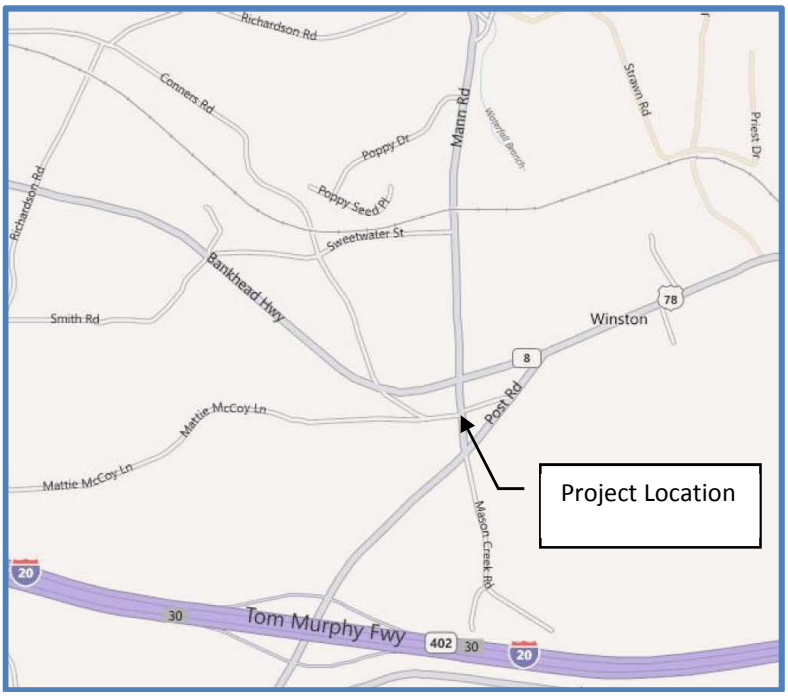
Georgia Department of Transportation

Value Engineering Study Report



SR 8/US 78 at Mann Road/Mason Creek Road and at Post Road Intersection Improvements, Douglas County

CSSFT-0008-00(375), PI No. 0008375

February 2012

Prepared by

Value Management Strategies, Inc.

VMS

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"Value Leadership"

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Date: February 15, 2012

To: Matthew J. Sanders, AVS
Georgia Department of Transportation
Engineering Services
600 Peachtree Street, NW, 5th Floor
Atlanta, Georgia 30308-3603

Subject: Final Value Engineering Study Report
SR 8/US 78 at Mann Road/Mason Creek Road and at Post Road Intersection Improvements, Douglas County, CSSFT-0008-00(375) PI No. 0008375

Dear Mr. Sanders:

Value Management Strategies, Inc. is pleased to transmit this Final VE Study Report for the referenced project. This report summarizes the events of the study conducted January 31 – February 3, 2012.

It was a pleasure working with GDOT on this project, and I look forward to the next collaboration. If you have any questions or comments concerning this final report, please do not hesitate to contact me at (253) 229-7703 or email dave@vms-inc.com.

Sincerely,

VALUE MANAGEMENT STRATEGIES, INC.

David A. Hamilton, PE, CVS-Life, CCE
VE Study Team Leader

Copy: (2 copies/CD/PDF) Addressee

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EXECUTIVE SUMMARY

FINAL

A Value Engineering (VE) study, sponsored by GDOT and facilitated by Value Management Strategies, Inc., was conducted for State Route 8 (SR 8)/US 78 at Mann Road/Mason Creek Road and at Post Road Intersection Improvements, CSSFT-0008-00(375), PI No. 0008375, in Douglasville, Georgia. The study was conducted January 31 to February 3, 2012. This *Executive Summary* provides an overview of the project, key findings, and the alternatives developed by the VE team.

PROJECT SUMMARY

Bankhead Highway (US 78/SR 8), Mann Road, Post Road, Conners Road, Mattie McCoy Lane, and Mason Creek Road currently are two-lane roadways with rural grassed shoulders. Bankhead Highway is functionally classified as an urban minor arterial, while Post Road is classified as a rural major collector. The remaining project side roads are classified as local roadways. The land along the south side of Bankhead Highway within the project limits varies between a mix of commercial, light industrial, and agricultural properties. The land use elsewhere within the project limits is primarily residential. Accidents along this corridor necessitate improvements to control traffic and signalize the main intersection at Bankhead Highway and Mason Creek Road, adjust the alignment and profile to meet current design criteria, and provide needed pedestrian improvements in the area.

The overlapping roadway network along Bankhead Highway (US 78/SR 8) will be consolidated into a single through east-west route (Bankhead Highway) and a single through north-south route (Post Road to Mason Creek Road to Mann Road) that converges at the aforementioned improved, signalized intersection and eliminates conflict points at other locations. The northern portion of Conners Road will be realigned from crossing Bankhead Highway at a substandard intersection skew to terminate directly into Bankhead Highway at a perpendicular angle.

Total construction cost for the project is currently estimated at $3,140,000, with an additional $4,180,000 needed for right-of-way.

PROJECT PURPOSE AND NEED

The purpose of the proposed project is to reduce the crash frequency and severity at the above intersections and improve the operation of the intersections. The proposed project will improve the intersection of Bankhead Highway with Mann Road and Mason Creek Road by adding a traffic signal, left turn lanes in all four directions, and right turn lanes on Bankhead Highway and Mason Creek Road. These changes are anticipated to reduce angle crashes caused by left-turning vehicles and improve the intersection's 2035 level of service (LOS) to B/B. Proposed pedestrian facilities at the intersection are intended to provide pedestrians with improved crossings of travel lanes and accessibility to the business in the intersection's southwest comer.

The need exists to improve the above intersections to address the rear end and angle crashes and to improve the LOS at the intersection of Bankhead Highway with Mann Road and Mason Creek Road and the intersection of Mason Creek Road and Post Road.

VE STUDY TIMING

The VE study was conducted following the submittal of the Concept Report, which was completed in January 2012. The project is scheduled for Ready to List (RTL) in April 2015.

VE STUDY OBJECTIVES

The objective of the VE study was to optimize the project design and to present alternatives that improve project procurement, reduce crashes, control capital cost, reduce future maintenance costs, control risk, and maximize competition for the proposed construction contract.

KEY PROJECT ISSUES

The items listed below are the key drivers, constraints, or issues being addressed by the project and considered during this VE study to identify possible improvements.

- The difference in elevations between the existing profiles and the proposed could make construction difficult.
- The Bankhead Highway (US 78/SR 8) intersection with Mann Road and Mason Creek Road has had 91 crashes over the last 6 years with 89% of these being angle crashes. The intersection currently operates at a LOS C/C for the AM/PM peak hours, and the 2035 future no-build anticipated LOS is F/F for the AM/PM peak hours.
- The Bankhead Highway (US 78/SR 8) intersection with Post Road has had 20 crashes over the last 6 years with 70% of these being rear end crashes and 15% being angle crashes.
- The intersection of Mason Creek Road and Post Road has had 12 crashes over the last 6 years with 58% of these being angle crashes. The intersection currently operates at a LOS C/C for the AM/PM peak hours, and the 2035 future no-build anticipated LOS is F/F for the AM/PM peak hours.

EVALUATION OF BASELINE CONCEPT

During the course of the VE study, a number of analytical tools and techniques were applied to develop a better understanding of the baseline concept. The first step in this process was to assess elements such as cost, performance, time, and risk from a qualitative perspective as they relate to project value. These elements required a deeper level of analysis, the results of which are detailed in the *Project Analysis* section of this report. The key performance attributes identified by the VE team for the project are listed in the table, "Performance Attributes."

Performance Attributes
Mainline Operations
Environmental Impacts
Maintainability
Construction Impacts

Below is a summary of the major observations and conclusions identified during the evaluation of the baseline concept which led the VE team to develop the alternatives and recommendations presented

in this report. These four attributes were selected because they represented the key elements of the project and provide a metric to discuss potential design improvements in each of these areas.

Mainline Operations

The Baseline Concept appears to address the key safety issues of the project and should reduce the number of crashes along the alignment. Adding the signal to control the intersection at Bankhead Highway and Mason Creek Road will provide for controlled left turns off of the mainline with adequate turning storage. The roadway section appears to be fairly generous with a 16-foot dimension to the ditch line and 4:1 fill slopes. Tightening the overall section could result in reduced right-of-way and fill requirements.

Environmental Impacts

Environmental issues appear to be addressed, but the Baseline Concept included in the Concept Report assumed a 55 mph design speed along Bankhead Highway. As the design evolved, it appears now that a speed of 45 mph may be acceptable. This may allow for significant changes to the alignment and profile through the use of shorter radius curves for both vertical and horizontal curves. This should result in a narrower section, reduced fill quantities, and fewer right-of-way requirements.

Maintainability

Maintainability for the Baseline Concept appears acceptable and no issues are noted other than maintaining the new fill slopes.

Construction Impacts

Constructibility is driving much of the project alignment since several areas require fills up to 12-foot-high to meet the longer vertical curves to meet the stopping sight distance criteria. Adding this depth of fill within the existing alignment under traffic conditions is not feasible, so shifting the alignment to along the fill section from STA 32+00 to 41+00 appears justifiable. However, since the 12 feet of fill was based on the 55 mph design speed, some reduction may be identified by changing to the 45 mph design speed and shortening the radii, but this is somewhat hampered by the fact that the east end of the alignment is already at 6% grade. Based upon these constraints, it appears that overall constructibility may already be optimized in the Baseline Concept.

VE ALTERNATIVES

The VE team developed 12 alternatives for improvement of the project. The following are the alternatives identified, along with their associated potential initial cost and/or life-cycle cost (LCC) savings, potential change in schedule, and a brief discussion of each. Please note that because the cost data depicted below represent *savings*, a number in parentheses represents a cost *increase*.

Alternative No. and Description	Initial Cost Savings	LCC Savings	Change in Schedule
A-1 Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner	**$260,100**	**$0**	**No Change**
Reducing the design speed from 45 mph to 35 mph for Conners Road at the intersection with Bankhead Highway allows the radius to be reduced and right-of-way requirements minimized.			
A-2 Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50	**$269,000**	**$0**	**No Change**
Performing a full pavement restoration along Mattie McCoy Lane appears to add very little value to the project. There may be specific issues with the existing pavement section, but justification for this investment has not been presented.			
A-4 Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment		**Design Suggestion**	
Some optimization may be possible by moving the alignment of Mason Creek further west, minimizing the cut/fill requirements. However, a number of competing costs including, right-of-way and roadway section width, could be balanced with alignment and profile adjustments. The potential savings is seen as modest, but some CAD modeling may be possible.			
A-6 Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet	**$9,500**	**$0**	**No Change**
Larger intersections like that at Bankhead Highway/Mason Creek Road perform a number of functions, primarily control of traffic and pedestrian movements. Larger radius curves at intersections simplify truck movements, but can also lead to higher speed for vehicles making right turns at the intersection. The 75-foot radius will perform as a traffic calming element and reduce the speed in the area.			
A-7 Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00	**$85,000**	**$0**	**No Change**
The project limit on the west end of Bankhead Highway appears to follow the existing alignment and profile for the last 200 feet, basically resulting in a skimming operation for paving. This appears to add very little value to the project unless the existing pavement is failing and in need of total replacement.			

A-8 Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00	**$68,000**	**$0**	**No Change**

Similar to Alternative A-7, the alignment and profile on the east end of the project appear to simply replace the existing pavement section. Unless there is a requirement to replace the pavement, it is recommended that the project limits be reduced.

A-10 Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way	**$3,900**	**$0**	**No Change**

Since the majority of the project cost is based on right-of-way procurement, all means should be considered to reduce the total impact to the public and control project cost. Flipping the orientation of the bulb on the cul-de-sac and shifting the location slightly east allows the bulb to be located within the existing right-of-way.

P-1 Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed	**$62,000**	**$0**	**+1 month**

It appears that some optimization is possible by further evaluation and adjustment in the alignment and profile of Bankhead Highway. Reducing the design speed from 55 mph to 45 mph, which has been approved, will allow a number of vertical and horizontal curves to be slightly reduced. This will result in reduced right-of-way requirements, less cut/fill, and will move the final grade closer to the existing profile, possibly reducing the length of the total project.

ROW-1 Use more slope easements in lieu of permanent right-of-way	**$743,000**	**$0**	**No Change**

GDOT has accepted the use of easements on a number of recent projects as an effective way to control the overall cost of right-of-way. Full right-of-way purchase may be prudent at specific locations due to maintenance access issues, but oftentimes easements provide the equivalent function at approximately 60% of the cost of a full right-of-way purchase.

S-1 Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively	**$203,800**	**$0**	**No Change**

Per GDOT Design Policy Manual Tables 6.4 and 6.6, clear zone dimensions of 24 feet and 18 feet are acceptable for 45 mph and 35 mph design speeds respectively. This will reduce the overall roadway section, minimizing the right-of-way needs.

S-2 Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway	**$136,000**	**$0**	**No Change**

Reducing the design speed on Bankhead Highway from 55 mph to 45 mph will now enable the roadway section to use 4-foot paved shoulders instead of the 6.5-foot typically used with 55 mph design speeds.

S-6 Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required	**$49,300**	**$0**	**No Change**

Since right-of-way for the project is a key cost driver, all attempts should be made to minimize right-of-way procurement. Changing the section from 4:1 fill slopes to 2:1 slopes with guardrail will allow the right-of-way needs for the project to be reduced.

VE STUDY RESULTS

A number of key findings, primarily the implications of changing from a 55 mph to a 45 mph design speed, create opportunities to reduce the construction and right-of-way cost to the project. Since the right-of-way appears to be driving the total cost of the project, a careful balancing of the roadway alignment, profile, and section is needed to identify the optimal combination of all elements. The reduced design speed allows the vertical and horizontal curve radii to be reduced, minimizing right-of-way needs as well as cut/fill quantities. As the alignment along Bankhead Highway is modified by using shorter radii, the alignment moves back towards the existing roadway, somewhat compounding constructibility due to the 4 or 5 feet of fill required to meet the new profile. Adjusting the profile with shorter vertical curves helps mitigate this impact by reducing fill depths.

The constructibility of an optimized project may need to include some type of temporary slope stabilization adjacent to the existing traffic lanes as fill is placed to meet the new higher profile. Geotechnical fabrics could be used to temporarily contain the new fill and minimize the need for extensive right-of-way purchase. Since the project is evolving from a 55 mph to 45 mph design speed, optimization of the project plan and profile can be accomplished effectively and VE alternatives incorporated into the new design.

Collectively, the VE alternatives present approximately $1,800,000 in potential cost savings to the project in both construction and right-of-way reductions. A large portion of this savings is attributed to Alternative ROW-1 which would convert a portion of the new right-of-way from direct purchase to easements. This change could be made without modification of the existing design. The remaining VE alternatives would require adjusting the alignment, profile, and section to capture the stated potential savings. Since there appears to be adequate time prior to the Ready to List date of April 2015, all of the alternatives are recommended to optimize the project.

Please refer to the *Project Analysis* section of this report for additional details on this analysis.

VE TEAM

VE Study Team

Name	Organization	Title
David Hamilton	Value Management Strategies, Inc.	VE Team Leader/Civil
Dominic Saulino	HNTB	Roadway Design/Constructibility
Lenor Bromberg	KEA Group	Roadway Design
Brian Sapp	HNTB	Roadway Design/Constructibility

Key Project Contacts

Name	Organization	Title
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Larry Bowman	GDOT	Environmental Services
Lisa Myers	GDOT	Engineering Services
Matt Sanders	GDOT	VE Specialist - Engineering Services
Eric Rickert	Gresham Smith & Partners	Design Consultant - PM

The results of this study are presented as individual alternatives to the baseline concept. Each alternative consists of a summary of the baseline concept, a description of the suggested change, a listing of its advantages and disadvantages, a cost comparison, discussion of schedule and risk impacts (if applicable), and a brief narrative comparing the baseline design with the alternative. Sketches and calculations are also presented where applicable.

The cost comparisons reflect a comparable level of detail as in the baseline estimate. A life-cycle benefit-cost analysis for major alternatives is included where appropriate.

VE ALTERNATIVES

VE studies result in the development of a number of alternatives. While it is possible for all alternatives to be implemented, typically there are combinations of some alternatives that may provide the best solution for the project, while other VE alternatives may be mutually exclusive and each represent different solutions for the same design task. This is due to the fact that some alternatives may be competing ideas or different ways to address the same function. Some alternatives are developed to answer a question raised by a decision maker or to resolve an open issue and found not to be beneficial to the ultimate project. The total net cost impact to the project of any combined set of selected alternatives may be lower than the collective savings total for each alternative.

VE ALTERNATIVE SUMMARY TABLE

Alternative No. & Description	Initial Cost Savings	LCC Savings	Change in Schedule
A-1 Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner	$260,100	$0	No Change
A-2 Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50	$269,000	$0	No Change
A-4 Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment	Design Suggestion		
A-6 Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet	$9,500	$0	No Change

Alternative No. & Description	Initial Cost Savings	LCC Savings	Change in Schedule
A-7 Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00	$85,000	$0	No Change
A-8 Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00	$68,000	$0	No Change
A-10 Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way	$3,900	$0	No Change
P-1 Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed	$62,000	$0	+1 Month
ROW-1 Use more slope easements in lieu of permanent right-of-way	$743,000	$0	No Change
S-1 Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively	$203,800	$0	No Change
S-2 Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway	$136,000	$0	No Change
S-6 Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required	$49,300	$0	No Change

Note: Because the cost data depicted above represent savings*, a number in parentheses represents a cost* increase*.*

VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner

Initial Cost Savings:	$260,100
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The current horizontal and vertical design for Conner Road ties into Bankhead Highway approximately 200 feet west of the existing Conner Road Intersection and utilizes the following design parameters:

- 35 mph design speed for horizontal and vertical alignment
- 20-foot clear zone provided to back of 2-foot flat ditch bottom
- 399.5-foot horizontal curve to tie back into the existing roadway alignment
- 5.9% superelevation rate
- 180-foot vertical curve (K value of 54.51)
- 1.3% profile grade to get back to existing grade
- 160-foot vertical curve (K value of 434.89) to complete the tie into existing grade

Description of Alternative Concept: The alternative concept would utilize a 25 mph design speed for the final approach to Bankhead Highway and would tie into Bankhead Highway approximately 113 feet west of the existing Conner Road Intersection. This adjustment would result in the following design parameters:

- 25 mph design speed for horizontal and vertical alignment
- 14-foot clear zone provided to back of 2-foot flat ditch bottom
- 144-foot horizontal curve to tie back into the existing roadway alignment
- 6.0% superelevation rate
- 120-foot vertical curve (K value of 26.00)
- 2.6% profile grade to get back to existing grade
- 125-foot vertical curve (K value of 27.17) to complete the tie into existing grade

Advantages:

- The length of construction along this portion of Conner Road would be reduced by approximately 173 feet
- Shifting the road back toward the existing alignment would result in less required right-of-way

Disadvantages:

- Minor change to the project documents

Discussion: The alternative concept requires a 10 mph reduction is design speed at the final approach to the intersection of Conner Road at Bankhead Highway. However, this is proposed to be a “T” intersection and the portion of Conner Road south of the existing intersection is proposed to be removed. The property immediately across from the proposed Conner Road Intersection is a

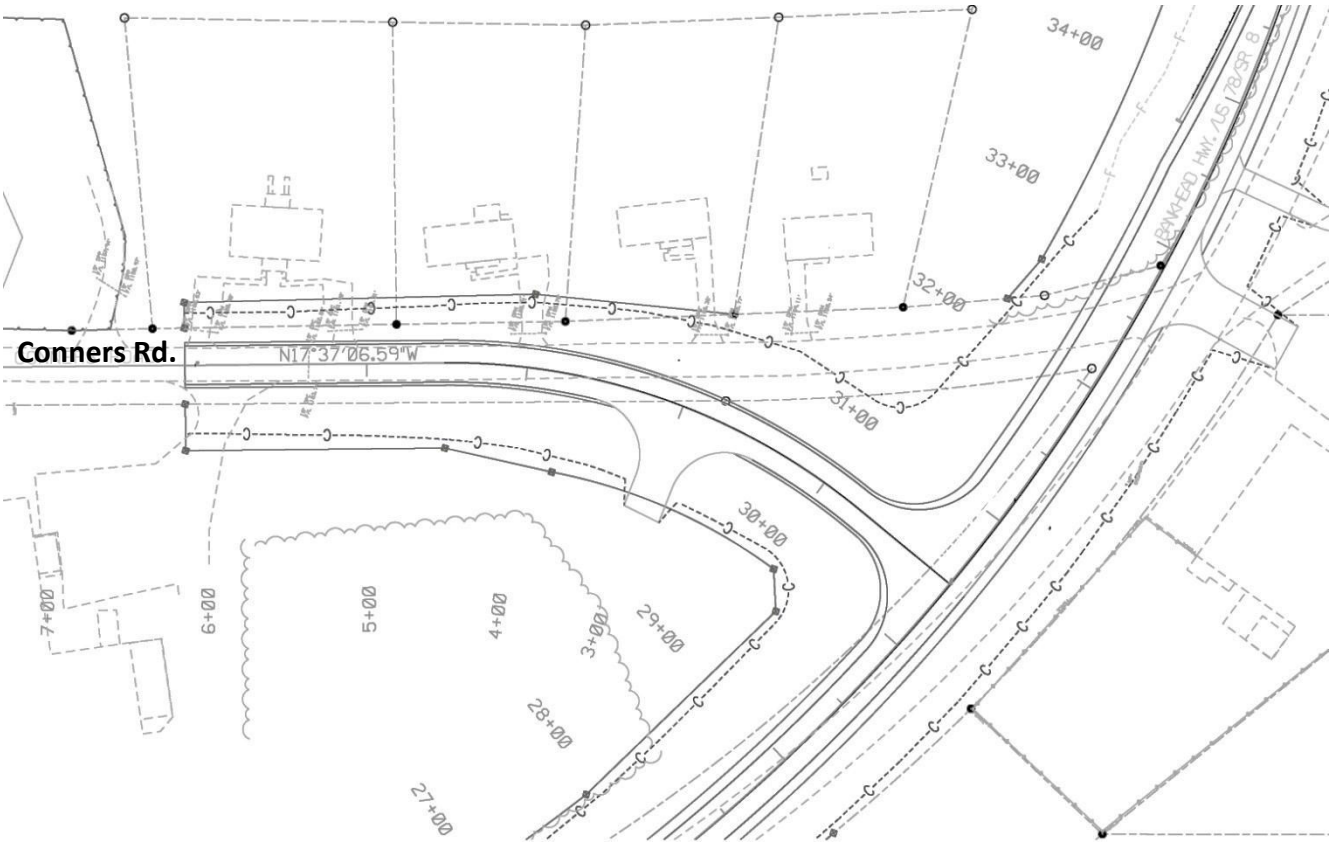
VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner

developed commercial parcel, so the likelihood of a through movement (southern leg) being implemented is very low.

There would be minimal design change to the horizontal and vertical alignments and cross sections, but since the project is in concept phase it does not appear this would affect the current schedule. There would be an approximate 5% reduction in right-of-way acreage to be acquired; therefore, there is a potential for minor time savings during right-of-way acquisition. The construction limits would be shortened by approximately 173 feet, so a minor reduction in construction time along Conner Road may be realized.

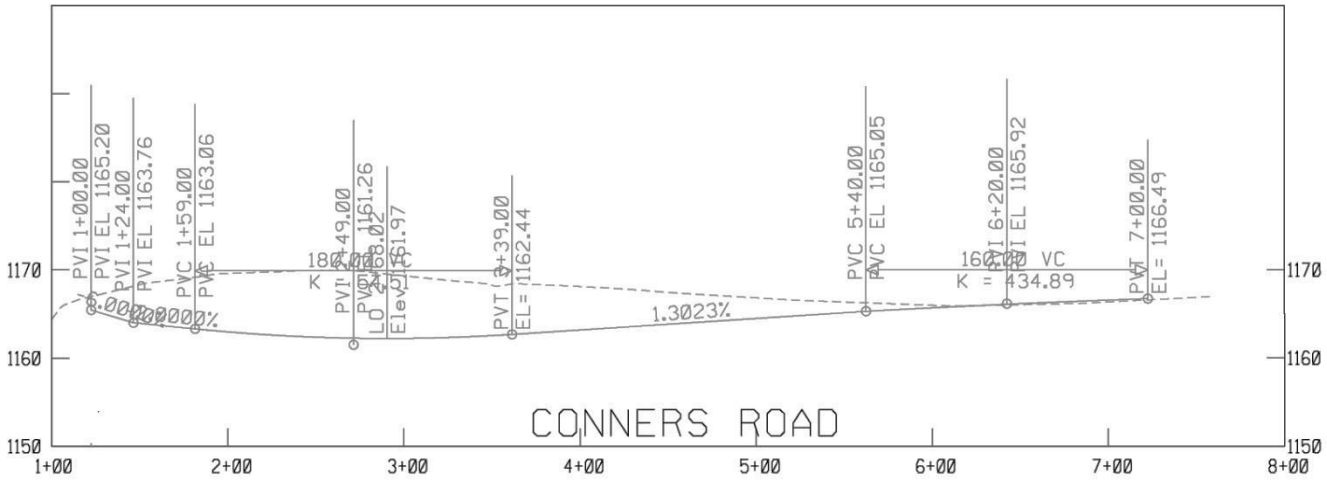
Baseline Concept Sketch



Plan – Bankhead Highway/Conners Road Intersection

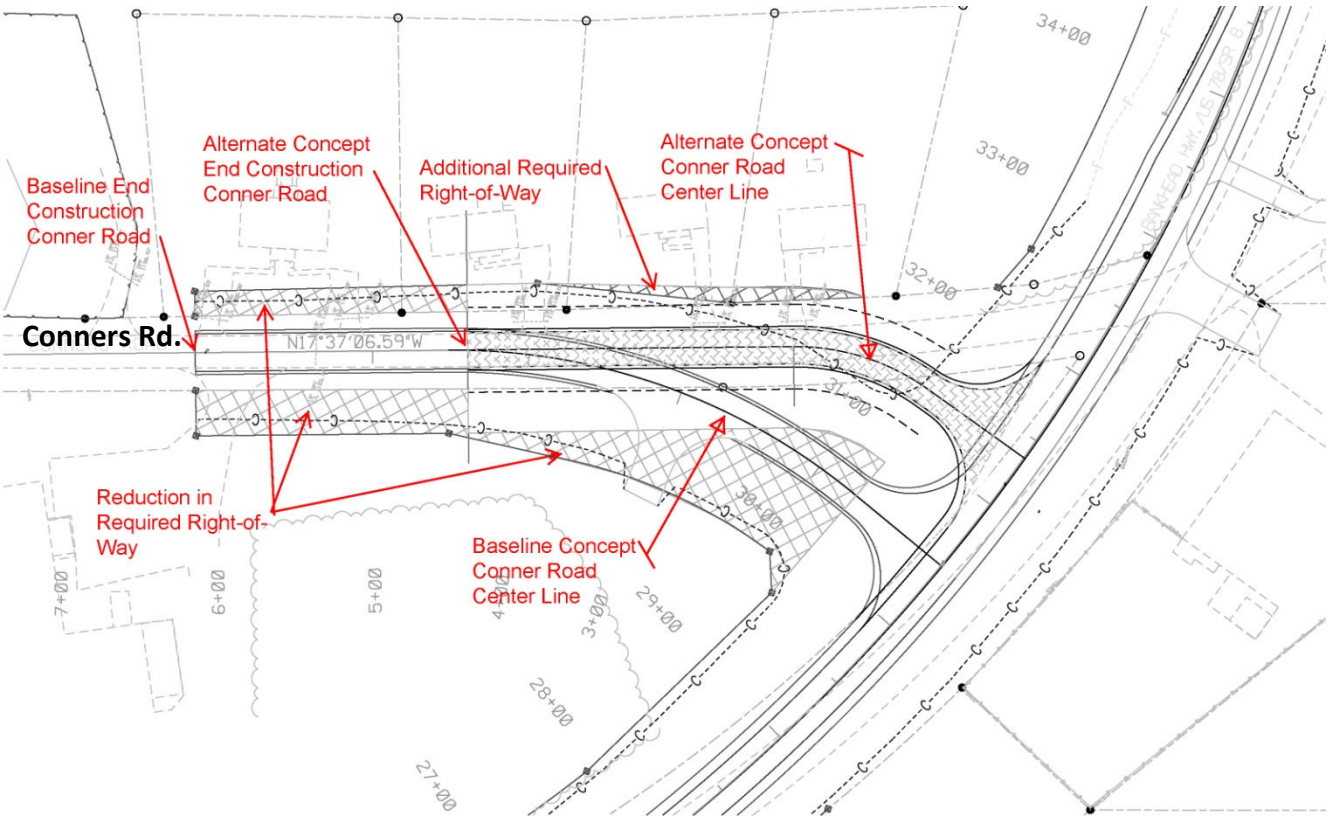
VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner



Profile – Conners Road

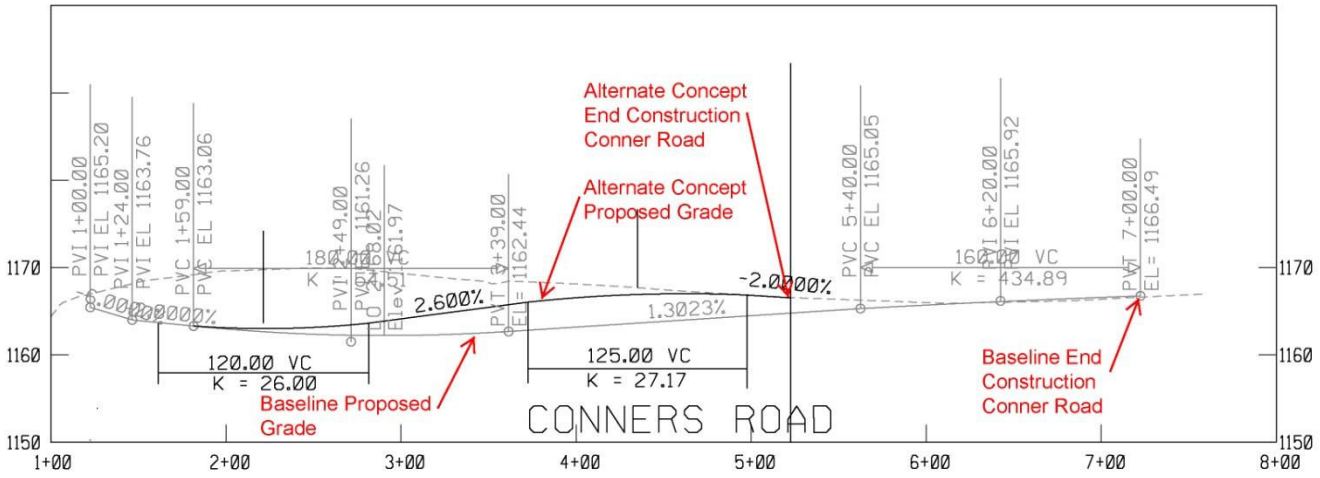
VE Alternative Concept Sketch



Plan – Bankhead Highway/Conners Road Intersection

VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner



Profile – Conners Road

Assumptions and Calculations:

Per AASHTO Roadside Design Guide: Clear zone for less than 40 mph for 2100 ADT = 14 feet
Per AASHTO Green Book: Sag vertical curve at 25 mph, K = 26
Maximum superelevation 6% for 25 mph, Min. radius = 144 feet

Alternative concept increases proposed grade from 1.3% to 2.6% in order to reach existing grade over a shorter distance.

Vertical curve (VC) calculation: K = L/A, K = 26, A = 4.6 26 = L/4.6 = 119.6 Use 120-ft VC (min)

Pavement: Construction length reduced by 173.4 feet
Total baseline quantities for entire project per Job Estimate Report:

310-5100	GR AGGR BS CRS 10 IN INCL MATL	30,250 SY	$15.57/SY	$470,993
402-1812	RECYL AC LEVELING, INC BM&HL	500 TN	$68.13/TN	$34,065
402-3130	RECYL AC 12.5MM SP, GP2, BM&HL	2,500 TN	$65.44/TN	$163,600
402-3190	RECYL AC 19 MM 5P, GP 1 OR 2, INC BM&HL	3,350 TN	$61.69/TN	$206,662
402-3121	RECYL AC 2SMM SP, GP1/2, BM&HL	10,000 TN	$55.28/TN	$552,800
413-1000	BITUM TACK COAT	3,000 GL	$2.10/GL	$6,300

Total cost for full depth pavement in baseline = $1,434,319
Using 30,250 SY total pavement area = $47.42/SY
Reduction of pavement construction by 173.4 feet long x 26 feet wide = 4,508.4 SF = 500.9 SY
Cost reduction for full depth pavement = $47.42/SY x 500.9 SY = $23,752.68 or $23,753
:. Total cost for full depth pavement in alternative concept = $1,410,586

VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner

Right-of-Way: Shift in alignment to the east and shortening the limit of construction by 173.4 feet reduces the amount of required right-of-way. The following areas were measured in CAD.

