VALUE ENGINEERING REPORT

US-84/SR-38/West Hill Avenue Grade Separation
At the Norfolk Southern Railroad
STPN0-0007-03(033), PI No 422710
Lowndes County

March 24, 2009

OWNER AND DESIGN TEAM:

Georgia Department of Transportation
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TABLE OF CONTENTS

VALUE ENGINEERING STUDY

US-84/SR-38/West Hill Avenue Grade Separation at Norfolk Southern Railroad
Valdosta, Georgia
STPN0-0007-03(033)
State Project No.: 422710

Executive Summary	2
Introduction	3
Consideration	4
Results Obtained	4
Recommendation Highlights	5
Summary Table	9
Study Identification	11
Team Member List	12
Project Description	12
Project Constraints	13
Project Design Briefing	13
Sketch Map	14
Value Engineering Recommendations	15
Appendix	53
Sources	55
Cost Model	56
FAST Diagram	57
Function Analysis	58
Creative Ideas / Idea Evaluation	62

EXECUTIVE SUMMARY

Executive Summary

VALUE ENGINEERING STUDY

US 84/SR 38/W. Hill Avenue Grade Separation @ Norfolk Southern Railroad
March 9-12, 2009

Introduction

This report summarizes the results of a value engineering (VE) study conducted on the proposed design for the US 84/SR 38/W. Hill Avenue Grade Separation at the Norfolk Southern Railroad project just west of downtown Valdosta, Georgia. The project begins just west of West Street and extends east approximately 0.62 miles to where the US 84/W. Hill Avenue one-way pair tapers back into a single five-lane roadway just east of Wells Street. The proposed project will construct a new four-lane W. Hill Avenue overpass section within the current five-lane roadway. The bridge approach sections will have a seven percent grade and will be contained within MSE walls. New one-way frontage roads will be constructed on both sides of the new mainline overpass section to provide local access to businesses and residences. These frontage roads will also provide operational connectivity of the local street system.

The proposed mainline roadway approach sections will consist of four, 12-foot lanes with a center 14-foot two-way left turn lane. The 330-foot long, three span prestressed concrete girder bridge spanning the railroad will have only four, 12-foot lanes and dual 6-foot sidewalks. To minimize the mainline roadway overpass section width, the bridge approach sections will be constructed using MSE walls. The project will also close South Thomas Street and reconstruct it approximately 535 feet to the east. Major contract work items include bridge construction, roadway embankment, bituminous concrete pavement, drainage, retaining walls, concrete side barrier, curb and gutter, and sidewalk. The total estimated project cost including right-of-way (R/W) is $21.8 million. The design is currently in the concept stage. The study took place March 9-12, 2009, at the Georgia DOT Central Office in Atlanta, using a four person VE team.

This report presents the VE Team's recommendations and all back-up information for consideration by the decision-makers. This **Executive Summary** includes a brief description of each recommendation. The **Study Identification** section contains information about the project and the team. The **Recommendations** section presents a more detailed description and support information about each recommendation. The VE team has included a "Mark-Up" calculation in the Recommendation Cost Worksheet. The mark-up calculation for this project is 13.57 percent and represents the cost of the additive items of Engineering and Inspection, Construction Contingency, Fuel Adjustment, Liquid AC Adjustment, and Utilities. Adding these non-construction costs to the construction/R/W costs results in a grand total project cost that is equal to the State's overall program cost. Lastly, the **Appendix** includes a complete record of the Team's activities and findings. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VE process.

Considerations

The project being evaluated under this study has an estimated construction cost of $19.2 million (not including R/W). The project impacts two specific historic properties and travels through several historic districts including the Norfolk Southern Railroad property. The VE team was advised to consider several constraints when developing their recommendations. The constraints were, 1) that recommendations could not negatively impact R/W, 2) recommendations could not negatively impact the historic properties and historic districts that are next to the project, and 3) traffic control would include a full detour for W. Hill Avenue traffic during construction of the mainline overpass section. The Project Concept Report has been approved. The Draft Environmental Assessment should be complete by April, 2009 and the Final Environmental Assessment should be complete by the end of the year. Right-of-way acquisition is scheduled for 2010 and construction is scheduled for 2012.

Results Obtained

The VE team focused their efforts on the high cost items of the project. Through the use of functional analysis and "brain storming" techniques, the team generated 59 ideas with 24 being identified for additional evaluation as possible recommendations or design suggestions. The VE team developed eight independent recommendations, one optional recommendation, and one alternative recommendation. The implementation of the eight independent recommendations has the potential to reduce the project cost by approximately $1.17 million. A detailed write-up of each recommendation is contained in the respective section of this report. A summary of the recommendations and design suggestions follows.

Recommendation Highlights

Idea A-4: Eliminate the sidewalk on the south side (right) of the W. Hill Avenue mainline roadway through the entire elevated section.

The current design proposes to construct concrete sidewalks on both sides of the W. Hill Avenue railroad overpass structure and its approach embankments. One lane, one-way frontage roads with sidewalks will also be constructed on the outside of the new mainline overpass section.

It is recommended that only a single sidewalk be constructed on the north side of the W. Hill Avenue mainline overpass section. Eliminating the sidewalk on one side will reduce the overall width of the W. Hill Avenue mainline overpass section. This concept will save R/W and reduce the project's impact on the various historical properties along the project. A single sidewalk will adequately accommodate pedestrian traffic along the elevated (seven percent grade) overpass section of W. Hill Avenue. The steep grade will discourage pedestrian traffic on this section since additional sidewalks will be available for pedestrian access along the frontage roads.

The total potential savings if accepted is $247,000.

Idea A-6 Eliminate the right turn lane from westbound W. Hill Avenue into Wells Street.

The current design will add a right turn lane along westbound W. Hill Avenue to northbound West Street.

It is recommended that the proposed right turn lane into West Street be eliminated. The right turn lane is not needed because the design speed for westbound W. Hill Avenue is relatively slow at 35 mph and the right turn demand into West Street is very low. Eliminating this right turn lane would reduce the amount of required R/W needed to construct this project.

The total potential savings if accepted is $60,500.

Idea C-1 OPTION 1 Use 60-inch Steel girders in-lieu-of BT-63 prestressed concrete girders to construct the W. Hill Avenue railroad overpass bridge.

The current design proposes to construct a 330-foot long three-span prestressed concrete bridge to carry W. Hill Avenue over the Norfolk Southern railroad tracks. The proposed structure will use BT-63 prestressed concrete beams for the superstructure.

It is recommended that the bridge be constructed using 60-inch Steel Beams in-lieu-of the BT-63 prestressed concrete beams. This concept would also lengthen the bridge by 105 feet and reduce the length of the MSE wall enclosed approach embankments. Using a continuous three-span steel beam bridge will reduce / minimize the time needed to set the beams and construct the bridge. The longer steel structure will reduce the length of the MSE wall approach sections

further reducing construction time. Reducing construction time will also reduce the duration of active construction over the railroad, the time the road has to be closed and the time traffic will have to use the long detour route, thereby reducing traffic staging costs.

The total potential savings if accepted is $100,000.

Idea C-1.1 OPTION 2 Use smaller BT-54 prestressed concrete beams in-lieu-of larger BT-63 prestressed concrete beams to construct the W. Hill Avenue railroad overpass bridge.

The current design proposes to construct a 330-foot long three-span prestressed concrete bridge to carry W. Hill Avenue over the Norfolk Southern railroad tracks. The proposed structure will use BT-63 prestressed concrete beams for the superstructure.

It is recommended that the bridge be constructed using BT-54 prestressed concrete beams in-lieu-of the BT-63 prestressed concrete beams. The BT-54 prestressed concrete beams have less depth than the BT-63 prestressed concrete beams and will reduce the overall height of the structure. It will also result in an overall reduction in the height of the bridge approach sections, the MSE walls supporting the approach sections, and lessen the grade on the approach sections. Using BT-54 beams will result in a cost savings due to a smaller / thinner superstructure, less MSE walls, and a reduced height of approach sections. Using the smaller beams will improve handling and speed the erection of the beams over the active railroad tracks.

The total potential savings if accepted is $200,000.

Idea D-1 Use a thinner pavement section for all frontage roads and side / cross streets in-lieu-of the same pavement design as the W. Hill Avenue mainline pavement.

The current pavement design for this project uses the same design for all pavement sections. The mainline, frontage roads, connector roads, and cross streets all have a 19.5-inch full depth asphalt section.

It is recommended that a thinner 12.5-inch asphalt section be used on the frontage roads and cross streets. Traffic projections for the frontage roads, connector roads, and cross streets are significantly lower than the new W. Hill Avenue mainline. These lower traffic projections allow the required depth of pavement to be less than currently designed.

The total potential savings if accepted is $295,000.

Idea D-3 Eliminate the New South Thomas Street Connector between W. Hill Avenue and the new One Way South Frontage Road.

The current design includes the construction of a new South Thomas Street connector road between the South Frontage Road and W. Hill Avenue. This street carries two-way traffic and has two 12-foot lanes. The new Thomas Street connector road is only 200 feet west of the South Wells Street connector road.

It is recommended that the new South Thomas Street connector road be eliminated and that all traffic be shifted to South Wells Street. This concept will provide a shorter more direct two-way connector between the South Frontage Road and W. Hill Avenue and better operational movement through the area. Projected delays for vehicles desiring to turn left at W. Hill Avenue from South Thomas Street approach five minutes in length which would increase drive frustration and negatively impact safety. Eliminating this unnecessary connector will reduce costs by reducing pavement, sidewalk, curb & gutter, R/W, and drainage facilities.

The total potential savings if accepted is $365,000.

Idea D-8 Make both sides of the Wells Street / W. Hill Avenue intersection right-in / right-out only.

The current design allows for both right and left turns to and from Wells Street to W. Hill Avenue from both sides of the proposed intersection.

It is recommended that the left turns to and from Wells Street be eliminated by extending the median on W. Hill Avenue to the west and by constructing raised islands on Wells Street. Eliminating the left turn movements on both sides will improve the operational efficiency of the local street system and improve safety. The left turn movements at Wells Street involve only a very minor amount of traffic. The construction of the proposed loop turn-around just east of Wells Street will provide for a direct u-turn through the split W. Hill Avenue crossover and improve safety. Instead of turning left at W. Hill Avenue to go westbound, vehicles would turn right, move to the left, and then make a u-turn through the crossover to go west. Left turning traffic from southbound West Street to eastbound W. Hill Street would turn right, move to the left, and turn left at Thomas St. and come back around.

Note: This change is also recommended if the new South Thomas Street connector is eliminated (See Idea D-3).

The total potential increase if accepted is ($7,000).

Idea D-10 Realign the West Street / W. Hill Avenue intersection to meet at a 90 degree angle.

The current design of the West Street / W. Hill Avenue intersection is skewed at an angle of 64.5 degrees. This intersection also contains a jug handle entrance to the proposed westbound frontage road on the south side of W. Hill Avenue.

It is recommended that the West Street / W. Hill Avenue intersection be shifted approximately 50 feet east along the alignment of W. Hill Avenue to create a 90 degree intersection. Realigning this intersection to 90 degrees will create a safer intersection. This change will also significantly reduce the project's impact on several R/W parcels including historic properties. It should eliminate the small take inside the historic district parcel 14 and construction will be reduced / limited near historic parcel 11. This change may also save the structure on parcel 13.

