VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Add a left turn lane into Old Symsonia Road (hospital)
BENEFITS	**RISKS/CHALLENGES**
• Provides storage for the left turn movement into Old Symsonia Road	• Unexpected material issues at culvert extension
• Allows through traffic to avoid left turn queue at Old Symsonia Road	• May need drainage/construction easements at culvert extension
• Better access for emergency vehicles going to the hospital	• Difficulty providing continuous access to the medical facilities during construction
• All work is accomplished within existing right-of-way	•
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VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Add a left turn lane into Old Symsonia Road (hospital)

DISCUSSION/JUSTIFICATION:

Construction of a left turn lane into Old Symsonia Road will only require removal of the existing median and slight widening near the intersection. The existing roadway should be utilized for maintenance of traffic, with work taking place within the median and outside of the existing roadway section. With the possible expansion of the hospital, left turns into Old Symsonia Road are likely to increase. Since the road work will already be occurring in the vicinity, this work will not impact the traveling public as a separate project.

The extension of the three-lane section was also evaluated and included removal of the raised medians, pavement replacement and installation of 6-foot shoulders. This item only includes the left turn lane at the road intersection. Both versions will require an extension of the box culvert or drainage pipe at the same intersection. The pavement widening for both projects will be very similar as well.

It is anticipated that development associated with the new hospital will continue. This project has an excellent opportunity to install a left turn lane supporting this growth.

IMPLEMENTATION CONSIDERATIONS:

Meetings with the hospital may need to occur to decide if their concerns are covered with this project. Additional widening on Old Symsonia Road may need to occur to help turning movements.

VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: Add a left turn lane into Old Symsonia Road (hospital)

DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Remove median		SY				300	30.00	9,000
Roadway widening		SY				9800	60.00	588,000
Maintain and control traffic		LS				1	15,000.00	15,000
Extend culvert		LS				1	95,000.00	95,000
Embankment in place		CY				1500	8.00	12,000
TOTAL COSTS*								**719,000**
							TOTAL (BASELINE LESS PROPOSED)	**(719,000)**

*Note: Total Costs are rounded to nearest thousand dollars

COST

VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Add a left turn lane into Old Symsonia Road (hospital)

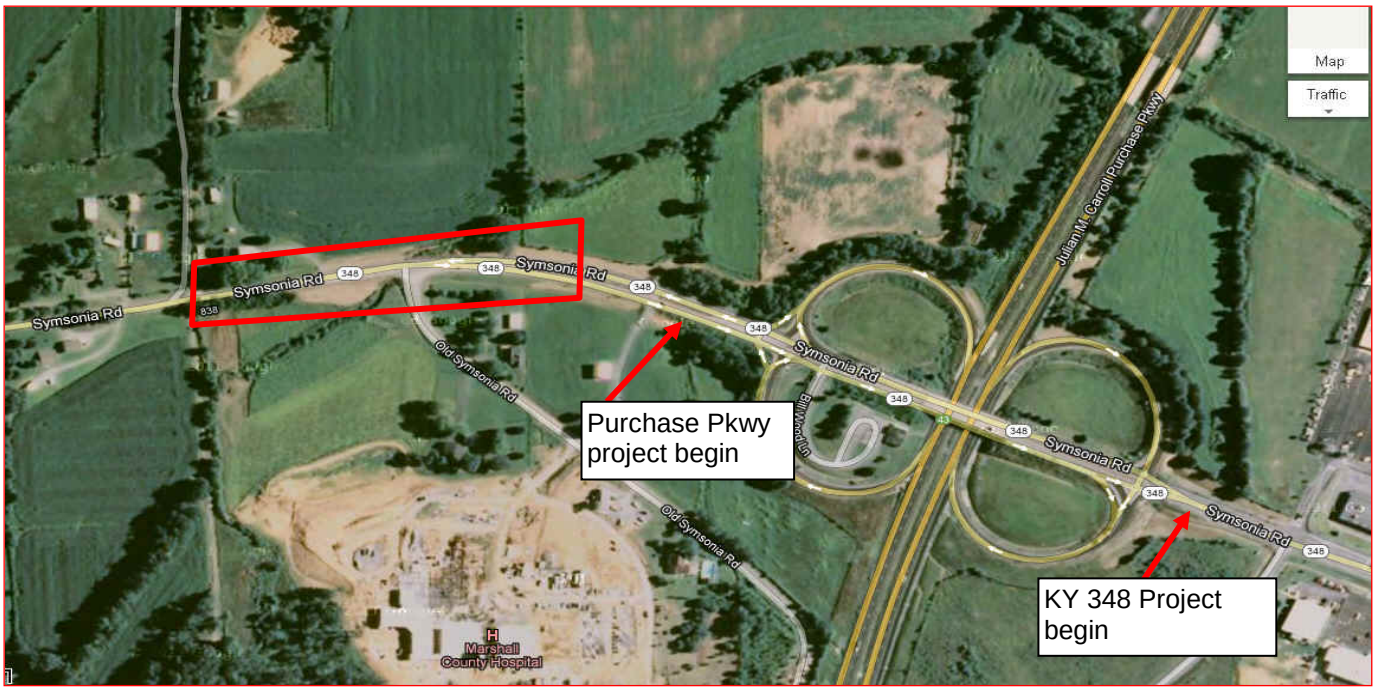
SKETCH OF BASELINE ASSUMPTION

VALUE ENGINEERING PROPOSAL AM-02

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Add a left turn lane into Old Symsonia Road (hospital)

SKETCH OF PROPOSED ALTERNATIVE



Install left turn lane into Old Symsonia Road. Includes minor median removal and tapers west of the intersection

VALUE ENGINEERING PROPOSAL M-07

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: **Combine both projects for construction**

FUNCTION: **Miscellaneous**

BASELINE ASSUMPTION:

Currently, two projects are proposed in this area; one for the Purchase Parkway and one for the KY 348 widening. The KY 348 widening project, 01-8002.00, proposes a five-lane section on the east side of the interchange. Initially, these projects were combined, but after further evaluation, the Cabinet determined that having two projects was more desirable due to funding issues and the need to upgrade the Parkway interchange to interstate standards rating priority.

PROPOSED ALTERNATIVE:

The Purchase Parkway interchange improvements have been scaled down from the initial design in 2001 when the two projects were being considered as one. Thus, the cost estimate for the construction of the new design for the interchange is decreased from $12.5 million to $5.4 million. The KY 348 widening,Item #1-8002.00, is estimated to cost $6.9 million. With the reduction of costs, and coordination that these two projects required during construction, it is recommended to combine these projects into one larger project.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 545,000	$ -	$ 545,000
PROPOSED ALTERNATIVE:	$ 245,000	$ -	$ 245,000
TOTAL (Baseline less Proposed)	$ 300,000	$ -	**$ 300,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL M-07

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE:	Combine both projects for construction
BENEFITS	**RISKS/CHALLENGES**
• No duplication of maintenance of traffic, including duplicate signing and lane closures	• Securing funding for both projects in time
• Reduction of construction time for the community	•
• No overlap of projects requiring less coordination between contractors, community and Cabinet personnel	•
• Much simpler contract administration for the Cabinet since only one contract would be required	•
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VALUE ENGINEERING PROPOSAL M-07

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Combine both projects for construction

DISCUSSION/JUSTIFICATION:

Both projects will require coordination, but combining these projects would drastically reduce necessary communication issues between contractors should each project become active at the same time. As currently scheduled, the Parkway project will be nearing completion when the KY 348 widening project is let. Combining these projects would allow for a single project manager, a single traffic control supervisor, along with a single contractor. This would provide much more streamlined contact for the Cabinet as well as the community when any issues arise. Putting the contracts back to back would extend the amount of time the community is under construction; combining the two projects should reduce the total length of project duration as many items can be completed concurrently.

The maintenance of traffic quantity is shown with a reduction of approximately 25%, as much of the signage, lane closures and shifts will overlap. Many other item costs are anticipated to be reduced due to larger quantities after combining contract items. Labor costs would be expected to reduce as well considering the reduction in time one project would require, not only with the contractor but with Cabinet personnel with a much simpler contract.

IMPLEMENTATION CONSIDERATIONS:

With the current financial situation of the nation, two projects may be more competitive with bidding from local and possibly other contractors interested in obtaining work.

VALUE ENGINEERING PROPOSAL M-07

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Combine both projects for construction

DESIGN ELEMENT	Markup	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Maintenance of traffic		LS	1	325,000.00	325,000	1	245,000.00	245,000
KYTC manpower **		LS	1	220,000.00	220,000			
TOTAL COSTS*					**545,000**			**245,000**
							TOTAL (BASELINE LESS PROPOSED)	**300,000**

*Note: Total Costs are rounded to nearest thousand dollars SAVINGS

** Assumes 2 inspectors for 6 months @ $25/hr each direct cost plus 1 resident engineer for 6 months @ $40/hr direct cost

VALUE ENGINEERING PROPOSAL M-08 DS

Kentucky Transportation Cabinet

Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: **Apply the utility legislation to this project and start the utilities work sooner**

FUNCTION: **Miscellaneous**

BASELINE ASSUMPTION:

Utility relocations typically occur on projects just prior to construction commencing. Utility relocations are required on both projects, Items #1-8002.00 and 1-8101.00, prior to beginning construction work. The VE team is not sure if all of the utility costs associated with these projects, including utilities within or outside of the existing right-of-way, have been incorporated into the estimates but it was assumed.

PROPOSED ALTERNATIVE:

Beginning utility relocations as soon as possible can help alleviate delays of either project. The utility relocations would occur concurrently with both projects to help eliminate conflicts caused by splitting the boundaries of the utility based upon the construction limits. The use of the legislation gives the KYTC the opportunity to pay for all relocations, possibly assisting local utility companies in financial assistance, that would have not been anticipated when this project was initially designed.

