VALUE ENGINEERING STUDY
OF

US 278 / SR 6

PROJECT NO. NHS-M003-00(158)
PI NOS. M003158

COBB & DOUGLAS COUNTIES, GA

April 26 – 27, 2005

Prepared by:
Ventry Engineering, L.L.C.

In Association With:
Georgia Department of Transportation

VALUE ENGINEERING STUDY
TEAM LEADER

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DATE_____

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I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by Ventry Engineering for the Georgia Department of Transportation. The study was performed during a two-day period on April 26 - 27, 2005.

The subject of the study was replacing the mainline concrete with 12 inches of GAB, 3 inches of 19mm superpave, and 12 inches of continually reinforced concrete (CRC) with a 2.08% cross slope.

PROJECT DESCRIPTION

US 278 / SR 6 is currently a 4-lane controlled access arterial consisting of four12-foot lanes with a 14-foot asphalt flush median and 4-foot paved shoulders. The roadway was constructed using a 1.5% cross slope. The existing paving section consists of 6 inches of GAB with 8 inches of PCC. Numerous pavement failures have been attributed to the fact that the project was constructed on fill through wetlands, and an increase in truck traffic.

METHODOLOGY

The Value Engineering Team followed the basic Value Engineering procedure for conducting this type of analysis.

This process included the following phases:

1. Investigation
2. Speculation
3. Evaluation
4. Development
5. Presentation
6. Report Preparation

Evaluation criteria identified as a basis for the comparison of alternatives included the following:

- Construction Time
- Traffic Disruption
- Equipment Requirements
- Future Maintenance
- Service Life
- Construction Cost
- Travel Time

I. EXECUTIVE SUMMARY

RESULTS – AREAS OF FOCUS

The following Areas of Focus were analyzed by the Value Engineering Team and from these areas the following Value Engineering Alternatives were developed and are recommended for Implementation:

A. Traffic Control/Maintenance of Traffic

Recommendation No. 1:

The Value Engineering Team recommends that *Value Engineering Alternative, Option 2* be implemented. This alternative uses detour roads during construction of intersections.

If this recommendation can be implemented, there is a possible savings of: **$432,032.**

If this Option cannot be implemented then the Value Engineering Team recommends that *Option 1* be implemented. This alternative uses a special Traffic Control/Maintenance of Traffic design for the intersections.

If this recommendation can be implemented, there is a possible savings of: **$405,079.**

B. Materials

Recommendation No. 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative develops a specification and includes it in the contract that would allow the contractor to crush the existing concrete pavement and reuse it as aggregate base.

If this recommendation can be implemented, there is a possible savings of: **$5,943,367.**

C. Contract Time

Recommendation No. 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative splits the project into two separate contracts of nine months each and includes intermediate completion dates.

RESULTS – AREAS OF FOCUS (Cont'd)

D. Constructability of Travel Lanes & Shoulders

Recommendation No. 4:

The Value Engineering Team recommends that Value Engineering Alternative *Option 2* be implemented. This alternative daylights the sub-grade from front slope to front slope and constructs the graded aggregate base from front slope to front slope for the low areas of the project.

If this recommendation can be implemented, there is a possible savings of: **$131,434.**

E. Constructability of Median

Recommendation No. 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative mills and resurfaces the asphalt median pavement.

If this recommendation can be implemented, there is a possible savings of: **$903,022.**

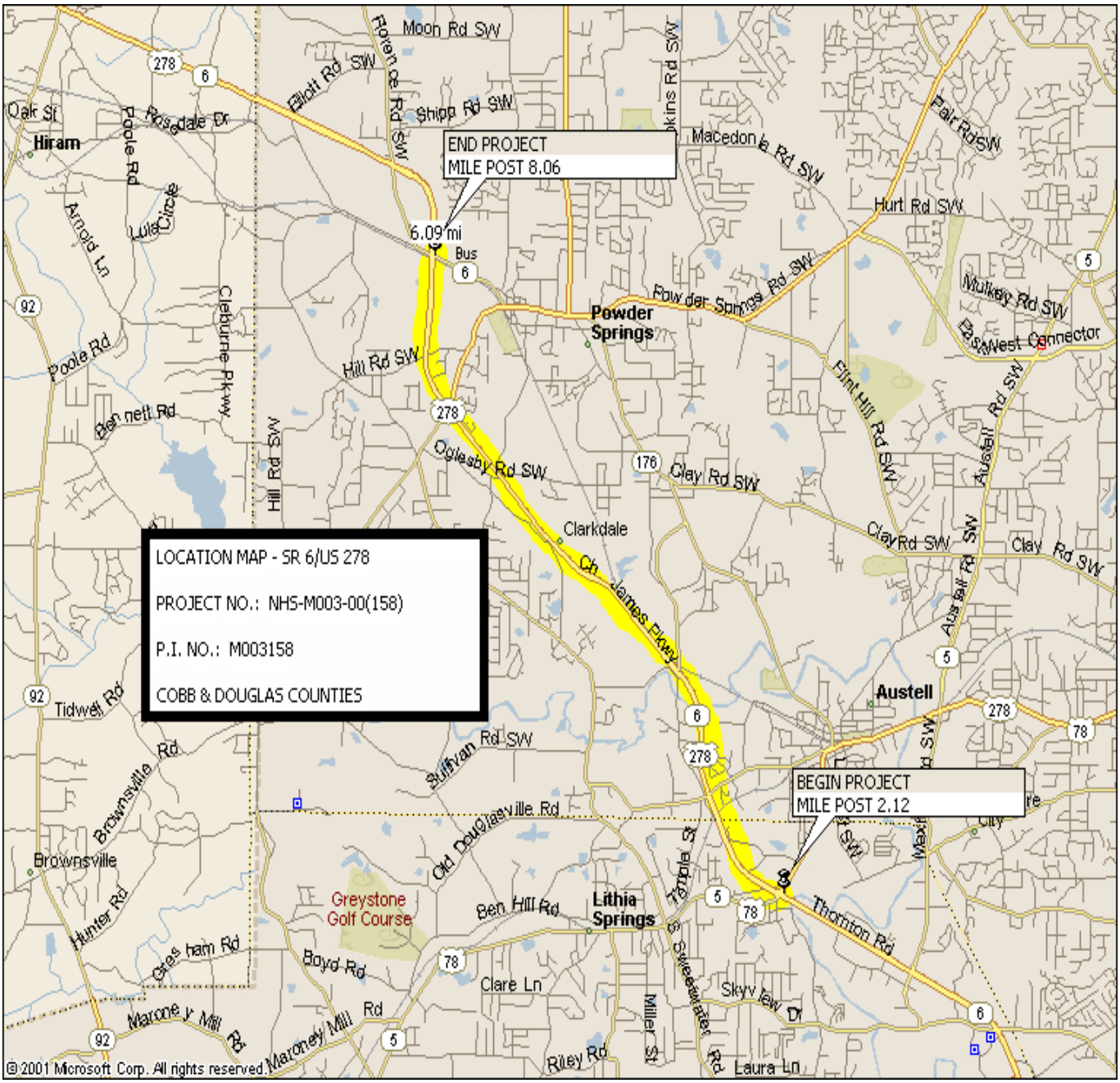
F. Staging

Recommendation No. 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative changes the staging to two stages, Stage one-Construct two 12 foot lanes and a 10 foot shoulder and Stage two- Construct the median, two 12 foot lanes and a 61/2 foot shoulder.

If this recommendation can be implemented, there is a possible savings of: **$68,464.**

II. LOCATION OF PROJECT



III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAMMEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
Bill Ventry	Ventry Engineering	Project Manager / Team Leader	850-627-3900
Tom Hartley	Ventry Engineering	Roadway Design / Traffic	850-627-3900
Bruce Nicholson	Ventry Engineering	Construction	850-627-3900
Lisa Myers	GADOT Engineering Services	Design/Construction	404-651-7468

PROJECT DESCRIPTION

Length: 6.20 Miles

Construction cost: $ 27,491,727

Design Speed: 55 MPH

Projected letting date: August, 2005

US 278 / SR 6 is currently a four-lane controlled access arterial consisting of four12-foot lanes with a 14-foot asphalt flush median and 4-foot paved shoulders. The roadway was constructed using a 1.5% cross slope. The existing paving section consists of 6 inches of GAB with 8 inches of PCC. Numerous pavement failures have been attributed to the fact that the project was constructed on fill through wetlands, and an increase in truck traffic.

