VALUE ENGINEERING STUDY

OF

KY 536 KENTON COUNTY
KY 536 BOONE COUNTY
KY 237 BOONE COUNTY

ITEM NUMBERS: 6-162, 6-158, & 6-8001

Boone-Kenton County, Kentucky

May 14-18, 2007

Prepared by:

VE GROUP, L.L.C.

In Association With:

KENTUCKY TRANSPORTATION CABINET

VALUE ENGINEERING STUDY
TEAM LEADER

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C.V.S. No. 20010901

DATE

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I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by VE Group for the Kentucky Transportation Cabinet. The study was performed during the week of May 14-18, 2007.

The subject of the study was the reconstruction of segments of KY 536 & KY 237 in Boone County and a segment of KY 536 in Kenton County. The two KY 536 projects are on either side of I-75 and the third project is KY 237 from US 42/127 to KY 18 including a Single Point Interchange at KY 18.

PROJECT DESCRIPTION

1. 6-162 – KY 536 Kenton County: This Project's concept was recently revised to construct a new 4.5 mile 4-lane divided urban facility form east of SR 25 to KY 17. This construction will be on both existing alignment as well as new alignment. Included in the design are roundabout intersections at KY 1303, Calvary Road and Independence Road.

2. 6-158 – KY 536 Boone County: This project is to construct 3+/- miles of 3 & 5-lane urban typical section from I-75 to just west of the existing US 42/127 intersection. Part of this work will be on new alignment.

3. 6-8001 – KY 237 Boone County: This project is to construct 5.2+/- miles of 5-lane urban typical section. Roundabouts are planned for the existing US 42/127 intersection and one approximately 1,000' east of the new US 42/127 alignment.

METHODOLOGY

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

This process included the following phases:

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

I. EXECUTIVE SUMMARY

METHODOLOGY

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

- Traffic Control
- Construction Time
- Roadway operational improvement
- Service Life
- Future Maintenance Cost
- Right of Way Cost
- Construction Cost
- Utility Impacts

I. EXECUTIVE SUMMARY

RESULTS – AREAS OF FOCUS

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

Recommendation Number 1:

The Value Engineering Team recommends that Value Engineering Alternative be implemented. This alternative will construct a Continuous Flow Intersection (CFI) traffic control for the intersection of KY-237 and KY-18.

If this recommendation can be implemented, there is a possible savings of ***$5,835,400.***

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will change KY 536 (Kenton County) to a 4-lane divided Urban typical with a raised median in 104' of right-of-way.

If this recommendation can be implemented, there is a possible savings of ***$1,225,321.***

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct a roundabout at Rogers Road and KY 237.

If this recommendation can be implemented, there is a possible savings of ***$285,680.***

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will reduce the border width and increase the two way left turn to 14' for KY 237 Typical Section.

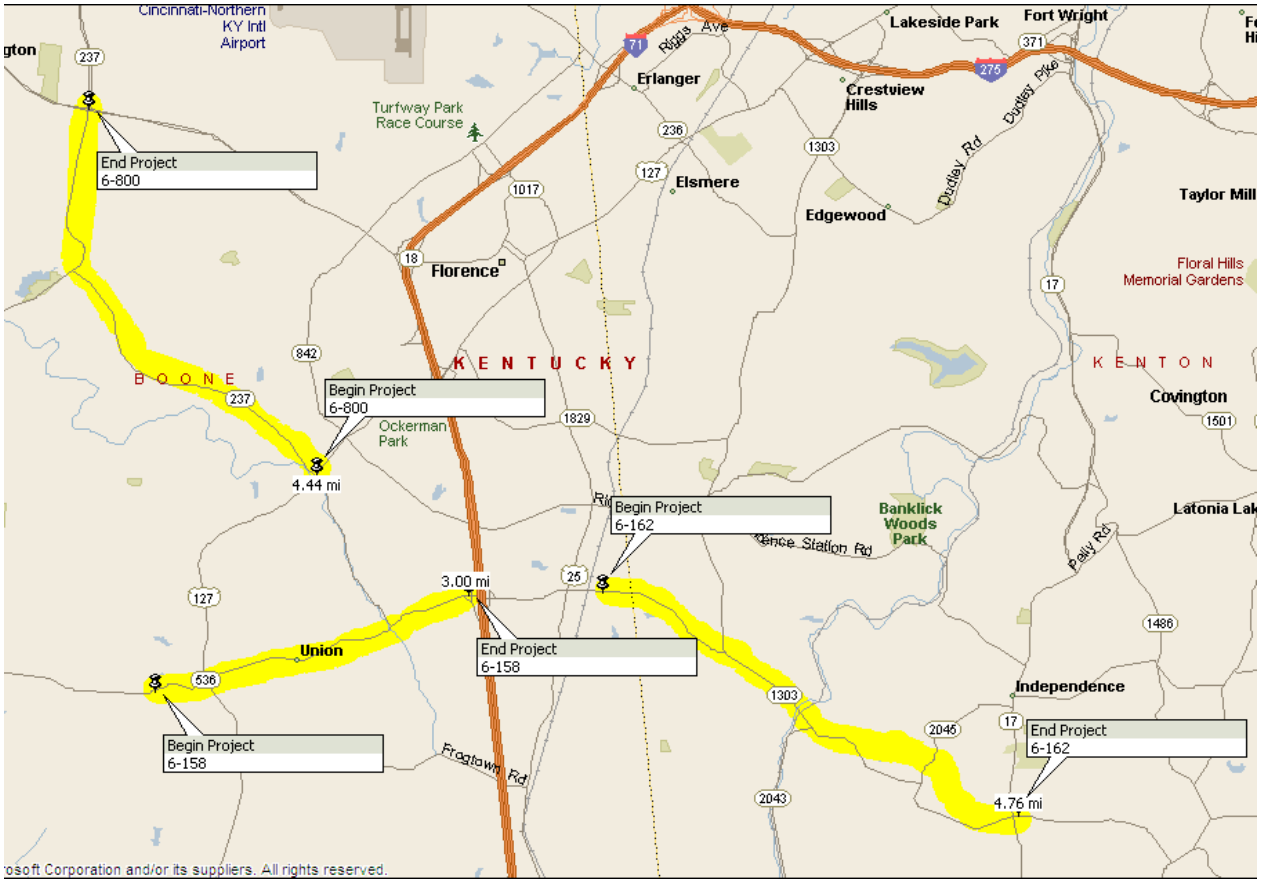
If this recommendation is implemented, there is a possible additional cost of ***$187,417.***

Recommendation Number 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct a Soil Nail Wall in place of a Cast in Place wall.

If this recommendation can be implemented, there is a possible savings of ***$428,793.***

II. LOCATION OF PROJECT



LOCATION MAP

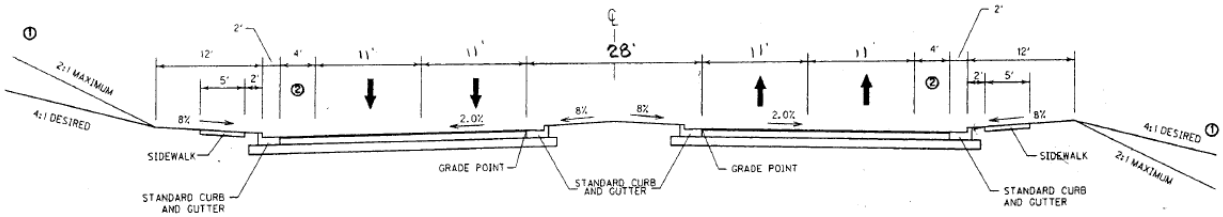
III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAMMEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
Thomas A Hartley, P.E., C.V.S.	VE Group	Team Leader	850/627-3900
Tom Howard, P.L.S.	VE Group	Right-of-Way	850/627-3900
Duncan Silver, P.E., P.L.S.	VE Group	Pavement	850/627-3900
Siamak Shafaghi	KYTC, Program Performance	Roadway	502-564-3280

PROJECT DESCRIPTION

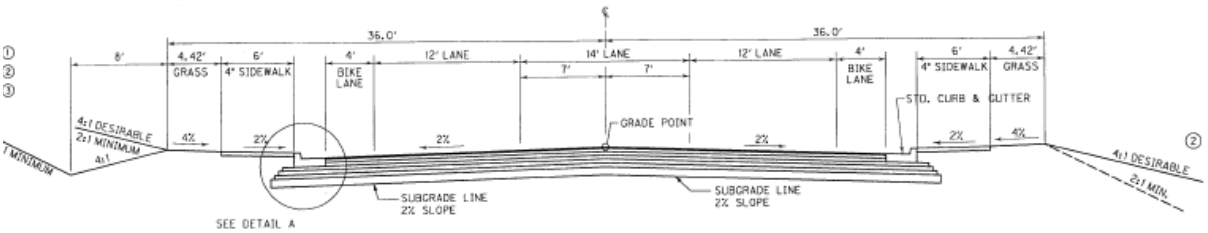
1. 6-162 – KY 536 Kenton County: This Project's concept was recently revised to construct a new 4.5 mile 4-lane divided urban facility form east of SR 25 to KY 17. This construction will be on both existing alignment as well as new alignment. Included in the design are roundabout intersections at KY 1303, Calvary Road and Independence Road. The construction cost estimate is at $23,400,000 +/- and right-of-way is estimated to be $2,336,000.



III. TEAM MEMBERS AND PROJECT DESCRIPTION

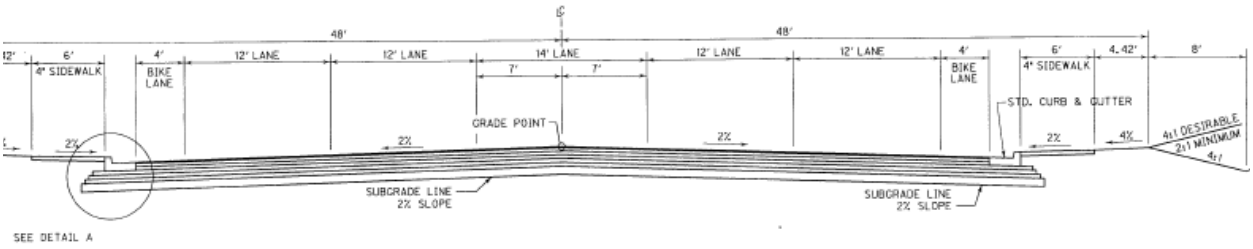
PROJECT DESCRIPTION

2. 6-158 – KY 536 Boone County: This project is to construct 3+/- miles of 3 & 5-lane urban typical section from I-75 to just west of the existing US 42/127 intersection. Part of this work will be on new alignment. The construction cost estimate is at $15,000,000 +/- and right-of-way is estimated to be $1,762,000.