DESIGN SUGGESTION

TITLE:	Apply the utility legislation to this project and start the utilities work sooner

BENEFITS	**RISKS/CHALLENGES**
• Allows for current letting schedules to be met for construction to begin	• Keeping the utility on schedule to complete their work prior to construction
• Smaller utility companies are not stretched for resources	• Still may not allow the utility enough money to cover all associated costs
• Utility relocations prior to beginning construction creates fewer conflicts for prime contractor	• The utility work schedule may be high if multiple projects within their service area
• Eliminates any claims from the prime or sub-contractors due to delays from utility relocation	•
• Agreements for relocation must be completed before payment to the utility, emphasizing early completion	•
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TITLE: Apply the utility legislation to this project and start the utilities work sooner

DISCUSSION/JUSTIFICATION:

The VE team identified the relocation of utilities as a high risk in the risk analysis. Therefore, emphasis should be placed on ensuring that all relocations have been completed prior to the beginning of construction work for this project. Many utility companies have difficulty in preparing to relocate their facilities due to lack of funding, especially those with limited budgets. If lack of capital is an issue for completing the relocations, this legislation allows the Cabinet to reimburse the costs so that the burden is not pushed onto the user.

The relocation of the utilities early also allows the letting and subsequent notice to proceed to remain on schedule. If the project is let and the contractor has to wait on utility relocations before beginning work, the Cabinet is subject to delay claims. If the delay is ongoing or affects the completion dates set for the construction project(s), experience has shown that the Cabinet has paid millions of dollars in delay claims. If an effort is made upfront to have the utilities clear before the prime contractor is set to begin, the Cabinet can expect a tremendous savings and/or delay.

IMPLEMENTATION CONSIDERATIONS:

With relocation by permit, the burden for cost was born by the utility company in comparison to an agreement where the costs are reimbursed by KYTC. In the past, any utility located within the existing right of way was usually the responsibility of the utility company to relocate, at their expense, for road projects. A utility agreement versus an encroachment permit can also emphasize completion dates and hold the utilities to complete their relocations before payment is received, giving incentive for earlier completion.

A copy of the legislation has been included with this report.

177.035 Cost of relocation of publicly and privately owned utility equipment and appliances to be borne by department -- Conditions.

(1) If the department determines that it is necessary for any fireplugs, pipes, mains, conduits, cables, wires, towers, poles, and other equipment and appliances, belonging to any municipality or a municipally owned utility, or any water district established pursuant to KRS Chapter 74, any water association established pursuant to KRS Chapter 273, any local school district, or any sanitation district established pursuant to KRS Chapter 220, to be removed or relocated on, along, over, or under a highway, in order to construct, reconstruct, relocate, or improve any highway, the municipality, municipally owned utility, water district, local school district, or the sanitation district shall relocate or remove them in accordance with the order of the department. The costs and expenses of relocation or removal required by this section, including the costs of installing facilities in a new location, and the cost of any lands, or any rights or interest in lands, and any other rights, acquired to accomplish the relocation or removal, shall be ascertained and paid by the department as a part of the cost of improving or constructing highways.

(2) The term "utility" as used in subsections (3) to (5) of this section shall mean any utility not referenced in subsection (1) of this section, and the term shall mean any utility as defined in KRS 278.010.

(3) If a utility has facilities located within the public right-of-way pursuant to KRS 416.140, the department may reimburse the utility the cost to relocate the utility's facilities to a location either within or without the public right-of-way if the relocation is required due to a highway construction project, subject to the following conditions:

(a) The utility shall be required to submit to the department for the department's approval a plan for relocating the utility's facilities. The plan shall include:

1. A proposal for the relocation, including plans and a cost estimate developed in accordance with department guidelines; and

2. A reasonable schedule of calendar days for completing the relocation that has been agreed to by the department. If, due to circumstances beyond the utility's control, the utility or the department cannot meet the specified completion date included in the plan, the department may grant an extension to the utility for a time period agreed upon by both parties; and

(b) The utility shall be required to have either:

1. Entered into a written agreement with the department to include the relocation of the facilities as part of the department's construction contract. The utility may, with the approval of the department, perform a portion of the relocation work under this subparagraph with contractors or employees of the utility; or

2. Entered into a written agreement with the department for the utility to remove all of its facilities that conflict with the highway construction project, as determined by the department, prior to letting the

construction contract. The utility may perform a portion or all of the relocation work under this subparagraph with contractors or employees of the utility.

(4) A utility that enters into an agreement with the department under subsection (3)(b) of this section shall be required to complete the relocation work in compliance with the schedule included in the plan required to be submitted under subsection (3)(a) of this section. The provisions of this subsection shall not apply if the department fails to undertake the highway construction project within the time period specified in the agreement, and in this instance, the department shall be required to reimburse the utility any allowable cost the utility has incurred to relocate its facilities in compliance with the plan approved by the department.

(5) The department shall reimburse a utility as authorized in subsection (3) of this section if the department is satisfied that the utility's facilities have been relocated in conformance with the plan approved by the department. The utility shall have twelve (12) months from the completion date of the relocation, according to the schedule of calendar days, to submit a reimbursement request for relocation costs to the department.

(6) The provisions of this section shall not amend or affect in any way the provisions of KRS 179.265.

Effective: July 13, 2004

History: Amended 2004 Ky. Acts ch. 154, sec. 1, effective July 13, 2004. -- Amended 1994 Ky. Acts ch. 112, sec. 1, effective March 29, 1994; and repealed and reenacted by ch. 279, sec. 2, effective July 15, 1994. -- Amended 1990 Ky. Acts ch. 281, sec. 1, effective July 13, 1990. -- Amended 1988 Ky. Acts ch. 207, sec. 1, effective July 15, 1988. -- Amended 1974 Ky. Acts ch. 74, Art. IV, sec. 20(1). -- Created 1972 Ky. Acts ch. 361, sec. 1.

Legislative Research Commission Note.(9/10/90). Section 2 of the enrolled version of House Bill 301 of the 1990 Regular Session, 1990 Ky. Acts ch. 191, purported to amend KRS 177.035, but the inclusion of that section of the bill was the result of an error in enrolling a Senate amendment which was not accepted by the House and from which the Senate subsequently receded. Pursuant to KRS 446.017, Section 2 of the enrolled version of House Bill 301 is void and has been severed from that bill. The above statutory text is a recodification of KRS 177.035, as amended by the 1990 Regular Session, without the amendment contained in Section 2 of House Bill 301. The original 1990 codification of KRS 177.035 and its accompanying note are superseded and without effect.

VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE: **Install wagon boxes on the ramps to reduce right-of-way purchase**

FUNCTION: **Miscellaneous**

BASELINE ASSUMPTION:

The proposed design for both ramps 3 and 4 show constructing the ramps on embankment at the current crossing of the gravel old railroad bed property access at approximate 309+20 ramp 3 and 411+70 ramp 4. Under this scenario, a parcel in the northeast quadrant is landlocked and will have to be acquired during right-of-way acquisition.

PROPOSED ALTERNATIVE:

An alternative to "filling" over the existing access road is to construct a 12'x15' wagon box under both ramp 3 and ramp 4 to allow access to the previously land locked parcel. In addition to eliminating the need for right-of-way acquisition of this parcel, it also leaves open the opportunity for future construction of a public multi-use facility or even a low volume public access road through the wagon boxes.

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 1,106,000	$ -	$ 1,106,000
PROPOSED ALTERNATIVE:	$ 524,000	$ -	$ 524,000
TOTAL (Baseline less Proposed)	$ 582,000	$ -	**$ 582,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE:	Install wagon boxes on the ramps to reduce right-of-way purchase
BENEFITS	**RISKS/CHALLENGES**
• Eliminates the need for right-of-way acquisition for the land-locked parcel	• Potential for long term maintenance on wagon box structures
• Potential for future uses of public access road for either a multi-use path or low volume access road	• Added cost to construct
• Eliminates the potential for maintenance on the "landlocked" parcel	•
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VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

TITLE: Install wagon boxes on the ramps to reduce right-of-way purchase

DISCUSSION/JUSTIFICATION:

By constructing wagon boxes under both ramps 3 and 4 at the current underpass just north of the KY 348 interchange, you would eliminate the need for acquiring a right-of-way parcel and have the benefit of future expansion for a public pedestrian/multi-use path facility or local access road. We based the construction costs for the wagon box on previous construction estimates. The cost consideration for wagon box is as follows:

$2,375 per lineal foot plus $40,000 for wing wall construction.

There is a minor reduction in earthwork where the culvert is and this is estimated at $5 / Cubic Yard.

The offsetting cost is the fee to acquire right-of-way for the parcel or $200,000/acre, from District 1, Commercial Value.

If the property is determined to be residential, then the average cost for acquisition is $20,000/acre.

If schedule becomes a priority and the property proves to be a difficult acquisition, then there is potential to advance the project quickly by constructing the wagon boxes to avoid a condemnation procedure.

IMPLEMENTATION CONSIDERATIONS:

In order to implement this consideration, the project team will need to decide if the additional construction costs for the culvert provides enough of a benefit by eliminating a total take (parcel is accessed by twin parkway structures over the dirt drive) as well as the potential for allowing for the potential for a pedestrian/multi-use/local access road.

After deciding to move ahead with this concept, the team will need to develop structures plans (either in-house or by consultant) and make sure that the plan development for the structure coincides with the roadway plan development.

VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

TITLE:	Install wagon boxes on the ramps to reduce right-of-way purchase							
DESIGN ELEMENT	**Markup**	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	%	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Earthwork - just in culvert areas (Ramps 3 and 4)		C.Y.	1250	5.00	6,250			
Ramp 3 - 12'x15' wagon box culvert		L.F.				95	2,375.00	225,625
Ramp 3 - wingwalls		L.S.				1	40,000.00	40,000
Ramp 4 - 12'x15' wagon box culvert		L.F.				92	2,375.00	218,500
Ramp 4 - wingwalls		L.S.				1	40,000.00	40,000
Right-of-way acquisition		AC	5.5	200,000.00	1,100,000			
TOTAL COSTS*					**1,106,000**			**524,000**
							TOTAL (BASELINE LESS PROPOSED)	**582,000**

*Note: Total Costs are rounded to nearest thousand dollars

SAVINGS

VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet

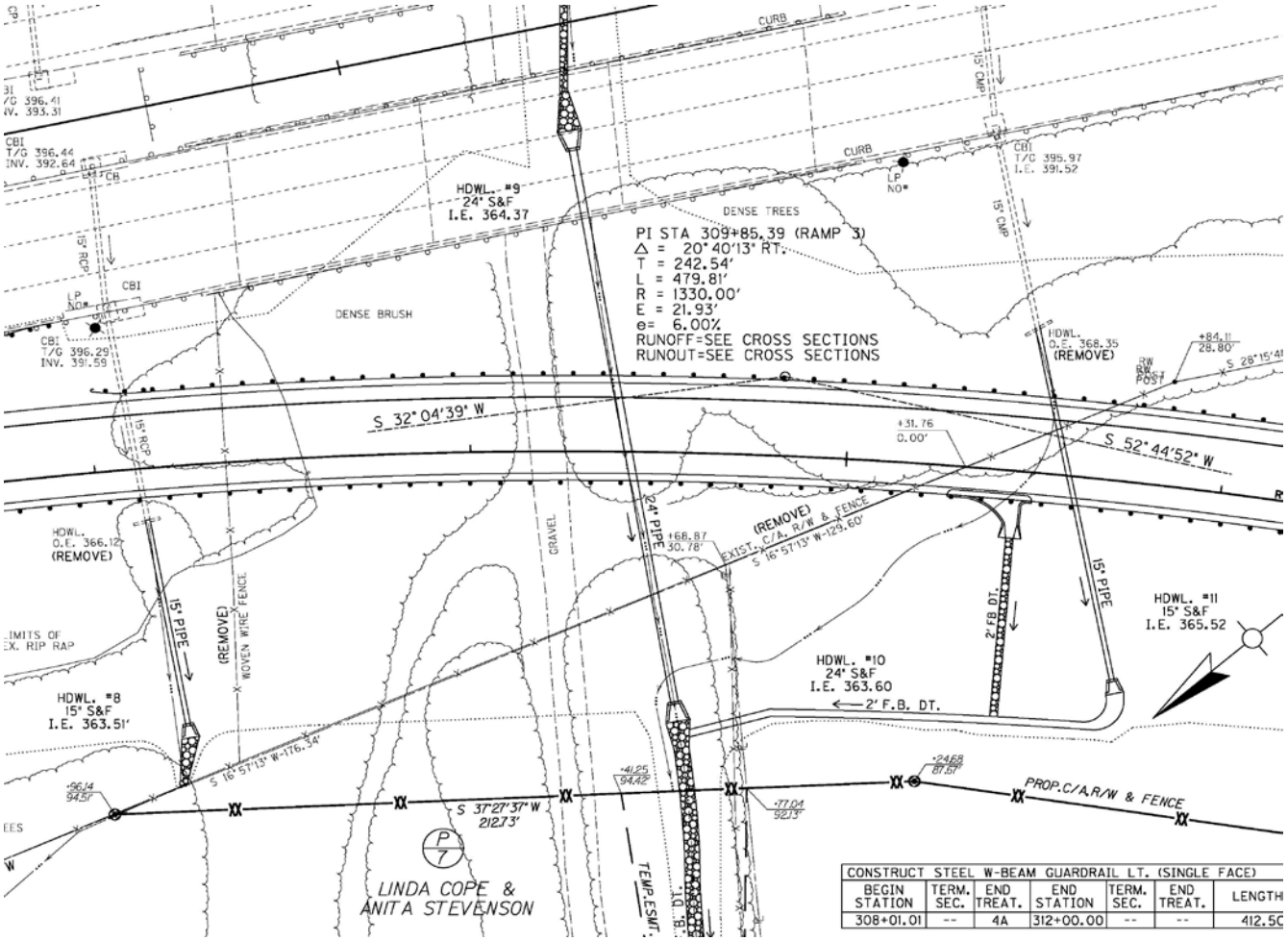
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348

Items #1-8101.00 & #1-8002.00

Marshall County

TITLE: Install wagon boxes on the ramps to reduce right-of-way purchase

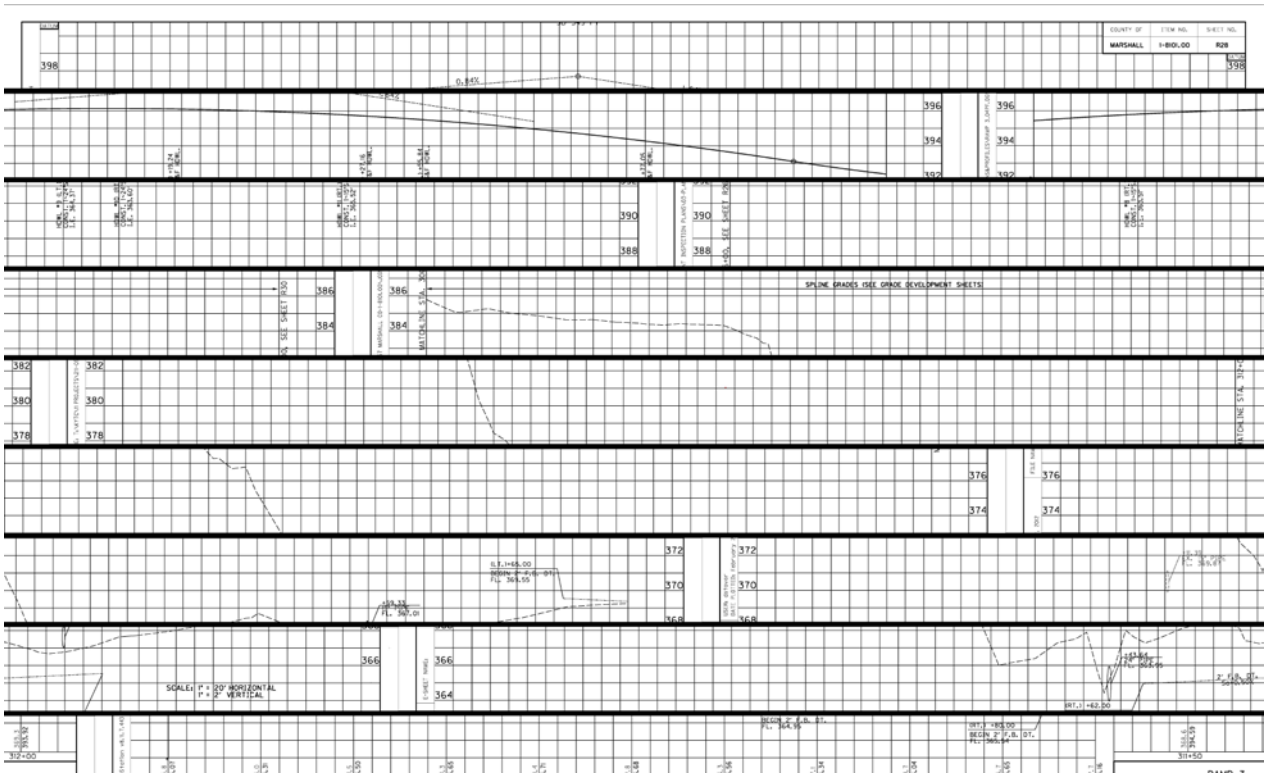
SKETCH OF BASELINE ASSUMPTION



CONSTRUCT STEEL W-BEAM GUARDRAIL LT. (SINGLE FACE)						
BEGIN STATION	TERM. SEC.	END TREAT.	END STATION	TERM. SEC.	END TREAT.	LENGTH
308+01.01	--	4A	312+00.00	--	--	412.50

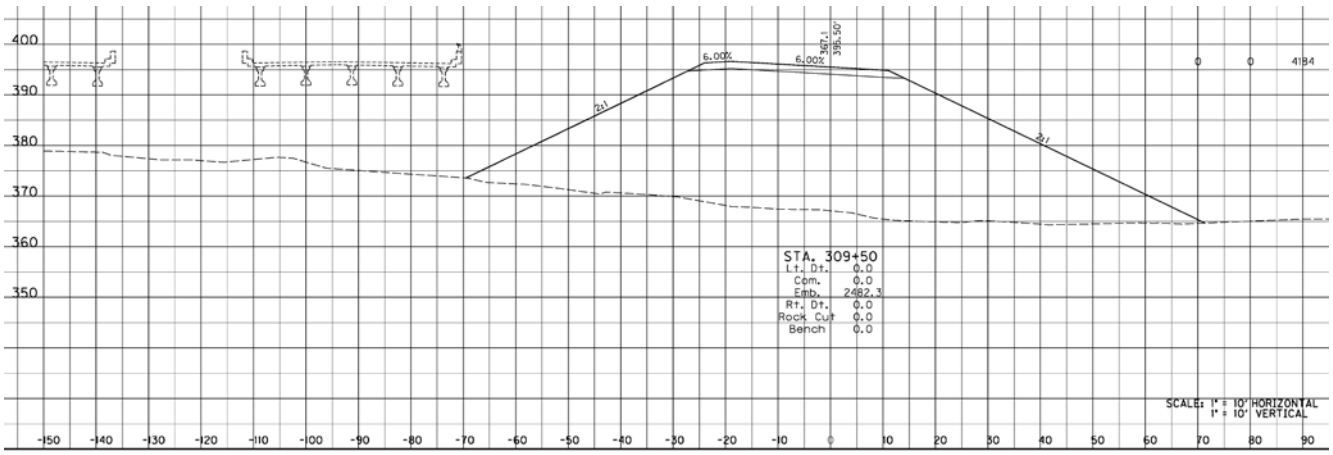
TITLE: Install wagon boxes on the ramps to reduce right-of-way purchase

SKETCH OF BASELINE ASSUMPTION



TITLE: Install wagon boxes on the ramps to reduce right-of-way purchase

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL M-12

Kentucky Transportation Cabinet
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