The total potential savings if accepted is $70,000.

Idea J-1 Increase the inlet spacing on the new W. Mill Avenue overpass approaches and combine the storm drains into a single trunk line.

The current design proposed to use dual trunk lines on the W. Hill Avenue bridge approach sections with inlets spaced a maximum distance of 265 feet apart.

It is recommended that the dual trunk lines through the steep approach section be eliminated and that the inlets on the north side of the roadway be removed. It is further recommended that the inlet spacing be increased. The approach sections have seven percent longitudinal slopes and using a single trunk line with increased inlet spacing should have no effect on gutter spread.

The total potential savings if accepted is $40,000.

Idea J-1.1 ALTERNATIVE to IDEA J-1 Combine the storm drains on the W. Hill Avenue overpass approaches into a single trunk line with the original inlet spacing.

The current design proposed to use dual trunk lines on the W. Hill Avenue bridge approach sections with inlets spaced a maximum distance of 265 feet apart.

It is recommended that the dual trunk lines through the steep approach section be eliminated and that the inlets on the north side of the roadway be removed. The approach sections have seven percent longitudinal slopes and using a single trunk line with increased inlet spacing should have no effect on gutter spread. With single stage construction dual trunk lines are not needed.

The total potential savings if accepted is $30,000.

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR SUMMARY OF POTENTIAL COST SAVINGS							
ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	SAVINGS POTENTIAL * (%)
	RECOMMENDATIONS						
A-4	Eliminate the sidewalk on the south side (right) of the W. Hill Avenue mainline roadway through the entire elevated section.	$262,000	$16,000	$246,000	N/A	$246,000	100%
A-6	Eliminate the right turn lane from westbound W. Hill Avenue into Wells Street.	$60,500	$0	$60,500	N/A	$60,500	100%
C-1	**Option 1** Use 60-inch steel girders in-lieu-of BT-63 prestressed concrete girders to construct the W. Hill Avenue railroad overpass bridge.	$5,536,000	$5,436,000	$100,000	N/A	$100,000	100%
C-1.1	**Option 2** Use smaller BT-54 prestressed concrete beams in-lieu-of larger BT-63 prestressed concrete beams to construct the W. Hill Avenue railroad overpass bridge.	$2,714,000	$2,514,000	$200,000	N/A	$200,000	100%
D-1	Use a thinner pavement section for all frontage roads and side / cross streets in-lieu-of the same pavement design as the W. Hill Avenue mainline pavement.	$455,000	$160,000	$295,000	N/A	$295,000	100%

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

SUMMARY OF POTENTIAL COST SAVINGS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	SAVINGS POTENTIAL * (%)
D-3	Eliminate the new South Thomas Street Connector between W. Hill Avenue and the new one way South Frontage Road.	$365,000	$0	$365,000	N/A	$365,000	100%
D-8	Make both sides of the Wells Street / W. Hill Avenue intersection right-in / right-out only.	$9,000	$16,000	(7,000)	N/A	(7,000)	100%
D-10	Realign the West Street / W. Hill Avenue intersection to meet at a 90 degree angle.	$388,000	$318,000	$70,000	N/A	$70,000	100%
J-1	Increase the inlet spacing on the new W. Mill Avenue overpass approaches and combine the storm drains into a single truck line.	$134,000	$94,000	$40,000	N/A	$40,000	100%
J-1.1	**Alternative to Idea J-1** Combine the storm drains on the W. Hill Avenue overpass approaches into a single trunk line with the original inlet spacing.	$93,000	$63,000	$30,000		$30,000	100%
	* Note: Savings Potential represents how much of an individual item, exclusive of any overlapping dependent items, can be implemented.						

STUDY IDENTIFICATION

Study Identification

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	**Date: March 9-12, 2009**
Location: Valdosta, Georgia	

VE Team Members

Name:	Title:	Organization:	Telephone:
Keith Borkenhagen, PE, CVS	VE Team Facilitator	MACTEC	623-556-1875
Alex Wiley, PE	Design	MACTEC	770-421-3481
Aruna Sastry, PE	Structures	Sastry and Associates	678-366-9375
William Dial, PE	Construction	StreetSmarts	770-813-0882

Project Description:

The project begins just west of West Street and extends east approximately 0.62 miles to where the US 84/W. Hill Avenue one-way pair tapers back into a single five-lane roadway just east of Wells Street. The proposed project will construct a new four-lane W. Hill Avenue overpass section within the current five-lane roadway. The bridge approach sections will have a seven percent grade and will be contained within MSE walls. New one-way frontage roads will be constructed on both sides of the new mainline overpass section to provide local access to businesses and residences. These frontage roads will also provide operational connectivity of the local street system.

The proposed mainline roadway approach sections will consist of four, 12-foot lanes with a center 14-foot two-way left turn lane. The 330-foot long, three span prestressed concrete girder bridge spanning the railroad will have only four, 12-foot lanes and dual 6-foot sidewalks. To minimize the mainline roadway section width, the bridge approach sections will be constructed using MSE walls. The project will also close South Thomas Street and reconstruct it approximately 535 feet to the east. Major contract work items include bridge construction, roadway embankment, bituminous concrete pavement, drainage, retaining walls, concrete side barrier, curb and gutter, and sidewalk. The total estimated project cost including right-of-way (R/W) is $21.8 million.

Project Constraints:

The VE team was given the following constraints:

- VE recommendations could not negatively impact R/W,
- A significant number of historic properties and historic districts are next to the proposed project,
- Traffic control would include a full detour for W. Hill Avenue traffic during construction of the mainline overpass section.

Project Design Briefing:

Prior to beginning work, the VE team was briefed on the design status of the project. The following items were discussed:

- The project consists of the reconstruction of W. Hill Avenue, west of downtown Valdosta.
- The project will separate the mainline roadway from the railroad by constructing a bridge over the Norfolk Southern Railroad tracks. The new mainline section will consist of four lanes with a center turn lane on the approach sections and sidewalks on both sides. The overpass approach sections will be constructed between MSE walls to minimize their overall width.
- The approach sections for the new overpass structure will have a 7% grade.
- The bridge section crossing the railroad will have four lanes and dual sidewalks. This reduced section will reduce project impacts on some properties / buildings.
- Local access will be provided through the construction of one-way frontage roads on both sides of the new mainline overpass section. The frontage roads will have 11-foot lanes to minimize R/W impacts.
- The area this project goes through has a lot of historic properties and districts. Two specific historic properties are impacted by this project and the new south side frontage road will be constructed on the Norfolk Southern Railroad property which has also been designated as historic.
- The project has an estimated construction cost of $11.6 million and R/W cost of $7.6 million.
- The State District Office indicates a preference for a full road closure (full detour) to construct the mainline overpass section in order to minimize the time needed to construct this phase. The detour would be approximately five miles in length.
- The State District Office indicates it would also consider the use of an Incentive / Disincentive type contract to expedite construction.
- Construction staging and traffic control will be complicated due to the work around / over an active railroad.
- Finding a location for the contractor to use as a work / storage area will be difficult. It is possible there is enough space in the turn-around area between the one-way pair on the east side of the project. Another possibility it to buy the entire furniture store property on the west side of the railroad tracks.
- The Draft Environmental Assessment is scheduled to be completed by the end of March. Construction is scheduled to start in 2012.

Project Sketch Map

Project Location: West Hill Avenue Railroad Crossing; West of Downtown Valdosta

VE RECOMMENDATIONS

DEVELOPMENT AND RECOMMENDATION PHASE

SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

IDEA No.:	**Sheet No.:**	**CREATIVE IDEA:** Eliminate the sidewalk on the south side of the W. Hill Avenue mainline roadway through the elevated section.
A-4	1 of 4	

Comp By: A.W. Date: 3/10/09 Checked By: K.B. Date: 3/16/2009

Original Concept: The current design proposes to construct a concrete sidewalk on both sides of the W. Hill Avenue railroad overpass structure and its approach embankments. The approach embankments have a seven percent grade and will be constructed between MSE retaining walls in the center of the existing five-lane roadway. One lane, one-way frontage roads will be constructed on the outside of the new mainline overpass section.

Proposed Change:

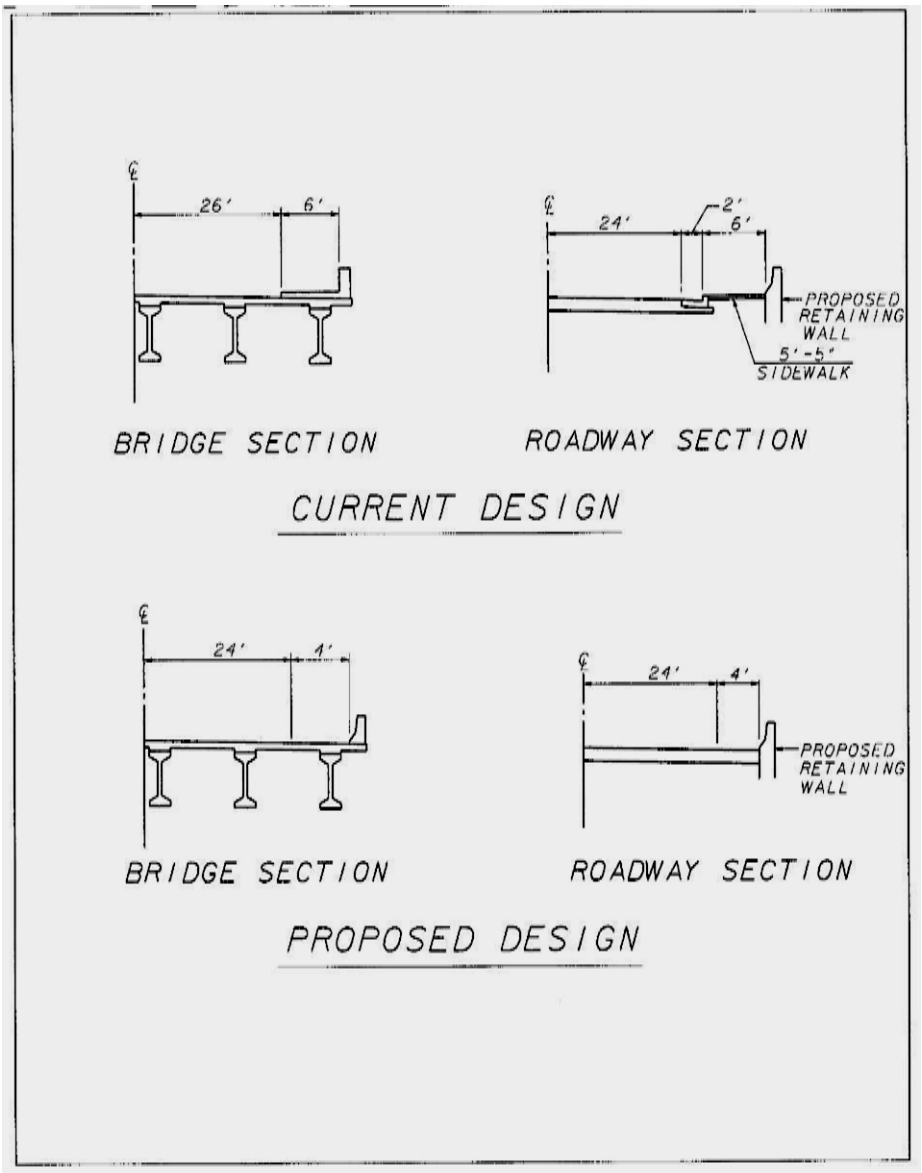
It is recommended that only a single sidewalk be constructed on the north side of the W. Hill Avenue mainline overpass section. The single sidewalk would start at Station 14+70 (near West Street) and end near Station 29+00 (at the gore for the start of the new north frontage road).

