

VALUE ENGINEERING REPORT

**Busbee – Frey Connector
Cobb County
CCDOT Project No. CO – 400; PI No. 0010157**

February 21, 2012

PROJECT OWNERS:



Cobb County
Department of Transportation
1890 County Services Parkway
Marietta, GA 30008-4014



Georgia Department of Transportation
600 West Peachtree Street
Atlanta, GA 30308

VALUE ENGINEERING CONSULTANT:



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Kennesaw, GA 30144

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EXECUTIVE SUMMARY

Executive Summary

VALUE ENGINEERING STUDY

**Busbee - Frey Connector
Cobb County
CCDOT Project No. CO-400; PI No. 0010157
February 6 - 9, 2012**

Introduction

This report presents the results of a value engineering (VE) study conducted on the proposed design for the construction of the Busbee – Frey Connector in northern Cobb County. The project consists of a new alignment, grade separation over I-75 in northern Cobb County that connects Frey Road to Townpark Lane. The project will also add access slip-ramps to the northern access ramps of the nearby I-75 and Chastain Road interchange. A traffic signal on Frey Road will be relocated to better accommodate the proposed new alignment. Portions of Frey Road and Busbee Drive will also be resurfaced and restriped. The primary purpose of the project is to provide an alternate crossing of I-75 that will relieve traffic and improve operations on Chastain Road at the I-75 interchange.

Major contract work items include structures, roadway paving, embankment, culverts, drainage improvements, sidewalks and curb and gutter. The total estimated project cost is \$14,724,000 and includes \$2,670,000 for right of way. The project was initiated by the Town Center Area Community Improvement District (CID) in conjunction with Cobb County DOT. In order to obtain funding for construction, the project has recently been reassigned through the GDOT Plan Development Process (PDP). The overall schedule is for R/W approval by November 2012 and letting in November 2013. The design is currently past the concept stage, preparing for preliminary plans although the environmental document is not yet approved. A concept team meeting is scheduled in April 2012. The study took place February 6 - 9, 2012, at the Georgia DOT Headquarters in Atlanta using a four-person VE team.

This report presents the 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 contains information about the project and the team. The Recommendations presents a detailed description and support information about each recommendation. 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.

Results Obtained

The VE team focused their efforts on the high cost items of the project. Using function analysis and brain storming techniques, the team generated 41 ideas with 23 identified for additional evaluation as possible recommendations or design considerations. The VE team developed 12

independent recommendations and one alternative recommendation. Implementing all the recommendations is not feasible however implementation of the independent, exclusive recommendations has the potential to reduce the project cost approximately \$5,500,000. A detailed write-up of each recommendation is contained in the respective portion of this report. The following is a summary of the recommendations.

Recommendation Summary

Idea A-1: Reduce the length of the bridge end spans.

In lieu of excessive bridge end spans, reduce both the west and east end spans by 39 and 42 feet respectively.

The total potential savings is \$1,439,000.

Idea A-3: Reduce the bridge sidewalk width from 15 feet to 10 feet.

The additional width sidewalks on the bridge are for potential enhancements and streetscaping that can be accomplished in other, less expensive areas. Reducing the bridge sidewalk width to 10 feet will be consistent with the proposed sidewalk width on the Busbee-Frey Connector.

The total potential savings is \$714,000.

Idea A-8: Use MSE walls to reduce the length of the bridge end spans.

In lieu of excessive bridge end spans, reduce both the west and east end spans by 33 and 36 feet respectively by using MSE walls.

The total potential savings is \$431,000.

Idea C-1: Realign Busbee-Frey Connector

Realign the Busbee-Frey Connector to Busbee Drive and eliminate the Townpark Lane tie-in to the Busbee-Frey Connector extension. This recommendation would eliminate the entire eastern portion of the project and most significantly, the new roadway crossing thorough the existing regional detention pond. It would allow an access driveway as the fourth leg at the intersection for potential development of the northern parcel.

The total potential savings is \$1,960,000.

Idea C-1.1 Alternative to Idea C-1 Eliminate the Townpark Lane tie-in to the Busbee-Frey Connector Extension.

This recommendation maintains the original alignment at the Busbee-Frey Connector and Busbee Drive intersection and eliminates the eastern portion of the project creating a T intersection. This recommendation also eliminates any work in the regional detention pond.

The total potential savings is \$2,060,000.

Idea C-2: Use 11 foot lanes for the Busbee-Frey Connector.

The current proposed plans call for 12 foot lanes on the Busbee-Frey Connector. The existing roadway network in the area is predominantly 11 foot lanes.

The total potential savings is \$362,000

Idea C-3: Reduce the median width from 20 feet to 16 feet on the Busbee-Frey Connector.

A narrower, 16 foot wide raised median provides the same function at a reduced cost.

The total potential savings is \$335,000.

Idea C-4: Use a 5-lane, flush median section for the Busbee-Frey Connector.

This new roadway will not have any development or access on either side eliminating the need for a raised median.

The total potential savings is \$521,900

Idea C-5: Use a 3-lane, flush median section for the Busbee-Frey Connector.

The design year traffic volumes can be accommodated by a 3-lane section.

The total potential savings is \$1,830,000.

Idea C-6: Use a roundabout at the Busbee-Frey Connector and Busbee Drive intersection.

As part of the GDOT PDP process, any signalized intersection is required to have a roundabout analysis and based on GDOT's program, a roundabout performs at an acceptable LOS and reduces construction costs. It would also provide an opportunity for an enhancement of gateway feature.

The total potential savings is \$75,000

Idea C-12: Reduce the pavement thickness.

The current design provides the standard CCDOT pavement thickness assuming 10% truck volumes. A review and a realistic truck percentage can allow a reduced thickness pavement section.

The total potential savings is \$245,000.

Idea F-6: Use fewer culvert cells at the regional detention pond crossing.

The current plans provide for a 6-cell culvert that serves as equalization piping. Both up and downstream conditions control the flow and storage in the RDP and fewer cells will provide the same function at reduced costs.

The total potential savings is \$321,000

Idea M-1: Use standard width 5 foot sidewalks on the Busbee-Frey Connector.

The entire sidewalk network within and outside the project limits are at 5 feet. Consider other alternatives for streetscape enhancements.

The total potential savings is \$1,560,000.

Busbee – Frey Connector
SUMMARY OF POTENTIAL COST SAVINGS

IDEA No.	RECOMMENDATION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS
A-1	Reduce the length of the bridge end spans	\$7,456,000	\$6,017,000	\$1,439,000	N/A	\$1,439,000
A-3	Reduce the bridge sidewalk width from 15 to 10 feet	\$7,456,000	\$6,742,000	\$714,000	N/A	\$714,000
A-8	Use MSE walls at bridge end spans; reduce the length of the bridge.	\$7,456,000	\$7,025,000	\$431,000	N/A	\$431,000
C-1	Realign Busbee-Frey Connector; eliminate eastern portion of project	\$5,740,000	\$3,780,000	\$1,960,000	N/A	\$1,960,000
C-1.1	Alternate to C-1; Eliminate Townpark Lane tie-in to Busbee-Frey Connector extension	\$5,740,000	\$3,680,000	\$2,060,000	N/A	\$2,060,000
C-2	Use 11 foot lanes for Busbe-Frey Connector	\$362,000	0	\$362,000	N/A	\$362,000
C-3	Reduce median width to 16 feet	\$343,000	\$8,000	\$335,000	N/A	\$335,000
C-4	Use 5-lane section for Busbee-Frey Connector	\$577,000	\$55,100	\$521,900	N/A	\$521,900
C-5	Use 3-lane section for Busbee-Frey Connector	\$1,830,000	0	\$1,830,000	N/A	\$1,830,000
C-6	Use a roundabout at the Busbee-Frey Connector / Busbee Drive intersection	\$425,000	\$350,000	\$75,000	N/A	\$75,000
C-12	Reduce pavement thickness	\$990,000	\$745,000	\$245,000	N/A	\$245,000
F-6	Use fewer culvert cells at regional detention pond	\$631,000	\$310,000	\$321,000	N/A	\$321,000

Busbee – Frey Connector
SUMMARY OF POTENTIAL COST SAVINGS

IDEA No.	RECOMMENDATION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS
M-1	Use 5 foot sidewalks on Busbee-Frey Connector	\$1,560,000	0	\$1,560,000	N/A	\$1,560,000

STUDY IDENTIFICATION

Study Identification

Project: Busbee – Frey Connector	Date: February 6 - 9, 2012
Study Location: GDOT General Offices, Atlanta, GA	

VE Team Members

Name:	Title:	Organization:	Telephone:
Peng Zhang, PE	Highway Design	AMEC	770-421-3400
Greg Grant, PE	Structures	RS & H	678-528-7229
Jeff VanDyke, PE	Highway Design	RS & H	678-528-7234
George Obaranec, PE, CVS	VE Team Facilitator	AMEC	770-421-3346

Project Description

This project consists of a new alignment, grade separation over I-75 in northern Cobb County that connects Frey Road to Townpark Lane. The project will also add access slip-ramps to the northern access ramps of the nearby I-75 and Chastain Road interchange. A traffic signal on Frey Road will be relocated to better accommodate the proposed new alignment. Portions of Frey Road and Busbee Drive will also be resurfaced and restriped. The primary purpose of the project is to provide an alternate crossing of I-75 that will relieve traffic and improve operations on Chastain Road at the I-75 interchange.

Major contract work items include structures, roadway paving, embankment, culverts, drainage improvements, sidewalks and curb and gutter. The total estimated project cost is \$14,724,000 and includes \$2,670,000 for right of way. The project was initiated by the Town Center Area Community Improvement District (CID) in conjunction with Cobb County DOT. In order to obtain funding for construction, the project has recently been reassigned through the GDOT Plan Development Process (PDP). The overall schedule is for R/W approval by November 2012 and letting in November 2013. The design is currently past the concept stage, preparing for preliminary plans although the environmental document is not yet approved. A concept team meeting is scheduled in April 2012. The study took place February 6 - 9, 2012, at the Georgia DOT Headquarters in Atlanta using a four-person VE team.

Project Design Briefing

The VE team received a project briefing by Chandria Brown, PE, the GDOT Project Manager and Chris Rideout, PE, Croy Engineering's Project Manager. Mr. Rideout was familiar with the project from its inception and provided the majority of the briefing. The following information and comments were presented:

- This project will connect the east and west sides of a rapidly growing area of the Town Center Area Community Improvement District (CID) and Kennesaw State University (KSU). The primary purpose is to relieve traffic congestion along Chastain Road by providing an alternate crossing.
- There is a project currently under construction for a new I-75 crossing to the south of Chastain Road. The 2 new crossings combined are estimated to relieve the Chastain Road traffic by about 20%. The traffic projections and analysis was developed comprehensively for both projects.
- The CID is responsible for funding the preliminary engineering (PE). CCDOT will acquire the required right of way and the project has recently been assigned through the GDOT PDP for federal funding.
- The slip ramps accessing both northern ramps are an important element of the project as they provide direct and uninterrupted access. They provide additional congestion relief to the interchange and are completely contained within existing right of way.
- The new crossing aligns with a parking deck on the KSU campus. Some realignment and reconstruction at the parking deck access will be required and is included in this project.
- There is a large regional detention pond (RDP) that will be affected by the Connector's extension to Townpark Lane. The area is currently classified as wetlands and will require wetlands mitigation credits and a Section 404 Nationwide permit. The plans provide for a 6-cell concrete box culvert for the road crossing. Bridging was not a viable alternative due to Cobb County's requirement for a no-rise condition.
- The proposed improvements accommodate the future tolling project along the I-75 corridor. That project's improvements are planned for the median.
- The current alignment has been coordinated with the adjacent improvements at the Kaiser Permanente building
- The property to the north of the new Busbee / Frey Connector, east of the interstate is planned for future development. The developer is working through Cobb County for rezoning and permits. The anticipated primary use would be for private student housing. Based on the current layout, there is no convenient access to the new Busbee-Frey Connector.
- KSU and the CID are interested in opportunities for corridor enhancement, landscaping amenities and signature / entryway statements although there are no specific plans at this time. The sidewalks are proposed at 10 feet wide on the Connector and 15 feet wide on the bridge as part of this criterion.

VE RECOMMENDATIONS

DEVELOPMENT AND RECOMMENDATION PHASE

Project: Busbee – Frey Connector

IDEA No.: A-1	Sheet No.: 1 of 7	CREATIVE IDEA: Reduce the length of bridge end spans.
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Comp By: GCG Date: 02-08-12 Checked By: GAO Date: 2-13-12

Original Concept:

The original concept calls for a 476 ft long, four-span, PSC beam bridge carrying the Busbee-Frey Connector over I-75. The bridge spans are 130 ft, 99 ft, 131 ft and 116 ft. The bridge is supported by concrete, multi-column, intermediate bents with spill-through end bents.

Proposed Change:

Reduce the length of the bridge end spans by moving the toe of slope closer to the edge of ramp.

Reduce the end span at Bent 1 by 39 feet (shown in the sketch). New end span = 130 feet – 39 feet = 91 feet. (39 foot reduction)

Reduce the end span at Bent 5 by 42 feet (shown in the sketch). New end span = 116 feet – 42 feet = 74 feet. (42 foot reduction)

Justification:

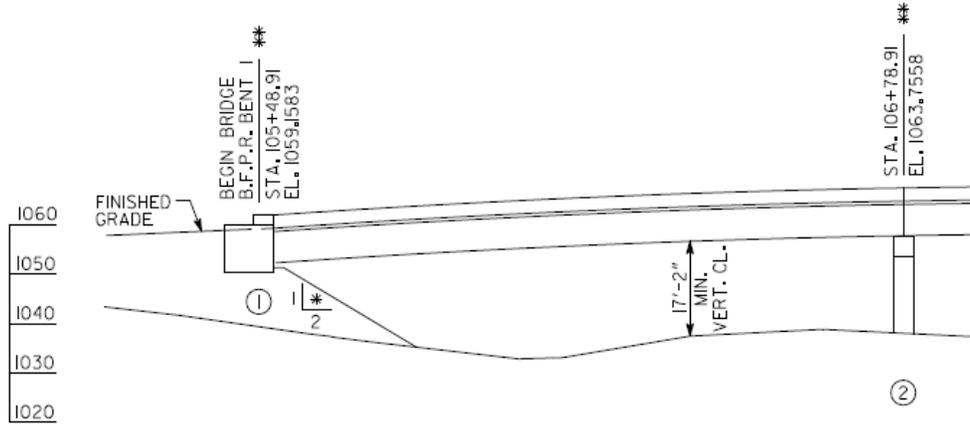
The end spans are extensive and can be shortened while providing the same function. Shortening the end spans reduces bridge costs.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$ 7,456,000		
Proposed	\$ 6,017,000		
Savings	\$ 1,439,000		\$ 1,439,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$ 1,439,000