Per the Preliminary Right-of-Way Estimate:

Commercial property:	Fee simple = $195,000/acre, Improvements (avg) = $300,926/acre
Residential property:	Fee simple = $35,000/acre, Improvements (avg) = $161,960/acre
All property:	Counters/Condemnation = $133,710/acre

Reductions:	Commercial (measured) = 0.356 ac	Residential (measured) = 0.065 acre
Increases:	Residential (measured) = 0.028 ac [result alignment shift east STA 2+00 to 3+00]	
Net reduction:	Commercial = 0.356 ac	Residential = 0.037 ac

Commercial:	Fee simple =	0.356 ac at $195,000/ac =	$69,420
	Improvements =	0.356 ac at $300,926/ac =	$107,130
Residential:	Fee simple =	0.037 ac at $35,00/ac =	$1,295
	Improvements =	0.037 ac at $161,960/ac =	$5,992
All:	Counters/Condemn =	0.393 ac at $133,710/ac =	$52,548

VE ALTERNATIVE A-1

Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
GR AGGR BS CRS 10 IN INCL MATL	SY	30,250	$15.57	$ 470,993			$ -
RECYL AC LEVELING,INC BM&HL	TN	500	$68.13	$ 34,065			$ -
RECYL AC 12.5MM SP,GP2,BM&HL	TN	2,500	$65.44	$ 163,600			$ -
RECYL AC 19 MM 5P,GP 1 OR 2 ,INC BM&HL	TN	3,350	$61.69	$ 206,662			$ -
RECYL AC 2SMM SP,GP1/2, BM&HL	TN	10,000	$55.28	$ 552,800			$ -
BITUM TACK COAT	GL	3,000	$2.10	$ 6,300			$ -
				$ -			$ -
Total Full Depth Pavement	SY	30,250	$ 47.42	$ 1,434,419	29,749	$ 47.42	$ 1,410,662
				$ -			$ -
Fee Simple Right-of-Way				$ -			$ -
Commercial Right-of-Way	AC	1.08	$ 195,000	$ 210,600	0.72	$ 195,000	$ 141,180
Residential Right-of-Way	AC	6.02	$ 35,000	$ 210,700	5.98	$ 35,000	$ 209,405
Agricultural Right-of-Way	AC	0.07	$ 5,000	$ 350	0.07	$ 5,000	$ 350
Industrial Right-of-Way	AC	0.10	$ 75,000	$ 7,500	0.10	$ 75,000	$ 7,500
Combined (all Right-of-Way)	AC	7.27	$ 133,710	$ 972,075	6.88	$ 133,710	$ 919,527
				$ -			$ -
Right-of-Way Improvements				$ -			$ -
Commercial Right-of-Way	AC	1.08	$ 300,926	$ 325,000	0.72	$ 300,926	$ 217,870
Residential Right-of-Way	AC	6.02	$ 161,960	$ 975,000	5.98	$ 161,960	$ 969,007
Agricultural Right-of-Way	AC	0.07	$ 214,286	$ 15,000	0.07	$ 214,286	$ 15,000
Industrial Right-of-Way	AC	0.10	$ 200,000	$ 20,000	0.10	$ 200,000	$ 20,000
				$ -			$ -
SUB-TOTAL				$4,170,644			$3,910,502
TOTAL (Rounded)				$4,170,600			$3,910,500
						SAVINGS	**$260,100**

VE ALTERNATIVE A-2

Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50

Initial Cost Savings: $269,000
LCC Savings: $0
Change in Schedule: No Change

Description of Baseline Concept: The baseline concept includes a 250-foot-long pavement replacement on Mattie McCoy Lane between STA 3+00 and 5+50. This section includes two 12-foot-wide travel lanes, curb and gutter, and ditches on both sides.

Description of Alternative Concept: Eliminate the roadway replacement on Mattie McCoy Lane between STA 3+00 and 5+50 and simply add minor ditching along the north and south side of the existing road as needed.

Advantages:

- Eliminates a sizable section of pavement, including grading and curbs
- Reduces local disruption in the area

Disadvantages:

- Minor amount of grading and ditching is required

Discussion: There does not appear to be an immediate justification for this new pavement along Mattie McCoy Lane. Since the alignment and profile do not change, there is little justification for these improvements. The only improvements needed are some new ditching on Mattie McCoy Lane and possibly guardrail or berm to close off the vacated portion where Conners Road joins Mattie McCoy Lane. These improvements could be done within the existing right-of-way.

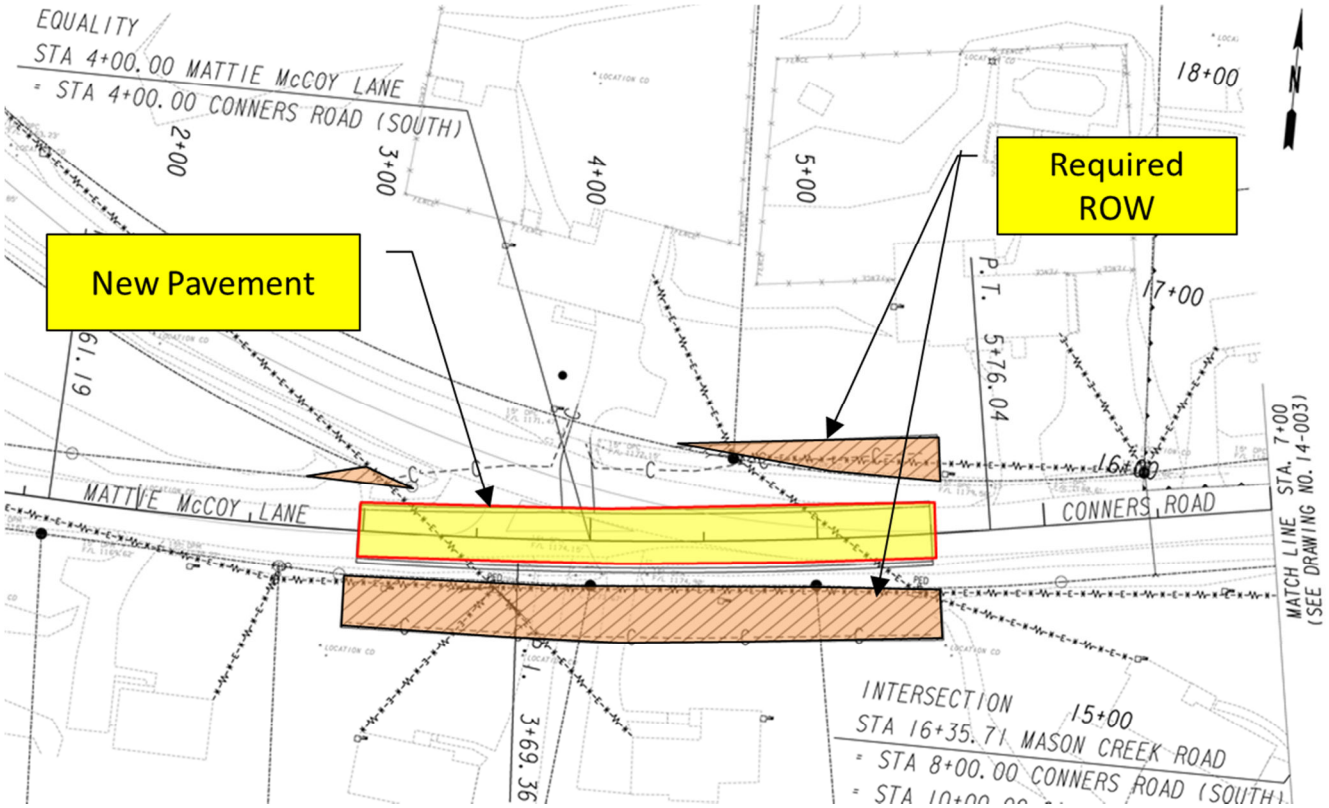
There may be public expectations for this portion of Mattie McCoy Lane to be paved, so some investigation is needed to review project notes, commitments, and exhibits which may have been presented in public meetings.

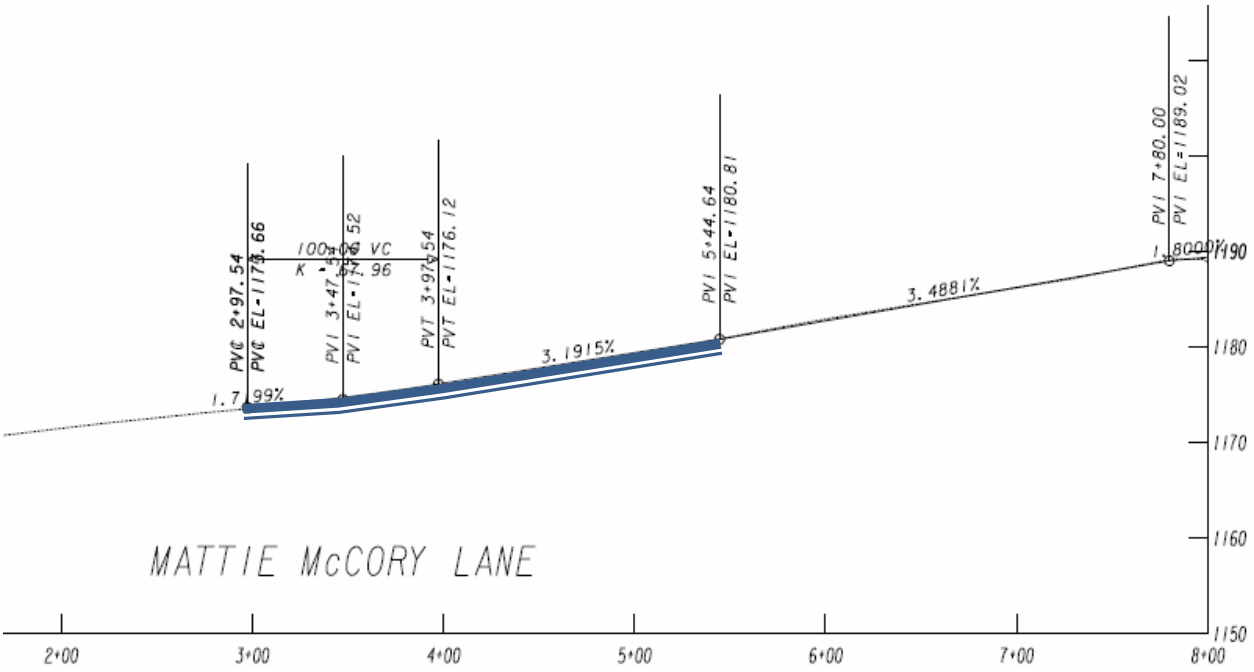
From a design schedule standpoint, this change would have minimal impact upon the final design since these improvements only affect one plan sheet plus several roadway sections.

VE ALTERNATIVE A-2

Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50

Baseline Concept Sketch

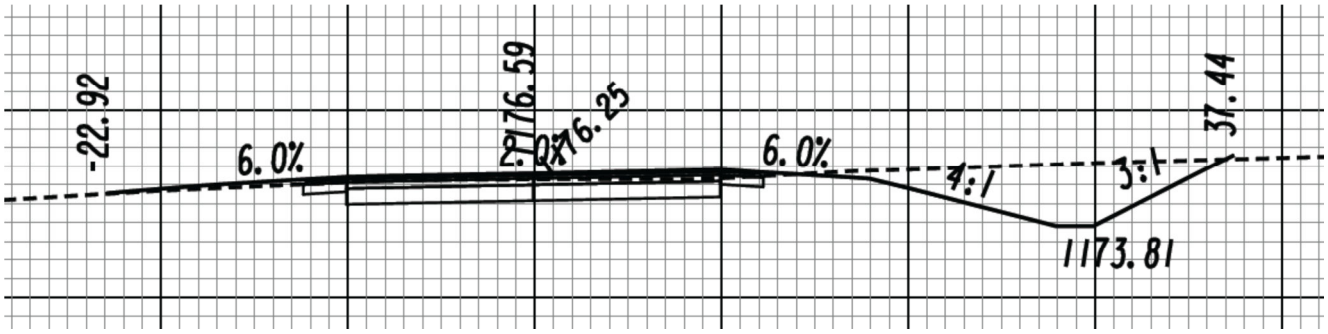




VE ALTERNATIVE A-2

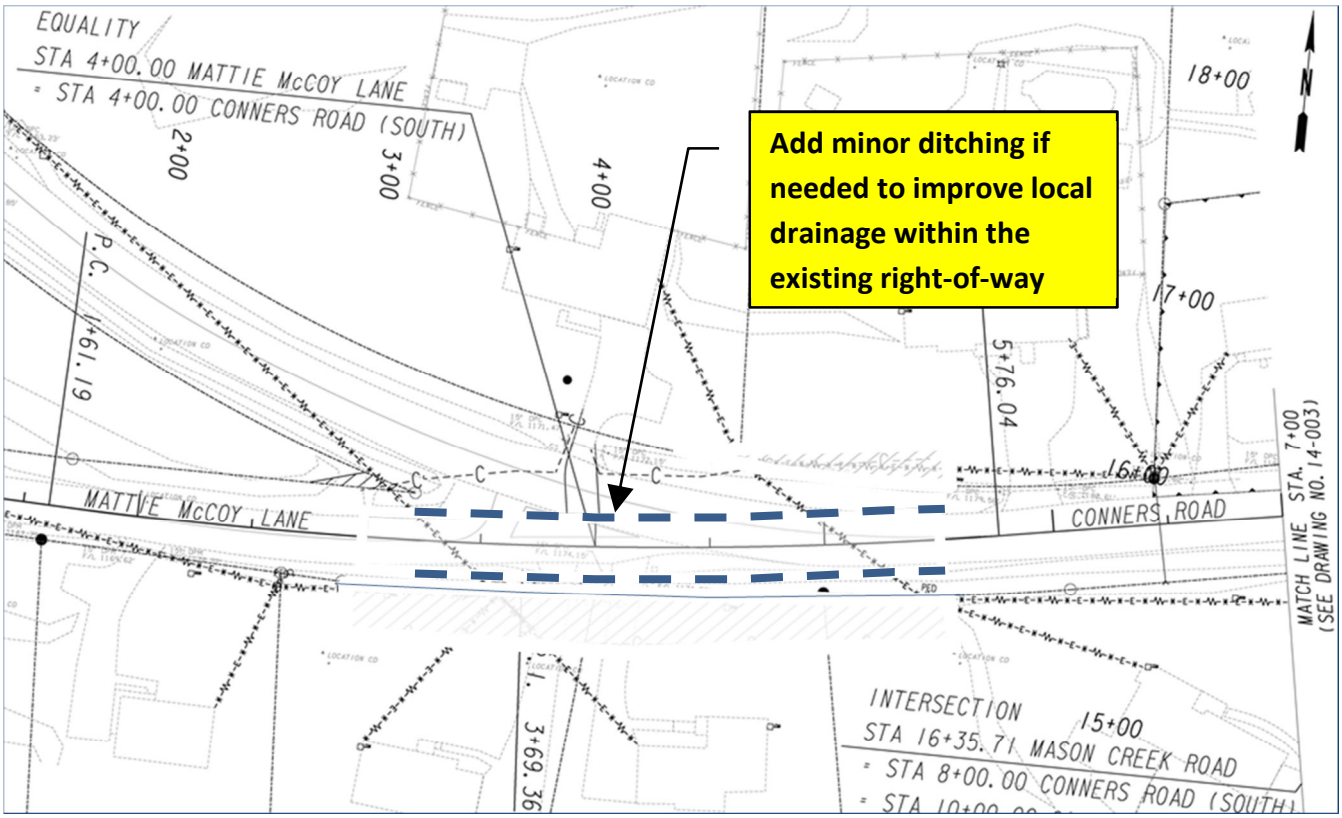
Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50

PROFILE



SECTION @ STA 14+12

VE Alternative Concept Sketch



Assumptions and Calculations: It is assumed that this change would reduce grading, aggregate, paving, and curb/gutters for an area approximately 245 feet x 24 feet. Some additional grading for ditches on the north and south sides of Mattie McCoy Lane could be included if improvements to the drainage system is desired.

VE ALTERNATIVE A-2

Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			$ -
Graded Aggregate Base Couse	SY	30,250	$ 15.56	$ 470,690	24,370	$ 15.56	$ 379,197
				$ -			$ -
Asphalt Pavment	SY	30,250	$ 31.85	$ 963,447	24,370	$ 31.85	$ 776,172
				$ -			$ -
Curb and Gutter	LF	2,060	$ 11.06	$ 22,784	1,570	$ 11.06	$ 17,364
				$ -			$ -
Grading- No./So. side of Mattie McCoy Lane	SY			$ -	1,000	$ 15.57	$ 15,570
				$ -			$ -
SUB-TOTAL				$1,456,921			$1,188,303
TOTAL (Rounded)				$1,457,000			$1,188,000
						SAVINGS	**$269,000**

VE ALTERNATIVE A-4

Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment

Initial Cost Savings:	Design Suggestion
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The baseline concept has realigned Mason Creek Road slightly east to facilitate constructibility.

Description of Alternative Concept: Review the profile of Mason Creek Road and consider options to reduce the profile and required cut/fill depths and move the alignment west, closer to the existing alignment.

Advantages:

- Reduces right-of-way requirements
- Minimizes cut/fill work

Disadvantages:

- Minor changes to the design

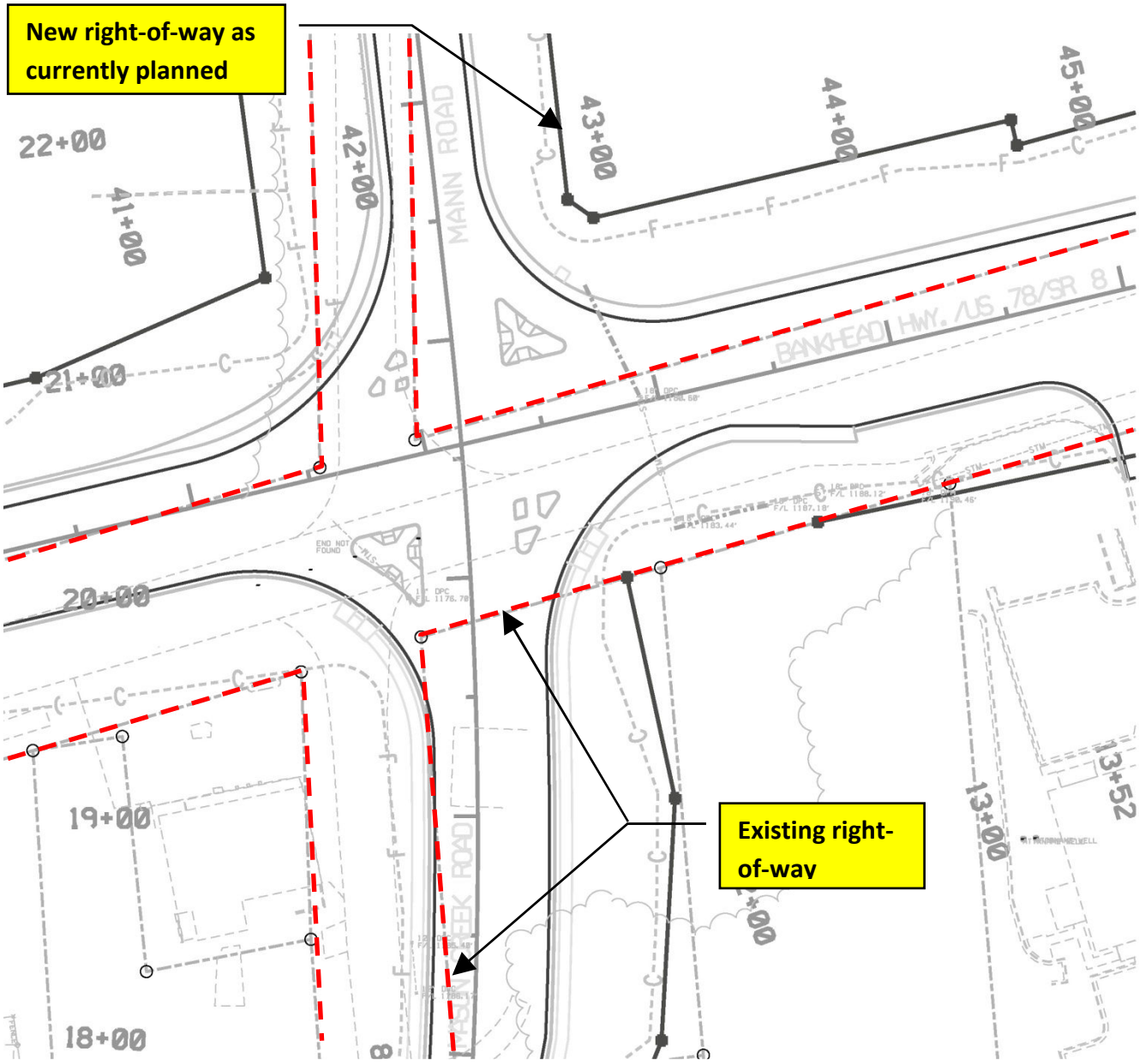
Discussion: Since a number of alignment and profile changes may be considered due to reducing the assumed design speed on Bankhead Highway from 55 mph to 45 mph, the crossroads could also be re-evaluated. Since a number of variables are in motion at this time, some re-balancing of the final solution may provide opportunities to control both right-of-way needs and cut/fill quantities. Potential savings may be in the range of $30,000 – 50,000 depending on the final grade and impact upon adjacent right-of-way. One of the key drivers is the grade difference between the existing road and the proposed profile, and the overall constructibility of the road. If the grade difference can be minimized to less than 2 – 3 feet through modifications to the profile and possibly some use of geotech fabrics to increase the slope on the new fill adjacent to the active roadway, it may be possible to move the alignment to the west.

Revisiting the alignment and profile on Mason Creek Road may add several days of design time, but could result in an optimized project.

VE ALTERNATIVE A-4

Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment

Baseline Concept Sketch



VE ALTERNATIVE A-6

Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet

Initial Cost Savings:	$9,500
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The current radius returns at the intersection of Bankhead Highway and Mann Road/Mason Creek Road are designed as follows:

- Northwest quadrant = 110.0-foot radius
- Northeast quadrant = 75.0-foot radius
- Southeast quadrant = 100.0-foot radius
- Southwest quadrant = 75.5-foot radius

Description of Alternative Concept: The alternative concept would utilize a 75-foot radius in the northwest and southeast quadrants. This would eliminate the raised refuge island on the northwest quadrant and reduce the size of the raised refuge island in the southeast quadrant.

Advantages:

- Reduces pavement and concrete quantities in northwest and southeast quadrants
- Provides better direction to the right-turning driver that they must slow to make the turn or stop on red prior to making the right turn
- Can still provide a minimum 100 SF median island area in southeast quadrant

Disadvantages:

- Minor changes to the design

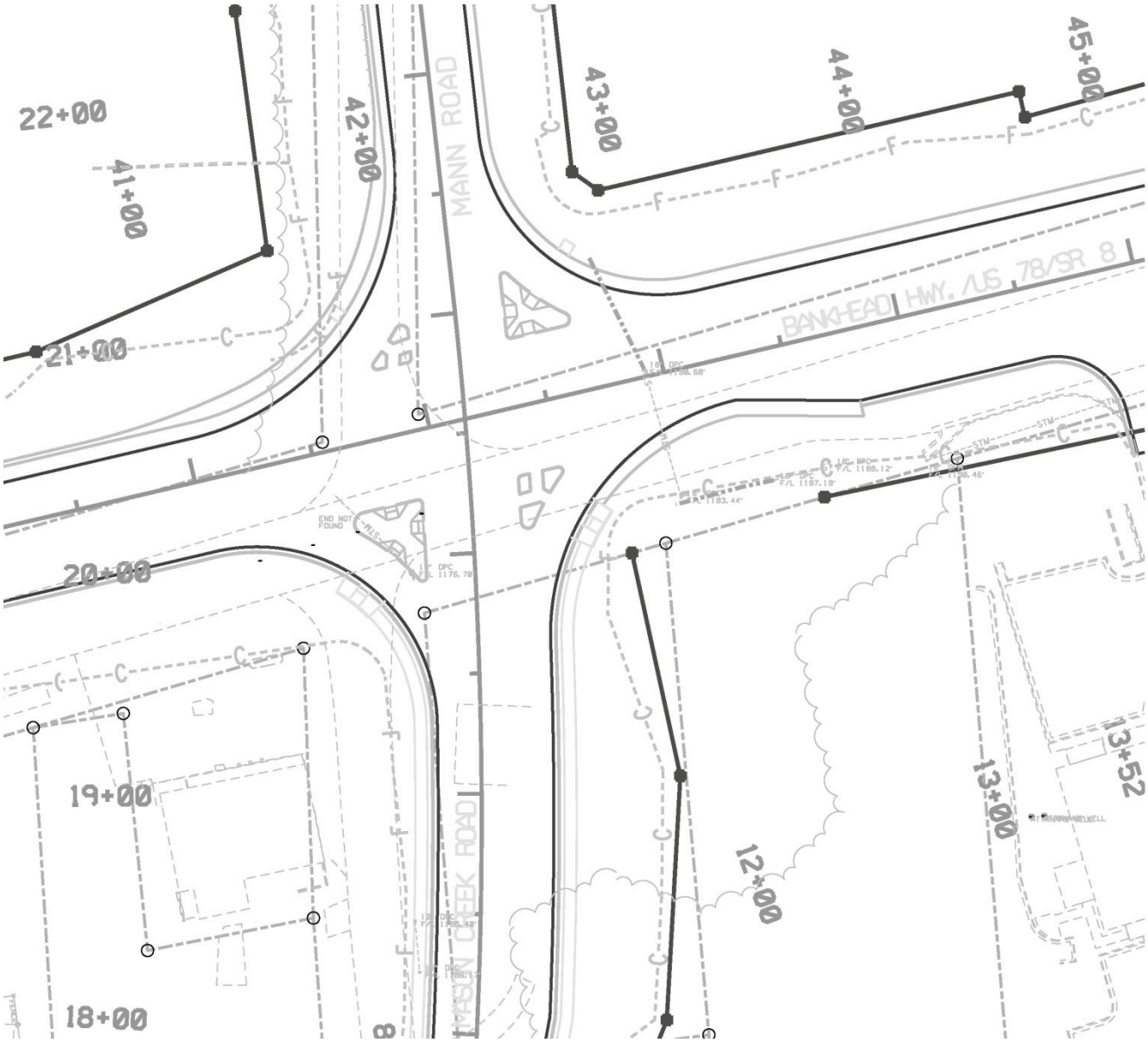
Discussion: The GDOT *Driveway Manual* indicates that radius returns should be a minimum of 75 feet when designing for trucks. The percent of truck volume along Bankhead Highway is moderate at 7%. The large 100+ foot radius returns provide an illusion that a free flow or yield condition is present for the right turn movements. Since a traffic signal is proposed to be installed at this intersection, right-turning vehicles will need to stop on red to determine if they can proceed with the right turn. The reduced radius will facilitate this direction and will provide right-turning drivers better visibility to cars approaching from the left since the approach angle will not be flattened as much as with the larger radii.

There would be minimal design change to the horizontal and vertical alignments and cross sections, but since the project is in concept phase it does not appear this would affect the current schedule. There would be no changes to right-of-way or construction schedules.

VE ALTERNATIVE A-6

Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet

Baseline Concept Sketch

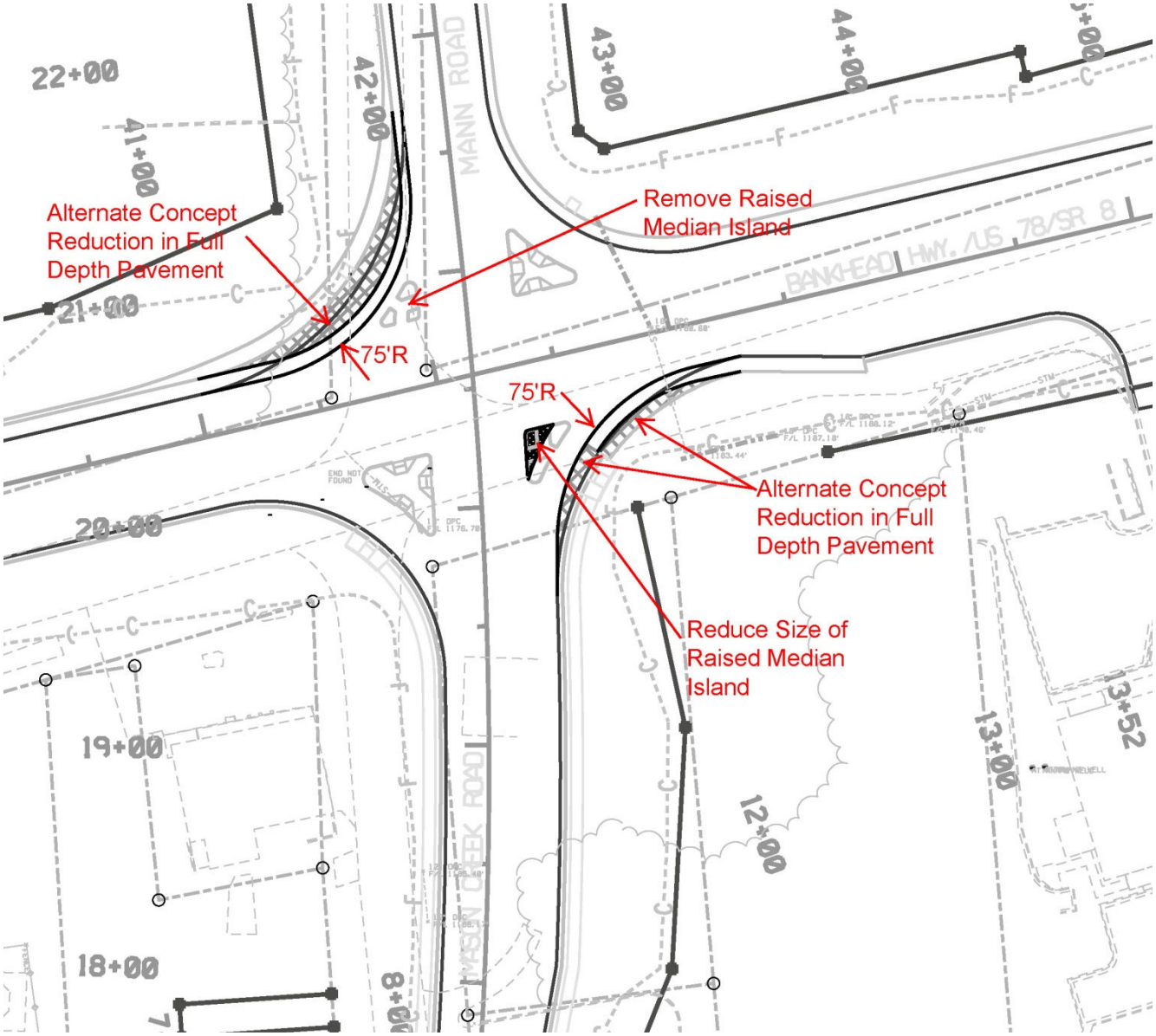


Bankhead Highway/Mann Road Intersection

VE ALTERNATIVE A-6

Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet

VE Alternative Concept Sketch



Bankhead Highway/Mann Road Intersection

VE ALTERNATIVE A-6

Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet

Assumptions and Calculations:

Per GDOT Driveway Manual: Radius return when designing for trucks = 75 feet

Pavement:

Total baseline quantities for entire project per Job Estimate Report:

310-5100	GR AGGR BS CRS 10 IN INCL MATL	30,250 SY	$15.57/SY	$470,993
402-1812	RECYL AC LEVELING, INC BM&HL	500 TN	$68.13/TN	$34,065
402-3130	RECYL AC 12.5MM SP, GP2, BM&HL	2,500 TN	$65.44/TN	$163,600
402-3190	RECYL AC 19 MM 5P, GP 1 OR 2, INC BM&HL	3,350 TN	$61.69/TN	$206,662
402-3121	RECYL AC 2SMM SP, GP1/2, BM&HL	10,000 TN	$55.28/TN	$552,800
413-1000	BITUM TACK COAT	3,000 GL	$2.10/GL	$6,300

Total cost for full depth pavement in baseline = $1,434,319
Using 30,250 SY total pavement area = $47.42/SY

Reduction of pavement construction measured in CAD:
Northwest quadrant = 982.14 SF = 109 SY
Southeast quadrant = 492 SF = 55 SY

Concrete Median (6 inch):

441-0748	CONC MEDIAN, 6 IN	200 SY	$43.98/SY	$8,796

Reduction of median construction measured in CAD:
Northwest quadrant = 179 SF = 20 SY
Southeast quadrant = 169 SF = 19 SY

VE ALTERNATIVE A-6

Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
GR AGGR BS CRS 10 IN INCL MATL	SY	30,250	$15.57	$ 470,993			$ -
RECYL AC LEVELING,INC BM&HL	TN	500	$68.13	$ 34,065			$ -
RECYL AC 12.5MM SP,GP2,BM&HL	TN	2,500	$65.44	$ 163,600			$ -
RECYL AC 19 MM 5P,GP 1 OR 2 ,INC BM&HL	TN	3,350	$61.69	$ 206,662			$ -
RECYL AC 2SMM SP,GP1/2, BM&HL	TN	10,000	$55.28	$ 552,800			$ -
BITUM TACK COAT	GL	3,000	$2.10	$ 6,300			$ -
				$ -			$ -
Total Full Depth Pavement	SY	30,250	$ 47.42	$ 1,434,419	30,086	$ 47.42	$ 1,426,652
				$ -			$ -
CONC MEDIAN 6 IN	SY	200	$ 43.98	$ 8,796	161	$ 43.98	$ 7,081
				$ -			$ -
SUB-TOTAL				$1,443,215			$1,433,733
TOTAL (Rounded)				$1,443,200			$1,433,700
						SAVINGS	**$9,500**

VE ALTERNATIVE A-7

Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00

Initial Cost Savings: $85,000
LCC Savings: $0
Change in Schedule: No Change

Description of Baseline Concept: The baseline concept has the beginning project station starting at 24+00 and is considered full depth pavement construction through this range as per the cross section and typical sections. There are both fill and cut slopes on either side of the cross sections for this range. There is a commercial driveway at approximate STA 26+50 RT.

Description of Alternative Concept: This alternative concept moves the beginning station from 24+00 to 26+00 to reduce the length of paving along this alignment, as well as some grading and erosion control.

Advantages:

- Reduces the amount of full depth paving
- Reduces some grading and erosion control
- Reduces some striping

Disadvantages:

- Not as much existing road improvements
- Connecting the new project to the existing road just after a curve

Discussion: The beginning project station at 24+00 is being changed to 26+00 to shorten the project limits. The profile and horizontal alignments match existing grade before this station range and allows for the construction of the project to terminate earlier than presented. This shortening of the beginning station will reduce full depth paving, striping, grading, and erosion control. The curve just before this station range meets the tangent section before the project limit station.

This alternative shifts the beginning project station to 26+00, but consider shifting this further to just before the commercial driveway and potentially placing the beginning project station at STA 26+71. Review maintenance of traffic plans with the combination of these changes and using full depth pavement through the merge of the existing pavement and proposed.

Review maintenance of traffic plans and consider the commercial driveway owner as to what they may prefer for either some modification to their entrance or none at all.