IV. INVESTIGATION PHASE

US 278 / SR 6
VALUE ENGINEERING STUDY BRIEFING

APRIL 26, 2005

NAME	AFFILIATION	PHONE
Bill Ventry	Ventry Engineering	850-627-3900
Tom Hartley	Ventry Engineering	850-627-3900
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Jeff Woodward	GADOT Dist. 7	770-528-3538
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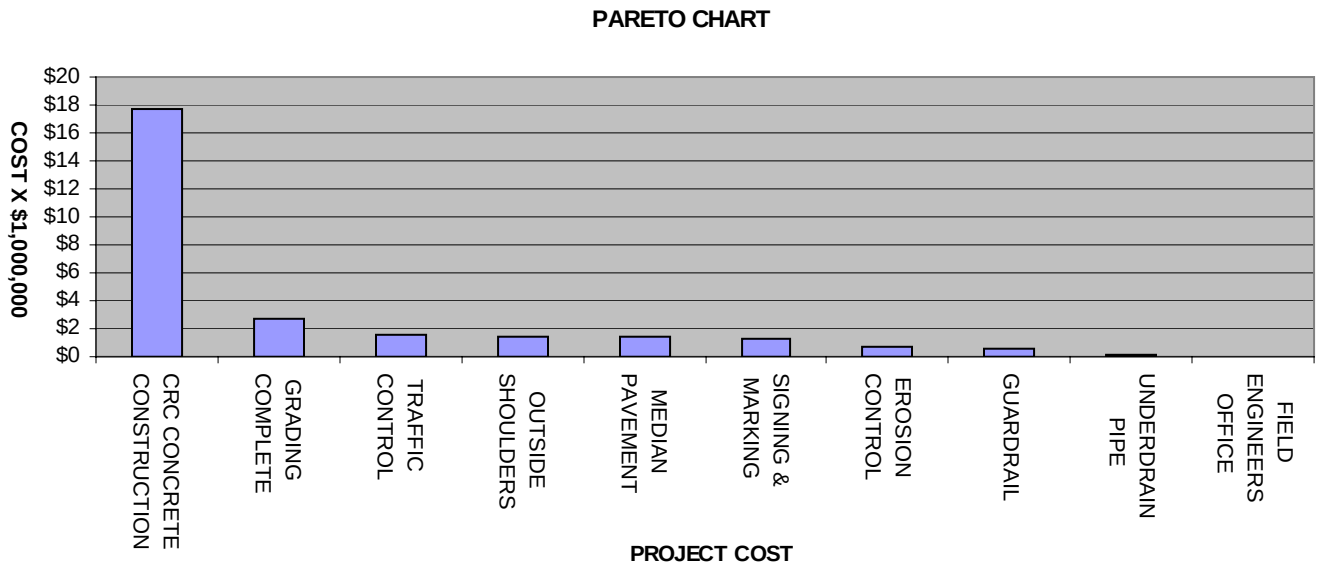
Kevin Stefanik	GADOT Traffic	404-635-8125
Lisa Myers	GADOT Engineering Services	404-651-7468

STUDY RESOURCES

NAME	AFFILIATION	PHONE
Jim Mills	Florida DOT	850-414-4318
Mike Lobdell	GADOT Dist. 7	404-463-4947
David Robins	GADOT Dist. 7	404-463-4947
Jeff Woodward	GADOT Dist. 7	770-528-3538
Lisa Myers	GADOT Engineering Services	404-651-7468
Ron Martin	M&M Excavating	954-485-1900

IV. INVESTIGATION PHASE



IV. INVESTIGATION

The following areas have been identified by the Value Engineering Team as areas of focus and investigation for the Value Engineering process:

A. Traffic Control/Maintenance of Traffic

B. Materials

C. Contract Time

D. Constructability

E. Staging

V. SPECULATION PHASE

Ideas generated, utilizing the brainstorming method, for performing the functions of previously identified areas of focus.

A. Traffic Control/Maintenance of Traffic

- Use a special Traffic Control/Maintenance of Traffic scheme for the intersections.
- Use detour roads during construction of intersections.

B Materials

- Develop a specification and include it in the contract that would allow the contractor to crush the existing concrete pavement and reuse it as either aggregate base or as aggregate in the new concrete pavement.
- Recycle the existing graded aggregate base.

C. Contract Time

- Revise the contract time to one year.
- Split the project into two separate contracts of nine months each.
- Have intermediate completion dates.

D. Constructability of Travel Lanes & Shoulders

- Daylight the sub-grade from front slope to front slope.
- Construct the graded aggregate base from front slope to front slope.

E. Constructability of Median

- Mill and resurface asphalt median pavement.

F. Staging

- Change the staging to two stages rather than three.
- Stage one- Construct two 12-foot lanes and a 10-foot shoulder.
- Stage two- Construct the median, two 12-foot lanes and a 6½-foot shoulder.

VI. EVALUATION PHASE

A. ALTERNATIVES

The following alternatives were formulated during the "eliminate and combine" portion of the Evaluation Phase.

A. Traffic Control/Maintenance of Traffic

Value Engineering Alternative-- Option 1: Use a special Traffic Control/Maintenance of Traffic design for the intersections.

Value Engineering Alternative--Option 2: Use detour roads during construction intersections.

B. Materials

Value Engineering Alternative: Develop a specification and include it in the contract that would allow the contractor to crush the existing concrete pavement and reuse it as either aggregate base or as aggregate in the new concrete pavement.

C. Contract Time

Value Engineering Alternative: Split the project into two separate contracts of nine months each and have intermediate completion dates.

D. Constructability of Travel Lanes & Shoulders

Value Engineering Alternative--Option 1: Daylight the sub-grade from front slope to front slope and construct the graded aggregate base from front slope to front slope for the entire project.

Value Engineering Alternative--Option 2: For low areas only.

E. Constructability of Median

Value Engineering Alternative: Mill and resurface asphalt median pavement.

F. Staging

Value Engineering Alternative: Change the staging to two stages: Stage one- Construct two 12-foot lanes and a 10-foot shoulder; and Stage two- Construct the median, two 12-foot lanes and a 6½ -foot shoulder.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES

The following Advantages and Disadvantages were developed for the Value Engineering Alternatives previously generated during the speculation phase. It also includes the Advantages and Disadvantages for the As Proposed.

A. Traffic Control/Maintenance of Traffic

"As Proposed": Lane closures at intersections.

Advantages

- Minimal throw away work/cost.

Disadvantages

- Too much control given to contractor.
- Longer construction time.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative--Option 1: Use a special Traffic Control/Maintenance of Traffic design for the intersections.

Value Engineering Alternative-- Option 2: Use detour roads during construction of intersections.

Advantages

- Less construction time at intersections.
- Less traffic disruption.

Disadvantages

- More temporary pavement in Option 1.
- Longer travel time in Option 2.

Conclusion

Carry forward for further evaluation.

B. Materials

"As Proposed": Contractor is to remove the concrete pavement, haul away and dispose of material.

Advantages

- Stockpile not required on the project.
- No special equipment required.

Disadvantages

- Transportation cost to haul away material.
- Does not utilize existing material.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: Develop a specification and include it in the contract that would allow the contractor to crush the existing concrete pavement and reuse it as either aggregate base or as aggregate in the new concrete pavement.

Advantages

- May be less construction time.
- Lower construction cost.
- Uses available material.
- No disposal of material required.
- Less environmental impact since material would be reused.

Disadvantages

- Requires special equipment.

Conclusion

Carry forward for further evaluation.

B. ADVANTAGES AND DISADVANTAGES (Cont'd)

C. Contract Time

"As Proposed": One contract for nine months with no intermediate completion dates.

Advantages

- Only one contractor to deal with.

