VALUE ENGINEERING STUDY

OF

KY 30

ITEM NUMBERS: 11-278.24 & 11-278.27

Laurel & Jackson County, Kentucky

April 9-13, 2007

Prepared by:

VE GROUP, L.L.C.

In Association With:

KENTUCKY TRANSPORTATION CABINET

VALUE ENGINEERING STUDY
TEAM LEADER

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C.V.S. No. 20010901

DATE

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I. EXECUTIVE SUMMARY

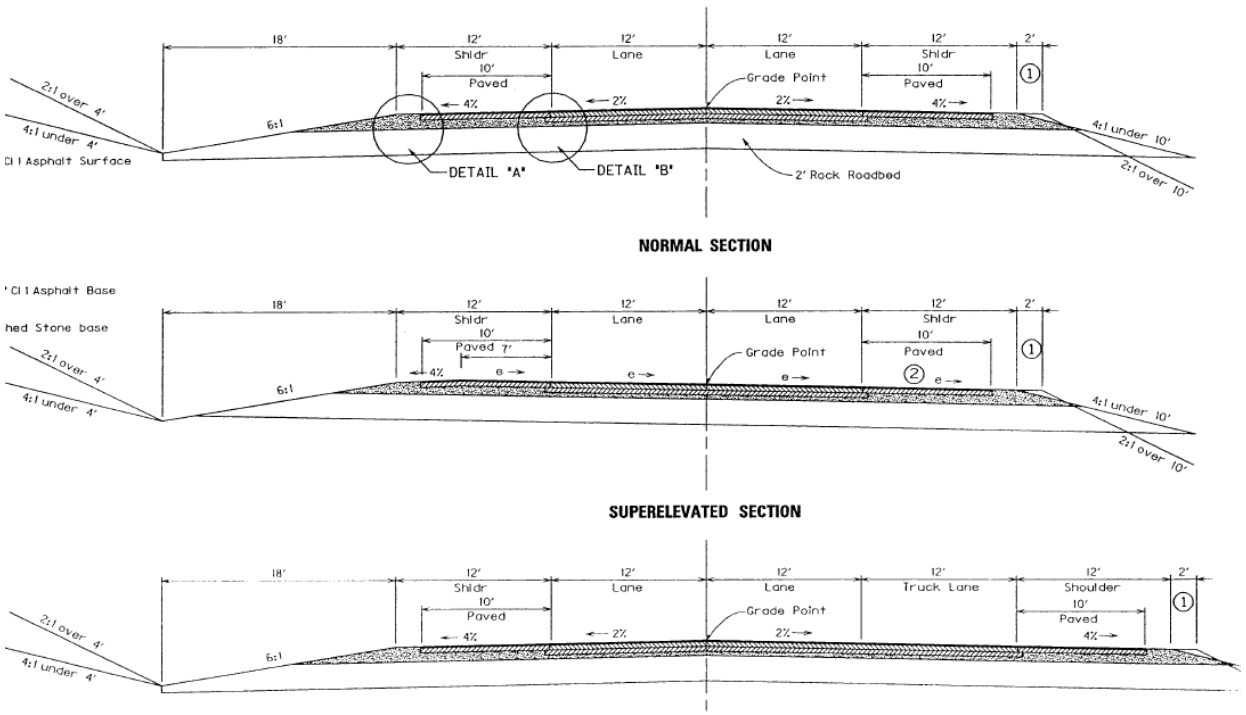
INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by VE Group for the Kentucky Transportation Cabinet. The study was performed during the week of April 9-13, 2007.

The subject of the study was realignment of SR 30 from the termination of Project Item Number 11-278.21 at Sugar Camp Road in Laurel County to US 421 in Jackson County.

PROJECT DESCRIPTION

These two projects will construct a new 9.71-mile, 2-lane roadway south of the existing alignment; bypassing Anneville, KY. The roadway will consist of 2-12' lanes, 2-12' shoulders (10' paved). The work will include a single 100' span bridge over Moores Creek. This alignment begins at elevation 1011' and proceeds east over rolling terrain reaching a maximum elevation of approximately 1285' and ends at US 421 at an elevation of 1205'. Existing ground elevations along the alignment ranges from 1011' to 1365'. Additional work includes raising and lowering intersecting roadways to match KY 30 profiles.



TYPICAL SECTION

I. EXECUTIVE SUMMARY

LOOKING EAST AT BEGIN PROJECT

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:

- Traffic Control
- Construction Time
- Service Life
- Future Maintenance Cost
- Construction Cost
- Utility Impacts

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. EARTHWORK

Recommendation Number 1:

The Value Engineering Team recommends that the Value Engineering Alternative Number 1 be implemented. This alternative raises the proposed grades.

If this recommendation can be implemented, there is a possible savings of ***$2,078,710.***

B. PAVEMENT

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative Number 1 be implemented. This alternative constructs 2-12' lanes with 13.5" crushed stone base, 6" structural asphalt, and a 1.25" asphalt surface and 2-12' shoulders with full depth crushed stone base, 4.5" of structural asphalt and 1.25" surface asphalt. (Maximum Aggregate Design)

If this recommendation can be implemented, there is a possible savings of ***$258.092.***

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative Number 2 be implemented. This alternative constructs pavement with 12' shoulders with 6' paved.

If this recommendation can be implemented, there is a possible savings of ***$149,039.***

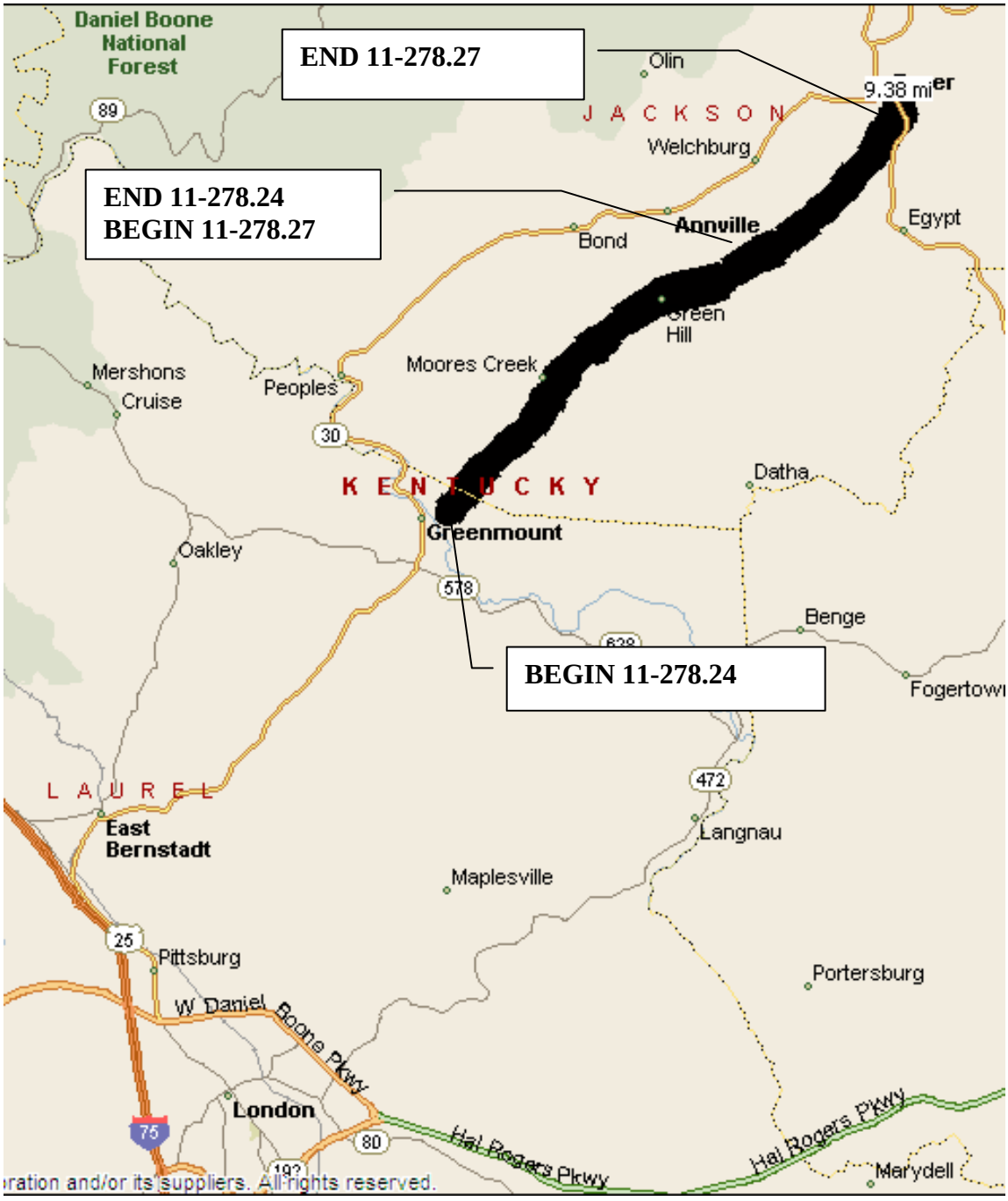
D. BOX CULVERT

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative replaces the Double 14' X 7' RCBC with a bridge.