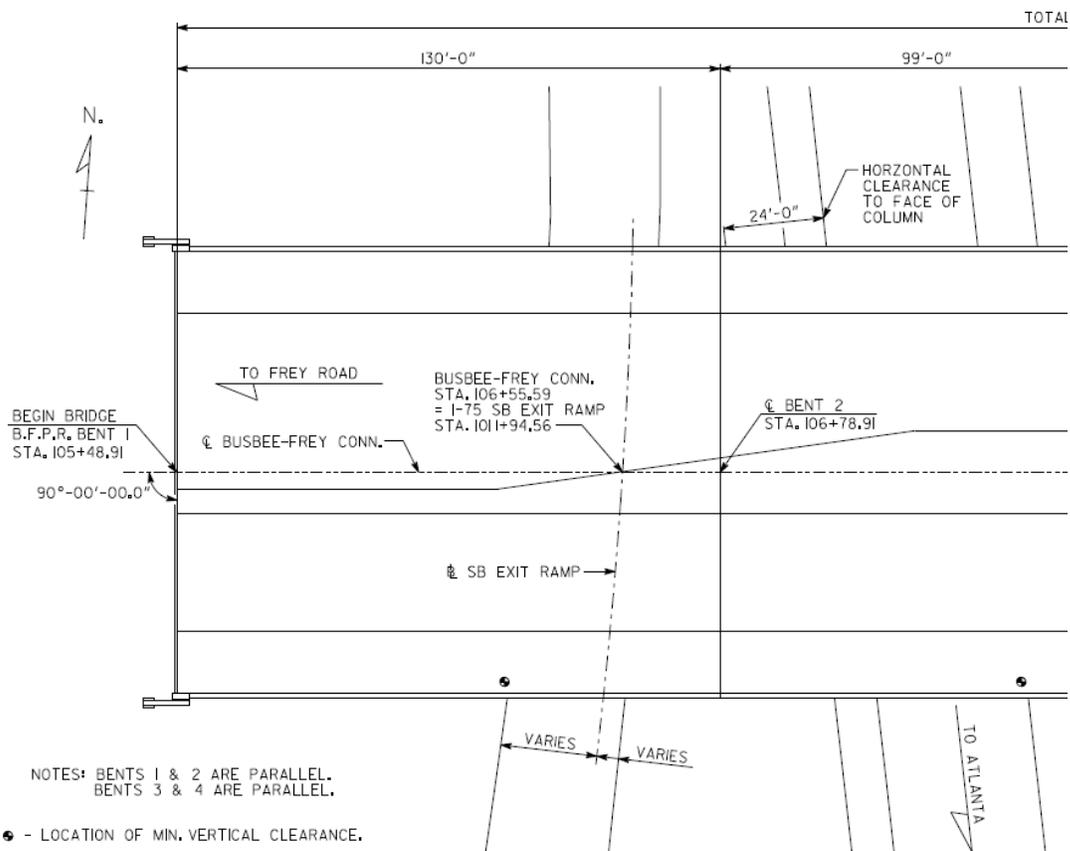
SKETCH

Project: Busbee – Frey Connector

Idea No.: A-1
Client: CCDOT/GDOT
Sheet 2 of 7



Original Concept - ELEVATION VIEW @ BENT 1

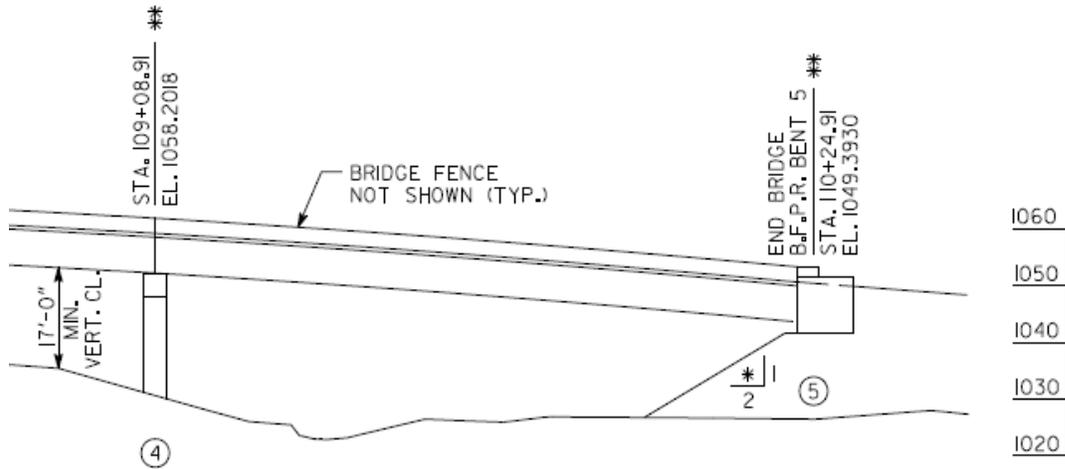


Original Concept - PLAN VIEW @ BENT 1

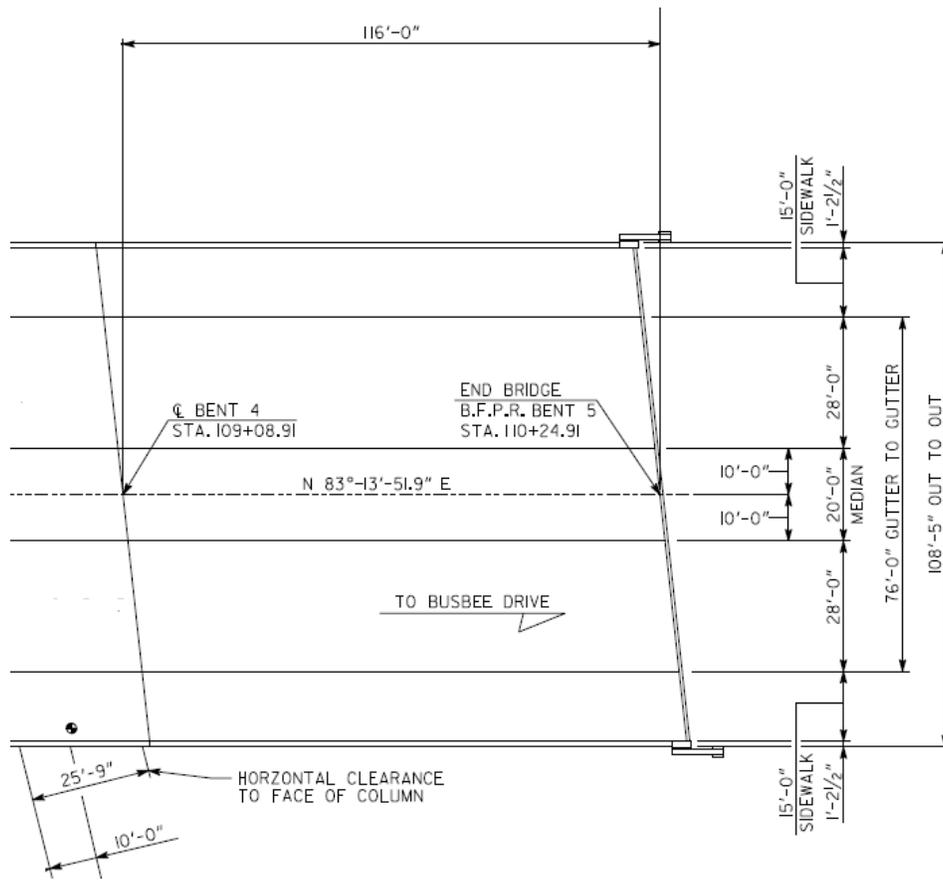
SKETCH

Project: Busbee – Frey Connector

Idea No.: A-1
Client: CCDOT/GDOT
 Sheet 3 of 7



Original Concept - ELEVATION VIEW @ BENT 5

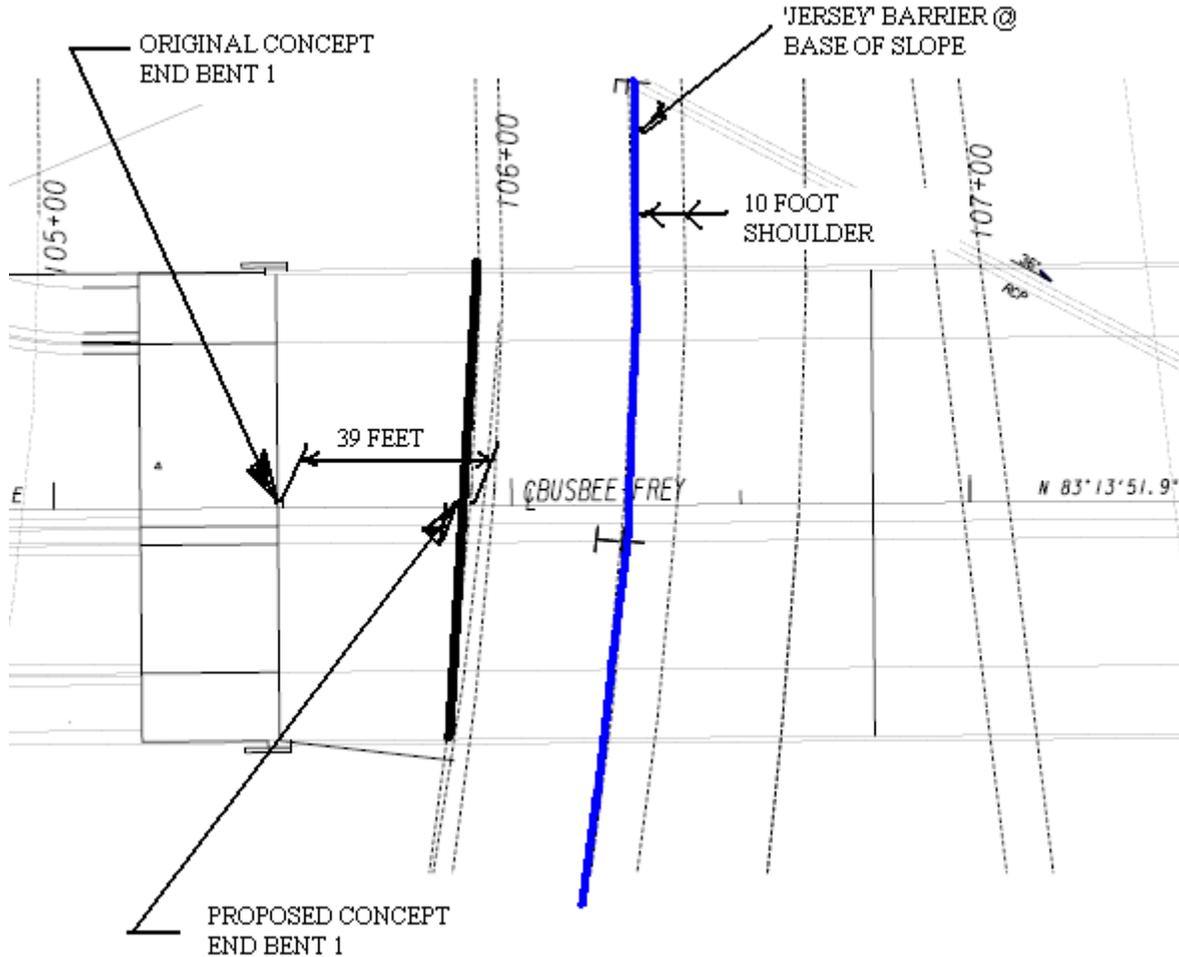


Original Concept - PLAN VIEW @ BENT 5

SKETCH

Project: Busbee – Frey Connector

Idea No.: A-1
Client: CCDOT/GDOT
Sheet 4 of 7



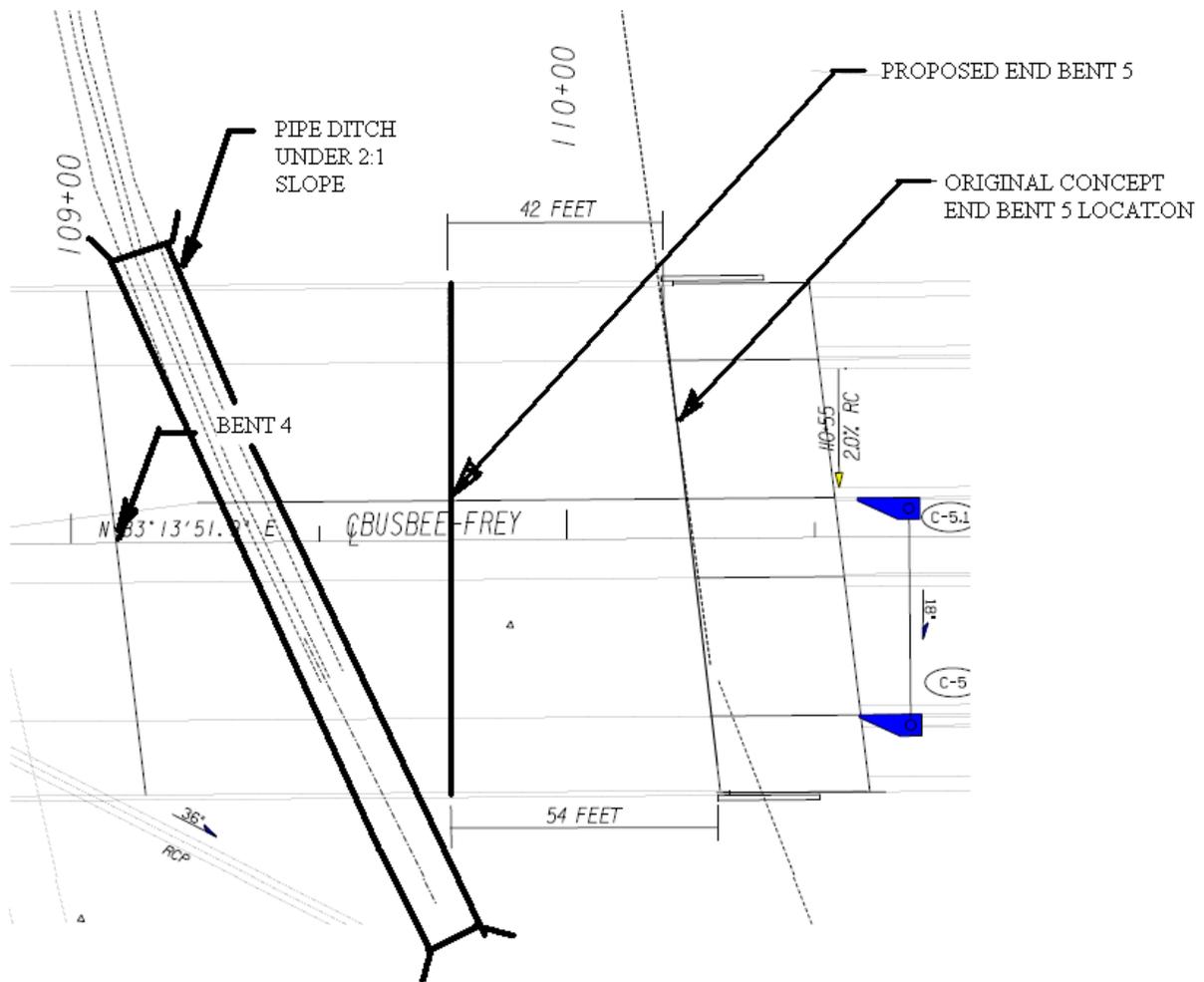
Proposed Concept - PLAN VIEW @ BENT 1

Provide barrier wall along 10 foot shoulder for ramp with leading edge guardrail to protect drivers from blunt end of guardrail (not shown in sketch). Assume 120 feet long

SKETCH

Project: Busbee – Frey Connector

Idea No.: A-1
Client: CCDOT/GDOT
Sheet 5 of 7



Proposed Concept - PLAN VIEW @ BENT 5

Provide a concrete pipe to carry the concrete flume through the 2:1 slope at the end of the shortened Bent 5 end span. Assume 48" pipe with 2 concrete headwalls (108 foot wide bridge + 2 side slopes of 10 feet each. Say 140 feet of pipe & 2 concrete headwalls.

CALCULATIONS

Project: Busbee – Frey Connector

Idea No.: A-1
Client: CCDOT/GDOT
 Sheet 7 of 7

Original Concept (OC)

Bridge Width (OC) = (1.21 ft overhang + 15 ft sidewalk + 28 ft lanes + 8 ft raised median) X 2

Bridge Width (OC) = 52.21 X 2

Bridge Width (OC) = 104.42 feet

Bridge Area (OC) = 104.42 feet x 476 feet

Bridge Area (OC) = 49,704 sq ft

Proposed Change (PC)

Bridge Width (PC) = (1.21 ft overhang + 15 ft sidewalk + 28 ft lanes + 8 ft raised median) X 2

Bridge Width (PC) = 52.21 X 2

Bridge Width (PC) = 104.42 feet

Bridge Length (PC) = 476 – (39 feet @ Bent 1) – (42 feet @ Bent 5) = 395 feet

Bridge Area (PC) = 104.42 feet x 375 feet

Bridge Area (PC) = 39,158 sq ft

Difference in Area = 49,704 – 39,158

Difference in Area = **10,546 sq ft; 1,172 sq yds**; additional pavement required

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53.81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

Length of Jersey side barrier = **120 feet**

Length of 48" pipe = **140 feet**

Number of 48" headwalls = **2**

Length of W beam guardrail = **100 feet**

Length of T beam guardrail = **30 feet**

Type 12 guardrail anchor = **1**

DEVELOPMENT AND RECOMMENDATION PHASE

Project: Busbee – Frey Connector

IDEA No.: A-3	Sheet No.: 1 of 4	CREATIVE IDEA: Reduce the bridge sidewalk width from 15 feet to 10 feet
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Comp By: GCG Date: 02/07/12 Checked By: GAO Date: 02/15/12

Original Concept:

The original concept calls for a 476 ft long, four-span, PSC beam bridge carrying Busbee-Frey Connector over I-75 with 15 foot wide sidewalks. Most of the sidewalk network in the area is at 5 foot width and the proposed Busbee-Frey Connector is at 10 foot wide. The additional bridge width was included primarily for streetscape features; benches, planters, etc.

Proposed Change:

Reduce the bridge sidewalks from 15 feet to 10 feet.

