Georgia Department of Transportation

I-20 Widening
Alcovy Road to SR142 Interchange
NH 20-2(167)

Newton County, Georgia

Value Engineering Study Report

Preliminary Design Submittal

February 2004

Design Consultant

Q^K4

and associated firms

Value Engineering Consultant

February 12, 2004

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 NH-20-2(167)
I-20 Widening at Alcovy Road in Newton County, Georgia
Value Engineering Study Report – LZA Job No. 717/05

Dear Ms. Myers:

We are pleased to submit 17 copies of the report on the Value Engineering (VE) workshop that took place 3 - 5 February 2004. The subject of the workshop was the widening of Interstate 20 at Alcovy Road, including replacement of the two I-20 bridges over Alcovy Road, widening of the two bridges over CSX Railroad, and improvements to Alcovy Road. At the time of the VE study the expected cost of the project was $30.7 million.

The project manager cited concerns with total project cost, construction sequencing, and impact on the community. The VE team provided developed alternatives that addressed these concerns. First, the team recommends converting the bridge to a 4-span structure and using prestressed beams in lieu of steel girders (see alternative BA-1/BA-2). This should reduce the construction cost by about $3.5 million. With regard to concerns about construction sequencing, the team recommends staging all I-20 on the eastbound bridge at Alcovy Road. This would eliminate one of four construction phases, reduce the construction duration by approximately four months, and reduce construction cost by about $255,000. The team noted that acquisition of right-of-way might be eased by moving Alcovy Road slightly towards the west. This would reduce the amount of industrial land to be acquired (the State already owns much of the property in the southwest quadrant of the interchange) and reduce the overall cost by about $148,000 (see alternative RW-2).

We encourage the GDOT project team and the design consultant to conduct an implementation session in the near future. The alternatives in this report offer opportunities to improve the value of the project, but most of the ideas are volatile. If the implementation of the alternatives is not determined in short order, the normal project momentum will reduce the net effect of the alternatives.

We sincerely appreciated this opportunity to work with you and project stakeholders. Please feel free to call should you have any questions as you consider implementation.

Yours truly,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

Charles R. McDuff, PE, CVS, CCE
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction	2
Project Description	2
Concerns and Objectives	2
Highlights of the Study	3
Summary of Potential Cost Savings	4

STUDY RESULTS

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

PROJECT DESCRIPTION

Project Description	71

VALUE ANALYSIS & CONCLUSIONS

General	113
Preparation Effort	113
Value Engineering Workshop Effort	113
Post-Workshop Effort	116
Value Engineering Workshop Participants	**117**
Economic Data	**119**
Cost Model	**120**
Function Analysis	**122**
Creative Idea Listing and Judgment of Ideas	**127**

EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering study reviewed the Georgia Department of Transportation (GDOT) Project Number NH-20-2(167), Newton County, *I-20 from Alcovy Road to State Route 142 and Alcovy Road Interchange, P.I. Number 210810*. This project widens I-20 from the Alcovy Road/CR 660 interchange to SR 142/Hazelbrand Road for a total of 1.82 miles. The design is being performed by $Q^K{}_4$, Atlanta, Georgia. The project is subject to full review by the Federal Highway Administration. At the time of the VE workshop, the project had progressed to the Preliminary Design level for the roadway and about 30% for the bridges. The VE workshop was conducted February 3 – 5, 2004. The project documents were dated March 6, 2003.

PROJECT DESCRIPTION

The approved concept is to widen Interstate 20 from the end of the existing six-lane section, west of Alcovy Road, to State Route 142 and also to widen Alcovy Road from an existing four-lane section south of Interstate 20 to tie to a future four-lane section south of State Route 142. The approved typical section for Interstate 20 is six lanes (three lanes in each direction) separated by a 40-foot paved median with barrier, and four lanes (two lanes in each direction) with 4-foot bike lanes, curb and gutter, sidewalks, and a 20-foot raised median on Alcovy Road. The minimum width of right-of-way is 100 feet on Alcovy Road while the work along Interstate 20 will be constructed within the existing right-of-way. The approved concept also includes replacement of the Interstate 20 bridges over Alcovy Road and widening of the existing bridges over the CSX Railroad.

At the time of the workshop, the estimated cost of the project was approximately $30.8 million.

CONCERNS AND OBJECTIVES

The primary concern voiced by the GDOT project manager was to ensure that the horizontal geometrics take into account the large amount of truck traffic to be accommodated. The general project setting is an area that ranges from light to heavy industrial land usage and feeds and receives traffic from I-20 at Alcovy Road and State Route 142. Achieving the satisfactory level of service on the I-20 mainline requires widening from the existing two lanes in each direction, to three lanes. This necessitates the reconstruction of the bridges at Alcovy Road and the bridge at the CSX Railroad crossing. This will complicate the phasing of construction as the mainline traffic must be shifted to make construction work possible.

Funding for the project was not seen as a problem at the time of construction. However, the State Legislature was in the process of considering a bill that could have significant effects on the State DOT project stream. For this reason, it was considered prudent to make the most of this VE workshop to help adsorb any funding cuts that might occur in the future.

Right-of-way costs were identified in excess of $6 million. This dictated a VE focus on ways in which right-of-way takings could be minimized.

The FHWA has asked that the maintenance of limited access characteristics for Alcovy Road in the areas adjacent to the I-20 corridor be extended as far as possible. Another safety consideration was the necessity to minimize the guardrail and any other potential traffic obstacles near the travel way of I-20.

HIGHLIGHTS OF THE STUDY

In the study, the team implemented value improvement practices applicable to highway design and construction. Under the practice, as ***Design To Capacity*** (***DTC***), the team reviewed approaches to meet capacity should be met in the most economical fashion, consistent with GDOT's stated goals and practices. To this end, Alternative PA-8 suggests keeping the current pavement in place on Alcovy Road and overlaying it, as compared to the current design that calls for full-depth replacement. This approach should meet current project capacity objectives while minimizing costs.

The second ***DTC***-related point raised is whether it is good value to construct a full-depth pavement, 40-ft.-wide median at this time. The traffic capacity represented by this additional pavement will not be brought into use for approximately 25 years. The team developed alternative MC-4/MC-5 to convert the median to grass, protected by a double-faced guard rail. The team also performed a life-cycle cost analysis to make sure that the added maintenance costs did not outweigh the first cost savings. In this instance, the ***DTC*** analysis parallels the results of the ***Function Analysis*** that indicated that median pavement represents money spent on capacity that may or may not be called on for years to come. The resulting initial cost savings of nearly $605,000 is only slightly offset by the $41,000 present worth of the added maintenance required by going to a grassed median.