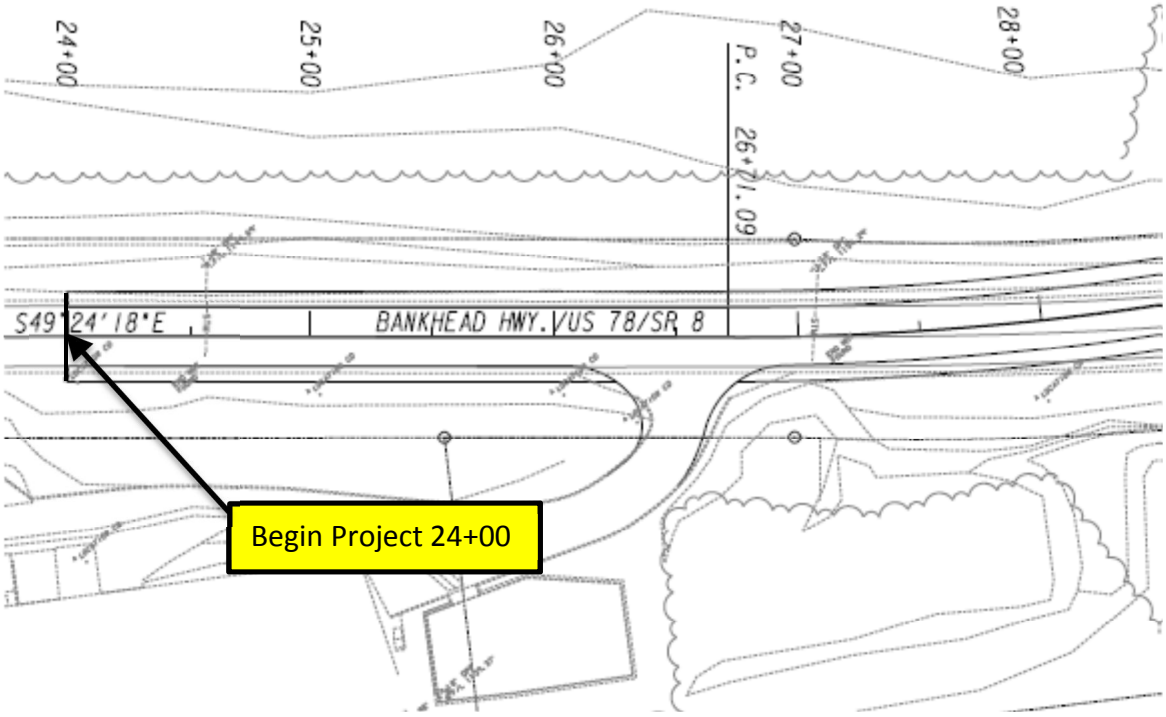
There should not be any changes to schedule impacts.

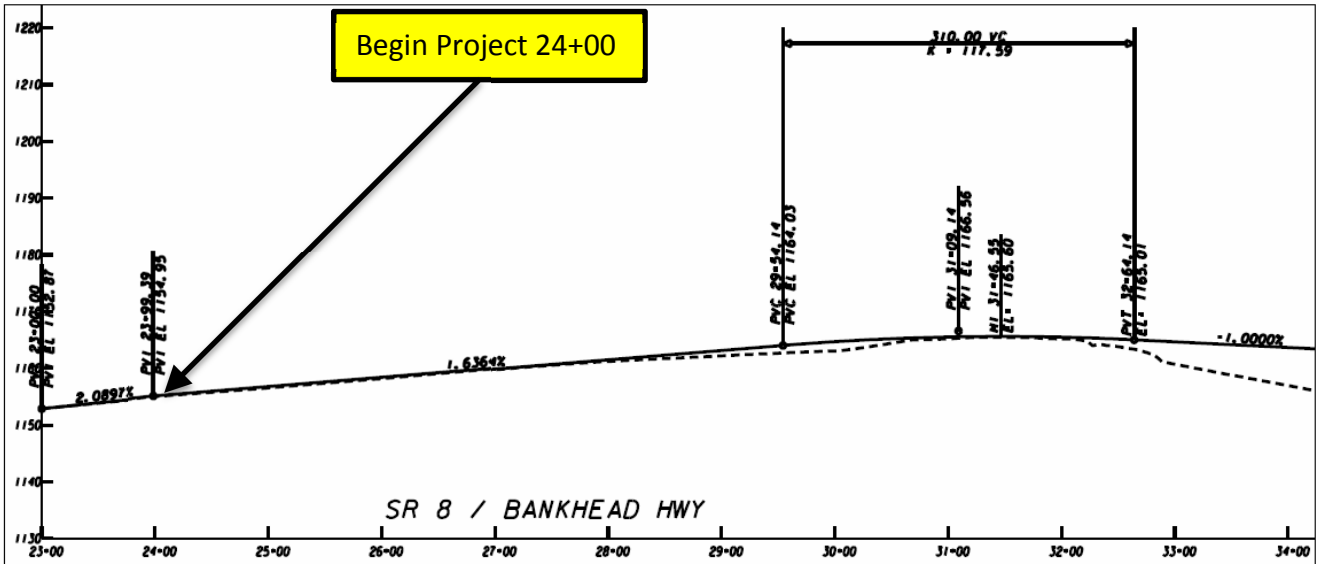
There may be a risk involved with needing tapers for shifting traffic along this same station ranges for the improved full depth paved shoulders. Some of the proposed full depth pavement proposed may have to be overlay if the existing pavement can be reused.

VE ALTERNATIVE A-7

Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00

Baseline Concept Sketch

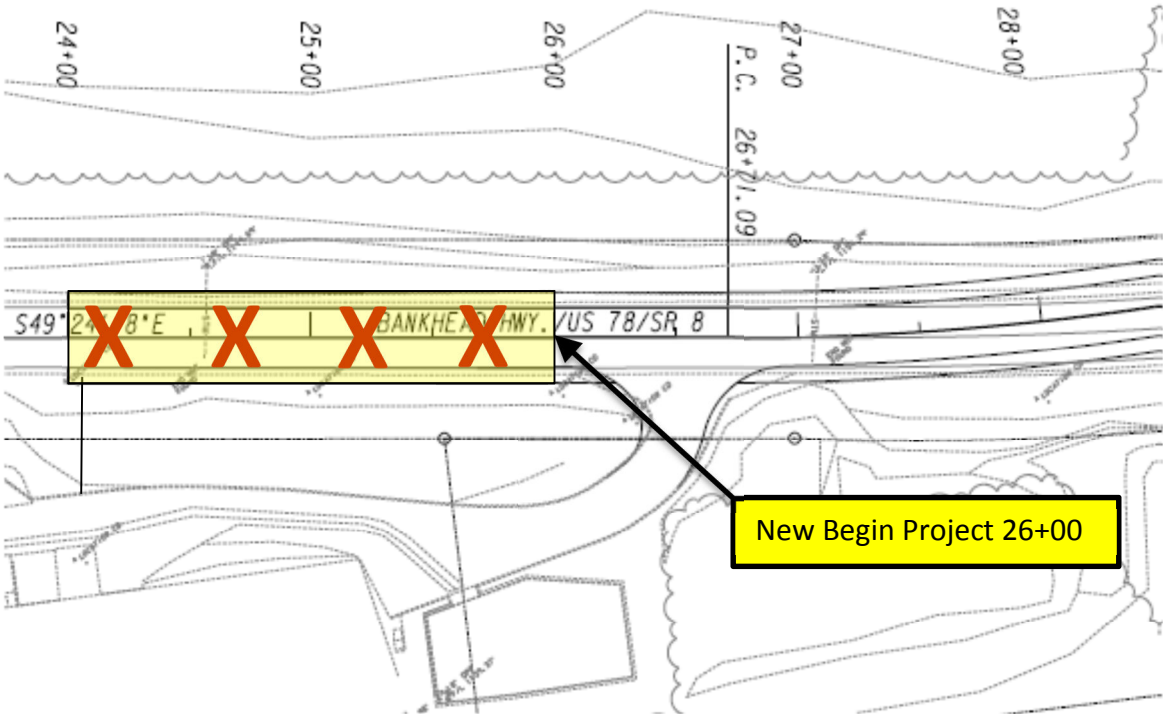


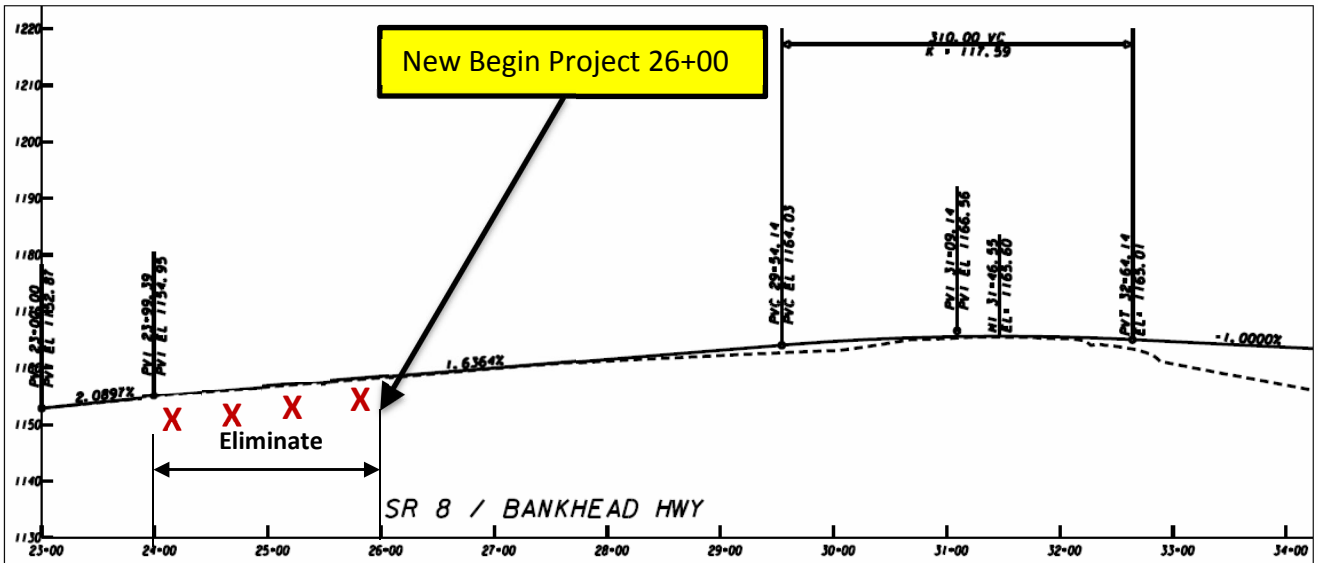


VE ALTERNATIVE A-7

Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00

VE Alternative Concept Sketch





VE ALTERNATIVE A-7

Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00

Assumptions and Calculations: As per cross sections provided for the VE study, the pavement depth was assumed full depth pavement from STA 24+00 to 26+00 and no overlay.

Assumed average width of 14 feet for 2:1 slopes where slope mats will be used on the left back slope from STA 24+00 to 26+00.

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
Graded Aggregate Base - 10in	SY	1,622	$ 15.57	$ 25,252	0	$ 15.57	$ -
Asphalt	SY	1,622	$ 31.85	$ 51,668	0	$ 31.85	$ -
Grading	CY						
(Fill)		1,129	$ 3.75	$ 4,234	0	$ 3.75	$ -
(Cut)		90	$ 2.30	$ 207	0	$ 2.30	$ -
Striping	LF						
Thermo Solid 5 IN, Yellow		400	$ 0.32	$ 128	0	$ 0.32	$ -
Thermo Solid 5 IN, White		400	$ 0.31	$ 124	0	$ 0.31	$ -
Erosion							
Temp Silt Fence, TYPE C	LF	200	$ 2.79	$ 558	0	$ 2.79	$ -
Slope Mats, 2:1 slopes	SY	2,800	$ 0.89	$ 2,492	0	$ 0.89	$ -
SUB-TOTAL				$84,663			$0
TOTAL (Rounded)				$85,000			$0
						SAVINGS	**$85,000**

VE ALTERNATIVE A-8

Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00

Initial Cost Savings: $68,000
LCC Savings: $0
Change in Schedule: No Change

Description of Baseline Concept: The baseline concept has the end project station at 53+31 and is considered full depth pavement construction through this range as per the cross section and typical sections. There are fill slopes on both sides of the cross sections for this range. There is a commercial driveway at approximate STA 52+30 LT. There is also required right-of-way on the left side with approximately a 16-foot offset from the existing right-of-way line.

Description of Alternative Concept: This alternative concept moves the ending station from 53+31 to 52+00 to reduce the length of paving along this alignment, as well as some grading, right-of-way, and erosion control.

Advantages:

- Reduces the amount of full depth paving
- Reduces some grading and erosion control
- Reduces some striping
- Shortens the right-of-way needed for one parcel and eliminates it from another
- Helps MOT for the commercial drive

Disadvantages:

- Not as much existing road improvements
- Less room for any needed traffic shift

Discussion: The end project station at 53+31 is being changed to 52+00 to shorten the project limits. The profile and horizontal alignments match existing grade before this station range and allows for the construction of the project to terminate earlier than presented. This shortening of the ending station will reduce full depth paving, striping, grading, right-of-way, and erosion control.

Review maintenance of traffic plans with the combination of these changes and using full depth pavement through the merge of the existing pavement and proposed.

Review maintenance of traffic plans and consider the commercial driveway owner as to what they may prefer for either some modification to their entrance or none at all.

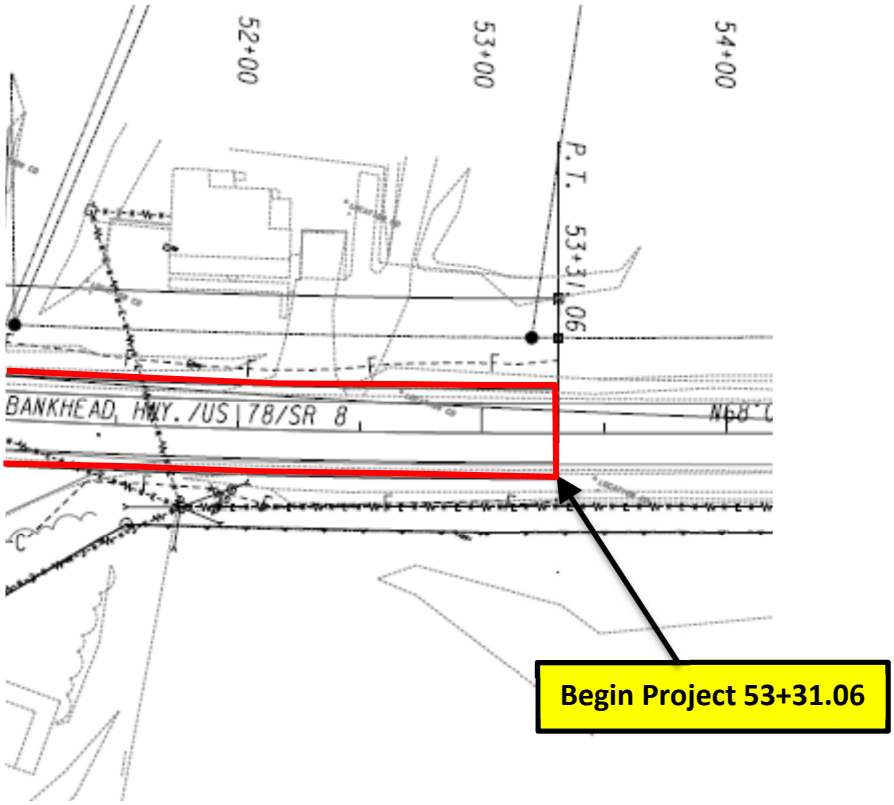
There should not be any changes that would impact the overall project schedule.

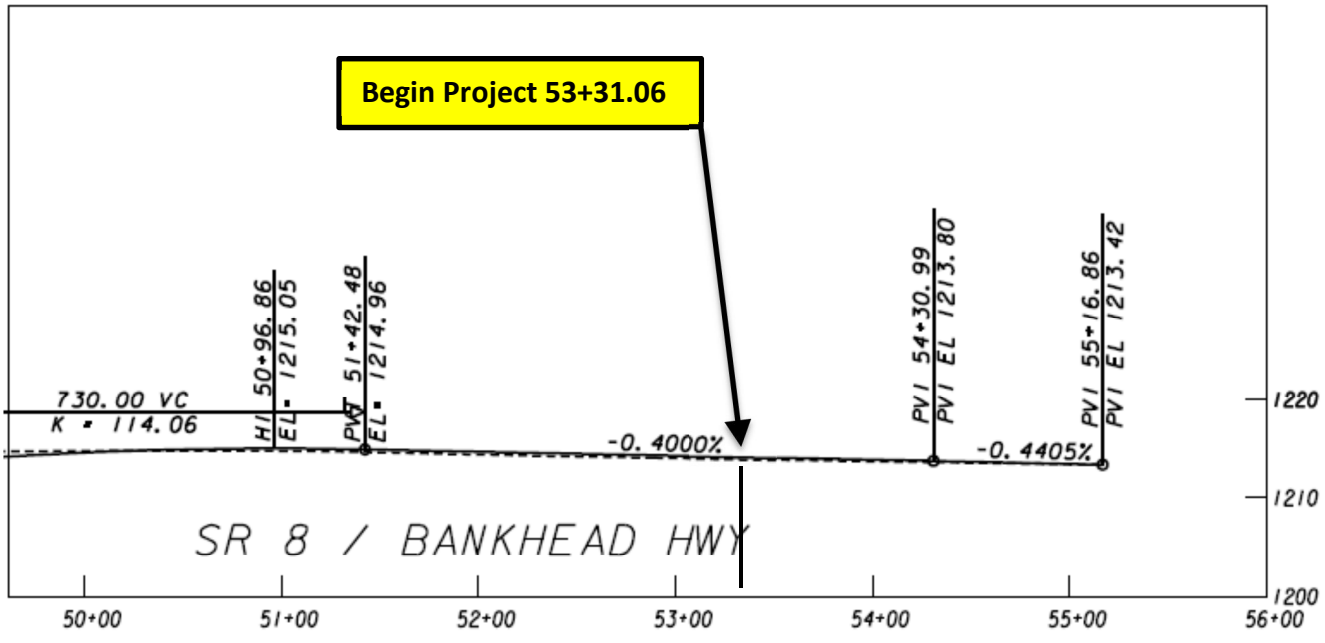
There may be a risk involved with needing tapers for shifting traffic along this same station range for the improved full depth paved shoulders. Some of the proposed full depth pavement proposed may have to be overlay if the existing pavement can be reused.

VE ALTERNATIVE A-8

Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00

Baseline Concept Sketch

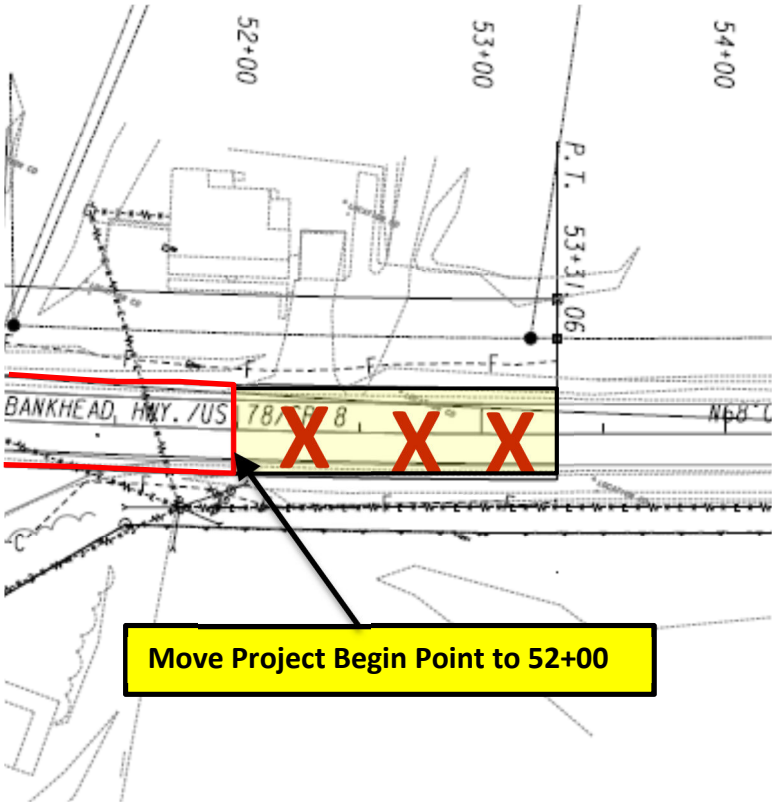


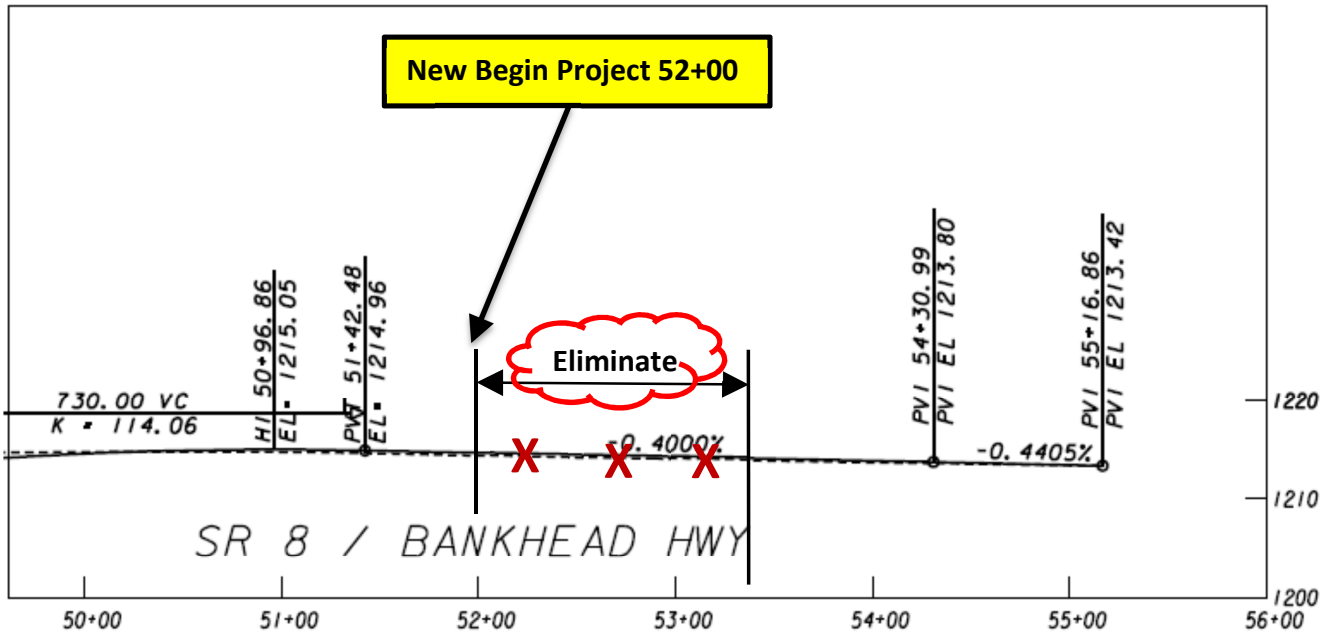


VE ALTERNATIVE A-8

Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00

VE Alternative Concept Sketch





VE ALTERNATIVE A-8

Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00

Assumptions and Calculations: As per cross sections provided for the VE study, the pavement depth was assumed full depth pavement from STA 52+00 to 53+31 and no overlay.

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
Graded Aggregate Base - 10in	SY	1,063	$ 15.57	$ 16,540	0	$ 15.57	$ -
Asphalt	SY	1,063	$ 31.85	$ 33,842	0	$ 31.85	$ -
Grading	CY						
(Fill)		75	$ 3.75	$ 281	0	$ 3.75	$ -
(Cut)		734	$ 2.30	$ 1,688	0	$ 2.30	$ -
Striping	LF						
Thermo Solid 5 IN, Yellow		262	$ 0.32	$ 84	0	$ 0.32	$ -
Thermo Solid 5 IN, White		262	$ 0.31	$ 81	0	$ 0.31	$ -
Erosion							
Temp Silt Fence, TYPE C	LF	262	$ 2.79	$ 731	0	$ 2.79	$ -
Right-of-Way	SF	2,096	$ 7.00	$ 14,672	0	$ 7.00	$ -
SUB-TOTAL				$67,920			$0
TOTAL (Rounded)				$68,000			$0
						SAVINGS	**$68,000**

VE ALTERNATIVE A-10

Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way

Initial Cost Savings:	$3,900
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The baseline concept includes a cul-de-sac on Post Road to accommodate local traffic which is currently exiting on Mason Creek Road. The bulb on the cul-de-sac is oriented to the south and requires approximately 1,874 SF of additional right-of-way.

Description of Alternative Concept: Flip the orientation of the cul-de-sac bulb from the south to the north side and eliminate the need for additional right-of-way.

Advantages:

- Eliminates one parcel from the right-of-way takes
- Reduces local impact to the community

Disadvantages:

- Minor change to the drawings

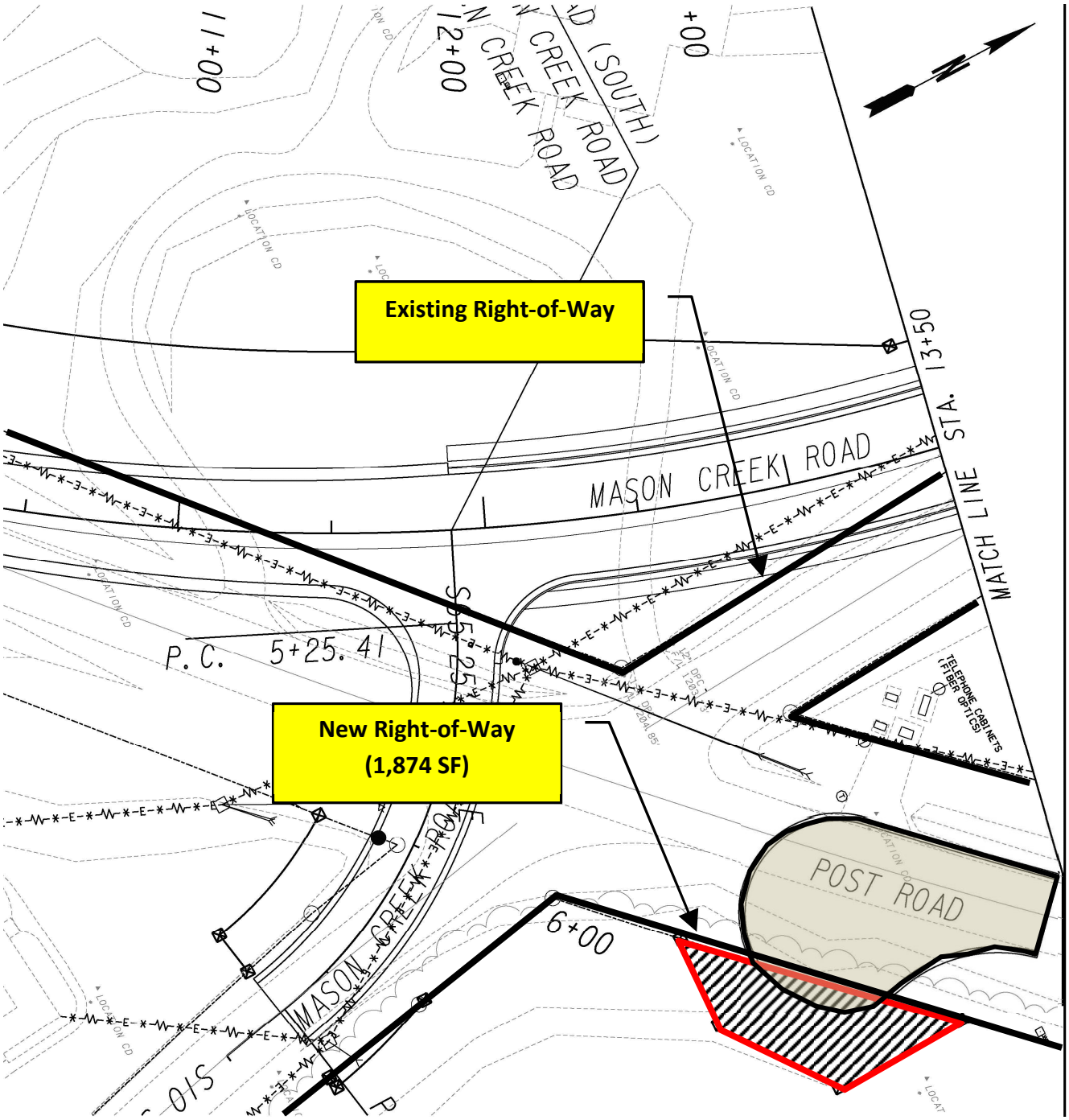
Discussion: This change results in a modest cost reduction, but performs the same function as the baseline concept at a slightly lower cost; however, the primary goal of this alternative is to reduce the administrative and legal implications involved with any right-of-way transaction.

This alternative will slightly reduce the level of effort required for the right-of-way acquisition on the project, but would not markedly change the delivery date of the project design.

VE ALTERNATIVE A-10

Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way

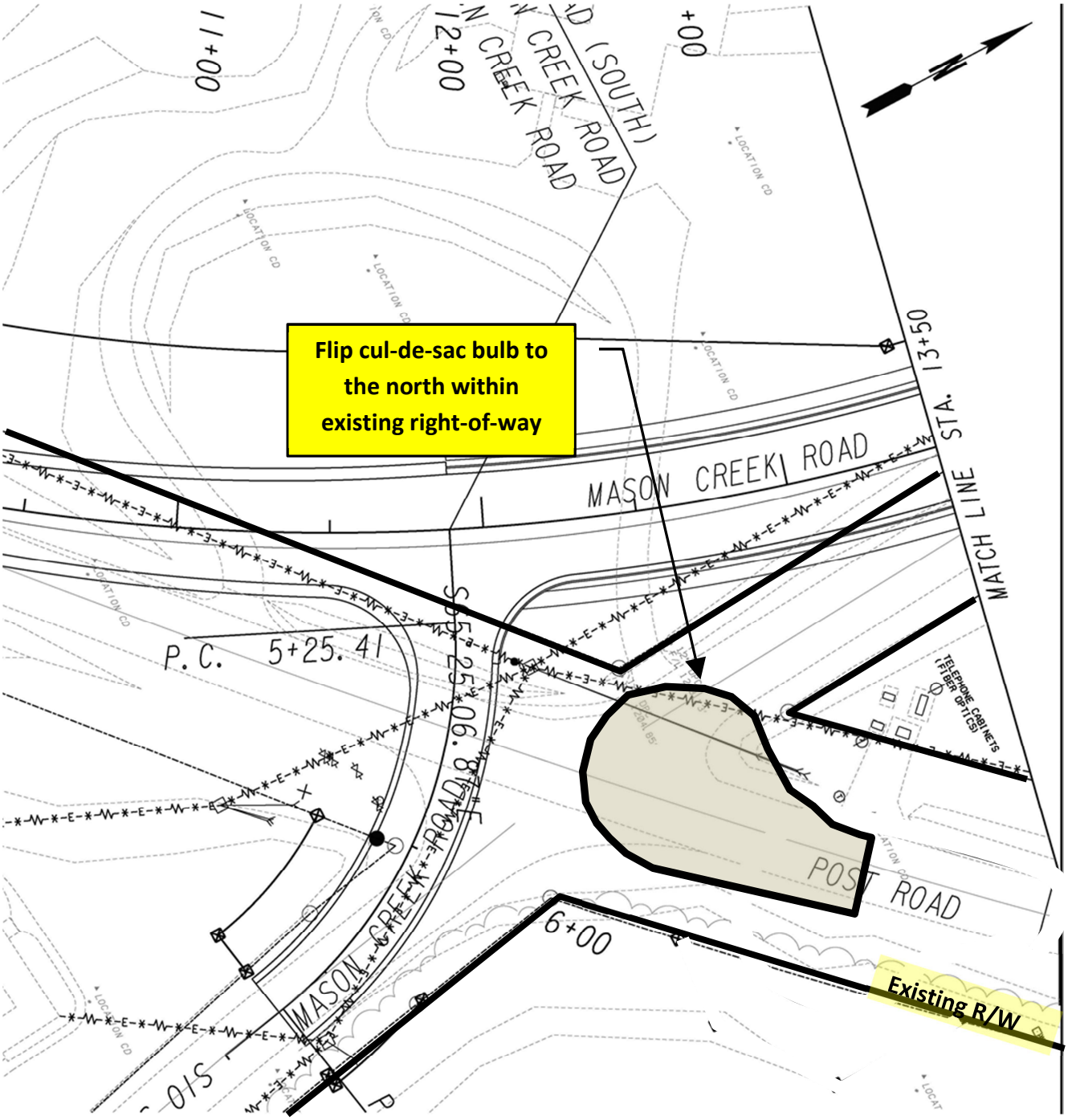
Baseline Concept Sketch



VE ALTERNATIVE A-10

Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way

VE Alternative Concept Sketch



VE ALTERNATIVE A-10

Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way

Assumptions and Calculations: None.

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
Right-of-Way (Residential Rate)	AC	0.0430	$ 35,000	$ 1,506			$ -
				$ -			$ -
Right-of-Way - Counter Offer Increase	%	1.00	$ 0.50	$ 753			$ -
Per Parcel Fees	LS	1	$ 1,675	$ 1,675			$ -
				$ -			$ -
SUB-TOTAL				$3,934			$0
TOTAL (Rounded)				$3,900			$0
						SAVINGS	**$3,900**

VE ALTERNATIVE P-1

Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed

Initial Cost Savings:	$62,000
LCC Savings:	$0
Change in Schedule:	+1 Month

Description of Baseline Concept: The baseline concept has the Bankhead Highway alignment offset to the north of the existing alignment. This offset was to allow for maintaining traffic during construction. The project was designed for a 55 mph design speed, so the horizontal and vertical curves reflect this design. Because of the shift in alignment and the 55 mph design speed that determines the alignment radius for vertical and horizontal, there is a significant amount of fill and cut along Bankhead Highway. By default, the right-of-way will generally move in and out proportionally to these cut and fill limits.

Description of Alternative Concept: This alternative concept looked at potentially moving the alignment back onto the existing roadway, which would lower the profile. This was spurred from the change in the design speed from 55 mph to 45 mph. When the profile was moved to the existing alignment, it was determined that an approximate 700-foot vertical section near the major culvert at STA 36+50 would still have a difference in elevation of 3 to 4 feet and would require full depth paving and a shift in traffic to construct. For this alternative, the proposed alignment was kept in place and then the vertical alignment was adjusted for the new 45 mph design speed. This would affect the grading quantities and the right-of-way footprint.