3 – LANE URBAN NORMAL CUT/FILL SECTION

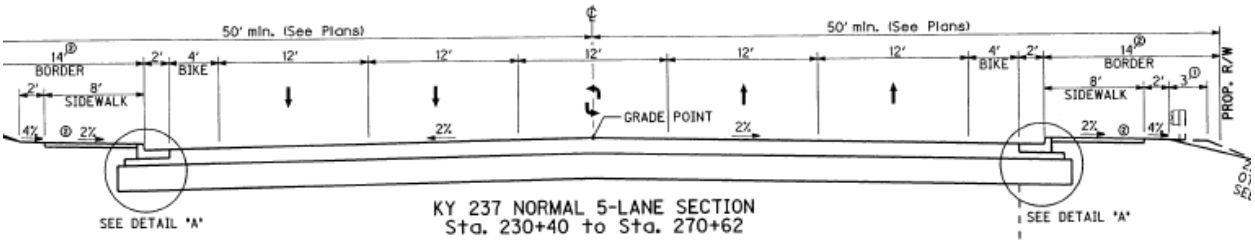
KY 536 – MT. ZION ROAD



5 – LANE URBAN NORMAL CUT/FILL SECTION

KY 536 – MT. ZION ROAD

3. 6-8001 – KY 237 Boone County: This project is to construct 5.2+/- miles of 5-lane urban typical section. Roundabouts are planned for the existing US 42/127 intersection and one approximately 1,000' east of the new US 42/127 alignment. The construction cost estimate is at $28,000,000 +/- and right-of-way is estimated to be $2,652,300.



A Single Point Urban Interchange (SPUI) is plan at the northerly limits of the project at the intersection of KY 18 and KY 237. This interchange will cost an estimated $10,000,000.

IV. INVESTIGATION PHASE

VALUE ENGINEERING STUDY BRIEFING

KY 536 KENTON COUNTY, KY 536 BOONE COUNTY, KY 237 BOONE COUNTY May 14, 2007		
NAME	**AFFILIATION**	**PHONE**
Thomas A Hartley, P.E., C.V.S.	VE Group, Team Leader	850/627-3900
Tom Howard, P.L.S.	VE Group, Right of Way	850/627-3900
Duncan Silver, P.E., P.L.S.	VE Group, Pavement	850/627-3900
Brad Eldridge	KYTC, Highway Design	502-564-3280
Richard Guidi	GRW, Highway Design	859-331-9220
Ben Robertson	GSP, Highway Design	502-627-8930
Dave Taylor	GSP, Highway Design	502-627-8902
Brent A Sweger	KYTC, Planning	502-564-7183
Siamak Shafaghi	KYTC, Program Performance	502-564-3280
Greg Sharp	Entran, Highway Design	859-233-2100
Glenn Hardin	Entran, Highway Design	859-233-2100
Jim Wathen	KYTC, Program Performance	502-564-4555

STUDY RESOURCES

KY 536 KENTON COUNTY, KY 536 BOONE COUNTY, KY 237 BOONE COUNTY May 14-18, 2007		
NAME	**AFFILIATION**	**PHONE**
Paul McCauley	KYTC, Right of Way	502-564-3210 X3477
Kevin Cargill	Schnabel Foundation Co.	770-971-6455
John Ledbetter	VE Group, LLC	850-627-3900

IV. INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET

KY 536 KENTON COUNTY, KY 536 BOONE COUNTY,
KY 237 BOONE COUNTY

May 14-18, 2007

ITEM	FUNCT. VERB	FUNCT. NOUN	* TYPE	COST	WORTH	VALUE INDEX
Pavement	Support	Traffic	B	$22,000,000	$22,000,000	1.00
Single Point Interchange	Separate	Traffic	B	$10,000,000	$1,000,000	**10.00**
Right of Way	Acquire	Rights	S	$6,750,000	$6,000,000	**1.12**
Earthwork	Set	Grades	B	$9,500,000	$9,500,000	1.00
Drainage	Convey	Water	S	$9,000,000	$9,000,000	1.00
Retaining Wall	Retain	Earth	S	$1,000,000	$750,000	**1.33**
Bike & Creek Arch Culvert	Separate	Traffic	B	$475,000	$400,000	**1.19**

***B – Basic S - Secondary**

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

IV. INVESTIGATION PHASE

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

A. SINGLE POINT INTERCHANGE

B. RIGHT OF WAY

C. RETAINING WALL

D. BIKE & CREEK ARCH CULVERT

V. SPECULATION PHASE

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

A. SINGLE POINT INTERCHANGE

- At grade intersection.
- Continuous flow intersection.
- Switch KY 18 over intersection.
- Tight Diamond Interchange with 2-lane KY 237 overpass.

B. RIGHT OF WAY

- Shift alignment of Sycamore Drive at Mt. Zion Road.
- Change KY 536 (Kenton County) to a 4-lane divided Urban typical with a raised median in 104’ of right-of-way.
- Construct a roundabout at Rogers Road and KY 237.
- Reduce border width and increase two way left turn lane for the KY 237 Typical Section.

C. RETAINING WALL

- Raise Grade.
- Shift alignment to the west.
- Soil Nail wall.

D. BIKE & CREEK ARCH CULVERT

- Construct bridge over creek and bike path.
- Use steel pipe arch to span over the creek and the bike path individually.
- Use steel pipe arch to span over both the creek and the bike path.

VI. EVALUATION PHASE

A. ALTERNATIVES

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

A. SINGLE POINT INTERCHANGE

Value Engineering Alternative Number 1:	***Construct an At Grade Intersection with 3-approach lanes, double lefts and a single right turn lane.***
Value Engineering Alternative Number 2:	***Construct an At Grade Intersection using the Continuous Flow Intersection design for KY 237 approaches.***
Value Engineering Alternative Number 3:	***Construct the Single Point Interchange with KY 18 over KY 237.***
Value Engineering Alternative Number 4:	***Construct a Compressed Tight Diamond Interchange with KY 237 on a 4-lane overpass structure.***

B. RIGHT OF WAY

Value Engineering Alternative Number 1:	***Shift alignment of Sycamore Drive at Mt Zion Road.***
Value Engineering Alternative Number 2:	***Construct KY 536 Kenton County with a 4-lane divided Urban typical with a raised median in 104 ft of right-of-way.***
Value Engineering Alternative Number 3:	***Construct a Roundabout at Rogers Road and KY 237.***
Value Engineering Alternative Number 4:	***Reduce the border width and increase the Two Way Left Turn for KY 237 Typical Section.***

VI. EVALUATION PHASE

A. ALTERNATIVES *(continued)*

C. RETAINING WALL

Value Engineering Alternative Number 1:	***Raise profile grade.***
Value Engineering Alternative Number 2:	***Construct Soil Nail Wall.***
Value Engineering AlternativeNumber3:	***Shift alignment to the west.***

D. BIKE & CREEK ARCH CULVERT

Value Engineering Alternative Number 1:	***Construct an 86' wide by 100' long bridge to span the creek and the bike path.***
Value Engineering Alternative Number 2:	***Construct the creek culvert and bike path culvert with Steel Plate arches.***

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES

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

A. SINGLE POINT INTERCHANGE

"As Proposed": The "As Proposed" Single Point Interchange at the intersection of KY 237 and KY 18 will shift the alignment of KY 237 approximately 200' to the west and construct the KY 237 overpass structure. The overpass structure will include the ramp termini from and to KY 18.

Advantages

- One signal.
- Reduced conflict points.

Disadvantages

- Poor pedestrian access.
- High cost structure.
- Additional right-of-way Costs.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: Construct an At Grade Intersection with 3-approach lanes, double lefts and a single right turn lane.

Advantages

- Lower construction cost.
- Less right-of-way acquisition.

Disadvantages

- Appears to fail operationally with design year traffic.

Conclusion

DROPPED FROM FURTHER EVALUATION.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

A. SINGLE POINT INTERCHANGE *(continued)*

Value Engineering Alternative Number 2: Construct an At Grade Intersection using the Continuous Flow Intersection design for KY 237 approaches.

Advantages

- Lower construction cost.
- More green time for through and left movements.
- Less pedestrian impacts.
- Smaller footprint than interchange alternative.
- Left turns removed from main intersection.

Disadvantages

- Driver unfamiliarity.
- More conflict points than SPUI.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 3: Construct the Single Point Interchange with KY 18 over KY 237.

Advantages

- Smaller structure.
- Less complicated structure.

Disadvantages

- Greater MOT impacts.
- Access issues along KY 18.

Conclusion

DROPPED FROM FURTHER EVALUATION.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

A. SINGLE POINT INTERCHANGE *(continued)*

Value Engineering Alternative Number 4: Construct a Compressed Tight Diamond Interchange with KY 237 on a 4-lane overpass structure.

Advantages

- Less structure.
- Simple structure.

Disadvantages

- Probably less operational improvement.
- More conflict points.

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

B. RIGHT OF WAY

"As Proposed": Minimum right-of-way widths for the projects are: KY 536 Kenton County – 108', KY 536 Boone County – 72' for 3-lane and 96' for 5-lane, and KY 237 Boone County – 100'. Also included in the right-of-way Acquisition is property to realign Sycamore Drive (KY 536 Boone County) and Rogers Road (KY 237 Boone County).

Advantages

- None Apparent.

Disadvantages

- Addition Right of Way Costs.
- Additional earthwork costs.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: Shift alignment of Sycamore Drive at Mt Zion Road

Advantages

- Reduce right-of-way take.

Disadvantages

- Creates very steep driveway connections to Sycamore Drive.
- Possibly requires addition whole take.

Conclusion

DROPPED FROM FURTHER EVALUATION.

B. RIGHT OF WAY *(continued)*

Value Engineering Alternative Number 2: Change KY 536 (Kenton County) to a 4-lane divided Urban typical with a raised median in 104' of right-of-way.

Advantages

- Reduced right-of-way take.
- Less grass to maintain.

Disadvantages

- Possible negative operational impacts for U-Turning Buses.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 3: Construct a roundabout at Rogers Road and KY 237.

Advantages

- Eliminates signal.
- Less Maintenance Costs.
- Reduces right-of-way take.

Disadvantages

- Drivers need to learn new traffic pattern.
- Possible impact to new housing development.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 4: Reduce the border width and increase the two way left turn to 14' for KY 237 Typical Section in 96' of right- of-way.

Advantages

- Overall reduction in right-of-way width.
- Reduced risk for left turn movement.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

C. RETAINING WALL

"As Proposed": Construct 310' of cast in place retaining wall 10' to 30' high along the east side of KY 237 and along the north side of Old Toll Road.

Advantages

- None apparent.

Disadvantages

- High construction cost.
- Excavation may impact building/parking lot.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: Raise profile grade.

Advantages

- Reduces height and length of retaining wall.

Disadvantages

- Too many impacts to the US 42 intersection.

Conclusion

DROPPED FROM FURTHER EVALUATION.

Value Engineering Alternative Number 2: Construct Soil Nail Wall.

Advantages

- Lower cost.
- Quicker construction.
- Top down construction.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

C. RETAINING WALL *(continued)*

Value Engineering Alternative Number 1: Shift alignment to the west.

Advantages

- Reduces height and length of retaining wall.

Disadvantages

- Too many impacts to the US 42 intersection.
- Constrained by bridge over Gunpowder Creek at Haines Drive.

Conclusion

DROPPED FROM FURTHER EVALUATION.

D. BIKE & CREEK ARCH CULVERT

"As Proposed": Construct 100' long concrete arch culvert (28' span – 9' rise) to convey the creek under the roadway and construct 100' long concrete arch culvert (12' span – 10' rise) to convey the bike path under the roadway.

Advantages

- Inexpensive construction.

Disadvantages

- Requires lighting of bike path.
- Bikers/Pedestrians will have security issues walking through a "Tunnel".
- 24/7 lighting required.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: Construct an 86' wide by 100' long bridge to span the creek and the bike path.