Justification:

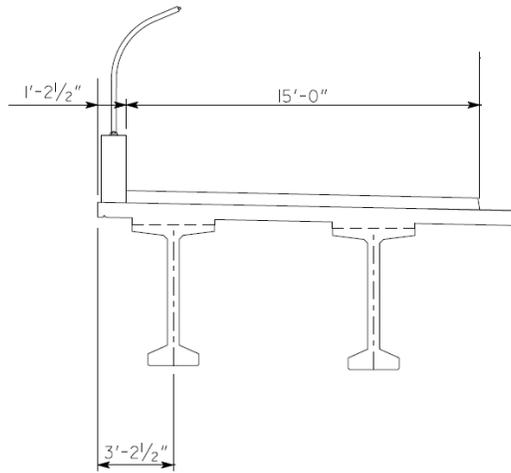
The 15 foot sidewalks are not part of a 15 foot wide sidewalk system and are proposed on the bridge only. The bridge is the most expensive component of the project per square foot. The 10 foot sidewalk width would still allow for small planters or other aesthetic items such as benches. An alternate and recommended approach is rather than spending the significantly higher bridge cost for enhanced features, create pocket parks or areas of feature immediately off of the bridge area at a significantly reduced cost.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$ 7,456,000		
Proposed	\$ 6,742,000		
Savings	\$ 714,000		\$ 714,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$ 714,000

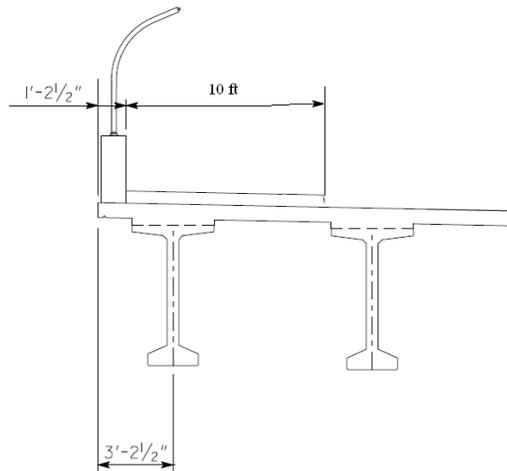
SKETCH

Project: Busbee – Frey Connector

Idea No.: A-3
Client: CCDOT/GDOT
Sheet 2 of 4



Original Concept



Proposed Change
Recommended Concept

CALCULATIONS

Project: Busbee – Frey Connector

Idea No.: A-3

Client: CCDOT/GDOT

Sheet 4 of 4

Original Concept (OC)

Bridge Width (OC) = (1.21 ft overhang + 15 ft sidewalk + 28 ft lanes + 8 ft median) X 2

Bridge Width (OC) = 52.21 X 2

Bridge Width (OC) = 104.42 feet

Bridge Area (OC) = 104.42 feet x 476 feet

Bridge Area (OC) = 49,704 sq ft

Proposed Change (PC)

Bridge Width (PC) = (1.21 ft overhang + 10 ft sidewalk + 28 ft lanes + 8 ft median) X 2

Bridge Width (PC) = 47.21 X 2

Bridge Width (PC) = 94.42

Bridge Area (PC) = 94.42 feet x 476 feet

Bridge Area (PC) = 44,944 sq ft

Difference in Area = 49,704 – 44,944

Difference in Area = **4,760 sq ft**

DEVELOPMENT AND RECOMMENDATION PHASE

Project: Busbee – Frey Connector

IDEA No.: A-8	Sheet No.: 1 of 8	CREATIVE IDEA: Reduce the length of bridge end spans by using MSE walls
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Comp By: GCG Date: 02-08-12 Checked By: GAO Date: 2-13-12

Original Concept:

The original concept calls for a 476 ft long, four-span, PSC beam bridge carrying Busbee-Frey Connector over I-75. The bridge spans are 130 ft, 99 ft, 131 ft and 116 ft. The bridge is supported by concrete, multi-column, intermediate bents with spill-through end bents. It is assumed the bridge will be pile supported.

Proposed Change:

Reduce the length of the bridge end spans by constructing MSE walls closer to the edge of ramp.

Reduce the end span at Bent 1 by (39 feet – 6 feet offset from face of wall to BFPR) (shown in the sketch). New end span = 130 feet – 33 feet = 97 feet. (33 foot reduction)

Reduce the end span at Bent 5 by (42 feet - 6 feet offset from face of wall to BFPR) (shown in the sketch). New end span = 116 feet – 36 feet = 80 feet. (36 foot reduction)

Justification:

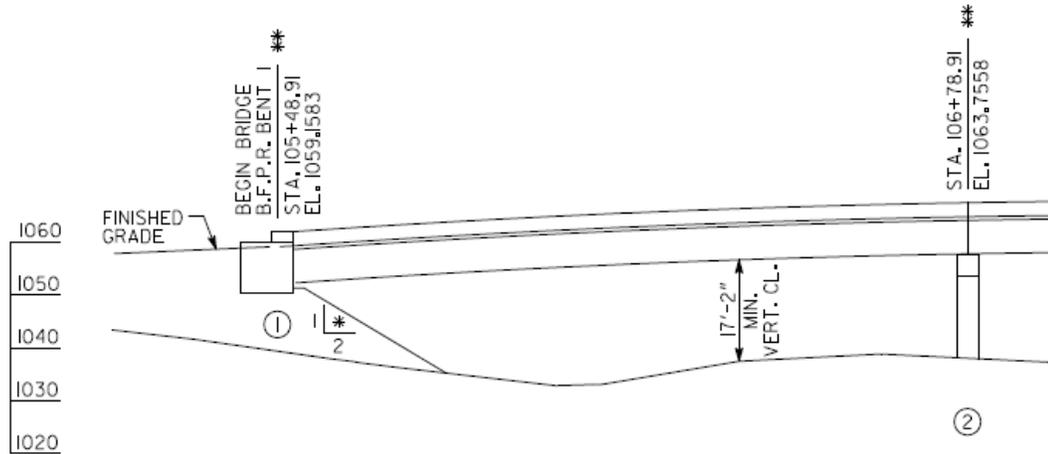
Constructing MSE walls in-lieu of open end spans could shorten the overall bridge length by 81 feet, if applied at both end spans. The current layout seems excessive and shorter end spans will reduce the overall project cost while providing the similar bridge function.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$ 7,456,000		
Proposed	\$ 7,025,000		
Savings	\$ 431,000		\$ 431,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$ 431,000

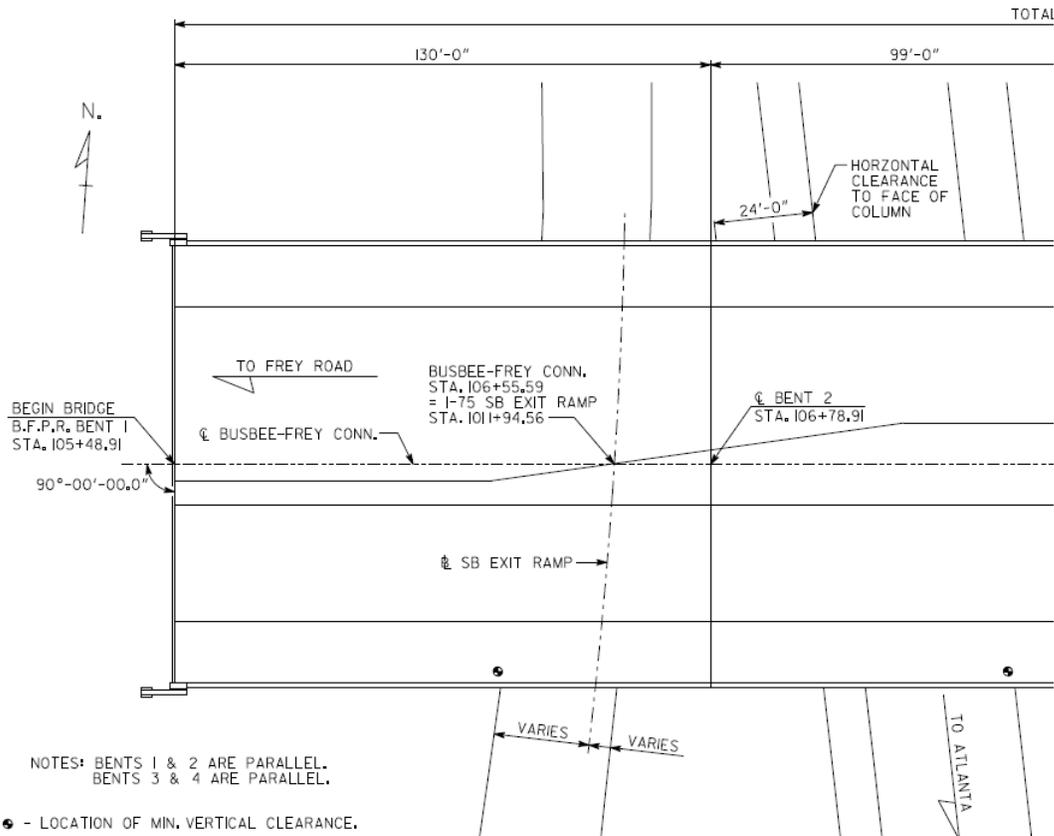
SKETCH

Project: Busbee – Frey Connector

Idea No.: A-8
Client: CCDOT/GDOT
Sheet 2 of 8



Original Concept - ELEVATION VIEW @ BENT 1

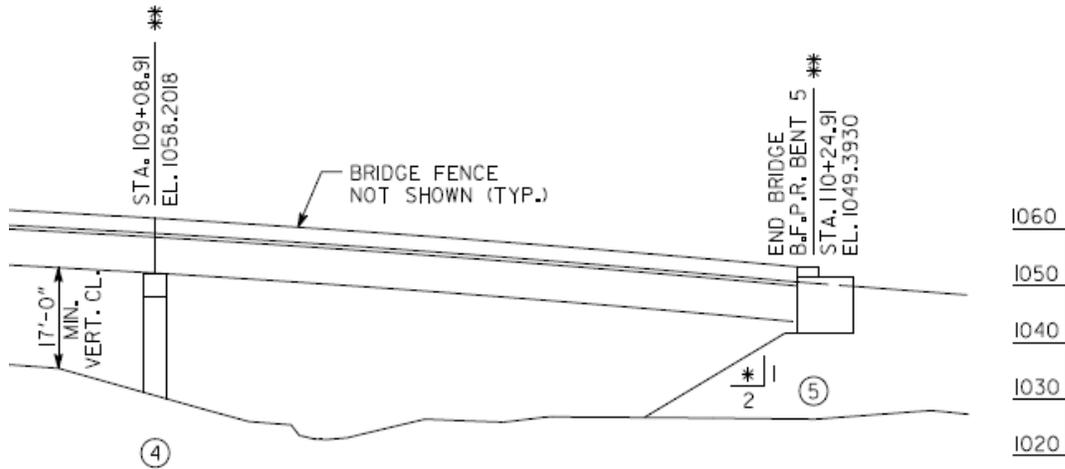


Original Concept - PLAN VIEW @ BENT 1

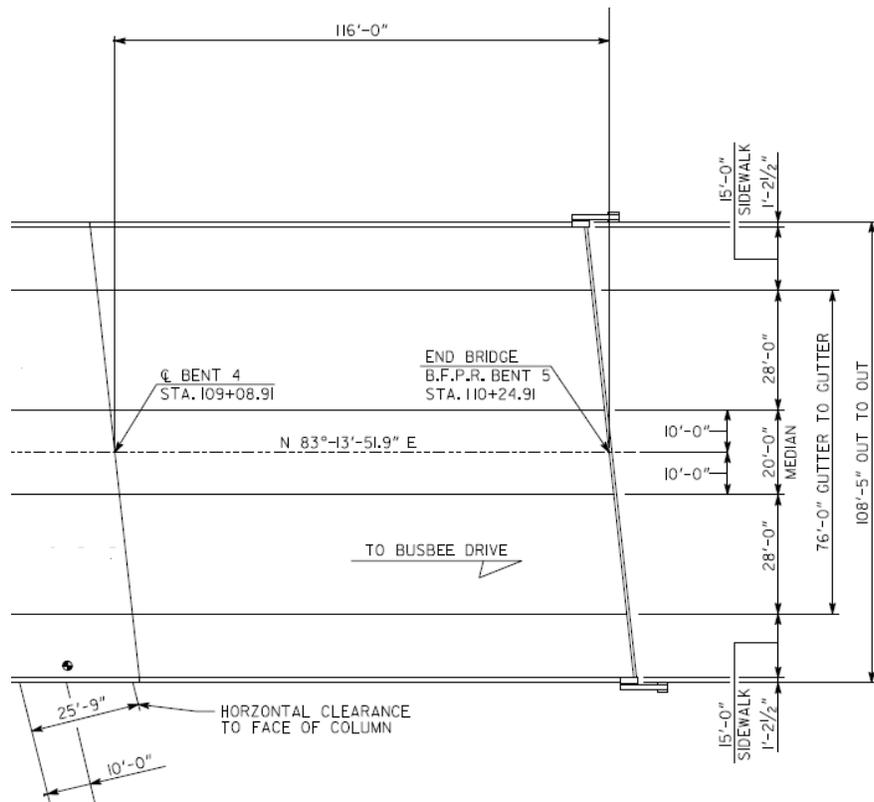
SKETCH

Project: Busbee – Frey Connector

Idea No.: A-8
Client: CCDOT/GDOT
Sheet 3 of 8



Original Concept - ELEVATION VIEW @ BENT 5

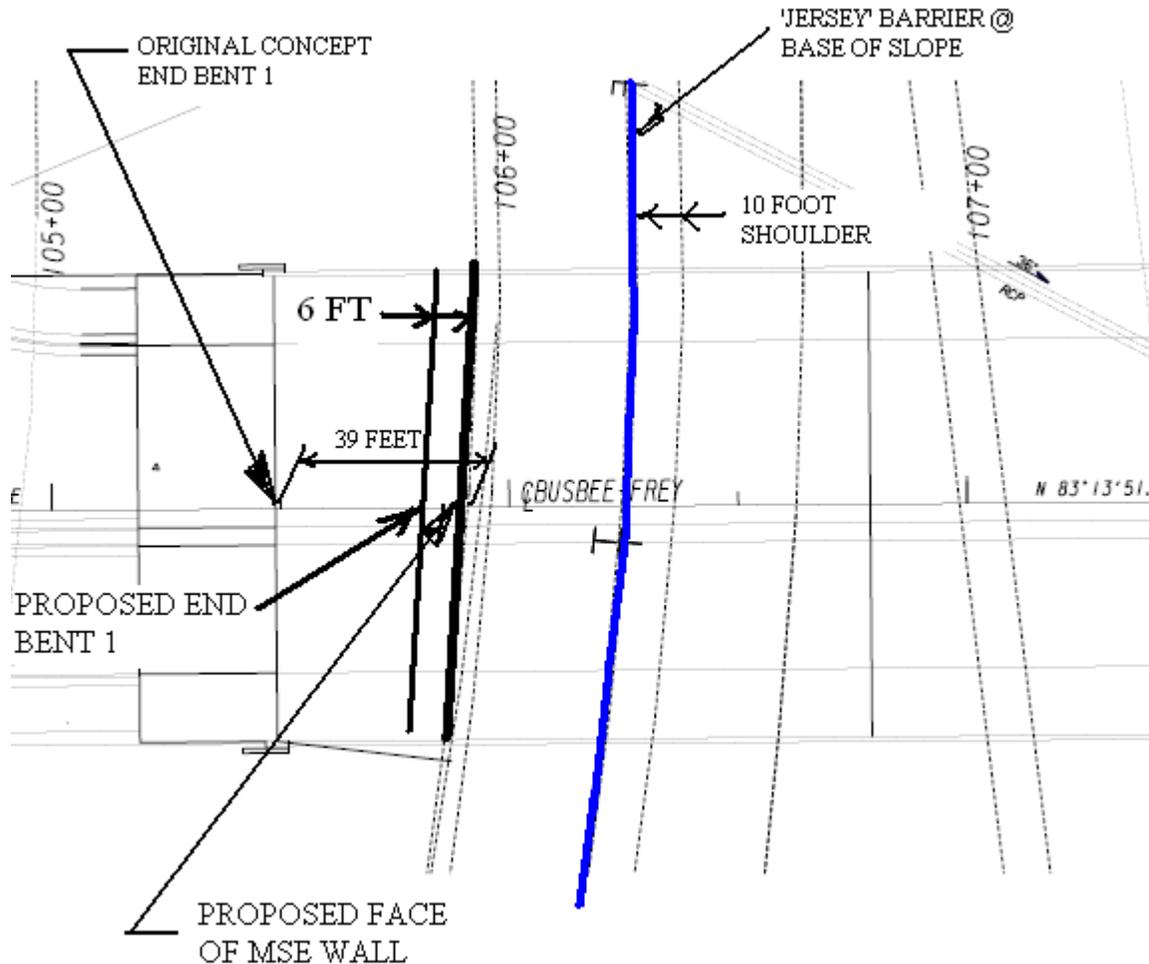


Original Concept - PLAN VIEW @ BENT 5

SKETCH

Project: Busbee – Frey Connector

Idea No.: A-8
Client: CCDOT/GDOT
Sheet 4 of 8



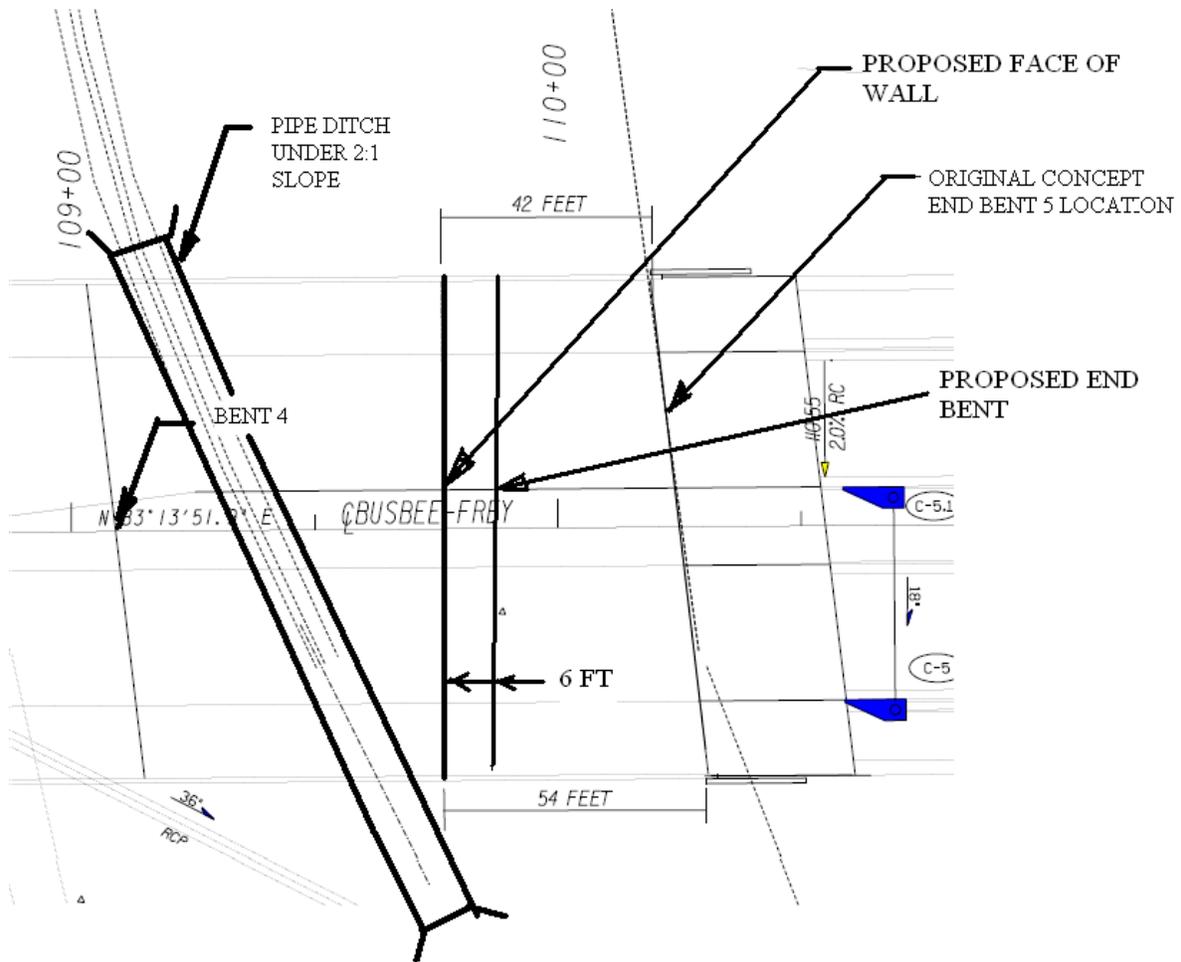
Proposed Concept - PLAN VIEW @ BENT 1 with MSE Wall