Advantages:

- Lowers the profile to reduce the amount of needed cut and fill
- Reduces the right-of-way footprint
- Allows for the horizontal alignment to be shifted closer to the existing at and north of the Bankhead Highway/Mann Road/Mason Creek Road Intersection
- Will help with maintenance of traffic if overlay is allowed

Disadvantages:

- Will create more of a “hidden dip” affect near the major culvert
- Traffic during staging will be closer to the construction

Discussion: Since the project’s design speed was changed to 45 mph, the horizontal alignment was analyzed to see if the alignment could be placed back over the existing alignment. Seeing that the vertical curve over the major culvert would still not meet the existing grade for some distance and considering time needed to redesign the horizontal for accuracy, the alternative kept the horizontal alignment at its proposed location, but modified the vertical profile to closer meet the 45 mph design criteria. The first curve at this new design speed was able to tighten up the curve length. The second curve was able to modify the 1% slope, adjust the PVI and then tighten its vertical curve. The second curve kept both slopes as they were, but tightened the vertical curve to match the existing roadway. This seems to direct attention to looking at shifting the alignment for a short distance back over the

existing alignment somewhere at or north of the Bankhead Highway Intersection. Much further study would have to be done to finalize this.

Review maintenance of traffic plans with the combination of these changes. Cross sections would have to be updated with the new profile to determine accurate earthwork reductions. The vertical profile would have to be tweaked in CADD and a COGO software to get accurate slope/curve combinations.

Reviewing maintenance of traffic plans, time to calculate the earthwork, right-of-way, and determining if the horizontal alignment should be shifted due to this 45 mph change will have to be considered from a management aspect.

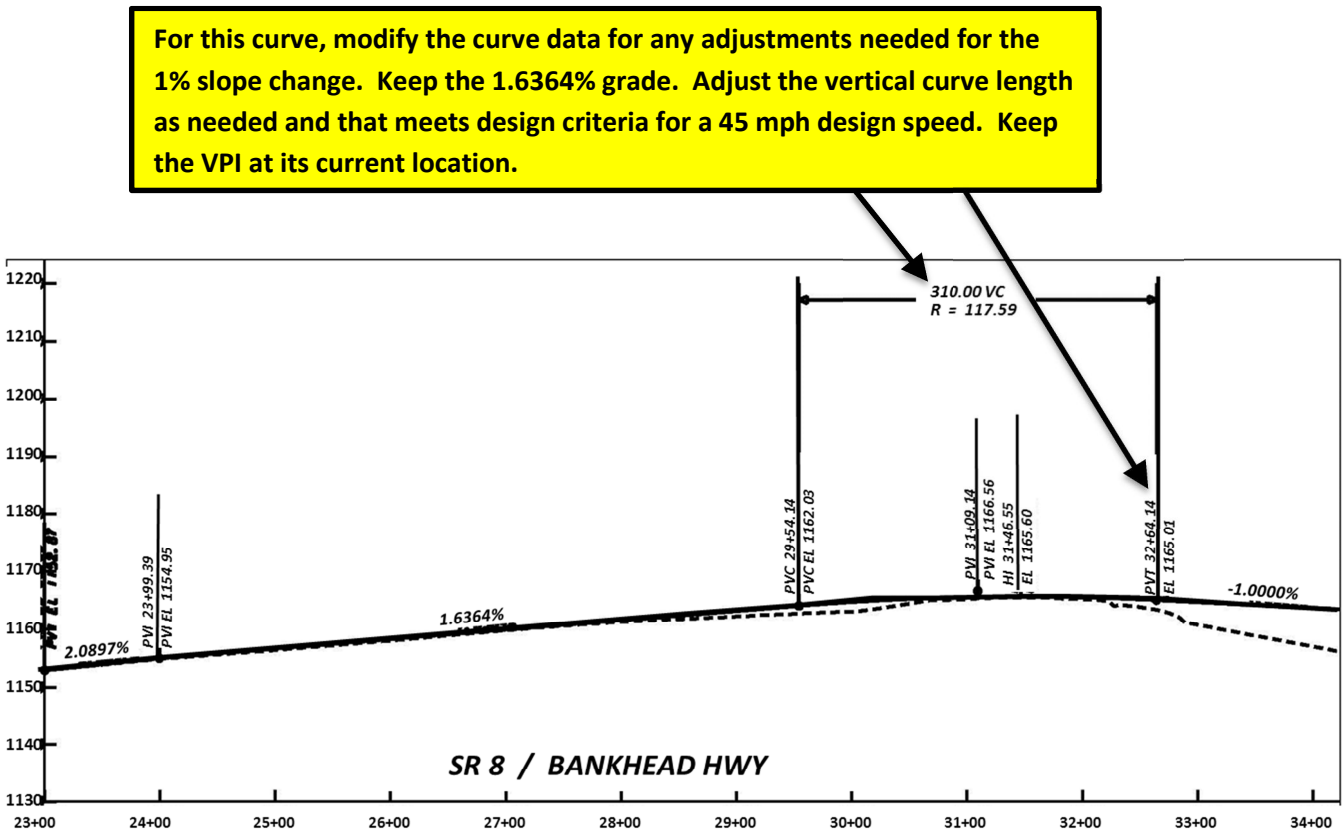
There could be 3 to 4 weeks of design changes in the horizontal and vertical alignment, the cross sections, and right-of-way updates for multiple alignments.

There may be a risk involved with needing tapers for shifting traffic along this alignment if full depth pavement is required for the entire alignment. Some of the proposed full depth pavement may have to be overlay instead if the existing pavement can be reused. The risk is whether or not the existing pavement can be reused.

VE ALTERNATIVE P-1

Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed

VE Alternative Concept Sketch

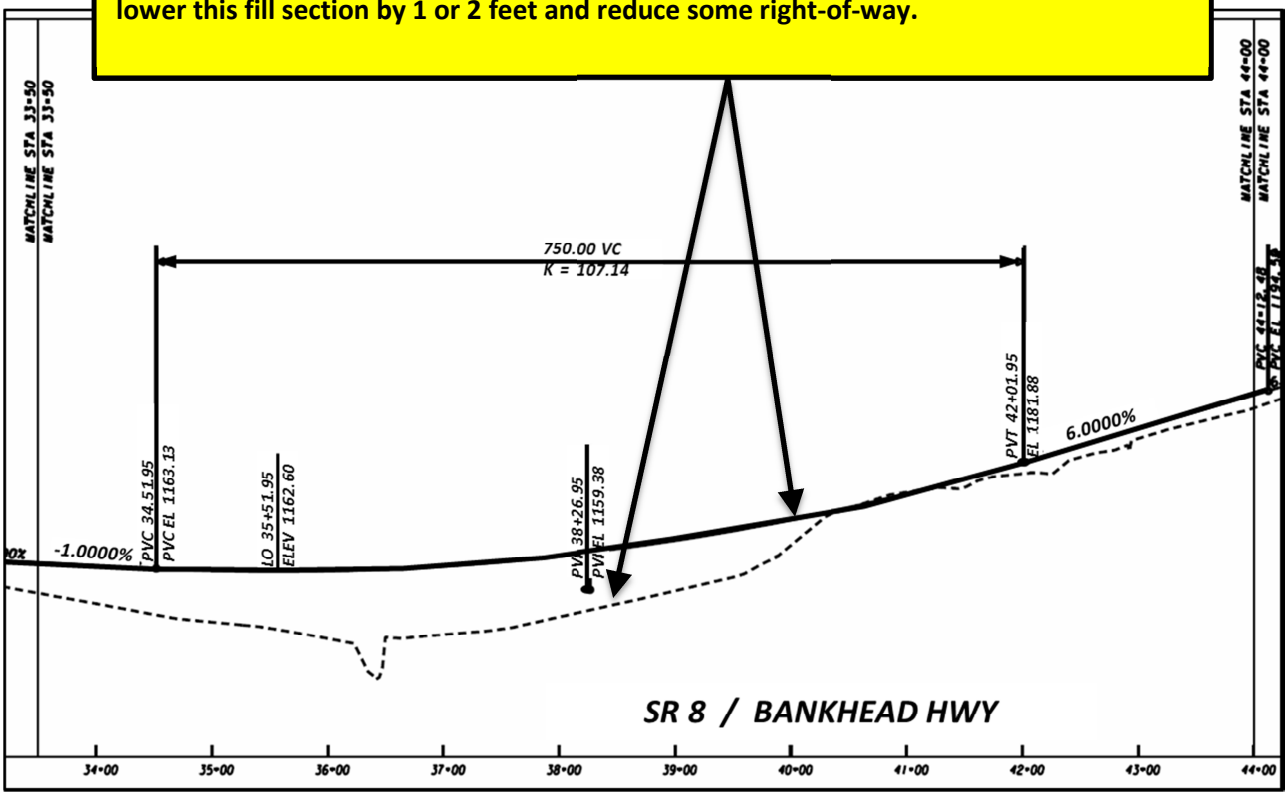


Profile – Bankhead Highway

VE ALTERNATIVE P-1

Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed

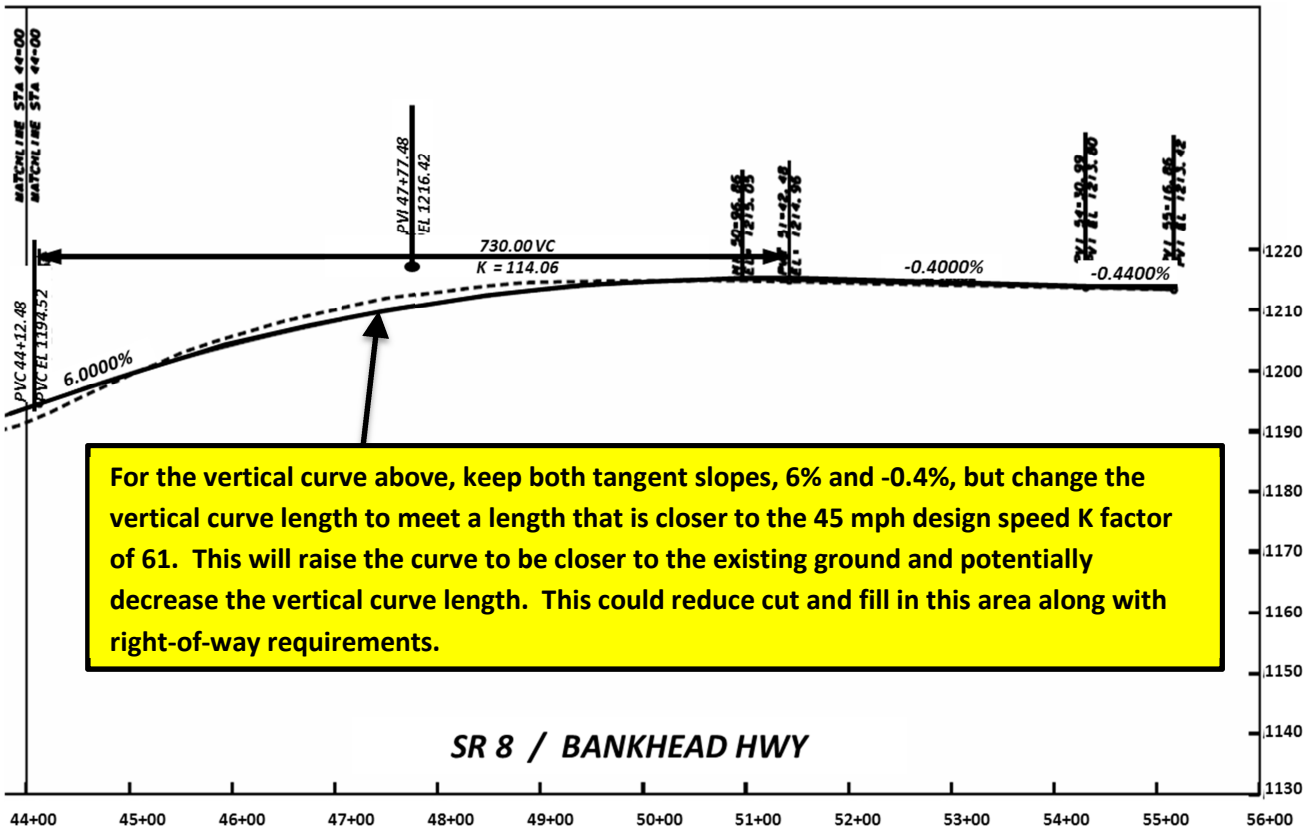
For the vertical curve below, consider dropping the 1% tangent slope some as mentioned before and keep the 6% slope afterwards to potentially decrease the vertical curve length. The VPI may need adjusting to accommodate an adequate vertical curve length to meet the 45 mph design speed. With this combination of changes, this could lower this fill section by 1 or 2 feet and reduce some right-of-way.



Profile – Bankhead Highway

VE ALTERNATIVE P-1

Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed



Profile – Bankhead Highway

Assumptions and Calculations: Analyzing the above comments in the proposed profile as the comments direct the new vertical design, it was assumed an average of 1 foot drop in fill along STA 31+09 to 42+02 from the profile above. It was also assumed a 1 foot reduction of cut along STA 44+00 to 51+00. Using these assumptions and reviewing the fill slopes for these station ranges on BOTH sides, it was also assumed an average of 3:1 slopes for both station ranges. For right-of-way, STA 31+09 to 42+02 for the left side ONLY was adjusted to 2 feet of shift since right-of-way was only on this side for this range. For STA 44+00 to 51+00 both sides had a right-of-way shift of 3 feet based on the cross section average slopes.

VE ALTERNATIVE P-1

Revise the profile and alignment on Bankhead Highway to account for a 45 mph design speed in lieu of the 55 mph design speed

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Grading	CY						
(Fill)		3,239	$ 3.75	$ 12,144	0	$ 3.75	$ -
(Cut)		2,074	$ 2.30	$ 4,770	0	$ 2.30	$ -
Right-of-Way	SF						
31+09 to 42+02 LT		2,186	$ 7.00	$ 15,302	0	$ 7.00	$ -
44+00 to 51+00 LT and RT		4,200	$ 7.00	$ 29,400	0	$ 8.00	$ -
SUB-TOTAL				$61,617			$0
TOTAL (Rounded)				$62,000			$0
						SAVINGS	**$62,000**

VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

Initial Cost Savings:	$743,000
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The baseline concept proposes to acquire permanent right-of-way for all shoulders and slopes to a point approximately 6 to 20 feet beyond the cut and fill limits along the project corridor. This results in 7.27 acres of right-of-way acquisition.

Description of Alternative Concept: The alternative concept utilizes permanent right-of-way to the shoulder breakpoint and easements for the slopes and ditches.

Advantages:

- Reduces amount of right-of-way to be maintained by GDOT or Douglas County

Disadvantages:

- Acquiring full right-of-way has been the norm at GDOT, but a number of new projects have accepted the concept of using slope easements

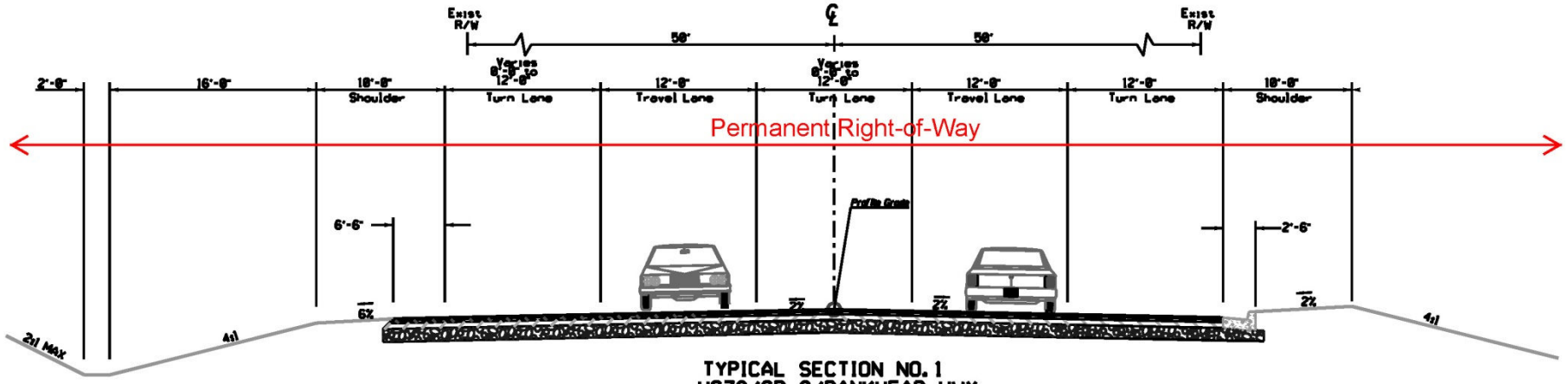
Discussion: The need and purpose of the project is to reduce crashes and provide improved operations at the area intersections. This can be accomplished with slopes and ditches included in easements instead of required right-of-way.

Since the project is in the early stages, Right-of-Way Plans are not yet developed. This change would not result in any changes to the design schedule. It is assumed that the acquisition of easements would require the same amount of time as permanent right-of-way; therefore, there are no anticipated changes to the right-of-way acquisition schedule.

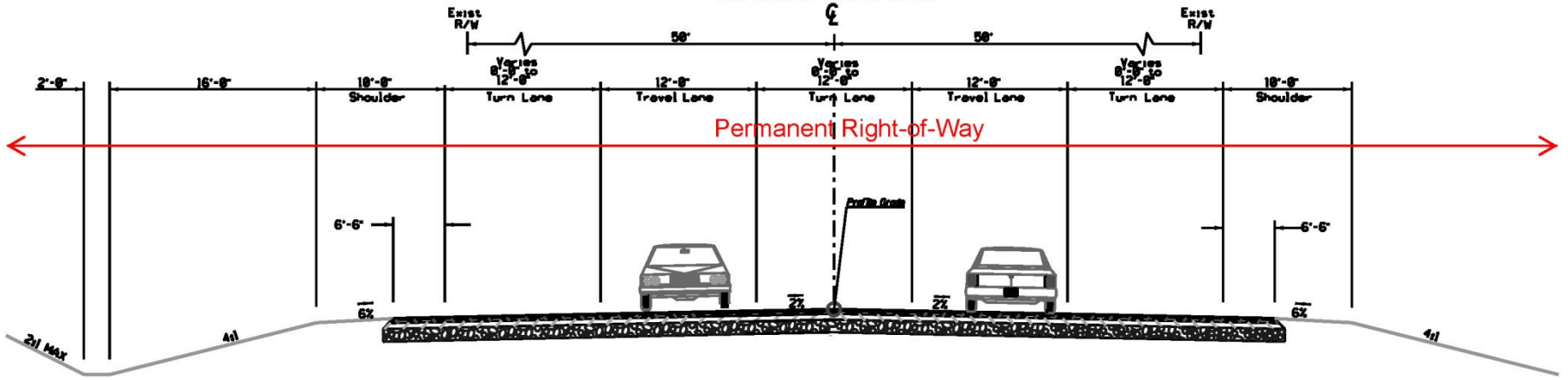
VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

Baseline Concept Sketch



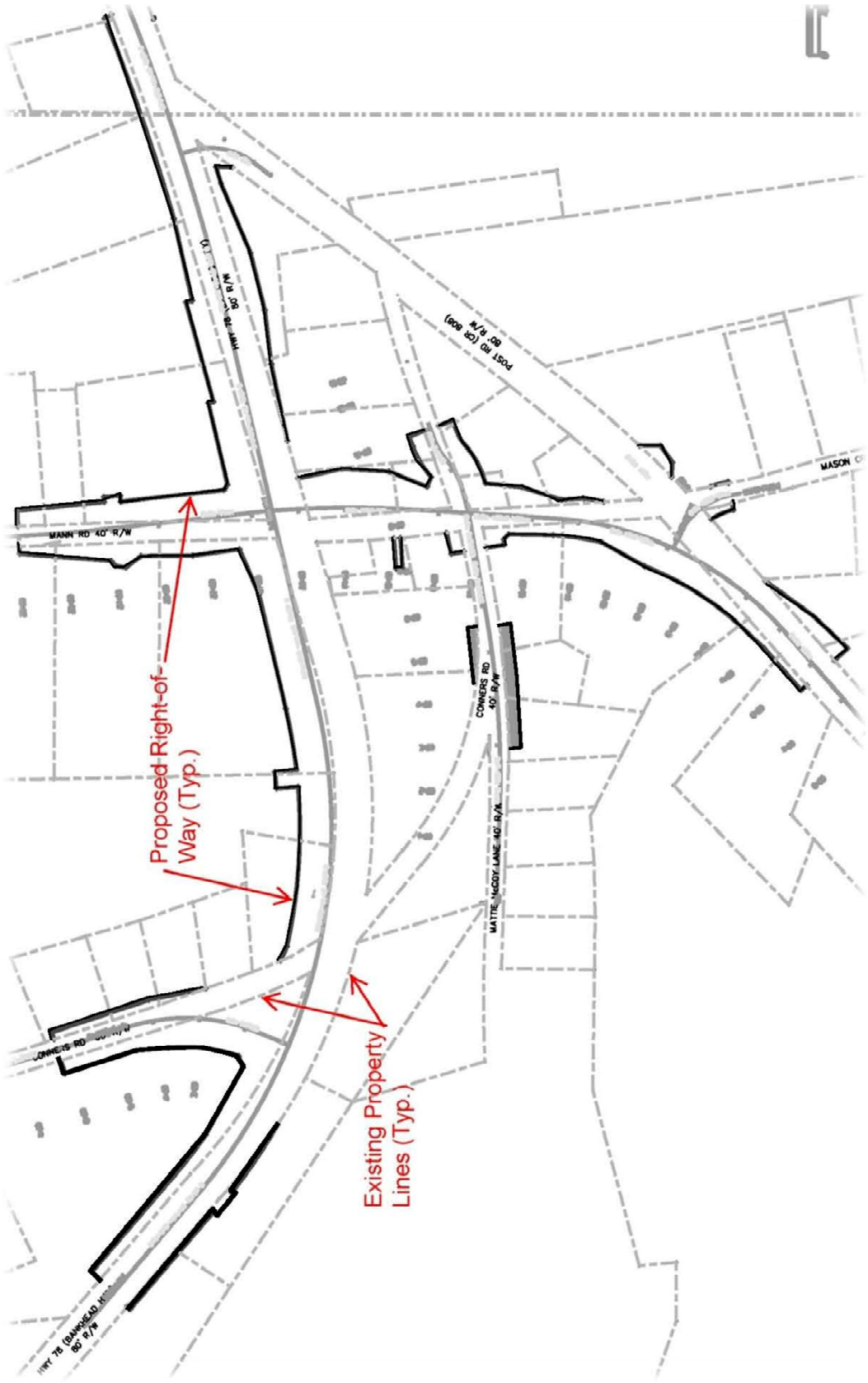
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

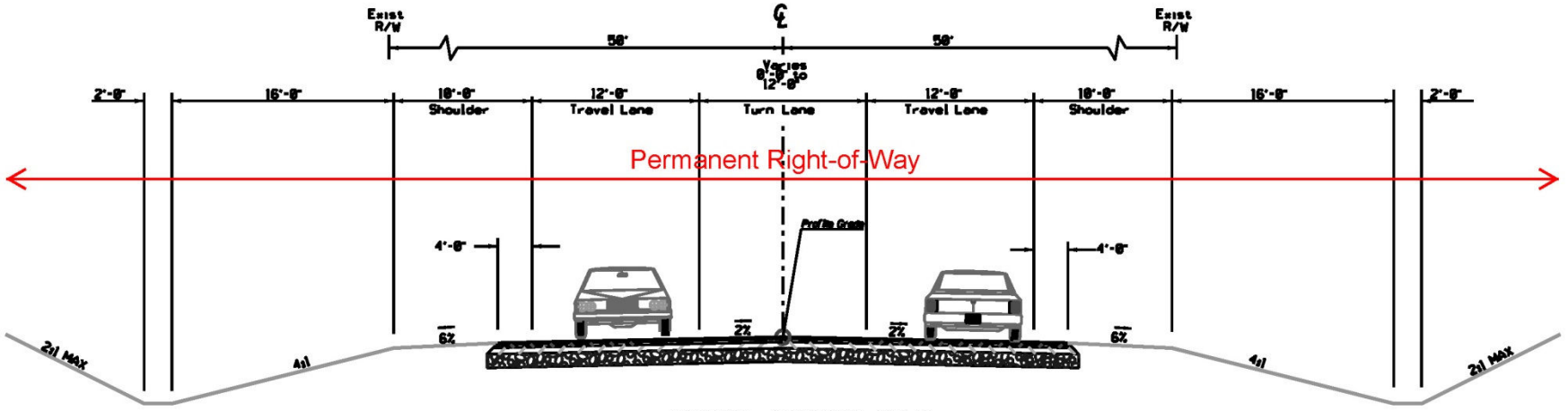
VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

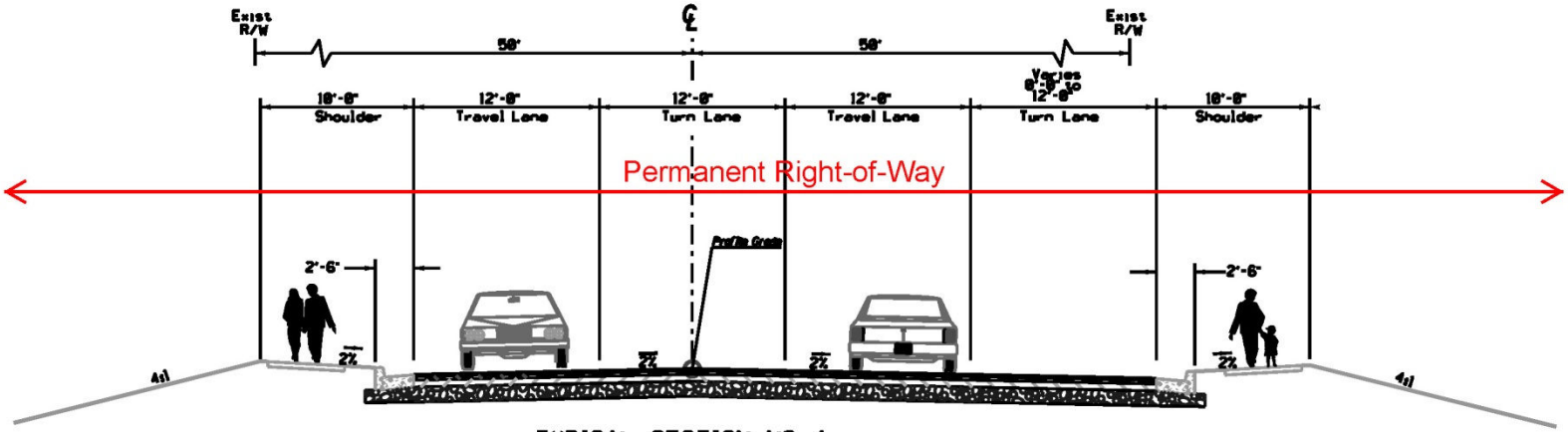


VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way



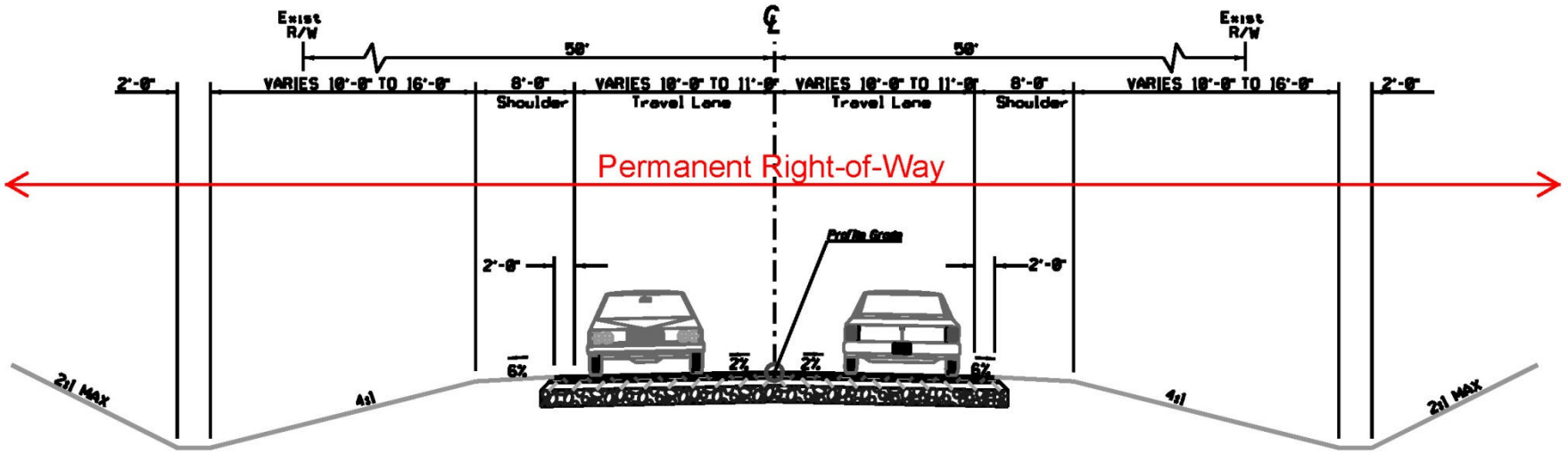
TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)



TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

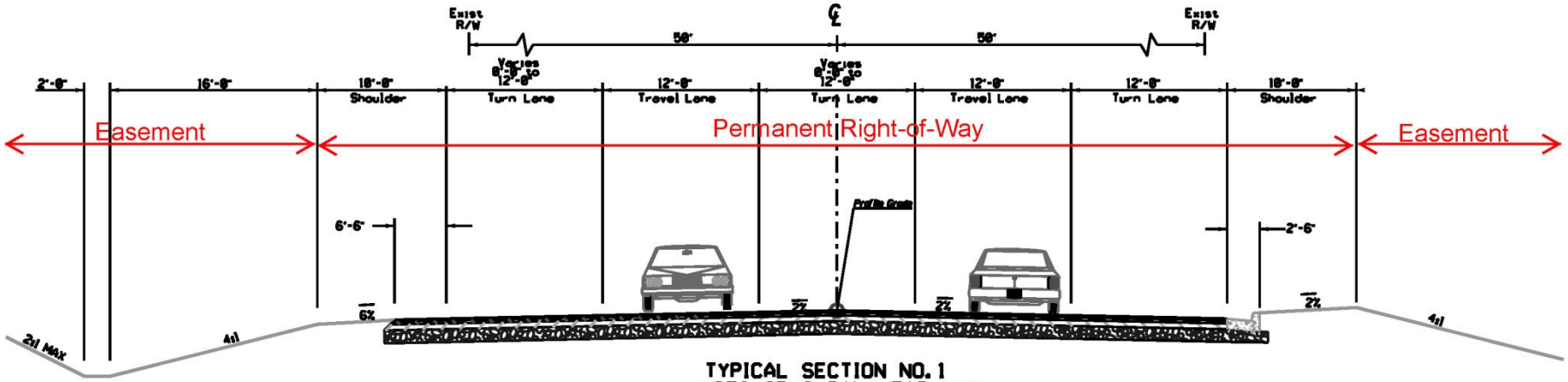


TYPICAL SECTION NO. 5
CONNERS ROAD (NORTH AND SOUTH),
MATTIE McCOY LANE,
POST ROAD (NORTH)
& MASON CREEK ROAD
SOUTH OF POST ROAD
INTERSECTION

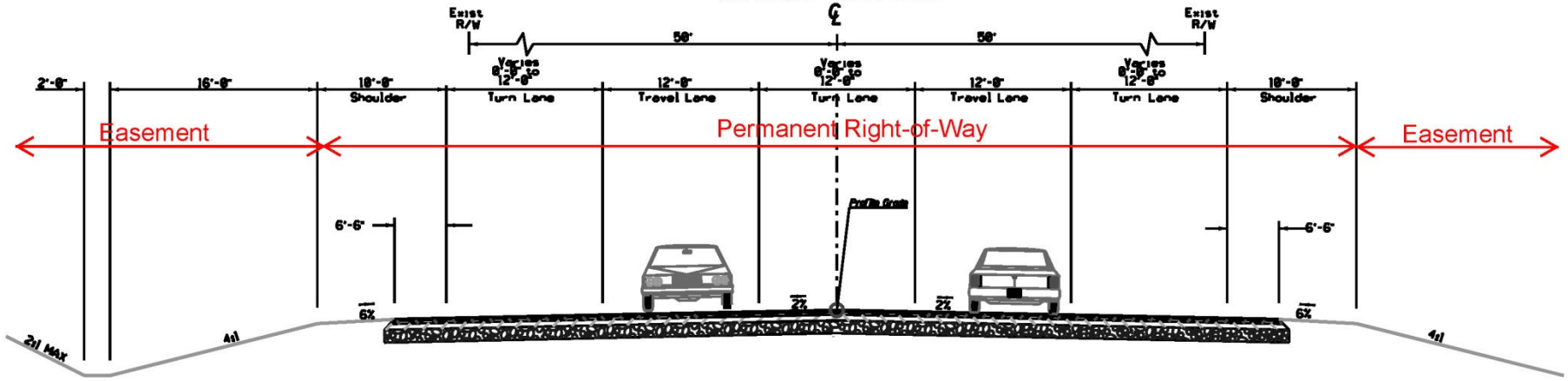
VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

