



MSL-0003-00(165)

HOV Lanes on I-20 Westside

From Bright Star Road to SR

6/Thornton Road

P.I. No. 0003165

Douglas County, Georgia

Value Engineering Study Report

March 2006

Design Consultant

Georgia Department of Transportation, District 7



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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March 27, 2006

Ms. Lisa L. Myers
Design Review Engineer Manager
State of Georgia Department of Transportation
General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: Project Number MSL-0003-00(165), P.I. No. 0003165, Douglas County
HOV Lanes on I-20 Westside From Bright Star Road to SR 6/Thornton Road
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc., is pleased to submit four hard copies and one electronic copy of the referenced report.

The VE team developed alternatives and design suggestions that improve the value of the project and reduce capital cost. These alternatives also meet the project goals of improving transit, easing congestion, reducing single-occupancy vehicle travel, increasing capacity, and improving safety.

We thank the State of Georgia Department of Transportation and DMJM Harris | AECOM representatives for assisting the VE team in generating creative, value-improving solutions for this project. We look forward to working with you on future assignments.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

A handwritten signature in black ink, reading "Luis M. Venegas".

Luis M. Venegas, PE, CVS-Life, LEED™ AP
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction	2
Project Description	2
Concerns and Objectives	2
Highlights of the Study	2

STUDY RESULTS

Introduction	6
Results of the Study	6
Evaluation of Alternatives	7
Considerations and Assumptions	7
Value Engineering Alternatives	9

PROJECT DESCRIPTION

Purpose and Need	50
Description of the Proposed Project	50
Proposed Design Features	51
Cost Data	53

VALUE ANALYSIS AND CONCLUSIONS

General	55
Preparation Effort	55
Value Engineering Workshop Effort	55
Post-Workshop Effort	58
Agenda	59
Value Engineering Workshop Participants	61
Economic Data	64
Cost Estimate Summary and Cost Histograms	65
Function Analysis	68
Creative Idea Listing and Judgment of Ideas	71

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was concept development phase of the High Occupancy Vehicle (HOV) Lanes on Interstate Highway 20 (I-20) Westside from Bright Star Road to State Route (SR) 6/Thornton Road known as Project MSL-0003-00(165), P.I. No. 0003165, in Douglas County, Georgia, being designed by DMJM Harris | AECOM.

PROJECT DESCRIPTION

The project proposes the addition of a barrier-separated single HOV lane in both directions from Bright Star Road to the Douglas County Multi-Modal Center and barrier-separated dual HOV lanes in both directions from the Multi-Modal Center to SR-6/Thornton Road. HOV access will be provided by means of three HOV exclusive interchanges and a slip ramp. The proposed project is approximately 11.4 miles long.

The current probable cost of construction is \$108,313,216 if flexible pavement is used on the mainline work or \$163,855,855 if rigid pavement is used. These costs include engineering and construction costs at either \$82,090,589 (for flexible pavement) or \$137,633,228 (for rigid pavement) and \$26,222,627 in right-of-way costs regardless of the pavement type.

CONCERNS AND OBJECTIVES

The project is a straightforward conceptual design for the addition of HOV lanes along an existing, heavily traveled corridor of I-20. The conceptual estimates indicate construction costs that are within acceptable parameters for this facility. However, the VE team noted several areas of concern: (1) The mandated use of concrete bridges, (2) the use of end spans at new bridges, and (3) employing a “flyover” to access the expanded Douglas County Multi-Modal Center.

The objective of the VE study was to identify opportunities to improve the value of the project while still meeting the project goals of improving transit, easing congestion, reducing travel time, improving safety, reducing single-occupancy vehicle travel, increasing capacity, and potentially reducing capital cost.

HIGHLIGHTS OF THE STUDY

When reviewing the highlights below, it is important to note that the current design is at the very early conceptual stage; as such, all proposed alternatives and their respective costs are order-of-magnitude numbers only and, if accepted, will require in-depth analysis and engineering.

The existing Douglas County Multi-Modal Center is being expanded as part of this project in order to accommodate the expected increase in HOVs, carpools, vanpools, and other higher occupancy means of transit. In order to facilitate access to the proposed HOV lanes from the multi-modal center, the current design proposes a new HOV-only full drop ramp/interchange that ultimately connects Dorris Road, Timber Ridge Drive, and Prestley Mill Road. Alternative No. 13 proposes the less costly solution of developing Dorris Road along the south side of the Douglasville Hospital property paralleling I-20 on the north side of Prestley Mill Road. This allows the proposed “flyover” at the Dorris Road/I-20 crossing to be eliminated and fully develops the Prestley Mill Road interchange to accommodate the new HOV-only interchange/full drop ramp. Cost savings associated with this alternative approach \$1,430,000.

The western portion of Douglas Road is being diverted to accommodate the grade change resulting from the new bridge at Bright Star Road and the added vehicle volume associated with the proposed Park-and-Pool Lot near the northwest corner of the Douglas Road/Stewart Parkway intersection. Alternative No. 3 is to rework the proposed profile without the diversion. Savings associated with this alternative could reach \$2,600,000. On a somewhat related theme, Alternative No. 1 would not construct the Bright Star Road Bridge to its ultimate width because the widening of Bright Star Road, a project to be undertaken by the county, is not planned for the foreseeable future. Initial savings are identified at about \$640,000.

It appears that a significant percentage of the proposed bridges could be shortened by employing mechanically stabilized embankment (MSE) walls and, where feasible, outside shoulders. This alternative, shown as Alternative Nos. 14/16, delineate cost savings of approximately \$3,333,000. In addition, Alternative No. 18 proposes constructing only one new bridge at the proposed HOV-only interchange for access to the multi-modal center, leading to initial cost savings of about \$1,440,000.

Since North County Line Road has minimal crossing traffic, it may be prudent to cul-de-sac this crossing. Alternate local arterial roadways can easily accommodate crossing I-20 at nearby locations and could reduce the project’s cost by nearly \$1,380,000, as shown on Alternative No. 9.

The Summary of Potential Cost Savings worksheet follows this narrative and summarizes these and all of the alternatives developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that addition of all project cost savings does not equal total savings for the project. A full listing of all of the ideas considered by the VE team can be found on the Creative Idea Listing worksheets in Section 4 of this report.

STUDY RESULTS

INTRODUCTION

The results are the major feature of a VE study since they represent the benefits that can be realized on the project by the owner, users, and designer. The results will directly affect the project design and will require coordination among the designer and the owner to determine the ultimate acceptance of each alternative.

During the conduct of the study, many ideas for potential value enhance were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that project comprises. For each alternative developed, the following information is provided:

- A summary of the original design;
- A description of the proposed change to the project;
- Sketches and design calculations, if appropriate;
- A capital cost comparison and life-cycle discounted present worth cost comparison of the alternative and original design (where appropriate);
- A descriptive evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted. A markup of 247%, as described in the Value Analysis and Conclusions section of the report, was used to generate an all-inclusive project cost for the right-of-way aspects of the project being compared.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) to track it through the value analysis process and facilitate referencing between the Creative Idea Listing and Evaluation worksheet, the Summary of Potential Cost Savings worksheet, and the alternatives.

RESULTS OF THE STUDY

The VE team generated 18 ideas for change during the Function Analysis and Creative Idea phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life-cycle cost efficiency, safety, maintainability, constructability, and soundness of the idea.

Of the 18 ideas generated, 8 of them were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 8 alternatives for change with an impact on project costs that are presented in detail following the Summary of Potential Cost Savings worksheet.

EVALUATION OF ALTERNATIVES

It is important to consider each part of an individual alternative on its own merit. There is a tendency to disregard an alternative because of concern about one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable, and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimate, where possible, is to be used as the pricing basis.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reader should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.

CONSIDERATIONS AND ASSUMPTIONS

In the preparation of this report and the alternatives that follow, the VE team made some assumptions with respect to conditions that may occur in the future. In addition, the VE team reviewed the project documentation, relying solely upon the information provided by the designer and owner and relying on that information as true, complete, and accurate. This summary of considerations and assumptions should be read in connection with the report.

- The alternatives rendered herein are as of the date of this report. The VE team assumes no duty to monitor events after the date or to advise or incorporate into any of the alternatives any new, previously unknown technology.
- The VE team assumes that there are no material documents affecting the design or construction costs that have not been seen. The existence of any such documents will necessarily alter the alternatives contained herein.
- The VE team is not warranting the feasibility of these alternatives or the advisability of their implementation. It is solely the responsibility of the designer, in accordance with the owner, to explore the technical feasibility and make the determination of implementation.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD** ALTERNATIVE NO.: **1**
Georgia Department of Transportation

DESCRIPTION: **DO NOT BUILD BRIDGE AT BRIGHT STAR ROAD TO ITS ULTIMATE WIDTH** SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The original design is to build the Bright Star Road bridge over I-20 four lanes wide to accommodate design year traffic.

ALTERNATIVE:

Build a two-lane bridge at this time to match the two-lane roadway. Widen the bridge at the same time the roadway is widened. Construct the bridge to accommodate future widening.

ADVANTAGES:

- Saves bridge cost now
- Future widening may not be necessary
- Not needed for the immediate future

DISADVANTAGES:

- The cost of the bridge will increase in the future

DISCUSSION:

Build only what is needed to accommodate opening day traffic. Upgrades can be completed when needed at a later date.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,914,666	—	\$ 1,914,666
ALTERNATIVE	\$ 1,276,144	—	\$ 1,276,144
SAVINGS	\$ 638,522	—	\$ 638,522

CALCULATIONS



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD
Douglas County, Georgia Department of Transportation
Design Development**

ALTERNATIVE NO.:

1

DESCRIPTION:

SHEET NO.: 2 of 3

Bridge as designed - $334' \times 66.42' = 22,184 \text{ SF}$
(4-Lanes)

Alt. Bridge - $334' \times 42.42' = 14,168 \text{ SF}$

$\therefore 8,016 \text{ SF} \times \$80/\text{SF} = \$641,280$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD**
Georgia Department of Transportation

ALTERNATIVE NO.: **3**

DESCRIPTION: **DO NOT BUILD DIVERSION OF DOUGLAS ROAD AT BRIGHT STAR ROAD**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The current design shows the intersection of Douglas Road and Bright Star Road relocated 600 ft. south of its current location due to the Bright Star Road bridge being raised approximately 5 ft. over I-20. Approximately 1,700 linear ft. of Douglas Road will be relocated.

ALTERNATIVE:

Keep Douglas Road in its current location. Tie Bright Star Road to meet its existing profile as soon as possible. The existing intersection is 300 ft. south of bridge. Assume at least 2 ft. of the 5-ft. elevation difference can be made up. Reconstruct Douglas Road to tie into Bright Star Road at its proposed elevation.

ADVANTAGES:

- Reduces reconstruction
- Reduces right-of-way costs/takes

DISADVANTAGES:

- None apparent

DISCUSSION:

The diversion of Douglas Road can be avoided by adjusting the proposed profile of Bright Star Road to meet the existing road profile sooner. This will reduce the amount of grade adjustment necessary on Douglas Road at Bright Star Road and save significant cost.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,933,455	—	\$ 2,933,455
ALTERNATIVE	\$ 381,880	—	\$ 381,880
SAVINGS	\$ 2,551,575	—	\$ 2,551,575

CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

3

DESCRIPTION:

SHEET NO.: 2 of 3

$$\text{Pav'4} = 12'' \text{ GAB} \rightarrow 12'' \times 110\# / \text{sq/in} \div 2000 = 0.66 \text{ Ton/sq} \times 4733 \text{ sq} = 3124 \text{ Tons}$$
$$1067 \text{ sq} = 704 \text{ Tons}$$

$$1700' \times 24 \div 9 = 4533 \text{ sq}$$

$$400' \times 24 \div 9 = 1067 \text{ sq}$$

$$\text{Driveway} = 200 \text{ sq}$$

$$8'' \text{ 25 MM} \rightarrow 8 \times 110 \div 2000 = 0.44 \text{ Ton/sq} \times 4733 \text{ sq} = 2083 \text{ Tons}$$
$$1067 \text{ sq} = 470 \text{ Tons}$$

$$4'' \text{ 19 MM} \rightarrow 4 \times 110 \div 2000 = 0.22 \text{ Ton/sq} \times 4733 \text{ sq} = 1041 \text{ Tons}$$
$$1067 \text{ sq} = 235 \text{ Tons}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD**
Georgia Department of Transportation

ALTERNATIVE NO.: **9**

DESCRIPTION: **CUL-DE-SAC NORTH COUNTY LINE ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

The existing bridge for North County Line Road over I-20 will be replaced due to the addition of HOV lanes along I-20.

ALTERNATIVE:

Cul-de-sac North County Line Road on either side of I-20 and remove the existing bridge.