If this recommendation can be implemented, there is a possible added cost of ***$15,716.***

II. LOCATION OF PROJECT



III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAM MEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE E-Mail
Thomas A Hartley, P.E., C.V.S.	VE Group	Team Leader	850/627-3900 thartley09@aol.com
Dickey Forrester, P.E.	VE Group	Construction	850/627-3900
Robert Semones, P.E.	KYTC Program Performance	Roadway	502/564-4555 Robert.semones@ky.gov
Quentin Smith	KYTC District II	Roadway	606/598-2195 Quentin.smith@ky.gov

PROJECT DESCRIPTION

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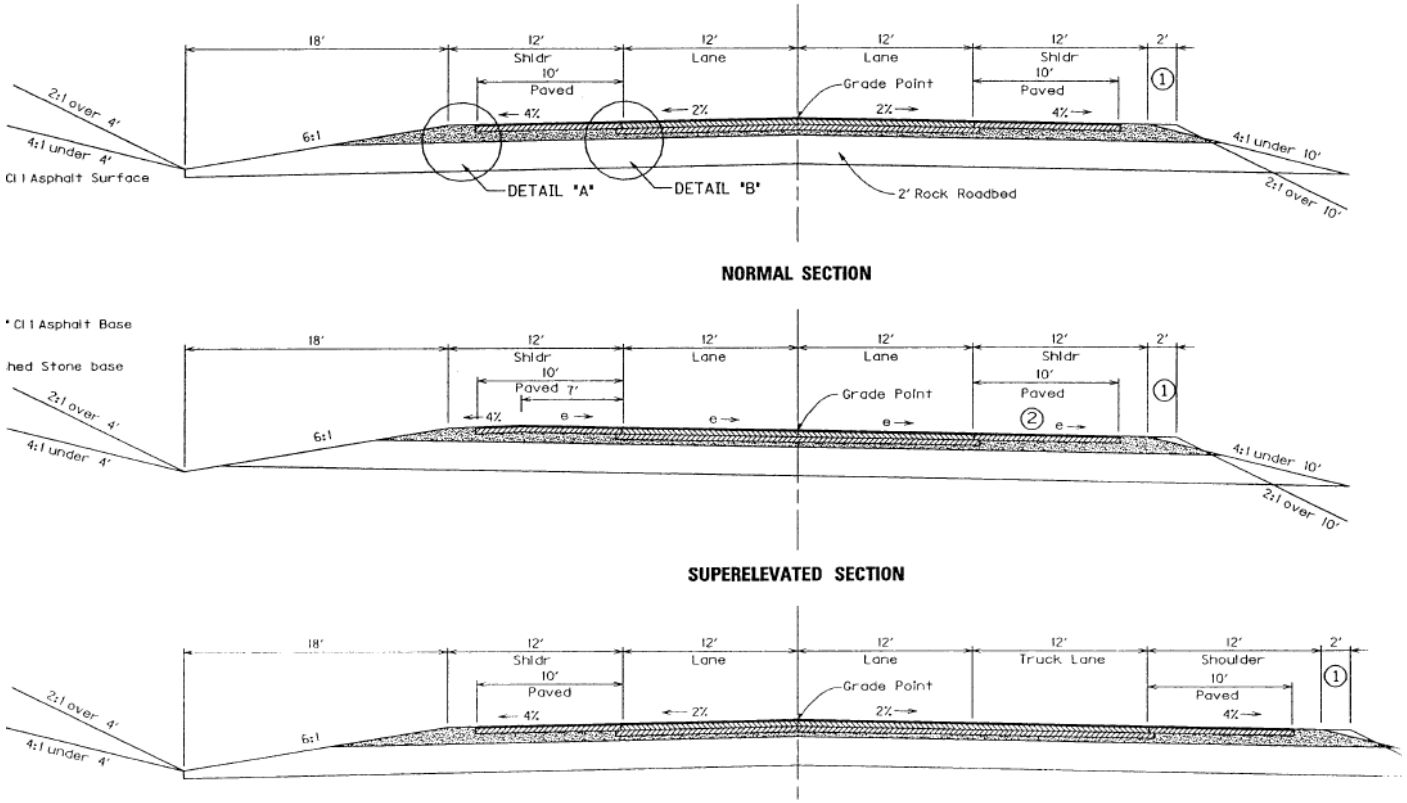
III. TEAM MEMBERS AND PROJECT DESCRIPTION

PROJECT DESCRIPTION



TYPICAL SECTION

LOOKING EAST AT BEGIN PROJECT

IV. INVESTIGATION PHASE

VALUE ENGINEERING STUDY BRIEFING

KY 30 APRIL 9, 2007		
NAME	**AFFILIATION**	**PHONE**
Thomas A Hartley, P.E., C.V.S.	VE Group	850/627-3900
Dickey Forrester, P.E.	VE Group	850/627-3900
Robert Semones, P.E.	KYTC Program Performance	502/564-4555
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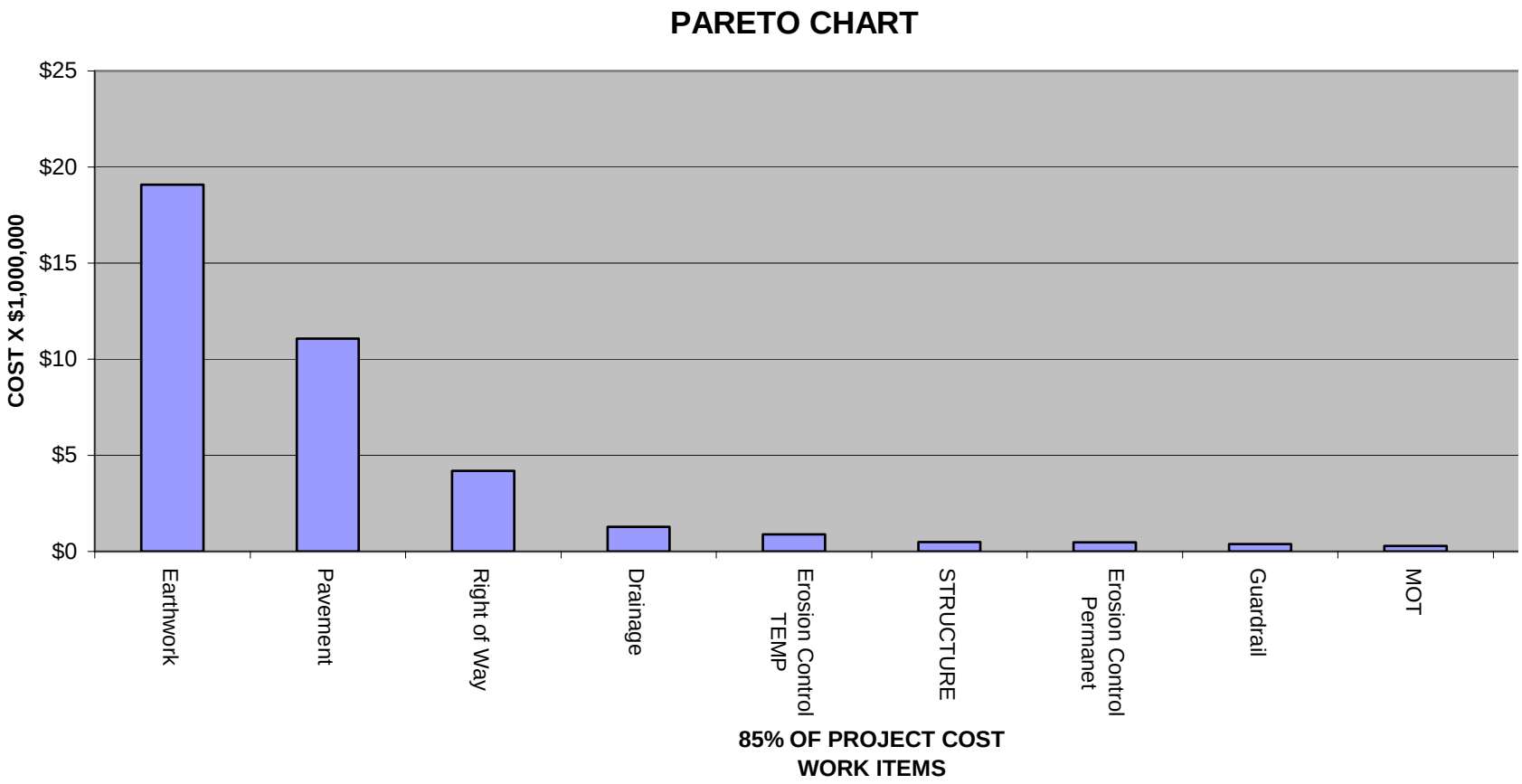
Siamak Shafghi, P.E.	KYTC Program Performance	502/564-4555
Jim Wathen, P.E.	KYTC Central Office	502/564-4555

STUDY RESOURCES

KY 30 APRIL 9-13, 2007		
NAME	**AFFILIATION**	**PHONE**
Steve Criswell, P.E.	KYTC Construction	502/564-4780 X3784
Josh Rogers, EIT	KYTC Bridge Division	502/564-4560 X3990

IV. INVESTIGATION PHASE

PARETO CHART



IV. INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET

KY 30 From Sugar Camp Road to US 421

APRIL 9-13, 2007

ITEM	FUNCT. VERB	FUNCT. NOUN	* TYPE	COST	WORTH	VALUE INDEX
Earthwork	**Establish**	**Grades**	**B**	**$19,100,000**	**$17,000,000**	**1.12**
Pavement	**Support**	**Vehicles**	**B**	**$11,100,000**	**$9,700,000**	**1.14**
Right of Way	Obtain	Rights	B	$4,200,000	$4,200,000	1.00
Drainage	**Convey**	**Water**	**S**	**$1,300,000**	**$1,150,000**	**1.13**
Temp Erosion Control	Maintain	Embankment	S	$900,000	$900,000	1.00
Bridge	Eliminate	Conflict	B	$500,000	$500,000	1.00

***B – Basic S - Secondary**

** Note: This worksheet is a tool of the Value Engineering process and is only used for determining the areas that the Value Engineering team should focus on for possible alternatives. The column for COST indicates the approximate amount of the cost as shown in the cost estimate. The column for WORTH is an estimated cost for the lowest possible alternative that would provide the FUNCTION shown. Many times the lowest cost alternatives are not considered implementable but are used only to establish a worth for a function. A value index greater than 1.00 indicates the Value Engineering team intends to focus on this area of the project.

IV. INVESTIGATION PHASE

The following areas have a value index greater than 1.00 on the proceeding Functional Analysis Worksheet and therefore have been identified by the Value Engineering Team as areas of focus and investigation for the Value Engineering process:

A. EARTHWORK

B. PAVEMENT

C. DRAINAGE

D. BOX CULVERT

V. SPECULATION PHASE

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

A. EARTHWORK

- Raise profile.
- Construct "False Cut."
- Raise profile and grade separate Boggs Road.
- Construct interchange at US 421.
- Relocate SR 578/SR 1190 Connector.

B. PAVEMENT

- Construct with Maximum Aggregate Design.
- Construct 12' shoulders with 6' paved.

C. DRAINAGE

- Size pipes according to the necessary flow.
- Replace double 14' x 7' concrete box culvert with a 30 Bridge.