Advantages

- Open space.
- No night time lighting.
- Less restriction for hydraulics.

Disadvantages

- High construction cost.

Conclusion

DROPPED FROM FURTHER EVALUATION.

Value Engineering Alternative Number 2: Construct the creek culvert and bike path culvert with Steel Plate arches.

Advantages

- None apparent.

Disadvantages

- Possible corrosion problems.
- Requires bike path lighting.

Conclusion

DROPPED FROM FURTHER EVALUATION.

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

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

B. RIGHT OF WAY

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE NUMBER 1
(3) VALUE ENGINEERING ALTERNATIVE NUMBER 2
(4) VALUE ENGINEERING ALTERNATIVE NUMBER 3

C. RETAINING WALL

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

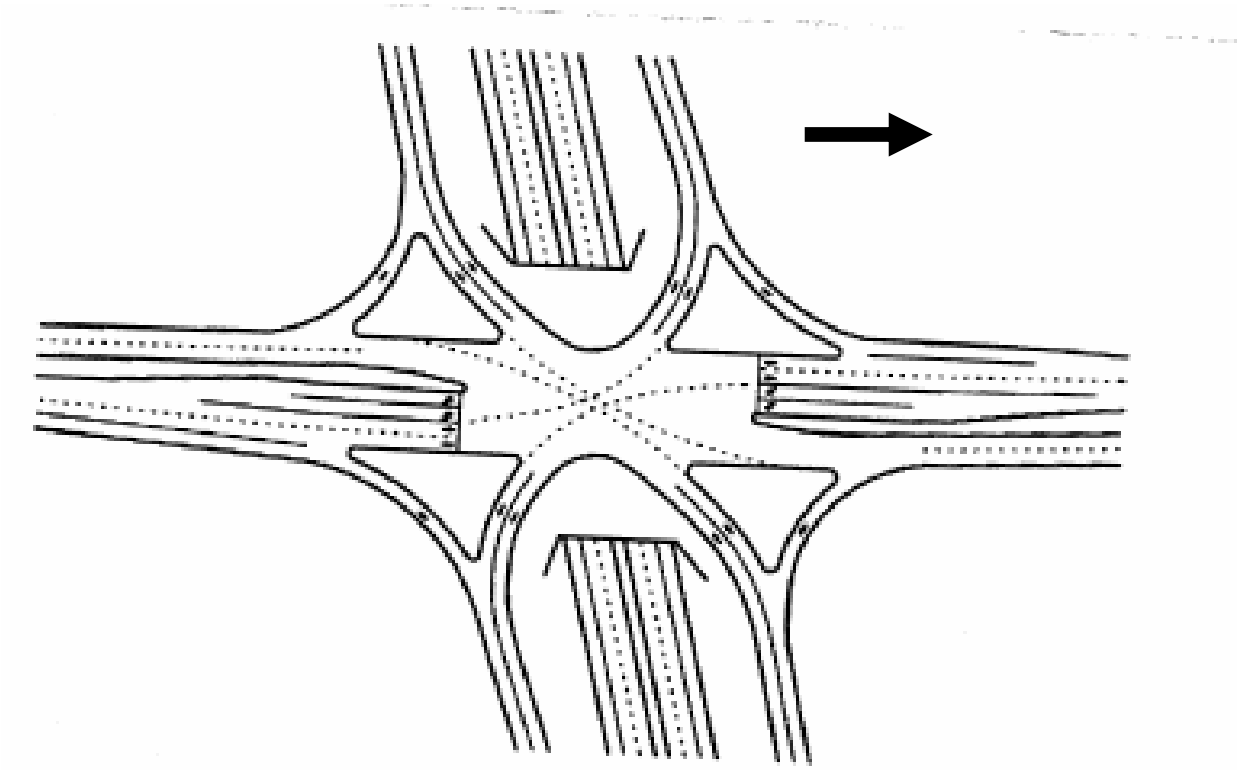
VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

1. "As Proposed"

The "As Proposed" traffic control for the intersection of KY-237 and KY-18 is a SPUI interchange. The SPUI interchange physically separates the major street through movements from the other movements by grade separating through movements. The turning movements and minor street through movements are served by a single signal on the minor street. Left turns from the ramps and at crossroad are aligned such that they oppose each other, eliminating a potential conflict. Because of the layout of the interchange, at-grade movements are served by a three-phase signal. Relatively long cycle lengths are typical due to the large intersection area. A typical SPUI will have 24 conflict points.

The SPUI structure has extra ramp extensions that necessities the use of steel framing and increases the structure area.



AS PROPOSED SINGLE POINT INTERCHANGE

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

1. "As Proposed"

The SPUI at-grade intersection has a lane configuration as follows:

Eastbound:
- 2 Left turn bays
- 1 Right lane

Westbound:
- 2 Left turn bays
- 1 Right lane

Northbound:
- 2 Through lanes
- 2 Left turn lanes
- 1Right turn lane

Northbound:
- 2 Through lanes
- 2 Left turn lanes
- 1 Right turn lane

The Highway Capacity Software indicates the intersection will operate "Under Capacity" in both AM & PM Peaks for the Design Year.

VII. DEVELOPMENT PHASE

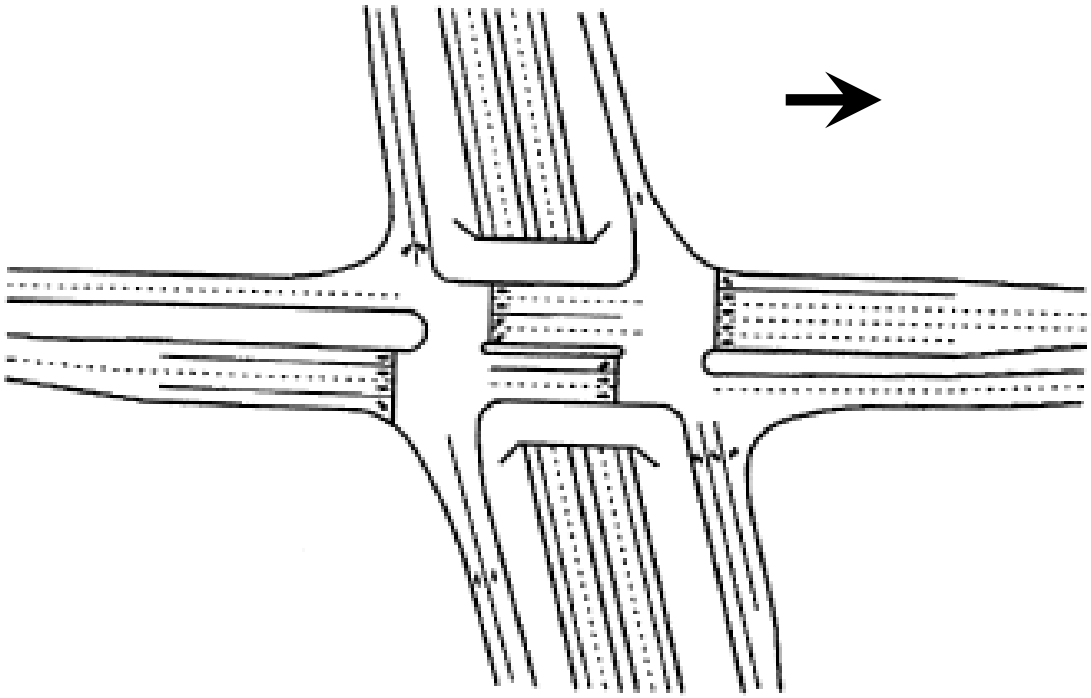
A. SINGLE POINT INTERCHANGE

Value Engineering Alternative Number 1

The Value Engineering Team recommends a Compressed Diamond Interchange (CDI) traffic control for the intersection of KY-237 and KY-18. CDI has 30 conflict points.

The CDI interchange physically separates the major street through movements from the other turning movements. The turning movements and minor through movements are served by two coordinated signals on the minor street. Typically, the CDI is controlled by four-phase overlap signal phasing system for the two intersections. Layouts of the left turns on the minor street are back to back, resulting a wider cross section at the structure relative to a SPUI interchange. Even with the increased cross section, there is less open space at a CDI relative to a SPUI, which allows for shorter signal clearance intervals.

The CDI structure is a simple rectangle configuration therefore the framing can be accomplished with pre-stressed AASHTO Beams that reduce structure costs.



VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

2. Value Engineering Alternative Number 1

The CDI at-grade intersection has a lane configuration as follows:

Eastbound:
- 2 Left turn bays
- 1 Right lane

Westbound:
- 2 Left turn bays
- 1 Right lane

Northbound:
- 2 Through lanes
- 2 Left turn lanes
- 1Right turn lane

Northbound:
- 2 Through lanes
- 2 Left turn lanes
- 1 Right turn lane

Highway Capacity Software indicates this interchange will operate “At Capacity” in the AM for the Design Year and “Over Capacity” in the PM for the Design Year and is not recommended. But would operate “At Capacity” for both AM & PM if KY 237 through lanes were increased to 3 in each direction.

SPUI INTERCHANGE/COMPRESSED DIAMOND
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
STRUCTURE (steel)	SF	$200.00	17,600.00	$3,520,000	0.00	$0
STRUCTURE	SF	$100.00	0.00	$0	13,200.00	$1,320,000
EARTHWORK	CY	$8.00	129,000.00	$1,032,000	124,600.00	$996,800
PAVEMENT	SF	$5.00	590,000.00	$2,950,000	590,000.00	$2,950,000
RETAINING WALLS	SF	$30.00	67,000.00	$2,010,000	67,000.00	$2,010,000
SIGNALS	EA	$50,000.00	1.00	$50,000	2.00	$100,000
CURB	LF	$18.00	12,000.00	$216,000	12,000.00	$216,000
SUBTOTAL				**$9,778,000**		**$7,592,800**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$484,809		$376,463
TRAFFIC CONTROL/MOT		1.6%		$154,690		$120,120
ENGINEERING & CONTINGENCY		10.0%		$977,800		$759,280
GRAND TOTAL				**$11,395,298**		**$8,848,663**