Justification: Eliminating the sidewalk on one side would reduce the overall width of the W. Hill Avenue mainline roadway and bridge typical sections. This concept would eliminate 1,100 feet of sidewalk and curb & gutter from the mainline overpass embankment and 330 feet of sidewalk from the bridge. This concept would save four feet of R/W and reduce the project's impact on the various historical properties along the project.

A single sidewalk will adequately accommodate pedestrian traffic along the elevated overpass section of W. Hill Avenue. The steep seven percent grades on the overpass section will discourage pedestrian traffic since additional sidewalks will be constructed along the north and south frontage roads and provide additional pedestrian access in the area.

LIFE CYCLE COST SUMMARY	**CAPITAL COST**	**FUTURE COST**	**TOTAL COST**
INITIAL COST: - Original	$262,000		
- Proposed	$16,000		
- Savings	$246,000		$246,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$246,000**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: A-4 Client: GDOT Sheet 2 of 4



COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: A-4 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design							
5-Foot Concrete Sidewalk (5 x 1,100) / 9 = 612 SY	SY	612	$33.09	$20,251.08	0		$0
Concrete Curb & Gutter	LF	1,100	$16.09	$17,699.00	0		$0
Embankment	CY	1,963	$5.00	$9,815.00	0		$0
R/W 5 x 1,430 = 7,150 SF	SF	7,150	$6.20	$44,330.00	0		$0
Bridge Reduction 4 x 330 = 1,320 SF	SF	1,320	$105.00	$138,600.00	0		$0
VE Design							
12.5 mm Superpave	TON	0		$0	21	$71.91	$1,510.11
19 mm Superpave	TON	0		$0	54	$76.00	$4,104.00
25 mm Superpave	TON	0		$0	81	$61.97	$5,019.57
8" Graded Aggregate Base	SY	0		$0	245	$15.02	$3,679.90
SUBTOTAL				$230,695.08			$14,313.58
MARK-UP (13.57%)				$31,305.32			$1,942.35
TOTAL				$262,000.40			$16,255.93
TOTAL ROUNDED				**$262,000.00**			**$16,000.00**

CALCULATIONS	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: A-4 Client: GDOT Sheet 4 of 4

Embankment:

½ x (25 ft x 530 ft) x 2 x 4 ft / 27 = 1,962.96 CY Say 1,963 CY

Pavement & Base:

2-Foot Strip Area: (2 ft x 1,100 ft) / 9 = 244.44 Say 245 SY

12.5 mm 245 SY x 165 #/SY / 2,000 #/Ton = 20.21 Say 21 Tons
19 mm 245 SY x 110 #/SY x 4 / 2,000 #/Ton = 53.9 Say 54 Tons
25 mm 245 SY x 110 #/SY x 6 / 2,000 #/Ton= 80.85 Say 81 Tons

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: A-6	**Sheet No.:** 1 of 4	**CREATIVE IDEA:** Delete right turn lane from westbound W. Hill Avenue to northbound West Street.
Comp By: A.W. Date: 03/11/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design will add a right turn lane along westbound W. Hill Avenue to northbound West Street.

Proposed Change:

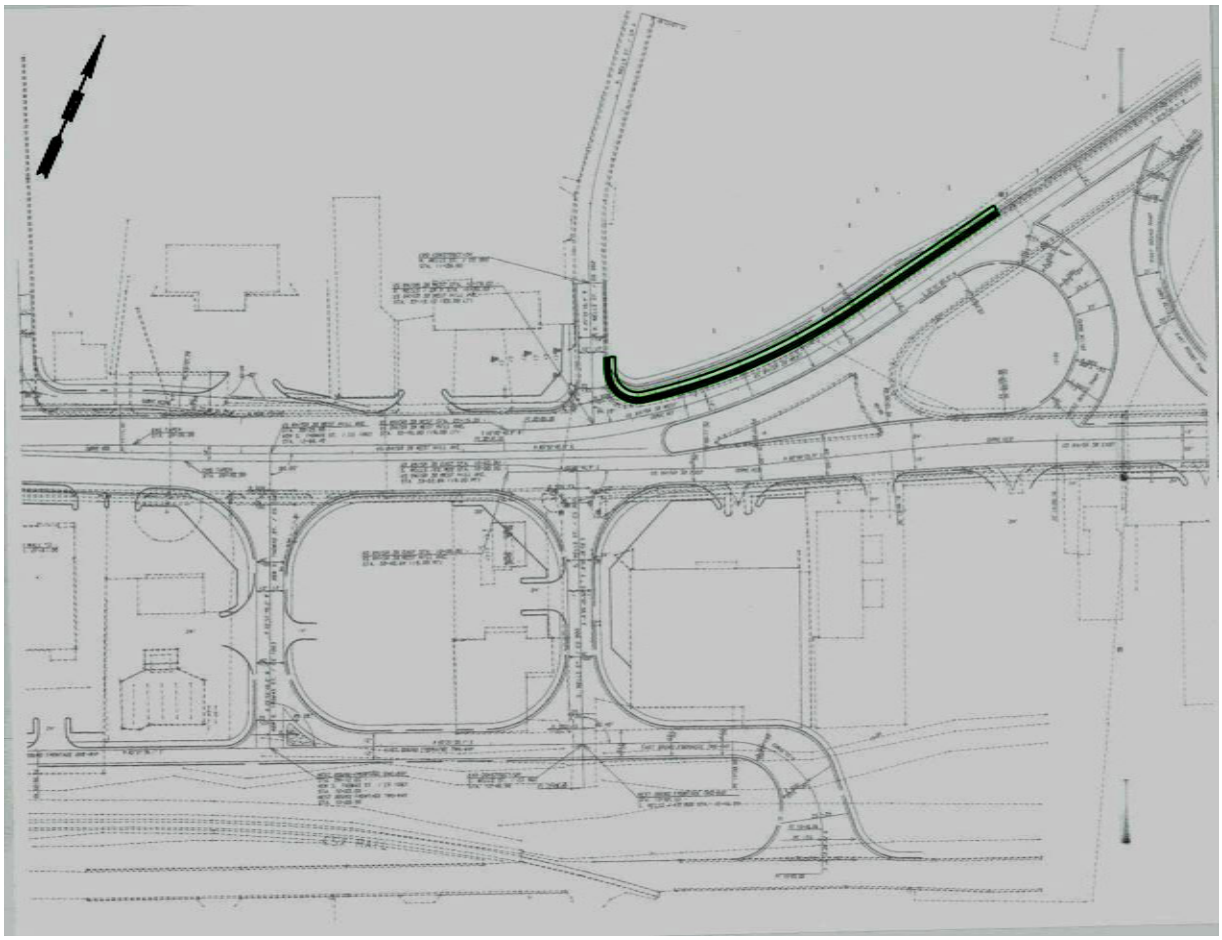
It is recommended that the proposed right turn lane into West Street be eliminated.

Justification:

The right turn lane is not needed because the design speed for westbound W. Hill Avenue is relatively slow at 35 mph and the right turn demand is very low. In addition, eliminating the right turn lane would reduce the amount of required R/W necessary for the construction of the project.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$60,500		
- Proposed	$0		
- Savings	$60,500		$60,500
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$60,500**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: A-6 Client: GDOT Sheet 2 of 4



<u>Recommended Alignment</u>

Eliminate Right Turn Lane

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: A-6 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Right-of-Way	SF	4,200	$6.20	$26,040	0		$0
12.5 mm Superpave	TON	38	$71.91	$2,733	0		$0
19 mm Superpave	TON	103	$76.00	$7,828	0		$0
25 mm Superpave	TON	155	$61.97	$9,605	0		$0
8” Graded Aggregate Base	SY	470	$15.02	$7,059	0		$0
SUBTOTAL				$53,265			$0
MARK-UP (13.57%)				$7,228			$0
TOTAL				$60,493			$0
TOTAL ROUNDED				**$60,500**			**$0**

CALCULATIONS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: A-6 Client: GDOT Sheet 4 of 4

Pavement and Right-of-Way Area:

300' x 12' = 3,600 SF
100 x (12+0/2) = 600

Total 4200 SF / 9 SF / SY = 467 SY USE 470 SY

Reduced area of asphalt:

12. 5 mm = 470 SY x 165 LB / SY / 2,000 LB / TON = 38 Tons
19 mm = 470 SY x 440 LB / SY / 2,000 LB / TON = 103 Tons
25 mm = 470 SY x 660 LB / SY / 2,000 LB / TON = 155 Tons
8" Graded Aggregate Base = 470 SY

Assume right-of-way is commercial.

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: C-1	**Sheet No.:** 1 of 4	**CREATIVE IDEA:** **Option 1** Use 60-inch Steel beams in-lieu-of BT-63 prestressed concrete beams to construct the W. Hill Avenue overpass structure.
Comp By: A.S. Date: 3/10/09 Checked By: K.B. Date:		

Original Concept:

The current design proposes to construct a 330-foot long three-span prestressed concrete bridge to carry W. Hill Avenue over the Norfolk Southern railroad tracks. The proposed structure will use BT-63 prestressed concrete beams for the superstructure.

Proposed Change:

It is recommended that the bridge be constructed using 60-inch Steel Beams in-lieu-of the BT-63 prestressed concrete beams. This concept would also lengthen the bridge by 105 feet (resulting in a 435-foot long bridge) and reduce the length of the MSE Wall enclosed approach embankments.

Justification:

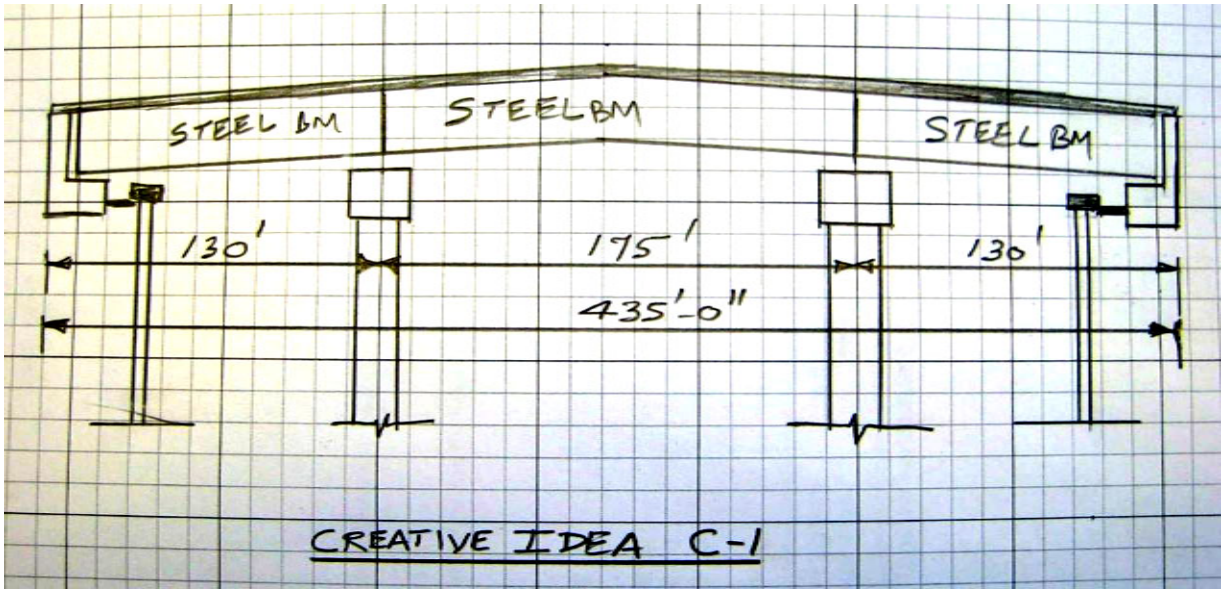
Using a continuous three-span steel beam bridge will reduce / minimize the time needed to set the beams and construct the bridge. Easier construction will reduce construction cost. Reducing the MSE walls / approach embankments height may also reduce costs.