D. BOX CULVERT

VI. EVALUATION PHASE

A. ALTERNATIVES

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

A. EARTHWORK

Value Engineering Alternative Number 1: ***Raise the proposed grades.***

Value Engineering Alternative Number 2: ***Construct the project with a "False Cut" in the fill section.***

Value Engineering Alternative Number 3: ***Raise the profile at Boggs Road and grade separate the two roadways.***

Value Engineering Alternative Number 4: ***Layout a "Diamond Interchange" at US 421 and only construct the eastbound SR 30 off ramp to US 421.***

Value Engineering Alternative Number 5: ***Connect SR 1190 to SR 578 north of the connection to SR 30.***

B. PAVEMENT

Value Engineering Alternative Number 1: ***Construct the Maximum Aggregate Pavement Design.***

Value Engineering Alternative Number 2: ***Construct the pavement with 12' shoulders with 6' paved.***

C. DRAINAGE

Value Engineering Alternative Number 1: ***Design and construct drainage pipes for the expected maximum flow.***

D. BOX CULVERT

Value Engineering Alternative Number 1: ***Replace the double 14' x 7' box culvert with a 30' span bridge.***

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. EARTHWORK

"As Proposed": **The proposed profile grades will generate approximately 5,769,925 CY of waste for both projects.**

Advantages

- No re-design required.
- No adjustment of right-of-way requirements.

Disadvantages

- Disposal of excess material.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: Raise the proposed grades.

Advantages

- Reduces cuts.
- Increases fill.
- Approaches balance earthwork.

Disadvantages

- Increased drainage structure lengths.
- May require more right-of-way.
- Possibly require more guardrail.
- Possibly not enough suitable material.

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

A. EARTHWORK *(continued)*

Value Engineering Alternative Number 2: ***Construct the project with a "False Cut" in the fill section.***

Advantages

- Increases fill.
- May reduce guardrail.
- Approaches balance earthwork.

Disadvantages

- Increased drainage structure lengths.
- May require more right-of-way.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 3: ***Raise the profile at Boggs Road and grade separate the two roadways.***

Advantages

- Reduces cut.
- Increases fill.
- Approaches balance earthwork.

Disadvantages

- Increased drainage structure lengths.
- Loss of access from/to Boggs Road.
- Adds a grade separation bridge to project.
- May require more right-of-way.
- Possibly require more guardrail.

Conclusion

DROPPED FROM FURTHER CONSIDERATION.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES *(continued)*

A. EARTHWORK *(continued)*

Value Engineering Alternative Number 4: ***Layout a "Diamond Interchange" at US 421 and only construct the eastbound SR 30 off ramp to US 421.***

Advantages

- Reduces cut.
- Approaches balance earthwork.

Disadvantages

- Require more right-of-way.
- Traffic does not warrant interchange.
- Increased future construction costs.

Conclusion

DROPPED FROM FURTHER CONSIDERATION.

Value Engineering Alternative Number 5: ***Connect SR 1190 to SR 578 north of the connection to SR 30.***

Advantages

- Reduces conflict points.
- Increases fill.
- Approaches balance earthwork.

Disadvantages

- Require more right-of-way.
- Steep grades.
- Increases drainage costs.

Conclusion

DROPPED FROM FURTHER CONSIDERATION.

B. PAVEMENT

"As Proposed": **Construct 2-12' lanes with 4" crushed stone base, 9" structural asphalt, and a 1.25" asphalt surface and 2-12' shoulders with full depth crushed stone base, 4.5" of structural asphalt and 1.25" surface asphalt. (Maximum Asphalt Design)**

Advantages

- Future MOT.

Disadvantages

- May be higher construction cost.
- Loss of shoulder service life if turn lanes added.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 1: ***Construct 2-12' lanes with 13.5" crushed stone base, 6" structural asphalt, and a 1.25" asphalt surface and 2-12' shoulders with full depth crushed stone base, 4.5" of structural asphalt and 1.25" surface asphalt. (Maximum Aggregate Design)***

Advantages

- Possibly less cost.
- Reduced loss of service life for turn lanes.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative Number 2: ***Construct pavement with 12' shoulders with 6' paved.***

Advantages

- Less cost.

Disadvantages

- Not consistent with rest of corridor.

Conclusion

Carry forward for further evaluation.

C. DRAINAGE

"As Proposed": **24" diameter pipe is minimum size for cover heights from 30' to 65' and 54" diameter pipe for cover heights over 65'.**

Advantages

- Repair access.

Disadvantages

- Higher construction cost.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: ***Design and construct drainage pipes for the expected maximum flow.***

Advantages

- Lower construction cost.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

D. BOX CULVERT

As Proposed": **Construct a double 14' x 7' Box Culvert at Pond Creek and the approach road from SR 30.**

Advantages

- Less maintenance.

Disadvantages

- Disturbs stream bed.
- Center wall may collect debris.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: ***Construct 30'over Pond Creek.***

Advantages

- Possibly less construction cost.
- Better wildlife access.
- Minimizes impact to stream.
- Wider unobstructed opening.

Disadvantages

- None apparent.

Conclusion

Carry forward for further evaluation.

VII. DEVELOPMENT PHASE

A. EARTHWORK

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE NUMBER 1
(3) VALUE ENGINEERING ALTERNATIVE NUMBER 2

B. PAVEMENT

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE NUMBER 1
(3) VALUE ENGINEERING ALTERNATIVE NUMBER 2

C. DRAINAGE

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

D. BOX CULVERT

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

VII. DEVELOPMENT PHASE

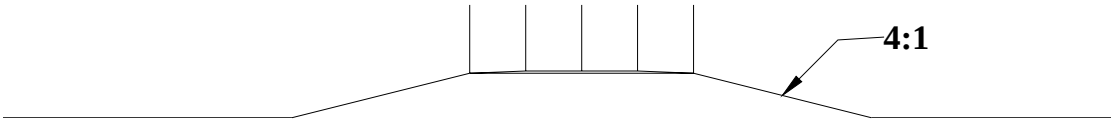
A. EARTHWORK

"As Proposed"

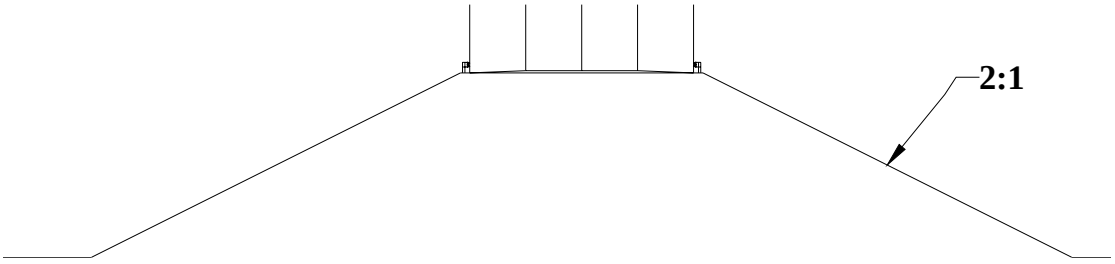
The proposed profile grades for both projects will require moving approximately 5,769,925 CY earth and rock; of which approximately 1,819,445 CY will be waste (accurate volumes for the 11-278.24 project were available and were estimated for the 11-278.27 project based on a similar ratio).

Fill heights less than 10' high will use a 4:1 fill slope and is increased to a 2:1 with fill heights above 10'. There are areas were the 4:1 has been used with fill heights above 10'.

AS PROPOSED < 10'



AS PROPOSED >10'



AS PROPOSED CROSS SECTION

Section #3 (11-278.24) is 6.78 miles in length and Section #4 (11-278.27) is 2.98 miles in length for a total of 9.76 miles of roadway. The typical lane widths and shoulder widths are the same on each project. Each section has the same typical sections for base and pavement.

A review of the earthwork quantities indicates large waste volumes on both sections of roadway.

VII. DEVELOPMENT PHASE

A. EARTHWORK

"As Proposed" *(continued)*

The following table breaks down these quantities:

LOCATION	UNCLASSIFIED	WASTE
SECTION #3	2,792,289 C.Y.	880,500 C. Y.
SECTION #4	2,977,636 C.Y.	938,945 C. Y.
TOTALS	**5,769,925 C.Y.**	**1,819,445 C.Y.**

This indicates that 31.5 percent of the unclassified excavation will be wasted. A considerable effort will be required to locate pits to waste this material with a large portion of the material probably off the project limits.

The advantages of retaining the as-proposed profile grade are that there is no need for any type of redesign work for the plans and the right-of-way will not require any additional parcels.

The disadvantage of the as-proposed profile grade is a large volume of excess waste that must be removed from the projects. Considering that some of the haul distances to dispose of the materials may be longer then desirable, the cost of removing the waste materials from the projects may be significant.

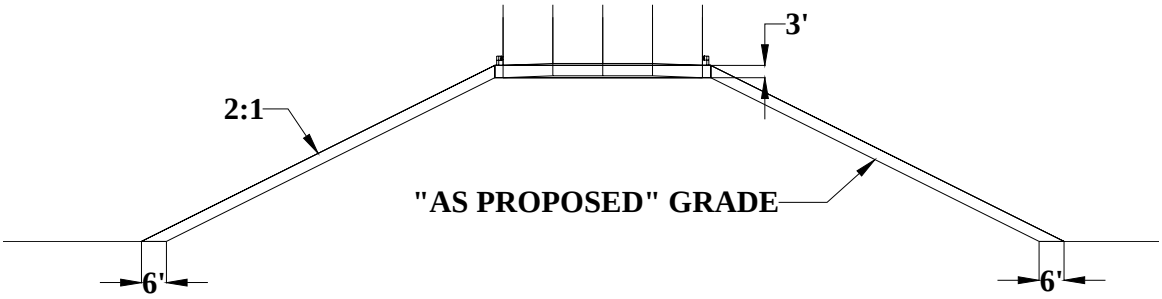
VII. DEVELOPMENT PHASE

A. EARTHWORK

Value Engineering Alternative Number 1

Raise the proposed grades. The obvious advantages of raising the profile grade would be a reduction in the unclassified excavation quantities and a decrease in the amount of waste materials. This raising of the profile grade will reduce the imbalance in the unclassified and waste quantities and would be a cost savings.

VE ALTERNATIVE
RAISE PROFILE 3'



The disadvantages of raising the profile will be a redesign of the plans, an increase in the length of drainage structures in the fill sections, such as the cross drain pipes, culverts and the bridge at Moore's Creek. Also to be considered is the possible need for additional right-of-way and the need for extra guardrail on fill sections were the additional depth of fill requires protection as the fill slopes change from a 4:1 condition to the steeper 2:1 slopes.

The following summary indicates the potential change in quantities for Section #3.