Disadvantages

- High probability of not finishing on time.
- No intermediate incentives.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: Split the project into two separate contracts of nine months each and intermediate completion dates.

Advantages

- Each contractor has the same amount of time to finish half the work.
- Better possibility of finishing the entire project in nine months.

Disadvantages

- Have two contractors rather than one.

Conclusion

Carry forward for further evaluation.

D. Constructability of the Travel Lanes & Shoulders

"As Proposed": Impervious material outside graded aggregate base with under-drain in the low areas of project.

Advantages

- Less excavation required.
- Less graded aggregate base material required.

Disadvantages

- May trap water under pavement.
- Requires under-drain in low areas of project.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative--Option 1: Daylight the sub-grade from front slope to front slope and construct the graded aggregate base from front slope to front slope for the entire project.

Value Engineering Alternative--Option 2: For low areas only.

Advantages

- Removes water under pavement.
- No underdrain required.
- Less future maintenance.
- Longer service life for pavement.

Disadvantages

- May be higher construction cost.

Conclusion

Carry forward for further evaluation.

E. Constructability of the Median

"As Proposed": Remove the existing base and pavement in the median and replace with 22.5" of Graded Aggregate Base, 330 lb/sy of 19 mm Superpave and 165 lb/sy of 12.5 mm Superpave.

Advantages

- All new median.
- Longer service life.

Disadvantages

- Higher construction cost.
- Does not use existing median.
- May be over designed for turn lane.
- Complicates construction staging.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: Mill and resurface the existing asphalt median pavement.

Advantages

- Less excavation required.
- Utilizes existing median.
- Lower construction cost.
- Less complicated staging.
- Less construction time.
- No drop off in median during construction.

Disadvantages

- Less service life.

Conclusion

Carry forward for further evaluation.

B. ADVANTAGES AND DISADVANTAGES (Cont'd)

F. Staging

"As Proposed": Three stages, Stage 1- Construct two 12-foot lanes, a 6½-foot shoulder and excavate part of the median, Stage 2- Construct two 12-foot lanes, a 6½-foot shoulder and excavate the remainder of the median, Stage 3- complete the construction of the median.

Advantages

- None apparent.

Disadvantages

- Median has to be constructed in three stages.
- More disruption to traffic.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: Change the staging to two stages, Stage one-Construct two 12-foot lanes and a 10-foot shoulder and Stage two- Construct the median, two 12-foot lanes and a 6½-foot shoulder.

Advantages

- Less disruption to traffic.
- Less construction time.
- Base would be in place for future widening on one side.

Disadvantages

- Higher construction cost.

Conclusion

Carry forward for further evaluation.

VII. DEVELOPMENT PHASE

A. TRAFFIC CONTROL/MAINTENANCE OF TRAFFIC

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE—OPTION 1 & 2

B. MATERIALS

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

C. CONTRACT TIME

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

D. CONSTRUCTABILITY OF TRAVEL LANES & SHOULDERS

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE—OPTION 1 & 2

E CONSTRUCTABILITY OF MEDIAN

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

F. STAGING

(1) AS PROPOSED

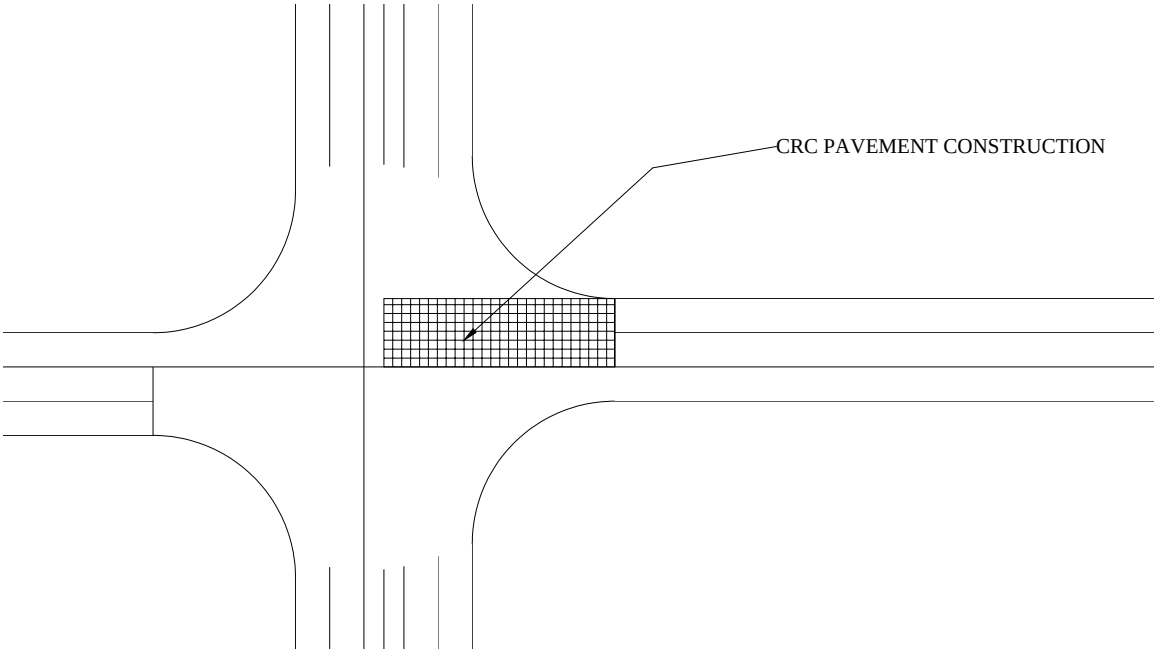
(2) VALUE ENGINEERING ALTERNATIVE

VII. DEVELOPMENT PHASE

A. TRAFFIC CONTROL/MAINTENANCE OF TRAFFIC

1. AS PROPOSED

The VE Team expects the construction of the new CRC pavement in the intersections will be difficult, disruptive to the traffic, and time consuming. The standard practice is to chop up the intersection into sections that will be excavated and construct the pavement. Several stages will be required with each stage taking approximately a week.



AS PROPOSED TRAFFIC CONTROL

The size and shape of the CRC Pavement will vary for each Traffic Control Stage and will depend on the ability of the contractor to keep traffic moving through the work zone. The VE Team estimates this will consume 30% of the Traffic Control Budget.

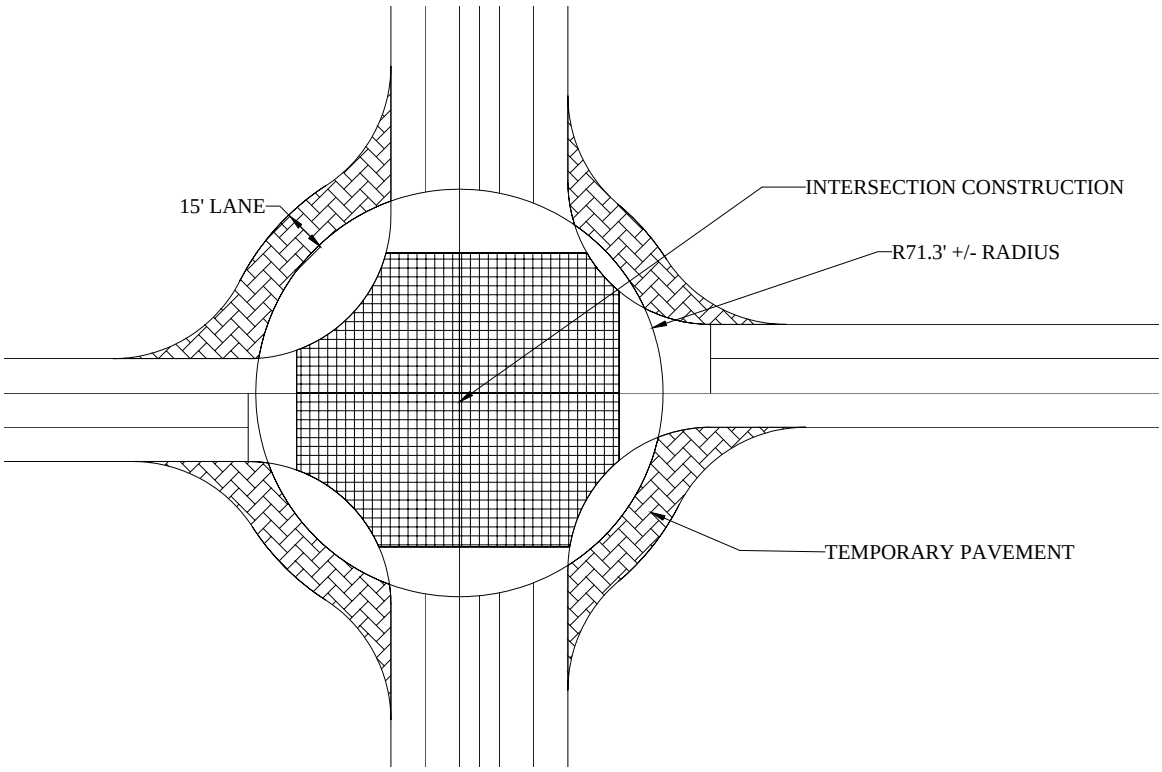
A. *TRAFFIC CONTROL/MAINTENANCE OF TRAFFIC (cont'd)*