Provide barrier wall along 10 foot shoulder for ramp with leading edge guardrail to protect drivers from blunt end of guardrail (not shown in sketch). Say 120 feet long
Add Type 12 guardrail anchor with T beam guardrail.

SKETCH

Project: Busbee – Frey Connector

Idea No.: A-8
Client: CCDOT/GDOT
Sheet 5 of 8



Proposed Concept - PLAN VIEW @ BENT 5 with MSE wall

Provide a concrete pipe to carry the concrete flume through the 2:1 slope at the end of the shortened Bent 5 end span. Say 48" pipe with 2 concrete headwalls (108 foot wide bridge + 2 side slopes of 10 feet each. Say 140 feet of pipe & 2 concrete headwalls.

CALCULATIONS

Project: Busbee – Frey Connector

Idea No.: A-8
Client: CCDOT/GDOT
 Sheet 7 of 8

Original Concept (OC)

Bridge Width (OC) = (1.21 ft overhang + 15 ft sidewalk + 28 ft lanes + 8 ft raised median) X 2
 Bridge Width (OC) = 52.21 X 2
 Bridge Width (OC) = 104.42 feet

Bridge Area (OC) = 104.42 feet x 476 feet
 Bridge Area (OC) = 49,704 sq ft

Proposed Change (PC)

Bridge Width (PC) = (1.21 ft overhang + 15 ft sidewalk + 28 ft lanes + 8 ft raised median) X 2
 Bridge Width (PC) = 52.21 X 2
 Bridge Width (PC) = 104.42 feet

Bridge Length (PC) = 476 – (33 feet @ Bent 1) – (36 feet @ Bent 5) = 407 feet

Bridge Area (PC) = 104.42 feet x 407 feet
 Bridge Area (PC) = 42,499 sq ft

Difference in Area = 49,704 – 42,499
 Difference in Area = **7,205 sq ft; 800 sq yds**

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53,81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

Length of Jersey side barrier = **120 feet**

Length of 48" pipe = **140 feet**

Number of 48" headwalls = **2**

Length of W beam guardrail = **100 feet**

Length of T beam guardrail = **30 feet**

Type 12 guardrail anchor = **1**

CALCULATIONS

Project: Busbee – Frey Connector

Idea No.: A-8

Client: CCDOT/GDOT

Sheet 8 of 8

Proposed Change (PC) continued

Wall at Bent 1

Say 105 ft wide x 20 feet high

Wrap around length 30 ft high x 60 ft (2:1 slope x 30 ft high)

Area = $105 \times 20 + 2 \text{ sides} \times 30 \times 60 \text{ ft} = 5,700 \text{ sq ft}$

Wall at Bent 5

Say same as bent 1”

Area = $105 \times 20 + 2 \text{ sides} \times 30 \times 60 \text{ ft} = 5,700 \text{ sq ft}$

Total area = **11,400 sq ft**

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-1	Sheet No.: 1 of 8	CREATIVE IDEA: Realign Busbee-Frey Connector to Busbee Drive and eliminate Townpark Lane Tie In to Busbee-Frey Connector extension
-------------------------	-----------------------------	---

Comp By: JJV Date: 02/07/12 Checked By: GAO Date: 2-14-12

Original Concept:

Extend Busbee-Frey Connector across Busbee Drive to Townpark Lane by crossing the Argonaut property / regional detention pond. This includes re-aligning western and eastern portions of Townpark Lane, constructing a new six barrel box culvert and significant wetlands and flood storage impacts in the regional detention pond, and a four legged signalized intersection of Busbee-Frey Connector and Busbee Drive.

Proposed Change:

Extend Busbee-Frey Connector across I-75 and re-align with Busbee Drive to the existing T intersection with Busbee Parkway. This change eliminates the continued extension of the Busbee-Frey Connector across the regional detention pond, the six barrel box culvert, and the re-alignment of the eastern and western leg of Townpark Lane. The projected 2280 ADT (2034 Build) through vehicles would likely turn left at Busbee Drive and proceed to Busbee Parkway to disperse. There is adequate capacity on the existing roadway system to accept any redistributed traffic volumes.

Justification:

Elimination of this portion of the Busbee-Frey Connector will reduce environmental mitigation, wetlands impacts, right of way, earthwork, paving, and drainage cost while not changing the project goal of reducing congestion on Chastain Road. These changes will likely eliminate the majority of wetland impacts and the associated environmental permitting. In addition, the impacts to the Zaxby’s detention pond and consequential replacement pond will be eliminated.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$5,740,000		
Proposed	\$3,780,000		
Savings	\$1,960,000		\$1,960,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$1,960,000

CONTINUATION

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

Idea No.: C-1
Client: CCDOT
Sheet 2 of 8

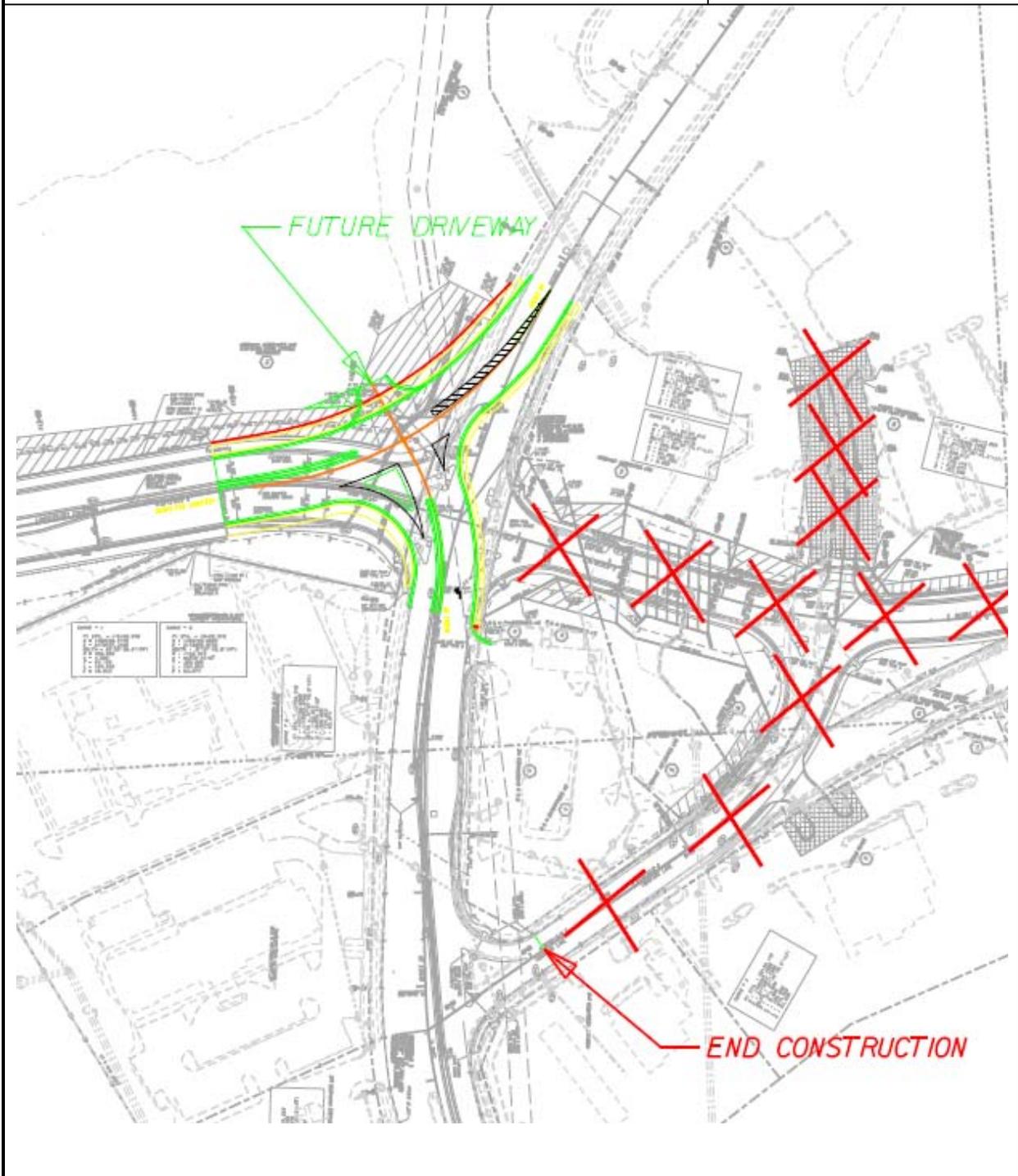
Based on our traffic analysis, the realigned roadway will operate at acceptable LOS' for both AM and PM peak design year hours. A dedicated right turn lane for access to the new slip ramp should be maintained and is included as part of this analysis. A continuous movement to Busbee Parkway could actually operate more efficiently for traffic on Buusbee Parkway, with the potential to eliminate the existing signal at Busbee Parkway and Townpark Lane.

An additional benefit of this recommendation is that it will allow a future driveway at the Busbee-Frey Connector / Busbee Drive intersection for the anticipated development for that corner property.

SKETCH

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-1
Client: CCDOT
Sheet 3 of 8



COST WORKSHEET							
Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-1		
					CLIENT: CCDOT/GDOT		
Comp BY: JJV Date: 2-8-12 Checked By: GAO Date: 2-14-12					Sheet 4 of 8		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
				0			0
Original Design:				0			0
Islands / Medians	SY	1,400	36.41	50,974			0
Curb & Gutter, TP 2	LF	9,000	9.74	87,660			0
Sidewalk	SY	4,000	80.00	320,000			0
Catch Basins	EA	50	1,797.00	89,850			0
18" RCP	LF	4,000	20.48	81,920			0
24" RCP	LF	500	42.30	21,150			
Box Culvert	CY	750	841.19	630,893			0
Pavemnt - Full Depth Section	SY	21,820	43.00	938,260			
Earthwork	LS	1	850,000.00	850,000			
Right of Way	AC	5.91	452,000.00	2,671,320			
VE Design:							
Islands / Medians	SY				1,331	36.41	48,462
Curb & Gutter, TP 2	LF				5,540	9.74	53,960
Sidewalk	SY				2,417	80.00	193,360
Catch Basins	EA				32	1,797.00	57,504
18" RCP	LF				3,240	20.48	66,355
24" RCP	LF				330	42.30	13,959
Box Culvert	CY				0	841.19	0
Pavement - Full Depth Section	SY				17,550	43.00	754,650
Earthwork	LS				1	818,889.00	818,889
Right of Way	AC				3.92	452,000.00	1,773,648
SUBTOTAL				5,742,027			3,780,787
TOTAL ROUNDED				5,740,000			3,780,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-1
Client: CCDOT/GDOT
Sheet 5 of 8**

Abbreviations

Busbee-Frey Connector – BFC
Townpark Lane – TL

Deductions to Quantities

Eliminated Islands / Medians

Triangle Island – BFC at Busbee Dr
(0.5 X 25ft long X 25ft wide) X sy/9sf = 34.7 SY
(0.5 X 15ft long X 15ft wide) X sy/9sf = 12.5 SY

Triangle Island – BFC at TL / Kaiser Dwy
(0.5 X 20ft long X 20ft wide) X sy/9sf = 22.2 SY

34.7sy + 12.5sy + 22.2sy = 69.4sy
1400sy original – 69.4sy = 1330.6sy Use **1331sy**

Eliminated Curb & Gutter, TP 2

BFC (128+65 – 117+65) X 2 sides = 2200lf
TL / Kaiser (96+80 – 90+50) X 2 sides = 1260lf

2200lf + 1260lf = 3460lf
9000lf original – 3460lf = **5540lf**

Eliminated 5ft Sidewalk

BFC (128+65 – 117+65) X 2 sides = 2200lf
TL / Kaiser (93+75 – 90+50) X 2 sides = 650lf

(2200lf + 650lf) X 5ft wide X sy/9sf = 1583sy
4000sy original – 1583sy = **2417sy**

Eliminated Drainage Structures

Catch Basins – 50each original - 18each eliminate = **32each**
18” RCP – 4000lf original – 760lf eliminated = **3240lf**
24” RCP – 500lf original – 170lf eliminated = **330lf**
6 Barrel Box Culvert 750cy original – 750cy = **0cy**

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-1
Client: CCDOT/GDOT
Sheet 6 of 8**

Eliminated Full Depth Pavement

BFC (128+65 – 117+65) x 36 ft wide x sy/9sf = 4,400 sy

TL (93+80 – 91+00) x 36 ft wide x sy/9sf = 1,120sy

Additional pavement for realignment;

$$\frac{1}{2} \times 150 \times 150 = 11,250 \text{ sf} = 1,250 \text{ sy}$$

$$4,400 \text{ sy} + 1,120 \text{ sy} - 1,250 \text{ sy} = 4,270 \text{ sy}$$

$$21,820 \text{ sy original} - 4,270 \text{ sy} = \mathbf{17,550 \text{ sy}}$$

Eliminated Earthwork

Assume \$6/cy

Pavement & Shoulders – 10ft fill X (36ft lanes + 12 shld + 12 shld) = 600sf

2:1 Slopes – 10ft fill X 20ft width X 0.5 = 100sf

$$(120+50 - 118+50) \text{ X } (600\text{sf} + 100\text{sf}) \text{ X } \text{cy}/27\text{cf} \text{ X } \$6/\text{cy} = \$31,111$$

$$\$850,000 \text{ LS original} - \$31,111 = \mathbf{\$818,889}$$

Eliminated Right of Way

Delete Parcels 4,5,& 6

Parcel 4 – 9,418sf Req'd R/W + 2,568sf Esmt = 11,986 sf

Parcel 5 – 12,145sf Req'd R/W + 3,620sf Esmt = 15,765sf

Parcel 6 – 53,429sf Req'd R/W + 10,311sf Esmt = 63,740sf

Additional R/W for realignment;

$$\frac{1}{2} \times 100 \times 100 = 5,000 \text{ sf}$$

$$(11,986\text{sf} + 15,765\text{sf} + 63,740\text{sf} - 5,000 \text{ sf}) = 86,491 \text{ sf} \times \text{ac}/43,560\text{sf} = 1.986 \text{ acres}$$

$$5.91\text{ac original} - 1.986 \text{ ac} = \mathbf{3.924 \text{ acres}}$$

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-1
Client: CCDOT/GDOT
Sheet 7 of 8**

HCM Signalized Intersection Capacity Analysis 5: Busbee-Frey Connector & Busbee Drive