Constructing a longer steel beam bridge will be significantly faster than constructing a large prestressed concrete beam bridge and additional high MSE wall enclosed approaches. This will reduce the time the road needs to be closed for construction. Reducing the road closure time (full detour) will also save traffic staging costs. The erection of a steel structure will be easier and perhaps safer due to the lighter units, although using steel beams could introduce additional long term maintenance costs. The length of the MSE walled approaches will be shortened on each end by 52.5 feet (at their highest point) saving additional time and cost.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$5,536,000		
- Proposed	$5,436,000		
- Savings	$100,000		$100,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$100,000**

SKETCH

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: C-1 Client: GDOT Sheet 2 of 4



COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: C-1 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Current design:							
BT-63 PSC Beams	SF	21,915	$105.00	$2,300,000			
MSE Wall Construction	LS			$2,573,935			
VE Concept:							
60" Steel Beams	SF				28,888	$130.00	$3,755,440
MSE Wall Construction	SF				23,082	$44.67	$1,031,091
NOTE: Assumes the entire road embankments will be built at one time and without shoring							
SUBTOTAL				$4,873,935			$4,786,531
MARK-UP (%)				$661,393			$649,532
TOTAL				$5,535,328			$5,436,063
TOTAL ROUNDED				**$5,535,000**			**$5,436,000**

CALCULATIONS	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: C-1 Client: GDOT Sheet 4 of 4

Original Cost of the BT-63 PSC Beam Bridge:

66.41 ft x 330 ft = 21,915 SF x $105/SF = $2,300,000

Cost of original MSE Walls (Lump Sum) = $2,573,935

Cost of VE proposed <u>longer</u> 60-inch structural steel beam Bridge:

66.41ft x 435 ft = 28,888 SF x $130/SF = $3,755,440

Cost of Wall construction:
1,021.26 ft x 10 ft average x 2 sides = 20,426 SF
Vertical face 66.41 ft x 20 ft x 2 sides = 2,656 SF

Cost of shorter walls: 23,082 SF x $44.67/SF = $1,031,091

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: C-1.1	**Sheet No.:** 1 of 4	**CREATIVE IDEA:** **Option 2** Use smaller BT-54 prestressed concrete beams in-lieu-of larger BT-63 prestressed concrete beams to construct the overpass bridge.
Comp By: A.S. Date: 3/10/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design proposes to construct a 330-foot long three-span prestressed concrete bridge to carry W. Hill Avenue over the Norfolk Southern railroad tracks. The proposed structure will use BT-63 prestressed concrete beams for the superstructure.

Proposed Change:

It is recommended that the bridge be constructed using BT-54 prestressed concrete beams in-lieu-of BT-63 prestressed concrete beams.

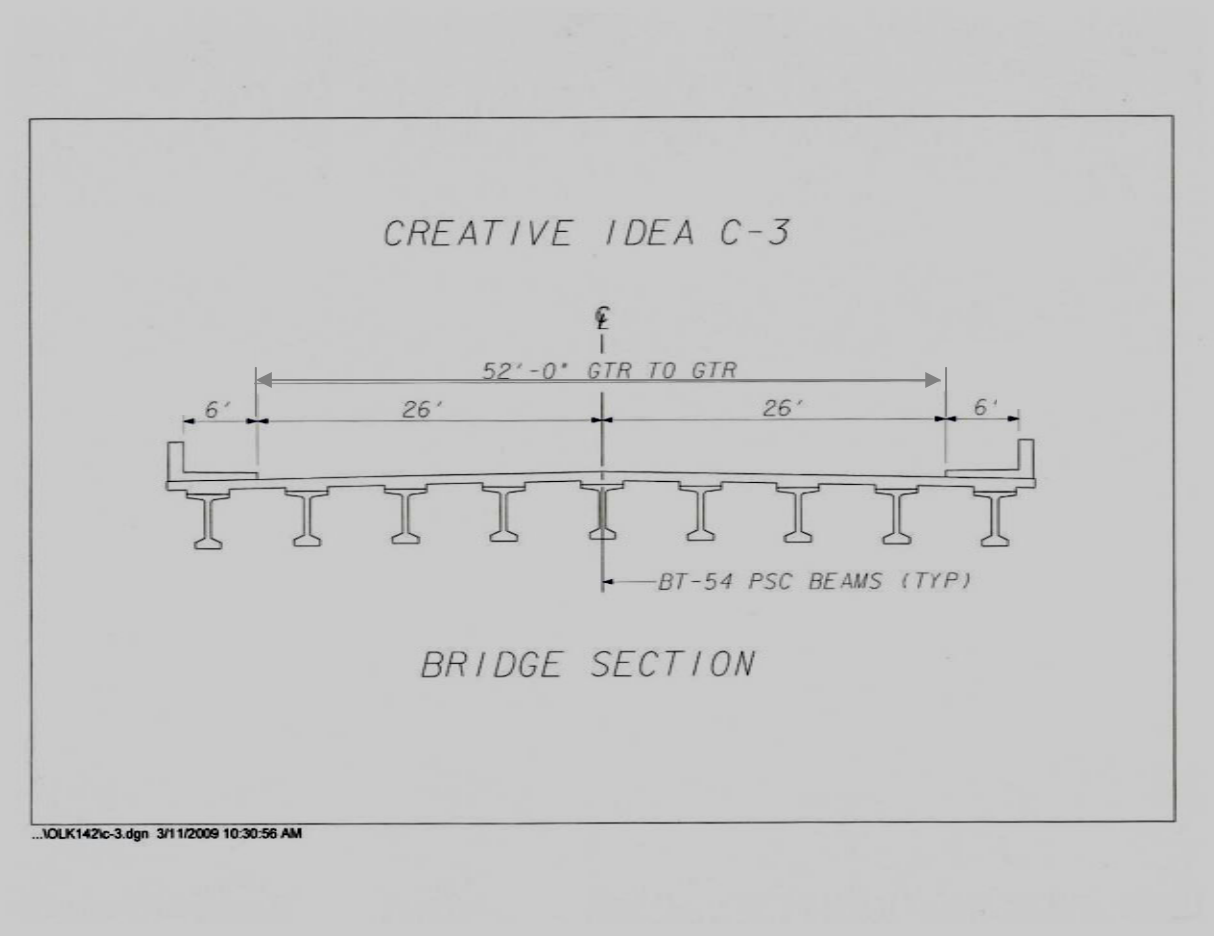
Justification:

The BT-54 prestressed concrete beams have less depth than the BT-63 prestressed concrete beams and will reduce the overall height of the structure. This reduction in beam depth will also result in an overall reduction in the height of the bridge approach sections, the MSE walls supporting the approach sections, and lessen the grade on the approach sections.

Using BT-54 beams will result in a construction cost savings due to a smaller superstructure and less MSE walls due to the reduced height of approach sections. Using the smaller beams will improve handling and speed the erection of the beams over the active railroad tracks.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$2,714,000		
- Proposed	$2,514,000		
- Savings	$200,000		$200,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$200,000**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: C-1.1 Client: GDOT Sheet 2 of 4



Recommended Scheme

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: C-1.1 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Use BT-63 PSC Beams	SF	21,915	$105.00	$2,300,000			
Cost of MSE Walls on approaches	SF	2,000	$44.67	$89,340			
VE Concept:							
Use BT-54 PSC Beams	SF				21,915	$101.00	$2,213,415
(Reduces height of Bridge and Eliminates some MSE walls)							
SUBTOTAL				$2,389,340			$2,213,415
MARK-UP (13.57%)				$324,233			$300,360
TOTAL				$2,713,573			$2,513,775
TOTAL ROUNDED				**$2,714,000**			**$2,514,000**

CALCULATIONS	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: C-1.1 Client: GDOT Sheet 4 of 4

Original Cost of BT-63 PSC Beam Bridge:

66.41 ft x 330 ft' = 21,915 SF x $105/SF = $ 2,300,000

Cost of Walls reduction in height (1 ft) = 2,000 SF x $44.67/SF = $89,340

Cost of Proposed BT-54 PSC Beam Bridge:
66.41 ft x 330 ft = 21,915 SF x $101/SF = $2,213,415

DEVELOPMENT AND RECOMMENDATION PHASE

SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

IDEA No.:	**Sheet No.:**	**CREATIVE IDEA:** Use a thinner pavement section for all frontage roads and side / cross streets in-lieu-of the same pavement design as the W. Hill Avenue mainline.
D-1	1 of 4	

Comp By: A.W. Date: 03/10/09 Checked By: K.B. Date: 3/16/2009

Original Concept: The current pavement design for this project uses the same design for all pavement sections. The mainline, frontage roads, connector roads, and cross streets all have a 19.5-inch full depth asphalt section.

The design calls for:

1.5" of 12.5 mm Superpave
4" of 19 mm Superpave
6" of 25 mm Superpave
8" of Graded Aggregate Base Course

Proposed Change:

It is recommended that a thinner 12.5 inch asphalt section be used on the frontage roads, connector roads, and cross streets. The following pavement section is recommended:

1.5" of 12.5 mm Superpave
2" of 19 mm Superpave
3" of 25 mm Superpave
6" of Graded Aggregate Base Course

Justification:

Traffic projections for the frontage roads, connector roads, and cross streets are significantly lower than the new W. Hill Avenue mainline (which is proposed as a full depth asphalt section). These lower projections allow the required depth of pavement to be less than currently designed.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$455,000		
- Proposed	$160,000		
- Savings	$295,000		$295,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$295,000**

SKETCH

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-1 Client: GDOT Sheet 2 of 4

FLEXIBLE PAVEMENT DESIGN ANALYSIS

Project: STPN0-0007-03(33) **County:** Lowndes
P.I. no.: 422710
Description: SR 38/US 84/W. Hill Ave. Grade Separation at Norfolk Southern RR

Traffic Data (NOTE: AADTs are one-way)
24-hour Truck Percentage: 11.50%
AADT initial year of design period: 900 vpd (2013)
AADT final year of design period: 1,350 vpd (2033)
Mean AADT (one-way): 1,125 vpd

Design Loading

Mean AADT		LDF		Trucks		18-K ESAL		Total Daily Loads
1,125	*	1.00	*	0.115	*	0.51	=	67

Total predicted design period loading = 67 * 20 * 365 = 489,100

Design Data
Terminal Serviceability Index: 2.50
Soil Support: 4.00
Regional Factor: 1.40

PROPOSED FLEXIBLE PAVEMENT STRUCTURE

Material	Thickness Inches	Thickness (mm)	Structural Coefficient	Structural Value
12.5 mm Superpave	1.50	(38)	0.44	0.66
19 mm Superpave	2.00	(51)	0.44	0.88
25 mm Superpave	1.00	(25)	0.44	0.44
	2.00	(51)	0.30	0.60
Graded Aggregate Base	6.00	(152)	0.16	0.96

Required SN = 3.23 Proposed SN = 3.54

>>> Proposed pavement is 9.5% Overdesign <<<

Remarks: Thomas St.