2. VALUE ENGINEERING ALTERNATIVE—OPTION NO. 1

The VE Team recommends constructing a temporary single lane Round About at the 6 intersections:

1. Center Street
2. Humphries Hill Road SW
3. West Side Road SW
4. Oglesby Road SW
5. Brownsville Road SW
6. Hill Road SW

This alternative will eliminate the need to shift traffic through the intersection as each of the "As Proposed" Construction Stages is executed. After completion of the concrete pavement construction, the approach pavement can be tied in.



TRAFFIC CONTROL/MAINTENANCE OF TRAFFIC
VALUE ENGINEERING ALTERNATIVE--OPTION NO. 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
ROUND ABOUT TEMP GAB @ 6 INTERSECTIONS	TN	$14.19	0	$0	825	$11,707
ROUND ABOUT TEMP 19MM SUPERPAVE @ 6 INTERSECTIONS	TN	$40.26	0	$0	825	$33,215
TRAFFIC CONTOL	LS	$1,500,000.00	30%	$450,000	0%	$0
SUBTOTAL				**$450,000**		**$44,921**
GRAND TOTAL				**$450,000**		**$44,921**

POSSIBLE SAVINGS: $405,079

VII. DEVELOPMENT PHASE

A. TRAFFIC CONTROL/MAINTENANCE OF TRAFFIC (cont'd)

2. VALUE ENGINEERING ALTERNATIVE—OPTION NO. 2

The VE Team recommends detouring the local traffic around the 6 intersections:

1. Center Street
2. Humphries Hill Road SW
3. West Side Road SW
4. Oglesby Road SW
5. Brownsville Road SW
6. Hill Road SW

This alternative will allow the contractor to construct half of the CRC pavement without providing access to side streets (with the exception of Center Street to the west of SR 6). During the construction of the northbound lanes, traffic on SR 6 will not be allowed to make turns to the east and during the southbound lane construction, traffic will not be allowed to make turns to the west. This will make these motorists use circuitous routes to reach their destinations.

This will allow the contractor to construct larger portions of the intersection pavement, reducing construction time.

DETOUR TRAFFIC CONTROL
VALUE ENGINEERING ALTERNATIVE--OPTION NO. 2
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
TRAFFIC CONSTROL (30% OF TOTAL	LS	$1,500,000.00	30%	$450,000	0%	$0
TEMP PAVEMENT FOR CENTER STREET WEST (500' x 12')	TN	$54.45	0	$0	300	$16,335
SUBTOTAL				**$450,000**		**$16,335**
CONSTRUCTION ENGINEERING				$0	10.0%	$1,634
GRAND TOTAL				**$450,000**		**$17,969**

POSSIBLE SAVINGS: $432,032

VII. DEVELOPMENT PHASE

B. MATERIALS

1. AS PROPOSED

The proposed project is the reconstruction of 5.94 miles of US 278 / SR 6 in Cobb and Douglas Counties. The existing roadway consists of two 12-foot travel lanes in each direction and a 14-foot median. The travel lanes were originally constructed of 6” graded aggregate base and 8” of PCC while the median is asphaltic concrete. No information was provided to the study team regarding the depth of the base and paving for the median or shoulders.

The subject project proposes to remove all the existing base and paving and replace it with all new materials. The contractor will be responsible to find a waste disposal area for the some 85,000 cy of material that will be generated by the construction.

B. MATERIALS

2. VALUE ENGINEERING ALTERNATIVE

The reconstruction of US 278 / SR 6 will remove approximately 36,000 CY of graded aggregate base. It will be the contractor's responsibility to dispose of this material. In *Section 104.06* of the Georgia Department of Transportation's *Standard Specifications*, the contractor is allowed to reuse existing crushed stone base at the contract price minus the equivalent cost of new materials. The contractor should be encouraged to make use of this available material.

It is the recommendation of the Value Engineering Team that consideration should be given to the use of the existing concrete pavement that is to be removed also. This material could be crushed and used as part of the graded aggregate base course. Or another option could be that this removed material could be used in the new continuously reinforced concrete pavement.

Attached to this study is a report from FHWA dated September 2004 regarding "Transportation Applications Of Recycled Concrete Aggregate". The following quote is taken from the recommendations of that study:

> "The use of RCA (recycled concrete aggregate) as an aggregate base for commercial projects is widespread throughout the United States. However, about one fourth of the States still do not use this material. The engineering, economic and environmental benefits of using this material make this an item to be seriously considered."

The study continues to say in the conclusions:

> "This material is becoming the aggregate base of choice in States such as Minnesota and California. This may be due to the high strengths provided by RCA base material …"

And further in the conclusions:

> "Texas is a leader in the use of recycled concrete aggregate (RCA) as an aggregate in the concrete pavement."

The value engineering team recommends that through the use of incentives that the use of recycled concrete aggregate be made a part of this project and part of that use could be in the new CRC as well as the base. With the phasing of this project as discussed elsewhere in this report, there could be study locations identified to create test areas to evaluate the effectiveness of this concept.

The cost estimate for grading complete would appear to be well below the actual cost. For instance, the cost for the removal and disposal of the concrete slabs alone may be close to $7 million. With the use of recycle concrete aggregates there could be an estimated savings of $5.9 million.

MATERIALS
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
GRADED AGGREGATE BASE	TN	$14.19	308,800.0	$4,381,872	234,080.0	$3,321,595
RECYCLED CONCRETE AGGREGATE (CRUSH PCC)	TN	$3.00	0.0	$0	74,720.0	$224,160
DEMOLISH & HAUL PCC TO CRUSHER (15 MILES)	CY	$15.00	0.0	$0	37,360.0	$560,400
HAUL RCA TO JOB SITE	TN	$2.50	0.0	$0	74,720.0	$186,800
REMOVAL OF PCC SLABS	SY	$35.00	167,270.0	$5,854,450	0.0	$0
GRAND TOTAL				**$10,236,322**		**$4,292,955**

POSSIBLE SAVINGS: $5,943,367

VII. DEVELOPMENT PHASE

C. CONTRACT TIME

1. AS PROPOSED

The subject project is the reconstruction of US 278 / SR 6 from the CSX Railroad bridge in Cobb County to near US 78 in Douglas County and is 5.94 miles in length. The existing roadway is Portland concrete cement and was constructed some 20 years ago. There are two 12-foot travel lanes in both directions and 14-foot center two-way left turn lane. The estimated cost is approximately $27.5 million.

The project is necessary because of the poor condition of the concrete pavement. Rather than the typical resurfacing project, the plans are to replace the existing pavement to a new depth of base and paving. The original 8 inches of graded aggregate base and 8 inches of Portland concrete pavement are to be completely removed. An additional 11 inches will be undercut to allow the retention of the existing profile grade line and to also remove any unsuitable material. The reason given for the failure of the existing roadway is due to subsurface drainage problems and this total removal is anticipated to address this situation.