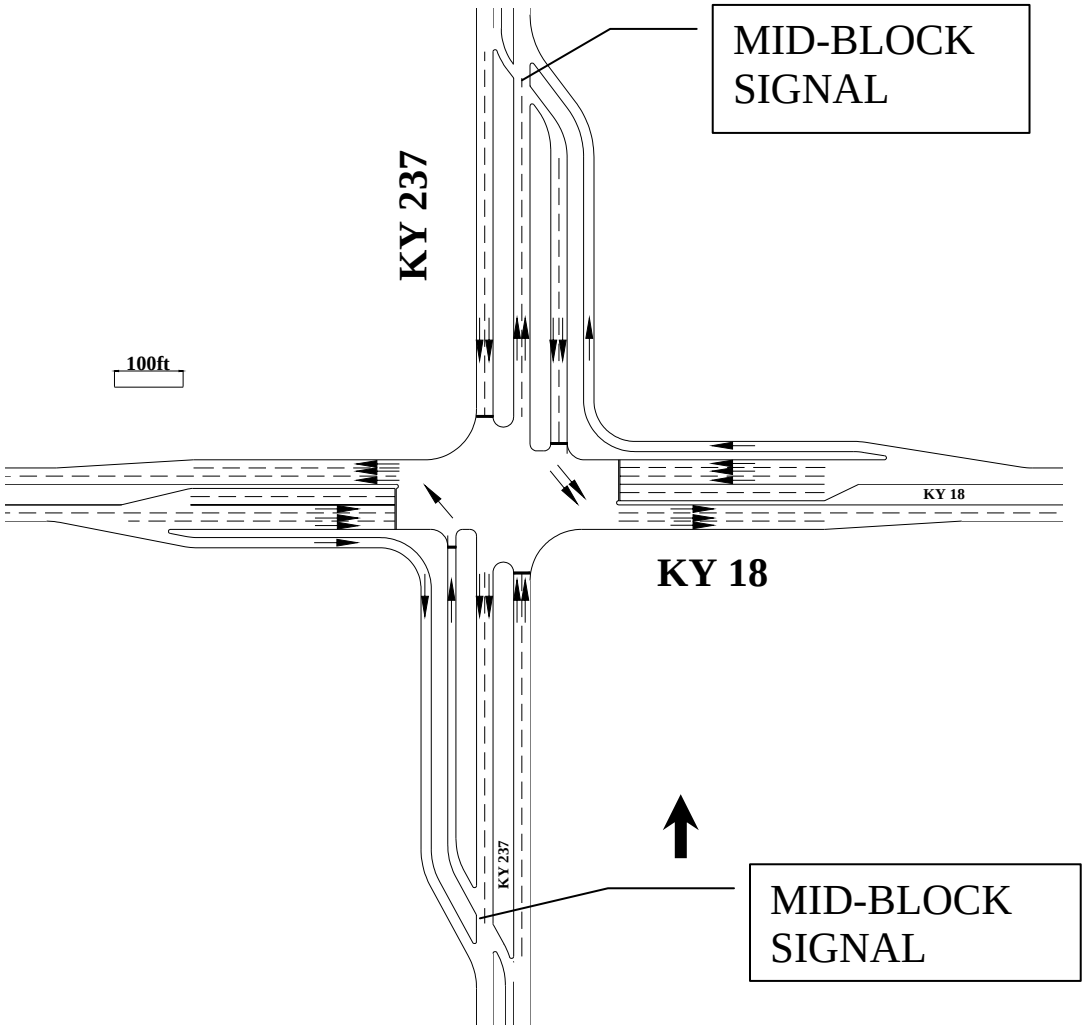
POSSIBLE SAVINGS: $2,546,636

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

3. Value Engineering Alternative Number 2

The Value Engineering team recommends a Continuous Flow Intersection (CFI) traffic control for the intersection of KY-237 and KY-18. A CFI removes the conflict between the left turn movement and the oncoming through movement by placing the left-turn movement in a separate traffic bay to the right of the oncoming movements. Left turning vehicles access the separated bay at a mid-block signalized intersection on the approach where continuous flow is desired. The left turning vehicles are subject to an additional signal. The CFI requires signal coordination for optimal performance to minimize left turn delay. The CFI restricts the U-turns and therefore should not be used if there is a high U-turn demand. The intersection of KY-237 and KY-18 appears to have a low volume of U-turns. Typically the right-of-way for a CFI is less than for an interchange. A typical CFI has 30 conflict points.



VALUE ENGINEERING ALTERNATIVE
CONTINUOUS FLOW INTERSECTION

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

3. Value Engineering Alternative Number 2

The CFI lane configuration is as follows:

Eastbound:
- 2 Left turn bays
- 3 Through lanes
- 1 Right lane separated

Westbound:
- 2 Left turn bays
- 3 Through lanes
- 1 Right lane separated

Northbound:
- 2 Through lanes
- 1 Continuous Flow Left turn lane
- 1Shared Right turn lane

Southbound:
- 2 Through lanes
- 2 Continuous Flow Left turn lane
- 1 Shared Right turn lane

A HCS planning analysis indicates that a CFI on KY 237 will be over capacity with the current two-lane approaches on KY 18. By adding an additional lane for the eastbound and westbound KY 18 approaches the intersection will operate “At” or “Under capacity” in the 2030 design year for both the AM and PM peak traffic volumes.

Right-of-way acquisition remains the same because of the possibility of constructing the Single Point Interchange at a future date when and if capacity warrants an interchange.

SPUI INTERCHANGE/CONTINUOUS FLOW INTERSECTION
VALUE ENGINEERING ALTERNATIVE NUMBER 2
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
STRUCTURE	SF	$200.00	17,600.0	$3,520,000	0.0	$0
EARTHWORK	CY	$8.00	129,000.0	$1,032,000	65,000.0	$520,000
PAVEMENT	SF	$5.00	590,000.0	$2,950,000	710,000.0	$3,550,000
RETAINING WALLS	SF	$30.00	67,000.0	$2,010,000	0.0	$0
SIGNALS	EA	$50,000.00	1.0	$50,000	3.0	$150,000
CURB	LF	$18.00	12,000.0	$216,000	30,600.0	$550,800
SUBTOTAL				**$9,778,000**		**$4,770,800**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$484,809		$236,544
TRAFFIC CONTROL/MOT		1.6%		$154,690		$75,475
ENGINEERING & CONTINGENCY		10.0%		$977,800		$477,080
GRAND TOTAL				**$11,395,298**		**$5,559,899**

POSSIBLE SAVINGS: $5,835,400

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

COST COMPARISON SHEET BACK UP CALCULATIONS

striping, signing, sidewalks, and landscaping. Three percent is determined to be appropriate for this SPUI. This percent is applied to the sum of all previous cost elements.

Drainage. Drainage may include the installation of storm sewers, pump stations, inlets, and all related work that is needed to carry water away from the interchange area. It is assumed that the drainage for the project would be a gravity flow type and that the existing storm sewers will be able to handle the added demand. Ten percent is used for this illustration. This percent is applied to the sum of all previous cost elements exclusive of minor items. Because of the site-specific nature of drainage requirements the percent selected can be determined only after careful study of the project site conditions.

Demolition. Demolition of existing pavement is required for the case study example. The cost of demolition includes breaking existing pavement and removal to an existing dump. The total area of pavement to be removed is estimated at 409,000 sq ft. A cost of $1.25 per square foot is applied. This assumes a haul distance of approximately 20 miles. Demolition is project specific and generally applicable to reconstruction projects. This category should be analyzed closely in actual practice. This particular case study assumes that additional utility line relocation is not required. Every site should be carefully evaluated to detect if utility lines must be relocated.

Engineering and Design. The detailed design and initial survey of the project are included in this cost. Nine percent of total construction cost is used for engineering and design.

Supervision and Administration. This category includes the cost to the organization or state agency that is responsible for inspecting the construction of the project and the reporting of progress and scheduling. Nine percent of total construction costs is used for supervision and administration.

All items that are estimated on a percentage basis assume that the case is average in every way. Unfortunately, this rarely occurs in practice as each individual project will have its own unique characteristics. An appropriate percent should be used from an agency's own data base of projects.

Right-of-Way. The area that is needed to construct the case study SPUI is taken from the conceptual design drawings. This area is superimposed onto the area currently being used by the AGI. The difference between the two is calculated. This difference includes a 10-ft easement and is the incremental amount of right-of-way that is needed to implement the SPUI design. The AGI is assumed to be at the existing available right-of-way. The total right-of-way for the SPUI and AGI is 867,000 and 481,000, respectively, given a 386,000-sq ft difference.

The incremental right-of-way area calculated is considered a clean quantity, which will never be the true case. The quantity is based on square feet and the cost is derived on a dollar per square foot basis. The cost of land is highly dependent on the location, area required, and specific economic viability of any given parcel of land. A typical price of open urban land varies anywhere from $1.00 to more than $50.00 per square foot. This can cause the viability of any design to wane and a sensitivity analysis often is warranted. The unit cost for right-of-way is $7.00 per square foot, and this assumes moderate land cost without significant problems in obtaining the area needed. This is seldom the case in practice, thus, local knowledge of right-of-way costs and availability of land at a given site should be investigated and used in specific project estimates.

Contingency. This item covers those unforeseen items and other uncertainties associated with the development of the conceptual design where there is lack of specific details. The percent contingency selected for the case is 20 percent of all project costs including right-of-way. The summary of all project cost items is presented in Table 10 based on the quantities calculated and the respective unit cost presented. The estimated total project cost for the SPUI is $16,304,000.

Table 11 provides the percent weight by cost of each category to the total cost of construction (see column three). The four primary cost categories (bridge, pavements, earthwork and retaining walls) represent 70.6 percent of the total cost of construction with the bridge having the highest percentage at 25.0 percent. These data compare favorably with the ranges presented in Figure 89. This type of comparison is a typical methodology for verifying an estimate against known standard ratios. Table 11 also shows the percent weight of all items to total project cost, excluding contingency, in the last column. The cost of additional right-of-way represents 19.8 percent of the total. This percentage appears reasonable.

Cost Impact of Other SPUI Design Considerations

The SPUI estimated in this case study reflects one set of design features. Because project site conditions differ depending on location, alternate SPUI designs may be considered in practice. Table 12 attempts to capture the impact different design considerations might have on project costs. Seven major design considerations are identified in Table 12 as the major roadway, bridge type, bridge span, retaining walls, ramp separation distance, drainage,

Table 10. Project cost estimate for 6-2-2-1 overpass SPUI.