2/8/2012

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Volume (vph)	30	65	75	345	500	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	11
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1711	1801	1711	1531
Flt Permitted	1.00	1.00	0.20	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	360	1801	1711	1531
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	71	82	375	543	266
RTOR Reduction (vph)	0	0	0	0	0	170
Lane Group Flow (vph)	33	71	82	375	543	96
Turn Type		Free	Perm			custom
Protected Phases	4			1		
Permitted Phases	4	Free	1	1	2	2
Actuated Green, G (s)	16.0	75.0	20.0	20.0	27.0	27.0
Effective Green, g (s)	16.0	75.0	20.0	20.0	27.0	27.0
Actuated g/C Ratio	0.21	1.00	0.27	0.27	0.36	0.36
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	397	1583	96	480	616	551
v/s Ratio Prot	c0.02			0.21		
v/s Ratio Perm		0.04	c0.23		c0.32	0.06
v/c Ratio	0.08	0.04	0.85	0.78	0.88	0.17
Uniform Delay, d1	23.6	0.0	26.1	25.5	22.5	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	58.2	11.9	16.6	0.7
Delay (s)	24.0	0.1	84.3	37.4	39.1	17.1
Level of Service	C	A	F	D	D	B
Approach Delay (s)	7.7			45.8	31.8	
Approach LOS	A			D	C	
Intersection Summary						
HCM Average Control Delay			34.7		HCM Level of Service	C
HCM Volume to Capacity ratio			0.67			
Actuated Cycle Length (s)			75.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			52.5%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

CALCULATIONS

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-1
Client: CCDOT/GDOT
 Sheet 8 of 8

HCM Signalized Intersection Capacity Analysis
5: Busbee-Frey Connector & Busbee Drive

2/8/2012

	→	↘	↙	←	↗	↖
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↘	↖
Volume (vph)	130	400	150	55	85	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	11	11
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1711	1801	1711	1531
Flt Permitted	1.00	1.00	0.67	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1200	1801	1711	1531
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	435	163	60	92	223
RTOR Reduction (vph)	0	0	0	0	0	152
Lane Group Flow (vph)	141	435	163	60	92	71
Turn Type		Free	Perm			custom
Protected Phases	4			1		
Permitted Phases	4	Free	1	1	2	2
Actuated Green, G (s)	16.0	50.0	6.0	6.0	16.0	16.0
Effective Green, g (s)	16.0	50.0	6.0	6.0	16.0	16.0
Actuated g/C Ratio	0.32	1.00	0.12	0.12	0.32	0.32
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	596	1583	144	216	548	490
v/s Ratio Prot	0.08			0.03		
v/s Ratio Perm		c0.27	c0.14		0.05	0.05
v/c Ratio	0.24	0.27	1.13	0.28	0.17	0.15
Uniform Delay, d1	12.5	0.0	22.0	20.0	12.2	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.4	114.8	3.2	0.7	0.6
Delay (s)	13.4	0.4	136.8	23.2	12.9	12.8
Level of Service	B	A	F	C	B	B
Approach Delay (s)	3.6			106.3	12.8	
Approach LOS	A			F	B	
Intersection Summary						
HCM Average Control Delay			26.8	HCM Level of Service		C
HCM Volume to Capacity ratio			0.39			
Actuated Cycle Length (s)			50.0	Sum of lost time (s)		4.0
Intersection Capacity Utilization			29.9%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-1.1	Sheet No.: 1 of 5	CREATIVE IDEA (ALTERNATIVE TO IDEA C-1): Eliminate Townpark Lane Tie In to Busbee-Frey Connector extension
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Comp By: JJV Date: 02/07/12 Checked By: GAO Date: 2-14-12

Original Concept:

Extend Busbee-Frey Connector across Busbee Drive to Townpark Lane by crossing the Argonaut property / regional detention pond. This includes re-aligning western and eastern portions of Townpark Lane, constructing a new six barrel box culvert and significant wetlands and flood storage impacts in the regional detention pond, and a four legged signalized intersection of Busbee-Frey Connector and Busbee Drive.

Proposed Change:

Extend Busbee-Frey Connector across I-75 to a T intersection with Busbee Drive. This change eliminates the continued extension of the Busbee-Frey Connector across the regional detention pond, the six barrel box culvert, and the re-alignment of the eastern and western leg of Townpark Lane. The projected 2280 ADT (2034 Build) through vehicles would likely turn left at Busbee Drive and proceed to Busbee Parkway to disperse.

Justification:

Elimination of this portion of the Busbee-Frey Connector will reduce environmental mitigation, wetlands impacts, right of way, earthwork, paving, and drainage cost while not changing the project goal of reducing congestion on Chastain Road. These changes will likely eliminate the majority of wetland impacts and the associated environmental permitting. In addition, the impacts to the Zaxby’s detention pond and consequential replacement pond will be eliminated.

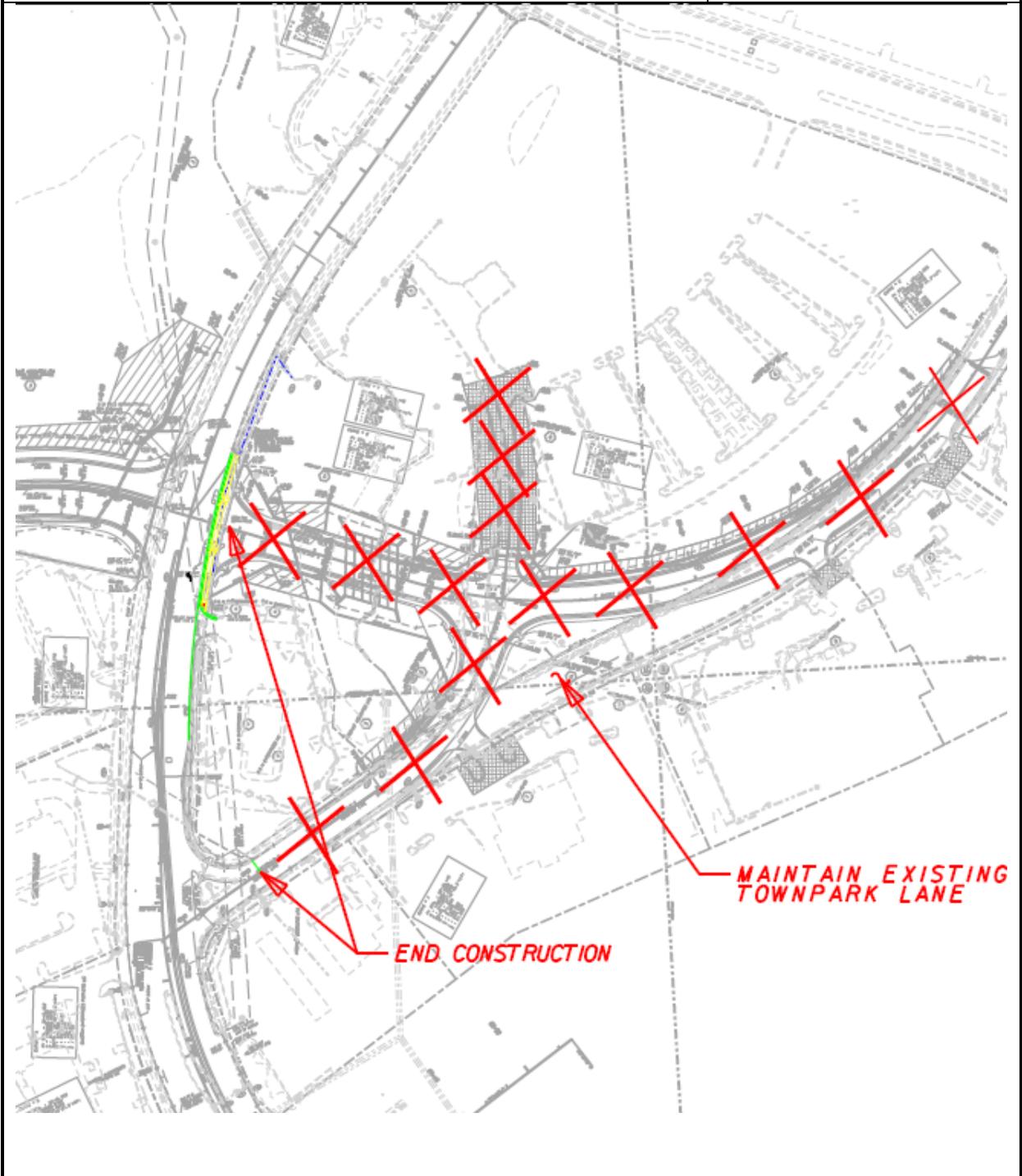
Based on our traffic analysis, a T intersection will operate at an acceptable LOS for both AM and PM peak design year hours. A dedicated right turn lane for access to the new slip ramp should be maintained and is included as part of this analysis.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$5,740,000		
Proposed	\$3,680,000		
Savings	\$2,060,000		\$2,060,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$2,060,000

SKETCH

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

Idea No.: C-1.1
Client: CCDOT
Sheet 2 of 5



COST WORKSHEET							
Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-1.1		
					CLIENT: CCDOT/GDOT		
Comp BY: JJV Date: 2-8-12 Checked By: GAO Date: 2-14-12					Sheet 3 of 5		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
				0			0
Original Design:				0			0
Islands / Medians	SY	1,400	36.41	50,974			0
Curb & Gutter, TP 2	LF	9,000	9.74	87,660			0
Sidewalk	SY	4,000	80.00	320,000			0
Catch Basins	EA	50	1,797.00	89,850			0
18" RCP	LF	4,000	20.48	81,920			0
24" RCP	LF	500	42.30	21,150			
Box Culvert	CY	750	841.19	630,893			0
Pavemnt - Full Depth Section	SY	21,820	43.00	938,260			
Earthwork	LS	1	850,000.00	850,000			
Right of Way	AC	5.91	452,000.00	2,671,320			
VE Design:							
Islands / Medians	SY				1,331	36.41	48,462
Curb & Gutter, TP 2	LF				5,540	9.74	53,960
Sidewalk	SY				2,417	80.00	193,360
Catch Basins	EA				32	1,797.00	57,504
18" RCP	LF				3,240	20.48	66,355
24" RCP	LF				330	42.30	13,959
Box Culvert	CY				0	841.19	0
Pavement - Full Depth Section	SY				16,300	43.00	700,900
Earthwork	LS				1	818,889.00	818,889
Right of Way	AC				3.81	452,000.00	1,722,120
SUBTOTAL				5,742,027			3,675,509
TOTAL ROUNDED				5,740,000			3,680,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-1.1
Client: CCDOT
Sheet 4 of 5**

Abbreviations

Busbee-Frey Connector – BFC
Townpark Lane – TL

Deductions to Quantities

Eliminated Islands / Medians

Triangle Island – BFC at Busbee Dr
(0.5 x 25ft long x 25ft wide) x sy/9sf = 34.7 SY
(0.5 x 15ft long x 15ft wide) x sy/9sf = 12.5 SY

Triangle Island – BFC at TL / Kaiser Dwy
(0.5 x 20 ft long x 20 ft wide) x sy/9sf = 22.2 SY

34.7 sy + 12.5 sy + 22.2 sy = 69.4 sy
1,400 sy original – 69.4 sy = 1,330.6 sy Use **1,331 sy**

Eliminated Curb & Gutter, TP 2

BFC (128+65 – 117+65) x 2 sides = 2,200 lf
TL / Kaiser (96+80 – 90+50) x 2 sides = 1,260 lf

2,200 lf + 1,260 lf = 3,460 lf
9,000 lf original – 3,460 lf = **5,540 lf**

Eliminated 5ft Sidewalk

BFC (128+65 – 117+65) x 2 sides = 2,200 lf
TL / Kaiser (93+75 – 90+50) x 2 sides = 650 lf

(2,200 lf + 650 lf) x 5ft wide x sy/9sf = 1,583 sy
4,000 sy original – 1,583 sy = **2,417 sy**

Eliminated Drainage Structures

Catch Basins – 50 each original - 18 each eliminate = **32 each**
18" RCP – 4000 lf original – 760 lf eliminated = **3,240 lf**
24" RCP – 500 lf original – 170 lf eliminated = **330 lf**
6 Barrel Box Culvert 750 cy original – 750 cy = **0 cy**

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-1.1
Client: CCDOT
Sheet 5 of 5**

Eliminated Full Depth Pavement

BFC (128+65 – 117+65) x 36ft wide x sy/9sf = 4,400 sy

TL (93+80 – 91+00) x 36 ft wide x sy/9sf = 1,120 sy

4,400 sy + 1,120sy = 5,520sy

21,820 sy original – 5,520sy = **16,300sy**

Eliminated Earthwork

Assume \$6/cy

Pavement & Shoulders – 10ft fill x (36 ft lanes + 12 shld + 12 shld) = 600 sf

2:1 Slopes – 10 ft fill x 20ft width x 0.5 = 100 sf

(120+50 – 118+50) (600 sf + 100 sf) x cy/27cf x \$6/cy = \$31,111

\$850,000 LS original- \$31,111 = **\$818,889**

Eliminated Right of Way

Delete Parcels 4,5,& 6

Parcel 4 – 9,418 sf Reqd R/W + 2,568 sf Esmt = 11,986 sf

Parcel 5 – 12,145 sf Reqd R/W + 3,620 sf Esmt = 15,765 sf

Parcel 6 – 53,429 sf Reqd R/W + 10,311 sf Esmt = 63,740 sf

(11,986 sf + 15,765 sf + 63,740 sf) x ac/43,560sf = 2.10 acres

5.91 ac original – 2.10 ac = **3.81acres**

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-2	Sheet No.: 1 of 3	CREATIVE IDEA: Use 11 foot lanes for the Busbee-Frey Connector
-------------------------	-----------------------------	---

Comp By: JJV Date: 02-07-12 Checked By: GAO Date: 2-14-12

Original Concept:
Use 12 ft lanes on the Busbee-Frey Connector

Proposed Change:
Use 11 ft lanes on Busbee-Frey Connector. Most of the remainder of the local roadway network is at 11 foot wide lanes including Frey Road and Busbee Drive.

Justification: This area can readily be accommodated using 11 foot lanes, matching the remaining roadway network.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$362,000		
Proposed	0		
Savings	\$362,000		\$362,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$362,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-2
Client: CCDOT/GDOT
Sheet 3 of 3**

Reduced bridge area: $476 \times 4 = \mathbf{1,904 \text{ sq ft}}$

Maintain 12 foot wide center turn lane for 3-lane section from Busbee Drive to Townpark lane.
4-lane section – 600 ft; 3-lane section 1,000 ft

Reduced pavement area;
 $(4 \times 600) + (2 \times 1,000) = 4,400 \text{ sq ft} = \mathbf{489 \text{ sq yds}}$

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53,81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

Majority of the earthwork reduction:
assume average fill height of 15 ft from sta 110+50 to 116+00; 550 ft
 $550 \times 15 \times (4) = 33,300 \text{ cu ft} = \mathbf{1,222 \text{ cu yds}}$

Reduced ROW;

$(4 \times 600) + (2 \times 1,000) = 4,400 \text{ sq ft} = \mathbf{0.101 \text{ acres}}$

Total Cost of ROW \$2,670,000.00
Total Area (ROW + ESMT) Required 5.91 Acres

Cost Per Acres
 $\$2,670,000 / 5.91 \text{ acres} = \$451,777 \text{ per acre}; \quad \mathbf{USE \$ 452,000 \text{ per acre}}$

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-3	Sheet No.: 1 of 3	CREATIVE IDEA: Use 16 foot median on Busbee-Frey Connector
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Comp By: JJV Date: 02/07/12 Checked By: GAO Date: 2-14-12

Original Concept:

Use a raised, 20 ft median on Busbee-Frey Connector.

Proposed Change:

Use a raised, 16 ft median on Busbee-Frey Connector.

Justification:

A narrower median width will provide the same function as the 20 foot wide median while reducing the overall roadway template, bridge width, right of way and construction costs. In areas where the median is narrowed to 4 feet to accommodate the left turn lane, use a flush median with pavement markings. A narrow, 2 foot wide raised median is an option that would provide stronger delineation however it could become an obstacle and a turning movement hazard.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$343,000		
Proposed	\$8,000		
Savings	\$335,000		\$335,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$335,000

COST WORKSHEET							
Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-3		
					CLIENT: CCDOT/GDOT		
Comp BY: JJV Date: 2-8-12 Checked By: GAO Date: 2-14-12					Sheet 2 of 3		
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	AC	0.07	452,000.00	31,188			
bridge area	SF	1,904	150.00	285,600			
Embankment	CY	1,222	8.00	9,776			
concrete median	SY	244	36.41	8,884			
Curb and gutter	LF	800	9.74	7,792			
VE Design:							
Roadway pavement	SY				178	43	7,654
SUBTOTAL				343,240			7,654
TOTAL ROUNDED				343,000			8,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-3
Client: CCDOT
Sheet 3 of 3**

Reduced bridge area: $476 \times 4 = \mathbf{1,904 \text{ sq ft}}$

Earthwork reduction: assume average fill height of 15 ft from sta 110+50 to 116+00; 550 ft
 $550 \times 15 \times (4) = 33,000 \text{ cu ft} = \mathbf{1,222 \text{ cu yds}}$

Reduce concrete median area; $550 \times 4 \text{ ft} = 2,200 \text{ sq ft} = \mathbf{244 \text{ sq yds}}$

Reduced curb and gutter; narrow median section – 400 ft
 $2 \times 400 = \mathbf{800 \text{ ft}}$

Additional pavement area – to compensate for narrower/ flush median – 400 ft
 $4 \times 400 = 1,600 \text{ sq ft} = \mathbf{178 \text{ sq yds}}$

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53.81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

Reduced ROW;
 BFC - 4 lane Section with 20ft raised median
 $(116+90 - 110+55 \text{ bridge}) + (105+19 \text{ bridge } 104+00) \times 4\text{ft} \times 1 \text{ ac}/43,560\text{sf} = \mathbf{0.069 \text{ acre}}$

Total Cost of ROW \$2,670,000.00
 Total Area (ROW + ESMT) Required 5.91 Acres

Cost Per Acres
 $\$2,670,000 / 5.91 \text{ acres} = \$451,777 \text{ per acre}; \mathbf{USE \$ 452,000 \text{ per acre}}$

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C - 4	Sheet No.: 1 of 3	CREATIVE IDEA: Use 5-lane section for Busbee-Frey Connector
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Comp By: JJV Date: 2-8-12 Checked By: GAO Date: 2-14-12

Original Concept: Use 4-lane, 20 foot raised median section for the Busbee – Frey Connector.