GRADE	UNCL DECREASE	EMB INCR	WASTE
PROPOSED	0	0	880,500
RAISED 1'	125,000	36,000	719,500
RAISED 2'	250,000	74,200	556,300
RAISED 3'	375,000	114,896	390,500
RAISED 4'	500,000	158,300	222,200
RAISED 5'	625,000	204,000	51,500

VII. DEVELOPMENT PHASE

A. EARTHWORK

Value Engineering Alternative Number 1 *(continued)*

The following is a summary for Section #4 quantities:

GRADE	UNCL DECREASE	EMB INCR	WASTE
PROPOSED	0	0	940,000
RAISED 1’	55,000	16,000	869,000
RAISED 2’	110,000	33,000	797,000
RAISED 3’	165,000	51,000	724,000
RAISED 4’	220,000	70,000	650,000
RAISED 5’	275,000	90,000	575,000

These earthwork quantities are based on ratios determined for Section #3. No cross-sections were available for Section #4.

It appears that due to existing right-of-way constraints it would not be possible to exceed three feet (3’) in raising the profile grade.

EARTHWORK (RAISE PROFILE 3')
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Unclassified Excavation-profile raised three feet	CY	$3.30	5,769,925.0	$19,040,753	5,229,925	$17,258,753
Adjust drainage structures	LS	$18,000	0.0	$0	1.0	$18,000
Guardrail	LF	$18.01	19,025.0	$342,640	20,927.5	$376,904
SUBTOTAL				**$19,383,393**		**$17,653,657**
MOBILIZATION			4.5%	$1,003,091	4.5%	$913,577
TRAFFIC CONTROL/MOT			0.0%	$0	0.0%	$0
CONTINGENCY			15.0%	$2,907,509	15.0%	$2,648,049
GRAND TOTAL				**$23,293,992**		**$21,215,282**

POSSIBLE SAVINGS: $2,078,710

EARTHWORK (RAISE PROFILE 2')
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Unclassified Excavation-profile raised two feet	CY	$3.30	5,769,925	$19,040,753	5,409,925	$17,852,753
Adjust drainage structures	LUMP	$12,000	0.0	$0	1.0	$12,000
Guardrail	LF	$18.01	19,025.0	$342,640	20,927.5	$376,904
SUBTOTAL				**$19,383,393**		**$18,241,657**
MOBILIZATION			4.5%	$1,003,091	4.5%	$944,006
TRAFFIC CONTROL/MOT			0.0%	$0	0.0%	$0
CONTINGENCY			15.0%	$2,907,509	15.0%	$2,736,249
GRAND TOTAL				**$23,293,992**		**$21,921,911**

POSSIBLE SAVINGS: $1,372,081

EARTHWORK (RAISE PROFILE 1')
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Unclassified Excavation-profile raised one foot	CY	$3.30	5,769,925	$19,040,753	5,589,925	$18,446,753
Adjust drainage structures	LS	$6,000.00	0.0	$0	1.0	$6,000
Guardrail	LF	$18.01	19,025	$342,640	20,927.5	$376,904
SUBTOTAL				**$19,383,393**		**$18,829,657**
MOBILIZATION			4.5%	$1,003,091	4.5%	$974,435
TRAFFIC CONTROL/MOT			0.0%	$0	0.0%	$0
CONTINGENCY			15.0%	$2,907,509	15.0%	$2,824,449
GRAND TOTAL				**$23,293,992**		**$22,628,540**

POSSIBLE SAVINGS: $665,452

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS

4-10-2007

SECTION #3

EARTHWORK (A)

VE 1 - RAISE PROFILE GRADE

18' + 12' + 12' + 12' + 12' + 18' = 84 FT

84' FROM FRONT OF DITCH TO FRONT OF EMBANKMENT

$84'_{\text{LENGTH}} \times 1'_{\text{DEPTH}} \times 1'_{\text{LINEAR FT.}} = 84^{\text{CU FT}}/_{27^{\text{CU FT}}/_{\text{CU YD}}} = 3.111 \text{ CU YDS/L.F.}$

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

4-10-2007

SECTION #3

FILL

299+00	to	304+00	500'
308+50	to	309+00	50'
312+00	to	313+00	100'
322+50	to	327+00	450'
329+50	to	336+00	650'
343+00	to	351+00	800'
363+00	to	365+00	200'
369+50	to	370+00	50'
386+50	to	432+00	4550'
440+50	to	450+00	950'
469+00	to	474+00	500'
477+00	to	488+00	1100'
503+50	to	508+50	500'
516+00	to	528+00	1200'
531+00	to	537+50	650'
540+00	to	543+00	300'
548+00	to	551+00	300'
553+00	to	556+00	300'
559+00	to	561+50	350'
567+50	to	569+50	200'
572+00	to	575+50	350'
586+50	to	590+50	400'
593+50	to	606+00	1250'
613+50	to	618+50	500'
622+00	to	624+50	250'
633+00	to	636+50	350'
			16700 LIN FT.

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

4-10-2007

SECTION #3

FILL

299+00	to	304+00	500'
308+50	to	309+00	50'
312+00	to	313+00	100'
322+50	to	327+00	450'
329+50	to	336+00	650'
343+00	to	351+00	800'
363+00	to	365+00	200'
369+50	to	370+00	50'
386+50	to	432+00	4550'
440+50	to	450+00	950'
469+00	to	474+00	500'
477+00	to	488+00	1100'
503+50	to	508+50	500'
516+00	to	528+00	1200'
531+00	to	537+50	650'
540+00	to	543+00	300'
548+00	to	551+00	300'
553+00	to	556+00	300'
558+00	to	561+50	350'
567+50	to	569+50	200'
572+00	to	575+50	350'
586+50	to	590+50	400'
593+50	to	606+00	1250'
613+50	to	618+50	500'
622+00	to	624+50	250'
633+00	to	636+50	350'
			16700 LIN FT.

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

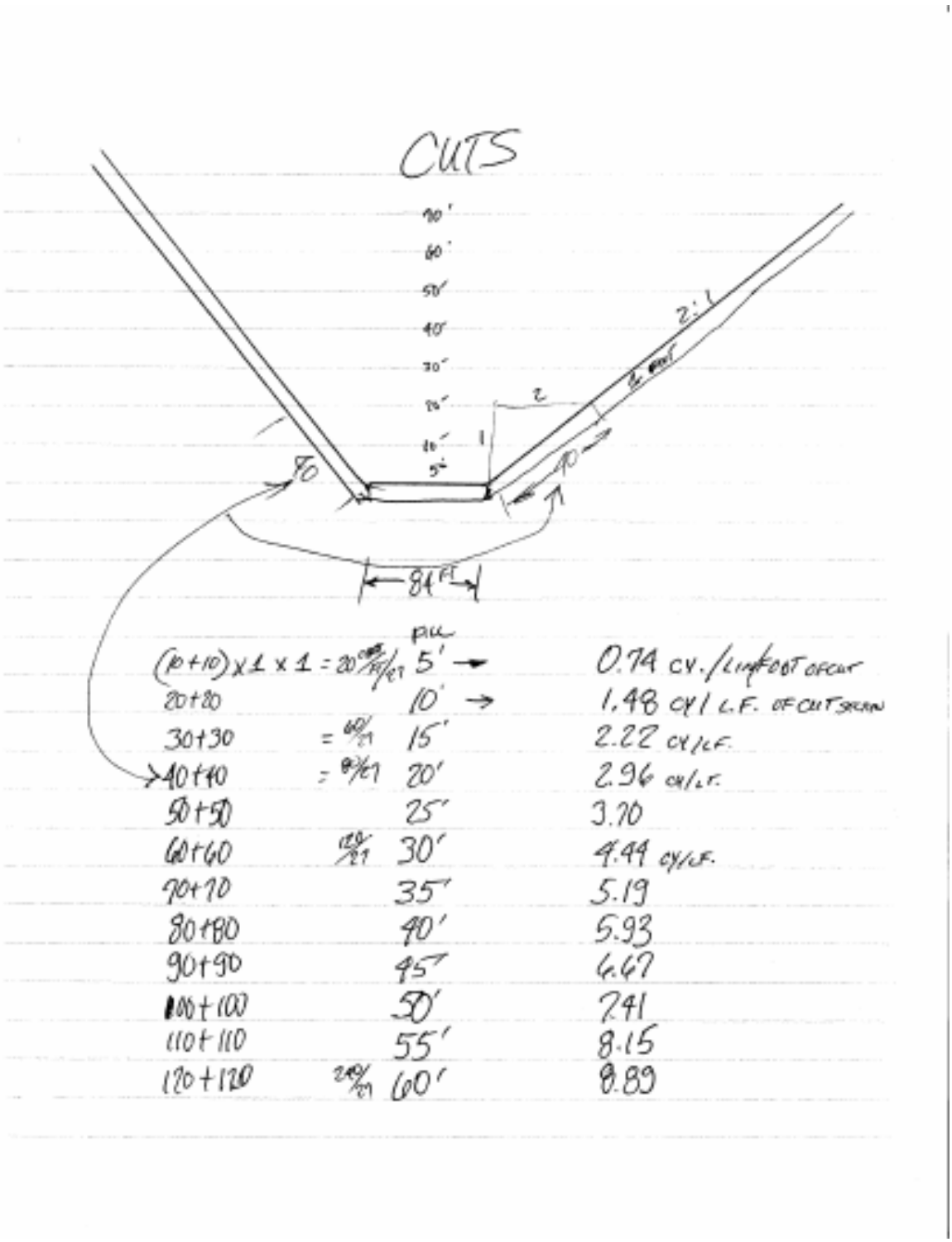
					C.Y.S.
561+50 to	567+50	600	20'	6.07	3642
569+50 to	572+00	250	5'	3.85	963
575+50 to	581+50	600	10'	4.59	2754
581+50 -	586+50	500	45'	9.78	4890
590+50 -	593+50	300	16	4.59	1377
606+00 to	613+50	750	10'	4.59	3443
618+50 to	627+00	350	25	6.81	2384
629+50 to	633+00	850	40'	9.04	7684
636+50 to	643+50	700	5'	X3.85	2695

124,630.5 cu yds
1st
OF
Our

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*



VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

CUTS

			CY/LIN FT. OF CUT	
5'	ROADWAY TEMPLATE	3.11	+ 0.74 =	3.85
10		3.11	+ 1.48 =	4.59
15		"	+ 2.22 =	5.33
20		"	2.96 =	6.07
25		"	3.70 =	6.81
30		"	4.44 =	7.55
35		"	5.19 =	8.30
40		"	5.93 =	9.09
45		"	6.67 =	9.78
50		"	7.41 =	10.52
55		"	8.15 =	11.26
60		"	8.89 =	12.00