ADVANTAGES:

- Cost savings

DISADVANTAGES:

- Cuts off through traffic over I-20

DISCUSSION:

Existing traffic north of I-20 can cross using Vulcan Drive or South Sweetwater to Lee Road or access Riley Road and/or McKnown Road to Burnt Hickory Road to cross over I-20. Existing traffic south of I-20 can cross using East County Line Road to Lee Road or West County Line Road to Midway/Burnt Hickory Road.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,472,781	—	\$ 1,472,781
ALTERNATIVE	\$ 97,332	—	\$ 97,332
SAVINGS	\$ 1,375,449	—	\$ 1,375,449

CALCULATIONS



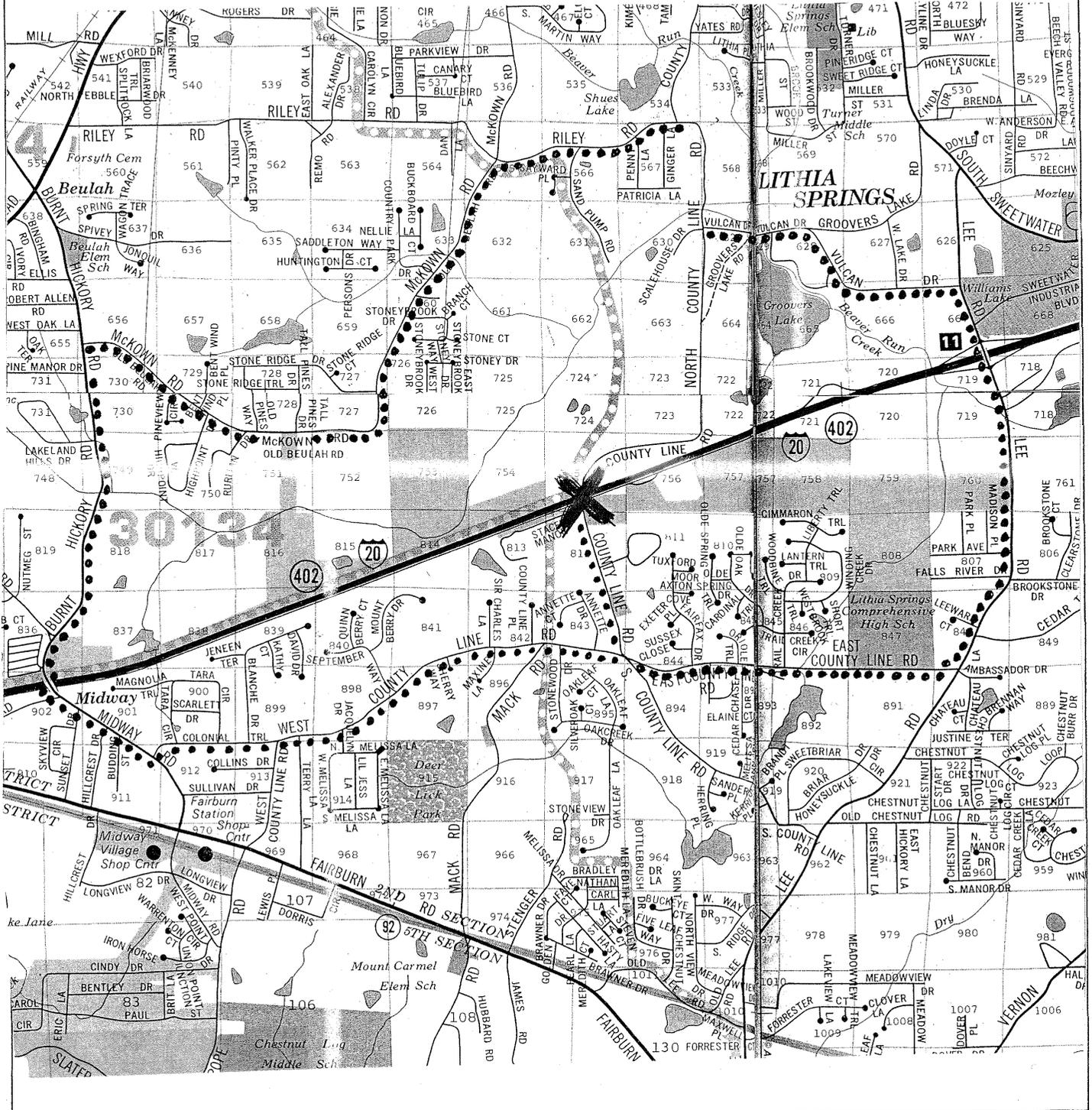
PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

9

DESCRIPTION:

SHEET NO.: 2 of 4



CALCULATIONS



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

9

DESCRIPTION:

SHEET NO.: 3 of 4

$$1700' \times 24' \div 9 = 4533 \text{ SQ}$$

$$12" \text{ GAB} = 0.666 \text{ Ton/SQ} \times 4533 \text{ SQ} = 2992 \text{ Tons}$$

$$8" \text{ 25MM} = 0.44 \text{ Ton/SQ} \times 4533 \text{ SQ} = 1995 \text{ Tons}$$

$$4" \text{ 19MM} = 0.22 \text{ Ton/SQ} \times 4533 \text{ SQ} = 997 \text{ Tons}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD** ALTERNATIVE NO.: **13**
Georgia Department of Transportation

DESCRIPTION: **DEVELOP DORRIS ROAD FOR ACCESS TO DOUGLAS COUNTY MULTI-MODAL CENTER AND RELOCATE HOV INTERCHANGE TO PRESTLEY ROAD** SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

The concept design for the multi-modal facility indicates a four-lane divided road with curb and gutter and 10-ft. sidewalks. The multi-modal road will be designed and constructed on Dorris Road. Dorris Road will extend over I-20 with a new bridge and a full HOV-only, full drop ramp tying into Timber Ridge Drive. Timber Ridge Drive will be improved westwardly to the new Prestley Mill Road/Timber Ridge intersection.

ALTERNATIVE:

Develop Dorris Road on the north side of I-20 for the multi-modal center roadway. There exists a dirt road for access to Douglas County Hospital’s property located in the southeastern section. Improve and upgrade the current intersection for Prestley Mill Road and Dorris Road to accommodate both HOV and single-occupancy vehicle/local traffic users. Right-of-way for this roadway could be sought from Douglas County Hospital as donation to reduce cost for the purpose of the roadway improvement.

ADVANTAGES:

- Eliminates proposed bridge
- Uses existing roadway
- Eliminates Timber Ridge Drive/Prestley Mill Road relocated intersection

DISADVANTAGES:

- May result in renegotiations with the hospital
- Impacts hospital’s property
- Through traffic on Prestley Road must use center lanes of new bridge/intersection

DISCUSSION:

A higher degree of efficiency will be obtained if Dorris Road is developed to access the multi-modal center from Prestley Road. A shorter driving distance is achieved with less impact on hospital ingress/egress. It is possible that this realignment could reduce the overall right-of-way costs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,454,608	—	\$ 4,454,608
ALTERNATIVE	\$ 3,020,268	—	\$ 3,020,268
SAVINGS	\$ 1,434,340	—	\$ 1,434,340

COST WORKSHEET



PROJECT: **MSL-0003-00(165), PI 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO:

13

DESCRIPTION

SHEET NO.: *2 of 2*

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
433-1300	SY	506	117.82	66,686	506	117.82	66,686
500-1006	LS	3592	653.00	2,345,997			2,345,997
<i>ROADWAY</i>							
310-1201	TH	31,548	20.99	662,192	5,318.39	20.99	111,633
402-1812	TN	10	39.19	391	3.00	39.19	117
402-3121	TN	23,000	36.68	843,640	3,250.13	36.68	119,214
402-3190	TN	7,700	39.29	302,533	1,625.06	39.29	63,848
402-3502	TH	6,150	36.77	226,135	609.39	36.77	22,407
413-1000	GL	7,325	0.96	7,032	775.59	0.96	744
4" CONC. S/W - 10' WIDE	SY				6155.55	34.00	209,288
TP 2 C 1/2 G	LF				5540	14.50	80,330
Sub-total				4,454,608			3,020,268
Mark-up at							
TOTAL							

VALUE ENGINEERING ALTERNATIVE



PROJECT:	HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD <i>Georgia Department of Transportation</i>	ALTERNATIVE NO.:	14/16
DESCRIPTION:	SHORTEN BRIDGES BY USING MECHANICALLY STABILIZED EMBANKMENT (MSE) WALLS WITH OUTSIDE SHOULDERS	SHEET NO.:	1 of 19

ORIGINAL DESIGN: (Sketch attached)

Bridges at Bright Star Road, SR 5, Midway Road, North County Line Road, and the west abutment of Mt. Vernon Road and the Multi-Modal bridge all have end slopes. Except for the North County Line Road Bridge, all others have end slopes with shorter end spans. The remainder of the bridge ends are on MSE walls with a minimum of 30 ft. as the clear zone from the edge of the travelway.

ALTERNATIVE: (Sketch attached)

Set bridge ends on MSE walls protected by a barrier in front of the wall adjacent to an outside 14-ft. shoulder.

ADVANTAGES:

- Shorter bridges result in less cost
- The short end spans can be eliminated, thereby eliminating the corresponding intermediate bent

DISADVANTAGES:

- Future additional lane expansion is curtailed
- 30-ft. clear zone is replaced with 14-ft. shoulder and barrier wall

DISCUSSION:

Shortening bridges with vertical MSE walls that match the cross-section of I-20 bridges over streams saves construction costs. Some bridges have end rolls that can be eliminated by putting walls at the outside shoulders. Other bridges already have MSE wall abutments located behind 30-ft. clear zones. If this is replaced with 14-ft. shoulders, the walls can be brought in and the bridges shortened; however, if there is a definite plan in the future that involves adding outside lanes, then eliminating the clear zone will not be feasible.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 4,276,719	—	\$ 4,276,719
ALTERNATIVE	\$ 942,932	—	\$ 942,932
SAVINGS	\$ 3,333,787	—	\$ 3,333,787

PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

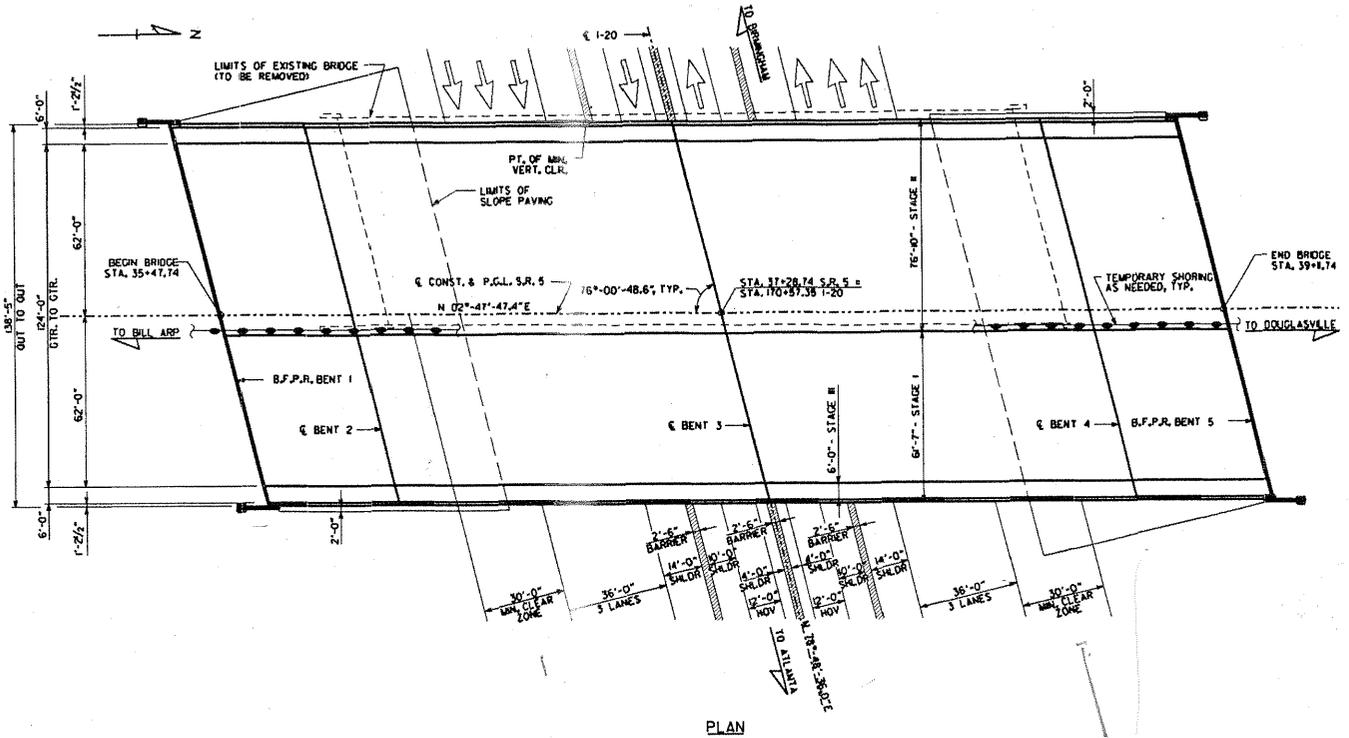
ALTERNATIVE NO.:

14/16

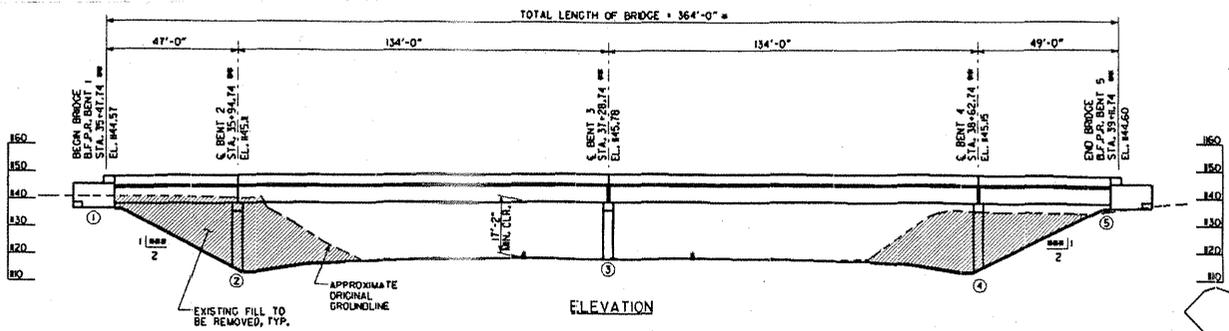
AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 19

SR 5 OVER I-20



PLAN



ELEVATION

NOTE: A BRIDGE LENGTH OF 330' WAS USED IN THE ORIGINAL COST ESTIMATES.