VE Alternative Concept Sketch



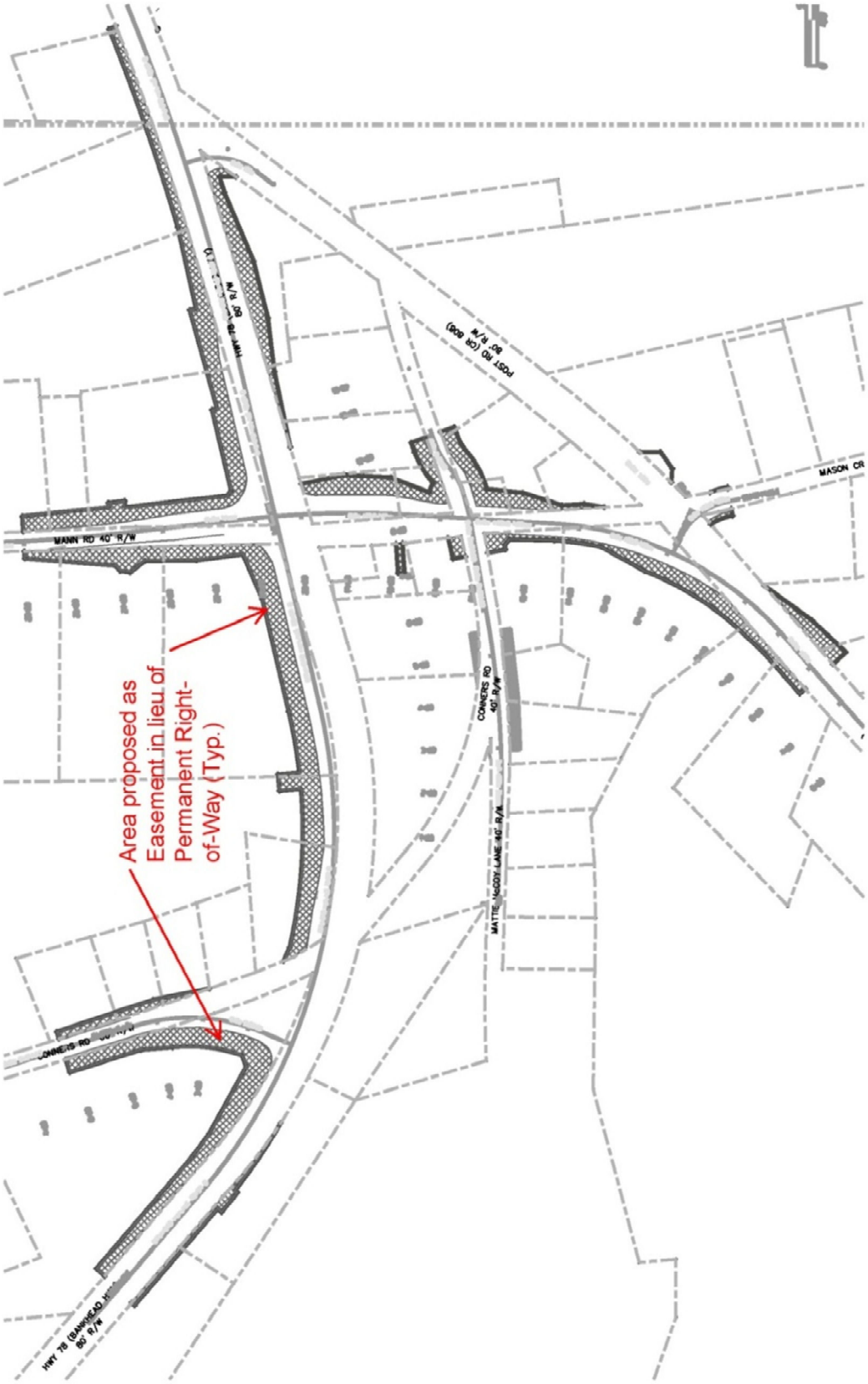
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

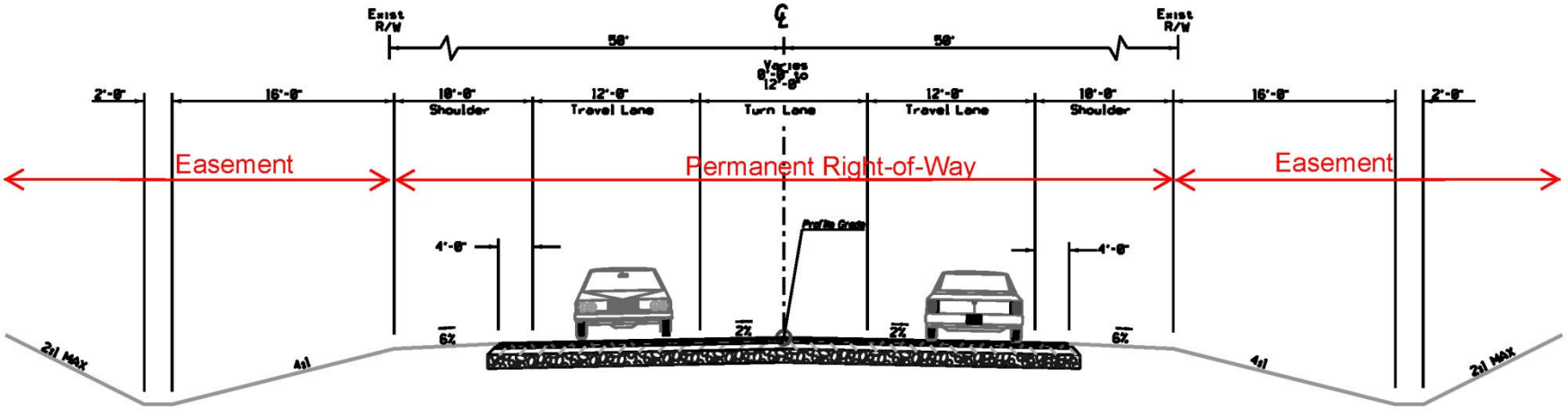
VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

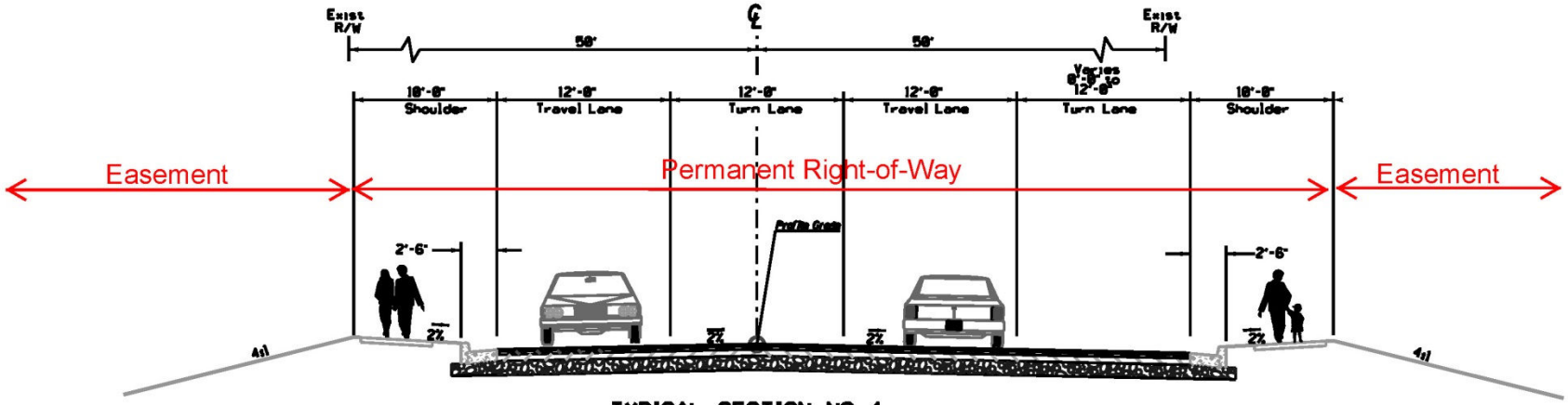


VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way



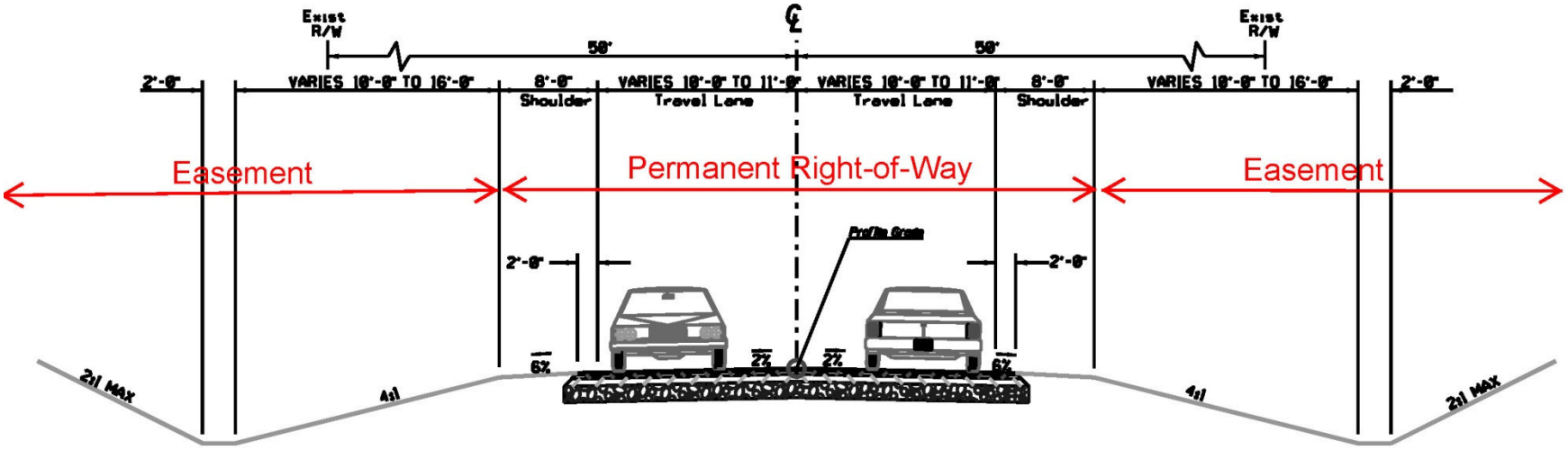
TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)



TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way



TYPICAL SECTION NO. 5
CONNERS ROAD (NORTH AND SOUTH),
MATTIE McCOY LANE,
POST ROAD (NORTH)
& MASON CREEK ROAD
SOUTH OF POST ROAD
INTERSECTION

VE ALTERNATIVE ROW-1

Use more slope easements in lieu of permanent right-of-way

Assumptions and Calculations:

Per the Preliminary Right-of-Way Estimate:
All property: 7.27 acres Cost = $2,916,225 Cost/Acre = $401,131/ac

The following areas were noted as outside the shoulder breakpoint and outside the existing right-of-way. The quantities were measured in CAD.

Proposed Easement Areas:

Area 1	0.097 acre
Area 2	0.772 acre
Area 3	0.101 acre
Area 4	1.229 acres
Area 5	0.964 acre
Area 6	0.342 acre
Area 7	0.311 acre
Area 8	0.255 acre
Area 9	0.021 acre
Area 10	0.029 acre
Area 11	0.384 acre
Area 12	0.002 acre
Area 13	0.012 acre
Area 14	0.114 acre
Total	**4.633 acres**

Assume the unit cost for easement would be 60% of the unit cost for permanent right-of-way.

Easement cost/acre = 0.60 x $401,131 = $240,678/ac

Alternative concept quantities:

Permanent right-of-way =	(7.27 – 4.633 Ac) x $401,131 =	$1,057,783
Easement =	4.633 x $240,678 =	$1,115,064
Net Reduction in Cost =		$743,376

Rounded = $743,000

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively

Initial Cost Savings:	$203,800
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The baseline concept typical sections for the 45 mph design speed note a 28-foot clear zone; the typical sections for 35 mph design speed note a 20-foot to 26-foot clear zone (it appears the cross sections and construction limits design files utilize a 20-foot clear zone). This design results in 7.27 acres of right-of-way acquisition.

Description of Alternative Concept: Revise the clear zone widths to 24 feet for 45 mph arterial and 18 feet for 35 mph local in accordance with the GDOT Design Policy Manual Tables 6.4 and 6.6. This adjustment will result in the construction limits and required right-of-way acreage being reduced.

Advantages:

- Reduction in right-of-way to be maintained by GDOT or Douglas County
- Potential reduction in earthwork volumes

Disadvantages:

- Plan sheets will need to be revised and the right-of-way estimate modified

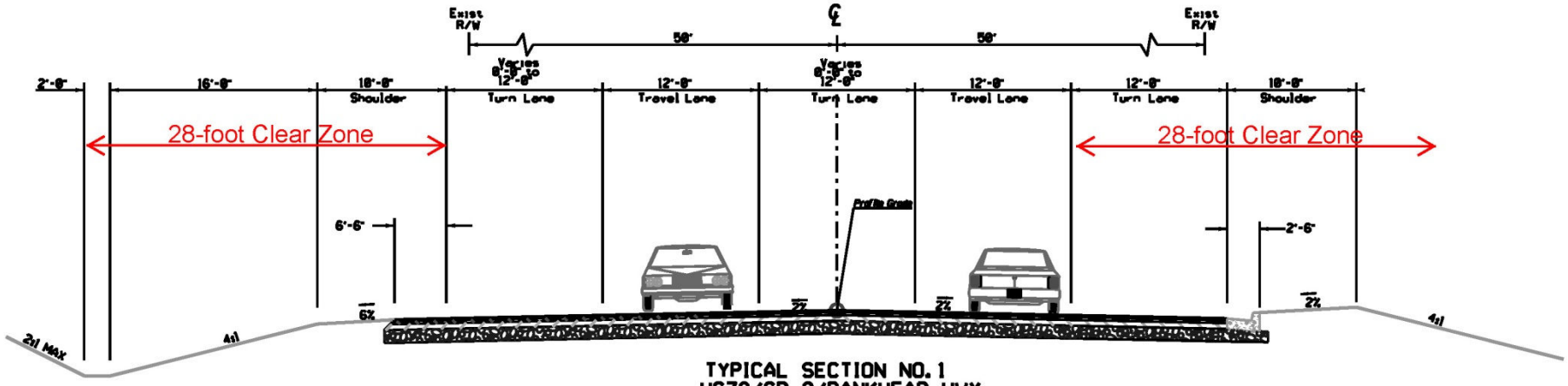
Discussion: There does not appear to be any existing site conditions to warrant clear zone width in addition to the standard widths prescribed for the project design speeds and roadway types.

The change in clear zone width would require revisions to the cross sections, limits, and right-of-way cost estimate; however, since the project is in the early stages the impact to schedule should be minimal. Since the project is in the early stages, Right-of-Way Plans are not yet developed. Although a reduction in right-of-way acreage would be realized, the same number of parcels would be affected, so there would be no reduction in the right-of-way acquisition schedule.

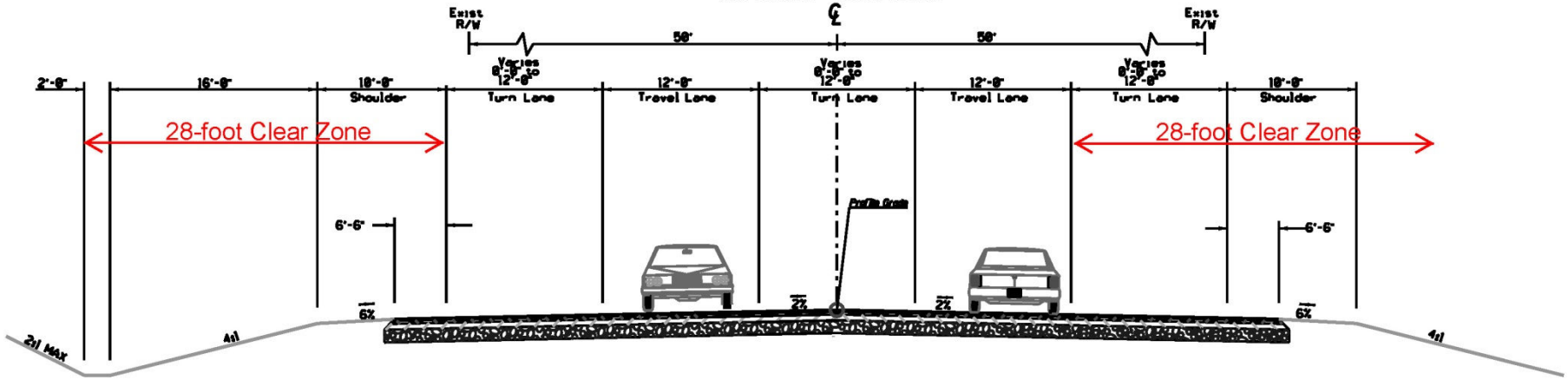
VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively

Baseline Concept Sketch



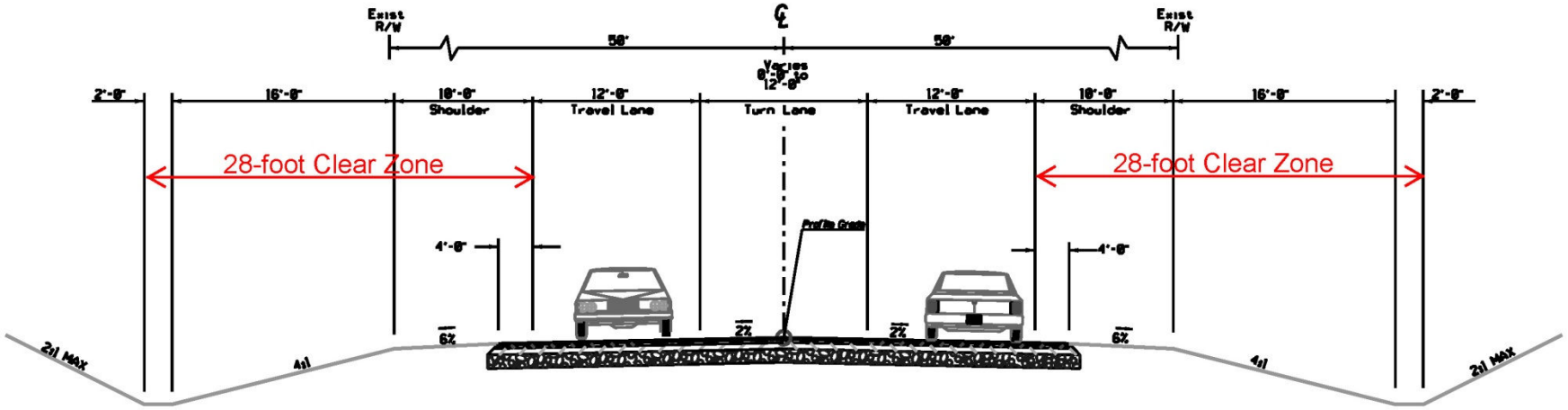
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



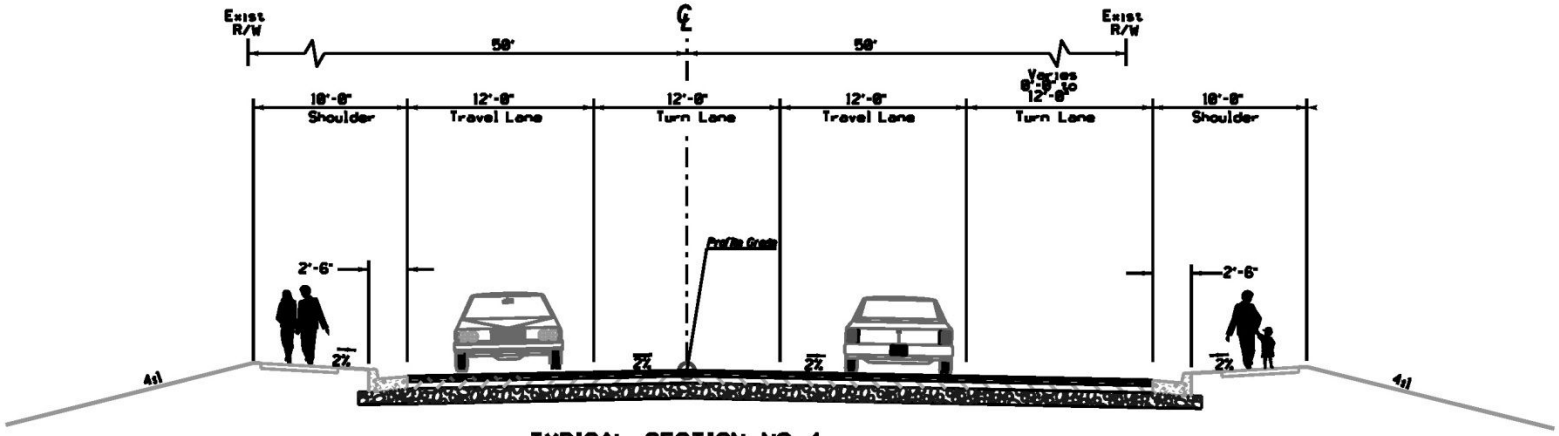
TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively



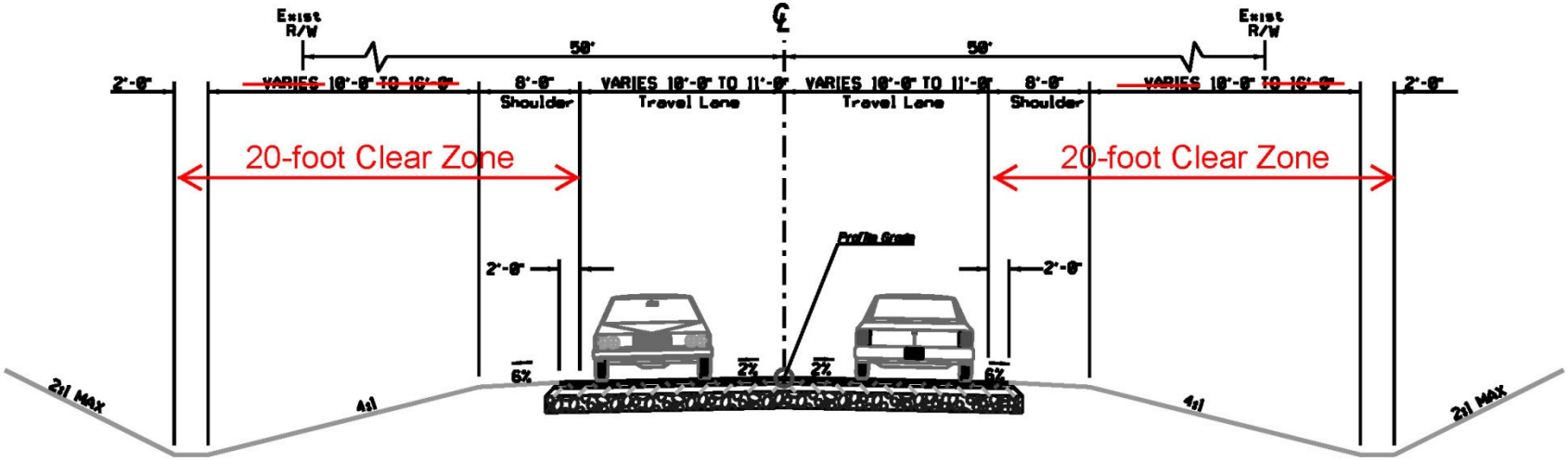
TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)



TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively



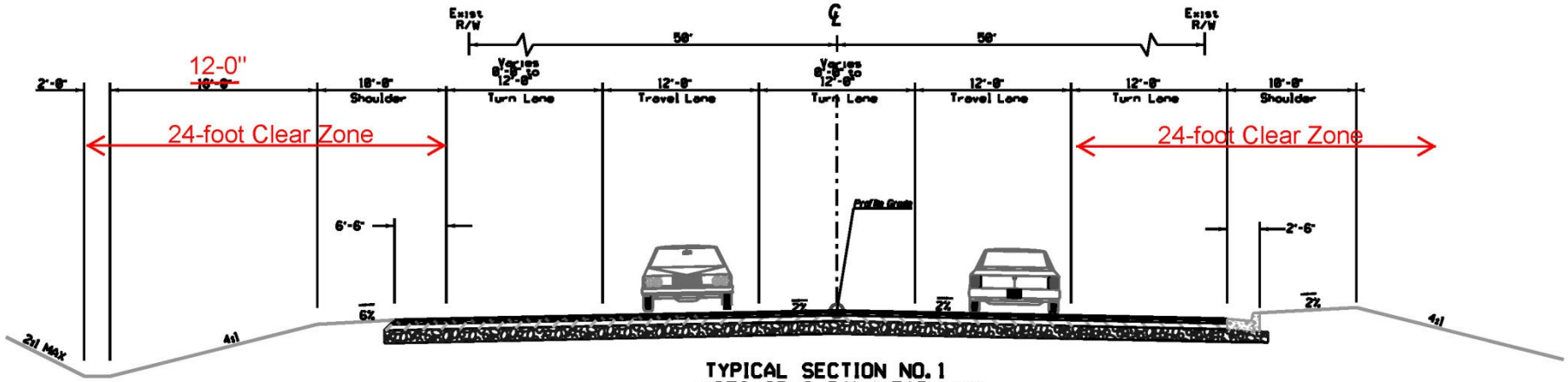
TYPICAL SECTION NO. 5
CONNERS ROAD (NORTH AND SOUTH),
MATTIE McCOY LANE,
POST ROAD (NORTH)
& MASON CREEK ROAD
SOUTH OF POST ROAD
INTERSECTION

Per review of Cross Sections the clear zone is designed for 20-feet; no 26-foot clear zones appear to be utilized.

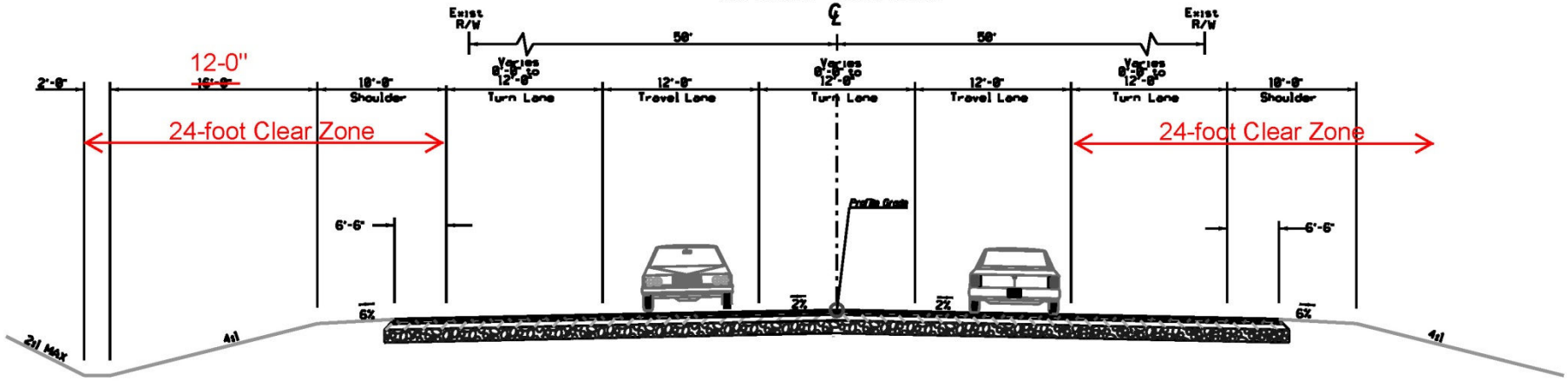
VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively

VE Alternative Concept Sketch



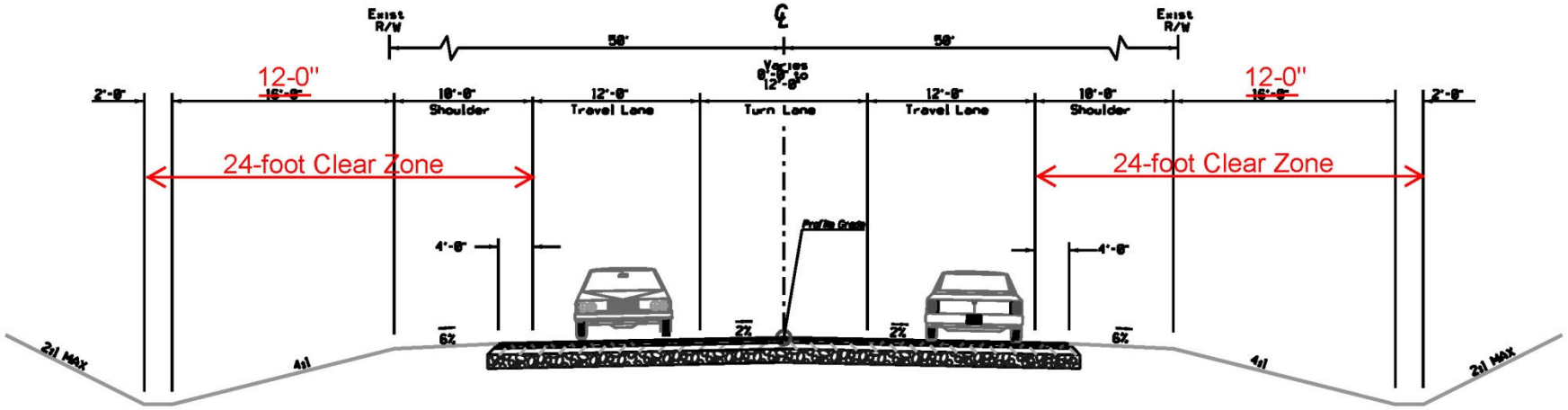
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



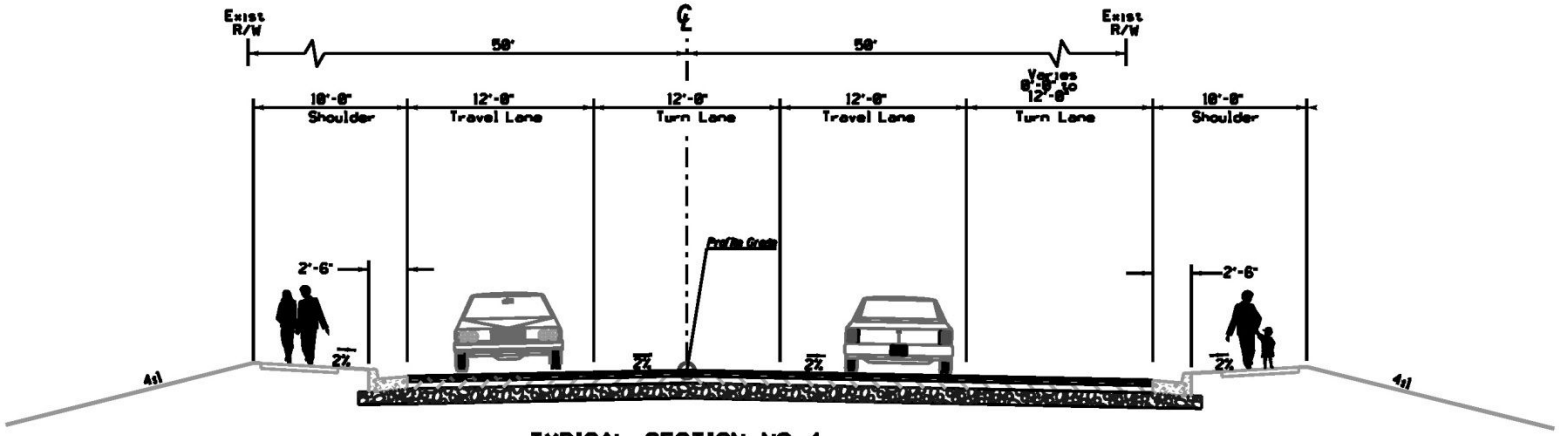
TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively



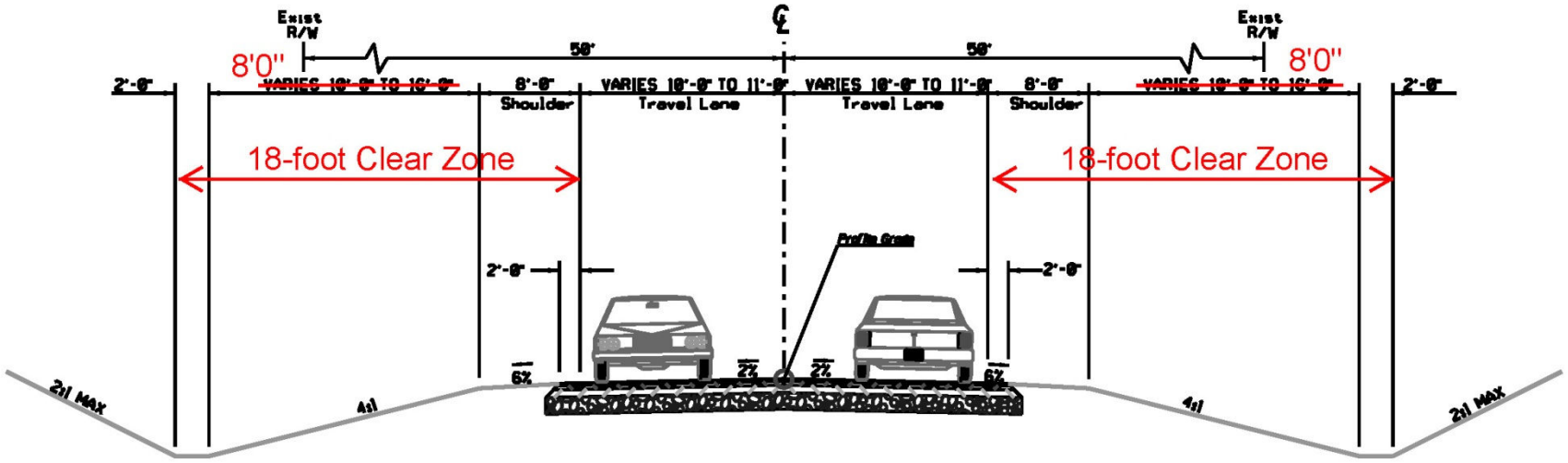
TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)



TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively



TYPICAL SECTION NO. 5
CONNERS ROAD (NORTH AND SOUTH),
MATTIE McCOY LANE,
POST ROAD (NORTH)
& MASON CREEK ROAD
SOUTH OF POST ROAD
INTERSECTION

VE ALTERNATIVE S-1

Reduce the clear zone dimension to 24 feet and 18 feet for the 45 mph and 35 mph design sections, respectively

Assumptions and Calculations:

Per Preliminary Right-of-Way Estimate: 7.27 acres cost = $2,916,225 cost/acre = $401,131
Assume reduction in limits of construction only within cross sections that include a ditch.