Prepared by Alex Wiley March 9, 2009
Date

Recommended _____
State Road Design Engineer **Date**

Approved _____
State Pavement Engineer **Date**

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: D-1 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
19 mm Superpave	TON	1,300	$76.00	$98,800	0		$0
25 mm Superpave	TON	2,000	$61.97	$123,940	0		$0
8" Graded Aggregate Base	SY	11,800	$15.02	$177,236	0		$0
6" Graded Aggregate Base	SY	0		$0	11,800	$11.85	$139,830
SUBTOTAL				$399,976			$139,830
MARK-UP (13.57%)				$54,277			$18,975
TOTAL				$454,253			$158,805
TOTAL ROUNDED				**$455,000**			**$160,000**

CALCULATIONS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-1 Client: GDOT Sheet 4 of 4

The new Thomas Street traffic is the heaviest side street traffic along and including the frontage roads. The pavement design is shown above. The following is a comparison of this recommended design and the original pavement design received from Daniel Saba on March 9, 2009 (and noted as prepared by Joshua Taylor).

Pavement areas calculated from CADD file:

West St.	4,820 SF
West side Frontage Road	23,560 SF
East side Frontage Road	54,100 SF
Thomas St.	10,500 SF
S. Wells St.	9,800 SF
N. Wells St.	3,030 SF
Total	105,810 SF / 9 SF/ YD = 11,757 SY Use 11,800 SY

The change in the asphalt design is in 19 mm and 25 mm courses:
Assume Asphalt at 110 LB / SY / 1 Inch for 19 mm and 25 mm courses

19 mm 4" Original vs. 2" Proposed = 2" Diff.
11,800 SY x 110 LB / SY x 2 / 2000LB/ TON = 1,298 Tons Use 1,300 Tons
25 mm 6" Original vs. 3" Proposed = 3" Diff.
11,800 SY x 110 LB / SY x 3 / 2000LB/ TON = 1,947 Tons Use 2,000 Tons

Graded Aggregate Base Course:

8" Original vs. 6" Proposed
11,800 SY

DEVELOPMENT AND RECOMMENDATION PHASE

SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

IDEA No.:	**Sheet No.:**	**CREATIVE IDEA:** Eliminate the New South Thomas Street Connector between W. Hill Avenue and the one way south frontage road.
D-3	1-Of 4	

Comp By: A.W. Date: 3/10/09 Checked By: K.B. Date: 3/16/2009

Original Concept:

The current design includes the construction of a new South Thomas Street connector road between the south frontage road and W. Hill Avenue. This street carries two-way traffic and has two 12-foot lanes. The new Thomas Street connector road is only 200 feet west of the South Wells Street connector road.

Proposed Change:

It is recommended that the new South Thomas Street connector road be eliminated and that all traffic be shifted to South Wells Street.

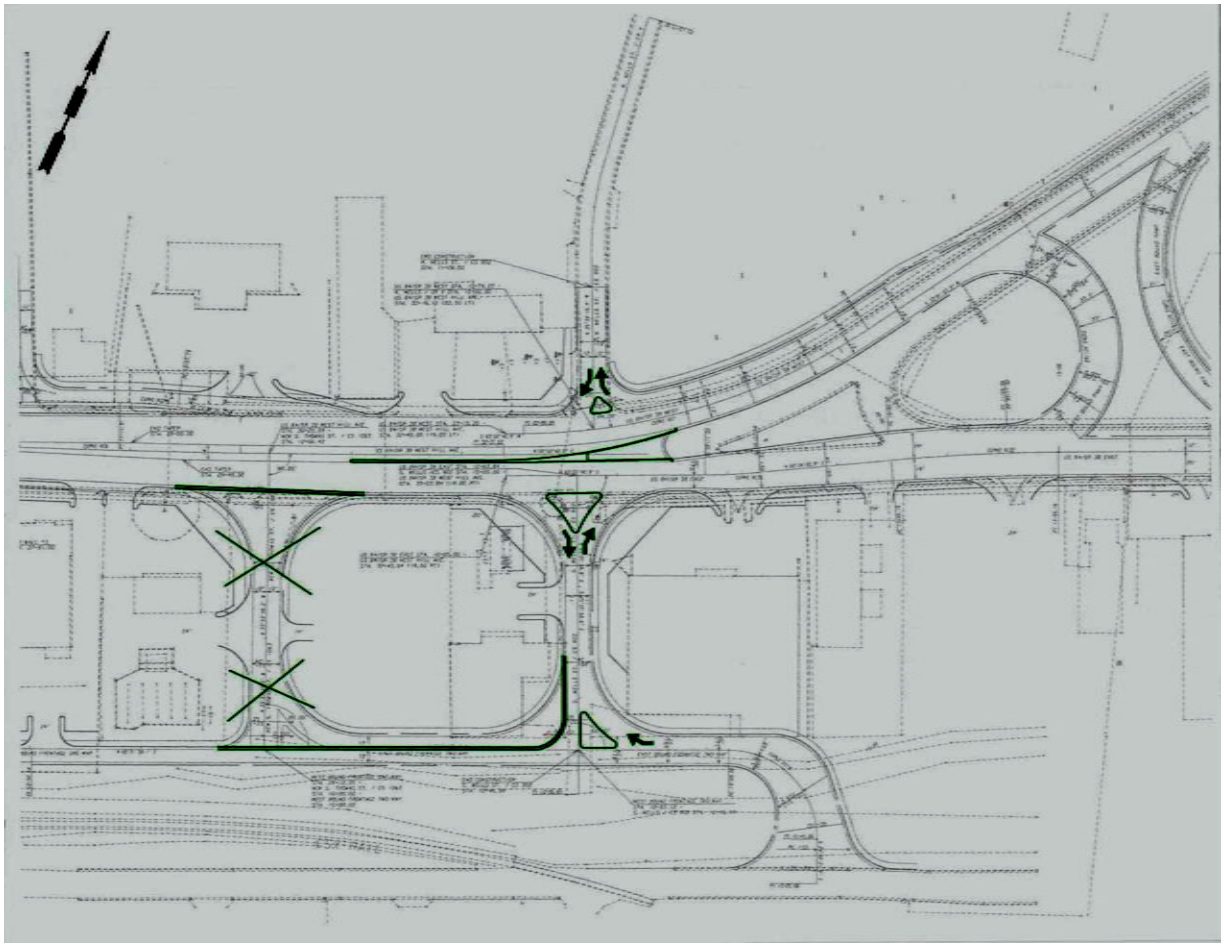
Justification:

The VE concept will provide a shorter more direct two-way connector between the frontage road and W. Hill Avenue. This shorter more direct two-way connection would provide better operational movement through the area. Projected delays for vehicles wishing to turn left at W. Hill Avenue from South Thomas Street approach five minutes in length. Delays of this magnitude increase drive frustration and would likely have a negative impact on safety.

Eliminating this unnecessary connector will reduce costs by reducing pavement, sidewalk, curb & gutter, R/W, and drainage facilities. Access to properties impacted by eliminating this connector can be provided along the south frontage road and/or W. Hill Avenue. Eliminating the Thomas Street connector will reduce the possibility of vehicles crossing W. Hill Avenue and entering the new (directly opposite the proposed Thomas Street / W. Hill Avenue intersection).

LIFE CYCLE COST SUMMARY	**CAPITAL COST**	**FUTURE COST**	**TOTAL COST**
INITIAL COST: - Original	$365,000		
- Proposed	$0		
- Savings	$365,000		$365,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$365,000**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-3 Client: GDOT Sheet 2 of 4



Recommended Alignment

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: D-3 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Current Thomas Street Design:							
Concrete Sidewalk	SY	117	$33.09	$3,871.53	0		$0
Concrete Curb & Gutter	LF	210	$16.09	$3,378.90	0		$0
Man Hole	EA	2	$2,283.47	$4,566.94	0		$0
Catch Basin	EA	5	$2,580.57	$12,902.85	0		$0
Drop Inlets	EA	2	$2,385.97	$4,771.94	0		$0
18” Storm Drain Pipe	LF	32	$18.19	$582.08	0		$0
24” Storm Drain Pipe	LF	547	$43.09	$23,570.23	0		$0
R/W	SF	22,502	$6.20	$139,512.40	0		$0
12.5 mm Superpave	TON	183	$71.91	$13,159.53	0		$0
19 mm Superpave	TON	487	$76.00	$37,012.00	0		$0
25 mm Superpave	TON	730	$61.97	$45,238.10	0		$0
8” Graded Aggregate Base	SY	2,212	$15.02	$33,224.24	0		$0
SUBTOTAL				$321,790.74			$0
MARK-UP (13.57%)				$43,667.00			$0
TOTAL				$365,457.74			$0
TOTAL ROUNDED				**$365,000.00**			**$0**

CALCULATIONS	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-3 Client: GDOT Sheet 4 of 4

Deleted Curb & Gutter:
Remove on Thomas Street: 470 LF
Add to W. Mill Avenue & EB Frontage Road 260 LF
Total Removed 470 LF – 260 LF = 210 LF

Deleted Sidewalk:
Remove on Thomas Street: (470 ft x 5 ft) / 9 = 261.11 SY Say 262 SY
Add to W. Mill Avenue & EB Frontage Road (260 ft x 5 ft) / 9 = 144.44 SY Say 145
Total Removed 262 SY – 145 SY = 117 SY

Deleted Drainage Features:
2 Man Holes
2 Drop Inlets
5 Catch basins
18: Pipe 32 feet
24" Pipe 547 feet

Pavement Area:
Thomas Street 10,500 SF (From CAD Program Calculation)
WB Lane on Frontage Road 12 ft x 200 ft = 2,400 SF
Total Pavement 10,500 + 2,400 = 12,900 SF 19,900 / 9 = 2,211.11 SY Say 2,212 SY
12.5 mm 2,212 SY x 165 #/SY / 2,000 #/Ton = 182.49 Say 183 Tons
19 mm 2,212 SY x 110 #/SY x 4 / 2,000 #/Ton = 486.64 Say 487 Tons
25 mm 2,212 SY x 110 #/SY x 6 / 2,000 #/Ton = 729.96 Say 730 Tons

R/W Area:
60 ft x 224 ft = 13,440 SF
½ x (32 ft x 32 ft) + ½ (60 ft x 60 ft) + ½ (65 ft x 60 ft) + ½ (60 ft x 60 ft) = 6,062 SF
12 ft x 250 ft = 3,000 SF
Total = 13,440 + 6,062 + 3,000 = 22,502 SF

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: D-8	**Sheet No.:** 1 of 4	**CREATIVE IDEA:** Make the Wells Street / W. Hill Avenue intersection right-in and right-out only for both the north and south side of the intersection.
Comp By: A.W. Date: 03/11/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design allows for both right and left turns to and from Wells Street to W. Hill Avenue from both sides of the proposed intersection.