Two other basic concerns for the project were cost and construction phasing. The value engineering team identified approximately $3.5 million in cost savings that would result from going to prestressed concrete bridge girders and changing the configuration of the bridge to a 4-span bridge (see alternative BA-1/BA-2). This is nearly 10 percent of the total construction cost. The team also pointed out that it is possible to eliminate one entire construction phase by diverting all I-20 traffic to the current eastbound I-20 bridge over Alcovy Road (see alternative BA-12). This would require that the eastbound on-ramp at Alcovy Road remain closed for a longer period of time, but the benefits to the contractors, in terms of simplified and safer construction, is expected to net well over $250,000 and reduce the construction period by at least four months.

We encourage the GDOT project team and the design consultant to conduct an implementation session in the near future. The alternatives in this report offer opportunities to improve the value of the project, but most of the ideas are volatile. If the implementation of the alternatives is not determined in short order, the normal project momentum will reduce the net effect of the alternatives.

STUDY RESULTS

INTRODUCTION

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

The results of this VE study are presented as individual alternatives for specific change. These may be in the form of VE alternatives (accompanied by cost estimates) or design suggestions (normally without cost estimates). Each alternative consists of a summary of the original design, a description of the proposed change, a life cycle cost comparison, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternative. Sketches and design calculations, where appropriate, are also presented. The cost comparisons reflect unit quantities, wherever possible, for determining overall cost.

Each design suggestion contains the same information as the VE alternative, except that normally no cost information is provided. Design suggestions are presented to bring attention to areas of the design which, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved systems operations, ease of maintenance, ease of construction, safer working conditions, etc. The reader is encouraged to review these design suggestions, which are intended to improve the quality of the project.

The alternatives developed are organized according to the order in which they were originally generated by the VE team during the function analysis/creative sessions. The *Alternative No.* facilitates cross-referencing the *Creative Ideas Listing and Evaluation* worksheets with the *Value Engineering Alternatives* and *Summary of Potential Cost Savings* worksheets.

RESULTS OF THE STUDY

This study team came up with 46 ideas for potential, creative changes in the current design and construction approach. Of these, 12 alternatives initially appeared to have high potential for positive change (rated four or five) and 13 were considered to be candidates for reconsideration in the event of future budget difficulties (rated three). Ultimately, nine alternatives were developed fully and are presented here.

The reviewer should also look back over the creative list for alternatives that may yet have potential use on the project. In particular, the numerous alternatives rated three were not seen as having the potential for acceptance that the other higher rated alternatives exhibited. The designers may be able to creatively combine some of these alternatives to help achieve their project goals.

EVALUATION OF ALTERNATIVES

When reviewing study results, it is important to consider each part of an individual alternative or design suggestion on its own merit. There may be a tendency to disregard an alternative because of concern about one portion of it. Consider each of the areas within an alternative that are acceptable and implement those parts 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 estimates, where possible, was used as the pricing basis. In the development of total project costs, the VE team used an average markup on unit costs to cover the designer's factors for general conditions, overhead, bonds, escalation and profit. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance are shown within each alternative.

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.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**

Newton County, I-20 Widening at Alcovy Road - NH-20-2(167)

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	BRIDGE AT ALCOVY ROAD (BA)					
BA-1/BA-2	Convert to 4-span bridge and use prestressed beams	$7,487,782	$4,084,383	$3,403,399	$109,114	$3,512,513
BA-3	Use MSE walls in lieu of paved end slopes	$7,704,782	$3,472,527	$4,232,255		$4,232,255
BA-12	Stage all lanes of I-20 on eastbound bridge	$1,500,000	$1,245,000	$255,000		$255,000
	RIGHT-OF-WAY (RW)					
RW-2	Move Alcovy Road to west - all takings on west side of road	$190,494	$42,000	$148,494		$148,494
RW-4	Realign City Pond Road to save gas station	$1,416,909	$141,873	$1,275,036		$1,275,036
	MISCELLANEOUS CONCRETE (MC)					
MC-1	Selectively eliminate curb and gutter	$619,344	$0	$619,344		$619,344
MC-4/MC-5	Use alternative median barrier on I-20	$899,294	$294,544	$604,750	($40,771)	$563,979
	PAVING ASPHALT (PA)					
PA-1	Maintain the current I-20 profile grade/lower Alcovy Road	$397,386	$119,751	$277,635		$277,635
PA-8	Revise Alcovy Road profile to utilize overlay	$273,007	$104,479	$168,528		$168,528

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**BA-1/BA-2**
DESCRIPTION:	**CONVERT TO FOUR-SPAN BRIDGE AND USE PRESTRESSED BEAMS**	SHEET NO.:	1 of 16

ORIGINAL DESIGN: (Sketch attached)

The design clear spans Alcovy Road with a three-span, continuous, steel plate girder superstructure. The spans for the unit are 100 ft. – 170 ft. – 100 ft. The three-span design was chosen, presumably, because the eight-foot median of Alcovy Road meanders beneath the bridge to accommodate the opposing dual left-turn movements for the Westbound I-20 on-ramp and the entrance to Industrial Drive.

ALTERNATIVE: (Sketch attached)

The alternative design is a four-span AASHTO Type III superstructure. This design will require high-strength concrete, but is within acceptable GDOT limits. The median will be increased to 10 feet to accommodate a 3-ft. column in the median, two 1 ft. 6 in. wide side barriers and 2 ft. of shy distance from the edge of travel lane to the barrier on each side.

Changing the superstructure beam type will result in a dramatic reduction in cost. The shorter superstructure depth will allow a 1 ft. reduction in the profile of I-20.

The length of bridge is slightly shorter because of the shallower beam depth.

ADVANTAGES:

- Reduces superstructure cost
- Reduces time to construct
- Reduces impact to I-20 (less fill)
- Reduces life cycle costs
- There would be an additional cost savings due to being able to lower the final grade on I-20 by the one foot (not calculated)

DISADVANTAGES:

- Construction staging will negatively impact Alcovy Road but can be dealt with
- Requires wider median
- Introduction of an obstruction in the roadway (albeit this is typical practice)

DISCUSSION:

It is standard practice to exhaust all possibilities to provide a prestressed beam alternative. The original design is easier to build. However, the price difference between the beam types and the additional fill on I-20 make the prestressed alternate very attractive.