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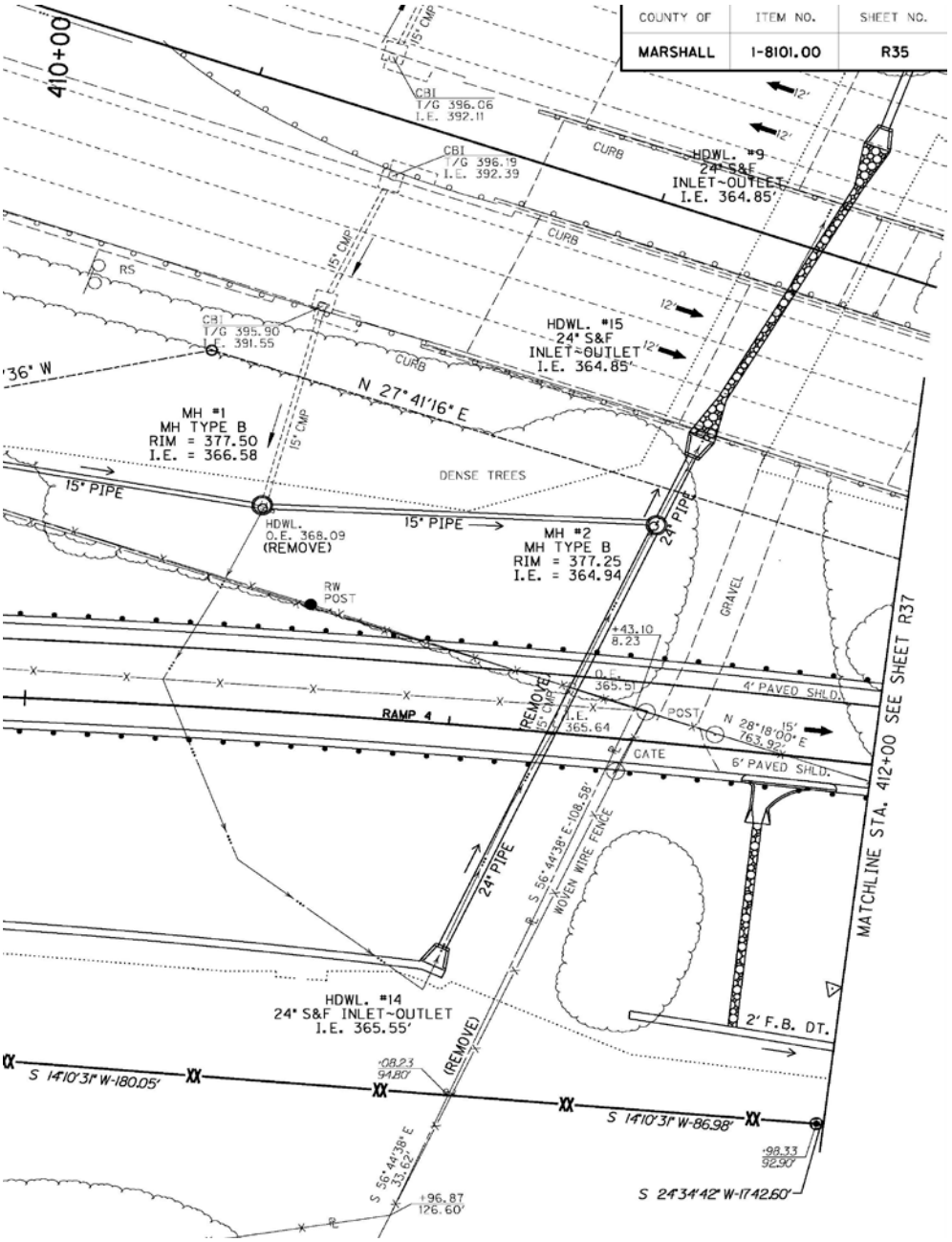

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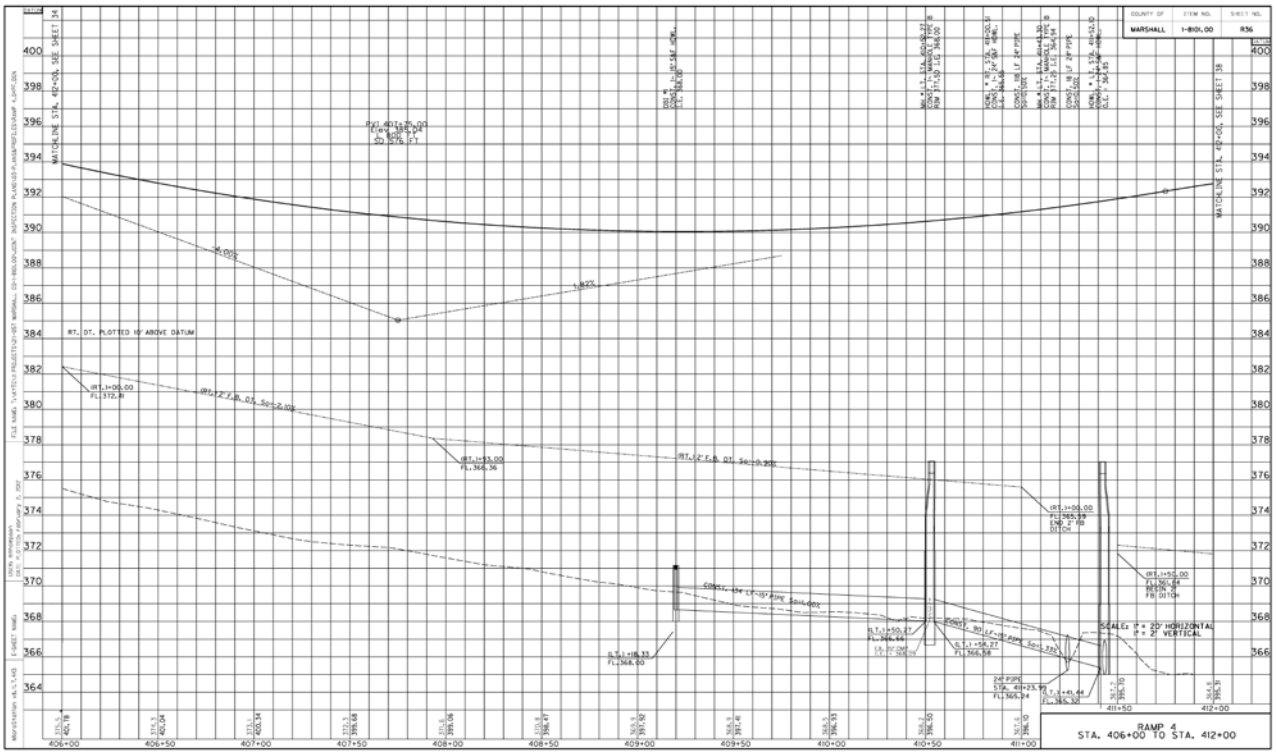

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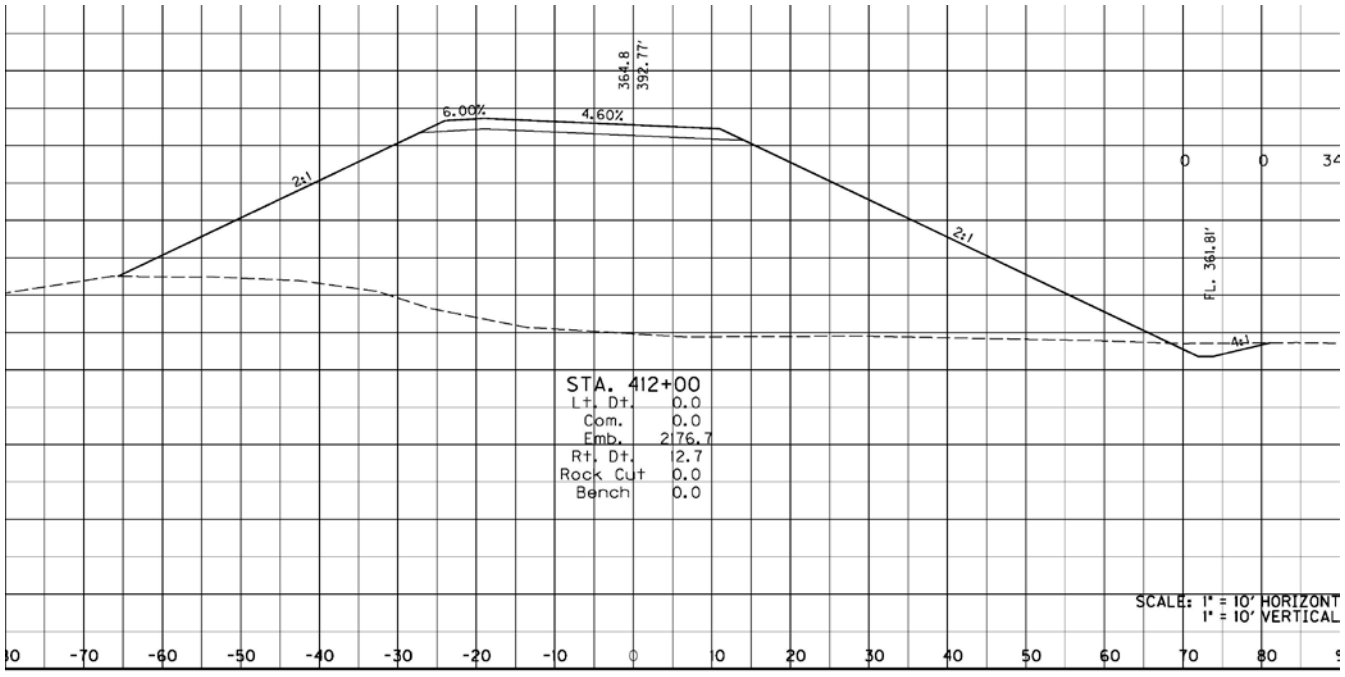