Proposed Change:

It is recommended that the left turns to and from Wells Street be eliminated by extending the median on W. Hill Avenue to the west and by constructing raised islands on Wells Street.

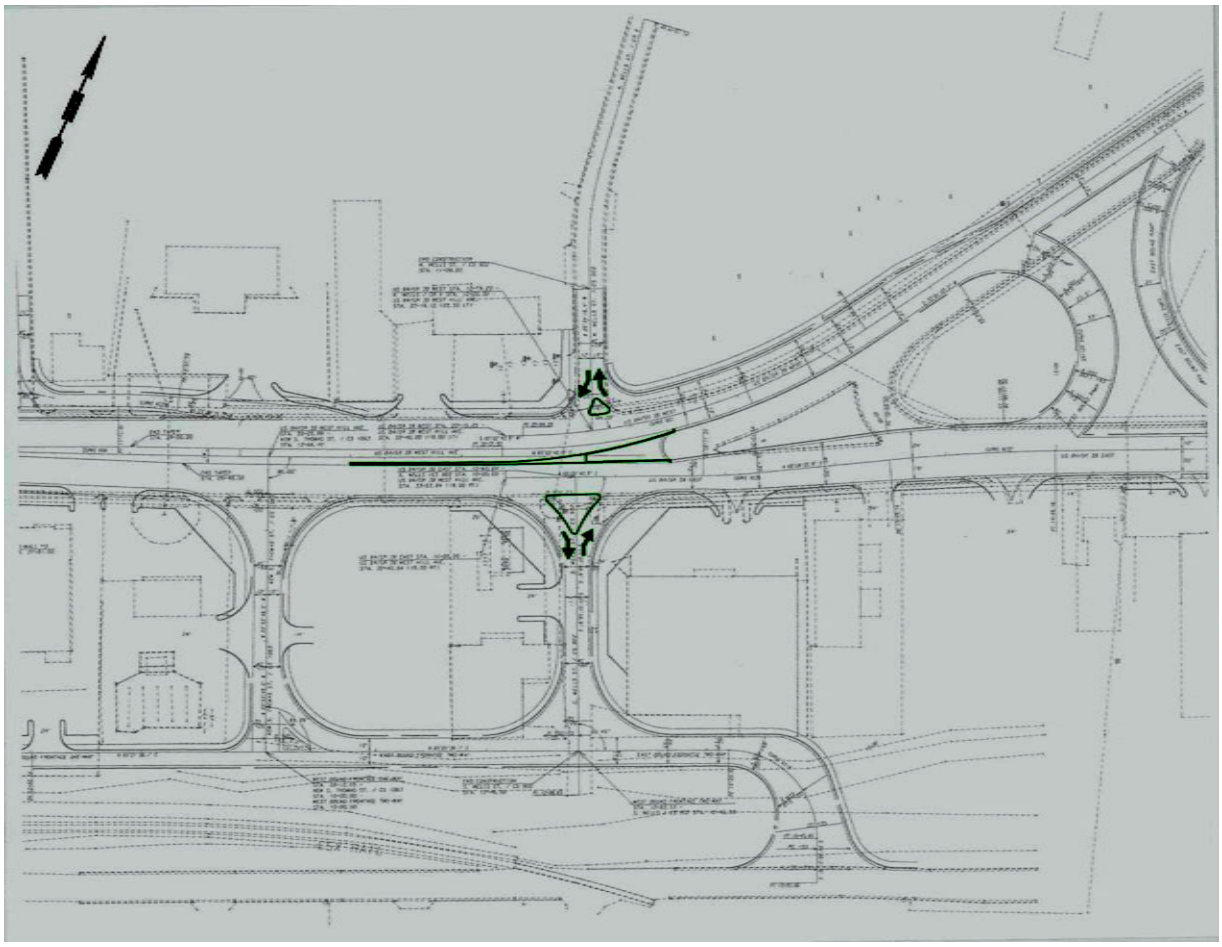
Justification: Eliminating the left turn movements will improve the operational efficiency of the local street system and improve safety. Projected delays to turn left on W. Hill Avenue approach five minutes. The left turn movements at Wells Street involve only a very minor amount of traffic. However, the median width of W. Hill Avenue is extremely wide at the intersection and W. Hill Avenue traffic has different approaches on the east side of the intersection than exists on the left side making site distance more critical.

The construction of the proposed loop turn-around just east of Wells Street will provide for a direct u-turn through the split W. Hill Avenue crossover and improve safety. Instead of turning left at W. Hill Avenue to go westbound, the vehicle would turn right, move to the left, and then make a u-turn through the crossover to go west. Left turning traffic from southbound West Street to eastbound W. Hill Street would turn right, move to the left, and turn left at Thomas St. and come back around.

Note: This change is also recommended if the new South Thomas Street is eliminated.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$9,000		
- Proposed	$16,000		
- Savings	($7,000)		($7,000)
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**(7,000)**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-8 Client: GDOT Sheet 2 of 4



Recommended Alignment

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: D-8 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
6" Concrete Island	SY				200	$58.00	$11,600
6" Concrete Header Curb	LF				160	$14.00	$2,240
12.5 mm Superpave	TON	26	$71.91	$1,870			
19 mm Superpave	TON	25	$76.00	$1,900			
25 mm Superpave	TON	38	$61.97	$2,355			
8" Graded Aggregate Base	SY	115	$15.02	$1,727			
SUBTOTAL				$7,852			$13,840
MARK-UP (13.57 %)				$1,066			$1,878
TOTAL				$8,918			$15,718
TOTAL ROUNDED				$9,000			$16,000

CALCULATIONS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-8 Client: GDOT Sheet 4 of 4

6" Concrete Islands (areas from MicroStation):
Wells St. (South) 940 SF / 9 SF / SY = 104 SY
Wells St. (North) 180 SF / 9 SF / SY = 20

Total 124 SY Use 125 SY

Median
(140' x 2') + [(2'+8'/2) x 75'] = 655 SF / 9 SF / SY = 73 SY Use 75 SY

Additional grassed median area (area from MicroStation): 1010 SF / 9 SF / SY = 112 SY
Use 115 SY

Concrete Header Curb: 160 LF

Reduced area of asphalt:

12. 5 mm = 125 + 75 +115 SY = 315 SY x 165 LB / SY / 2000 LB / TON = 26 Tons
19 mm = 115 SY x 440 LB / SY / 2000 LB / TON = 25 Tons
25 mm = 115 SY x 660 LB / SY / 2000 LB / TON = 38 Tons
8" Graded Aggregate Base = 115 SY

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: D-10	**Sheet No.:** 1 o 5f	**CREATIVE IDEA:** Realign the West Street / W. Hill Avenue intersection to meet at a 90 degree angle and adjust its connection to the north frontage road.
Comp By: W.E.D. Date: 3/11/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design of the West Street / W. Hill Avenue intersection is skewed at an angle of 64.5 degrees. This intersection also contains a jug handle entrance to the proposed westbound frontage road on the south side of W. Hill Avenue.

Proposed Change:

It is recommended that the West Street / W. Hill Avenue intersection be shifted approximately 50 feet east along the alignment of W. Hill Avenue to create a 90 degree intersection.

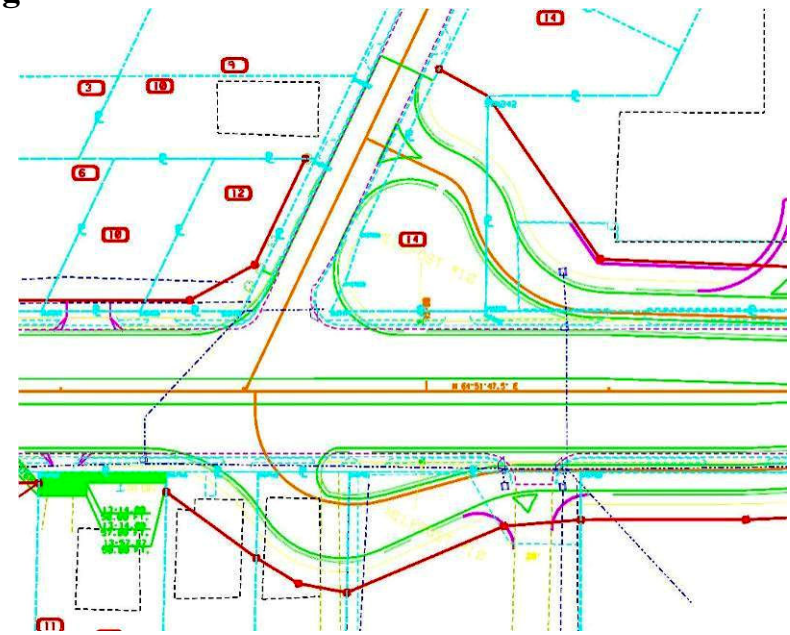
Justification:

The realignment of the West Street / W. Hill Avenue intersection to 90 degrees will create a safer intersection. This change will also significantly reduce the project's impact on several R/W parcels including historical properties. It should eliminate the small take inside the Historic District Parcel 14 and construction will be reduced / limited near historic parcel 11. This change may also save the structure on parcel 13.

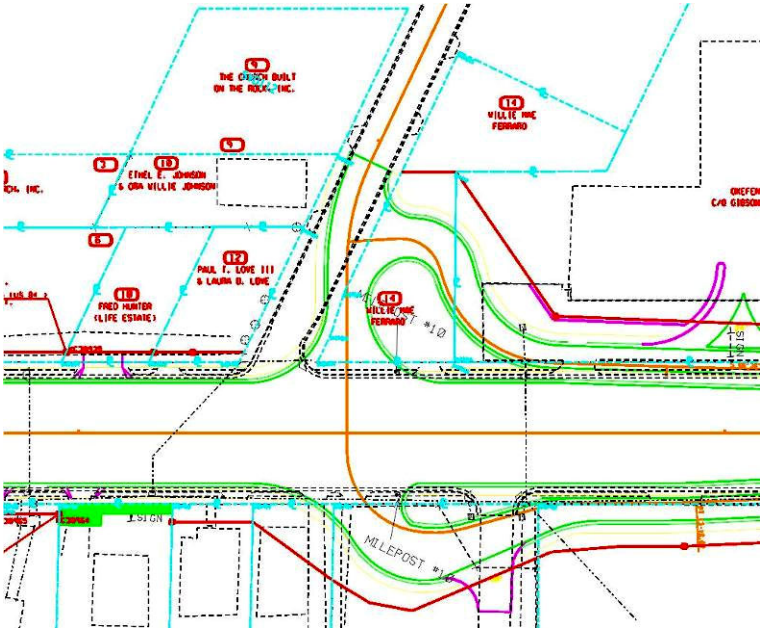
LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$388,000		
- Proposed	$318,000		
- Savings	$70,000		$70,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$70,000**

SKETCH	
Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-10 Client: GDOT Sheet 2 of 5