FILLS

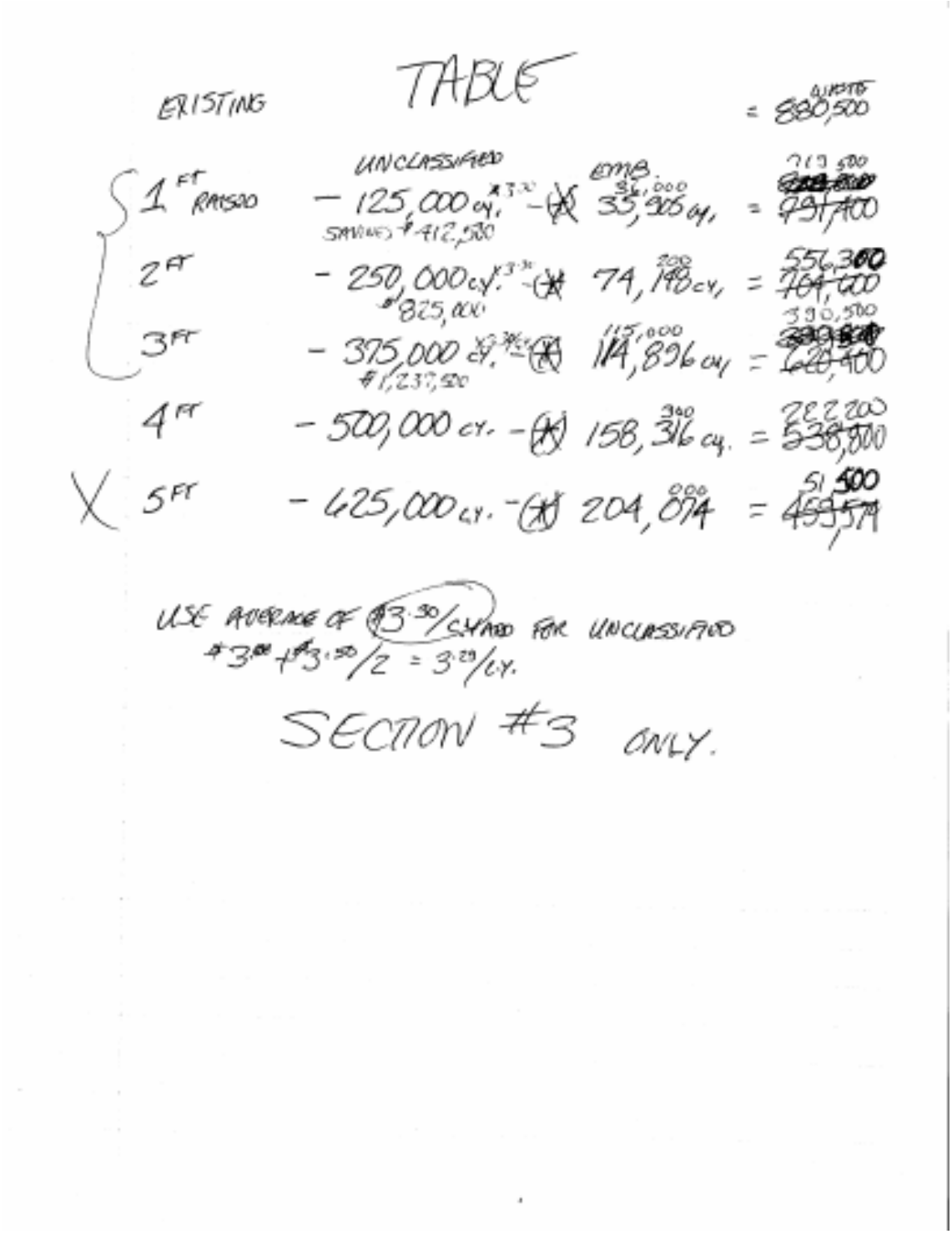
1' = 2.15 CY./LIN FEET
2' = 2.22 X 2' = 4.44
3' = 2.30 X 3' = 6.88
4' = [illegible] X 4' = 9.48
5' = 2.44 CY./LIN FEET X 5' = 12.22 CU YD/LIN FT. OF FILL

(1')	2.15 X 16,700 LINEAR	=	35,905 CU YDS	LENGTH OF ROAD
(2')	[illegible] X "	=	[illegible]74,148	
(3')	[illegible] X "	=	114,896	
(4')	9.48 X "	=	158,316	
(5')	12.22 X 16,700	=	204,074	

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*



VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

TABLE

SECTION #4

RAISING PROFILE GRADE

0	UNCLASS		EMB.	WASTE 340,000 CY.
1	-55,000 CY. ×3.30 = $181,500	—	16,000	= REDUCED TO 869,000
2	-110,000 CY. ×3.30 = $363,000	—	33,000	= 797,000
3	-165,000 CY. ×3.30 = $544,500	—	51,000	= 724,000
4	-220,000 CY. ×3.30 = $726,000	—	70,000	= 650,000
5	-275,000 CY. SAVINGS $907,500 =	—	90,000 CY.	= 575,000

THESE ARE ESTIMATED NUMBERS BASED ON SECTION #3 - NO CROSS-SECTIONS WERE FURNISHED FOR SECTION #4

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

SECTION 4

SECTION #3 = 6.78 MILES IN LENGTH — 2,792,289 C.Y.
SECTION #4 = 2.98 MILES IN LENGTH — 2,977,636 C.Y. UNCLASS
9.76 MILES TOTAL

$\frac{2.98}{6.78} = 0.4395 \Rightarrow 44\%$

UNCLASS 125,000 X 44% = 55,000 C.Y. / FT UNCLASS

PERCENTAGE ON SECTION #3 BASED ON LENGTH OF PROJECT.

EMB.		UNCLASSIFIED REMOVED
1'	16,000 C.Y. INCREASED	55,000
2'	33,000 C.Y.	110,000
3'	51,000 C.Y.	165,000
4'	70,000 C.Y.	220,000
5'	90,000 C.Y.	275,000

SECTION #3 — RATIO & PROPORTION
2,792,289 EX. UNCLASS — 880,300 CY. WASTE
SECTION #4: 2,977,636 CY UNCLASS — 938,945 CY. WASTE
TOTAL 5,769,925 — 1,819,445 CY. TOTAL WASTE

31.5% WASTE

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

COMBINE SECTION #3 + #4
EARTHWORK
PREVIOUS 5,769,925

	UNC. REDUCED	AMT $ SAVED	NEW UNC. QUANT.
1'	180,000 CY.	$594,000	5,589,925 CY.
2'	360,000	$1,188,000	5,409,925 CY.
3'	540,000	$1,782,000	5,229,925 CY.
4'	720,000	$2,376,000	5,049,925 CY.
5'	900,000	$2,970,000 SAVED	4,869,925 CY.

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

CROSS DRAIN PIPES SECTION #3

STA	PIPE SIZE	COVER FILL	LENGTH		SIDESLOPE LT	& RT	
300+36	36"	8'	107'	102 LF	4:1	4:1	
323+40	36"	16'	190'	102 LF	4:1	4:1	
331+06	42"	32'	310'	87 LF	4:1	4:1	
345+80	42"	21'	294'	87 LF	4:1	4:1	
363+50	30"	9'	116	109 LF	4:1	4:1	P.C.
369+33	24"	3'	75'	53 LF P.C.	4:1	4:1	
376+24	24"	3'	67'	53 LF	P.C. 4:1	4:1	
#413 @ 100/LF	391+57	BOX 8'x4'	11'	116'	#1,160	2:1	2:1 5000 LF
	441+00	18"	15'	136'	39 LF	P.C. 6'x3'	2:1
#332 @ 7%	443+65	8'x5' BOX	35'	286'	#2,860	2:1	12'x3' 2:1 #4000 LF
	451+00	30"	6'	97'	108 LF	12'x6' BOX	2:1
	471+40	24"	15'	237'	53 LF	4:1	4:1
	479+09	24	42'	300'	53 LF	2:1	6'x53' 2.5 to 1 300 LF

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

SECTION #3

STA.	DIA.	UNDER FILL	LENGTH	PRICE	SIDE SLOPE LF	& RT.
482+33	54"	72'	486'	28"	2:5 to 1	2:5 to 1
490+21	24"	17'	206'	53% LF.	D.C.	3:1
506+92	18"	23'	338'	39% LF.	3:1	D.C.
517+50	18"	29'	235'	39"	3:1	3:1
522+35	54"	73'	450'	28" LF.	3:1	3:1
541+50	18"	14'	213'	39% LF.	D.C.	4:1
549+40	24"	15'	188'	53"	4:1	3:1
558+95	24"	15'	343	53"	4:1	4:1
573+65	30"	22'	160'	108% LF.	4:1	4:1
587+85	30"	16'	180'	108/LF.	4:1	4:1
599+45	24"	14'	123'	53"	4:1	2:1
600+40	12"	25'	152'		2:1	2:1
616+85	36"	10'	152'	108% LF.	4:1	4:1
623+00	36"	12	148'	108" LF.	4:1	4:1

VII. DEVELOPMENT PHASE

A. EARTHWORK

COST COMPARISON SHEET BACK UP CALCULATIONS *(continued)*

SECTION #3

STA	DIA	FILL	LENGTH	SKEW	LT & RT.
634+50	24"	13'	115'	53°	4:1 D.C. 4:1 D.C.
645+50	29"	19'	178'	53°	2:1 12X53° 2:1 $648.00

(8 2:1)

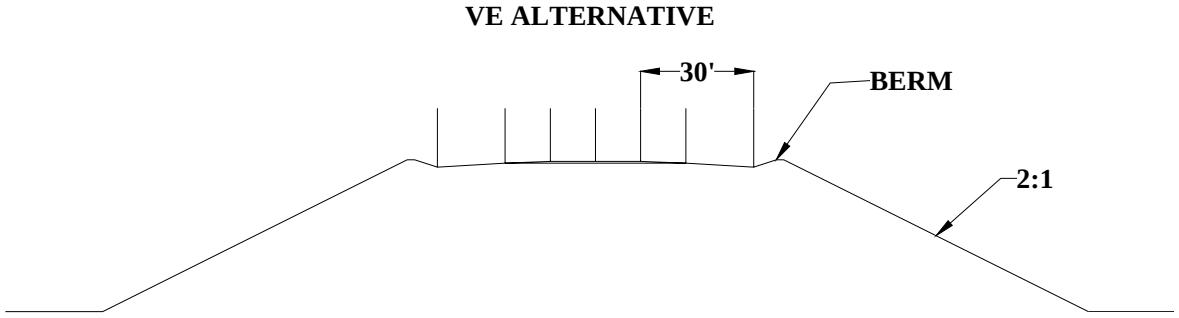
$18,080.00

VII. DEVELOPMENT PHASE

A. EARTHWORK

Value Engineering Alternative Number 2

Construct the project with a "False Cut" in the fill sections over 10'. This alternative would place excess fill outside the clear zone to create a small berm as shown in the drawing below.