Bankhead Highway (45 mph design speed)

Typical Section Clear Zone (CZ) = 28 feet Required CZ = 24 feet

Station Left	Length	Width	Station Right	Length	Width
24+00 to 32+50	850 ft	4 ft	28+00 to 35+00	700 ft	4 ft
45+00 to 48+50	350 ft	4 ft	40+50 to 55+17	1,467 ft	4 ft
50+50 to 55+17	467 ft	4 ft			

Total reduction Bankhead Highway = 3,834 ft x 4 ft = 15,336 SF

Post Road/Mason Creek Road/Mann Road (45 mph design speed)

Typical Section CZ = 28 feet Required CZ = 24 feet

Station Left	Length	Width	Station Right	Length	Width
8+03 to 9+03	100 ft	4 ft	8+03 to 11+53	350 ft	4 ft
27+03 to 27+53	50 ft	4 ft	22+03 to 27+53	550 ft	4 ft

Total reduction Post Road/Mason Creek Road/Mann Road = 1,050 ft x 4 ft = 4,200 SF

Mattie McCoy Lane (35 mph design speed)

Typical Section CZ = 20 feet Required CZ = 18 feet

Station Left	Length	Width	Station Right	Length	Width
			3+12 to 5+12	200 ft	2 ft

Total reduction Mattie McCoy Lane = 200 ft x 2 ft = 400 SF

Conners Road (North) (35 mph design speed)

Typical Section CZ = 20 feet Required CZ = 18 feet

Station Left	Length	Width	Station Right	Length	Width
1+00 to 6+00	500 ft	2 ft	1+00 to 5+00	400 ft	2 ft

Total reduction Conners Road (North) = 900 ft x 2 ft = 1,800 SF

Conners Road (South) (35 mph design speed)

Typical Section CZ = 20 feet Required CZ = 18 feet

Station Left	Length	Width	Station Right	Length	Width
10+50 to 11+50	100 ft	2 ft	10+50 to 11+50	100 ft	2 ft

Total reduction Conners Road (South) = 200 ft x 2 ft = 400 SF

Total Alternative Concept quantities:
Reduction in right-of-way = (22,136 SF/43,460 SF/acre) x $401,131/acre = $203,843

Total Right-of-Way Saved: **Rounded = $203,800**

VE ALTERNATIVE S-2

Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway

Initial Cost Savings:	$136,000
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The typical section for Bankhead Highway calls for a 6.5-foot paved shoulder on both sides of the mainline travel lanes from the beginning to the end of the mainline alignment, starting at STA 24+00 and ending at STA 53+31. Following this paved shoulder is the 2-foot dirt strip that completes the full 10-foot shoulder that is required for two-lane arterial roadways designed for 55 mph design speeds.

Description of Alternative Concept: This project will now be designed for a 45 mph design speed. This allows the design criteria to change for the shoulder widths for paved and unpaved sections. The paved shoulder will now be 4 feet instead of the previously designed 6.5 feet for a 55 mph design speed. The total shoulder width can now be reduced to 8 feet instead of the previously designed 10 feet based on the new design speed criteria.

Advantages:

- Reduces the amount of full depth shoulder pavement by 2.5 feet on both shoulders
- Reduces the overall shoulder width for the shoulders from 10 feet to 8 feet
- Reduces some right-of-way need because of the smaller shoulder width and the reduction in the needed cut and fill limits
- Grading for some fill areas and some cut back slopes will be reduced

Disadvantages:

- There will not be as much full depth paved shoulder usable for maintenance of traffic during staging
- Shoulder is not as wide for motorist to pull over for refuge

Discussion: The design speed in the provided plans for Bankhead Highway was 55 mph. The project's design speed for this mainline was changed from 55 mph to 45 mph, which changes different design elements like shoulder paved and total widths. Following the GDOT Design Policy Manual's guidelines for the design speed of 45 mph, these shoulders were reduced from 6.5 feet to 4 feet for the paved width and the total width was reduced from 10 feet to 8 feet. This reduces the cross sectional foot print of Bankhead Highway, which reduces the amount of pavement, grading, and right-of-way needed for construction.

Grading calculations could be reviewed when design is modified to account for a more accurate increase in the reduction of grading if this alternative is accepted.

The maintenance of traffic plans should be reviewed again to see the affects from the smaller full depth paved shoulder widths on any areas of staging that may utilize these paved shoulders, if any.

VE ALTERNATIVE S-2

Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway

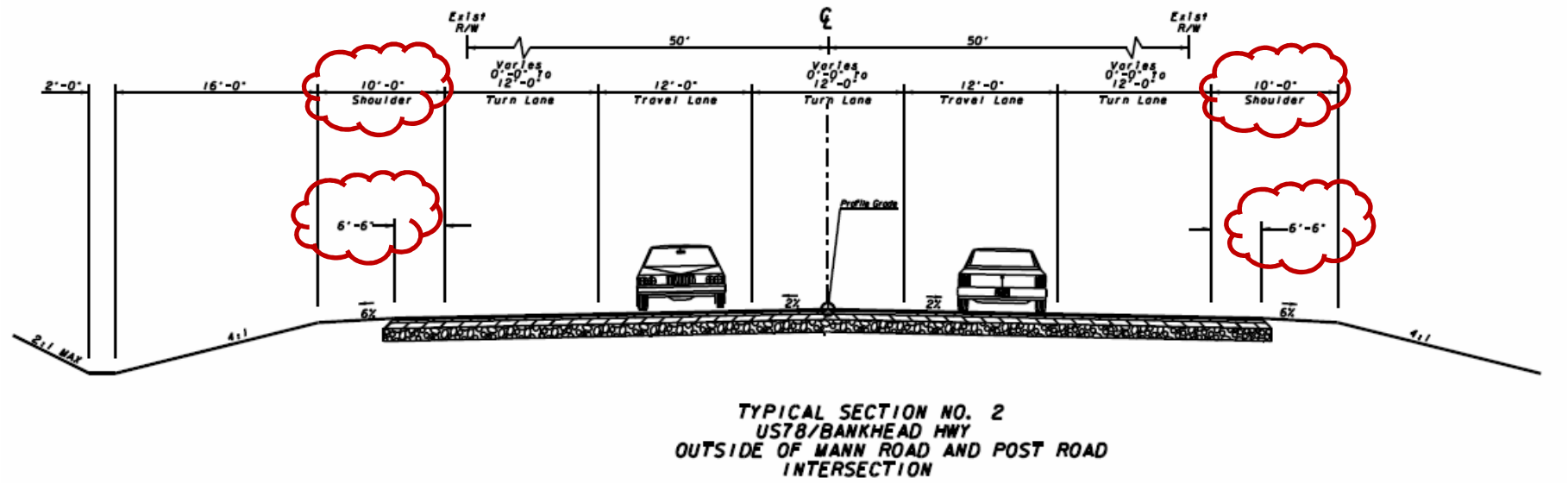
There should not be any significant schedule impacts from this change, but there will be less asphalt to construct and less grading volumes to grade with the reduced shoulder which should show some time savings, but not enough to note. There should be a negligible increase in time to modify cross section, plan sheets, typical sections, etc., from a design schedule impact. Design = less than 1 week added; Construction = less than 1 week saved; no net change in schedule.

The use of the paved shoulders at the "tie in" points at the beginning and end of the project sometimes utilizes the full depth paved shoulders to allow temporary traffic to be shifted upon it for room to construct the proposed roadway. This reduces the area by shortening the paved shoulder width.

VE ALTERNATIVE S-2

Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway

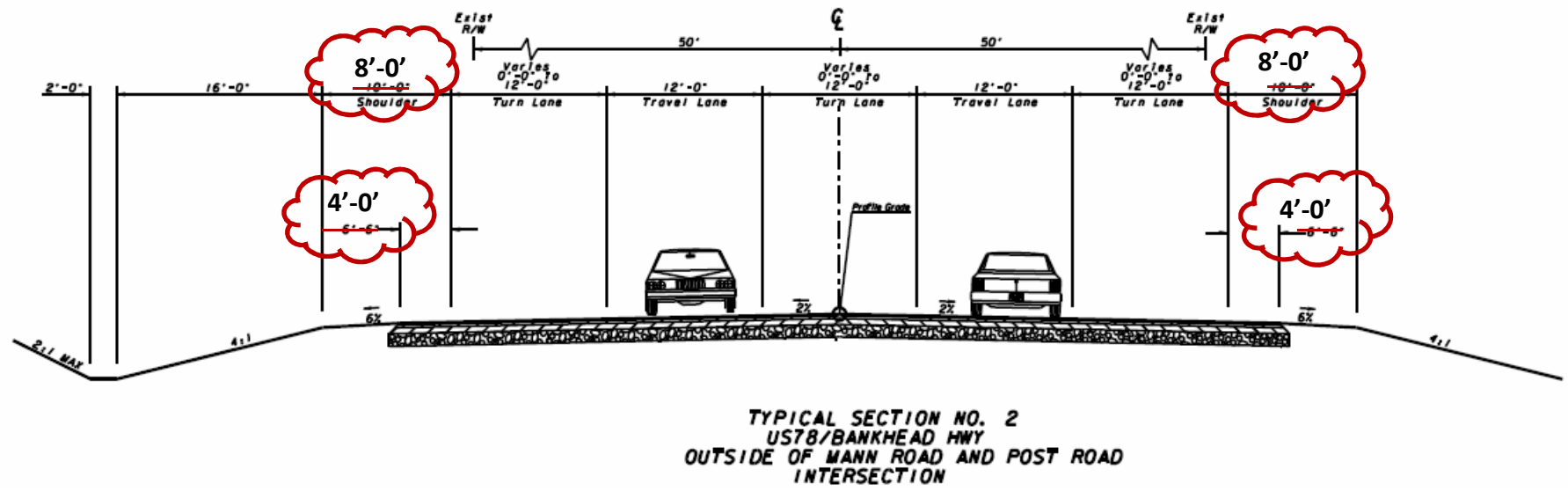
Baseline Concept Sketch



VE ALTERNATIVE S-2

Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway

VE Alternative Concept Sketch



TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

VE ALTERNATIVE S-2

Use a 4-foot shoulder in lieu of 6.5-foot on Bankhead Highway

Assumptions and Calculations: From right-of-way data provided, a cost of $7 per SF was obtained for right-of-way.

For earthwork, calculated fill sections along Bankhead Highway per stations shown in the cost worksheet would produce a reduction of fill volume and not be a "wash". Along this same range, an averaged 10-foot height as measured from the cross sections, was used for calculations.

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Graded Aggregate Base - 10in	SY	1,732	$ 15.57	$ 26,956			$ -
Asphalt	SY	1,732	$ 31.85	$ 55,154			$ -
Right-of-Way	SF						
LT = 950ft + 1031ft = 1981ft		4,953	$ 7.00	$ 34,668			$ -
RT = 600ft + 200ft = 800ft		2,000	$ 7.00	$ 14,000			$ -
Grading	CY						
STA 34+00 to 40+00 LT & RT (Fill)		1,111	$ 3.75	$ 4,167			$ -
STA 45+50 to 48+00 RT (Cut)		278	$ 2.30	$ 639			$ -
				$ -			$ -
SUB-TOTAL				$135,583			$0
TOTAL (Rounded)				$136,000			$0
						SAVINGS	**$136,000**

VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required

Initial Cost Savings:	$49,300
LCC Savings:	$0
Change in Schedule:	No Change

Description of Baseline Concept: The baseline concept typical sections call for 4:1 fill slopes outside the shoulder break point to tie either into a flat bottom ditch or the existing ground. This design results in 7.27 acres of right-of-way acquisition.

Description of Alternative Concept: Revise the 4:1 slopes to 2:1 and utilize guardrail in order to reduce the amount of right-of-way required. The shoulder will be widened by 5.5 feet to account for the additional width required for guardrail installation.

Advantages:

- Reduction in right-of-way to be maintained by GDOT or Douglas County
- Potential reduction in earthwork volumes

Disadvantages:

- Additional guardrail to maintain
- Possible access issues for future driveway permits on currently undeveloped parcels

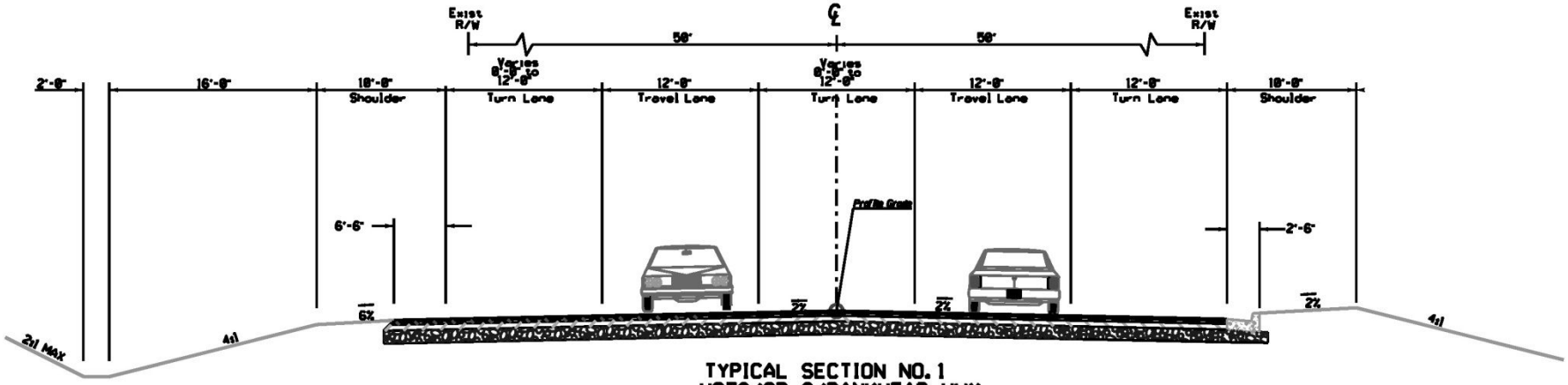
Discussion: GDOT Design Policy Manual states, "All front slopes (foreslopes) should be 4:1 or flatter, and no steeper than 2:1. GDOT discourages the use of 2:1 front slopes with guardrail unless economic constraints (construction costs, right-of-way impacts, or environmental impacts) outweigh the practicality of a 4:1 front slope." The need and purpose of the project is to reduce crashes and provide improved operations at the area intersections. The right-of-way costs are 56% of the total project cost. The projected savings accounts for right-of-way reductions only. Given the relatively low reduction in right-of-way needs, the implementation of this idea may not be justified.

The change in slope would require revisions to the cross sections, limits, and right-of-way cost estimate; however, since the project is in the early stages the impact to schedule should be minimal. Since the project is in the early stages, Right-of-Way Plans are not yet developed. Although a reduction in right-of-way acreage would be realized, the same number of parcels would be affected, so there would be no reduction in the right-of-way acquisition schedule.

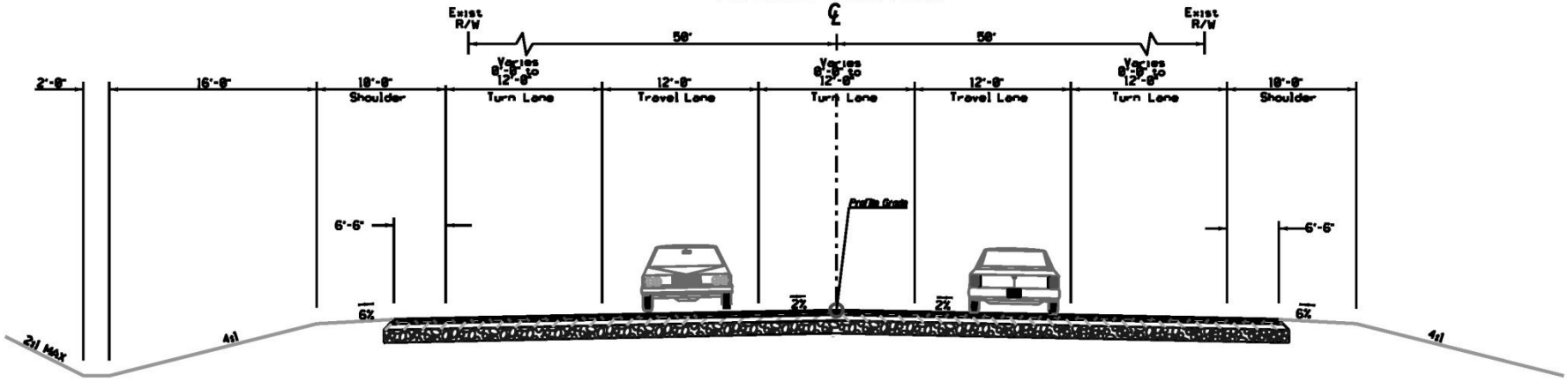
VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required

Baseline Concept Sketch



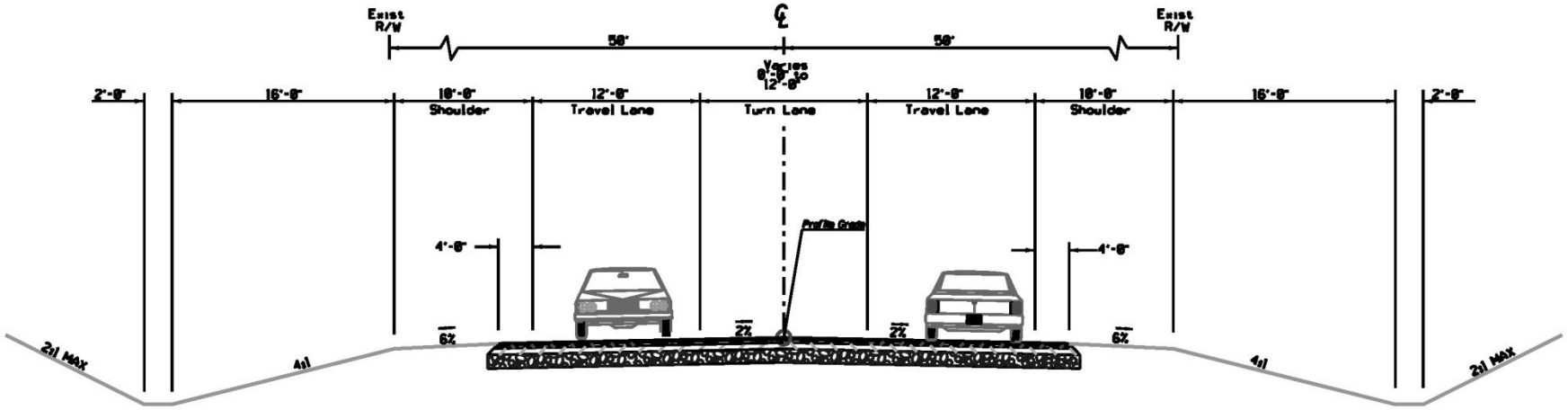
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



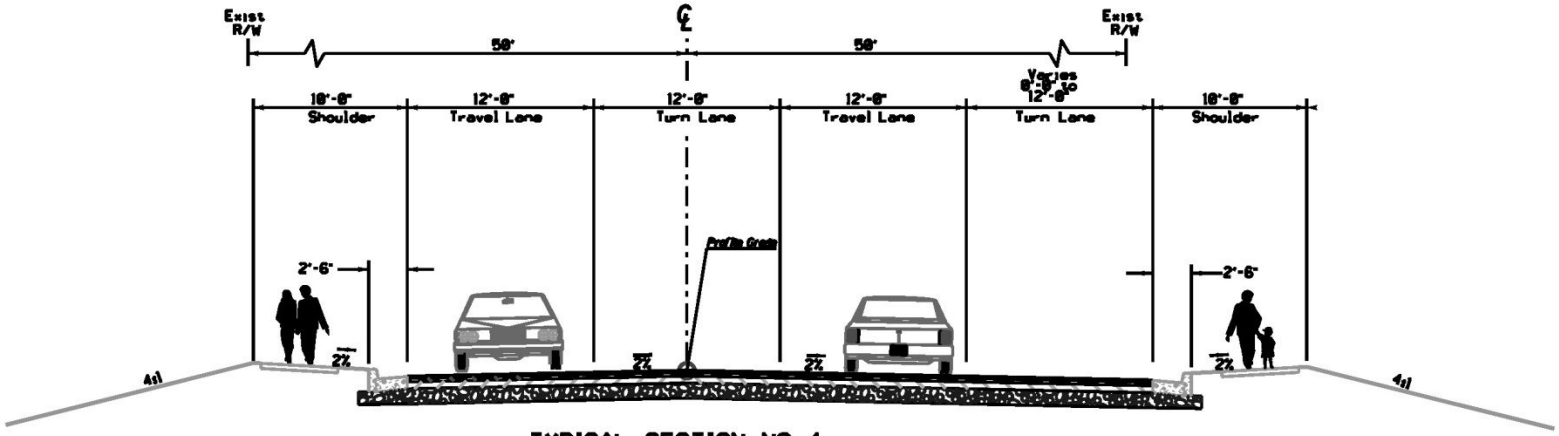
TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required



TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)

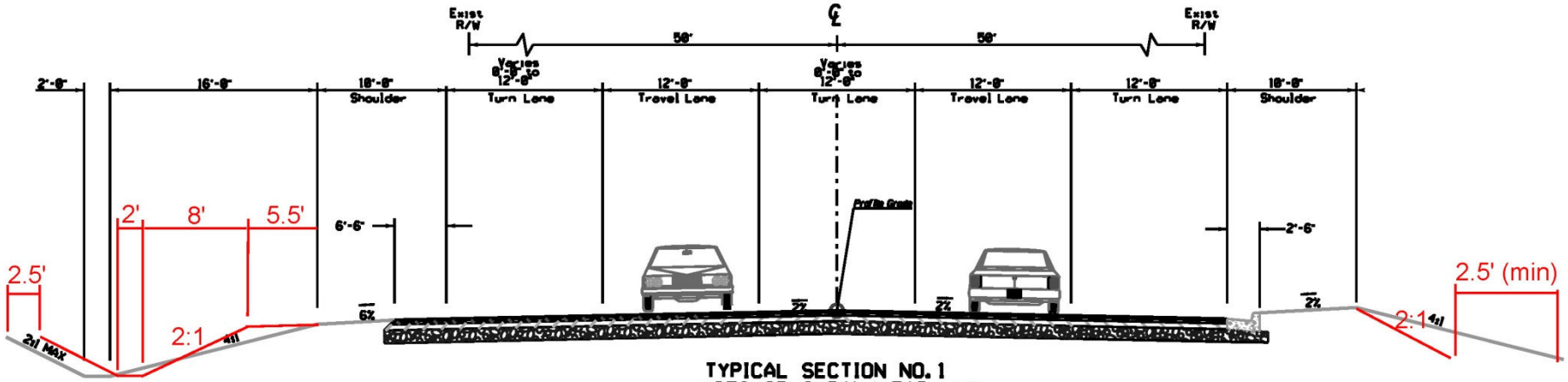


TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

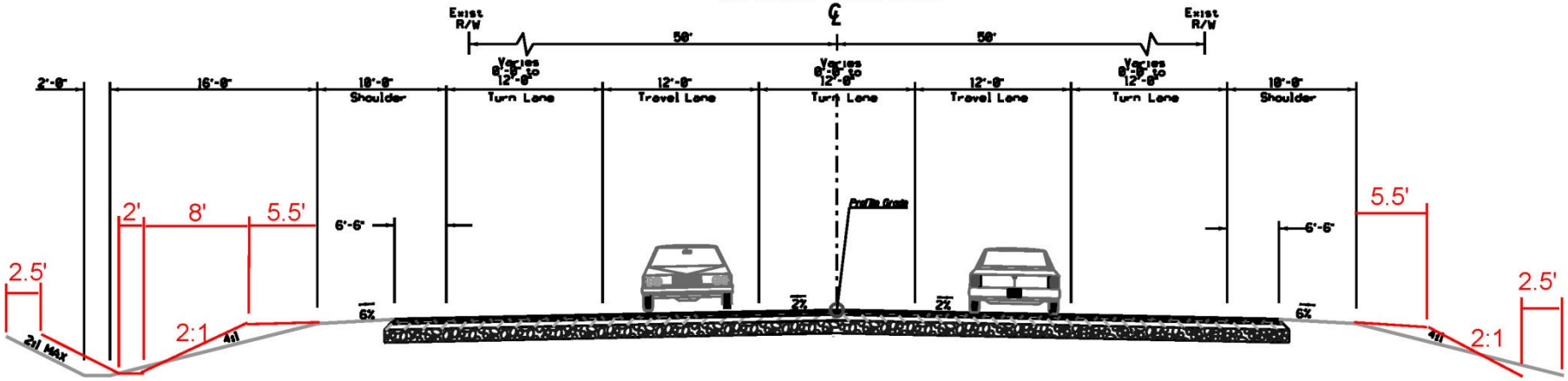
VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required

VE Alternative Concept Sketch



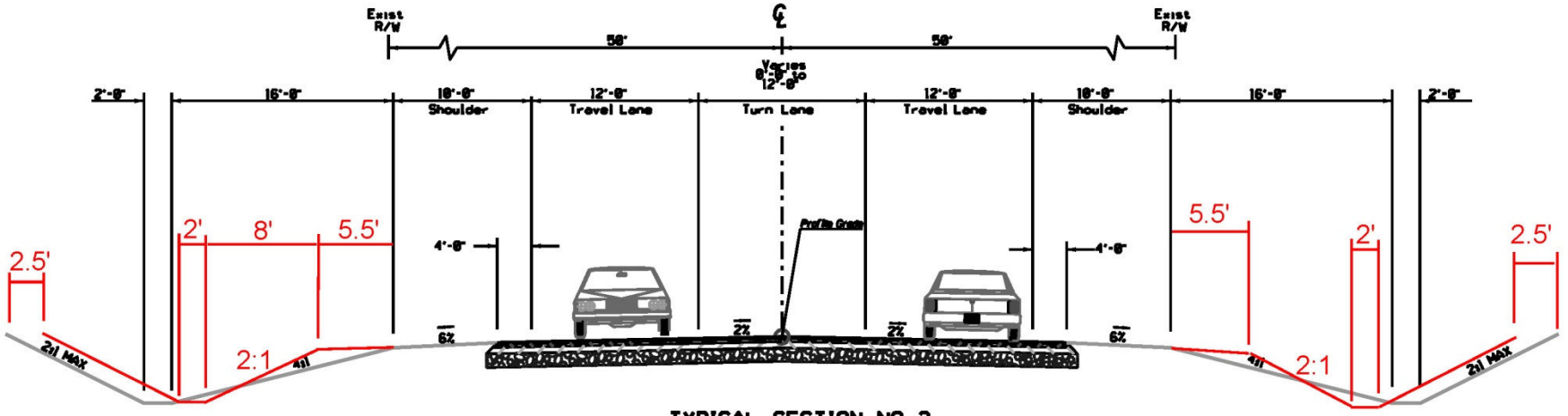
TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



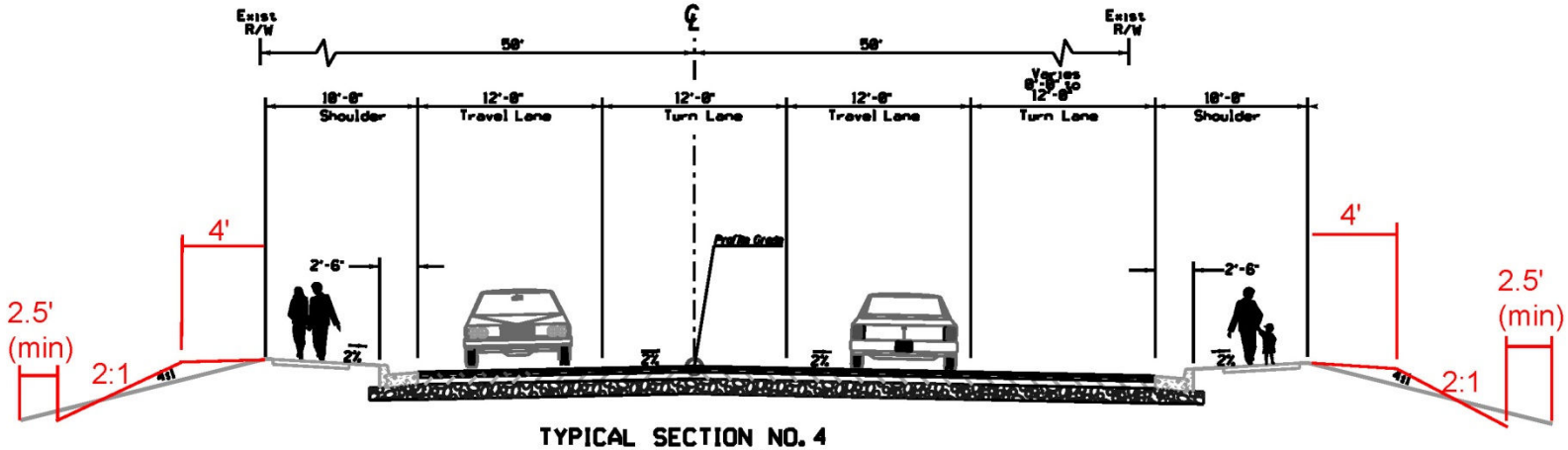
TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required



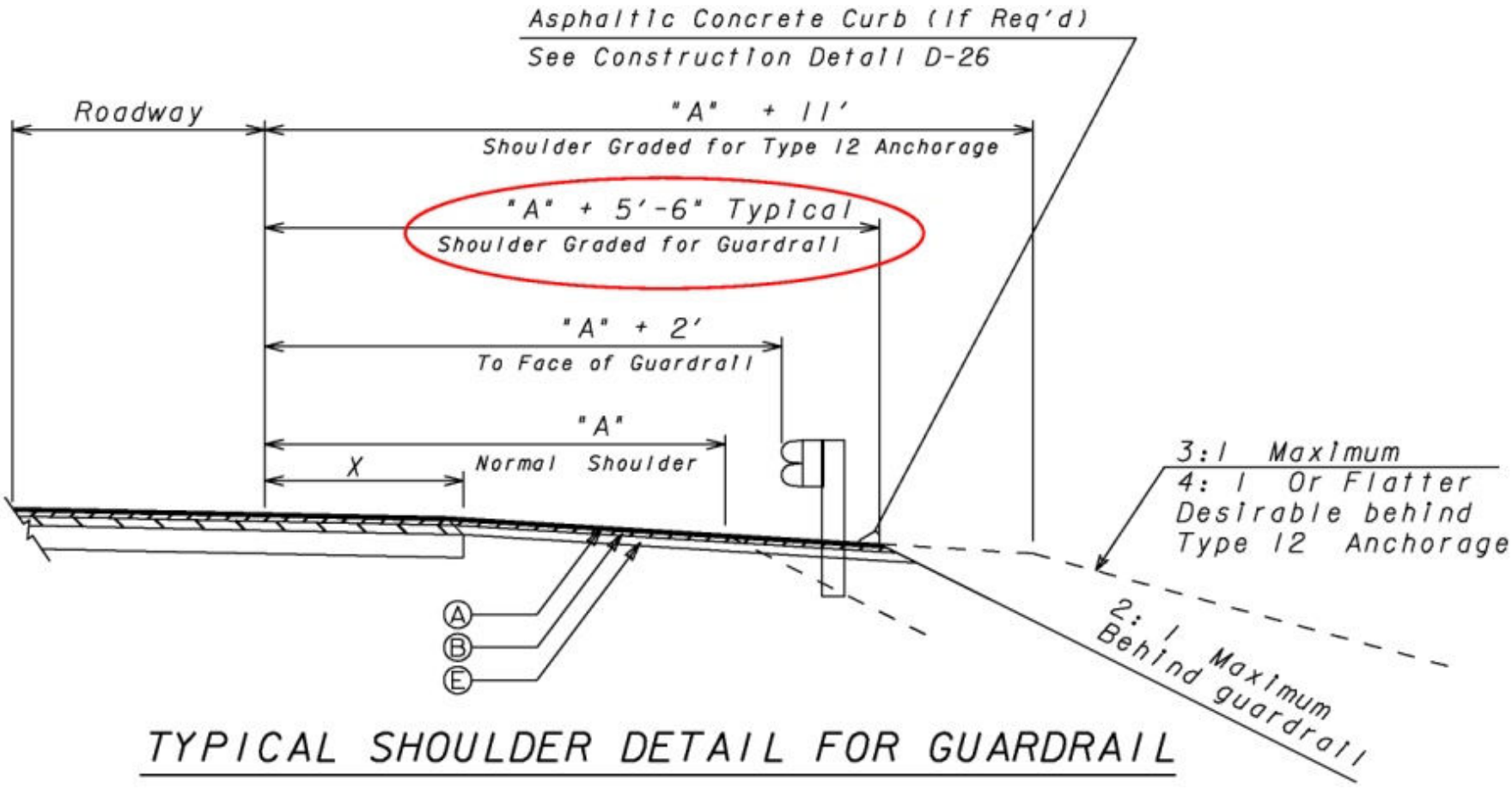
TYPICAL SECTION NO. 3
MANN ROAD &
POST ROAD (SOUTH)



TYPICAL SECTION NO. 4
MASON CREEK ROAD
BETWEEN POST ROAD (SOUTH)
INTERSECTION AND BANKHEAD HWY/
SR8/ US 78 INTSERCTION

VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required



VE ALTERNATIVE S-6

Change the 4:1 slopes to 2:1 and reduce the amount of right-of-way required

Assumptions and Calculations:

Per Preliminary Right-of-Way Estimate: 7.27 acres Cost = $2,916,225 Cost/acre = $401,131

The proposed 4:1 slope for 16 feet outside the shoulder breakpoint on Bankhead Highway and Post Road/Mason Creek Road/Mann Road would be replaced with a 2:1 for 8 feet outside the revised shoulder breakpoint. The revised shoulder breakpoint is 5.5 feet outside the baseline concept.

Bankhead Highway (45 mph design speed)

Station Left	Length	Width	Station Right	Length	Width
24+00 to 33+75	975 ft	2.5 ft	28+00 to 55+17	2,717 ft	2.5 ft
42+00 to 55+17	1,317 ft	2.5 ft			

Total reduction Bankhead Highway = 5,009 ft x 2.5 ft = 12,522.5 SF

Post Road/Mason Creek Road/Mann Road (45 mph design speed)

Station Left	Length	Width	Station Right	Length	Width
8+03 to 11+88	100 ft	2.5 ft	8+03 to 11+53	350 ft	2.5 ft
25+50 to 26+00	50 ft	2.5 ft	21+00 to 21+53	50 ft	2.5 ft
27+03 to 27+53	50 ft	2.5 ft	22+03 to 27+53	550 ft	2.5 ft

Total reduction Post Road/Mason Creek Road/Mann Road = 1,150 feet x 2.5 feet = 2,875 SF

Total Right-of-Way Saved: 15,397 SF

Total Alternative Concept Quantities:

Reduction in right-of-way cost = (15,397 SF/43,460 SF) x $401,131/acre = $141,791

Minus cost for additional guardrail = 6,159 LF x $15.02/lf = - $92,508

Total = $49,282 **Rounded = $49,300**

Initial Cost Estimates

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
				$ -			
				$ -			$ -
Right of Way	Ac	7.270	$ 401,131	$ 2,916,225	6.917	$ 401,131	$ 2,774,423
				$ -			$ -
Additional Guardrail	LF			$ -	6,159	$ 15.02	$ 92,508
				$ -			$ -
				$ -			$ -
SUB-TOTAL				$2,916,225			$2,866,931
PROJECT MARK-UPS				$0			$0
TOTAL (Rounded)				$2,916,230			$2,866,930
						SAVINGS	**$49,300**

PROJECT INFORMATION

BACKGROUND

Bankhead Highway (US 78/SR 8), Mann Road, Post Road, Conners Road, Mattie McCoy Lane, and Mason Creek Road currently are two-lane roadways with rural grassed shoulders located west of Douglasville, Georgia in Douglas County. Bankhead Highway is functionally classified as an urban minor arterial, while Post Road is classified as a rural major collector. The remaining project side roads are classified as local roadways. The land along the south side of Bankhead Highway within the project limits varies between a mix of commercial, light industrial, and agricultural properties. The land use elsewhere within the project limits is primarily residential. The project vicinity map is shown in Figure 1.