Original Design



VE Proposal



COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

Idea No.: D-10
Client: GDOT
Sheet 3 of 5

CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design							
12.5 mm Superpave	Tons	137.53	$71.91	$9,889.60	0	0	0
19 mm Superpave	Tons	366.74	$76.00	$27,872.24	0	0	0
25 mm Superpave	Tons	550.11	$61.97	$34,090.32	0	0	0
8” GAB	SY	1667	$15.02	$25,038.34	0	0	0
Curb and Gutter	LF	1128	$16.09	$18,149.52	0	0	0
Sidewalk	SY	274	$33.09	$9,066.66	0	0	0
Right of Way	LS	1	LS	$217,153.00	0	0	0
VE Study							
12.5 mm Superpave	Tons	0	0	0	126.23	$71.91	$9,076.84
19 mm Superpave	Tons	0	0	0	336.6	$76.00	$25,581.60
25 mm Superpave	Tons	0	0	0	504.9	$61.97	$31,288.65
8” GAB	SY	0	0	0	1530	$15.02	$2,2980.6
Curb and Gutter	LF	0	0	0	1003	$16.09	$16,138.27
Sidewalk	SY	0	0	0	250	$33.09	$8,272.5
Right of Way	LS	0	0	0	1	LS	$166,861.00
SUBTOTAL				$341,259.68			$280,199.46
MARK-UP (13.57%)				$46,308.94			$38,023.07
TOTAL				$387,568.62			$318,222.53
TOTAL ROUNDED				**$388,000.00**			**$318,000.00**

CALCULATIONS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

Idea No.: D-10
Client: GDOT
Sheet 4 of 5

Right of Way

Parcel #	Original(sf)	Proposed(sf)	Difference(sf)	comment
12	1020	337	-683	
13	1450	550	-900	saves structure ($40,000 cost)
14	7320	7072	-248	removes take from Historic District
15	2952	1450	-1502	
16	5216	6776	1560	
18	10615	10728	113	
Total	28573	26913	-1660	

Right of Way Cost

Parcel #	Original($)	Proposed($)	Difference($)	comment
12	$6,324	$2,089	-$4,235	
13	$48,990	$3,410	-$45,580	saves structure ($40,000 cost)
14	$45,384	$43,846	-$1,538	removes take from Historic District
15	$18,302	$8,990	-$9,312	
16	$32,339	$42,011	$9,672	
18	$65,813	$66,514	$701	
Total	$177,153	$166,861	-$50,292	

Pavement

		Area			Weight (tons)	
Material	Units	Original (sy)	Proposed (sy)	unit weight (#/sy)	Original	Proposed
12.5 mm	tons	1667	1530	165	137.5275	126.225
19 mm	tons	1667	1530	440	366.74	336.6
25 mm	tons	1667	1530	660	550.11	504.9
GAB	sy	1667	1530	na	na	na

CALCULATIONS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR	Idea No.: D-10 Client: GDOT Sheet 5 of 5

Curb and Gutter

Original	lf	1128
Proposed	lf	1003

Sidewalks

Original	sy	2464
Proposed	sy	2248

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: J-1	**Sheet No.:** 1 of 2	**CREATIVE IDEA:** Increase the inlet spacing on the new W. Mill Avenue overpass approaches and combine the storm drains into a single trunk line.
Comp By: W.E.D. Date: 3/10/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design proposed to use dual trunk lines on the W. Hill Avenue bridge approach sections with inlets spaced a maximum distance of 265 feet apart (average spacing of 200 feet).

Proposed Change:

It is recommended that the dual trunk lines through the steep approach section be eliminated and that the inlets on the north side of the roadway be removed. It is further recommended that the inlet spacing be increased.

Justification:

The approach sections have seven percent longitudinal slopes and using a single trunk line with increased inlet spacing should have no effect on gutter spread. The following changes should be made:

Eliminate the dual trunk lines and remove inlets on the north side of the roadway. Eliminate structure B-2 and the associated piping from B-1 to B-2 and from B-2 to B-3. Add piping from B-3 to E-1. Eliminate structure I-2 and the associated piping from I-1 to I-2 and from I-2 to I-3. Add piping from structure I-1 to H-1. Eliminate piping from I-3 to I-4 and I-4 to H-4. Add piping from I-3 to H-3 and I-4 to L-10.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$134,000		
- Proposed	$94,000		
- Savings	$40,000		$40,000
FUTURE COST: – Savings			$0
TOTAL PRESENT WORTH SAVINGS			**$40,000**

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: J-1 Client: GDOT Sheet 2 of 2		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Existing Concept:							
18" Storm Drain	LF	2,317	$35.19	$81,535.23			
Catch Basin, GP1	EA	14	$2,580.57	$36,127.98			
(Quantity Take-offs from 30% Plans)							
VE Concept:							
18" Storm Drain	LF				1,575	$35.19	$55,424.25
Catch Basin, GP1	EA				12	$2,580.57	$30,966.84
SUBTOTAL				$117,663.21			$82,449.81
MARK-UP (13.57%)				$15,966.90			$11,188.44
TOTAL				$133,630.11			$93,638.25
TOTAL ROUNDED				**$134,000.00**			**$94,000.00**

DEVELOPMENT AND RECOMMENDATION PHASE		
SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR		
IDEA No.: J-1.1	**Sheet No.:** 1 of 2	**CREATIVE IDEA:** **Alternative Idea to J-1** Combine the storm drains on the W. Hill Avenue overpass approaches into a single trunk line with original inlet spacing.
Comp By: W.E.D. Date: 3/10/09 Checked By: K.B. Date: 3/16/2009		

Original Concept:

The current design proposed to use dual trunk lines on the W. Hill Avenue bridge approach sections with inlets spaced a maximum distance of 265 feet apart.

Proposed Change:

It is recommended that the dual trunk lines through the steep approach section be eliminated and that the inlets on the north side of the roadway be removed. This would require the following changes:

Eliminate piping from B-1 to B-2 and from B-2 to B-3. Add piping from B-1 to E-1 and B-2 to E-2.

Eliminate piping from I-1 to I-2, I-2 to I-3 and I-3 to I-4. Add piping from structure I-1 to H-1, I-2 to H-2, and I-3 to H-3.

Eliminate piping from I-4 to H-4. Add piping from and I-4 to L-10.

Justification:

The approach sections have seven percent longitudinal slopes and using a single trunk line with increased inlet spacing should have no effect on gutter spread. With single stage construction dual trunk lines are not needed.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$93,000		
- Proposed	$63,000		
- Savings	$30,000		$30,000
FUTURE COST: – Savings			
TOTAL PRESENT WORTH SAVINGS			**$30,000**

COST WORKSHEET

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR					Idea No.: H-1 Client: GDOT Sheet 2 of 2		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Existing Concept:							
18" Storm Drain	LF	2,317	$35.19	$81,535.23			
(Quantity Take-offs from 30% Plans)							
VE Concept:							
18" Storm Drain	LF				1,575	$35.19	$55,424.25
SUBTOTAL				$81,535.23			$55,424.25
MARK-UP (13.57%)				$11,064.33			$7,521.07
TOTAL				$92,599.56			$62,945.32
TOTAL ROUNDED				**$93,000.00**			**$63,000.00**

APPENDIX

Sources

Approving/Authorizing Persons

Name:	Position:	Telephone:
Ron Wishon	GDOT – Engineering Services, Acting Project Review Engineer	404-631-1753
Tim Matthews	Project Designer – Road Design	404-631-1552

Personal Contacts

Name:	Telephone:	Notes:
Daniel Sabia	404-631-1550	Called to get traffic counts at the various intersections.
Daniel Sabia	404-631-1550	Get copy of the pavement design for the project.
Daniel Sabia	404-631-1550	Called to obtain earthwork quantity for the W. Hill Avenue overpass embankments

Documents/Abstracts

Reference:	Reference:
Engineer's Cost Estimate	Preliminary Pavement Design
R/W Cost Estimate	Preliminary Design Report
30% Plans	CAD Design Program
100 Scale Plan Layout	
Cross Sections	
Traffic Analysis	

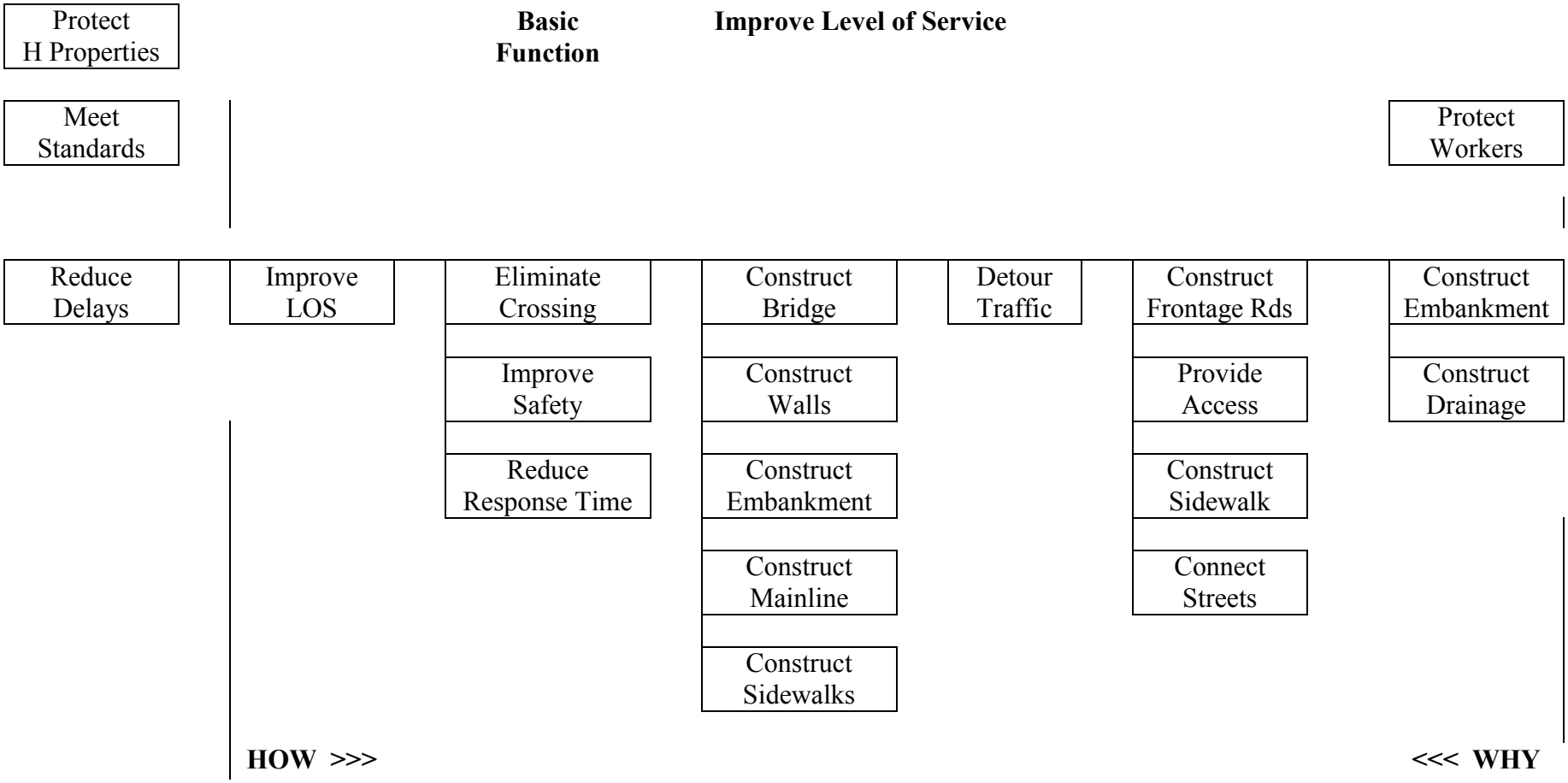
SR 38/US 84/W. Hill Avenue Grade Separation
@ Norfolk Southern Rail Road
Cost Model / Distribution

Item	Description	$ Amount	% of Total Project
A	Right of Way	$7,618,000	39.7%
B	Retaining Walls	$2,574,000	13.4%
C	Bridge	$2,300,000	12.0%
D	Bituminous Pavement	$1,641,000	8.5%
E	Grading Complete	$1,000,000	5.2%
F	Aggregate Base Course	$582,000	3.0%
	80% Line		
G	Miscellaneous	$544,000	2.8%
H	Storm Drain Pipe	$540,000	2.8%
I	Temp/Perm Erosion Control	$415,000	2.2%
J	Catch Basins, Drop Inlets, Manholes	$396,000	2.1%
K	Concrete Curb & Gutter	$263,000	1.4%
L	Temporary Drainage Complete	$250,000	1.3%
M	Temporary Barrier	$217,000	1.1%
N	Signing & Marking	$200,000	1.0%
O	Concrete Sidewalk	$200,000	1.0%
P	Bituminous Leveling Course	$175,000	0.9%
Q	Concrete Side Barrier	$154,000	0.8%
R	Traffic Control	$124,000	0.6%
	Sub Total	**$19,193,000**	**99.8%**
*	Engineering & Inspection	$579,000	
*	Construction Contingency	$579,000	
*	Fuel Adjustment	$378,000	
*	Liquid AC Adjustment	$980,000	
*	Utilities	$88,000	
	Project Grand Total	**$21,797,000**	
	Note: The sum of the five asterisked items above will be used as the Mark-Up percentage in the Recommendation Cost Worksheets.		