FALSE CUT

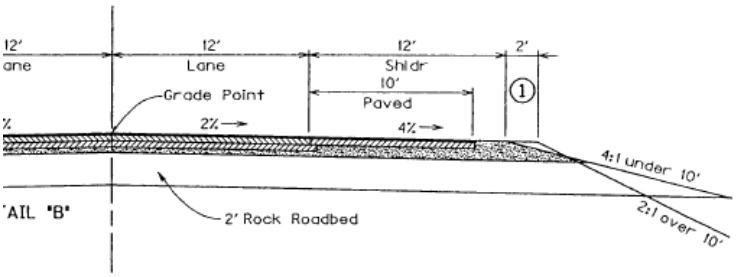
This alternative would reduce the amount of excess material that will have to be hauled off by the contractor as well as reduce the amount of guardrail required on the projects. Ideally, this typically would be used between two closely spaced cut sections to allow the storm water to run along the outside swale to the first opportunity to drain down the outside slope. After a detailed review of the cross sections, drainage considerations and right-of-way constraints this alternative was **DROPPED FROM FURTHER CONSIDERATION.**

VII. DEVELOPMENT PHASE

B. PAVEMENT

"As Proposed"

The "As Proposed" pavement design used the Maximum Asphalt Design as shown below.

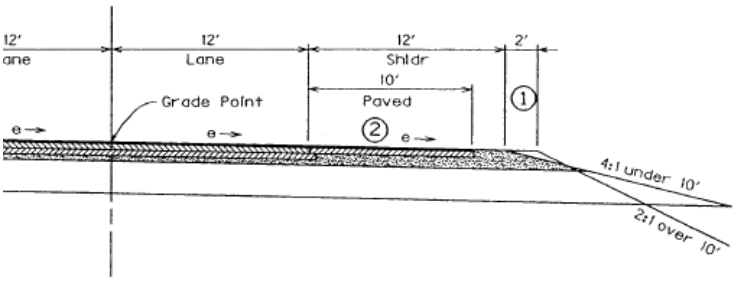


NOTE: SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER

① SHOULDERS SHALL BE WIDENED 2' WHERE GUARDRAIL IS TO BE INSTALLED

② SUPERELEVATED SHOULDERS SHALL BE CONSTRUCTED TO STANDARD SUPERELEVATION, EXCEPT NOT FLATTER THAN THE SLOPES INDICATED FOR NORMAL SHOULDERS.

NORMAL SECTION



NEW CONSTRUCTION

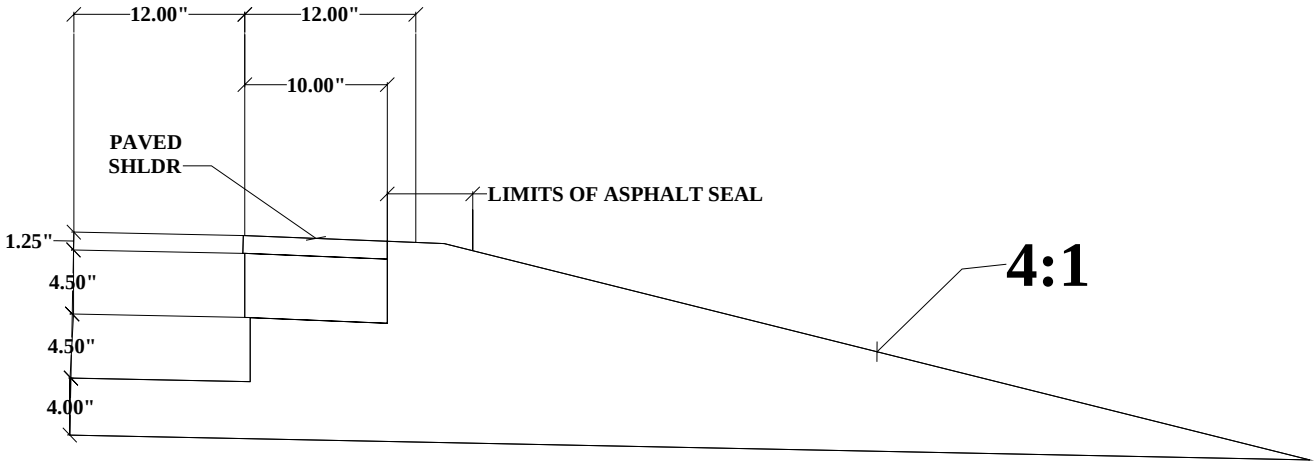
-using-

PAVEMENT
4" Depth Crushed Stone Base
9" Depth CL 2 Asphalt Base 1.00D PG 64-22 (4.5"+4.5")
1.25" Depth CL 2 Asphalt Surface 0.38D PG 64-22

SHOULDERS
Full Depth Crushed Stone Base
4.50" Depth CL 1 Asphalt Base 1.00D PG 64-22
1.25" Depth CL 1 Asphalt Surface 0.38D PG 64-22

ASPHALT SEAL
Emulsified Asphalt RS-2 (2.4 lb/sq yd)
Asphalt Seal Aggregate (20 lb/sq yd)
(Two applications of each)

.

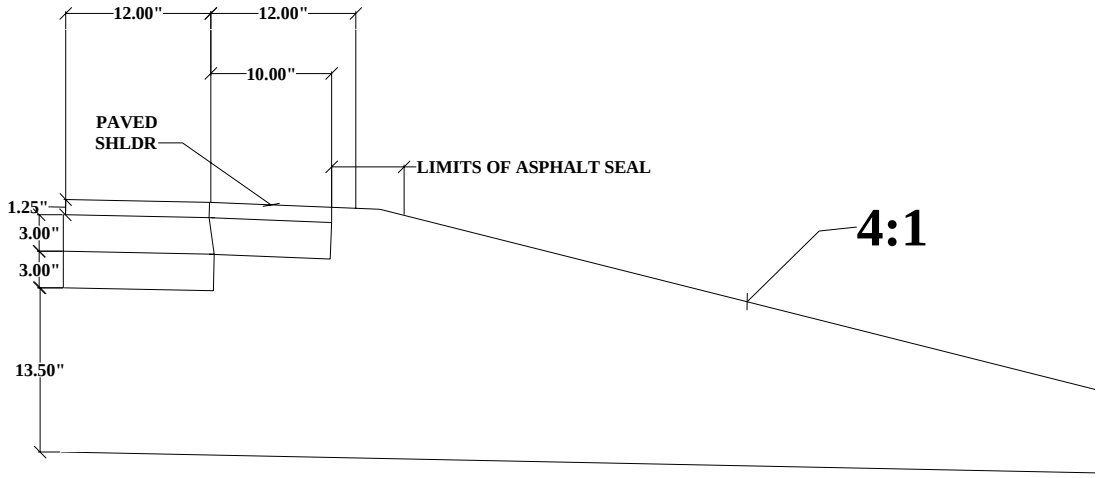


VII. DEVELOPMENT PHASE

B. PAVEMENT

Value Engineering Alternative Number 1

Construct 2-12’ lanes with 13.5” crushed stone base, 6” structural asphalt, and a 1.25” asphalt surface and 2-12’ shoulders with full depth crushed stone base, 4.5” of structural asphalt and 1.25” surface asphalt. (Maximum Aggregate Design)



*MAXIMUM AGGREGATE PAVEMENT DESIGN**
VALUE ENGINEERING ALTERNATIVE NUMBER 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
CL 2 ASPH SURF 0.38D PG64-22	TN	$51.01	9,748.9	$497,289	9,748.9	$497,289
CL 2 ASPH BASE 1.00D PG64-22	TN	$51.24	71,912.7	$3,684,809	23,602.1	$1,209,373
CL 2 ASPH BASE 1.50D PG64-22	TN	$49.82	0.0	$0	24,339.7	$1,212,604
CRUSHED STONE BASE	TN	$17.77	24,833.5	$441,292	83,813.2	$1,489,361
SUBTOTAL				**$4,623,390**		**$4,408,627**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$239,260		$228,146
TRAFFIC CONTROL/MOT		0.0%		$0		$0
CONTINGENCY		15.0%		$693,509		$661,294
GRAND TOTAL				**$5,556,159**		**$5,298,067**

POSSIBLE SAVINGS: $258,092

***COST FOR 2 - 12' LANES FOR LENGTH OF PROJECT**

VII. DEVELOPMENT PHASE

B. PAVEMENT

COST COMPARISON SHEET BACK UP CALCULATIONS

AS PROPOSED

MAIN LINE

	80020.39	64520.63	15499.76	LF	14.25 DEPTH	LB	TN
CL 2 SURF		23.79167	40973.9	SY	1.25	5889998	2,945.00
CL 2 BASE 1		24	41332.69	SY	4.5	21389669	10,694.83
CL 2 BASE 2		24.75	42624.34	SY	4.5	22058096	11,029.05
CRUSHED STONE		24.75	42624.34	SY	4	15003768	7,501.88

	64528.63	28719.41	35809.22	LF	DEPTH	LB	TN
CL 2 SURF		23.79167	94662.34	SY	1.25	13607711	6,803.86
CL 2 BASE 1		24	95491.25	SY	4.5	49416724	24,708.36
CL 2 BASE 2		24.75	98475.36	SY	4.5	50960996	25,480.50
CRUSHED STONE		24.75	98475.36	SY	4	34663325	17,331.66

VE

	80020.39	64520.63	15499.76	LF	20.75 DEPTH	LB	TN
CL 2 SURF		23.79167	40973.9	SY	1.25	5889998.5	2,945.00
CL 2 BASE 1		24	41332.69	SY	3	14259779	7,129.89
CL 2 BASE 2		24.75	42624.34	SY	3	14705397	7,352.70
CRUSHED STONE		24.75	42624.34	SY	13.5	50637716	25,318.86
EXCAVATION			18035.21	CY			