The as proposed project will place 12 inches of graded aggregate base, 3 inches of 19 mm Superpave and 12 inches of continuously reinforced concrete. All traffic is proposed to be shifted to one side of the roadway to provide one 12-foot travel lane in each direction. The existing traffic approaches 30,000 vehicles per day. With only one lane of traffic in both directions, the impact of this project will be great. It is the Georgia Department of Transportation's intention to keep this impact to the shortest time possible. Because of this, the contract time for this project is only 9 months.

C. CONTRACT TIME

2. VALUE ENGINEERING ALTERNATIVE (cont'd)

The reconstruction of US 278 / SR 6 is an above average project in concept and in its cost. The most significant thing about this project is the extremely tight time allotment of 9 months to complete the construction.

A more detailed analysis should be made to determine if the contract time can be met. If the project is broken into 4.5 months to complete all removal and 4.5 months to complete all the new base and paving, a more realistic conclusion can be made about the possibility of one contractor completing the project on schedule. For the 5.94-mile project there are primarily three items which have to be removed: the Portland concrete pavement, the graded aggregate base and the additional 11 inches of roadway excavation required. The quantities for these three items are estimated as follows:

ITEM	QUANTITY
PORTLAND CONCRETE PAVEMENT	48,250 CY
GRADED AGGREGATE BASE	36,000 CY
ROADWAY EXCAVATION	66,260 CY
TOTAL REMOVAL	**150,510 CY**

In the 4.5 months being used for this analysis, there would be 135 days. This means in order to remove the 150,510 CY of material described above from the roadway, 1,115 cubic yards of material would have to be removed each and every day, including weekends, holidays and inclement weather days.

In continuing with this analysis, there would also be 4.5 months with 135 days to place all the new base and pavement. The following table lists the primary roadway items to be constructed:

ITEM	QUANTITY
GRADED AGGREGATE BASE	310,000 TN
19 MM SUPERPAVE	33,100 TN
25 MM SUPERPAVE	8,400 TN
CRC PAVEMENT	171,500 SY
RCC SHOULDERS	7,900 SY

In the construction industry, placing about 2,000 tons per day is an above average accomplishment. When reviewing the first three items in the above table, a total of 177 days would be required. Similarly, the placement of concrete can be analyzed by assuming the placement of 2,000 linear feet, 12 foot wide as being a productive workday. Therefore, it would require approximately 63 days to complete the CRC and approximately 16 days to complete the RCC. In summary, there would be 256 days required to place the new base and paving. And again, this is workdays, not counting weekends, holidays and inclement weather days.

C. CONTRACT TIME (cont'd)

2. VALUE ENGINEERING ALTERNATIVE

In conclusion, there appears to be far more work required than can be accomplished in the 9 months that are proposed for this project. The analysis above also did not allow any construction days for the other contract items such as guardrail, erosion control, signing and pavement marking.

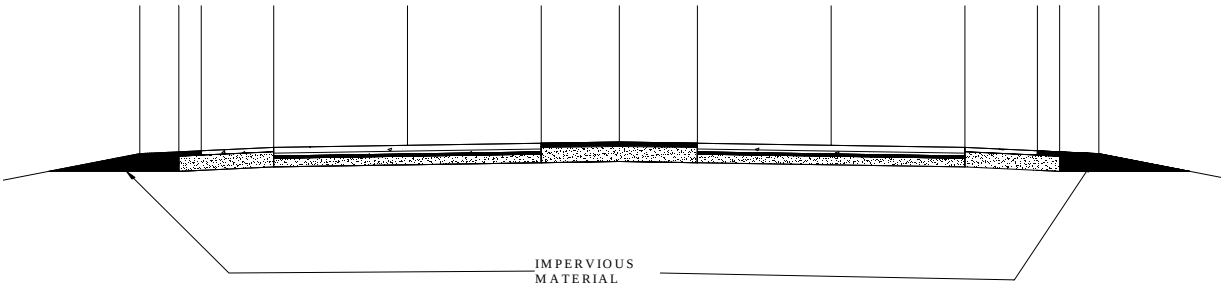
With the Department's desire to have the work completed within 9 months, the contract time should be addressed in a different manner. It is the recommendation of the value engineering team that rather than one project with this time constraint that the Georgia Department of Transportation let two contracts with the 9 month time constraint. It follows that in consideration of the quantity analysis discussed above, that two contracts would mean that the quantities would be essentially halved. In the removal portion of the contract, only 600 tons would have to be excavated/milled and hauled off. In the new base and paving portion of the contract, some 128 days would be needed. It is much more realistic that these quantities can be accomplished in 9 months.

Also, the Value Engineering Team recommends that contained within the two contracts that certain milestone dates should be incorporated to keep the work on track. An acceptable mid-point or critical location can be identified in each contract and an intermediate completion date established requiring all work be completed for that portion of the project by the desired date. Attractive incentives for early completion should also be included along with liquidated damages assessed for not completing the work in the allotted time.

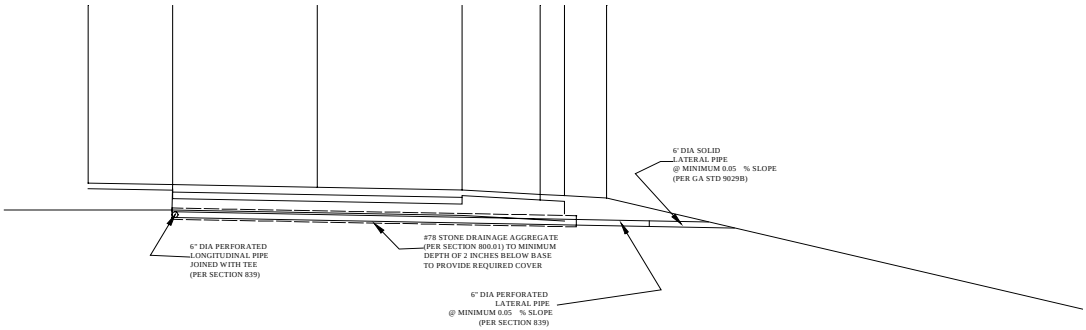
D. CONSTRUCTABILITY OF TRAVEL LANES & SHOULDERS

1. AS PROPOSED

The project concept recommends that a new top of sub-grade line be established for the entire roadway except for the last 3.6 feet on each side. This typical section was used due to the subsurface drainage problem that has been evident since the original construction of US 278 / SR 6 in this area. The typical section still has the existing impervious material outside the paving structure as shown in the typical section below.



The proposed typical section will still retain subsurface drainage. To address this, longitudinal and lateral drainage is included near the low points of the project. There are five identified low points on the project. Longitudinal pipe and trench are to extend to 500 feet on either side of the low points. Lateral drain pipe are to be connected at 100 foot intervals to this longitudinal pipe and extend to the ditch line or fill slope. The as proposed typical section shown below addresses subsurface drainage.