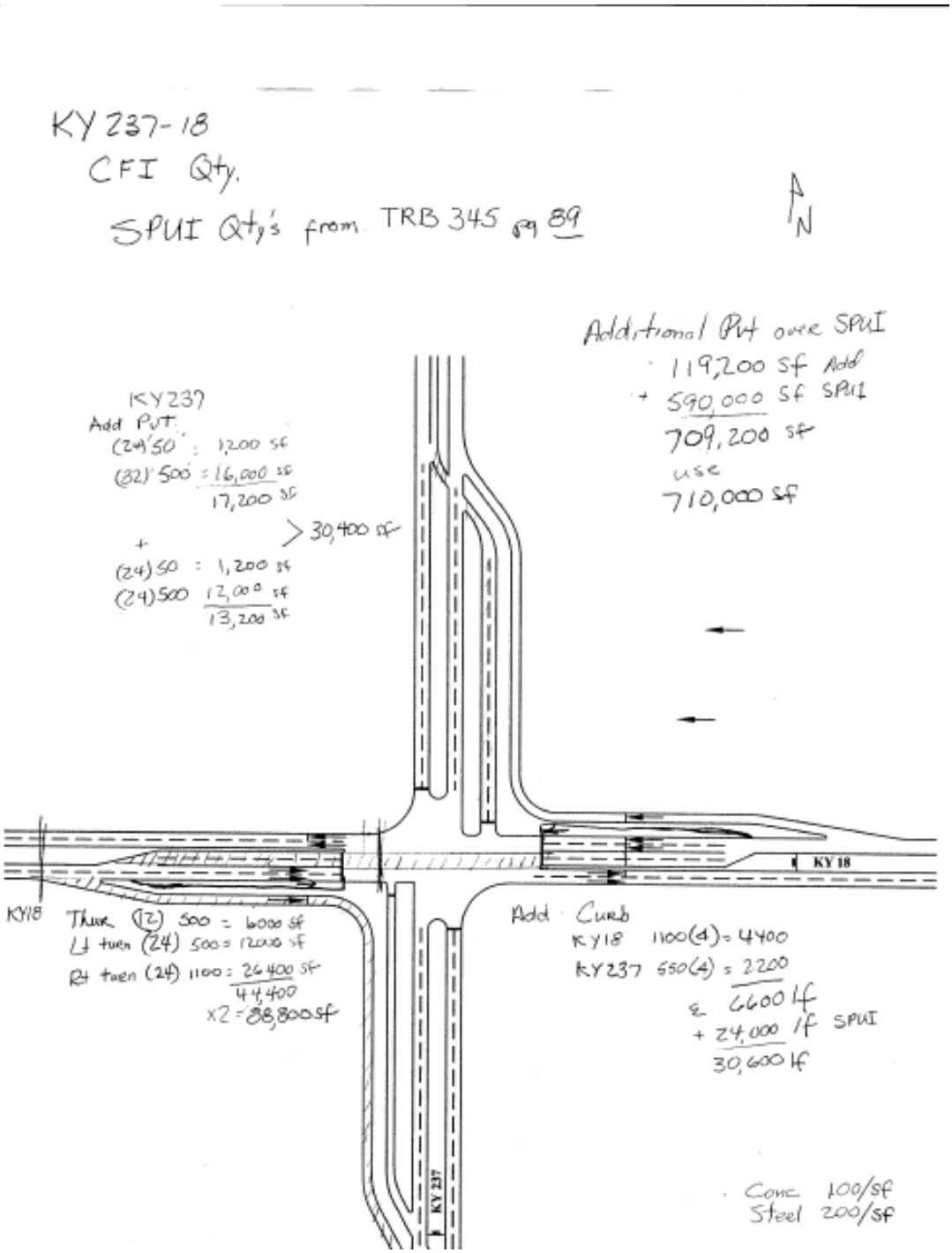
Project Components	Total Quantity	Units	Unit Price	Total Cost
Bridge Structure	$ 27,000	SF	$ 85.00	$ 2,295,000
Pavements				
Road Over	266,000	SF	4.00	1,064,000
Arterial	190,000	SF	2.00	380,000
Ramps	134,000	SF	2.00	268,000
Earthwork	129,000	CY	9.00	1,161,000
Retaining Walls	67,000	SF	20.00	1,340,000
Signalization	12	Heads	10,500.00	126,000
Lighting	34	Poles	5,700.00	194,000
Curbs	12,000	LF	10.00	120,000
Subtotal				6,948,000
Mobilization			4%	278,000
Traffic Control			7%	486,000
Subtotal				7,712,000
Minor Items			3%	231,000
Drainage			10%	771,000
Demolition	409,000	SF	1.25	511,000
Construction Cost				9,225,000
Engr/Design			9%	830,000
Constr Admin/Inspct			9%	830,000
ROW	386,000	SF	7.00	2,702,000
				13,587,000
Contingency			20%	2,717,000
Total Project Cost				$ 16,304,000

First Quarter 1990, Southern U.S. Construction Costs

VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

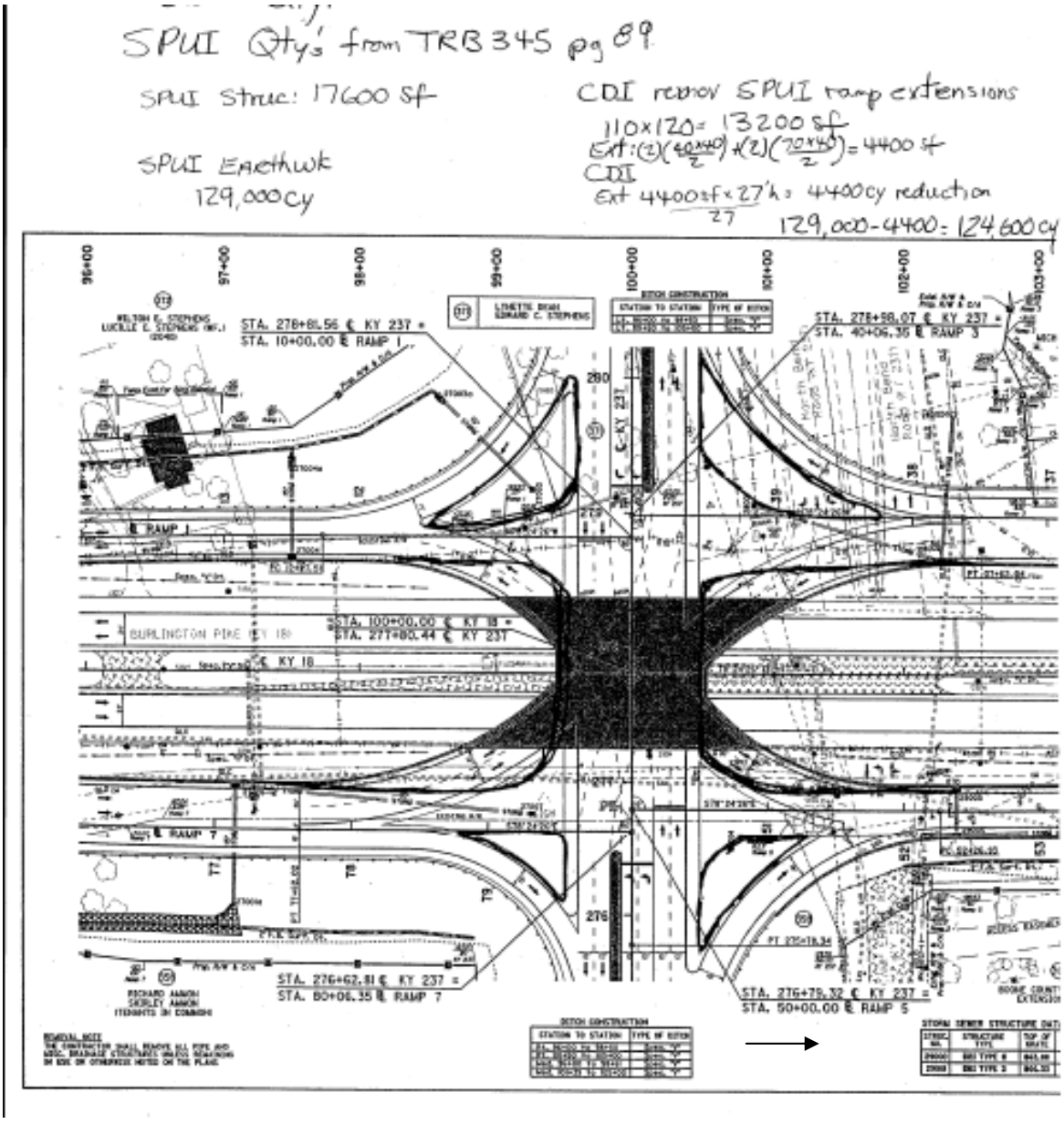
COST COMPARISON SHEET BACK UP CALCULATIONS



VII. DEVELOPMENT PHASE

A. SINGLE POINT INTERCHANGE

COST COMPARISON SHEET BACK UP CALCULATIONS



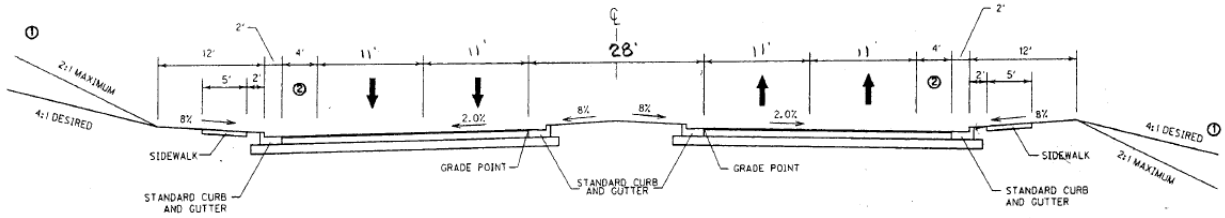
VII. DEVELOPMENT PHASE

B. RIGHT-OF-WAY

1. "As Proposed"

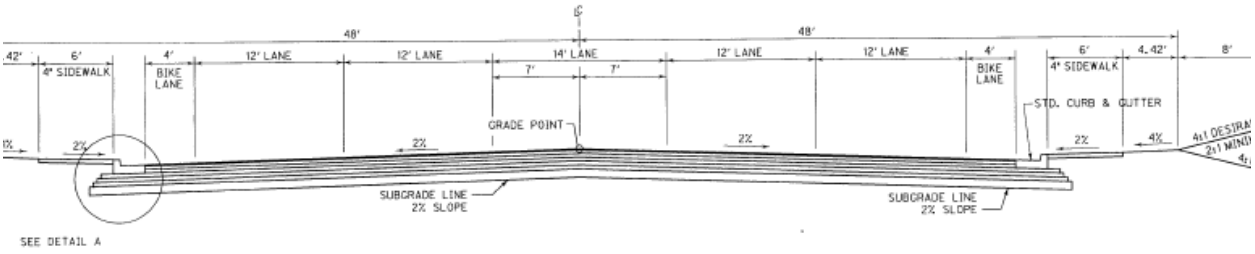
The Right-of-way is determined mainly by the typical section requirements. These three projects have slightly different typical sections. The KY 237 project also realigns the intersection at Roger's Lane that requires additional right-of-way.

The SR 536 typical in Kenton County uses a 28' median, four 11' lanes, 5' sidewalks and 12' border width from face of curb for a minimum of 104' of right-of-way.



NORMAL SECTION

The SR 536 typical in Boone County uses a 14' wide two way left turn lane, four 12' travel lanes, 6' sidewalks and 12' border widths from face of curb for a minimum of 96' of right-of-way.