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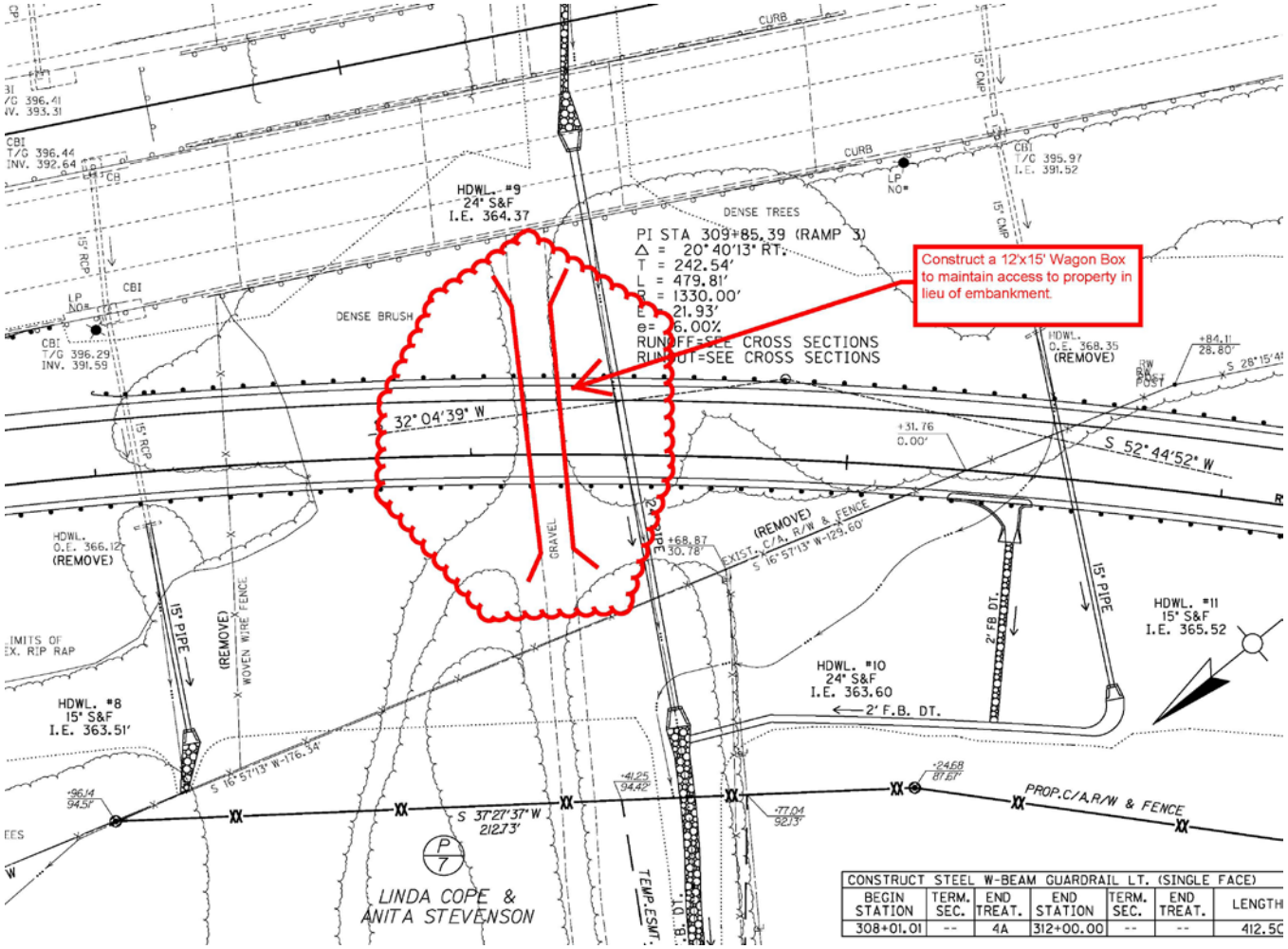
SKETCH OF PROPOSED ALTERNATIVE



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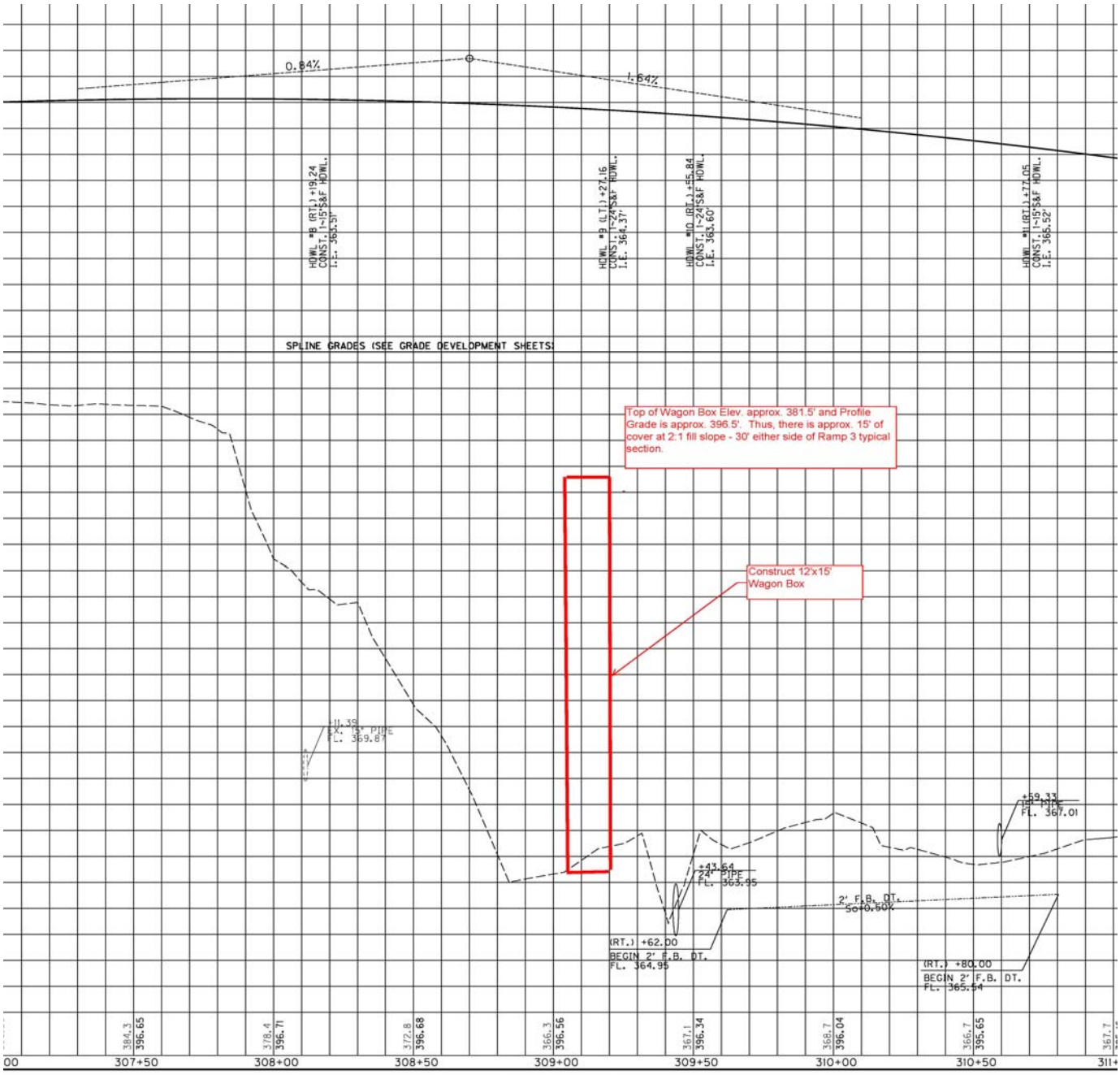

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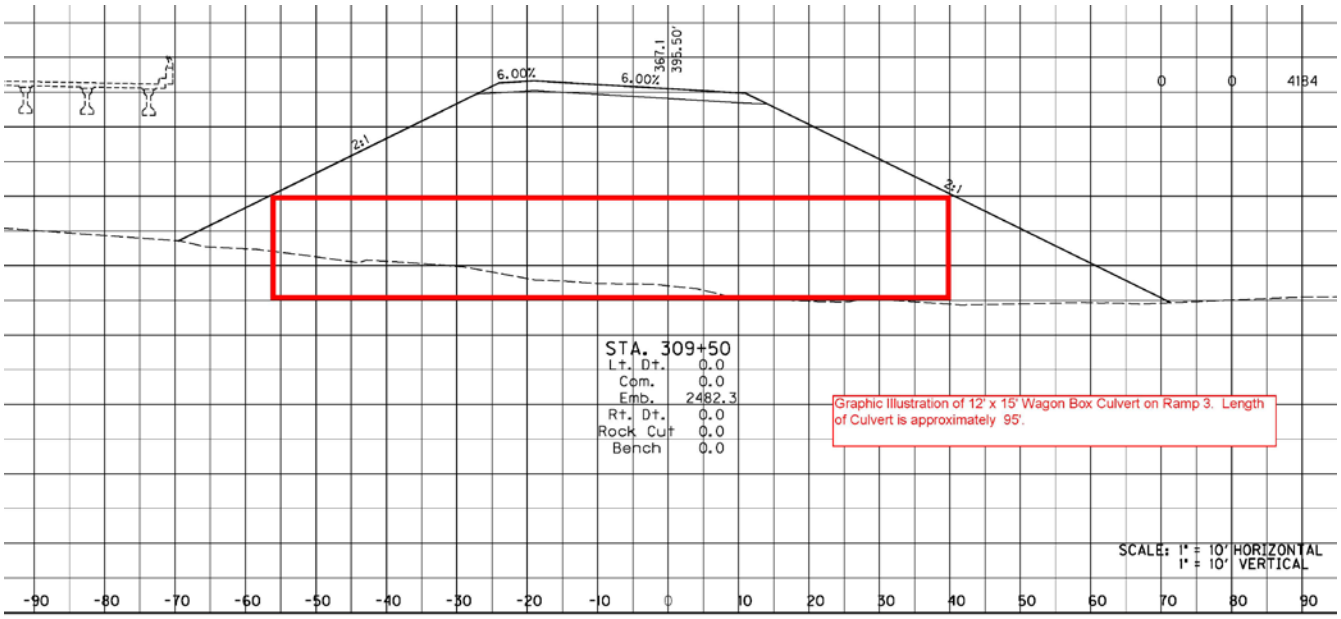