The life cycle cost savings indicated below are derived from eliminating painting the steel girders 15 years into the life of the bridge. This is made possible by using prestressed concrete girders in lieu of steel.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 7,487,782	$ 109,114	$ 7,596,896
ALTERNATIVE	$ 4,084,383	$ 0	$ 4,084,383

SAVINGS	**$ 3,403,399**	**$ 109,114**	**$ 3,512,513**

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**BA-3**
DESCRIPTION:	**USE MSE WALLS IN LIEU OF PAVED END SLOPES**	SHEET NO.:	1 of 5

ORIGINAL DESIGN: (Sketch attached)

The design clear spans Alcovy Road with a three-span, continuous, steel plate girder superstructure. The spans for the unit are 100 ft. – 170 ft. – 100 ft. The three-span design was chosen, presumably, because the eight-foot median of Alcovy Road meanders beneath the bridge to accommodate the opposing dual left-turn movements for the Westbound I-20 on-ramp and the entrance to Industrial Drive.

ALTERNATIVE: (Sketch attached)

In lieu of the 2:1 paved end slopes with the associated end spans and concrete intermediate bents, the alternative design calls for a two-span prestressed concrete beam bridge with MSE walls at the abutments.

ADVANTAGES:

- Saves initial cost
- Expedites construction
- Enhances the bridge aesthetics

DISADVANTAGES:

- Limits the eventual build-out width of Alcovy Road going under I-20 by eliminating the area in the end slopes (the future use of this area would seem to be unlikely)
- Requires some redesign
- Similar to BA-1/BA-2, this alternative introduces center columns on the Alcovy Road cross-section

DISCUSSION:

The MSE wall has the noted advantages and accomplishes the required functions at a reduced cost.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 7,704,782**	**—**	**$ 7,704,782**
ALTERNATIVE	**$ 3,472,527**	**—**	**$ 3,472,527**

SAVINGS	**$ 4,232,255**	**—**	**$ 4,232,255**

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**BA-12**
DESCRIPTION:	**STAGE ALL LANES OF I-20 ON EASTBOUND BRIDGE**	SHEET NO.:	1 of 6

ORIGINAL DESIGN: (Sketch attached)

The design indicates that staging of traffic through the construction site for the new bridge at Alcovy Road will be done in three phases.

ALTERNATIVE: (Sketch attached)

The phasing of this bridge project could be streamlined if the eastbound on-ramp at Alcovy Road could be closed to permit two eastbound and two westbound lanes to be diverted to the current eastbound bridge structure during construction of the westbound bridge.

ADVANTAGES:

- Initial cost savings due to reducing the time of construction by approximately four months
- The contractor has a much less complicated work zone
- Eliminates at least one phase of construction (improve operations on I-20)
- Minimizes concrete barrier relocation
- Improves larger section of bridge work zone (easier facilitated construction)

DISADVANTAGES:

- The closure of the eastbound on-ramp would be for a longer period than currently anticipated
- More skewed, “larger” shift for westbound traffic—all the way across

DISCUSSION:

It is difficult to put a price tag on the benefit to be derived from providing the contractor with a clearer work zone. The savings below are based on reducing the construction period by four of the 24-month construction duration. This may not incorporate all the cost savings to be experienced, since the intangible work zone benefits to the contractor may net a significantly lower bid from the contractors. Another potential source of cost savings (not included below) would be the four-month reduction in job site overhead expenses (construction housing, site clerk(s), utilities, security, etc.).

The traffic benefits/advantages by eliminating a stage of construction are significant, although also not something than can be specifically calculated. There is at least one less traffic shift (safety/operations benefit) and, therefore, less handling of concrete barrier (cost savings).

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,500,000**	**—**	**$ 1,500,000**

ALTERNATIVE	**$ 1,245,000**	**—**	**$ 1,245,000**
SAVINGS	**$ 255,000**	**—**	**$ 255,000**

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**BA-12**
DESCRIPTION:	**STAGE ALL LANES OF I-20 ON EASTBOUND BRIDGE**	SHEET NO.:	2 of 6

DISCUSSION Continued:

Another somewhat modified alternative to the staging plan is to keep the respective traffic on each roadway and bridge but eliminate/reduce shoulders on the bridges to provide a much larger median work zone. This will facilitate construction of a much larger “median bridge” which can be used for the second stage for both eastbound and westbound traffic, allowing for the simultaneous construction of the outer portions of the bridge.

The overall benefit of this is that a stage of construction can be eliminated, saving on construction barrier, moving it and transporting it. Another benefit of this scheme is that the amount of traffic shifts is reduced and does not need to cross the median. Eastbound traffic stays on the eastbound side as does the westbound traffic.

This alternative would reduce the number of stages and more importantly the number of interstate traffic shifts. The temporary median pavement will be similar to the original scheme. The amount of concrete barrier needed will also probably be the same. However, due to the reduced stages, the number of times it needs to be moved will be reduced resulting in safer operations on the interstate. This will also allow for a much larger and more convenient bridge work zone for the contractor.

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**RW-2**
DESCRIPTION:	**MOVE ALCOVY ROAD TO WEST—PLACES RIGHT-OF-WAY TAKES ON ONE SIDE OF ROAD**	SHEET NO.:	1 of 5

ORIGINAL DESIGN:

The current horizontal alignment results in right-of-way takes being fairly evenly distributed on east and west sides of Alcovy Road.

ALTERNATIVE:

Shift Alcovy Road to the west to eliminate right-of-way takings on the eastside—DOT owns more property on the west side. It is also less developed.

ADVANTAGES:

- Eliminates/minimizes wall at Station 175+75 (+/-)
- Minimizes right-of-way takings
- Necessitates less developed land purchase
- Extends bike lane to southern project limit

DISADVANTAGES:

- Minor shift/taper in Alcovy Road
- Requires moderate redesign

DISCUSSION:

Shifting Alcovy Road to the west will allow for more convenient right-of-way acquisition as well as reduced areas since more land is already owned along the east and it is less developed. The properties on City Pond Road are complete takings. Circulation around the hotel will have to be maintained.