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD**
 Douglas County, Georgia Department of Transportation
Design Development

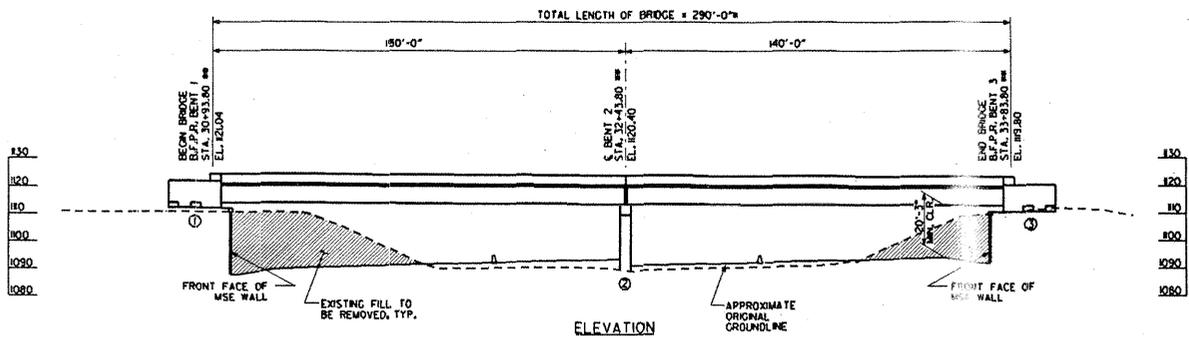
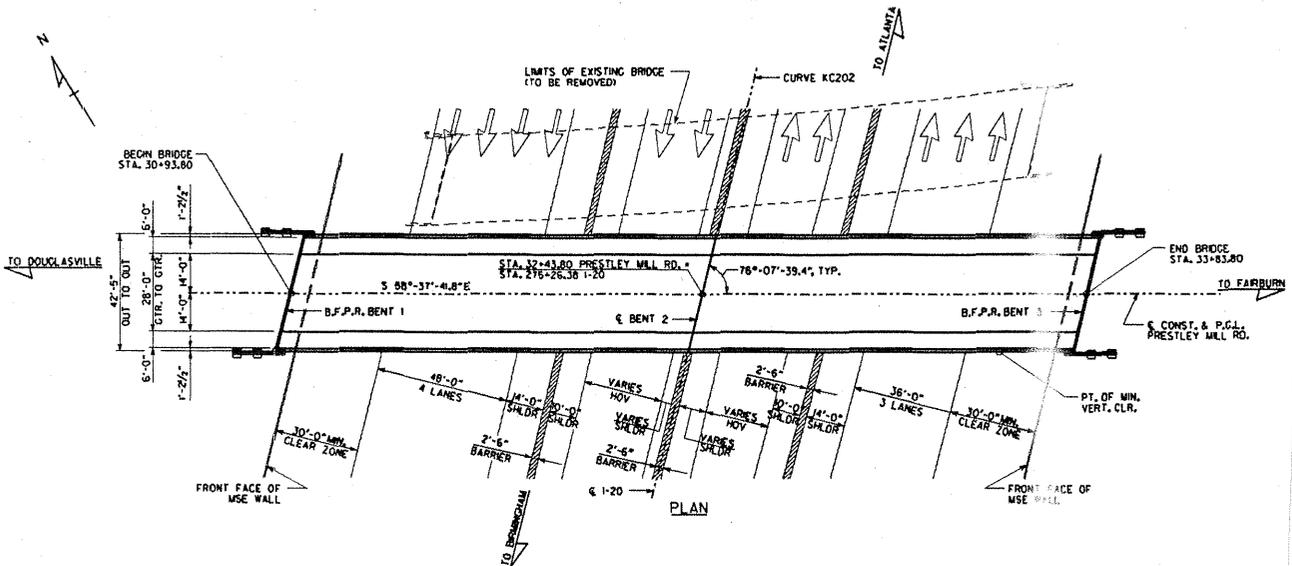
ALTERNATIVE NO.:

14/16

AS DESIGNED ALTERNATIVE

SHEET NO.: 4 of 19

PRESTLEY MILL RD. OVER I-20



NOTE: A BRIDGE LENGTH OF 430' WITH END SPANS WAS USED IN THE ORIGINAL COST ESTIMATE.



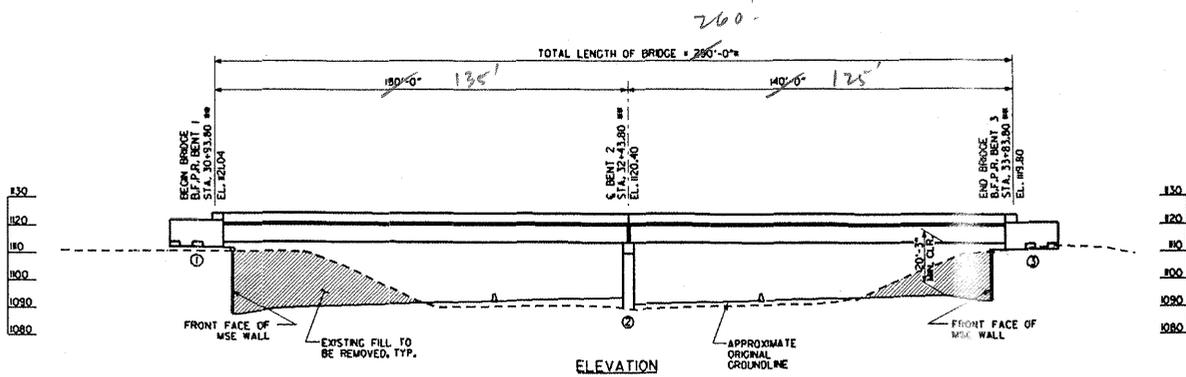
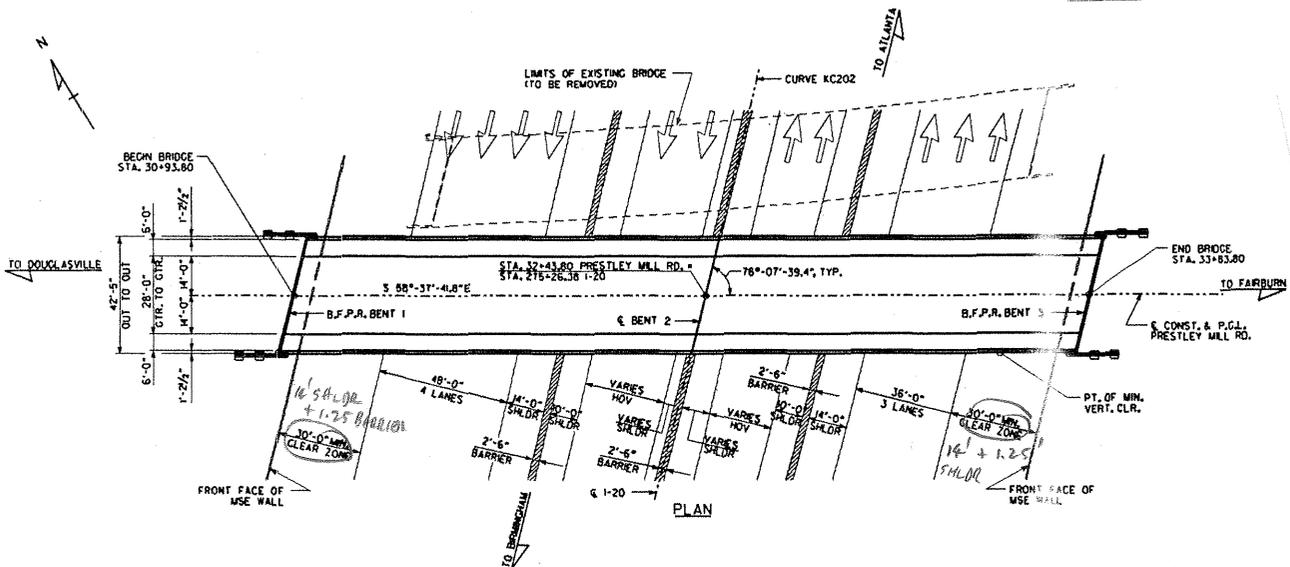
PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

14/16

AS DESIGNED ALTERNATIVE

SHEET NO.: 5 of 19





PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

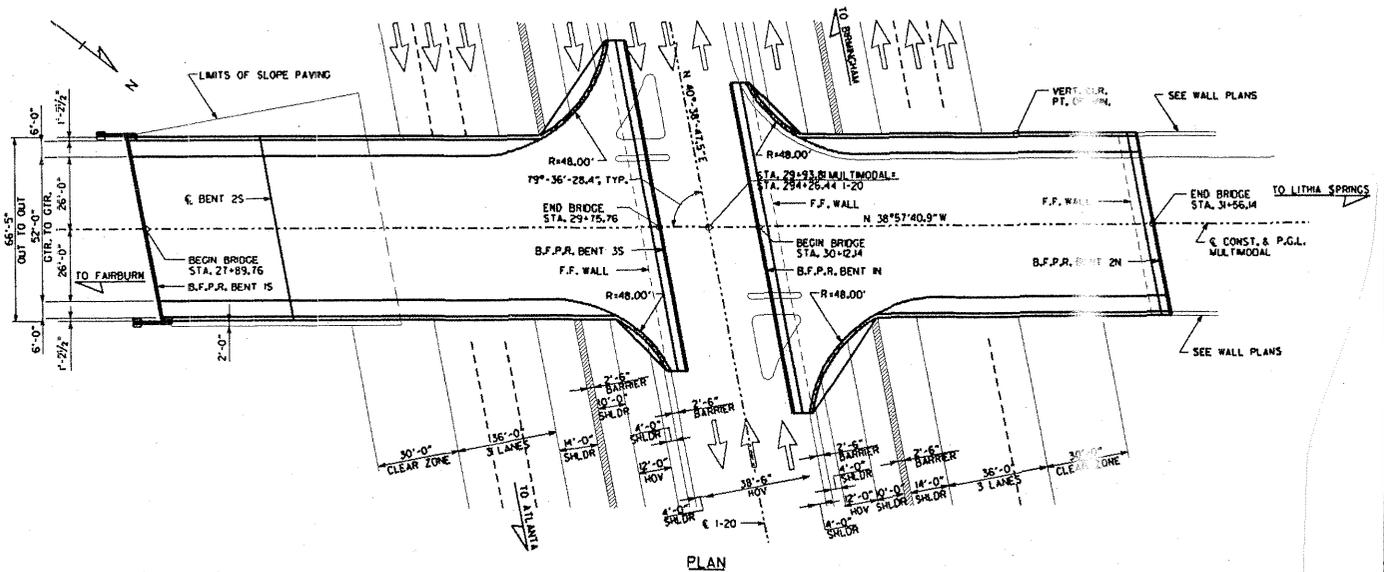
ALTERNATIVE NO.:

14/16

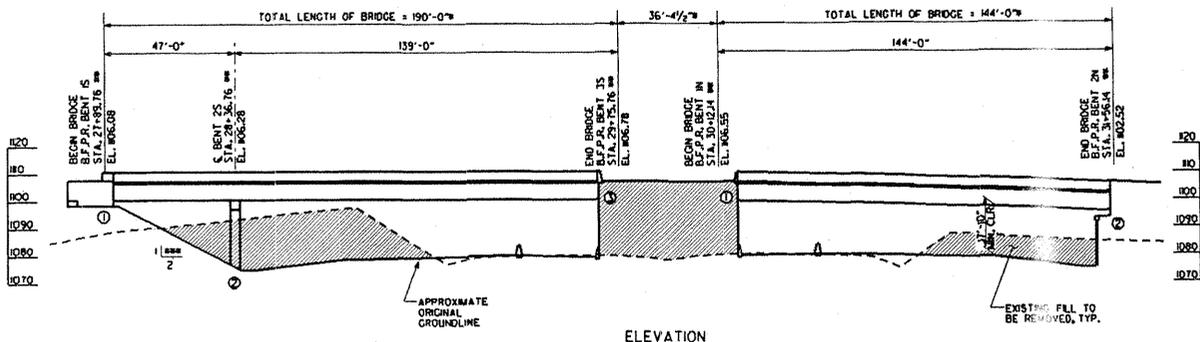
AS DESIGNED ALTERNATIVE

SHEET NO.: 6 of 19

MULTIMODAL OVER I-20



PLAN



ELEVATION

NOTE: A BRIDGE LENGTH OF 130' WAS USED IN THE ORIGINAL COST ESTIMATE. THIS WOULD ACCOUNT FOR 1 BRIDGE ONLY SINCE THE TOTAL BRIDGE COST IS PROPORTIONAL TO 2 BRIDGES INSTEAD.



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD**
 Douglas County, Georgia Department of Transportation
Design Development

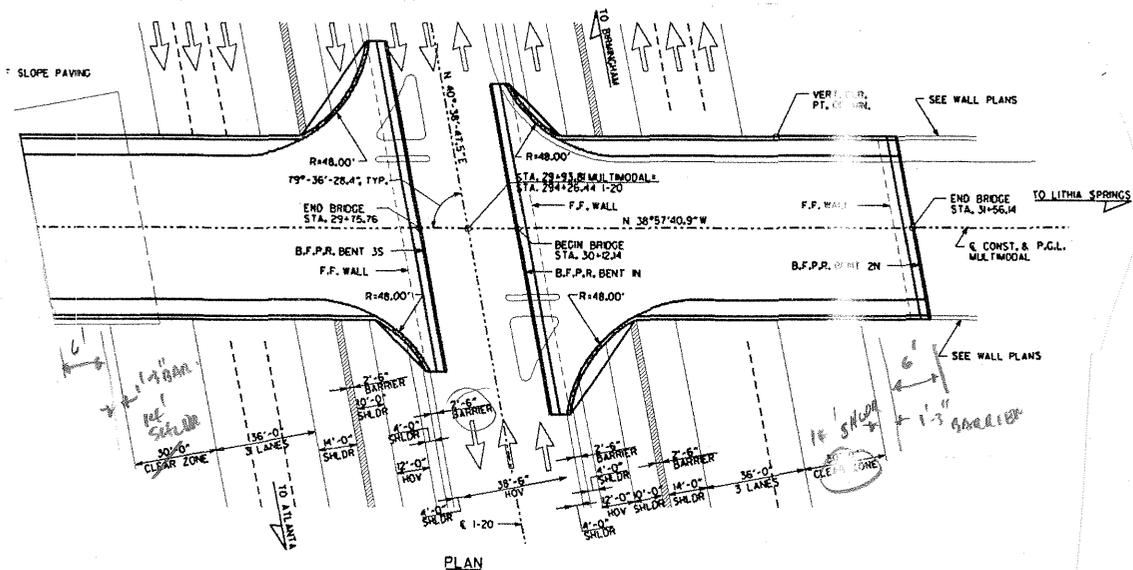
ALTERNATIVE NO.:

14/16

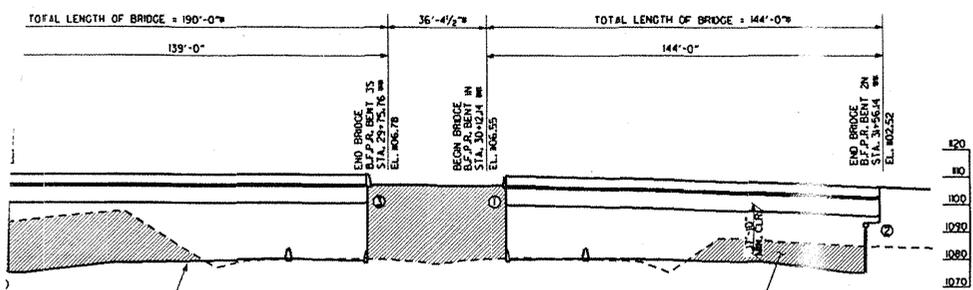
AS DESIGNED ALTERNATIVE

SHEET NO.: 7 of 19

MULTIMODAL OVER I-20



PLAN



ELEVATION

PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

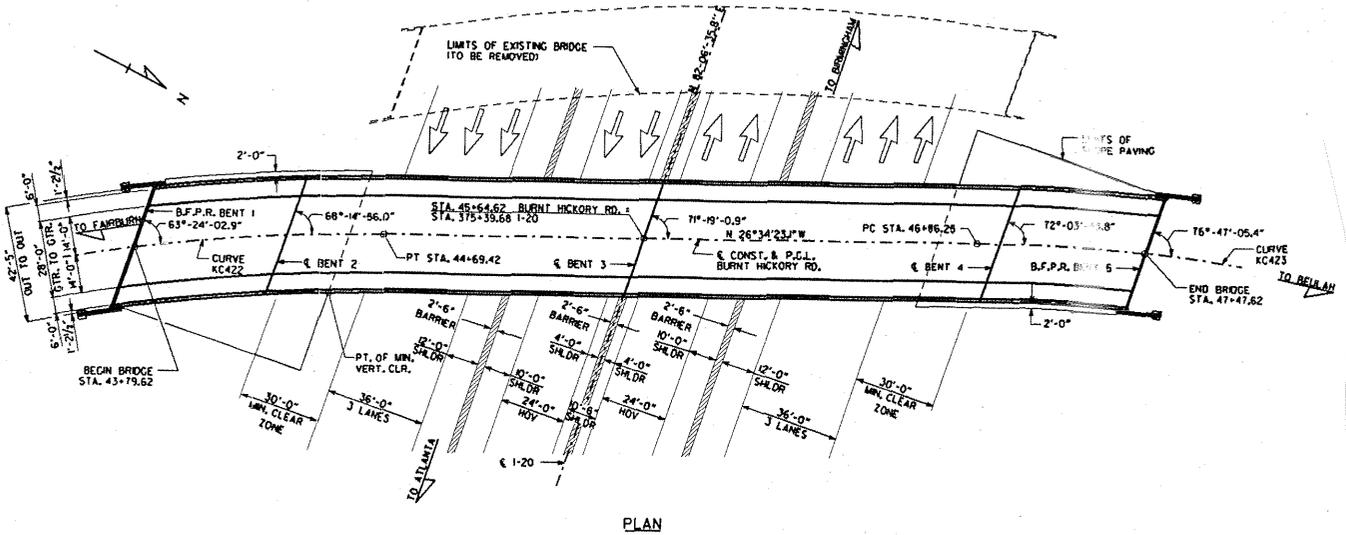
ALTERNATIVE NO.:

14/16

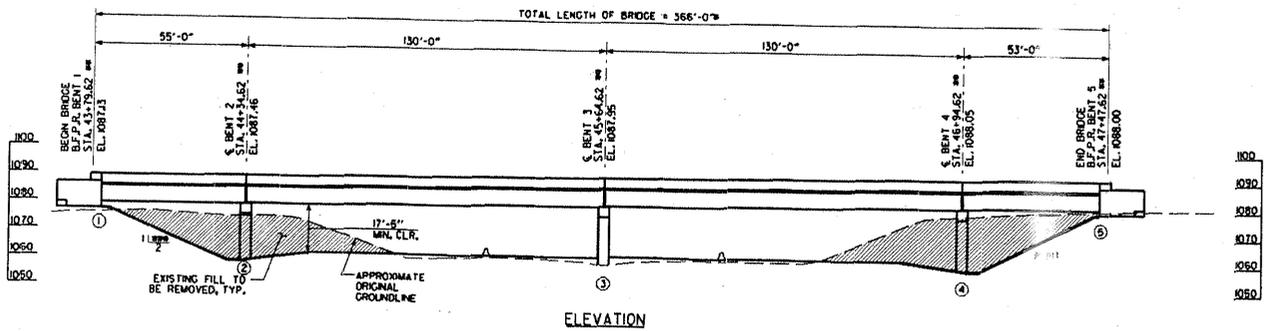
AS DESIGNED ALTERNATIVE

SHEET NO.: 8 of 19

BURNT HICKORY RD (MIDWAY RD) OVER I-20



PLAN



ELEVATION

NOTE. A BRIDGE LENGTH OF 350' WAS USED IN THE ORIGINAL COST ESTIMATE.



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

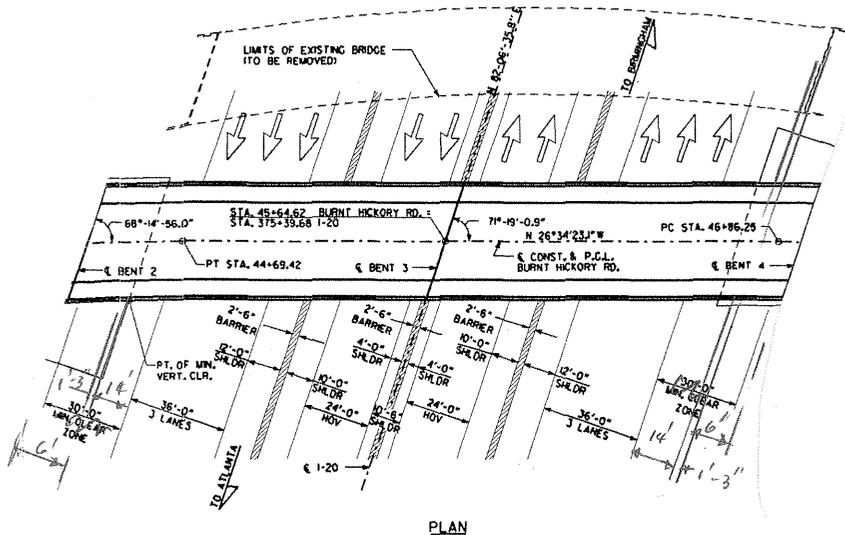
ALTERNATIVE NO.:

14/16

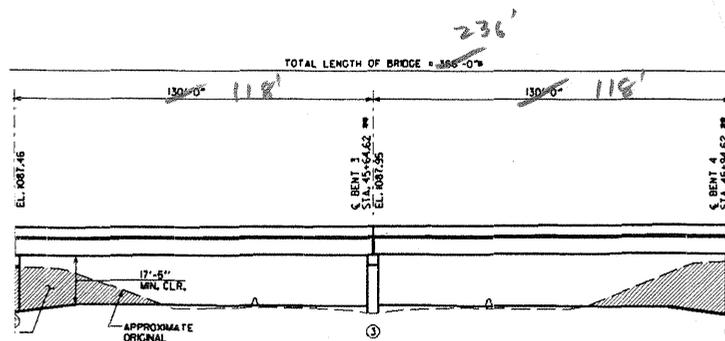
AS DESIGNED ALTERNATIVE

SHEET NO.: 9 of 19

MIDWAY RD (BURNT HICKORY RD) OVER I-20



PLAN



ELEVATION



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
Design Development

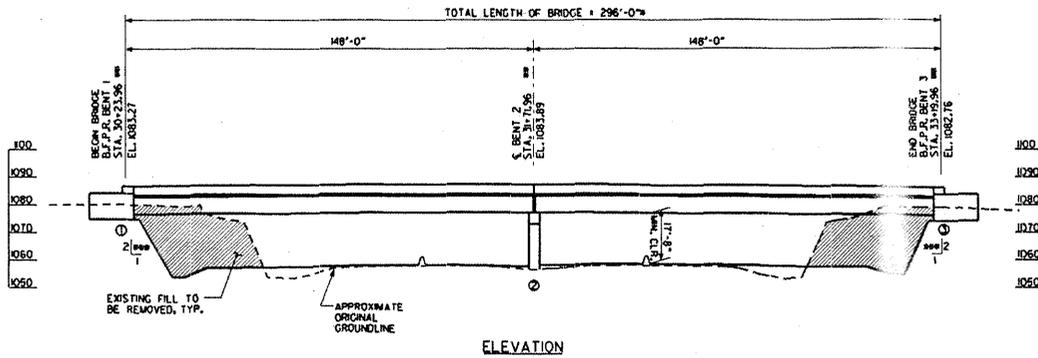
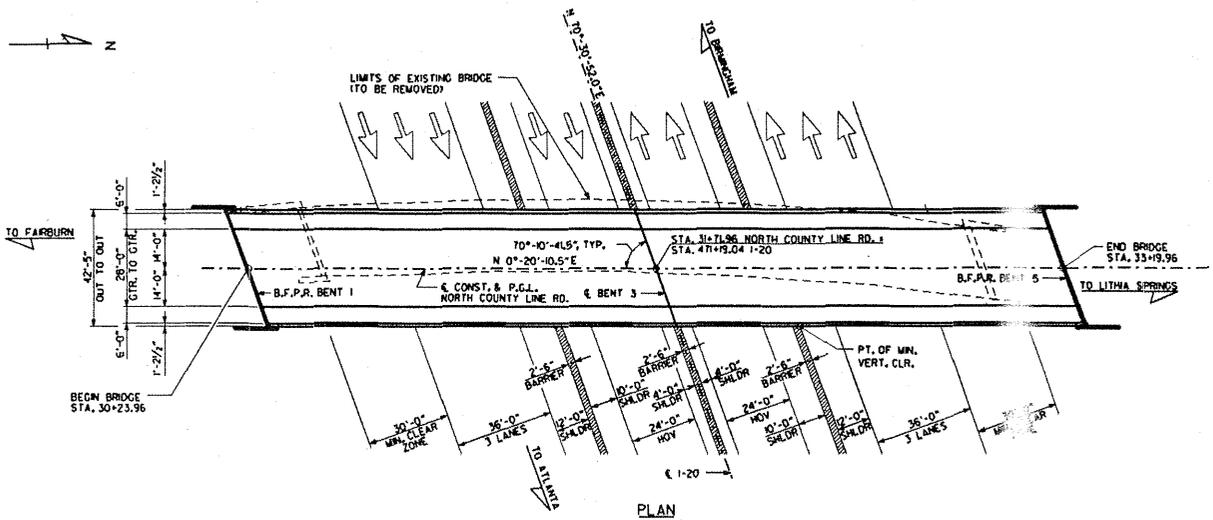
ALTERNATIVE NO.:

14/16

AS DESIGNED ALTERNATIVE

SHEET NO.: 10 of 19

N. COUNTY LINE ROAD OVER I-20



NOTE: A BRIDGE LENGTH OF 360' WAS USED IN THE ORIGINAL COST ESTIMATE.



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

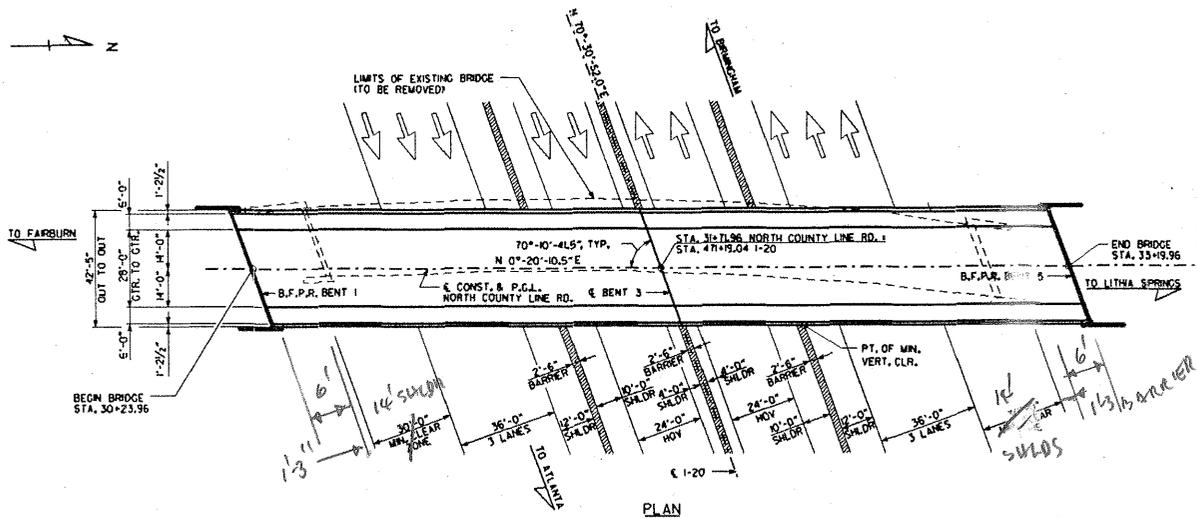
ALTERNATIVE NO.:

14/16

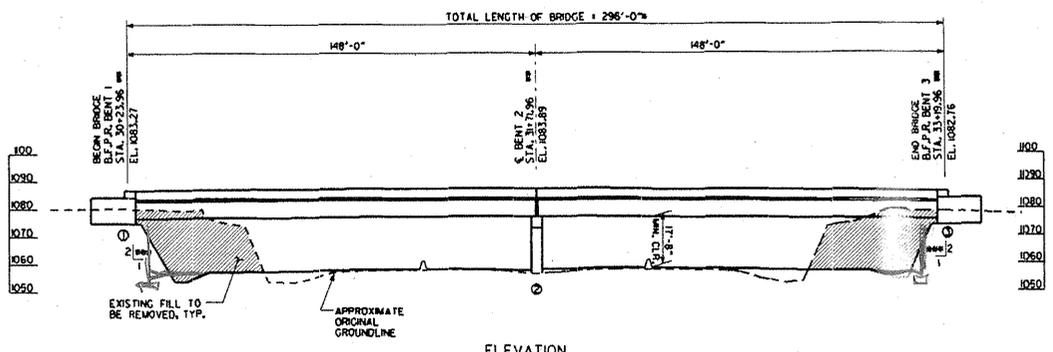
AS DESIGNED ALTERNATIVE

SHEET NO.: 11 of 19

N. COUNTY LINE RD. OVER I-20



PLAN



ELEVATION

PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

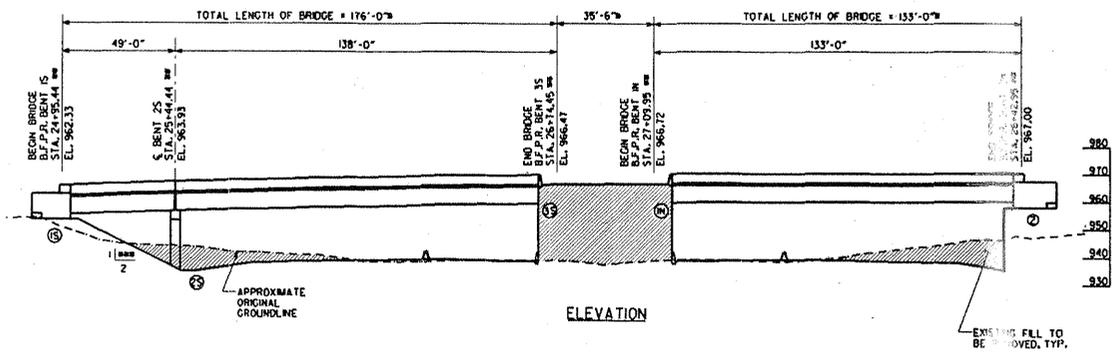
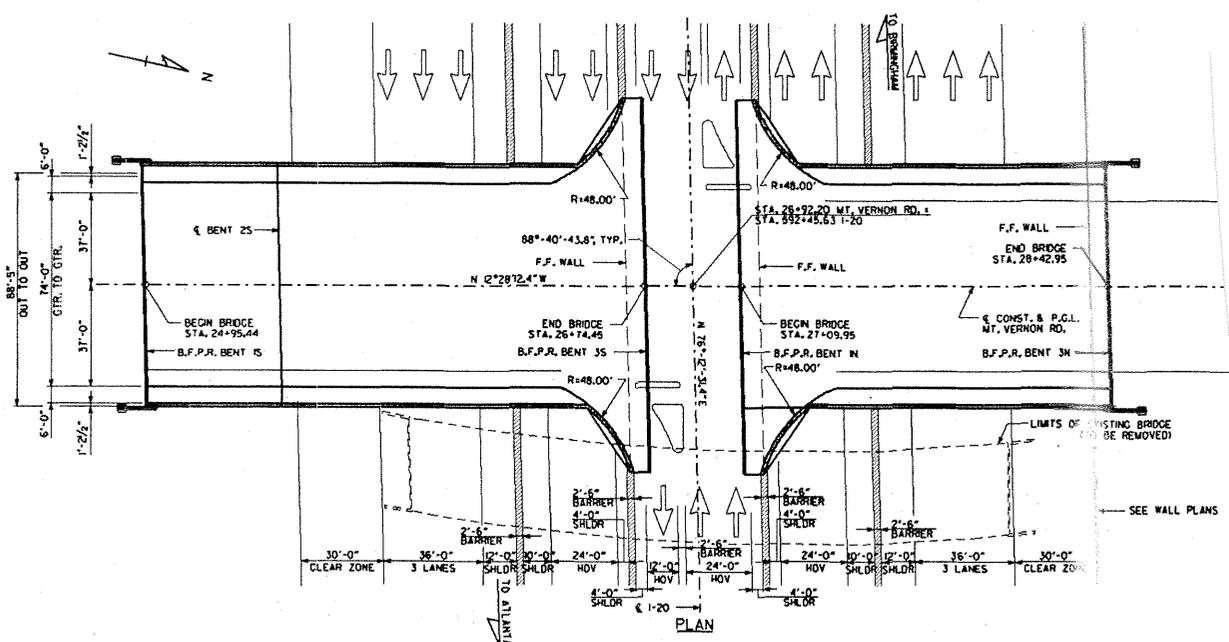
ALTERNATIVE NO.:

14/16

AS DESIGNED ALTERNATIVE

SHEET NO.: 12 of 19

MT. VERNON RD. OVER I-20



NOTE: A TOTAL BRIDGE LENGTH OF 300' WAS USED IN THE ORIGINAL COST ESTIMATE.



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
 Design Development

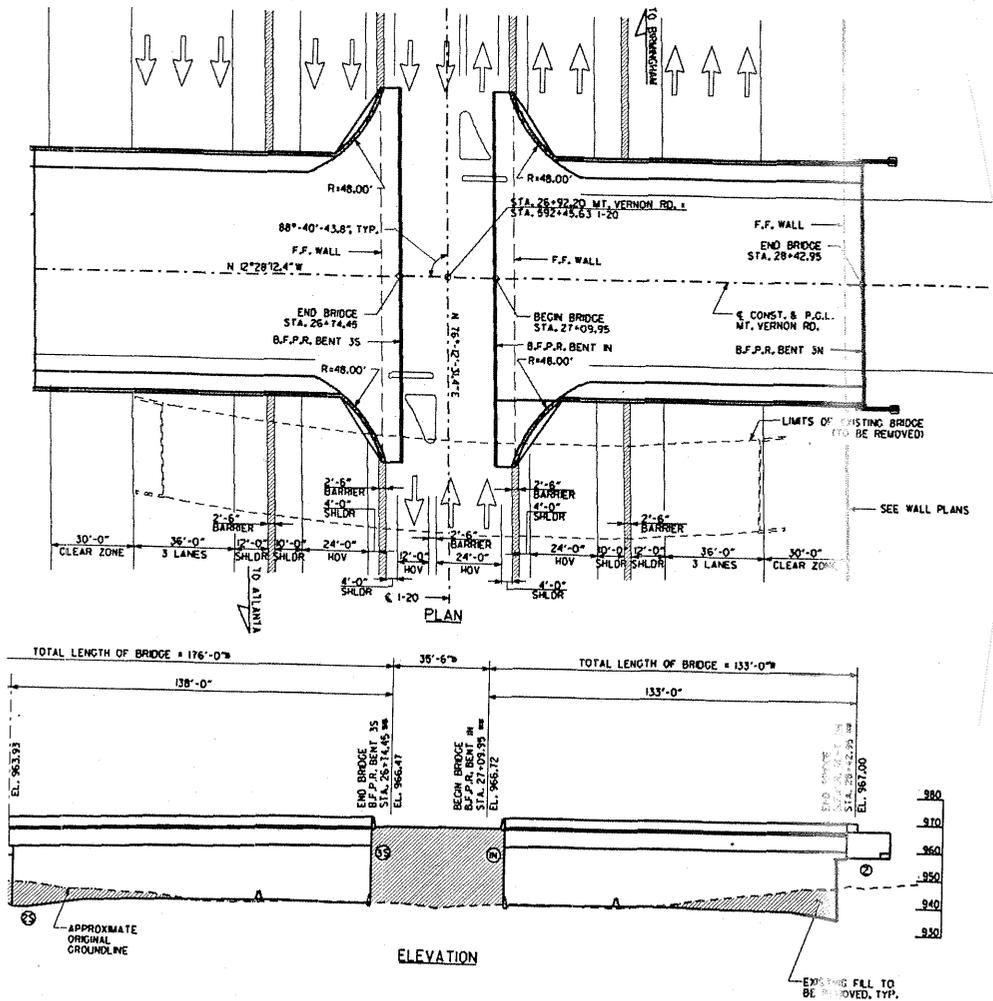
ALTERNATIVE NO.:

14/16

AS DESIGNED ALTERNATIVE

SHEET NO.: 13 of 19

MT. VERNON RD. OVER I-20



CALCULATIONS



PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD
Douglas County, Georgia Department of Transportation
Design Development**

ALTERNATIVE NO.:

14/16

DESCRIPTION:

SHEET NO.: 14 of 19

• SR 5 OVER I-20

$$\text{NEW SPAN LENGTH} = \frac{2' + 4' + 12' + 10' + 2.5' + 14' + 136' + 14' + 1.25' + 6'}{\sin(76.0135^\circ)} = 104.86' \text{ USE } 105'$$

$$\text{BRIDGE CAN BE SHORTEN BY} = 330' - 2 \times 105' = 155'$$

$$\text{UNIT PRICE} = \$3,716,700.17 \div (330' \times 140') = \$80.45 / \text{SF}$$

$$\text{DELTA} = \$80.45 \times 155' \times 140' = \$1,765,765.00$$

• BRIGHT STAR RD. (PRELIM. PLANS NOT AVAILABLE. SEE SR 5 OVER I-20)

$$\text{NEW SPAN LENGTH} = \frac{101.75'}{\sin(268^\circ)} = 109.74' \text{ USE } 110'$$

$$\text{BRIDGE CAN BE SHORTEN BY} = 330' - 2 \times 110' = 110'$$

$$\text{UNIT PRICE} = \$1,767,003.17 \div (330' \times 42') = \$127.49 / \text{SF}$$

$$\text{DELTA} = \$127.49 \times 110' \times 42' = \$589,003.80$$

• PRESTLEY MILL RD. OVER I-20

$$\text{NEW BRIDGE LENGTH} = 290' - 2 \times (30' - 14' - 1.25') \div \sin(76.1276^\circ) = 259.61' \text{ USE } 260'$$

$$\text{BRIDGE CAN BE SHORTEN BY} = 430' - 260' = 170'$$

$$\text{UNIT PRICE} = \$720,003.14 \div (430' \times 52') = \$32.20 / \text{SF}$$

$$\text{DELTA} = \$32.20 \times 170' \times 52' = \$284,648.00$$

CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

14/16

DESCRIPTION:

SHEET NO.: 15 of 19

• MULTIMODAL CENTER

$$\text{NEW SPAN LENGTHS} = \frac{6' + 1.25' + 4' + 12' + 10' + 2.5' + 14' + 36' + 14' + 1.25' + 6'}{\sin 79.6079^\circ} = 108.78 \text{ USE } 109'$$

BRIDGE CAN BE SHORTENED BY: $130' - 109' = 21'$ / BRIDGE

$$130' - 109' = 21' \text{ / BRIDGE}$$

$$\text{UNIT PRICE} = \$2,345,997.24 \div (130 \times 64' \times 12) = \$140.99 / \text{SF}$$

$$\text{DELTA} = \$140.99 \times 42' \times 64' = \$378,981.12$$

• MIDWAY RD (BURNT HICKORY RD) OVER I-20

$$\text{NEW SPAN LENGTHS} = \frac{2' + 4' + 24' + 10' + 2.5' + 12' + 36' + 14' + 1.25' + 6'}{\sin(71.32^\circ)} = 117.96' \text{ USE } 118'$$

$$\text{BRIDGE CAN BE SHORTENED BY: } 350' - 2(118') = 114'$$

$$\text{UNIT PRICE} = \$1,387,200 \div (350' \times 40') = \$99.09 / \text{SF}$$

$$\text{DELTA} = \$99.09 \times 114' \times 40' = \$451,850.40$$

• N. COUNTY LINE RD. OVER I-20

$$\text{NEW SPAN LENGTHS} = \frac{2' + 4' + 24' + 10' + 2.5' + 12' + 36' + 14' + 1.25' + 6'}{\sin(70.1752^\circ)} = 118.79' \text{ USE } 119'$$

$$\text{BRIDGE CAN BE SHORTENED BY} = 360' - 2(119') = 122'$$

$$\text{UNIT PRICE} = \$876,002.67 \div (360' \times 38') = \$64.04$$

$$\text{DELTA} = \$64.04 \times 122' \times 38' = \$296,889.44$$

CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

14/16

DESCRIPTION:

SHEET NO.: 16 of 19

- MT. VERNON RD. OVER I-20

$$\text{NEW SPAN LENGTHS} = \frac{0' + 1.25' + 4' + 24' + 10' + 2.5' + 12' + 36' + 14' + 1.25' + 26'}{\sin(88.6788^\circ)} = 117.03 \text{ use } 118'$$

$$\text{BRIDGE CAN BE SHORTENED BY} = 360' - 2(118') = 124'$$

$$\text{UNIT PRICE} = \$1,537,503.11 \div (360' \times 38') = \$112.39/\text{SF}$$

$$\text{DELTA} = \$112.39 \times 124' \times 38' = \$529,581.68$$

ADDITIONAL MSE WALLS

- AT SR 5 OVER I-20

$$\text{AVG. HT.} = 20'$$

$$\text{LENGTH} = \frac{124' + 2 \times 1.167'}{\sin 68^\circ} + 2 \times 0.5 \times 40' = 176.25'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF}$$

$$\text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 176.25' \times 20' + \$66.70(176.25' + 40') = \$120,765.63 \times 2 = \$253,531.25$$

- AT BRIGHT STAR RD.

$$\text{AVG. HT.} = 20'$$

$$\text{LENGTH} = \frac{38' + 2 \times 1.167'}{\sin 68^\circ} + 2 \times 0.5 \times 40' = 83.50'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF}$$

$$\text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 83.50' \times 20' + \$66.70(83.50' + 40') = \$61,460.35 \times 2 = \$122,920.70$$

CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

14/16

DESCRIPTION:

SHEET NO.: 17 of 19

ADDITIONAL MSE WALLS

- AT MULTIMODAL OVER I-75

$$\text{AVG. HT.} = 21'$$

$$\text{LENGTH} = \frac{52' + 2 \times 1.167'}{\sin(79.6079^\circ)} + 2 \times 0.5 \times 42' = 97.24'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF} \quad \text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 97.24' \times 21' + \$66.70(97.24 + 42') = \$74,367.12$$

- AT MIDWAY RD (BURNT HICKORY RD) OVER I-20

$$\text{AVG. HT.} = 21'$$

$$\text{LENGTH} = \frac{40' + 2 \times 1.167'}{\sin 71.32^\circ} + 2 \times 0.5 \times 42' = 86.69'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF} \quad \text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 86.69' \times 21' + \$66.70(86.69 + 42') = \$66,602.64/\text{BT.}$$

$$\times 2 = \$133,205.28$$

- AT N. COUNTY LINE RD. OVER I-20

$$\text{AVG. HT.} = 21'$$

$$\text{LENGTH} = \frac{40' + 2 \times 1.167'}{\sin(70.18^\circ)} + 2 \times 0.5 \times 42' = 87.0'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF} \quad \text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 87.0' \times 21' + 66.70(87.0' + 42') = \$66,830.79/\text{BT.}$$

$$\times 2 = \$133,666.58$$

CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

14/16

DESCRIPTION:

SHEET NO.: 18 of 19

ADDITIONAL MSE WALLS

- AT MT. VERNON RD. OVER I-20

AVE. HT = 21'

$$\text{LENGTH} = 86' + 2 \times 1.167' + 2 \times 0.5 \times 42' = 130.33'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF} \quad \text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 130.33' \times 21' + \$66.70(130.33' + 42') = \$98,720.37$$

- AT PRESTLEY MILL RD. OVER I-20

AVE. HT. = 20'

$$\text{LENGTH} = 40' + 2 \times 1.167' + 2 \times 0.5 \times 40' = 82.33'$$

$$\text{PANEL UNIT PRICE} = \$31.87/\text{SF} \quad \text{COPING} = \$66.70/\text{LF}$$

$$\text{COST} = \$31.87 \times 82.33' \times 21' + \$66.70(82.33' + 40') = \$66,200.41/\text{BT}$$

$$\times 2 = \$126,520.82$$

VALUE ENGINEERING ALTERNATIVE



PROJECT:	HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD <i>Georgia Department of Transportation</i>	ALTERNATIVE NO.:	17
DESCRIPTION:	MIDWAY ROAD AND BURNT HICKORY ROAD BRIDGE DETOUR OVER I-20	SHEET NO.:	1 of 4

ORIGINAL DESIGN:

The original bridge design for Midway Road and Burnt Hickory Road shifts the new bridge approximately 100 ft. east on the new alignment. This will allow bridge construction to proceed while maintaining traffic. Required additional right-of-way is indicated on concept map. The Vasant Road and Midway Road intersection skew will be improved and adjusted to the northeast.

ALTERNATIVE: (Sketch attached)

Close Midway Road and Burnt Hickory Road Bridge over I-20 and detour existing traffic. Remove the existing bridge and install the proposed bridge in the existing location. This alternative will reduce and eliminate additional right-of-way requirements along both Midway Road and Burnt Hickory Road.