FAST DIAGRAM

Study — **Project Name**: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR

Basic Function — **Improve Level of Service**



INFORMATION PHASE – FUNCTION ANALYSIS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR
Function: Improve Level of Service

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
A	**Right of Way**	Store	Project	$7,618,000	39.7%	Yes
		Provide	Staging			
		Accommodate	Frontage Roads			
		Provide	Access			
B	**Retaining Walls**	Raise	Grade	$2,574,000	13.4%	Yes
		Minimize	R/W			
		Support	Roadway			
		Preserve	Hist. Property			
		Separate	Roadways			
C	**Bridge**	Cross	Railroad	$2,300,000	12.0%	Yes
		Eliminate	Access			
		Eliminate	RR Crossing			
		Accommodate	Sidewalks			
		Provide	FR Circulation			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR
Function: Improve Level of Service

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
D	**Bituminous Pavement**	Provide	Surface	$1,641,000	8.5%	Yes
		Support	Load			
		Carry	Traffic			
		Provide	Access			
E	**Grading Complete**	Construct	Roadway	$1,000,000	5.2%	Yes
		Construct	Frontage Rds			
		Construct	Embankment			
F	**Aggregate Base Course**	Support	Pavement	$582,000	3.0%	Yes
		Achieve	Str. Number			
G	**Miscellaneous**	Construct	Project	$544,000	2.8%	No
H	**Storm Drainage Pipe**	Drain	Pavement	$540,000	2.8%	Yes
		Remove	Water			
		Transfer	Water			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR
Function: Improve Level of Service

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
I	**Temp/Perm Erosion Control**	Control	Sediment	$415,000	2.2%	No
		Protect	Area			
J	**Catch Basins/Drop Inlets/Manholes**	Catch	Water	$396,000	2.1%	Yes
		Drain	Pavement			
		Trap	Water			
K	**Concrete Curb & Gutter**	Channel	Water	$263,000	1.4%	Yes
		Channel	Traffic			
		Protect	Pedestrians			
		Minimize	Earthwork			
		Reduce	R/W			
L	**Temporary Drainage Complete**	Facilitate	Construction	$250,000	1.3%	Yes
		Facilitate	Staging			
M	**Temporary Barrier**	Facilitate	Staging	$217,000	1.1%	No
		Improve	Safety			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: SR 38/US 84/W. Hill Avenue Grade Separation @ Norfolk Southern RR
Function: Improve Level of Service

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
N	**Signing and Markings**	Separate	Traffic	$200,000	1.0%	No
		Direct	Traffic			
		Advise	Motorists			
O	**Concrete Sidewalk**	Provide	Access	$200,000	1.0%	Yes
		Carry	People			
		Widen	Bridge			
P	**Bituminous Leveling Course**	Stage	Project	$175,000	0.9%	Yes
		Match	Pavement			
Q	**Concrete Side Barrier**	Protect	Wall	$154,000	0.8%	Yes
		Redirect	Traffic			
R	**Traffic Control**	Stage	Construction	$124,000	0.6%	Yes
		Protect	Railroad			
		Detour	Traffic			
		Protect	Motorists			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
A	**Right of Way**		
A-1	Eliminate/Reduce the Median Width in Mainline	Reduce R/W / Pavement Costs, Safety Impacts	X
A-2	Eliminate the Sidewalks on the Mainline	Sidewalks Currently Exist on Roadway	X
A-3	Eliminate the Sidewalks on the Frontage Roads	Evaluate Each FR to Determine Sidewalk Need	✓
A-4	Eliminate One Sidewalk on the Mainline	Reduce R/W, Sidewalk, and Embankment	✓
A-5	Eliminate the New South Thomas Street	See Idea D-3	X
A-6	Eliminate the Right Turn Lane at Wells Street	Reduce R/W and Pavement Costs	✓
B	**Retaining Walls**		
B-1	Extend the Length of the Bridge	See Idea C-2	✓
B-2	Use a Decorative Finish on the Walls	State Will Use Ashlar Finish on Walls	X
B-3	Use MSE Walls	Already in Plans	X
B-4	Eliminate Walls Wherever Possible	See Idea C-2	X
B-5	Reduce Wall Height By Reducing Bridge Height	Reduce Bridge, Wall, & Embankment Cost	✓
B-6	Eliminate Center Shoring & Construct Entire Width	Check Cost of Shoring,	✓
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
B-7	Construct Frontage Road First and Use for Local Access and Detour	Not Enough Capacity	X
B-8	Construct Frontage Road Across the Railroad and Use for Partial Traffic Stage with Full Detour for Trucks	Requires Additional Railroad Crossings and Protection. Could Pose Safety Concerns	X
C	**Bridge**		
C-1	Use Steel Girders in-lieu-of Concrete Girders	Quicker Construction, Shallower Depth	✓
C-2	Extend the Length of the Bridge to Shorten Walls	Possible Cost reduction, Lower Height	✓
C-3	Use Smaller Concrete Girders	Reduce Depth of Beam, Lower Structure	✓
C-4	Eliminate the Sidewalk(s) on the Bridge	See Idea A-4	X
C-5	Construct 11-Foot Lanes on the Bridge (mainline)	See Idea D-2	X
C-6	Construct/Paint 4-Foot Median on Bridge and Eliminate one or both sidewalks	Coordinate With Idea A-1 Concept	X
C-7	Construct 11-Foot Lanes on Bridge with 4-Foot Painted Median	Coordinate With Idea D-2	X
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
D	**Bituminous Pavement**		
D-1	Evaluate the Current Pavement Design for the Mainline and Frontage Roads	Reduce Pavement Thickness, Reduce Cost, Accelerate Construction	✓
D-2	Consider the Use of 11-Foot Lanes on the Mainline	Reduce Cost, Safety Impacts with Trucks	X
D-3	Eliminate the New Thomas Street	Reduce R/W, Pavement, Sidewalk Costs	✓
D-4	Evaluate/Revise the Turn Around at the One Way Pair	Reduce Cost and Possibly R/W Needs	✓
D-5	Straighten the Mainline Approach to the One Way Pair	See Idea A-1	X
D-6	Construct a Roundabout at the West End of the One Way Connector	Simplify Traffic Movements Through Area Roundabout would Require Additional R/W	X
D-7	Shift the Mill Avenue Turn Around to the West at the One Way Connector	Reduce Pavement Costs	✓
D-8	Make Both Wells Street Intersections Right-In and Right Out	Improve Safety	✓
D-9	Evaluate Frontage Road Connection to West Street	Combine with Idea D-10	X
D-10	Re-Design West Street Interchange to 90 Degrees	Better Intersection Connection, Eliminate Historic Property Impact	✓
D-11	Consider Constructing a Two Way Frontage Road	Improve Traffic Flow to Local Area	✓
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
E	**Grading Complete**		
E-1	Extend the Length of the Bridge	See Idea C-2	X
E-2	Lower the Bridge Height and Embankment Height	See Idea C-1	X
E-3	Eliminate the New Thomas Street	See Idea D-3	X
E-4	Modify the West End of the One Way Connector	See Ideas D-4, D-6, and D-7	X
E-5	Evaluate/Revise the Westbound Portion of the Hill Avenue Connector	See Ideas D-4, D-6, and D-7	X
F	**Aggregate Base Course**		
F-1	Increase Aggregate Base & Reduce the Asphalt Pav't	Possible Cost Reduction	✓
F-2	Eliminate the New Thomas Street	See Idea D-3	X
F-3	Reduce the Pavement Sections	See Idea D-1	X
H	**Storm Drain Pipe**		
H-1	Use a Single System Within the Retaining Walls	Reduce Cost, Simplify Construction	✓
H-2	Eliminate the Thomas Street Drainage	See Idea D-3	X
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
J	**Catch Basins/Inlets/Manholes**		
J-1	Increase the Inlet Spacing in the Wall Section	Reduce Cost, Simplify Construction	✓
J-2	Use a Single Drainage System in the Wall Section	See Item H-1	X
J-3	Revisit/Revise the Drainage System in the Wall Section	Check Pipe Sizes, Depth Underground, Etc.	DS
K	**Concrete Curb and Gutter**		
K-1	Eliminate Thomas Street	See Idea D-3	X
K-2	Eliminate One or Both Sidewalks on the Mainline	See Idea A-4	X
K-3	Use Header Curb on the High Sides of the Roads	More Expensive than Current C & G Method	X
M	**Temporary Barrier**		
M-1	Evaluate the Amount Needed Based on Different Detour Concepts	Consider as a Design Suggestion Under the Traffic Control Item (R)	DS
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
O	**Concrete Sidewalks**		
O-1	Eliminate One or Both Sidewalks on Mainline within the Wall Section	See Item A-4	X
O-2	Eliminate One or Both Sidewalks on the Frontage Rds	See Item A-3	X
O-3	Eliminate the New Thomas Street	See Item D-3	X
O-4	Eliminate One or Both Sidewalks on the Bridge	See Item A-4	X
P	**Bituminous Leveling Course**		
P-1	Question the Amount Of Leveling Material	Possible Design Suggestion, Cost Reduction	DS
Q	**Concrete Side Barrier**		
Q-1	Reduce the Length of the Walls	See Item C-2	X
R	**Traffic Control**		
R-1	Raise the Cost for this Item to Reflect the Full Detour	Possible Design Suggestion	DS
R-2	To Explore Whether the Frontage Roads Can be Extended Across the Railroad and Serve as a Detour		
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
R-3	Consider Using an Incentive/Disincentive Contract	Accelerate Construction, Reduce Closure Time	DS
R-4	Evaluate Signing, Temp Barrier, Etc. Needed for Road Closure and Full Detour	Assure Adequate Cost in Contract	DS
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			