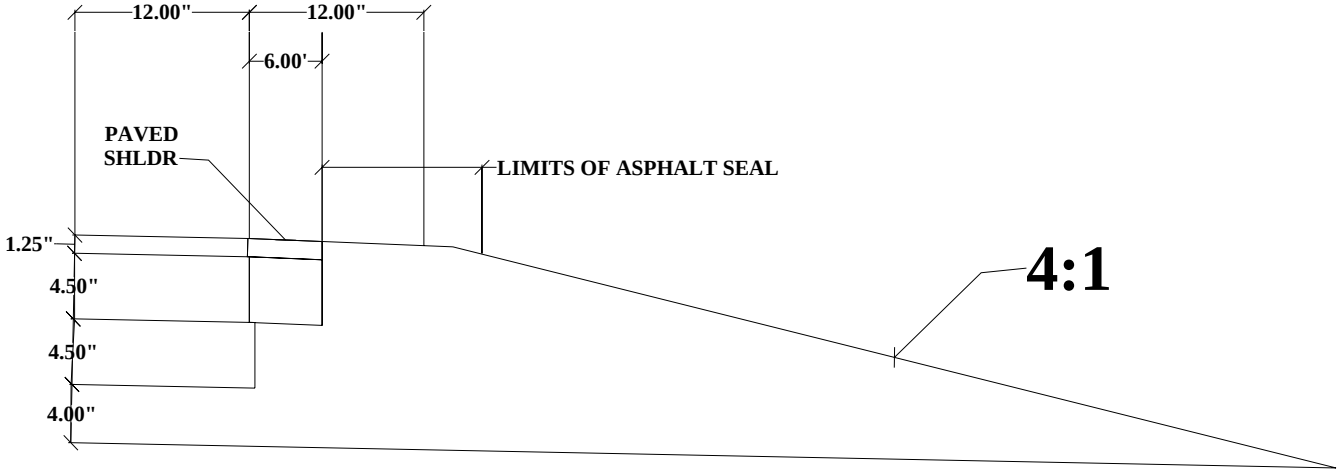
	64528.63	28719.41	35809.22	LF	DEPTH	LB	TN
CL 2 SURF		23.79167	94662.34	SY	1.25	13607711	6,803.86
CL 2 BASE 1		24	95491.25	SY	3	32944482	16,472.24
CL 2 BASE 2		24.75	98475.36	SY	3	33973997	16,987.00
CRUSHED STONE		24.75	98475.36	SY	13.5	116988722	58,494.36
EXCAVATION			41666.9	CY			

VII. DEVELOPMENT PHASE

B. PAVEMENT

Value Engineering Alternative Number 2

Construct pavement with 12’ shoulders with 6’ paved.



12' SHOULDERS/W 6' PAVED

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
CL 1 ASPH SURF 0.38D PG64-22	TN	$49.60	8,195.18	$406,481	4,917.11	$243,889
CL 1 ASPH BASE 1.00D PG64-22	TN	$41.85	29,502.66	$1,234,686	17,701.60	$740,812
CRUSHED STONE BASE	TN	$17.70	77,557.71	$1,372,772	81,022.58	$1,434,100
EXCAVATION (TO LOWER SUBGRADE 6.5")	CY	$3.30	0	$0	59,702.12	$197,017
EMULSIFIED ASPHALT RS-2	TN	$295.10	912.16	$269,178	1,824.32	$538,357
ASPHALT SEAL AGGREGATE	TN	$45.00	109.46	$4,926	218.92	$9,851
SUBTOTAL				**$3,288,043**		**$3,164,025**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$170,156		$163,738
TRAFFIC CONTROL/MOT		0.0%		$0		$0
CONTINGENCY		15.0%		$493,206		$474,604
GRAND TOTAL				**$3,951,406**		**$3,802,367**

POSSIBLE SAVINGS: $149,039

VII. DEVELOPMENT PHASE

B. PAVEMENT

COST COMPARISON SHEET BACK UP CALCULATIONS

AS PROPOSED

SHOULDERS

	80020.39	64520.63	15499.76	LF	DEPTH	LB	TN
CL 1 SURF		20	34443.91	SY	1.25	4951312	2,475.66
CL 1 BASE		20	34443.91	SY	4.5	17824724	8,912.36
CL 1 BASE 2		28	48221.48	SY	0	0	-
CRUSHED STONE		28	48221.48	SY	8.5	36069664	18,034.83
ASPHALT SEAL AGGREG		8	13777.56	SY	2	551102.6	275.55
EMULSIFIED ASPHALT RS-2		8	13777.56	SY	2	66132.31	33.07

	64528.63	28719.41	35809.22	LF	DEPTH	LB	TN
CL 2 SURF		20	79576.04	SY	1.25	11439056	5,719.53
CL 2 BASE 1		20	79576.04	SY	4.5	41180603	20,590.30
CL 2 BASE 2		40	159152.1	SY	0	0	-
CRUSHED STONE		40	159152.1	SY	8.5	1.19E+08	59,522.88
ASPHALT SEAL AGGREG		8	31830.42	SY	2	1273217	636.61
EMULSIFIED ASPHALT RS-2		8	31830.42	SY	2	152786	76.39

VE

	80020.39	64520.63	15499.76	LF	DEPTH	LB	TN
CL 1 SURF		10	17221.96	SY	1.25	2475656.1	1,237.83
CL 1 BASE		10	17221.96	SY	4.5	8912362	4,456.18
CL 1 BASE 2		38	65443.43	SY	0	0	-
CRUSHED STONE		38	65443.43	SY	8.5	48951686	24,475.84
ASPHALT SEAL AGGREG		18	30999.52	SY	2	1239980.8	619.99
EMULSIFIED ASPHALT RS-2		18	30999.52	SY	2	148797.7	74.40

	64528.63	28719.41	35809.22	LF	DEPTH	LB	TN
CL 2 SURF		10	39788.02	SY	1.25	5719528.2	2,859.76
CL 2 BASE 1		10	39788.02	SY	4.5	20590302	10,295.15
CL 2 BASE 2		38	151194.5	SY	0	0	-
CRUSHED STONE		38	151194.5	SY	8.5	113093474	56,546.74
ASPHALT SEAL AGGREG		18	71618.44	SY	2	2864737.6	1,432.37
EMULSIFIED ASPHALT RS-2		18	71618.44	SY	2	343768.51	171.88

VII. DEVELOPMENT PHASE

C. DRAINAGE

"As Proposed"

KYTC Policy for pipe size under high fills is as follows:

1. 24" DIA. pipe is minimum size for cover heights from 30' to 65'.
2. 54" DIA. pipe is minimum size for cover heights greater than 65'.

This policy applies without regard to the actual quantity of water that needs to be conveyed.

VII. DEVELOPMENT PHASE

C. DRAINAGE

Value Engineering Alternative

The Value Engineering Team considered challenging the policy on these projects, but after reviewing the drainage calculations it was revealed that at these two locations the pipes were sized appropriately for the flow of water expected.

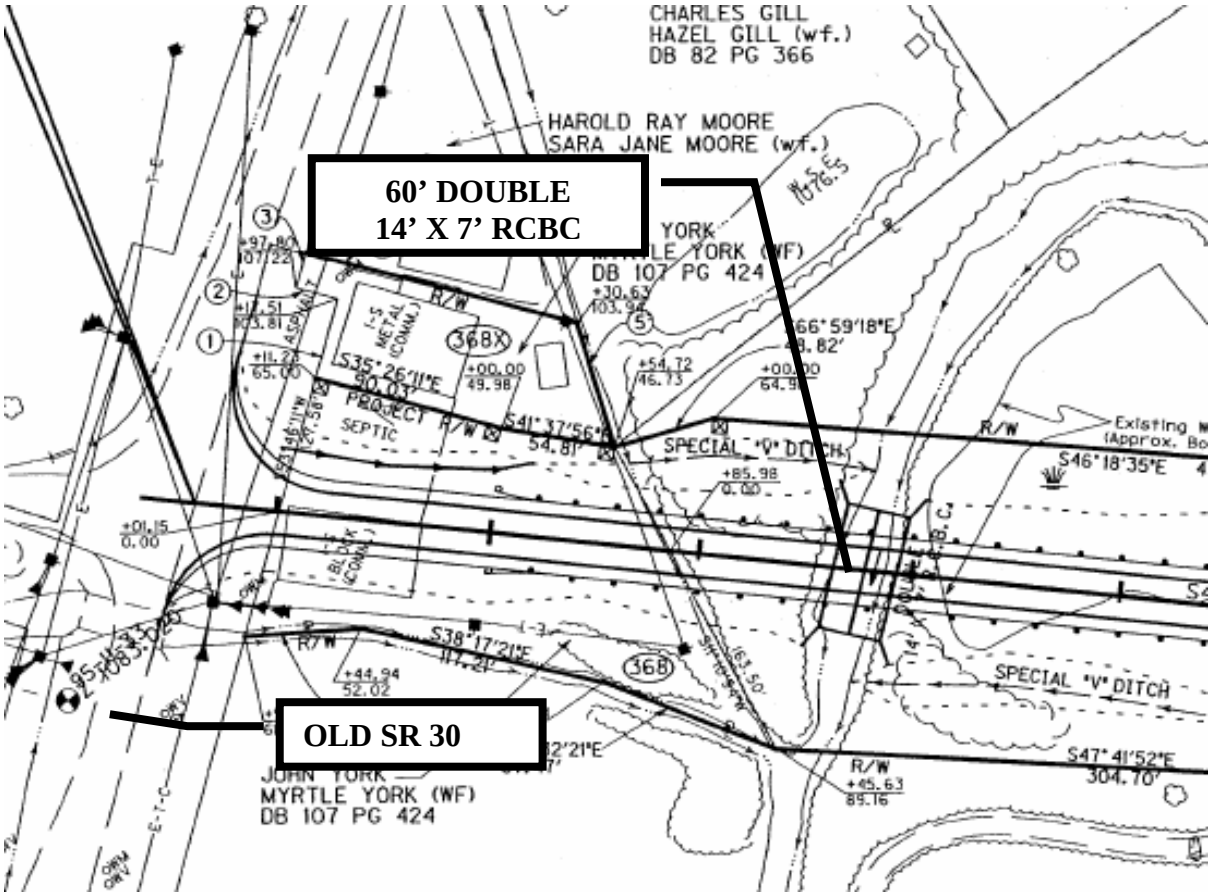
DROPPED FROM FURTHER CONSIDERATION.