D. CONSTRUCTABILITY OF TRAVEL LANES & SHOULDERS (cont'd)

2. VALUE ENGINEERING ALTERNATIVE

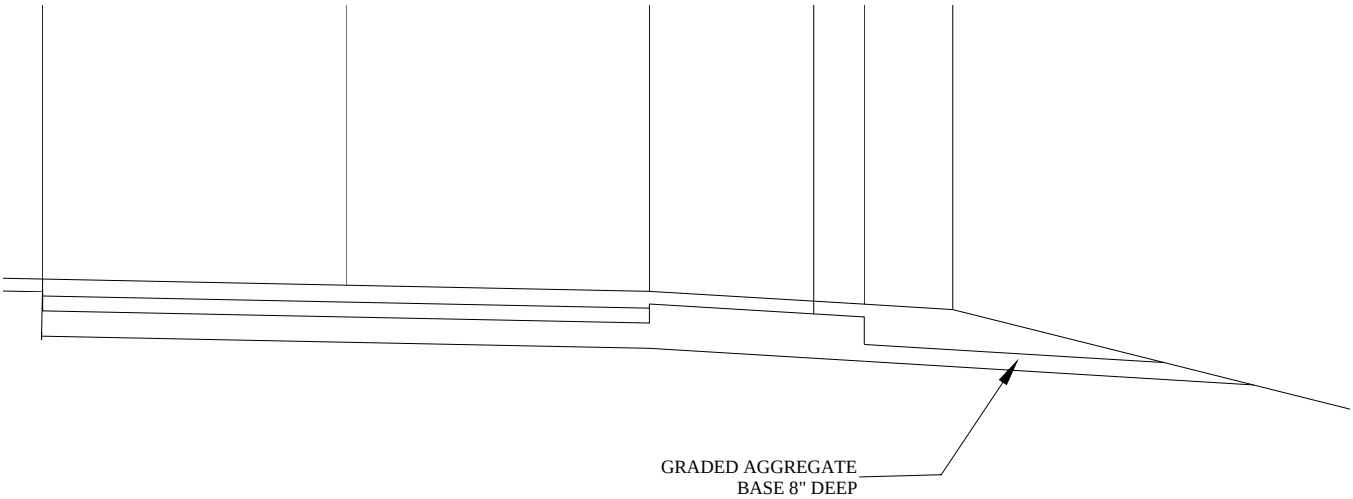
The problem of subsurface drainage is a principle factor in the failure of most roadways. The study project does attempt to address this problem by removing the drainage in five low points. The proposed typical section will still retain subsurface drainage. And, the problem affects the entire 5.94-mile project and not just the 0.95 miles included. It is therefore the recommendation of this value engineering study that one of the following options should be considered:

OPTION 1:

The first option recommended by the value engineering team is that the bottom course of the graded aggregate base be extended to "daylight" in the front slope. This will allow any subsurface water that accumulates in the base to drain to the ditch line or front slope. The estimated cost for this alternative is some $300,000 more than the project as proposed.

OPTION 2:

The second option recommended by the value engineering team is the same as above with the exception that the daylighting of the base occurs only in the low point areas identified by the project concept. This would mean that there would only be a base course extension for the 5000 feet in the low areas. The cost for using this option would result in a savings of approximately $131,000.



UNDERDRAIN **VALUE ENGINEERING ALTERNATIVE** **COST COMPARISON SHEET**						
DESCRIPTION	**UNITS**	**UNIT COST**	**PROP'D QTY.**	**PROP'D COST**	**V.E. QTY.**	**V.E. COST**
GRADED AGGREGATE BASE	TN	$14.19	308800	$4,381,872	311630	$4,422,030
UNDERDRAIN PIPE INCL DRAINAGE AGGREGATE	LF	$12.05	14240	$171,592	0.0	$0
GRAND TOTAL				**$4,553,464**		**$4,422,030**

POSSIBLE SAVINGS: $131,434

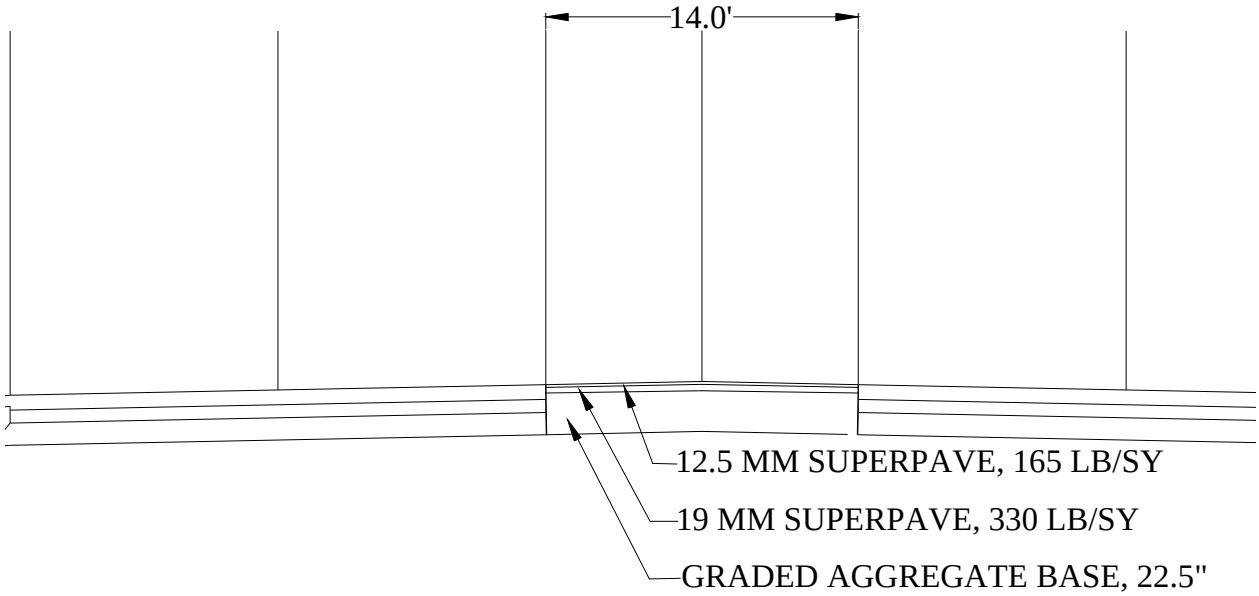
VII. DEVELOPMENT PHASE

E. CONSTRUCTABILITY OF MEDIAN

1. AS PROPOSED

The existing median of US 278 / SR 6 is a 14-foot wide two-way left turn lane. From information presented, the original median was grass but was reconstructed using about 8 inches of graded aggregate base and 4 inches of asphaltic concrete. The asphalt median provides a good contrast for the traveling public from the texture of the concrete travel lanes.

The study project proposes to remove the median to a depth of 27 inches to align with the top of the subgrade for the travel lanes and outside shoulders. The median will be reconstructed with 22.5 inches of graded aggregate base, 330 lb/sy of 19mm superpave, and 165 lb/sy of 12.5mm Superpave. The cost to construct the median as proposed is an estimated $1.4 million.