5 – LANE URBAN NORMAL CUT/FILL SECTION

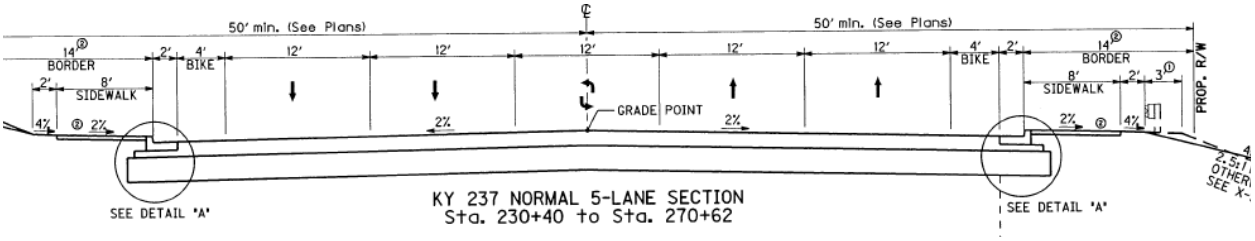
KY 536 – MT. ZION ROAD

VII. DEVELOPMENT PHASE

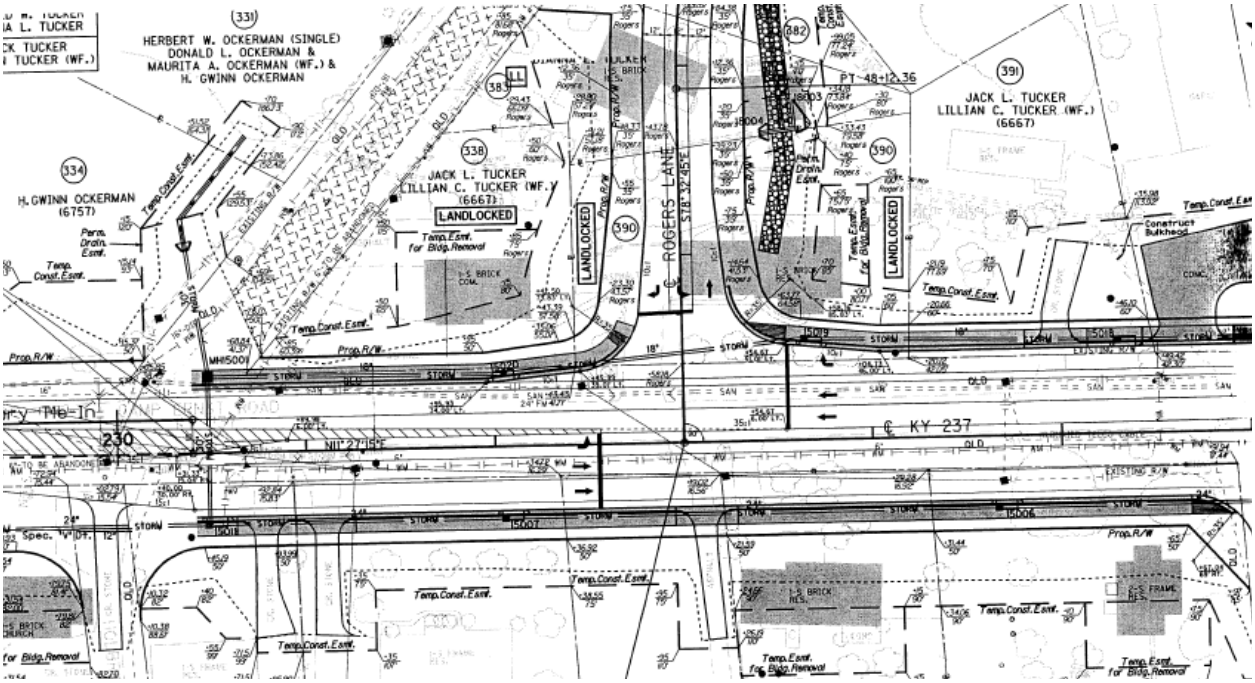
B. RIGHT-OF-WAY

1. "As Proposed"

The SR 237 Typical in Boone County uses a 14' wide border from face of curb, 4' bike lanes, four 12' travel lanes and a 12' wide two way left turn lane for a minimum of 100' of right-of-way.



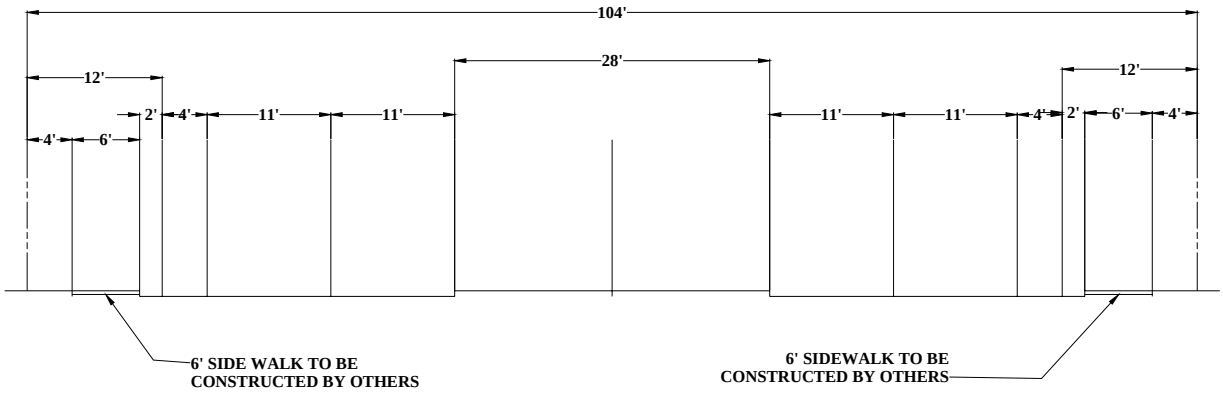
Re-Align Roger's Lane to tie to SR 237 approximately 300' east of the present intersection and install a left turn lane onto SR 237 and a right turn lane from SR 237 onto Roger's lane. A traffic light will also be installed.



AS PROPOSED ROGER'S LANE INTERSECTION

2. Value Engineering Alternative Number 1

Change KY 536 (Kenton County) to a 4-lane divided Urban typical with a raised median in 104’ of right-of-way, that is accomplished by reducing the border width to 12’ from the face of curb to the right-of-way line and eliminating the proposed sidewalk. This area is developing and there appears to be no need for pedestrian facilities. As developers request connection to the highway, make it a condition of their driveway permit to construct a 6’ sidewalk along their frontage with KY 536.



VALUE ENGINEERING ALTERNATIVE
KY 536 (KENTON COUNTY) TYPICAL SECTION

The Value Engineering Team understands the sidewalk will be constructed piece meal early in the life of the project and at some point in time when pedestrian traffic warrants another construction project will be required to fill in the gaps and make the sidewalk continuous through out the corridor.

REVISE KY 536 (KENTON COUNTY) TYPICAL SECTION
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Sidewalk	S.Y	**$35.00**	26,400.00	$924,000	0.0	$0
SUBTOTAL				**$924,000**		**$0**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$45,813		$0
TRAFFIC CONTROL/MOT		1.6%		$14,618		$0
ENGINEERING & CONTINGENCY		10.0%		$92,400		$0
RIGHT-OF-WAY	SF	$1.55	1,509,600	$2,339,880	1,413,800	$2,191,390
GRAND TOTAL				**$3,416,711**		**$2,191,390**

POSSIBLE SAVINGS: $1,225,321

VII. DEVELOPMENT PHASE

B. RIGHT-OF-WAY

COST COMPARISON SHEET BACK UP CALCULATIONS

AS PROPOSED RIGHT OF WAY ACQUISITION:

On existing alignment: 17,950' X 48' = 861,600
New alignment 6,000' X 108 = 648,000
Total 1,509,600 SF

Estimated total Land Cost = $2,339,880/1,509,600 = $1.55/SF

VALUE ENGINEERING ALTERNATIVE RIGHT OF WAY ACQUISITION:

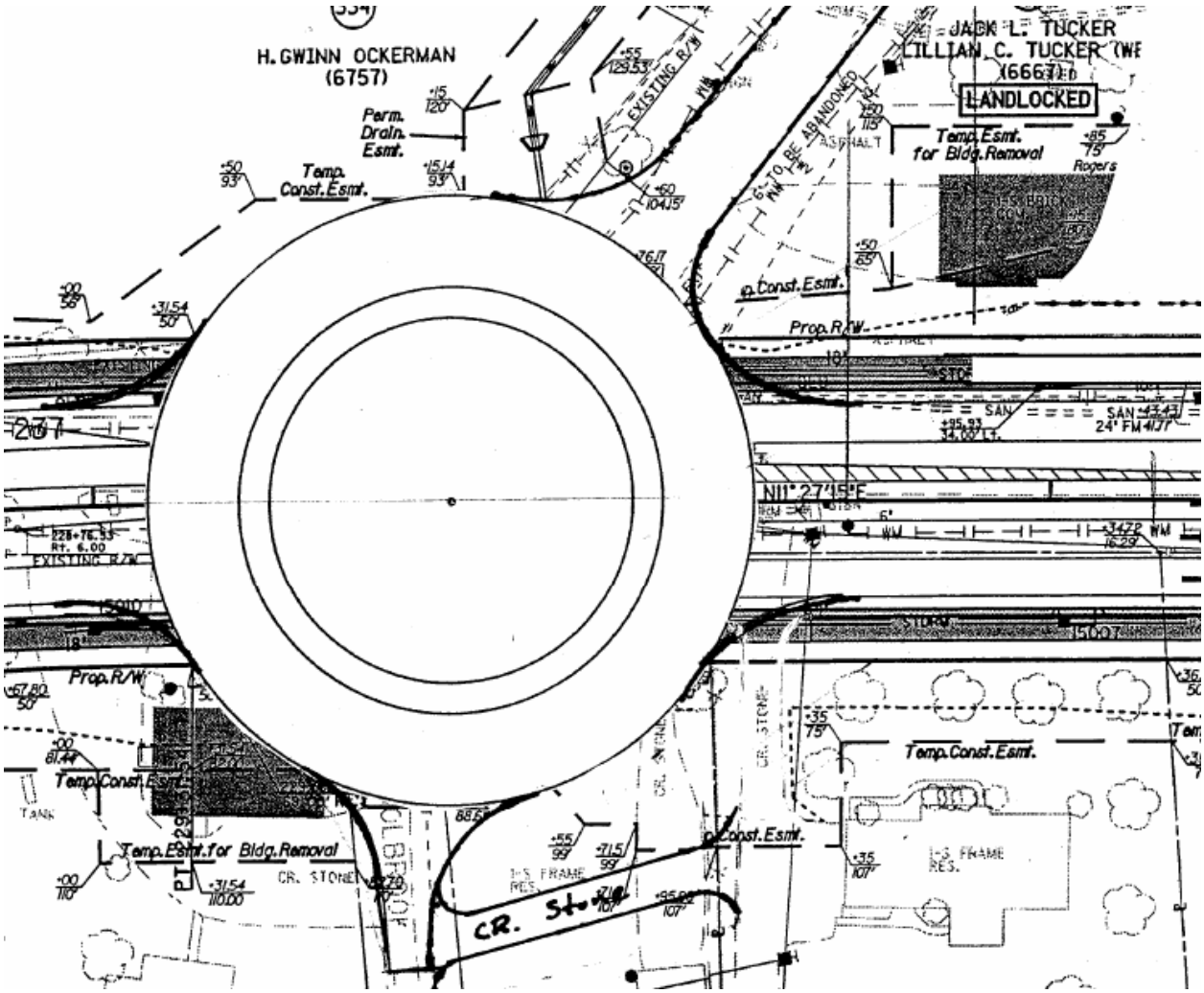
On existing alignment: 17,950' X 44' = 789,800
New alignment 6,000' X 104 = 624,000
Total 1,413,800 SF

VII. DEVELOPMENT PHASE

B. RIGHT-OF-WAY

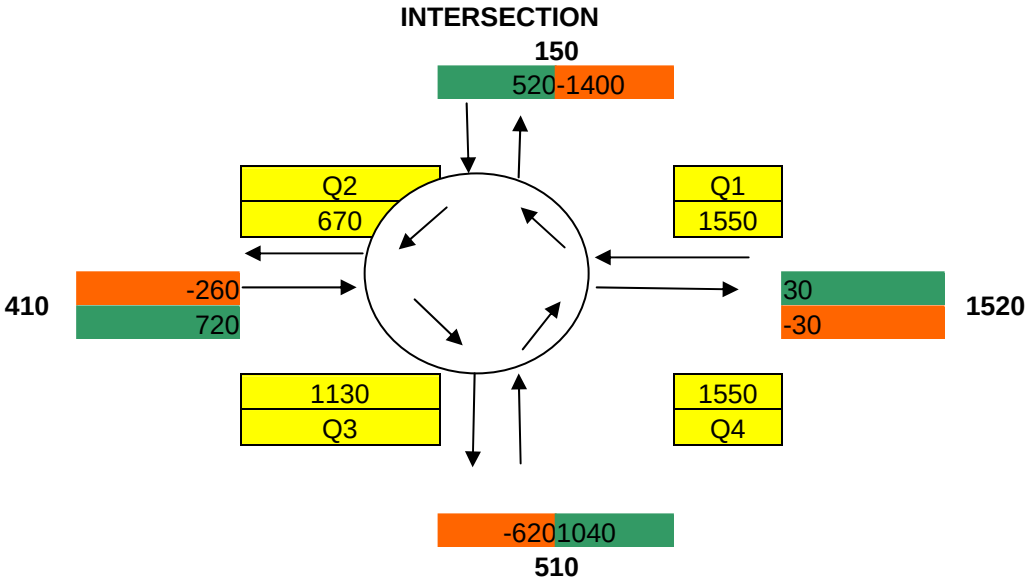
3. Value Engineering Alternative Number 2

Construct a roundabout at Rogers Road and KY 237.