In addition, the retaining wall around the pump station could be minimized and the bike lane can be extended to the project limits.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 190,494	—	$ 190,494
ALTERNATIVE	$ 42,000	—	$ 42,000
SAVINGS	$ 148,494	—	$ 148,494

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**RW-4**
DESCRIPTION:	**REALIGN CITY POND ROAD TO SAVE GAS STATION**	SHEET NO.:	1 of 5

ORIGINAL DESIGN:

City Pond Road intersects Alcovy Road at Station 198+46. The angle of intersection is 90°. This proposed alignment of City Pond Road necessitates the displacement of the Circle K gas station which is located in the northwest quadrant of the intersection.

ALTERNATIVE: (Sketch attached)

Under this alternative, City Pond Road is realigned to intersect Alcovy Road at Station 199+25, approximately 80° north of the original alignment. The realignment also intersects Alcovy Road at 90º. This alternative removes the need to displace the Circle K gas station.

ADVANTAGES:

- Reduces right-of-way
- Better operations (intersection farther from westbound ramps)
- No UST impact

DISADVANTAGES:

- Increases construction cost
- Requires moderate redesign

DISCUSSION:

The primary value of this alternative is that it avoids a costly and time-consuming displacement. Secondly, it provides slightly better traffic operations and avoids impacts to underground storage tanks. Cost calculations are based on an assumption that the Circle K gas station displacement will cost about $1,000,000.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,416,909	—	$ 1,416,909
ALTERNATIVE	$ 141,873	—	$ 141,873
SAVINGS	$ 1,275,036	—	$ 1,275,036

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**MC-1**
DESCRIPTION:	**SELECTIVELY ELIMINATE CURB AND GUTTER**	SHEET NO.:	1 of 6

ORIGINAL DESIGN:

Curb and gutter sections are proposed in the following locations:

- Alcovy Road left side: Station 160+50 – Station 198+50
- Alcovy Road right side: Station 160+50 – Station 214+00
- City Pond Road both sides: Station 44+00 – Station 50+00
- Industrial Drive right side: Station 50+00 – Station 65+50

ALTERNATIVE: (Sketch attached)

This alternative eliminates curb and gutter except at the following locations:

- Alcovy Road both sides: Station 185+00 – Station 188+00; a rural section in this area (under the I-20 overpass) would either necessitate the use of retaining walls or lengthen the bridge.
- Alcovy Road left side: Station 195+00 – Station 198+50 and right side Station 195+50 – Station 200+00; relatively dense development and parking lots in close proximity to Alcovy Road makes rural section impractical in the areas.

ADVANTAGES:

- Reduces construction cost
- Reduces construction time

DISADVANTAGES:

- Adds right-of-way needed
- Typical section discontinuity

DISCUSSION:

The existing and likely future land use in this project is not sufficiently developed to warrant the use of a curb and gutter (urban) section, in most locations. Much of the development is industrial and is set back a considerable distance from the roadways. For these reasons utilization of a rural section is a viable alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 619,344	—	$ 619,344
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 619,344	—	$ 619,344

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**MC-4/ MC-5**
DESCRIPTION:	**USE ALTERNATIVE MEDIAN BARRIER ON I-20**	SHEET NO.:	1 of 9

ORIGINAL DESIGN: (Sketch attached)

The design requires concrete median barrier and full depth pavement build-up from edge of inside shoulder to edge of inside shoulder for the length of the project on I-20. This design was chosen presumably to prevent median crossover and to provide pavement for future expansion including HOV. GDOTs further HOV expansion plan calls for this stretch of I-20 under Tier 7, which is low in priority.

ALTERNATIVE: (Sketch attached)

The alternative design provides the positive barrier on I-20 preventing median crossover accidents. Two options for median barrier provided are double-faceguard (w shape) or a cable barrier system similar to the system used by SCDOT on their interstates. This alternative design also eliminates a significant portion of full-depth pavement structure which will most likely never be used during its functional life (within 20 years).

ADVANTAGES:

- Reduces cost
- Reduces time for construction
- Reduces pavement maintenance

DISADVANTAGES:

- Requires mowing (maintenance)
- Requires more maintenance when median barrier is struck by vehicles
- Reduces future maintenance of traffic (MOT) options

DISCUSSION:

Since there is no planned expansion of I-20 that is likely to be implemented in the foreseeable future, paving the median may be unnecessary, other than for a more maintenance-free design. The cost saving makes this alternative attractive. Note that the $40,771 cost increase is due to the present worth of the cost to mow the grassed median over the next 20 years.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 899,294	$ 0	$ 899,294
ALTERNATIVE	$ 294,544	$ 40,771	$ 335,315
SAVINGS	$ 604,750	$ (40,771)	$ 563,979

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**PA-1**
DESCRIPTION:	**MAINTAIN THE CURRENT I-20 PROFILE GRADE/ LOWER ALCOVY ROAD**	SHEET NO.:	1 of 6

ORIGINAL DESIGN: (Sketch attached)

The proposed profile grade would raise the interstate about 5 ft. at the overpass. The Alcovy Road profile is to be raised about 2 ft. in some areas.

ALTERNATIVE:

Maintain the I-20 profile at the existing grade. Lower the Alcovy Road profile about 6 ft.

ADVANTAGES:

- Initial cost savings
- Minimizes grading on I-20
- Facilitates I-20 construction
- Can be coordinated with parallel VE bridge alternatives for additional benefits

DISADVANTAGES:

- Creates constructability issues on Alcovy Road
- Drainage appears to be workable but needs to be closely reviewed
- Significant redesign

DISCUSSION:

Maintaining the existing profile on I-20 would significantly reduce the required earthwork on I-20. This will have several significant benefits beyond cost savings (reduced construction time), including allowing for easier staging/sequencing on I-20. Rather than building up approaches to the bridge, they will generally be flush with the existing grade. There will be some constructability and sequencing issues on Alcovy Road, however, they should be workable. This scheme has additional benefits when coupled with the additional bridge alternative (see alternative BA-1/BA-2). There would be some additional cost savings (not calculated) for reduced earthwork due to not having to raise the ramp. While the cost savings have been based on lowering Alcovy Road by 6 ft., further discussions within the VE workshop indicate that Alcovy Road may have acceptable clearance with being lowered only 4 ft., generating additional cost savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 397,386	—	$ 397,386
ALTERNATIVE	$ 119,751	—	$ 119,751
SAVINGS	$ 277,635	—	$ 277,635

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**GEORGIA DEPARTMENT OF TRANSPORTATION** ***Newton County – I-20 Widening at Alcovy Road – H-20-2(167)***	ALTERNATIVE NO.:	**PA-8**
DESCRIPTION:	**REVISE ALCOVY ROAD PROFILE TO UTILIZE OVERLAY**	SHEET NO.:	1 of 3

ORIGINAL DESIGN:

Between Station 171+50 and Station 197+50 a distance of 2,600 lf full depth pavement is proposed for Alcovy Road.