ADVANTAGES:

- Reduces construction cost for roadway
- Reduces right-of-way impact
- Reduces project schedule
- Reduces overall right-of-way cost
- Construction materials reduced
- Safer work environment

DISADVANTAGES:

- Closes Midway/Burnt Hickory Roads for a specific period of time
- Inconveniences local users

DISCUSSION:

This alternative will allow construction to be performed within the existing right-of-way, reducing project cost. Local county roads facilitate detour routes common to residents in the area and currently used by residents.

It is always advantageous to allow the construction contractor to complete the required construction without having to maintain traffic and perform work-arounds. Turning the site over to the contractor for the required construction period is safer for both construction personnel and public travelers and will reduce the amount of time required for completion of the work at hand.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 3,756,637	—	\$ 3,756,637
ALTERNATIVE	\$ 3,576,203	—	\$ 3,576,203
SAVINGS	\$ 180,434	—	\$ 180,434



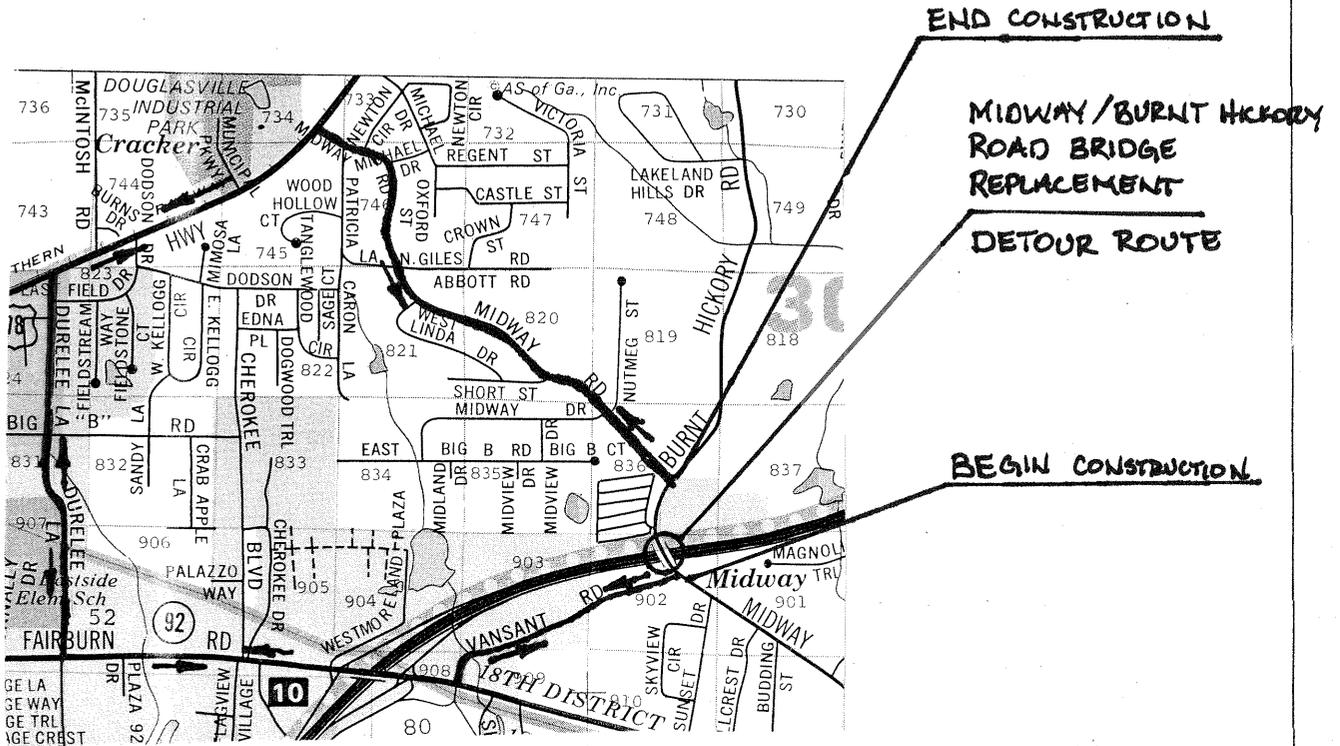
PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

17

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

17

DESCRIPTION:

SHEET NO.: 3 of 4

AREA FOR RIGHT-OF-WAY REDUCTION (RESIDENTIAL):

$$A_1 = 100(0.50) \times 410$$

$$= 20,500 \text{ SF} / 43560$$

$$= 0.470 \text{ ACS}$$

$$A_2 = 98(0.50) \times 170'$$

$$= 8330 \text{ SF} / 43560$$

$$= 0.19 \text{ ACS}$$

$$A_3 = 90(0.50) \times 470 = \frac{21,150 \text{ SF}}{43,560}$$

$$= 0.48 \text{ ACS}$$

$$= 0.48 \text{ ACS}$$

$$A_4 = 15'(0.50) \times 490$$

$$= 3675 \text{ SF} / 43560 = 0.084 \text{ ACS}$$

$$A_1 + \dots + A_4 = \underline{1.224 \text{ ACS}} \text{ RESIDENTIAL}$$

AREA FOR RIGHT-OF-WAY REDUCTION (COMMERCIAL):

$$A = 75(0.50) \times 130'$$

$$= 4875 \text{ SF} / 43560$$

$$= \underline{0.112 \text{ ACS}}$$

RIGHT-OF-WAY COST REDUCTION:

RESIDENTIAL: $1.224 \text{ ACS} \times \$19,602 = \$23,992.85$

COMMERCIAL: $0.112 \text{ ACS} \times \$256,568 = \$28,735.62$

TOTAL ROW REDUCTION $\underline{\underline{\$52,728.47}}$

MARK-UP @ $\underline{\underline{\$130,344.78}}$
 247%

$\boxed{\$183,073.25}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD** ALTERNATIVE NO.: **18**
Georgia Department of Transportation

DESCRIPTION: **BUILD ONLY ONE BRIDGE BETWEEN CENTER AND FULL DROP RAMPS AT PROPOSED MULTI-MODAL HOV-ONLY INTERCHANGE** SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes to build multi-modal bridges over I-20 eastbound and westbound and develop access roads to Timber Ridge Drive.

ALTERNATIVE: (Sketch attached)

Build only the bridge over I-20 westbound connecting the center with the full drop ramps and do not build the access road to Timber Ridge Drive.

ADVANTAGES:

- Saves cost by not building bridge over I-20 eastbound and associated roadway
- Bridge may not be needed

DISADVANTAGES:

- Lengthens travel between multi-modal center and Prestley Mill Road
- Eliminates an amenity

DISCUSSION:

Not building the bridge over I-20 eastbound and the associated roadway to Timber Ridge Drive translates into a large cost savings with minimal impact to traffic flows.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,441,476	—	\$ 1,441,476
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS	\$ 1,441,476	—	\$ 1,441,476



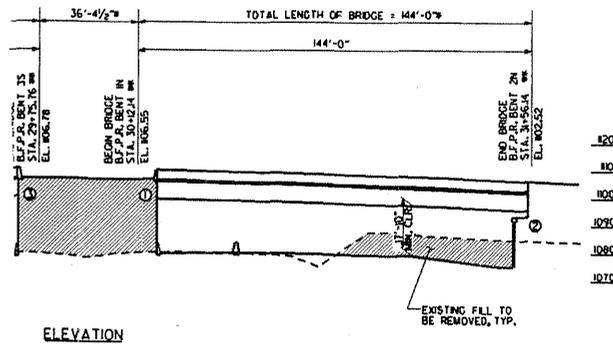
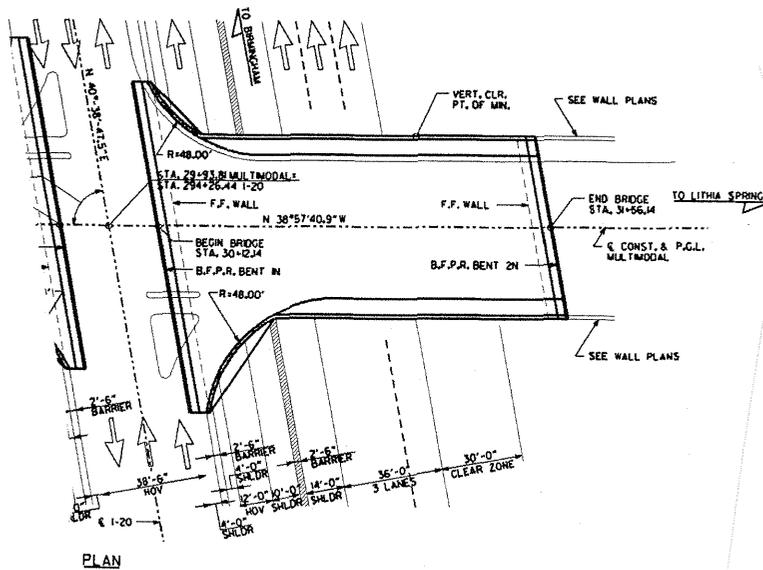
PROJECT: **MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD**
 Douglas County, Georgia Department of Transportation
Design Development

ALTERNATIVE NO.:

18

AS DESIGNED ALTERNATIVE

SHEET NO.: **3** of 5



CALCULATIONS



PROJECT: MSL-0003-00(165), PI No. 0003165, HOV LANES ON I-20 WEST
 FROM BRIGHT STAR ROAD TO SR 6 / THORNTON ROAD
 Douglas County, Georgia Department of Transportation
 Design Development

ALTERNATIVE NO.:

18

DESCRIPTION:

SHEET NO.: 4 of 5

• MULTIMODAL CENTER BRIDGE

$$\text{UNIT PRICE} = \$2,345,997.24 \div (130' \times 66' \times 2) = \$140.99/\text{SF}$$

$$\text{DELTA} = \$2,345,997.24 \div 2 = \$1,172,998.62$$

• RIGHT-OF-WAY

$$150' \times 450' = 67,500 \text{ SF} \div 43,560 = 1.55 \text{ ACRES} \times \$7,841 = \$12,153.55$$

$$\times 3.472 (247.2\% \text{ MLU})$$

$$= \$42,197.13$$

• AREA = $450' (48' + 24') / 2 = 16,200 \text{ SF} / 9 = 1,800 \text{ SY}$

$1\frac{1}{2}'' - 12.5 \text{ mm} \text{ E-TOP} = (110 \text{ lb/in.}^2 \text{ SY } 1.5'') 1,800 \div 2000 = 148.5 \text{ TNS}$

BINDER 10mm = $(110 \text{ lb/in.}^2 \text{ SY } 4'') 1,800 \div 2000 = 396.0 \text{ TNS}$

ASPH. BASE, 25mm = $(110 \text{ lb/in.}^2 \text{ SY } 8'') 1,800 \div 2000 = 792.0 \text{ TNS}$

GAB = $(120 \text{ lb/in.}^2 \text{ SY } 12'') 1,800 \div 2000 = 1,188 \text{ TNS}$

CURB + GUTTER = $2 \times 450' \times \quad = 900 \text{ FT.}$

SIDEWALK = $2 \times 450' \times 10' / 9 = 1000 \text{ SY.}$

PROJECT DESCRIPTION

PURPOSE AND NEED

The primary purpose of the proposed I-20 HOV lane system project is to facilitate transit by managing congestion. This will be accomplished by adding capacity to the I-20 corridor and reducing the number of single occupancy vehicles (SOVs) traveling in the general use lanes. As an added benefit, this project will promote the use of vanpools, carpools, and mass transit, thereby improving air quality.

For the purpose of developing the concept, the I-20 project corridor has been divided into two projects. Project 1, MSL-0003-00(165), begins at Bright Star Road and ends at SR-6 in Douglas County, an approximate distance of 11.4 miles. Project 2, NHS-000 1-00(760), begins at SR-6 in Douglas County, continues through Cobb County, and ends at US-280/H. E. Holmes Drive in Fulton County, an approximate distance of 8.1 miles.

DESCRIPTION OF THE PROPOSED PROJECT

Project 1, the subject of this VE study, adds a barrier-separated single HOV lane in both directions from Bright Star Road to the Douglas County Multi-Modal Center and barrier-separated dual HOV lanes in both directions from the Multi-Modal Center to SR-6/Thornton Road. HOV access will be provided by means of three HOV-exclusive interchanges and a slip ramp. The project is approximately 11.4 miles long.

The western terminus for the project is at the existing Bright Star Road over I-20 in Douglas County and is designed to be a full HOV interchange. The eastern terminus of the project forms the western terminus of Project 2.

The western terminus is logical because the HOV lanes end at an HOV interchange, which will provide the optimal operation for HOV and general purpose traffic. Bright Star Road has connectivity to SR-5 to the south along Douglas Boulevard and to the north with the County's proposed project to connect Bright Star Road to SR-5 north of I-20. In addition, a future HOV project, P.I. No. 0003435, MSL-0003-00(435), will extend the HOV lanes west from Bright Star Road to Liberty Road. The eastern terminus is logical because this project will transition into Project 2 at SR-6/Thornton Road.

Currently, I-20 from Bright Star Road to SR-6 is a six-lane facility, with an eight-lane section between SR-5 and Chapel Hill Road. The traffic analysis indicates that one HOV lane in each direction is required from Bright Star Road to the HOV interchange east of Prestley Mill Road, and two HOV lanes are required from the HOV interchange to SR-6. The proposed HOV alternative will improve the level of service, reduce traffic density, and increase the average speeds on the general use lanes. There will continue to be congestion on I-20 during peak travel hours; however, the HOV system will help minimize the level of congestion on the general use lanes occurring during the peak periods. In addition, the HOV-only interchanges will help alleviate congestion at the existing interchanges by shifting traffic away from the general use interchanges.

PROPOSED DESIGN FEATURES

Proposed Typical Sections

- I-20 West of Bright Star Road
 - HOV section: 5-ft. inside shoulder, one 12-ft. wide lane, 2-ft. buffer section
 - SOV section: 12-ft. inside shoulder, three 12-ft. wide lanes, 14-ft. outside shoulder
- 1-20 Bright Star Road to Douglas County Multi-Modal Center
 - HOV section: 5-ft. inside shoulder, one 12-ft. wide lane, 10-ft. outside shoulder
 - Median barrier separating the HOV and SOV lanes
 - SOV section: 14-ft. inside shoulder, three 12-ft. wide lanes, 14-ft. outside shoulder
- 1-20 Multi-Modal Center to SR-6/Thornton Road
 - HOV section: 5-ft. inside shoulder, two 12-ft. wide lanes, 10-ft. outside shoulder
 - Median barrier separating the HOV and SOV lanes
 - SOV section: 12-ft. inside shoulder, three 12-ft. wide lanes, 14-ft. outside shoulder
- HOV entrance and exit Ramps: 5-ft. inside shoulder, one 12-ft. wide lane, 6-ft. outside shoulder

HOV Access Points

Three types of access points to the HOV lanes are proposed: Buffer separation, slip ramp access into the barrier-separated lanes, and HOV full drop ramps.