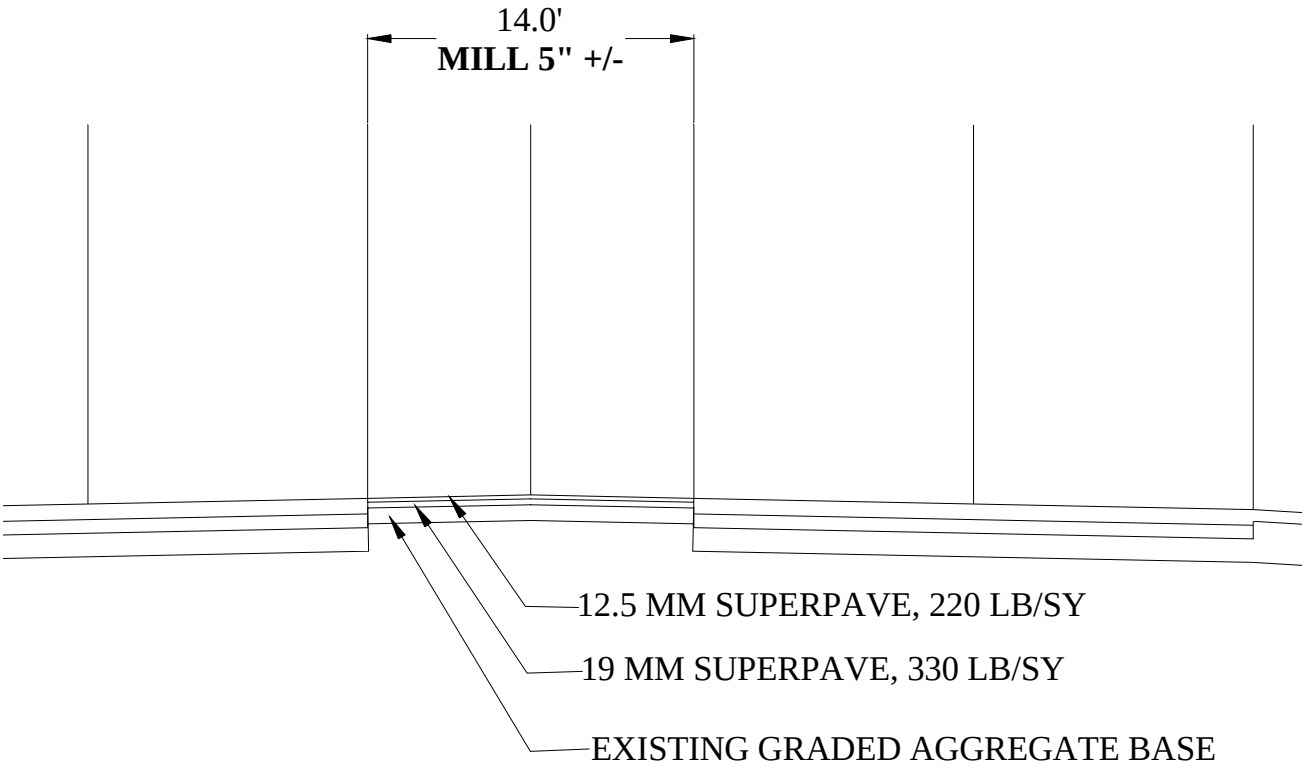


E. CONSTRUCTABILITY OF MEDIAN (cont'd)

2. VALUE ENGINEERING ALTERNATIVE

The ***Value Engineering Alternative*** for the construction of the median is to basically leave it in place. The short time function of the median will remain as being a two-way left turn lane. In long range, this roadway section is proposed to be a divided six-lane roadway with the median containing concrete median barrier.

Therefore, it is the recommendation of the value engineering study is to simply mill and inlay the median section. The proposed typical section would include milling to a depth of 5 inches and placing 330 lb/sy of 19mm superpave and 220 lb/sy of 12.5mm superpave. The value engineering recommended typical section for the median is shown below. The estimated savings for using this alternative is $903,000.



MEDIAN CONSTRUCTION
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
12.5 MM SUPERPAVE, 165 LB/SY	TN	$38.20	4201	$160,478		
19 MM SUPERPAVE 330 LB/SY	TN	$40.26	8402	$338,265	8402.0	$338,265
GRADED AGGREGATE BASE, 22.5"	TN	$14.19	62135.0	$881,696		
12.5 MM SUPERPAVE, 220 LB/SY	TN	$14.19			5370.0	$76,200
ASPHALT CONCRETE MILLING, VARIABLE DEPTH	SY	$1.29			48800.0	$62,952
GRAND TOTAL				**$1,380,438**		**$477,417**

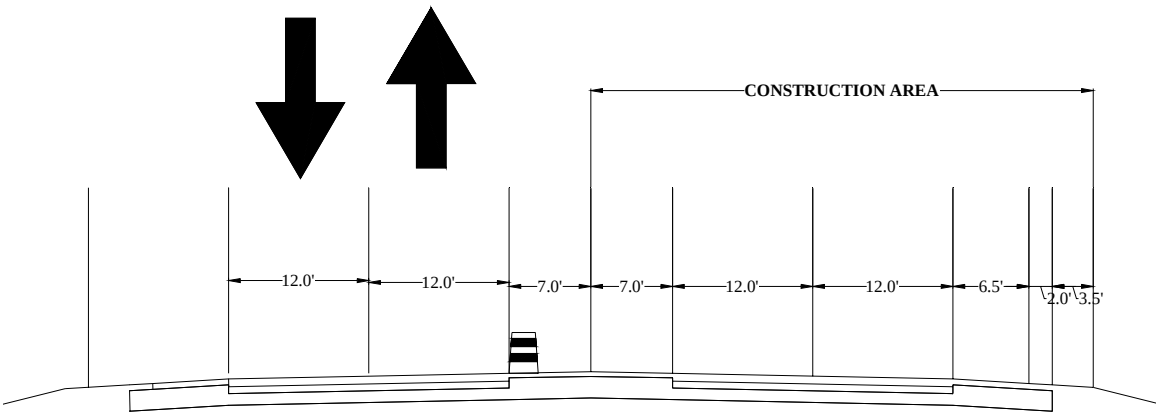
POSSIBLE SAVINGS: $903,022

VII. DEVELOPMENT PHASE

F. STAGING

1. AS PROPOSED

The proposed construction staging will be in 3 stages:

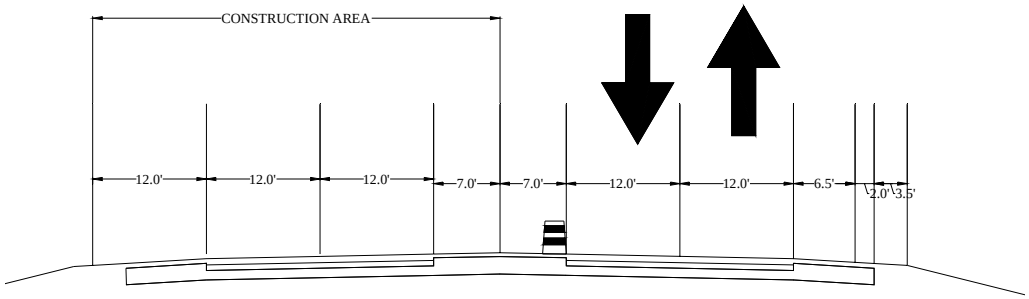


AS PROPOSED
TRAFFIC CONTROL
STAGE 1

1. Reduce traffic to one lane in each direction on the existing two southbound lanes and construct the new northbound lanes and as much of the median as possible.

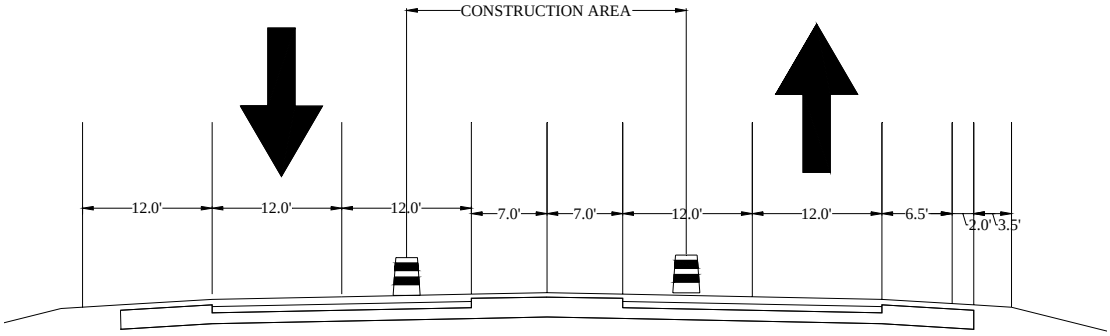
F. STAGING

1. AS PROPOSED (cont'd)



AS PROPOSED
TRAFFIC CONTROL
STAGE 2

2. Shift the traffic to the newly constructed northbound lanes and construct the new southbound lanes and as much of the median as possible.



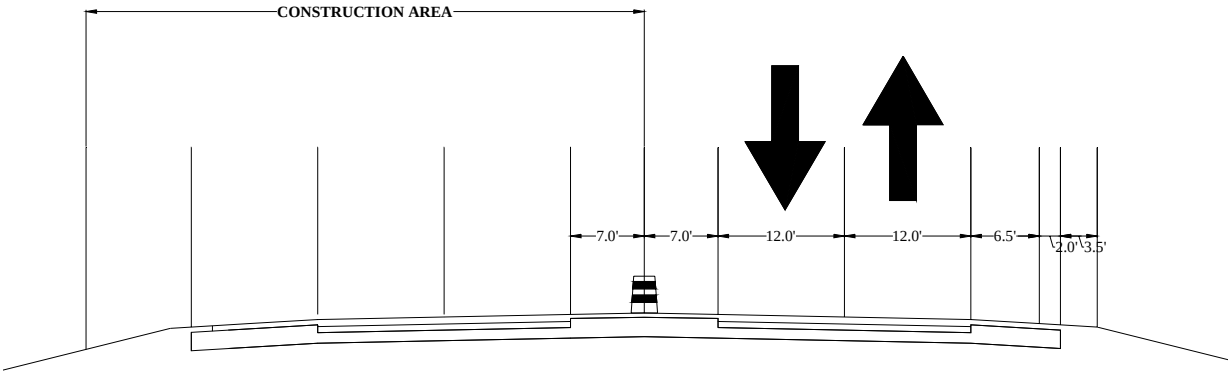
AS PROPOSED
TRAFFIC CONTROL
STAGE 3

3. Shift one lane of traffic to the completed northbound and southbound lanes and complete the median construction.

F. STAGING (cont'd)

2. VALUE ENGINEERING ALTERNATIVE

The VE Team recommends constructing the project in two traffic control stages. Constructing the project in two stages will shorten the construction time by eliminating the need to reconfigure the traffic control devices and allowing more access to the work areas. This is done by widening one of the RCC shoulders from 6.5 feet to 10.0 feet and using it as a travel lane during construction as shown below.