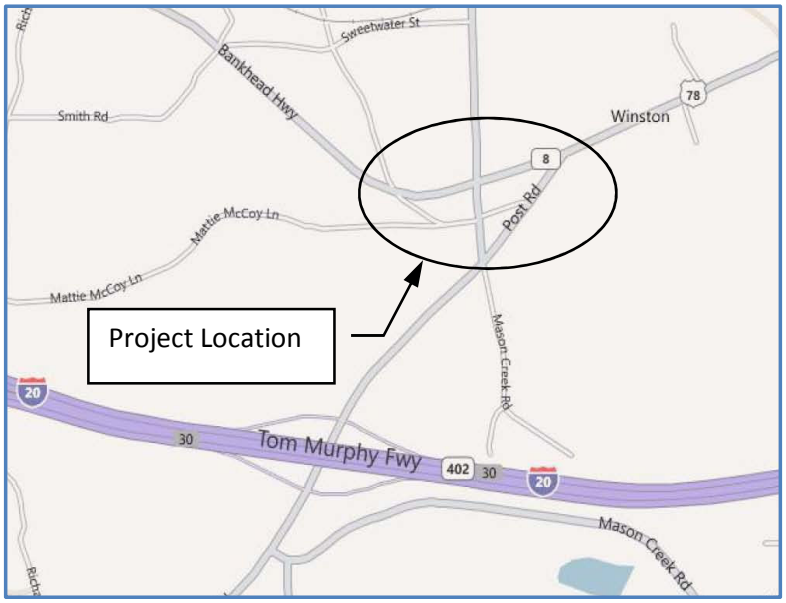


Figure 1 – Vicinity Map

Crash Data

The crash data along the sections of Bankhead Highway, Mann Road/Mason Creek Road, Mattie McCoy Lane, Conners Road, and Post Road within the project limits was obtained for the period between January 1, 2004 and December 31, 2009. The crashes which were reported to have occurred along Bankhead Highway and Mann Road/Mason Creek Road roadways are summarized in Table 1 and Table 2 on the following page. As shown in Table 1, there were a total of 118 crashes reported to have occurred along Bankhead Highway for the 6-year period, which included 66 injury crashes and 2 fatal crashes. As shown in Table 2, there were a total of 87 crashes reported to have occurred along Mann Road/Mason Creek Road for the 6-year period, which included 48 injury crashes and 2 fatal crashes.

Table 1. Summary of Traffic Crash History along Bankhead Highway (SR8/US 78), MP 4.81 to 5.38

	Accidents			Accidents Per 100 Million Vehicle Miles[1]		
Year	Total	Injury	Fatal	Total	Injury	Fatal
2004	19	11	1	1123 (490)	650 (123)	59.08 (1.29)
2005	16	6	0	945 (534)	355 (135)	0.00 (1.48)
2006	21	13	1	1241 (531)	768 (132)	59.08 (1.38)
2007	25	13	0	1477 (514)	768 (126)	0.00 (1.34)
2008	14	8	0	827 (471)	473 (116)	0.00 (1.33)
2009	23	15	0	1359 (463)	886 (114)	0.00 (1.05)
Total	118	66	2			
Average	**20**	**11**	**0.33**	**1182 (501)**	**650 (124)**	**19.69 (1.31)**

Note: (1) The number in parentheses represents the statewide average crash rates for Urban Minor Arterials

Table 2. Summary of Traffic Crash History along Mann Road/Mason Creek Road, MP 6.03 to 6.31

	Accidents			Accidents Per 100 Million Vehicle Miles[1]		
Year	Total	Injury	Fatal	Total	Injury	Fatal
2004	5	1	1	3883 (189)	777 (60)	777 (1.55)
2005	8	5	0	6213 (150)	3883 (50)	0.00 (1.68)
2006	19	12	1	14755 (156)	9319 (54)	777 (2.00)
2007	22	12	0	17084 (168)	9319 (57)	0.00 (1.87)
2008	10	4	0	7766 (141)	3106 (46)	0.00 (1.45)
2009	23	14	0	17861 (118)	10872 (38)	0.00 (1.44)
Total	87	48	2			
Average	**15**	**8**	**0.33**	**11648 (154)**	**6213 (51)**	**259 (1.59)**

Note: (1) The number in parentheses represents the statewide average crash rates for Rural Local roadway

Traffic Projections

Traffic (AADT):

Roadway Segment	2011 Existing Year ADT	2015 Base Year ADT	2035 Design Year ADT
Bankhead Highway (US 78/SR 8)	9,300	9,800	14,400
Post Road	8,150	8,600	12,800
Mann Road	4,200	4,400	6,600
Conners Road	1,350	1,450	2,150
Mason Creek Road	4,200	4,400	6,600

PROJECT DESCRIPTION

The overlapping roadway network along Bankhead Highway (US 78/SR 8) will be consolidated into a single through east-west route (Bankhead Highway) and a single through north-south route (Post Road to Mason Creek Road to Mann Road) that converges at the aforementioned improved, signalized intersection and eliminates conflict points at other locations. The northern portion of Conners Road will be realigned from crossing Bankhead Highway at a substandard intersection skew

to terminate directly into Bankhead Highway at a perpendicular angle. The portion of Conners Road south of Bankhead Highway to Mattie McCoy Lane will be removed. This resulting new intersection will also have a westbound right turn lane on Bankhead Highway. Post Road from the south end of the project will be realigned to tie directly into the northern portion of Mason Creek Road. The southern remnant of Mason Creek Road will then be rearranged to intersect perpendicularly into the realigned Post Road/Mason Creek Road.

This realignment follows the majority of traffic movements and is anticipated to improve the intersection's 2035 LOS from F/F to C/C. This realignment, when included with Mann Road, will also create a continuous north-south through route for motorists leading to the existing I-20 Interchange on Post Road immediately south of the project. The northern portion of Mason Creek Road would also have a continuous two-way left turn lane up to Bankhead Highway and Mann Road. The northern remnant of Post Road will remain in place with a cul-de-sac on its southern end, while its intersection with Bankhead Highway will be reconfigured to be right in, right out. This intersection realignment of Post Road with Bankhead Highway combined with the divergence of through traffic to Mason Creek Road is anticipated to reduce rear end and angle crashes and improve its 2035 LOS from E/C to C/B.

The project begins on Bankhead Highway (US 78/SR 8) just west of the intersection with Conners Road at MP 4.81 and ends just east of the present Post Road Intersection at MP 5.38 for a total project length of 0.57 miles. The entire project is located within Douglas County and the unincorporated community of Winston. The project is also 3.5 miles east of the City of Villa Rica and 2.5 miles west of the City of Douglasville. The project limits on Post Road begin approximately 430 feet south of the intersection with Mason Creek Road. The project limits on Mann Road begin at the intersection with Bankhead Highway and ends 700 feet to the north.

The project proposes improving the intersecting roadway network of Bankhead Highway (US 78/SR 8), Post Road, Mann Road, Conners Road, Mattie McCoy Lane, and Mason Creek Road within the unincorporated Winston community. This will entail intersection improvements as well as consolidating traffic movements into a single through east-west route and north-south route to simplify driving movements and eliminate conflict points. The following improvements are proposed for the project:

- Bankhead Highway (US 78/SR 8) will be improved with left and right turn lanes in the westbound and eastbound directions at a proposed signalized intersection with Mann Road and Mason Creek Road. A westbound right turn lane will also be added at a new T intersection with the northern portion of Conners Road. The vertical geometry of Bankhead Highway will be upgraded throughout the project to comply with current AASHTO stopping sight distance guidance.

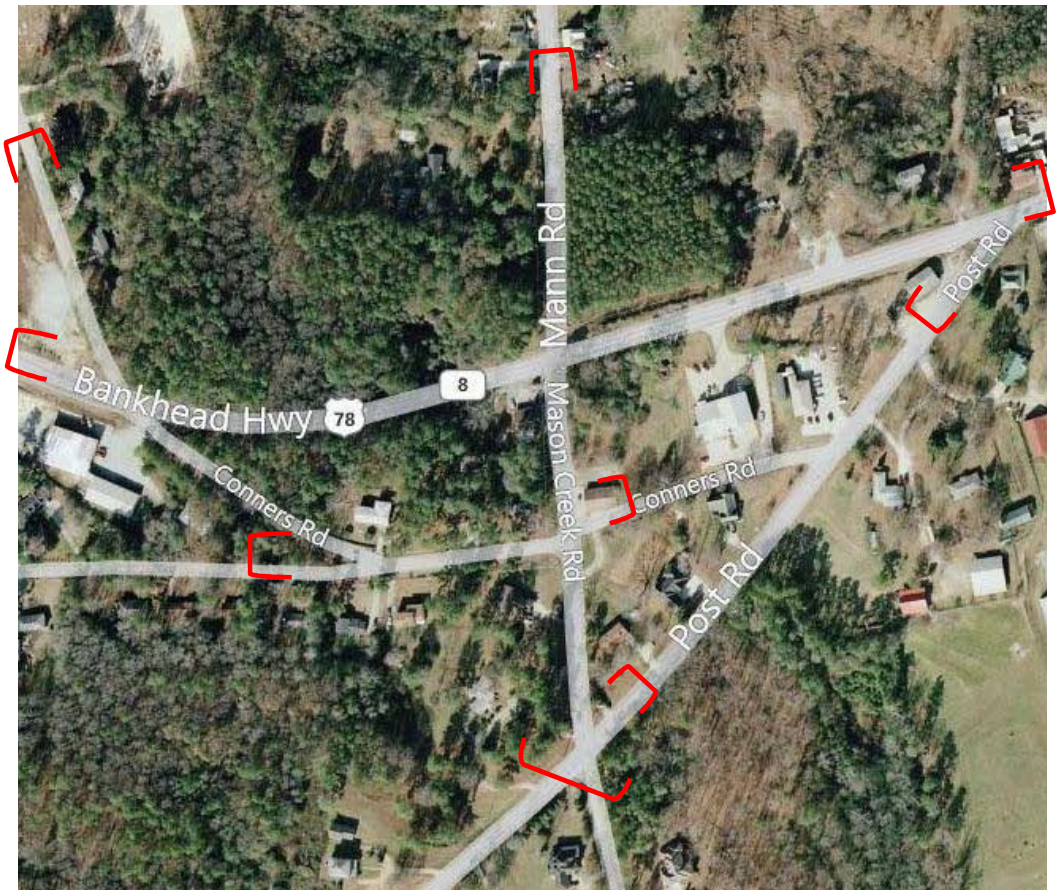
- Mann Road will be improved with a southbound left turn lane at the intersection with Bankhead Highway. Its vertical geometry will also be upgraded throughout the project to comply with current AASHTO stopping sight distance guidance.

- The southern portion of Post Road would be reconfigured to tie directly into the northern portion of Mason Creek Road to convey the majority of traffic movements. The southern

portion of Mason Creek Road would be realigned to intersect perpendicularly with this new connection and the portion of Post Road north of this location will be stubbed with a cul-de-sac and accessed from the southern portion of Conners Road. The existing intersection of the northern portion of Post Road with Bankhead Highway will be altered to have a 70 degree intersection skew and to have right in/right out access only.

- The northern portion of Mason Creek Road will be improved with northbound right and left turn lanes at the intersection with Bankhead Highway. A two-way left turn lane is also proposed on Mason Creek Road from south of Bankhead Highway to the intersection of the southern portions of Mason Creek Road and Post Road. Urban border areas will also be added to both sides of the roadway to improve pedestrian connectivity. Finally, the vertical geometry of Mason Creek Road will be upgraded to comply with current AASHTO stopping sight distance guidance.

- Conners Road presently crosses Bankhead Highway at a sub-standard intersection skew prior to traversing south to intersect with Mattie McCoy Lane, Mann Road, and Post Road. The northern portion of Conners Road would be realigned from its present alignment to terminate into Bankhead Highway at a perpendicular angle. The southern portion between Bankhead Highway and Mattie McCoy Lane would be eliminated and the remaining southern portion of Conners Road would be reconfigured to tie directly into Mattie McCoy Lane.



Project Limits

INFORMATION PROVIDED TO THE VE TEAM

The following project documents were provided to the VE team for their use during the study:

- Project Concept Report dated Dec. 22, 2011
- Project Cost Estimate dated Sept. 1, 2011
- Project Plans and Sections dated January 2012

PROJECT DRAWINGS

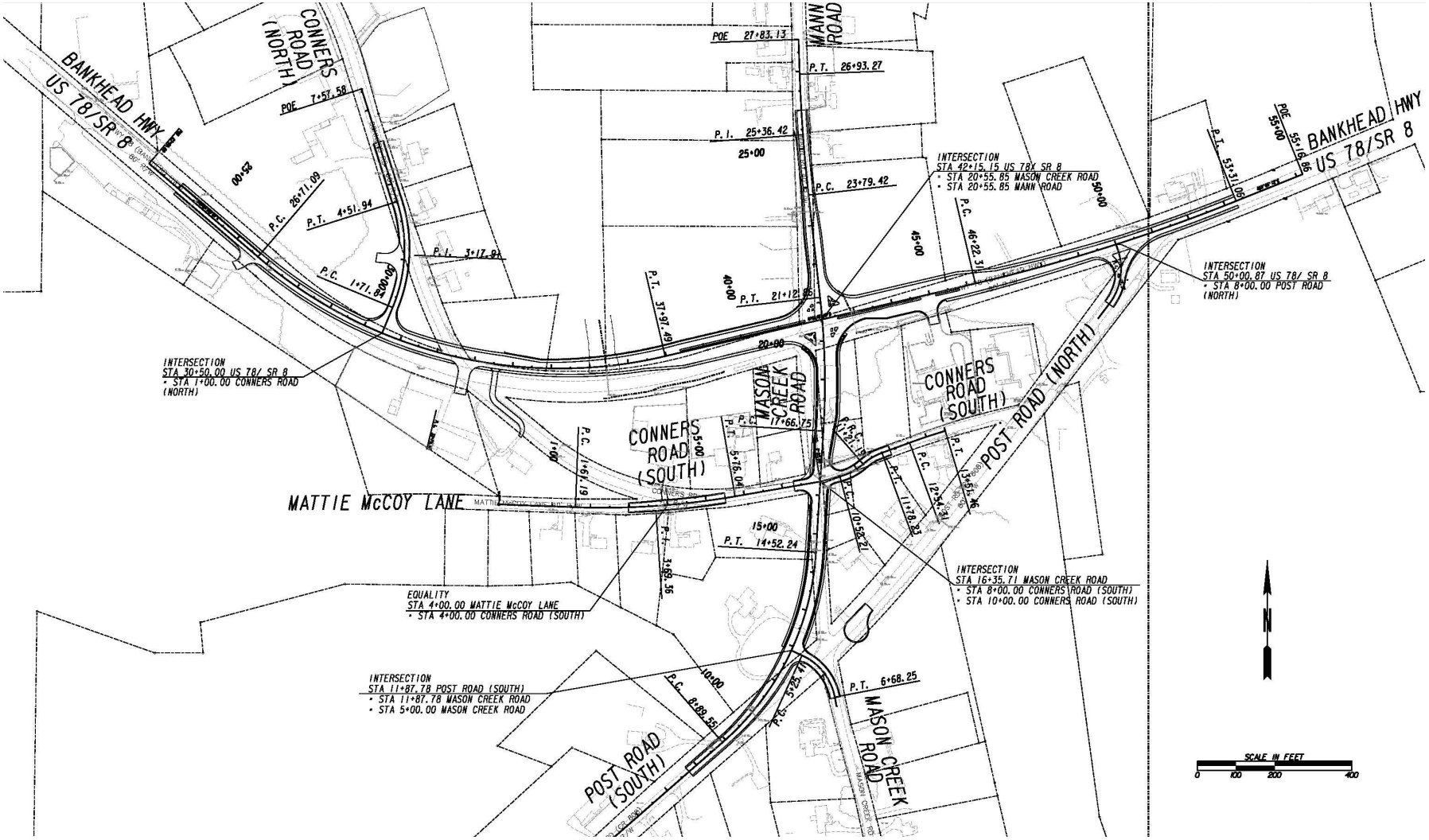
Selected sheets from the project drawings are included on the following pages.

PROJECT COST ESTIMATE

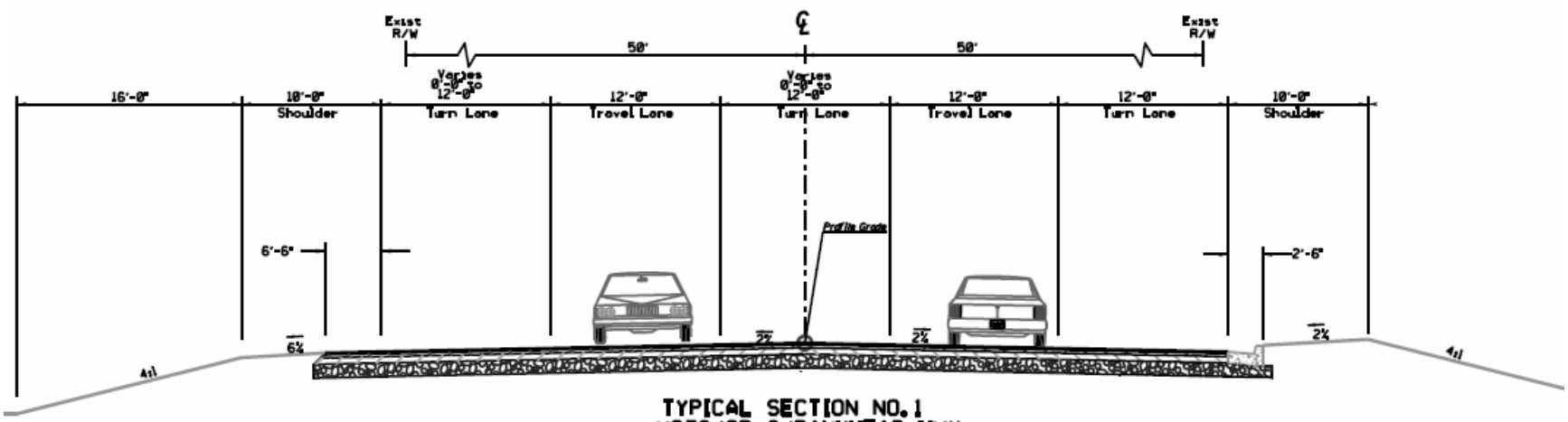
The project cost estimate that was used as the baseline for the VE study is included at the end of this section. The total construction cost per the Project Concept Report dated January 24, 2012 is estimated at $3,140,000 with right-of-way costs estimated at an additional $4,180,000.

PROJECT SCHEDULE

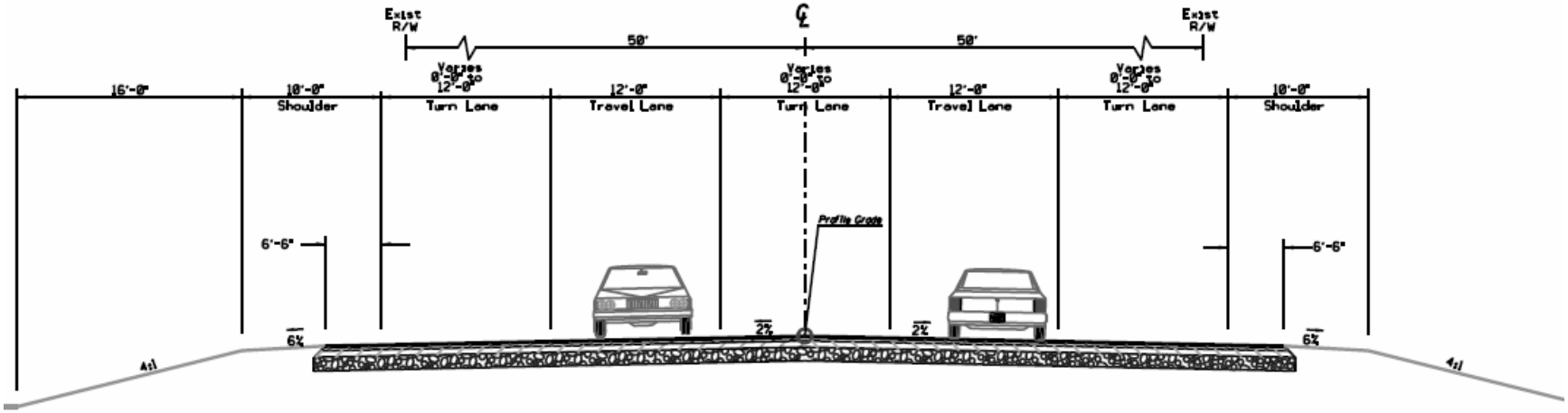
Schedule Item	Begin	End
Environmental process	Nov 2010	Jan 2013
Preliminary construction plans	Jan 2012	Jan 2013
Complete right-of-way plans	Feb 2013	Mar 2013
Complete the Section 404 Permit	Jan 2013	Jul 2013
Complete final construction plans	Apr 2013	Oct 201
Complete to purchase right-of-way	Mar 2013	Feb 2014



PROJECT PLAN

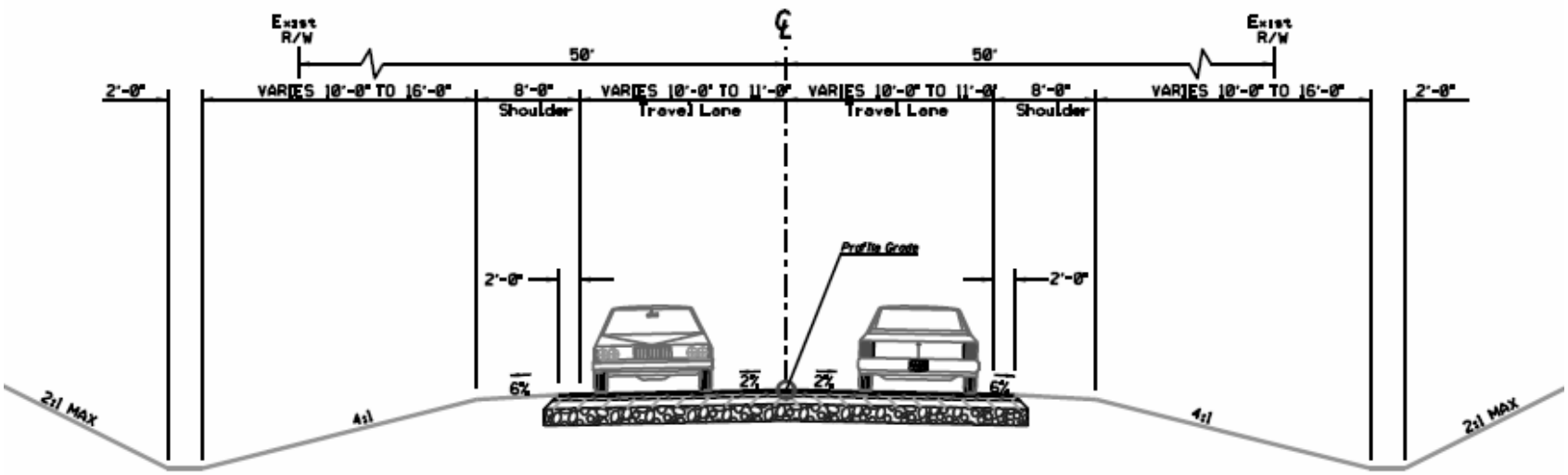


TYPICAL SECTION NO. 1
US78/SR 8/BANKHEAD HWY
AT MANN ROAD AND POST ROAD INTERSECTION
WITH CURB AND GUTTER ON
EB RIGHT TURN LANE



TYPICAL SECTION NO. 2
US78/BANKHEAD HWY
OUTSIDE OF MANN ROAD AND POST ROAD
INTERSECTION

MAINLINE SECTION



SIDEROAD SECTION

GEORGIA DEPARTMENT OF TRANSPORTATION

JOB ESTIMATE REPORT

Date: 8/25/2011 JOB NUMBER: 0008375

DESCRIPTION: US 78/BANKHEAD HWY @MANN ROAD SAFETY IMPROVEMENT PROJECT

ITEMS FOR GDOT PROEJCT CSSFT-0008-00(375)

LINE	ITEM	U/M	DESCRIPTION	QUANT.	PRICE	AMOUNT	SUBTOTALS
5	150-1000	LS	TRAFFIC CONTROl-C5SFT-0008-00(375)	1	$ 150,000	$ 150,000	**$ 150,000**
10	210-0100	LS	GRADING COMPLETE -CS5FT-0008-00137S)	1	$ 800,000	$ 800,000	**$ 800,000**
15	310-5100	SY	GR AGGR BS CRS 10 IN INCL MATL	30,250	$ 15.57	$ 470,890	**$ 470,890**
20	402-1812	TN	RECYL AC LEVELING,INC BM&HL	500	$ 68.13	$ 34,065	
25	402-3130	TN	RECYL AC 12.5MM SP,GP2,BM&HL	2,500	$ 65.44	$ 163,588	
30	402-3190	TN	RECYL AC 19 MM 5P,GP 1 OR 2 ,INC BM&HL	3,350	$ 61.69	$ 206,672	
35	402-3121	TN	RECYL AC 2SMM SP,GP1/2, BM&HL	10,000	$ 55.28	$ 552,814	
40	413-1000	GL	BITUM TACK COAT	3,000	$ 2.10	$ 6,309	**$ 963,447**
45	441-0748	SY	CONC MEDIAN, 6 IN	200	$ 43.98	$ 8,796	
49	441-0104	SY	CONC SIDEWALK, 4 IN	840	$ 36.82	$ 30,927	
50	441-6216	LF	CONC CURB & GUTTER/ 8"X24"TP2	2,060	$ 11.06	$ 22,784	**$ 62,507**
55	550-1180	LF	STM DR PIPE 18",H 1-10	290	$ 31.34	$ 9,090	
60	550-1240	LF	STM DR PIPE 24",H 1-10	1,277	$ 34.78	$ 44,410	
65	550-1360	LF	STM DR PIPE 36",H 1-10	100	$ 61.75	$ 6,175	
70	550-2180	LF	SIDE DR PIPE 18",H 1-10	650	$ 23.86	$ 15,507	
73	550-1300	LF	STM DR PIPE 30",H 1-10	166	$ 47.09	$ 7,816	
74	550-3324	EA	SAFETY END SECTION 24",STD,4:1	1	$ 941.06	$ 941	
79	550-3330	EA	SAFETY END SECTION 30",STD,4:1	2	$ 1,655	$ 3,309	
84	550-4218	EA	FLARED END SECT 18 IN, ST DR	4	$ 451.48	$ 1,806	
89	550-4224	EA	FLARED END SECT 24 IN, ST DR	5	$ 533.80	$ 2,669	
94	550-4236	EA	FLARED END SECT 36 IN, ST DR	2	$ 1,015	$ 2,029	
99	668-1100	EA	CATCH BASIN, GP 1	8	$ 2,031	$ 16,250	
119	668-2100	EA	DROP INLET, GP 1	1	$1,766.23	$ 1,766	**$ 111,769**
104	641-1200	LF	GUARDRAIL, TP W	1,238	$ 15.02	$ 18,595	
109	641-5001	EA	GUARDRAIL ANCHORAGE, TP 1	3	$ 603.02	$ 1,809	
114	641-5012	EA	GUARDRAIL ANCHORAGE, TP 12	1	$ 1,910	$ 1,910	**$ 22,314**
124	647-1000	LS	TRAFFIC SIGNAL INSTALLATION NO -.	1	$ 60,000	$ 60,000	**$ 60,000**
129	653-0120	EA	THERM PVMT MARK, ARROW, TP 2	27	$ 66.33	$ 1,791	
134	653-1502	LF	THERMO SOLID TRAF ST, SIN YEL	10,800	$ 0.33	$ 3,515	
139	653-1804	LF	THERM SOLID TRAF STRIPE, 8",WH	1,250	$ 1.76	$ 2,205	
144	653-1501	LF	THERMO SOLID TRAF ST SIN, WHI	15,650	$ 0.31	$ 4,925	
149	653-3501	GLF	THERMO SKIP TRAF ST, SIN, WHI	1,100	$ 0.27	$ 301	
154	653-6004	SY	THERM TRAF STRIPING, WHITE	456	$ 2.95	$ 1,343	**$ 14,081**

159	163-0232	AC	TEMPORARY GRASSING	5	$ 117.48	$ 587	
164	163-0240	TN	MULCH	120	$ 209.09	$ 25,091	
169	163-0300	EA	CONSTRUCTION EXIT	10	$1,154.31	$ 11,543	
174	163-0520	LF	CONSTR AND REMOVE TEMP PIPE SLOPE DRAIN	140	$ 13.52	$ 1,893	
179	165-0101	EA	MAINT OF CONST EXIT	10	$ 514.82	$ 5,148	
184	165-0030	LF	MAINT OF SILT FENCE, TP C	1,150	$ 1.01	$ 1,162	
189	171-0030	LF	TEMPORARY SILT FENCE, TYPE C	2,300	$ 2.79	$ 6,419	
194	603-2181	SY	STN DUMPED RIP RAP, TP 3, 18"	100	$ 41.23	$ 4,123	
199	603-7000	SY	PLASTIC FILTER FABRIC	100	$ 4	$ 410	**$ 56,376**
204	700-6910	AC	PERMANENT GRASSING	8	$433.71	$ 3,470	
209	700-7000	TN	AGRICULTURAL LIME	8	$29.57	$ 237	
214	700-7010	GL	LIQUID LIME	30	$19.07	$ 572	
219	700-8000	TN	FERTILIZER MIXED GRADE	5	$396.46	$ 1,982	
224	700-8100	LB	FERTILIZER NITROGEN CONTENT	420	$1.94	$ 814	
229	716-2000	SY	EROSION CONTROL MATS, SLOPES	3170	$0.89	$ 2,831	**$ 9,905**
ENGINEERING COST ESTIMATE						**$ 2,721,289**	**$ 2,721,289**
ENGINEERING AND INSPECTION @ 5%							**$ 136,065**
CONTRUCTION CONTINGENCY							**$ -**
TOTAL LIQUID AC ADJUSTMENT							**$ 288,974**
TOTAL CONSTRUCTION TOTAL							**$ 3,146,328**
TOTAL UTILITY COST							**$ 95,179**
TOTAL RIGHT OF WAY							**$ 4,182,000**
TOTAL COST							**$ 7,423,507**

PROJECT ANALYSIS

SUMMARY OF ANALYSIS

The following analysis tools were used to study the project:

- Key Project Factors
- Cost Model
- Function Analysis

KEY PROJECT FACTORS

The first day of the VE study included meetings with the project stakeholders and a site visit. The following summarizes key project issues and site visit observations identified during these sessions.

Project Issues

The following are some of the issues and concerns associated with the project.

Constructibility:

- The difference in elevations between the existing profiles and the proposed could make construction difficult.

Crashes:

- The Bankhead Highway (US 78/SR 8) intersection with Mann Road and Mason Creek Road has had 91 crashes over the last 6 years with 89% of these being angle crashes. The intersection currently operates at a LOS C/C for the AM/PM peak hours, and the 2035 future no-build anticipated LOS is F/F for the AM/PM peak hours.

- The Bankhead Highway (US 78/SR 8) intersection with Post Road has had 20 crashes over the last 6 years with 70% of these being rear end crashes and 15% being angle crashes.

- The intersection of Mason Creek Road and Post Road has had 12 crashes over the last 6 years with 58% of these being angle crashes. The intersection currently operates at a LOS C/C for the AM/PM peak hours, and the 2035 future no-build anticipated LOS is F/F for the AM/PM peak hours.

Site Visit Observations

A site visit was conducted in order to visually assess the project site conditions. The following observations were made by the VE team.

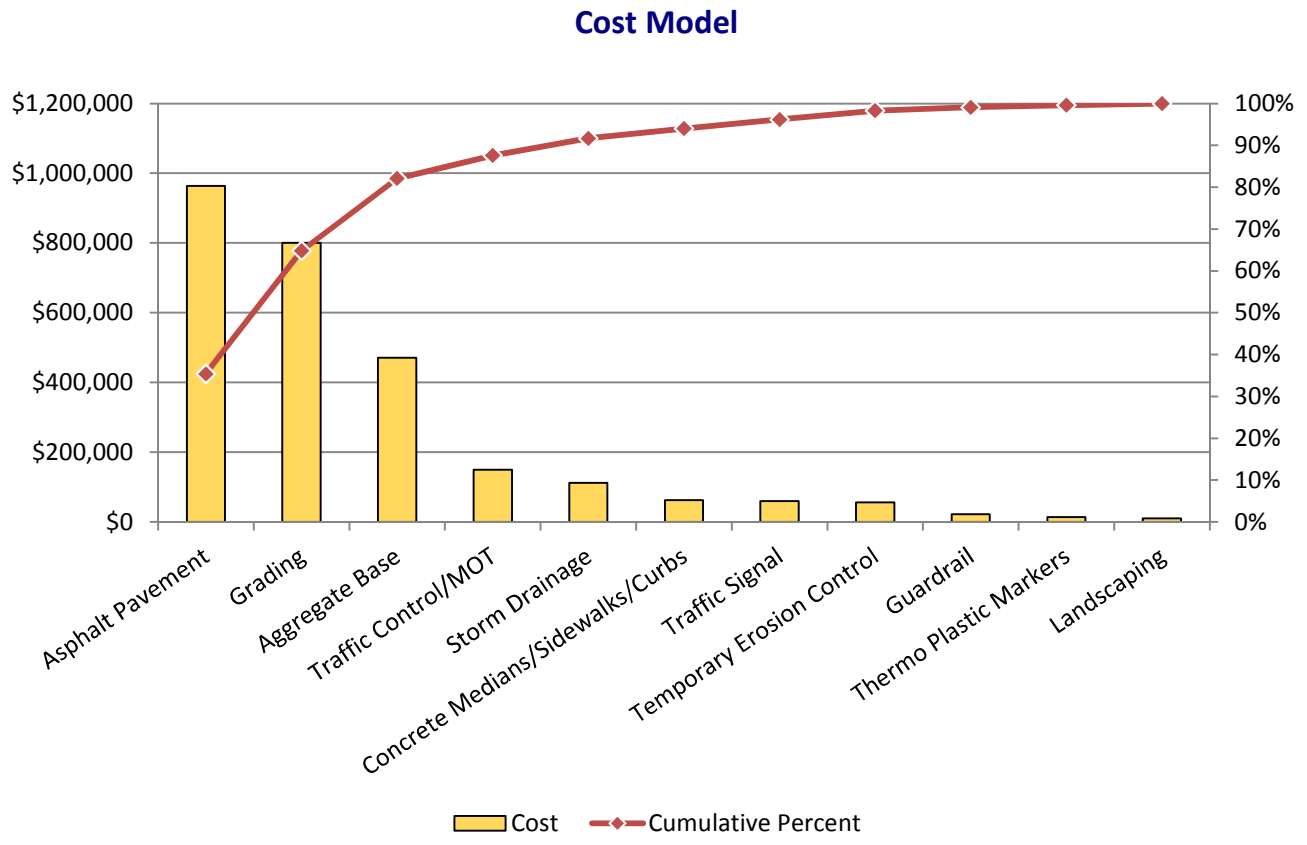
- There are a number of cut/fill locations along the alignment which require new right-of-way.
- The section is based on 4:1 and 2:1 side slopes.
- Right-of-way is a major cost of the total project.
- The existing pavement along Mason Creek appears to be quite rough and cracked.
- The improvements appear to address the key safety issues, particularly stopping sight distance and skew angles.
- Construction phasing is improved by modifying the alignment onto new right-of-way.
- Sidewalks appear to be somewhat formal for this portion of Douglas County.
- The road names clearly need to be modified since Post Road is being closed and re-routed.
- The initial design speed criteria of 55 mph appears to have been modified/reduced to 45 mph.
- The heavy tree cover along the roadways in the area compound the stopping sight distance caused by several of the crests and sags on the profiles.