- Buffer-separated section west of Bright Star Road: At the beginning of the project, HOV access west of Bright Star Road will not have the barrier separation. The barrier will begin at Bright Star Road. Vehicles will have a distance of 2,500 ft. to merge into the buffer-separated HOV lanes.
- Bright Star Road: A new HOV interchange (full drop ramp) will be constructed at the new location of Bright Star Road.
- Douglas County Multi-Modal Center: A new HOV interchange (full drop ramp) will be constructed with connection to the north directly into the Douglas County Multi-Modal Center, a park-and-ride facility with access to the Georgia Regional Transportation Authority Express system and the Douglas County Vanpools. The interchange will connect in the south to Timber Ridge Drive.
- Slip Ramp east of SR-92: A new slip ramp will be constructed using an entrance-only ramp for eastbound traffic and an exit-only ramp for westbound traffic.
- Mt. Vernon Road: A new HOV interchange (full drop ramp) will be constructed at the new location of Mt. Vernon Road.

Enforcement Areas

HOV enforcement areas that are a minimum of 12-ft. wide will be located at the following locations:

- The gore at the bottom of the HOV interchange exit ramps at Bright Star Road, Multi-Modal Center, and Mt. Vernon Road;
- The median at the top of the HOV entrance and exit ramps at Bright Star Road, Multi-Modal Center, and Mt. Vernon Road; and

- The taper of the slip ramps east of SR-92.

Emergency Access Points

Exit gates and/or movable barriers will be designed as part of the barrier between the HOV and SOV lanes along the project corridor. In the event of an accident that stops traffic inside the barrier-separated HOV lanes, emergency exit gates/movable barriers will provide easier access for emergency vehicles and will also allow trapped vehicles to exit the HOV lanes. These gates/movable barriers will be located approximately every mile along the project corridor except where the permanent HOV access points are located.

Park-and-Pool Lot Locations

Four locations between Bright Star Road and SR-6 have been identified as potential sites for Park-and-Pool Lots. The Park-and-Pool Lots are facilities where commuters rendezvous to use carpools and vanpools, and the lots are not used by public transportation. The four sites are located adjacent to existing rights-of-way and near HOV access points.

- Site 1
 - Access: Located off Douglas Boulevard/Bright Star Road
 - HOV access point: HOV full drop ramp at Bright Star Road
 - Note: This parcel may be developed soon.
- Site 2
 - Access: Located off Slater Mill Road/SR-92
 - HOV access point: Slip ramp east of SR-92
 - Note: Signal located at Slater Mill Road and SR-92.
- Site 3
 - Access: Located off Sweetwater Industrial Boulevard/Lee Road
 - HOV access point: HOV full drop ramp at Mt. Vernon Road
 - Note: Sweetwater Industrial Boulevard connects Mt. Vernon and Lee Road
- Site 4
 - Access: Located off Mt. Vernon Road at Cornerstone Baptist Church
 - HOV access point: HOV full drop ramp at Mt. Vernon Road
 - Note: Church structure is a potential displacement with this project.

Structures

To accommodate the typical HOV section of roadway, the span lengths over I-20 will be approximately ±130 ft. Precast, prestressed concrete girders are proposed for these bridges.

Bridge	Size (ft.)	Description of Work
Bright Star Road	330 X 42	Construct new bridge with full drop ramps for access only to the HOV lanes. Bridge location is 55 ft. west of the existing bridge.
SR-5/Bill Arp Road	330 X 140	Stage-construct a new bridge by shifting the mainline alignment. Lengthen and raise bridge to accommodate HOV lanes on I-20.
Prestley Mill Road	430 X 52	Replace bridge on new location west of existing bridge to remove curve and improve skew over I-20. Lengthen and raise bridge to accommodate HOV lanes on I-20. Install sidewalks on bridge.
Multi-Modal Center	130 X 64	Construct new bridge with full drop ramps for access only to the HOV lanes. Bridge location is just west of the existing Douglas County Multi-Modal Center and connects Dorris Road to Timber Ridge Drive.
SR-92	N/A	Bridge is currently under design by GDOT. Bridge will be widened and lengthened at existing location to accommodate the HOV lanes on I-20.
Midway Road	350 X 40	Replace bridge on new location east of existing bridge to improve skew and flatten curve over I-20. Lengthen and raise bridge to accommodate HOV lanes on I-20.
North County Line Road	360 X 38	Replace bridge at current location by closing bridge and implementing a detour to Lee Road. Slightly improve alignment to remove curve from bridge. Raise and lengthen bridge to accommodate HOV lanes on I-20.
Lee Road	280 X 92	Bridge is planned to be advertised by Douglas County in the near future. Bridge will be widened and lengthened at existing location to accommodate the HOV lanes on I-20.
Mt. Vernon Road	360 x 64	Replace bridge with full HOV interchange on new location west of existing bridge to remove curve and improve skew over I-20. Lengthen bridge to accommodate HOV lanes on I-20.
I-20 Mainline	300 x 195	Widen existing bridge in both directions to accommodate the new HOV lanes.

COST DATA

The current probable cost of construction is \$108,313,216 if flexible pavement is used on the mainline work or \$163,855,855 if rigid pavement is used. These costs are noted on the undated Estimate Report for File “003165” prepared by DMJM Harris | AECOM.

The construction and engineering cost includes either \$82,090,589 (for flexible pavement) or \$137,633,228 (for rigid pavement) and \$26,222,627 in right-of-way costs regardless of the pavement type.

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis procedure used during the VE study. It is followed by separate narratives and conclusions concerning the following:

- VE Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histogram
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study, and the key procedures involved were organized into three distinct parts: (1) Preparation, 2) VE workshop, and 3) post-study. A Task Flow Diagram that outlines each of the procedures included in the VE study is attached for reference.

PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks, gathering necessary background information on the facility, and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It included five phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase

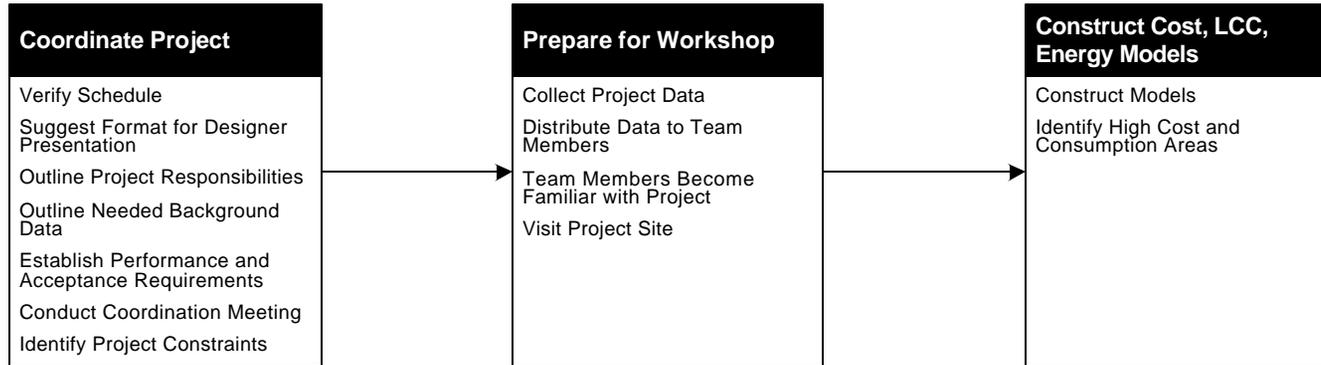
Information Phase

At the beginning of the study, the conditions and decisions that influenced the development of the project must be reviewed and understood. For this reason, the design development manager presented information about the project to the VE team on the first day of the session. Following the presentation, the VE team discussed the project using the following documents:

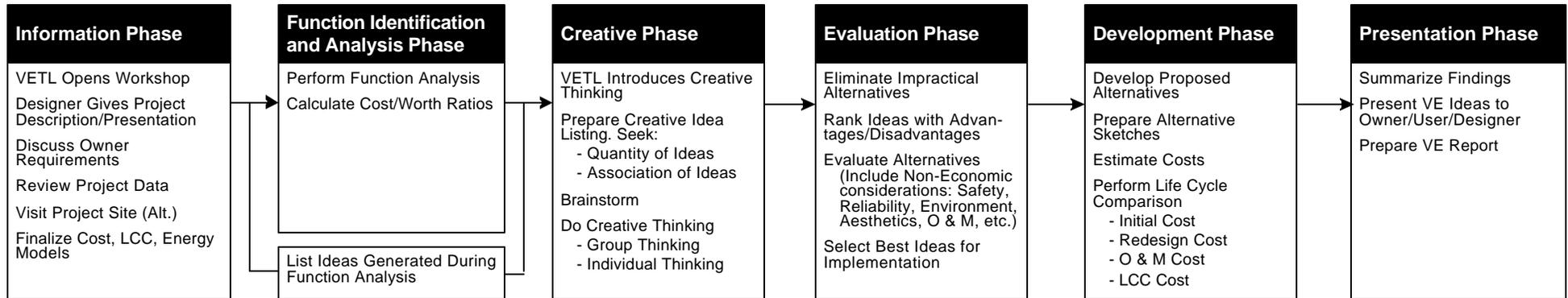


Value Engineering Study Task Flow Diagram

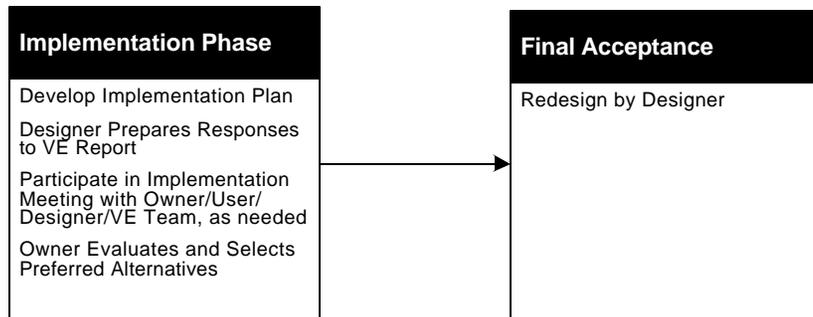
Preparation Effort



Workshop Effort



Post-Workshop Effort



- Draft Project Concept Report prepared by DMJM Harris | AECOM, undated, containing the following:
 - Cost Estimates
 - Typical Sections
 - Capacity Analysis Results
 - Bridge Inventory
 - Minutes of Coordination Meetings
 - Programmed Projects in Corridor
 - Confirming Plan's Network Schematics Showing Thru Lanes
 - Local Government Comments – Resolutions from City of Douglasville
- I-20 HOV Crash Data prepared by DMJM Harris | AECOM, undated
- I-20 HOV Key Contacts prepared by DMJM Harris | AECOM, undated
- CD with drawings prepared by DMJM Harris | AECOM, undated, containing the following:
 - I-20 Centerline
 - Existing Contours
 - Existing Ramps and Side Road Alignments
 - Edge of Pavement
 - Proposed Property Lines
 - Topography
 - Utilities
- Large and half size aerial maps of the corridor prepared by DMJM Harris | AECOM, dated January 2006

Function Identification and Analysis Phase

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element, serve as a basis for alternative functional categorization, and assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and Function Analysis Systems Technique (FAST) diagram.

Creative Phase

This VE study phase involved the creation and listing of ideas. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and association of ideas.

The GDOT and DMJM Harris | AECOM representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas

found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts in terms of how well it met the design intent. Advantages and disadvantages were discussed, and by consensus, the team rated the ideas on a scale of zero to five, with the best ideas rated five. Only the highly rated ideas were developed into alternatives.

The creative listing was reevaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally highly rated items may not have been developed into alternatives.

Development Phase

During the development phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the alternative; life-cycle cost comparisons, where applicable; and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the Study Results section.

POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this VE study report. Personnel from GDOT and DMJM Harris | AECOM will analyze each alternative and prepare a short response, recommending either incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour Value Engineering (VE) study on the **MSL-0003-00(165), PI No. 0003165, High Occupancy Vehicle Lanes on Interstate (I) 20 West from Bright Star Road to State Route (SR) 6 / Thornton Road** project located in Douglas County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

VE Study Agenda

The VE study will follow the outline described below and be conducted March 13 – 15, 2006. The study will be conducted in Room 274, Personnel Conference Room in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

Monday, March 13th

9:00 am – 9:15 am **General Introduction of all Parties and review of the VE Process**

9:15 am - 11:00 am **Owner's / Designer's Presentation**

GDOT is to present information concerning the project including, but not necessarily limited to: rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:00 am - 12:00 noon **Commence Function Analysis Phase**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost / worth or value index ratios will be calculated, and high cost / low worth areas for study identified. In addition, the VE team will continue defining the function of each element / system to gain a thorough understanding of the project's needs and requirements.