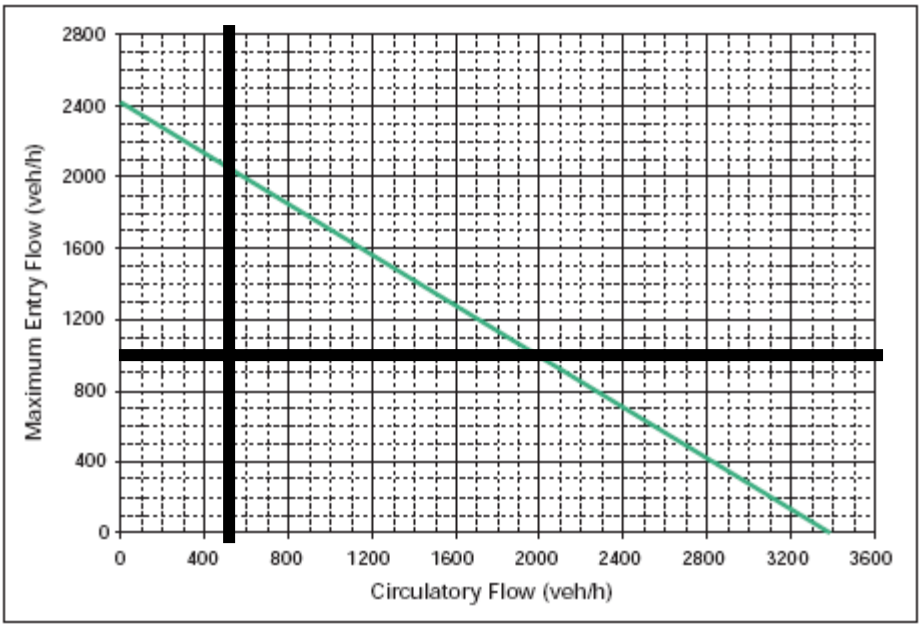


This is a 2-lane 180' +/- diameter roundabout. It will operate satisfactorily for the design years as shown in the traffic analysis. This alternative will reduce right-of-way acquisition.

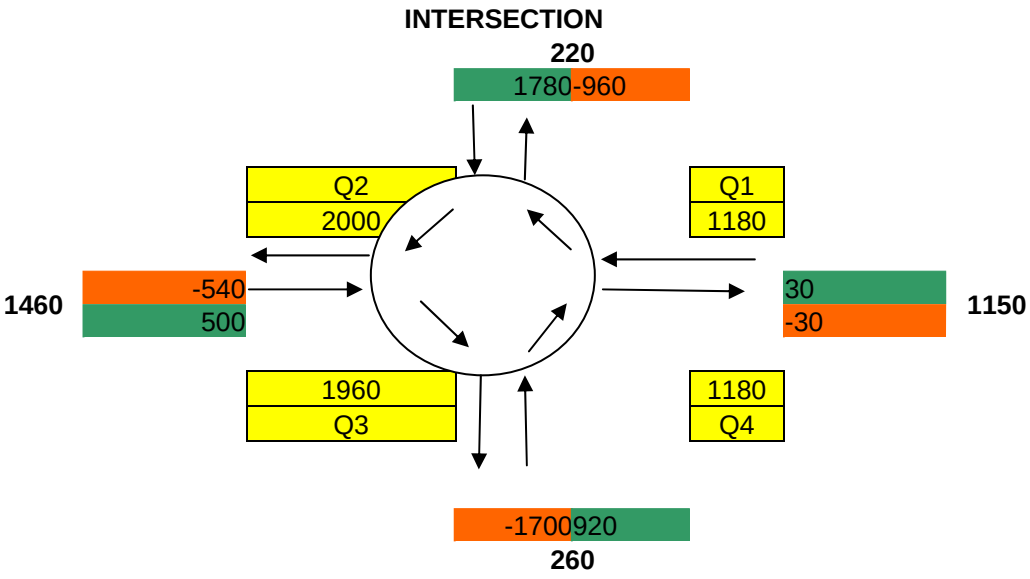
During the presentation the Value Engineering Team was informed that a Housing Development will be constructed to the east of the "As Proposed" intersection. If the developer is unable or unwilling to relocate the Housing Development entrance to Holbrook Lane then the roundabout would also work at that location, but the savings would be reduces to about $100,000 (no signal).



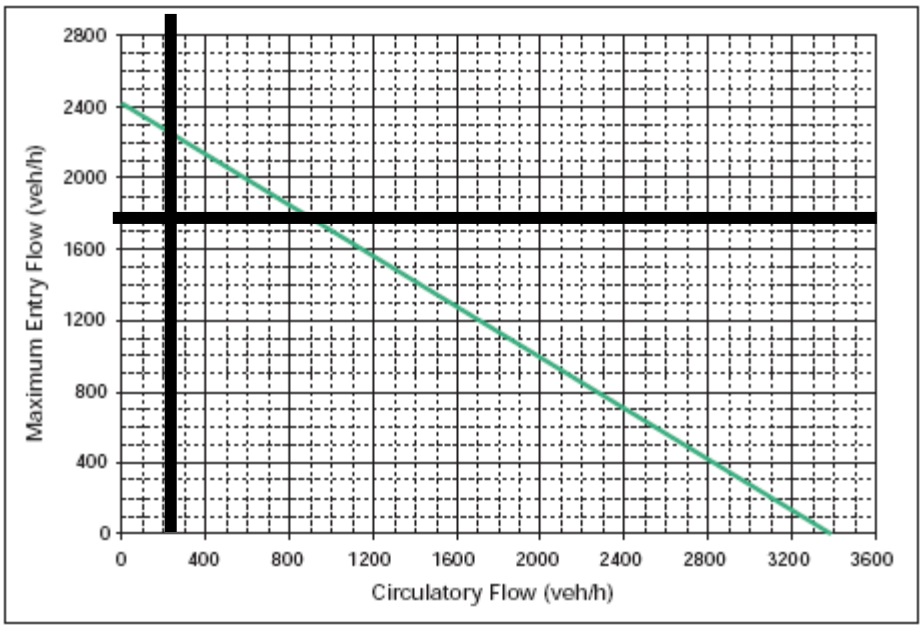
			520				
		120	390	10	-1400		
670	QUAD 2	RT	THRU	LT	OUT	QUAD 1	1550
-260	OUT		N			RT	10
490	LT					THRU	10
720 10	THRU		W		E	LT	10 30
220	RT					OUT	-30
1130	QUAD 3		S			QUAD 4	1550
		OUT	LT	THRU	RT		
		-620	130	900	10		
			1040				



AM



			1780				
		330	1440	10	-960		
2000	QUAD 2	RT	THRU	LT	OUT	QUAD 1	1180
-540	OUT		N			RT	10
240	LT					THRU	10
500 10	THRU	W			E	LT	10 30
250	RT					OUT	-30
1960	QUAD 3		S			QUAD 4	1180
		OUT	LT	THRU	RT		
		-1700	200	710	10		
			920				



PM

ROUNDABOUT @ ROGER'S LANE
VALUE ENGINEERING ALTERNATIVE NUMBER 2
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Asphalt Pavement	S.Y.	$45.00	2,189.00	$98,505	1571.0	$70,695
Traffic Signal	Ea.	$50,000.00	1.00	$50,000	0.0	$0
SUBTOTAL				**$148,505**		**$70,695**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$7,363		$3,505
TRAFFIC CONTROL/MOT		1.6%		$2,349		$1,118
ENGINEERING & CONTINGENCY		10.0%		$14,851		$7,070
Building Removal	Ea.	$60,000.00	5.00	$300,000	2.0	$120,000
Relocation Assistance	Ea.	$4,500.00	5.00	$22,500	2.0	$9,000
Misc. Relocation	Ea.	$1,500.00	1.00	$1,500	0.0	$0
GRAND TOTAL				**$497,068**		**$211,388**

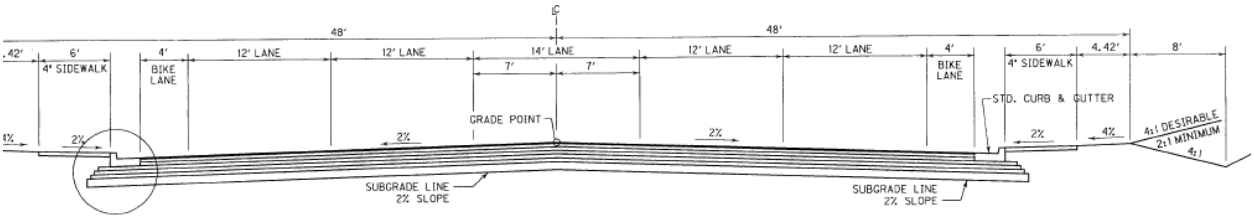
POSSIBLE SAVINGS: $285,680

VII. DEVELOPMENT PHASE

B. RIGHT OF WAY

4. Value Engineering Alternative N umber 3

Reduce the border width and increase the two way left turn to 14’ for KY 237 Typical Section within 96’ of right-of-way.



VALUE ENGINEERING ALTERNATIVE TYPICAL SECTION

This is the same typical as the KY 536 Boone County. It reduces the right-of-way take, but increases the amount of pavement. The extra 2’ of lane width in the two way left turn lane will reduce the risk of sideswipe crashes.