Proposed Change: Use 5-lane, flush median section.

Justification: This section of Busbee- Frey Connector is a relatively short section and is not expected to have any driveways or access points along its alignment, therefore not requiring a raised median for access control. A 5-lane, flush median section will adequately handle the traffic demands and reduce project costs.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$577,000		
Proposed	\$55,100		
Savings	\$521,900		\$521,100
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$521,900

COST WORKSHEET							
Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-4		
					CLIENT: CCDOT/GDOT		
Comp BY: JJV Date: 2-8-12 Checked By: GAO Date: 2-14-12					Sheet 2 of 3		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
				0			0
Original Design:				0			0
				0			0
right of way	ACRE	0	452,000.00	51,302			0
curb and gutter	LF	1,648	10.54	17,370	0	1.00	0
concrete median	SY	178	36.41	6,481			0
earthwork	CY	9,167	8.00	73,336			0
bridge area	SF	2,856	150.00	428,400			0
				0			0
VE Design:				0			0
				0			0
roadway pavement	SY			0	1,282	43.00	55,126
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
SUBTOTAL				576,889			55,126
TOTAL ROUNDED				577,000			55,100

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-4
Client: CCDOT
Sheet 3 of 3**

This recommendation applies to Busbee – Frey Connector
Sta 104+00 to 117+00; 1,300 ft; bridge length – 476 ft

$$1,300 - 476 = 824 \text{ ft}$$

Pavement addition:

$$14 \text{ foot wide center lane; } 14 \times 824 = 11,536 \text{ sq ft} = \mathbf{1,282 \text{ sq yds}}$$

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53.81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

$$\text{Reduce concrete curb and gutter } 2 \times 824 = \mathbf{1,648 \text{ ln ft}}$$

Earthwork reduction: assume average fill height of 15 ft from sta 110+50 to 116+00; 550 ft
 $550 \times 15 \times 6 = 49,500 \text{ cu ft} = \mathbf{1,833 \text{ cu yds}}$

$$\text{Right of way reduction: } 824 \times 6 = 4,944 \text{ sq ft; } \mathbf{0.1135 \text{ acre}}$$

Total Cost of ROW \$2,670,000.00
 Total Area (ROW + ESMT) Required 5.91 Acres

Cost Per Acres
 $\$2,670,000 / 5.91 \text{ acres} = \$451,777 \text{ per acre; USE } \mathbf{\$ 452,000 \text{ per acre}}$

Reduced bridge area; 6 feet narrower
 $476 \times 6 = \mathbf{2,856 \text{ sq ft}}$

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-5	Sheet No.: 1 of 7	CREATIVE IDEA: Use 3-lane section
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Comp By: JJV Date: 2-8-12 Checked By: GAO Date: 2-13-12

Original Concept: Use 4-lane, 20 foot raised median section for the Busbee – Frey Connector.

Proposed Change: Use 3-lane, flush median section for Busbee – Frey Connector. Acquire required right of way for future full-width widening.

Justification: Based on the traffic volumes projected, a 3-lane section will address the demands and operate at an acceptable Levels of Service (LOS). All project functions can be provided with a 3-lane section. Acquiring or dedicating the full width right of way will allow for future widening is desired.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$1,830,000		
Proposed	0		
Savings	\$1,830,000		\$1,830,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$1,830,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-5
Client: CCDOT/GDOT
Sheet 3 of 7**

This recommendation applies to Busbee – Frey Connector
Sta 104+00 to 117+00; 1,300 ft; bridge length – 476 ft

$$1,300 - 476 = 824 \text{ ft}$$

Pavement reduction:

reduce 2 – 12 foot lanes, include 20 ft median; net pavement reduction – 4 feet
 $4 \times 824 = 3,296 \text{ sqft} = \mathbf{366 \text{ sq yds}}$

Cost of Square Yard Full Depth Paving

12.5 mm	165lbs/sy X 1sy X 1ton/2000lb X \$59.93/ton =	\$ 4.94
19 mm	220lbs/sy X 1sy X 1ton/2000lb X \$57.93/ton =	\$ 6.37
25 mm	660lbs/sy X 1sy X 1ton/2000lb X \$53.81/ton =	\$17.76
10" GAB	\$13.16/sy	\$13.16
Total SY Cost		\$42.23 /sy
	USE	\$43.00 per SY

Reduce concrete curb and gutter $2 \times 824 = \mathbf{1,648 \text{ ln ft}}$

Reduce concrete median area; $(100 + 300) \times 4 \text{ ft} = 1,600 \text{ sq ft} = \mathbf{178 \text{ sq yds}}$

Earthwork reduction: assume average fill height of 15 ft from sta 110+50 to 116+00; 550 ft
 $550 \times 15 \times (12 + 12 + 6) = 247,500 \text{ cu ft} = \mathbf{9,167 \text{ cu yds}}$

Right of way reduction: none; buy required r/w for ultimate 4-lane, divided section.

Reduced bridge area: $476 \times 2(12) = \mathbf{11,424 \text{ sq ft}}$

CALCULATIONS

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-5
Client: CCDOT/GDOT
 Sheet 4 of 7

HCM Signalized Intersection Capacity Analysis
2: Busbee-Frey Connector & Frey Road

2/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘
Volume (vph)	5	15	55	35	370	490	170	295	45	35	945	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			-5%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.95		1.00	0.95	1.00
Fr _t	1.00	1.00	0.85	1.00	0.91		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1844	1567	1814	1746		1770	3469		1770	3539	1583
Flt Permitted	0.10	1.00	1.00	0.75	1.00		0.16	1.00		0.49	1.00	1.00
Satd. Flow (perm)	189	1844	1567	1426	1746		298	3469		921	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	16	60	38	402	533	185	321	49	38	1027	228
RTOR Reduction (vph)	0	0	31	0	59	0	0	15	0	0	0	160
Lane Group Flow (vph)	5	16	29	38	876	0	185	355	0	38	1027	68
Turn Type	Perm		Perm	Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	39.0	39.0	39.0	39.0	39.0		30.0	25.0		28.0	24.0	24.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	39.0		30.0	25.0		28.0	24.0	24.0
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49		0.38	0.31		0.35	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	92	899	764	695	851		204	1084		365	1062	475
v/s Ratio Prot		0.01			0.50		0.06	0.10		0.01	0.29	
v/s Ratio Perm	0.03		0.02	0.03			0.28			0.03		0.04
v/c Ratio	0.05	0.02	0.04	0.05	1.03		0.91	0.33		0.10	0.97	0.14
Uniform Delay, d1	10.8	10.6	10.7	10.8	20.5		22.6	21.1		17.3	27.6	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.1	0.0	0.1	0.1	38.5		42.6	0.8		0.6	20.7	0.6
Delay (s)	11.9	10.6	10.8	10.9	59.0		65.2	21.9		17.9	48.3	21.1
Level of Service	B	B	B	B	E		E	C		B	D	C
Approach Delay (s)		10.8			57.1			36.3			42.7	
Approach LOS		B			E			D			D	

Intersection Summary			
HCM Average Control Delay	45.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

CALCULATIONS

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-5
Client: CCDOT/GDOT
 Sheet 5 of 7

HCM Signalized Intersection Capacity Analysis 5: Busbee-Frey Connector & Busbee Drive

2/8/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘	
Volume (vph)	10	20	65	85	450	5	400	150	95	20	55	45	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1860		1711	1801	1531	1711	1801	1531	
Flt Permitted	0.21	1.00	1.00	0.74	1.00		0.58	1.00	1.00	0.65	1.00	1.00	
Satd. Flow (perm)	392	1863	1583	1384	1860		1046	1801	1531	1177	1801	1531	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	11	22	71	92	489	5	435	163	103	22	60	49	
RTOR Reduction (vph)	0	0	50	0	1	0	0	0	68	0	0	36	
Lane Group Flow (vph)	11	22	21	92	493	0	435	163	35	22	60	13	
Turn Type	pm+pt		Perm	pm+pt			pm+pt		Perm	pm+pt		Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases	4		4	8			2		2	6		6	
Actuated Green, G (s)	23.0	19.0	19.0	23.0	19.0		30.0	22.0	22.0	21.0	17.0	17.0	
Effective Green, g (s)	23.0	19.0	19.0	23.0	19.0		30.0	22.0	22.0	21.0	17.0	17.0	
Actuated g/C Ratio	0.35	0.29	0.29	0.35	0.29		0.46	0.34	0.34	0.32	0.26	0.26	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	224	545	463	513	544		575	610	518	413	471	400	
v/s Ratio Prot	0.00	0.01		c0.01	c0.27		c0.10	0.09		0.00	0.03		
v/s Ratio Perm	0.01		0.01	0.05			c0.24		0.02	0.01		0.01	
v/c Ratio	0.05	0.04	0.04	0.18	0.91		0.76	0.27	0.07	0.05	0.13	0.03	
Uniform Delay, d1	15.0	16.5	16.5	14.3	22.1		13.7	15.6	14.6	15.1	18.3	17.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.1	0.2	0.8	21.3		9.0	1.1	0.3	0.2	0.6	0.1	
Delay (s)	15.5	16.6	16.7	15.1	43.5		22.7	16.7	14.8	15.3	18.9	18.0	
Level of Service	B	B	B	B	D		C	B	B	B	B	B	
Approach Delay (s)		16.5			39.0			20.1			18.0		
Approach LOS		B			D			C			B		
Intersection Summary													
HCM Average Control Delay			27.0									HCM Level of Service	C
HCM Volume to Capacity ratio			0.76										
Actuated Cycle Length (s)			65.0									Sum of lost time (s)	12.0
Intersection Capacity Utilization			59.5%									ICU Level of Service	B
Analysis Period (min)			15										
c. Critical Lane Group													

CALCULATIONS

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-5
Client: CCDOT/GDOT
 Sheet 6 of 7

HCM Signalized Intersection Capacity Analysis
2: Busbee-Frey Connector & Frey Road

2/8/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↕	↗	↖	↑↑	↗
Volume (vph)	135	110	100	110	95	100	215	1180	55	365	635	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		2%			-5%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.92		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1844	1567	1814	1762		1770	3515		1770	3539	1583
Flt Permitted	0.40	1.00	1.00	0.63	1.00		0.36	1.00		0.10	1.00	1.00
Satd. Flow (perm)	729	1844	1567	1194	1762		664	3515		182	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	120	109	120	103	109	234	1283	60	397	690	82
RTOR Reduction (vph)	0	0	90	0	42	0	0	4	0	0	0	44
Lane Group Flow (vph)	147	120	19	120	170	0	234	1339	0	397	690	38
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	20.0	16.0	16.0	20.0	16.0		49.0	37.0		58.0	42.0	42.0
Effective Green, g (s)	20.0	16.0	16.0	20.0	16.0		49.0	37.0		58.0	42.0	42.0
Actuated g/C Ratio	0.22	0.18	0.18	0.22	0.18		0.54	0.41		0.64	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	207	328	279	293	313		509	1445		417	1652	739
v/s Ratio Prot	c0.03	0.07		0.02	0.10		0.06	0.38		c0.18	0.19	
v/s Ratio Perm	c0.13		0.01	0.07			0.19			c0.43		0.02
v/c Ratio	0.71	0.37	0.07	0.41	0.54		0.46	0.93		0.95	0.42	0.05
Uniform Delay, d1	32.1	32.5	30.8	29.4	33.7		10.8	25.2		27.0	15.9	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.6	3.1	0.5	4.2	6.6		3.0	11.7		33.5	0.8	0.1
Delay (s)	50.8	35.7	31.3	33.6	40.3		13.8	36.9		60.5	16.7	13.2
Level of Service	D	D	C	C	D		B	D		E	B	B
Approach Delay (s)		40.3			37.9			33.5			31.3	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM Average Control Delay			33.9			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			86.5%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

CALCULATIONS

Project: Busbee – Frey Connector; PI 0010157
Cobb County

Idea No.: C-5
Client: CCDOT/GDOT
 Sheet 7 of 7

HCM Signalized Intersection Capacity Analysis 5: Busbee-Frey Connector & Busbee Drive

2/8/2012

Movement:	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	40	135	355	175	165	5	85	155	50	35	115	55	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1855		1711	1801	1531	1711	1801	1531	
Flt Permitted	0.64	1.00	1.00	0.59	1.00		0.68	1.00	1.00	0.64	1.00	1.00	
Satd. Flow (perm)	1195	1863	1583	1098	1855		1219	1801	1531	1151	1801	1531	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	43	147	386	190	179	5	92	168	54	38	125	60	
RTOR Reduction (vph)	0	0	283	0	1	0	0	0	38	0	0	42	
Lane Group Flow (vph)	43	147	103	190	183	0	92	168	16	38	125	18	
Turn Type	pm+pt		Perm	pm+pt			pm+pt		Perm	pm+pt		Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases	4		4	8			2		2	6		6	
Actuated Green, G (s)	20.0	16.0	16.0	24.0	18.0		22.0	18.0	18.0	22.0	18.0	18.0	
Effective Green, g (s)	20.0	16.0	16.0	24.0	18.0		22.0	18.0	18.0	22.0	18.0	18.0	
Actuated g/C Ratio	0.33	0.27	0.27	0.40	0.30		0.37	0.30	0.30	0.37	0.30	0.30	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	437	497	422	506	557		480	540	459	459	540	459	
v/s Ratio Prot	0.01	0.08		0.04	0.10		0.01	0.09		0.01	0.07		
v/s Ratio Perm	0.03		0.07	0.11			0.06		0.01	0.02		0.01	
v/c Ratio	0.10	0.30	0.24	0.38	0.33		0.19	0.31	0.04	0.08	0.23	0.04	
Uniform Delay, d1	13.7	17.5	17.3	12.1	16.3		12.7	16.2	14.9	12.3	15.8	14.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	1.5	1.4	2.1	1.6		0.9	1.5	0.1	0.4	1.0	0.2	
Delay (s)	14.1	19.0	18.6	14.3	17.9		13.6	17.7	15.0	12.7	16.8	15.0	
Level of Service	B	B	B	B	B		B	B	B	B	B	B	
Approach Delay (s)		18.4			16.0			16.0			15.6		
Approach LOS		B			B			B			B		
Intersection Summary													
HCM Average Control Delay			16.9									HCM Level of Service	B
HCM Volume to Capacity ratio			0.35										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	16.0
Intersection Capacity Utilization			47.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-6	Sheet No.: 1 of 10	CREATIVE IDEA: Use a roundabout at the Busbee-Frey Connector / Busbee Drive Intersection
-------------------------	------------------------------	---

Comp By: PZ Date: 2-8-12 Checked By: GAO Date: 2-13-12

Original Concept:

Install a signalized intersection at Busbee-Frey Connector and Busbee Drive intersection.

Proposed Change:

Construct a single lane roundabout at Busbee-Frey Connector @ Busbee Drive.

The recommended roundabout is sized as a double lane roundabout but analyzed as a single lane roundabout, which allows for future improvements and widening without requiring additional right of way and reconstruction.

Justification:

GDOT roundabout analysis tool Version 1.3 was used to analyze the single lane roundabout at this intersection. The analytical results showed that a single lane roundabout operated at an acceptable level of service for design year 2034 in both AM peak and PM peak conditions. Our analysis included a separate by-pass ramp for the eastbound to southbound movement.