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Conclude the Function Analysis Phase and Commence the Creative Phase**

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

Tuesday, March 14th

8:30 am - 10:00 am **Conclude Creative Phase and Complete Evaluation / Analytical Phase**

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

10:00 am - 12:00 noon **Development Phase**

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

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 5:00 pm **Continue Development Phase**

Wednesday, March 15th

8:30 am - 12:00 am **Continue Development Phase**

12:00 noon - 1:00 pm **Lunch**

1:00 pm - 4:00 pm **Conclude Development Phase and Commence Summary Worksheets**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS



PROJECT: HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO SR 6/THORNTON ROAD <i>Georgia Department of Transportation</i>		Date: March 13–15, 2006
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Keisha Jackson em: keisha.jackson@dot.state.ga.us	Georgia Department of Transportation (GDOT), Office of Environmental/Location National Environmental Protection Act (NEPA) Specialist	ph: 404-699-6866 fx: 404-699-4440
Michael Lankford em: michael.lankford@dot.state.ga.us	GDOT, District 7, Area 3 Area Engineer	ph: 404-559-6699 fx: 404-559-4178
Teresa Lannon em: teresa.lannon@dot.state.ga.us	GDOT, Office of Urban Design Assistant Design Group Manager	ph: 404-656-5441 fx: 404-657-7921
Jerry Milligan em: jerry.milligan@dot.state.ga.us	GDOT, Right-of-Way Office Right-of-Way	ph: 770-986-1541 fx: 770-986-1558
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office Design Review Engineer Manager	ph: 404-651-7468 fx: 404-463-6131
Ken Werho em: ken.werho@dot.state.ga.us	GDOT, Traffic Safety and Design Design and Concept Review Engineer	ph: 404-635-8144 fx: 404-635-8116
Vince Wilson em: vince.wilson@dot.state.ga.us	GDOT, General Office, Bridge Design Assistant Group Leader	ph: 404-656-532 fx: 404-651-7076
Wayne Fedora em: r.wayne.fedorsa@fhwa.dot.gov	U.S. Department of Transportation, Federal Highway Administration Urban Transportation Engineer	ph: 404-562-3651 fx: 404-562-3703
Dan Bodycomb, PE em: dan.bodycomb@dmjmharris.com	DMJM Harris AECOM Project Manager	ph: 770-980-6364 fx: 770-980-6048
Harley Griffin em: hgriffin@delonhampton.com	Delon Hampton & Associates, Chartered Project Manager	ph: 404-524-8030 fx: 404-524-2575
Alex Pascual, PE em: apascual@hntb.com	HNTB Structural Engineering/Bridge Engineer	ph: 404-946-5700 fx: 404-841-2820

ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation and the DMJM Harris | AECOM design team. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	2006
Construction Startup:	2008
Construction Duration:	±24 Months (2010)
Economic Planning Life:	35 years for Pavement 50 years for Bridges
Cost	
Composite Markup:	Included
Markup on Right-of-Way Costs:	247%

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

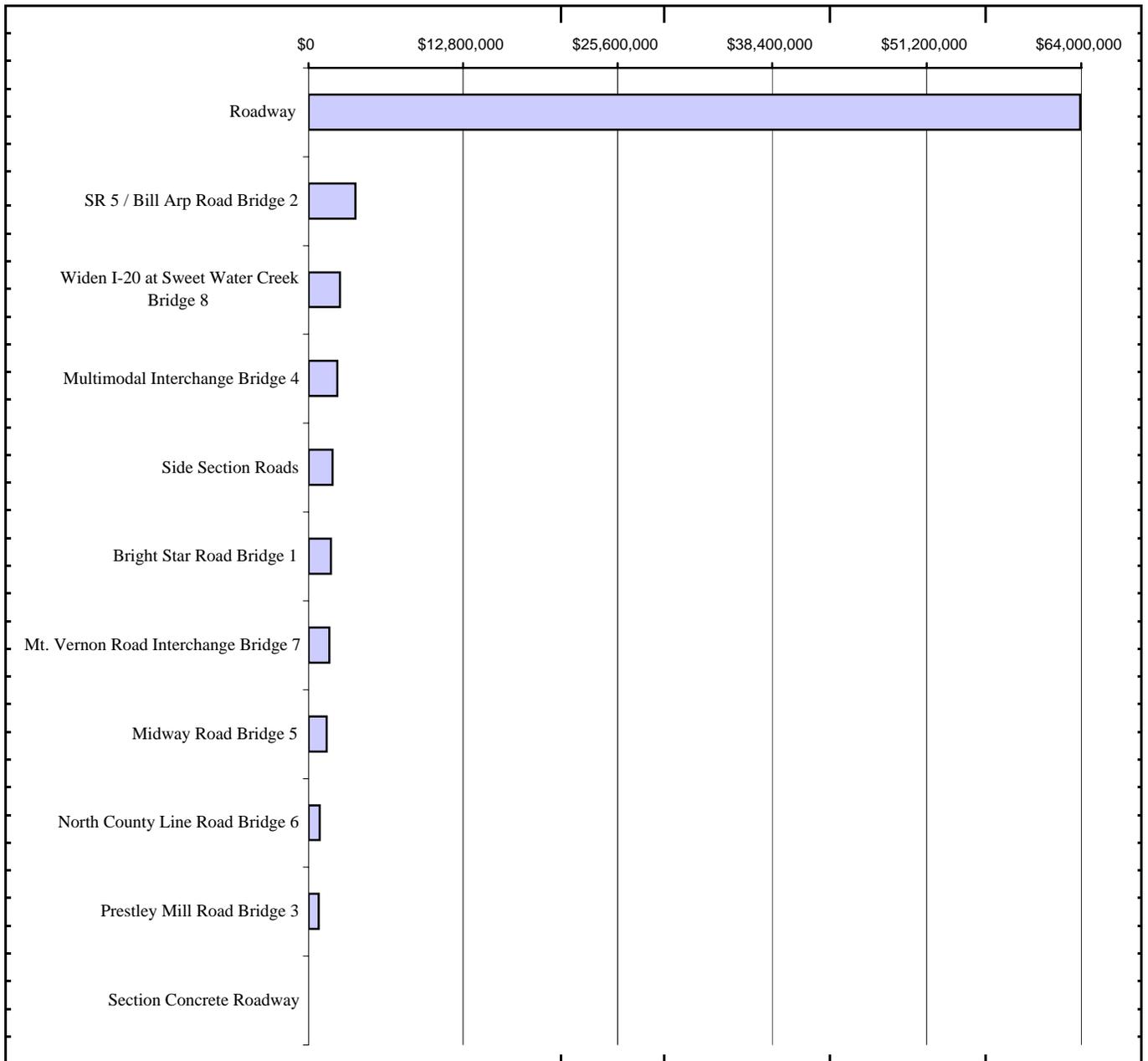
The VE team prepared a cost model for the project that is included following this page. The cost model is arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and is based on the *Estimate Report for File "003165"* prepared by the DMJM Harris | AECOM design team. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until the analysis of function. Based on these preliminary judgments, there appears to be a potential for initial savings in the following areas:

- Roadway
 - 25mm Superpave
 - Concrete Barriers
 - Aggregate Subbase
 - 12.5mm Superpave
- Bridges
 - SR 5/Bill Arp Road
 - Sweetwater Creek
 - Multi-Modal Interchange
- Other
 - Side Section Roads

COST HISTOGRAM



Project: MSL-0003-00(65),PI No. 0003165, HOV LANES ON I-20 Douglas County, Georgia Concept Development			
TOTAL PROJECT - Asphalt Pavement (Includes E&C)	COST	PERCENT	CUM. PERCENT
Roadway	63,976,137	77.93%	77.93%
SR 5 / Bill Arp Road Bridge 2	3,930,313	4.79%	82.72%
Widen I-20 at Sweet Water Creek Bridge 8	2,648,554	3.23%	85.95%
Multimodal Interchange Bridge 4	2,412,683	2.94%	88.89%
Side Section Roads	2,041,925	2.49%	91.37%
Bright Star Road Bridge 1	1,914,666	2.33%	93.71%
Mt. Vernon Road Interchange Bridge 7	1,764,438	2.15%	95.86%
Midway Road Bridge 5	1,531,749	1.87%	97.72%
North County Line Road Bridge 6	983,186	1.20%	98.92%
Prestley Mill Road Bridge 3	886,938	1.08%	100.00%
Section Concrete Roadway	0	0.00%	100.00%
Construction Subtotal	\$ 82,090,589	100.00%	
Right-Of-Way - Land Commercial (14.91 Acres)	\$ 3,727,500		
Right-Of-Way - Land Industrial (6.5 Acres)	\$ 1,202,500		
Right-Of-Way - Land Residential (5.85 Acres)	\$ 114,600		
Right-Of-Way - Improvements	\$ 1,863,000		
Right-Of-Way - Relocation Residential (2)	\$ 40,000		
Right-Of-Way - Relocation Commercial (2)	\$ 50,000		
Right-Of-Way - Damages-Proximity Parcels (5)	\$ 140,000		
Right-Of-Way - Damages-Cost to Cures Parcels (17)	\$ 315,000		
Right-Of-Way - Damages-Uneconomic Remnant (1)	\$ 100,000		
Right of Way Subtotal	\$ 7,552,600		
Scheduling Contingency @	55.00%	\$ 4,153,930	
Administration / Court Costs	60.00%	\$ 7,023,918	
Inflation Factor	40.00%	\$ 7,492,179	
Right of Way Subtotal	\$ 26,222,627		
GRAND TOTAL	\$ 108,313,216	Comp Mark-Up:	31.94%



FUNCTION ANALYSIS

A function analysis was performed to (1) define the requirements for each project element and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. The Random Function Analysis worksheet indicating the functions provided by the project is attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

Function Analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product but have a relatively low worth to the basic function.

In addition to the random function analysis, the VE Facilitator worked with members of the study team to develop a Function Analysis System Technique (FAST) diagram. The FAST diagram was used to show the flow of functions. It helped to confirm that the project is addressing those issues that have been voiced by the owner as being important. The diagram was generated by asking the key question, What is the most important function to be accomplished by this project? The answer is characterized by a verb/noun pair, shown on the left side of the diagram. The team continued to ask how this function is provided, and the function(s) to the right answers this question.

To confirm that the functions are logically connected, the team started with the function on the far right of the diagram and asked, Why is this function being provided? The answer should be the function(s) immediately to the left on the diagram. If the result is a true FAST diagram, the flow of functions from right to left will answer the question, Why? No FAST diagram is ever complete. The readers of this report may wish to challenge themselves to see how far they can carry the construction of the FAST diagram.

This FAST diagram notes the critical function paths and identifies the project's basic function as follows: **IMPROVE/TRANSIT** by **Easing/Congestion**, **Reducing/SOV Traffic**, and **Increasing/Capacity**, thereby **improving/safety**, **facilitating/mobility**, **reducing/travel time**, and **improving arterial efficiency**. The FAST diagram follows the Random Function Analysis worksheet.

RANDOM FUNCTION ANALYSIS



PROJECT: **HOV LANES ON I-20 WESTSIDE FROM BRIGHT STAR ROAD TO
SR 6/THORNTON ROAD**
Georgia Department of Transportation

SHEET NO.: **1 of 1**

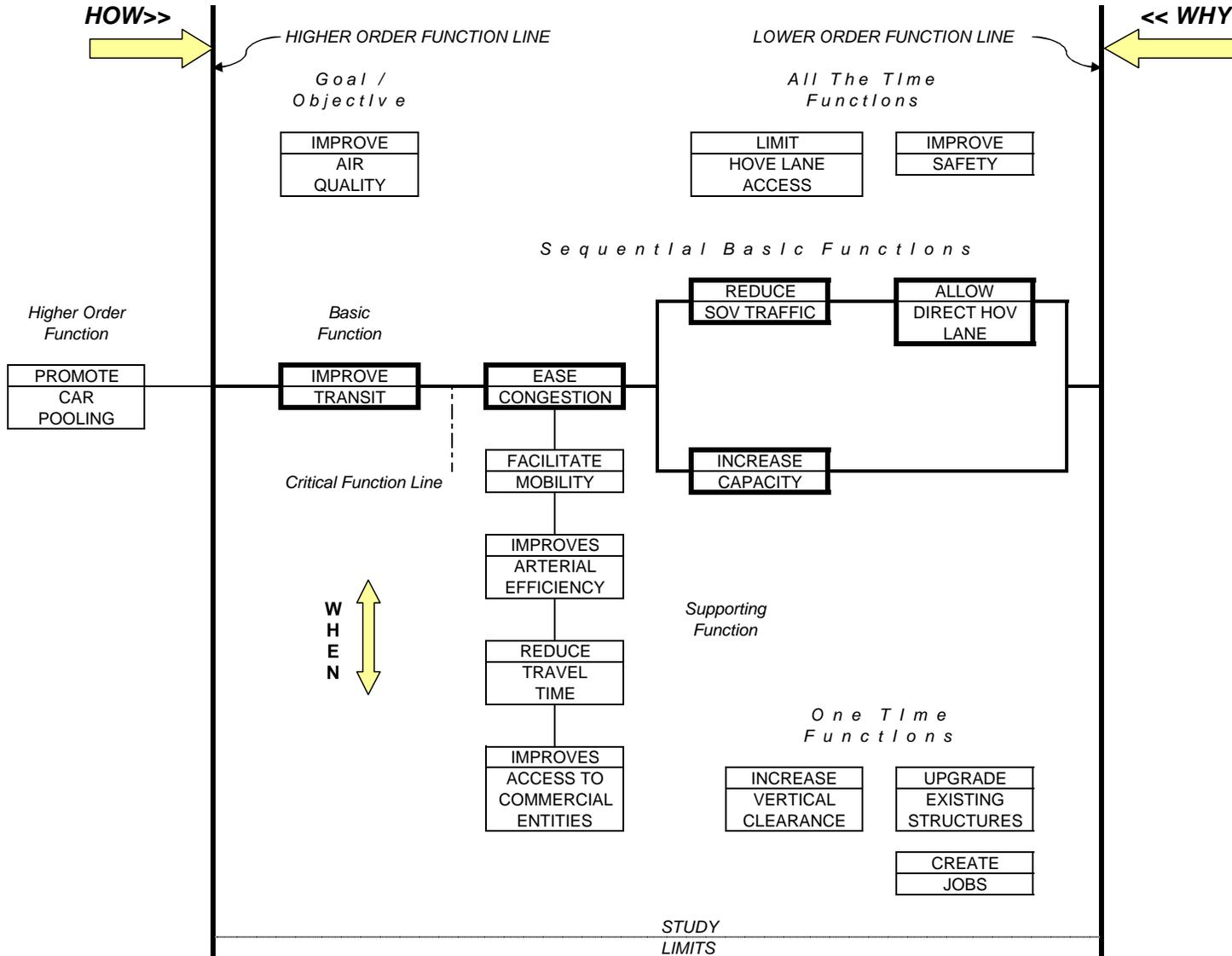
DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
HIGH OCCUPANCY VEHICLES	Ease	Congestion	B
	Improve	Transit	B
	Improve	Air Quality	S
	Reduce	Travel Time	B
	Limit	(HOV) Access	RS
	Promote	Car Pooling	G / O
	Increase	Capacity	B
	Reduce	(SOV) Travel	B
	Increase	(Vertical) Clearance	S
	Upgrade	(Existing) Structures	RS
	Allow	Direct (HOV Lane) Access	G / O
	Facilitate	Mobility	B
	Improve	(Arterial) Efficiency	S
	Improve	Safety	RS
	Create	Jobs	S
	Improve	Access to (Commercial Entities)	S

Function defined as:	Action Verb	Kind:	B = Basic	HO = Higher Order	G = Goal
	Measurable Noun		S = Secondary	LO = Lower Order	U = Unwanted
			RS = Required Secondary	O = Objective	

FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)
MSL-0003-00(65), PI No. 0003165, HOV LANES ON I-20



Georgia Department of Transportation, District 7
 Douglas County, Georgia



CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas were generated using conventional brainstorming techniques as recorded on the following page. These ideas were then discussed and the advantages/disadvantages of each considered. The VE team compared each of the ideas with the concept solution to determine whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop.

Typically, all ideas rated four or above are included in the study report. If a highly rated idea was not incorporated, it may have been combined with another idea, or it may have been discarded as a result of additional research that indicated it was not cost effective or technically feasible.

All readers are encouraged to review the Creative Idea Listing and Evaluation worksheets since they may suggest additional ideas that can be applied to the design.