INCREASE TWLTL AND REDUCE BORDER WIDTH
VALUE ENGINEERING ALTERNATIVE NUMBER 3
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
PAVEMENT ADDED	SF	$5.00	-	$0	54,496	$272,480
SUBTOTAL				**$0**		**$272,480**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$0		$0
TRAFFIC CONTROL/MOT		1.6%		$0		$4,311
ENGINEERING & CONTINGENCY		10.0%		$0		$27,248
RIGHT-OF-WAY	SF	$1.07	**1,706,540**	$1,825,998	1,597,548	$1,709,376
GRAND TOTAL				**$1,825,998**		**$2,013,415**

POSSIBLE ADDITIONAL COST: $187,417

VII. DEVELOPMENT PHASE

B. RIGHT OF WAY

COST COMPARISON SHEET BACK UP CALCULATIONS

AS PROPOSED RIGHT OF WAY ACQUISITION:

On existing alignment:	16,971' X 40' =	678,840
New alignment	10,277' X 100' =	1,027,700
	Total	1,706,540 SF

Estimated total Land Cost = $1,828,138/1,708,540 = $1.07/SF

VALUE ENGINEERING ALTERNATIVE RIGHT OF WAY ACQUISITION:

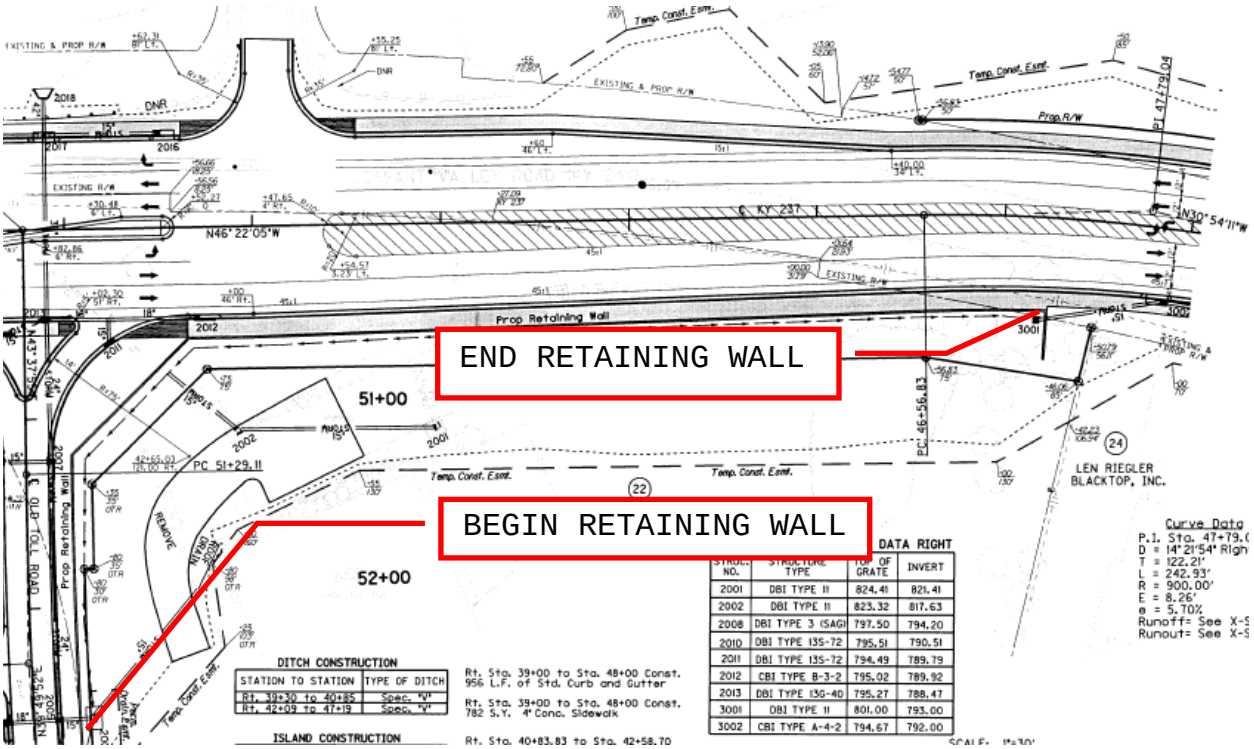
On existing alignment:	16,971' X 36' =	610,956
New alignment	10,277' X 96' =	986,592
	Total	1,597,548 SF

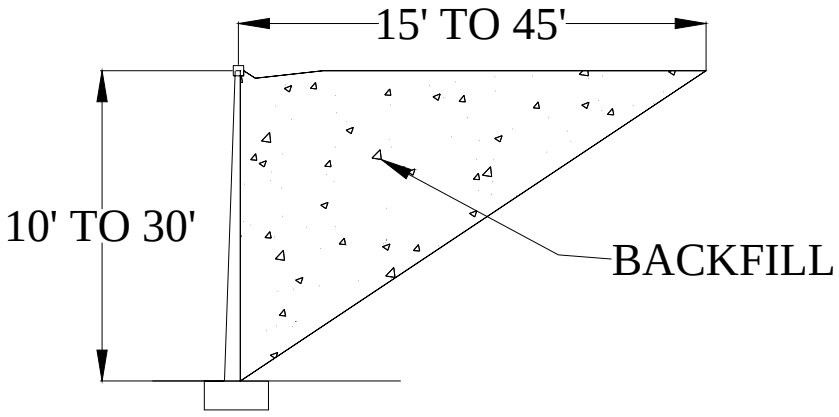
VII. DEVELOPMENT PHASE

C. RETAINING WALL

1. "As Proposed"

Construct 14,400 SF of Cast in Place retaining wall 10' to 30' high along the east side of KY 237 and along the north side of Old Toll Road.





AS PROPOSED
CIP WALL

VII. DEVELOPMENT PHASE

C. RETAINING WALL

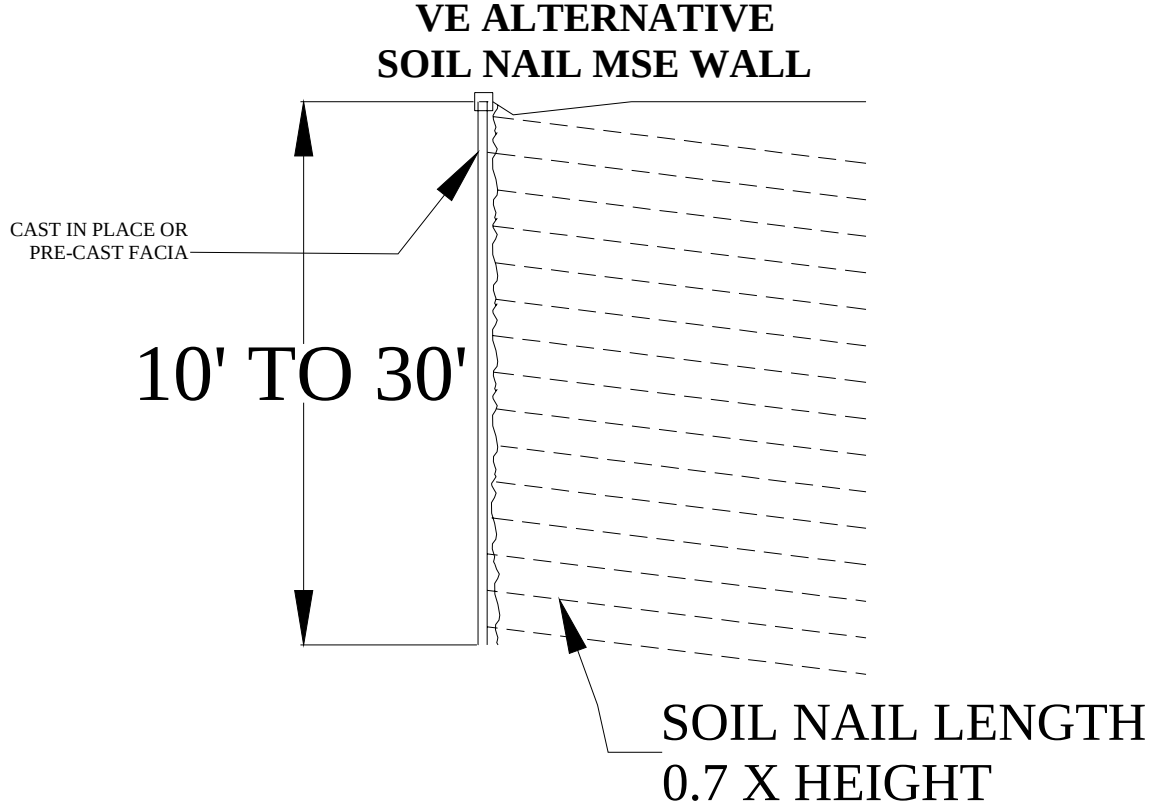
1. "As Proposed"

The roadway centerline is shifted to the east and encroaches on the Church Property that is about 30' higher than the roadway grade. The building is too close to the new right-of-way to allow for a slope to be carried to existing ground. The retaining wall will hold the existing ground. It appears that with a cast in place wall the contractor will have to cut enough of the earth behind the wall to allow for the construction of the wall. It is assumed that it will be cut at a maximum of a 1.5:1.0 slope.

C. RETAINING WALL

2. Value Engineering Alternative

Construct a Soil Nail Wall in place of a Cast in Place wall. This construction will be accomplished while the excavation is going on. The contractor will excavate a nearly vertical wall in 5' cuts, then reinforce the earth with soil nails and spray gunite on the face of the wall to hold the soil. When the excavation is completed the newly reinforced earth will be faced with a suitable covering, either a cast in place facia or pre-cast panel facia.



RETAINING WALL
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
CAST IN PLACE WALL	SF	$69.44	14,400.00	$999,936	0.0	$0
SOIL NAIL WALL	SF	$55.00	0.0	$0	14400.0	$792,000
EARTHWORK (EXCAVATE & BACKFILL)	CY	$8.00	20000.0	$160,000	0.0	$0
SUBTOTAL				**$1,159,936**		**$792,000**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$57,511		$39,269
TRAFFIC CONTROL/MOT		1.6%		$18,350		$12,530
ENGINEERING & CONTINGENCY		10.0%		$115,994		$79,200
GRAND TOTAL				**$1,351,791**		**$922,998**

POSSIBLE SAVINGS: $428,793

VII. DEVELOPMENT PHASE

C. RETAINING WALL

COST COMPARISON SHEET BACK UP CALCULATIONS

RETAINING WALL COMP

KY 237	AREA	WIDTH		VOLUME
4250	25	1250	37.5	23437.5
4300	27	1350	40.5	27337.5
4350	29	1450	43.5	31537.5
4400	29	1450	43.5	31537.5
4450	29	1450	43.5	31537.5
4500	28	1400	42	29400
4550	27	1350	40.5	27337.5
4600	27	1350	40.5	27337.5
4650	17	850	25.5	10837.5
4700	10	500	15	3750
				9038.889

OLD TOWN

200	10	2000

14,400.00

$	69.44	CIP	$1,000,000.00
$	60.00	SOIL NAIL	$ 864,000.00
			$ 136,000.00

VIII. SUMMARY OF RECOMMENDATIONS

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

Recommendation Number 1:

The Value Engineering Team recommends that Value Engineering Alternative be implemented. This alternative will construct a Continuous Flow Intersection (CFI) traffic control for the intersection of KY-237 and KY-18.

If this recommendation can be implemented, there is a possible savings of ***$5,835,400.***

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will change KY 536 (Kenton County) to a 4-lane divided Urban typical with a raised median in 104' of right-of-way.

If this recommendation can be implemented, there is a possible savings of ***$1,225,321.***

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct a roundabout at Rogers Road and KY 237.

If this recommendation can be implemented, there is a possible savings of ***$285,680.***

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will reduce the border width and increase the two way left turn to 14' for KY 237 Typical Section.

If this recommendation is implemented, there is a possible additional cost of ***$187,417.***

Recommendation Number 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct a Soil Nail Wall in place of a Cast in Place wall.

If this recommendation can be implemented, there is a possible savings of ***$428,793.***

KY 536 KENTON COUNTY, KY 536 BOONE COUNTY, KY 237 BOONECOUNTY VALUE ENGINEERING STUDY PRESENTATION

May 18, 2007

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