VII. DEVELOPMENT PHASE

D. BOX CULVERT

"As Proposed"

The approach road from old SR 30 to the end of the 11-278.24 project crosses over Pond Creek. A 60' long Double 14' x 7' Reinforce Concrete Box Culvert will be constructed to carry the approach road over the creek as shown below.

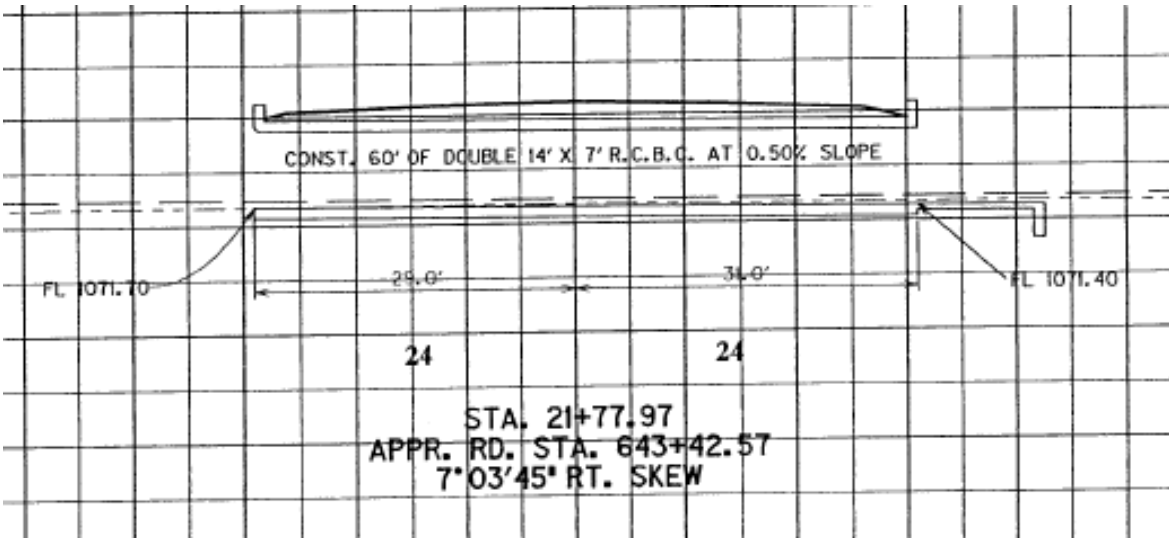


BOX CULVERT LOCATION

VII. DEVELOPMENT PHASE

D. BOX CULVERT

"As Proposed" *(continued)*



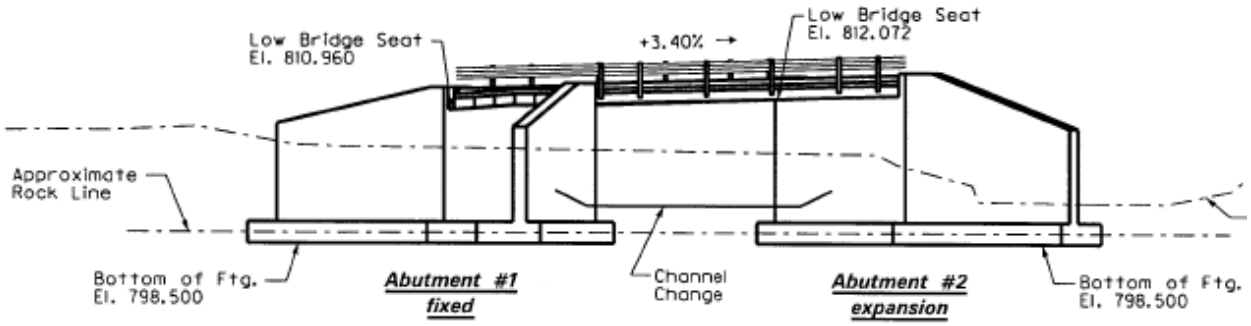
CROSS SECTION

VII. DEVELOPMENT PHASE

D. BOX CULVERT

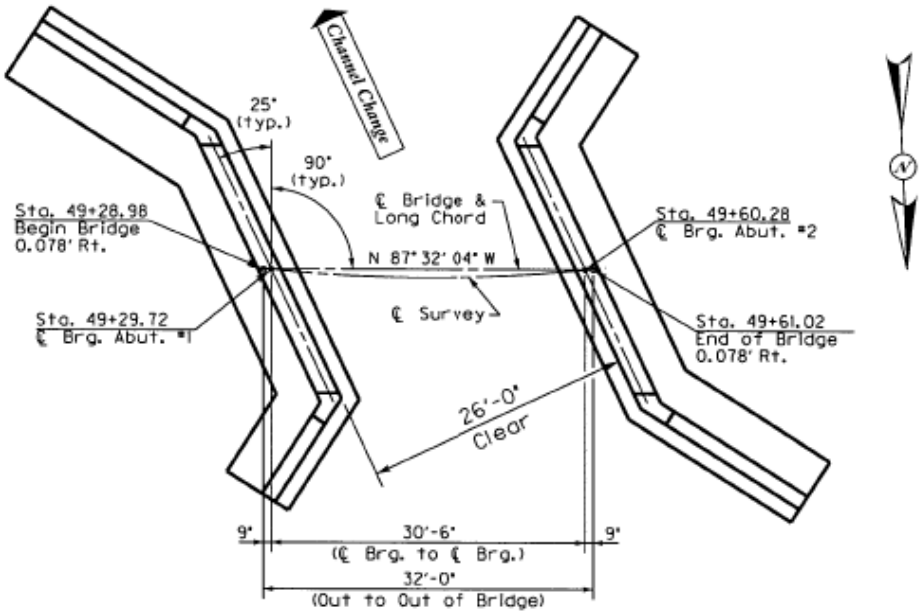
Value Engineering Alternative

The Value Engineering Team recommends replacing the Double 14' x 7' RCBC with the bridge shown below.



ELEVATION

30'-6" CB21 PPC Box Beam, Simple Span
HS25 Live Load ~ 30'-6" Shoulder Width @ Bridge
7° Skew Rt. ~ 22'-6" Bridge Roadway Width ~ 2:1 Fill Slopes

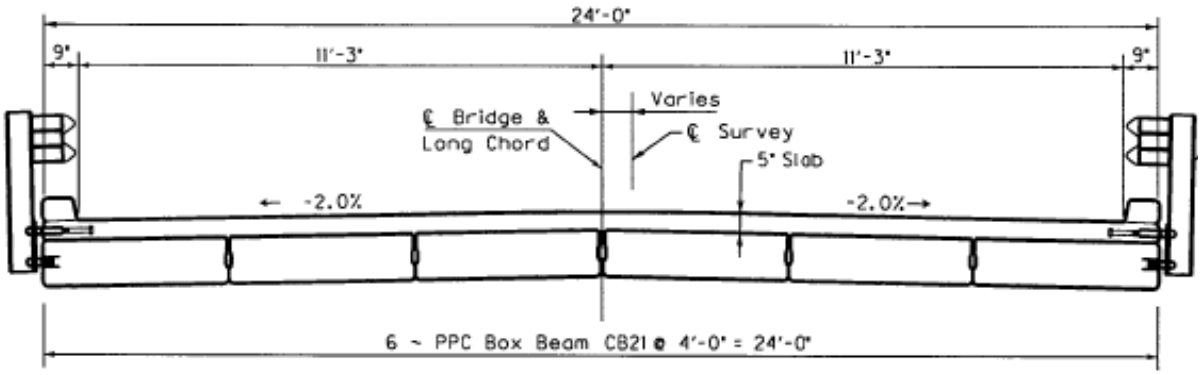


PLAN

~Superstructure not shown~

D. BOX CULVERT

Value Engineering Alternative *(continued)*



TYPICAL SECTION

The economic analysis indicated this would be a slightly more expensive alternative than the "As Proposed." The center wall of the box culvert may trap and collect debris that may ultimately block the channel, causing flooding. With the wider opening of a bridge and nothing to trap debris there will be less risk of flooding with the bridge alternative.

BOX CULVERT
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
CLASS "A" CONCRETE	CY	$340.00	178.1	$60,554	100.0	$34,000
REINFORCEMENT STEEL	LB	$0.80	32,553.0	$26,042	8,000.0	$6,400
FOUNDATION PREP	LS	$3,000.00	1.0	$3,000		$0
STRUCTURAL EXCAVATION	CY	$37.00	13.0	$481		$0
CLASS "AA" CONCRETE	CY	$450.00	0.0	$0	11.1	$4,995
REINFORCEMENT STEEL (SLAB)	LB	$1.00	0.0	$0	1,600.0	$1,600
BOX BEAMS	LF	$300.00	0.0	$0	180.0	$54,000
ARMORED EDGE	LF	$45.00	0.0	$0	48.0	$2,160
SUBTOTAL				**$90,077**		**$103,155**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		4.5%		$4,662		$5,338
TRAFFIC CONTROL/MOT		0.0%		$0		$0
CONTINGENCY		15.0%		$13,512		$15,473
GRAND TOTAL				**$108,251**		**$123,967**

POSSIBLE ADDITIONAL COST: $15,716

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. EARTHWORK

Recommendation Number 1:

The Value Engineering Team recommends that the Value Engineering Alternative Number 1 be implemented. This alternative raises the proposed grades.

If this recommendation can be implemented, there is a possible savings of ***$2,078,710.***

B. PAVEMENT

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative Number 1 be implemented. This alternative constructs 2-12' lanes with 13.5" crushed stone base, 6" structural asphalt, and a 1.25" asphalt surface and 2-12' shoulders with full depth crushed stone base, 4.5" of structural asphalt and 1.25" surface asphalt. (Maximum Aggregate Design)

If this recommendation can be implemented, there is a possible savings of ***$258.092.***

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative Number 2 be implemented. This alternative constructs pavement with 12' shoulders with 6' paved.

If this recommendation can be implemented, there is a possible savings of ***$149,039.***

D. BOX CULVERT

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative replaces the Double 14' X 7' RCBC with a bridge.

If this recommendation can be implemented, there is a possible added cost of ***$15,716.***

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VALUE ENGINEERING STUDY PRESENTATION
APRIL 13, 2007

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