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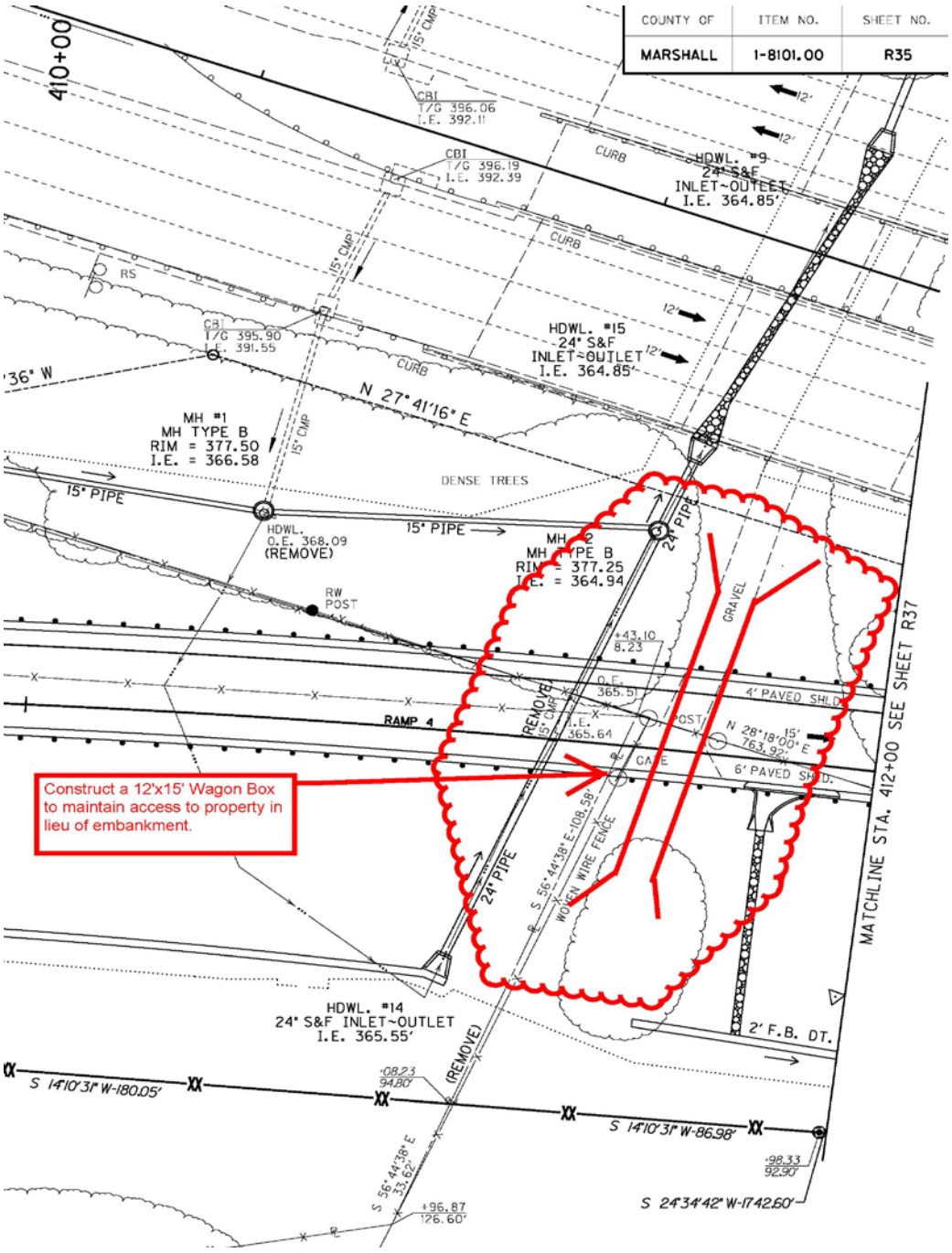

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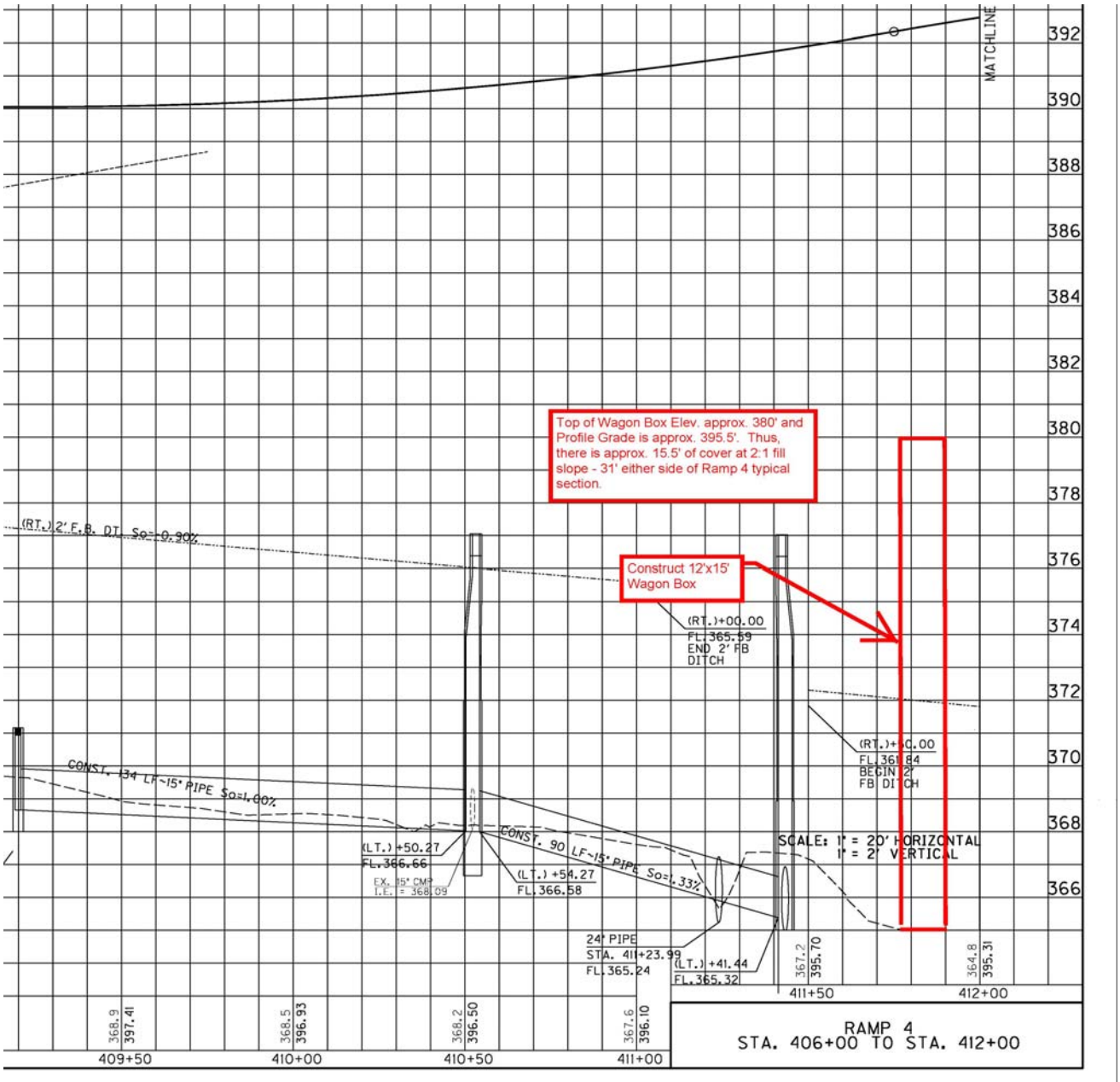

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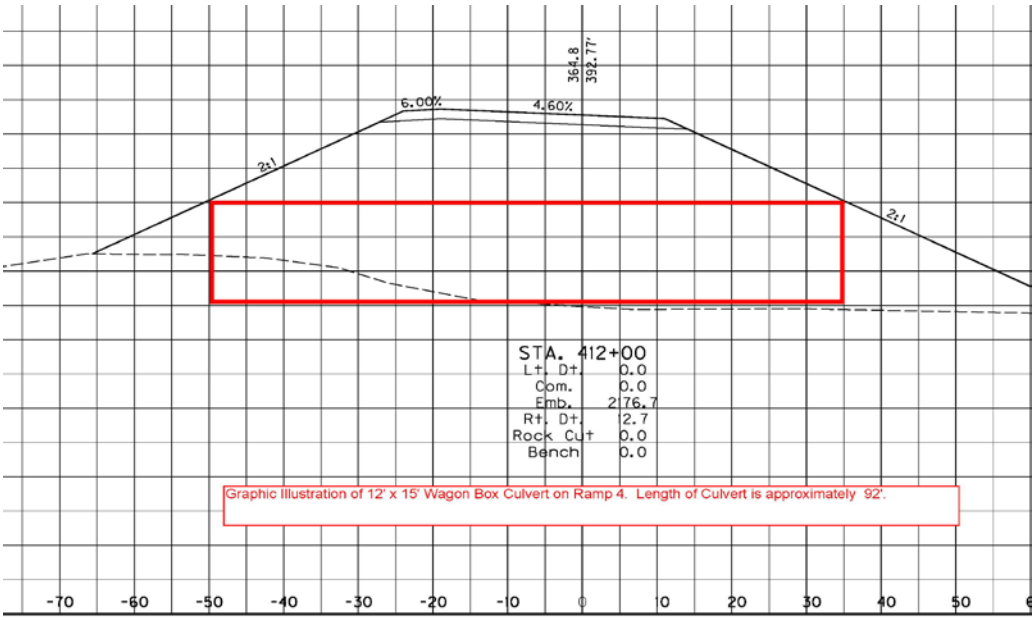

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APPENDICES

APPENDIX A
Study Participants

Appendix A – Study Participants

The following pages include the sign in sheets for the workshop study, including participants from the kick-off meeting and the VE study presentation.

VE STUDY ATTENDEES
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

February 2012					NAME	ORGANIZATION	POSITION	TELEPHONE		CELL	
14	15	16	17					E-MAIL			
X	X	X	X		Renee Hoekstra	RH & Associates, Inc.	Team Leader	623	266-3943	623	764-7490
								rhpartnering@earthlink.net			
X	X	X	X		Laurie Dennis	RH & Associates, Inc.	Assistant Team Leader	206	200-9798		
								lmdennis@earthlink.net			
X			X		Boday Borres	KYTC	Transportation Engineering Branch Manager	502	564-3280	502	229-5737
								boday.borres@ky.gov			
X	X	X	X		Brent Sweger	KYTC	VE Coordinator	502	564-9900	410	693-5822
								brent.sweger@ky.gov			
TC	TC		TC		Mike McGregor	KYTC	TEBM	270	898-2431	270	994-1908
								mike.mcgregor@ky.gov			
X	X	X	X		Jan Cunningham	Qk4	Constructability Team Member	502	585-2222	502	777-2877
								jcunningham@qk4.com			
X	X	X	X		David Kratt	Qk4	Highway Team Member	502	585-2222	502	435-0382
								dkratt@qk4.com			
X	X				Steve Weber	Qk4	Structural Team Member	502	585-2222	502	550-6263
								sweber@qk4.com			
X	X	X	X		Phil Demosthenes	Consultant	Access Management Team Member	303	349-9497	303	349-9497
								phil@pdemos.com			
	X	X	X		Taylor Kelly	Qk4	Highway Team Member	502-	585-2222	502	229-2226
								tkelly@qk4.com			

F = Full Time, P = Part Time; TC = Teleconference

VE STUDY ATTENDEES
Julian M. Carroll Purchase Parkway Interchange & Widening of KY 348
Items #1-8101.00 & #1-8002.00
Marshall County

RH & Associates, Inc.