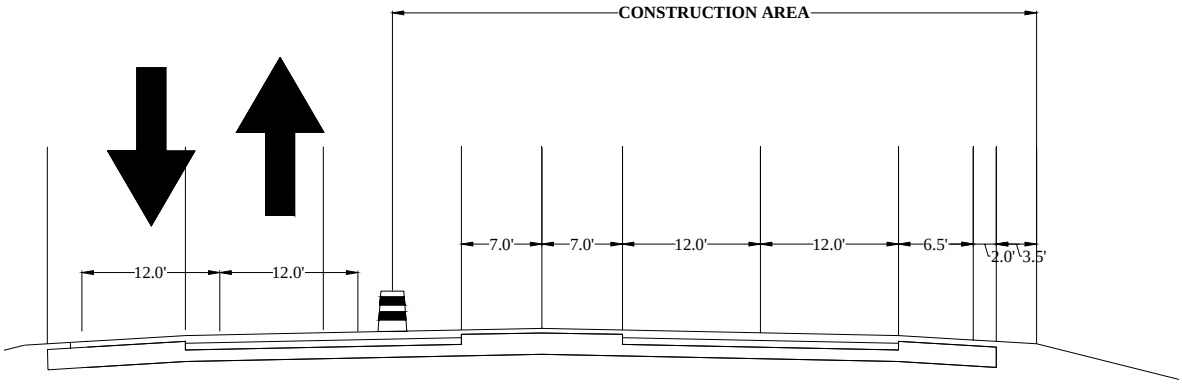


VE STAGE 1
TRAFFIC CONTROL

1. Shift one lane of traffic in each direction to the northbound lanes, construct the new southbound travel lanes and a 10-foot RCC shoulder.

F. STAGING

2. VALUE ENGINEERING ALTERNATIVE (cont'd)



VE STAGE 2
TRAFFIC CONTROL

2. Shift the traffic to the newly constructed southbound shoulder and southbound travel lane and construct the median and new northbound travel lanes and the proposed 6.5-foot RCC shoulder.

If future traffic demand require the widening of the roadway to a 6-lane highway the base material for the widened southbound lane will already be in place as well as more room for traffic control during that construction.

For the cost comparison, the Value Engineering Team assumed the reduction of one construction stage would result in a 25% cost savings for Traffic Control.

CONSTRUCTION STAGING
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
TRAFFIC CONTROL	LS	$1,500,000.00	1	$1,500,000	1	$1,050,000
RCC SHOULDER PAVEMENT	SY	$29.97	47288	$1,417,135	60019	$1,798,672
				$0	132	$0
SUBTOTAL				**$2,917,135**		**$2,848,672**
GRAND TOTAL				**$2,917,135**		**$2,848,672**

POSSIBLE SAVINGS: $68,464

VII. DEVELOPMENT PHASE

F. DESIGN COMMENTS

1. *Project Exceptions:*

The length of project table lists no project exceptions. Yet on the Roadway Log, there are four bridges that are shown as exceptions. These exceptions need to be included in the length of project table.

2. *Staging vs. Phasing:*

Item #5 of the project General Notes lists the method of prosecution for the contractor to follow in building the project. The stages listed here would be more appropriately described as phases. Also, since the third and fourth "stages" are to be constructed first, the numbering should be changed: i.e., "stage" 3 should become phase 1; "stage" 4 should become phase 2; "stage" 1 should become phase 3; and "stage" 2 should become phase 4.

3. *Intermediate Completion Dates:*

One of the most important items in this contract is to get the work completed as quickly as possible. Therefore, it is recommended that intermediate completion dates with appropriate incentives/disincentives should be included for the phasing as discussed above.

4. *Guardrail:*

There are numerous general notes that pertain to the use, application and installation of guardrail. The notes begin with Note #19 and continue through Note #30. It is recommended that the format be changed under the single heading of guardrail and then continue with a letter system to include all pertinent items. In explanation, Item #19 would be guardrail and then each item would be a separate letter item.

5. *CRC and RCC Pay Items:*

The pay items for CRC and RCC are described as being paid by the cubic yard. The Detail Estimate has the items as being paid by the square yard. The project plans need to be changed to square yards.

6. *Project Limits:*

The project phasing allows the closing of one side of the roadway and shifting all traffic to one side with one lane of traffic in each direction. It is recommended that the project limits be sufficiently lengthened to provide appropriate traffic shifts on the approaches to the project.

F. DESIGN COMMENTS (cont'd)

7. *GA STD 9029B:*

Underdrain pipe is included in the project. So also should be GA STD 9029B. This standard details the proper construction of this pay item. Often overlooked is the requirement for solid corrugated metal pipe on the outlet end, the white flexible delineator, and the animal screen.

8. *Section 150 Traffic Control:*

In the proposal presented to the value engineering team, Section 150 B. 2 included allowable times for single lane closures. As presented, traffic is to be shifted to one side of the roadway eliminating the need for this section. If the resultant two travel lanes are ever allowed to be reduced to one lane with flagger/pilot car control, the allowable times should be included.

9. *Detailed Estimate: Cost Estimate Report:*

In the section of pay item costs for median items, the quantities for 12.5mm Superpave and 19mm Superpave appear to be reversed.

VIII. SUMMARY OF RECOMMENDATIONS

It is the recommendation of the Value Engineering Team that the following Value Engineering Alternatives be carried into the Project Development process for further development.

A. Traffic Control/Maintenance of Traffic

Recommendation No. 1:

The Value Engineering Team recommends that Value Engineering Alternative, Option 2 be implemented. This alternative uses detour roads during construction of intersections.

If this recommendation can be implemented, there is a possible savings of: **$432,032.**

If this Option cannot be implemented then the Value Engineering Team recommends that Option 1 be implemented. This alternative uses a special Traffic Control/Maintenance of Traffic design for the intersections.

If this recommendation can be implemented, there is a possible savings of: **$405,079.**

B. Materials

Recommendation No. 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative develops a specification and includes it in the contract that would allow the contractor to crush the existing concrete pavement and reuse it as aggregate base.

If this recommendation can be implemented, there is a possible savings of: **$5,943,367.**

C. Contract Time

Recommendation No. 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative splits the project into two separate contracts of nine months each and includes intermediate completion dates.

D. Constructability of Travel Lanes & Shoulders

Recommendation No. 4:

The Value Engineering Team recommends that Value Engineering Alternative Option 2 be implemented. This alternative daylights the sub-grade from front slope to front slope and constructs the graded aggregate base from front slope to front slope for the low areas of the project.

If this recommendation can be implemented, there is a possible savings of: **$131,434.**

E. Constructability of Median

Recommendation No. 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative mills and resurfaces the asphalt median pavement.

If this recommendation can be implemented, there is a possible savings of: **$903,022.**

F. Staging

Recommendation No. 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative changes the staging to two stages, Stage one- Construct two 12-foot lanes and a 10-foot shoulder and Stage two- Construct the median, two 12-foot lanes and a 6½-foot shoulder.

If this recommendation can be implemented, there is a possible savings of: **$68,464.**

IX. APPENDICES

TRB RECYCLE OF CONCRETE PAVEMENT TO REUSE AS AGGREGATE BASE