ALTERNATIVE:

Between Station 171+50 and Station 197+50, there is no apparent reason why the Alcovy Road profile cannot be revised to locate it approximately 3½ in. above the existing pavement elevation. By revising the profile in this manner, the existing pavement can be overlaid.

ADVANTAGES:

- Reduces construction cost
- Simpler construction staging
- May slightly reduce construction impact on local traffic

DISADVANTAGES:

- Requires some redesign
- The originally planned, finished roadway surface would probably be smoother

DISCUSSION:

The profile of Alcovy Road is very flat in the area in question, making it a good candidate for overlay/widening. A point profile, which closely matches the existing pavement surface, would easily meet design criteria for Alcovy Road.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 273,007	—	$ 273,007
ALTERNATIVE	$ 104,479	—	$ 104,479

SAVINGS	**$ 168,528**	**—**	**$ 168,528**

PROJECT DESCRIPTION

This project has been under consideration for several years and is currently defined by much of the traffic history of its general, geographical setting. The key components include Interstate 20, the I-20 bridges over Alcovy Road and CSX railroad, Alcovy Road and other State and local roads. The current concept is best described in the enclosed Revised Project Concept Report (dated December 16, 2003) and the Preliminary Field Plan Review Inspection Report (Inspection Date: May 1, 2003; Report Date: May 5, 2003).

This project is being carefully integrated with projects that will be constructed before and after this one.

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

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

- Value Engineering Workshop Participants
- Economic Data
- Cost Model
- Function Analysis
- Project Value Objectives© Questionnaire
- 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 operating needs, 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. 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 includes six phases:

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

Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the Design Project Manager for the Georgia Department of Transportation and the project manager from the design firm, $Q^K{}_{4,}$ presented information about the project to the VE team on first day of the session. Following the presentation, the VE team reviewed the project materials in preparation for the function analysis and creative phases. These materials included:

- Construction drawing set dated 19 January 2004
- Project Status Report – dated 3 February 2004
- Preliminary Cost Estimate, prepared by $Q^K{}_4$ and dated 30 June 2003
- Preliminary Field Plan Review Inspection Report, inspection date 1 May 2003, report dated 5 May 2003
- Concept Validation Report, prepared by Presnell Associates, Inc., dated 4 December 2001
- Revised Concept Report, dated 16 December 2003
- Project Concept Report Approval, dated 27 June 2000
- Project Concept Report, dated 27 August 1999
- Set of GDOT standard drawings (English measure)
- Bridge construction drawings, extracted from overall construction drawing set – 1982

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 to 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 as a logical review of the key necessities to be delivered by this project.

Creative Phase

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. 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 Georgia DOT project management and their design team may wish to review the creative list since they 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 creative listing was re-evaluated 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 high-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 section entitled *Study Results*.

Presentation Phase

The last phase of the VE study was the presentation of the alternatives. The VE team screened the VE alternatives before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to the representatives GDOT and their design team. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from the GDOT and their design team 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. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise on the project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following:

Charles R. McDuff	VE Facilitator	Lewis & Zimmerman Associates, Inc.
George Obaranec	Civil/Roadway/Contructibility	Delon Hampton Associates
Greg Grant	Structural Engineer	HNTB Corporation
Larry Cook	Highway Engineer	HNTB Corporation

Mr. George Merritt, a Transportation Engineer with District 2 of the FHWA, participated in the Value Engineering workshop, contributing to the VE effort as a team member.

OWNER'S/DESIGNER'S PRESENTATION

Representatives from the Georgia DOT, and the design team project manager from $Q^K{}_{4,}$ presented an overview of the project on Tuesday, 3 January 2004. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team "up-to-speed" regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention. The attendance list for this presentation is attached.

VALUE ENGINEERING TEAM'S INFORMAL ORAL PRESENTATION

There was an informal presentation of the VE team's developed alternatives on the last day of the workshop, 5 January 2004. Attending this session was the Georgia DOT project manager and the VE coordinator, along with the members of the VE team.

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

NO.	IDEA DESCRIPTION	ADVANTAGES	DISADVANTAGES	A	B	C	D	E	RATING
	BRIDGE AT ALCOVY ROAD (BA)								
BA-1	Convert to a 4-Span bridge	Initial cost savings	Moderate redesign	+	+	∅	∅	+	5
BA-2	Use prestressed beams	Reduced time of construction							See BA-1
BA-3	Use MSE walls for abutments	Initial cost savings	Limits future expansion	+	+	∅	∅	+	2
BA-4	Reduce length of bridge								3
BA-5	Consider 2-Span bridge								See BA-4
BA-6	Re-align Alcovy Road to reduce skew and bridge length	Evaluated and found to be not cost effective							2
BA-7	Route Alcovy Road over I-20	Much too costly							1
BA-8	Remove ramp from bridge	Future design consideration							3
BA-9	Build separate bridge for ramp	Future design consideration							3
BA-10	Reduce median lane width across bridge	Initial cost savings	Limits safety	+	—	—	—	+	1
BA-11	Place half of Alcovy Road in new span, keep existing bridge	Not cost effective							4
BA-12	Stage all lanes of I-20 on eastbound bridge	Simplifies construction	Some redesign required	+	∅	∅	∅	∅	4

RATING CRITERIA: A = Capital Costs B = Maintainability C = Ease of Operation D = Safety E = Life Cycle Costs

EVALUATION: (+) = Better Than Existing Condition; (∅) = Same as Existing Condition; (—) = Worse Than Existing Condition