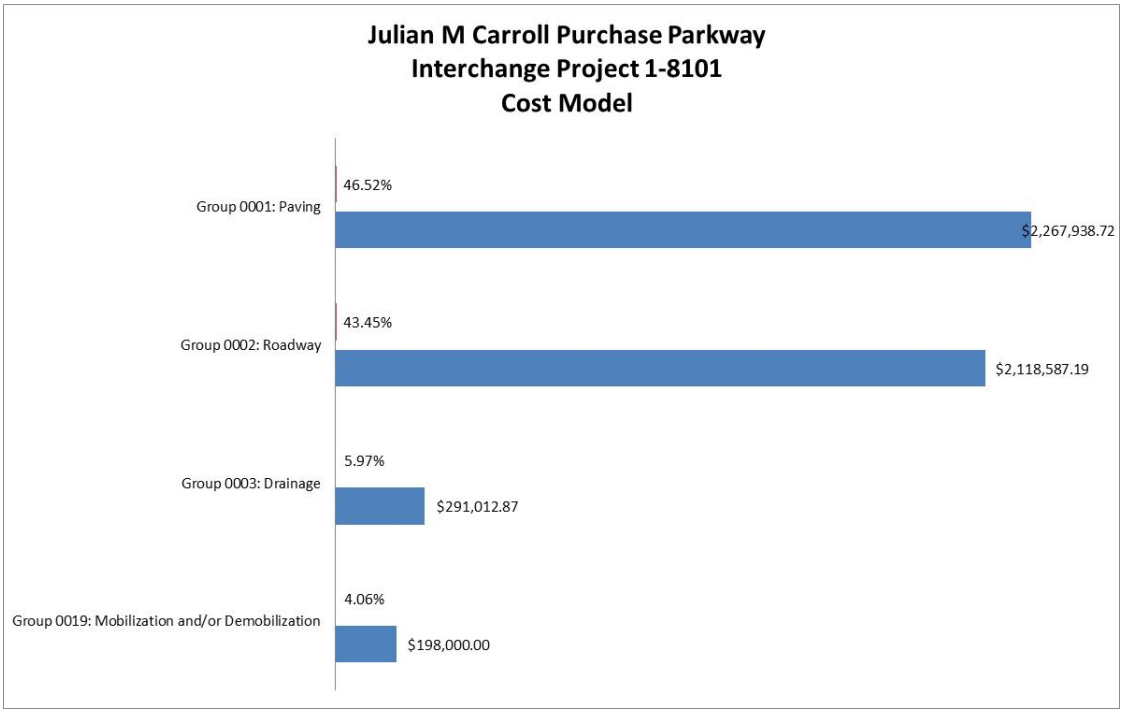
February 2012					NAME	ORGANIZATION	POSITION	TELEPHONE		CELL	
14	15	16	17					E-MAIL			
X			X		Rick Sullivan	F&H	Project Manager KY348 Widening				
X					Susan Oatsman	KYTC	District 1 Design Engineer				
X			X		Kyle Joiner	F&H	Design Engineer KY348 Widening				
X					Chad Stoerger	F&H	Project Engineer KY348 Widening				
X			X		Ben Quinn	AEI	JCPP Interchange Project Manager				
			TC		Roy Sturgill	KYTC	Construction Review QAB				
			TC		Jeff Jasper	KYTC	Highway Design Director				
			TC		David Martin	KYTC	Highway Design Location Engineer				

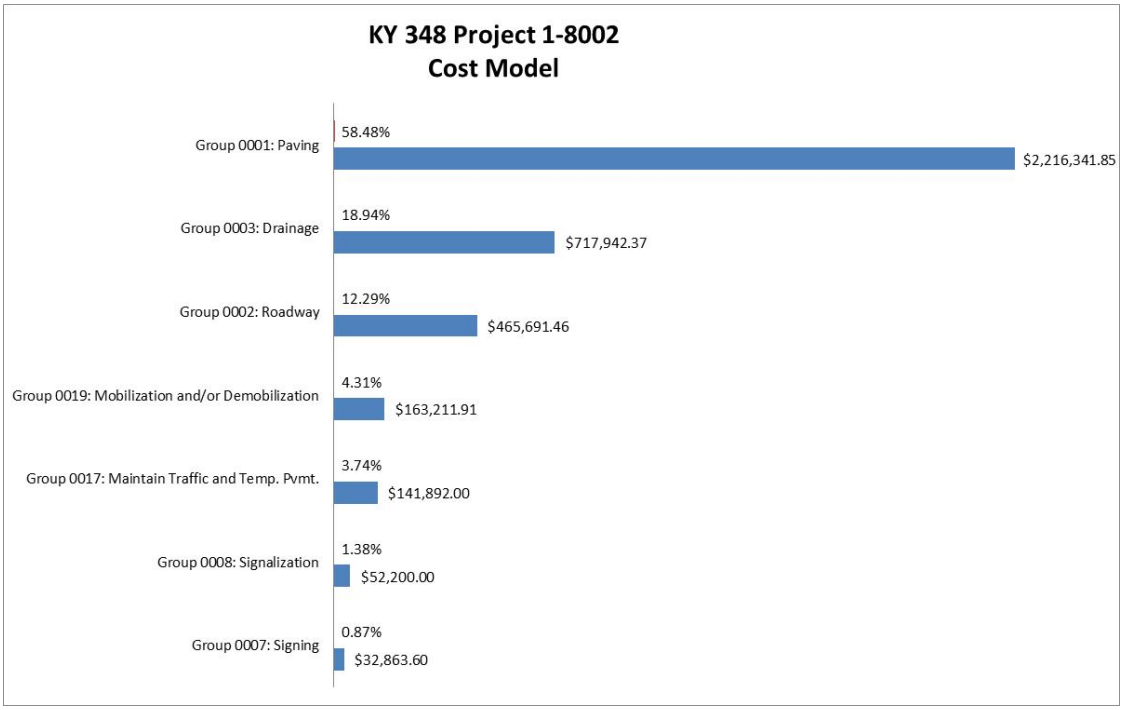
F = Full Time, P = Part Time; TC = Teleconference

APPENDIX B
Pareto Cost Models

Appendix B – Cost Models

The team studied two projects, however these were reviewed as a single project. Both projects have separate cost models that were completed. These are shown below:





APPENDIX C
Function Analysis

Appendix C – Function Analysis

Function definition and analysis is the heart of Value Engineering. It is the primary activity that separates VE from all other "improvement" programs. The objective of this phase is to ensure the entire team agrees upon the purposes for the project elements. Furthermore, this phase assists with development of the most beneficial areas for continuing study.

The VE team identified the functions of the projects based on the entire corridor using active verbs and measurable nouns. This process allowed the team to truly understand all of the functions associated with the project.

Function	Classification
Obtain Interstate Designation	***Higher Order***
Improve Operations	***Basic***
Improve Capacity	Secondary
Improve Safety	Secondary
Reduce Crashes	Secondary
Support Commercial Growth	Secondary
Eliminate Weaves	Secondary
Maintain Access	Secondary
Eliminate Turns	Secondary
Relocate Utilities	Secondary
Accommodate Drainage	Secondary
Accommodate Pedestrians	Secondary
Accommodate Medical Traffic	Secondary
Accommodate Expansion	Secondary
Establish Minimum Standards	Secondary
Accommodate Turning Movements	Secondary
Accommodate Trucks	Secondary
Accommodate Bicycles	Secondary

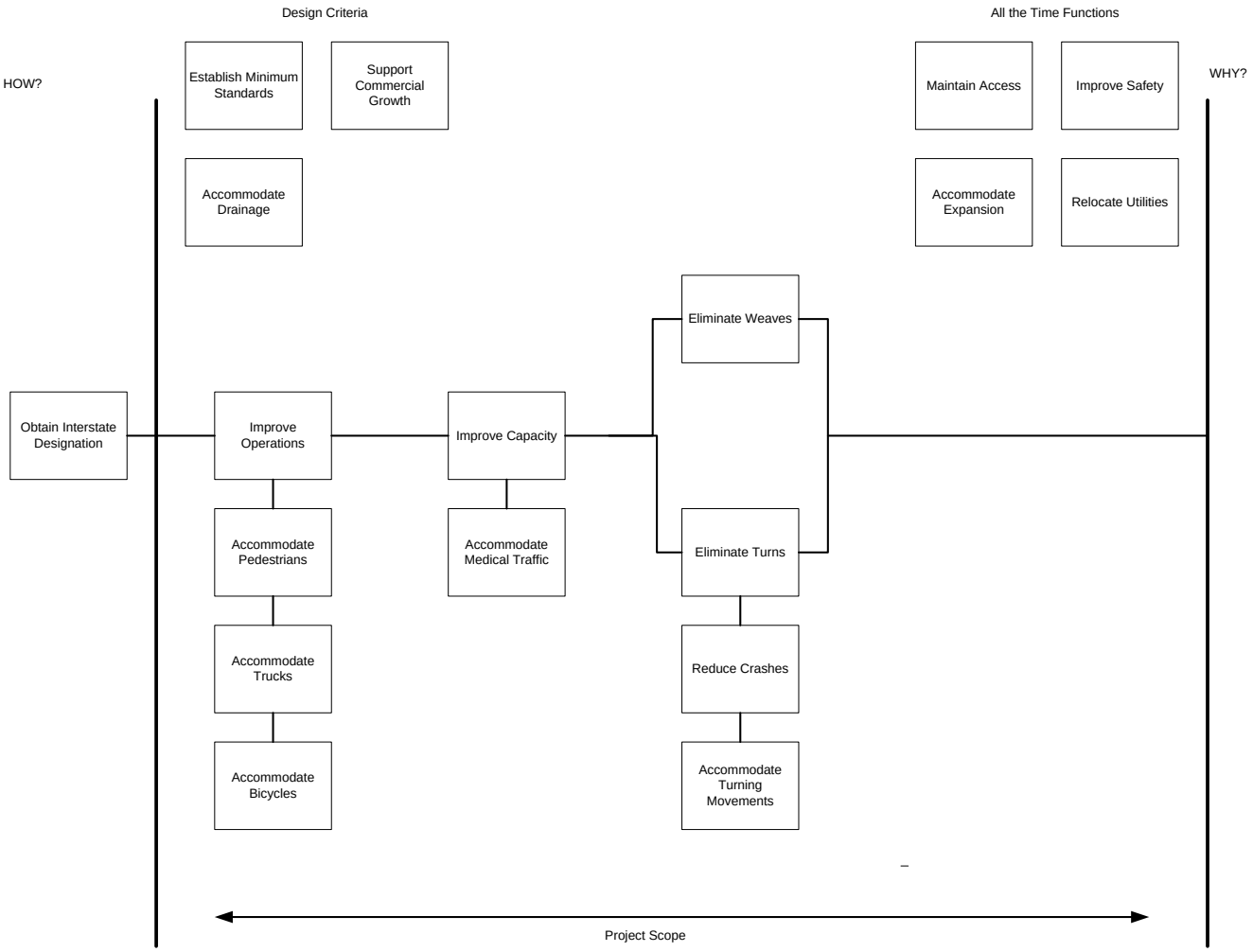
The definitions of the classifications are:

Higher Order Function defines the problem (study) goal and is outside the scope of the study.

Basic Function defines a performance feature that *must* be obtained to satisfy only user's needs not desires. It answers the question, “What must it do?”.

Secondary Functions defines required performance features other than those that must be accomplished. These are the user’s desires and answers the question, “What else do we want or does it do?”.

The following represents the Function Analysis Systems Technique (FAST) Diagram completed for this project.



APPENDIX D
Creative Idea List & Evaluation

Appendix D – Creative List and Evaluation Process

Creative Idea List

The list of ideas and comments that resulted from the study is included in this appendix. Some of the ideas were selected for further development as represented in the previous section.

Performance Attributes

The project manager helped to define the key performance attributes for the VE team members to use for evaluation. The following key attributes were used to score the ideas (see below):

- **Phaseability –** Accommodates future expansion of system and accommodates the future I-69 Corridor
- **Preserve Mainline Operations** – Access management and capacity
- **Local Operations** – Access to businesses and future development

Evaluation Process

To aid in the evaluation of the ideas, the team scored the ideas using a nominal group technique. The ideas were scored relative to the performance attributes as described above.

Group Nominal Technique Evaluation Results Score

The prioritization for further development and documentation is as follows:

Score =

- 1-4 – Number of votes meeting the criteria (Workbook)
- 0 – Number of votes meeting the criteria (No workbook)
- DS – Design Suggestion (No workbook)
- DS* – Design Suggestion (Workbook)
- FF – Fatal Flaw
- ABC – Already Been Considered

The creative idea list represents all of the ideas and includes scoring for the ideas that were rated using the group nominal technique.

Creative Idea List

No.	Description	Comments	Score
AB	**Accommodate Bicycles**		
AB-01	Add bike lanes on both sides		0
AB-02	Add a separate bicycle path		0
AB-03	Add bike lanes on both sides by reducing 12' lanes and medians		1
AB-04	Add a bike lane on one side only		FF
AB-05	Shared lanes with signage only		1
AB-06	Accommodate bikes through the interchange		0
AB-07	Widen the existing sidewalk to accommodate bike		w/AB-02
EW	**Eliminate Weaves**		
EW-01	Use a parcel clover leaf interchange concept (flop diamond)		ABC
EW-02	Improve to a 3-lane urban on KY 348		4
EW-03	Reduce the number of access points on KY 348		0
ET	**Eliminate Turns**		
ET-01	Install non-mountable median on KY 348		2
ET-02	Install roundabouts at the end of both ramps		0
ET-03	Replace the Wal-Mart (Ash) signal with a roundabout		0
ET-04	Install a roundabout at Commerce		0
ET-05	Install a roundabout at KY 641		0
ET-06	Install a roundabout at Old Symsonia, hospital entrance		0
ET-07	Create cross-parcel connections		0
ET-08	Install a frontage or backage road on KY 348		0
ET-09	Install roundabouts at all major intersections		3
IO	**Improve Operations**		
IO-01	Add right turn lanes instead of widening to 5 lanes		1
IO-02	Add right turn lanes		0
IO-03	Install mid-block U-turns instead of left hand turns		Dropped
IO-04	Develop access management plan and MOU (memorandum of understanding)		1
IO-05	Reduce the speed limit, change the breaking point		2
IO-06	Install dedicated left-turn lanes		0
IO-07	Install signal system		0
IO-08	Add signals		0
IO-09	Increase the length of the dedicated turn lanes to meet current KYTC policy		DS
AP	**Accommodate Pedestrians**		
AP-01	Extend the sidewalk across the bridge		1
AP-02	Eliminate the sidewalk on one side		0
AP-03	Extend the sidewalk into businesses		2
AP-04	Add a pedestrian bridge		0
AP-05	Use the railroad underpass for multi-use		0
AP-06	Create a local street connection using the railroad underpass		DS*
RC	**Reduce Crashes**		

Creative Idea List

No.	Description	Comments	Score
RC-01	Eliminate signals		0
RC-02	Provide offset left turns using a wider TWLTL (two-way left turn lane)		1
AT	**Accommodate Trucks**		
AT-01	Use concrete at the ramp intersections		0
AT-02	Increase the left-turn radii for trucks		1
AM	**Accommodate Medical Traffic**		
AM-01	Extend project limits west to include the hospital entrance		4
AM-02	Add a left turn lane into Old Symsonia Road (hospital)		2
AM-03	Eliminate the private cut-through road to KY 348		DS
AM-04	Ensure the lane widths can accommodate emergency vehicles during construction		DS
IC	**Improve Capacity**		
IC-01	Widen the offramps to increase storage to meet current KYTC policy		DS
IC-02	Improve the capacity of the Ash approach to KY 348		0
M	**Miscellaneous**		
M-01	Improve KY 348 to 3 lanes to Old Symsonia		w/AM-01
M-02	Improve KY 348 to 2-lane divided section with paved shoulders to Old Symsonia		0
M-03	Remove the 2 bridges over the railroad		0
M-04	Put the pedestrians in the median on the bridge		0
M-05	Leave the 3-lane rural and do spot improvements to improve capacity		w/IO-01
M-06	Add streetscape		0
M-07	Combine both projects for construction		1
M-08	Apply the utility legislation to this project and start the utilities work sooner		DS*
M-09	Do all the utility work for the ultimate build-out		0
M-10	Provide 3-lane rural and add a wider shoulder		0
M-11	Provide 5 lanes of pavement, stripe for 3 lanes		0
M-12	Install wagon boxes on the ramps to reduce right-of-way purchase		3

APPENDIX E
Supporting Data

Appendix E – Supporting Data

Team Observations

The VE team identified observations, concerns and opportunities to be addressed during the creative generation of potential ideas and alternatives. The following is a list of the VE team's observations:

1. A new signal is being added at Commerce
2. The project team does not want to touch any of the existing structures
3. This is a very old project, it has been on the books for 11 years
4. The project team has done a very thorough job on minimalizing the changes to the existing interchange
5. The project is very late in design
6. The right-of-way process is starting from scratch
7. There are two separate projects being reviewed for this VE study
8. It is critical to get the interstate shields in place
9. This interchange is a higher priority due to I-69 status
10. The Red Cross is being evicted from the old toll building
11. No crash history is available, the information is based on anecdotal information
12. The current design approach is going to increase accidents/occurrences
13. Updates are currently being done to the plans
14. There are inconsistencies in the design criteria related to design speed, curb and gutter and urban versus rural designation
15. There is an apparent lack of recent interface with the stakeholders and the public in the area
16. There is a strong potential for growth around the hospital
17. Vertical clearance project requirements are being met with the current design
18. Not clear what available tolerances were accounted for in the current vertical clearance related to future overlay/improvements
19. Phaseability has been considered in the existing design
20. No deficiencies exist related to the current structures
21. The bridge is wide enough to accommodate bikes and pedestrians

Risk Registry

During the kick-off meeting, the project team identified the risk elements related to the overall project success. The group also defined the probability and the severity of the risk if the occurrence happened. The following risk registry summarizes those discussions.

The VE team used the risk elements and identified potential ideas and alternatives to mitigate those items which are included as ideas on the creative idea list.

Probability of Occurrence	Highly Likely	Likely	Possible	Unlikely	Very unlikely	MATRIX KEY
	> 70%	51 - 70%	21 - 50%	5 - 20%	< 5%	
Severity of Impact	Catastrophic	Substantial	Moderate	Marginal	Negligible	
	100	50	20	5	1	
Risk Rating	Extremely High		High		Moderate	Low
	Red (50- 500)		Orange (15 - 49)		Yellow (3 - 14)	Green (0 - 2.9)

Identify the Risk		Assign the Risk	Classify the Risk			Quantify	Quantify	Risk Response	
Risk ID	Description of Risk	Who does the risk affect?	Probability of Impact %	Severity of Impact (numeric)	Risk Rating	$$ Impact	Time Impact	Avoid? Mitigate? Accept? Transfer?	Comments
1	FHWA changing their minds about the interchange design standards or change in personnel		51%	20	40.0			Accept	
2	Armory not accepting the access change		21%	5	5.0			Mitigate	Minor changes
3	Right-of-way negotiations, i.e. condemnation		70%	50	100.0	Increase	Several Months	Mitigate	40 parcels need to be taken
4	Continued development pressures		25%	5	5.0			Mitigate	
5	Closing off the underpass at the abandoned railroad		70%	20	40.0	Increase in costs		Accept	Right-of-way purchase, if can't negotiate, potential impacts to design or additional costs to remove
6	Timing of the utility relocations on 348		75%	100	500.0	Increase in costs		Mitigate	Schedule impacts
7	Funding source for construction not available		15%	100	50.0	None	None	Accept	No money no project
8	Unaccounted future growth/traffic volumes related to the hospital		65%	5	10.0				