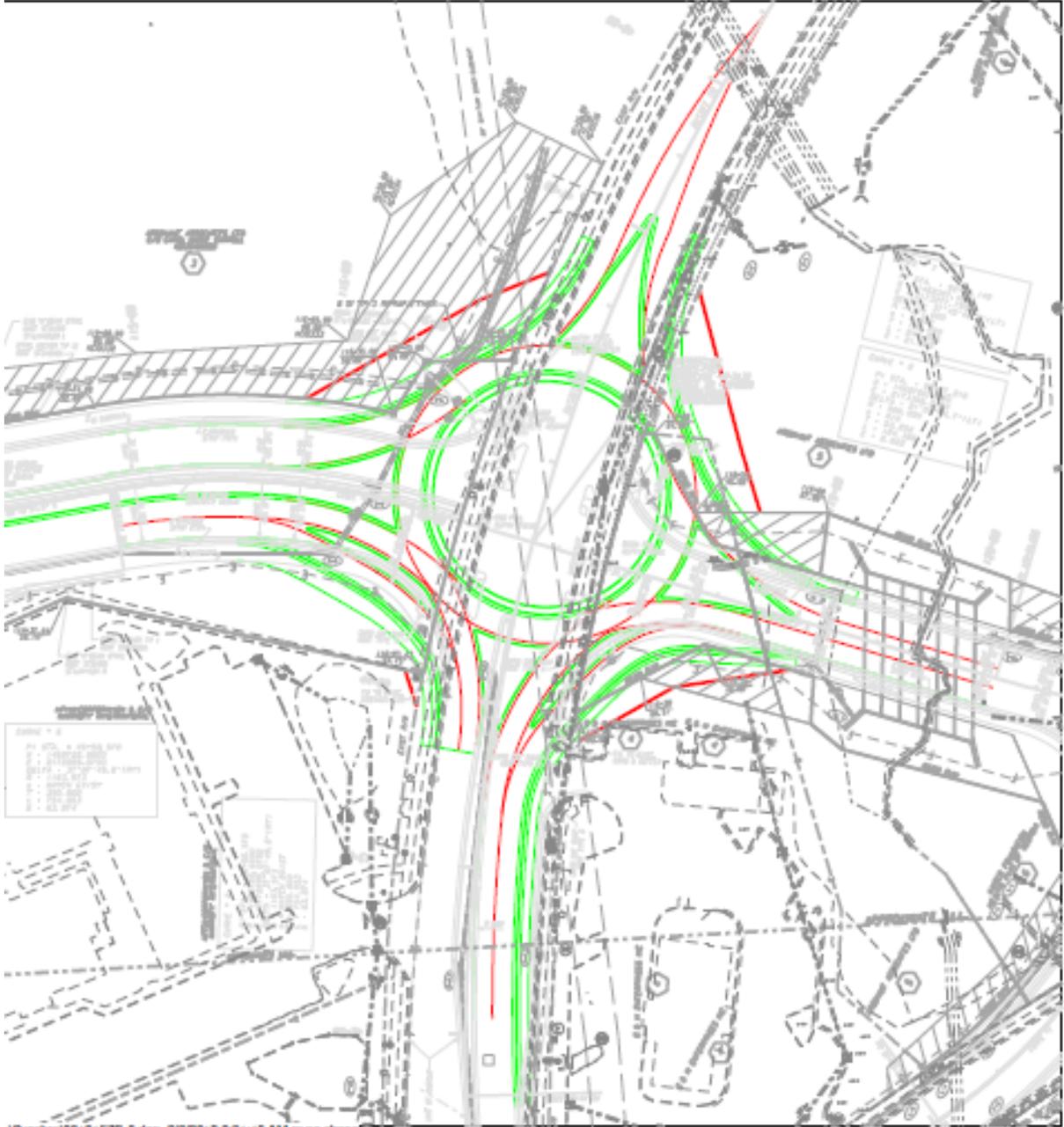
Construction of the single lane roundabout required additional asphalt pavement, concrete curb & gutter, concrete medians and r/w however the overall construction cost with eliminating the signal is lower. This recommendation would be most ideally implemented with a single lane in each direction on Busbee-Frey Connector. Additionally, the roundabout provides an ideal gateway feature opportunity for KSU or the CID.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$425,000		
Proposed	\$350,000		
Savings	\$75,000		\$75,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$75,000

SKETCH

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT
Sheet 2 of 10**



COST WORKSHEET

Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-6		
					CLIENT: CCDOT/GDOT		
Comp BY: PZ Date: 2-8-12 Checked By: GAO Date: 2-13-12					Sheet 3 of 10		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
AT INTERSECTION OF:				0			0
BUSBEE-FREY CONNECTOR &				0			0
BUSBEE DRIVE				0			0
				0			0
Original Design:		0	1.00	0	0	1.00	0
PAVEMENT	SY	4,382	43.00	188,426			0
CURB & GUTTER	LF	1,467	9.74	14,289			0
CONC. ISLAND	SY	172	36.41	6,263			0
SIDEWALK	SY	755	20.92	15,795			0
ADA RAMP	EA	4	866.89	3,468			0
RIGHT OF WAY	AC	0	452,000.00	0			0
TRAFFIC SIGNAL	EA	1	150,000.00	150,000			0
MAST ARM POLE	EA	4	6,000.00	24,000			0
VIDEO DET SYS	EA	4	5,600.00	22,400			0
				0			0
VE Design:				0			0
PAVEMENT	SY			0	4,014	43.00	172,602
CURB & GUTTER	LF			0	1,643	9.74	16,003
CONC. ISLAND	SY			0	870	36.41	31,677
SIDEWALK	SY			0	779	20.92	16,297
ADA RAMP	EA			0	6	866.89	5,201
RIGHT OF WAY	AC			0	0.239	452,000.00	108,028
TRAFFIC SIGNAL	EA			0	0	150,000.00	0
MAST ARM POLE	EA			0	0	6,000.00	0
VIDEO DET SYS	EA			0	0	5,600.00	0
SUBTOTAL				424,639			349,808
TOTAL ROUNDED				425,000			350,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 4 of 10**



Roundabout Analysis Tool

v 1.3
Updated: 9/8/10

Welcome to GDOT's Roundabout Analysis Tool. This tool is designed for the user to determine the functionality of a proposed roundabout. The analysis is based on NCHRP Report 572 and the FHWA's Roundabout Design Guide (2000) standards. Please read the notes in the Instructions tab before using the spreadsheet.

Analyst:	AMEC	<i>Insert Project Information Here in the BLUE SPACE. This information is linked to the Single Lane and Multi Lane Worksheets.</i>
Agency/Company:	AMEC	
Date:	2/7/2012	
Project Name or PI#:	0010157	
Year, Peak Period:	2034 AM	
County/District:	COBB	
Intersection:	BUSBEE-FREY CONNECTOR	

Roundabout Considerations Worksheet

Roundabouts may not operate well if there is too much traffic entering the intersection or if the percentage of traffic on the major road is too high. Candidate intersections shall be analyzed to determine whether a roundabout will perform acceptably. Shown below are thresholds to determine if a roundabout capacity analysis is required:

# of circulatory lanes	ADTs (current/ build year)	% traffic on Major Road
Single Lane	less than 25,000	less than 90%
Multi-Lane	less than 45,000	less than 90%

Other things to consider when evaluating roundabouts as an alternative are Right of Way, sight distance, environmental impacts, and access to adjacent properties.

Volume Information (for Analysis Time Period)

1 Enter the Major/Minor Street ADT Volumes in the Chart below:

	Volumes	Split
Major Street	12,030	48%
Minor Street	12,950	52%
Total volumes	24,980	

Proximity to Other Intersections

2 How close is the nearest signal (miles or feet)?

3 Is the proposed intersection located within a coordinated signal network? Go up to next section...

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 5 of 10**

➔ **Proposed Design Configuration Chart**

Directions for this Section only: (see Instructions Tab for other sections)

1. Select the type of roundabout you are analyzing.
2. Key in the number of approaches and the street names at the proposed intersections.
3. Complete the Approach Characteristics Chart:
 - a. Select the Street Name from the pulldown menu for each approach leg
 - b. Select the Lane Type for each entry approach lane
*The first box is the inner lane, the second box is the outer lane
 - c. Select Yes or No if a right turn bypass will be added to each approach leg

Roundabout Characteristics

Roundabout Type:

of Approaches:

Name of Streets:

Chart Key:

Single Lane	Street Name	
	All	
	Bypass?	
Multi-lane	Street Name	
	Inner Ln	Outer Ln
	Bypass?	

Approach Leg Characteristics:

	North Leg (1)	NE Leg (2)	East Leg (3)	SE Leg (4)
Street Name:	BUSBEE DRIVE		BUSBEE FREY CONNECTOR	
Entry Lane Config	All	All	All	All
Bypass to Adj Leg?	No		No	
	South Leg (5)	SW Leg (6)	West Leg (7)	NW Leg (8)
Street Name:	BUSBEE DRIVE		BUSBEE FREY CONNECTOR	
Entry Lane Config	All	All	All	All
Bypass to Adj Leg?	Yes		Yes	

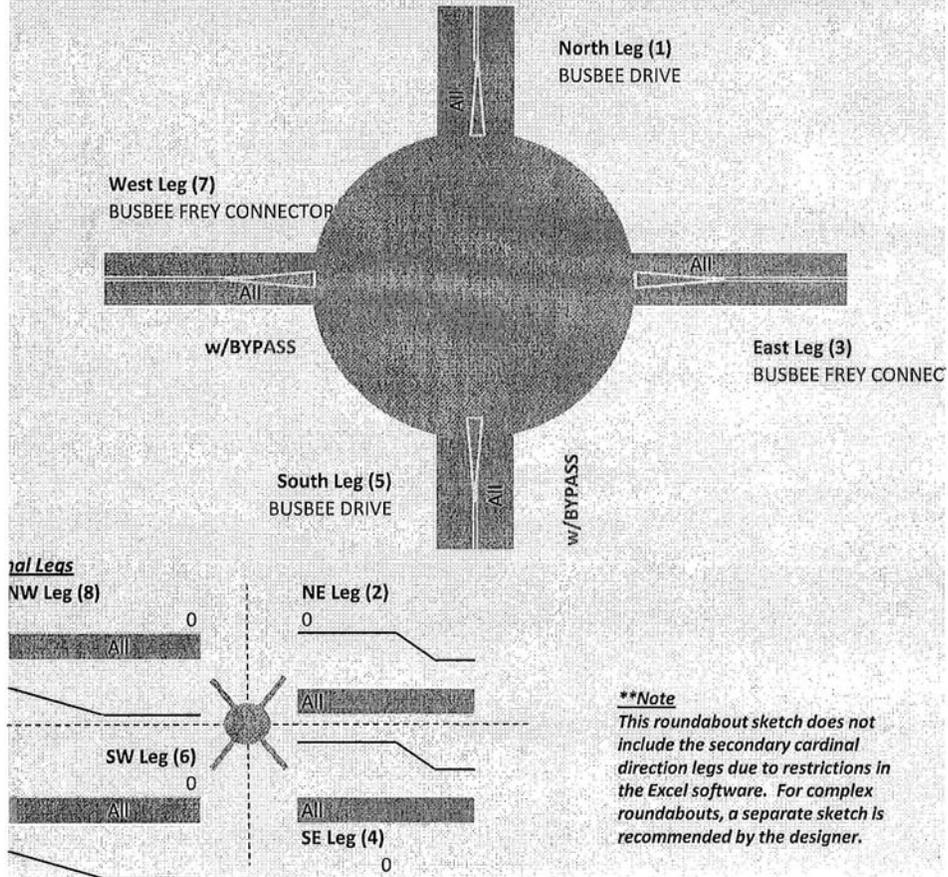
Additional

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 6 of 10**

Preliminary Roundabout Rendering**



CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 7 of 10**

Roundabout Analysis Tool
Single Lane

2/7/2012
Version 1.3

General & Site Information	
Analyst:	AMEC
Agency/Company:	AMEC
Date:	2/7/2012
Project Name or PI#:	0010157
Year, Peak Hour:	2034 AM
County/District:	COBB
Intersection:	BUSBEE-FREY CONNECTOR

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			5		150		10	
	NE (2), vph								
	E (3), vph	20				5		20	
	SE (4), vph								
	S (5), vph	55		85				15	
	SW (6), vph								
	W (7), vph	45		450		400			
	NW (8), vph								
Output	Total Vehicles	120	0	540	0	555	0	45	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	90%	100%	90%	100%	90%	100%	90%	100%
% SU/ Bus	7%	0%	7%	0%	7%	0%	7%	0%
% Trucks/ Combin.	3%	0%	3%	0%	3%	0%	3%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
F _{HV}	0.937	1.000	0.937	1.000	0.937	1.000	0.937	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	6	0	174	0	12	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	23	0	0	0	6	0	23	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	64	0	99	0	0	0	17	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	52	0	522	0	464	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	139	0	626	0	644	0	52	0
Conflicting flow, pcu/h	1084	0	649	0	58	0	186	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here...	Standard Single Lane

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 8 of 10**

Roundabout Analysis Tool
Single Lane

2/7/2012
Version 1.3

Results: Approach Measures of Effectiveness								
NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	382	NA	590	NA	1066	NA	939	NA
V/C ratio	0.36		1.06		0.60		0.06	
Control Delay, sec/pcu	15		76		8		4	
LOS	B		F		A		A	
95th % Queue (ft)	44		473		113		5	
UK Model**								
UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	621	NA	858	NA	1180	NA	1111	NA
V/C ratio	0.22		0.73		0.55		0.05	
Control Delay, sec/pcu	7		15		7		3	
LOS	A		B		A		A	
95th % Queue (ft)	23		176		91		4	

Notes:

Unit Legend:

vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)						
Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)	W (7)	S (5)				
Select Exit Leg for Bypass (TO)	S (5)	E (3)				
Volumes						
Right Turn Volume removed from Entry Leg	50	90				
Volume Characteristics (for entry leg)						
PHF	0.92	0.92				
F _{HV}	0.94	0.94				
<i>NOTE: Volume Characteristics for Exit Leg are already taken into account</i>						
Entry/Conflicting Flows						
Entry Flow	58	104				
Conflicting Flow	180	52				
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr	944	1073				
V/C ratio	0.06	0.10				
Control Delay, sec/pcu	4.1	3.7				
LOS	A	A				
95th % Queue (ft)	5	9				

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 9 of 10**

Roundabout Analysis Tool
Single Lane

2/7/2012
Version 1.3

General & Site Information	
Analyst:	AMEC
Agency/Company:	AMEC
Date:	2/7/2012
Project Name or PI#:	0010157
Year, Peak Hour:	2034 PM
County/District:	COBB
Intersection:	BUSBEE-FREY CONNECTOR

Volumes		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			5		155		40	
	NE (2), vph								
	E (3), vph	35				5		135	
	SE (4), vph								
	S (5), vph	115		175				155	
	SW (6), vph								
	W (7), vph	55		165		85			
	NW (8), vph								
Output	Total Vehicles	205	0	345	0	245	0	330	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	85%	100%	85%	100%	85%	100%	85%	100%
% SU/ Bus	5%	0%	5%	0%	5%	0%	5%	0%
% Trucks/ Combin.	10%	0%	10%	0%	10%	0%	10%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
F _{HV}	0.889	1.000	0.889	1.000	0.889	1.000	0.889	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	6	0	190	0	49	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	43	0	0	0	6	0	165	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	141	0	214	0	0	0	190	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	67	0	202	0	104	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	251	0	422	0	300	0	404	0
Conflicting flow, pcu/h	520	0	342	0	257	0	397	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here...	Standard Single Lane

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: C-6
Client: CCDOT/GDOT
Sheet 10 of 10**

Roundabout Analysis Tool
Single Lane

2/7/2012
Version 1.3

Results: Approach Measures of Effectiveness								
NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	672	NA	802	NA	874	NA	759	NA
V/C ratio	0.37		0.53		0.34		0.53	
Control Delay, sec/pcu	9		9		6		10	
LOS	A		A		A		A	
95th % Queue (ft)	49		88		43		89	
UK Model**								
UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	929	NA	1025	NA	1072	NA	996	NA
V/C ratio	0.27		0.41		0.28		0.41	
Control Delay, sec/pcu	5		6		5		6	
LOS	A		A		A		A	
95th % Queue (ft)	31		57		32		56	

Notes:

Unit Legend:

vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)						
Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)	W (7)	S (5)				
Select Exit Leg for Bypass (TO)	S (5)	E (3)				
Volumes						
Right Turn Volume removed from Entry Leg	200	45				
Volume Characteristics (for entry leg)						
PHF	0.92	0.92				
F _{HV}	0.89	0.89				
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow	245	55				
Conflicting Flow	544	214				
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr	656	912				
V/C ratio	0.37	0.06				
Control Delay, sec/pcu	8.7	4.2				
LOS	A	A				
95th % Queue (ft)	49	5				

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: C-12	Sheet No.: 1 of 3	CREATIVE IDEA: Reduce pavement thickness
--------------------------	-----------------------------	---

Comp By: PZ Date: 2-8-12 Checked By: GAO Date: 2-13-12

Original Concept: Use standard CCDOT pavement thickness
 12.5 mm Superpave 1.5 in
 19 mm Superpave 2 in
 25 mm Superpave 6 in
 GAB 10 in
 Truck percentage is 10%
 Pavement is 17.1% underdesign.

Proposed Change:
 The recommended pavement section is:
 12.5 mm Superpave 1.5 in
 19 mm Superpave 2 in
 25 mm Superpave 3 in
 GAB 8 in

Justification:
 The listed truck percentage for the Busbee-Frey Connector is 10% which is rather high and unrealistic. This is a new roadway with no direct access to the interstate and not intended as a truck route. Most of the anticipated traffic is expected to be single unit vehicles. It would be worthwhile to review the truck percentage as it is a significant factor in the overall pavement design.
 Assuming the truck percentage to be 5%, recalculating the required pavement makeup yields a significant cost reduction. Applying the GDOT pavement design process, the required structural number (SN) is 2.50. The original design has a SN of 4.48 (76% overdesign). The recommended pavement has a SN of 3.86 (54% overdesign).