RATING: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; D

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

NO.	IDEA DESCRIPTION	ADVANTAGES	DISADVANTAGES	A	B	C	D	E	RATING
	MAINTENANCE OF TRAFFIC (MT)								
MT-1	Sever existing Industrial Drive connection to Alcovy Road	Future design consideration							3
MT-2	Make Industrial Drive one-way, use slip ramp			+	∅	—	—	∅	1
MT-3	Use single-point interchange at Alcovy Road	Not cost effective							1
	RIGHT-OF-WAY (RW)								
RW-1	Selectively reduce right-of-way width	Initial cost savings		+	∅	∅	∅	∅	4
RW-2	Move Alcovy Road to west, put R/W takes on west side of roadway	Initial cost savings		+	∅	∅	∅	∅	4
RW-3	Cut off Industrial Drive at Alcovy Road	Future design consideration							3
RW-4	Realign City Pond Road to keep gas station property	Initial cost savings	Complicates design	+	∅	∅	∅	∅	4
RW-5	Connect City Pond Road to Harland Drive	Not cost effective							1
RW-6	Use half cloverleaf at Alcovy Road	Not cost effective							1
RW-7	Realign eastbound off-ramp (in Southwest quadrant), sell left over property	Future design consideration							3
RW-8	Combine eastbound ramps and Industrial Drive	Operationally unacceptable							1
RW-9	Move entire interchange	Not cost effective							1

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EVALUATION: (+) = Better Than Existing Condition; (∅) = Same as Existing Condition; (—) = Worse Than Existing Condition ABD = Already Being Done

RATING: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; DS = Design Suggestion

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

SHEET NO.: 3 of 5

NO.	IDEA DESCRIPTION	ADVANTAGES	DISADVANTAGES	A	B	C	D	E	RATING
	MISCELLANEOUS CONCRETE (MC)								
MC-1	Eliminate curb and gutter								4
MC-2	Use straight-face median barrier								3
MC-3	Selectively eliminate sidewalk								4
MC-4	Use double-face guardrail in lieu of concrete median barrier								4
MC-5	Use cable barrier in lieu of concrete median barrier								See MC-4
MC-6	Use four foot wide sidewalk								1
MC-7	Use grass medians in lieu of concrete								1

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EVALUATION: (+) = Better Than Existing Condition; (∅) = Same as Existing Condition; (—) = Worse Than Existing Condition ABD = Already Being Done

RATING: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; DS = Design Suggestion

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

NO.	IDEA DESCRIPTION	ADVANTAGES	DISADVANTAGES	A	B	C	D	E	RATING
	CSX BRIDGE (BC)								
BC-1	Build new bridge with concrete	Evaluated and found not cost effective							4
BC-2	Build bridge in way to avoid have to build crash walls								See BC-1
BC-3	Flatten horizontal curve	Little cost return							1
BC-4	Put railroad in tunnel	Not technically acceptable							1
BC-5	Reduce bridge width	Required width							1
BC-6	Use 1-span, railroad bridge in median area	Not technically acceptable							2

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EVALUATION: (+) = Better Than Existing Condition; (∅) = Same as Existing Condition; (—) = Worse Than Existing Condition ABD = Already Being Done

RATING: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; DS = Design Suggestion

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

NO.	IDEA DESCRIPTION	ADVANTAGES	DISADVANTAGES	A	B	C	D	E	RATING
	PAVING – ASPHALT (PA)								
PA-1	Maintain profile of I-20	Initial cost savings	Moderate redesign	+	∅				5
PA-2	Use soil cement mix in lieu of Graded Aggregate Base (GAB)	Insufficient data to develop alternative							2
PA-3a	Use concrete for ramps	These two alternatives will be normally considered later in the design process							3
PA-3b	Use asphalt for ramp shoulders								3
PA-4	Eliminate bikeway on Alcovy Road								See RW-1
PA-5	Utilize 12’ inside shoulders on I-20	Reduced safety							1
PA-6	Investigate alternate barrier type								See MC-4
PA-7	Review pavement design on Alcovy Road	Future design consideration							3
PA-8	Revise Alcovy Road profile to implement overlay pavement	Initial cost savings	Moderate redesign	+	+	+	∅	∅	4
PA-9	Use 14’ flush median								See RW-1

RATING CRITERIA: A = Capital Costs B = Maintainability C = Ease of Operation D = Safety E = Life Cycle Costs

EVALUATION: (+) = Better Than Existing Condition; (∅) = Same as Existing Condition; (—) = Worse Than Existing Condition ABD = Already Being Done

RATING: 1→2 = Not to be Developed; 3→4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; DS = Design Suggestion

DESIGN TEAM PRESENTATION

MEETING PARTICIPANTS

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION** DATE: **FEBRUARY 3, 2004**

Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
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Joe Wheeler joe.wheeler@dot.state.ga.us	GADOT – Consultant Design Project Manager	ph 404-657-9759 fx 404-433-6136
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Jerry Milligan em	GDOT– Right-of-Way	ph 404-463-2575 fx

ECONOMIC DATA

The VE team developed economic criteria to evaluate information gathered from the Georgia Department of Transportation and their Q^K4 design team. To express costs in a meaningful manner, the VE 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:	2004
Construction Bid:	2008
Right-of-Way Acquisition Scheduled for	2006
Right-of-Way Cost Assumptions *(Provided by Jerry Milligan, ODOT R/W)*	Residential Land - $ 0.88/s.f. Industrial Land - $3.55/s.f. Commercial Land - $6.35/s.f.
Construction Duration:	24 – 30 Months
Economic/Useful Life:	20 years starting in 2010
Discount Rate / Interest:	4.20%
Annual Inflation	5.00%
Operation and Maintenance Costs *(Industry Norms)*:	
Equipment - With Many Moving Parts	5.00%-5.50%+ of Capital Cost
Equipment - With Minimal Moving Parts	3.50%-4.00% of Capital Cost
Equipment - Electronic	3.00% of Capital Cost
Structural	1.00%-2.00% (or less) of Capital
Cost Estimating Mark-up (Based on four years inflation and 10% for engineering and construction)	33.80% (1.338)
Budget for Construction (From Current Concept)	$24,583,000
Budget for Reconstruction	$ 6,129,000

(Note—These budge figures are defined by the current concept estimate)