COST MODEL

The VE team leader prepared a cost model from the cost estimate presented in the *Project Information* section of this report. The model is organized to identify major construction elements or trade categories, the original estimated costs, and the percent of total project cost for the significant cost items.

The cost model clearly showed the cost drivers for the project and was used to guide the VE team during the VE study. The following conclusions were noted by the VE team regarding the project costs:

- More than 57% of the total project cost is estimated for new right-of-way for the project, so containment of the project footprint is key to controlling overall project costs.
- Grading costs are a significant portion of the construction scope and efforts should be made to minimize cut/fill requirements by further evaluation of the design speed, vertical/horizontal curves, and the total roadway section.



FUNCTION ANALYSIS

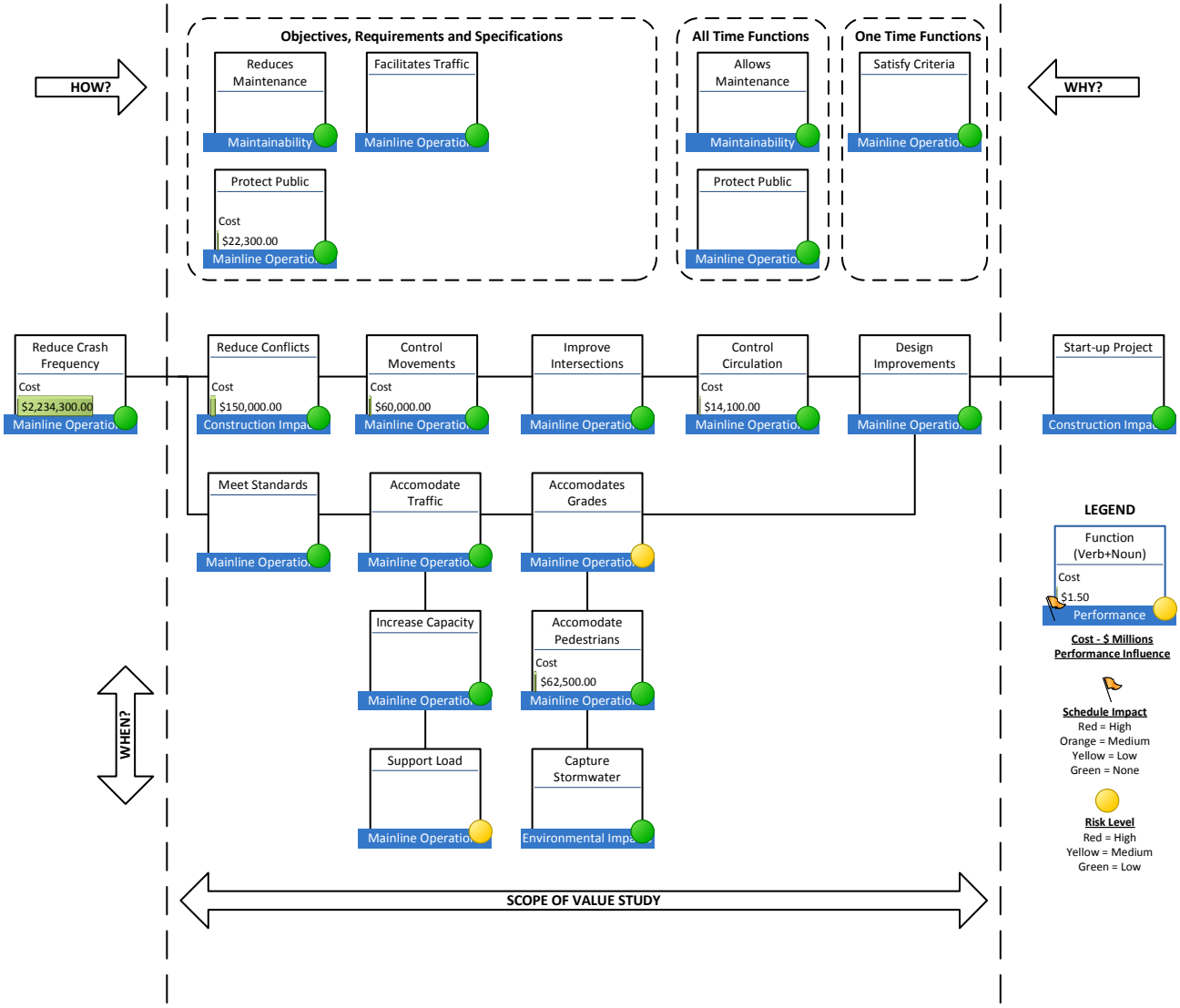
Function analysis was performed and a Function Analysis System Technique (FAST) Diagram was produced, which revealed the key functional relationships for the project. This analysis provided a greater understanding of the total project and how the project's performance, cost, time, and risk characteristics are related to the various functions identified.

The FAST diagram arranges the functions in logical order so that when read from left to right, the functions answer the question, "How?" If the diagram is read from right to left, the functions answer the question, "Why?" Functions connected with a vertical line are those that happen at the same time as, or are caused by, the function at the top of the column (a "When?" relationship).

Random Function Determination

Project Element	Function	Cost	Performance	Risk
Need	Improve Intersections	$0	Mainline Operations	Low
Purpose	Reduce Crash Frequency	$2,234,300	Mainline Operations	Low
Purpose	Protect Public	$22,300	Mainline Operations	Low
Alignment	Accommodate Traffic	$0	Mainline Operations	Low
Alignment	Reduce Conflicts	$150,000	Construction Impacts	Low
Alignment	Control Circulation	$14,100	Mainline Operations	Low
Traffic Signal	Control Movements	$60,000	Mainline Operations	Low
Traffic Signal	Accommodate Pedestrians	$62,500	Mainline Operations	Low
Crosswalks	Protect Public	$0	Mainline Operations	Low
Shoulders	Allow Maintenance	$0	Maintainability	Low
Shoulders	Facilitate Traffic	$0	Mainline Operations	Low
Pavement	Support Load	$0	Mainline Operations	Medium
Pavement	Reduce Maintenance	$9,900	Maintainability	Low
Pavement	Improve Safety	$0	Mainline Operations	Low
Section	Increase Capacity	$0	Mainline Operations	Low
Section	Capture Stormwater	$168,200	Environmental Impacts	Low
Sidewalk	Accommodats Pedestrians	$0	Environmental Impacts	Low
Profile	Accommodate Grades	$0	Mainline Operations	Medium
Criteria	Meet Standards	$0	Mainline Operations	Low

FAST Diagram



VALUE IMPROVEMENT

Value Methodology (VM) has traditionally been perceived as an effective means for reducing project costs. This paradigm only addresses one part of the value equation, oftentimes at the expense of the role that VM can play with regard to improving project performance. Project costs are fairly easy to quantify and compare; performance is not.

Project performance must be properly defined and agreed to by the project team at the beginning of the VE study. The performance requirements and attributes developed are then used throughout the study to identify, evaluate, and document alternatives. This process emphasizes the interrelationship between the elements of performance, cost, and time and can be quantified and compared in terms of how they contribute to overall value.

The following pages describe the steps in the Value Improvement process.

Define Performance Requirements

Performance requirements represent essential, non-discretionary aspects of project performance. Any concept that fails to meet the project's performance requirements, regardless of whether it was developed during the project's design process or during the course of the VE study, cannot be considered as a viable solution. Concepts that do not meet a performance requirement cannot be considered further unless such shortcomings are addressed through the VE study process in the form of VE alternatives. It should be noted that in some cases a performance requirement may also represent the minimum acceptable level of a performance attribute. The following performance requirements were selected for this project.

Performance Requirement	Definition
Highway Design Standards	Any deviation from the GDOT Highway Design Manual must be approvable by the District's Design Reviewer.
Structural Design Standards	Any structure on the project must comply with current structural design standards.
Environmental Review Process	Any concept or design modification considered must comply with state and federal environmental law and be compatible with the environmental review process.
Critical Project Milestones	Several critical schedule milestones must be met in order to meet legislative and/or funding requirements. These include meeting the project let date of April 2015.

Define Performance Attributes

Performance attributes represent those aspects of a project's scope that may possess a range of potential values. For example, an attribute called "Environmental Impacts" may have a range of acceptable values for a project ranging from 1 acre to 20 acres of wetlands mitigation. It is clear that a concept that offered 15 acres of mitigation would perform at a higher level than one that offered 5 acres, but both would meet the project's need and purpose, and their values (i.e., the relationship between performance and cost) could be rationally compared. The following performance attributes were selected for this project.

Mainline Operations

An assessment of traffic operations and safety on the mainline facility(s), including off-ramps and collector-distributor roads. Operational considerations include LOS relative to the 20-year traffic projections, as well as geometric considerations such as design speed, sight distance, lane widths, and shoulder widths.

Maintainability

An assessment of the long-term maintainability of the transportation facility(s). Maintenance considerations include the overall durability, longevity, and maintainability of pavements, structures, and systems; ease of maintenance; accessibility and safety considerations for maintenance personnel.

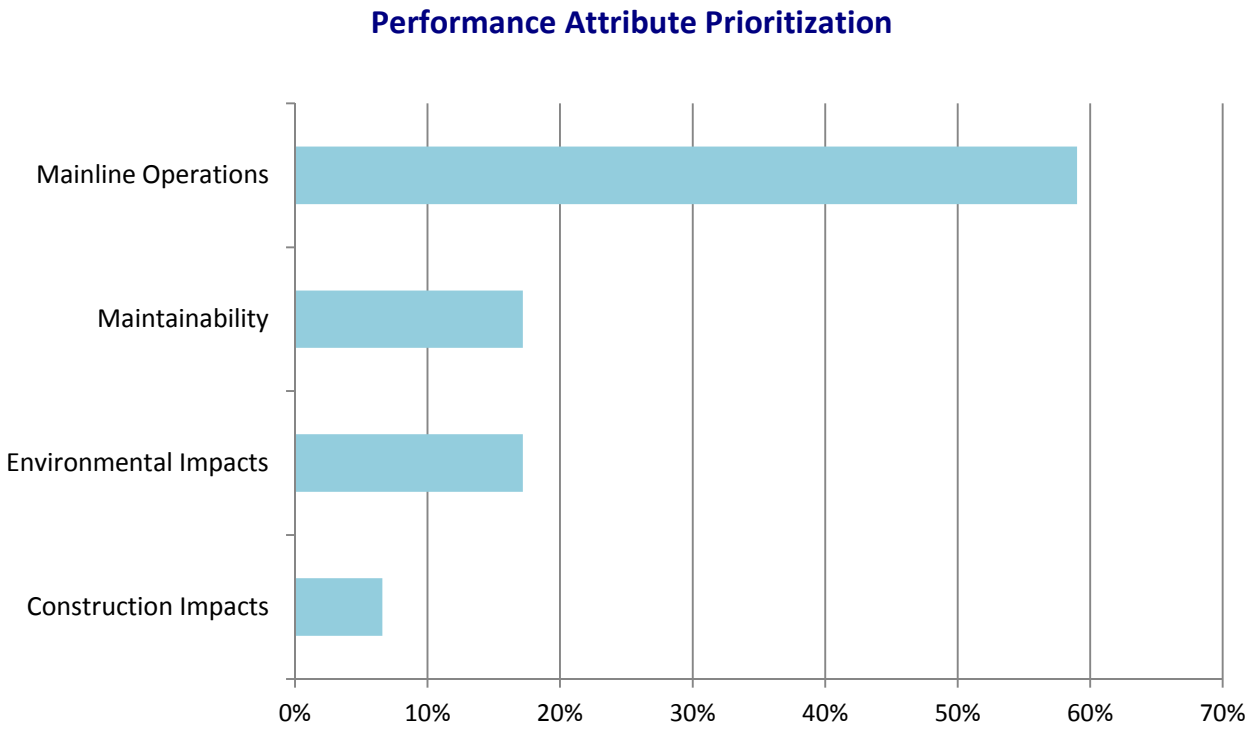
Construction Impacts

An assessment of the temporary impacts to the public during construction related to traffic disruptions, detours, and delays; impacts to businesses and residents relative to access, visual, noise, vibration, dust, and construction traffic; environmental impacts related to water quality, air quality, soil erosion, and local flora and fauna.

Prioritize Performance Attributes

The performance attributes of a project are seldom of equal importance. Therefore, a systematic approach must be utilized in order to determine their relative importance in meeting the project's need and purpose.

Once the performance attributes were defined and their scales developed, the VE team prioritized them based on their relative importance to the project and feedback gained during the VE Kick-off Meeting. The Analytic Hierarchy Process (AHP) was utilized in the prioritization process. The performance attributes were systematically compared in pairs, asking the question: "An improvement to which attribute will provide the greatest benefit relative to the project's need and purpose?" VE team members were then asked to indicate their understanding and the relative intensities of their preferences based upon their experience with GDOT on this and other projects. The chart below provides the results of this analysis and includes the complete breakdown of the priorities, expressed as a percentage of the whole.



Performance of Baseline Concept

The project team evaluated the performance of the Baseline Concept relative to the scales previously identified. The information below reflects the performance rationale for each attribute.

Mainline Operations

The Baseline Concept appears to address the key safety issues of the project and should reduce the number of crashes along the alignment. Adding the signal to control the intersection at Bankhead Highway and Mason Creek Road will provide for controlled left turns off of the mainline with adequate turning storage. The roadway section appears to be fairly generous with a 16-foot dimension to the ditch line and 4:1 fill slopes. Tightening the overall section could result in reduced right-of-way and fill requirements.

Environmental Impacts

Environmental issues appear to be addressed, but the Baseline Concept included in the Concept Report assumed a 55 mph design speed along Bankhead Highway. As the design evolved, it appears now that a speed of 45 mph may be acceptable. This may allow for significant changes to the alignment and profile through the use of shorter radius curves for both vertical and horizontal curves. This should result in a narrower section, reduced fill quantities, and fewer right-of-way requirements.

Maintainability

Maintainability for the Baseline Concept appears acceptable and no issues are noted other than maintaining the new fill slopes.

Construction Impacts

Constructibility is driving much of the project alignment since several areas require fills up to 12-foot-high to meet the longer vertical curves to meet the stopping sight distance criteria. Adding this depth of fill within the existing alignment under traffic conditions is not feasible, so shifting the alignment to along the fill section from STA 32+00 to 41+00 appears justifiable. However, since the 12 feet of fill was based on the 55 mph design speed, some reduction may be identified by changing to the 45 mph design speed and shortening the radii, but this is somewhat hampered by the fact that the east end of the alignment is already at 6% grade. Based upon these constraints, it appears that overall constructibility may already be optimized in the Baseline Concept.

IDEA EVALUATION

The ideas generated by the VE team were carefully evaluated, and project-specific attributes were applied to each idea to assure an objective evaluation.

PERFORMANCE ATTRIBUTES

The following are key performance attributes identified for this project and used to assist the VE team in evaluating the ideas:

- Mainline Operations
- Environmental Impacts
- Maintainability
- Construction Impacts

The VE team enlisted the assistance of GDOT and consultant design team for background information on the importance of these attributes as they related to this project. Information gained during the Kick-off Meeting assisted the VE team as they evaluated various creative ideas to improve the value of this project.

EVALUATION PROCESS

The VE team generated and evaluated ideas on how to perform the various project functions using other approaches. The idea list was grouped by function or major project element. Each idea was evaluated with respect to the functional requirements of the project. Performance, cost, time, and risk may also have been considered during this evaluation.

Once each idea was fully evaluated, it was given a total rating number. This is based on a scale of 1 to 7, as indicated by the rating index described in the *Value Engineering Process* section of this report. Ideas rated 5 to 7 were developed further and those that were found to have the greatest potential for value improvement are documented in the *Value Engineering Alternatives* section of this report. The rationale for why ideas that were rated highly but were not developed as alternatives is documented later in this section.

IDEA SUMMARY

All of the ideas that were generated during the Speculation Phase using brainstorming techniques were recorded on the following pages. Ideas received an idea code based on the function statement under which it was brainstormed. The following table indicates the functions related to each idea code.

Idea Code	Related Function
A	Alignment
P	Profile

Idea Code	Related Function
ROW	Right-of-Way
S	Section

A detailed idea evaluation summary is also included. This summary includes additional information related to how each idea improves or degrades the elements of performance, cost, time (schedule), and risk. Only those elements where the idea differs from the baseline concept are included in this summary.

IDEA SUMMARY LIST

Idea Code and Description	Rating
A-1: Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner	5
A-2: Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50	5
A-3: Specify the requirements for the roadway segments being abandoned	DS
A-4: Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment	6
A-5: Reduce the length of the radius on the northwest corner of the Bankhead Highway/ Mason Creek Intersection and eliminate the raised median islands on the northwest corner	DIS
A-6: Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet	5
A-7: Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00	5
A-8: Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00	5
A-9: Plan on detours for the north/south connector roads and build the improvements using the existing right-of-way in lieu of purchasing additional property	4
A-10: Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way	5
P-1: Revise the profile and alignment on Bankhead Highway to account for a 45 mph in lieu of the 55 mph design speed	6
ROW-1: Use more slope easements and fewer permanent rights-of-way	6
S-1: Modify the ditch line to meet the 45 mph clear zone criteria in lieu of the 55 mph	5
S-2: Use a 4-foot paved shoulder in lieu of a 6.5-foot on Bankhead Highway	5
S-3: Use 2-foot paved shoulders in lieu of 4-foot on side roads with 25 mph design speeds	DIS
S-4: Add short retaining walls to reduce right-of-way requirements for both mainline and side roads	DIS
S-5: Add guard rail on alignments from STA 35+00 to 39+00 on Bankhead Highway and reduce the width of the section by 5 feet	5

Idea Code and Description	Rating
S-6: Change the 4:1 slopes to 3:1 or 2:1 slopes and reduce the amount of right-of-way required	6

DEV: Develop [as a VE Alternative]
DS: Design Suggestion
ABD: Already Being Done [in the Baseline Concept]
DIS: Dismissed

DETAILED IDEA EVALUATION SUMMARY

A-1: **Reduce the radius of the horizontal curve at Conners Road from STA 1+00 to 3+00 and revise the profile on the north end to tie into the existing profile sooner** — Overall Rating: **5**

Attributes	*Rating*	*Comments*
Construction Impacts	Improved	Less cut material.

General comments: Could be a small cost savings; reduces the overall environmental footprint of the project.

A-2: **Eliminate the pavement replacement on Mattie McCoy Lane from STA 3+00 to 5+50** — Overall Rating: **5**

Attributes	*Rating*	*Comments*
Construction Impacts	Improved	Slightly less construction to do.
Maintainability	Degraded	May require future maintenance.

General comments: The County would need to maintain the existing roadway; some additional ditch improvements may be needed along the existing roadway.

A-3: **Specify the requirements for the roadway segments being abandoned** — Overall Rating: **DS**

Attributes	*Rating*	*Comments*
Construction Impacts	Unchanged	Clarifies the scope of work.

General comments: Clarifies the contractors work.

A-4: **Move the alignment of Mason Creek Road from STA 16+00 to 27+00 further west, closer to the existing alignment**

Overall Rating: **6**

General comments: Reduces right-of-way, but complicates construction phasing for the grading operation. Could possibly detour traffic on Mason Creek Road to solve the phasing issues.

A-5: **Reduce the length of the radius on the northwest corner of the Bankhead Highway/Mason Creek Intersection and eliminate the raised median islands on the northwest corner**

Overall Rating: **DIS**

Attributes	*Rating*	*Comments*
Mainline Operations	Improved	Improves traffic flow.

General comments: Combined with A-6.

A-6: **Reduce the radius on the corners of Bankhead Highway/Mason Creek Road down to 75 feet**

Overall Rating: **5**

Attributes	*Rating*	*Comments*
Mainline Operations	Improved	Improves traffic flow.

General comments: May be able to eliminate the raised medians at the intersection; slows the right turn traffic which may improve safety.

A-7: **Shorten the project limits on the west end of Bankhead Highway from STA 24+00 to 26+00**

Overall Rating: **5**

General comments: May need to do the formal tie-in of the profile a little further to the west. Since the profile skims the existing grade in this segment, it should be possible to reduce the total length of the project.

A-8: **Shorten the east end of the project on Bankhead Highway from STA 53+31 to 52+00**

Overall Rating: **5**

General comments: Similar to A-7; the existing and proposed grades are almost identical in this area.

A-9: **Plan on detours for the north/south connector roads and build the improvements using the existing right-of-way in lieu of purchasing additional property**

Overall Rating: **4**

General comments: Selectively using some detours in this area will improve the overall constructibility of the project and could reduce construction phasing cost.

A-10: **Move the cul-de-sac further south on Post Road and flip the bulb to the north side to take advantage of existing right-of-way**

Overall Rating: **5**

Attributes	*Rating*	*Comments*
Environmental Impacts	Improved	Less right-of-way needed.

General comments: Moving the cul-de-sac south and flipping the alignment will place this element on existing rather than new right-of-way.

P-1: **Revise the profile and alignment on Bankhead Highway to account for a 45 mph in lieu of the 55 mph design speed**

Overall Rating: **6**

Attributes	*Rating*	*Comments*
Environmental Impacts	Improved	Reduces many of the curves and right-of-way needs.

General comments: Reducing the design speed from 55 mph to 45 mph should allow for more flexibility in the design, including horizontal and vertical curves, and reduce the impacts to the right-of-way.

ROW-1: **Use more slope easements and fewer permanent rights-of-way**

Overall Rating: **6**

Attributes	*Rating*	*Comments*
Mainline Operations	Degraded	Future access is more difficult.
Maintainability	Degraded	More difficult to access the facilities.

General comments: Temporary construction easements typically cost approximately 60% of that for a permanent right-of-way purchase.

S-1: **Modify the ditch line to meet the 45 mph clear zone criteria in lieu of the 55 mph**

Overall Rating: **5**

Attributes	*Rating*	*Comments*
Construction Impacts	Improved	Narrower roadway

General comments: The ditch line in the baseline concept (55 mph) extends the section well beyond the existing right-of-way in many locations, increasing the project cost. Since the criteria can now be reduced to a design speed of 45 mph, the section can be reduced and the right-of-way requirements re-evaluated.

S-2: **Use a 4-foot paved shoulder in lieu of a 6.5-foot on Bankhead Highway**

Overall Rating: **5**

Attributes	*Rating*	*Comments*
Mainline Operations	Degraded	Narrower paved portion of the shoulder.

General comments: The 4-foot paved shoulder is allowable for a 45 mph design speed.

S-3: **Use 2-foot paved shoulders in lieu of 4-foot on side roads with 25 mph design speeds**

Overall Rating: **DIS**

General comments: Would not work since the side roads are classified as 35 mph sections.

S-4: **Add short retaining walls to reduce right-of-way requirements for both mainline and side roads**

Overall Rating: **DIS**

Attributes	*Rating*	*Comments*
Environmental Impacts	Improved	Less impact due to narrower right-of-way.
Construction Impacts	Degraded	Adds walls to the project.
Maintainability	Degraded	Walls need to be maintained.

General comments: The viability of the idea depends on the unit price of the right-of-way and the cost of the wall. After further investigation by the VE team, it was found that the price of the retaining wall was much higher than the price for the right-of-way. One exception of this may be the commercial properties.

S-5: **Add guard rail on alignments from STA 35+00 to 39+00 on Bankhead Highway and reduce the width of the section by 5 feet**

Overall Rating: **5**

General comments: May be able to reduce footprint of alignment.

S-6: **Change the 4:1 slopes to 3:1 or 2:1 slopes and reduce the amount of right-of-way required** Overall Rating: **6**

Attributes	*Rating*	*Comments*
Environmental Impacts	Improved	Reduces limits of disruption.
Maintainability	Degraded	Steeper slopes are difficult to maintain.

General comments: The roadway section can be reduced by several feet on both sides, reducing the amount of right-of-way required.

VALUE ENGINEERING PROCESS

A systematic approach is used in the VE study. The key procedures followed were organized into three distinct parts: (1) Pre-Study Preparation, (2) VE Study, and (3) Post-Study Procedures.

PRE-STUDY PREPARATION

In preparation for the VE study, the team leader reviews critical aspects of the project and areas for improvement. In the week prior to the start of the VE study, the value team reviews the documents provided by the designer to become better prepared for the study. In addition, performance attributes and requirements are initially identified that are relevant to the project.

VE STUDY

The VM Job Plan is followed to guide the teams in the consideration of project functionality and performance, potential schedule issues, high cost areas, and risk factors in the design. These considerations are taken into account in developing alternative solutions for the optimization of project value. The Job Plan phases are:

- Information Phase
- Function Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Information Phase

At the beginning of the VE study, the design team presents a more detailed review of the design and the various systems. This includes an overview of the project and its various requirements, which further enhances the value team's knowledge and understanding of the project. The project team also responds to questions posed by the VE team.

The project's performance requirements and attributes are discussed, and the performance of the baseline concept is evaluated.

Function Phase

Key to the VE process is the function analysis techniques used during the Function Phase. Analyzing the functional requirements of a project is essential to assuring an owner that the project has been designed to meet the stated criteria and its need and purpose. The analysis of these functions in terms cost, performance, time and risk is a primary element in a VE study, and is used to develop

alternatives. This procedure is beneficial to the VE team, as it forces the participants to think in terms of functions and their relative value in meeting the project's need and purpose. This facilitates a deeper understanding of the project.

Speculation Phase

The Speculation Phase involves identifying and listing creative ideas. During this phase, the VE team participates in a brainstorming session to identify as many means as possible to provide the necessary project functions. Judgment of the ideas is not permitted in order to generate a broad range of ideas.

The idea list includes all of the ideas suggested during the study. These ideas should be reviewed further by the project team, since they may contain ideas that are worthy of further evaluation and may be used as the design develops. These ideas could also help stimulate additional ideas by others.

Evaluation Phase

The purpose of the Evaluation Phase is to systematically assess the potential impacts of ideas generated during the Speculation Phase relative to their potential for value improvement. Each idea is evaluated in terms of its potential impact to performance, cost, time and risk. Once each idea is fully evaluated, it is given a total rating number. This is based on a scale of 1 to 7, as indicated by the following rating index.

7 = Major Value Improvement 6 = Moderate Value Improvement 5 = Minor Value Improvement 4 = Possible Value Improvement	These ratings represent the subjective opinion of the VE team regarding the potential benefits of the concepts in order to prioritize them for development.
3 = Minor Value Degradation	Concept results in a minor cost or performance improvement at the expense of the other.
2 = Moderate Value Degradation	Concept reduces cost but creates an unacceptable degradation to performance.
1 = Major Value Degradation	Concept is not technically feasible or does not meet project need and purpose.

Ideas rated 4 to 7 are developed further and those found to have the greatest potential for value improvement are documented in the *Value Engineering Alternatives* section of this report.

Development Phase

During the Development Phase, the highly rated ideas are expanded and developed into value alternatives. The development process considers the impact to performance, cost, time, and risk of the alternative concepts relative to the baseline concept. This analysis is prepared as appropriate for each alternative, and the information may include a performance assessment, initial cost, and life-cycle cost comparisons, schedule analysis, and an assessment of risk. Each alternative describes

the baseline concept and proposed changes and includes a technical discussion. Sketches and calculations are also prepared for each alternative as appropriate.

Presentation Phase

The VE study concludes with a preliminary presentation of the VE team's assessment of the project and VE alternatives. The presentation provides an opportunity for the owner, project team, and stakeholders to preview the alternatives and develop an understanding of the rationale behind them.

POST-STUDY PROCEDURES

A *Final VE Study Report* is prepared after the completion of the workshop. This report summarizes the activities and results of the VE study.

VE STUDY AGENDA

Project:	CSSFT-0008-00(375), PI No. 0008375, Douglas County SR8/US78 @ CR268/Mason Creek Road & CR 808/Post Road
Dates:	31 January – 03 February 2012
Location:	Georgia Department of Transportation (GDOT) One Georgia Center 600 West Peachtree Street, NW Engineering Services Conference Room (404-631-1755), 5th Floor, Rm 5CR1L2 Atlanta, Georgia 30308
GDOT	Mr. Matt Sanders, AVS, 404-631-1752 (msanders@dot.ga.gov)
Facilitator:	Mr. David Hamilton, PE, CVS-Life, CCE, LEED® AP; 253-229-7703 (dave@vms-inc.com), Value Management Strategies, Inc. (VMS)

Value Management Strategies, Inc. (VMS) will conduct a 32-hour Value Engineering (VE) study on the SR 8/US 78 @ CR268/Mason Creek Road and CR 808/Post Road project in Douglas County, Georgia. It is expected the GDOT design team will provide a formal presentation concerning the project on the first day of the workshop and be available to answer questions during the VE effort. The VE study will follow the outline described below.

VE Study Agenda

Tuesday, 31 January

8:00 AM – 0845AM	**VE Team Arrives – Set-up (5th Floor, Engineering Services Conference Room 5CR1L2)**
8:45 AM – 9:00 AM	**Set-up of Project Exhibits**
9:00 AM – 12:00 AM	**Kick-off Meeting - General Introductions of All Parties, Review of the VE Process Owner's / Designer's Presentation and Information Phase**

The GDOT design team and stakeholders are expected to present information concerning the project including, but not necessarily limited to: rationale for design, criteria for specific areas of study, project constraints, and the reasons for design decisions.

12:00 Noon – 1:00 PM **Lunch**

Tuesday, 31 January (Continued)

1:00 PM – 3:00 PM **Commence Function Analysis Phase (5th Floor, Engineering Services Conference Room 5CR1L2)**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. In addition, the VE team will continue defining the function of each element/system to gain a thorough understanding of the project's needs and requirements and refine the Function Analysis System Technique (FAST) diagram(s).

3:00 PM – 5:00 PM **Conclude the Function Analysis Phase and Commence the Creative Phase**

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association by eliminating roadblocks to creativity and deferring judgment.

Wednesday, 01 February **(5th Floor, Engineering Services Conference Room 5CR1L2)**

8:00 AM – 10:00 AM **Conclude Creative Phase and Complete Evaluation/Analysis Phase**

The VE team will finalize the brainstorming session and analyze the ideas listed in the creative phase and select the best ideas for further development.

10:00 AM – 12:00 Noon **Development Phase**

The VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations, and written substantiation.

12:00 Noon – 1:00 PM **Lunch**

1:00 PM – 5:00 PM **Continue Development Phase**

Thursday, 02 February **(5th Floor, Engineering Services Conference Room 5CR1L2)**

8:00 AM – 12:00 Noon **Continue Development Phase**

12:00 Noon – 1:00 PM **Lunch**

1:00 PM – 5:00 PM **Continue Development Phase**

Friday, 03 February

8:00 AM – 9:00 AM **Conclude Development Phase and Prepare Summary Worksheets for Informal Oral Presentation Continue Development Phase (5th Floor, Engineering Services Conference Room 5CR1L2)**

The VE team prepares a summary of the value engineering alternatives with descriptions and initial and life cycle costs for an informal oral presentation to representatives of the owner and design team. Draft copies of the *Summary of Potential Cost Saving* worksheets are prepared for distribution to VE presentation attendees.

9:00 AM – 11:00 AM **Conduct Informal Presentation (5th Floor, Engineering Services Conference Room 5CR1L2)**

The VE team presents its alternatives to the owner and design team representatives and is available to clarify any points.

11:00 AM **Adjourn**

VE STUDY MEETING ATTENDEES

Project No.: CSSFT-0008-00(375) County: Douglas PI No.: 0008375 Date: January 31 – February 3, 2012

Days

FIRST	LAST	NAME		DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
✓	✓	Lisa L. Myers		Engineering Services	404-631-1770	lmyers@dot.ga.gov
✓	✓	Matt Sanders		Engineering Services	404-631-1752	msanders@dot.ga.gov
✓	O	Melissa Harper		Construction	404-631-1971	mharper@dot.ga.gov
✓	O	Nabil Raad		Traffic Safety & Design	404-635-8126	nraad@dot.ga.gov
✓	✓	Perry Black		Program Delivery	404-631-1224	peblack@dot.ga.gov
✓	O	Larry Bowman		Environmental Services	404-631-1362	lbowman@dot.ga.gov
✓	✓	Dave Hamilton		VMS Team Leader	253-229-7703	Dave@vms-inc.com
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O	✓	Derrick Cameron		Program Delivery	404-631-1223	dcameron@dot.ga.gov

✓ Check all that attend **O** Did Not Attend 11 Attended Project Overview (Day 1) 10 Attended Project Presentation (Day 4)