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$990,000		
Proposed	\$745,000		
Savings	\$245,000		\$245,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$245,000

COST WORKSHEET

Project: Busbee - Frey Connector; Cobb County					IDEA No.: C-12		
					CLIENT: CCDOT/GDOT		
Comp BY: PZ Date: 2-8-12 Checked By: GAO Date: 2-13-12					Sheet 2 of 3		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
Original Design:							
GAB 10 IN	SY	21,500	13.16	282,940			
12.5MM SP	TN	3,100	59.93	185,783			
19 MM SP	TN	2,400	57.93	139,032			
25 MM SP	TN	7,100	53.81	382,051			
VE Design:							
GAB 8 IN	SY				21,500	10.53	226,352
12.5MM SP	TN				3,100	59.93	185,783
19 MM SP	TN				2,400	57.93	139,032
25 MM SP	TN				3,600	53.81	193,716
SUBTOTAL				989,806			744,883
TOTAL ROUNDED				990,000			745,000

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: F-6	Sheet No.: 1 of 3	CREATIVE IDEA: Use fewer culvert crossings at the Regional Detention Pond (RDP)
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Comp By: PZ Date: 2-7-12 Checked By: GAO Date: 2-13-12

Original Concept: Use 6 cell culvert at the regional detention pond (RDP). The flows into and out of the RDP are controlled by the 2 – 72 inch pipes at the upstream end and an outfall control structure at the downstream end. The proposed culverts serve as equalization flow chambers, not necessarily for capacity or flood storage.

Proposed Change: Reduce number of culvert cells to 2 and excavate additional volume to compensate for lost flood storage if required.

Justification: The RDP flows are controlled by the upstream and downstream structures and piping. The proposed culverts serve only as equalization measures and not for capacity. Any flood storage volume may be mitigated by additional excavation and regrading of the RDP.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$631,000		
Proposed	\$310,000		
Savings	\$321,000		\$321,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$321,000

COST WORKSHEET							
Project: Busbee - Frey Connector; Cobb County					IDEA No.: F-6		
					CLIENT: CCDOT/GDOT		
Comp BY: PZ Date: 2-7-12 Checked By: GAO Date: 2-13-12					Sheet 2 of 3		
CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
Item	Unit	No. Units	Cost/Unit	Total Cost	No. Units	Cost/Unit	Total Cost
				0			0
Original Design:				0			0
				0			0
				0			0
6 cell culvert	LS	1	630,892.00	630,892	0	1.00	0
				0			0
				0			0
				0			0
				0			0
VE Design:				0			0
				0			0
2 cell box culvert	LS			0	1	235,297.00	235,297
additional earthwork	LS			0	1	75,000.00	75,000
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
				0			0
SUBTOTAL				630,892			310,297
TOTAL ROUNDED				631,000			310,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: F-6
Client: CCDOT
Sheet 3 of 3**

Cost of 6 cell box culvert; **\$630,892**

Assume 1/3 of cost and add \$25,000 for wingwalls

$$(630,892 / 3) + \$25,000 = \mathbf{\$235,297}$$

Assume additional excavation / earthwork to compensate for lost storage:
\$75,000 allows for about 10,000 cu yds of excavation.

DEVELOPMENT AND RECOMMENDATION PHASE

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

IDEA No.: M-1	Sheet No.: 1 of 3	CREATIVE IDEA: Use narrower sidewalks, 5 feet on Busbee-Frey Connector
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Comp By: JVD Date: 2-8-12 Checked By: GAO Date: 2-13-12

Original Concept: Use 10 foot sidewalk on Busbee – Frey Connector, 15 feet wide on the bridge.

Proposed Change: Use standard 5 foot wide sidewalks. This will provide a narrower shoulder and roadway /earthwork template and a narrower bridge.

Justification: The entire sidewalk network within and adjacent to the project is 5 feet in width, even Frey Road on the KSU side of the project. Realistically, this is currently not and is not anticipated to be a high pedestrian area. Maintaining the standard width sidewalk will reduce project costs while continuing to provide a pedestrian network.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	\$1,560,000		
Proposed	\$0		
Savings	\$1,560,000		1,560,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			\$1,560,000

CALCULATIONS

**Project: Busbee – Frey Connector; PI 0010157
Cobb County**

**Idea No.: M-1
Client: CCDOT
Sheet 3 of 3**

This recommendation applies to Busbee – Frey Connector
Sta 104+00 to 117+00; 1,300 ft; both sides; includes 476 ft bridge length

Sidewalk reduction:

$$(1,300 - 476) 2(5) = 8,240 \text{ sq ft} = \mathbf{916 \text{ sq yds}}$$

Earthwork reduction: assume average fill height of 15 ft from sta 110+50 to 116+00; 550 ft
 $550 \times 15 \times 10 = 82,500 \text{ cu ft} = \mathbf{9,167 \text{ cu yds}}$

Right of way reduction, only on north side: $550 \text{ ft} \times 5 \text{ ft} = 2,750 \text{ sq ft} = \mathbf{0.063 \text{ acres}}$

Assume \$10,000 reduction in wall on south side.

Bridge area reduction:

$$476 (2) 10 = \mathbf{9,520 \text{ sq ft}}$$

APPENDIX

Approving/Authorizing Persons

Name:	Position:	Telephone:
Michael Wright	District Engineer; CCDOT	770-528-4375
Chandria Brown	Project Manager – Program Delivery	404-631-1580
Lisa Myers	Acting State Project Review Engineer	404-631-1770

Personal Contacts

Name:	Telephone:	Notes:
Chris Rideout	770-971-5407	Project Design Briefing
Chris Rideout	770-971-5407	R/W information
David Hedeem	In-person discussion	Project Ecologist
Bill Duvall	In-person discussion	Structural Engineer

Documents/Abstracts

Reference:	Reference:
Preliminary Plans including cover, typical sections, construction plans, profiles and cross-sections	Preliminary R/W Cost Estimate
Preliminary Cost Estimate	Preliminary Bridge Layout
Project Concept Report	100 Scale Layout
Project Traffic Data	Approved 1993 Project Concept Report

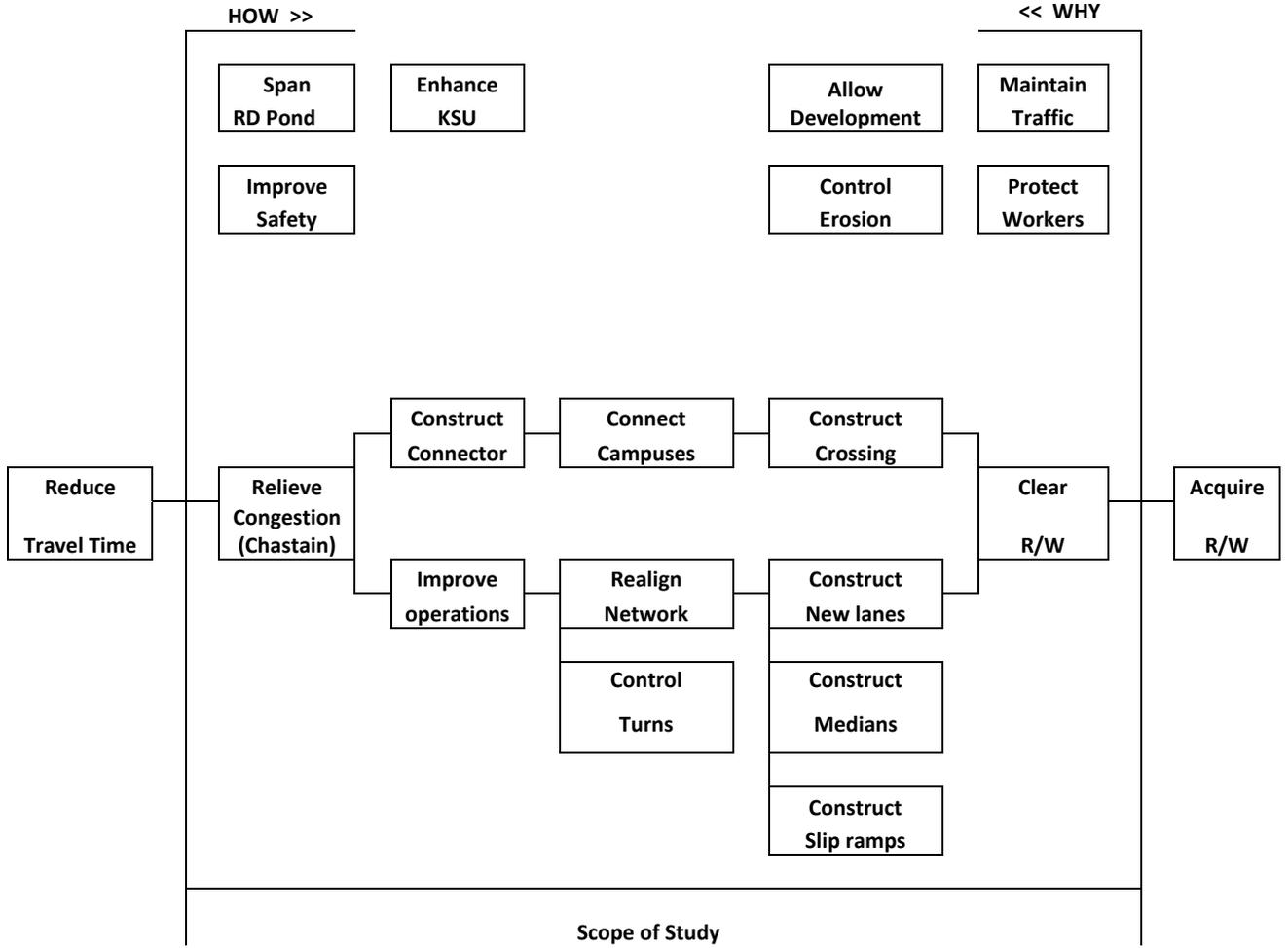
Busbee – Frey Connector

Cost Model / Distribution

Item	Description	Amount	% of Total Project
A	Structures	\$7,280,000	49.44
B	Right-of-Way	\$2,670,000	18.13
C	Asphalt pavement	\$1,212,000	8.23
D	Signals	\$874,000	5.94
E	Earthwork	\$850,000	5.77
F	Culvert	\$631,000	4.29
G	Temporary traffic control	\$250,000	1.70
H	Drainage	\$174,800	1.19
I	Erosion control	\$151,300	1.03
J	Pavement marking	\$151,300	1.03
K	Concrete curb and gutter	\$125,600	0.85
L	Guardrail	\$105,600	0.72
M	Concrete sidewalk	\$83,700	0.57
N	Concrete wall	\$70,200	0.48
O	Concrete median	\$51,000	0.35
P	Landscaping	\$43,200	0.29
	Total Project Cost	\$14,724,200	

Note: This cost model is based on the construction cost estimate prepared by Croy Engineering, 1-13-12

FAST DIAGRAM



INFORMATION PHASE – FUNCTION ANALYSIS

Project: Busbee – Frey Connector

Basic Function: Relieve congestion

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
A	Structures	separate	grade	\$7,280,000	49.44%	Yes
		span	interstate			
		connect	E/W sides			
		allow	pedestrians			
		incorporate	aesthetics			
		span	drainage			
		accommodate	future widening			
		improve	access			
B	Right of Way	allow	construction	\$2,670,000	18.13%	Yes
		store	project			
		control	access			
		span	pond			
		accommodate	pedestrians			
		establish	corridor			
		compensate	owners			
		control	development			
C	Asphalt Pavement	support	loads	\$1,212,000	8.23%	Yes
		improve	traffic			
		connect	E/W sides			
		control	access			
		separate	traffic			
		maintain	typical section			
		separate	movements (ramps)			
D	Signals	control	traffic	\$874,000	5.94%	No
		inform	motorist			
		sequence	traffic			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: Busbee – Frey Connector

Basic Function: Relieve congestion

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
E	Earthwork	support	load	\$850,000	5.77%	No
		transfer	load			
		establish	grade			
		displace	volumes (detention)			
		convey	drainage (ditches)			
F	Culvert	convey	flow	\$631,000	4.29%	Yes
		span	pond			
		support	roadway			
		satisfy	permit			
		compensate	flood storage			
		accommodate	no-rise			
G	Temporary Traffic Control	construct	project	\$250,000	1.70%	No
		protect	workers			
		protect	motorists			
		shift	traffic			
		access	businesses			
H	Drainage	convey	runoff	\$174,800	1.19%	No
		control	spread			
		discharge	runoff			
		enhance	pavement			
I	Erosion Control	control	erosion	\$151,300	1.03%	No
		maintain	permit			
J	Pavement Markings	inform	motorist	\$151,300	1.03%	No
		Control	traffic			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: Busbee – Frey Connector

Basic Function: Relieve congestion

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
K	Concrete Curb & Gutter	delineate	edge	\$125,600	0.85%	No
		separate	shoulder			
		convey	drainage			
		optimize	r/w			
L	Guardrail	delineate	approach	\$105,600	0.72%	No
		protect	obstruction			
M	Concrete sidewalk	allow	pedestrians	\$83,700	0.57%	Yes
		allow	streetscape			
N	Concrete wall	retain	fill	\$70,200	0.48%	No
		minimize	r/w			
		protect	Development			
		reduce	earthwork			
O	Concrete median	separate	traffic	\$51,000	0.35%	Yes
		limit	movements			
		satisfy	standards			
P	Landscaping	beautify	project	\$43,200	0.29%	No
		enhance	aesthetics			
		promote	CID			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
A	Structures		
A-1	Reduce bridge end spans		✓
A-2	Use 11 foot lanes	See C-2	✓
A-3	Reduce bridge sidewalk to 10 feet		✓
A-4	Reduce median width to 16 feet	See C-3	✓
A-5	Use 5 lane section; 14 foot flush median	See C-4	✓
A-6	Use 3 lane section	See C-5	✓
A-7	Use steel bridge	Span arrangements are difficult; not enough vertical relief.	X
A-8	Use MSE walls at end spans		✓
A-9	Eliminate bent 2; reconfigure bridge spans	Not enough horizontal offset	X
A-10	Shift / tighten ramp gore areas / shorten bridges	Not enough ramp storage; vertical clearance concerns	X
A-11	Use narrower sidewalks	See A-3 and M-1	✓
A-12	Enhance only north side of bridge	Only visible side; see M-1	✓
A-13	Construct half diamond at Frey underpass	Beyond project footprint; new interchange access	X
A-14	Relocate new crossing further north to main parking deck	Affect residential area; stream crossing	X
B	Right of Way.		
B-1	Include additional R/W at culverts for future maintenance	Ultimately a condition of permit and County directive	X
C	Asphalt Pavement		
C-1	Realign Busbee / Frey Connector / Busbee Drive intersection; eliminate Townpark Lane extension work		✓
C-2	Use 11 foot lanes		✓

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
C-3	Reduce median width to 16 feet		✓
C-4	Use 5 lane section		✓
C-5	Use 3 lane section		✓
C-6	Use roundabout at Busbee / Frey Connector and Busbee Drive intersection		✓
C-7	Separate dedicated I-75 NB ramp movement	Already incorporated	X
C-8	Eliminate slip ramps	Helps alleviate congestion on Chastain. No additional R/W required	X
C-9	Develop DDI / eliminate crossing	Requires extensive traffic analysis; not a long-range remedy; proximity of adjacent signals	X
C-10	Add additional lanes to Chastain bridge	Continues to congest Chastain	X
C-11	Use 5 foot wide sidewalk	5 foot sidewalk used throughout area; see M-1	✓
C-12	Review truck volumes; use thinner pavement section	Standard CCDOT section	✓
D	Signals		
D-1	Eliminate signal at Busbee / Frey Connector and Busbee Drive intersection; use roundabout	See C-6	✓
E	Earthwork		
E-1	Over excavate / compensate for lost flood storage volume	See F-3	✓
E-2	Raise / modify profile at culvert	See F-4	✓

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
F	Culvert		
F-1	Eliminate work at regional detention pond (RDP)	See C-1	✓
F-2	Use flat slab bridge	Review with respect to no-rise conditions	X
F-3	Construct bridge; compensate / excavate for lost flood storage volume	Review with respect to no-rise conditions	X
F-4	Raise / modify profile at culvert	Review with respect to no-rise conditions	X
F-5	Use bottomless culvert	Alternate to bridge; F-3	X
F-6	Use fewer culverts	Acting as equalization tubes	✓
G	Temporary traffic control		
H	Drainage		
H-1	Eliminate use of flanking inlets	Required for additional flow capacity	X
I	Erosion Control		
J	Pavement marking		
K	Concrete curb and gutter		
L	Guard Rail		
M	Concrete sidewalk		
M-1	Use narrower sidewalk, 5 feet		✓
M-2	Construct separate pedestrian crossing / trail	Adding obstructions to I-75	X
N	Concrete wall		
N-1	Shift Busbee / Frey Connector to minimize walls	Increases bridge span	X

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	CREATIVE IDEA	COMMENTS	IDEA RATING
O	Concrete median		
O-1	Use grass median	Very small opportunity; already under consideration	X
P	Landscaping		
✓ = Will be considered further; X = will be dropped; DC = Design Consideration; written for consideration by design team			