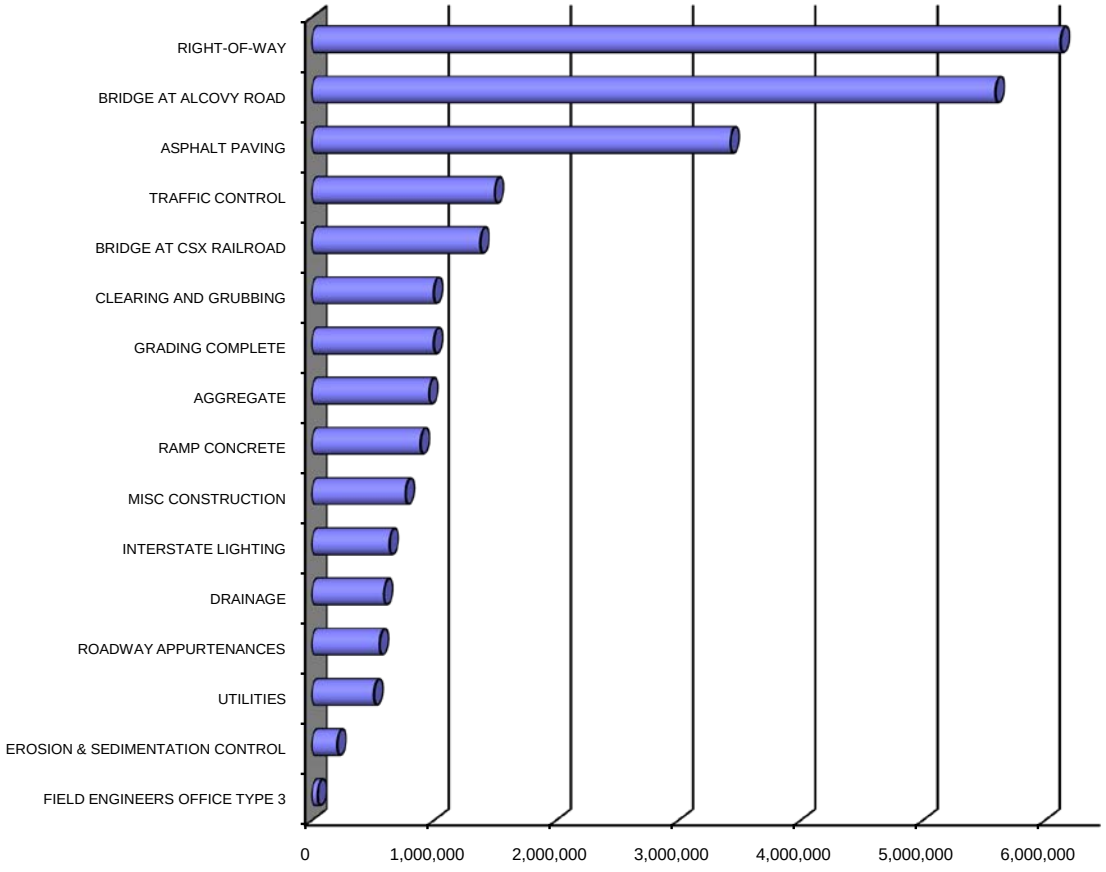
COST MODEL

The VE team prepared a cost model for the project in the Pareto charting format as an aid to identifying high cost areas. This cost model follows. As the work of the team progressed, the Cost Histogram content was checked against the cost/worth ratios in the function analysis section, to see if the team maintained the correct focus during the study, to net the best results for the workshop.

CONCEPT 1 COST HISTOGRAM

PROJECT: Newton Co. - I-20 Widening at Alcovy Road - NH-20-2(167)

TOTAL PROJECT	COST	PERCENTAGE	CUMM. PERCENTAGE
RIGHT-OF-WAY	6,128,850	24.30%	24.30%
BRIDGE AT ALCOVY ROAD	5,596,250	22.19%	46.49%
ASPHALT PAVING	3,428,220	13.59%	60.09%
TRAFFIC CONTROL	1,500,000	5.95%	66.03%
BRIDGE AT CSX RAILROAD	1,380,600	5.47%	71.51%
CLEARING AND GRUBBING	1,000,000	3.97%	75.47%
GRADING COMPLETE	1,000,000	3.97%	79.44%
AGGREGATE	962,680	3.82%	83.26%
RAMP CONCRETE	891,820	3.54%	86.79%
MISC CONSTRUCTION	769,956	3.05%	89.85%
INTERSTATE LIGHTING	638,000	2.53%	92.38%
DRAINAGE	593,000	2.35%	94.73%
ROADWAY APPURTENANCES	557,650	2.21%	96.94%
UTILITIES	511,511	2.03%	98.97%
EROSION & SEDIMENTATION CONTROL	210,000	0.83%	99.80%
FIELD ENGINEERS OFFICE TYPE 3	50,000	0.20%	100.00%
TOTAL	**$ 25,219,000**		



Costs in graph are not marked-up.

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. As part of this, a Random Function Analysis based on the major construction elements was performed. 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. To ascertain a better understanding of how well this design is functioning, and to highlight areas of the project that could be improved, the cost/worth (C/W) Analysis was performed on most of the key construction elements. When the C/W is calculated, it can generally be interpreted as follows:

C/W = 1.00	Good Value
C/W = Greater than 1.00	Area that needs to be reviewed
C/W = 2.00 or greater	Must question value and find out underlying reasons

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. A review of the C/W ratios, in this project, revealed that this is “tight” project, with reasonable return on the dollars spent. This makes the work of the VE team more strenuous because it is hard to find significant cost savings without getting into scope-cutting activities.

FUNCTION ANALYSIS AND COST-WORTH

PROJECT: **GEORGIA DEPARTMENT OF TRANSPORTATION**
Newton Co. – I-20 Widening at Alcovy Road – NH-20-2(167)

SHEET NO.: 1 of 1

NO.	ELEMENT	FUNCTION			COST (000)	WORTH (000)	COMMENTS
		VERB	NOUN	KIND			
1	RIGHT-OF-WAY	Accommodate	Construction	U	6,128	5,500	C/W = 1.114
2	UTILITIES	Protect	Existing Services	RS	512	512	C/W = 1.000
3	TRAFFIC CONTROL (Construction)	Protect	Vehicles/People	RS	1,500	1,200	C/W = 1.250
4	CLEARING AND GRUBBING	Facilitate	Construction	RS	1,000	650	C/W = 1.538
5	GRADING	Establish	Roadway Elevation	B	1,000	750	C/W = 1.333
6	AGGREGATE	Support	Road Surface	B	963	700	C/W = 1.378
7	RAMP CONCRETE	Support	Ramp Traffic	B	900	900	C/W = 1.000
8	ASPHALT PAVING	Support	Mainline Traffic	RS	3,428	3,428	C/W = 1.000
9	MISCELLANEOUS CONCRETE	Construct	Gutters	S	195	175	C/W = 1.114
	---CONCRETE BARRIER	Protect	Vehicles	RS	254	225	C/W = 1.129
	---RETAINING WALL	Protect	Pump Station	S	23	10	C/W = 2.300
	---REMOVE EXIST BRIDGE	Facilitate	Construction	RS	100	100	C/W = 1.000
10	DRAINAGE	Improve	Traction	S	900	800	C/W = 1.126
11	ROADWAY APPURTENANCES	Channel	Traffic	RS	558	558	C/W = 1.000

Function defined as: Action Verb
Measurable Noun

Kind: B = Basic
S = Secondary
RS = Required Secondary

HO =Higher Order
LO =Lower Order
U = Unwanted

Cost/Worth Ratio =
(Total Cost ÷ Basic Worth)

PROJECT VALUE OBJECTIVES ©

VALUE is defined by Webster as: *to rate or scale in usefulness, importance or general worth*. Improving value is a major objective of Lewis & Zimmerman Associates Inc.'s value management (VM) studies. Value studies improve the design, constructibility, and operability of your facility.

In conducting a value study, it is imperative that the value-team understand the owner's specific requirements and priorities in undertaking the construction project. In other words, we must answer the question: What *value objectives* must we achieve? For instance, should the designer attempt to win a design award with the project; should materials be able to withstand a mortar attack; should systems be designed for ordinary or continuous usage; should the design be approached as a short-term solution to a problem? In a similar vein, does the owner want to create in the design a certain image that will influence the eventual user? Indeed, each project developer or owner has his own unique set of value objectives.

By clearly understanding your *value objectives*, the value-team can better evaluate the ideas it generates based on how well each idea meets to those objectives. Moreover, the ideas generated by the value-team will have a greater probability of being implemented by you and your designer because they reflect your specific requirements.

To assist the Georgia DOT value-team in understanding your *value objectives*, we have developed the following questionnaire. During the orientation meeting / designers' presentation, the information derived from the questionnaire and the ensuing discussion will be transmitted to the value-team, reviewed and made the basis of the evaluation of all ideas generated by the team. As the ideas are evaluated by the value-team, their relative impact on the value objectives are appraised by arrows indicating improvement, degradation, or no change.

1. **Aesthetic Value - The aesthetics of the project should be such that:**
   - ➢ the project wins a design award
   - ➢ the project is pleasing to the general public
   - ➢ the project makes a statement about the State of Georgia
   - ☐ the facility is strictly utilitarian in nature
   - ☐ other _____

2. **Durability - The project should be constructed to withstand:**
   - ☐ light usage
   - ➢ normal wear and tear on this type of facility associated with industrial-type traffic
   - ☐ excessive abuse including vandalism
   - ☐ a mortar attack from a terrorist
   - ☐ other _____

3. **Expected Useful Life - The project should be constructed for an economic planning period of:**
   - ☐ 20 to 30 year
   - ➢ over 30 years

- ☐ other _____

4. Capital Costs - The project's budget and your ability to meet that budget is:

- ☐ critical to the project's survival
- ☐ vitally important to financial success
- ☐ flexible if improvements can be made
- ☐ moderately important
- ☐ of little importance
- ➢ other – depends on pending legislation that may affect availability of funds

5. Life Cycle Costs - The costs of operating and maintaining the facility are:

- ☐ extremely important to consider
- ➢ to be kept to industry norms
- ☐ slightly important
- ☐ not important
- ☐ other _____

6. Driving factors behind this project (Please check all that apply):

- ➢ Must fulfill requirements of projected traffic demands
- ☐ Time for a normal upgrade
- ☐ Got the money and know we will need capacity in the future
- ☐ other _____

7. User Concerns - The facility should be designed to accommodate primarily:

- ➢ the GDOT maintenance and operations staff responsible for the bridges and roadway
- ➢ the traveling public
- ☐ the special security needs of this troubled time
- ☐ and/or other _____

8. Neighbors - How important is the design of the facility with respect to the approval of those sharing adjacent properties?

- ☐ extremely important
- ☐ slightly important
- ➢ should be considered
- ☐ of no importance

9. End User Input - To what degree have GDOT and the public been involved in the project's formulation?

- ☐ little input; designer has done all the work
- ➢ active participation
- ☐ little input at this time from the public due to the early stage of the project
- ➢ GDOT established criteria
- ☐ other _____

10. Reliability - Construction of the systems within the facility should be such that:

- ➢ it remains fully operational under all conditions (to be further defined in discussions)
- ☐ it remains partially operational under all conditions
- ☐ it remains fully operational only during normal usage

- ☐ other _____

11. Time - The established date the facility is to be operational is:

- ☐ critical and must be achieved
- ☐ critical and should be advanced if at all possible
- ➢ moderately flexible
- ☐ totally flexible
- ☐ other _____

12. Time vs. Money - If there were a choice between saving significant construction cost (5% or more) at the expense of delaying the completion date, how long of a delay is acceptable?

- ☐ none
- ☐ one month
- ☐ two months
- ☐ six months
- ➢ more than six months

13. Safety - The degree to which safety features of the facility should affect the design is:

- ➢ meet current industry norms
- ☐ design must make users feel totally safe
- ☐ other _____

15. Use this space for other objectives.

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

16. Please indicate your top 5 value objectives in constructing this project.

_____ aesthetics	_____ durability	_____ expected life
_____ capital costs	__X_ life cycle costs	__X_ return on investment
_____ convenience	_____ neighbors	_____ end user input
_____ reliability	_____ time	_____ time vs. money
__X_ ease of operation	__X_ safety	__X_ other _____

CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas, alternative proposals and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

The brainstorming headings utilized during the creative phase were, in this order:

BA	**BRIDGE AT ALCOVY ROAD**
MT	**MAINTENANCE OF TRAFFIC**
RW	**RIGHT-OF-WAY**
MC	**MISCELLANEOUS CONCRETE**
BC	**CSX BRIDGE**
PA	**PAVING - ASPHALT**

These ideas were then discussed and the advantages/disadvantages of each listed. The VE team compared each of the ideas with the as-designed solution determining whether it improved value, was equal in value, or lessened the value of the design in terms of: (A) Aesthetics, (B) Capital Cost, (C) Durability, (D) Safety and (E) Expected Life. The criteria for evaluating these creative ideas were derived from the responses to the Project Value Objectives Questionnaire (PVO©). These responses were provided by the VE participants, working in open session, on the first day of the study.

The ideas were then ranked on a scale of one to five on how well the VE team believed the idea met these criteria overall. The higher rated ideas were then developed into formal alternatives and included in the Study Report. Typically, all ideas rated four or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept as not being 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.